



Viaduc de Millau, France



ΕΛΛΗΝΙΚΗ  
ΕΠΙΣΤΗΜΟΝΙΚΗ  
ΕΤΑΙΡΕΙΑ  
ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ  
& ΓΕΩΤΕΧΝΙΚΗΣ  
ΜΗΧΑΝΙΚΗΣ

# Τα Νέα

73

## της Ε Ε Ε Ε Γ Μ

### Abstract Thinking and Experience in Geotechnical Engineering

One may have the impression that Geotechnical Engineering is today a mature applied science that offers all the necessary tools and basic understanding to address satisfactorily our professional challenges. In the research arena a similar mood may be detected: we are twisting methodologies, adding perhaps minor details, with the purpose of extending knowledge (or writing papers). The current avalanche of new journals in Geotechnics reinforces this opinion. There is probably some truth in the previous positioning but consider the following sentence published in 1948, the year of *Géotechnique*'s first volume, by a well-known geotechnical engineer and scientist:

In 1936 Soil Mechanics had created what may be termed an ideal model of soil behaviour and had given the engineer a set of theoretical concepts which cover all important aspects of soil behaviour. [...] The days in which significant discoveries could be made in the laboratory or in the working desk seem to have gone forever.

The author was K. Terzaghi. Despite the impact that such a strong statement could have in his time it is somewhat heartwarming to realize that even such a towering and formidable figure of our science had difficulties to grasp the future.

Innovation in all aspects of Soil and Rock Mechanics and Geotechnical Engineering seems to be very active in every aspect of our field of knowledge, from teaching practices to design and construction techniques. In fact, one difficulty

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(συνέχεια από την πρώτη σελίδα)

we are facing is the excess of information. When dealing with engineering approaches simplicity is often preferred to (unnecessary) sophistication. Of course, the key aspects of the problem should be captured. But, how do we achieve a balance between simple but accurate identification of main behavioural traits and unnecessary detail?

All aspects of university education, skilfully described by Carlos Santamarina, as well as a subsequent continuous education and practice, play a decisive role. But I will concentrate on two aspects that help in the practice of geotechnical engineering: abstract thinking and past experience. Both are closely linked. A brilliant support for this link has already provided by the Greek philosopher Plato. He wondered why an individual could develop specific ideas on a given subject. He found an explanation in that every individual had a life previous to being born. During this period, they were exposed to a variety of circumstances. Later on, down to Earth, they simply recalled their past experiences. Plato's explanation for the difficult concept of thinking is, by no means, silly. It highlights the decisive role of past experience in thinking. Neuroscientists distinguish concrete thinking from abstract thinking. The powerful one behind thinking. It is at the core of learning, knowledge and memory.

Eduardo Alonso discusses exploratory and independent thinking in geotechnical engineering. A preview of the discussion is posted here. For the full text please go to <http://www.icevirtuallibrary.com/info/GLETTLinkedInFullDiscussion>

## Rockfall experimental investigation in 3D space

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**ABSTRACT:** Rockfalls are phenomena with disastrous effects on human activities and infrastructure. Their complexity has resulted in significant simplifications in both the analysis methodologies and the experimental investigation procedures. The predominant approach is to conduct a two-dimensional analysis on a characteristic slope section. However, in recent years, various three-dimensional rockfall analysis software have been developed and have become increasingly popular as they incorporate fewer assumptions. The calibration and verification of such software depends on experimental investigations. However, the vast majority of experimental investigations have been treated as 2D problems, without taking into account crucial parameters encountered in 3D space, such as the lateral dispersion of the trajectory; the configuration of the block at impact; the angular velocity etc. Trajectory data in 3D space are essential as they can provide insight into the complex mechanics of an impact and also can be used for software calibration and verification purposes. A methodology for 3D data acquisition is presented in this paper and results from laboratory tests are presented, underlining the importance of the aforementioned parameters.

**KEYWORDS:** rockfall trajectory modelling, coefficient of restitution, rotational motion, laboratory investigation

### 1 INTRODUCTION

Rockfall is a gravitational-driven geomorphic process that occurs rapidly on steep natural or manmade slopes. Rockfalls have disastrous effects on human activities and infrastructure, and therefore pose a significant natural hazard. However, due to the complex nature of the phenomenon, analysis methods incorporate assumptions that may sometimes lead to oversimplifications, as will be thoroughly discussed hereafter.

During a rockfall and while the block is in the air, it moves along a parabolic path under the sole action of gravity. Since no external forces are acting on the block, the trajectory lies in vertical plane. At contact with the slope, the block might rebound resulting to a new parabolic trajectory either roll or slide. Deformation will occur on the slope depending on the surficial material; for low strength materials, i.e. weathered zone, debris etc., plastic deformations shall occur resembling the form of a crater, whereas for rocky slopes the surface will remain intact with no visible impact traces, implying that deformation is in the elastic regime. Hereafter, only the rebound mechanism for rocky slopes will come under consideration.

The scope of this paper is to present a methodology for rockfall experimental investigation aiming at assisting further research on understanding the complex nature of a rockfall, by allowing the study of parameters that were hitherto neglected, and at providing data that will contribute to the calibration and verification of 3D rockfall analysis software that have become increasingly popular in design practice

## 2 LITERATURE REVIEW

The post-impact part of the trajectory is calculated according to the Coefficients of Restitution (COR), which are assumed to be overall values that take into account all the characteristics of the impact and describe the change in the block's velocity magnitude (Giani, 1992). Various definitions are available but there is no consensus on which of them are more appropriate for rockfall trajectory modelling (Chau et al., 2002).

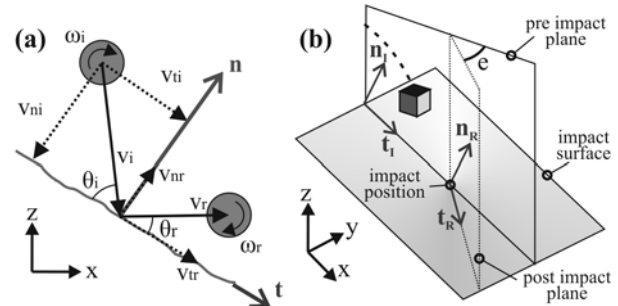


Figure 1. (a) Pre- and post-impact motion characteristics and (b) schematic representation of lateral dispersion, denoted as  $e$ .

### 2.1 Coefficient of Restitution definitions

The most widely-used definitions originate from the theory of inelastic collision, as described by Newtonian mechanics. For an object impacting on a rocky slope, the kinematic COR ( $v_{COR}$ ) is defined as:

$$v_{COR} = v_r / v_i \quad (1)$$

where  $v$  is the velocity magnitude and the subscripts  $i$  and  $r$  denote the trajectory stage before and after the impact respectively.

Two different mechanisms participate in the energy dissipation process. Normal to the slope energy loss is due to the deformation of the colliding entities, while in the tangential direction energy loss is due to the friction between them. Therefore, the following definitions have prevailed in rockfall analyses:

$$n_{COR} = v_{nr} / v_{ni} \text{ and } t_{COR} = v_{tr} / v_{ti} \quad (2)$$

where the first subscript,  $n$  or  $t$ , denotes the normal or tangential components of the velocity respectively.

Definitions based on energy ratios are also found in the literature. The energy coefficient ( $E_{COR}$ ) is defined by the ratio of the translational energies after and before the impact according to Eq. 3 and by analogy the total energy coefficient ( $ET_{COR}$ ) is defined by Eq. 4 which considers angular motion.

$$E_{COR} = (0.5 \cdot m \cdot v_r^2) / (0.5 \cdot m \cdot v_i^2) \quad (3)$$

$$ET_{COR} = (0.5 \cdot m \cdot v_r^2 + I \cdot \omega_r^2) / (0.5 \cdot m \cdot v_i^2 + I \cdot \omega_i^2) \quad (4)$$

where  $I$  is the moment of inertia and  $\omega$  the angular velocity.

Some research has concentrated on the role and measurement of rotational velocity, but on the whole it only takes into account the rotation relative to the axis that is normal to the trajectory plane. Observation and analysis in 3D space is complex, since three rotations can be underway simultaneously, each about a principal axis.

In design practice, the values for the coefficients of restitution are acquired from the suggested values found in the literature. Those values are mainly connected to the surface

material type and originate from experimental studies or back analyses of known rockfall events.

It must be noted that those definitions incorporate the assumption that the mass of the block is concentrated at its center, which is represented by a single point. Therefore, the effects of shape, rotational motion and configuration of the block at impact are neglected, even though it is evident that they affect the resulting motion. Additionally, the definitions regard 2D space; hence, lateral dispersion of the trajectory cannot be simulated.

## 2.2 Relevant studies

Although many experimental studies have been conducted, the measurement of lateral dispersion and rotational motion has seldom been taken into account due to the inherent difficulties in acquiring the trajectory in 3D space.

Chau et al. (2002) conducted a laboratory experimental study with spherical blocks impacting on a planar surface; both were made of plaster. The initial trajectory was set to a free fall, while the impact surface was set to various inclinations in order to evaluate the effect of the slope's angle. Additionally, the rotation normal to the trajectory plane (1D rotation) was measured and used to define the ratio between rotational and translational energies post impact, denoted as  $\beta$ . This ratio was introduced by the Japan Railroad Association and its value was recommended as 0.1. They showed that for spherical blocks, the theoretical upper bound for  $\beta$  is 0.4 and was experimentally found to be a function of the slope angle, resembling the maximum  $\beta$  value at a slope angle of 40 degrees.

Dorren et al. (2005) conducted a real-scale experimental research in order to investigate the mitigating effect of forest presence. Lateral dispersion was considered by measuring the distance and direction between each subsequent impact from the traces caused on the ground or against trees, using a laser distance meter. This is a relatively simple and accurate technique in order to encounter dispersion; however, it cannot be implemented in rocky slopes due to the lack of impact traces. Based on that data, Bourrier et al. (2009) proposed a probabilistic model which accounts for lateral dispersion on the basis of pre-impact trajectory orientation, slope aspect and dip direction.

The idea of using a stereo-photogrammetric technique in rockfall experimental studies was introduced by Dewez et al. (2010). A real-size experimental study was conducted in French Polynesia, where natural rock blocks were released by an excavator placed at the top of a convex. The 3D position was computed for the block center, but the stereo system used did not provide the required accuracy for a detailed survey of the boulder, which would allow for a reconstruction of the block for each frame and therefore for the measurement of rotational motion.

## 3 LABORATORY INVESTIGATION

In order to evaluate the effects of lateral dispersion, rotational motion and the configuration of the block at impact, a laboratory testing program was implemented consisting of 50 tests for cubic and 25 for spherical blocks.

Experiments were held with an artificial material, namely a high strength, cement-based grout. The usage of an artificial material has advantages as a variety of shapes and sizes can be easily achieved. The material used is stable and cohesive, exhibits zero segregation and is shrinkage-compensating, resulting in uniform samples. This material has already been used for investigating the effect of the material properties of free-falling blocks with cubical shape along with eight natural rock materials and was found to correlate well with natural rocks as a function of inherent material properties (Asteriou et al., 2013b). Additionally, it

has been used to address the effect of impact energy on the COR values (Asteriou et al., 2013a).

Blocks were cast in moulds resembling a cubic shape of 3 cm sides and a spherical shape of 4 cm in diameter. The impact surface was a cast cuboid of 15 cm sides with a height of 5 cm, which was fixed in a massive dead weight base ensuring the preservation of the momentum caused by impact.

The release mechanism constituted of an inclined tube, in which the falling object was inserted from one side and released from the other, resulting in a parabolic trajectory. Blocks were released under the same conditions and the impact surface was set to a horizontal position.

The trajectory of the falling block was recorded by two synchronized HD digital SLR cameras at a capture rate of 60 fps. Analysis of the trajectory and the necessary calculations were made in MatLab, where the computational steps described in the next chapter were executed.

## 4 3D TRAJECTORY ACQUISITION METHOD

Data acquisition is based on stereo-photogrammetric and machine vision techniques, and consists of the stages: stereo pair calibration; image rectification; object recognition and feature extraction; stereo triangulation; object reconstruction and; trajectory reconstruction. A brief overview of the computational procedure steps is presented below. The detailed analysis of each step is beyond the scope of this paper.

A digital image is created by a perspective projection of a scene to the camera lenses. The image plane has a 2D coordinate system where position measurements are achievable in pixel coordinates. The camera has a 3D reference coordinate system, based on the image plane and directing towards to the field.

In order to reconstruct the 3D scene from the image plane coordinates, the intrinsic and extrinsic camera parameters must be available. The intrinsic camera parameters (focal length, principal point and geometric distortion) characterize the optical, geometric and digital characteristics of the camera and are used to connect the image point coordinates to the corresponding coordinates in the camera reference space. The extrinsic parameters identify the transformation between the camera and the world reference coordinate systems.

For this experimental procedure, the Camera Calibration Toolbox for Matlab was used (Bouquet, 2008). The main advantages of this toolbox are that both internal and external parameters are simultaneously computed along with their uncertainties; is quite flexible compared to classical calibration techniques as the cameras are placed in arbitrary positions; is relatively simple and quick, and; the code is open source which allows modifications. Calibrating a stereo camera pair with the aforementioned toolbox is done by acquiring synchronized images of a planar grid that moves freely in the scene.

Image rectification is the transformational process done in order to correct the unavoidable lens distortion effect in an image. Images present radial and tangential distortion due to camera lenses irregularities. From the stereo pair calibration, the distortion characteristics are computed and with an inverse mapping procedure, according to the method proposed by Brown (Brown, 1966), images are rectified allowing direct position measurements.

Two different procedures were implemented in order to locate the corresponding points; one regarding the scene and the other for the tracking of the object. As the scene remains static throughout the experimental process, the corresponding points can be defined by a single stereo-



image pair. An image cross-correlation technique was implemented, in which a comparison of small areas between the two images is made in order to identify common patterns and features, which form the correspondences of the stereo-pair.

However, this technique is time consuming and produces numerous corresponding points, which are unnecessary and even misleading for the tracking process of the block. A cube can be defined by measuring the edge points of any viewable side, since its orientation is easily computed; the opposite, non-viewable points are normal to the plane defined by the viewable edge points, at a distance equal to the side length towards the positive z axis of the camera reference coordinate system. In order to acquire the projection points of the cube edges in the two images, each cube side was painted with a different high-contrast color, resulting in a unique color pattern for each corner. Hereafter, corner detection and color recognition algorithms were implemented, defining the edge points for each stereo-image pair.

Stereo triangulation refers to the process of determining a point in 3D space given its projections onto two images, by calculating the intersection of the two vectors.

Scene reconstruction is done by matching the computed 3D points to the features of the scene, such as the boundary points that define the impact surface. The analysis coordinate system is defined with the origin placed in the center of the impact surface, and x and y axes directed towards the slope's strike and dip direction respectively. Therefore, the z axis becomes vertical.

Object reconstruction is done using a least-squares fit method of rigid body rotation and translation (Challis, 1995). Applying the method for an identical imaginary block stationed in the center of the analysis coordinate system and the measured 3D points of the block for every frame, results to the rigid body transformational parameters (a 3x3 rotational matrix and a 1x3 translational vector) as well as the reconstruction error for each frame. The translational vector coincides with the position of the block in the analysis coordinate system and its orientation relative to the imaginary stationary block is acquired by decomposing the rotational matrix to the Euler angles.

Finally, by combining the scene with the object position for all the frames of each test, trajectory characteristics are retrieved (translational and angular velocities, orientation, impact and rebound angles etc.), out of which the COR values are calculated according to the definitions presented in section 2.

## 5 PRESENTATION AND EVALUATION OF RESULTS

As presented in chapter 2, there are various definitions of COR. Therefore, when performing a rockfall simulation one must be well aware of the definitions used in the available program in order to select the appropriate values and produce reasonable results. Moreover, using suggested values implies that COR values are material constants, but it is widely stated in the relevant literature that COR depends on various parameters (velocity, impact angle, block shape, mass, etc.).

The shape effect is significantly reflected on the calculated COR values. The mean values for vCOR are 0.44 and 0.76 for the cubic and spherical blocks respectively. In general, vCOR is better for use in correlations as it provides more consistent trends compared to nCOR (Asteriou et al., 2012).

Another important effect of shape is the rebound angle. As can be seen from Fig. 2, the upper boundary for the rebound angle is similar for both block shapes. However, for the spherical blocks, values are concentrated over a narrow

range, in contrast to the cubic blocks where angles as low as  $\sim 0^\circ$  are exhibited, suggesting sliding rather than rebound.

Normal COR (nCOR) is significantly affected by shape, as shown in Fig. 2. An increasing trend of nCOR along with the increase of the rebound angle describes the response of both block shapes. This is more evident for spherical blocks due to the fact that these blocks' configuration at impact does not differentiate between test repetitions.

