SIMSG ISSMGE

ISSMGE Bulletin

Volume 10, Issue 2
April 2016

International Society for Soil Mechanics and Geotechnical Engineering
If the quality of the distributed file is not satisfactory for you, please access the ISSMGE website and download an electronic version.
www.issmge.org

TABLE OF CONTENTS

Message from the President

Dear Members of ISSMGE,
Dear Colleagues,

The last time I wrote a message for your attention in the ISSMGE Bulletin was nearly one year ago. In the meantime, the ISSMGE and geotechnical activities throughout the world have developed satisfactorily.

As planned, our five **Regional Conferences** on Soil Mechanics and Geotechnical Engineering took place in 2015 and all of them were very successful. The following reports can be found in the issues of the ISSMGE Bulletin:

- For ***the XVI African Regional Conference*** in Hammamet, Tunisia, see: http://issmge2014.ust.hk/~issmge/aug2015/3a.Conference_Report.pdf
- For ***the XVI European Conference*** in Edinburgh, Scotland, United Kingdom, see: http://issmge2014.ust.hk/~issmge/oct2015/4a.Conference_report_ECSMGE.pdf
- For ***the 15th Asian Regional Conference*** in Fukuoka, Kyushu, Japan, see: http://issmge2014.ust.hk/~issmge/feb2016/5a.Conference_report_1.pdf

The reports for ***the 12th Australia and New Zealand Conference*** in Wellington, New Zealand is included in this issue, while ***the XV Pan American Conference*** in Buenos Aires, Argentina, should also be published very soon.

We are now already in the process of preparing for the 19th International Conference on Soil Mechanics and Geotechnical Engineering (19th ICSMGE) which will be held next year in Seoul, 17-22 September 2017. The call for abstracts has been launched earlier this year and the Members Societies are now asked to forward them to the Conference Organising Committee by the end of May 2016. The format of the Conference will be very similar to the 18th ICSMGE Paris, September 2013. After two days of plenary sessions, there will be two days of parallel sessions. In the plenary sessions, 11 Technical Committees of the ISSMGE (TCs) have requested and been given slots in which to deliver original Honours Lectures.

Message from the President (Con't)

These can be seen in the conference programme (http://www.icsmge2017.org/program/program_01.asp). The parallel sessions will be organised by the TCs either in the form of Discussion Sessions (dealing with the written contributions sent by the Members Societies) or Workshops (organised by the TCs).

There are now a total of 14 ISSMGE Honours Lectures under the responsibility of the corresponding TCs (see: http://www.issmge.org/en/awards/honour-lectures) and these lectures often feature within conferences organised by the TCs of in other speciality events. The most recent Honours Lecture created (February 2016) is the John Burland Lecture proposed by the TC306 on Geo-Engineering Education.

The Board of the ISSMGE, together with the Chairs of the Board Level Committees met in September 2015 in Edinburgh, on the occasion of the XVI European Conference, hosted by the British Geotechnical Association (BGA) and then in Phoenix (Arizona) in February 2016 on the occasion of the Geo-Structures Congress of the ASCE, hosted by the Geo-Institute (the US Member Society).

The Council of the ISSMGE held its mid-term meeting in Edinburgh on Sunday 13th September 2016, the day before the opening of the European Conference. Currently there were 89 Member Societies and 72 of them were allowed to vote. Unfortunately in the meeting only 52 Members Societies were present or represented (through proxies). The main decisions taken were:

- The life of a Technical Committee of the ISSMGE is no more linked to the presidential term of office (the corresponding amendment to bylaw 16.1 was voted for unanimously);
- To accept the new Cooperation Agreement for the FedIGS (Federation of the International Geo-Engineering Societies) which confirms a much lighter structure than the one envisaged in the initial agreement in 2007 (there were 42 votes in favour, 6 against and 4 abstentions)

Since the Council meeting a 90th Member Society has joined the ISSMGE: the Algerian Geotechnical Society (ALGEOS). Warm welcome to the ALGEOS: we are very pleased to have you with us!

During this last year the ISSMGE has pursued its strong commitment ("battle"!) for Open Access to geotechnical literature. More and more often the organisers of geotechnical conferences are encouraged to negotiate with the publishers of the proceedings so that free access to all the papers is allowed through an appropriate electronic link or through uploading on the ISSMGE website. It can be anticipated that the corresponding resources on our website will increase sharply in the coming years. It is one of the reasons for which we are presently in the process of redesigning the ISSMGE website. This work is done under the leadership of the Innovation and Development Committee, chaired by Dimitrios Zekkos. We shall have more news about this action very soon now.

Allow me to encourage you strongly to look at the series of Webinars which are on the ISSMGE website (see: http://www.issmge.org/en/resources/recorded-webinars). There are 5 more webinars delivered by: Prof. Richard Jardine, Prof. An-Bin Huang, Prof. George Gazetas, Prof. Samuel I.K. Ampadu and Prof. Lyesse Laloui. We are truly grateful to our colleagues who accept to devote their time to the ISSMGE and share their knowledge with us in an outstanding manner.

A lot of effort has also been devoted in 2015 by the Corporate Associates Presidential Group, chaired by Sukumar Pathmanandavel and the Technical Oversight Committee, chaired by Pierre Delage in order to discuss and hopefully narrow the gap between the state of practice and the state-of-the-art in geotechnical engineering. In particular, a very successful break-out session was organised in Edinburgh between ISSMGE TCs and CAs representatives. A companion message from Sukumar and Pierre, summarising the various actions in 2015, is included in the April 2016 issue of the ISSMGE Bulletin.

Pierre Delage

Sukumar Pathmanandavel

I wish to all of you the best in your geotechnical activities and… in your other activities!

Roger Frank, 15th March 2016

Message from the Chairs of TOC and CAPG

Introduction

Some exchanges started last year (in 2015) between the Corporate Associates Presidential Group (CAPG) and the Technical Oversight Committee (TOC) of the ISSMGE to better understand the possible impact of the activities of the Technical Committees (TCs) with respect to geotechnical practice. According to the ISSMGE Guidelines, besides organising conferences, the objectives of the TCs include "disseminating and developing knowledge and practice to the membership of the ISSMGE, establishing guidelines and technical recommendations and interacting with industry and overlapping groups working in areas related to the TC's specialist area". These objectives are fully in line with the concern of CAPG.

Composition of the Technical Committees (TCs)

TCs numbered 10i are devoted to Fundamental aspects but their activities can actually either be directly interesting and used in practice (Numerical methods, Lab and In-situ testing or Physical modelling) or be able to better understand complex problems (Unsaturated soils and Micro-macro). Their members are mainly from academia (more than 80%) but interaction with practice is clear, in particular in complex practical problems where the expertise of academics is required. TCs numbered 2ij devoted to Applications are directly linked to practice (Earthquake, Deep foundations, Ground improvement, Offshore geotechnics, to name a few) with a larger membership from companies (average 50%, 75% in Offshore). Their activities (Conferences, Workshops, Short courses, State of the art reports or Guidelines when they exist) are of utmost importance for practice. TCs 30i are concerned with Impacts on Society (Floods, Energy geotechnics, Risk, to name a few) with again clear interest for practice.

Knowledge of Knowledge

Whereas TC members (from research and practice) can directly benefit from TC activities, the question as to whether commercial geotechnical companies (affiliated or not to ISSMGE) can also benefit from them arises. To progress in this regard, a joint CAPG-TOC poll was carried out in early 2015 with a questionnaire concerning the production of State of the Art (SOA) and State of Practice (SOP) by TCs. Up to date SOAs and SOPs by TCs would definitely be quite useful to allow the transfer of knowledge towards practice, to improve methods and benefit from the latest developments. This raises the issue of knowledge of knowledge. How can we know what people know? The answer received by many TCs to the poll showed that things were not so simple, with rather few up to date SOAs and SOPs (with some exceptions including Environmental, Ground improvement or Heritage). Note that the SOA provided in ISSMGE Conferences some time ago on selected topics were in this regard quite useful (such SOA are still produced in some TC Conferences). Note also that the International Commission on Large Dams (ICOLD) devotes its Conferences to a limited number of (hot) Questions about which specialists are invited to contribute (ICOLD also provides Guidelines/Bulletins on many aspects of Dam engineering). This is perhaps an option to reconsider with respect to the needs of geotechnical practice.

Debate in social media (Géotechnique letters LinkedIn site)

In this context, an interesting debate about the interactions between practice and research/innovation recently took place through a post by the Chair of CAPG on the LinkedIn site of the journal Géotechnique Letters, including the following points:

- The question of the direction followed by the progresses of geotechnical practice, no longer given by a few "giants", with more widespread knowledge and expertise and an enormous growth of Geotechnical engineering in the last decades;
- How old are the methods used in practice, and how far do the risks taken and the fear of litigation limit the adoption of innovative methods and the resulting cost reduction? Beside risk considerations, how strong is conservatism and in which fields is it more prevalent?
- What happens to the insights gained in practice from the many projects conducted in companies all over the world?
- How can clients ask at the same time for innovative solutions and proven performances?

Message from the Chairs of TOC and CAPG (Con't)

- How to define a fair share of the risks linked to adopting innovative solutions between owners, contractors, designers and researchers?
- Is the link between research and practice weaker or stronger than before?
- Are governments ready to support intensive collaboration between research and practice to narrow the gap on key problems? Do they know how to proceed on a national or international basis?
- What is the proportion of ISSMGE members with respect to the total number of Geotechnical engineers in the world?

Break out session at the ISSMGE Edinburgh conference

A highly successful breakout session was organised by TOC & CAPG where the Chair of the TOC presented on the State of the art and State of practice concepts, and members of the core team of the CAPG presented to the audience results of the survey of the TCs on State of the art and State of practice, as well as practical concerns encountered by practitioners in the day to day operation of commercial geotechnical practice. The role of academic research in practical applications to both small scale and major geotechnical projects was also discussed. UK's Ground Engineering magazine (9 Oct 2015) reported on these discussions. The debate in social media (above) picked up on key themes from this discussion.

What does 2016 hold for TOC – CAPG cooperation?

- Creation and distribution of a global survey on the state of the art versus state of practice in the varied fields of geotechnical and geo-environmental engineering.
- Increase engagement and number of Corporate Associates of the ISSMGE

We invite all members of the ISSMGE to participate in these two important activities for the ISSMGE. Please contact the undersigned for registration of interest and further information.

Pierre Delage
Chair of the Technical Oversight Committee (pierre.delage@enpc.fr)

Sukumar Pathmanandavel
Chair of the Corporate Associates Presidential Group (Sukumar.pathmanandavel@gmail.com)

Paris, France - Sydney, Australia, 2 April 2016

Research Highlights

Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan

There are three geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science (IIS), the University of Tokyo, Japan. One[1] at Dept. of Civil Engineering is led jointly by Prof. Junichi Koseki and Associate Prof. Taro Uchimura, and the other two[2,3] at IIS are led respectively by Prof. Reiko Kuwano and Associate Prof. Takashi Kiyota. They are supported technically by Mr. Takeshi Sato and Mr. Toshihiko Katagiri.

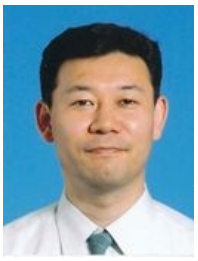

Junichi Koseki


Taro Uchimura


Reiko Kuwano


Takashi Kiyota


Takeshi Sato


Toshihiko Katagiri

As of April 1st, 2016, 12 PhD students, 25 master course students and 3 visiting engineers in total, including 26 overseas students, are conducting their research activities at these laboratories under the supervision of the above academic staff, to be briefly introduced below. Though the three laboratories are independent from each other in principle, they occasionally enjoy joint PhD seminars among them and group tours in cooperation with Prof. Jiro Kuwano's laboratory of Saitama University, Japan.

[1] http://geotle.t.u-tokyo.ac.jp/index.html
[2] http://geo.iis.u-tokyo.ac.jp/
[3] http://www.gdm.iis.u-tokyo.ac.jp/index_e.html

Research Highlights (Con't)

Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan

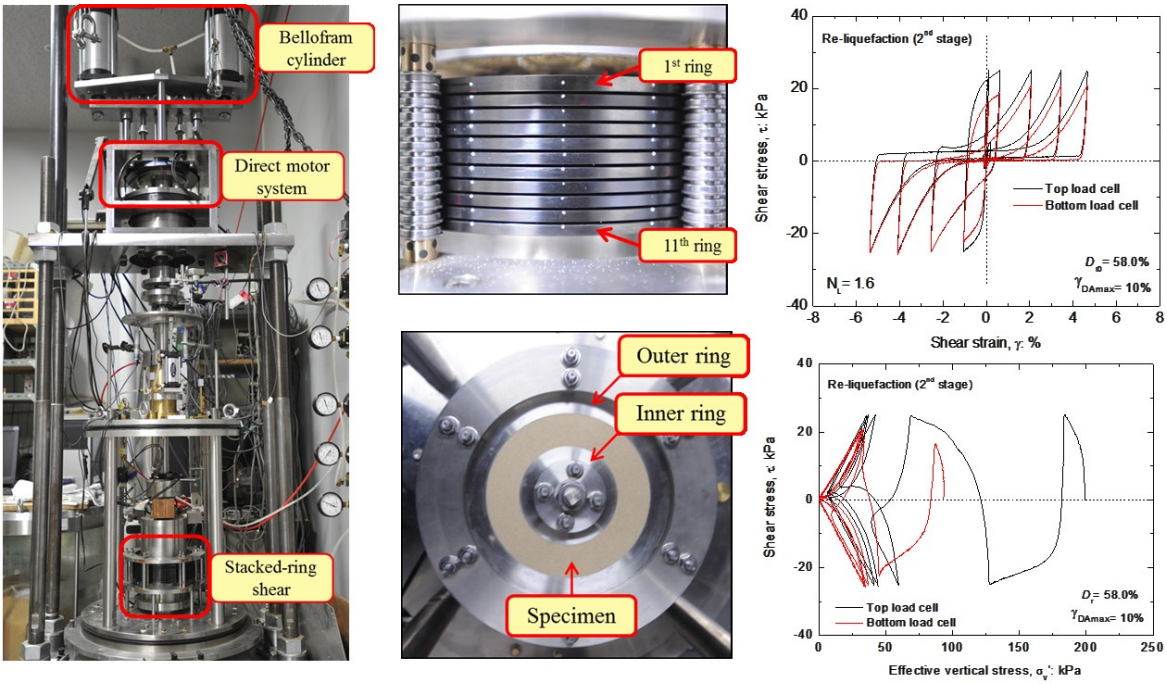
1. Research topics at Geotechnical Engineering Laboratory, Dept. of Civil Engineering

1.1 Liquefaction properties of sandy ground

After the 1964 Niigata Earthquake, Japan, Prof. Kenji Ishihara initiated his pioneering studies on liquefaction. Subsequently, Prof. Ikuo Towhata expanded the research scope, for example, by investigating the liquefaction-induced lateral flow and aging effects on liquefaction resistance.

Currently, by using triaxial, torsional shear and stacked-ring simple shear apparatuses as well as a 1-g shaking table, the following topics are being studied:

- Repeated liquefaction properties of sandy soils
- Liquefaction characteristics of segregated sandy to silty soil deposits
- Cyclic behavior of partially saturated sandy soils and iron ore fines



Stacked-ring simple shear apparatus and typical test results (Wahyudi et al., 2015, Int. J. Geomech. ASCE)

1.2 Design and performance of earth, underground and foundation structures

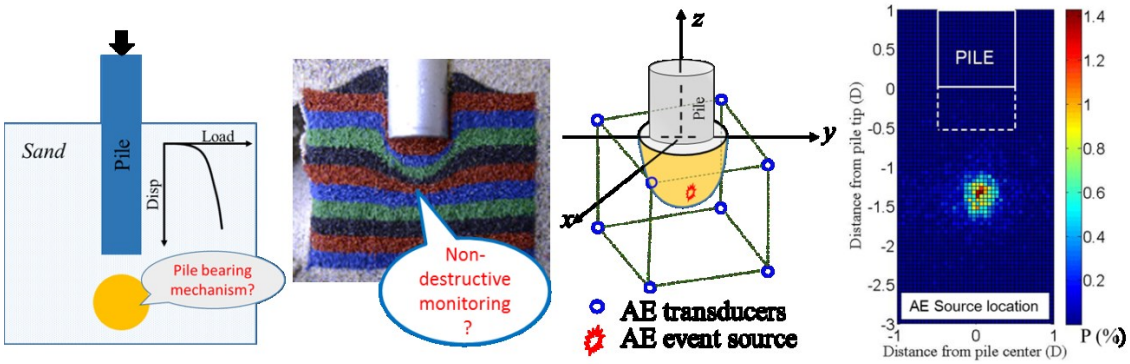
The late Prof. Masami Fukuoka continued his studies on seismic earth pressures and reinforced soil retaining walls after moving from Public Works Research Institute, Ministry of Construction, Japan, to the Geotechnical Engineering Laboratory in 1971. After moving from IIS to Dept. of Civil Engineering in 1995, Prof. Fumio Tatsuoka also continued his studies on geosynthetic-reinforced soils to improve their performance against large earthquake loads, including the development of the pre-loaded and pre-stressed geosynthetic-reinforced soil bridge piers.

