



Salt Islands in Dead Sea
(από Γιάννη Μεταξά)

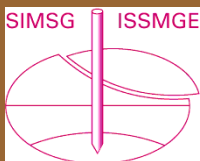


ΕΛΛΗΝΙΚΗ
ΕΠΙΣΤΗΜΟΝΙΚΗ
ΕΤΑΙΡΕΙΑ
ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ
& ΓΕΩΤΕΧΝΙΚΗΣ
ΜΗΧΑΝΙΚΗΣ

Τα Νέα της ΕΕΕΕΕΓΜ

138

Αρ. 138 – ΜΑΙΟΣ 2020



Π Ε Ρ Ι Ε Χ Ο Μ Ε Ν Α

Άρθρα	3	Feds revoked Edenville Dam license over fears it could not survive major flood	27
- The Q-slope Method for Rock Slope Engineering	3	Michigan dam failure caught on video	28
- Fehmarn: The world's longest road/rail tunnel	4	Edenville Dam failure: the astonishing video of the collapse sequence	29
- Custom Refuge Chamber Strengthens Safety on Small TBM	5	Edenville Dam breach: interpreting the failure	30
- Late great engineers: Archimedes of Syracuse	6	- Dam failure causes flooding, stranding homeowners in Lenroot, Wisconsin, U.S.	31
Νέα από τις Ελληνικές και Διεθνείς Γεωτεχνικές Ενώσεις	8	- Austria centre for realistic underground research May 2020	32
- International Society for Soil Mechanics and Geotechnical Engineering	8	- California reservoir needs to be drained due to risk of failure	34
ISSMGE News & Information Circular May 2020	8	- The July 2018 Xe Nammo hydro power complex dam failure: a new paper	34
- International Commission on Large Dams	9	Ενδιαφέροντα - Σεισμοί	36
World declaration on Dams Safety	9	- Cutting-edge earthquake research on old Whirokino Bridge south of Foxton	36
- BRITISH TUNNELLING SOCIETY / YOUNG MEMBERS ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΣΗΡΑΓΓΩΝ & ΥΠΟΓΕΙΩΝ ΕΡΓΩΝ	11	- Shallow M4.9 earthquake hits Kiruna, Sweden -- the country's biggest mine-related quake ever	36
Διαδικτυακό workshop "Tackling Uncertainty in Tunnelling"	11	Ενδιαφέροντα - Γεωλογία	38
- Chinese National Committee on Large Dams (CHINCOLD)	11	- Geology and Chemistry Drive Animal Migration in the Serengeti	38
Διακρίσεις Ελλήνων Γεωτεχνικών Μηχανικών	14	Ενδιαφέροντα - Περιβάλλον	40
- Prof. George Gazetas from NTUA delivered the 38 th Annual Geosystems Engineering Distinguished Lecture	14	- Gravitricity to pilot £1m gravity-based energy storage system in Edinburgh	40
Προσεχείς Γεωτεχνικές Εκδηλώσεις:	15	- Natural Wonders of China	40
- 2021 GEOASIA7 7th Asian Regional Conference on International Geosynthetics Society	16	Ενδιαφέροντα - Λοιπά	45
- Joint meeting of ISSMGE TC201 and TC210, ICOLD TC E and TC LE "Dams and Levees: Particle Movements – Case Studies, Experiments, Theory"	16	- Οδικές διαδρομές που προκαλούν δέος	45
- ICOLD 27th Congress - 89th Annual Meeting Sharing Water: Multipurpose of Reservoirs and Innovations	17	- Ο ελληνικός δρόμος με τις 30 συνεχόμενες στροφές	45
- 12th International Conference on Geosynthetics	19	- Iconic pedestrian bridge over Scioto River connects city life of Dublin, Ohio	45
Ενδιαφέροντα Γεωτεχνικά Νέα	21	- «Φυσικά» ρομπότ	48
- Incredible domino failure	21	- Double helix of masonry — researchers uncover the secret of Italian renaissance domes	50
- How Do Sinkholes Form?	21	- EUREKA	52
- Σωρεία αστοχιών χωμάτων φραγμάτων		- Απίστευτοι Οδηγοί Αυτοκινήτων και Χειριστές Μηχανημάτων	52
Road damage reported in Putnam County after dam failure	21	- 10 Bridge Failures Explained how they happened	52
- Dam in Middle Georgia Bursts, Draining Lake	22	Νέες Εκδόσεις στις Γεωτεχνικές Επιστήμες	54
- More than 75 000 evacuate after dam failure leads to severe flooding in Uzbekistan and Kazakhstan	22	Ηλεκτρονικά Περιοδικά	56
Dam failure on May 1st in Uzbekistan. The 29m dam which finished in 2017, burst. Over 80000 people were evacuated.	23		
Sardoba Reservoir: a major dam collapse in Uzbekistan on 1 May 2020	23		
70,000 Evacuated After Breach in Uzbek Dam, Investigation into Failure Launched	24		
Almost \$1bn worth of damage caused by bursting of Sardoba dam in Uzbekistan	24		
Tens of thousands evacuated after Uzbekistan dam bursts	25		
Sardoba Dam Failure—Uzbekistan Collapse InSAR Disaster Forensics	25		
- Swirling sinkhole devours huge chunk of land in Kenya	26		
- What Is The Future Of Tailings Dams?	26		
- Edenville Dam Dam Failure	27		

Ουδέν κακόν αμιγές καλού. Λόγω του κορωνοϊού αναγκαστήκαμε να προσφύγουμε στις νέες τεχνολογίες για διαδικτυακές συνεδριάσεις της Εκτελεστικής Επιτροπής της ΕΕΕΕΓΜ! Με το καλό να γίνη δυνατή η παρακολούθησή τους από όλα τα ενδιαφερόμενα μέλη μας.

The Q-slope Method for Rock Slope Engineering

Q-slope is an empirical rock slope engineering method for assessing the stability of excavated rock slopes in the field. Intended for use in reinforcement-free road or railway cuttings or in open cast mines, Q-slope allows geotechnical engineers to make potential adjustments to slope angles as rock mass conditions become apparent during construction. Through case studies across Asia, Australia, Central America and Europe, a simple correlation between Q-slope and long-term stable slopes was established. Q-slope is designed such that it suggests stable, maintenance-free bench-face slope angles of for instance 40-45°, 60-65° and 80-85° with respective Q-slope values of approximately 0.1, 1.0 and 10. Q-slope was developed by supplementing the Q-system which has been extensively used for characterizing rock exposures, drill-core, and tunnels under construction for the last 40 years. The Q' parameters (RQD, J_n , J_a & J_r) remain unchanged in Q-slope. However, a new method for applying J_r/J_a ratios to both sides of potential wedges is used, with relative orientation weightings for each side. The term J_w , which is now termed J_{wice} , takes into account long-term exposure to various climatic and environmental conditions such as intense erosive rainfall and ice-wedging effects. Slope relevant SRF categories for slope surface conditions, stress-strength ratios and major discontinuities such as faults, weakness zones or joint swarms have also been incorporated. This paper discusses the applicability of the Q-slope method to slopes ranging from less than 5m to more than 250m in height in both civil and mining engineering projects.

<https://www.youtube.com/watch?v=rLSHOMsBzk4&feature=youtu.be&fbclid=IwAR0H-7YHrkYSOBNRM-BEBRubx0QTs1GMshHkb5ozfYIikZGApSBczpL2sCe0>

[Gecko Geotechnics](#)

Fehmarn: The world's longest road/rail tunnel



In the future Scandinavia and the rest of Europe will be connected by the world's longest road and rail tunnel.

The fixed immersed tunnel link across the Fehmarnbelt will be more than 18 km long and carry a four-lane motorway alongside a twin track-electrified railway.



The fixed link will reduce the travel time between Scandinavia and Continental Europe. At a speed of 110 km per hour, this will offer motorists a journey time of approximately 10 minutes through the tunnel. For train passengers, the journey will take seven minutes from coast to coast. The duration of a train journey between Hamburg and Copenhagen will be cut short from about four and a half to merely three hours.

The immersed tunnel solution under Fehmarnbelt is a study in innovative thinking, as it challenges existing tunnel building standards. It improves functionality through its pioneering longitudinal ventilation system and state-of-the-art safety and security features.

The Fehmarnbelt tunnel will be more than five times the length of the tunnel under Øresund linking Denmark and Sweden, and more than three times the length of the Trans-Bay Tube Bart Tunnel in San Francisco in California, the current world record holder.

In close collaboration with Tunnel Engineering Consultants (TEC) og Arup, Ramboll is advising Fehmarn A/S on the design of the immersed tunnel solution.



Project data

Fehmarnbelt between Denmark and Germany

Client: *Femern Bælt A/S*

Completion: 2028

<https://ramboll.com/projects/rdk/femernbaelt>

Custom Refuge Chamber Strengthens Safety on Small TBM

Designing a refuge chamber to fit a 4.4m diameter tunnel boring machine with limited gantry space. Learn about the custom engineering that went into building two 10-person, 24-hour TunnelSAFE refuge stations.

Key takeaways

- The drainage tunnel project will use a 4.4m diameter EPBM
- Personnel on a TBM with limited gantry space can still benefit from a custom-made, high-quality tunnelling refuge chamber
- Two crescent designed refuge chambers were commissioned based on the feedback of a risk assessment

A tunnel project in the Middle East, vital to the enhancement of the country's underground drainage network maintains high safety standards with two custom refuge chambers. The project aims to provide a sustainable solution to stormwater run-off and discharge of surface. The \$251 million project is the second phase of development, which includes the construction of a rainwater discharge tunnel, pumping station, and rainwater treatment facility.

A leading Chinese manufacturer will provide the Tunnel Boring Machine (TBM) for this section of the drainage tunnel project.

Due to the terrain, phase two of the project will use an Earth Pressure Balance Machine (EPBM). EPB's are designed to operate in softer ground conditions which contain water under pressure. Geological conditions considered include stratum such as Rus Formation, Midra Shale, and Simsim Limestone as well as varying water table ranges due to the proximity of the tunnel to the shallow coastal waters off the Qatar peninsula.

The project is scheduled to be completed at the end of 2021 in preparation for the 2022 World Cup.

Challenges

- Installing a refuge chamber within a TBM with [limited gantry space](#)
- Complying with [European Standard](#) (EN 16191:2014)

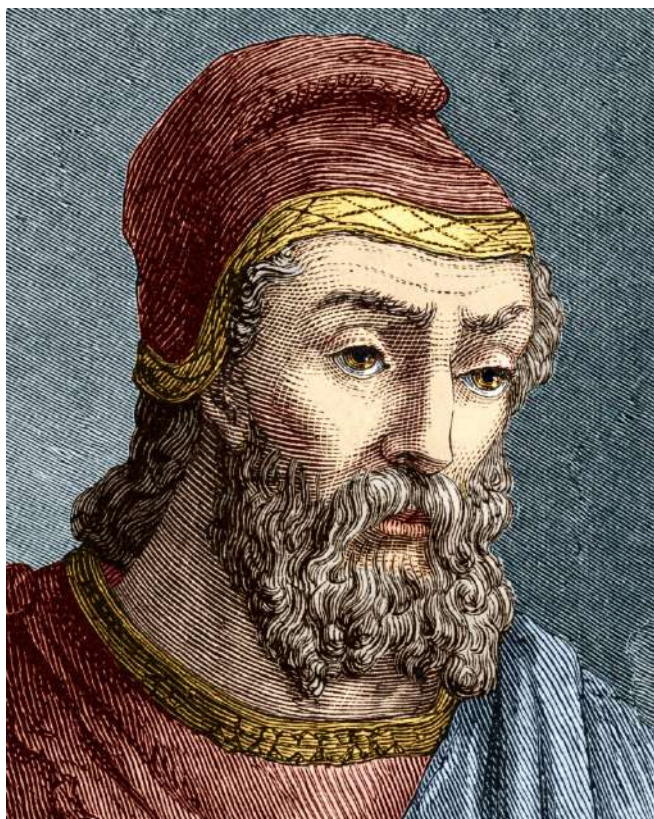
Solutions

- Custom refuge chamber engineering – [crescent design](#), custom battery box, custom scrubber
- Meeting [EN 16191:2014 guidelines](#)

<https://minearc.com/blog/custom-refuge-chamber-small-tbm>

Late great engineers: Archimedes of Syracuse

Remembered primarily for inventing a rudimentary screw pump, there is so much more to the Ancient Greek polymath Archimedes of Syracuse, the greatest scientist of antiquity, writes Nick Smith.



Archimedes of Syracuse (c. 287-212 BC), Greek mathematician, physicist and engineer.

"Give me a lever and a place to stand and I will move the earth." These are supposed to be the words of the greatest scientist of antiquity, and yet, as with so much about Archimedes of Syracuse, it is virtually impossible to separate myth from reality.

The legendary flash of bath-time inspiration – the original 'eureka' moment that we were taught at school – while almost certainly apocryphal, has passed indelibly into science folklore. It remains popular as the only incident of public nudity related to the history of hydrostatics, and yet is unlikely to have been the inspiration for Archimedes' two-volume treatise *On Floating Bodies*. As one biographer, Eduard Jan Dijksterhuis puts it: "the overflowing of water from the bath does not teach anything about the upward thrust acting on a body immersed in water."

Today, Archimedes' legacy rests on a vague portfolio of ideas: he anticipated calculus, formulated the eponymous hydrostatic principle, developed the design of the screw pump and devised an approach to determining π (pi) that was to be used for more than a thousand years, while one of the bounds he established for π (22/7) has remained a universal approximation ever since.

While there is very little in the way of verifiable historical fact about the life of Archimedes, there is a wealth of unsubstantiated and fanciful detail. An early Arabian biographer claimed that the ancient Greek mathematician was the son of Pythagoras, and there are claims he was a pupil of Plato. Both positions can be dismissed easily, but the fact that they routinely

make their way into modern discussions about Archimedes seems to amplify the point that biographical facts about him are scarce. But what we do know about the man described by the author of *A Contextual History of Mathematics* as the "most original and profound mathematician of antiquity", is that there are today nine extant treatises by Archimedes, covering subjects such as *On the Sphere and Cylinder*, *On the Equilibrium of Planes*, *Quadrature of the Parabola*, *Method concerning Mechanical Theorems* and more besides.

There are some biographical facts that have gained consensus with historians. Because we know that Archimedes died during the sack of Syracuse in the Second Punic War (placing his death at c.212BC), and because we know that he was 75 years old when he was killed by a Roman centurion (the 12th century Byzantine Greek historian John Tzetzes is considered reliable on this point), we can extrapolate that Archimedes was born in or around the year 287BC. Because he spent most of his life in the Greek city-state of Syracuse (modern Sicily) where he was a close acquaintance of King Hiero II, it is assumed that this is also his birthplace. Historians think he may have spent his early career in Egypt, but are more definite on the notion that Archimedes published his works in the form of correspondence with leading mathematicians of the time, including Conon of Samos and Eratosthenes of Cyrene.

As for his death, the ancient Greek biographer Plutarch (writing hundreds of years after the event) says the centurion that put Archimedes to the sword did so when the latter refused to leave his mathematical diagrams to attend a meeting with the occupying General Marcus Claudius Marcellus. His last words have been handed down to us as *Noli turbare circulos meos* ('do not disturb my circles'), but these are not mentioned in Plutarch or anywhere else reliable.

Equally apocryphal, according to *Encyclopaedia Britannica*, is the story that Archimedes used a huge array of mirrors to burn the Roman ships besieging Syracuse. *Britannica* also questions the historical reliability of his two most famous quotations about levers and displaced bathwater, while admitting that this assortment of unsubstantiated anecdotes creates a picture of "his real interest in catoptrics (the branch of optics dealing with the reflection of light from mirrors, plane or curved), mechanics and pure mathematics."

"Give me a lever and a place to stand and I will move the earth"

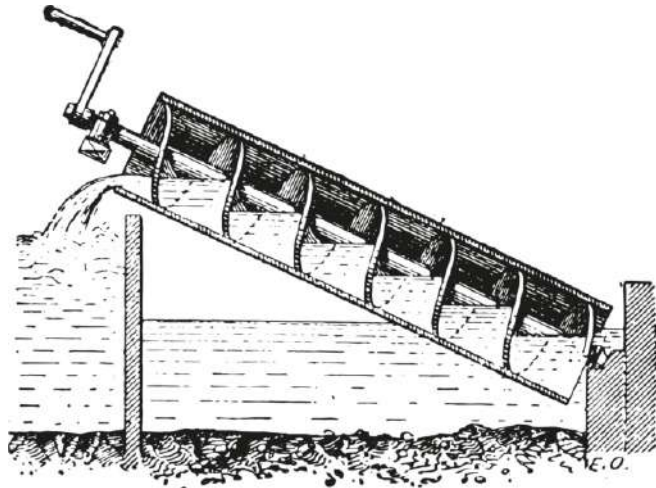
Archimedes

(σ.ε. δός μοι πᾶ στῶ καὶ τὰν γᾶν κινήσω)

As [Johnny Ball says in his book *Wonders Beyond Numbers*](#), the most famous legend concerning Archimedes is the one in which he "jumped out of the bath and ran down the street in the nude" having shouted 'Eureka!' (which is traditionally translated as 'I have it'). Ball explains that what Archimedes 'had' was a scientific method of verifying the authenticity of the metallic composition of a crown commissioned by King Hiero II, subsequently produced by two jewellers from a bar of pure gold. According to Ball, when the king saw the crown, "he was thrilled, until someone whispered in his ear that the jewellers were not completely honest and may have substituted less valuable silver for some of the gold, which they'd kept for themselves. The problem was how he could prove it without bashing the crown back into its original gold bar shape? Hiero turned to Archimedes for help, but even he had no idea how to solve the conundrum until one day, as he climbed into the bath, water slopped over the sides..."

The story continues that when the crown was placed into a body of water, it displaced more water by volume than the original volume of the gold bar, proving that the gold had been adulterated with a lighter metal, silver. Most tellings of

the tale rejoice in the supposition that the king, armed with the evidence of malfeasance that he required, then executed the two jewellers, despite there being not one shred of evidence for this. However, the 'incident' led to Archimedes being able to report in his treatise *On Floating Bodies* what has now become known as the Archimedes Principle, which is that a solid denser than a fluid will, when immersed in that fluid, be lighter by the weight of the fluid it displaces. His other associated observations were that an object immersed in water will displace its own volume of water, while an object less dense than water will sink until it has displaced its own weight and will then float, effectively weightless, on the surface. Which is why ships float. Archimedes used this knowledge to design the *Syracusia*, which at 110m presses a claim for being the largest transport ship of antiquity. Capable of carrying nearly 2000 people, it was too big to dock at any port in Sicily and so was sailed to Alexandria, where it was presented to the king, Ptolemy III Euergetes.



Archimedes screw or Archimedean screw or screw pump, vintage engraved illustration. Dictionary of words and things – Larive and Fleury – 1895.

Although not famous in his lifetime as a mathematician, from his treatises we can deduce what breakthroughs Archimedes made. In his *On the Sphere and Cylinder* he tells us that the surface area of any sphere of radius r is four times that of its greatest circle (expressed today as $S = 4\pi r^2$), while the volume of a sphere is two-thirds that of the cylinder in which it is inscribed, leading to the formula for the volume $V = \frac{4}{3}\pi r^3$. For anyone doubting the significance of the second of these discoveries, Archimedes left instructions for a sphere within a cylinder to be carved on his tomb, a fact confirmed by Roman statesman Cicero who rediscovered the monument a century-and-a-half after Archimedes' death. In his *Measurement of the Circle*, that exists only as a fragment, we see his approach to defining π , which consists of inscribing and circumscribing regular polygons with large numbers of sides. His work on large numbers appears in a treatise called *The Sand-Reckoner* in which he created a place-value system of notation with the base 100,000,000, allowing him to express how many grains of sand it would take to fill the entire universe. Apart from the nine extant works, we can infer from later authors that he wrote other treatises that have not survived, as well as books of contested provenance on topics such as touching circles and geometrical puzzles.

It wasn't to be until the 8th and 9th centuries, when his treatises were translated into Arabic, that the true significance of Archimedes as a mathematician was appreciated and his work was developed by medieval Islamic mathematicians. The invention of the printing press meant that his work (in

Greek this time) gained widespread popularity in Europe, influencing the likes of Johannes Kepler and Galileo Galilei (who praised Archimedes as 'superhuman'). His influence extended into the 17th century via Latin translations that reached René Descartes and Pierre de Fermat, and so had a profound influence on post-Renaissance mathematics. Today, the Fields Medal awarded by the International Congress of the International Mathematical Union – one of the highest honours in mathematics – carries a portrait of Archimedes along with the inscription *Transire suum pectus mundoque potiri* ('rise above oneself and grasp the world').

(Rick Smoth / THE ENGINEER, May 2020, pp. 24-35, http://www.journal-download.co.uk/digitalmagazines/theengineer/the-engineer-may2020/page_35.html - THE ENGINEER, 14th May 2020, <https://www.theengineer.co.uk/late-great-engineers-archimedes-of-syracuse>)

ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ



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

ISSMGE News & Information Circular May 2020

<https://www.issmge.org/news/issmge-news-and-information-circular-may-2020>

Message from the President:

We are all under the threat by the COVID-19 and have suffered and affected by it one way or the other. Many universities and training centres are closed. Many students and engineers may not be able to access and receive necessary education and training. This is a serious disruption to their future. However, the free ISSMGE's online "Virtual University" should be able to assist them while they are at home or under quarantine. We have developed seven full courses including:

- Course 1: Risk-Mitigation, monitoring & Observational Methods
- Course 2: In Situ Testing
- Course 3: Earthquake Engineering
- Course 4: Foundations
- Course 5: Soil Characterization
- Course 6: Geo-Engineering Education
- Course 7: Unsaturated Soil Mechanics

In addition, there are many webinars available online. Please visit the ISSMGE website to find out more details as follows:
<http://virtualuniversity.issmge.org/>

Please let whoever needs the education and training know in your countries and regions.

Please watch out the COVID-19 and take great care of your health conditions. God Bless you all.

Charles Wang Wai Ng

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

The Abstract submission deadline has been extended to 31st May 2020. For more information:
<http://icsmge2021.org/>

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. Technical Committees

TC221 – Tailings and Mining Waste – A NEW TECHNICAL COMMITTEE

This is a newly formed TC, and it is actively seeking nominations for members from the Member Societies. Please make sure that your Member Society representative is aware of your interest in joining this committee.

TC217- Land Reclamation

The new chairman of TC217 – Land Reclamation, Prof Jian CHU, has requested that Member Societies nominate (or re-nominate) members. If you are already a member of TC217, please could you advise your Member Society whether you wish to continue in that role.

4. Current Technical Committee Members

As part of the annual maintenance of the online database, all Technical Committee members were sent an email from the ISSMGE webmasters asking them to confirm their membership by clicking on a link. If you have not received the message, but believe you should have, please contact your Member Society to confirm your email address.

5. Bulletin

The latest edition of the ISSMGE Bulletin (Volume 14, Issue 2, April 2020) is available from the website:
<https://www.issmge.org/publications/issmge-bulletin/vol-14-issue-2-april-2020>

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](https://www.issmge.org/filemanager/article/390/Guidelines%20for%20ISSMGE%20Technical%20Committees%20revised%20Nov19.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>. However, for updated information concerning possible changes due to the coronavirus outbreak (ie. postponements, cancellations, change of deadlines, etc), please refer to that specific event's website.