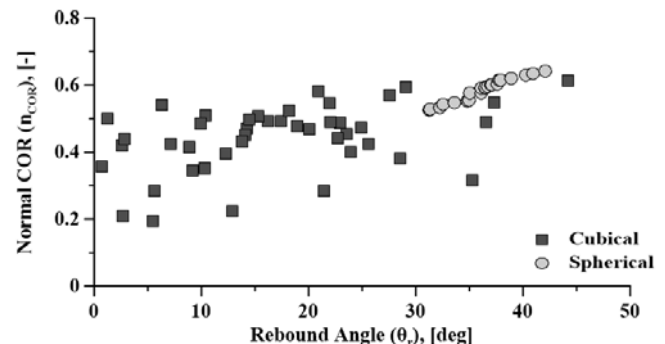


Figure 2. Normal COR versus rebound angle.

Tangential COR ( $t_{COR}$ ) acquires relatively consistent values for both shapes, while no trend with rebound angle is shown.

Based on the total energy definition, COR values can be calculated with an accurate consideration of the rotational motion by expanding Eq. 4 in 3D space. The aforementioned  $ET_{COR}$  in comparison to  $E_{COR}$ , that considers only the translational motion of the block, is presented in Fig. 3. Additionally, the plotted 45° line forms the boundary denoting which definition results to a greater value.

It is evident that  $ET_{COR}$  present greater values compared to  $E_{COR}$ . Moreover, those are well correlated with the linear model shown in Fig. 3, which allows for an estimation of the total kinetic energy COR from the translational definition, which is tremendously easier to acquire.

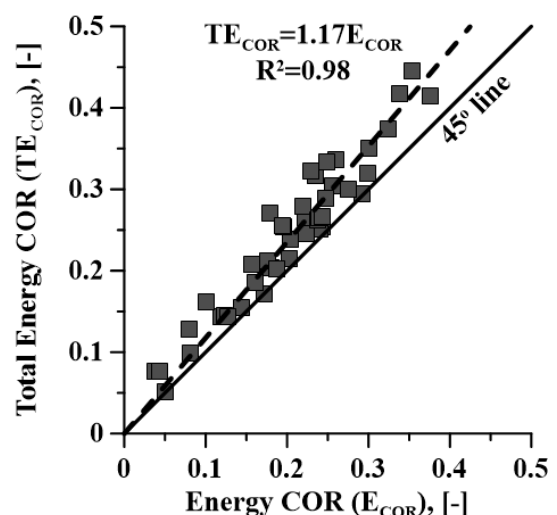


Figure 3.  $TE_{COR}$  versus  $E_{COR}$  values for the cubical blocks.

### 5.1 Lateral Dispersion

A visualization of the lateral dispersion is presented by the polar plot at Fig. 4. The radius axis presents the rebound angle and the angle axis the orientation of the rebound trajectory.

It is evident that cubical blocks present a significant lateral dispersion compared to the spherical blocks as shown in

Fig. 4. The histograms of the dispersion are presented in Fig. 5 for both block types. Values are normally distributed as was verified with the Kolmogorov-Smirnov statistical test. It is seen that dispersion is symmetrically distributed around its mean value, which coincides with the pre-impact mean dip direction in both cases. This can be interpreted as a quality measure of the experimental procedure and the set-up, since a skewed distribution would imply that post-impact dip direction, or equivalently the lateral dispersion, was biased by irregular testing conditions, such as non-random block release.

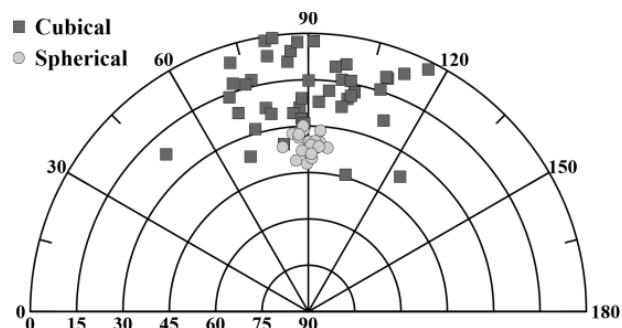


Figure 4. Rebound trajectories of the cubical and spherical blocks.

Based on the fitted normal distributions it is concluded that under the tested conditions, a cubical block has a 68% possibility to exhibit a lateral dispersion in the range of  $\pm 15$  degrees, or a 95% possibility to rebound with a lateral dispersion in the range of  $\pm 30^\circ$ , whereas for the spherical blocks lateral dispersion has over 95% possibility to be less than  $\pm 10^\circ$ .

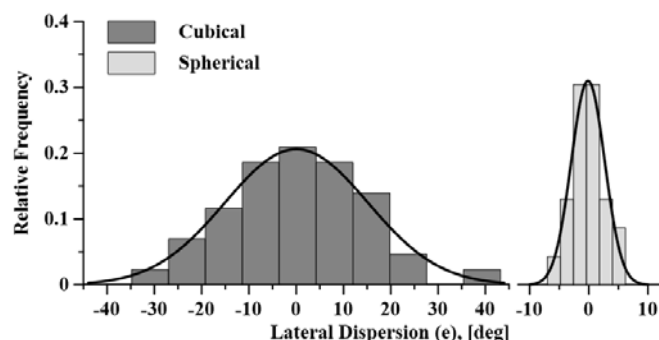


Figure 5. Histograms of lateral dispersion.

Since in design practice it is common to evaluate the scenarios for the 95% of all possible cases, it can be seen that with the 2D rockfall analysis methodology, where no dispersion can be simulated, a significant effect which is crucial for the design of mitigation measures is not considered.

However, when the slope's aspect and the orientation of the post-impact trajectory are not parallel, it is reasonable to expect a non-normal distribution of the dispersion, since the slope will tend to guide the boulder to a specific direction. Expressing the relations between the strike and the dip direction of the slope, the orientation of the surface and the shape of the boulders, forms part of the ongoing research currently conducted in the lab with the presented methodology.

## 5.2 Consideration of rotational motion

The rotational energy versus the translational energy for the cubical blocks is plotted in Fig. 6. Additionally, the boundaries for ratio  $\beta$  from the Japan Railroad Association (JRA) and Chau et al. (2002) are also plotted.

It is seen that current data are located between the aforementioned  $\beta$  ratios. The best fit line exhibits a slope that corresponds to a  $\beta$  ratio of 0.2, which is considerably higher than the proposed ratio from JRA. Additionally, the theoretical upper bound for the  $\beta$  ratio proposed by Chau et al. is in accordance with the present data.

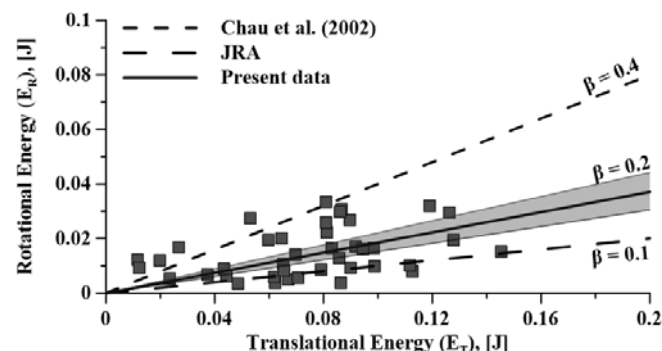


Figure 6. Rotational versus Translational energy, denoting the ratio  $\beta$ .

## DISCUSSION

Rockfall complexity has resulted in significant simplifications in the analysis methodologies and the experimental investigation procedures based on 2D approaches. As the phenomenon takes place in 3D space, a methodology for acquiring the trajectory was developed based on stereo-photogrammetric and machine vision techniques and a laboratory investigation was carried out in order to evaluate those simplifications.

Based on the presented results, it is shown that shape affects significantly lateral dispersion following impact; an effect that has been hitherto neglected due to the usage of 2D analysis methods but which is of great importance as dispersion of up to  $45^\circ$  can occur for cubic blocks. This is in contrast to spherical blocks where dispersion is significantly lower. Moreover, an assessment of the rotational component of the motion was made and correlated with the translational component, allowing for a quick estimation. Additionally, a comparison between the proposed definitions for the coefficients of restitution was made, and some important parameters were highlighted.

Further research is under progress in the Engineering Geology and Rock Mechanics laboratory of the School of Civil Engineering at the National Technical University of Athens. Additionally, research has been recently extended in the field by conducting tests in real scale, in order to establish sound methods and correlations for predicting rockfall trajectories more accurately.

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The electronic version of the Proceedings can be downloaded from: <https://www.etcg.upc.edu/congressos/eygtec-2014/docs/EYGEC2014.pdf>

and the photos taken during the Conference are available in: <https://www.etcg.upc.edu/congressos/eygtec-2014/photo-gallery>

## XII IAEG Congress

### The highest dam of the world in a challenging geological environment The proposed Rogun 335m high dam, Tajikistan

**Paul G. Marinos, Independent consultant**  
**Alessandro Palmieri, Former lead dam specialist, World Bank**

**Torino 2014**



Figure 2-1: Map of Tajikistan indicating Rogun dam site

The dam on the Vakhshriver tributary of the Amu Darya, the Oxos river of the antiquity. Alexandria the Eschateis in the north of the country (Khojand)



NUREK DAM, 300m high, downstream of ROGUN

Rogundamon Vakhshriver, Amu Darya tributary



Owner: Government of Tajikistan

Status: Under construction

Construction begun in 1976

Height: 335m (max option)

Reservoir: 13.3km<sup>3</sup>

Flood: PMF 7,500 to 7,770m<sup>3</sup>/s  
1/10,000 5,600 to 5,700 m<sup>3</sup>/s

Power: Turbines 6 - Installed capacity 3,600 MW

Studies started in 1963 and construction activities in 1976

Studies: 1963-1978 Hydroproject Tashkend  
1992-1993 Hydroproject Tashkend  
2000 Hydroproject Institute Moscow (HPI)  
2004-2006 Lahmeyer and HPI  
2009-present HPI

In 2007, the Government of Tajikistan requested the World Bank to assist with the Techno-Economic Assessment Study and Environmental and Social Impact Assessment Study

2011 Consultant for Techno-Economical Assessment (TEAS): Consortium Coyne et Bellier/ Electroconsult/ IPA

2011 Consultant Environmental and Social Impact: Poyry and Panel of Experts on Engineering and Dam Safety

Panel of Experts  
Engineering and Dam Safety

Roger Gill, Hydropower  
Ljiljana Spacic-Grill, Dam Engineering, Seismic Eng  
Paul Marinos, Engineering Geology  
Ezio Todini, Hydrology  
Gregory Morris, Sedimentology  
John Gummer, Energy

- To ensure due diligence and international quality standards in studies
- To provide independent advice and guidance in the assessment process
- To share technical expertise and knowledge

Has added significant value to the prospect of developing a sustainable project at Rogun.

### 1. The geological context

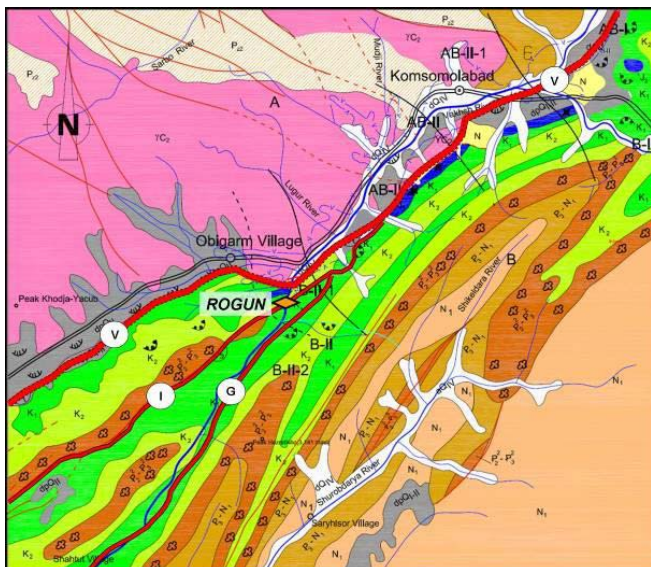


India-Asia collision and induced deformation within Eurasia.

Note that the Rogun HPP is located within the western syntax of the Himalaya, which is characterized by intensive shortening. (BRGM for TEAS, 2014)



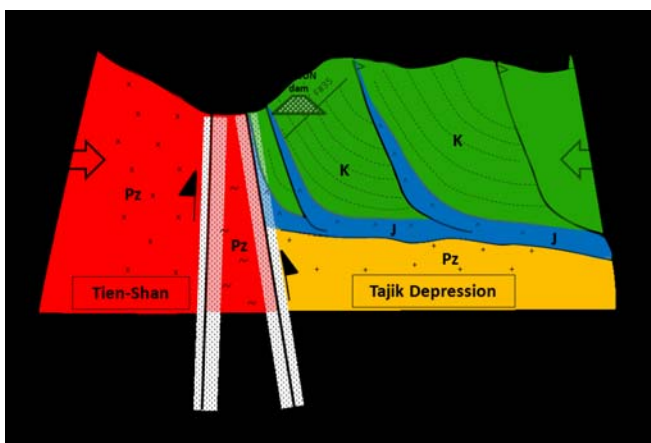
## Regional geology Depression, decollement and thrusting structures and faults



(extract of structural geology map of Rogun HPP, 1975)

### Principal faults

1. Crustal faults
  - > 500 km long, 50 km deep
  - Guissar-Kokshalfault,
  - Illiak-Vakhsh fault, N boundary of the Tajik Depression
2. Regional faults in the TD
  - ~100 km long, rooted in Jurassic salt layer
  - Ionakshfault in dam foundation
  - Gulizindan fault
3. Local faults
  - <5 km long
  - Fault no.35, in dam foundation



(from TEAS consultant reports)

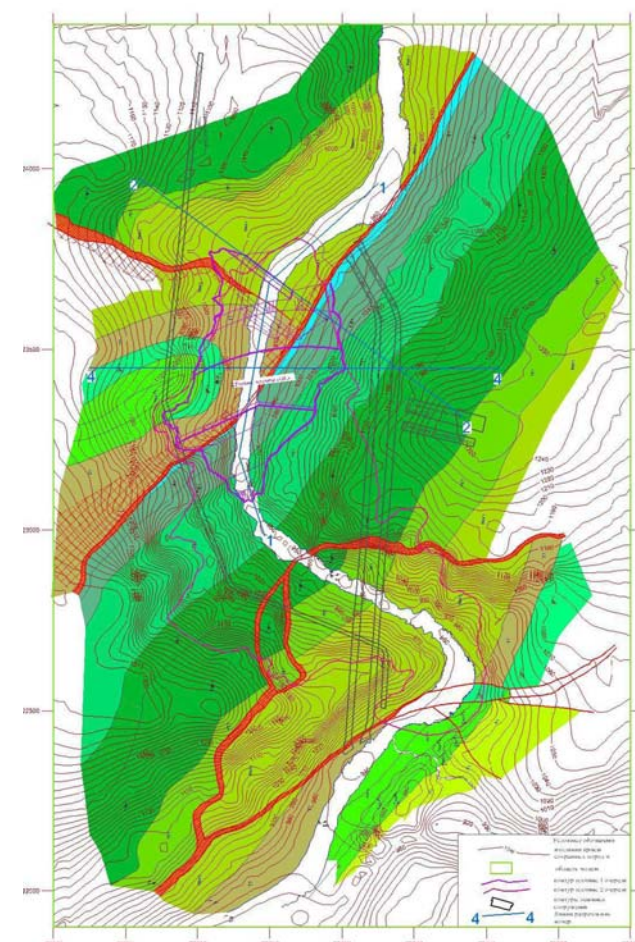
### 2. The site Geology and selection of the dam type Design implications

In light red the foot print of the dam, in blue the stage I construction for early power production



### Rogun dam Site Geology

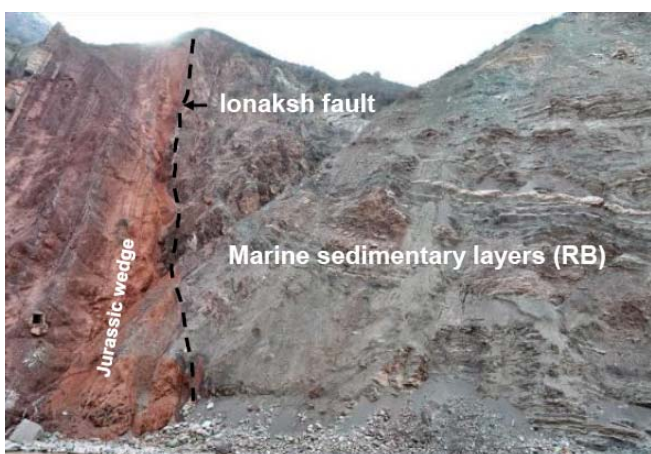
Alternations of sandstones and siltstones





