The Second Half Century of Rock Mechanics

FINAL PROGRAMME

11th Congress of the International Society for Rock Mechanics
Lisbon, Portugal
9 - 13 July 2007

Organised by
Portuguese Geotechnical Society (SPG)

Co-sponsored by
Spanish Society for Rock Mechanics (SEMIGE)
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MESSAGE FROM THE CHAIRMAN OF THE 11th ISRM CONGRESS

The Second Half-Century of Rock Mechanics

The Sociedade Portuguesa de Geotecnia (SPG), Portuguese National Group of the ISRM, will host the 11th ISRM Congress, to be held in Lisbon, from July 7 through July 13, 2007.

In the past 50 years, Rock Mechanics has established itself as a recognized subject in Geotechnical Engineering. Now, 40 years later, and at the same location where the 1st ISRM Congress was held, SPG proposes to review the evolution of Rock Mechanics, and to define new perspectives and developments in Rock Engineering.

In order to widen the contribution of all participants, the Congress format shall comprise parallel sessions and specialized sessions, so that as many as possible papers may be orally presented. State-of-the-art presentations of technological developments shall also be featured. It is foreseen that all papers shall be accessible, so that fruitful discussions may be maintained during the Congress.

The Congress shall have several themes of general interest, presented by invited keynote lecturers and general reporters, with presentation and discussion of selected papers in plenary sessions. International Workshops in Madrid, Spain and Ponta Delgada (Azores), Portugal, focusing new and developing subjects will be organized. A technical exhibition, a short course and the selection of one-day field trips for six interesting sites is planned.

The main venue of the Congress is the CCL – Lisbon Congress Centre located in the Park of Junqueira, near the Tagus River, providing sufficient space for the professional exhibition and for the poster presentations. Also the LNEC Congress Centre will be used in the previous days, July 7-8 for the ISRM Board and Council meetings, Commissions Meetings and a short course, as well as, two important Workshops On DUSEL and Application of Geophysics to Rock Engineering.

Lisbon, the capital of Portugal, is a historical city with a mild climate, which offers all the necessary infrastructures for the success of the 11th ISRM Congress. Besides the old castle, churches, palaces, museums and typical streets, Lisbon offers a lot of opportunities for shopping, as well as modern, comfortable and reasonably priced accommodation. A variety of scenic places can be found near Lisbon, such as Sintra, Óbidos or Palmela, together with the famous resorts of Estoril and Cascais.

The answer of the ISRM community to the 11th ISRM Congress has been quite good, and an excellent week of presentations and fruitful discussions can be expected. The Organizing Committee will be really pleased to welcome you in Lisbon next July.

Luís Ribeiro e Sousa
Chairman of the 11th ISRM Congress
CONGRESS REPRESENTATIVES

International Advisory Board

Nielen van der Merwe, ISRM President
John Hudson, ISRM President - Elected
Martin J. Pretorius, ISRM Vice President for Africa
Zhao Jian, ISRM Vice President for Asia
John St George, ISRM Vice President for Australasia
Claus Erichsen, ISRM Vice President for Europe
François E. Heuzé, ISRM Vice President for North America
Eda Freitas de Quadros, ISRM Vice President for South America
Qian Qihu, ISRM Vice President at Large
Luís Ribeiro e Sousa, ISRM Vice President at Large
Luís Nolasco Lamas, ISRM Secretary General

Organizing Committee

Luís Ribeiro e Sousa (Portugal), Congress Chairman
Claudio Olalla, Spain, Congress Co-Chairman
Nuno Grossmann, Portugal, Congress Co-Chairman
José Vieira de Lemos, Portugal, Technical Programme Chairman
Pedro Bernardo, Portugal, General Secretary
Ricardo Resende, Portugal, Treasurer
Manuel Romana Ruiz, Spain, President of the Workshop on Underground Works under Special Conditions
Ana Malheiro, President of the 2nd Workshop on Volcanic Rocks
Pedro Sola, President of the Workshop on Preservation of Natural Stone and Rock Weathering
António Pinto da Cunha, Portugal
Áurea Perucho, Spain
Celso Lima, Portugal
Eduardo Quintanilha de Menezes, Portugal
José Muralha, Portugal
Luís Nolasco Lamas, Portugal
Noemi Schclar Leitão, Portugal
Vicente Cuellar, Spain

International Scientific Committee

Carlos Dinis da Gama, Portugal, Chairman
Alcibíades Serrano, Spain
António Campos e Matos, Portugal
Carlos Brito Pina, Portugal
Charles Fairhurst, USA
Don Banks, USA
Eurípedes Vargas Jr., Brazil
Fernando Peres Rodrigues, Portugal
Georg Vavrosky, Austria
Herbert Einstein, USA
John Franklin, Canada
José Dias, Angola
José Rosado Catarino, Portugal
Marek Kwasniewski, Poland
Michel van Sint Jan, Chile
Nguyen Minh Duc, France
Nick Barton, Norway
Pierre Bérest, France
Ricardo Oliveira, Portugal
Richard Stacey, South Africa
Robert Hack, The Netherlands
Rui Correia, Portugal
Sergey Yufin, Russia
Shunsuke Sakurai, Japan
Walter Wittke, Germany
Wang Sijing, China
Registration & Congress Information

CONTACTS

Congress Secretariat
11th ISRM Congress
Sociedade Portuguesa de Geotecnia
LNEC – Av. do Brasil, 101
1700-066 Lisboa, Portugal

Phone: +351 21 8443419
Fax: +351 21 8443021
e-mail: isrm2007@lnec.pt
http://www.isrm2007.org

REGISTRATION AND INFORMATION DESK

The registration is located at LNEC Congress Centre and CCL - Lisbon Congress Centre.

Opening hours:
LNEC     Sunday, July 8     18.00-20.00
CCL      Monday, July 9     08.00-19.00
         Tuesday, July 10    08.00-19.00
         Wednesday, July 11  08.00-19.00

Registration fees
Fee            until May 31     On-site
ISRM participant EUR 550     EUR 650
Non ISRM participant EUR 600     EUR 700
Student         EUR 300     EUR 300
Accompanying person EUR 25     EUR 25

Registration fee for participants includes:
– Admission to all technical sessions
– Admission to the technical exhibition
– Admission to Opening and Closing Ceremony
– Welcome Reception
– Coffees and lunches on July 9 to 12
– Congress Proceedings with CD-ROM
– Congress bag and publications

Accompanying persons includes:
– Admission to the Opening and Closing Ceremony
– Welcome Reception

Accommodation
In order to make your hotel reservation, it is suggested to contact Top Atlântico – the official travel agency for ISRM 2007.
Follow the link to their website or directly the Congress website
Rua Sousa Lopes, Lote MNO, Loja 6
1600-207 Lisboa, Portugal
Maria José Lima
mjose.lima@topatlantico.com phone: +351 217 926 167

Congress Information

− Congress Main Theme
  The Second Half Century of Rock Mechanics

Congress Venue

LNEC Congress Centre (from July, 7 to 8)
LNEC – Av. do Brasil, 101
1700-066 Lisboa, Portugal
Phone: + 351 21 443 3149
Fax: + 351 21 443 30 21
Email: isrm2007@lnec.pt
http://www.isrm2007.org

CCL - Lisbon Congress Centre (from July, 9 to 13)
Praça das Indústrias
1300-307 Lisbon
Portugal

How to get to the LNEC Congress Centre

Taxi ride from the airport to the LNEC Congress Centre will take approximately 10 minutes and the cost is about EUR 5. Taxis are available 24-hours a day. The average taxi fare to the city centre is EUR 10 - 15 (ride time 15-30 minutes).

Local buses 45 and 83 run to LNEC and operate 06:00-24:00.

LNEC is easily accessible by taking the metro to the Alvalade station (green line). The bus/metro combined tickets can be bought at Lisbon Airport on the Post Office (CTT).

How to get to the CCL – Lisbon Congress Centre

The main venue of the Congress is the CCL located in the “Park of Junqueira” in Lisbon. The CCL lies by the Tagus river, near one of the best known monuments of Lisbon, the Belem tower, a few minutes away from the city centre, in an area served by many alternative means of transportation.

To get to the Congress Centre, you may take the bus (no. 727 and no. 56) or the tramway (no. 15) or by taxi, which is a good option due to the low fare prices.
Public Transportation
When inside the city, the major transportation companies - Carris and Metro – cover the entire city with regular buses and subway stations with 4 lines at your service. Besides these regular companies, there are more than 3,500 taxis at disposal. The price of which depends on the service provided.

The normal urban taxi fare is:
Day: EUR 2.00 + 0.40 EUR/km
Night, weekend and holidays: EUR 2.50 + 0.48 EUR/km
Telephone booking: EUR 0.80
Underground ticket: EUR 0.70
Bus ticket: EUR 1.30

Car Parking
Parking at LNEC Congress Centre is available and free of charge inside the installations.

Parking is available in front of the CCL. Exit tickets may be validated in the morning, they may be bought for the several days of the Congress and the price is 10 EUR / day.

Cloakroom and Luggage
A cloakroom and luggage storage is located on the first floor next to the Registration Desk. Opening hours correspond with the opening hours of the Registration Desk.

Internet
As a courtesy to all delegates, internet terminals are available on the Technical Exhibition space and on the Internet Room.

Technical Exhibition
Technical exhibition is located close to the meeting rooms. Please see the Exhibition Catalogue.
Opening hours:
Monday, July 9  09.00-17.00
Tuesday, July 10  09.00-17.00
Wednesday, July 11  09.00-17.00
Thursday, July 12  09.00-17.00

Mobile Phones
Delegates are politely requested to keep their mobile phones switched off in the meeting room during all sessions.

Smoking
11th ISRM Congress is a non-smoking congress. Therefore, the organizers would like to thank the participants in advance for not smoking at the Congress Centre, Technical Exhibition and poster area as well as during coffee breaks and lunches.

Messages
Personal messages can be placed on the message board located at the registration area.

Programme Changes
The organizers cannot assume liability for any changes in the program due to external or unforeseen circumstances.

Official Carrier
The Star Alliance™ member airlines are pleased to be appointed as the Official Airline Network for 11th ISRM Congress held in Lisbon from 9 to 13 July, 2007.

Simply call the reservation office of any participating Star Alliance member airline and quote the event code TP003S7
Registered participants plus one accompanying person traveling to the event are automatically granted a discount of up to 20%, depending on the class of travel.

Air lines not included: air New Zealand, British Midland, Singapore, Thai airways and US airways.

Booking office information can be found at: www.staralliance.com/conventionsplus

Discounts are offered on published business and economy class fares, excluding website/internet fares, senior and youth fares, group fares and Round the World fares.

Please note: For travel from Japan and New Zealand, special fares or discounts are offered by the participating airlines on their own network.

Liability and Insurance
The Organizing Committee is not liable for any damage on health or property of any congress participant or accompanying person in the course of or resulting from participation in the congress. Participants are advised to have their own insurance.
GENERAL INFORMATION

Official Language
English is the official language of the Congress.

Currency and Exchange Rate
As a member of the European Monetary System, the EUR is the Portuguese monetary unit. At present, the bills in circulation are EUR: 5.00; 10.00; 20.00; 50.00; 100.00; 200.00; and 500.00. The coins are as follows: 1 cent; 2 cents; 5 cents; 10 cents; 20 cents; 50 cents; EUR 1.00 and 2.00.

Currency exchange facilities are available in most banks, hotels and airports and operate at normal business hours. Credit cards are accepted in most restaurants and shops, the most widely used being Visa, MasterCard, American Express and Diners Club. ATMs are widely scattered over the city. Current exchange rates can be found at www.x-rates.com.

Business Hours
The banks are open from 8:30 to 15:00 from Monday to Friday. The bank at the airport is open 24 hours a day 7 days a week.

Shops usually open 9:00 to 13:00 and from 15:00 to 19:00 on weekdays; shops close at 13:00 on Saturdays. There are also a number of shopping centres, which are usually open until 22:00 to midnight.

Most Restaurants open for lunch from noon to 15:00 and for dinner from 19:00 to 23:00.

Pharmacies work from 9:00 to 13:00 and from 15:00 to 19:00 on weekdays and from 9:00 to 13:00 on Saturdays. Outside this schedule, there’s always one pharmacy on service nearby until 22:00.

Car Rental
As soon as arriving at Lisbon airport one can choose between the world wellknown rent a car companies such as Avis, Hertz, Budget, Auto Cerro among others.

Useful Telephone Numbers

<table>
<thead>
<tr>
<th>Service</th>
<th>Number</th>
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<tbody>
<tr>
<td>Emergency</td>
<td>112</td>
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<tr>
<td>Police</td>
<td>217654242</td>
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<tr>
<td>Taxi Operator</td>
<td>218119000</td>
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<tr>
<td>Santa Maria Hospital</td>
<td>213594000</td>
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<tr>
<td>Fire-fighters</td>
<td>213422222</td>
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<tr>
<td>Airport</td>
<td>218413500</td>
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</tbody>
</table>

Climate and Clothing
The climate in Lisboa is temperate, offering the best of both Atlantic and Mediterranean Sea breezes all year round. August is usually the hottest month and light clothes are recommended.

Electricity
The local current is 220 AC and the connection is made by a two-pin plug. Travellers from the USA will require a voltage converter. Travellers from the UK will require a plug adapter and this is best bought in the UK, as they are hard to find in Lisboa.

Shopping
Most shops accept Visa, MasterCard, American Express and Diners Club. There are some areas in Lisboa specially devoted to shopping. Downtown, the area frequently called “Baixa”, there you can find here some of the best shops, restaurants, theatres and many more. This is one of the oldest commercial areas in Lisboa.
Shopping centres are almost everywhere in the city. Bigger or smaller, they’ll do their best to suit your needs. We decided to list the bigger surfaces: Colombo, Vasco da Gama, Amoreiras and El Corte Inglês. These areas include several shops of different branches of business, including restaurants and leisure facilities like movie theatres.

Amoreiras Shopping Centre, located in the centre of Lisboa, was opened in 1985 and counts on 2 floors with 350 shops. It is opened everyday between 10h00 and 23h00.

Vasco da Gama lies on the newest heart of the city – the Parque das Nações (Nations Park), where the Expo 98 was held. Inaugurated in 1999 and counting on 156 shops and 35 restaurants, it opens between 10h00 and 00h00 everyday. Colombo Shopping Centre is excellently located near the football field of Benfica. Providing services to the public since 1997, it has 3 commercial floors with 437 shops and 69 restaurants operating everyday, from 10h00 to 00h00.

**Telephone Country Code**

+351

**Local Taxes**

All fees are inclusive of local taxes. All delegates are liable to pay VAT regardless of whether they are based in Portugal or not and this amount should not be deducted from the fee under any circumstances. VAT is currently levelled at 21% in Portugal (except in restaurants, where it is 12%). Stores that offer tax-free shopping facilities carry a sign to this effect.