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

ISSMGE Events

6TH INTERNATIONAL CONFERENCE ON FORENSIC GEOTECHNICAL ENGINEERING, 10-12-2020 - 12-12-2020

Indian Institute Technology Delhi, New Delhi, India; Language: English; Organiser: TC 302 - Forensic Geo-technical Engineering; Contact person: Prof. Prashanth Vangla; Address: Department of Civil Engineering, IIT Delhi; Phone: +91 9611189007; Email: Prashanth.Vangla@civil.iitd.ac.in; Website: <http://tc302-issmge.com/>;



International Commission on Large Dams

World declaration on Dams Safety

The construction, operation and maintenance of dams and their storage reservoirs have provided significant benefits to humankind throughout history. Storage of water behind dams regulates natural streamflow, provides benefits resulting from increased water availability, renewable energy production and reduction of adverse impacts caused by nature's extremes of flooding and drought. This document addresses the importance of the dam safety, which encompasses water dams, mining tailings dams and levees.

Growing population in our fragile world is causing steady increases in demand for water, food, energy, minerals and flood control. **Dams are critical infrastructure to meet these basic human needs as well as rising standards of**

living. At the same time, however, dams create new hazards involving potential risks to downstream communities, including potential adverse impacts on life, property and the environment. The potential for dam safety incidents, possibly resulting in an uncontrolled or catastrophic release of stored water is of the highest concern.

The profession of dam engineering has a profound ethical responsibility to carry out its professional duties so that dams and reservoirs are designed, constructed and operated in the most effective and sustainable way, while also ensuring that both new and existing dams are safe during their entire lifespan, from construction to decommissioning.

ICOLD and Dam Safety

For almost a century, the International Commission on Large Dams (ICOLD) has made dam safety one of its highest organizational commitments, as stated in the ICOLD Mission statement:

«ICOLD leads the profession in setting standards and establishing guidelines to ensure that dams are built and operated safely, efficiently, economically, and are environmentally sustainable and socially equitable.»

Before the creation of ICOLD in 1928, knowledge on dam safety was disparate, while the need for building water storage infrastructure was very high and growing. It therefore became a priority of ICOLD to disseminate the understanding of the design and operation of dams based on experience within the global dam engineering community. And along with this dissemination came a strong focus on dam safety that has permeated up to the modern era.

ICOLD has played a key role in improving dam safety through its work in collecting and analyzing information on the lessons learned from past successes and failures. Since the very beginning, ICOLD and its thousands of professionals within the member countries have continuously contributed to the improvement of dam safety through publication of technical papers and exchange of experience during Annual Meetings and Congresses. ICOLD's Technical Committees develop Bulletins for publication that summarize the current state of the practice.

Since the creation of ICOLD, the number of failures compared to the total number of dams in operation has been reduced significantly, which is a positive achievement that reflects the worldwide influence of ICOLD in raising dam design and management standards. Nonetheless, constant vigilance and commitment to dam safety is still required in order to continue the global trend towards safer dams. Any dam incident is a matter of the gravest concern for dam professionals. **It is our ICOLD Declaration that Dam Safety is our highest priority.**

Changing Conditions of Dam Safety

Due to the vital need for water, food, energy, minerals and flood control, the total number of dams worldwide continues to grow. Maintaining the present trend of a decreasing incidence of dam failure is a never-ending challenge for the profession. ICOLD's role in knowledge transfer and capacity building through the dissemination of the best practices is as pertinent as ever. The science, technology and human roles in dam safety are in constant evolution with many changing conditions:

- **Ageing of existing infrastructure,** creating new concerns related to the longevity of construction material and equipment, including infilling of reservoirs with sedimentation.

- **Lack of experience in dam safety management and operations** in some countries engaged in building dams, requiring the need for capacity building.
- **Retirement of experienced personnel** in all countries, leading to a deficiency in qualified engineers trained in dam design.
- **Increasing participation of the private sector** in the development of dams as well as increasing cost and time pressure on developers, designers, contractors and operators, creating a need for new governance conditions for dam safety.
- **Climate change causes changes in extreme precipitation** and drought events, resulting in increased hydrological risks. It is critical to consider changes in climate during planning and management, including resilient design and adaptive reservoir operation of dams. In some regions, this results in a need to increase the height of dams, expand spillway capacity, modify reservoir operating procedures, and/or construct new dams. There may also be a need to assess and address other hazards created by climate change as part of the planning, design and operational phases.
- **The most suitable sites for dams have largely been utilized**, thus new dams must be built in more and more challenging locations, especially regarding geological conditions.
- **Changing local, regional and national governance** can have a significant impact in regulatory authority for dams.

As a recognized international organization of experts in dam engineering, ICOLD calls upon governmental authorities and financing institutions to promote an awareness of the subject of Dam Safety. **The goal of this ICOLD World declaration on Dam Safety is to restate the fundamentals of dam safety** that have been learned over time. Furthermore, all involved entities should be reminded to ensure, through the fulfillment of their responsibilities, that these fundamentals are respected in order to minimize risks associated with dams and reservoirs.

Pillars of Dam Safety

With almost a century of commitment to dam safety, and knowing that the zero risk does not exist, ICOLD recognizes several overarching pillars of dam safety:

- **Structural integrity of dams is the keystone to dam safety.** Best current practices of dam design and performance during the occurrence of hazardous events such as extreme floods and earthquakes have been largely documented by ICOLD bulletins in order to create a sound basis on which existing and future dam structures should be designed, built and operated in safe conditions.
- **A routine surveillance and maintenance programme is necessary for early detection.** Inspection and upkeep are of high importance to minimize the risk and to ensure dam safety in the long term. Periodic safety review by qualified engineers that are highly experienced in dam safety assessment is mandatory. Supervision of dams should be based on both the operator's self-supervision and periodic external safety reviews by an independent and competent authority or institution.
- **An instrumentation and monitoring programme is essential throughout the life of a dam.** A comprehensive dam monitoring programme is necessary to: a) determine behavior during construction; b) assess performance during first reservoir filling; c) compare actual performance with design; d) characterize long-term behavior; e) provide early warning of abnormal conditions; f) capture & analyze response to events, such as large floods, earthquakes, etc.; g) predict future performance of dam; and h) demonstrate safe management of the dam to regulatory authorities.

- **Design-Intrinsic risks need to be adequately addressed.** These risks are based on dam type, materials, ageing, foundations, hydraulic structures, etc., in which good practices and surveillance are the keys for safety.
- **Natural hazard risks change with time, thus should be regularly reviewed and updated.** These hazard risks like floods and earthquakes are external threats, for which risks are accepted based on known science and likelihood of occurrence.
- **Emergency planning is of utmost importance for all dams.** Emergency plans should be developed with the objective of avoiding loss of life and reducing damage to property, infrastructure and the environment resulting from a dam failure. The first filling of the reservoir being a critical period during which the emergency plan must be ready for implementation in a timely manner. Periodic review, updates and practice of the emergency plan is mandatory.
- **Adequate training of operators is part of a comprehensive dam safety programme.** Those placed in charge of dams bear an important responsibility to maintain their training and understanding of their dam. Mis-operation of a dam, especially of spillway gates, can lead to accidents, downstream flooding or potential overtopping of the dam.
- **Sharing lessons learned benefits the entire industry, making all dams safer.** The experience of ICOLD has shown that sharing lessons from dam incidents and failures is crucial to improve state-of-the-art practices. For all involved parties, it is thus imperative that any documentation on dam incidents, including independent expert reports on the root causes of such incidents, be made freely accessible to the international community.
- **A comprehensive dam safety approach will allow minimization of risks.** This is done through collaboration of national organizations to support dam safety: structural measures for strengthening the structure's integrity and stability; measures to minimize the consequences of failures as well as education and public awareness about dams. A comprehensive dam safety approach should also consider the fact that river basins, many of which are transboundary basins, often include several dams, or systems of dams and levees.
- **A dam owner has the ultimate responsibility for its dam.** ICOLD recognizes that the safety of all dams is primarily the responsibility and liability of owners and operators. Adequate personnel and financial resources as well as relevant know-how are essential conditions to meet this responsibility.
- **The role of regulatory authorities is paramount for safety.** Regulatory authorities should take a strong role in ensuring adequate site investigation, best practice design standards, quality construction, contractual frameworks, emergency preparedness and operational compliance within accepted guidelines and standards. Developing norms, standards and safeguards is a key factor to proper dam safety surveillance.
- **An international perspective to dam safety can be enlightening.** International organizations such as ICOLD, which provide guidelines based on worldwide experience, can provide important guidance to designers, owners and government authorities to better understand the current state of best practices for design and safety of dams.

Summary Declaration

With the aspirational goal of working towards continuous reduction of dam safety incidents, ICOLD, as the leading international organization committed to dam safety, calls upon **all involved professionals and companies to make a firm commitment to safety improvements and risk reductions at all dams.**

Furthermore, **Governments, Financial Institutions and other Developers, in their contribution to the development and regulation of dam infrastructure, are called**

upon to make a similar political and financial commitment so that the all-important safety recommendations for dams outlined in ICOLD Bulletins, will be disseminated to the relevant entities and followed to completion.

This common effort will contribute immeasurably to the overarching ICOLD vision:

“Better Dams for a Better World”

Approved on October 18th 2019, in Porto.

International Commission On Large Dams



BRITISH TUNNELLING SOCIETY / YOUNG MEMBERS ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΣΗΡΑΓΓΩΝ & ΥΠΟΓΕΙΩΝ ΕΡΓΩΝ

Οι Επιτροπές Νεαρών Μελών της British Tunnelling Society και της Ελληνικής Επιτροπής Σηράγγων και Υπογείων Έργων διοργάνωσαν την Πέμπτη 21 Μαΐου 2020 διαδικτυακό workshop με τίτλο **Tackling Uncertainty in Tunnelling**. Συντονιστές του workshop ήταν τα μέλη της ΕΕΣΥΕ και της ΕΕΕΕΓΜ Δρ. Βασίλης Μαρίνος και Δρ. Ανδρέας Μπενάρδος.

Workshop Leaders:

Dr Vasilis P. Marinos Assoc. Prof., Aristotle University of Thessaloniki

1st Part - Engineering Geological Evaluation for the Geotechnical Design of Tunnels, with Special Emphasis to Tunnel Behaviour Appraisal: Experiences from 62 tunnels in Greece

The presentation argues that the use of classification ratings must be accompanied by an understanding of the actual rock-mass behaviour in tunnelling. The assessment of ground behaviour in tunnelling is based on the identification of the rock-mass type and the engineering geological characteristics - “keys” that dictate the stability or instability of the tunnel. Having defined the most critical failure mechanism and the temporary support philosophy, principles for every behaviour type are discussed in order to contain and control the specific failure mechanism upon excavation. Within this framework, a classification scheme for assessing the rockmass behaviour in tunnelling is presented. This study is based on the experience from the design and construction of 62 mountain tunnels in northern Greece, through a wide variety of geological conditions.

Dr Andreas Benardos Assoc. Prof., National Technical University of Athens

2nd Part - Challenging Uncertainty and Cost in Underground Engineering

The presentation focuses on issues relating to the problems and risks encountered in underground construction giving special focus on the inherent uncertainty of the geotechnical conditions, its management and on the potential solutions that can assist in proactively assessing potential problematic zones with greater efficiency. In addition, cost characteristics

of underground projects are going to be addressed utilizing as-built data coming from a dataset containing numerous modern-day Greek tunnels and revealing the linkage between construction cost and the prevailing geotechnical conditions in terms of GSI.

Dear Colleagues,

Greetings from the Chinese National Committee on Large Dams (CHINCOLD). Welcome to visit CHINCOLD Cloud Platform at <http://www.chincold-smart.com/en>, which is a fast pass for dam engineers to communicate with experts world-wide directly, and a very useful tool for experience exchanging and practice sharing regarding dams.

In this month, we recommend the information on the platform below:

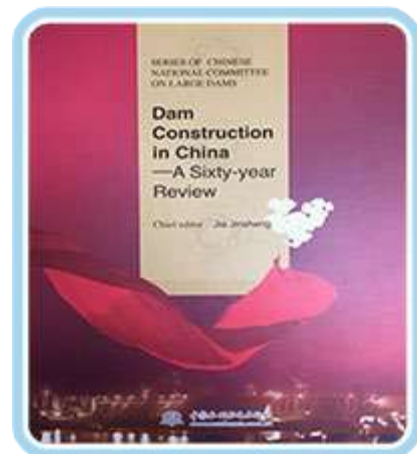
Literature:

Literature on the platform consists of Conferences Proceedings, Presentation Documents, CHINCOLD Publications. <http://www.chincold-smart.com/en/wisdom-lib/liter/index/1>

1. We uploaded a publication

Dam Construction in China -A Sixty-year Review. It summarized systematically the great achievements and successful experiences in dam construction in China from 1949 to 2009. And currently we are preparing to publish the book “Dam Construction in China -A Seventy-year Review”.

<http://www.chincold-smart.com/en/wisdom-lib/liter/is-sue/publications/60s-dam-cons/list/60s-dam-cons>



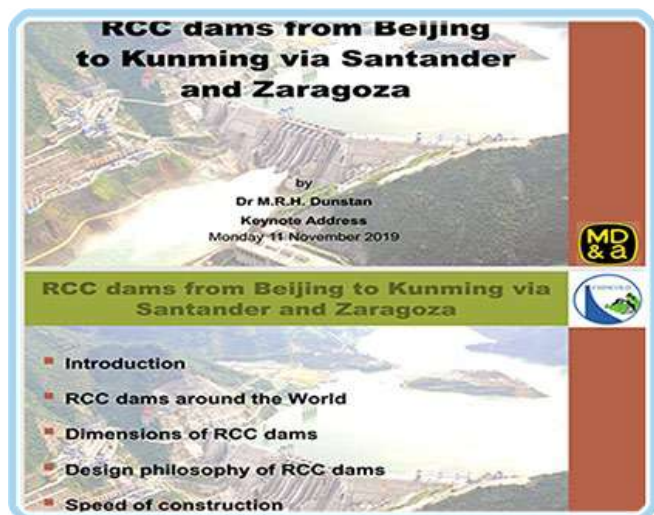
2. We uploaded the related materials of 8th International Symposium on RCC Dams

The 8th International Symposium on RCC Dams was held in Nov. 2019 in Kunming, China. We uploaded the related papers, presentations, and pictures, including those of the well-known experts such as Dr. M.R.H. Dunstan and Dr. Marco Conrad, as well as some new technologies in China.

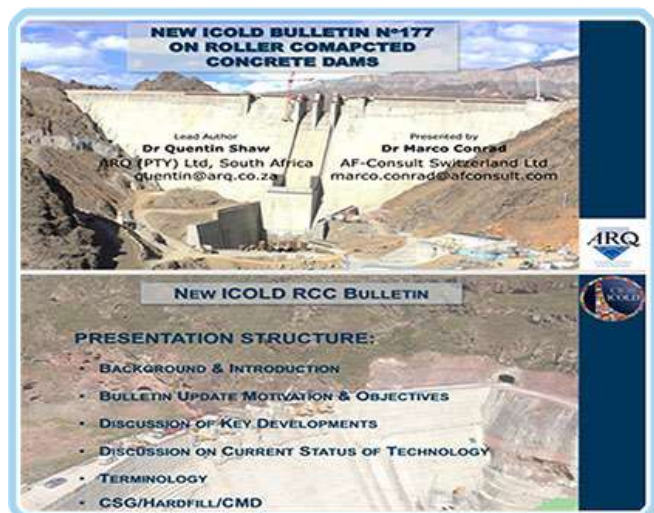
<http://www.chincold-smart.com/en/wisdom-dtl/liter/proceedings/LM001E/thesis/8899>



<http://www.chincold-smart.com/en/wisdom-dtl/liter/rpt-ppt/P021/thesis/8957>



<http://www.chincold-smart.com/en/wisdom-dtl/liter/rpt-ppt/P021/thesis/8960>



<http://www.chincold-smart.com/en/wisdom-dtl/liter/rpt-ppt/P021/thesis/8966>



Proceeding:

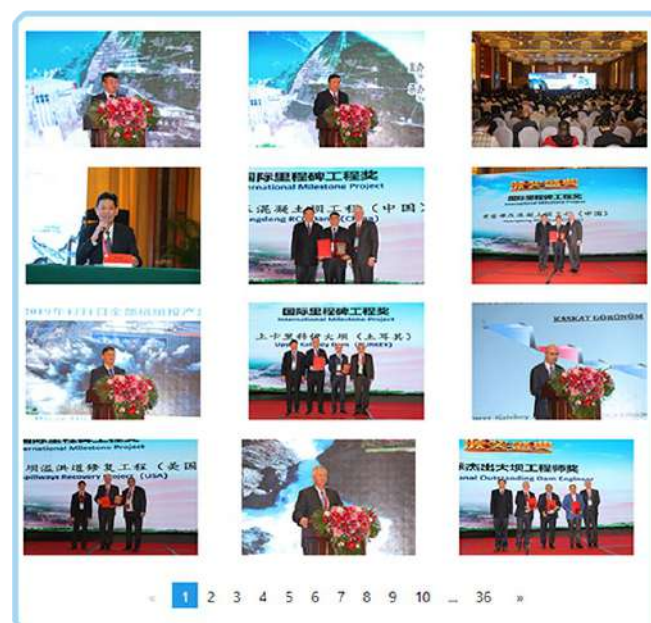
<http://www.chincold-smart.com/en/wisdom-lib/liter/china-tech-data/proceedings/thesis-list/LM001E/all/1>

Presentations:

<http://www.chincold-smart.com/en/wisdom-lib/liter/china-tech-data/rpt-ppt/thesis-list/P021/all/1>

Pictures:

<http://www.chincold-smart.com/en/wisdom-lib/liter/china-tech-data/pictures/pictures-list/1/all/1>



Data Of Dams in China:

In this section, you can check and view the dams over 100m in China by height/ River /Province or City /Storage Capacity/ Installed Capacity

<http://www.chincold-smart.com/en/wisdom-lib/liter/stat/in-ter-stat/stat>

Home / Literature & Experts / Literature / Dams in China

Dams over 100m in China 2014

Q Type to filter...

River: Yellow River Jinsha River Lancang River Wuyang River Seikan River Guhe River Bailong River [+More](#) [+MultiSelect](#)

Province: Sichuan Yunnan Guizhou Hubei Xinjiang Qinghai Chongqing Hunan Zhejiang Hainan Tibet Shanxi Gansu [+More](#) [+MultiSelect](#)

Type: ER VA CFRD RCCRG RG RCCVA CM PG(I) TE ACKRD X CB VA(I) [+MultiSelect](#)

Height(m): 0-100 100-120 120-150 150-180 180-200 >200 [+More](#) [+MultiSelect](#)

Order By: Height River Province/City Storage Capacity Installed Capacity [Card](#) [Table](#)

No.	Name	Year of start	Year of completion	River	Province/City	Country/City	TYPE	Height(m)	Storage Capacity(10 ⁴ m ³)	Installed Capacity(MW)
1	SHALUNJIANGGOU	2007	2019		Sichuan	Maerkang	ER	212	2897000	2000
2	JINPING1	2005	2015	Yalong River	Sichuan	Yanyuan	VA	305	7760000	3600
3	JIABASHAKOU	2014	2020		Sichuan	Yibang	ER	265	10767900	3000
4	JIAOWAN	2002	2017	Lancang River	Yunnan	Fengqing	VA	294.5	15043000	4200
5	BAIMETAU	2013	2022	Jinsha River	Sichuan Yunnan	Xingnan/Gaige	VA	289	18800000	19000
6	JIUCUO	2004	2015	Jinsha River	Sichuan		VA	283.5	12914000	11860
7	WUGONGDE	2016	2029	Jinsha River	Sichuan Yunnan	Huidang/Lupan	VA	270	7600000	10100
8	WUCUNHOU	2006	2015	Lancang River	Yunnan		ER	261.5	23795000	2850
9	CHAIKA			Lengyangxia/Qinghai/Qinghai	Xinghai/Tongde		CFRD	254	4104000	2000
10	LANINA	2004	2019	Yellow River	Qinghai	Gurani	VA	250	1679000	4000
11	DASHIHA	2012		Kunming River	Xinjiang/Xinjiang	Wensu/Wushi	CFRD	250		900
12	SHANZHU	2013			Sichuan	Xiangyang		250	1100000	450
13	CHANGHEBA	2010	2019	Dadu River	Sichuan	Kangding	ER	240	1075000	2600

News:

For the latest news, you can view the latest progress of the dams and hydropower projects in China and around the world.

<http://www.chincold-smart.com/en/committee-dynamic/news/list/1>



Water resource ministry looking at infrastructure to boost growth
Apr. 2020

News

[more...](#)

- Shuakhevi hydropower plant project to generate 450 GWh of power in Georgia
Apr. 2020
- Water resource ministry looking at infrastructure to boost growth
Apr. 2020
- CTG kicks off 7.6 billion yuan Yangtze River protection projects in Wuhan
Apr. 2020
- ARENA provides funding to study 600-MW Owen Mountain Pumped Storage
Apr. 2020
- Nearly three-quarters of global generating capacity added in 2019 came from renewables
Apr. 2020

Experts:

In this section, we display the profile and achievements of some of the experts of dams.

<http://www.chincold-smart.com/en/wisdom-lib/domain-expert/all/list/1>

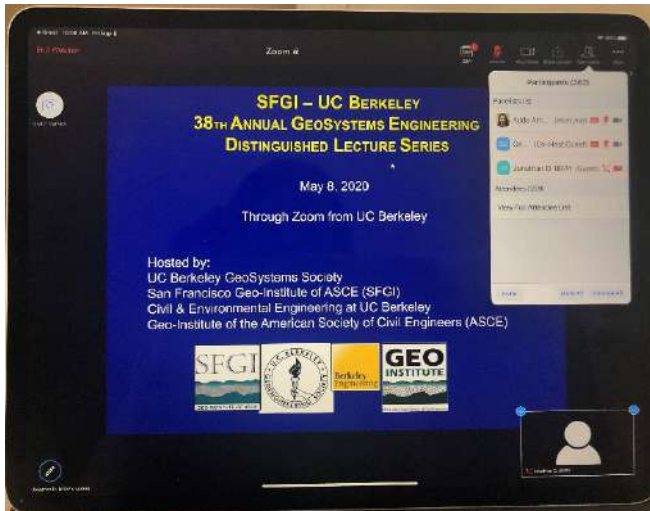
If you would like to introduce your achievements to the colleagues around the world, please click <http://www.chincold-smart.com/en/member-area/individual-member/appExpert> to apply.