Currently, by using a 1-g shaking table and small to medium scale model pile loading test facilities, the following studies are carried out:

- Seismic performance of embankments consisting of partially saturated sandy soils
- Seismic performance of spread foundations resting on liquefiable/non-liquefiable subsoil layers
- Non-destructive evaluation of particle crushing under vertically loaded pile using multiple AE measurements
- Countermeasures against clogging of underground pipes induced by liquefaction of surrounding soils

Research Highlights (Con't)

Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan



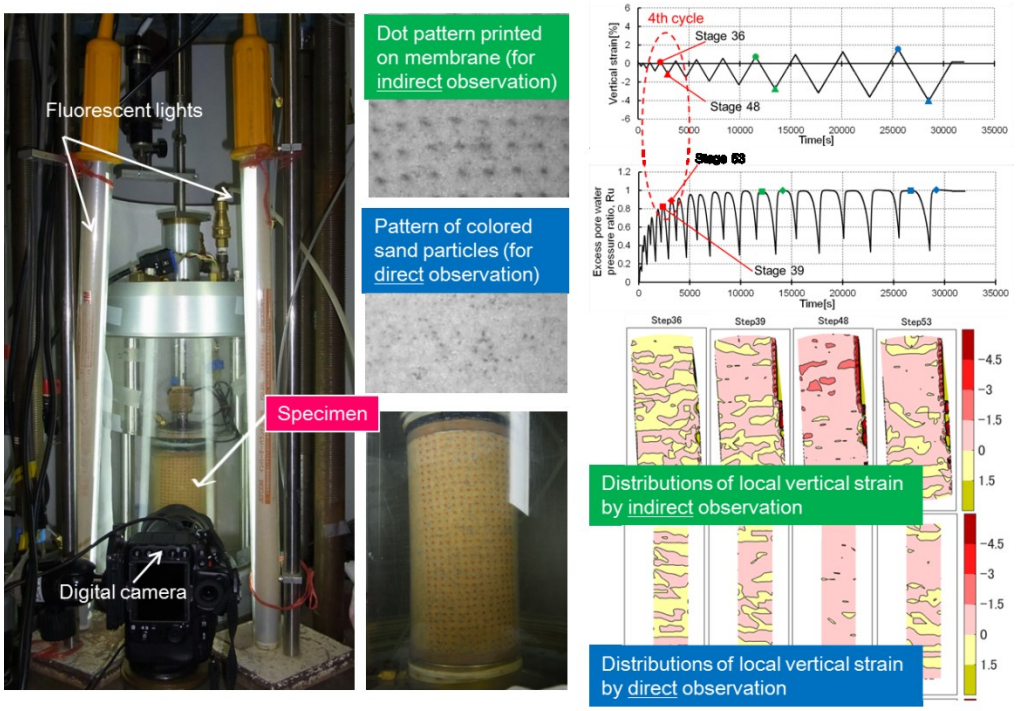
Acoustic emission characteristics during pile penetration in sand (Mao, 2015, PhD thesis, Univ. og Tokyo)

1.3 Accurate evaluation of deformation and strength characteristics of geo-materials

In 1941, the late Prof. Takeo Mogami published his first paper on dilatancy of dry sand, based on a series of laboratory tests using a special direct shear apparatus consisting of three sand boxes. Since then, the laboratory has been focusing on development of precise soil testing apparatuses to evaluate accurately the deformation and strength characteristics of geo-materials.

Currently, the following studies are conducted by using special measurement techniques and apparatuses:

- Testing quality assessment based on local deformation measurements during unconfined compression tests on cemented soils
- Direct and indirect evaluation of local deformation characteristics of sands based on image analyses during liquefaction process in triaxial and torsional shear tests
- Non-destructive evaluation of particle crushing and sliding using multiple AE measurements in triaxial tests
- Effects of step-wise change of loading rates and cyclic and creep loading histories on properties of cemented/uncemented soils



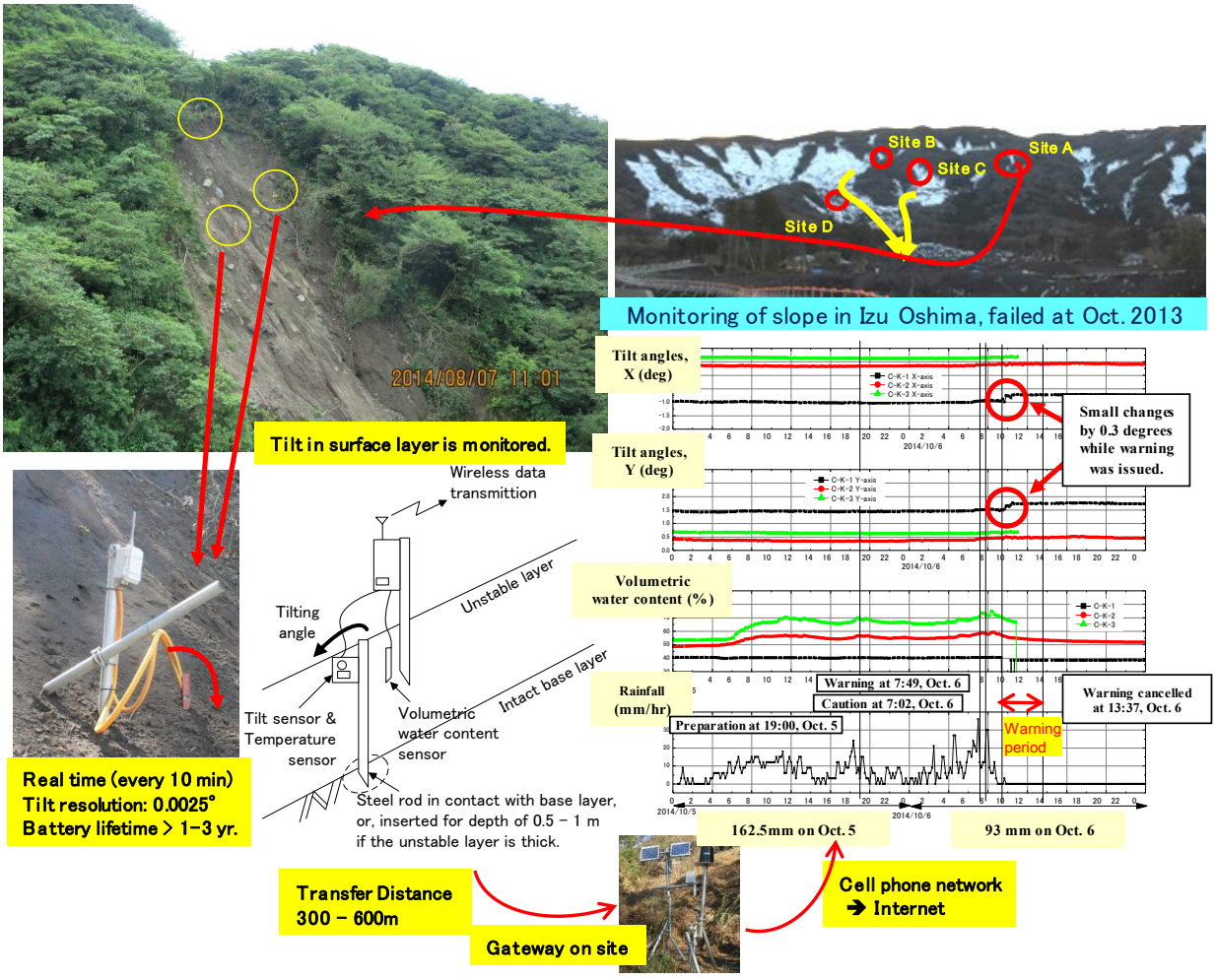
Direct and indirect observations of local deformation properties of saturated Toyoura sand specimen in undrained cyclic triaxial tests (Hoshino et al., 2015, Bulletin of ERS. Univ. of Tokyo)

Research Highlights (Con't)

Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan

1.4 Monitoring and early warning for landslide disasters

A low-cost and simple slope monitoring and early warning system has been developed since 2005. A steel rod is inserted into the slope surface vertically to a depth of 0.5 - 1m, and its tilting behavior (rotation) is observed continuously. A low-cost and low power tilt sensor with MEMS (Micro Electro Mechanical Systems) technology is used, and a continual data is transferred every 10 minutes with resolution of 0.0025 degrees. The real time data can be accessed on a web site through the internet. Summarizing more than 80 cases of slope monitoring, it is proposed to issue a warning when continuous tilting is observed with the tilting rate higher than 0.1 degree / hour. The figure below shows an example of the system deployed on scars of debris flow which occurred in Izu Oshima, a volcanic island in Tokyo, Japan, in October, 2013. The scars are monitored with 10 tilt sensors during rainy summer of 2014 before restoration works starts. No secondary failure occurred in this site fortunately, but a small tilting was observed on Site C just after a heavy rainfall due to Typhoon 18 in October. The local government had issued a warning already by judgement based on the rainfall data at this time, and it coincided to the observed tilting on Site C.



A slope monitoring and early warning system deployed on scars after debris flow disaster in Izu Oshima

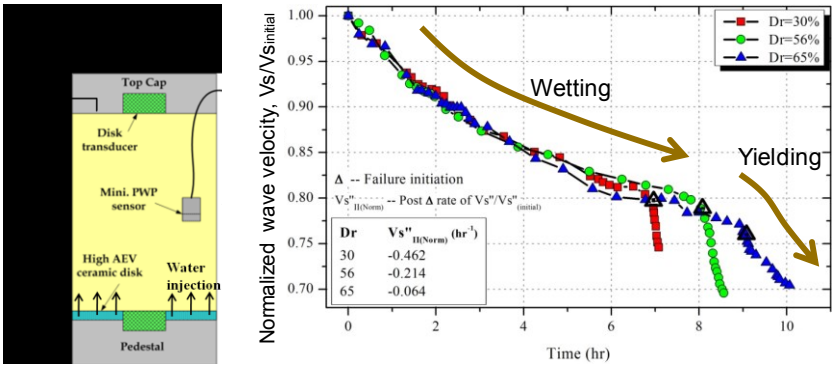
Research Highlights (Con't)

Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan

1.5 Unsaturated soil mechanics and its applications

In relation to the study on landslide disaster mitigation, several topics on unsaturated soil mechanics are studied, and its applications are proposed.

(1) In a process of surface failure of slope due to heavy rainfall, the water content increases in the surface layer, and consequently shear strain develops with increasing rate. This process is simulated in a triaxial specimen as shown in the figure on the right. An anisotropic stress is applied to unsaturated specimen. And then, water is slowly injected through permeable ceramic disc on the a pedestal, while the external stress is constant. The elastic wave velocity through the specimen is monitored using piezo devices during this process. The wave velocity shows clear reduction corresponding to wetting of specimen, and further quick reduction when the specimen starts to yield under considerable degree of saturation. This trend is observed both in P wave and S wave velocities. The wave velocity through a surface layer of slopes should show a similar trend during a process of failure due to rainfall, and this can be useful to monitor slopes for an early warning.

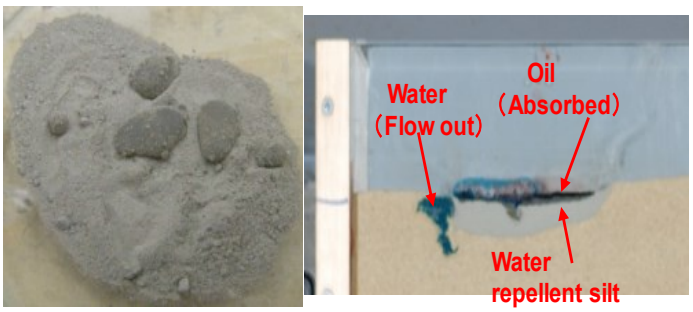


Wave velocity though unsaturated soil in wetting and yielding

(2) Vegetation is an economical measure to protect slope surfaces against erosion due to heavy rainfall. Contribution of the tensile strength of plant root is also expected to restrain shear failure. However, vegetated ground shows higher permeability compared to non-vegetated ground. In this study, vetiver, a poaceous species whose root grows rapidly to a depth of 2m or more, is planted on flat ground and a 1D vertical column of unsaturated soil. After the root grow into the soil, water infiltration from the top surface is observed by using volumetric water contents sensors. The permeability coefficient of soil increased by up to 30% with well-grown root system.

Evaluation of permeability in a soil with vetiver root

(3) It is proposed that water repellent fine soil be used to restrain ground contamination with oil. A silty material is placed along facilities (machines, pipelines, etc.) which might discharge oil. The silt absorbs the oil effectively. However, ordinary silt without water repellency also absorb moisture in the air, or spilled water, and it will lose the ability to absorb oil when the oil is dripped on it. Therefore, the silt is chemically treated to be water repellent by a kind of silane finishing. In the left picture, a mixture of water and oil is dripped on a layer of water repellent silt. The oil is separated and absorbed into the silt, while the water flows out of the silt area.



Left: water repellent silt with water drip on it;
Right: selective absorption of oil by water repellent silt

Research Highlights (Con't)

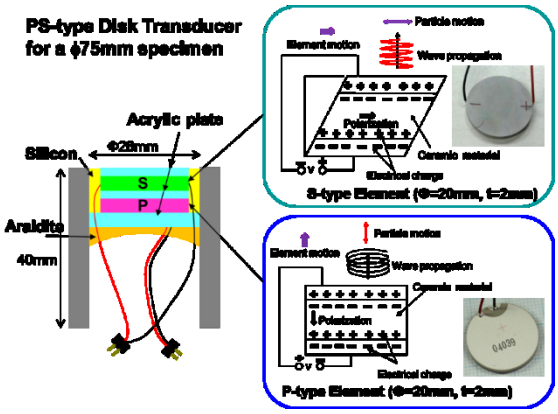
Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan

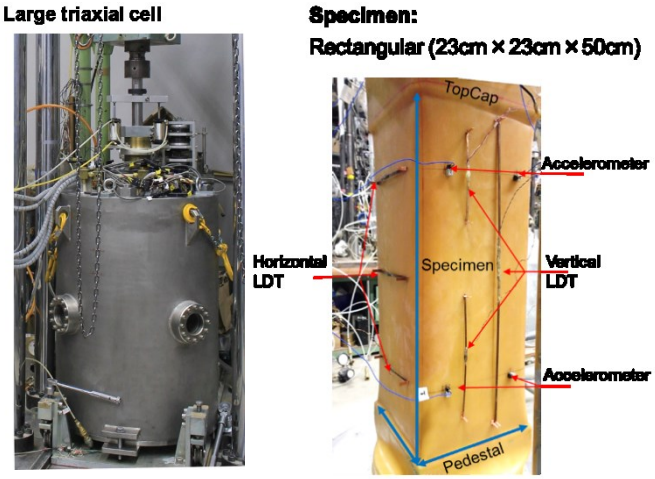
2. Research topics at Kuwano Laboratory, IIS

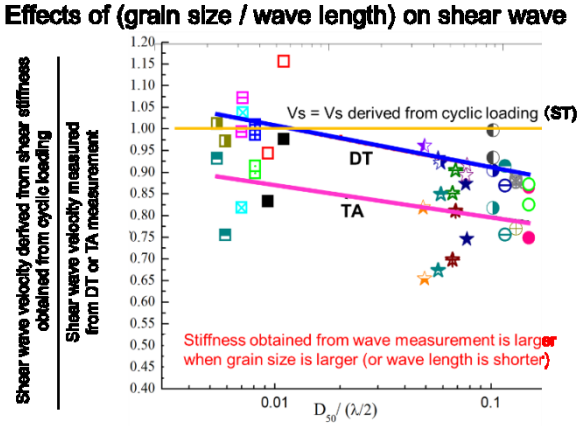
The geotechnical engineering laboratory in IIS, the University of Tokyo, has been built up over the past 40 years. Professor Tatsuoka and Professor Koseki had made great contributions by developing various testing apparatus, measuring sensors, and test methods, including LDTs, IIS type loading system for triaxial and torsional shear, Trigger and Accelerometer method to measure elastic wave velocities, among others. Currently, Prof. Kuwano took over the laboratory and continues to make further advancement for the development of laboratory testing.

2.1 Elastic wave measurement for laboratory specimens

A disk shape sensor to measure the elastic wave for a laboratory soil specimen, called a Disk Transducer, has been developed. The Disk Transducer is capable of measuring both P and S waves simultaneously by utilizing a multichannel oscilloscope. The elastic properties of soil obtained from Disk Transducer method are compared with those from other methods, including small cyclic loading, Bender Element, and Trigger Accelerometer method. The Disk Transducer having a diameter of 80mm has been installed in a large triaxial apparatus for rectangular specimen with coarse grained material.

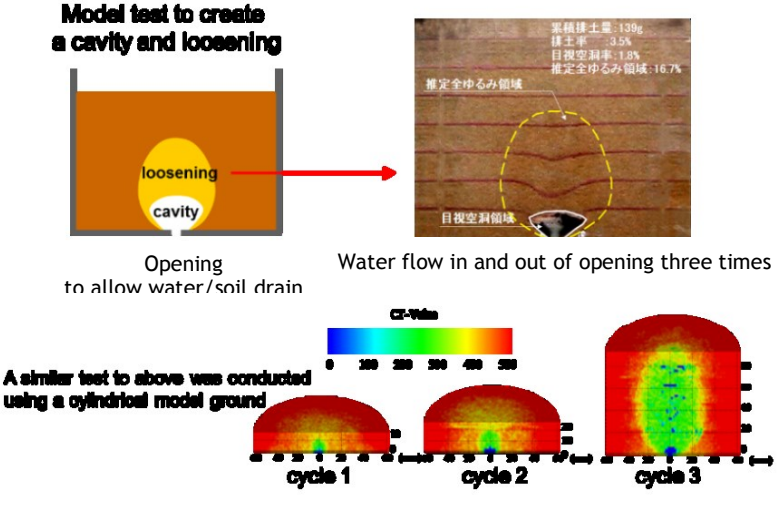






2.2 Ground cave-ins

Local subsides or cave-in's of the ground often occur in urban area. The complicated underground situation as well as the necessity of urgent restoration do not usually allow full investigation of the real cause. The detailed mechanism of the phenomenon has not been, therefore, well understood. A cave-in is usually initiated by the formation of cavity in the ground. When the location of the subsurface cavity is deep in the ground, the detection of the cavity is not easy. Then it is possible that the hidden



Research Highlights (Con't)

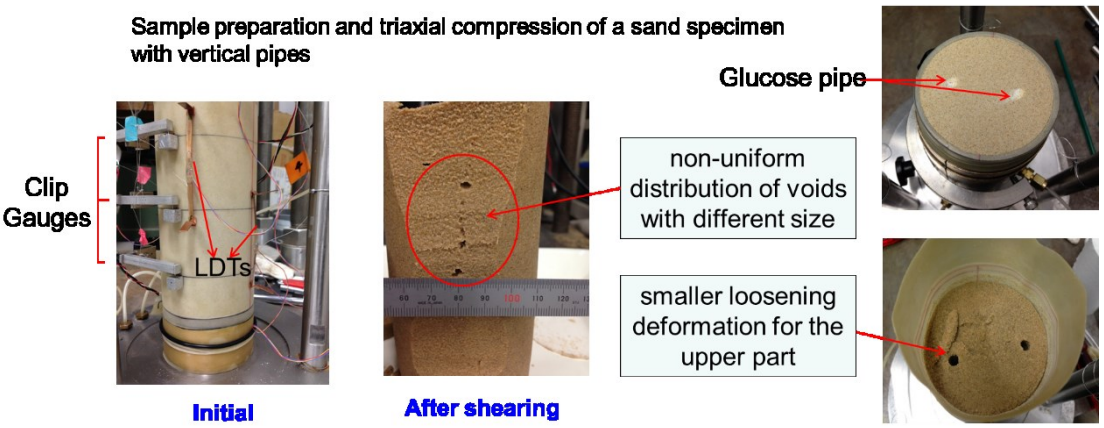
Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan

cavity expands for a long time to eventually cause sudden large-scale collapse. Characteristics of formation/expansion of cavity and surrounding ground loosening are investigated, aiming at effectively indicating dangerous pattern of cavity and loosening.