**Credit Cards and Traveller’s Cheques**

Major credit cards are widely accepted by most hotels, restaurants and shops. Traveller's cheques may be refused in some places and it is best therefore to exchange these at a bank.
## Final Programme

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<th>Hour</th>
<th>6 July 2007 (Friday)</th>
<th>7 July 2007 (Saturday)</th>
<th>8 July 2007 (Sunday)</th>
<th>9 July 2007 (Monday)</th>
<th>10 July 2007 (Tuesday)</th>
<th>11 July 2007 (Wednesday)</th>
<th>12 July 2007 (Thursday)</th>
<th>13 July 2007 (Friday)</th>
<th>14 July 2007 (Saturday)</th>
<th>15 July 2007 (Sunday)</th>
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<tr>
<td>08-09</td>
<td>Registration - CCL</td>
<td>Registration - LNEC</td>
<td>Registration - LNEC</td>
<td>Registration - CCL</td>
<td>Parallel Sessions</td>
<td>Parallel Sessions</td>
<td>Specialized Sessions</td>
<td>Parallel Sessions</td>
<td>Parallel Sessions</td>
<td>Specialized Sessions</td>
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<tr>
<td>09-10</td>
<td>Opening session</td>
<td>Parallel Sessions</td>
<td>Muller Lecture</td>
<td>T2-2</td>
<td>T4-2</td>
<td>T5-2</td>
<td>T1-2</td>
<td>T2-3</td>
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<td>11-12</td>
<td>Lunch break</td>
<td></td>
<td>Muller Lecture</td>
<td>T2 - Keynote Lecture</td>
<td>T2 - General Report</td>
<td>T3 - Keynote Lecture</td>
<td>T3 - General Report</td>
<td>T6 - Keynote Lecture</td>
<td>T7 - Keynote Lecture</td>
<td>T7 - General Report Rocha Medal 2007</td>
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<tr>
<td>16-17</td>
<td>Coffee break</td>
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<td>Muller Lecture</td>
<td>T2 - Keynote Lecture</td>
<td>T2 - General Report</td>
<td>T3 - Keynote Lecture</td>
<td>T3 - General Report</td>
<td>T6 - Keynote Lecture</td>
<td>T7 - Keynote Lecture</td>
<td>T7 - General Report Rocha Medal 2007</td>
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<tr>
<td>17-18</td>
<td>Parallel Sessions</td>
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<td>Muller Lecture</td>
<td>T2-1</td>
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<td>18-19</td>
<td>Closing Session</td>
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<td>Muller Lecture</td>
<td>T2-1</td>
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<td>19-20</td>
<td>Registration - LNEC</td>
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<td>Muller Lecture</td>
<td>T2-5</td>
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<tr>
<td>20-...</td>
<td>Board Dinner</td>
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<td>Muller Lecture</td>
<td>T2-5</td>
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CEDEX – Spanish Laboratory for Civil Engineering, Madrid; LNEC – Portuguese Laboratory for Civil Engineering, Lisbon; CCL – Lisbon Congress Centre; MA – Main Auditorium
TECHNICAL PROGRAMME

FRIDAY, JULY 6

Workshop W1 - Underground Works under Special Conditions

Organizing Committee

Manuel Romana, Spain (Chairman)
Aurea Perucho, Spain (Co-Chairman)
Manuel Arnaiz, Spain (AETOS President)
Celso Lima, Portugal
Claudio Olalla, Spain
E. Quintanilha de Menezes, Portugal
Davor Simic, Spain

Scientific Committee

Nick Barton, Norway
Richard Bieniawski, USA
Benjamín Celada, Spain
Vicente Cuéllar, Spain
J. M. Gutiérrez-Manjón, Spain
Martin Herrenknecht, Germany
John Hudson, United Kingdom
Ricardo Lain, Spain
Paul Marinos, Greece
Carlos Oteo, Spain
José Luis Rojo, Spain
Luis Sopeña, Spain

Organization

The Workshop is organised by the Spanish Society for Rock Mechanics (the ISRM National Group), with the collaboration of CEDEX (the Spanish Official Civil Engineering Research Institution) and of AETOS (the ITA National Group), in the frame of the 11th Congress of ISRM.

Organized by:
in collaboration with:

Objectives
The theme of this Workshop is “Underground works under special conditions”. Tunnelling –and mining- is almost always a hazardous work, involving potential dangers, and requiring no small doses of engineering good sense and geological awareness. But in conventional sense the term “special condition” implies an increased difficulty which can be due to different causes: geological, geotechnical and/or technological ones.

During the last decades a great advance in tunnelling construction has been produced, and specially in the last years an increasing number of tunnels have been excavated, and many others are now under construction all around the world. And not only the number but also the characteristic of the tunnels have experienced a remarkable change, like the maximum depth, the cross sections, the construction techniques, with TBM’s that have supposed a great change in the tunnel conception, among others.

Not only the increasing number of highways, but specially the construction of high speed railways have imposed very strict conditions in their layout, that have conducd to an increasing number of tunnels excavated at great depths, or crossing rock masses with a lower geomechanical quality than would have been desirable.

All those conditions and reasons gave as result the idea to create a discussion forum where all the new techniques and advances could be presented and commented by the maximum international experts in these area.

The main objective of this Workshop is to provide an opportunity for the presentation and discussion for all the professionals interested in the wonderful world of tunnels.

Language
The official language of the Workshop is English.

Registration Fee
EUR 300, including: attending Workshop, proceedings (book and CD) and buffet lunch plus coffees.

Date and Place
The Workshop “Underground Works under Special Conditions” will be held on the 6th of July 2007, just before the 11th Congress of ISRM (Lisbon, 9-13th July 2007), at CEDEX Conference Room in Madrid (Spain), in street Alfonso XII 3, Madrid.
Map: CEDEX location
Keynote Lectures

- The nature of special conditions in underground construction - J. A. Hudson (UK)

- Geological Strength Index (GSI). A characterization tool for assessing engineering properties for rock masses - P. Marinos, V. Marinos & E. Hoek (Greece and USA)

General Reporter - Professor Paul Marinos (Greece)

Technical Papers

- Hard rock bursting phenomena in Maule tunnel - F. Abadía Anadón.

- Ground reaction curves of tunnels considering post-peak rock mass properties - L. R. Alejano, E. Alonso & G. Fdez.-Manín

- Passage of the Cariño fault in the terrestrial emissary 'A Malata - EDAR Prioriño Cape - B. Antuña, I. Pardo de Vera, H. Antuña, J. L. Sánchez

- Instability assessment of a deep ramp influence on the surrounding exploitation openings in a copper mine - C. Dinis da Gama & V. Navarro Torres

- Design and construction of the Telleda tunnel - A. Fernández, J. Piquer, B. Celada & E. Roig

- Safety in tunneling machines - C. Fernández, C. Martinez & J. C. Sancho

- Rehabilitation of Lapa tunnel, Metro do Porto - P. Ferreira, M. S. Martins & L. Ribeiro e Sousa

- Evaluation of the deformation modulus of rock masses using RMR: Comparison with dilatometer tests - J. M. Galera, M. Alvarez & Z. T. Bieniawski

- The selection of a cutter for a tunnel boring machine and the estimation of its useful life - C. Lain Huerta, P. Ramírez Oyanguren & R. Lain Huerta

- Modelling and validation of ground behaviour in a very old tunnel rehabilitation - V. Navarro Torres, C. Dinis da Gama & S. Longo

- Geotechnical behaviour of shaly rocks crossed by the Pajares tunnel (Section 1) - J. M. Rodríguez-Ortiz, J. M. Gutiérrez-Manjón, J. Ramos-Gómez & J. A. Saenz de Santamaría

- Improving the reliability of GSI estimation: the integrated GSI-RMI system - G. Russo

- Effect of lower seam old workings on longwall powered supports in upper seam - V. R. Sastry, R.Nair & M. S. Venkat Ramaiah

- Evaluating the ground pressures on the TBM and the lining for Guadarrama base tunnel - D. Simic

- Crossing of fault zones in the MSF Faido by using the observational method - R. Stadelmann, M. Rehbock-Sander & M. Rausch

- Calculation of the pre-stressed anchorage by 3D infinite element - Y. F. Wang, Y. H. Wang & H. Y. Xie

- Field test study on the endurance of early embedded bolts - X.M. Zeng & S. M. Li
### Programme

<table>
<thead>
<tr>
<th>Time</th>
<th>Schedule</th>
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</thead>
<tbody>
<tr>
<td>8.30-9.30</td>
<td>Inscriptions</td>
</tr>
<tr>
<td>9.30-10.00</td>
<td><strong>Opening session</strong></td>
</tr>
<tr>
<td></td>
<td>Chairman: General Director CEDEX</td>
</tr>
<tr>
<td></td>
<td>Co-chairman: General Director Laboratorio de Geotecnia (CEDEX)</td>
</tr>
<tr>
<td>10.00-14.00</td>
<td><strong>Morning session</strong></td>
</tr>
<tr>
<td></td>
<td>Chairman: Prof. Luis Sousa</td>
</tr>
<tr>
<td></td>
<td>Secretary: Dr. Áurea Perucho</td>
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<tr>
<td></td>
<td>10.00-10.45</td>
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<td>10.45-11.30</td>
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<td>11.30-12.00</td>
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<td>12.00-14.00</td>
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<td>14.00-15.30</td>
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<tr>
<td></td>
<td>Buffet lunch at CEDEX</td>
</tr>
<tr>
<td>15.30-18.50</td>
<td><strong>Afternoon session</strong></td>
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<tr>
<td></td>
<td>Chairman: Spanish officer</td>
</tr>
<tr>
<td></td>
<td>Secretary: Dr. José Estaire</td>
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<tr>
<td></td>
<td>15.30-17.10</td>
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<td>17.10-17.30</td>
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<td>17.30-18.50</td>
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<tr>
<td></td>
<td>18.50-19.00</td>
</tr>
<tr>
<td></td>
<td>Chairman Workshop: Prof. Manuel Romana</td>
</tr>
</tbody>
</table>

### Contact

**TILESA OPC**
Londres, 17 - 28028 Madrid. Spain
Tel. +34 91 361 2600 - Fax: +34 91 355 9208
email: isrm2007w1@tilesa.es

**Sociedad Española de Mecánica de Rocas**
Laboratorio de Geotecnia (CEDEX)
C/. Alfonso XII, 3
28014 Madrid (Spain)
Tel.: +34 91 335 73 24 / 51
Fax.: + 34 91 335 73 22
E-mail: semr@cedex.es

**More information:**
www.isrm2007w1.tilesa.es
www.semr.es

### Registration and Accommodation Form
Registration can be made on line (www.isrm2007w1.tilesa.es) or filling the Registration and Accommodation Form given below and sending it to our contact address given before.
There is the possibility to pay by bank transference to the following account number:
BARCLAYS BANK
SWIFT: BARCESMM
NUM: 0065-0156-5200-01033771
SATURDAY, JULY 7

ISRM Board Meeting
Date:   Saturday, July 7
Time:   9.30-18.30
Venue:   LNEC Congress Centre
Room:   3

International DUSEL Workshop
Time   9.30-17.00
Room    Small Auditorium
LNEC Congress Centre

Background
The US National Science Foundation is proposing to construct a Deep (~ 2km) Underground Science and Engineering Laboratory (DUSEL) in the United States. Although the primary motivation is to provide a long term (~50 + years) facility for particle physics (neutrino) research, DUSEL is to be a multidisciplinary research facility. This Workshop will focus on opportunities for Rock Mechanics Research and International Collaboration through DUSEL. The topics chosen are those that appear to be of most interest from discussions to date; see Technical Report GeoSciences and GeoEngineering Research at DUSEL (available on www.dusel.org), but other topics may be mentioned by participants.

Programme

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Discussion Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>09.30</td>
<td>Welcome and Introduction DUSEL, Rock Mechanics and ISRM</td>
<td>Charles Fairhurst, Univ. Minnesota, USA</td>
</tr>
<tr>
<td></td>
<td>DUSEL, Rock Mechanics and ISRM</td>
<td>John A.Hudson, President-Elect ISRM</td>
</tr>
<tr>
<td>10.00</td>
<td>DUSEL –Background and Potential</td>
<td>Derek Elsworth, Penn State Univ. USA</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>11.00</td>
<td>Tectonics, Geology and In Situ Stresses</td>
<td>Francois Cornet, Inst. Physique du Globe, Paris, France</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>11.45</td>
<td>Scale Effects in Rock Mechanics –Time</td>
<td>Pierre Bérest, Ecole Polytechnique, Palaiseau, France</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>12.30-14.00</td>
<td>Lunch</td>
<td>Emmanuel Detournay, Univ. Minnesota, USA</td>
</tr>
<tr>
<td>14.00</td>
<td>Scale Effects in Rock Mechanics -Size</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td>Emmanuel Detournay, Univ. Minnesota, USA</td>
</tr>
<tr>
<td>14.45</td>
<td>Coupled Effects (THMC)</td>
<td>Derek Elsworth</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>15.30</td>
<td>Internat’l Collab’n; DUSEL and URLs</td>
<td>Peter Blümling, NAGRA, Switzerland</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>16.15</td>
<td>Geophysical Imaging (‘Transparent Earth’)</td>
<td>Paul Young, Univ. Toronto, Canada</td>
</tr>
<tr>
<td></td>
<td>This important topic will be the subject of a Workshop on Sunday July 8. Dr Young will briefly introduce the Sunday Workshop</td>
<td></td>
</tr>
<tr>
<td>16.30-17.00</td>
<td>Summary and Conclusions.</td>
<td>Charles Fairhurst.</td>
</tr>
</tbody>
</table>

Registration.
There is no fee for registration, but attendance will be limited to ~40 participants. Please inform Professor Fairhurst via E-mail (fairh001@umn.edu ) if you plan to attend the Workshop.
<table>
<thead>
<tr>
<th><strong>Board Diner</strong></th>
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<tr>
<td><strong>Date:</strong></td>
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<tr>
<td><strong>Time:</strong></td>
</tr>
</tbody>
</table>
| **Venue:** | Palácio Pombal  
R. António Maria Cardoso, no. 37  
Lisbon |
SUNDAY, JULY 8

**ISRM Council Meeting**
Time: 14.00-19.00  
Venue: Main Auditorium  
LNEC Congress Centre

**ISRM & JTC Commissions Meetings**
Date: Sunday, July 8;  
Time: 9.30-12.30  
Venue: LNEC Congress Centre & CCL – Lisbon Congress Centre

<table>
<thead>
<tr>
<th>No.</th>
<th>Designation</th>
<th>Local</th>
<th>Date, hour</th>
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<tbody>
<tr>
<td>L01</td>
<td>European Council</td>
<td>Material Department, LNEC Congress Centre</td>
<td>July 8, 9.30-12.30</td>
</tr>
<tr>
<td>L02</td>
<td>Asian Council</td>
<td>Room 3, LNEC Congress Centre</td>
<td>July 8, 9.30-12.30</td>
</tr>
<tr>
<td>L03</td>
<td>ISRM Commission on Maintenance and Repair</td>
<td>Geotechnical Department, LNEC Congress Centre</td>
<td>July 8, 9.30-12.30</td>
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<tr>
<td>L04</td>
<td>Commission on Case Histories in Rock Engineering</td>
<td>Amphitheater, LNEC Congress Centre</td>
<td>July 8, 9.30-12.30</td>
</tr>
<tr>
<td>L05</td>
<td>ISRM Commission on Education</td>
<td>Dams Department, LNEC Congress Centre</td>
<td>July 8, 9.30-12.30</td>
</tr>
<tr>
<td>L06</td>
<td>Commission on Testing Methods</td>
<td>CQC 1, LNEC Congress Center</td>
<td>July 8, 9.30-12.30</td>
</tr>
<tr>
<td>L07</td>
<td>JTC 1 - Joint Technical Committee on Landslides and Engineered Slopes</td>
<td>Geotechnical Department, LNEC Congress Centre</td>
<td>July 8, 9.30-12.30</td>
</tr>
<tr>
<td>1A</td>
<td>JTC 2 - Joint Technical Committee on Representation of Geo-engineering Data in Electronic Form</td>
<td>Room 1A, CCL Lisbon Congress Centre</td>
<td>July 12, 12.30-13.30</td>
</tr>
<tr>
<td>1B</td>
<td>JTC 3 - Joint Technical Committee on Education and Training</td>
<td>Room 1B, CCL Lisbon Congress Centre</td>
<td>July, 10, 14.30-17.30</td>
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<tr>
<td>1A</td>
<td>JTC 5 - Sustainable Use of Underground Space</td>
<td>Room 1A, CCL Lisbon Congress Centre</td>
<td>July 11, 9.30-15.00</td>
</tr>
<tr>
<td>1B</td>
<td>JTC 6 - Joint Technical Committee on Ancient Monuments and Historical Sites</td>
<td>Room 1B, CCL Lisbon Congress Centre</td>
<td>July 11, 14.30-17.30</td>
</tr>
<tr>
<td>L08</td>
<td>JTC7 – Soft Rocks and Indurated Soils</td>
<td>CQC 2, LNEC Congress</td>
<td>July 8, 9.30-12.30</td>
</tr>
<tr>
<td>L09</td>
<td>ITA Meeting</td>
<td>Room 4, LNEC Congress Centre</td>
<td>July 8, 11.00-12.30</td>
</tr>
</tbody>
</table>

7th International Workshop on Application of Geophysics to Rock Engineering

Time: 9.30-17.30  
Room: Small Auditorium  
LNEC Congress Centre

During the Commission meeting, the ISRM Commission on Application of Geophysics to Rock Engineering will organize the 7th Workshop on Application of Geophysics to Rock Engineering.