Contact:

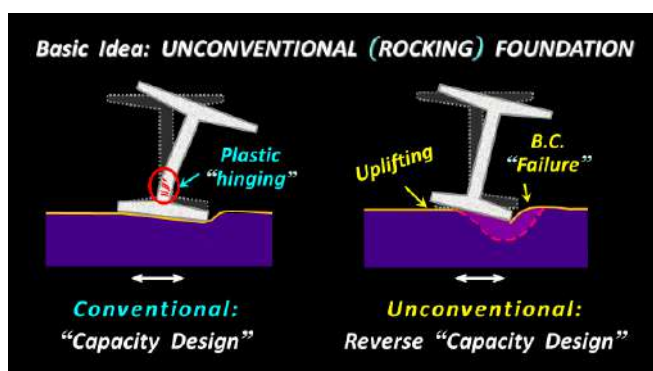
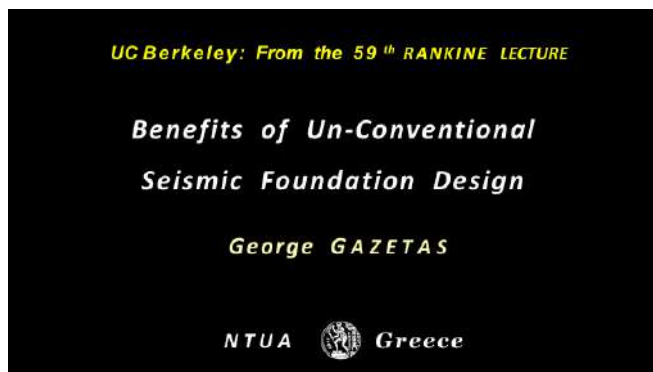
If you have any questions or suggestions, we are happy to be contacted at chincold-en@vip.126.com or chincolden@gmail.com.

ΔΙΑΚΡΙΣΕΙΣ ΕΛΛΗΝΩΝ ΓΕΩΤΕΧΝΙΚΩΝ ΜΗΧΑΝΙΚΩΝ

Prof. George Gazetas from NTUA delivered the 38th Annual Geosystems Engineering Distinguished Lecture

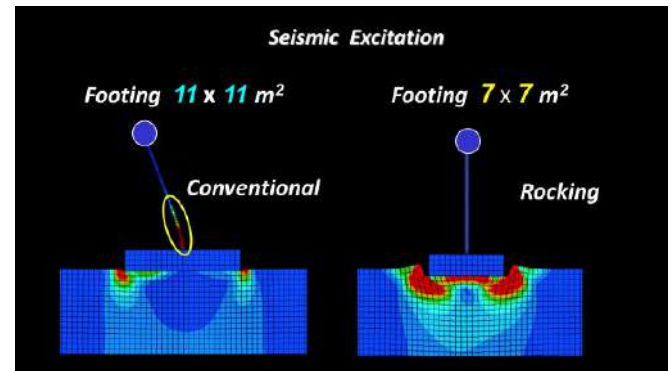


Prof. George Gazetas from NTUA delivered the 38th Annual Geosystems Engineering Distinguished Lecture, a joint event co-sponsored by UC Berkeley and the San Francisco ASCE Geo-Institute Chapter.

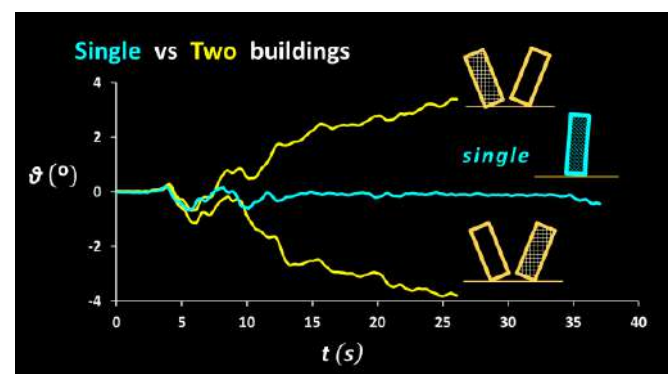
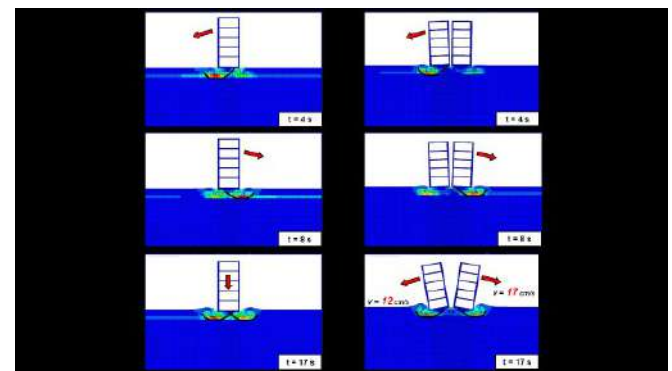


The event dates back to 1983, when Evert Hoek, Ralph B. Peck and Robert V. Whitman were the first speakers! It has

since included many distinguished and exceptional speakers. This year's event took place on May 7-8, 2020 via Zoom due to the COVID-19 pandemic travel restrictions. It was nonetheless, extremely well attended, with over 300 participants.



Prof. Gazetas' presentation was on the "Benefits of Un-Conventional Seismic Foundation Design", and was based on the 59th Ranking Lecture he delivered in 2019. The lecture was recorded and is available at: <https://www.youtube.com/watch?v=pOXzqjTo34o>



(στοιχεία από την Καθ. Άντα Αθανασοπούλου – Ζέκκου και τον Καθ. Γιώργο Γκαζέτα)

ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

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

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>

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

International Conference on Geotechnical Engineering Education, June 23-25, 2020, Athens, Greece, www.eras-mus.gr/microsites/1168

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics – IACMAG - CHALLENGES and INNOVATIONS in GEOMECHANICS, 01-07-2020 ÷ 04-07-2020, Torino, Italy, www.symposium.it/en/events/2020/16th-international-conference-of-iacmag?navbar=1

5th Annual Urban Underground Space & Tunnelling conference, 20th – 22nd July 2020, Singapore, www.me-as-sets.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 Off-shore 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>

WTC 2020 ITA-AITES World Tunnel Conference, September 2020, Kuala Lumpur, Malaysia, www.wtc2020.my

RTG²EE - Recent Trends in Geotechnical and Geo-Environmental Engineering and Education, Online Conference, 10 – 11 September 2020, Bali, Indonesia, <https://rtgee.org>

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>

EUROENGE 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>

Cities on Volcanoes 11 - Volcanoes and Society: environment, health and hazards, 25-30 September 2020, Heraklion, Crete, <https://pcoconvin.eventsair.com/volcanoes11>

EUROCK 2020 Hard Rock Excavation and Support, 12-14 October 2020, Trondheim, Norway, www.eurock2020.com

E-UNSAT 2020 4th European Conference on Unsaturated Soils - Unsaturated Horizons, 19 to 21 October 2020, Lisbon, Portugal, <https://eunsat2020.tecnico.ulisboa.pt>

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

HYDRO 2020 Strategies for future progress, 24-28 October 2020, Strasbourg, France, www.hydropower-dams.com/hydro-2020

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 Symposium of the Macedonian Association for Geotechnics, 29-31 October 2020, Ohrid, North Macedonia, mag@qf.ukim.edu.mk

3rd Conference of the Arabian Journal of Geosciences (CAJG), 2-5 November 2020, Sousse, Tunisia, <https://cajq.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>

CouFrac 2020 - International Conference on Coupled Processes in Fractured Geological Media: Observation, Modeling, and Application, November 11- 13, 2020, Seoul, Korea, <http://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](http://www.engr.psu.edu/xiao/ICSE-10/Call%20for%20abstract.pdf)

88th ICOLD Annual Meeting & Symposium on Sustainable Development of Dams and River Basins, 28-November to 3-December 2020, New Delhi, India, <https://www.icold2020.org>

ASIA 2020 Eighth International Conference and Exhibition on Water Resources and Renewable Energy Development in Asia, 8-10 December 2020, Kuala Lumpur, Malaysia, www.hydropower-dams.com/asia-2020

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

ARMS11 11th Asian Rock Mechanics Symposium, Challenges and Opportunities in Rock Mechanics, 2021, Beijing, China, www.arms11.com

ISGPEG 2020 International Conference on Innovative Solutions for Geotechnical Problems in Honour of Prof. Erol Guler, 2021, Istanbul, Turkey, www.isgpeg2020.org/en

ARMS11 11th Asian Rock Mechanics Symposium, Challenges and Opportunities in Rock Mechanics, Beijing, China, www.arms11.com

14th Baltic Sea Geotechnical Conference 2020 Future Challenges for Geotechnical Engineering, 18-20 January 2021, Helsinki, Finland, www.ril.fi/en/events/bsgc-2020.html

Nordic Geotechnical Meeting Urban Geotechnics, 18-20 January 2021, Helsinki, Finland, www.ril.fi/en/events/ngm-2020.html

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

XIII International Symposium on Landslides - Landslides and Sustainable Development, 21-26 February 2021, Cartagena, Colombia, www.scq.org.co/xiii-isl

- Geosynthetics Properties
- Geosynthetics Solutions for Natural Disasters
- Innovative Uses and Solutions
- New Geosynthetic Products
- Polymeric and Clay Geosynthetic Barriers
- Reinforced Walls and Slopes
- Reinforcement of Embankments and Unpaved Roads
- Seismic Analysis and Applications of Geosynthetics Solutions
- Soil-Geosynthetic Interaction
- Stormwater Management and Water Storage
- Sustainability of Earth Works with Geosynthetics

Contact Us

Conference Secretariat E-mail: secretariat@geoasia7.org



7th Asian Regional Conference on International Geosynthetics Society March 1-4, 2021, Taipei, Taiwan www.geoasia7.org

It is my great happiness to inform you that **The 7th Asian Regional Conference on International Geosynthetic Society (GeoAsia7)** will be held on **March 01-05 in 2021** at **Taipei International Convention Center (TICC)**, Taipei, Taiwan. The main theme of the GeoAsia7 is **Hazard's Risk Management, Innovation, and Sustainability**. Several subjects on modern geosynthetic technologies and activities will be covered up to match up the main theme. The GeoAsia7 is organized by the Chinese Taipei Chapter of the International Geosynthetics Society.

Themes & Topics

Theme Hazard's Risk Management, Innovation, and Sustainability

Topics

- Agricultural Applications
- Case Histories
- Design Approaches and Numerical Solutions
- Drainage and Filtration
- Durability and Long-term Performance
- Erosion Control and Coastal Protection
- Geosynthetics in Environmental Applications
- Geosynthetics in Dynamic Applications
- Geosynthetics in Hydraulic Applications
- Geosynthetics in Mining Applications
- Geosynthetics in Highways and Railways

AFRICA 2021 Water Storage and Hydropower Development for Africa, 13-15 April 2021, Lake Victoria, Uganda, www.hydropower-dams.com/africa-2021

EUROGEO WARSAW 2020 7th European Geosynthetics Congress, 16-19 May 2021, Warsaw, Poland, www.eurogeo7.org

WTC 2021 World Tunnel Congress 2021 - Underground solutions for a world in change, 16-19 May 2021, Copenhagen, Denmark, www.wtc2021.dk

TISOLS Tenth International Symposium on Land Subsidence, Living with Subsidence, 17-21 May 2021, Delft - Gouda, the Netherlands, www.tisols2020.org/tisols2020

7th International Conference on Industrial and Hazardous Waste Management 18 - 21 May, 2021, Chania, Crete, Greece, <http://hwm-conferences.tuc.gr>



Joint meeting of ISSMGE TC201 and TC210, ICOLD TC E and TC LE "Dams and Levees : Particle Movements – Case Studies, Experiments, Theory" June, 2020, Budapest, Hungary www.isc6-budapest.com

This workshop aims to promote research dissemination of earlier and current research related to damages of dikes and dams. Only lecture (with abstract) and lecture with paper (ISC6) are possible options. We expect some of the contributions related to risk assessment, experimental testing and in particular particle movement phenomena (piping, internal erosion, filtering and segregation).

Topics

- Particle movement phenomena concepts
- Case studies, small and large scale experiments related to piping and particle movement phenomena

- Investigations and risk assessment

Any further queries about the workshop contact

Emőke Imre imreemok@hotmail.com
 Cor Zwanenburg Cor.zwanenburg@deltares.nl
 Rémy Tourment remy.tourment@irstea.fr
 Li Min Zhang cezhangl@ust.hk



6th International Conference on Geotechnical and Geophysical Site Characterization "Toward synergy at site characterisation", June 2021, Budapest, Hungary, www.isc6-budapest.com



ICOLD 27th Congress - 89th Annual Meeting Sharing Water: Multipurpose of Reservoirs and Innovations

4 - 11 June 2021, Marseille, France
<https://cigb-icold2021.fr/en/>

The French Committee of Dams and Reservoirs has selected the theme "**Sharing water: multipurpose of Reservoirs and Innovations**" for the symposium organized the **7th of June 2021**.

Themes of the symposium

Theme 1: Territorial and Water Multi-Purpose Issues

- **1A.** Evaluation of current and future resources and needs
- **1B.** Evaluation of socio-environmental and bio-diversity benefits and impacts, positive and negative externalities
- **1C.** Analysis of resilience and adaptability of projects to respond to climate change and changing uses. Decision making methods for choosing a solution, cost-benefits analysis at a regional scale
- **1D.** Lessons learnt from recent water resource crises (drought, floods...)

Theme 2: Governance and Funding

- **2A.** Institutional aspects, stakeholder commitments and inter-relationships
- **2B.** Financial aspects, project funding
- **2C.** Participatory approaches, stakeholders involvement

- **2D.** Special cases of cross-border assets

Theme 3: Innovative solutions in reservoir uses

- **3A.** Multi-usage hydraulic projects: energy storage, hydropower, hybrid solutions with other renewable intermittent energies, irrigation, navigable waterways, water supply, floods mitigation, protection against marine submersions...
- **3B.** Combining structural and non-structural solutions
- **3C.** Integrating a project into a territory with multiple reservoirs
- **3D.** Complementarities and synergies with intermittent renewable energy, related issues

Theme 4: Operating multi-usage facilities

- **4A.** Hydrology for resource management at short and medium term
- **4B.** Tools for operation related decision making including risk management
- **4C.** Short, medium and long-term operation simulation and modelling
- **4D.** Water sharing criteria, trade-off between uses, operation compatibility of additional uses
- **4E.** Performance evaluation of asset management methods

Contact

MCO Congrès SAS
 Administrative Secretariat
 Ms. Claire Bellone
 Villa Gaby
 285 Corniche JF Kennedy
 13007 Marseille, France
 Tel.: +33 (0)4 9509 3800 / Fax: +33 (0)4 9509 3801
 Email: claire.bellone@mcocongres.com



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

EGRWSE 2020 - 3rd International Conference on Environmental Geotechnology, Recycled Waste Materials and Sustainable Engineering, 17-19 June 2021, Izmir, Turkey, www.egrwse2020.com

2nd ICPE 2021 The Second International Conference on Press-in Engineering, 19-21 June 2021, Kochi, Japan, <https://icpe-ipa.org/>

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/#>

IS-Cambridge 2020 10th International Symposium on Geotechnical Aspects of Underground Construction in Soft Ground, 28 June to 01 July 2021, Cambridge, United Kingdom, www.is-cambridge2020.eng.cam.ac.uk



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.



DFI Deep Mixing, 5-8 July 2020, TBD, Gdansk, Poland, www.dfi.org/DM2020

7th ICRAAGE International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, 12-15 July 2021, Bengaluru, India, <http://7icragee.org>

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

37th General Assembly of the European Seismological Commission, September 2021, Corfu, Greece, www.esccgreece2020.eu



5th International Workshop on Rock Mechanics and Engineering Geology in Volcanic Fields 9÷11 September 2021, Fukuoka, Japan

Contact Person: Prof. Takatoshi Ito
E-mail: jsrm-office@rocknet-japan.org



SYDNEY 7iYGECE 2021 7th International Young Geotechnical Engineers Conference A Geotechnical Discovery Down Under, 10-12 September 2021, Sydney, Australia, <http://icsmgce2021.org/7iygece>

SYDNEY ICSMGCE 2021 20th International Conference on Soil Mechanics and Geotechnical Engineering, 12-17 September 2021, Sydney, Australia, www.icsmgce2021.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>

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

LARMS 2021 - IX Latin American Rock Mechanics Symposium Challenges in rock mechanics: towards a sustainable development of infrastructure, 15 - 18 May 2022, Asuncion, Paraguay, <https://larms2021.com>



Eurock 2022

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

Contact Person: Lauri Uotinen
E-mail: lauri.uotinen@aalto.fi



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





9th International Congress on Environmental Geotechnics

**Highlighting the role of
Environmental Geotechnics in Addressing
Global Grand Challenges**

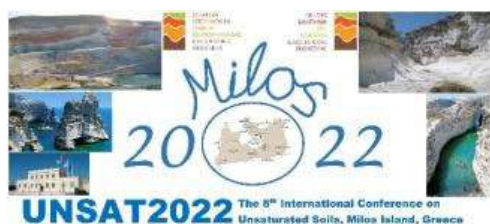
26-29 June 2022, Chania, Crete island, Greece

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 "Highlighting 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.

Contact Information

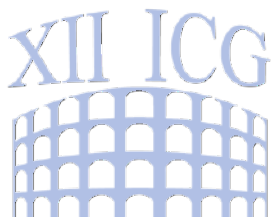
- Contact person: Dr. Rallis Kourkoulis
- Email: rallisko@grid-engineers.com



UNSAT2022

8th International Conference on Unsaturated Soils

June or September 2022, Milos island, Greece



12th International Conference on Geosynthetics

September 18 – 22, 2022, Rome, Italy

www.12icg-roma.org

It is a great pleasure and honour to invite you to attend the XII International Conference on Geosynthetics that will be held in Rome, Italy, 18-22 September 2022. Years after the successful EuroGeo 2, which was held in Bologna in October 2000, the Italian Geotechnical Society (AGI) and the Italian Chapter of IGS (AGI-IGS) are ready to host the 12th ICG. The entire geosynthetics engineering community, both in Italy and worldwide, has reached full awareness over the last two decades, and this is why the main conference focus will be given to the sustainable use of geosynthetics in a variety of innovative and also consolidated applications.

The conference topics will address through general and parallel sessions the most recent developments in geosynthetics, stimulating fruitful technical and scientific interaction within professionals.

We believe that 12th ICG will provide an excellent opportunity to present recent experience and developments to an audience of engineers, geologists and consultants, public and private contractors, local national and international authorities, and to all those involved in research and practice related to geosynthetics.

Topics

- Sustainability with Geosynthetics
- Geosynthetics Properties and Testing
- Soil-Geosynthetic Interaction
- Durability and Long Term Performance
- Reinforced Walls and Slopes
- Basal reinforced Embankments, GEC, piles and shallow foundations
- Seismic design with geosynthetics
- Unpaved and paved roads
- Railways and other Transportation Applications
- Landfills and remediation of contaminated sites
- Filtration and Drainage
- Erosion Control and coastal applications
- Hydraulic applications: canals, reservoirs and dams
- Innovative materials and technologies
- Design approaches and other applications
- Case Histories
- Mining applications
- Tunnels and underground constructions

Contact

AGI Associazione
Geotecnica
Italiana

Tel. +39 06 4465569

Tel. +39 06 44704349

Mob. +39 06 44361035

Email info@12icg-roma.org

Email agi@associazionegeotecnica.it

Postal Address Viale dell'Università 11, 00185 Roma



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

Incredible domino failure

Secant pile retaining wall about 8 - 9 m deep, with no anchors or bracing. The soil behind looks quite sandy, silty, with low cohesion.



https://www.facebook.com/hananth.kumar/vid-eos/3173553302663487/UzpfSTew-MDAwMzY3NzY4MTgzNTpWSzoyMDkyMjgyMDk3NTg0NTQ4/?multi_per-malinks=2093288260817265%2C2092768224202602¬if_id=1588541449040175¬if_t=group_activity

(Από τον συνάδελφο Γιάννη Μεταξά)



How Do Sinkholes Form?

Sinkholes form through both natural and human-made processes.

This demonstration shows what is happening underground when sinkholes form.

Courtesy: <https://goo.gl/pKUV6Z>

<https://www.facebook.com/TechInsiderPresents/videos/676356219238434/>

<https://www.youtube.com/watch?v=e-DVIOpQs8E> (σ.ε. στο τέλος έχει άσχετη διαφήμιση!).



Σωρεία αστοχιών χωμάτινων φραγμάτων

Road damage reported in Putnam County after dam failure



A Friday night dam failure in Putnam County, NY, USA washed one road away and damaged another, officials said, although no injuries or evacuations were reported.



Putnam County EMA Director Tyler Smith shared pictures showing the dam failure had cut a hole through an area road. He said the earthen dam had failed because of a blockage caused by a beaver dam.

Water rose and spilled over, damaging the roads and causing flash flooding through the area Friday night.

The road over the dam was severely damaged, with some damage reported along Industrial Drive, which was down to one lane Saturday.

(Adam Tamburin / Nashville Tennessean, Apr 4, 2020, <https://eu.tennessean.com/story/news/2020/04/04/road-damage-reported-putnam-county-after-dam-failure/2947637001>)



https://twitter.com/damnews_en/status/1257098880367247360



Dam in Middle Georgia Bursts, Draining Lake

A middle Georgia dam has burst, with a local official saying the failure was caused by recent heavy rains.

A middle Georgia dam has burst, with a local official saying the failure was caused by recent heavy rains.

Lake Tchukolako dam breached around 6 a.m. Friday. The lake is the center of the 1,000-person town of Ivey, 25 miles (40 kilometers) east of Macon, WMAZ-TV reported.

No one was hurt and no homes were damaged, said Wilkinson County Emergency Management Director Emma Bacon. The breach cut off water to the town for a time but did not wash out a nearby Norfolk Southern Railway track, Bacon said.

Bacon said she found in February that the dam needed repairs. Ivey Mayor Brenda Broach says the city, county and Holiday Hills Homeowners Association have been working together in recent months on repairs. She called the breach "bad luck" after a lot of recent rain.

The situation is under control, Broach said, but she's sad that people lost their lake. City, county and state officials responded to attempt to fix the breach.

An investigation by The Associated Press last year identified 1,688 high-hazard dams rated in poor or unsatisfactory condition in 44 states and Puerto Rico. Georgia led the nation with nearly 200 high-hazard dams in unsatisfactory or poor condition.

(Associated Press, May 1, 2020, <https://www.us-news.com/news/best-states/georgia/articles/2020-05-01/dam-in-middle-georgia-bursts-draining-lake>)



More than 75 000 evacuate after dam failure leads to severe flooding in Uzbekistan and Kazakhstan



More than 75 000 people evacuated their homes in the border areas of Uzbekistan and Kazakhstan following a reservoir dam failure, which resulted in widespread flooding on May 1, 2020.

The Sardoba Reservoir Dam on the Uzbek side broke early Friday, causing the Syr Darya river to overflow. The floods affected more than 600 homes in southern Kazakhstan, left about 50 people injured, and caused crop damage-- mostly to cotton-- worth more than 400 000 dollars.

The dam encountered failure due to heavy rain and strong winds, the government said.

In Uzbekistan, about 70 000 people from 22 villages in the Syrdarya region fled their homes. The government assured that the people were displaced to safer districts and were provided with food.

In Kazakhstan, authorities evacuated around 5 400 people from four villages in the Maktaaral district, province of Turkistan, according to governor Ummirzak Shukkeyev. Some people had left the area on their own, he added.

The Uzbek government noted that it had managed to lessen the flow of water and divert it to a nearby lake. However, officials in the southern Turkistan region criticized the Uzbek government for not being able to provide prompt information on the status of flood control.

The Sardoba Reservoir was completed in 2017, after seven years of construction that started under the supervision of president Shavkat Mirziyoev, who was the prime minister at that time. Mirziyoev visited the region to manage the evacuation and cleanup operations.



https://www.youtube.com/watch?v=E6N0QYH15Ug&feature=emb_logo

"They said that not a drop of water would reach Maktaraal district. Nevertheless, what happened has happened."