A significant number of sinkholes have appeared in Pokhara, Nepal since 2013. The process of sinkhole formation seems to be still continuing. Field investigations have been conducted several times so far in the collaborative study with Tribhuvan university, Kiyota lab and Kuwano Lab.

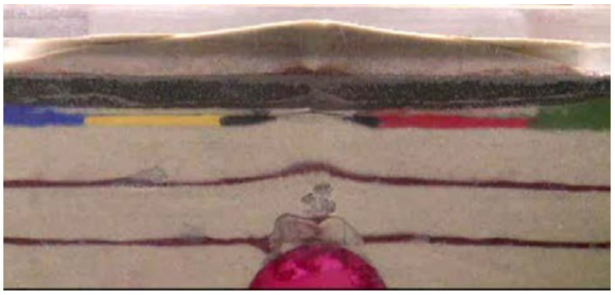
2.3 Internal erosion

Internal erosion of the ground sometimes causes serious disaster such as slope failure and ground cave in. Effects of internal erosion of soil on its mechanical behavior were investigated. Soil specimens subjected to different pattern and degree of internal erosion were prepared and tested in triaxial and torsional shear. Piping and a cavity were introduced in the specimen using soluble material. Small scale internal erosion was achieved using a special pedestal allowing escape of fine particles from a specimen. The degree of internal erosion was found to be evaluated by the turbidity of the drained water.

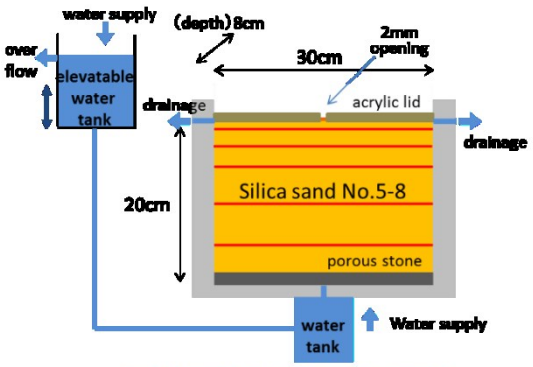


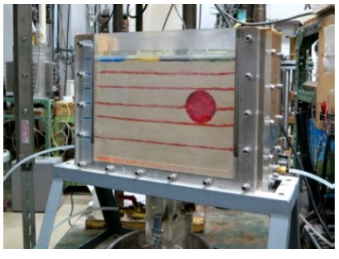
2.4 Sand boiling

A number of sand boils occurred in the coast of Tokyo Bay at Great East Japan Earthquake. A series of model tests was conducted to simulate the phenomenon of sand eruption from the crack of pavement. A model sand layer was prepared in the small soil chamber and the surface was covered by a lid with a slit opening. Liquefaction was generated by the 1G shaking table or upward seepage flow. It was observed that the flow rate of water at the opening and grain size are important factors for the sand eruption.



Sand eruption with disturbance/loosening of the liquefied ground





Model test setup for sand eruption

Research Highlights (Con't)

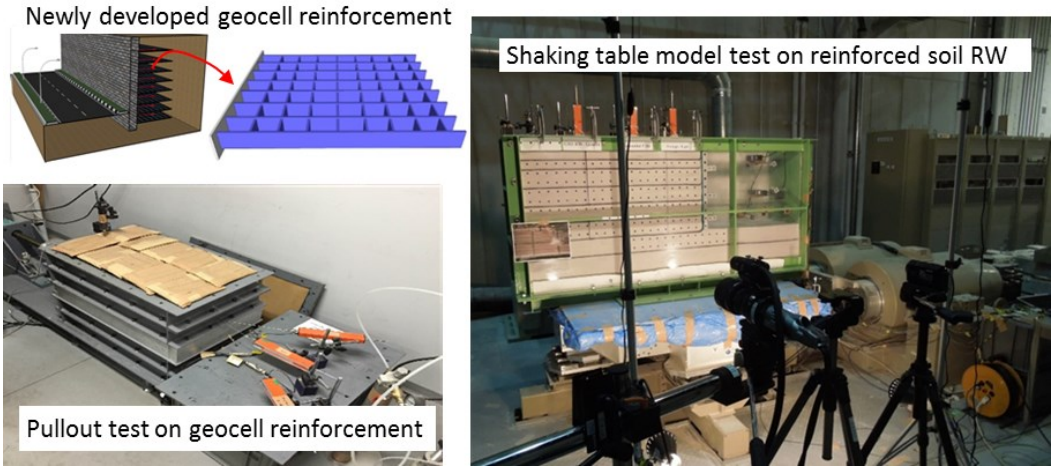
Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan

3. Research topics at Kiyota Laboratory (Geo-disaster Mitigation Engineering Lab), IIS

Kiyota laboratory, established in 2010 in IIS, is working for mitigation measures of earthquake and rainfall-induced geo-disasters through the various approaches based on laboratory tests and field surveys.

3.1 Development of geocell reinforced retaining wall

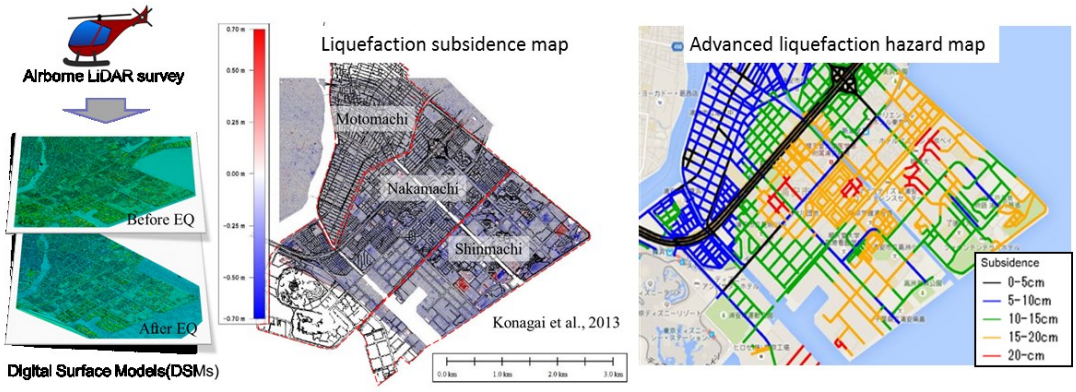
Geosynthetic reinforced retaining wall has been widely used for important infrastructures due to its high seismic stability, small deformability and cost effectiveness. Kiyota laboratory recently developed a square-shaped geocell as a tensile reinforcement of retaining walls, considering the advantage of geocells to confine larger backfill particles and a higher anchorage capacity when laterally pulled. Comparing the pullout test and shaking table model test results to those of the commonly used geogrids, it was found that the square-shaped geocell shows the highest pullout resistance as well as a higher seismic stability. Currently, we are investigating the influence of the combined effects of the backfill particle size, compaction degree and geocell size on the seismic stability of the reinforced retaining wall.



Newly developed geocell reinforcement and testing apparatuses

3.2 Advanced liquefaction hazard map

Liquefaction hazard maps have been prepared in many organizations to assess the impact of liquefaction caused by the scenario earthquake, which is classified based on the value of liquefaction potential. They, however, provide no quantitative indicator of damage extent. This study aims to investigate the relationship between liquefaction potential and liquefaction-induced road subsidence obtained from raster images converted from airborne LiDAR data before and after the 2011 Tohoku Earthquake, and to apply this relationship for a new hazard map showing expected liquefaction-induced road subsidence, which would be useful for emergency vehicles and road restoring operations.



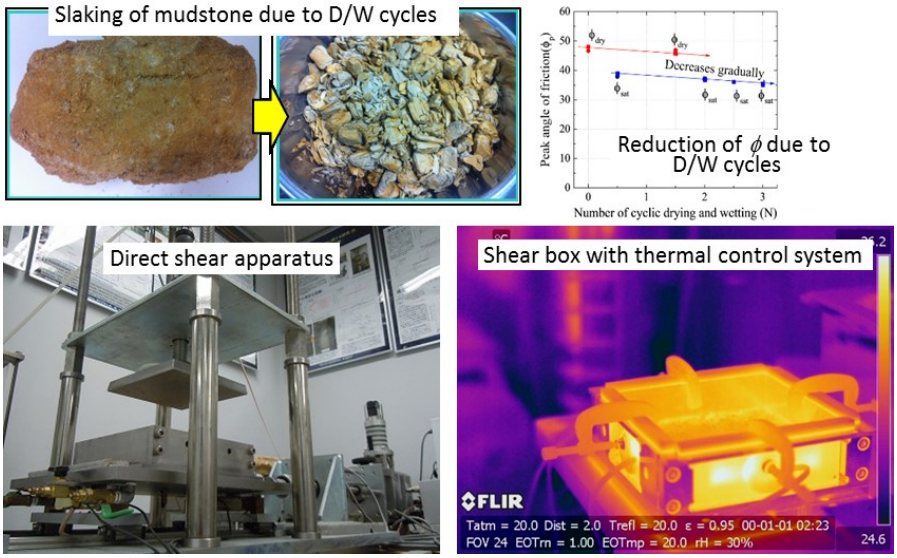
Liquefaction subsidence map after the 2011 Tohoku Earthquake and advanced liquefaction hazard map

Research Highlights (Con't)

Geotechnical engineering laboratories at Department of Civil Engineering and Institute of Industrial Science, the University of Tokyo, Japan

3.3 Effect of slaking on direct shear behavior of crushed mudstone

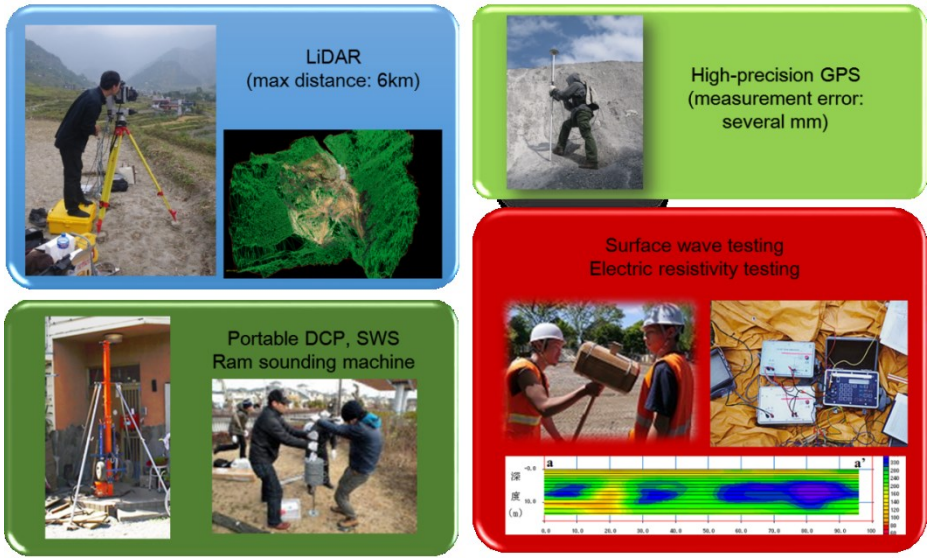
Slaking of the mudstones on exposure to wetting and drying environments has given rise to slope instability. The mechanism of strength reduction of mudstone due to the slaking is investigated by direct shear tests, in which the sample is subjected to cyclic wetting and drying under the prescribed normal/shear stress conditions. Current experiments on the mudstones show a gradual decrease of the internal friction angle with the number of drying and wetting cycles and that higher slaking index and lower water content before the wetting accelerate the slaking.



Modified direct shear apparatus and test result on slaking-induced determination of mudstone

3.4 Field investigation on geotechnical issues

Kiyota laboratory frequently visits to areas affected by devastating earthquakes and rainfalls (e.g., Nepal in 2015; Taiwan in 2016), and conducts field surveys on geotechnical issues, which contribute to the emergency response and disaster prevention in future. We have a range of technical tools available to conduct field investigation.



Field survey equipment in Kiyota laboratory, IIS

Major Projects

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

Jonathan Hale, Alexandre Hubaut, Philippe Vincent
Menard Bachy, 13-15 Lyon Park Road 2113 Macquarie Park NSW
jhale@menardbachy.com.au, ahubaut@menardbachy.com.au, pvincent@menardbachy.com.au

1. Introduction

Menard Bachy has carried out over the last 15 years a large number of groundwater containment structures utilising a wide range of techniques. One particular technique is the Soil Bentonite (SB) wall which is one of the most efficient, cost effective and environmentally friendly solutions to implement in-situ cut off (low permeability) walls. SB walls have been utilised historically for a wide range of applications including confinement of contaminated ground water around landfills, toxic tailing ponds but also for the improvement of performance of dams and other types of water retaining structures. In the delivery of complex projects SB walls have also been utilised in combination with other mechanical and hydraulic structures such as PVC membranes, hydraulic gates, leachate collection trenches, and sumps but also sheet piles and other retention systems.

For the particular case of sites presenting environmental challenges, involving soil and groundwater pollution, a strategy requiring both removal and treatment of the source of the contamination as well as control of the contaminated groundwater plume acting as the pollution carrier is required. In the case of urban excavations where treatment is complicated by access and impact on community contamination confinement is often preferred. In any case, the adopted strategy needs to take into account the future use of the site, combined solutions involving both the reduction of the source of pollution and control of the pollution carrier generally offer the most sustainable outcome.

This paper presents a range of projects performed in Australia and overseas utilising different forms of SB walls. A particular focus is given on project methodology, site validation and trial testing but also production and quality control. The paper also provides a comparison of the environmental impact that different cut off wall techniques have and how they compare with SB type walls.

2. Technical options for constructions of a groundwater barrier

2.1 Slurry cut-off wall

Slurry Walls are a trenching technique that utilises the thixotropic properties of a fluid to provide excavation support. The slurry prevents the trench from collapsing by providing outward pressure, hence balancing the inward hydraulic forces and preventing water flow into the trench. Slurry design vary based on the in-situ soil and groundwater composition, however typical properties are highly viscous (flow cone <40seconds), a density slightly higher than water (>1025kg/m^3) and filtrate loss <25ml.

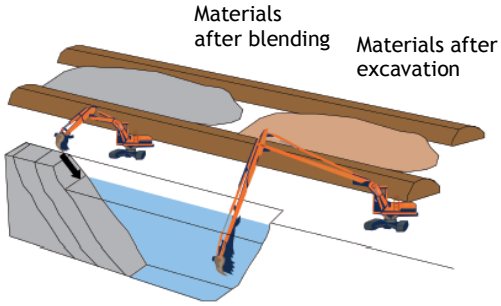


Figure 1: Schematic of slurry wall excavation under bentonite slurry

The method is a continuous process where excavation and backfilling operations are undertaken through the slurry.

(Stage 1) The leading face of the excavation is progressed using a long reach excavator, typically capable of 18m - 20m deep reach. Deeper excavation (up to +50m depth) is then progressed in panel sections using a crane rig equipped with a clam shell excavation tool. Excavation is then verified by physical observation of key material (aquitard) and depth measurements.

Picture 1: Slump Testing

(Stage 2) The leading face is then followed with a backfilling operation that progressively displaces the slurry to balance out the excavated

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

volume, in this way a balance in slurry height is targeted. Slurry height is maintained at a minimum of 1m-2m higher than the in-situ groundwater to ensure the outward pressure is maintained. Typically the backfilling process firstly utilises a tremie pipe that allows initial backfilling of the trench from the base of the excavation to the top. The secondary phase utilises a batter to maintain the progressive filling operation of the trench.

(Stage 3) The back fill material is specific to each application of the slurry cut-off wall and is designed prior to installation. Example backfill material comprises Soil Bentonite, Cement Bentonite, Soil Cement Bentonite or a combination of permeable and reactive material (implemented in Drainage and Permeable Reactive Barriers). Mixing operations utilising in-situ material is carried out concurrently to the excavation process. Backfill material primarily engineered from imported material may be mixed off-site or in a centralised mixing area. Verification of mixing is undertaken by regular testing for backfill slump and slurry viscosity as well as periodic permeability testing as appropriate.

Picture 2: Viscosity

This continuous process is one key defining aspect of the method resulting in one element without multiple joints often required with most forms of alternative cut-off wall techniques.

Picture 3: Clam Shell – Mascot (left), Mayfield (centre) and Long Reach Excavator (Right) Mt Arthur Coal

2.2 Bio-polymer drains

Bio-polymer trenches are constructed for draining, diverting or collecting groundwater or leachate or underground gas. They offer a cost effective way to construct deep collection drain trenches by eliminating the difficulties and costs associated with temporary shoring and dewatering associated with conventional construction.

Bio-Polymer trenches utilise the continuous trenching method as described in Section 2.1, however the slurry composition consists of polymer chains within the fluid that is highly viscous, entrain suspended soil particles and engage the trench surface to promote trench stability. Similar to the bentonite slurry technique the excavation and backfilling operations are undertaken through the Bio-Polymer slurry for trench stability. However following trench installation the polymer chains are readily broken down through a chemical reaction leaving the permeable backfill material in place.