The registration fee EUR 50 will cover the printing cost of the proceedings and a CD-Rom.
Programme

9:30-9:35 Opening Remarks - Koichi Sassa (Geosystem Research Institute, Japan)

Morning Session 1 - Working Group Report and Near Surface Seismic
Session Chairperson: Koichi Sassa (Japan)

9:35-10:00 ISRM Suggested methods for land and borehole geophysics in rock engineering - by Toru Takahashi (Working Group Coordinator, Fukada Geological Institute, Japan)

10:00-10:25 Near-surface seismic profile in the northern part of Beijing city - by Xu Chang, Yike Liu (Chinese Academy of Sciences, China), and Yanghua Wang (Imperial College London, UK)

10:25-10:45 Coffee Break

Morning Session 2 - Basic Studies on the Application of Geophysics to Rock Engineering
Session Chairperson: Bodo Lehmann (Germany)

10:45-11:10 Reactive Flow in a Fracture: Scale Effects in the Interpretation of Seismic Measurements - by Angel Acosta-Colon, David D. Nolte and Laura J. Pyrak-Nolte (Purdue University, USA)

11:10-11:35 Issues for the inversion of seismic reflection data for geotechnical properties - by Binzhong Zhou (CSIRO Exploration and Mining, Australia), Peter Hatherly (University of Sydney, Australia), Milovan Urosevic (Curtin University, Australia), and Troy Peters (VelSeis Processing, Australia)

11:35-12:00 Application of Seismic Interferometry to Cross-Well Seismology - by Toshifumi Matsuoka and Kazuya Shiraishi (Kyoto University, Japan)

12:00-12:25 Crosswell Imaging by 2-D oriented migration - by Yike Liu, Xu Chang (Chinese Academy of Sciences, China), and Hongchuan Sun (University of Utah, USA)

12:25-13:45 Lunch

Afternoon Session 1 - Application of Geophysics to Tunneling
Session Chairperson: Peter Hatherly (Australia)

13:45-14:10 Exploration of the tunnel alignment using geophysical methods to increase the safety for planning and respectively minimizing the risk - by Bodo Lehmann, Dirk Orlowsky and Rudiger Misiek (Deutsche Montan Technologie, Germany)

14:10-14:35 The geostatistical prediction technique of geological conditions ahead of the TBM driven tunnel face - by Kenji Aoki, Yoshitada Mito and Chuan Sheng Chang (Kyoto University, Japan)

14:35-15:00 ISIS - Integrated Seismic Imaging System for geological Prediction ahead of Hard Rock Tunnels - by Rudiger Giese, Stefan Lueth, Kay Krueger, Sylvio Mielitz, Peter Otto and Gunter Borm (GeoForschungsZentrum Potsdam, Germany)

15:00-15:25 OnSITE: Development of an On-line Seismic Imaging System for Tunnel Excavation - by Gunter Borm, Rudiger Giese, tefan Lueth, Tomas Bohlen, Serge Shapiro, Stwfan Buske, Ulrich Polom, Edwin Fecker, Klaus-Wolfgang Becker, Norbert Pralle and Thomas Dickmann (GeoForschungsZentrum Potsdam, Germany)

15:25-15:45 Coffee Break
Afternoon Session 2 Application of Geophysics to Construction of Subsurface Storage
Session Chairperson: Laura J. Pyrak-Nolte (USA)

15:45-16:10 Seismic prediction of hard rock fault zones and confirmation by tunnel observations - by Calin Cosma and Nicoleta Enescu (Vibrometric Oy, Finland), Kimmo Kemppainen (Posiva Oy, Finland), Turo Ahokas and Eero Heikkinen (Poyry Oy, Finland)

16:10-16:35 Current status of high-level radioactive waste disposal program and growing expectations for geophysical technology in Japan - by Hiroyuki Tsuchi and Junichi Goto (Nuclear Waste Management Organization of Japan, Japan)

16:35-17:00 Cross-hole seismic survey for spent fuel interim storage facility - by Yasushi Okajima, Jiro Tsuchiyama (Recyclable-Fuel Storage Company, Japan), and Toshifumi Matsuoka (Kyoto University, Japan), and Dai Nobuoka, Hiroyuki Azuma and Takeshi Iwamoto (OYO Corporation, Japan)

17:00-17:25 Study on creating hydraulic tomography for crystalline rock using frequency dependent elastic wave velocity - by Patric Bruines, Kenichi Ando (Obayashi Corporation, Japan), Kimitaka Yoshimura, Susumu Sakashita (Radioactive Waste Management Funding and Research Center, Japan), Hirofumi Okumura (JPOWER, Japan), and Yuzo Ohnishi, Satoshi Nishiyama (Kyoto University, Japan)

17:25-17:30 Closing Remarks - Laura J. Pyrak-Nolte (Purdue University, USA)

Course
Geomechanical Parameter Evaluation in Rock Engineering Practice

Sunday, 8 July 2007, 9:00 – 18:15
LNEC Congress Centre, Room 2

Course contents
The use of numerical modelling is becoming more extensive in Rock Engineering projects, with increasingly complex models being applied in everyday practice. Major difficulties for the engineer are often the determination of the input parameters required by the code, and the assessment of their influence on the results of the analysis. The main purpose of the course is to discuss characterization techniques, with a view to supplying the parameters for numerical models. Topics to be covered include the characterization of jointing and mechanical/hydro-mechanical properties of rock masses. The application of back-analysis techniques in rock mechanics will also be addressed. Specific needs of the codes more commonly used in rock engineering will be discussed.

Lecturers
L. Nolasco Lamas (Coordinator, LNEC, Portugal)
Carlos Esteves (EDP, Portugal)
Eda Quadros (IPT, Brazil)
Erik Johansson (Sannio & Riekkola, Finland)
Jorge Neves (EDP, Portugal)
José Muralha (LNEC, Portugal)
J. Vieira de Lemos (LNEC, Portugal)
L. Ribeiro e Sousa (University of Porto, Portugal)
M. Pinho de Miranda (EDP, Portugal)
Nuno Grossmann (LNEC, Portugal)
Tiago Miranda (University of Minho, Portugal)

Programme
8.45 Registration and distribution of documentation
9.00 Opening
9.10  L. Lamas & J. Muralha (LNEC, Portugal)
An overview of site characterization need in rock engineering projects

9:55  Eda Quadros (IPT, Brazil)
Hydraulic characterization of rock masses

10.40  Coffee Break

11.00  Erik Johansson (Finland)
Determination of rock stresses

12.15  Luís Sousa (Univ. of Porto, Portugal) & Tiago Miranda (Univ. of Minho, Portugal)
Use of artificial intelligence techniques and updating of geomechanical parameters

13.00  Lunch Break

14.30  Nick Barton (Norway)
Coupled characterization of rock joints and rock masses, considering deformation strength, flow and seismic: an overview

15.45  J. Vieira de Lemos (LNEC, Portugal)
Relevance of the geomechanical parameters in numerical modelling

16.30  Coffee Break

16.50  M. Pinho de Miranda, C. Esteves & J. Neves (EDP, Portugal), N. Grossmann & J. Muralha (LNEC, Portugal)
Baixo Sabor concrete dam site – case study

18.05  Conclusions and closing

Council Welcome Reception
Time:  19.00-20.30
Venue:  LNEC Congress Centre
MONDAY, JULY 9

The Second Half Century of Rock Mechanics

Opening Session
Time 9.00-10.00
Room Main Auditorium

Müller Lecture
Co-Chairmann Nielen van der Merwe (ISRM President, South Africa) & Pierre Habib (France)
Time 10.00-10.45
Room Main Auditorium
Lecturer Ted Brown (Australia)
Topic Rock Mechanics - The Basic Mining Science: Challenges in Underground Mass Mining

Plenary Session P1
Co-Chairmann Charles Fairhurst (USA) & Shunsuke Sakurai (Japan)
Time 11.15-13.15
Room Main Auditorium
T2 – The Path from Characterization to Modelling
Lecturer Loren Lorig (Chile)
Topic Using Numbers from Geology
General Reporter Xia-Ting Feng (China)
T5 – Earthquake Engineering and Rock Dynamics
Lecturer Takashi Akiyama (Japan)
Topic Evaluation Method of Seismic Stability of Foundation/Slope at Nuclear Plants in Japan

Plenary Session P2
Co-Chairmann Marc Panet (France) & Martin Pretorius (South Africa)
Time 14.30-16.15
Room Main Auditorium
T5 – Earthquake Engineering and Rock Dynamics
General Reporter J. Vieira de Lemos (Portugal)

T4 – Tunnels, Caverns and Underground Mining
Lecturer Dick Stacey (South Africa)
Topic Are Rock Engineers Addressing Risk Appropriately in Mining?
General Reporter Sergey Yufin (Russia)

Parallel Session T2-1 The Path from Characterization to Modelling
Co-Chairmann Fernando Pardo (Spain) & Ming Cai (Canada)
Time 16.45-18.30
Room 5A

Authors Papers
Erich Pimentel (Switzerland) A laboratory testing technique and a model for the swelling behavior of anhydritic rock
R. Doostmohammadi, M. Moosavi, Th. Mutschler & C. Osan (Iran &
Swelling pressure of mudstone under cyclic wetting and drying
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Paper Title</th>
</tr>
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<tbody>
<tr>
<td>Rakesh Kumar, K.G. Sharma &amp; A. Varadarajan (India)</td>
<td>Strain softening behaviour and constitutive modeling of schist</td>
</tr>
<tr>
<td>Z.A. Erguler &amp; R. Ulusay (Turkey)</td>
<td>Estimation of uniaxial compressive strength of clay-bearing weak rocks using needle penetration resistance</td>
</tr>
<tr>
<td>M. Kwaśniewski &amp; M. Takahashi (Poland &amp; Japan)</td>
<td>Effect of confining pressure, intermediate principal stress and minimum principal stress on the mechanical behavior of a sandstone</td>
</tr>
<tr>
<td>D.S. Cheon, C. Park, J.H. Synn &amp; S. Jeon (Korea)</td>
<td>Laboratory study on the characteristics of breakout under polyaxial stress conditions</td>
</tr>
<tr>
<td>S.C. Yuan &amp; J.P. Harrison (UK)</td>
<td>The local degradation approach applied to the modelling of brittle fracture of anisotropic heterogeneous rock</td>
</tr>
</tbody>
</table>

**Parallel Session T4-1  Tunnels, Caverns and Underground Mining**

**Co-Chairman:** Machado do Vale (Portugal) & Don Banks (USA)

**Time:** 16.45-18.30

**Room:** Main Auditorium

<table>
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<th>Papers</th>
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<tbody>
<tr>
<td>T. Miranda, A. Gomes Correia &amp; L. Ribeiro e Sousa (Portugal)</td>
<td>Geomechanical parameters updating in an underground work</td>
</tr>
<tr>
<td>G. Russo &amp; P. Grasso (Italy)</td>
<td>On the classification of the rock mass excavation behaviour in tunnelling</td>
</tr>
<tr>
<td>A. Rejeb &amp; J. Rutqvist (France &amp; USA)</td>
<td>Spatio-temporal evolution of the Excavation Damaged Zones (EDZ): Lessons learned from the French Tournemire site in indurate clay</td>
</tr>
<tr>
<td>C. Derek Martin &amp; Rolf Christiansson (Canada &amp; Sweden)</td>
<td>Interpreting in-situ stress measurements using geological models, Sweden</td>
</tr>
<tr>
<td>A. Gaich, M. Pötsch &amp; W. Schubert (Austria)</td>
<td>Rock mass characterisation for tunnelling and mining using 3D images</td>
</tr>
<tr>
<td>H. Kusumi &amp; M. Nakamura (Japan)</td>
<td>Engineering estimation method of rock masses on the tunnelling root by conversion analysis using seismic velocity and electric resistivity</td>
</tr>
<tr>
<td>N. Shimizu, A. Imaizumi, S. Takeo &amp; S. Sakurai (Japan)</td>
<td>Toward the design of attractive underground space: Coupling human sensibility and rock mechanics</td>
</tr>
</tbody>
</table>

**Parallel Session T5-1  Earthquake Engineering and Rock Dynamics**

**Co-Chairman:** Carlos Pina (Portugal) & Dick Stacey (South Africa)

**Time:** 16.45-18.30

**Room:** 5B

<table>
<thead>
<tr>
<th>Authors</th>
<th>Papers</th>
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</thead>
<tbody>
<tr>
<td>Ö. Aydan, M. Daido, N. Tokashiki, A. Bilgin &amp; T. Kawamoto (Japan &amp; Turkey)</td>
<td>Acceleration response of rocks during fracturing and its implications in earthquake engineering</td>
</tr>
</tbody>
</table>
R. Yoshinaka, T. Sasaki, K. Sasaki & S. Horikawa (Japan)  
Consideration on stability and collapse at earthquake of rock slope based on a case

W. Lin, W. Soh, H. Ito, E.-C. Yeh, M. Kwaśniewski & C.-Y. Wang (Japan, Taiwan & Poland)  
Comparison of in-situ stress orientations and magnitudes determined by anelastic strain recovery measurement and borehole breakout analysis in the vicinity of an active fault