(Julie Celestial / THE WATCHERS, May 4, 2020, <https://watchers.news/2020/05/04/more-than-75-000-evacuate-after-dam-failure-leads-to-severe-flooding-in-uzbekistan-and-kazakhstan>)

Dam failure on May 1st in Uzbekistan. The 29m dam which finished in 2017, burst. Over 80000 people were evacuated.



Sardoba Reservoir: a major dam collapse in Uzbekistan on 1 May 2020

On Friday 1 May 2020 a major collapse occurred in the earth-filled dam of Sardoba Reservoir in Uzbekistan, causing extensive flooding. The video below, [posted to Youtube](#), shows the breach with water pouring through, and the development of the resultant flooding:-



https://www.youtube.com/watch?v=Ub9Eyg2kR2o&feature=emb_logo

The location is 40.337, 68.421. Below is a Google Earth image, from 2019, showing the embankment. I have pinpointed where the failure occurred. At the time of the image the reservoir was not full:-



Google Earth image of the location of the Sardoba Dam failure on 1 May 2020.

Planet Labs have captured a slightly hazy but admirably clear image of the site of the dam failure (image captured on 3 May 2020):

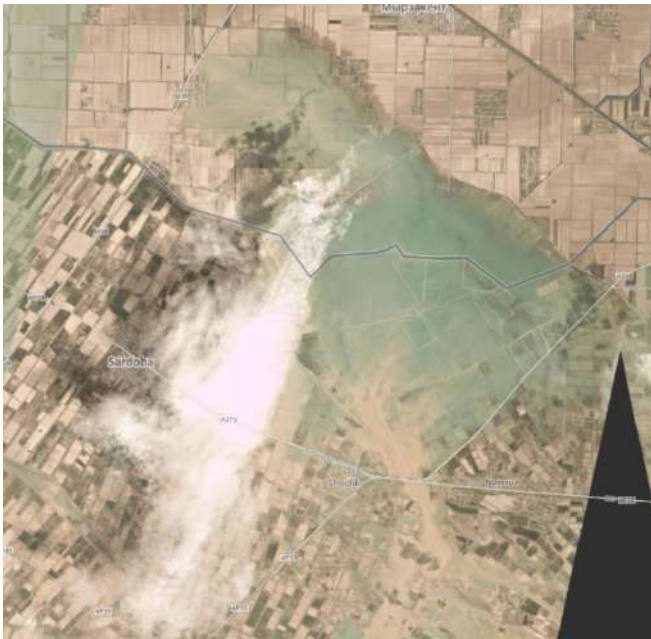


Note the breached embankment, the drained reservoir and the clear downstream erosion and outwash deposits. Interestingly, the image from 1 May 2020, the day of the breach, we affected by haze or high altitude cloud. However, the image does capture the ongoing failure of the structure:-



This image, also from 3 May 2020, shows the very extensive

flooding downstream:-



Flooding from the Sardoba Dam failure in action. Planet Labs PlanetScope image captured on 3 May 2020.

(Dave Petley / AGU / THE LANDSLIDE BLOG, 4 May 2020, <https://blogs.agu.org/landslideblog/2020/05/04/sardoba-dam-failure>)

70,000 Evacuated After Breach in Uzbek Dam, Investigation Into Failure Launched

On May 1, around 6 a.m., after a long rainy week a section of the earthen wall forming the Sardoba Reservoir gave way. The reservoir was completed in 2017, after seven years of construction. The reservoir, 29 meters deep, was designed to hold 922 million cubic meters of water for irrigation of the surrounding agricultural lands in Sirdaryo and Jizzakh regions.

The dam and reservoir were completed just three years ago, suggesting that the failure was the result of either design or construction flaws. It will be interesting to watch who ends up with the blame for the dam's failure.

(Catherine Putz, Staff Author / THE DIPLOMAT, May 04, 2020, <https://thediplomat.com/2020/05/70000-evacuated-after-breach-in-uzbek-dam-investigation-into-failure-launched/?amp=1>)

Almost \$1bn worth of damage caused by bursting of Sardoba dam in Uzbekistan

The Sardoba dam in Uzbekistan burst on May 1 and has caused almost a billion dollars of damage.

Dramatic video released on social media shows the moments shortly after the Sardoba dam burst in Uzbekistan, flooding nearby villages and causing nearly a billion dollars' worth of damage.

Uzbekistan and Kazakhstan evacuated 70,000 and 5,400 people, respectively, from the Syr Darya river basin after the dam burst on the Uzbek side of the reservoir on May 1 just

before 06:00 local time, when heavy rains and stormy winds caused the Sardoba dam wall to partially collapse. Officials warned that the dam was critically weakened and could crumble altogether, but that workers had been dispatched to shore it up.



https://www.youtube.com/watch?v=wGUJ0aP9c54&feature=emb_logo



A total of 22 Uzbek villages and four Kazakh villages were affected by the flood.

The reservoir was intended to provide irrigation to farms in the Sirdaryo region, but there were also many other plans for taking advantage of the infrastructure.

(bne IntelliNews, May 6, 2020, <https://intellinews.com/al-most-1bn-worth-of-damage-caused-by-bursting-of-sardoba-dam-in-uzbekistan-182551>)

Tens of thousands evacuated after Uzbekistan dam bursts

The wall of the Sardoba reservoir dam in eastern Uzbekistan burst early on Friday and at least 70,000 people have been evacuated.



(sk-cr/as/wdb, May 03, 2020, <https://www.hindustantimes.com/world-news/tens-of-thousands-evacuated-after-uzbekistan-dam-bursts/story-CKcV9EGD2nqGo9xguUsDMP.html>)

Sardoba Dam Failure—Uzbekistan Collapse In-SAR Disaster Forensics



After 7 years of construction, the dam was recently completed to provide irrigation water to the surrounding districts. Holding 922 million cubic meters of water, the dam was meant to improve the agricultural output of the area and provide a source of electricity; with electricity from a hydroelectric plant to be added in the future. This breach of the 30 meter high dam led to the evacuation of nearly 100,000 people. While the exact failure mode of the early morning breach of May 1 is still unclear, the current statements seem to point to overtopping of a lower section of the dam by wind driven waves.



Before Failure. Courtesy of [NASA](#).

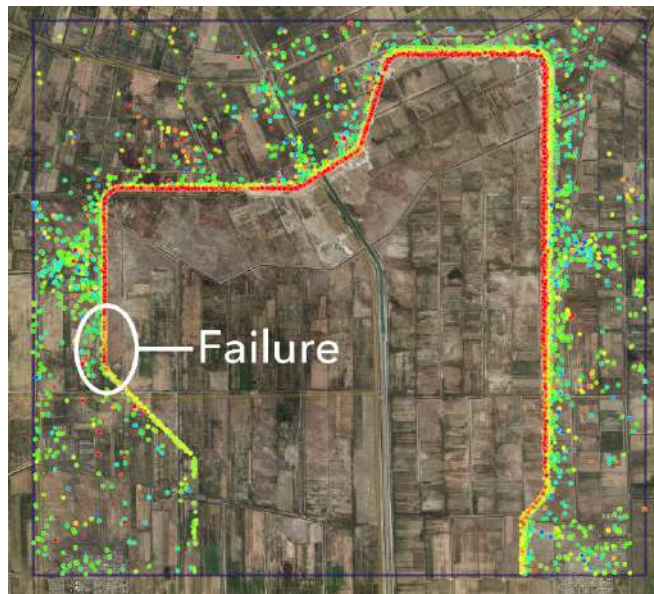


After Failure. Courtesy of [NASA](#).

Forensic information from the InSAR Archive

A key strength of the Sentinel 1 and Copernicus platform is the ability to 'go back in time' and view the deformation of a structure with consistent over flights. Pulling a bit more than the past year of data on Sardoba showed some fascinating results. Sentinel provides some insight into the settlement of this structure over time. Recognizing that all new dam structures settle it is interesting to see rates of 100 mm per year continuing in some sections. The area of the failure did not have the greatest crest subsidence rate during this period. This failed section abuts a turn in the dam where there was significantly less subsidence in the past year. Looking closer at the settlement patterns, it seems there is noticeable differential movement along this stretch of the crest not as prevalent in others. Perhaps this played a role in the failure mode as the differential settlement could lead to weak zones or cracking. An alternative progressive slope failure mode

would potentially demonstrate uplift at the toe of the embankment which was not noted in this data. However, erratic uplift and subsidence can be seen in the nearby field beneath the structure and could be a factor for consideration. We hope that this data, developed in conjunction with Ovela will be useful to Uzbek authorities in the disaster assessment and recovery process.



In the radar images from Sentinel 1 above, red indicates subsidence (down) and blue indicates uplift (up) over the year that the dam was observed. The color scale used is -50 to +50mm. This was obtained from the Ascending orbital data looking east. The failed section is noted by the circle.

(May 26, 2020, <https://www.schnabel-eng.com/blog/2020/05/26/sardoba-dam-failure>)



Swirling sinkhole devours huge chunk of land in Kenya

A swirling sinkhole swallowed a huge chunk of land in the county of Kericho in Great Rift Valley, Kenya, on May 1, 2020, as heavy rains continue to pound the country. As of May 4, the death toll across the country reached 164, government officials confirmed. Kenya's rainy season lasts from March to May.



The sinkhole initially tucked in water from a puddle, before it started rapidly devouring the swamp.

The region where the shocking scene happened is part of the

East African Rift Valley-- a tectonically-active zone that is slowly splitting apart the African Plate. The rift system is marked by substantial volcanic activity, including lava emissions from cracks along the rifts of volcanoes such as Mount Kilimanjaro and Mount Kenya.

Shifts in the plates can unveil cracks and underground voids that can become visible if the soil over it erodes, which is what happened in the county.



"As water flows into the ground, it filters its way through the grains of dirt, rock, and sand in the topsoil and even through the grains of the underlying bedrock," Weather Network meteorologist Scott Sutherland explained.

"If that bedrock is made of something like gypsum, limestone, or dolomite, the water can wear it away, simply by dissolving away some of the sediments that make up the rock."

"This can take a long time with normal water, but with constant or repeated exposure, this can carve large holes and even extensive cave systems through the bedrock. If the water happens to be acidic, however, such as absorbing carbon dioxide before it trickles down through the top-soil, this can dramatically speed up the process."

Heavy rainfall has been affecting the region over the past few weeks, causing hundreds of deaths and widespread damage.

(Julie Celestial / THE WATCHERS, May 5, 2020, <https://watchers.news/2020/05/05/swirling-sinkhole-devours-huge-chunk-of-land-in-kenya>)



What Is The Future Of Tailings Dams?

Safer tailings storage facilities (TSFs) – or tailings dams – can be achieved when mine owners, contractors and engineering consultants work closely together, according to SRK Consulting's senior geotechnical engineer Linda Spies.

Speaking after a recent Southern African Institute of Mining and Metallurgy (SAIMM) conference focusing on tailings dams, Spies says that mining executives today required more assurance that their tailings dams are safe, with controls becoming much stricter. Greater transparency was also being demanded by other stakeholders such as investors and communities.



Pollution control dam

Learning From The Past

"After several hundred lives were lost in two well-publicised tailings dam failures in Brazil in 2015 and 2019, awareness of tailings dam risks has been raised within the mining industry and in the public eye globally," she states. "These latest failures were especially significant insofar as senior management at the mining companies were for the first time being implicated directly with charges of manslaughter and environmental damage."

Spies notes that while conferences on this topic usually involve mostly tailings dam practitioners and academics, this event had strong representation from owners and contractors, who are responsible for tailings dam construction, and consultants, who design TSFs and monitor their construction.

"This meant that the discussion was more holistic and valuable, enriched with insights from these various perspectives," she explains. "This is vital in promoting innovation, safety and environmental and social responsibility in the design, operation and closure of tailings dams."

Best Practise Showcase & Application

Although the tone of the event was serious in light of recent failures, there was also an optimism flowing from the showcasing of best practice in the field and how this was being successfully applied.

In her own case study presentation on a lined tailings dam at a South African platinum mine, Spies highlighted the complexities introduced by the liner requirement – and how good drainage design and quality assurance were an important part of the solution.



Platinum tailings

Upstream Tailings Dams

Among the key issues discussed at the conference was whether upstream tailings dams should be allowed – as this was one of the commonalities in the recent Brazilian failures. High-level input was given in a panel discussion by senior leaders from a mining company, a law firm and an insurance firm, including technical opinions from tailings industry expert and specialist geotechnical engineer Adriaan Meintjes, a partner and corporate consultant from SRK.

According to SRK principal hydrogeologist and numerical modeller Sheila Imrie, who also presented at the event, tailings is rightly receiving considerable attention from a combined engineering and scientific perspective and will continue to do so in the future.

"The continued application of the latest technologies by the industry's top experts is critical," says Imrie. "Industry must also ensure that sufficiently detailed research, monitoring and numerical modelling informs the future design and current management of tailings dams."

She presented a paper on '3D Seepage Modelling in Tailings Storage Facility Analysis and Design for Low Permeability Lined Basins' with SRK colleague civil engineer Wesley Rouncivell. A key to the safe operation of tailings dams in the future involves comprehensive, rigorous monitoring on a regular and real-time basis.

In another SRK presentation, GIS specialist Ansu Louw and civil engineer Riaan van der Colf gave their insights on a 'GIS-enabled, web-based TSF monitoring solution' by SRK to enhance monitoring of tailings facilities.

(Louise Smyth / **ENGINEERLIVE**, 13th May 2020, <https://www.engineerlive.com/content/what-future-tailings-dams>)



Edenville Dam Dam Failure



Feds revoked Edenville Dam license over fears it could not survive major flood

Numerous violations and longstanding concerns that the Edenville Dam could not withstand a significant flood led the Federal Energy Regulatory Commission to revoke its license for power generation in September 2018, federal records show.

The dam, located on the border of Midland and Gladwin coun-

ties, failed late Tuesday afternoon, leading to the failure of a downstream dam on the Tittabawassee River and forcing evacuations in Midland County.

The extent of the damage is not yet determined.

The energy commission (FERC), which regulates U.S. power generation, notified the dam's previous owner as far back as 1999 that it needed to increase capacity of the Edenville dam's spillways to prevent a significant flood from over-coming the structure. FERC subsequently notified the dam's new owner, Boyce Hydro Power LLC, when the license transferred in 2004.

By June 2017, the commission cracked down, citing the owner's "longstanding failure to address the project's inadequate spillway capacity at this high hazard dam."

"Thirteen years after acquiring the license for the project, the licensee has still not increased spillway capacity, leaving the project in danger," wrote Jennifer Hill, director division of Hydropower Administration and Compliance. "The spillway capacity deficiencies must be remedied in order to protect life, limb and property."

Notable by FERC was Edenville's classification as a high hazard dam, meaning its failure could present significant risk to life and property, especially in the downstream village of Sanford, city of Midland and Northwood University.

Boyce Hydro had argued to FERC that it had ongoing litigation with the Michigan Department of Environmental Quality over gaining permits to construct more spillway capacity.

A spillway is essentially an overflow valve, allowing excess water to safely flow around the dam without damaging the structure.

Boyce Hydro owns four dams on the Tittabawassee River, which runs southeasterly through mid-Michigan, emptying into the Saginaw River at Saginaw. The three other dams were still creating hydropower at the time of Tuesday's breach. They create Wixom, Sanford, Secord and Smallwood lakes. The Sanford Lake dam subsequently failed on Tuesday.

In January, a two-county authority called the Four Lakes Task Force agreed to purchase the four dams and lakes for \$9.4 million from Boyce Trusts, using money from a special tax district to help rehabilitate the structures. The cost of improving the dams was expected to be \$100 million and the sale was expected to be complete by early 2022.

That action came after years of citations issued by FERC against the owners of the Edenville dam. They included violations for making unauthorized repairs, unauthorized earth moving, failure to file proper safety plans, failure to provide recreational areas and public access, failure to secure necessary property rights and failure to comply with water quality orders.

But the government's most significant concern, by far, was the failure to increase the capacity of spillways that would allow the dam to survive a "probable maximum flood" event.

FERC argued that the Edenville structure, constructed in 1925, could not handle 50% of a probable maximum flood for the region and that even Boyce's insufficient and incomplete plans would only increase capacity to 66% of a probable maximum flood.

In an effort to retain its license, Boyce Hydro and the Sanford Lake Association argued that revocation of the license would not improve public safety, because revoking the license would make the dam less attractive to potential buyers and

because ceasing power generation would kill the only other source of revenue that could be used to expand its spillway capacity.



A screenshot of a video posted on Facebook by Ryan Kaletto shows flooding caused by a breach at the Edenville Dam in Midland County.

In its 2018 request, Boyce Hydro LLC also argued that the "odds of a 'probable maximum flood' event occurring in the next 5 to 10 years is 5 to 10 in one million," according to federal records.

FERC denied the request for a rehearing, finding that revocation of the license would not endanger the public.

"Michigan DEQ has extensive dam safety regulations, including enforcement mechanisms such as the ability to commence a civil action for appropriate relief for violations," commissioners found. "For over 14 years, the commission has gone to great lengths to compel compliance with the license requirements and Boyce Hydro has delayed, disregarded its responsibility, and claimed that it was not financially capable of meeting such requirements. Meanwhile, Boyce Hydro continued to benefit from the revenues generated by the project."

(The Detroit News, May 20, 2020, <https://eu.detroit-news.com/story/news/local/michigan/2020/05/20/edenville-dam-power-license-revoked-failure-reinforce-structure/5226539002>)

Michigan dam failure caught on video



https://www.youtube.com/watch?v=Hc3u_CHVHJ8

Footage captured of the Edenville Dam embankment failing to hold back floodwaters on Tuesday, May 19, 2020 in Edenville, Michigan.

Edenville Dam failure: the astonishing video of the collapse sequence

Yesterday I posted about the remarkable and devastating failure of the Edenville Dam in Michigan on Tuesday 19 May 2020. There are now heartbreaking images online showing the damage that the resulting flood has caused downstream. Given the known weakness of the dam, this is an unacceptable situation.

From a technical perspective, the most remarkable aspect of this failure is that the sequence of events that induced the breach is caught on video. I tweeted about this yesterday, but it turns out that the landslide that initiated the collapse was also captured, by Lynn Coleman, and posted to Youtube by MLive. This video is astonishing.

As always we should crowdsource an interpretation of this sequence of events, but allow me to give an initial (and not definitive) interpretation. At the start of the video a small amount of water is seen to have overtopped the dam.



Stills from the video of the Edenville Dam failure.

It would be tempting to surmise that this was a simple overtopping, but I don't think that is correct. I think the video shows that the crest of the dam has deformed and dipped, creating a depression through which water has started to flow. In other words, the video starts with the dam wall undergoing the early stages of failure, which in turn has allowed a small amount of overtopping.

The Edenville Dam failure then develops apace. The slope fails rapidly, initially forming a large toe bulge and there is major deformation at the crest.

The failure is rapid and mobile – the still below is only two or so seconds later. Note the blurring of the toe of the landslide due to the rapidity of motion. There is also a hint of some dust or vapour in this area, and above the main body of the slide, which is interesting too.



Stills from the video of the Edenville Dam failure.

The landslide has clearly not failed through the full width of the dam as there is no sign of water pouring through. However, it is likely to have left only a very slender thickness of dam in place. I would hypothesise that this rapidly collapsed under the pressure of the reservoir water as a few seconds later water appears on the landslide deposit.

The full breach rapidly develops after this.

This video is going to be a classic in the teaching of geotechnical failures, but it also clarifies the events that led to the Edenville Dam failure. It would have been simple to ascribe this to a simple overtopping event that occurred when the capacity of the spillway was exceeded. But in reality the events are more worrying than that – the dam appears to have undergone a slope failure; a failure of its integrity. This should never occur, and to me it suggests that the problems at the Edenville Dam went further than known issues with the spillway.

(Dave Petley / AGU – THE LANDSLIDE BLOG, 21 May 2020, <https://blogs.agu.org/landslideblog/2020/05/21/edenville-dam-failure-2>)

Edenville Dam breach: interpreting the failure

Many thanks to all of those who contributed to the discussion yesterday about the catastrophic Edenville Dam breach in Michigan. I thought it would be helpful to summarise views expressed, many of which have come from experts in the field.

First, it is clear that this was not an engineered failure – in other words, it was not planned. There was some discussion on Twitter and in the comments that this was the failure of a fuse plug – i.e. a designed failure point that would release water to prevent overtopping. I can find no evidence that Edenville Dam had a fuse plug, and I do not think that a fuse plug failure would behave in the way shown in the video.

Planet Labs have a wonderful high resolution image of the aftermath of the failure; I would be surprised if a fuse plug is intended to leave this type of catastrophic breach:-



Planet Labs image of the aftermath of the Edenville dam breach.

The style of failure implies that the dam had become saturated in this area. A key question is going to be why this happened. One suggestion is that the water level exceeded the impermeable barrier, allowing water to flow into the structure. An alternative is that the dam was suffering from seepage prior to the floods. The Google Earth imagery is interesting – this image is from 2018.

Is there an indication here that there was deformation in the dam? Or that works had been undertaken? I'm not sure. It will be interesting to see both the monitoring records for the dam and the maintenance that had been undertaken, as well as the design cross-sections.

The mechanism of failure is undoubtedly a rotational slip. It is possible that this started as a smaller failure at the crest of the dam, which then drove a larger failure in the main

face. However, I favour the interpretation that high pore water pressures, and a loss of unsaturated conditions, through the dam volume drove the failure. There are some indications in the video that high pore water conditions were present in the lower part of the structure.



Google Earth image of the site of the Edenville dam breach.

Readers have rightly pointed out that earthfill embankment dams are not unusual and, when well designed and maintained, they are not unsafe. This dam was completed in 1924. However, these structures do require maintenance – would you expect a train built in 1924 to still work without extensive restoration – and they were designed for a time when rainfall levels were different. Climate change – global heating – is driving increases in rainfall intensities and durations, meaning that the Probable Maximum Flood is increasing in very many places.

I always get howls of protest when I say that climate change is important, but it is the case. These structures, worldwide, are going to need a substantial upgrade to cope with that increase in rainfall, and that's going to be very expensive. In the interim we will see more failures of this type.

There is also some interesting analysis of the performance of the dam prior to failure online, using INSAR data. It is astonishing that such an interpretation can be generated so quickly. At present I find it hard to interpret this data though – the results seem to indicate deformation across much of the structure, and the section that failed seems to show uplift not, as I would expect, subsidence. This needs further work, but INSAR remains an exceptionally exciting area of work for these types of investigations, and for pre-failure monitoring.

The failure of the dam is a catastrophe for people living in this area. Planet Labs have an online gallery of high resolution images of the impacts. The Planet Labs image below shows some of the downstream flooding for example:



Planet Labs image of the aftermath of the Edenville dam breach.

But we must not forget that the effects lie upstream as well. There are numerous houses located around the lakes whose

value will have been based upon the proximity to the water. The failure of the dam will have a profound impact, and of course the ecology of the lakes will also have been destroyed.

(Dave Petley / AGU – THE LANDSLIDE BLOG, 22 May 2020, <https://blogs.agu.org/landslideblog/2020/05/22/edenville-dam-breach>)



Dam failure causes flooding, stranding homeowners in Lenroot, Wisconsin, U.S.



A flash flood due to dam failure blocked roads and stranded residents of eight homes in the town of Lenroot in Sawyer County, Wisconsin, Wednesday to Thursday, May 27 to 28, 2020.

Roads turned into rivers following the dam failure which took place at 23:20 UTC (18:20 LT) along the Mosquito Brook Flowage, according to the county emergency management.