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

Table 1: Advantages of different types of slurry cut off wall

Groundwater Barrier	*Advantages*
Soil Bentonite	• Lowest cost of all underground barriers • High productivity • Verifiable continuity and depth • Low permeability (10^{-9} m/sec) • Positive connection with aquitard (key inspection possible) • Excellent resistance to contaminated groundwater • Accommodates large strains and is ideal where large ground movements are to be expected • The slurry remains fluid, allowing time for penetrating difficult layers or obstacles • Can be combined with HDPE membrane to provide air tightness • Re-use of most of the excavated materials
Soil Cement	• Most of the advantages of SB slurry walls apply to SCB walls • Higher strength than SB or CB walls • Greater trench stability is possible because the SCB backfill creates a shorter backfill slope • More resistant to erosion and burrowing animals – essential in levee applications
Cement Bentonite	• Useful on smaller project with limited access or narrow work zones because of the smaller equipment footprint • Low Permeability (10^{-8} m/sec) • No excavated soils are used in the final barrier wall, which is beneficial in areas with contaminated backfill soils • Since CB slurry is heavier than bentonite slurry and self-hardens, this method can provide improved trench stability and more easily overcome weaker ground conditions • Since the slurry sets after ~1 day, overlapping segments can be constructed in any direction or order to form a continuous barrier • Segments can be used to traverse up or down moderate slopes (5-15%) with minimal earthwork construction • Construction of walls through porous ground conditions is possible • Can be used to remove unsuitable materials below the groundwater without shoring or dewatering • CB backfill, once set, has a higher strength than SB backfill
Composite Slurry Walls	• Use of the slurry method allows for the economical insertion of vertical panels or elements into the ground in a narrow self-supporting trench, even below the groundwater table • Use of plastic panels may be necessary in extremely aggressive groundwater environments or in cases where methane or other gas migration needs to be prevented • The use of the slurry trench technique provides a way to install steel sheeting in difficult driving conditions
Combination Slurry Wall Systems	• Minimum cost for maximum benefit using two or more slurry wall technologies • Capability to solve isolated constructability issues with minimum cost and risk • Capability to modify groundwater patterns by diverting, extracting or containing groundwater with one continuous system

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

The ability to support continuous trenches within complex groundwater and contaminated environments for the backfill of a wide range of media provides an opportunity that is both cost effective and low risk. The applications are somewhat limited to the imagination of the engineers tasked with solving the groundwater and contaminated land issues. Some examples of applications consist of:

- Drainage lines combined with HDPE liners allow the capture of leachate and gas and avoid draw down of neighbouring groundwater environments
- Rapid installations of air sparging systems for treatment of contaminated plumes
- Subsurface drain to lower groundwater level or encapsulated sites

(a) (b) (c)

Picture 4: Conventional Trenching Methods (left & center) compared to Slurry Trench (right), (a) propping, (b) sheet piling, (c) bio-polymer

2.3 Permeable reactive barriers

Permeable reactive barriers (PRB) are an in-situ method of remediating contaminated ground water plumes. The bio-polymer trenching method is utilised for the installation of an engineered back fill material to target and treat ground water as it flows through the barrier wall.

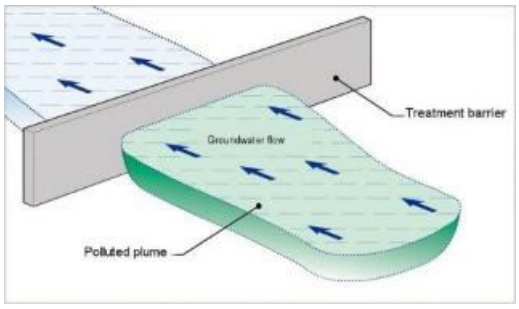


Figure 2: Active Barrier Polluted plumed treated when passing

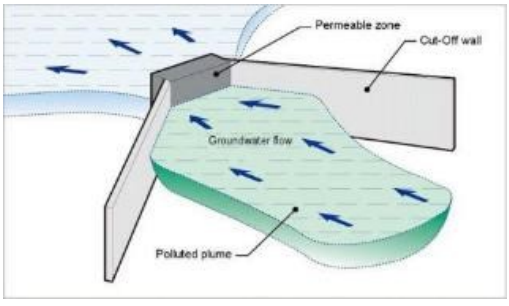


Figure 3: Funnel Gate Polluted plumed forced to a high capacity

The bio-polymer trenching method allows rapid installation without over excavation of contaminated soils and unnecessary exposure to construction personnel.

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

PRB walls address a wide range of contaminants such as chlorinated solvents, organics, metals, inorganics and radionucleides. Several processes are used within PRBs to treat contaminants which include:

- Adsorption (e.g., using activated coal and zeolite for organics)
- Precipitating for non-organics (e.g., lead precipitation using lime)
- Degradation (e.g., PCE, TCE can be degraded by iron filings)

Often the primary cost for PRB installations is the reactive material installed within the barriers. Hence there is pressure to optimise the barrier dimensions to achieve the ideal residence time and concentration for the intended design life. Reactive material is often blended with a clean sand to reduce the density of a reactive material across the barrier. Funnel and gate systems offer opportunities to utilise low cost soil bentonite cut-off walls to funnel ground water into a treatment zone. This zone can further be designed with a cell arrangement that allows maintenance of the reagent material. This concept allows a controlled response to the investment in reactive material as well as facilitates long term monitoring of the treatment process.

3. Case studies

3.1 Slurry cut-off wall

3.1.1 Soil bentonite slurry: Mayfield, NSW

The Mayfield site is approximately 155 ha within the former Newcastle Steelworks site on the south bank of the Hunter River at Mayfield. Over a period of 130 years this site has housed copper smelters, steelworks and ancillary operations. Steelworks wastes (slag) have been used to fill much of the site. The site was previously occupied by coke ovens, gas holders and other processes associated with steel making. Contaminants of concern identified on site include petroleum hydrocarbons (including benzene, toluene, ethyl benzene and xylenes), metals, ammonia, cyanide, phenols and polycyclic aromatic hydrocarbons.

Following the in-depth review of 32 options and alternatives, Menard Bachy was engaged to design and construct the barrier wall to reduce the migration of contaminated groundwater to the adjacent Hunter River, as part of a remediation strategy for the site.

The strategy finally adopted for the steelworks site initially relied on containment and comprised the following key elements as shown in Fig. 4:

- Construction of an upgradient groundwater barrier wall diverting flows away from the most contaminated area of the site (Area 1)
- Sealing the site surface area with an inert capping layer, which both prevents the infiltration of surface water, and provides a physical barrier between contaminated soils and humans on the site.
- Improved drainage infrastructure and contouring of the site, which will contribute to both the reduction of surface water infiltration and the management of possible contaminated surface water run-off from the site.

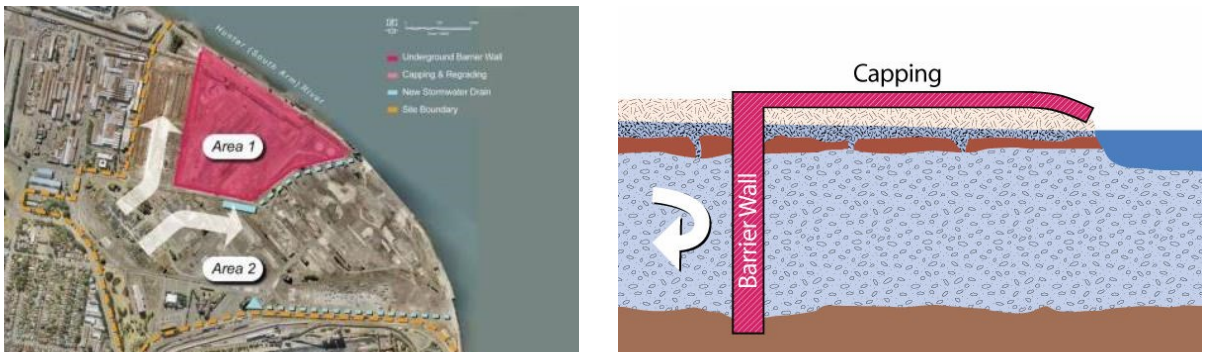


Figure 4: Schematic of Mayfield Site Remediation concept

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

The soil bentonite wall is 1,510m long, 0.8m wide and has depths ranging from 25m to 49m, keyed into the basal confining layer of clay or weathered rock. Given the range of depths of excavation, two pieces of equipment working in sequence were used: a backhoe modified to dig to 25 metres to complete the first phase of the trench, and a mechanical clamshell to excavate the deeper material.

The success of the ground barrier was demonstrated through a thorough quality control program implemented during each phase of the project and which satisfied the design criteria:

- Maximum required permeability of 10^{-8}m/s
- Surface completion to be trafficable: long term settlement of the wall less than 50 mm total settlement, and 1:50 differential distortion

The long term performance of the wall is being closely monitored via a system of groundwater monitoring wells fitted with automatic water level loggers located both inside and outside of the barrier wall.

3.1.2 Soil bentonite slurry: Mt Arthur MINE, NSW

The Mt Arthur alluvial cut-off wall project comprised the construction of a dam wall style bund along the western boundary of BHP Billiton's Mt Arthur Coal site, near Denman Road, Muswellbrook. The structure was required to protect the mine from a 1000yr flood event. Due to the presence of alluvial gravel deposits above the bedrock, the cut-off wall was required beneath the flood levee to block off subsurface flow given the increase in water pressure in association to the proposed flood.

Picture 5: Bentonite slurry supported trench

The cut-off wall was 1340m in length and was socketed into the underlying bedrock at depths ranging between 4m and 13m below existing ground level. The Slurry Bentonite cut-off wall was constructed prior to the bund wall with a target permeability of 1 x 10^{-9}m/s, with a thickness of 0.8m.

One of the main challenges on the project was to allow for utilisation of water from the mine into the slurry design. Water quality testing of the source water showed results up to 5 times the recommended limit for slurry design, recording Total Dissolved Solids at 2500mg/L and Hardness at 1000mg/L. Resulting mix design found an additional 30% additional bentonite was required to achieve the target slurry properties.

Picture 6: Slurry sedimentation assessment mine water compared with local tap water

Assessment of the actual depth to rock compared with the assumed rock depth from geotechnical investigations, found a close relationship. Variation is likely explained by varying soil/rock strength and possible variation due to the constructed working platform. This assessment for the client and contractor is crucial to provide accurate budget estimates, however variation is always likely based on the actual encountered aquitard interface.

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

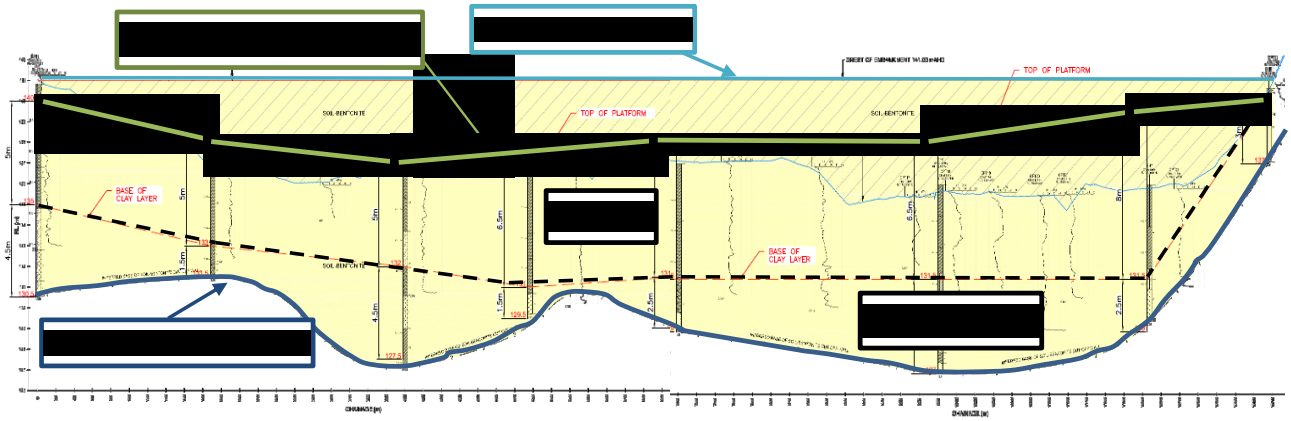


Figure 5: Geological section compared with barrier wall toe

3.1.3 Soil bentonite slurry: Liddell Coal MINE, NSW

Operational requirements at Liddell Coal Operations (Glencore) required an increase in water storage within one of the water storage dams. In order to achieve the design capacity of 2GL Menard Bachy was engaged by Glencore to install a bentonite slurry cut off wall in the mining spoil around the perimeter of the new water storage dam. This cut off wall was designed to prevent the flow of water through the mining spoil anticipated when the water level was increased in the water storage dam above 1GL. The design permeability was set at 1 x 10^{-8}m/s.

Over this 5 week period in 2014, 5,200m^2 of bentonite slurry cut off wall was installed over 600 linear metres. The ground conditions consisted of up to 7m of replaced overburden overlying shale bands and clay over bedrock. The max depth excavated using the longreach excavator was 14m.

Picture 7: Barrier wall being excavated through dragline spoil

The existing dam had been constructed within the area of an old dragline spoil area. As a result the subsurface material consisted a wide range of material including boulders up to 1m in diameter. This provided a unique constructability challenge to implement a barrier with large obstructions. To handle the obstructions the risk was assessed as a possible increase in trench width at localised obstruction locations and a reduced productivity. Considering the project was a remote site the risk of an enlarged trench was

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

observed as acceptable. A Komatsu PC850 was paired with a long arm boom to meet the challenge of clearing the obstructions, however during the project a typical 0.8m trench width was maintained for the full length of the wall.

Picture 8: Subsurface material – up to 1m diameter

3.1.4 Cement bentonite slurry: Port Bonython, NSW

The Santos Port Bonython Hydrocarbon Fractionation Plant is located on Weeroona Bay, approximately 35km from Whyalla in the Northern Spencer Golf. Soil and groundwater beneath the site appeared to be primarily impacted by crude oil leaking from adjacent storage tanks. The groundwater impacts were in the form of light non-aqueous phase liquids (LNAPL) typically floating on the groundwater or locked up in the formation and dissolved phase hydrocarbons in the groundwater. The presence of both off-site impacts and the potential for discharge to the marine environment necessitated a rapid evaluation of long-term mitigation and remediation options. In a collaborative evaluation of options a cement bentonite barrier wall was selected by Santos as the preferred remedial alternative, as it provides the highest level of confidence that off-site migration would be controlled and the long-term impacts mitigated.

The barrier wall is aligned adjacent to and sub-parallel to the ocean shoreline over a length of about 450m and is required to extend to a typical depth of 6-7m below initial surface level. The scope of works included the pre-excavation along the wall alignment through extremely high strength, abrasive sandstone, progressive backfilling and re-excavation under cement bentonite slurry, installation of a capping beam spanning the trench, the tracking and burial of contaminated soil and finally reinstating the site to natural contour levels.

Picture 9: Depth sounding

After the initial rock breaking excavation, the wall was re-excavated under the cement bentonite slurry in panels which replaced the excavated material with the final cement bentonite mix to form the low permeability barrier. The mix design adopted produced a final wall with a permeability in the order of 5 x 10^{-9}m/sec and unconfined compressive strength of approximately 80kPa.

3.2 Permeable reactive barriers

3.2.1 Continuous PRB walls: Bellevue, WA, Australia

A waste storage site operated a chemical/oil recycling and treatment facility in Bellevue, WA until a fire destroyed the facility in February 2001. Following the fire a series of investigations and risk assessments were undertaken at and in the vicinity of the property. Groundwater investigations confirmed the presence of a plume of hydrocarbons and halogenated organics originating from the former waste storage site. Subsequent groundwater monitoring indicated the presence of a separate off-site plume from a local source containing trichloroethene (TCE). Monitoring of data indicated that the two plumes converged beneath the escarpment prior to entering the Damplands.

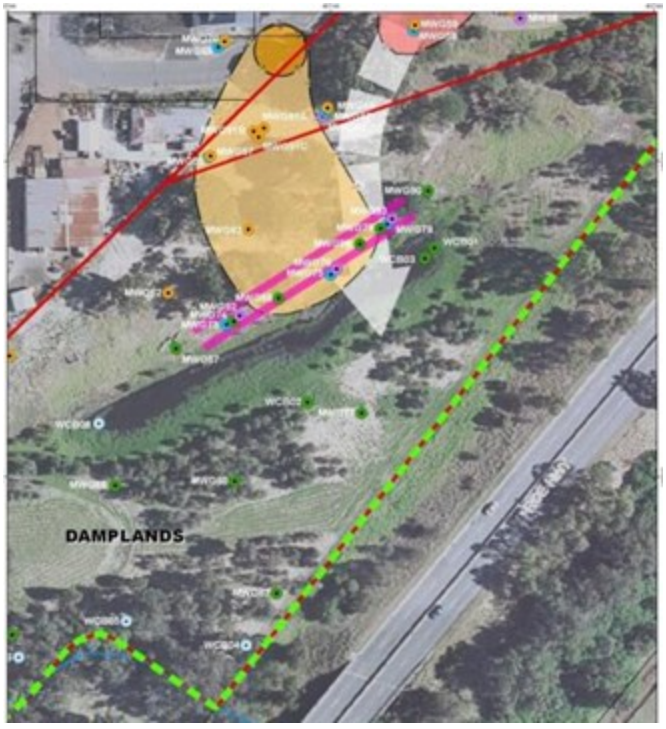
A zero valent iron (ZVI) permeable reactive barrier (PRB) was proposed. As elevated concentrations of nitrate in the groundwater were confirmed during the delineation investigation, calculations showed that most of the ZVI material thickness would be consumed through nitrate passivity. Thus, a second PRB for denitrification was also designed upstream and in front of the ZVI wall.