L. A. Nazarova, L. A. Nazarov & P. G. Dyadkov (Russia)  
Modeling the stress-strain state of large-size geomechanical objects on the basis of tectonophysical, seismological, geophysical and geodetic data

C. Sigarán-Loría & R. Hack (Costa Rica & The Netherlands)  
Verification of two-dimensional numerical earthquake site effects on a dam site, Costa Rica

Y.-H. Jong, C.-I. Lee and S. Jeon (Korea)  
Numerical simulation for estimation of blast-damaged zone around a tunnel

Zilong Zhou, Guowei Ma & Xibing Li (Singapore & China)  
Dynamic Brazilian splitting and spalling tests for granite

**Poster Session T2**  
**The Path from Characterization to Modelling**  
Time: 14.30-18.30  
Authors should be at the poster session between: 16.15-16.45

**Poster Session T5**  
**Earthquake Engineering and Rock Dynamics**  
Time: 14.30-18.30  
Authors should be at the poster session between: 16.15-16.45
## TUESDAY JULY 10

### Parallel Session T2-2  The Path from Characterization to Modelling

**Co-Chairman**
Euripedes Vargas (Brazil) & Resat Ulusay (Turkey)

**Time**
9.00-10.45

**Room**
5A

<table>
<thead>
<tr>
<th>Authors</th>
<th>Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.P Luong, M. Emami Tabrizi, B. Halphen &amp; J.C. Eytard (France)</td>
<td>Non-destructive evaluation of the stable behavior of a quasi-brittle sandstone</td>
</tr>
<tr>
<td>M. Romana &amp; B. Vásárhelyi (Spain &amp; Hungary)</td>
<td>A discussion on the decrease of unconfined compressive strength between saturated and dry rock samples</td>
</tr>
<tr>
<td>F. Tonon (USA)</td>
<td>Determining fracture size probability distribution functions from trace length probability distribution functions</td>
</tr>
<tr>
<td>Steve Hencher &amp; Rob Knipe (UK)</td>
<td>Development of rock joints with time and consequences for engineering</td>
</tr>
<tr>
<td>N.T. Ford, R.J. Pine &amp; Z.N. Flynn (UK)</td>
<td>Discrete fracture network modelling and characterisation of rock masses for block caving design</td>
</tr>
<tr>
<td>R. Jimenez-Rodriguez &amp; C.D. Klose (Spain &amp; USA)</td>
<td>Recent developments for automatic identification of rock discontinuity sets</td>
</tr>
<tr>
<td>J. Muralha (Portugal)</td>
<td>Stress paths in laboratory rock joint shear tests</td>
</tr>
</tbody>
</table>

### Parallel Session T4-2  Tunnels, Caverns and Underground Mining

**Co-Chairman**
Fengshen Shen (China) & Nick Barton (Norway)

**Time**
9.00-10.45

**Room**
Main Auditorium

<table>
<thead>
<tr>
<th>Authors</th>
<th>Papers</th>
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<tbody>
<tr>
<td>L. Cantieni &amp; G. Anagnostou (Switzerland)</td>
<td>On the variability of squeezing in tunneling</td>
</tr>
<tr>
<td>Celso Lima, Nadir Plasencia &amp; Carlos Esteves (Portugal)</td>
<td>Picote II underground powerhouse – Geotechnical characterization and design</td>
</tr>
<tr>
<td>Feng Xia-Ting, Su Guoshao &amp; Jiang Quan (China)</td>
<td>Intelligent stability analysis and design optimum of a large hydraulic cavern group under high geo-stress condition</td>
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<tr>
<td>Fu Bing-jun, Zhang Jing-jian &amp; Li Zhongkui (China)</td>
<td>Discussion on 1st stage construction techniques for deeply buried long tunnels in the West Line of the Mega South to North Water Diversion Project in China</td>
</tr>
<tr>
<td>Niels Foged, Lisa Jakobsen, Peter Jackson</td>
<td>Rock mass characterization for tunnels in the Copenhagen limestone</td>
</tr>
</tbody>
</table>
K. Tsusaka, C. Tanimoto, Y. Mitarashi & T. Aoki (Japan)

A study on development of loosening zone and allowable limit of deformation in tunnelling

Parallel Session T5-2
Earthquake Engineering and Rock Dynamics
Co-Chairman Abdolhadi Ghazvinian (Iran) & Giovanni Barla (Italy)
Time 9.00-10.45
Room 5B

Authors

J. Tastet, I. Contrucci, E. Klein, P. Bigarré & L. Driad-Lebeau (France)

Large-scale field experiment to calibrate microseismic source parameters applied to real-time monitoring of post-mining instabilities

P. Horyl, R. Šňupárek & J. Havaj (Czech Republic)

Strengthening of longwall gate support against dynamic effects of rockbursts in coal mines

M. Corigliano, C. G. Lai & G. Barla (Italy)

Seismic vulnerability of rock tunnels using fragility curves

Li Jianchun, Wei Xiaoguan & Ma Guowei (Singapore)

Stress wave propagation across discontinuous granite medium

G. Kneib (Germany)

Derivation of elastic rock parameters via active and passive tunnel seismic methods

T. Mori, M. Nakajima, K. Iwano, M. Tanaka, S. Kikuyama & Y. Machijima (Japan)

Application of the fiber optical oscillation sensor to ae measurement at the rock compression test

Y. Yamauchi, Y. J. Jiang & Y. Tanabashi (Japan)

Dynamic characteristics of unstable rock blocks

Plenary Session P3

François Heuzé (USA) & Qian Qihu (China)

Bearing Capacity of Shallow and Deep Foundations in Rock with the Hoek and Brown Failure Criterion

So-Keul Chung (Korea)

To what Extent can we Predict the Long-term Behaviour

Plenary Session P4

Eda Quadros (Brazil) & Zhao Jian (Singapore)

14.30-16.15

Main Auditorium
**Parallel Session T1-1 Rock Engineering and Environmental Issues**

**Co-Chairman** Aurea Perucho (Spain) & Mehdi Goreichi (France)

**Time** 16:45-18:30

**Room** 5A

**Authors**

N. Barton (Norway) Thermal over-closure of joints and rock masses and implications for HLW repositories

E. Johansson, J.A. Hudson, M. Hakala, J. Sjöberg, S. Riikonen & P. Syrjänen (Finland, UK & Sweden) Rock mechanics research for radioactive waste disposal in Finland

G. Armand, Y. Wileveau, J. Morel, M. Cruchaudet & H. Rebours (France) Excavation damaged zone (EDZ) in the Meuse Haute Marne underground research laboratory

C.A. Garzonio (Italy) Water storage of thermal waters in a closing down mine (Gavorrano, Italy)

M.H. Yu, I.F. Jefferson & M.G. Culshaw (UK) Fault reactivation, an example of environmental impacts of groundwater rising on urban area due to previous mining activities

J.A. Taylor & R.J. Fowell (UK) Mining instability and the misuse of the 10-times-seam thickness rule

Yue Zhong qi, Li Lihui, Yang Zhifa, Lu Min, Xu JianHong & Zheng Jian (China) An investigation on long-term stability and integrity of surrounding rocks in Longyou caverns caved 2000 years ago

**Parallel Session T3-1 Slopes, Foundations and Open Pit Mining**

**Co-Chairman** Anna Laura (Brazil) & Manuel Romana (Spain)

**Time** 16:45-18:30

**Room** Main Auditorium

**Authors**

Takahiro Eguchi, Katsumi Ooyabu, Kentaro Kido & Masaaki Tsukui (Japan) Long-term monitoring of deformation behavior of large excavated rock slope in a dam site

Zhou Weiyuan, Lin Peng, Yang Qiang & Yang Ruoqiong (China) Challenging problems in the Xiaowan super large arch dam under construction

G. Ballivy, C. Gravel, T. El Malki, P. Rivard, B. The shear strength of joints in existing dam foundations
<table>
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<tr>
<th>Rousseau &amp; J. Gagnon (Canada &amp; France)</th>
<th>Bearing capacity of jointed rock foundations under gravity concrete dams</th>
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<tr>
<td>A. Fahimifar &amp; M. Imani (Iran)</td>
<td>Brief and systematic evaluation for deformation characteristics of dam site rock mass by shock response value</td>
</tr>
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<td>Y. Ito, K. Agui, K. Kikuchi, M. Fujieda, T. Kobayashi &amp; T. Saito (Japan)</td>
<td>Deformation reinforcement theory and its application in the dam toe anchorage design</td>
</tr>
<tr>
<td>Yang Qiang, Chen YingRu &amp; Liu Yaoru (China)</td>
<td>El Cune slide in mudstones and shales in Colombia: history and analyses</td>
</tr>
<tr>
<td>A.J. Gonzalez-Garcia &amp; J. Montero-Olarte (Colombia)</td>
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**Parallel Session T6-1 Petroleum Engineering and Hydrocarbon Storage**

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<tr>
<td>B. Haimson (USA)</td>
<td>Micromechanisms of borehole failure in reservoir rocks</td>
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<tr>
<td>J.B. Santos, E.V. Barroso, E. A. Vargas Jr., J. T. Castro, C. Gonçalves &amp; E. Campos (Brazil)</td>
<td>Studies of mechanisms associated with sand production using X Ray CT scan in real time</td>
</tr>
<tr>
<td>F. Cuisiat, E. Skurtveit &amp; R. Cleave (Norway)</td>
<td>Fault seal prediction in unconsolidated sediments with a novel experimental apparatus</td>
</tr>
<tr>
<td>R. Boualleg, H. Sellami, A. Rouabhi, S. Menand &amp; C. Simon (France)</td>
<td>Effect of rocks anisotropy on deviation tendencies of drilling systems</td>
</tr>
<tr>
<td>Yang Chunhe, Li Yiping, Qian Qihu, Wei Donghou, Chen Feng &amp; Yin Xueying (China)</td>
<td>Feasibility study of using the existing solution-mined caverns in Jintan Salt Mine as gas storage</td>
</tr>
<tr>
<td>T. Maejima, H. Uno, Y. Mito, C.S. Chang &amp; K. Aoki (Japan)</td>
<td>Three-dimensional hydrogeological modelling around the large rock cavern for the LPG storage project</td>
</tr>
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**Poster Session T3 Slopes, Foundations and Open Pit Mining**

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**Poster Session T4 Tunnels, Caverns and Underground Mining**

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5
WEDNESDAY, JULY 11

Parallel Session T1-2  Rock Engineering and Environmental Issues
Co-Chairman Meifeng Cai (China) & Ricardo Oliveira (Portugal)
Time 9.00-11.00
Room 5B

Authors

U. Heinemann & M. Tegelkamp (Germany)
A. Sato & A. Sawada (Japan)
F. Valès, M. Bornert, H. Gharbi, D. Nguyen Minh
& C. Eyard (France)
L. Jacobsson, M. Flansbjer, R. Christiansson & T.
Jansson (Sweden)
T. Koyama & L. Jing (Sweden)
Y. Obara, K. Sasaki, Y. Yoshinaga & Y. Suzuki
(Japan)
L. Mörén & J. Sjöberg (Sweden)

Papers

Planung des Neckardükers Sirnau in Esslingen
Analysis of tracer migration process in the crack by means of X-ray CT
Micromechanical investigations of the hydro-mechanical behaviour of
argillite rocks by means of optical full field strain measurement and acoustic
emission techniques
Measurement of micro crack volume in low porosity crystalline rock
Fluid flow and tracer transport simulations for rock fractures under normal
loading and shear displacement
Influence of water vapor pressure of surrounding environment on fracture
toughness and crack velocity of rocks
Rock erosion in spillway channels - a case study of the Ligga spillway

Parallel Session T2-3  The Path from Characterization to Modelling
Co-Chairman Marec Kwasniewski (Poland) & Wulf Schubert (Austria)
Time 9.00-11.00
Room 5A

Authors

Shang Yanjun, Shi Yongyue, Yuan Guangxiang & Sun
Yuanchun (China)
A. Ghazvinian, M. R. Nikudel & V. Sarfarazi
(Iran)
G. Barla, M. Barla, M. Camusso & M.E.
Martinotti (Italy)
M. Pötsch, M. Blümel, T.
Schieg & C. Seywald
(Austria)
J.S. Coggan, A.
Wetherelt, X.P. Gwynn
& Z.N. Flynn (UK)
P.H.S.W. Kulatilake,

Papers

Discontinuity distribution in granites and its effects on rock mass
classification
Effect of rock bridge continuity and area on shear behavior of joints
Setting up a new direct shear testing apparatus
The dilation potential of rough rock joints under CNL and CNS conditions
Comparison of hand-mapping with remote data capture systems for effective
rock mass characterisation
Estimation of rock mass strength and deformability for a 30m cube in three
Parallel Session T3-2  
Slopes, Foundations and Open Pit Mining

**Co-Chairman** Celso Lima (Portugal) & M. Tsesarsky (Israel)

**Time** 9.00-11.00

**Room** Main Auditorium

**Authors**

Feng Jili & He Manchao (China)

Modeling of excavated rock slope at Antaibao coal mine, China

M.F. Handley & K.N. Karparov (South Africa)

Proposed thrust failure analytical method for slope collapse in open pit mines

Suseno Kramadibrata, Ridho K. Wattimena, Budi Sulistianto, Ganda M. Simangunsong & Armstrong Tobing (Indonesia)

Study on shear strength characteristic of coal bearing strata

J.E.T. Quintanilha de Menezes & A.I. Soares Cardoso (Portugal)

Rock slope stabilization and numerical modelling with pretensioned metallic meshes

R.S. Pistone, A.G. Coelho, R. Freitas, J. Santos & P. Sousa

Stabilization of the Arrábida Cliffs, on the EN 379-1, in Setúbal

A. Serrano, A. Perucho & J. Estaire (Spain)

Slope stability in heterogeneous materials

J.P. Tshibangu, S. Wittemans, B. Deschamps & S. Duray (Belgium)

Evaluation of the rock mass properties using the downhole hammer drilling logs

I. Vrkljan, B. Kavur and N. Štambuk Cvitanović (Croatia)

Strength and deformation properties of the concrete-to-rock contact

Plenary Session P5

**Co-Chairman** Anthony Meyers (Australia) & John Hudson (UK)

**Time** 11.30-13.15

**Room** Main Auditorium

**T7 – Safety Evaluation and Risk Management**

**Lecturer** Herbert Einstein (USA)

**Topic** Changing Uncertainties through Updating from Experiments to the Observational Method

**General Reporter** Joe Carvalho (Canada)
Rocha Medal Ceremony
Recipient: Hideaki Yasuhara (Japan)
Topic: Thermo-Hydro-Mechano-Chemical Couplings that Define the Evolution of Permeability in Rock Fractures

Parallel Session T2-4
The Path from Characterization to Modelling
Co-Chairman: K.G. Sharma (India) & Richard Snupárek (Czech Republic)
Time: 14.30-16.15
Room: 5A