### Site geology – Lithology

- Upper Jurassic evaporites: halite, gypsum, anhydrite, 400 m thick; 20 m reddish mudstone cap
- Lower Cretaceous continental series: alternating sandstone, siltstone, mudstone (shales), 1100 m thick
- Marine sedimentary series: siltstone, shales, gypsum, dolomite, limestone; often fossiliferous; 550 m thick



Exploring the Ionakhsh fault



Breccia in the context of the Ionakhsh fault



The impermeable clay cap over the salt in the Ionakhsh fault

**The site is tight and there are several constraints, namely:**

- The Ionakhsh creeping fault and potential seismic movements
- Salt wedge in the foundations
- Fault No. 35 and potential seismic movements
- Location of intake portal for existing diversion tunnels

**Initial thoughts for an arch gravity dam avoiding the Ionakhsh and other fault**

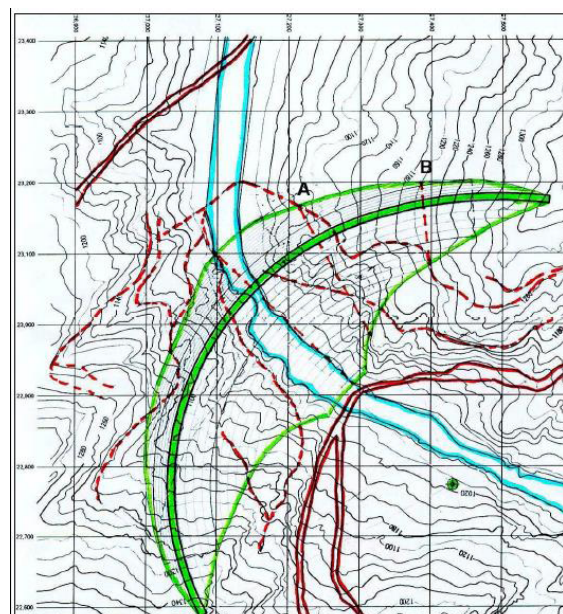


Figure 3.9.2: Tentative layout of concrete arch gravity dam at the Rogun site with traces of geological faults (was abandoned in view of difficulty with the faults)



## Dam Foundations



**Concrete dam:** not suitable due to high heterogeneity although persistence of strong layers. Presence of active, creeping faults (creep estimated up to a few mm/year) in the case of gravity dam.

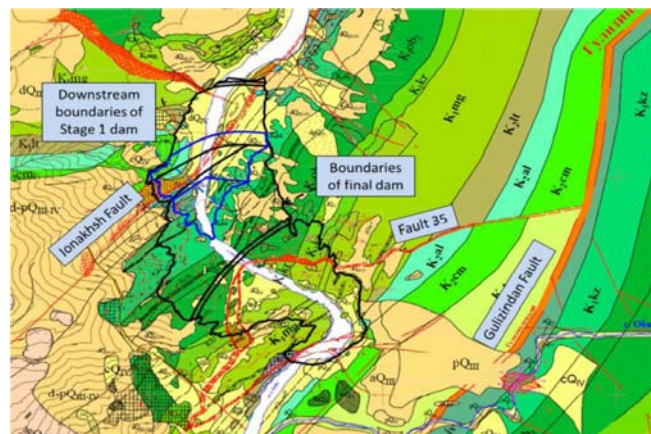
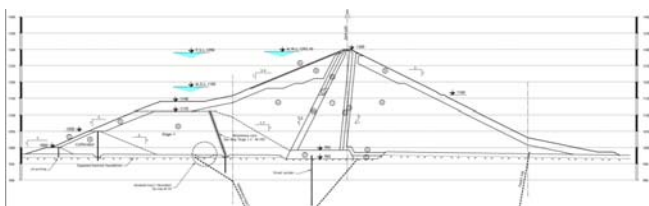
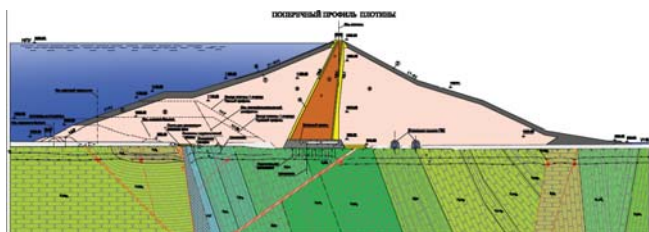
**Embankment dam:** can accommodate faults movements, for both earthquake-associated displacement and aseismic creep.

Activity of faults needs to be considered also in tunnel design.

Risk of co-seismic ground rupture causing large displacements along the Ionakshand #35 faults is considered low.

No sign of Quaternary displacements along these fault exist, as reported.

### Typical cross section of the dam –TEAS Consortium



Dam site geological map with Ionaksh Fault and other main faults; limits of Stage 1 dam are highlighted in blue for the downstream site (upstream, there are same as for the final dam, which will include the Stage 1 dam)

### Conditions of dam abutments

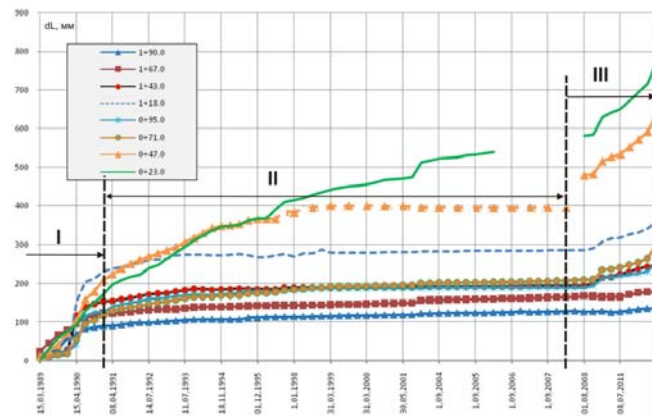
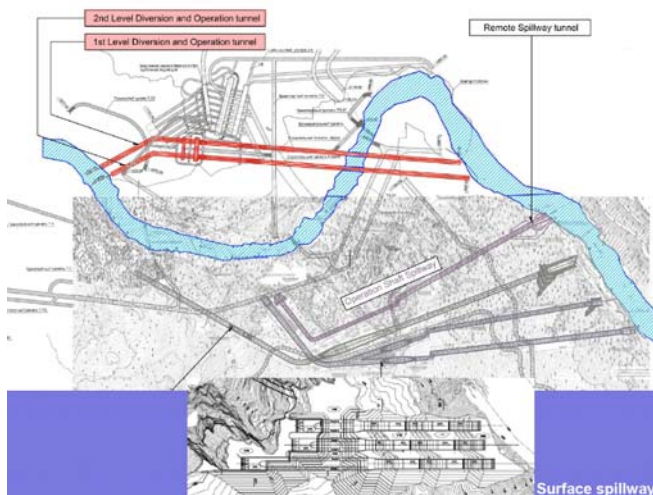


1. Rock mass permeability under the dam is not high. A conservative design in depth of the grout curtain would further reduce the hydraulic gradient against any potential impact on the salt wedge upstream.



2. Narrow saddles exist on the abutments beyond the dam axis; due to stress relaxation, rock mass is probably more permeable in these zones, thus lateral extension of the ground curtain might be necessary, into the right abutment, depending on the position the pre-reservoir ground water table (hydraulic barrier).





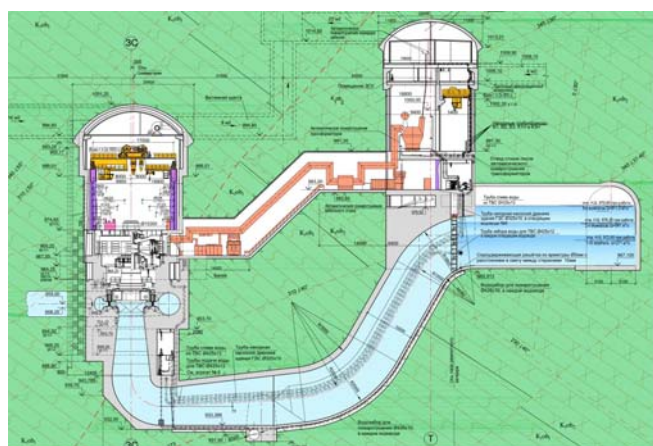
The convergence as presented in the graph of HPI report 2012.

Significant wall closure has been recorded amounting to 600mm in the siltstone sections up to the middle of 2008 and about 750mm up to August 2102.

*Note: the scale of time is irregular and the gradient of convergence is actually lower.*

### The causes

The PoE suggested, the possibility of progressive distress of the rock mass in association with the ageing of the strengthening measures applied since the late 80s, to be the reason of the time dependent deformation and not a gradual deterioration of the petrographic quality due to softening of the siltstone. Such a state can be addressed efficiently by additional support in the sidewalls



### ASSESSMENT OF THE POWERHOUSE CAVERN

-The machine cavern is located in a series constituted by sandstone and siltstone.

It is approximately 21m wide, 69m high and 220m long.

Large amount of excavation have been already conducted, mainly in the siltstone area, where the elevation of the excavated floor is today more than 30m in height.

Time dependent deformations were exhibited since the late 80s and questions were raised about an increasing creep behavior possible to compromise its stability. This is mainly for the siltstone section.

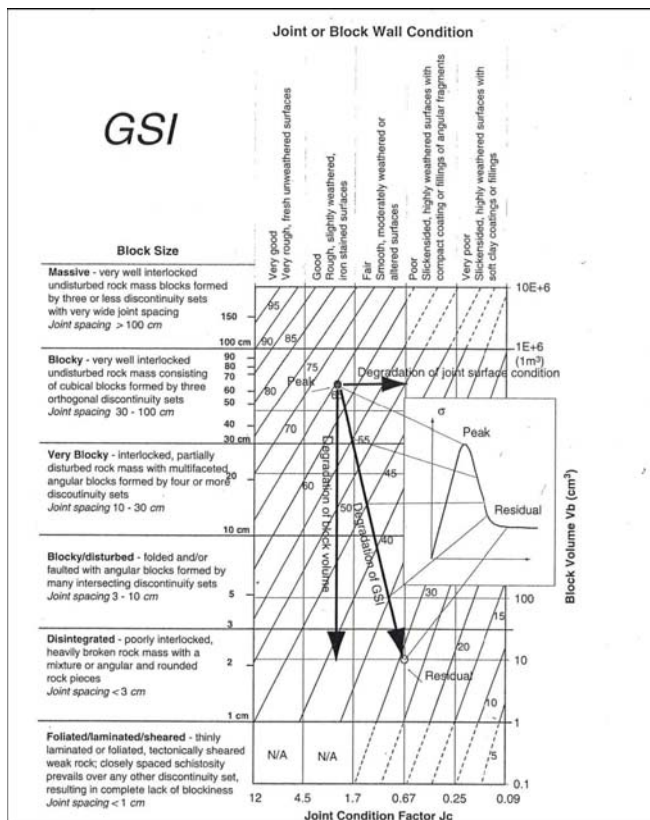


Placement of struts to face deformations



Distressing of the siltstones after excavation, under the concrete struts





A residual GSI (from Cai et al)

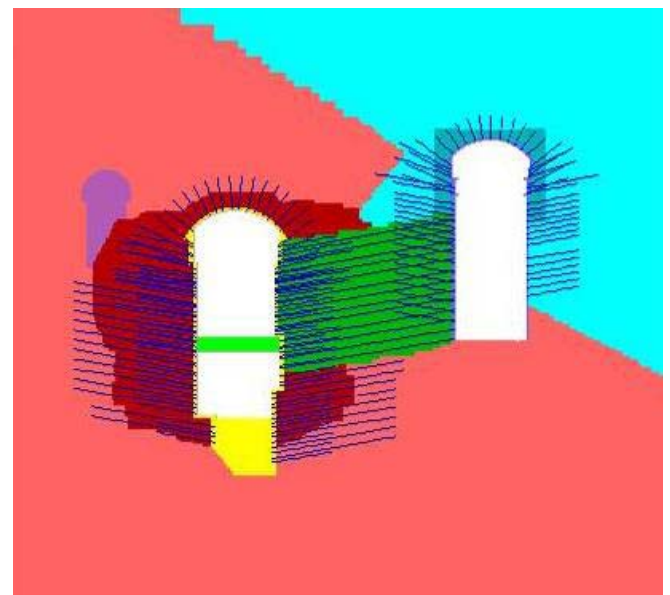


Distressed siltstone in cavern

### Results of the Powerhouse –Transformer Hall 2D Model

Identification of possible remedial measures and preliminary evaluation of their behaviour

- Installation of additional tendons
- Multiple Packer Sleeved Pipe System in the pillar between PH and TH
- Possibility of struts
- Installation of a suitable monitoring system

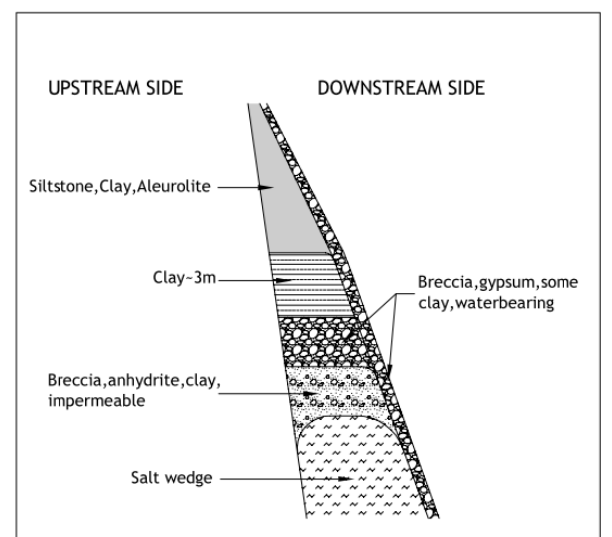
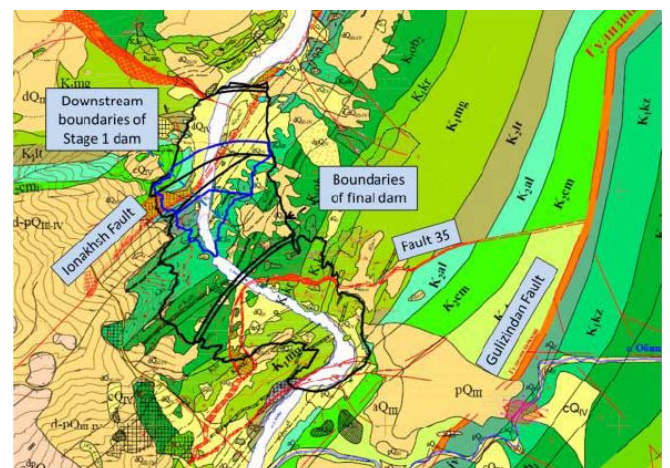


Modelling by G. Barla

### 4. The salt wedge

Assessing conditions and mitigation measures

A salt wedge exists under the upstream part of the dam axis along the creeping Ionakhsh fault which, if not addressed effectively to prevent dissolution by the potential hydraulic gradient, could impact the feasibility of the project.



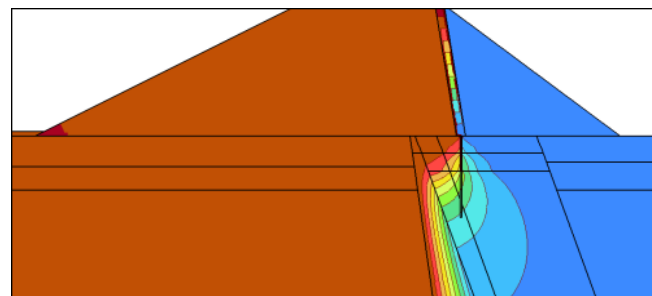
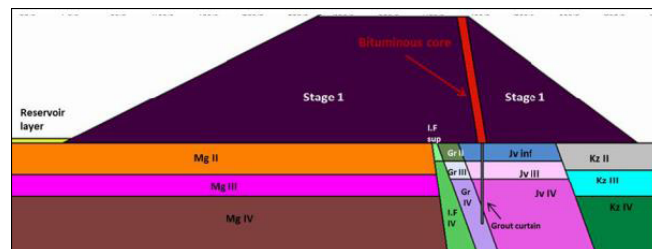
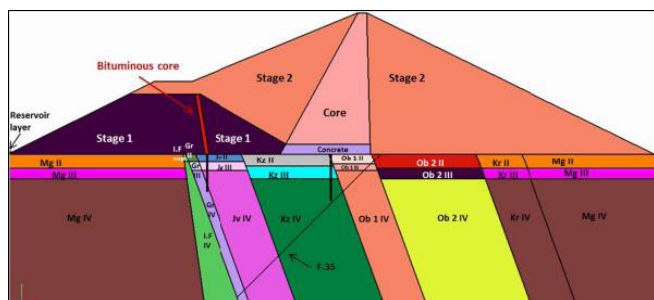


In Nurek area

- The geometry of the saltbody has been extensively investigated since the first studies
- Salt body has a wedge shape with a thickness increasing with depth.
- Under the effect of orogenic forces the salt is being extruded at an estimated rate of 2.5 cm per year.
- It is being dissolved at the same rate, resulting at present stage, in a state of equilibrium.
- The impoundment of the Rogun reservoir would result in an increase in the hydraulic gradient and this increase, if not mitigated, would result in an increase in the dissolution rate and a formation of cavity.