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

Each PRB was designed to be 76 m long and extending down to the Leederville Formation clay layer at depth of approximately 11 m. The ZVI PRB was a mixture of ZVI and sand. The denitrification PRB was a mixture of saw dust, chips and sand.

Menard Bachy was awarded the contract for the construction of the pair of PRBs based on an alternative proposal using deep trenching technology with a biopolymer slurry in lieu of execution of caissons and secant piles using a large diameter steel casing pushed into the ground and excavating the soil from within the casing. This alternative had a number of advantages including lesser cost and reduction of total and on site construction time, controlled width and continuity, control of key in depth, simplification of the environmental management plan, and lesser consumption of PRB material.



Picture 10: Operation Diagram

Picture 11: One of two parallel trenches dug to install permeable reactive barriers in Bellevue

This project is the first application of a ZVI wall of industrial scale in Australia utilising the technique of PRB trenching.

3.2.2 Funnel & Gate PRB: Solva Chemie Plant, Berbe, Switzerland

The solvent reprocessing plant belonging to Solva Chemie is located at Bätterkinden, between Soleure and Berne. Until 1992, without a protective concrete slab, plant subsoil was polluted by chlorinated solvent infiltrations. The source of contamination having run dry, ground water was still polluted by a mixture of chlorinated solvents that canton authorities requested to be eliminated in accordance with the Swiss Federal order on contaminated sites.

The Engineering Consultant (Geotechnisches Institute) studied several solutions and proposed treatment of the natural ground water to the authorities, via an active wall through which solvents would be eliminated. The characteristic feature of this site is a ground water table with a low flow rate (about 10 l/min for the whole site) flowing towards Mühlibach, a subsoil with average perviousness and watertight substratum. After agreement from the authorities, the Geotechnisches Institute chose the solution proposed by Sif Groutbor (Soletanche Bachy subsidiary), associated with ATE, of installing a filtering gate.

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

This system includes the following:

- A water-collecting drainage system: horizontal drilling and draining wall,
- A soil bentonite slurry wall,
- A filtering gate built according to the patented panel-drain technology, containing a filter with a volume of 1 m^3 and weighing about 5 tons, through which water can filter. They also patented a treating product "Iron" with an added set of catalysts, enabling lower pollutant levels to canton administration-permitted thresholds. The whole unit is gravity operated, is always accessible via the top and requires minimal maintenance.
- A discharge system including an observation well and gravity flow towards Mühlibach.

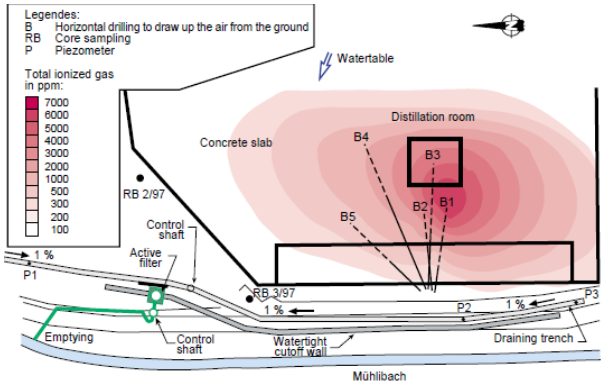


Figure 6: Operation Diagram

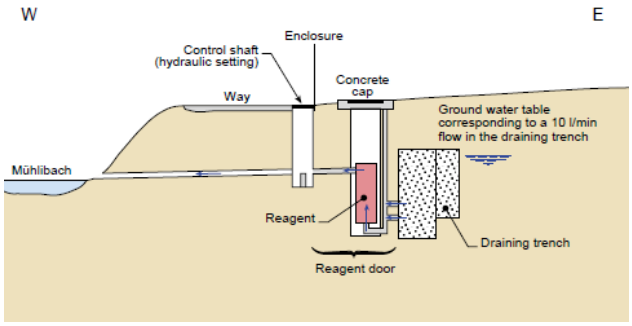


Figure 7: Schematic section

Ground Water samples were analysed both upstream and downstream. The following table presents the results obtained and demonstrate the effectiveness in reducing concentration of key contaminants immediately following the installation of the Funnel and gate system.

Table 2: Analysis results after 15 days of operations

Dissolved elements (µg/l percentage)	Upsteam	Downstream
Vinyl chloride	3	0.23
Trichlorethylene	94	0.46
Cis 1-2 dichlorethylene	199	2
Perchlorethylne	25	0.16
1.1.1. trichlorethane	9	0.22
1.1 dichlorethane	0.67	0.5

4. Sustainability considerations

The key contribution of slurry wall technologies to the sustainable development aspect is the ability to install underground structure whilst both involving limited quantities of excavation and minimal amount of imported materials such as cement or steel both high contributors in CO_2 emissions for instance.

Another key benefit of the slurry wall techniques over other traditional methods is associated with the very high production rates. This translates into overhead cost savings and benefit projects with tight construction schedules. In particular, the performance of civil works in urban contaminated environment can often lead to negative impact on the local community. Production of excessive noise, increased traffic and potential for air contamination represent a few of such adverse impacts. As a result, a reduction in overall program of works results in decreased impact over the local communities.

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

Further, excavation works are carried out under slurry limiting both risk of generating dust but also providing increased certainty in construction schedules through improved ability to control geotechnical risks such as subterranean voids and presence of localised weaker strata. Experience indeed shows that many conventional shoring techniques suffer extended delays due to unforeseen ground conditions of either geotechnical or hydrogeological nature.

The ability to install cut off walls in a controlled fashion, with minimal exposure of contaminated material and in an unmatched of time provides unrivalled construction benefits for modern urban civil works.

When scoring sustainability for geotechnical works, the estimated carbon footprint can often be an important indicator. Carbon footprint is the sum of all emissions of CO_2 in a year, induced by site activities and by the production of materials used in construction.

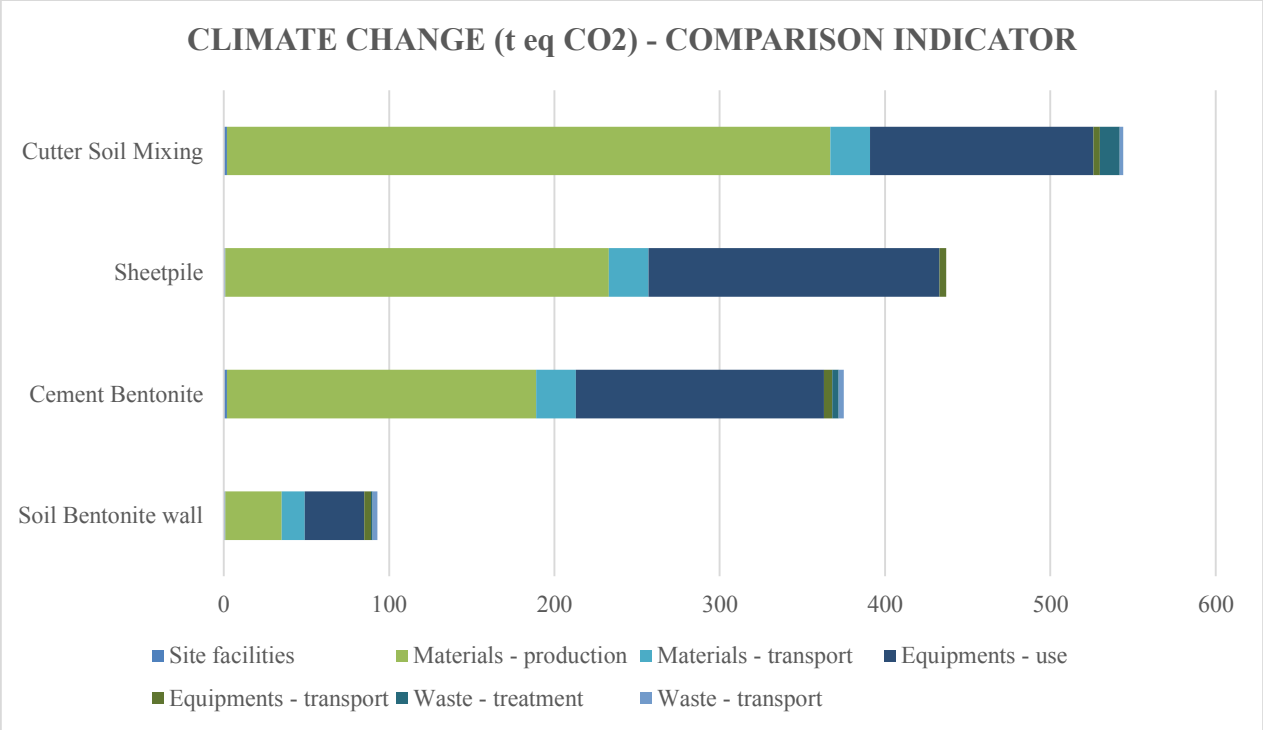


Figure 8: Climate Change (t eq CO_2) – Comparison of various Cut off wall schemes (Prism solution – Menard Bachy)

Today's access to new tools for assessing and benchmarking several environmental indicators for various competing solutions allows for accurate comparison of ground improvement techniques and assist both contractors and clients in retaining the "best for project" schemes. Figure 9 illustrates a comparison being performed on a range of solutions in accordance with the European Norm En 15804.

Going forward, it is anticipated that regulation to limit carbon emmissions with the view to limit the impact on climate change will become tougher. Further, increasing constraints on urban development to meet stringent environmental regulation as well as stakeholders requirements to limit impact on local communities are strong incentives to develop more environmentally friendly techniques.

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

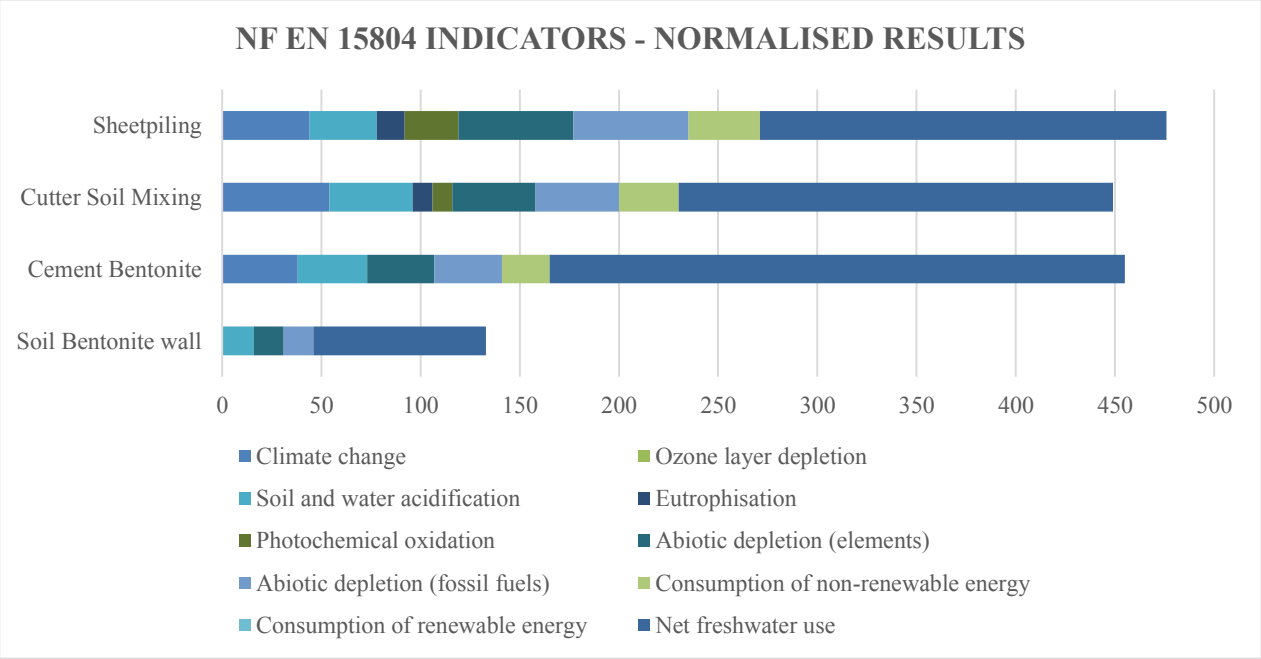


Figure 9: NF EN 15804 Indicators – Comparison of various Cut off wall schemes (Prism solution – Menard Bachy)

5. Conclusions and Recommendations

Low permeability barriers can be succesfully implemented to control groundwater in a diverse range of applications such as open cut excavation in urban environement, control of horizontal seepage and channeling of contaminated water to prevent discharge in watercourses but also control of groundwater inflow in open cut mines, upgrades of dam and landfills capacity.

The methods utilised to install such walls are readily adaptable through use of a range of alternative stabilising agents to also install permeable barriers. These can then be utilised to install deep collection drains, or even reactive agents to breakdown or capture groundwater contamination.

Whilst enabling to perform tasks that could not be achieved before, the methods of slurry bentonite and bio-polymer installation of underground barriers also grant significant benefits in advancing the construction performance on criteria such as cost, program and environmental impact.

The slurry wall concept is a highly flexible construction technique that is proven to be the most effective method for developing in ground installations. Therefore the future of slurry type wall is somewhat limited to the imagination of the engineer/environmentalist assessing individual projects over a wide range of industries.

6. References

Bouzalakos S, Crane R, Liu H, Timms W, *Geotechnical and modelling studies of low permeability barriers to limit mine water seepage*. Water in Mining congress, Chile, 28-30 May 2014

BRGM/RP – 25609 – FR, *Quelles techniques pour quels traitements - Analyse couts - bénéfices,* May 2010

Jones. S, Spaulding,C & Smyth.P. *Design and construction of a deep soil-bentonite groundwater barrier wall at Newcastle, Australia*. Proceedings of the 10th Australia New Zealand Conference on Geomechanics 2007, Brisbane

Major Projects (Con't)

Utilisation of deep groundwater barrier walls using soil bentonite and biopolymer slurries in geotechnical and environmental applications

Liausu,P & Spaulding,C. *Construction d'une paroi etanche en sol-bentonite sur le site de l'ancienne acierie de Newcastle*. Revue Travaux 2007, no. 836, pp. 75-79

NEPM (2003). *Impact Statement for the National Environment Protection (Air Toxics) Measure* 2003, National Environment Protection Council, NSW Australia

Ryan,C & Spaulding,C. *Vertical groundwater barriers for contaminated site reclamation*. Proceedings of the 10th Australia New Zealand Conference on Geomechanics 2007, Brisbane

Spaulding,C. *Soil Bentonite Cut-off Walls for Confinement of Existing Landfills: Tempe Tip - A Case Study*. XVIth SEAsian Geotech Conference 2007

US EPA (1998), '*Evaluation of Subsurface Engineered Barriers at Waste Sites*' EPA-542-R-98-005, July 1998

TC report

Joint workshop at ECSMGE, Edinburgh, 13th September 2015

TC205 – Safety and serviceability in geotechnical design
ETC10 – Evaluation of Eurocode 7
TC304 – Engineering Practice of Risk Assessment and Management
ISO 19900 – General requirements for offshore structures

The programme of this workshop lasted from 10am to 5pm, with a break in the early afternoon so that delegates could also attend the workshop of ETC7 – Numerical analysis. It consisted of three sessions:

- Ground anchors and foundations
- Design dominated by water pressure
- Characteristic values (with ISO 19900)

Despite the difficulty of having the sessions in advance of the main conference, and parallel with many other TC workshops and the Council meeting, about 30 delegates attended and took part in vigorous discussion.

The notes below give a very brief review of the main points discussed. Presentations are available at http://www.geotech.group.shef.ac.uk/tc205/.

Prelude

Before the main meeting began, as an audience had arrived early, Brian Simpson showed a presentation that had been sent in by Martin Ziegler, who was unfortunately unable to attend. Noting that "none of the current design approaches [in EC7] is perfect", Prof Ziegler proposed a return to the "original" formulation, retaining separate factors on materials, resistances, actions and action effects.

Ground anchors and foundations (chair: Colin Smith)

A significant debate during the recent development of Eurocode 7 has been the difference in approach taken to design of ground anchors and tension piles, which, in some circumstances, perform very similar functions. In particular, all ground anchors are required to be individually tested, but tension piles are not. Adriaan van Seters considered this question, recommending that acceptance testing be implemented on micropiles as it is on anchors.

Brian Simpson presented a summary of the work of EC7 Evolution Group 1, which had developed a new Section 8 on Ground anchors. Eurocode 7 takes no account of calculation as a design verification of anchors, relying entirely on the results of testing. The terminology used in the new section was explained by thinking through the "Life story of a ground anchor", including: testing, preloading and use during its design life. As noted by Simpson et al. (2015), the UK has found that when the new section is used in combination with factored variable loading (surcharges), the results are too conservative.

Trevor Orr spoke about Irish practice for the design of anchors, in particular the allowable creep rates adopted. Tim Lansivaara questioned some of the factors of safety required for anchors, especially asking whether proof loading to high factors is really necessary. In very soft soil it is not possible to stress anchors in retaining walls to such high factors without causing passive failure. He commented that in these soils there is little difference between the forces required to prevent ULS and SLS failures, so any factors applied to SLS forces have a critical effect on the design.

TC report (Con't)

Joint workshop at ECSMGE, Edinburgh, 13th September 2015

Design dominated by water pressure (chair: Trevor Orr)

Brian Simpson presented some recent thinking on the "HYD" limit state (hydraulic heave), showing that water pressures must be assessed cautiously, taking account of the worst credible distribution of permeability, and that factors of safety are of little use in correcting for poor assessments of water pressure (conference paper Simpson and Katsigiannis 2015).

Bernd Schuppener presented a German perspective (Schuppener 2015). The aim was to ensure that however safety formats are changed the resulting design is unaffected, remaining the same as for previous German standards. Hence the DA2* approach is preferred, with partial factors chosen to be equivalent to previous global factors.

The need for "robustness" in design was acknowledged, one speaker noting the need to design against the theft of dewatering pumps!