Authors
António Viana da Fonseca & Sandra Coelho (Portugal)
L.I. González de Vallejo & T. Hijazo (Spain)
M. Souley, M. Boulon, I. Rahmani & A. Thoraval (France)
D. Bruel & J. Charlety (France)
A.G. Thompson & C.R. Windsor (Australia)
Y. Mito, C.S. Chang, K. Aoki, H. Matsui, S. Niunoya & M. Minami (Japan)
A.I. Savich, E.G. Gaziev, V.I. Rechitski & A.V. Kolichko (Russia)

Papers
Characterization of variable weathered profiles by using DPR
A new procedure to assess in-situ rock stress by empirical and probabilistic methodologies
Laboratory measurements of hydraulic exchanges and associated hydromechanical couplings between fracture and rock mass in the case of a sandstone
Moment-frequency distribution used as a constraint for hydro-mechanical modeling in fracture networks
Block formation around excavations using deterministic and probabilistic methods
Evaluation of fracturing process of soft rocks at great depth by AE measurement and DEM simulation
Validation of determination of rock deformation moduli by different methods

Parallel Session T4-3
Tunnels, Caverns and Underground Mining
Co-Chairman: A. Gonzalez-Garcia (Colombia) & John Harrison (UK)
Time: 14.30-16.15
Room: Main Auditorium

Authors
Tai-Tien Wang, Wei Lo, Yung-Chin Ding & Shyh-Toung Liu (Taiwan)
F. Krenn, J. Brandl, H.-Ch. Kurzweil & R. Galler (Austria)
G. Beer & Ch. Dünser (Austria)
S. Stefanizzi, G. Barla & P.K. Kaiser (Italy & Canada)

Papers
Study on tunnel excavation disturbed zone in weak rock with time-dependent behavior
First approaches to an adaptable geomechanical design using databases
Advanced numerical simulation of the tunnel excavation/construction process with the boundary element method
Numerical modeling of strain driven fractures around tunnels in layered rock masses
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<tr>
<td>J.H. Lee, S. Akutagawa, H. Iida &amp; Y. Yokota (Japan)</td>
<td>Parameter identification and subsidence prediction by Artificial Neural Networks and FEM database for design and construction of NATM tunnels</td>
</tr>
<tr>
<td>L. Cantieni &amp; G. Anagnostiou (Switzerland)</td>
<td>On the adequacy of the plane strain assumption in tunnel analyses</td>
</tr>
<tr>
<td>A. Preh, R. Poisel &amp; B. Bogner (Austria)</td>
<td>The influences of the height of overburden and unsupported tunnel length on tunnel face stability</td>
</tr>
</tbody>
</table>

**Parallel Session T7-1 Safety Evaluation and Risk Management**

**Co-Chairman**: Chikaosa Tanimoto (Japan) & Robert Zimmermann (Sweden)

**Time**: 14.30-16.30

**Room**: 5B

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<tr>
<th>Authors</th>
<th>Papers</th>
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<tr>
<td>Rainer Poisel, Hans Angerer, Max Pöllinger, Thomas Kalcher &amp; Harald Kittl (Austria)</td>
<td>Risk management of the landslide Lärchberg – Galgenwald (Austria)</td>
</tr>
<tr>
<td>Wang Zhiwang, Li Duanyou &amp; Cheng Qiuming (China &amp; Canada)</td>
<td>Zonation of the landslide hazards based on weights of evidence modeling</td>
</tr>
<tr>
<td>M. Castelli, A. Allodi, C. Scavia &amp; M. Frayssines (Italy &amp; France)</td>
<td>A Fracture Mechanics approach to the study of rock fall triggering</td>
</tr>
<tr>
<td>Jae-Young Choi &amp; Chung-In Lee (Korea)</td>
<td>An estimation of rock mass rating using 3D indicator kriging approach</td>
</tr>
<tr>
<td>R. Sousa &amp; H. H. Einstein (USA)</td>
<td>Risk Analysis for tunneling projects using Bayesian Networks</td>
</tr>
<tr>
<td>W. Wittke &amp; P. Wittke-Gattermann (Germany)</td>
<td>Risiken bei TVM-Vortrieben in klüftigem Fels</td>
</tr>
<tr>
<td>D.F. Malan (South Africa)</td>
<td>Rock mass monitoring as a hazard assessment tool in deep Merensky and UG2 stopes</td>
</tr>
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**Parallel Session T2-5 The Path from Characterization to Modelling**

**Co-Chairman**: Derek Elsworth (USA) & Pinto da Cunha (Portugal)

**Time**: 16.45-18.30

**Room**: 5A

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<tr>
<td>T. G. Carter, M. S. Diederichs &amp; J. L. Carvalho (Canada)</td>
<td>A unified procedure for Hoek-Brown prediction of strength and post yield behaviour for rockmasses at the extreme ends of the rock competency scale</td>
</tr>
</tbody>
</table>
Parallel Session T3-3  Slopes, Foundations and Open Pit Mining
Co-Chairman Jiro Yamatomi (Japan) & J. Luiz Vallejo (Spain)
Time 16.45-18.30
Room Main Auditorium

Authors
S. Ohtsuki, H. Kusumi & T. Matsuoka (Japan)
A.G. Thompson (Australia)
Kang Hongpu & Lin Jian (China)
He Manchao, Chen Xin, Liang GuoPing, Qian HuaShan, Zhou YongFa & Zhuang XiaoYan (China)
K.M. Moffitt & S.F. Rogers (Canada)
Fu-Shu Jeng, Hung-Hui Li, Tsan-Hwei Huang & Yo-Ming Hsieh (Taiwan)

Papers
3D simulation analysis of failure of rock slope with crack propagation by DEM
An innovative approach for the use of 3D images in the mechanical analysis of blocks in a rock mass
Step-path characterization in rock slopes: An integrated digital imaging-numerical modeling approach
Re-evaluation of an anchored slope using a digital terrain model
Active and passive earth pressures on retaining walls assuming a non-linear strength criterion and constant dilatancy
Visual sensibility analysis of Slope Mass Rating (SMR) correction parameters using continuous functions
Rock engineering in karst: Belgian case histories

Parallel Session T4-4  Tunnels, Caverns and Underground Mining
Co-Chairman A. Campos e Matos (Portugal) & Paul Marinos (Greece)
Time 16.45-18.30
Room 5B
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<tr>
<th>Authors</th>
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<tbody>
<tr>
<td>A.K. Verma &amp; D. Deb (India)</td>
<td>Statistical and neural regression approach for prediction of longwall chock-shield support pressure</td>
</tr>
<tr>
<td>I.R. Berdugo, E.E. Alonso, A. Gens &amp; E.E. Romero (Spain)</td>
<td>Alternative support designs for tunneling gypsiferous-anhydritic claystones</td>
</tr>
<tr>
<td>D. Saiang &amp; E. Nordlund (Sweden)</td>
<td>Failure mechanisms around shallow tunnels in brittle rock</td>
</tr>
<tr>
<td>H. Hagedorn, M. Rehbock-Sander &amp; R. Stadelmann (Switzerland)</td>
<td>Gotthard Base tunnel: Rock burst phenomenon during construction of a multifunctional section in a fault zone area</td>
</tr>
<tr>
<td>Christopher Laughton, Mark Kuchta &amp; William Roggenthen (USA)</td>
<td>Design of a large deep cavern at the United States Deep Underground Science and Engineering Laboratory (DUSEL)</td>
</tr>
<tr>
<td>J.W. Latilla, J.J. van Wijk, H. Booysen, C. Silver &amp; P. Fourie (South Africa)</td>
<td>Pre-split surface blasting to modify goaf behavior above shortwall panels</td>
</tr>
<tr>
<td>A. Majdi, A. Ghomghaleh &amp; M.H. Arabzadeh (Iran)</td>
<td>Theoretical prediction of ground settlement induced by longwall mining</td>
</tr>
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**Poster Session T1**

**Rock Engineering and Environmental Issues**

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<th>Poster Session T6</th>
<th>Petroleum Engineering and Hydrocarbon Storage</th>
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THURSDAY, JULY 12

SPECIALIZED SESSIONS

Specialized Sessions will be organized in cooperation with the ISRM Commissions, ISRM Interest Groups and by ISRM NG’s. Until now the planned Sessions are:

S01 – Rockfall – Mechanism and Hazard Assessment

Organization: JTC1 – Joint Technical Committee on Landslides and Engineered Slopes
Responsible – Herbert Einstein (MIT, USA)
Room: Main Auditorium

Part 1. Standard oral presentations. The papers are listed below in the three categories:

Laboratory and Analytical/Numerical Studies
Field Studies
Design Studies

Laboratory and Analytical/Numerical Studies:

9.00-9.10 Analysis of Stability Conditions of Rock Slopes Based on Laser Scanner Surveys
   A.M. Ferrero, G. Forlani, M. Migliazza, R. Roncella, P. Grasso, E. Rabbi

9.10-9.20 GIS-Based Rockfall Hazard Assessment in Support of Decision Making
   S. Charalambous & M. Sakellariou

9.20-9.30 Rock Avalanches: Experimental Study of the Main Parameters Influencing Propagation
   I. Manzella & V. Labiouse

9.30-9.40 An Overview of Numerical Models For Rock Avalanche Runout Analysis
   M. Pirull & C. Scavia

9.40-9.50 3D Modelling of Rock Mass Falls Using the Particle Flow Code PFC3D
   A. Preh & R. Poisel

9.50-10.00 Kinematics of Overhanging Rock Slopes
   M. Tsesarsky & Y.H. Hatzor

10.00-10.15 Discussion

Field Studies:

10.15-10.30 Thermal Effects on Rock Slopes: A Case Study of the "Rochers de Valabres" Slope (France)
   V. Merrien-Soukatchoff, C. Clement, Y. Gunzburger & C Dünner

Poster - Rock Fall Susceptibility on a Large Scale: A Mechanical-Probabilistic Methodology
   M. Castelli & C. Scavia

10.30-10.45 Coffee Break

Design Studies:

10.45-11.00 Probabilistic Rockfall Encounter Analysis Using a Three-Dimensional Simulation Model
   T. Nishimura & H. Kiyama
Part II Debate on rockfall hazard rating systems
11.00-12.30

Rockfall hazard rating systems are widely used. Consequently several systems exist and some have been used for many years. Also, some systems go beyond hazard rating and include risk rating. It seems therefore opportune at this time to discuss positive and problematic aspects of these systems. This will be done in form of a classic “English” debate. The debaters are people who have created and/or used these systems: Larry Pierson (USA), Rainer Poisel (Austria), Claudio Scavia (Italy), Duncan Wyllie (Canada).

S02 – Rock Mechanics Data: Representation and Standardisation

Organization: JTC2 – Joint Technical Committee on Representation of Geo-Engineering Data in Electronic Format
Responsible – David Toll (UK)
Room: 1A

Programme

9.00-9.10 Introduction
   David Toll, (Chair JTC2) & Zuyu Chen (Chair CCHRE)

9.10-9.30 A rock properties database in XML
   John Curran (Canada)

9.30-9.50 Some new developments on the representation and standardization of rock mechanics data: From the laboratory to the full-scale project
   George Exadaktylos (Greece)

9.50-10.10 Representing quality and uncertainty for geo-engineering data
   Wiebke Tegtmeier (The Netherlands)

10.10-10.30 Coffee Break

10.30-10.50 Representing slopes in XML
   David Toll (Singapore/UK)

10.50-11.10 A slope classification method by mechanical models and key parameters for case history documentation with XML format
   Shihai LI (China)

11.10-11.30 An introduction to the Chinese state database for rock collapse, landslides and debris flows
   Yueping Yin (China)

11.30-11.50 Database for landslides and engineered slopes related to China’s water resources development based on XML
   Zuyu Chen (China)

11.50-12.30 Discussion

JTC2 is a Joint Technical Committee on **Representation of Geo-engineering Data in Electronic Form** of the

CCHRE is a Commission on **Case Histories in Rock Engineering** of the *International Society for Rock Mechanics* (http://www.isrm.net/casehistories)
S03 – Innovations in Underground Construction

Organization: ISRM/ITA Joint Session, (12 July 2007 - 14-18 h)
Responsibles – ISRM: Gernot Beer (Austria) & L. Ribeiro e Sousa (ISRM VP, Portugal)
ITA: André Assis (Brazil) & Harvey Parker (ITA Past-President, USA)
Room: Main Auditorium

14h00-14h05 Opening
Co-Chairmen: Harvey Parker (ITA) & L. Ribeiro e Sousa (ISRM)

14h05-14h30 Technology Innovations in Underground Construction - The European Perspective & European Integrated Project TUNCONSTRUCT
Gernot Beer (TU Graz - Austria)

14h30-14h45 Innovative technologies for road tunnel construction
T. Adachi & A. Higashide (Obayashi - Japan)

14h45-15h00 Robotics Devices in Underground Construction
Felix Amberg (Amberg Engineering - Switzerland)

15h00-15h15 Innovations Technology in Deep Coal Mining
He Manchao (Mining China University - China)

15h15-15h30 Innovative Methods to Improve Geotechnical Investigations
Andre Assis (University of Brasilia - Brazil)

15h30-16h00 Coffee Break

16h00-16h15 Innovative Approaches in Monitoring Data Evaluation and Interpretation
Wulf Schubert (TU Graz - Austria)

16h15-16h30 Innovations in Maintenance and Repair of Tunnels
Carlos Bosch (Dragados - Spain )

16h30-16h45 Risk Analyses and Life Cycle Costs of Underground Facilities
Harvey Parker (ITA - USA)

16h45-18h00 Debates
Animators - André Assis (ITA) and Gernot Beer (ISRM)

Debate Topics:
- Simulation Modeling and AI Techniques
- Geotechnical Investigation
- Life Cycle Costs
- Risk Analyses and Management
- Monitoring
- Mechanized Excavation Technology

Debaters with short interventions were invited.
S04 – Application of Geophysics to Rock Engineering

Organization: ISRM Commission on Application of Geophysics to Rock Engineering
Responsible – Koichi Sassa (Japan)
Room: 5A

Programme

14.00-14.10 Opening

14.10-14.30 Progress report of the Commission on the Application of Geophysics to Rock Engineering
Koichi Sassa (Geosystem Research Institute, Japan)

14.30-14.50 Fractures as Time-Dependent Structures: Characterizing Alterations & Changing Length Scales
Laura J. Pyrak-Nolte (Purdue University, USA)

14.50-15.10 Imaging dynamic rock fracture with acoustic emission and x-ray tomography
R. Paul Young & Ben D. Thompson (University of Toronto, Canada)

15.10-15.30 Observation of fracture processes in creeping rock masses by seismic monitoring
Stefan Mertl & Ewald P. Brueckl (Vienna University of Technology, Austria)

15.30-15.50 Geophysical Monitoring for CO2 Sequestration
Toshifumi Matsuoka & K. Onishi (Kyoto University, Japan)

15.50-16.10 Extracting geotechnical information from seismic reflection surveys – examples from Australian coal mines
Peter J. Hatherly (University of Sydney, Australia), Binzhong Zhou (CSIRO Exploration and Mining, Australia), Milovan Urosevic (Curtin University, Australia), & Troy Peters (VelSeis Processing, Australia)

16.10-16.30 Coffee Break

16.30-16.50 Suggested methods for Land and Borehole Geophysics in Rock Engineering
Toru Takahashi, Toshiaki Takeuchi (Fukada Geological Institute, Japan), & Koichi Sassa (Geosystem Research Institute, Japan)

16.50-18.00 Discussion

S05 – Maintenance and Repair of Underground Structures

Organization: ISRM Commission on Maintenance and Repair of Underground Structures in Rock Masses
Responsible – L. Ribeiro e Sousa (Portugal)
Room: 5A

Programme

9.00-9.20 Maintenance and Repair of Underground Structures in Rock Masses
L. Ribeiro e Sousa (University of Porto, Portugal)

9.20-9.35 Japanese State of the Art on Tunnelling Maintenance Technology
Toshihiro Asakura (Kyoto University, Japan) & Yoshiyuki Kojima (RTRI - Railway Technical Research Institute, Japan)

9.35-9.50 Damage to Mountain Tunnels by Earthquake and Deformation Mechanism
Yoshihiro Shigeta, Yoshiyuki Kojima, Takeshi Matsunaga, Kazuhiro Tsukada (RTRI, Japan) & Toshihiro Asakura (Kyoto University, Japan).
Applications to deepest coal mines
He Manchao (China University of Mining and Technology, China)

Old Railway Tunnels Incorporate at Bilbao Metro
Manuel Romana (University of Valencia, Spain)

A review of methods for enlarging transportation tunnels while maintaining current traffic capacity during construction
F. Tonon (University of Texas, USA)

Coffee Break

Juncal tunnel, Rehabilitation Project
M. Hohermuth (Amberg, Switzerland) & V. Freitas (REFER, Portugal).