#### Approach -Modelling

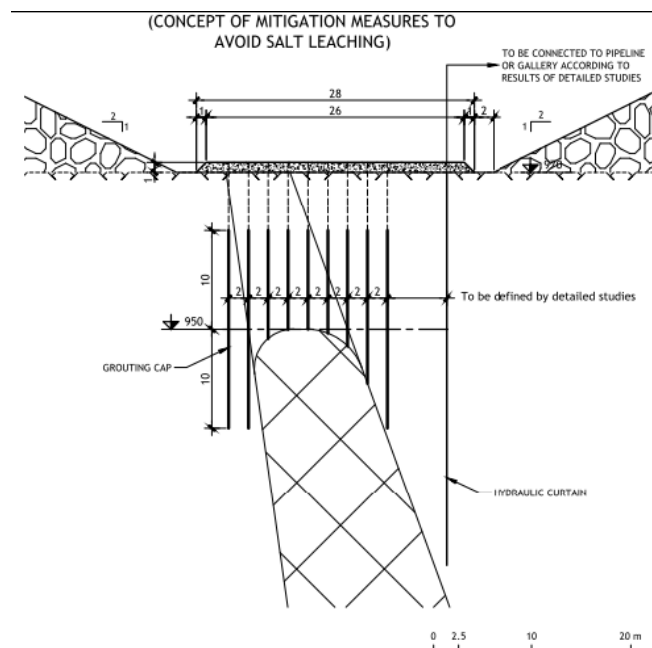
- Modelling,
- Following an initial modelling by the Soviet designers
  - **Three interconnected sub-models have been set up by TEAS consultant**
    - Groundwater flow model
    - Dissolution process model
    - Transport model
- Assess independently existing models
- Assess a number of scenarios
- Carry out sensitivity analysis on the most sensitive parameters
- Assess mitigation measures efficiency
- Carry out risk assessment



#### Proposed by the initial designer, 1978 and the TEAS consultant, 2013.

- Grouting of the rock all around the top of the salt wedge
- Hydraulic barrier: series of boreholes on the downstream side of the salt wedge to maintain reservoir pressure so as to minimize water gradient between the two sides of the salt wedge
- Both measure to be applied One will cover any possible deficiency of the other.

A 3rd level of protection using a brine curtain initially considered is not further considered due to clogging of injection holes and the enormous quantities of salt required.







Grouting of the salt zone along the Ionakhsh fault

#### RECOMMENDATIONS –MAINTENANCE

If the two mitigation measures would happen to fail or lose their efficiency, the grouting and hydraulic barrier would have to be re-implemented.

- Stage1: the re-grouting and reinstallation of the hydraulic barrier can be performed from the crest of the stage1 dam.
- Stage2, the only option for re-grouting and hydraulic barrier restoration would then be to operate from the banks, above the reservoir water level. This could be implemented only using directional boring.

Accurate monitoring of the salt dome rise:

- measurement of the displacements within the salt wedge and the embedding rock, follow-up of the deformations within the salt body by series of inclinometers.

Monitor potential salt leaching, the following systems are proposed:

- groundwater head monitoring, in order to check the hydraulic barrier efficiency (boreholes and pressure cells),
- water conductivity monitoring to check the model reliability and the on-going leaching process if any (boreholes and conductivity cells),
- microgravity in order to check the salt rising rate at IonakhshFault and potential cavity generation
- regular sonar inspection of the dam face once impounded, to detect any abnormal deformation of the upstream face.

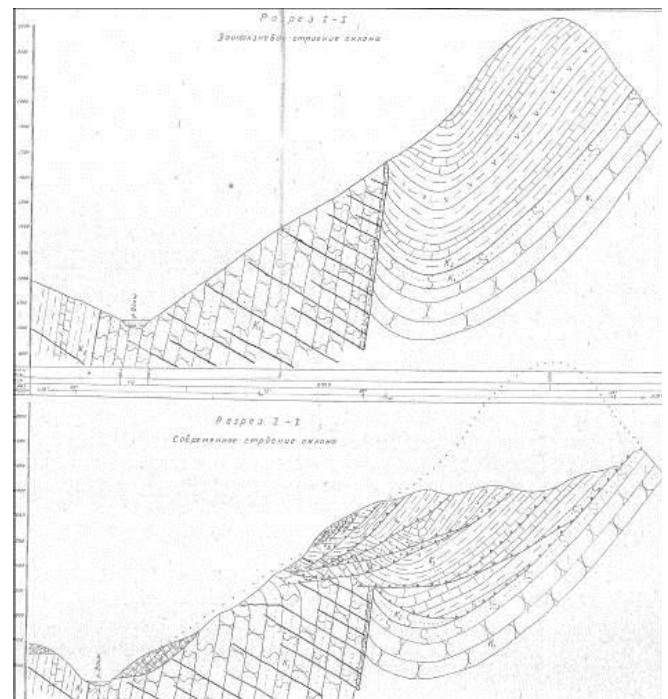
#### 5. THE DOWNSTREAM STRANGE GEOMORPHOLOGY A HUGE LANDSLIDE OR NOT?



#### The downstream atypical area at the right valley side



#### Geological setting of the Right Bank



Proposed model in previous studies

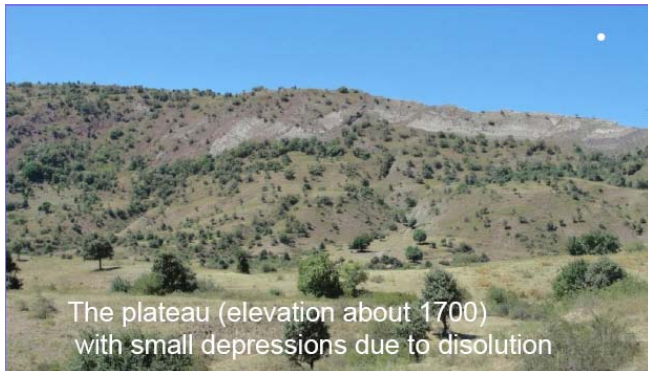


Sinks on the plateau, right valley side downstream of the dam



## RIGHT VALLEY DOWNSTREAM

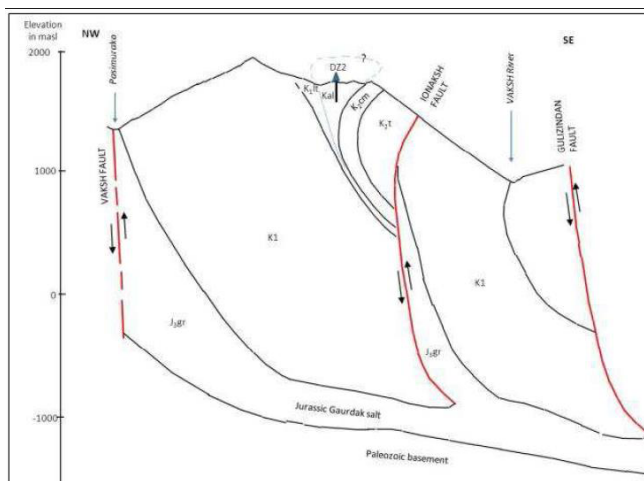
Present assessment: A tectonic structure, due to evaporitic diapirism not to a landslide.



**Geology in the mood.**

**Design have to comprehend it for a peaceful cohabitation of a man structure with nature**

- Few rock debris on the surface
- Topography uphill does not suggest large scale movement
- Geophysics in 2005 anticipated shallow overburden;
- Results of 2012 geophysics show compact low specific gravity material
- New borehole revealed continuous, undisturbed, compact gypsum/anhydritic deposits in mudstone matrix, starting from shallow depth: the reason of sinks due to dissolution



A tectonic structure not a landslide  
Model by the Consultant of TEAS



# ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ



## Ιστότοπος Ορυκτά

Με την πρωτοβουλία του Συνδέσμου Μεταλλευτικών Επιχειρήσεων Ελλάδος (Σ.Μ.Ε.) και με τη συνεργασία και επιστημονική επιμέλεια της Σχολής Μηχανικών Μεταλλείων – Μεταλλουργών του Ε.Μ.Π. και του Τμήματος Γεωλογίας και Γεωπεριβάλλοντος του Ε.Κ.Π.Α., δημιουργήθηκε ο ιστότοπος [www.orykta.gr](http://www.orykta.gr) για να προσφέρει πληροφορίες κυρίως για τα ελληνικά ορυκτά, τις εμφανίσεις τους στον Ελλαδικό χώρο, την γεωλογική και κοιτασματολογική τους ταυτότητα, τις διάφορες χρήσεις τους στην καθημερινή ζωή, καθώς και τις εργασίες εκμετάλλευσης, εμπλουτισμού και εν γένει αξιοποίησής τους.



## Report on the 23rd European Young Geotechnical Engineers Conference (EYGEC-2014)

50 delegates from 26 European countries nominated by their respective Member Societies gathered in Barcelona in September for the 23rd European Young Geotechnical Engi-

neers Conference (EYGEC-2014). The Conference was organized by the Department of Geotechnical Engineering and Geosciences of the Technical University of Catalonia (UPC) on behalf of the Spanish Society for Soil Mechanics and Geotechnical Engineering. The organizing committee was chaired by Professors Marcos Arroyo and Antonio Gens and composed by Ph.D. students and Postdocs, several of whom had themselves participated in previous EYGEC meetings. The Conference took place in the main lecture theatre of the Civil Engineering School. Conference participants, including senior lecturers, were lodged together in a Students Residence close to the Conference venue.



## Opening ceremony

The Conference lasted for three days, the first two were devoted to lectures and presentations and a technical visit was organized for the third day. A welcome reception was offered during the evening prior to the Conference. In the opening ceremony, chaired by Sebastià Olivella (Dean of the Barcelona Civil Engineering School), the President of the ISSMGE, Roger Frank, addressed the delegates with an overview of the International Society's role, objectives and activities. Special mention was made of the Young Members Presidential Group as the most suitable way for the Conference attendants to engage with the ISSMGE.

Oral presentations were made by all delegates; a consistently high standard of both presentations and technical content was achieved; no doubt reflecting the fact that all participants had been especially selected by their National Societies. In addition, Professors César Sagaseta (University of Cantabria) and Lidija Zdravkovic (Imperial College) were invited to deliver special lectures to the Conference. Lectures were also presented by Professors A. Gens and A. Ledesma from UPC. Discussion of presentations and lectures was often lively, filling the time allocated without difficulty.



## Αναμνηστική φωτογραφία συνέδρων

Participants had to submit papers summarising their work in advance of the Conference that were subjected to review and revision before publication. Although, in accordance with the EYGEC guidelines issued by the ISSMGE, there was no conference theme, it was possible to structure papers and presentations around a number of topics: Experimental studies and constitutive models, Dynamics problems, Pile foundations, Geo-environmental problems, Marine geotechnics, Soil improvement, Geo-hazards, and Soil-structure interaction. All papers have been collected in a Proceedings volume; the electronic version can be downloaded from the Conference website

(<https://www.etcg.upc.edu/congressos/eygtec-2014/docs/EYGEC2014.pdf>).

A prize was awarded to the best paper and presentation. It was won by Audrey Huckert from France for the contribution: "Experimental and numerical approaches of the design of geosynthetic reinforcements overlying voids". Runner-ups were Henri de Chaunac (Belgium) and Çağdaş Arda (Turkey).

On the third day of the Conference, there was Technical visit to the Sagrera station works that involve a very large anchored excavation and water table drawdown operations. The Sagrera station will become the main transport hub of Barcelona linking high speed train lines with conventional railway, bus station and two metro lines. Participants went on to visit the Sagrada Familia church, in the vicinity of which a tunnel for the high-speed train had been recently constructed sparking strong public controversy.



Μαθητευόμενοι μάφειροι Ισπανικών tappas

Fortunately there was also time for social events. In the first evening, a cooking workshop was held in which participants enthusiastically learnt to produce a variety of Spanish tapas. And the results were consumed during dinner with the same enthusiasm! On the second day, the Conference dinner was held in which the award for best paper/presentation was presented. The full set of photographs taken during the Conference is available in the Conference website (<https://www.etcg.upc.edu/congressos/eygtec-2014/photo-gallery>).

Following the long tradition of the EYGEC meetings, the Conference provided an excellent opportunity for promising young geotechnical engineers to present their work, discuss their results, share experiences and, of course, make new friends and connections.

Η ΕΕΕΕΓΜ δημοσίευσε πρόσκληση συμμετοχής στην διαγωνιστική διαδικασία για την επιλογή του εκπροσώπου της. Υπεβλήθησαν τα ακόλουθα τρία άρθρα:

«Passive stabilization of liquefiable soils: rheological testing and macroscopic modeling», Georgia Agapoulaki,

«Rockfall experimental investigation in 3D space», Pavlos Asteriou,



Παρουσίαση άρθρου από τον Παύλο Αστερίου

«Experimental and numerical investigation of the seismic response of rectangular tunnels», Grigorios Tsinidis & Kyriazis Pitilakis.

Επελέγη το άρθρο του Π. Αστερίου, Πολιτικού Μηχανικού, υποψήφιου διδάκτορος του ΕΜΠ, το οποίο παρουσιάζεται στην πρώτη ενότητα του παρόντος τεύχους (SESSION T3: Geo-hazards).

# ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

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

Shale and Rock Mechanics as Applied to Slopes, Tunnels, Mines and Hydrocarbon Extraction, Special One day Symposium, May 12, 2015, Montreal, Quebec, Canada, [www.isrm2015.com/Page/PageContent/ShaleSymposium](http://www.isrm2015.com/Page/PageContent/ShaleSymposium)

World Tunnel Congress 2015 and 41<sup>st</sup> ITA General Assembly: Promoting Tunnelling in South East European (SEE) Region, 22 - 28 May 2015, Dubrovnik, Croatia, <http://wtc15.com>

COMPUDYN 2015 5<sup>th</sup> International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, 25-27 May 2015, Crete Island, Greece, [www.2015.compdyn.org](http://www.2015.compdyn.org)



**31 May - 03 June, 2015, Doha, Doha, Qatar**  
[www.undergroundfoundations.com](http://www.undergroundfoundations.com)

Developing robust geotechnical planning through internationally-proven techniques that will guarantee Qatar's readiness for upcoming developments

Building on the strong foundations of the successful underground series, the Underground Infrastructure & Deep Foundations Summit Qatar is back for 2015!

Qatar continues to gear up for a wave of key sporting events over the next seven years, including the Handball World Championships (2015), the World Championships in Athletics (2019), and, of course, the World Cup (2022). As the country is expected to have over one million visitors by 2022, the big question is will Qatar be able to deliver some of its key \$200bn infrastructure and building projects, such as the World Cup stadia and Qatar Rail, in time for these major events to accommodate all its visitors?

With a global, first-class speaker line-up of geotechnical and structural experts who share a wealth of academic and practical experience, the 5th Annual Underground Infrastructure & Deep Foundations Summit Qatar will be an unmissable opportunity to join leaders in the field as they tackle the major issues concerning Qatar's construction sector, such as dewatering and waterproofing, project plan-

ning and stakeholder management, and constructing alongside existing buildings and infrastructure.

Key topics to be discussed:

- **Qatari Turf:** Exploring the geotechnical conditions specific to Qatar, and overcoming related issues including rising water table levels and cavities
- **Going Underground:** With over 10 major upcoming tunnelling projects in Qatar alone, including Inner Doha Resewerage Implementation Strategy (IDRIS), we explore the methodologies being used in these projects and the challenges of delivering these tunnels
- **International to Regional:** Discussing the key strategies being implemented successfully across and beyond the region which can be adapted to Qatari projects
- **Project Insights** into the most ground-breaking projects; including tunnels, stadiums, roads and highways, rail, metro, high-rise buildings, and many more

Questions? Contact us on +971 4 364 2975 or email [enquiry@igpc.ae](mailto:enquiry@igpc.ae).