Characteristic values (chair: Lovisa Moritz)

This workshop was joined by Joek Peuchen on behalf of ISO 19900, *General requirements for offshore structures*. Hans Schneider presented a review of recent developments in the thinking of EC7's Evolution Group 11, *Characterization*. He discussed the use of a flexible partial factor to taking into account uncertainties, and the characterisation of brittle soils such as quick clays for the purposes of design calculations. He presented statistical approaches to derive characteristic values of soil strength in cases where a limited number of test results is to be combined with pre-existing knowledge.

Joek Peuchen said that resistance factoring is favoured in ISO 19900, in order to account for geotechnical uncertainties such as uncertainty of the zone/shape/volume of soil involved in a limit state. The representative value of resistance, which is to be factored, is not clearly defined, as has been attempted for characteristic values are in Eurocode 7. However, he considered that both Eurocode 7 and ISO 19900 provide inadequate or ambiguous guidance to practitioners for determination of characteristic values of soil properties. The ISO was intended to be consistent with ISO 2394 – *Reliability of structures* – released in 2015, but this is work in progress.

References

Schuppener, B (2015) When and where should factors be applied to water pressures? - A German perspective.

Simpson, B, Katsigiannis, G. (2015) Safety considerations for HYD limit state. Proceedings of the 16th European Conference on Soil Mechanics and Geotechnical Engineering, Geotechnical Engineering for Infrastructure and Development, p.4325-4330, ICE. Link: http://www.icevirtuallibrary.com/doi/abs/10.1680/ecsmge.60678.vol7.685

Simpson, B, Gavins, M & Mothersille, D (2015) Eurocode 7 Section 8 - Ground anchors: development of the UK National Annex. Proceedings of the 16th European Conference on Soil Mechanics and Geotechnical Engineering, Geotechnical Engineering for Infrastructure and Development, p.4319-4324, ICE. Link: http://www.icevirtuallibrary.com/doi/full/10.1680/ecsmge.60678.vol7.684

Conference Reports

The 12th Australia New Zealand conference on Geomechanics

Conference details

The 12th Australia New Zealand Conference on Geomechanics (ANZ 2015) was held at Shed 6 and TSB Arena, Wellington, New Zealand from 22 – 25 February 2015. The theme of the conference was 'The Changing Face of the Earth: Geomechanics & Human Influence'.

ANZ 2015 is the Australasia regional conference of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) and is held approximately every 4 years.

The conference included 2 technical fieldtrips, 5 keynote presentations, 4 concurrent sessions, 137 paper presentations and 23 poster presentations. The social functions included the Welcome Reception, Poster Session and Happy Hour, and Conference Gala Dinner evening.

The ANZ 2015 was held in the Shed 6 and TSB Arena facilities on the Wellington Waterfront. The Shed 6 venue capably housed the plenary and concurrent sessions plus delegate registration, while the TSB Arena housed the exhibition hall, poster presentations and refreshments.

Conference themes

The main conference theme for ANZ 2015 was '*The Changing Face of the Earth: Geomechanics & Human Influence*'.

The worldwide community is currently facing great change; a changing climate, an evolving legislative environment and changing human perceptions and awareness of the cause and effects of our actions. This change presents an exciting series of risks and opportunities within our industry. This conference sought to explore and better understand the drivers for changing our world and the impact we make – be this in marine and coastal areas or the built environment, from open cast mining to creating brand new communities.

The conference subthemes include:

1. Risk considerations in geomechanics
2. Environmental matters in geomechanics
3. Seismic analysis and performance
4. Land development for human activity
5. Land stability and stabilisation
6. Linear infrastructure route development
7. Structural foundation systems
8. Ground improvement
9. Land based surface and underground mining
10. Geotechnical analyses
11. Material properties and testing

Conference Reports

The 12th Australia New Zealand conference on Geomechanics (Con't)

Keynote and award lectures

There were three invited keynote lectures (Prof. George Gazetas, Dr Fred Baynes and Prof. Jonathan Bray) and two award lectures: John Jaeger Lecture (John Carter) and NZGS Geomechanics Award Lecture (John Wood).

Prof. George Gazetas

Dr Fred Baynes

Prof. Jonathan Bray

The keynote speakers were very well received and they were considered a technical highlight for the conference.

The keynote speakers were selected based on their technical expertise and personal recommendations from the conference committee/wider geotechnical community. This worked very well as they were not only technically very good, but were charismatic presenters that brought energy to the conference.

The topics covered in the keynote lectures very loosely connected to the theme. We suggest that this was a result of a very broad theme and the background of the keynote speakers.

Conference concurrent sessions

Generally, there were four concurrent sessions for presentation of the technical papers.

The allocation of papers to different streams was a time consuming process, and substantial time needs to be allowed for this by future organisers.

We noted that some of the very technical or specific streams had few people attend, however those who did attend appeared to enjoy the content. It is felt that keeping such specific topics together works well in such conferences.

The presentation rooms were in very close proximity which made moving between the streams relatively easy. This worked very well and should be borne in mind by future organisers when considering their venues.

The technical session chairs were selected by the organising committee and briefed for each session. This worked well as TCC prepared specifically updated briefing sheets on-site for each concurrent session.

Conference Reports

The 12th Australia New Zealand conference on Geomechanics (Con't)

Conference Awards for Best Paper

There were four technical awards for conference papers. These included:

- Best Conference Paper
- Runner Up Best Conference Paper
- NZ YGP Best Paper
- AU YGP Best Paper

The winners were:

Best Paper
"Development of horizontal soil mixed beams as a shallow ground improvement method beneath existing houses" by Rob Hunter.

Runner up
"Overview of the role of testing and monitoring in the verification of driven pile foundations" by Julian Seidel.

NZ Best YGP
"Site specific hazard analysis for geotechnical design in New Zealand" by Brendon Bradley.

AU Best YGP
"Reducing the risk of acidic groundwater through modelling the performance of a permeable reactive barrier in Shoalhaven floodplain" by Udeshini Pathirage.

There was also a 'People's Choice Poster Award' where delegates could vote for their favourite poster during the conference. The winners were:

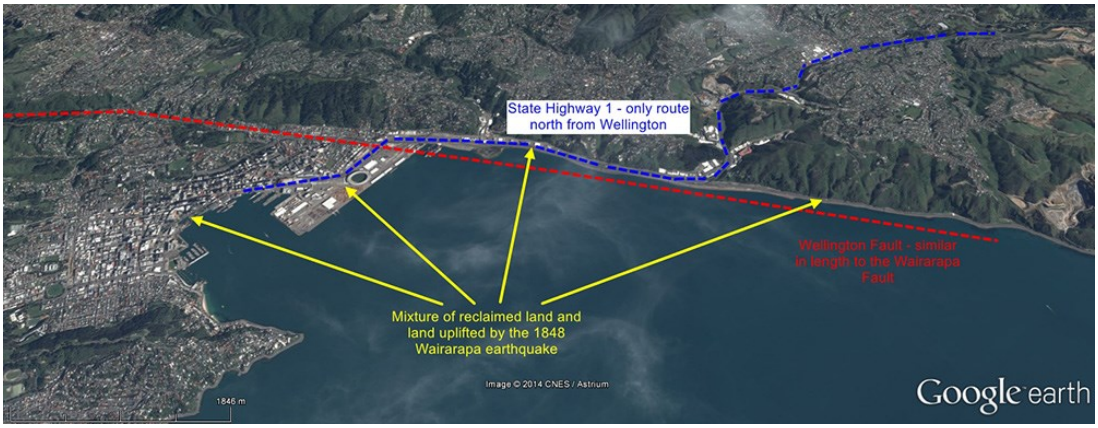
1st to Maxim Millen *- "Earthquake induced rotation and settlement of building foundations".*

2nd to Christopher Robson *- "Engineering geology and stabilisation of the 2011 landslide which closed SH3 in the Manawatu Gorge, New Zealand".*

Field Trips

There were two field trips: one geology focused field trip to the Wellington Fault and one geotechnical engineering focused field trip to the MacKays to Peka Peka Expressway Project site.

- The Wellington Fault trip was very popular and sold out (42 tickets were booked. The price per person was NZ$90 plus GST).



Conference Reports

The 12th Australia New Zealand conference on Geomechanics (Con't)

- The MacKays to Peka Peka Expressway Project trip was less well subscribed and a lot smaller (11 tickets were booked; the price per person was $90 plus GST).

Earlier organisation of the field trips and more advertising may have increased overall popularity of the fieldtrips but verbal feedback during the conference was that they were both successful trips.

The committee believes that two trips were appropriate and do not believe the conference would have benefitted from offering any more.

Social Events

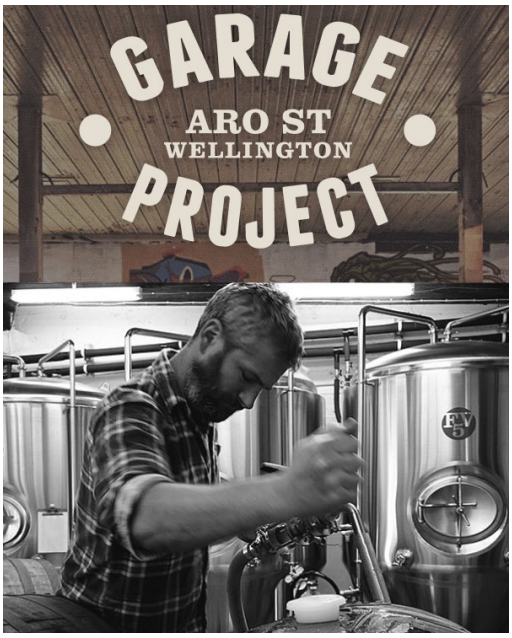
The Social subcommittee had the following key responsibilities:

- Welcome Reception event;
- Poster Happy Hour event;
- Gala dinner; and
- Lunch, morning and afternoon refreshments.

The Welcome Event was held at the Boat Shed on the Waterfront. The event was designed to be an informal social networking event with good food (by Ruth Pretty Catering) and beer tasting (by the Garage Project) – other beverages were also available. The event was well attended with an estimated 300 attendees. Some acoustic issues were noted during the event presentation (by Ruth Pretty and the Garage Project) – increased volume on the microphone would have allowed the presenters to be heard at the back of the busy venue.

Conference Reports

The 12th Australia New Zealand conference on Geomechanics (Con't)



The Poster event was held as a Poster Happy Hour. The event was designed to encourage conference delegates to spend time reading the posters, talking to the authors and voting for the people's choice poster. Catering was again provided by Ruth Pretty, including wine and beer (beer was once again provided by the Garage Project). The event was well attended, although the beer ran out quite early on. The caterers assumed it was more of a wine and food event. Clearer advice on the demographic attending the event should have been provided in hindsight (Engineers like beer!).

The Gala dinner was held at the Museum of New Zealand Te Papa Tongawera – in the Wellington Foyer. Room décor was by Event Impressions and catering (and beverages) by Te Papa catering. MC and entertainment was provided by popular New Zealand comedian Dai Henwood. Dai's set was very well received by the vast majority of the gala dinner attendees, who enjoyed his casual witty style. Two top tables were designated for the representatives from AGS, ISSMGE, NZGS and several conference committee members. Background music was provided by the Atlas Quintet. The Gala Dinner was 7:30pm arrival for 8pm dinner. The Bar closed at 11pm, with the venue being vacated at 11:30pm. The event was well received and attended by an estimated 300 attendees.

Lunch, morning and afternoon refreshments were provided by Ruth Pretty Catering (along with the field trip packed lunches). Food and cold and hot beverages were served on several long tables in the exhibition space to provide more opportunity for the attendees to mingle with and visit the exhibitor stands. Attendees/exhibitors with specific dietary requirements were catered for on a separate table (still in the exhibition area) to prevent possible mix up. The daily catering was particularly well received. A coffee cart providing complimentary hot drinks all day long was also situated in the exhibition area. It is recognised that additional signage or "advertising" of the cart should have been provided perhaps during the session host's introduction to increase coffee cart awareness and use.

Guy Cassidy
Chair ANZ 2015 (on behalf of the ANZ 2015 Organising Committee)

Conference Reports

The workshop of Seismic Soil Classification, Chile

Date: December 9-10, 2015
Venue: Chilean Chamber of Construction building, Providencia, Santiago, Chile

The workshop of Seismic Soil Classification for Chile was held on 9th and 10th of December 2015, at the Chilean Association of Construction (CCC) sponsored by the CCC and the Chilean Society for Soil Mechanics, SOCHIGE. The Organising Committee was composed of: Verdugo Ramon (Chair) and the board of SOCHIGE. The expert panel was composed of: Dr. Ricardo Dobry (USA), Dr. Ikuo Towhata (Japan), Dr. Kyriazis Pitilakis (Greece).

Photo 1. Group meeting after the workshop

The workshop aims at bringing together professionals from the civil structural and geotechnical specialties to discuss the proposal for a new seismic soil classification for Chile. In this event, the conclusions of an almost two-year investigation conducted by a committee integrated by geotechnical professionals from the academia and civil industry were discussed. The new proposal was compared to international codes and was subjected to the review of leading international experts. There was special interest in knowing the opinion of the prominent experts from different continents who were involved in various ways in the development of their own country´s codes.

Conference Reports

The workshop of Seismic Soil Classification, Chile (Con't)

After the 8.8 magnitude Chile Earthquake that occurred on February 27th, 2010, it was decided that the seismic soil classification of Chile should be improved. The first main proposal of the Geotechnical committee was to change the requested soil seismic parameters used to classify seismically the soil response. SPT and undrained shear strength are no longer desirable seismic soil classification parameters; instead, shear wave velocity and predominant soil period are considered to be better related with soil deformation and rigidity and more applicable to seismic soil classification. Methods, such as the H/V spectral ratio (Nakamura's) method to obtain close approximation of the soil natural period and the MASW, SASW and others methods to determine shear wave velocity for the 30m from the surface (following international code tendencies) were proposed as valid procedures. A second main proposal was to introduce a new elastic response spectra with inputs parameters which are: (a) A soil maximum acceleration depending on the Shear Wave Velocity of the top 30m and the predominant soil period and (b) The predominant soil natural period. The spectra is a Newmark´s type with a maximum pseudo acceleration of 2.5 times the maximum soil acceleration (PGA or an equivalent value), ranging from 0.3sec to 1.2 times the soil predominant natural period. After the maximum pseudo acceleration at 1.2 times the soil natural period, the spectrum decays in relation to the period.

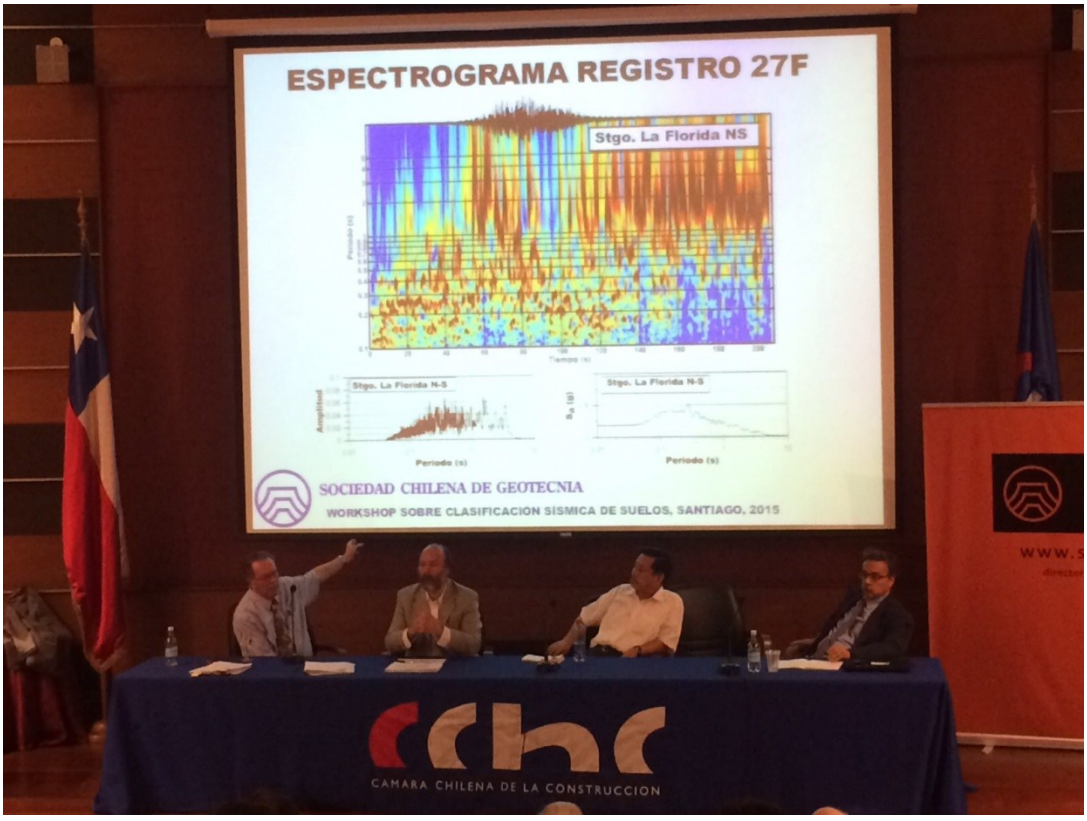


Photo 2. Dr. Dobry's discussion with participants

In the workshop, the following different topics related to the committee´s proposal were discussed: exploration depth, seismic source, relevance of Seismic Zones, PGA or an equivalent parameter, the use of Predominant frequency as site parameter, use of Shear wave velocity of the first 30m and so on. The discussion was at moments very heated but nonetheless very productive, fulfilling the objective of having all professionals expert input on the topics at hand.

Conference Reports

The workshop of Seismic Soil Classification, Chile (Con't)

In the workshop context, some of the international specialists' suggestions were:

(a) Despite that Nakamura´s method has shown good results in the natural soil period determination, low costs and fast execution, the theoretical basis is weak and more investigation should be considered before using it in a code,
(b) More investigation is needed in the influence of local earthquakes in the observed structure damages,
(c) Use deterministic approach with earthquakes Mw > 8.0,
(d) Abandon seismic zoning.

From the audience, there were concerns about the use of the validity of the Nakamura method, the source effect in the spectrum and the possible implications of the consideration of one soil spectrum for one specific site.