Residential areas downstream towards the Mosquito Brook Springs and Mosquito Brook Road were affected by waters more than 0.6 m (2 feet) deep, stranding homeowners on the road's dead-end.

Roads were damaged, according to Sawyer County Record. On the other hand, buildings did not appear affected, initially.

Both Mosquito Brook Road and Porky's Road remain closed to traffic Thursday morning and barriers were also set up by the town of Lenroot.

The Sawyer County Sheriff's Office reported that the upstream Mosquito Brook Flowage was compromised, possibly leaving Porky's Road residents land-locked.

Prior to the burst, the Hayward area received almost 76 mm (3 inches) of rain.

Thomas Wolff, associate professor emeritus at Michigan State University who has been studying dams for more than 50 years, warned citizens about aging dams in the U.S., following the Edenville and Sanford dam failures in the past week.

"American Society of State Dam Safety Officials (ASDSO) estimates more than 2 170 at-risk dams in the high hazard category," he said.

"High hazard refers to consequences that include the potential loss of life. So there are similar situations all around the U.S., and it is just a matter of when and where there is a very rare, but very large storm event that leads to overtopping and destructive erosion, or other types of failure."

Wolff noted that the public should be made aware of where such conditions occur, and in the absence of repair, mapping of which areas would flood in case of a breach.

Flooding will remain over mainly rural areas of northwestern Sawyer County.

(Julie Celestial / THE WATVHERS, May 28, 2020, <https://watchers.news/2020/05/28/dam-failure-causes-flooding-stranding-homeowners-wisconsin-us>)



Austria centre for realistic underground research May 2020

Robert Galler, Chair of Subsurface Engineering, Montanuniversität Leoben, and Head of the ZaB-Zentrum am Berg project, Austria

ZaB-Zentrum am Berg, the new, cutting-edge testing facility opened in Austria, has been designed and developed to provide a realistic environment for research and education in the underground sector. Research topics at the facility are diverse and include fire safety; geology and geophysics; geo-thermal energy; NATM and TBM technology; underground mining techniques; sustainability and the environment; concrete technology; ICT applications; measurement and analysis technology; and numerical simulation.



Location within Erzberg mine

The centre is situated in a disused part of the Erzberg iron ore mine in the Styria region, proved to be an ideal location for the facility due to its existing tunnel system and its connections to regional road and rail networks. The facility comprises almost 3km of tunnels with different cross sections and varying overburden to facilitate research projects under various conditions.

The €30 million construction cost of ZaB-Zentrum am Berg was shared with €6 million contributions from the BMVIT, the Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology; the BMWFW, Austrian Federal Ministry for Digital and Economic Affairs; and the Montanuniversität Leoben, with the remaining €12 million allocated by the Province of Styria.

Excavation of the new areas of the centre using NATM to create twin tube, two-lane motorway sections, and a twin tube single-track railway line, began in 2016. The tunnels are each

connected with cross-passages. Parts of the existing Pressler and Kerpely tunnels of the mine were also repaired to be incorporated into the ZaB facility.



Railway tunnel Portals



Portal of the motorway tunnels

Geology

The Erzberg mine site is located at the north edge of the northern greywacke zone with the lithology comprising essentially limestone; siderite, rohwand dolomite and ankerite; Blasseneck porphyroid; and Eisenerzer beds of shale, phyllite. The Blasseneck porphyroid and the Eisenerzer beds had been categorised as problematic during construction of the old northern tunnels and had been supported, whereas the Sauberge limestone and the ore-bearing limestones were stable without further support and only showed rupturing due to jointing.



Challenging geotechnical conditions

The existing tunnels are predominantly damp with some dripping and isolated running water ingress, which was drained through the west tube of the rail tunnel toward the south portal. Starting at the south portal, the west tube of the rail



tunnel joins the south tube of the road tunnel. The cover above the centre tunnels ranges from 217m to a maximum of 235m.

The rail and motorway portals are both situated on level Dreikönig, but they are in distinct geotechnical conditions. Preparation of the slopes at both locations was therefore quite different. In the area of the railway portal, long bolts had to be used to avoid slope stability problems. As this portal is situated in a wooded area, rock fall was not an issue. In the area of the motorway portal, it was necessary to construct an intermediate level to minimise rock fall.

Although geological strata were available for observation in the open cut mine levels of the 1960s, the construction team encountered a number of challenges in the new mined headings. These included fault zones, containing completely sheared materials, and open fault zones presenting an open width of about 1m. In the old galleries of the former underground iron ore mine, six challenging sections had to be re-opened to connect them to the four new motorway and railway tunnels. This involved a substantial amount of manual work using small units of equipment.



Reopening the old galleries

Fire safety research

Several tragic tunnel fires that occurred around the turn of the millennium revealed that a lot more research was needed in the area of fire safety. Fires in enclosed spaces are characterised by rapid propagation and the sudden development of smoke gases. Air currents create an additional negative effect on fire behaviour. The efforts of emergency services are made extremely difficult and often seriously dangerous by the incandescent flame front, poisonous clouds of smoke and poor visibility conditions.



Rescue training underground

Fire safety investigations that take place in laboratories are of limited reliability and even tests that take place in existing tunnels cannot emulate a real catastrophe. Tests in existing tunnels are also laborious and expensive since the tunnel has to be closed and traffic has to be diverted. Also, in existing tunnels it is only possible to carry out tests with a restricted fire load in order to avoid damage to the structure.

The test tunnels are equipped with extensive ventilation equipment that can realistically represent the function of various ventilation systems. Extraction fans for the removal of exhaust gases and jet fans to influence the longitudinal air flow in the tunnel are also installed. This means that both longitudinal ventilation and semi-transverse ventilation can be simulated in the test tunnels.



Research and education underground

References

- [Equipping TBMs for tough conditions](#) – TunnelTalk, November 2019
- [NATM Master of Engineering programme](#) – TunnelTalk, August 2019

(TunnelTalk, May 2020, <https://www.tunneltalk.com/Research-and-Development-May2020-Underground-research-development-training-centre.php>)



California reservoir needs to be drained due to risk of failure



California reservoir needs to be drained due to risk of failure

California officials decided to drain a reservoir as its dam could fail under a strong seismic event.

The Anderson reservoir, an artificial lake in Californian Santa Clara County, was created in 1950 by the construction of the Anderson Dam, an earth dam that reaches a height of 73 meters.

The volume of the lake is large in comparison to neighboring reservoirs. Its total volume is 111 million cubic meters accounting for 53% of the total district's capacity distributed in 10 reservoirs.

11 years ago, officials announced that the reservoir should not exceed 74% of its total capacity, as it is constructed along the Calaveras Fault, a major branch of the San Andreas Fault System, and, hence, a powerful earthquake (6.6 with the dam at the epicenter, or 7.2 within 2 kilometers of the dam) could potentially result in a dam collapse. In that scenario, a 10-meter height wave would strike Morgan Hill, a city in Santa Clara County, and another 2,4-meter height wave would hit San Jose.

Today, the reservoir is below 30% of its total capacity due to a drought period that has struck California. It has been deliberately kept below 45% since Autumn, 2019.

According to the Santa Clara Valley Water District, a plan to upgrade the Anderson Dam that would cost \$563 million, was introduced in 2012. Reconstruction works would initiate in 2022, but, a lack of permits has delayed the procedures. "Valley Water has been working with several state and federal agencies through the years to secure the proper permits as the scope of the project has increased due to additional safety and design requirements," Norma Camacho, Santa Clara Valley Water Chief Executive Officer, stated.

Given the delays, it was decided to drain the lake before the implementation of the retrofit project. The reservoir must be drained by October 1, 2020, according to the U.S. Federal Energy Regulatory Commission.

This decision can cause significant ramifications. According to Christopher Hakes, a Valley Water dam safety official, the water level in the reservoir provides a supporting effect for the dam's body. "Lowering reservoir levels beyond the current level would decrease the structural reliability of the intake structure and its protection against earthquakes," Hakes had mentioned back in December 2019.

Camacho also added that the drainage would impact the wildlife and severely reduce the water reserve which is significant given that drought periods in California have become very common.

A video showing what would happen if Anderson Dam failed is presented below.

Sources: [USAtoday](#), [Weather](#), [Associated Press](#)



What would happen if Anderson Dam failed

Mercury News/Santa Clara Valley Water

(geoengineer, Mar. 04, 2020, <https://www.geoengineer.org/news/california-reservoir-needs-to-be-drained-due-to-risk-of-failure>)



The July 2018 Xe Namnoy hydropower complex dam failure: a new paper

The July 2018 Xe Namnoy hydropower complex dam failure: a new paper

On 23 July 2018 a saddle dam at the Xe Namnoy hydropower complex in Laos failed and breached, releasing 350 million cubic metres of water. The resultant flood inundated an area of about 46 square kilometres along the Vang Ngao River, a tributary of the Mekong River basin, causing massive damage. I featured [a detailed review of that event by Richard Meehan and Douglas Hamilton in 2019](#). They considered the cause of the failure:

An initial review of this failure by the first author was presented in late 2018, and was followed six months later by a review by an independent expert panel drawn by the Lao government from the [International Committee on Large Dams \(ICOLD\)](#). Both reviews concur in finding that the failure was caused by a foundation failure beneath one of the project saddle dams.

A paper has recently been published in the journal [Geomorphology](#) ([Latrubesse et al. 2020](#)) that also consider carefully the causes and impacts of this event. Whilst the paper is focused mainly on modelling and understanding the flood that resulted from the breaching of the dam, it also considers the failure mechanism of the dam itself. Interestingly the authors have examined the materials from which the dam was constructed.

What is not in doubt is that heavy rainfall prior to the failure induced the breach event. However, the dam did not overtop – indeed analysis in the paper suggests that the water was at least 15 m below the crest of the saddle dam when failure occurred. This suggests that the problem was a structural problem within the dam or within its foundation. [Latrubesse et al. \(2020\)](#) provide this illustration of the aftermath of the failure at the saddle dam. This is the clearest picture of the

failure site that I have seen:-



The site of the saddle dam breach at the Xe Namnoy hydropower complex in Laos. Image from [Latrubesse et al. \(2020\)](#), using a drone video published at <https://news.v.daum.net/v/20180803103600946?f=m>.

Note the weathered material that formed the saddle dam, sitting on top of basaltic bedrock. Images B and C show slumping in the aftermath of the breach.

The core of the dam used weathered materials quarried locally. The research team examined the characteristics of these materials. They concluded that the dam materials may have had a lower clay content than the designers had anticipated, which in turn provided a higher level of permeability than had been expected. Thus, [Latrubesse et al. \(2020\)](#) suggest that water penetrated into the core of the dam, driving piping and, ultimately, triggering a rotational failure in the dam itself, which then allowed the breach to occur.

This mechanism of failure is a hypothesis rather than a definitive analysis. But of course it is interesting at this point because of the similarity in mechanism to the failure of the Edenville Dam earlier this month.

On reflection 1: an official report on a collision between a train and a landslide in the UK in 2019

The UK Rail Accident Investigation Branch has published a report into a collision between a train and landslide debris at

Corby in Northamptonshire on 13 June 2019. Key finding:

The investigation found that the cutting slope had failed because it was not designed to cope with a large volume of water that had accumulated at its crest. Flood water had accumulated at the crest because two adjacent flood storage ponds had overfilled with water from a nearby brook.

On reflection 2: Coastal rockfalls in Sidmouth, Devon

The coastal cliffs of Sidmouth in Devon, in the Southwest of the UK, [have undergone three significant collapses in a 24 hour period](#). Many parts of the UK are undergoing an exceptionally dry Spring, so the failures are generating large plumes of dust.

Reference

Latrubesse, E.M, Park, E., Sieh, K. et al. 2020. [Dam failure and a catastrophic flood in the Mekong basin \(Bolaven Plateau\), southern Laos 2018](#). *Geomorphology*, **352**, 107221.

(Dave Petley / AGU THE LANDSLIDE BLOG, 28 May 2020, <https://blogs.agu.org/landslideblog/2020/05/28/the-july-2018-xe-namnoy-hydropower-complex-dam-failure-a-new-paper>)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΣΕΙΣΜΟΙ

Cutting-edge earthquake research on old Whirokino Bridge south of Foxton



The Whirokino Trestle and the decommissioned bridge south of Foxton.

The decommissioned Whirokino Bridge south of Foxton will give scientists and engineers around the world invaluable new insights into the strength of key infrastructure during seismic events.

The 90-year-old bridge on SH1 was recently replaced by Waka Kotahi NZ Transport Agency with a wider \$70m structure over the Manawātū River and Moutoa floodplain.

Deconstruction of the old bridge is giving Dr Lucas Hogan from the University of Auckland an unprecedented opportunity to do "real-life" testing of how a long bridge behaves in an earthquake.

"We have done a lot of bridge testing in the lab, and this is a unique opportunity to put a real bridge through its paces and even push it to failure," says Dr Hogan.

His research is the result of a ground-breaking partnership between a multitude of government, academic and corporate organisations.

The Whirokino research project has been planned for two years.

It is funded by the Earthquake Commission and QuakeCoRE and is being carried out in cooperation with Waka Kotahi as the owner of the bridge.

Dr Hogan had to wait until the Covid-19 lockdown was lowered to level 3 to join his colleague Dr Max Stephens in their new extended bubble to start the first phase of the research.

"That first stage includes installing instruments on the bridge to find out how it moves dynamically," says Dr Hogan.

"Because seismic waves travel at a finite speed, one end of a bridge will start shaking before the other.

"In a long bridge, this can potentially cause a whipsaw effect.

"While many computer models have shown this effect, there is very little physical testing to prove it.

"The Whirokino Bridge provides an opportunity to see how

these long bridges behave, which is very important given that there are many such bridges over braided rivers in the South Island."

The research will take place over 10 weeks and will include removing sections to test at the University of Auckland, as well as testing the piles on site to simulate the stresses of earthquake shaking by pushing and pulling in a controlled manner.

"This will tell us a lot about how these bridges behave after 90 years in service.

"Having the whole bridge means we can also test potential fixes for making the columns and piles more robust which could be used on any similar bridges if needed," says Dr Hogan.

Dr Hogan says a big focus will be on how the piles holding the bridge up behave in earthquake conditions.

"These types of piles are used in around half of all bridges in New Zealand, and many internationally, so it's very practical science."

EQC head of strategic research Dr Jo Horrocks said the Commission invested over \$17m each year in research to create stronger homes and infrastructure to reduce the impact of natural hazards.

"We're really pleased to be part of the team on this project.

"That we have so many organisations involved shows the importance of ensuring New Zealand has resilient infrastructure," says Dr Horrocks.

Waka Kotahi senior manager project delivery Andrew Thackwray says with more than 4500 bridges on New Zealand's roading networks, strong, safe bridges are vital to keep the country moving.

"New Zealand's engineers have created a terrific network of bridges that have proven to be extremely robust despite all the natural hazards we are exposed to in this country.

"This research will let us continue that proud tradition and build even more resilient bridges," he says.

Waka Kotahi is working closely with a division of Fletcher, Brian Perry Civil, and deconstruction experts from Jurgens Demolition, to support the scientists in carrying out their research, without adding to costs or timeframes.

In order to integrate the work effectively into the demolition programme, the research team have become an integral part of the project team.

Fletcher regional manager Andy Burgess said the company supports and knows how important this once-in-a-generation opportunity is for all those involved.

(Merania Karauria / MANAWATU Guardian, 11 May, 2020, https://www.nzherald.co.nz/manawatu-guardian/news/article.cfm?c_id=1503567&objectid=12330971)



Shallow M4.9 earthquake hits Kiruna, Sweden - the country's biggest mine-related quake ever

A shallow earthquake registered by the USGS as M4.9 with a depth of 10 km (6 miles) hit Kiruna, Sweden, at 01:12 UTC (03:12 LT) on Monday, May 18, 2020. This was the country's biggest mining-related earthquake ever and the most powerful in 12 years-- it hit an LKAB-owned mine in the town, which is the world's largest iron ore mine.

The epicenter was located about 3 km (2 miles) east of Kiruna.

The quake hit the 100-year-old mine in several areas-- 13 people were at work when it struck, but no injuries were reported as they were quickly evacuated. The mine has been closed until further notice.

Three hours after the quake, LKAB reported that the shaking caused rocks to crash into the mine and that there was still seismic activity at the site.



On Tuesday, May 19, around 300 mine workers descended into the area to assess the damage, following the initial assessment of rock mechanic engineers on Monday.

"There is still activity, but it's gone down significantly compared to yesterday. It's not something that has been felt in Kiruna, other than perhaps a little during the night," [said](#) Bjorn Lund, a seismologist at the Uppsala University, on Tuesday morning.

Electrician Johnny Kumpula told Swedish public radio broadcaster that he and a colleague were down in the mine when the earthquake occurred. "I fell off the couch. It sounded like a bomb exploding, or like thunder. Pictures came down from the walls and there was a lot of dust," he described.



"My colleague and I looked at each other and said 'let's get out of here', and then we took our mining helmets and left."

Residents in the town also felt the tremor, with one local sharing her experience after the quake woke her up. "I jumped up from bed and ran to the window to look outside," adding that she could not go back to sleep as the bed was shaking.



The town and mine of Kiruna, Sweden.

The tremor was Sweden's most powerful in 13 years and the biggest ever mining-related earthquake. Fredrik Bjorkenwall, an LKAB spokesperson, said the shake could be felt from around 20 km (12 miles) away.

The most powerful earthquake in the country was an M4.3, which occurred in Sjöbo in December 2008.

(Julie Celestial / THE WATCHERS, May 19, 2020, <https://watchers.news/2020/05/19/shallow-m4-9-earthquake-hits-kiruna-sweden-the-country-s-biggest-mine-related-quake-ever>)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΓΕΩΛΟΓΙΑ

Geology and Chemistry Drive Animal Migration in the Serengeti

Fieldwork in Tanzania suggests that soil chemistry—influenced by local volcanism and tectonic activity—might help dictate the record-setting migration of over a million wildebeests.



Over a million wildebeests migrate through the Serengeti ecosystem every year.

The most famous migration in the animal kingdom is undoubtedly that of wildebeests. Every year, roughly 1.2 million of the ungulates wind their way through Africa's Serengeti ecosystem. Researchers now have preliminary evidence that this record-setting migration is dictated by more than just precipitation patterns: Soil chemistry is also a likely driver.

A Perilous Journey

"The Serengeti is one of the last great migratory systems we've got left. "Wildebeests resemble shaggy cows with long, skinny legs. "They look funny," said Simon Kübler, a geoscientist at the Ludwig Maximilian University of Munich. "They look like a mixture of several animals." Most people know the animals from nature documentaries showing them traversing the Mara River, a perilous crossing marked by drownings and hungry crocodiles.

Every year, the animals journey roughly 500 kilometers through wide plains covered with short grasses, as well as through wooded areas and landscapes with mixed grasses and shrubs. They're following the route that their ancestors did, and that movement merits study, said Josephine Mahony, an environmental scientist at the University of Oxford not involved in the research. "The Earth has lost a lot of its migratory ecosystems over time. The Serengeti is one of the last great migratory systems we've got left."

Scientists have often studied wildebeest migration from a climatic perspective but rarely from the angle of rock chemistry and weathering, said Kübler. And what's in the ground might have a significant influence on animal grazing patterns because soil nutrient levels modulate vegetation growth.



Scientists obtained a "chemical fingerprint" of the Serengeti landscape, allowing them to determine how factors such as geology, volcanism, and tectonic activity might be affecting soil chemistry and nutrient availability, which in turn influence vegetation growth and therefore migration patterns.

Credit: iStock.com/mantaphoto

The Chemistry of the Serengeti

Last October, Kübler and three colleagues from German and African institutions met in Serengeti National Park in Tanzania. Starting in the southeastern part of the park, the researchers spent 2 weeks in a beige Toyota Land Cruiser re-tracing the wildebeests' clockwise migration route.

Along the way, Kübler and his collaborators collected samples of rock, soil, and vegetation. The aim, said Kübler, was to obtain a "chemical fingerprint" of the landscape. That fingerprint would allow the team to determine how factors such as geology, volcanism, and tectonic activity might be affecting soil chemistry and nutrient availability, which in turn influence vegetation growth and therefore migration patterns.

Most of the samples are still awaiting analysis in a laboratory in Arusha, Tanzania, said Kübler. But the team, represented by Eileen Eckmeier from the Ludwig Maximilian University of Munich, presented several preliminary results at this month's EGU2020: Sharing Geoscience Online, a virtual series hosted by the European Geosciences Union.

The site farthest south that the team sampled—within the animals' springtime grazing grounds—is characterized by soils enriched by a nearby volcano, the researchers found. Ol Doinyo Lengai, roughly 50 kilometers east of Serengeti National Park, holds a unique honor among volcanoes: It produces magma rich in sodium and calcium. (That's unlike most other volcanoes, which spew out silica-rich magma.)

Ash from Ol Doinyo Lengai rains down on the southeastern part of the park and sprinkles calcium into the soil, Kübler said. "You can see calcium carbonate concretions in the soils."

"The geological system that's underlying the entire ecosystem might be stable for longer periods of time." This nutrient contributes to soil fertility, which in turn promotes vegetation growth. Calcium also helps animals develop strong bones. It's probably not a coincidence that wildebeests graze here with their young, said Kübler. "We believe that the activity of Ol Doinyo Lengai, as the calcium source for the southeastern part of the ecosystem, is critical for keeping the migration alive."

The next site that the team visited was a transitional grazing spot where wildebeests spend late fall and early winter. Chemical analyses are still in progress, but "we believe that

the nutrient levels in the soils [here] are probably the lowest,” said Kübler. “Wildebeest can only stay for a limited amount of time until they migrate farther north.” Water-induced erosion likely contributes to the poor soil quality in this region, the team concluded.

The third and final site the scientists analyzed was near the northernmost border of the park, where wildebeests spend the late summer and early fall. Because of high precipitation levels in this area, rocks experience more chemical weathering, the team hypothesized, which releases nutrients into the soil and promotes vegetation growth. Furthermore, there’s a source of fresh rock because tectonic activity and uplift are occurring near this part of the park, said Kübler. “Tectonic processes can expose fresh and unweathered rocks.”

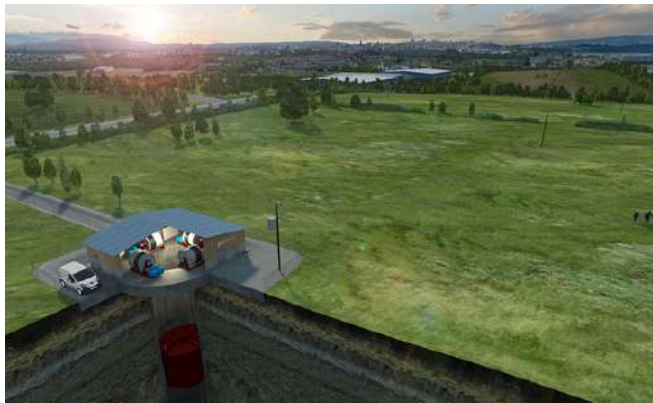
In the future, Kübler and his colleagues plan to study the timescales over which geologically important processes like volcanism and tectonic activity occur. “Climatic signals may be active on shorter timescales,” said Kübler. “The geological system that’s underlying the entire ecosystem might be stable for longer periods of time.”