5<sup>th</sup> International Congress on Construction History, June 3rd-7th, 2015, Chicago, USA, [www.5icch.org](http://www.5icch.org)

2<sup>nd</sup> International Course on Geotechnical and Structural Monitoring, 4-5-6 June 2015, Poppi, Tuscany, Italy, [www.geotechnicalmonitoring.com/en/home-2](http://www.geotechnicalmonitoring.com/en/home-2)

ISFOG 2015 3<sup>rd</sup> International Symposium on Frontiers in Offshore Geotechnics, Oslo, Norway, 10-12 June 2015, [www.isfog2015.no](http://www.isfog2015.no)



**6<sup>ο</sup> ΔΙΕΘΝΕΣ ΣΥΝΕΔΡΙΟ  
ΑΣΦΑΛΤΙΚΑ ΜΙΓΜΑΤΑ ΚΑΙ ΟΔΟΣΤΡΩΜΑΤΑ**  
Θεσσαλονίκη, 10-12 Ιουνίου 2015  
<http://iconfbmp.civil.auth.gr>

Το Εργαστήριο Οδοποιίας του Τμήματος Πολιτικών Μηχανικών του Α.Π.Θ., σε συνεργασία με το BERI (Built Environment Research Institute) του Πανεπιστημίου Ulster, Αγγλίας και το CAIT (Center for Advance Infrastructure Technology) του Πανεπιστημίου Μισισιπή, ΗΠΑ, διοργανώνει το 6<sup>ο</sup> Διεθνές Συνέδριο "Ασφαλτικά Μίγματα και Οδοστρώματα" (6<sup>th</sup> ICONFBMP).

Το 6<sup>ο</sup> ICONFBMP υποστηρίζεται από τα διεθνή Ινστιτούτα, Οργανισμούς ή Ενώσεις: το Ινστιτούτο Πολιτικών Μηχανικών (ICE) Αγγλίας, το Ερευνητικό Εργαστήριο Μεταφορών (TRL) Αγγλίας, το Ινστιτούτο Αυτοκινητοδρόμων & Μεταφορών (CIHT) Αγγλίας, το Συμβούλιο Έρευνας Μεταφορών (TRB) ΗΠΑ, την Αμερικανική Κοινότητα Πολιτικών Μηχανικών-Ινστιτούτο Μεταφορών & Ανάπτυξης (ASCE T&D),



το Ινστιτούτο Τεχνολογίας Ασφάλτου (ΙΑΤ), την Ευρωπαϊκή Ένωση Ασφαλτικών Οδοστρώματων (ΕΑΡΑ), τη Διεθνή Κοινωνία για Ασφαλτικά Οδοστρώματα (ISAP) και την Ομοσπονδιακή Διοίκηση Αεροπορίας (FAA).

Το 6<sup>ο</sup> ICONFBMP είναι συνέχεια των πέντε προηγούμενων Συνεδρίων που οργανώθηκαν με επιτυχία στην Θεσσαλονίκη τα έτη 1992, 1996, 2002, 2007, και 2011.

Σκοπός του Διεθνούς Συνεδρίου είναι η παρουσίαση νέων τεχνολογιών, τάσεων, προδιαγραφών και ερευνητικών δραστηριοτήτων τόσο στο εξωτερικό όσο και στην Ελλάδα, στα ασφαλτικά υλικά και οδοστρώματα.

Επίσης, η ανταλλαγή απόψεων και εμπειριών προς όφελος των ενασχολούμενων με την Οδοποιία και Αεροδρόμια και ειδικότερα την μελέτη, κατασκευή, συντήρηση και διαχείριση των οδοστρώματων οδών και αεροδρομίων, ανακτημένων και ανακυκλωμένων υλικών, καθώς και την παραγωγή και χρήση υλικών και ασφαλτικών μιγμάτων.

Για οποιαδήποτε πληροφορία σχετικά με το 6<sup>ο</sup> Συνέδριο, ή για ανακοινώσεις και Πρακτικά προηγούμενων Συνεδρίων, μπορείτε να επικοινωνείτε τηλεφωνικά με την Γραμματεία του Συνεδρίου, τηλ. 2310 995835, 553207, fax: 2310 995789, ή ηλεκτρονικά στη διεύθυνση: [6iconfbmp@civil.auth.gr](mailto:6iconfbmp@civil.auth.gr)

Σε περίπτωση επικοινωνίας με ταχυδρομείο χρησιμοποιήστε την παρακάτω διεύθυνση:

Εργαστήριο Οδοποιίας ΑΠΘ  
(Για το 6<sup>ο</sup> Διεθνές Συνέδριο "Ασφαλτικά Μίγματα και Οδοστρώματα")  
Τμήμα Πολιτικών Μηχανικών  
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης  
541 24 Θεσσαλονίκη



83rd ICOLD Annual Meeting & Congress Hydropower' 15,  
13-20 June 2015, Stavanger, Norway,  
[www.icoldnorway2015.org](http://www.icoldnorway2015.org)



### **Geotechnique Symposium in Print 2015 Geotechnical Earthquake Engineering London, 15 June, 2015**

[www.ice.org.uk/events/geotechnique-symposium-in-print-2015](http://www.ice.org.uk/events/geotechnique-symposium-in-print-2015)

The many large earthquakes of the last decade, including the series in Christchurch in 2010-11 and the Tohoku earthquake in Japan, have focussed even greater attention on the cyclic behaviour of soils during these events. Great advances have recently been made on all aspects of soil dynamics, from the prediction of liquefaction based on site investigation to the impact of shaking on geotechnical systems.

This symposium will provide a forum for the presentation and discussion of the latest research findings and implications to practice in areas including:

- Dynamic response of geotechnical systems

- Prediction of liquefaction and evaluation of its impacts
- Seismic stability of slopes

The symposium has attracted many excellent papers from the UK, Europe, North America and Asia. These cover the full range of Soil Dynamics and Geotechnical Earthquake Engineering, from micromechanics using DEM to the latest developments on liquefaction prediction based on site investigation.

Event organiser: [ICE](http://www.ice.org.uk)

Contact: [events@ice.org.uk](mailto:events@ice.org.uk)



DMT 15 The 3<sup>rd</sup> International Conference on the Flat Dilatometer, Rome 15-17 June 2015, [www.dmt15.com](http://www.dmt15.com)



### **Summer School Series in Greece "SOUTH AEGEAN CRUST PROCESS" "SANTORINI VOLCANOTECTONIC LAB" 15-20 of June 2015, Santorini, Greece**

The Geology Department of the Aristotle University of Thessaloniki (Greece) organizes a Summer School in the SANTORINI Island (Cyclades, Southern Greece), 15-20 of June 2015. The program includes lectures, practical tutorials, field work and visits to the archaeological sites and the active volcano.

**CONTENTS:** *Physical Volcanology and Volcanotectonics, Regional Geology (Aegean), Earthquake Geology and Seismotectonics, Fault Geometry and Seismic Activity, Engineering Geology (rock falls - slope stability and foundation in volcanic rocks), Archaeology and Archaeoseismology, Natural Hazards-Mitigation.*

Lectures will be held in a municipality hall of Pyrgos Village in Santorini by specialist scientists, professors of the above mentioned subjects e.g.:

I. Cemen (*Alabama University, Department of Geosciences*), A. Chatzipetros, M. Fytikas, V. Marinou, C.B. Papazachos, S. Pavlides (*Aristotle University of Thessaloniki, School of Geology*). Walter Friedrich (*University of Aarhus*).

**TO WHOM :** Graduates in Geosciences, Physics, Geography, Engineering and other related subjects, and Postgraduate Students, Post-doctoral fellows, Researchers etc (\*). Minimum number of Students 12; Maximum 20.



COST : 1000-1200 Euro per person approximately. The cost includes tuition fees, accommodation and transportation within the island for the field trips and work. Accommodation at a local Hotel (Single, double and triple rooms. Breakfast, light meals and a dinner are included).

Expression of Interest: [kaklis@geo.auth.gr](mailto:kaklis@geo.auth.gr);  
[Pavlides@geo.auth.gr](mailto:Pavlides@geo.auth.gr)

(\*) Undergraduate Students (last 2 semesters) could also be accepted,



### **The First Kazakhstan – USA Geotechnical Engineering Workshop Astana and Almaty, Kazakhstan, 13-16 July 2015**

During the 18<sup>th</sup> International Conference for Soil Mechanics and Geotechnical Engineering, which was held in Paris (France), bilateral agreements (Memorandums) between Kazakhstan Geotechnical Society (KGS) and US National Society for ISSMGE (Geo-Institute, ASCE) were signed. The agreements outline prospects for cooperation between societies, issues of exchange of experience and knowledge, scientific and normative documentations, training of specialists in the field of geotechnical engineering, and organization of joint geotechnical conferences, seminars, workshops and webinar. In this connection KGS and the ASCE Geo-Institute will organize the First Kazakhstan-USA Geotechnical Engineering Workshop scheduled to take place at the L.N. Gumilyov Eurasian National University in Astana (the new capital of Kazakhstan) from 13-14 July, 2015 and in Almaty (largest city in Kazakhstan) from 15 -16 July.

#### **Workshop Theme and Topics**

TRANSPORTATION AND ENERGY GEOTECHNICS *Highways, Railways, Tunneling, Bridges, Wind Energy, Geosynthetics, and Geothermal Energy Systems*

The workshop will have a strong industry related component to highlight geotechnical and construction opportunities in Kazakhstan associated with EXPO 2017 in Astana. Practitioners, university faculty, and researchers are all encouraged to participate in the workshop.

#### **Landline for correspondence:**

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#### **Post address:**

Geotechnical Institute, ENU of L.N.Gumilyov,  
7 Munaitpasov str., Astana, Kazakhstan, 010008



ICGE 2015 International Conference in Geotechnical Engineering – Colombo-2015, 10 - 11 August 2015, Colombo, Colombo, Sri Lanka, <http://www.slgslk/?p=564>

China Shale Gas 2015 - an ISRM Specialized Conference, 6-8 September 2015, Wuhan, China,  
[http://english.whrsm.cas.cn/ic/ic/201405/t20140509\\_120692.html](http://english.whrsm.cas.cn/ic/ic/201405/t20140509_120692.html)



### **"Underground Construction" Conference 8-9 September 2015, Krakow, Poland [www.inzynieria.com](http://www.inzynieria.com)**

#### **Contact**

#### **INŻYNIERIA Publishing House**

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24th European Young Geotechnical Engineers Conference in Durham, UK, 11-12 September, 2015,  
<https://www.dur.ac.uk/conference.booking/details/?id=419>

16<sup>th</sup> European Conference on Soil Mechanics and Geotechnical Engineering "Geotechnical Engineering for Infrastructure and Development", 13 - 17 September 2015, Edinburgh, UK, [www.xvi-ecsmge-2015.org.uk](http://www.xvi-ecsmge-2015.org.uk)

Workshop on Volcanic Rocks & Soils, 24 - 25 September 2015, Isle of Ischia, Italy, [www.associazionegeotecnica.it](http://www.associazionegeotecnica.it)



### **The 7<sup>th</sup> International Symposium on Roller Compacted Concrete (RCC) Dams Chengdu, China, Sept. 24th -25th, 2015 [www.chincold.org.cn](http://www.chincold.org.cn)**

Chinese National Committee on Large Dams (CHINCOLD) and Spanish National Committee on Large Dams (SPANCOLD) have the honor to invite professionals to the 7th International Symposium on Roller Compacted Concrete (RCC) Dams. The symposium will be held from 24th to 25th Sept. 2015 in Chengdu City, China.

RCC dams have the virtues of saving a great deal of concrete, building quickly, making project cost down and early bringing into playing project advantages and so on. Hence, the technique of constructing dams has been quickly spread and applied since it came out. CHINCOLD and SPANCOLD have devoted to promote the technology from early 1990's. The first Symposium on RCC dams was jointly organized by the two committees in 1991 in Beijing China, which was a success start of the series of RCC Symposiums. It is great to find that there are more than 400 dams of this type in more than 40 countries today.

Following those successful and fruitful Symposiums held in Beijing (China) in 1991, Santander (Spain) in 1995, Chengdu (China) in 1999, Madrid (Spain) in 2003, Guiyang (China) in 2007 and Zaragoza (Spain) in 2012, the coming one jointly organized by CHINCOLD and SPANCOLD, will continue to contribute significantly to the knowledge and application of RCC technology with a wide range of contents and international scope. The Symposium will serve as a perfect venue for professionals from all over the world to exchange ideas and technology about the latest developments dealing with RCC dams.

Beside international best practice, the participants will also have the occasion to visit some famous RCC dams in China in operation or under construction, such as Guangzhao RCC Gravity Dam (H=200.5m), Longtan RCC Gravity Dam (H=216.5m), Suofengying RCC Gravity Dam (H=122m), Mamaya RCC Gravity Dam (H=109m) and etc. Also a technical exhibition for enterprises related to RCC technology will be held during the Symposium.

#### Topics

1. Materials and mixture proportions
2. Planning and design
3. Construction and quality control
4. Performance and monitoring
5. RCC dams on non-rock foundation
6. Rehabilitation of RCC dams and upgrading of old dams with RCC
7. Other uses of RCC in dam construction and hydraulic structures
8. Technological innovations and new trends
9. Cemented Material dams (CSG, Hardfill, soil-cemented, and etc.)

#### Secretariat

Ms. Yao ZHANG & Ms. Xiao WANG  
Secretariat of RCC 2015  
Chinese National Committee on Large Dams  
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Fax: +86-10-68712208  
Email: [chincold-en@vip.126.com](mailto:chincold-en@vip.126.com)  
Website: <http://www.chincold.org.cn>



## Athens 2015 International Landfill Mining Conference

**September 24-25, 2015, Athens**

<http://www.erasmus.gr/microsites/1050/welcome-address>

#### Topics

The conference will include presentations from Greek and foreign speakers, with topics:

- Landfill Mining
- International Experience in Landfill Mining
- Recovery of Resources from Municipal Solid Waste
- New Technologies in Waste Management
- Restoration of landfills and contaminated sites
- Closed Landfills: Monitoring and Alternative Uses

**Participation to the conference is FREE.** However, you are kindly requested to preregister in order to secure your participation in the Conference.

The conference is addressed to universities, research institutes, public institutions, businesses and non-profit organizations.

#### Registration

Conference Organising Secretariat  
ERASMUS S.A.  
1 Kolofontos & Evridikis Str.  
16121 Athens  
Tel: +30 210 7414700  
Fax: +30 210 7257532  
E-mail: [register@erasmus.gr](mailto:register@erasmus.gr)



**The 2nd International Symposium on Transportation Soil Engineering in Cold Regions**  
**September 24-26, 2015, Novosibirsk, Russia**  
<http://transoilcold2015.stu.ru/index.htm>

We are pleased to invite you to Novosibirsk, Russia, for the 2nd International Symposium on Transportation Soil Engineering in Cold Regions to be held on September 24-26, 2015.

**The 1st International Symposium on Transportation Soil Engineering in Cold Regions** was held in 2013 and offered a unique platform to foster knowledge sharing and exchanging experiences for the prevention of cold region subgrade soils and foundation problems impacting transportation facilities such as railways and highways.

#### Main Topics

- Mechanical behaviour of soil and aggregate in transportation in cold regions
- Coupled modelling of mechanical and physical processes in transportation soil for cold regions
- Slope stability of embankments and their foundations in permafrost
- Frost heave in ballast and subgrade beneath slab track
- Thaw weakening of soil in transportation
- Field measurement of stress, deformation, temperature, moisture
- Long-term evaluation of subgrade functionality
- Nondestructive evaluation of subgrade soils and aggregate layers in cold regions
- Water-heating mode subgrade in cold regions
- Protection of subgrade from avalanches

### Contact us

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Phone: +86 1358 1986 007

### Postal Address:

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Siberian State University of Railway Engineering  
Faculty of Railway Construction  
191, D. Kovalchuk Street  
630049, Novosibirsk  
Russia



### GE Basements and Underground Structures Conference 2015 6 - 7 October 2015, London, UK <http://basements.geplus.co.uk>

*Ground Engineering* is delighted to bring you the eighth annual Basements and Underground Structures Conference, the only event exploring the procurement, design and delivery of underground spaces.

From large infrastructure projects to commercial developments and residential extensions, the basement market offers extensive opportunities which are set to continue as urban land remains a premium.

Attend the 2015 conference to:

- Capitalise on future project opportunities and explore client pipelines
- Meet the new standards in basement design and improve safety onsite
- Learn from innovative case studies from projects being delivered in challenging ground conditions and in constrained sites
- Network with clients, tier 1 contractors, designers, tier 2 contractors and the whole supply chain
- Mitigate geotechnical risk to prevent damage to neighbouring structures

Whatever the scale, location or stage of the basements you are involved in, Basements and Underground Structures gives you the industry's best opportunity to improve your knowledge and understand where future opportunities will arise.