Photo 3. Closing words

At the end of the Conference, the vice president of SOCHIGE thanked all the participants and announced that the upcoming Chilean Geotechnical Congress would be held in Valdivia from the 5th to the 7th of December 2016.

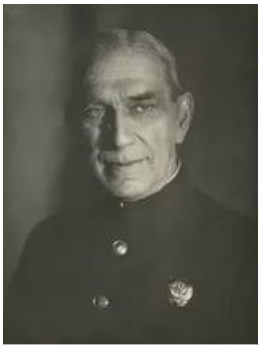
By Marcelo Gonzalez
South America Editor

Conference Reports

Geotechnical seminar "Reading of Gersevanov", Russia

Geotechnical Seminar named "READING OF GERSEVANOV" was held in Moscow (Russia) on March 16, 2016 and the Medal Gersevanov was awarded by Russian Geotechnical Society to Prof. Yoshinori Iwasaki (Geo Research Institute, Osaka, Japan).

Nikolai Mikhalovich Gersevanov (1879-1950). N.M. Gersevanov studied engineering from 1896 to 1901 in St Petersburg and then was engaged in construction of railroads and ports in Baltic Sea for 15 years. As usual of eminent researchers in Russia, N.M. Gersevanov showed his ability to practical engineers as well as analytical scientists. He developed the design of pile and refusal of pile driving of the well-known *'Gersevanov formula'* in 1917. In 1923, he moved to Moscow and became the Head of Department of Port Structures of the Moscow Institute of Transport Engineering till 1930. In 1931, the All-Union Institute of Bases of Structures (presently the Russian Institute of Bases and Underground Structures) was created by his initiative and N.M. Gersevanov became its scientific director and remained at this post until the end of his life. N.M. Gersevanov was the founder of Russian School of Soil Mechanics is called Father of Soil Mechanics in Russia.



N.M. Gersevanov (1879-1950)

Research Institute of Bases and Underground Structures was renamed as Gersevanov Research Institute of Bases and Underground Structures in 1973 to remain the name of Gersevanov forever in future.

The Gersevanov Medal was established in 1999 by Russian Society of Soil Mechanics and Geotechnical Engineering (RSSMGE) to commemorate N.M. Gersevanov as Father of Soil Mechanics in Russia.

The Gersevanov Medal is for individual researchers and engineers for their achievements in the fields of soil mechanics, foundation engineering, geotechnical and geo-ecology annually by the combination of scientific and social activities for the geotechnical fields.

The Organizing Committee of SEMINAR OF GERSEVANOV consists of representatives of several academic and research organizations of RSSMGE (Russian Geotechnical Society), Russian Architecture and Construction Academy. Honored Scientist of Russian Federation, President of Russian Geotechnical Society Prof. V.A. Ilichev; Director of GERSEVANOV Research Institute of Bases and Underground Structures (NIIOSP) of Research Center of Construction, JSC Dr. I.V. Kolybin, Prof. Z. G. Ter-Martirosyan (Moscow State Civil Engineering University) and Prof. A.B. Ponomarev (Perm National Polytechnic University) welcomed the participants (Photo 1, 2).

Photo 1. Opening Ceremony of Reading of Gersevanov (seminar), from the left to the right: Dr. Igor Kolybin, Prof. Zaven Ter-Martirosyan, Prof. Vyacheslav Ilichev and Prof. Andrey Ponomarev

Photo 2. Audience of the geotechnical Seminar Gersevanov, 2016 in Moscow

Conference Reports

Geotechnical seminar "Reading of Gersevanov", Russia (Con't)

On 16 March, 2016 as the first non-Russian professor out of Russia, Dr. Yoshinori Iwasaki (Geo Research Institute, Chair of ATC19 on Historical Sites, Japan) received his Medal of Gersevanov for outstanding achievements in geotechnical engineering, especially for introducing the principles of authenticity of cultural heritage for geotechnical aspects (Photos 3 and 4).

Photo 3. Award Ceremony of Prof. Yoshinori Iwasaki: from the left to the right: Prof. Zaven Ter-Martirosyan, Prof. Yoshinori Iwasaki, Prof. Vyacheslav Ilichev and Prof. Andrey Ponomarev

Photo 4. The Award Ceremony by Medal of "Gersevanov" of Prof. Yoshinori Iwasaki (Geo-Research Institute, Osaka, Japan): from the left to the right: Prof. Askar Zhussupbekov, Prof. Zaven Ter-Martirosyan, Prof. Vyacheslav Ilichev and Prof. Andrey Ponomarev

Honorary guest from Japan Prof. Yoshinori Iwasaki presented the invited lecture on the topic «*Authenticity and integrity of compacted sand of ancient foundation of the Angkor monument and soil improvement for conservation*» (Photo 5).

Photo 5. Keynote Lecturer - Prof. Yoshinori Iwasaki

Conference Reports

Geotechnical seminar "Reading of Gersevanov", Russia (Con't)

Then, Prof. N. S. Nikiforova and Dr. Y.A. Gotman presented solution of structural safety of underground objects in difficult engineering and geological conditions by changing of soil properties by example (Photo 6), Halabyan-Baltic tunnel in Moscow. Prof. Z.G. Ter-Martirosyan gave his lecture on improvement of weak saturated soils by column piles as base of structures (Photo 7). Prof. I. T. Mirsayapov reported on calculation of deformation of reinforced vertical elements of soil basis under static and cyclic loadings (Photo 8). Final speech was a lecture of Dr. V.G. Ofrikhter on the topic "use of landfill of municipal solid waste as grounds".

Photo 6. Keynote Lecturers: from the left to the right: Prof. Nadezhda Nikiforova and Dr. Yurii Gotman

Photo 7. Keynote Lecturer- Prof. Zaven Ter-Martirosyan

Photo 8. Keynote Lecturer- Prof. Ilizar Mirsayapov

Prof. Askar Zhussupbekov introduced the CV of Professor Yoshinori Iwasaki and his activity as Chairman of ATC19 (Historical Sites) for Russian geotechnical members. Experts of GERSEVANOV Research Institute of Bases and Underground Structures actively participated in the discussion of urgent issues on presented reports (Photo 9).

Conference Reports

Geotechnical seminar "Reading of Gersevanov", Russia (Con't)

Invited Prof. Yoshinori Iwasaki visited also leading geotechnical laboratory of Moscow State Civil Engineering University where discussed with Head of geotechnical laboratory Dr. Armen Ter-Martirosyan about research activity in this University (Photo 10). Dr. Yoshinori Iwasaki attended the geotechnical campus Baltiy, Ltd. and discussed about International cooperation of geo-monitoring issues of historical buildings in Moscow, especially at Red Square (Photos 11 and 12).

Photo 9. Special Reporter of Prof. Askar Zhussupbekov

Photo 10. The visiting of leading geotechnical laboratory of Moscow State Civil Engineering University: from the left to the right: Dr. Armen Ter-Martirosyan and Prof. Yoshinori Iwasaki

Photo 11. Visiting of Baltiy, Ltd. from the left to the right: Dr. Andrew Shaposhnikov (General manager of Russian Geotechnical Society), Prof. Askar Zhussupbekov (president of Kazakhstan Geotechnical Society), Prof. Yoshinori Iwasaki (General director of GRI, Japan) and Dr. Vadim Semkin (General director of Baltiy, Ltd., Russia)

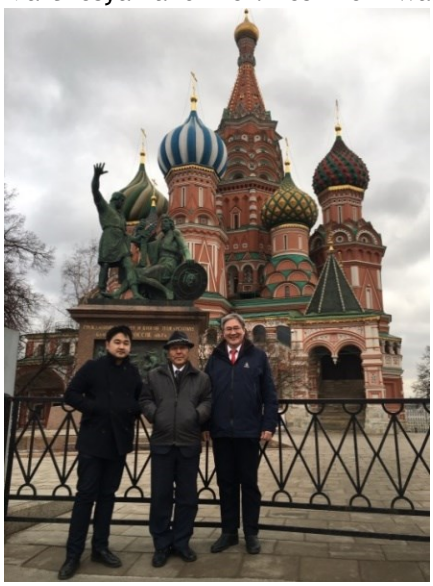


Photo 12. Technical tour to historical culture heritage Saint Basil's Cathedral in Red Square: from the left to the right: Mr. Vitaly Kogai (NIIOSP, Moscow, Russia), Prof. Yoshinori Iwasaki (GRI, Osaka, Japan) and Prof. Askar Zhussupbekov (ENU, Astana, Kazakhstan)

Event Diary

ISSMGE EVENTS

Please refer to the specific conference website for full details and latest information.

2016

First South African Geotechnical Conference
Date: Thursday 05 May 2016 - Friday 06 May 2016
Location: Sun City, 25.3403 S, 27.0908 E, South Africa
Language: English
Organizer: Geotechnical Division of the South African Institution of Civil Engineering (SAICE)
E-mail: info@geotechnicaldivision.co.za
Website: www.geotechnicaldivision.co.za

Underground Construction Prague 2016
Date: Monday 23 May 2016 - Wednesday 25 May 2016
Location: Clarion Congress Hotel Prague, Czech Republic
Language: English
Organizer: Czech Tunnelling Association
Contact person: SATRA, spol. s r. o.
Address: Sokolská 32, 120 00, Prague 2, Czech Republic
Phone: +420 296 337 181
Fax: +420 296 337 189
E-mail: ps2016@satra.cz
Website: http://www.ucprague.com

NGM 2016, The Nordic Geotechnical Meeting
Date: Wednesday 25 May 2016 - Saturday 28 May 2016
Location: Harpan Conference Centre, Reykjavik, Iceland
Language: English
Organizer: The Icelandic Geotechnical Society
Contact person: Haraldur Sigursteinsson
Address: Vegagerdin, Borgartún 7, IS-109, Reykjavik, Iceland
Phone: +354 522 1236
Fax: +354 522 1259
E-mail: has@vegagerdin.is
Website: http://www.ngm2016.com

International Mini Symposium Chubu (IMS-Chubu)
Date: Thursday 26 May 2016 - Saturday 28 May 2016
Location: Disaster Mitigation Research Building, Nagoya University, Nagoya, Aichi, Japan
Language: English
Organizer: The Japanese Geotechnical Society
Contact person: International Affairs Department, Japanese Geotechnical Society
Address: 4-38-2 Sengoku, Bunkyo-ku, 112-0011, Tokyo, Japan
Phone: +81-3-3946-8671
Fax: +81-3-3946-8678
E-mail: kokusai@jiban.or.jp
Website:
https://www.jiban.or.jp/index.php?option=com_content&view=article&id=1737:2016052628&catid=16:2008-09-10-05-02-09&Itemid

Event Diary (Con't)

SEAGC2016
Date: Tuesday 31 May 2016 - Friday 03 June 2016
Location: Dorsett Grand Subang, Subang Jaya, Selangor, Malaysia
Language: English
Organizer: Malaysian Geotechnical Society and Institution of Engineers, Malaysia
Contact person: SEAGC2016 Secretariat
Address: c/o IEM Training Centre Sdn Bhd, No.33-1A (1st Floor) Jalan 52/18, PO Box 224 (Jalan Sultan), 46720, Petaling Jaya, Selangor, Malaysia
Phone: +(603) 7958 6851
Fax: +(603) 7958 2851
E-mail: seagc2016@gmail.com/ choy.iemtc@gmail.com
Website: www.mygeosociety.org/SEAGC2016

Fourth International Conference on New Developments in Soil Mechanics and Geotechnical Engineering
Date: Thursday 02 June 2016 - Saturday 04 June 2016
Location: Near East University, Nicosia, North Cyprus, Turkey
Language: English
Organizer: Turkish Society of Soil Mechanics and Geotechnical Engineering and Near East University
Contact person: Cavit Atalar
Address: Near East University, PO Box 670, Nicosia, North Cyprus, Mersin 10,TURKEY
Phone: 0090 392 223 6464
Fax: 0090 392 223 6461
E-mail: zm2016@neu.edu.tr, zm2016@kibris.net
Website: http://zm2016.neu.edu.tr/

Third International Course on Geotechnical and Structural Monitoring
Date: Tuesday 07 June 2016 - Friday 10 June 2016
Location: The Castle of Counts Guidi, Poppi (Tuscany), Italy
Language: English
Contact person: NHAZCA S.r.l.
Address: Via Cori snc (Area Metro C), 00177, Rome (Latium), Italy
Phone: +39 06 9521 6501
Fax: +39 06 9521 6550
E-mail: info@geotechnicalmonitoring.com
Website: http://www.geotechnicalmonitoring.com/en/

12th International Symposium on Landslides
Date: Sunday 12 June 2016 - Sunday 19 June 2016
Location: Naples, Italy
Language: English
Contact person: Italian Geotechnical Association (AGI)
Address: Viale dell'Università, 11 - 00185, Roma, Italy
Phone: +39 064465569 - 0644704349
E-mail: agi@associazionegeotecnica.it
Website: http://www.isl2016.it/

Event Diary (Con't)

8ème Journées Africaines de la Géotechnique
Date: Monday 20 June 2016 - Friday 24 June 2016
Location: Hotel Sawa, DOUALA, Cameroon
Language: French and English
Organizer: CTGA
E-mail: http://www.8jag-cngc.org/8jag/contact/
Website: www.8jag-cngc.org

1st International Conference on Natural Hazards & Infrastructure: Protection, Design, Rehabilitation
Date: Tuesday 28 June 2016 - Thursday 30 June 2016
Location: Minoa Palace Resort & Spa, Chania, Crete, Greece
Address: Pampouki 3, N. Psychiko,15451, Athens, Greece
Phone: +30 210 7723383, +30 210 6721798
E-mail: secretary@iconhic2016.com
Website: http://iconhic2016.com/

Conference in Honour of Michele Maugeri
Date: Friday 01 July 2016 - Friday 01 July 2016
Location: University of Catania Department of Civil Engineering and Architecture (DICAR) Auditorium - Edificio della Didattica Cit, Catania, Italy
Language: English
Organizer: Italian Geotechnical Society
Contact person: AGI
Address: Viale dell'Università 11, 00185 Rome, Italy
Phone: +39 06 4465569
Fax: +39 06 44361035
E-mail: agi@associazionegeotecnica.it
Website: www.associazionegeotecnica.it

GeoChina 2016
Date: Monday 25 July 2016 - Wednesday 27 July 2016
Location: Shandong, China
Language: English
Organizer: Shandong University in Cooperation with Shandong Department of Transportation and University of Oklahoma
Contact person: Antony Warden
Address: Shanghai, China
Phone: +86-021-54721773
E-mail: geochina.sec@gmail.com
Website: http://geochina2016.geoconf.org/

8th Asian Young Geotechnical Engineering Conference (8 AYGEC)
Date: Friday 05 August 2016 - Sunday 07 August 2016
Location: Astana, Kazakhstan
Language: English
Organizer: Kazakhstan Geotechnical Society
Contact Person: Prof. Askar Zhussupbekov - Chairman of Organizing Committee of the 8th AYGEC
Address: 2 Satpayev Str, Astana, Kazakhstan, 010008,
Phone: +7-7172-35-37-40
Fax: +7-7172-34-47-96
E-mail: astana-geostroi@mail.ru
Website: http://kgs-astana.wix.com/8aygec

Event Diary (Con't)

5th African Young Geotechnical Engineering Conference
Date: Wednesday 10 August 2016 - Friday 12 August 2016
Location: KNUST, Kumasi, Ghana
Language: English
Organizer: Ghana Geotechnical Society
Contact person: Ing. Felix Jojo Ayeh
Address: Civil Engineering Department, Private Mail Bag ,Kumasi, Ghana
Phone: +233(0)264452786
E-mail: 5aygec16@gmail.com

1st International Conference on Energy Geotechnics ICEGT 2016
Date: Monday 29 August 2016 - Wednesday 31 August 2016
Location: Auditorium Maximum (Audimax) of Kiel University, Kiel, Germany
Language: English
Organizer: ISSMGE TC308 on Energy Geotechnics
Contact person: ICEGT 2016 Secretariat
Address: Ludewig Meyn Str. 10, 24118, Kiel, Germany
Phone: +49 - (0) 431 - 880 1976
Fax: +49 - (0) 431 - 880 4376
E-mail: secretary@icegt-2016.de
Website: http://www.iceg-2016.de/

3rd ICTG International Conference on Transportation Geotechnics
Date: Sunday 04 September 2016 - Wednesday 07 September 2016
Location: Vila Flor Cultural Centre and University of Minho, Guimaraes, Portugal
Language: English
Organizer: Portuguese Geotechnical Society and University of Minho
Contact person: Prof. A. Gomes Correia (Chair)
Address: University of Minho, School of Engineering, 4800-058, Guimarães, Portugal
Phone: +351253510200
Fax: +351253510217
E-mail: agc@civil.uminho.pt
Website: http://www.webforum.com/tc3

5th International Conference on Geotechnical and Geophysical Site Characteristion (ISC'5)
Date: Monday 05 September 2016 - Friday 09 September 2016
Location: QT Hotel, Gold Coast, QLD, Australia
Language: English
Organizer: Leishman Associates
Address: 113 Harrington St, 7000, Hobart, TAS, Australia
Phone: 03 6234 7844
E-mail: hannah@laevents.com.au
Website: http://www.isc5.com.au

3rd European Conference on Unsaturated Soils - Paris 2016
Date: Monday 12 September 2016 - Wednesday 14 September 2016
Location: Ecole des ponts ParisTech, Marne la Vallée, France
Language: English
Organizer: Ecole des ponts
Contact person: Severine Beaunier
Address: PFC, Maison des ponts, 15 Rue de la Fontaine au Roi ,75011 Paris, France
Phone: 33144582700
E-mail: severine.beaunier@enpc.fr
Website: http://eunsat2016.sciencesconf.org/

Event Diary (Con't)

13th Baltic States Geotechnical Conference
Date: Thursday 15 September 2016 - Saturday 17 September 2016
Location: Vilnius University, Vilnius, Lithuania
Language: English
Organizer: Baltic Sea states Geotechnical Societies / Main organizer Lithuanian Geotechnical Society
Contact person: Danutė Sližytė
Address: Saulėtekio ave. 15-510, LT-10224,Vilnius, Lithuania
Phone: +37068690044
Fax: +37052500604
E-mail: danute.slizyte@vgtu.lt
Website: http://www.13bsgc.lt