Citation: Kornei, K. (2020), Geology and chemistry drive animal migration in the Serengeti, *Eos*, 101, <https://doi.org/10.1029/2020EO144423>. Published on 27 May 2020.

(Katherine Kornei, Science Writer / Eos Science News by AGU, 27 May 2020, <https://eos.org/articles/geology-and-chemistry-drive-animal-migration-in-the-serengeti>)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΠΕΡΙΒΑΛΛΟΝ

Gravitricity to pilot £1m gravity-based energy storage system in Edinburgh



It is envisaged the system could eventually be installed in disused mine shafts

UK start-up signs land rental agreement to build its first energy storage demonstrator at the Port of Leith

Gravitricity is set to build a £1m working demonstration of its innovative energy storage system which harnesses the power of gravity to store energy and provide grid balancing services, having secured a land rental agreement for the pilot project in Edinburgh.

In what would be the first working demonstrator for its gravity-based energy storage system, the UK start-up said it planned to begin building work on the project in October this year at an industrial site at the Port of Leith. The company plans for the pioneering energy storage system to be up and running by December.

Gravitricity's 'battery' works by raising multiple heavy weights, totalling up to 12,000 tonnes, in a deep shaft and releasing them again when energy is required. The company envisages installing the system underground in disused mines around the world, providing a cost effective means of energy storage to provide flexibility services to grids that are becoming increasingly reliant on renewables.

Earlier this year the company secured £300,000 funding from Innovate UK to assess the suitability of former mine shafts in South Africa for the technology, with previous research¹ having indicated the system could potentially store energy at half the lifetime cost of lithium ion batteries.

The pilot project at the Port of Leith is set to trial the system at a much smaller scale, with a 16-metre high rig due to be installed that would utilise the port's electrical network and grid connection to demonstrate the speed of response of the energy storage system, Gravitricity explained.

"This grid-connected demonstrator will use two 25-tonne weights suspended by steel cables," said the firm's lead engineer Miles Franklin. "In our first test we'll drop the weights together to generate full power and verify our speed of response. We calculate we can go from zero to full power in less than a second - which can be extremely valuable in the

frequency response and back-up power markets. We will then run tests with the two single weights, dropping one after the other to verify smooth energy output over a longer period."

Franklin said the two-month test programme - supported by a previous £640,000 grant from Innovate UK - would provide valuable data to help inform the development of Gravitricity's first full-scale 4MW energy storage project, earmarked to commence in 2021.

¹ <https://www.businessgreen.com/news/4013456/gold-rush-gravitricity-secures-gbp300-scope-south-african-mines-energy-storage-potential>

(Michael Holder / BusinessGreen, 11 May 2020, <https://www.businessgreen.com/news/4015015/gravitricity-pilot-gbp-gravity-energy-storage-edinburgh>)



Natural Wonders of China

1. Zhangye Danxia National Geopark



Seven Colored Danxia "Rainbow Mountains"



Binggou Danxia "Ice Valley"



Zhangye Danxia National Geopark houses 2 of the most unique geological formations in the world and without a doubt one of China's most awe-inspiring natural wonders. The striking layers of color of the Rainbow Mountains and oddly phallic shaped rock columns in Ice Valley are formed from layers of sand and mudstone that have slowly eroded away over the years exposing the striking colors and shapes seen today.

China is actually home to many different danxia formations around the country, with Zhangye Danxia, of course, being the most spectacular of them all. What actually is danxia you ask? It's a specific geological formation in China created when sand/mudstone is broken apart by tectonic movements creating many different faults and resulting in the creation of dramatic red cliffs.

2. Tibetan Plateau



Sunrise in Tagong, Kham, Tibet.



Hiking in the Tibetan Grasslands.

When we go to Tibet we truly do feel like we've crossed over into another country. Different landscapes, different architecture, different culture and different languages all flood your senses in a beautiful way up on the Tibetan Plateau. It truly is a must see Natural Wonder of China...and cultural wonder and architectural wonder and yeah, it's just wonderful place!

3. Wulingyuan Scenic Area, Zhangjiajie



Mountains in the mist in Wulingyuan Scenic Area.



Declared a UNESCO World Heritage Site in 1992, the stunning pillars of Wulingyuan Scenic Area formed as a result of physical erosion from wind and water over many thousands of years. The rock in this area is composed of sandstone, which is easily eroded from weathering. The erosion that caused the incredible "floating mountains" of Zhangjiajie is quite unique compared to other geological formations throughout the world. The majority of the weathering in Zhangjiajie is actually a result of the freezing and thawing cycle of the dense foliage that grows on the rocks. Over thousands of years of freeze and thaw, the mountains have been gradually chipped away little by little, forming the now independently standing columns seen today.

4. Li River, Guilin



On top of a mountain at sunset in Xingping, Guilin.



Views down the river from our bamboo raft. A cruise down the river is a must when in Guilin!

Formally known as the Lijiang River Scenic Zone, the Li River in Guilin definitely lives up to its hype. Here, striking, finger-like karst mountains line either side of the river making for some unique and jaw-dropping views. The mountains here are similar to those of Zhangjiajie, except not as "column", or finger-like. These guys still retained their typical mountain shape, unlike those of Zhangjiajie which are just straight up and down columns.

Unlike the sandstone mountains of Zhangjiajie, the mountains here are of karst composition, meaning they're made of limestone. The natural erosion that causes the unique mountains of Guilin is due to chemical dissolution, in which the rock gets slowly dissolved by the water surrounding it. This also creates some insane caves inside the mountains, of which Guilin has some of the largest in the world.

5. Huanglong Pools



Picture stunningly clear water and natural multicolored pools that cascade down a picturesque mountain valley lined with waterfalls and temples and you've got the awesomeness that is the Huanglong Pools. Formally known as the Huanglong National Scenic and Historic Interest area, this beauty has been a UNESCO World Heritage Site since 1992.

Inside of the Huanglong Scenic Area you can feast your eyes on over 2600 pools, a stunning 14 meter tall 68 meter wide waterfall, another smaller waterfall, a "washing cave" as they call it (basically it looks like a cross section of a cave with water flowing over it), and two ancient temples.



Huanglong's travertine landscape was formed via a combination of terrain, glacial movement, rapid deposition of calcium carbonate from mineral springs in the area, and the strong natural sunlight that comes with being at a high altitude. Travertine is basically a type of limestone that forms these kinds of cascading terraces like you see at Huanglong.

While this landscape is not unique to China (other places in the world, like Yellowstone National Park in the US, for example) have these same type of pools, at 3.6 kilometers long from the first terrace to the last, the length of these cascading pools is the **LONGEST IN THE WORLD** making them an absolute wonder to behold.

6. Tiger Leaping Gorge



The entrance to Tiger Leaping Gorge, as seen from the road

One of the largest and most legendary gorges in the world, Tiger Leaping Gorge is simply spectacular to behold. At 3790m deep and 15 km long there is certainly a lot to marvel at and explore. Sharp rocky peaks cut through the clouds while the Jinsha River (a primary tributary of the famous Yangtze River) roars through the canyon below. As a section of the Yangtze River flows through the gorge, the area is actually considered a part of the 3 Parallel Rivers of Yunnan Protected Areas World Heritage Site (wow, that's a mouthful).

The gorge gets its unique name from a legend that tells of a tiger that was chased by a hunter into the gorge and escaped by leaping across the narrowest part of the river (25 meters in width) from one boulder to another.



7. Detian Waterfall



Located on the border between China and Vietnam, the Detian waterfall or Ban Gioc waterfall as it's named in Vietnamese is the 4th largest transcontinental waterfall in the world and the **LARGEST WATERFALL IN ASIA!!**

Detian Falls is 200 meters wide and 70 meters tall and is divided into a total of 3 layers of cascades that flow through tropical trees and brush creating a very surreal and ethereal look. While the waterfall runs year round it is most impressive from late spring to early fall when the flow of water is at its strongest.



<https://www.crawfordcreations.org/natural-wonders-china/>

6. Stone Forest, Yunnan Province



This is a legitimate naturally made stone forest museum in the world. This incomparable limestone formation is the only Karst scenic area in subtropics plateau which lies between 1500m-1900m altitude. 200 million years in the making, this unique piece of natural art is a result of tectonics movement in a previously large sea area with limestone deposits. This picturesque natural wonder has been a UNESCO World Heritage Sites since 2007.

7. Yellow Mountain, Anhui Province

Mount Huang or most commonly known as the Yellow Mountain of China is known for its "five matchless" things: breathtaking sunrise, vividly detailed rocks, comforting pines, majestic sea of clouds, and calming thermal spring—which explains why it is one of China's most photogenic scenery. What more can you ask for?



8. Longsheng Rice Terraces, Guangxi



Although the formation of this magnificent land creation is man-made, this is still a natural wonder that has been handed over through history since the Yuan Dynasty. This expanse covers an entire 66 kilometers of southeast Longsheng. It is indeed a visual treat amongst tourists but it should be kept in mind that this was also an innovative way of farming in the past.

9. Yamdrok Lake, Tibet



The "swan lake" or "jade lake in the upper pastureland" of Tibet has a coverage of 130 kilometer-length and 70 kilometer-width. This magnificent body of fresh water which streams below the snow capped mountains is just one of the three largest holy lakes in Tibet. The panoramic view, however, of the river from an elevated angle is indescribable.

11. Silver Cave, Guangxi Province



If you want a more indoor type of nature tripping, then enter the out-of-this-world dimension of Silver Cave. It is a floor-type cave that features a variety of stalactites that look like silver sparkling. The dramatic formation inside is highlighted even more with rainbow-like lights. Legend has it that "anyone who has been to Silver Cave would never short of money." Who knows, you may even entering through a tunnel of good fortune!

12. Heaven Lake, Jilin Province

No one calls a place "Heaven" if it doesn't look heavenly, but the sight of Heaven Lake is definitely one for the books and its name is never to be argued. Heaven Lake is a crater lake

that sits on the border between China and North Korea. The royal blue water is a standout foreground of the volcanic Baekdu Mountain's caldera that surrounds it. Though it can be a tricky journey, the sight can never be found elsewhere.



13. Taklamakan Desert, Xinjiang Uyghur Autonomous Region



Never thought a desert could exist in China? China's diverse land area also covers this extremely beautiful Taklimakan Desert. It is located at the country's northwest region and covers an expanse of 337,000 sq km. It has also witnessed the footsteps of the early people as it has a recorded history that dates 4000 years ago. The sand dunes is a feast in the eyes.

14. Mount Lu, Jiangxi Province



The magnificent oval shaped mountain happens to house a UNESCO World Heritage Site Lushan National Park. It is a nature attraction within a nature attraction. In Mount Lu, you can visit its famous sites like the Immortal Caverns, Three Tiled Springs, Luling Lake, Botanical Gardens, and tons of more! It was also dubbed as China's summer capital.

15. Yalong Bay, Hainan Province



Before ending your trip in China, take some R & R in the beach or end your itinerary at Yalong Bay. Yalong Bay has been very accessible to tourists for the past recent years. Its white sand shore stretches up to 7.8 kilometers. This relaxing and mesmerizing beach can probably be your best journey-ender.

<https://trekeffect.com/blogs/travel/15-spectacular-natural-wonders-china>

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΛΟΙΠΑ



<https://www.e-archimedes.gr/latest/item/7537-?fbclid=IwAR0EH9twBWf1jiMmm9oRWGVz-Vk22OrRubbKrLw1q8exm04zH3SkSt6leU>



**Ο ελληνικός δρόμος με τις 30 συνεχόμενες
στροφές**
**Με μαγευτική θέα στον Αργολικό κόλπο και το Ναύ-
πλιο**



Περισσότερες από τριάντα συνεχόμενες στροφές πάνω στον άγριο ορεινό όγκο του Κτενιά, στην Πελοπόννησο, συνθέτουν μία από τις πιο γνωστές οδικές αρτηρίες της χώρας.

Ο λόγος για την παλαιά εθνική οδό Άργους-Τριπόλεως, η οποία είναι γνωστή και με την ονομασία Κωλοσοούρης. Η τρομερή αυτή διαδρομή κατά το ανέβασμα προσφέρει μία εκπληκτική θέα προς τον Αργολικό κόλπο και το Ναύπλιο, ενώ στο ερημικό τοπίο που την περιβάλλει παρατηρείται και ένα γκρεμισμένο οχυρό της γερμανικής κατοχής.

Ο Κωλοσοούρης, λοιπόν, παλιά αποτελούσε μία από τις μεγαλύτερες οδικές καρμανιόλες της χώρας, με πολύ στενό δρόμο, στροφές 180 μοιρών μια ανάσα από τον γκρεμό και ολισθηρό

οδόστρωμα. Δεδομένου ότι ήταν η μοναδική αρτηρία για την κεντρική Πελοπόννησο, μπορεί να αναλογιστεί κανείς την επικινδυνότητα της οδήγησης στον συγκεκριμένο δρόμο.

Απολαύστε μια πτήση πάνω από τον 40 χλμ. θρυλικό δρόμο, απολαμβάνοντας τα πλάνα που εξασφάλισε ο youtuber [haanity](https://www.youtube.com/watch?v=KeMse7_fEv0).



https://www.youtube.com/watch?v=KeMse7_fEv0

(newsbeast, 12.05.2020, <https://www.newsbeast.gr/travel/destinations/arthro/6274801/o-ellinikos-dromos-me-tis-30-synechomenes-strofes>)



Iconic pedestrian bridge over Scioto River connects city life of Dublin, Ohio



"We strive to provide the best quality of life and environment in which our residents and business can thrive."

The aforementioned quote is taken directly from the mission statement for the city of Dublin, Ohio. This city, which is home to more than 47,000 residents, lies to the northwest of the state's capital. Keeping on brand with its status as a namesake for the largest city and capital of Ireland, the Columbus suburb annually hosts the Dublin Irish Festival, one of the largest Irish cultural events in the U.S. The city is also home to over 20 corporate headquarters, over 4,300 businesses, and the walkable Bridge Street District.

It comes as no surprise then that such a community would desire to create an iconic landmark that would help connect

its residents and visitors to the plentiful offerings found throughout the vibrant city.

Back in 2007, the city of Dublin had envisioned a bridge that would serve both pedestrians and bicyclists in the community. That year, the city council adopted a community plan which for the first time depicted a pedestrian crossing linking the east and west sides of the Scioto River, which runs north to south through the city.

"We have historic Dublin on the west side of the river, and then we have a newer development called Bridge Park on the east side of the river," Megan O'Callaghan, Deputy City Manager and Chief Operating Officer for the city of Dublin, told Roads & Bridges. "There's a lot of activity going on on both sides of the river—residential, restaurants, shopping, business. So this connection will serve as a great amenity for the residents in Dublin."

From vision to design

The goal for the city of Dublin was to create a signature bridge across the Scioto River that would connect the future Riverside Crossing Park on the east side to commercial, residential, and retail facilities in downtown Dublin on the west side. The future Riverside Crossing Park encompasses both sides of the river and features infrastructure and open space designed to support all aspects of city life—with public plazas, outdoor ice skating, rock climbing, river access, and nature paths all available for public enjoyment.

While the public had access to cross the river via roadway bridges along Bridge Street to the south and Emerald Parkway to the north, the city was looking for an opportunity to provide an attractive amenity for pedestrians and cyclists. According to O'Callaghan, who served as the city's project manager for the Scioto River pedestrian bridge, the other bridges can be a bit daunting for people who want to walk or bike across the river, as they are designed to accommodate vehicular traffic. "Having a connection that's dedicated to both bicyclists and pedestrians is important for us to create that walkable environment in this area of town," O'Callaghan said.

Sometime after the city council's adoption of the community plan for the pedestrian bridge, Dublin officials engaged architect Endrestudio of Emeryville, California to develop concepts for the future pedestrian bridge connection across the river. By January 2016, the final design process for the bridge began, with T.Y. Lin International serving as the prime consultant.



Over a decade of planning and work has allowed the city to achieve its goal of bringing its residents and visitors an iconic, signature pedestrian bridge now called the Dublin Link.

Through the eye of a needle

The recently opened pedestrian bridge over the Scioto River is a 760-ft-long structure that passes through a concrete pylon tower that resembles the eye of a needle and follows an S-curve alignment. Designing the pylon shape for construction was one of the most complex pieces T.Y. Lin was tasked to tackle.

"That was from the architect's original vision of the bridge was to have this needle-shape pylon with the bridge passing through the eye of the needle," Dan Fitzwilliam, P.E., Senior Bridge Engineer for T.Y. Lin International, told Roads & Bridges. "So the bridge actually doesn't get supported at all by the pylon, it's completely suspended through that section."

The designer explained that the pylon base had to be built parallel to the river flow to minimize water disturbance and scour. The design team produced detailed 3-D BIM models of the pylon geometry, including all rebar, embedded steel elements, and electrical and lighting to identify and resolve potential clashes between elements. For T.Y. Lin, the 3-D modeling proved to be extremely valuable for defining the complex twisting shape of the pylon in a way that was constructible for the contractor.

Another challenging component for the design team came in the form of the bridge's S-curve alignment, which was a necessary design choice for the shape since the identified landing areas on the east and west bank of the river were not quite aligned with one another. A suspension bridge style was selected, and in order to provide unobstructed views and walkways, the stays could only be attached to one edge of the superstructure.

"There's a single main cable coming down each way from the pylon," Fitzwilliam explained. "[On a] conventional cable stay, you have pairs of stays supporting both sides of the deck. So to support it on one edge of the deck only, the bridge ended up having some torsion in the deck. And by putting that S-shape curve into the deck, we are able to balance a little bit of that torsion by creating an arching effect in the plan direction."

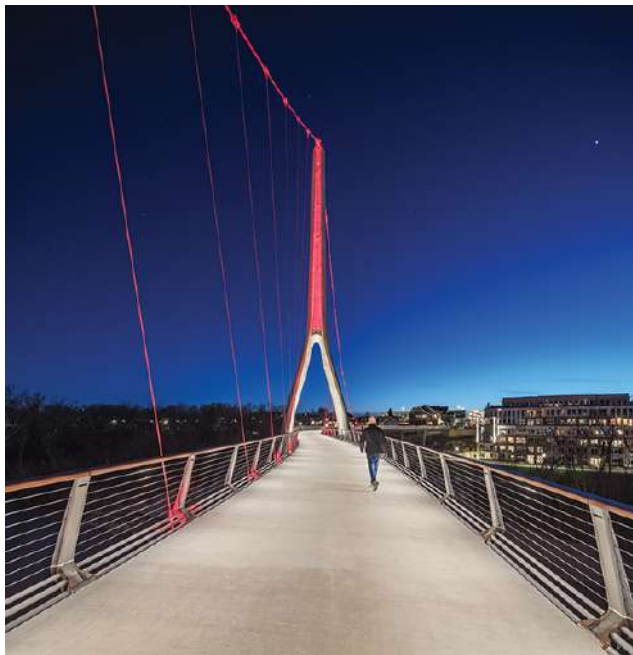
According to the designer, the bridge effectively cantilevers out 14 ft from the stay attachment point. The resulting torsion generated from the asymmetrical supports is carried by a combination of the closed form of the triangular steel box girder and counter-torsion of the reverse curve on the opposite span of the bridge.

Since the bridge is a lightweight, cable-supported structure, a number of vibrational studies were conducted on the bridge to verify that the structure had torsional stability under a particular set of conditions. "In this bridge, we were relatively stable vertically, but we had some potential for vibrations in the transverse direction," Fitzwilliam said. "So we ended up designing a mass damper for the bridge. We put in two of these mass dampers at the midpoint of each span, the main span. And typically mass dampers are used in bridges as vertical mass dampers to dampen any vertical vibrations, but in this case we needed to dampen horizontal vibrations." Fitzwilliam explained that this is called a pendulum tuned mass damper, which acts in a horizontal direction.

Constructing in the river

For the city of Dublin and contractor Kokosing Construction, one of the initial challenges involved procurement of the cable system materials for the bridge since the coiled cables were only available from three different companies, all of which were located in Europe. This led to an extensive pro-

cess of identifying the right fabricator and later to an extensive testing process as specified in the contract. "The testing took quite a few months to work through all of the specification details, and the testing parameters, and then the actual testing itself," O'Callaghan said. "There were only two labs I believe that could perform one of the specific tests."



The city had the pylon lit up red one night, an aesthetic feature made possible by a sophisticated LED lighting package to illuminate the structure at night with various colors.

O'Callaghan also explained that the unique elements of the bridge's pylon—which took about a year to build—required every form to be custom made. Additionally, the bridge's structural steel was fabricated in Tampa, Florida, with triangular-shaped beams about 10 ft wide. This project also saw the first time in Ohio that the contractor was selected through a Construction Manager/General Contractor (CM/GC) process, allowing the city of Dublin to solicit contractors prior to the completion of design work.

"There aren't any bridges [like this] in the state, so we really had to work closely with the contractor and work closely with the designer," O'Callaghan said. "We reached out to a few other entities who had built a suspension-type bridge, and we also identified a couple of S-curve shape bridges, so we reached out to those entities to discuss. But this really is a one-of-a-kind bridge, especially in the U.S."

As construction of the bridge was required to occur in the river, the team had to build a causeway at the beginning of the construction process. The causeway, which has remained in place, served as a work pad for the contractor as the team built the pylon and set the steel. It is currently being used to facilitate the bridge painting of the structural steel. Once the finishing touches are complete, the causeway will be removed and the riverbed will be restored to the same condition it was found pre-construction.

Opening to a pandemic

Originally, the city's plan was to open the bridge with a community celebration over St. Patrick's Day weekend, with a bridge opening and illumination ceremony planned for March 13, 2020, the day before the holiday festivities were to take place.

"Unfortunately, that's the week COVID-19 started rearing its

head, and we ended up having to cancel," O'Callaghan said. "So what we did was we just did a quiet opening the following Monday morning [March 16]. And the community's really been enjoying it during this time." She said the city plans to celebrate the opening as soon as it is deemed safe to do so.



The eye-of-the-needle concrete pylon tower shape was one of the most complex pieces to design.

The 14-ft-wide bridge deck is intended for bicyclists and pedestrians to coexist on the structure over the Scioto River. The path along the bridge is an extension of the city's extensive shared-use path system that covers over 140 miles throughout Dublin. While there is no striping to separate lanes for various users, the city has posted guidelines for bikes to yield to pedestrians, as well as for pedestrians to move to the right when being passed, etc.

Additionally, the city has taken extra steps to post signage for bridge users to be mindful of social distancing guidelines to prevent the spread of coronavirus. "We've placed signs at either end of the bridge letting our residents know that we invite them to enjoy the bridge but to practice social distancing," O'Callaghan said. "We also ask that they not touch the handrails and things like that."



Construction of the 760-ft-long structure taking place over the Scioto River. The bridge follows an S-curve alignment.

The Dublin Link

Around the time of the opening, it was announced that the pedestrian bridge over the Scioto River was given a name, one that would capture the iconic status of the bridge for the community it serves—The Dublin Link.

A smooth final touch to the bridge's aesthetic is the addition of a sophisticated LED lighting package to illuminate the

structure at night. O'Callaghan says the city is "having fun with the lighting," which is changeable and color-programmable. In the weeks following the opening, the city had the pylon lit up red one night, while another night it displayed red, white, and blue lighting.

All of this has helped the city achieve its goal to bring its residents and visitors an iconic, signature bridge. "The community I think really enjoyed watching the bridge being built, and they have really enjoyed being able to experience it since it's been open," O'Callaghan said. "And it really has turned into that landmark that it was envisioned to be."