The programme is designed to bring together those working on large, medium and small scale projects, in sectors including infrastructure, commercial and residential. Join us at the conference to have your questions answered so you can succeed in the sector:

- How will basement design change in the next three years?

- What are main contractors looking for from the supply chain in order to reduce the costs of construction?
- To what extent is top down construction changing the feasibility of projects and the timescales for delivery?
- How have Basement Impact Assessments changed the way developments are planned in London?
- What does the UK infrastructure market hold in terms of future underground spaces and structures?
- Will the market continue to be focused on Central London or are opportunities emerging across the UK?

The conference also provides an excellent learning and networking opportunity for the industry and is essential for anyone already or looking to be involved in underground projects.

For registration enquiries:

Nigel Plain  
T: +44 (0) 203 033 4253  
E: [nigel.plain@EMAP.com](mailto:nigel.plain@EMAP.com)



EUROCK 15 ISRM European Regional Symposium & 64th Geomechanics Colloquy, 7 - 9 October 2015, Salzburg, Austria, [www.eurock2015.com](http://www.eurock2015.com)



### Shotcrete for Underground Support XII New Developments in Rock Engineering, TBM tunnelling, Deep Excavation and Underground Space Technology October 11-13, 2015, Singapore [www.engconf.org/conferences/civil-and-environmental-engineering/shot-crete-for-underground-support-xii](http://www.engconf.org/conferences/civil-and-environmental-engineering/shot-crete-for-underground-support-xii)

The 12<sup>th</sup> International Conference on Shotcrete for Underground Support (ECI SUS XII) will be held in Singapore this year. This event is organized by Engineering Conferences International (ECI) and supported by NTU-JTC Research Centre (NTU-JTC 13C), the Society of Rock Mechanics and Engineering Geology (SRMEG), International Tunnelling and Underground Space Association (ITA-AITES) and Studiengesellschaft für unterirdische Verkehrsanlagen mbH (STUVA).

ECI SUS XII aims to pool the consolidated efforts from engineers, researchers and project managers from across the world to share and update state-of-the-art technology and best practices in rock engineering, TBM and deep excavation.

### Topics

- Development in Shotcrete technology for soft ground tunnelling and subsea tunnels
- Development in TBM, deep excavation and underground space technology
- Shotcrete reinforcement design

- Mechanical properties of Shotcrete under elevated temperature and corrosion environment
- Methods and equipment for Shotcrete installation
- Laboratory tests, on-site quality control and repair of Shotcrete
- Numerical simulation of tunnel rock support with Shotcrete
- TBM tunnelling in challenging ground conditions
- Development in rock tunnelling and rock blasting
- Grouting and water control for tunnels
- Application of Eurocodes in rock tunnelling
- New technology in rock exploration and site investigation
- Developments in fibre-reinforced Shotcrete
- Case studies

Engineering Conferences International  
32 Broadway, Suite 314, New York, NY 10004  
T: 1-212-514-6760 F: 1-212-514-6030  
E: [info@engconfintl.org](mailto:info@engconfintl.org)



**5th International Symposium on Geotechnical Safety and Risk (ISGSR 2015)**  
**13-16 October 2015, Rotterdam, The Netherlands**  
[www.isgsr2015.org](http://www.isgsr2015.org)

It is my great pleasure to invite you to the fifth International Symposium on Geotechnical Safety and Risk (ISGSR) 2015, which will be held in Rotterdam, the Netherlands. The 5th ISGSR is a continuation of a series of symposiums on geotechnical risk assessment and management, safety and reliability, which started in 2007 in Shanghai, China.

The most recent and very successful conference was held at the end of 2013 in Hong Kong, China. It proved again the great value of sharing knowledge and experiences from research and practice between the international geotechnical engineering community, especially the members of TC304 and TC205 of ISSMGE and of GEOSNet.

The 5th ISGSR will be even more special, because it will be combined with the presentation of the end results of the Geo-Impuls programme in the Netherlands. It is a five year long, joint industry programme which aims at reducing geotechnical failure substantially in 2015. Implementing Geo Risk Management and the tools developed by the Working Groups in our projects and organizations are the key conditions in reaching this ambitious goal. The Dutch geo-engineers and managers would be honoured to present and discuss their results with the international geo-community.

On behalf of the organizing committee I am looking forward to welcoming you in Rotterdam in October 2015!

**Conference themes**

1. Geotechnical Risk Management and Risk Communication
2. Variability in Ground Conditions and Site Investigation
3. Reliability and Risk Analysis of Geotechnical Structures

4. Limit-state design in Geotechnical Engineering
5. Assessment and Management of Natural Hazards
6. Contractual and Legal Issues of Foundation and (Under)Ground Works
7. Case Studies, Monitoring and Observational Method

**Contact**

For information on registration, social events, accommodation, sessions, sponsorship and general inquiries, please contact:

**ISGSR2015 c/o KIVI**  
P.O. Box 30424  
2500 GK THE HAGUE  
THE NETHERLANDS

Tel.: +3170 3919890  
Fax: +3170 3919840  
Email: [isgsr2015@kivi.nl](mailto:isgsr2015@kivi.nl)



**26-28 October 2015, Bordeaux, France**  
[www.hydropower-dams.com/pdfs/hydro2015.pdf](http://www.hydropower-dams.com/pdfs/hydro2015.pdf)

Following the successful HYDRO 2009 conference in Lyon, Aqua~Media International is very pleased to be returning to France for HYDRO 2015.

France has a major history of hydropower development, with experience in all major types of dams and power-plants. EDF and other leading companies in the French hydro industry continue to be active both within France and worldwide.

France produces around 68 TWh/year from hydropower (about 15 per cent of total production) from its installed hydro capacity of nearly 25 500 MW. There is an additional 440 MW of hydro in operation in overseas departments and on Corsica.

During the HYDRO 2015 programme, EDF and others from the French industry will be ready to share experience on industrial, environmental and societal topics, such as innovation in high-tech tools, planning and development, expansion of generation capacity, safety issues, social benefits associated with river basin development, including governance with local stakeholders, uprating and refurbishment, the role and benefits of pumped-storage, and many other topics.

**Conference Themes**

**POTENTIAL, PLANNING AND DEVELOPMENT**

- Development opportunities worldwide
- Climate change and carbon trading
- Greenhouse gas emissions from reservoirs



- Hydro development in harmony with the environment
- Social aspects and communications
- Preserving and promoting cultural heritage
- Maximizing the multiple benefits of hydro

#### TECHNOLOGY: ELECTRO-MECHANICAL EQUIPMENT

- Innovation in design
- Pumped-storage: role, benefits and technical advances
- Hydraulic machinery (R&D and operational issues)
- Up-rating and refurbishment
- Operation and maintenance
- Remote controlled operation
- Electrical engineering
- Flow measurement and instrumentation

#### CIVIL WORKS: PLANNING, DESIGN AND CONSTRUCTION

- Underground works and tunnelling
- Dam engineering: Materials, design and construction
- Spillways and gates: design and function
- Managing problems of sedimentation
- Flood discharge works SAFETY
- On-site safety during dam construction
- Ensuring public safety around dams
- Managing external threats: physical and cyber security
- Safety of powerplants, transformer caverns and underground works
- Designing for safe operation of gates, valves and penstocks

#### FINANCIAL, COMMERCIAL AND CONTRACTUAL ASPECTS

- New approaches to financing (BRICS NDB, hybrid financing, etc)
- Managing financial and commercial risk
- Structuring of projects
- Concession agreements and contractual issues
- Project preparation to avoid financial delays
- Case studies SUCCESSION PLANNING
- Motivating students and young professionals
- Experience of young engineers in joining the profession
- Educational and exchange programmes
- Passing on knowledge and experience to the next generation

#### HYDRO 2015

Mrs Margaret Bourke  
Conference Project Manager  
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Fax: + 44 20 8773 7255  
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International Conference on Engineering Geology in New Millennium, 26-31 October 2015, New Delhi, India,  
<http://iseqindia.org/pdfs/1st%20circular-international-IAEG.pdf>

6th International Conference on Earthquake Geotechnical Engineering, 2-4 November 2015, Christchurch, New Zealand, [www.6icege.com](http://www.6icege.com)

SEOUL 2015 - 25th World Road Congress Roads and Mobility – Creating New Value from Transport, 2-6 November, 2015, Seoul, Republic of Korea,  
<http://www.aipcrseoul2015.org>

4<sup>ο</sup> Πανελλήνιο Συνέδριο Ανανεώσιμων, Νοέμβριος 2015, Θεσσαλονίκη, [www.etepam.gr](http://www.etepam.gr).

The 15th Asian Regional Conference on Soil Mechanics and Geotechnical Engineering, 9-13 November 2015, Fukuoka, Japan, <http://www.15arc.org>

15th Pan-American Conference on Soil Mechanics and Geotechnical Engineering, 15 - 18 November 2015, Buenos Aires, Argentina, <http://conferencesba2015.com.ar>

VIII South American Congress on Rocks Mechanics, 15 - 18 November 2015, Buenos Aires, Argentina, <http://conferencesba2015.com.ar>

Sixth International Conference on Deformation Characteristics of Geomaterials IS Buenos Aires 2015, November 15th to 18th 2015, [www.saiq.org.ar/ISDCG2015](http://www.saiq.org.ar/ISDCG2015)

Geo-Environment and Construction, 26-28 November 2015, Tirana, Albania, Prof. Dr. Luljeta Bozo, [lulibozo@gmail.com](mailto:lulibozo@gmail.com); [luljeta\\_bozo@universitetipolis.edu.al](mailto:luljeta_bozo@universitetipolis.edu.al)



### **The 1st International Conference on Geo-Energy and Geo-Environment (GeGe2015)** **4th and 5th December 2015, Hong Kong** <http://gege2015.ust.hk>

This is the first conference of its kind to cover both geo-energy and geo-environment areas that are highly relevant and essential to maintaining the sustainability of the society. Researchers from these areas are most welcome to join, to contribute and share new ideas and information, and to advance scientific knowledge for the benefit of mankind.

#### **Themes of GeGe2015**

##### **Day 1: Themes for Geo-Energy**

1. Energy geo-structures such as piles, walls and tunnels
2. Geo-storages such as CO<sub>2</sub> sequestration and radioactive waste disposal
3. Energy extraction application such as conventional and unconventional energy, and geothermal energy
4. Energy policy and management relating to geotechnical aspects

##### **Day 2: Themes for Geo-Environment**

1. Reused and recycled materials for geotechnical works
2. Bio-geotechnology such as the use of vegetation and bacteria
3. Landfills
4. Geo-environmental policy and management

In case of enquiries, please contact:

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2015 6<sup>th</sup> International Conference Recent Advances in Geotechnical Engineering and Soil Dynamics, December 7-11, 2015, New Delhi (NCR), India, [wason2009@gmail.com](mailto:wason2009@gmail.com); [wasonfeg@iitr.ernet.in](mailto:wasonfeg@iitr.ernet.in), [sharmamukat@gmail.com](mailto:sharmamukat@gmail.com); [mukut-feg@iitr.ernet.in](mailto:mukut-feg@iitr.ernet.in), [gvramanaiitdelhi@gmail.com](mailto:gvramanaiitdelhi@gmail.com), [ajay-cbri@gmail.com](mailto:ajay-cbri@gmail.com)

Southern African Rock Engineering Symposium an ISRM Regional Symposium, 5 January 2016, Cape Town, South Africa, <http://10times.com/southern-african-rock>

GeoAmericas 2016 3<sup>rd</sup> Panamerican Conference on Geosynthetics, 11 – 14 April 2016, Miami Beach, USA, [www.geoamericas2016.org](http://www.geoamericas2016.org)

World Tunnel Congress 2016 “Uniting the Industry”, April 22-28, 2016, San Francisco, USA, <http://www.wtc2016.us>

7th In-Situ Rock Stress Symposium 2016 - An ISRM Specialised Conference, 10-12 May 2016, Tampere, Finland, [www.rs2016.org](http://www.rs2016.org)

84th ICOLD Annual Meeting, 16-20 May 2016, Johannesburg, South Africa, [www.sancold.org.za/index.php/activities/icold-annual-meeting-2016](http://www.sancold.org.za/index.php/activities/icold-annual-meeting-2016)



[www.ucprague.com](http://www.ucprague.com)

The [Czech Tunnelling Association ITA-AITES](http://www.ita-aites.cz) organizes an international tunnelling conference “**Underground Construction Prague**” at a three-year interval.

We are pleased to inform you that the next conference will be held in the capital of the Czech Republic, Prague from **23 to 25 May 2016**. You are cordially invited to this thirteenth conference.

Past conferences, especially Underground Construction Prague 2010 and 2013, confirmed that the Prague conference thanks to its scientific programme, venue and social programme found a firm position among similar European conferences. This confirms the participation of distinguished European and international experts at each conference.

We hope that the attractiveness of the **13<sup>th</sup> International Conference Underground Construction Prague 2016** will be enhanced by connection with the **3<sup>rd</sup> Eastern European Tunnelling Conference (EETC 2016)**.

The **EETC** is a biennial regional tunnelling conference. It aims to promote the sharing of knowledge, experience, skills, ideas and achievements in the design, financing and

contracting, construction, operation and maintenance of tunnels and other underground facilities among the countries of Eastern Europe, on an organized basis and with agreed aims.

The conference will surely bring interesting information about the important constructions in the Czech Republic, as over 4 km long railway tunnel Ejpvovice currently excavated by an EPB shield, upcoming project of the Prague metro line D or findings from the recently realised extraordinary constructions - the automotive Blanka tunnel complex and extension of line A of the Metro. We also hope that our Slovak colleagues who were involved in the preparation of the conference, will present a series of posts that will be inspired by the unprecedented scope of the existing tunnel excavation in the Slovak Republic. Eastern European countries will also be actively represented with a number of significant constructions in their countries.

The joint conference will be held at the Clarion Congress Hotel Prague and will include a technical exhibition and a poster session. The conference dinner will take place at the extraordinary and favorite environment of the Brevnov Monastery in Prague 6.

## Contacts

### Czech Tunnelling Association ITA-AITES

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### Secretariat of the Preparatory Committee

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### Organising agency

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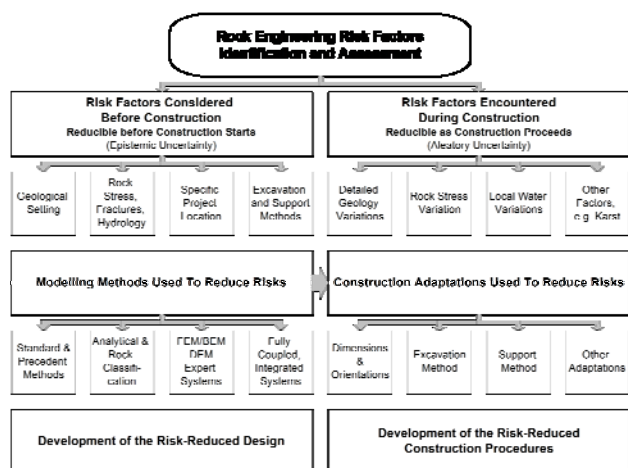
### GEOSAFE: 1st International Symposium on Reducing Risks in Site Investigation, Modelling and Construction for Rock Engineering - an ISRM Specialized Conference 25 – 27 May 2016, Xi'an, China [www.geosafe2016.org/dct/page/1](http://www.geosafe2016.org/dct/page/1)

Professor John A. Hudson of the UK (President of the ISRM 2007-2011) and Professor Xia-Ting Feng (President of the ISRM 2011-2015) look forward to welcoming you to the first GEOSAFE Symposium being held in Xi'an, China, 25-27 May 2016. The Symposium is sponsored by the International Society for Rock Mechanics (ISRM), the Chinese Society for Rock Mechanics and Engineering (CSRME) and the Chinese Academy of Sciences (CAS).

The reason for holding the Symposium is to develop methods for improving safety in rock engineering construction—through the three aspects of site investigation, modelling and construction procedures. The emphasis will be on improving our knowledge of these three aspects so that the

risks can be reduced. We welcome papers describing developments in all aspects of rock mechanics and rock engineering.

The flowchart below indicates how the rock engineering risk factors can be considered through the 'risks considered before construction' and the 'risks encountered during construction'. Thus, papers related to any of the subjects in the flowchart will be most welcome. We encourage both theoretical and practically orientated papers. In addition to the presentation of these papers, there will be Keynote lectures introducing the three key subject areas each of the three days.