International Geotechnical Engineering Conference on Sustainability in Geotechnical Engineering Practices and Related Urban Issues
Date: Friday 23 September 2016 - Saturday 24 September 2016
Location: Ramada Powai Hotel and Convention Centre, Saki Vihar Road, Powai, Mumbai Maharashtra, India
Language: English
Organizer: Indian Geotechnical Society Mumbai Chapter with Indian Geotechnical Society (IGS) and ISSMGE
Contact person: Prof. Deepankar Choudhury
Address: Professor and Organising Secretary, Department of Civil Engineering, IIT Bombay, Powai, 400076 Mumbai, Maharashtra, India
Phone: +91-22-25767335
Fax: +91-22-25767302
E-mail: igsmumbai@gmail.com
Website: http://www.igsmumbaichapter.in/

69th Annual Canadian Geotechnical Conference - GeoVancouver2016
Date: Sunday 02 October 2016 - Wednesday 05 October 2016
Location: Westin Bayshore Hotel, Vancouver, British Columbia, Canada
Language: English and French
Organizer: The Canadian Geotechnical Society (see: www.cgs.ca)
Contact person Dr. Mustapha Zergoun, P.Eng., P.E.
Address: Suite 900, 1281 West Georgia Street, V6E 3J7, Vancouver, British Columbia, Canada
Phone: 604-684-4384
Fax: 604-684-5124
E-mail: mzergoun@thurber.ca
Website: http://www.geovancouver2016.com

9th All-Ukrainian Scientific-Technical Conference "Soil mechanics, geotechnics and foundation engineering": "Geotechnical innovations and implementation of Eurocodes in Ukraine"
Date: Tuesday 11 October 2016 - Thursday 13 October 2016
Location: Dnieper state academy of construction and architecture, Dnipropetrovsk, Ukraine
Language: English, Ukrainian, Russia
Organizer: Ukrainian society of soil mechanics, geotechnics and foundation engineering
Address:SE NDIBK, 5/2 Preobrazhenska street ,03037, Kiev-37, Ukraine
Phone: (056) 247-08-88
E-mail: iepi@pgasa.dp.ua
Website: www.niisc.com (section: Conferences)

Event Diary (Con't)

XVIII Brazilian Conference on Soil Mechanics and Geotechnical Engineering - COBRAMSEG 2016
Date: Wednesday 19 October 2016 - Saturday 22 October 2016
Location: Minascentro, Belo Horizonte, MG, Brazil
Language: Portuguese and English
Organizer: ABMS - Brazilian Society for Soils Mechanics and Geotechnical Engineering
E-mail: contato@cobramseg2016.com.br
Website: http://www.cobramseg2016.com.br/

SFGE 2016 – Shaping the Future of Geotechnical Education – International Conference on Geo-Engineering Education
Date: Thursday 20 October 2016 - Saturday 22 October 2016
Location: Minascentro, Belo Horizonte, MG, Brazil
Language: English
Organizer: ISSMGE TC306 and ABMS - Brazilian Society for Soil Mechanics and Geotechnical Engineering
Contact person: Michele Calvello
E-mail: sfge2016@cobramseg2016.com.br / michele.calvello@gmail.com
Website: http://cobramseg2016.com.br/index.php/sfge-sobre/?lang=en

V South American Young Geotechnical Engineers Conference - SAYGEC/GEOJOVEM 2016
Date: Thursday 20 October 2016 - Saturday 22 October 2016
Location: Minascentro, Belo Horizonte, MG, Brazil
Language: Portuguese, Spanish, English
Organizer: ABMS - Brazilian Society for Soil Mechanics and Geotechnical Engineering
Contact person Profa. Terezinha Esposito
E-mail: geojovem@cobramseg2016.com.br
Website: http://www.cobramseg2016.com.br

11th ANZ Young Geotechnical Professionals Conference (11YGPC)
Date: Tuesday 25 October 2016 - Friday 28 October 2016
Location: Queenstown, New Zealand
Language: English
Organizer: NZGS
Contact person: Frances Neeson
E-mail: 11ygpc@gmail.com
Website: http://www.nzgs.org/resources/pdfs/YGP_11Queens2016formsv1.pdf

5th International Conference on Geotechnical Engineering and Soil Mechanics
Date: Monday 14 November 2016 - Wednesday 16 November 2016
Location: Tehran, Iran
Organizer: International Conference on Geotechnical Engineering and Soil Mechanics
Contact person: 009888931328
Address: Unit2, No 14, Eftekharnia Alley, Larestan St, Motahari Ave, 1595914911 Tehran, Iran
Phone: 9888931507
Fax: 9888931275
E-mail: info@igs.ir
Website: www.igs.ir

Event Diary (Con't)

Geotec Hanoi 2016
Date: Thursday 24 November 2016 - Friday 25 November 2016
Location: JW Marriott Hotel Hanoi, No 8 Do Duc Duc Road, Me Tri Ward, South Tu Liem District, Hanoi, Vietnam
Language: English
Organizer: FECON, VSSMGE, and JGS
Contact person: GEOTEC HANOI 2016 Secretariat
Address: FECON Corp, 15th Floor, CEO Tower, Lot HH2-1 Urban Me Tri Ha, Pham Hung Street, Ward Me Tri, Nam Tu Liem District, Hanoi, Vietnam
Phone: +84 4 6269.0481 / 82
Fax: +84 4 6269 0484
E-mail: secretariat@geotechn.vn
Website: www.geotechn.vn

International Conference on Forensic Geotechnical Engineering
Date: Thursday 08 December 2016 - Saturday 10 December 2016
Location: Satish Dhawan Auditorium,Bangalore, Karnataka, India
Language: English
Organizer: ISSMGE TC 302
Contact person: Dr. Anbazhagan
Address: Indian Institute of Science, 560012, Bangalore, Karnataka, India
Phone: 00918022932467
E-mail: anbu@civil.iisc.ernet.in

2017

Advances in Laboratory Testing and Modelling of Soils and Shales
Date: Wednesday 18 January 2017 - Friday 20 January 2017
Location: Swiss Alps, Switzerland
Language: English
Organizer: Prof. Lyesse Laloui and Prof. Alessio Ferrari
Contact person Ms Valentina Favero
Address: EPFL-ENAC-IIC-LMS, Station 18 ,CH-1015,Lausanne, Switzerland
Phone: +41 (0)21 693 23 13
E-mail: valentina.favero@epfl.ch
Website: http://atmss.epfl.ch

International Conference on New Challenges In Geotechnical Engineering, ICNCGE-2017
Date: Monday 23 January 2017
Location: FAST National University, Lahore, Punjab, Pakistan
Language: English
Organizer: Pakistan Geotechnical Engineering Society - PGES
Contact person: Syed Badar Ul Hussnain
Address: NESPAK House, 1-C, Block N, Model Town Lahore-Pakistan, 54700, Lahore, Punjab, Pakistan
Phone: +92 42 99090325
Fax: +92 42 99231950
E-mail: icncge2017@gmail.com
Website: http://www.pges-pak.org/home/icncge-2017

Event Diary (Con't)

BCRRA 2017 - Tenth International Conference on the Bearing Capacity of Roads, Railways and Airfields.
Date: Wednesday 28 June 2017 - Friday 30 June 2017
Location: ATHENS, Greece
Language: English
Local Organizer: National Technical University of Athens (NTUA)
Contact person: Prof. Andreas Loizos
Address: 5, Iroon Polytechniou str.,15773, ATHENS, Greece
Phone: + 30 210 7721279
Fax: + 30 210 7724254
E-mail: aloizos@central.ntua.gr
Website: http://www.bcrra2017.com/

GeoMEast 2017
Date: Saturday 15 July 2017 - Wednesday 19 July 2017
Location: Sharm El-Sheikh, Egypt
Language: English
Organizer: The Egyptian Housing and Building Research Center (HBRC) in cooperation with the Soil-Structure Interaction Group in Egypt (SSIGE)
Contact person: Hany Farouk Shehata
Address: Tower C, Maamora Towers, 7th District, Nasr City, 11727 ,Cairo, Egypt
Phone: +201110666775
E-mail: hanyfarouk808@gmail.com
Website: http://www.geomeast2017.org/

PBD-III Vancouver 2017 - The 3rd International Conference on Performance Based Design in Earthquake Geotechnical Engineering
Date: Sunday 16 July 2017 - Wednesday 19 July 2017
Location: Westin Bayshore Hotel (http://www.westinbayshore.com/) Vancouver, British Columbia, Canada
Language: English
Organizer: TC203 (Earthquakes)
Website: http://pbdiiivancouver.com/

ICSMGE 2017 - 19th International Conference on Soil Mechanics and Geotechnical Engineering, Seoul
Date: Sunday 17 September 2017 - Thursday 21 September 2017
Location: Coex Convention Center, Seoul, Korea
Language: English and French
Organizer: Organising Committee of ICSMGE 2017
Contact person: Ms. Soi LEE
Address: 4F, SUNGJI Building, 192, Bangbae-ro, Seocho-gu, 137-835, Seoul, Republic of Korea
Phone: +82-2-6288-6347
Fax: +82-2-6288-6399
E-mail: secretariat@icsmge2017.org
Website: http://www.icsmge2017.org

Event Diary (Con't)

2018

4th International Symposium on Cone Penetration Testing (CPT'18)
Date: Thursday 21 June 2018 - Friday 22 June 2018
Location: Delft University of Technology (TUD), Delft, Netherlands,
Language: English
Organizer: Delft University of Technology (endorsed by TC102)
Contact person: Prof. Michael Hicks, Dr. Federico Pisanò and Ir. Joek Peuchen
Address: Faculty of Civil Engineering and Geosciences, Section of Geo-Engineering, Building 23, Stevinweg 1, 2628 CN Delft, The Netherlands
Phone: +31 70 31 11299
E-mail: info@cpt18.org
Website: http://www.cpt18.org

The 7th International Conference on Unsaturated Soils (UNSAT2018)
Date: Friday 03 August 2018 - Sunday 05 August 2018
Location: The Hong Kong University of Science and Technology (HKUST), Hong Kong, China
Language: English
Organizer: The Hong Kong University of Science and Technology (HKUST)
Contact persons: Prof. Charles W. W. Ng (Chair), Miss Shirley Tse (Administrative Secretary) or Dr Anthony Leung (Technical Secretary)
Address: Geotechnical Centrifuge Facility, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, HKSAR, China
Phone: (852) 2358-0216
Fax: (852) 2243-0040
E-mail: unsat2018@ust.hk
Website: http://www.unsat2018.org

2019

ISDCG 2019 – 7th International Symposium on Deformation Characteristics of Geomaterials
Date: Wednesday 26 June 2019 - Friday 28 June 2019
Location: Technology and Innovation Centre (TIC) of the University of Strathclyde, Scotland, UK,
Language: English
Organizer: TC101
Website: *in construction*

ECSMGE 2019 - XVII European Conference on Soil Mechanics and Geotechnical Engineering
Date: Sunday 01 September 2019 - Friday 06 September 2019
Location: Harpa Conference Centre Reykjavik, Iceland
Language: English
Organizer: The Icelandic Geotechnical Society
Contact person: Haraldur Sigursteinsson
Address: Vegagerdin, Borgartún 7, IS-109, Reykjavik, Iceland
Phone: +354 522 1236
E-mail: has@road.is
Website: http://www.ecsmge-2019.com

FOR FURTHER DETAILS, PLEASE REFER TO THE WEBSITE OF THE SPECIFIC CONFERENCE

Corporate Associates

S.N. Apageo S.A.S.
ZA de Gomberville
BP 35 - 78114 MAGNY LES HAMEAUX
FRANCE

Deltares
PO Box 177
2600 AB Delft,
THE NETHERLANDS

Golder Associates Inc
1000, 940-6th Avenue S.W.
Calgary, Alberta
CANADA T2P 3T1

Jan de Nul N.V.
Tragel 60,
B-9308 Hofstade-Aalst
BELGIUM

NAUE GmbH Co KG
Gewerbestrasse 2
32339 Espelkamp-Fiestel
GERMANY

Norwegian Geotechnical Institute
P.O. Box 3930 Ullevaal Stadion
N-0806 OSLO
NORWAY

SOLETANCHE BACHY SA
133 boulevard National, 92500 Rueil-Malmaison,
FRANCE

Tensar International Ltd
Cunningham Court
Shadsworth Business Park
Blackburn, BB1 2QX,
UNITED KINGDOM

Terre Armée
280, avenue Napoléon Bonaparte
92506 Rueil Malmaison Cedex
France

Huesker Synthetic GmbH
Fabrikstrasse 13-15
48712 Gescher
GERMANY

Zetas Zemin Teknolojisi AS
Merkez Mah. Resadiye Cad. No. 69/A
Alemdag, Umraniye
Istanbul, 34794
TURKEY

Siemens Energy
Kaiserleistrasse10
63067 Offenbach
GERMANY

International I.G.M. s.a.r.l.
P.O.Box: 166129 Achrafieh
Beirut
LEBANON

TenCate Geosynthetics
9, rue Marcel Paul
B.P. 40080
95873 Bezons Cedex
FRANCE

RCF Ltd
4C Ologun Agbeje
Victoria Island
Lagos,
Nigeria

Coffey Geotechnics
8/12 Mars Road
Lane Cove West
NSW, 2066
AUSTRALIA

A.P. van den Berg
IJzerweg 4
8445 PK Heerenveen
THE NETHERLANDS

Corporate Associates (Con't)

Huesker Ltda
Rua Romualdo Davoli, 375
Cond. El Dorado
CEP 12238.577 São José dos Campos SP
BRAZIL

GHD Pty, Ltd.
57-63 Herbert Street
Artarmon NSW 2064
AUSTRALIA

Maccaferri
Via Kennedy 10
40069 Zola Predosa (Bologna)
ITALY

AECOM Asia Company Ltd
8/F, Tower 2, Grand Central Plaza
138 Shatin Rural Committee Road
Shatin, NT
HONG KONG

Hayward Baker Inc.
1130 Annapolis Road, Suite 202
Odenton, MD 21113
UNITED STATES

Vibropile Australia
Attn: Serhat Baycan
PO Box 253
Mulgrave, VIC 3170
AUSTRALIA

Terrasol
42/52 Quai de la Rapée - CS7123075583
Paris CEDEX 12
FRANCE

LLC "Bazis Design Academy"
3-A, "Nurly-Tau"
Al - Farabi Ave., 5/1,
Almaty
KAZAKHSTAN

Ove Arup & Partners Ltd.
13 Fitzroy Street
London W1T 4BQ
UNITED KINGDOM

LLC GEOIZOL
Bolshoy PR PS h.25//2 lits E.
197198 Saint Petersburg

Geostroy, ZAO
Zagorodny prospect, 27/21
St.Petersburg, 191187
RUSSIA

Novosibirsk Engineering Center Ltd.
Televisionnaya Street,15
Novosibirsk 630048
RUSSIA

Foundation Donors

The Foundation of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) was created to provide financial help to geo-engineers throughout the world who wish to further their geo-engineering knowledge and enhance their practice through various activities which they could not otherwise afford. These activities include attending conferences, participating in continuing education events, purchasing geotechnical reference books and manuals.

- **Diamond: $50,000 and above**
  - **a.** ISSMGE-2010 http://www.issmge.org/
  - **b.** Prof. Jean-Louis and Mrs. Janet Briaud https://www.briaud.com and http://ceprofs.tamu.edu/briaud/
- **Platinum: $25,000 to $49,999**
- **Gold: $10,000 to $24,999**
  - **a.** International I-G-M http://www.i-igm.net/
  - **b.** Geo-Institute of ASCE http://content.geoinstitute.org/
  - **c.** Japanese Geotechnical Society http://www.jiban.or.jp/
  - **d.** The Chinese Institution of Soil Mechanics and Geotechnical Engineering – CCES www.geochina-cces.cn/en
  - **e.** Korean Geotechnical Society www.kgshome.or.kr
  - **f.** Comité Français de Mécanique des Sols et de Géotechnique www.cfms-sols.org
- **Silver: $1,000 to $9,999**
  - **a.** Prof. John Schmertmann
  - **b.** Deep Foundation Institute www.dfi.org
  - **c.** Yonsei University http://civil.yonsei.ac.kr

Foundation Donors (Con't)

d. CalGeo – The California Geotechnical Engineering Association
www.calgeo.org

e. Prof. Ikuo Towhata
towhata.ikuo.ikuo@gmail.com
http://geotle.t.u-tokyo.ac.jp/

f. Chinese Taipei Geotechnical Society www.tgs.org.tw

g. Prof. Zuyu Chen
http://www.iwhr.com/zswwenglish/index.htm

h. East China Architectural Design and Research Institute ECADI
http://www.ecadi.com/en/

i. TC 211 of ISSMGE for Ground Improvement
www.bbri.be/go/tc211

j. Prof. Askar Zhussupbekov www.enu.kz/en, www.kgs-astana.kz

k. TC302 of ISSMGE for Forensic Geotechnical Engineering
http://www.issmge.org/en/technical-committees/impact-on-society/163-forensic-geotechnical-engineering

l. Prof. Yoshinori Iwasaki yoshi-iw@geor.or.jpwww.geor.or.jp

m. Mr. Clyde N. Baker, Jr.

n. Prof. Hideki Ohta

o. Prof. Eun Chul Shin www.incheo@incheon.ac.kr n.ac.krecshin

p. Prof. Tadatsugu Tanaka

- **Bronze: up to $999**

a. Prof. Mehmet T. Tümay http://www.coe.lsu.edu/administration_tumay.html
mtumay@eng.lsu.edu

b. Nagadi Consultants (P) Ltd www.nagadi.co.in

c. Professor Anand J. Puppala
University of Texas Arlington
http://www.uta.edu/ce/index.php

d. ARGO-E (Geoengineer.org)
http://www.argo-e.com