Preliminary Identification of Swiss Road Tunnels Pathologies based on Geotechnical GIS Data
F. Sandrone, V. Labiouse & J.-F. Mathier (EPFL, Switzerland)

Maintenance of Tunnels and the Use of AI Techniques
R. Leal e Sousa (MIT, USA), L. Ribeiro e Sousa (University of Porto, Portugal) & Cristina Silva (Polytechnical School of Porto, Portugal)

Debate

Programme

Presentation of the commission and its objectives, presentation of the guideline
Christophe Didier (France)

Main hazard assessment methods used in post mining context
Nielen van Der Merwe (South Africa)

Application to the French Lorraine ore basin
Jean-Pierre Josien (France)

Main geophysical methods to characterise underground characteristics
Andrej Kotyrba (Poland)

Some treatment techniques adapted to mine closure
Mark Mainz (Germany)

Coffee Break

Monitoring techniques dedicated to mine closure
Ömer Aydan (Japan)

Data base management and GIS use in mine closure planning
Won Kyong Song (Korea)

Debate
**S07 – Mining**

Organization: ISRM Interest Group on Mining  
Responsible – Bruce Hebblewhite (Australia)  
Room: 1A  
Duration: 14.30-18.00h  
Keynote Speaker: Bruce Hebblewhite (Australia)  
Role of Rock Mechanics in Modern Mine Design and Operations

Themed presentations:  
(It is anticipated that selected papers submitted through National Groups will be presented in this forum, under these headings, followed by a more comprehensive workshop discussion session)  
- Deep and High Stress Mining  
- Open Pit Geomechanics  
- Mass Mining Systems  
Facilitated discussion forum on mine design (with respect to Rock Mechanics components and contributions). (This discussion will focus on the international state of the art; current issues; future directions).

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**S08 – Rock Blasting Induced Vibrations**

Organization: ISRM NG Portugal  
Responsibles – C. Dinis da Gama & Pedro Bernardo (IST, Portugal)  
Room: 1B

Main topics:  
- New developments in vibration monitoring and control  
- Structured behaviour under blast vibrations  
- Evolution of damage safety control  
- Human discomfort thresholds for blast vibrations  
- Towards innovative blasting techniques

**Programme:**

9.00-9.15 Introduction

9.15-9.30 Controlled blasting technique for navigation lock trench excavation at the TGP  
Dai Huichao & Zhu Hongbing (China)

9.30-9.45 Research of energy distribution during dynamic loading of rocks.  
V. Petros, J. Saucer & Z. Kadlec (Czech Republic).

9.45-10.00 Advances of the drill and blast method in Tunnelling.  
Gunther Brem & Jens Gattermann (Germany).

10.00-10.15 Evaluation of fracturing process of soft rocks at great depth by AE measurement and DEM simulation.  

10.15-10.30 Numerical simulation for estimation of blast-damaged zone around a tunnel.  
Y. Jong, C. Lee & S. Jean (Korea)

10.30-10.45 Coffee Break
10.45-11.00 Basting vibrations control for Environmental Impact Studies and it’s remote monitoring – A case study in Azores.
Gustavo Paneiro & C. Dinis da Gama (Portugal).

11.00-11.15 Controlling vibration parameters in structures located at short distances to rock blasting operations.
Pedro Bernardo (Portugal).

11.15-11.30 Vibration propagation during the Leixões Harbour deepening works.
Ricardo Resende & Jorge Gomes (Portugal)

11.30-11.45 Blasting quality control – drilling
Eduardo Gomes, Carlos Galiza, Santos Vaz, Pedro Batista e Luís Ramos (Portugal)

11.45-12.30 Debate

S09 – 3D Laser Scanning Applied to Geotechnical Problems

Organization: ISRM NG The Netherlands
Responsible – Robert Hack (The Netherlands)
Room: 1B

Programme

14.00-14.10 Introduction
Robert Hack (The Netherlands)

14.10-14.30 Rock mass characterisation for geotechnical analyses using 3D computer vision
Markus Poetsch (Austria)

14.30-14.50 Analysis of laser scanner data collected during a survey of faces in a rock quarry
Rotonda T., Marsella M., Lizzadro L. & Ricca A (Italy)

14.50-15.10 Fracture mapping using 3D laser scanning techniques
Slob, Q. Feng, K. Röshoff, H.R.G.K. Hack & A.K. Turner (The Netherlands & USA)

15.10-15.40 Coffee Break

15.40-16.00 Laserscanning as a tool for Mining: Applications in Hambach Surface mine
Robrecht Schmitz (Germany)

16.00-16.20 Rock fall hazard assessment of Malaysian motorway rock slopes based on laser scanner surveys
M. Ferrero, G. Forlani, P. G. Grasso, R. Migliazza, E. Rabbi, R. Rondella, I. Voya (Italy)

16.20-17.30 Discussion

S10 – Underground Waste Disposal: Progress and Challenges

Organization: ISRM Interest Group on Underground Waste Disposal
Responsible – Wang Ju (China)
Room: 5B
Main topics:
New developments in underground waste disposal, especially in geological disposal of high level radioactive waste
The coupled T-H-M-C behaviour of host rocks for geological repositories
• Numerical modeling in underground waste disposal engineering
• Performance assessment of geological repositories
• Characterization of fractured media
• Time dependent behaviour of excavated damaged zones
• Challenges facing underground waste disposal
• Debate

Programme

14.00-14.20 Geomechanical challenges within the framework of the French 2006 Planning Act on the sustainable management of radioactive waste
Corinne Bauer (ANDRA_DS/IT, France)

14.20-14.40 Key scientific challenges in geological disposal of high level radioactive waste
Wang Ju, (China National Nuclear Co., China)

14.40-15.00 Studies of the Excavation Damage Zone at the Åspö Hard Rock Laboratory, Sweden
Rolf Christiansson & Christer Andersson (Sweden)

15.00-15.20 Long-term behaviour of Beishan granite at elevated temperature
L. George Tham (Hong Kong)

15-20-15.40 Interpreting in-situ stress measurements using geological models, Sweden
Derek Martin, Rolf Christiansson (Canada & Sweden)

15.40-16.00 Time Dependent Fracture Growth in Intact Crystalline Rock: new laboratory procedures
Tobias Backers, Ove Stephansson (Sweden)

16.00-16.20 Observations and analysis of an in situ heating test in Opalinus clay
Antonio Gens (Spain)

16.20-16.40 Coffee Break

16.40-17.00 The In Situ PRACLAY Demonstration & Confirmation Experiments
Frédéric Bernier (Belgium)

17.00-17.20 Creep behaviour in thermal and mechanical consolidation tests on Boom clay
Cui Yujun (France)

17.00-17.20 3D Laser Scanning Techniques applying to tunnel documentation and geological mapping at Åspö Hard Rock Laboratory, Sweden
Feng Quanhong & Kennert Röshoff (Sweden)

17.20-18.00 Debate

FRIDAY, July 13

TECHNICAL VISITS

Technical Visit 1: Lisbon Metro
Duration: 1/2 day

Cost: EUR 10

(departures in the morning)

Visits to the Lisbon Metro

Lunch: not included

The Lisbon Metro has presently the following major projects in progress:

- **The Baixa Project:** Blue Line extension towards the river Tagus, Baixa/Chiado – Santa Apolónia, its conclusion being foreseen for the end of 2005.

- **The S. Sebastião Project:** Red Line extension westward, Alameda - S. Sebastião, its conclusion being foreseen for the end of 2007. Volcanic formations are expected near the last stretch.

After the conclusion of these projects the Lisbon Metro will be operating with 6 cars trains (maximum configuration) a network of about 40 km double track with 52 stations divided in 4 lines:

**Blue Line:** Falagueira - Santa Apolónia with a length of approx. 13 km and featuring 17 stations.

**Yellow Line:** Odivelas – Rato with a length of approx. 11 km and featuring 13 stations.

**Green Line:** Telheiras - Cais do Sodré with a length of approx. 9 km and featuring 13 stations.

**Red Line:** S. Sebastião – Oriente with a length of approx. 7 km and featuring 9 stations.
Apart from the projects under construction, the following extensions are presently being studied:

**Yellow Line** the extension Rato - Alcântara with a length of about 3 Km and featuring 3 new stations, this extension will provide a new interface with the Lisbon - Cascais suburban railway line enabling a faster and easier connection with the northern zone of Lisbon.

**Green Line** the extension Telheiras - Pontinha, with a length of about 3 km and featuring 3 stations which will serve a fast expanding zone and will enable the access to the Blue Line and to the “Pontinha” depot.

**Red Line** the extensions, westwards from S. Sebastião in direction of Campo de Ourique with a length of about 3 km and featuring 3 new stations, and on the North end from Oriente station a fork with two branches is under consideration. One of the branches will bend westwards and proceed in direction of the Lisbon International Airport with a length of about 3 km and featuring 3 new stations, the other branch will proceed northwards in direction of Sacavém with a length of about 2 km and features 2 new stations.

With the completion of all these projects the Lisbon Metro network will have a total length of approx. 54 km and 65 stations increasing the coverage of the town urban zones to a better extent, providing a complete net of primary interfaces which will increase significantly the intermodality in Lisbon.

On the other hand, the meshing effect in the network will be much more evident and the length of the lines will be more adequate for an optimized operational exploitation.

**Accompanying person from the Organizing Committee:**

R. Resende (LNEC)
Technical Visit 2: Somincor Mine

Duration: 1 day

Cost: EUR 20

(departure from Lisbon – 08:00h, arrival in Lisbon – 20:00h)

Morning: visit to the underground Neves-Corvo mine  
Lunch: in the mine facilities (included)  
Afternoon: visit to the ore dressing plants

Company: 
SOMINCOR is a company which operates the copper and zinc mining complex of Neves Corvo, exploited in Neves-Corvo mine, in the Alentejo region, South of Portugal. In June 2004, the EuroZinc Mining Corporation acquired the Neves-Corvo mine through the purchase of SOMINCOR from the Rio Tinto Group (RTG) and Empresa de Desenvolvimento Mineiro, SGPS, S.A. (EDM).
**Highlights:**
The unique feature of the Mine is its copper and tin grades. Current geological reserves consist of copper ore grading 7.94% Cu, and of copper/tin ore grading 13.62% Cu and 2.42% Sn. There are substantial further resources of complex sulphides, as well as copper, precious metals and cassiterite. The main copper reserves are located in two massive sulphide deposits, called Corvo and Graça, some 280 to 630 m below surface. Because of the high ore value and the orebody geometry, mining by a cut and fill method has been selected.

Processing of ore is achieved by two concentrators, a copper concentrator and a copper/tin concentrator. Both are conventional plants with the main feature being the fine grind required to obtain good liberation. A 25% copper concentrate is produced with recoveries in excess of 92%. Two types of tin concentrate are produced, high grade of 50% Sn and a low grade of 35% Sn, with overall recovery of 65%. Concentrates are marketed to a selection of smelters on long term contracts.

**General Geology:**

The Neves-Corvo deposits are located in Southern Portugal towards the western end of the Iberian Pyritic Belt. The initial discovery was made in 1977 by a consortium consisting of the Portuguese State, Penarroya and BRGM as a result of the diamond drilling of selected gravimetric anomalies. Since the discovery, more than 200 surface diamond drill holes amounting to over 150 Km, have been drilled. These have defined five massive sulphide orebodies: Neves, Corvo, Graça, Zambujal and Lombador.

Preliminary evaluations showed the copper rich deposits of Corvo and Graça to be viable, and as result the company Somincor was formed in 1980 to exploit these deposits. Project work started in 1981 with the driving of an incline ramp of 17m² cross section at an 18° gradient. This was followed by the start of 5 m² concrete lined vertical shaft for ore extraction.

The orebodies of Neves-Corvo are lenses of massive sulphides with important mineralisation of the upper and lower wallrocks, and are similar in some respects to other deposits within the Iberian Pyrite Belt. However, they are unique in the high copper and tin grades which occur in the ores, and unusual in their strong metal zonation patterns.

All the orebodies are located at the top of a complex volcano-sedimentary group (VS) which overlies the phyllite-quartzite group (PQ) of upper Devonian age, and which is in turn overlain by greywackes and shales of the Lower Carboniferous flysch. The VS consists of three piles of acid tuffs separated by shale units, and there is a discontinuous black shale horizon.
immediately below the orebodies. Between the ore level and surface there is a repetition of the volcanic shales and flysch units. The rocks have been folded into a gentle anticline oriented NW - SE which plunges to the south-east, with orebodies on both flanks of the fold. Several sets of sub-vertical faults occur and displace the deposits, and low-angle thrust faults are also present.

Accompanying person from the Organizing Committee:

C. Dinis da Gama (IST).

Technical Visit 3: Clona Mine

Duration: 1 day

Cost: EUR 20

departure from Lisbon – 08.00h, arrival in Lisbon – 20.00h)

Morning: visit to the underground salt mine
Lunch: free - in Loulé city (not included)
Afternoon: visit to Loulé city and surroundings (beaches)

Rock salt mine – A city below another city

In Portugal, there only exist three rocksalt exploitations. The only one which does it according to traditional methods, with men working in the depth, is situated at Loulé. It is the CLONA, a company which already exists since 34 years.

The area of exploitation concession, in Loulé, is 1200ha, although, at the surface, the mining park is only 5ha. The deposit starts at 100m depth, but, due to a requirement of the method, it is only exploited below 230m.