The Symposium is being held in conjunction with

- The Workshop on Underground Research Laboratory (URL) Networking, and
- The Workshop on Discontinuous Deformation Analysis. Also, there will be a
- Short Course on "Understanding Structural Geology for Input to Rock Mechanics Analyses and Modelling" with field tuition which will precede the Symposium (Profs Cosgrove and Hudson from Imperial College London, UK). and
- Best Paper Prizes for each of the three sessions, plus a Best Young Person's Paper Prize (< 35 years old).

#### Contact Us

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NGM 2016 - The Nordic Geotechnical Meeting, 25 - 28 May 2016, Reykjavik, Iceland, [www.ngm2016.com](http://www.ngm2016.com)



## 19<sup>th</sup> Southeast Asian Geotechnical Conference & 2<sup>nd</sup> AGSSEA Conference Deep Excavation and Ground Improvement 31 May – 3 June 2016, Subang Jaya, Malaysia

The 19<sup>th</sup> Southeast Asian Geotechnical Conference and 2<sup>nd</sup> Association of Geotechnical Societies in Southeast Asia Conference (19SEAGC-2AGSSEA) will be held in Kuala Lumpur, Malaysia on 31 May – 3 June 2016. A pre-conference short course will be held on 30 May 2016 and the Southeast Asia Young Geotechnical Engineers' Conference on 31 May 2016. The Southeast Asian Geotechnical Society was founded in 1967 at AIT Bangkok by Dr Za-Chieh Moh. In 2007 the Association of Geotechnical Societies in Southeast Asia was founded also by Dr Za-Chieh Moh. At the 17SEAGC held in Taipei in 2010, it was decided that the 18SEAGC-1AGSSEA Conference will be held in Singapore in 2013. The Singapore Conference was a great success with more than 350 participants. This 19SEAGC-2AGSSEA to be held in Kuala Lumpur, Malaysia is also expected to be well supported and successful. The Conference will have an Opening Keynote Address, Chin Fung Kee Lecture, Za-Chieh Moh Lecture, S L Lee Lecture, Keynote Lectures, Special Lectures, and Special Session Lectures to be delivered by distinguished geotechnical experts and eminent academicians. Contributed papers from member countries and abroad will also be presented.

The Conference theme is **Deep Excavation and Ground Improvement**.

The Conference covers a broad range of themes related to geotechnical engineering, including but not limited to:

- Soil Characterization and Properties
- Ground Improvement and Stabilization
- Shallow and Deep Foundations
- Slope Stability, Excavations and Retaining Structures
- Geosynthetics and Geo-Products
- Field Testing and Performance Monitoring
- Engineering Geology and Rock Mechanics
- Design Analysis and Modelling
- Embankments and Dams
- Tunnelling and Underground Space Development
- Others are also welcomed.

SEAGC2016 Secretariat  
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## ISSMGE TC211 Conference Session within the framework of the 19<sup>th</sup> Southeast Asian Geotechnical Conference

Originally the executive board of the TC211 had envisaged to organize a new International Symposium on Ground Improvement at Brussels as organized in 2012. But analysing the international event diary, it has finally been decided to organize a plenary TC211 session at the next 19<sup>th</sup> SOUTHEAST ASIAN Geotechnical Conference. Indeed, the theme of

this conference is "Deep Excavation and Ground Improvement". After the executive board of the TC211 received an invitation of the organizing committee of the 19th SEAGC, it was decided to group the effort to organize together an official GI session in agreement with our reference terms:

**"GROUND IMPROVEMENT works:  
Recent advances in R&D, design and QC/QA"**

At this occasion, a **Louis Ménard Lecture** focusing on this theme will be delivered.

In addition, a **Honor lecture** concentrating on execution aspects of ground improvement works will also be proposed to the audience.

Finally, the program of the session will be completed by the **presentation of five selected papers** within the panel of papers received by the official organizing committee of the conference.

A call for abstract is currently open. The authors have to submit their abstract before the extended deadline of 30 April 2015 to the following address: [seagc2016@gmail.com](mailto:seagc2016@gmail.com)



**ISL 2016  
Experience, Theory, Practice  
Napoli, June 12th-19th, 2016  
[www.isl2016.it](http://www.isl2016.it)**

The Landslides risk has strongly increased over the last decade, mainly because of ever growing population and relevant bigger exposure. In many countries, this is also due to expanded civil and industrial settlements, as well as widened infrastructures and lifelines. For this reason, in order to perform risk analysis and management, it is necessary a better understanding of landslides' mechanics, accounting for relevant soil and rock properties and their behaviour in well documented case histories. Other natural hazards, such as storms, earthquakes and volcanism, may act as landslide triggers in some areas. These will be the main topics of the next ISL that will take place in Napoli in June 2016. These themes will be viewed using the classic approach of the modern science, i.e. moving from experience to practice through theory. Experience gives the keys to understand phenomena thus focusing on factors that play a major role. Theory channels data from experience within a mathematical approach which is extremely useful to predict similar future events. Practice exploits the results of both experience and theory in order to protect people and man-made works, but also allows to go back to the theory that can thus be improved and replaced, if necessary, with a new and more successfully theory. Diverse events will fill the meeting: special lectures delivered by renowned academics and professionals, a "Young Session", a Round-robin, a prize for the best paper recently published in scientific journals, and a prize for the best symposium paper. Cultural events, postsymposium technical trips and further surprises will come along. We encourage proposals for organizing additional special sessions.

**Technical queries**

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**Conference Secretariat**

**Associazione Geotecnica Italiana (AGI)**

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**2016**

**6<sup>th</sup> International Conference on  
Recent Advances in Geotechnical Earthquake  
Engineering and Soil Dynamics  
August 1-6, 2016, Greater Noida (NCR), India  
[www.6icragee.com](http://www.6icragee.com)**

This International Conference is in continuation of the previous five such conferences organized by the Missouri University of Science & Technology, Rolla (US), under the chairmanship of Prof. Shamsheer Prakash. All the previous Conferences have proved to be highly successful events. The Conference shall have invited Keynote Lectures, State of the Art and Practice (SOAP) Lectures, Special Presentation Lectures (SPL) and contributed original research papers for discussion and publication in the proceedings.

**Themes**

- 1a. "Dynamic Properties of Soils and Soil-Like Materials, Engineering Soil Parameters and Constitutive Relations"
- 1b. "New Field and Laboratory Methods and Results, Data Base, Large Scale Field Tests, Centrifuge Tests"
2. "Wave Propagation, Engineering Vibrations and Solutions, Vibrations of Machine Foundations, Blast, Traffic and Construction Vibrations, Vibration Problem of High Speed Railways, Vibration Absorption"
- 3a. "Engineering Seismology: Near Fault and Directivity Effects, Geologic Indicators of Rupture Direction, Geometric Effects on Ground Motions, Motion Parameters for Design, Borehole Arrays, Seismological and Strong Motion Arrays, Interpretation of Field Array Data, Site Amplification"
- 3b. "Local Site Effects: 1-D/2-D Wave Propagation Predictions and Measurements, Nonlinear versus Equivalent Linear Analysis, Effective Stress versus Total Stress Analysis"
- 4a. "Liquefaction and Seismically-Induced Settlement, Ground Failures, Seismic Studies of Bhuj (India), Kobe, Lima Peru, Chile, Taiwan, China, Turkey, U.S., New Zealand (Christchurch) and other Recent Earthquakes, Spatial Liquefaction"
- 4b. "Stability and Displacement Performance of Slopes, Landfills and Earth Dams under Earthquakes"
- 5a. "Soil-Structure Interaction under Dynamic Loading for both Shallow and Deep Foundations, Effect of Vibra-



tions of High Speed Railways on Soils and Soil-Structure”

- 5b. “Soil-Foundation Interaction Triggered by Seismic Faulting”
- 6a. “Seismic Analysis and Design of Retaining and Marine Structures, Field Studies on Retaining Walls in California, Japan, India and other countries”
- 6b. “Seismic Hazard Zonation: Earthquake Risk Assessment with Earthquake Risk Management, Microzonation Projects and Procedures, Use of Building Codes to Reduce Earthquake Hazards”
- 7a. “Case Histories of Geotechnical Earthquake Engineering, Failures and Geotechnical Analysis of Recent Earthquakes, Reports of Recent Damaging Earthquakes”
- 7b. “Seismic Analysis and Retrofit of Foundations of Bridges and other Sub-Structures, Seismic Retrofit Projects and Procedures”
- 8. “Model and Full-Scale Tests of Geotechnical Structures including Centrifuge Tests, Recent Advances from Earthquake Simulation Facilities such as NEES, E-Defense, NCEE”

For further information please contact:

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### **4th GeoChina International Conference Sustainable Civil Infrastructures: Innovative Technologies for Severe Weathers and Climate Changes**

**July 25-27, 2016, Shandong, China**

<http://geochina2016.geoconf.org>

On behalf of the Organizing Committee, we are pleased to invite you to attend the 4th GeoChina International Conference 2016 to be held in Shandong, China from July 25 to 27, 2016. This Sustainable Civil Infrastructures using Innovative Technologies and Material is endorsed by a number of leading international professional organizations.

This conference will provide a showcase for recent developments and advancements in design, construction, and safety Inspections of transportation Infrastructures and offer a forum to discuss and debate future directions for the 21st century. Conference topics cover a broad array of contemporary issues for professionals involved in bridge, pavement, geotechnical, tunnel, railway, and emerging techniques for safety Inspections. You will have the opportunity to meet colleagues from all over the world for technical, scientific, and commercial discussions.

Shandong, with a history of more than 5,000 years, is considered one of the birthplaces of Chinese civilization. It is being developed into a modern international economic, financial, and trade center. Recent rapid construction in China has provided great opportunities for bridge, pavement, geotechnical, and tunnel engineers to use their knowledge and talents to solve many challenging problems involving highway bridge structures, pavements, materials, ground improvement, slopes, excavations, and tunnels with innovative solutions and cutting-edge technologies.

**Accepted papers will be published on ASCE GSP Series (EI Indexed)**, subjected to the approval by the Geo-Institute Technical Coordination Council. However, the authors may need to give up the publication at the ASCE GSP Series, once their paper is selected for publications in the special issues, to avoid any dual publication. Therefore, only one version of the paper will be published through this conference, i.e., either in the ASCE GSP Series or in the special issue of the journals.

Selected papers from the conference may be considered for publications in the special issues of

1. Journal of Performance of Constructed Facilities, ASCE (SCI Indexed),
2. Journal of Testing and Evaluation, ASTM (SCI Indexed),
3. International Journal of Geomechanics, ASCE (SCI Indexed),
4. Geomatics, Natural Hazards and Risk (GNHR) (SCI Indexed),
5. International Journal of Pavement Research and Technology (IJPRT) (EI Indexed),

subjected to a full peer review process as set forth by the Editors of ASTM International, ASCE, GNHR, and IJPRT.

Themes of the conference.

#### **Transportation Geotechnical Engineering**

- Non-Destructive Characterization of Geomaterials
- In-situ Test Methods for Site Characterization, Design and Quality Control of Earth Structures and Subgrades
- Soils and Rock Instrumentation, Behavior and Modeling
- Advances in Unsaturated Soil, Seepage, and Environmental Geotechnics
- Soil Behavior and Laboratory Testing
- Foundation Failure and Repair
- Earth Retaining Walls and Slope Stability
- Bridge Approach Embankment
- Natural Hazard and Disaster Monitoring
- Geosynthetic Reinforced Soil Retaining Structure
- Engineering Issues in Ground Subsidence
- Seismically Induced Hazards and Mitigation
- Dynamic Behavior of Soils and Foundations
- Physical, Numerical, Constitutive Modeling of Soil Behavior
- Geophysical Testing in Civil and Geological Engineering
- Innovative and Sustainable Geomaterials and Geosystems

#### **Pavement Engineering**

- Airfield pavement analysis, rehabilitation and performance
- Recycled Asphalt Pavement
- Pavement design, modeling, performance evaluation, & management
- Sustainable Long Life Pavement
- Ground Improvement, and Chemical / Mechanical Stabilization for Pavement and Geotechnical Applications

- Moisture Damage in Asphaltic Concrete Materials
- Geotechnical Properties and Their Effects on Portland Concrete Pavement Behavior and Performance
- Warm Mix
- Rehabilitation strategy selection and preventative maintenance treatments
- Accelerated Testing of Pavement Structures and Materials
- Material, Design, Construction, Maintenance and Testing of Pavement
- Asphalt Binder and Mixture Characterization
- Construction and Rehabilitation of Jointed Concrete Pavement, Reinforced Concrete Pavement, and Continuously Reinforced Concrete Pavement
- Bridges Deck Pavement
- Stabilization, Recycling, Foamed Bitumen and Emulsion, Granular Materials
- Roadway Widening
- NanoTechnology & Its Application to Civil Infrastructure
- Asphalt Mix-Design, HMA Testing, & Material Property Characterization

### Bridge Engineering

- Assessment of Structures, Non-Destructive Evaluation, Inspection Technologies, Structural Health Monitoring, Remote Monitoring of Structures, Scour Assessment
- Seismic Design Issues and Approaches for Bridges, Highways and Underground Structures
- Design Methods and Materials, Innovative Repair Methods and Materials, Durable and Sustainable Designs, Innovative Materials, Advances in Foundation Design/Construction, Accelerated and/or Performance Based Design/Construction, Aesthetics and Environment
- Extreme-Hazard Resilient Structures - Risk/Reliability Assessments, Emergency Management Practices, Multi-hazard Design, Enhanced Post-Earthquake Serviceability, Scour Assessment and Restoration, Quality Control/Quality Assurance.
- State-of-the-Arts and State-of-the-Practices on Bridge Design, Construction and Maintenance

### Tunneling Engineering

- Tunnel Management and Inventory, Monitoring and Settlement Control
- Emerging Technologies, Lining Design & Precast Segment Advances
- Innovation in Tunneling Design, Construction, Repair, Rehabilitation
- Fire & Life Safety, Vulnerability & Security
- Tunneling in Soft Ground, Ground Conditioning and Modification
- Advanced prediction technology of tunnel construction geology
- Deep excavations and urban tunnelling

### Railroad Engineering

- Railway Track Substructure
- High Speed Rail System
- Seismic Design for Railway Structures
- Economics of Railway Engineering and Operations
- Structures, Maintenance and Construction

### Dam, Geomatics, Geoscience, Geophysics, and Hazards

- Dam Engineering, Geo-Sciences, Geomatics, Geophysics, and Gravity.

- Geophysical Testing in Civil and Geological Engineering in Transportation Geotechnical Engineering.
- Natural Hazard and Disaster Monitoring in Transportation Geotechnical Engineering.
- Seismically Induced Hazards and Mitigation in Transportation Geotechnical Engineering.
- Extreme-Hazard Resilient Structures - Risk/Reliability Assessments, Emergency Management Practices, Multi-hazard Design, Enhanced Post-Earthquake Serviceability, Scour Assessment and Restoration, Quality Control/Quality Assurance in Bridge Engineering.
- Geological Disaster Control Technology.

Secretary Generals

Dr. Zhanyong Yao, Shandong University

Dr. Dar Hao Chen, University of Oklahoma, Texas Department of Transportation

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EUROC 2016 - ISRM European Regional Symposium Rock Mechanics & Rock Engineering: From Past to the Future, 29-31 August 2016, Ürgüp-Nevşehir, Cappadocia, Turkey  
<http://eurock2016.org>



*3<sup>rd</sup> ICTG  
International Conference  
on Transportation Geotechnics*

**4 - 7 September 2016, Guimaraes, Portugal**  
[www.civil.uminho.pt/3rd-ICTG2016](http://www.civil.uminho.pt/3rd-ICTG2016)

The Transportation Geotechnics International Conference series began under the auspices of ISSMGE-TC 3 and was initiated in 2008 at the University of Nottingham, UK, as an International event designed to address the growing requirements of infrastructure for societies. The 2<sup>nd</sup> International Conference on Transportation Geotechnics took place in 2012, at Sapporo, Japan, under the ISSMGE-TC202 that follows the TC-3 activities for the period 2009-2013. To continue the successful of these conferences and the output of ISSMGE-TC-202, the 3<sup>rd</sup> was scheduled for 2016, at Guimarães, Portugal. Following the previous one, the challenges addressed by this conference will include a better understanding of the interactions of geotechnics on roads, rails, airports, harbours and other ground transportation infrastructure with the goal of providing safe, economic, environmental, reliable and sustainable infrastructures. The 3<sup>rd</sup> ICTG will be composed of workshops and several types of sessions, as well as a technical exhibition, to better disseminations of findings and best practices. A special attention will be paid to the publication of all the peer review papers, some of them in specialised international journals.

On behalf of the organizing committee I am honoured to invite you to the 3<sup>rd</sup> ICTG in the City of Guimarães, UNESCO World Heritage (September 4-7, 2016).