This feature published as "Signature Link" in May/June 2020 issue

(Tim Bruns / ROAD&BRIDGES, May 13, 2020, <https://www.roadbridges.com/iconic-pedestrian-bridge-over-scioto-river-connects-city-life-dublin-ohio>)



«Φυσικά» ρομπότ

Έμπνευση από τις κινήσεις ζώων, πτηνών και ερπετών παίρνουν οι ερευνητές για να δώσουν ξεχωριστές δεξιότητες στη νέα γενιά ρομπότ



Πριν από λίγα χρόνια ένα ανθρωπόμορφο ρομπότ το οποίο είχε την ικανότητα να κάνει άγαρμες κινήσεις μιμούμενο αυτές του ανθρώπου ήταν η κυρίαρχη εικόνα η οποία μας ερχόταν στο μυαλό όταν αναφερόμασταν στη ρομποτική. Πλέον, αυτή η εικόνα τείνει να παρέλθει: οι επιστήμονες μελετώντας την κίνηση πολλών και διαφορετικών οργανισμών έχουν καταφέρει να την ενσωματώσουν σε ρομποτικές κατασκευές. Μαζί με την εκκλεπτυση των κινήσεων των ρομπότ, μεταβάλλεται και η αντίληψη που έχει ο άνθρωπος για αυτά: ήδη έχουν αναδυθεί επιστημονικά πεδία όπως αυτό της Κοινωνικής Ρομποτικής, το οποίο μελετά την εικόνα που έχει ο άνθρωπος για τα ρομπότ και την αλληλεπίδρασή του με αυτά. Σε αυτό το αφιέρωμά σας παρουσιάζουμε ρομπότ ικανά να εκτελούν επιδέξιες κινήσεις, οιωνοί ενός μέλλοντος όπου τα ρομπότ θα μιμούνται σε τέτοιο βαθμό της κινήσεις ζωντανών οργανισμών, που ίσως να δυσκολευόμαστε να αναγνωρίσουμε ότι δεν πρόκειται για έμβιο οργανισμό.

PigeonBot

Από τότε που ο άνθρωπος κατάφερε να πετάξει παρατεταμένα πάνω από το έδαφος, δεν σταμάτησε να αναζητεί λύσεις για να καταστήσει την πτήση πιο αποδοτική και ασφαλή. Και φυσικά, ένας από τους αποδοτικότερους τρόπους για να πάρει ιδέες ήταν η μελέτη της ανατομίας των πτηνών. Η πτέρυγα

ενός πουλιού έχει δεκάδες φτερά, των οποίων η συντονισμένη κίνηση προσφέρει στο πτηνό μια εξαιρετική ευελιξία. Μέχρι σήμερα οι επιστήμονες δεν είχαν καταφέρει να μιμηθούν αυτή τη λεπτή κίνηση – όλα τα τεχνητά πτερύγια, όσο και αεροδυναμικά να είναι, παραμένουν μονοκόμματα και καθόλου πρόσφορα για εκλεπτυσμένες κινήσεις. Ερευνητές από το Πανεπιστήμιο του Στάνφορντ μελέτησαν την κίνηση των φτερών περιστέρων χρησιμοποιώντας ως σημείο αναφοράς δύο σημεία άρθρωσης των φτερών – και αφού χαρτογράφησαν την κίνηση, κατασκεύασαν το «PigeonBot», ένα ιπτάμενο ρομπότ το οποίο διαθέτει πτερύγια τα οποία δεν έχουν σχεδόν τίποτα να ζηλέψουν από αυτά των περιστέρων. Το ρομπότ αυτό έχει την ικανότητα να απλώνει και να διπλώνει τα πτερύγιά του κατά τη διάρκεια της πτήσης, ικανότητα η οποία του επιτρέπει να εκτελεί ευέλικτες κινήσεις. Μάλιστα, στο πλαίσιο της έρευνας με σκοπό την κατασκευή του εν λόγω ιπτάμενου ρομπότ, τα αποτελέσματα της οποίας δημοσιεύτηκαν πρόσφατα στην επιστημονική δημοσίευση «Science Robotics», οι επιστήμονες διαπίστωσαν ότι τα περισσότερα ενδέχεται να χρησιμοποιούν συγκεκριμένες αρθρώσεις για να ελέγξουν την κίνηση των φτερών, γνώση η οποία μέχρι σήμερα δεν ήταν γνωστή. Σύμφωνα με τους ερευνητές, τα συγκεκριμένα φτερά μπορούν να αποτελέσουν έμπνευση για νέες γενιές φτερά στα αεροπλάνα ή στα μη επανδρωμένα αεροπλάνα (drones), των οποίων η ευελιξία θα καταστήσει την πτήση πιο ευέλικτη και τα μη επανδρωμένα αεροπλάνα ικανότερα να αποφεύγουν συγκρούσεις.

Ο σαλταδόρος

Μπορεί αυτό το συμπαθητικό ρομποτάκι να δείχνει ανίσχυρο όμως, όπως υποδηλώνει και το όνομά του, μπορεί να γίνει πολύ «άτακτο» χοροπηδώντας και φτάνοντας σε απόσταση από το έδαφος όσο τέσσερις φορές το ύψος του. Οι μηχανικοί «τένοντες» του μικρού αυτού ρομπότ μιμούνται αυτούς των Γαλάγγων, ημιπιθήκων που ενδημούν στην Αφρική και των οποίων η ανατομία τόσο των τενόντων όσο και των μυών τους επιτρέπει να κάνουν πολλαπλά πηδήματα καθώς μετακινούνται. Σύμφωνα με τους ερευνητές, ο «Salto» μπορεί να χρησιμοποιηθεί σε αποστολές οι οποίες απαιτούν πρόσβαση σε στενά περάσματα, όπως στην περίπτωση αναζήτησης ανθρώπων κάτω από συντρίμια ή εξερεύνησης σε βραχώδεις περιοχές. Παρ' όλο που ο «Salto» κατασκευάστηκε για πρώτη φορά το 2016 από ερευνητές του Πανεπιστημίου του Μπέρκλεϊ, οι βελτιώσεις στις κινήσεις του ρομπότ συνεχίζονται, με την τελευταία έκδοση να παρουσιάζεται μόλις πριν από λίγους μήνες. Η συγκεκριμένη έκδοση είναι και η πιο εξελιγμένη, οι τεχνικές προδιαγραφές της οποίας επιτρέπουν στο μικρό ρομπότ να χοροπηδάει για σχεδόν δέκα λεπτά με ικανοποιητική σταθερότητα ακόμη και σε ελαφρώς ανώμαλα εδάφη. Ωστόσο, μένουν αρκετά να γίνουν: το συμπαθητικό ρομποτάκι δεν έχει επαρκή αντίληψη του χώρου ώστε να μπορεί να χοροπηδάει σε μη συνηθισμένες επιφάνειες, όπως παραδείγματος χάριν σε σκάλες, ούτε να αποφεύγει εμποδία τα οποία βρίσκει στον δρόμο του.

Κορμί φιδίο

Ανάμεσα στη λίστα με τα ρομπότ με τις πιο επιδέξιες κινήσεις δεν θα μπορούσε φυσικά να λείπει το ρομπότ το οποίο μιμείται την κίνηση του φιδιού. Όχι επειδή το φίδι είναι ιδιαίτερα επιδέξιο στις κινήσεις του, αλλά επειδή παραμένει μια πρόκληση για τον άνθρωπο να κατασκευάσει ένα ρομπότ του οποίου το σώμα να είναι εξίσου μαλακό και ευλύγιστο με αυτό ενός φιδιού. Ερευνητές από το Πανεπιστήμιο Ηλεκτροεπικοινωνιών στο Τόκιο της Ιαπωνίας παρουσίασαν πριν από λίγους μήνες ένα ρομπότ το οποίο χάριν στα διάκενα τα οποία υπάρχουν μεταξύ των τεχνητών τμημάτων του σώματός του, μπορεί να συρθεί μέχρι και σε κάθετες επιφάνειες χωρίς να αποκολληθεί από αυτές. Μια ιδιαίτερα απαιτητική δοκιμασία στην οποία υποβάλλεται η πλειονότητα των ρομπότ είναι το σκαρφάλωμα μιας σκάλας. Το ρομπότ-φίδι έδειξε ενθαρρυντικά αποτελέσματα σε αυτού του είδους τη δοκιμή, αφού κατάφερε να α-

νέβει τις σκάλες, με το σώμα του να «μοιράζεται» στα σκαλοπάτια διατηρώντας στο πέρασμά του στενή επαφή με την επιφάνειά τους, όπως ακριβώς θα έκανε ένα ερπετό. Μάλιστα, οι ερευνητές έχουν τη δυνατότητα να προσαρμόσουν στο «κεφάλι» του ηλεκτρονικού φιδιού δαγκάνες οι οποίες μπορούν να μεταφέρουν αντικείμενα, ικανότητα η οποία είναι πολύτιμη για περιπτώσεις όπου υπάρχει η ανάγκη μεταφοράς υλικών μέσω πολύ στενών περασμάτων.

Ηρεμη δύναμη

Ενα από τα εντυπωσιακότερα ρομπότ από άποψη κινησιολογίας είναι το «Mini cheetah», ένα ρομπότ του οποίου το σώμα έχει σχεδιαστεί σύμφωνα με τον σωματότυπο του γατόπαρδου. Τον περασμένο Νοέμβριο ερευνητές από το Τεχνολογικό Ινστιτούτο της Μασαχουσέτης έκαναν μια επίδειξη των τελευταίων δυνατοτήτων του τεχνητού αυτού γατόπαρδου, κατά την οποία τα ρομπότ κατάφεραν να παίξουν μέχρι και... ποδόσφαιρο – υποτυπωδώς μεν, αλλά κάνοντας κινήσεις οι οποίες είναι ήδη εντυπωσιακές για ένα ρομπότ. Το σώμα τους είναι ευλύγιστο σε τέτοιον βαθμό ώστε ακόμη κι όταν συγκρουστούν με ένα εμπόδιο έχουν την ικανότητα να επανέρχονται σε τετράποδη στάση. Το βάρος τους είναι μόνο δέκα κιλά, κάτι το οποίο αφήνει το περιθώριο για πολύ ευέλικτες κινήσεις, όπως το να κάνει... κωλοτούμπα 360 μοιρών, με το σώμα του να επανέρχεται έπειτα στην αρχική του θέση. Ενα από τα βασικά πλεονεκτήματα του συγκεκριμένου ρομπότ είναι ότι ακόμη κι αν κάποια εξαρτήματα φθαρούν κατά τη λειτουργία του, μπορούν εύκολα να αντικατασταθούν, αφού αυτά κουμπώνουν μεταξύ τους σαν τουβλάκια λέγκο. Οι ερευνητές έχουν αναπτύξει σε τέτοιον βαθμό το εν λόγω ρομπότ, ώστε δοκιμάζον λογισμικά τεχνητής νοημοσύνης τα οποία θα δώσουν τη δυνατότητα στους τεχνητούς γατόπαρδους να προσανατολιστούν με ευκολία στον χώρο αλλά και να κάνουν «έξυπνες» κινήσεις, όπως να αποφεύγουν εμπόδια τα οποία συναντούν στον δρόμο τους.

Τελειοποιώντας τις μανούβρες

Το κολιμπρί είναι ένα από τα εντυπωσιακότερα πουλιά, τόσο λόγω των φανταχτερών χρωμάτων του τα οποία του δίνουν μια εξωτική εμφάνιση όσο και λόγω των κινήσεών του. Μια εντυπωσιακή ικανότητα του κολιμπρί είναι ότι μπορεί να αρπάζει την τροφή του παραμένοντας στον αέρα, χωρίς να προσγειωθεί σε παρακείμενη επιφάνεια: κάνοντας επιδέξιες μανούβρες, μπορεί να κινηθεί δεξιά-αριστερά, προς τα πίσω, ή να κάνει στροφή 180 μοιρών γύρω από έναν νοητό άξονα μέχρι να προσεγγίσει με ακρίβεια τον στόχο του και να αρπάξει την τροφή. Η ικανότητα αυτή του πτηνού προσέλκυσε το ενδιαφέρον των ερευνητών, οι οποίοι επιχείρησαν να κατασκευάσουν ένα ρομπότ το οποίο να εκτελεί με την ίδια επιδεξιότητα μανούβρες. Και καθώς φαίνεται, τα κατάφεραν. Ερευνητές από το Πανεπιστήμιο Περντιού στην Ιντιάνα των ΗΠΑ κατασκεύασαν ένα ρομπότ-κολιμπρί μόλις δώδεκα γραμμαρίων, το οποίο μπορεί να κάνει ανάλογες κινήσεις υποστηριζόμενο από το τίναγμα των φτερών του το οποίο μιμείται αυτό του κολιμπρί. Αυτές οι κινήσεις εκτελούνται με ακρίβεια χάριν σε ένα λογισμικό τεχνητής νοημοσύνης το οποίο είναι ενσωματωμένο στο τεχνητό πτηνό και το οποίο του επιτρέπει να μαθαίνει ανάλογα με το περιβάλλον στο οποίο βρίσκεται τους ελιγμούς τους οποίους πρέπει να εκτελέσει ώστε να προσεγγίσει τον στόχο του. Το εν λόγω ρομπότ βρίσκεται ακόμη σε φάση ανάπτυξης, ενώ στόχος των ερευνητών είναι να μπορεί να σηκώνει βάρη, ικανότητα η οποία, συνδυασμένη με την ακρίβεια κινήσεων, ενδέχεται να αποδειχθεί πολύτιμη για ιπτάμενες συσκευές οι οποίες θα κινούνται με ακρίβεια στον ιστό της πόλης μεταφέροντας φορτία.

«Αρχαίο» ρομπότ

Τα ρομπότ μπορούν να αποδειχθούν πολύτιμο εργαλείο στα χέρια των ερευνητών ώστε να μελετήσουν το... παρελθόν. Ο λόγος για το OroBOT, ένα ρομπότ-κροκόδειλο το οποίο κατα-

σκευάστηκε από επιστήμονες του Πανεπιστημίου του Χούμπλ στο Βερολίνο με σκοπό να διερευνήσουν τον τρόπο με τον οποίο κινούνταν ερπετά του γένους *Orobate*, ένας αντιπροσωπευτικός σκελετός του οποίου βρέθηκε το 2004 και ο οποίος εκτιμάται ότι ανήκει σε ένα ερπετό το οποίο έζησε κατά την Πέρμια Περίοδο, δηλαδή τουλάχιστον 248 εκατομμύρια χρόνια πριν. Όπως εκτιμούν οι επιστήμονες, τα ζώα αυτά είναι πρόγονοι των σύγχρονων πτηνών, θηλαστικών και ερπετών, ως εκ τούτου το ερευνητικό ενδιαφέρον είναι μεγάλο. Τρία χρόνια μετά την ανακάλυψη του σκελετού ερευνητές βρήκαν απολιθωμένα ίχνη τα οποία εκτιμούν ότι ανήκουν σε άτομο του γένους αυτού. Αξιοποιώντας τα απολιθώματα αυτά αλλά και τον σκελετό, οι ερευνητές κατασκεύασαν υπολογιστικά μοντέλα τα οποία τους βοηθούν να διερευνήσουν τα διαφορετικά ενδεχόμενα κίνησης του ζώου. Ωστόσο, θέλοντας να κατανοήσουν με ποιον τρόπο αντιδρούν τα μοντέλα αυτά σε φυσικές συνθήκες, δημιούργησαν το ρομπότ στου οποίου την κίνηση αποτυπώνεται η εικόνα της επιστημονικής κοινότητας σχετικά με το βάδισμα των εν λόγω ζώων και τον τρόπο με τον οποίο αυτά λυγίζουν το σώμα τους. Με το μοντέλο αυτό οι επιστήμονες ευελπιστούν ότι θα αναπαραστήσουν με ακρίβεια τις κινήσεις εξαφανισμένων ειδών ώστε να κατανοήσουν καλύτερα τις αλληλεπιδράσεις τους με άλλα ζώα, αλλά και με το περιβάλλον.

RoboFly, για όλες τις επιφάνειες

Ενα μικροσκοπικό ρομποτάκι το οποίο μπορεί να πετάει, να κινείται σε υδάτινο περιβάλλον και να περπατάει στο έδαφος – αυτό είναι το RoboFly, ένα ρομπότ το οποίο είχε παρουσιαστεί το 2018, έπειτα όμως από προσαρμογές, οι οποίες ανακοινώθηκαν πρόσφατα από ερευνητές του Πανεπιστημίου της Ουάσιγκτον, μετατράπηκε σε κάτι παραπάνω από μια ιπτάμενη τεχνητή μέλισσα. Το μικρό αυτό ρομπότ βάρους μόλις 74 γραμμαρίων μπορεί να μεταφέρεται με άνεση από την επιφάνεια ενός υγρού στον αέρα καθώς και να προσγειώνεται χωρίς φθορές στο έδαφος. Η ιδιότητα αυτή το καθιστά ιδιαίτερα ικανό να ανταποκρίνεται σε διάφορες συνθήκες του περιβάλλοντος, κάτι το οποίο μπορεί να αξιοποιηθεί σε αποστολές διάσωσης ή σε εξερευνήσεις όπου το υγρό στοιχείο εναλλάσσεται με το στερεό. Όπως και η προηγούμενη έκδοση του ρομπότ, έτσι και αυτό μπορεί να προμηθεύεται ενέργεια ασύρματα από μια πηγή λείζερ, ενώ στόχος των ερευνητών είναι να κάνουν τις απαραίτητες προσαρμογές ώστε αυτό να μπορεί να φορτίζει και από άλλες πηγές ενέργειας, όπως το ασύρματο δίκτυο ή ακόμη και το φως μιας λάμπας.

Φυτό επιστημονικής φαντασίας

Ενα ξεχωριστό είδος ρομπότ είναι αυτά τα οποία θα μπορούσαν να χαρακτηριστούν με τον, μέχρι πρότινος, όρο της επιστημονικής φαντασίας «σάιμποργκ» (cyborg): ένας τεχνητός οργανισμός ο οποίος συνδυάζει τις φυσικές λειτουργίες ενός φυσικού οργανισμού με αυτοματοποιημένες λειτουργίες τις οποίες συναντούμε συνήθως σε ένα ρομπότ. Ενα παράδειγμα τέτοιας τεχνολογίας είναι τα ρομποτικά φυτά, φυτά δηλαδή τα οποία μεγαλώνουν με φυσικό τρόπο, πλην όμως η κίνησή τους μπορεί να ρυθμιστεί σε μεγάλο βαθμό με τη χρήση αλγορίθμων. Ερευνητές από το Τεχνολογικό Ιδρυμα Μασαχουσέτης μετέτρεψαν διάφορα είδη φυτών σε σάιμποργκ, εμφυτεύοντας στον βλαστό τους ηλεκτρόδια τα οποία επιτρέπουν τον έλεγχο της κίνησης του φυτού από τον υπολογιστή αλλά και αισθητήρες οι οποίοι μπορούν να δεχθούν διάφορα ερεθίσματα από το περιβάλλον και να στέλνουν ειδοποιήσεις μέσω ενός υπολογιστή. Οι προσαρμογές αυτές σε έναν οργανισμό όπως το φυτό γίνεται στο πλαίσιο της προσπάθειας των ερευνητών να δοκιμάσουν τη συνδεσιμότητα των ηλεκτρονικών συσκευών με το φυσικό περιβάλλον, καθώς και να αξιοποιήσουν την ευαισθησία των φυτών να ανταποκρίνονται σε ερεθίσματα του περιβάλλοντος.

([Τσιμπούκης Πάνος](https://www.tovima.gr/2020/05/17/science/fysika-rompot) / ΤΟ ΒΗΜΑ, 17.05.2020, <https://www.tovima.gr/2020/05/17/science/fysika-rompot>)

Double helix of masonry — researchers uncover the secret of Italian renaissance domes



Santa Maria del Fiore in Florence, Italy, a World Heritage site, is the largest masonry dome standing today. Through computational methods, researchers from Princeton and the University of Bergamo have mathematically proven the structural physics at work in domes of this type. Photograph by Mark Boss on Unsplash.

What can modern engineering learn from an erstwhile jeweler who built the largest masonry dome in existence?

The construction of the Florentine duomo by Filippo Brunelleschi has been an engineering marvel for more than 500 years, showcasing ancient techniques that still hold valuable insights for modern engineering. Until now, it has remained a mystery how the master goldsmith and sculptor managed to build the masterpiece that pushes the limits of what is possible to construct even with modern building technologies, and how the masters who followed Brunelleschi carried on the tradition.

In a collaborative study in the July 2020 issue of [Engineering Structures](#), researchers at Princeton University and the University of Bergamo revealed the engineering techniques behind self-supporting masonry domes inherent to the Italian renaissance. Researchers analyzed how cupolas like the famous duomo, part of the Cathedral of Santa Maria del Fiore in Florence, were built as self-supporting, without the use of shoring or forms typically required.

"Nothing is more moving," said Attilio Pizzigoni, co-author of the study, "than reading the lightness of the heavens in stone, in an absolute and simple form such as that of the Florentine cupola."

[Sigrid Adriaenssens](#), professor of civil and environmental engineering at Princeton, collaborated on the analysis with graduate student Vittorio Paris and Pizzigoni, professor of engineering and applied sciences, both of the University of Bergamo. Their study is the first to quantitatively prove the physics at work in Italian renaissance domes and to explain the forces that allow such structures to have been built without formwork typically required, even for modern construction. Previously, there were only hypotheses in the field about how forces flowed through such edifices, and it was unknown how they were built without the use of temporary structures to hold them up during construction.

For Adriaenssens, the project advances two significant questions. "How can mankind construct such a large and beautiful structure without any formwork — mechanically, what's the innovation?" she asked. Secondly, "What can we learn?" Is there some "forgotten technology that we can use today?"

The detailed computer analysis accounts for the forces at work down to the individual brick, explaining how equilibrium is leveraged. The technique called discrete element modeling (DEM) analyzed the structure at several layers and stages of construction. A limit state analysis determined the overall

equilibrium state, or stability, of the completed structure. Not only do these tests verify the mechanics of the structures, but they also make it possible to recreate the techniques for modern construction.

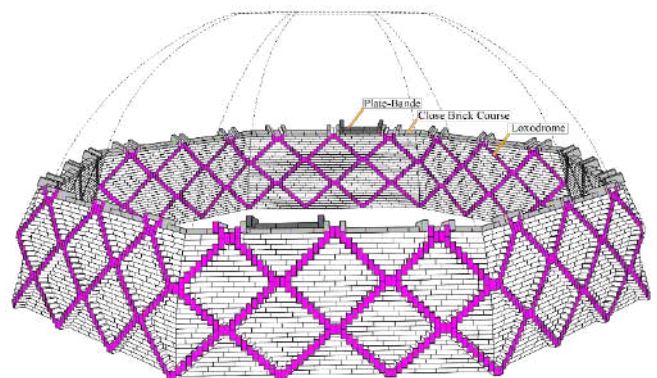
The researchers said the results could be especially useful in cases where remote construction, by drone for example, could be done with minimal temporary supports.

"With these studies," said Pizzigoni, "we aim to approach moments in history when the sole form of technology available to man was the abstract rationality of geometry. [...] What we as designers, architects and builders can learn from the past is the knowledge of a structural equilibrium of form based on the geometry of materials and of their reciprocal measurements in three-dimensional space."