Clona extract 700 to 1000t of salt per day, and may do so, if that shall be the option, at least, during some thousands years. The access to the mine is done through two shafts. At shaft 1, there exists a lift, which transports people. At shaft 2, passes the ore, which is extracted at a rhythm of 5t per each two minutes and half. In case of emergency, people may also be removed there through.
Down there, if all the tunnels were put in a single straight line, a distance of 60km would be obtained. The adits have a height of more than 4m by a width of 10m, constituting real underground roads. Trucks descend into the mine partially dismantled, through shaft 1, which has a diameter of no more than 4.2m. All together, there are 12 vehicles travelling along the adits. There, the extraction of the ore is done, which is then internally transported, gets on a conveyor belt, and proceeds until the so-called rolling zone. Before ascending to the surface through shaft 2, the ore is ground. These two shafts allow also the permanent ventilation of the mine.

Further to the scarcely rewarding rock salt, the mine holds in it other potentialities which may create profit. Such is the case the tourism exploitation, as it is an industrial plant which works and can be visited. It may function as an attraction pole from the geologic and the health points of view.

This type of mine, on the other hand, may equally be used as depositories for industrial waste which has been duly made inert.

Accompanying person from the Organizing Committee:

P. Bernardo (SPG)

Technical Visit 4: Marble Quarries

Duration: 1 day

Cost: EUR 20

(departure from Lisbon – 08:00h, arrival in Lisbon – 20:00h)

Morning: visit to marble quarries (underground and open pit)
Lunch: free - in Vila Viçosa (not included)
Afternoon: visit to Ducal Palace and Vila Viçosa castle
End of the afternoon: visit to CEVALOR, technological centre specialized in dimension stones

Minimum number of participants: 30
Maximum number of participants: 40
Dimension stones in Portugal:

Dimension stones, which include ornamental stones, consist of rough stone and quarried blocks of igneous, sedimentary, and metamorphic rocks, including granite, marble, limestone, sandstone, and slate. These stones, strength, toughness, hardness, and resistance to environmental damage, find application as panels, slabs, and other shapes in building and construction, monuments, and in curatings. In Portugal, non metallic mineral resources, rocks and industrial minerals, constitute a sector of large economic relevance, due to the important volumes produced and processed, and the number of workers involved. This is a very dynamic industrial activity, which has progressively been modernized, in order to meet the more advanced extractive and processing technologies, thus contributing to higher levels of production and quality and to increased competitiveness in the markets.

The activity in non metallic mineral resources sector in Portugal includes two main branches: rocks and industrial minerals. The rock activity sector comprehend Dimension stones and Industrial stones. Recently, the Portuguese authorities have developed, in the domain of dimension stones, geological, geophysical, analytical and technological new studies and drillings, aiming the selecting of areas where these rock masses show adequate features for the production of ornamental stones. In these selected areas, the unexpected geological risks are reduced and it is possible to obtain higher exploitation rates, with adequate block sizes, improving companies competitiveness. Despite the large known reserves of dimension stones in Portugal, the recent environmental tendency forced the developing of new exploitation methods. For example, in marble exploitation, underground mining methods are being studied and started to be used, in order to increase the reserves and maintain common production levels activity.
Marble quarries in Portugal:

Marbles are mainly produced in the Estremoz-Borba-Vila Viçosa anticline and represent approximately 55% of the total production of dimension stones. The pink type, named "Rosa Puro", is the most valued one. Other areas, such as Viana do Alentejo, Trigaches and Ficalho, although small, produce very beautiful ornamental stones with a variety of colours ranging from greenish and greyish to black and white. In the anticline, at Borba, there is a specialized technological center (CEVALOR) for studying, evaluating and promoting dimension stones.

Accompanying person from the Organizing Committee:

N. Grossmann (LNEC)

Technical Visit 5: Multipurpose Alqueva Project

Duration: 1 day

Cost: EUR 20

(Departure from Lisbon – 07:00h, arrival in Lisbon – 20:00h)

Morning: visit to the Pedrógão dam and global irrigation system
Lunch: in a restaurant (not included)
Afternoon: visit to the Alqueva dam and global irrigation system

Company:
EDIA is a company whose capital is exclusively public and its target is designing, executing, building and operating the Multipurpose Alqueva Project, as well as promoting the economy and social development of its intervention area, which covers 19 municipalities in Alentejo (province of Portugal).
A Business Project:

According to the company strategic orientation, EDIA has defined as top priorities several business areas: Water – the main component of the project; Renewable energies – different origins; Tourism – activity increased by the project; Environment – preservation, management and requalification; Agriculture – irrigation network; Innovation and technology – supporting tools for conceiving and developing of strategies and projects.

Alqueva Dam and Reservoir:

The Alqueva dam is part of the Alqueva dam infrastructure, located on the river Guadiana. It forms a reservoir with a huge storage capacity, and features the following:

- 96m in height
- 83km long reservoir
- 3 150hm3 useable capacity
- 250km2 in area

Power Station:

The Alqueva dam is the only large hydro power plant in southern Portugal, located on the Guadiana river. It is equipped with two reversible pump-turbine/generator sets, with a unit power of about 130MW each.
The reversible pump-turbine/generators transform the potential energy of the water in the reservoir into electric energy, and also allow the pumping of the water from the Pedrógão reservoir to the large Alqueva reservoir, making it possible to store the energy in off-peak or extra-low load hours.

**Pedrógão Dam and Power Station:**

The Pedrógão dam is also on the Guadiana River, 23km downstream of the Alqueva dam. This dam makes the turbine-pump operations possible, to direct the flows from the Alqueva reservoir to the Pedrógão reservoir and then back again to Alqueva.

The Pedrógão dam and its reservoir have the following features:

- Gravity dam made of conventional concrete and RCC (Roller Compacted Concrete)
- 43m in height
- 54hm³ useable capacity
- Fish ladder

The Pedrógão dam incorporates a small hydroelectric power station, with two 5MW generators. The Pedrógão station could see its installed capacity increased, should be economically viable, and two hydraulic circuits have been built into the body of the dam, one in the right bank and other in the left bank. These could be used to pump the water to the Ardila and Pedrógão subsystems, or to produce electricity.

**Accompanying person from the Organizing Committee:**

A. Tavares de Castro (LNEC)

**Technical Visit 6: Rossio Tunel**

**Duration:** 1/2 day (morning)

**Cost:** EUR 10

The Rossio Railway Tunnel, inaugurated in 1889, is 2,613 m long, has 2 tracks and is one of the main accesses to the Lisbon centre. Due to the deterioration of the brick masonry lining in some zones, which was associated with a decrease in the safety levels in the tunnel, it was decided to close the tunnel temporarily in order to rehabilitate it. The local conditions are difficult in some zones, especially due to the very low overburden under an old part of the city.

In approximately half of the tunnel length it was decided to demolish the old masonry lining and to replace it by a reinforced concrete support, with an increase in the clearance. A reinforced concrete invert was designed for the total length of the tunnel. Safety conditions were also improved by the provision of an evacuation gallery and a shaft with access to the surface in the middle part of the tunnel.

At the time of the visit demolition of the masonry lining and installation of the new preliminary support is expected to be at its final stages. The final support will be under construction.

**Accompany person from the Organizing Committee:**

Luís Lamas (LNEC)
SOCIAL EVENTS

Welcome Reception
Date: Monday, July 9
Time: 19.30
Venue: Gare Marítima de Alcântara
Sala Almada Negreiros
Price: Included in the registration fee for delegates and accompanying persons

Banquet
Date: Wednesday, July 11
Time: 20.30
Venue: Tapada da Ajuda Pavillon
Calçada da Tapada, Tapada da Ajuda, 1349-017 Lisboa
Price: EUR 50

Tour Desk
At the Congress Centre CCL you will find a “tour de sk” from TopAtlântico the official travel agency for ISRM where you can reserve the following tours:

Lisbon Tour
An authentic taste of Lisbon in only a few hours… Drive through one of the main Avenue of the city, till Rossio square – heart of the city. Continuing for a little walk in Alfama, the oldest and the most picturesque quarter of the city, with a stop for wine tasting in a handicraft shop. Proceeding along the riverside to enjoy Praça do Comercio – ex libris of Lisbon and one of the Tagus Bridges (cross if possible), till Belem quarter, dedicated to the discoveries. Then, a unique opportunity to visit the church of Jerónimos, masterpiece of the Manuelin style and the coach Museum, who exhibits the world largest collection. Finally, a panoramic view of Belem tower and the Monument of the discoveries, built to celebrate the 500 years of death of D.Henrique, “the navigator”. Free time to lunch.

Departure 09.00 / 14.30 Price : EUR 33 - Half Day

Fátima (Full day)
Óbidos / Alcobaça / Nazaré / Batalha / Fátima
Leaving Lisbon, we drive northwards and arrive at our first point of visit: the beautiful walled town of Óbidos with its narrowed streets and the Pousada do Castelo. We then drive to Alcobaça where we can visit the 12th century Church of the Monastery with the tombs of Pedro and Inês de Castro. We drive to Nazaré - The most colourful Portuguese fishing village, where we are going to have lunch. If possible we go to the Sitio to have a panoramic view of the beach and village. In the afternoon, we go to Batalha Monastery, a masterpiece of Gothic considered a heritage of humanity by UNESCO. Finally we arrive at the Fátima’s Sanctuary, center of Christian faith and a local of world pilgrimage, to visit the Basilica where the tombstones of Lucia, Jacinta and Francisco are, as well as the Chapel of Apparitions, heart of the shrine. Eventually, we will have time to attend to the mass. At the end of the day we will return to Lisbon through the colourful farming region.

Departure 09.00 Price - with lunch EUR 84 - Full Day

Sintra Deluxe
We leave in direction of the majestic and romantic Pena Palace** (except on Mondays, substituted for Queluz Palace) situated in one of the highest peaks of Sintra mountain range. It possesses a mixture of styles that gives an incomparable aspect to it. We visit Sintra where we stop to lunch. Free time to take a walk in the streets of the village to appreciate the several antiques and handicraft shops, restaurants and tea-rooms to taste the so well delicious tarts known as “queijadas”. We leave to Colares*, region demarcated and recognized for its table wines, following until Cabo da Roca, the most western point in continental Europe, passing for the beach of Guincho until Boca do Inferno always sea viewing enjoying the landscape until Cascais where we take a glimpse of the fishing port. We return to Lisbon by Estoril Coast where we can have a panoramic view of the Casino and its gardens.

Departure 09.00 Price: with lunch EUR 79 - All day
Sintra/Cabo da Roca/Cascais/Estoril

We departure on an unforgettable afternoon discovering the "Coast of the Sun" and it’s beaches. **Estoril**, a cosmopolitan village between Lisbon and Cascais attracting with its mild climate and several activities that have to offer such as golf, casino, horse racing and motoring as well as for its beautiful beaches of fine sand. We follow to Cascais and its colourful bay, a fishing village and at the same time a ranch of summinger, an illustrated postcard combining the sun and a sea that extends until Guincho losing itself in the dunes. We pass through Boca do Inferno – a picturesque cliff formed by the erosion of the sea. Stop at *Cabo da Roca* (of 1 April the 31 October) - the westernmost point of Europe to admire the beautiful landscape. We continue to Sintra and its Mountains with its luxuriant vegetation framing our tour. We visit the charming Village Palace (visit, except on Wednesdays- visit of Palace of Queluz) in Moorish style with its conic chimneys and manueline style windows as well as its tile panels, reinforcing the interest for its interior.

**Departure** 14.30  **Price**: EUR 54 - Half Day

Arrábida / Sesimbra

We cross the Bridge over the Tagus river to admire the magnificent view of Lisbon. We drive to Sesimbra’s Castle for a panoramic sight of this fishing centre. We then leave to Azeitão, agricultural village recognized for its baroque and beautiful fountains and farms. We visit a famous wine cellar to sample the local moscatel wine, and also a handicraft centre to admire its “tiles” (hand made glazed tiles) as we continue to Arrábida Mountain - a unique natural park created with the purpose to preserve the natural elements liked the local fauna and flora, coves with its beaches of limpid water, and the architectural legacy, as for example the Convent of Arrábida. Panoramic sight of Setúbal and Troia. Stop at Pousada do Castelo in Palmela. Finally we return to Lisbon by the extensive Vasco da Gama Bridge.

**Departure** 14.30 – **Price**: EUR 54 (Monday to Friday) - Half Day

Évora

The Roman City

We drive south, through the widest cork region in the whole world for an exiting journey into the past. As we arrive at Alentejo’s capital, we visit the old ruins of the Roman Temple, the Romanesque Gothic Cathedral with its massive towers from the 16TH century, the Bones Chapel and the University that occupies the former building of the Jesuit University. A walk along its nice “white streets” will help you appreciate the typical sights of this city, formerly city of kings, artists and humanists, which with the “help” of Geraldo Sempavor was considered World Heritage (lunch included). Driving back to Lisbon we pass through Setúbal, famous fishing centre.

**Departure** 09.00  **Price**: EUR 79.50  (Tuesday and Saturday) - Full Day
Workshop W2 – Volcanic Rocks

Days: July 14, 15

Organization
The workshop is organized by LREC (Regional Laboratory of Civil Engineering) in conjunction with SPG (Portuguese Geotechnical Society) and Azores University.

Organizing Committee
Ana Malheiro, Portugal (President)
Isabel Dias, Portugal
João Carlos Nunes, Portugal
Maria de Jesus Gonçalves, Portugal
Roberto Dutra, Portugal
Rui Santos, Portugal

Scientific Committee
Alcibiades Serrano, Spain
Áurea Perucho, Spain
Cláudio Olalla, Spain
Fernando Vieira, Portugal
João Carlos Nunes, Portugal
Luís Ribeiro e Sousa, Portugal
Luiz Hernandez, Spain
Luiz Vallejo, Spain
Tetsuya Suzuki, Japan
Vladimir Nikolayevich Zhukov, Russia
Zilda França, Portugal

Objectives
This Workshop will provide an excellent opportunity to improve data on geotechnical characterization of volcanic rocks formations, namely about the use of geomechanical empirical systems, and to shorten distances between rock mechanics researchers and engineers that are involved with its practical application.

The Workshop will also offer a good opportunity for the presentation and discussion on several actual issues related with volcanic rocks problems. It also intends to be the meeting place of people with different professional practices and backgrounds – namely consultants and researchers – but having in common the same interest in volcanic rocks. A further objective is the emergence of new solutions and new approaches to the problems. A significant exchange of experiences among the participants is therefore expected.

We hope that the presentations and discussions held during the Workshop will contribute to achieve these broad objectives.