#### Conference themes

Theme 01: Optimized geomaterial (including hydraulically bound materials and asphalt mixtures) use, reuse and recycling

Theme 02: Unsaturated soil mechanics in transportation geotechnics

Theme 03: Earthworks design, technology and management

Theme 04: Slope stability, stabilisation, and asset management

Theme 05: Mechanistic-empirical design (road, railways and airfields)

Theme 06: Rail track substructures, including transition zones.

Theme 07: Subsurface sensing for transportation infrastructure

Theme 08: Macro and Nanotechnology applied to transportation geotechnics

Theme 09: Effect of climate change

Theme 10: Sustainability in transportation geotechnics

Theme 11: Case histories

Theme 12: Others

#### Secretariat

3rd ICTG Secretariat  
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#### **13 Baltic States Geotechnical Conference Historical Experiences and Challenges of Geotechnical Problems in Baltic Sea Region 15 - 17 September 2016, Vilnius, Lithuania <http://www.13bsgc.lt>**

On behalf of the ISSMGE, the Lithuanian Geotechnical Society, Vilnius University, Vilnius Gediminas Technical University, Kaunas University of Technology and Klaipėda University warmly invite you to participate in the 13th Baltic Sea Geotechnical Conference, which will be held in Vilnius, Vilnius University, Universiteto St. 3, on the 15-17th of September, 2016.

The main aim for all countries around the Baltic Sea and of the 13th Baltic Sea Geotechnical Conference is to provide a forum for an intensive transfer of ideas and experiences with other engineering and research groups.

The conference is not limited only to the countries of the Baltic Sea area and participants from other regions are also warmly welcome.

#### Conference topics

The topics of the conference sessions are as follows:

- Geotechnical art and historical experiences
- Soil and rock investigation
- Design experiences and theoretical solutions
- Geoenvironmental engineering
- Case histories

Special topics such as geotechnical construction problems, improvement methods, erosion control will be particular interest to the Conference.

Contact persons:

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#### **EuroGeo 6 – European Regional Conference on Geosynthetics 25 – 29 Sep 2016, Istanbul, Turkey [www.eurogeo6.org](http://www.eurogeo6.org)**

The Turkish Chapter of IGS joyfully announces that the 6th European Geosynthetics Conference will be held on September 25-28, 2016, in the unique city of Istanbul. After Maastricht (1996), Bologna (2000), Munich (2004), Edinburgh (2008) and Valencia (2012), the profession will convene in Istanbul.

We are looking forward to seeing academicians, manufacturers, practitioners and designers in the geosynthetics field at EuroGeo6. We want to extend a special invitation to engineers in general contracting firms, who will widely benefit from the Conference by learning more about the extraordinary financial and technical advantages geosynthetics pro-



vide. In an environment where the number of "Design-Build" and "Build-Operate-Transfer" types of contracts all around the world is multiplying, passing on such information to general contractors becomes of great importance. Turkey has a powerful contracting industry, active not only in Turkey but on an International level, which will be used as leverage in this direction.

Proposed Sessions for the 6th European Geosynthetics Conference:

- Roads, Railroads and Other Transportation Applications
- Hydraulic Applications
- Mining
- Landfills
- Reinforced Walls and Slopes
- Direct and Life-cycle Cost Savings
- Environmental Benefits
- Sustainability
- Durability
- Innovations and New Developments
- Drainage and Filtration
- Polymeric and Clay Geosynthetic Barriers
- Properties and Testing • Physical and Numerical Models
- Monitoring • Quality Control and Quality Assurance
- Wastewater and Fresh Water Storage • Embankments on Soft Soils
- Seismic Applications
- Coastal Protection
- Pavements
- Unpaved Roads
- Lightweight Construction
- Agricultural Applications
- Geosynthetics as Formwork

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**ARMS 9**  
**9th Asian Rock Mechanics Symposium**  
**ISRM Regional Symposium**  
**October 2016, Bali, Indonesia**  
[rkw@mining.itb.ac.id](mailto:rkw@mining.itb.ac.id)

Contact Person: Dr Ridho Wattimena  
Indonesian Rock Mechanics Society (IRMS)  
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**GeoAsia 6**  
**6th Asian Regional Conference on Geosynthetics**  
**8-11 November 2016, New Delhi, India**  
<http://seags.ait.asia/news-announcements/11704>

India is a fast developing economy requiring large scale infrastructures. Liberalization of economy has further facilitated planning and execution of many large scale infrastructure, including roads, railways, power and water resources, which will further promote applications of

Geosynthetics for infrastructural works. Spending in XII Plan (2012 - 17) in infrastructure is estimated to be USD 01 Trillion, which is expected to grow for infrastructure activities for the XIII Plan (2017 - 2022).

6th Asian Regional Conference would be a step towards providing opportunity for exchange of experiences, practices and collaborations to facilitate flow of appropriate technology to enable successful implementation of infrastructure projects. It will be organized by the Indian IGS Chapter under the auspices of the IGS.

Main Theme of the Conference

**Geosynthetics for Infrastructure Development**

Sub-Themes

- Roads and Railways
- Hydraulic Applications
- Ground Improvement and Slope Stability
- Erosion Control
- Environmental Applications
- Natural Fibre Geotextiles
- Geosynthetic Testing



**GeoAfrica 2017**

The 3rd African Regional Conference on Geosynthetics, 9 – 13 October 2017, Morocco



**11<sup>th</sup> International Conference on Geosynthetics**  
**(11ICG)**  
**16 - 20 Sep 2018, Seoul South Korea**  
[csyoo@skku.edu](mailto:csyoo@skku.edu)

# ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

## Top 20 Geotechnical News of 2014!

Στο τεύχος αρ. 118 του δεκεμβρίου 2014 του Geoengineer δημοσιεύθηκε ο κατάλογος με τα γεωτεχνικά γεγονότα με τα περισσότερα «κτυπήματα» στην ιστοσελίδα του. Παραλείποντας τα αναφερόμενα σε ανακοινώσεις συνεδρίων έχουμε:

[Shallow, Magnitude 5.9 earthquake triggers landslides in Cephalonia, Greece](#) (4803 views, January 28th, 2014)

[Sinkhole damages eight vintage valuable Corvettes at National Corvette Museum, in Bowling Green, Kentucky](#) (2446 views, February 17th, 2014)

[8.2 quake hits northern Chile, triggering tsunami warning](#) (2426 views, April 2nd, 2014)

[New research shows how faults warn us before a big earthquake](#) (2256 views, January 14th, 2014)

[Buildings prone to cliff collapse are being demolished in Port Hills, Christchurch](#) (2075 views, January 29th, 2014)

[Slow moving landslide in Jackson, Wyoming, urges for evacuation of the area](#) (2004 views, April 17th, 2014)

[A West Coast earthquake early warning system at stake due to lack of funding, as Japan's is active since 2007](#) (1908 views, April 11th, 2014)

[Key takeaways from Geo-Congress 2014 \(23-26 February 2014\) in Atlanta, GA](#) (1906 views, February 28th, 2014)

[Second Major Earthquake hits Cephalonia island in Greece](#) (1904 views, February 4th, 2014)

[Railroad retaining wall collapses and is caught live on video](#) (1883 views, May 2nd, 2014)

[Ground collapse near riverbank in Brazil \[video\]](#) (1878 views, January 13th, 2014)

[Landslide in Mexico results in coastal highway collapse \[video\]](#) (1849 views, January 3rd, 2014)

[Opening the classroom to the geo-profession 2](#) (1841 views, April 8th, 2014)

[Cephalonia earthquakes: EERI and GEER to investigate the seismic activity impact](#) (1797 views, February 10th, 2014)

[Dudgeon wind farm foundation installation](#) (1768 views, March 27th, 2014)

[Storm damage in Dawlish rail, U.K. cuts off regions and calls for inland lines](#) (1765 views, March 11th, 2014)

[Keynetix Release Standalone Data Entry Module for HoleBASE SI](#) (1734 views, April 10th, 2014)

[Cephalonia earthquake, preliminary damage observations](#) (1730 views, February 7th, 2014)

[LiDAR technology: a new perspective in landslide risk evaluation](#) (1715 views, April 10th, 2014)

## ΕΝΔΙΑΦΕΡΟΝΤΑ - ΛΟΙΠΑ

### Work starts on Calatrava-designed Greek Orthodox Church on World Trade Center site



Work has begun on a Greek Orthodox Church designed by Spanish architect [Santiago Calatrava](#) to replace a building that was destroyed by the collapse of New York's World Trade Center buildings on 9/11.

Santiago Calatrava has designed the Saint Nicholas National Shrine building for the Greek Orthodox Church, which will occupy a site at 130 Liberty Street on the edge of the National September 11 Memorial park.



Influenced by two existing places of worship in Istanbul – the Hagia Sofia and the Church of the Holy Saviour in Chora

– Calatrava's scheme was selected from over a dozen proposals to replace a 19th century building that was destroyed by falling debris and building parts from World Trade Center Tower Two during the 9/11 attacks in 2001.

The site of the church has been moved to accommodate the new World Trade Center masterplan, and the new building will sit opposite the pavilion of the 9/11 museum by Norwegian architecture firm [Snøhetta](#).

"A former small tavern, the Church was always an interesting counterpoint to the skyscrapers that grew up around it," said Calatrava in an open letter to the Greek Orthodox community after winning the commission.



"Like its forebear, the new Church is to be a tiny jewel in Lower Manhattan," he said.

Built largely from white Vermont marble, the central dome-shaped structure and a portion of the rest of the building will be clad in a translucent skin that will make the building "illuminate from the inside" at night.

"The new Church is principally based around a central Cupola," explained Calatrava. "This is purposefully different for the rectilinear lines of the former Church. Indeed, it harkens back to both the Greek classical architecture of the Acropolis and the Byzantine architecture of the Hagia Sophia."

A public "Ground Blessing" ceremony earlier this month marked the beginning of construction on the project.

During the ceremony, Calatrava compared the reconstruction of the church to "the rebuilding of the Parthenon in Athens by the ancient Greeks," according to a statement released by his studio.

The Greek Orthodox Church is currently seeking donations towards the \$20 million cost of the project.





(de zeen magazine, 30 October 2014,  
[http://www.dezeen.com/2014/10/30/santiago-calatrava-saint-nicholas-greek-orthodox-church-world-trade-center-site-new-york/#disqus\\_thread](http://www.dezeen.com/2014/10/30/santiago-calatrava-saint-nicholas-greek-orthodox-church-world-trade-center-site-new-york/#disqus_thread))

View the future Saint Nicholas National Shrine in this high definition virtual tour of the facility. The design is by world renowned architect Santiago Calatrava. For more information, visit [www.stnicholaswtc.org](http://www.stnicholaswtc.org).

<https://www.youtube.com/watch?v=hNAk9NGUu2E>



[http://www.stnicholaswtc.org/en\\_GB/home](http://www.stnicholaswtc.org/en_GB/home)



## Τα 10 κορυφαία επιτεύγματα του 2014!

Τη λίστα με τα δέκα κορυφαία επιτεύγματα στην επιστήμη και την τεχνολογία για το 2014 δημοσίευσε το Ινστιτούτο Φυσικής που εδρεύει στο Λονδίνο.

Η δημοσίευση έγινε στην επιθεώρηση «Physics World» που εκδίδει το βρετανικό ινστιτούτο.

Στην κορυφή της λίστας φιγουράρει η προσεδάφιση της διαστημοσυσκευής Philae στον κομήτη 67P/Churyumov-Gerasimenko στο πλαίσιο της αποστολής Rosetta του Ευρωπαϊκού Οργανισμού Διαστήματος (ESA).

Η προγραμματισμένη αποστολή του Philae τελείωσε 64 ώρες μετά την προσεδάφισή του, όταν οι μπαταρίες του εξαντλήθηκαν, αλλά όχι πριν προλάβει να μεταδώσει στη

Rosetta και από εκεί στο κέντρο επιχειρήσεων του Ευρωπαϊκού Οργανισμού Διαστήματος (ESA) ένα πλήρες σύνολο αποτελεσμάτων που αναλύονται τώρα υποβάλλονται σε ανάλυση από επιστήμονες σε όλη την Ευρώπη.

Μεταξύ άλλων, το Philae εντόπισε οργανικά μόρια στην επιφάνεια του κομήτη 67P/Τσουριούμοφ-Γκερασιμένκο (Τσούρι).

Οι οργανικές χημικές ενώσεις, αυτές δηλαδή που περιέχουν άνθρακα, αποτελούν τη βάση της ζωής στη Γη και ενδέχεται να μας βοηθήσουν να εντοπίσουμε χημικές ουσίες που σχηματίστηκαν ή ήρθαν από το διάστημα στον πλανήτη μας κατά την πρώτη φάση μετά τη δημιουργία του.

Οι ερευνητές του ESA θεωρούν πιθανή μια «ανάσταση» του Philae εάν οι ηλιακοί συλλέκτες του ρομπότ απορροφήσουν ξανά ηλιακή ακτινοβολία.



## To Top-10

Τη δεκάδα για το 2014 συμπληρώνουν αρκετά άλλα σημαντικά επιτεύγματα από διάφορα πεδία της φυσικής όπως:

\* Η ανίχνευση νετρίνων από τις πυρηνικές αντιδράσεις στην «καρδιά» του Ήλιου από τη διεθνή ερευνητική κοινοπραξία Μπορεξίνο.

\* Ένα πείραμα με τη βοήθεια λέιζερ, στην Εθνική Εγκατάσταση Ανάφλεξης (NIF) των ΗΠΑ, που έφερε πιο κοντά την υλοποίηση της πυρηνικής σύντηξης και, έτσι, μια νέα πηγή φθηνής ενέργειας.

\* Η δημιουργία από Βρετανούς και Αμερικανούς επιστήμονες της πρώτης ακουστικής ακτίνας έλξης, που μπορεί να έλξει ένα αντικείμενο μέσω ηχητικών κυμάτων.

\* Η πρόκληση από μια διεθνή επιστημονική ομάδα μίνι εκρήξεων τύπου σούπερ νόβα στο εργαστήριο.

\* Η μέτρηση από Ισραηλινούς ερευνητές για πρώτη φορά της υπερβολικά ασθενοδύς μαγνητικής αλληλεπίδρασης ανάμεσα σε δύο ηλεκτρόνια.

\* Η δημιουργία από Ρώσους και Αμερικανούς επιστήμονες μιας νέας ολογραφικής μνήμης, που επιτρέπει την αποθήκευση δεδομένων σε μαγνητικά ολογράμματα.

\* Η συμπίεση κβαντικών δεδομένων από Καναδούς ερευνητές.

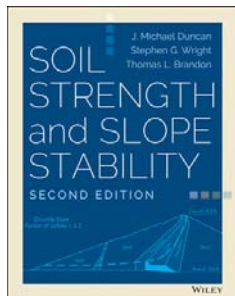
Πηγή: econews.gr



### **Αγγλο-ελληνικό γλωσσάρι γεωλογικών όρων**

Βρίσκεται επί γραμμής και είναι καταφορτώσιμη η 4<sup>η</sup> έκδοση του ψηφιακού αγγλο-ελληνικού γλωσσαρίου γεωλογικών όρων, όπως πάντα στην ιστοδιεύθυνση [http://www.eleto.gr/download/Bodies/Geoterms\\_Glossary.pdf](http://www.eleto.gr/download/Bodies/Geoterms_Glossary.pdf)

# ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ



## **Soil Strength and Slope Stability, 2nd Edition**

**J. Michael Duncan, Stephen G.  
Wright, Thomas L. Brandon**

*Soil Strength and Slope Stability,  
Second Edition* presents the latest

thinking and techniques in the assessment of natural and man-made slopes, and the factors that cause them to survive or crumble. Using clear, concise language and practical examples, the book explains the practical aspects of geotechnical engineering as applied to slopes and embankments. The new second edition includes a thorough discussion on the use of analysis software, providing the background to understand what the software is doing, along with several methods of manual analysis that allow readers to verify software results. The book also includes a new case study about Hurricane Katrina failures at 17<sup>th</sup> Street and London Avenue Canal, plus additional case studies that frame the principles and techniques described.

Slope stability is a critical element of geotechnical engineering, involved in virtually every civil engineering project, especially highway development. *Soil Strength and Slope Stability* fills the gap in industry literature by providing practical information on the subject without including extraneous theory that may distract from the application. This balanced approach provides clear guidance for professionals in the field, while remaining comprehensive enough for use as a graduate-level text. Topics include:

- Mechanics of soil and limit equilibrium procedures
- Analyzing slope stability, rapid drawdown, and partial consolidation
- Safety, reliability, and stability analyses
- Reinforced slopes, stabilization, and repair

(WILEY, October, 2014)



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