Verifying the physics of the dome

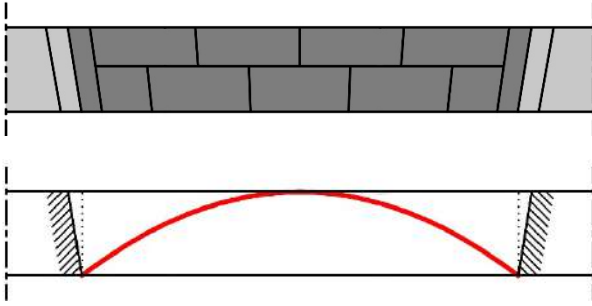
The specific structure that the team studied was Santa Maria, in Ciel d'Oro, of Montefiascone, Italy. The crux of their analysis rests on the geometrical pattern of bricks used throughout the interior dome, which appears to be the lynchpin vital in making the structure self-supporting. The bricks form a herringbone, a V-shaped pattern, between the horizontal field bricks and vertical bricks at the beginning and end of the horizontal rows. The arrangement creates lines of staggered vertical bricks that extend diagonally across the curvature of the dome.

The arrangement produced is a complex cross-herringbone spiraling pattern. One herringbone from both the left and right angles repeatedly cross each other, providing stability for the interior bricks and maintaining the dome's curvature. The researchers' analysis showed essentially that this is a double-helix of support that distributes and equalizes weight and thrust within the structure. This system of cross-herringbone veins is known as a double loxodrome.



The double loxodrome is comprised of rows of vertical bricks that crisscross around the dome and are filled in by horizontal bricks. Effectively, each course of bricks creates a structural element known as a plate-bande that wedges interior bricks between the vertical end caps. Image: courtesy of the researchers.

Each course of horizontal bricks pushes outwards on the vertical herringbone bricks, forming rows of plate-bandes, or straight arches inside the double loxodrome. The physical thrust of the horizontal bricks toward the vertical bricks, keeps the horizontal bricks in place during construction and provides stability to the entire structure once completed. This is the key to the dome's stability. One of the researchers' primary findings is that for domes with radial geometry, the herringbone brick pattern enables the bricks to be wedged as plate-bandes and not slide inwards, which would make the dome collapse.



The plate-bande is the integral element that distributes force throughout the dome, maintaining the shape and stability of the structure. Image: courtesy of the researchers.

The simple yet ingenious physics exhibited by the structure "is an elementary act that transforms the amorphous and inert material into a sign of life that [motivates] the tensions between opposing forces and composes them in their equilibrium," said Pizzigoni. Italian renaissance domes are an architectural form that "recognizes the disciplinary complexity" of blending the ideals of "stability, beauty, and utility, that runs between engineering, construction, and architecture.

From ancient to modern construction

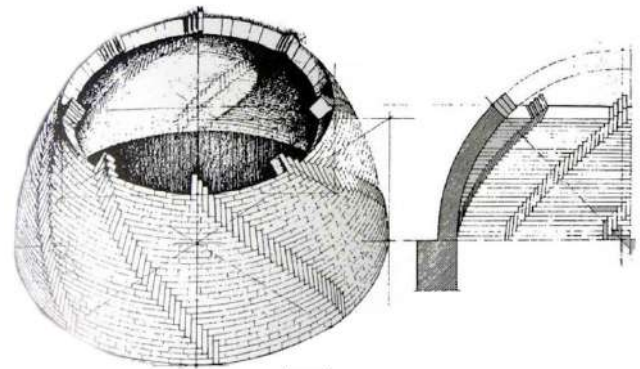
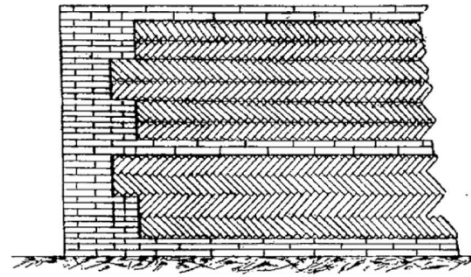
While the physics of the structure are no longer grounds for considerable debate after this computational verification, the historical origins of the herringbone technique remain unexplained. Since Brunelleschi did not leave behind drawings or construction notes, some researchers attribute the technique to an influence from Arab and Byzantine domes. For example, the Friday Mosque (Masjid-i Jami') of Ardestan in Isfahan, Iran, was built with the technique circa 1088 C.E., a century before the construction of the Santa Maria del Fiore's dome in Florence.



The Ardestan Friday Mosque in Isfahan, Iran built circa 1088C.E. exhibits the double loxodrome technique.

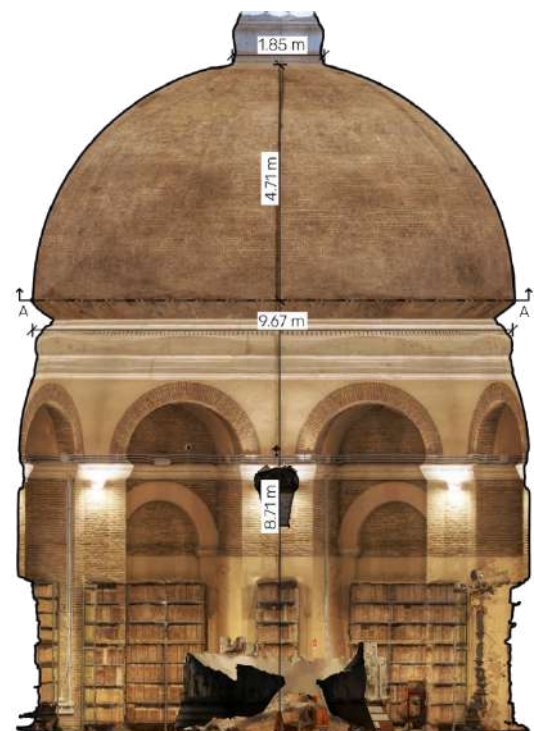
Others regard the origins as a derivation of the Roman technique called opus spicatum, wherein bricks are tightly laid in a herringbone pattern without requiring much mortar. Such brick patterns were commonly used in ancient Roman and medieval firebacks in stone hearths to prevent corrosion of lime mortar that occurs with exposure to heat and flame or as field bricks in walls to increase stability.

In the Florentine duomo, Brunelleschi only used a single helix, so the lines of vertical bricks do not cross one another. Instead, they simply remain parallel, as they do in opus spicatum. This does not affect the stability of the structure, and the physics of the plate-bande are still the integral element that allows for the height, size, and stability of the Florentine duomo, as well as enabling construction without formwork.



An ancient Roman technique used in walls and hearths called opus spicatum, resembles the single loxodrome used by Brunelleschi in the Florentine duomo. Images: Opus spicatum, drawing of C. G. de Montauzan. Revolution dome and herringbone spiralling pattern, drawing of F. C. Gurrieri.

Since the double loxodrome technique was used after Brunelleschi by the Sangallo masters throughout Italy, including in St. Peter's Basilica in the Vatican, this suggests to researchers that the Sangallo domes were an evolution on Brunelleschi's original single loxodrome structure. The Sangallo architects went on to build many double loxodrome domes across Italy during the renaissance. What remains unknown is why the method was not used after the 16th century, said Paris.



St. Peter's Basilica in Rome, built by the Sangallo masters and consecrated in 1626, exhibits the double loxodrome technique.

The team hopes to resurrect these forgotten techniques in the present. "Perhaps the most intriguing aspect of such studies," said Pizzigoni, "is a rethinking of a future determined by building techniques abandoned by mechanical science." The researchers anticipate that this study could have practical applications for developing construction techniques deploying aerial drones and robots. Using these unmanned machines for construction would increase worker safety, as well as enhance construction speed and reduce building costs.

Another advantage of unearthing new building techniques from ancient sources is that it can yield environmental benefits. "The construction industry is one of the most wasteful ones, so that means if we don't change anything, there will be a lot more construction waste," said Adriaenssens, who is interested in using drone techniques for building very large span roofs that are self-supporting and require no shoring or formwork.

"Overall, this project speaks to an ancient narrative that tells of stones finding their equilibrium in the wonder of reason," said Pizzigoni, "from Brunelleschi's dome to the mechanical arms of modern-day robotics where technology is performative of spaces and its social use."

Support for this research was provided by the University of Bergamo, and the Princeton University International Fund at the Office for International Affairs and Operations at Princeton University. Software 3DEC was provided by Itasca C.G. under the Education Partnership Program.

(Amelia Herb / PRINCETON, May 18, 2020, <https://engineering.princeton.edu/news/2020/05/18/double-helix-masonry-researchers-uncover-secret-italian-renaissance-domes>)



EUREKA



Παρακολουθήστε το ντοκιμαντέρ «ΕΥΡΗΚΑ! Επιστήμη, τέχνη και τεχνολογία των αρχαίων Ελλήνων» σε σκηνοθεσία Νικήτα Μήκα και σε αφήγηση του Ομότιμου Καθηγητή του Εθνικού Μετσόβιου Πολυτεχνείου Θεοδόση Τάσιου. Το ντοκιμαντέρ, που αποτελεί μία συμπαραγωγή της COSMOTE TV και του Μουσείου Ηρακλειδών, μας ξεναγεί στην μεγάλη έκθεση αρχαίας ελληνικής τεχνολογίας με τον τίτλο "EUREKA", που το 2017 παρουσιάστηκε στην Κίνα.

Το ντοκιμαντέρ παρουσιάστηκε σε Α' τηλεοπτική προβολή, στο COSMOTE HISTORY HD, την Παρασκευή 10 Απριλίου και έκτοτε, και μέχρι το τέλος της καραντίνας, είναι ελεύθερα προσβάσιμο σε όλους, ως μια προσφορά πολιτισμού όλων των

συντελεστών προς όλους τους Έλληνες.



https://www.youtube.com/watch?v=6PvVs0gMuJE&fbclid=IwAR3L4xIRN20I6y3AY5VEpJpbTGp7q9VOGMO8rxMEIIFWISYdvX32O_qITkI

[Herakleidon Museum](#)



Απίστευτοι Οδηγοί Αυτοκινήτων και Χειριστές Μηχανημάτων



Does anybody have a driver's license.MP4



Εξαιρετικός Χειριστής σε Εξαιρετικό Μηχάνημα.mp4



10 Bridge Failures Explained How they happened

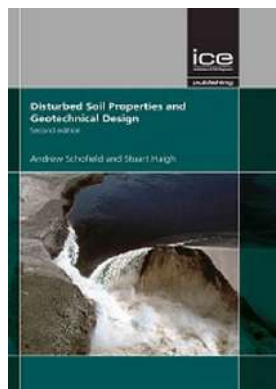
In recent months a number of bridge failure events have occurred and gained significant attention. Today we're going to take a look at 10 bridge failure events and explain to you just how they happened.



<https://www.youtube.com/watch?v=KRtefycRGdE&feature=youtu.be&fbclid=IwAR2B9OIobC6QawuKdGbiHU-vfLHVdJ3LiNkj5AQQRkYRwxdARnPPKT8TVvI>

[DailyTop10s](#)

ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ



Disturbed Soil Properties and Geotechnical Design, Second Edition

Andrew Schofield and Stuart Haigh

Disturbed Soil Properties and Geotechnical Design, Second edition describes the developments lead-

ing to the Original Cam Clay model, focusing on fundamentals of the shearing of soil. The first edition explained and illustrated fallacies in past work of engineering geologists, and laid groundwork for the understanding that should form the basis of modern geotechnical design.

With the changing environment, and the increasing size of construction projects, engineers now need a better understanding of ground behaviour to prevent future catastrophes such as the 1976 Teton Dam failure shown on the cover. The further additions in this book will help geotechnical engineers acquire this knowledge.

Disturbed Soil Properties and Geotechnical Design, Second edition:

- provides an outline of the energy-based Cam-clay approach that can predict geotechnical deformations
- illustrates further fallacies in commonly used $c-\phi$ Coulomb soil mechanics
- describes the use of centrifuge modelling in geotechnical design, based on examples from the last four decades

Once armed with the simple concepts of wet/weepy and dry/thirsty sides of the critical state line, readers will better understand if soil will tend to contract or dilate in drained shearing, and if pore pressures caused by undrained shearing will be positive or negative.

Full of technical and personal insights, this is a rewarding book that forces the rethinking of modern geotechnical engineering. Much like the first edition, this book remains an invitation for the unconverted to re-examine the basic understanding of soil behaviour, and for the converted to ensure that the teaching, vocabulary and nomenclature used in describing strength models for soil, accurately reflect the underlying concepts.

Book Review

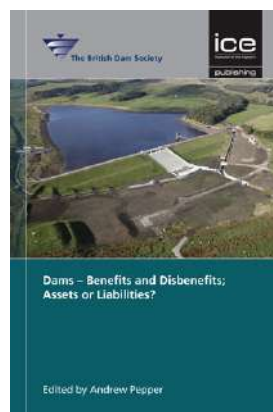
"This 182-page book is a useful reference for anyone interested in or gaining knowledge of the development of critical-state soil mechanics, a theory of plasticity which was initially jointly developed by Schofield in the 1950s.

Topics covered range from simple planar sliding of soil to plastic design in geotechnical engineering. Historical coverage starts with Coulomb's theory of strength, through Taylor's recognition that interlocking between grains provides a component of strength, to Schofield's work on the Cam clay soil model and critical state concepts.

Many other seminal geotechnical engineering contributions are discussed, critically reviewed and in some cases refuted. Limitations of the Cam clay model with regard to anisotropy, soil sensitivity and cyclic loading are acknowledged. The establishment and development of geotechnical centrifuge model testing in the UK is included together with mobilisable strength design, where calculations of the deformation of geotechnical systems are based on energy dissipation."

Colin Rawlings Jacobs/High Speed Two, UK

(ICE Publishing, 22 November 2017)



Dams - Benefits and Disbenefits; Assets or Liabilities?

Edited by Andrew Pepper

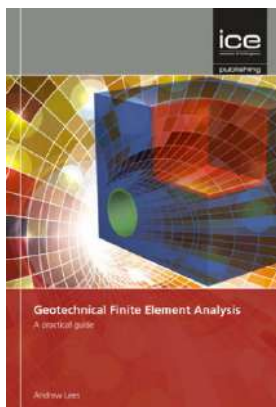
This book contains the proceedings of the 19th Biennial Conference of the British Dam Society, *Dams - Benefits or Disbenefits; Assets or Liabilities?*

Work to reservoirs and dams today covers far more than engineering, and the papers in this book show how engineers integrate their work with other disciplines to minimise the adverse impacts of schemes that are essential to ensure the safety of the public, while maximising other potential benefits to society.

Anyone with a professional interest in dams and reservoirs, such as dam owners, designers, or constructors, will find papers of direct relevance to them.

In addition to papers on dam construction and modifications, there are papers on the discontinuance of existing reservoirs, with the many engineering and environmental factors that have to be taken into account. The need to provide and exercise drawdown capability, while mitigating any adverse environmental impacts, is another area of increasing interest that is covered by several papers.

(ICE Publishing, 22 August 2016)



Geotechnical Finite Element Analysis

Andrew Lees

Geotechnical Finite Element Analysis provides the latest practical guidance and comprehensive explanations of applying finite element analysis (FEA) in geotechnical design – from planning and analysis, determining how the FEA relates to the design process and explaining the decisions that need to be made at each stage through to validation of results and reporting.

This highly illustrated guide expands on the practical benefits of FEA, such as the analysis of complex problems, overall increased productivity and revenue, and explains the complex theory behind the decisions that need to be made at each stage of a project.

Geotechnical Finite Element Analysis:

- features as the first practical and internationally applicable guidebook in this subject area
- includes detailed guidance on using FEA together with international design codes
- clarifies the factors to consider when selecting from the various constitutive models
- attests as a training aid, facilitated by complete worked examples
- covers 160 competence statements from the COGAN Competency Tracker maintained by NAFEMS.

Geotechnical Finite Element Analysis aims to combine essential learning material in one place. As a practical guide, textbook, reference and training tool, it is aimed at practising civil, structural and geotechnical engineers, and those undergoing training in geotechnical FEA and performing geotechnical FEA in design.

(ICE Publishing, 11 October 2016)

analysis of soils and rocks, site investigation and ground improvement techniques as well as exploring the geotechnical structures with geosynthetics.

Produced by the Institution of Civil Engineers, ICE Textbooks offer clear, concise and practical information on the major principles of civil and structural engineering. They are an indispensable companion to undergraduate audiences, providing students with:

- A comprehensive introduction to core engineering subjects
- Real-life case studies and worked examples
- Key learning aims, revision points and chapter summaries
- Further reading suggestions

(ICE Publishing, 11 June 2015)



Core Concepts of Geotechnical Engineering

Sanjay Kumar Shukla

Core Concepts of Geotechnical Engineering is a practical introduction for students to the analysis, design, construction, maintenance and renovation of geotechnical structures.

It presents the key principles of engineering geotechnical structures beginning with shallow and deep foundations and retaining structures through to slopes, embankments, earth dams, machine foundations, buried structures and tunnels. The book guides the students through the



**An official journal of the
International Society for Soil Mechanics and
Geotechnical Engineering**
www.geocasehistoriesjournal.org/pub/issue/view/44

Ολοκληρώθηκε ο Volume 5, Issue 2, του International Journal of Geoengineering Case Histories με τα παρακάτω περιεχόμενα:

- [Electrical Resistivity at Internal Erosion Locations in Levees](#), Stacey Tucker-Kulesza, Cassandra Rutherford, Michelle Bernhardt-Barry
- [Forensic Analysis of Levee Failures: The Breitenhagen Case](#), Job J. Kool, Willem Kanning, Torsten Heyer, Cristina Jommi, Sebastiaan N. Jonkman
- [Geotechnical Observations of Dams Failed During the 2015 Historic Flooding in South Carolina](#), Inthuorn Sasanakul, Sarah L. Gassman, Charles E. Pierce, William Ovalle-Villamil, Ryan Starcher, Emad Gheibi, Mostaqur Rahman
- [Infiltration Study for Deep Foundations in Ephemeral Streams](#), Naresh C. Samtani



Geo-Trends Review
A Crowdsourcing Magazine for the Geotechnical Engineering Community - Issue #11 - MAY 2020
www.mygeoworld.com/geotrends/issues/11-may-2020



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

IGS NEWSLETTER – May 2020

Helping the world understand the appropriate value and use of geosynthetics

<https://www.geosyntheticssociety.org/newsletters/>

- Watch: Nathalie Touze's Full Giroud Lecture [READ MORE](#)
- Geosynthetics: A Force For Good? [READ MORE](#)
- 10 Questions With...Ian D. Peggs [READ MORE](#)
- Geomembranes In The Spotlight At ACigs Events [READ MORE](#)
- GeoAmericas 2020 - It Will Be Awesome! [READ MORE](#)
- SAVE THE DATE: 7th Asian Regional Geosynthetics Conference (GeoAsia7) [READ MORE](#)
- UK Chapter Symposium Postponed [READ MORE](#)
- IGS Peru Postpones GeoIngenieria 2020 [READ MORE](#)
- Calendar of Events

[READ MORE AT GEOSYNTHETICSSOCIETY.ORG](http://www.geosyntheticssociety.org)

ΕΚΤΕΛΕΣΤΙΚΗ ΕΠΙΤΡΟΠΗ ΕΕΕΕΓΜ (2019 – 2022)

Πρόεδρος	:	Μιχάλης ΜΠΑΡΔΑΝΗΣ, Δρ. Πολιτικός Μηχανικός, ΕΔΑΦΟΣ ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ Α.Ε. mbardanis@edafos.gr , lab@edafos.gr
Α' Αντιπρόεδρος	:	Χρήστος ΤΣΑΤΣΑΝΙΦΟΣ, Δρ. Πολιτικός Μηχανικός, ΠΑΝΓΑΙΑ ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ Ε.Π.Ε. editor@hssmge.gr , ctsatsanifos@pangaea.gr
Β' Αντιπρόεδρος	:	Μιχάλης ΠΑΧΑΚΗΣ, Πολιτικός Μηχανικός mpax46@otenet.gr
Γενικός Γραμματέας	:	Γιώργος ΜΠΕΛΟΚΑΣ, Δρ. Πολιτικός Μηχανικός, Επίκουρος Καθηγητής ΤΕΙ Αθήνας gbelokas@teiath.gr , gbelokas@gmail.com
Ταμίας	:	Γιώργος ΝΤΟΥΛΗΣ, Πολιτικός Μηχανικός, ΕΔΑΦΟΜΗΧΑΝΙΚΗ Α.Ε.- ΓΕΩΤΕΧΝΙΚΕΣ ΜΕΛΕΤΕΣ Α.Ε. gdoulis@edafomichaniki.gr
Έφορος	:	Γεώργιος ΓΚΑΖΕΤΑΣ, Δρ. Πολιτικός Μηχανικός, Ομότιμος Καθηγητής Ε.Μ.Π. gazetas@central.ntua.gr , gazetas50@gmail.com
Μέλη	:	Ανδρέας ΑΝΑΓΝΩΣΤΟΠΟΥΛΟΣ, Δρ. Πολιτικός Μηχανικός, Ομότιμος Καθηγητής ΕΜΠ aanagn@central.ntua.gr Παναγιώτης ΒΕΤΤΑΣ, Πολιτικός Μηχανικός, ΟΜΙΛΟΣ ΤΕΧΝΙΚΩΝ ΜΕΛΕΤΩΝ Α.Ε. otmate@otenet.gr Μαρίνα ΠΑΝΤΑΖΙΔΟΥ, Δρ. Πολιτικός Μηχανικός, Αναπληρώτρια Καθηγήτρια Ε.Μ.Π. mpanta@central.ntua.gr
Αναπληρωματικά Μέλη	:	Χρήστος ΣΤΡΑΤΑΚΟΣ, Πολιτικός Μηχανικός, NAMA Α.Ε. stratakos@namalab.gr Βάγια ΞΕΝΑΚΗ, Δρ. Πολιτικός Μηχανικός, ΕΔΑΦΟΜΗΧΑΝΙΚΗ Α.Ε. yxenaki@edafomichaniki.gr
Εκδότης	:	Χρήστος ΤΣΑΤΣΑΝΙΦΟΣ, Δρ. Πολιτικός Μηχανικός, ΠΑΝΓΑΙΑ ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ Ε.Π.Ε. editor@hssmge.gr , ctsatsanifos@pangaea.gr

ΕΕΕΕΓΜ

Τομέας Γεωτεχνικής
ΣΧΟΛΗ ΠΟΛΙΤΙΚΩΝ ΜΗΧΑΝΙΚΩΝ
ΕΘΝΙΚΟΥ ΜΕΤΣΟΒΙΟΥ ΠΟΛΥΤΕΧΝΕΙΟΥ
Πολυτεχνειούπολη Ζωγράφου
15780 ΖΩΓΡΑΦΟΥ

Τηλ. 210.7723434
Τοτ. 210.7723428
Ηλ-Δι. secretariat@hssmge.gr ,
geotech@central.ntua.gr
Ιστοσελίδα www.hssmge.org (υπό κατασκευή)

«ΤΑ ΝΕΑ ΤΗΣ ΕΕΕΕΓΜ» Εκδότης: Χρήστος Τσατσανίφος, τηλ. 210.6929484, τοτ. 210.6928137, ηλ-δι. ctsatsanifos@pangaea.gr,
editor@hssmge.gr, info@pangaea.gr

«ΤΑ ΝΕΑ ΤΗΣ ΕΕΕΕΓΜ» «αναρτώνται» και στην ιστοσελίδα www.hssmge.gr