Date and Place
The International Workshop on Volcanic Rocks will be held from 14th to 15th July, at Laboratório Regional de Engenharia Civil, Rua de S. Gonçalo, s/nº, Ponta Delgada:

Language
The official language of the workshop is English.
Topics
1. Characterization of Volcanic Formations
2. Case Studies
3. Construction Materials
4. Earthquake Engineering and Rock Dynamics
5. Foundations
6. Slope Stability
7. Tunneling

Keynote Lectures
- Contemporary views of slope instability on active volcanoes
  D. Elsworth, B. Voight & J. Taron (USA)
- Volcanism and volcanic products in Azores
  João Luís Gaspar, Gabriela Queirós & Teresa Ferreira (Portugal)

General Reporter
Paul Marinos (Greece)

General Programme
- July, 13rd – Fly to Ponta Delgada, Azores
- July, 14th – Workshop oral/poster presentations
- July, 15th – Technical visit
- July, 16th – Travel to Lisbon or to other islands

Scientific Programme (July, 14th)

<table>
<thead>
<tr>
<th>Hours</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00 - 09:30</td>
<td>Registration, at LREC Auditorium</td>
</tr>
<tr>
<td>09:30 - 10:30</td>
<td>Opening Session and Keynote Lecture “Contemporary views of slope instability on active volcanoes”, by Derek Elsworth (USA)</td>
</tr>
<tr>
<td>10:30 - 10:45</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>10:45 - 11:30</td>
<td>Workshop W2 General Reporter, Paul Marinos (Greece)</td>
</tr>
<tr>
<td>11:30 - 11:45</td>
<td>Volcanostratigraphic profiles for the Azores region: a contribution for the EC 8 Regulations and the characterization of volcanic rocks geomechanical behaviour A.M. Malheiro &amp; J.C. Nunes</td>
</tr>
<tr>
<td>11:45 - 12:00</td>
<td>The volcanic rocks of the Canary Islands. Geotechnical properties J.A. Rodríguez-Losada, L.E. Hernández-Gutiérrez, C. Olalla, A. Peruchó, A. Serrano &amp; R. del Potro</td>
</tr>
<tr>
<td>12:00 - 12:15</td>
<td>Geotechnical features of the welded ignimbrites of the Canary Islands J.A. Rodríguez-Losada, L.E. Hernández-Gutiérrez &amp; A.L. Mora-Figueroa</td>
</tr>
<tr>
<td>12:30 - 12:45</td>
<td>Strength and deformability of low density pyroclasts A. Serrano, C. Olalla, A. Peruchó &amp; L. Hernández-Gutiérrez</td>
</tr>
<tr>
<td>12:45 - 13:00</td>
<td>The Jameos del Agua cave (Lanzarote, Canary Islands): some morphological and geological features and the stability state over the auditorium by accurate geomechanical site investigations F.L.J. Carmona, S. Signorelli, M.L.P. Cabrera, S. Zafrrilla &amp; A.C. Carrillo</td>
</tr>
</tbody>
</table>
13:00 - 14:30  Lunch, at Azores University

14:30 - 15:15  **Keynote Lecture “Geological hazards at the Azores Region”, by João Luis Gaspar (Portugal)**

15:15 - 15:30  Innovative underground works at Socorridos, Madeira Island, Portugal  
*P. Cafofo & L.R. Sousa*

15:30 - 15:45  Shallow foundations on collapsible rocks  
*A. Serrano, C. Olalla & A. Perucho*

15:45 - 16:00  Foundation of the “Los Tilos” arch bridge in La Palma Island  
*D. Simic*

16:00 - 16:15  Collapse of welded tuff caused by groundwater flow  
*T. Suzuki*

16:15 - 16:30  Rock failures in volcanic rock area in Hokkaido  
*Y. Ito, K. Agui, Y. Kusakabe & T. Sakamoto*

16:30 - 16:45  Debris slope stability analysis in an active volcano area  
*T. Apuani, M. Masetti & A. Utini*

16:45 - 17:00  Preliminary analysis of instability phenomena at Vulcano Island, Italy  
*P. Tommasi, A. Graziani, T. Rotonda & C. Bevivino*

17:00 - 17:15  Coffee Break

17:15 - 17:30  Slope stability on volcanic rocks - the case study of the cut slopes of the Funchal Airport  
*F.T. Jeremias & J. Muralha*

17:30 - 17:45  Stabilization of landslides in the Lisbon Volcanic Complex  
*A. Pinto, D. Cardoso & H. Lopes*

17:45 - 18:00  Strength of volcanic rock masses in edifice instability: insights from Teide, Tenerife  
*R. del Potro & M. Härlimann*

18:00 - 18:15  Volcanic mega-landslides in Tenerife (Canary Islands, Spain)  

18:15 - 18:30  Numerical simulation of tunnel construction in volcanic rocks  
*G. Beer & C. Duenser*

18:30 - 18:45  Road tunnels at Madeira Island, Portugal  
*F. Moura & L.R. Sousa*

18:45 - 19:00  Effects of volcanic seismic events on the Stromboli stability by finite difference numerical modeling  
*T. Apuani, A. Merri & M. Masetti*

19:00 - 19:30  **Closing Session**

**Poster Session**
Posters: Portrait format; 0.8m x 1.2m maximum size

**Technical Visit (July, 15th)**
9:00* – Bus departure (to pick up the participants in their hotels)
9:15 – Visit to Carvão lava cave (Ponta Delgada)
11:45 – Departure from Ponta Delgada marina towards Ribeira Quente village (sea trip)
13:15 – Bus at Ribeira Quente harbour
13:30 – Furnas lake fumarolic field (view of the cook procedures regarding the “Cozido das Furnas” that will be served at lunch).
14:00-16:00 – Lunch at Terra Nostra Hotel: typical dish “Cozido das Furnas”.
Optional visit to the Terra Nostra garden.
16:00 – Departure from Furnas
16:00-18:00 – Return to Ponta Delgada, with some technical stops.

* 1st Group: 9.15 – 10.00 (bus – 9.00)
  2nd Group: 10.00 – 10.45 (bus - 9.45)
  3rd Group: 10.45 – 11.30 (bus - 10.30)

Accompanying person’s fee admission to the technical visit is EUR 90,00.

Travel and Accommodation
The Organizing Committee suggests the travel agency PANAZORICA for booking the airplane tickets and, if necessary, accommodation and other traveling issues.
Ponta Delgada offers several hotels of different classes and locations. Workshop participants are recommended to make their hotel reservation, as well as the airplane ticket reservation, in due time, since July is a vacations month and a period of higher hotels reservations rates.
We suggest the following hotels:
- Vip Executive Azores **** ([www.viphotels.com](http://www.viphotels.com))
- Hotel Marina Atlântico **** ([www.bensaude.pt](http://www.bensaude.pt))
- Holiday Inn Azores **** ([www.holidayinnazores.com](http://www.holidayinnazores.com))
- Hotel do Colégio **** ([www.hoteldocolegio.com](http://www.hoteldocolegio.com))
- Royal Garden Hotel **** ([www.investacor.com](http://www.investacor.com))
- Hotel Avenida **** ([www.bensaude.pt](http://www.bensaude.pt))
- Hotel Canadiano *** ([http://www.hoteisplatano.com](http://www.hoteisplatano.com))
- São Miguel Park Hotel *** ([www.bensaude.pt](http://www.bensaude.pt))
- Vila Nova Hotel ([http://www.hoteisplatano.com](http://www.hoteisplatano.com))
- Hotel Ponta Delgada *** ([www.hotelpdl.com](http://www.hotelpdl.com))

The travel agency can also help you to choose an optional program after the workshop, including a visit to others Azorean islands, if you want.

PANAZORICA - AGENCIA DE VIAGENS
Incoming Department
Congress, Incentives
SPECIAL EVENTS
Tel: + 351 296 301 722
FAX: + 351 296 301 729
josecogumbreiro@panazorica.pt

Contacts
Secretariat Workshop W2
Laboratório Regional de Engenharia Civil
Maria de Jesus Gonçalves
FRIDAY, JULY 13

Workshop W3 - Preservation of Natural Stone and Rock Weathering

ORGANIZING COMMITTEE
Pedro Sola, Chairman (Spain)
José Estaire, Co-chairman (Spain)
Rafael Montejo (Spain)
Juan A. Díez (Spain)
Claudio Olalla (Spain)

SCIENTIFIC COMMITTEE
Andrés Carbó (Spain)
Chikaosa Tanimoto (Japan)
Francisco Jurado (Spain)
José Delgado Rod.(Portugal)
Luis González Vallejo (Spain)
José Mª. García-Miguell (Spain)
José Mª. Rodríguez Ortiz (Spain)
José Muralha (Portugal)
Jose Vieira de Lemos (Portugal)
Luigi Binda (Italy)
Mª Ángeles García del Cura (Spain)
Manuel Romana (Spain)
Paulo Lourenço (Portugal)
Pilar Luxán (Spain)
Rosa Esbert (Spain)
Yossef Hatzor (Israel)

ORGANIZATION
This Workshop has been organised by the Spanish Society for Rock Mechanics (the ISRM National Group) with the collaboration of CEDEX (the Spanish Official Civil Engineering Research Institution) in the frame of the 11th Congress of ISRM).

LANGUAGE
The official language of the Workshop is English.

KEYNOTE LECTURES
• Bulk and surface properties in stone conservation
  J. Delgado Rodrigues (Portugal)
• Interventions in foundations, applicable techniques and pathology
  J. Mª Rodríguez Ortiz (Spain)

TECHNICAL PAPERS
SESSION 1
Topics:
• Processes of rock degradation
• Stone conservation. Treatments
• Compatible material for restoration
• Preservation. Risk assessment
• In situ and laboratory testing. Monitoring
• Influence of measuring conditions on roughness parameters of ornamental rocks F. J. Alonso, P. Vázquez, R.M. Esbert & J. Ordaz
• Natural and artificial micro-craking in limestones: a model of response to freezing-thawing M. Bost & J.S. Guedon Dubied
• Digital image processing techniques as a tool for evaluating and mapping patinas on granite monuments R. Bustamante & N. Prendes
• Water-rock interaction and its effect on the weathering of Yungang grottoes J.Z. Huang
• Latvian dolomite – stone in art and architecture S. Kondratjeva
• Weathering and consolidation of grottoes along the Silk Road of China Z.X. Li
• Bowing of marble slabs: an integrated measurement system to monitor and predict the façade weathering P. Marini, R. Bellopede, C. de Regibus & L. Manfredotti
• Monitoring of water absorption in sedimentary rocks by X-ray computer tomography A. Rodríguez-Rey, V.G. Ruiz de Argandoña, L.M. Suárez del Río, L. Calleja, C. Celorio & J. Descheirder
• Characteristics and morphology of weathering crusts on porous limestone, the role of climate and air pollution A. Török
• Some aspects of degradability of argillaceous rocks M.C. Torres-Suárez & A. Alarcón-Guzmán
• Analysis of weathering and internal texture on the engineering properties of granites G. Vasconcelos, P.B. Lourenço, C.S.A. Alves & J. Pamplona
• Geological environment and engineering characteristics of Jiaohé C. Wenwu, H. Wenfeng, Z. Jingke & S. Manli

SESSION 2

Topics:
• Rock mechanics studies for monuments. Modelling
• Foundation problems
• Rock slope problems at protected sites
• Case histories

• Characterization and conservation of vesicular basalt materials of bronze age Nuraghi (Sardinia) C. Atenzi, G. Pia, U. Sanna & N. Spanu
• Volcanic rocks (middle and early Miocene) in Sardinian bronze age constructions C. Atenzi, G. Pia, U. Sanna & N. Spanu
• Application of different techniques for the construction of basement levels in singular buildings M.A. de Juan García
• Reinforcement of the Puente de Toledo and Puente de Segovia bridges during the works on the M-30 motorway, Madrid F. de la Guardia Escardó
• The crossing of the Canal Imperial de Aragón with the Ronda de la Hispanidad in Zaragoza J. García-Mezquita
• Reinforcement of the foundations of the west wing of the Barcelona Clinic Hospital J. García-Mina
• The restoration of San Pedro cliff at the Alhambra, an example of the preservation of historic sites J.L. justo, J. Saura, P. Durand, A. Morales, J.M. Azañón & D. Castro
• Mechanical analysis of weakness planes and durability of cladding stone used in monuments and singular buildings A.M. López-Buendía, J.M. Cuevas, F. Mateos & M. Montoto
• Rock mechanics tests in the church of the Serra do Pilar monastery J. Muralla
• Excavation of a building located in the historical old town of Valladolid L. Prieto
• Geological patterns in the collapse of certain rock sanctuaries of Spain C. Sáenz
• Consolidation treatment for the Roman Bridge in Córdoba J. Santos
• Stabilization and consolidation of Mogao Grottoes in China X.D Wang, H.Y. Zhang & M.Q. Zhang

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WORKSHOP PROGRAMME (12TH – 15TH JULY)

<table>
<thead>
<tr>
<th>Day</th>
<th>Timetable</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday</td>
<td>12-July</td>
<td>19:00  Bus departure from Lisbon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23:00  Arrival at Mérida (Spain)</td>
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<tr>
<td>Friday</td>
<td>13-July</td>
<td>9:00 - 11:30  Visit to Roman Theatre and Museum (Mérida)</td>
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<td>11:30 - 12:30  Trip from Mérida to Trujillo</td>
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<td></td>
<td></td>
<td>13:00 - 14:00  Technical Session: Restoration of monuments (F. Jurado (Spain))</td>
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<tr>
<td></td>
<td></td>
<td>14:30 - 16:00  Lunch</td>
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<tr>
<td></td>
<td></td>
<td>16:00 - 18:00  Visit to Trujillo bus departure from Trujillo</td>
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<tr>
<td></td>
<td></td>
<td>20:00  Arrival at Madrid</td>
</tr>
<tr>
<td>Saturday</td>
<td>14-July</td>
<td>8:30 - 9:00  Registration</td>
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<tr>
<td></td>
<td></td>
<td>9:00 - 14:00  Technical Session</td>
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<tr>
<td></td>
<td></td>
<td>14:00 - 15:30  Lunch</td>
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<td></td>
<td></td>
<td>Afternoon  Visit to Madrid (free)</td>
</tr>
<tr>
<td>Sunday</td>
<td>15-July</td>
<td>8:30  Bus departure to Segovia (optional)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10:00  Visit to Segovia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13:30  Lunch</td>
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<tr>
<td></td>
<td></td>
<td>15:30  Bus departure to Madrid</td>
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<tr>
<td></td>
<td></td>
<td>17:30  Arrival at Madrid (Metro station Nuevos Ministerios - Aeropuerto)</td>
</tr>
</tbody>
</table>

N.B.: Trujillo is a town situated 100 km away from Mérida

TECHNICAL SESSION PROGRAMME (14TH JULY)

<table>
<thead>
<tr>
<th>Timetable</th>
<th>Activity</th>
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<tbody>
<tr>
<td>8:30 - 9:00</td>
<td>Registration and collecting of books</td>
</tr>
<tr>
<td>9:00 - 9:15</td>
<td>Inauguration</td>
</tr>
<tr>
<td>9:15 - 9:45</td>
<td>Key Note Lecture I</td>
</tr>
<tr>
<td></td>
<td>J. Delgado Rodrigues</td>
</tr>
<tr>
<td>9:45 - 11:00</td>
<td>Workshop presentations (Session I)</td>
</tr>
<tr>
<td>11:00 - 11:30</td>
<td>Coffee break</td>
</tr>
<tr>
<td>11:30 - 12:00</td>
<td>Key Note Lecture II</td>
</tr>
<tr>
<td></td>
<td>José M. Rodríguez Ortiz</td>
</tr>
<tr>
<td>12:00 - 13:30</td>
<td>Workshop presentations (Session I)</td>
</tr>
<tr>
<td>13:30 - 13:45</td>
<td>Round table and questions</td>
</tr>
<tr>
<td>13:45 - 14:00</td>
<td>Closure</td>
</tr>
<tr>
<td>14:00 - 15:30</td>
<td>Lunch</td>
</tr>
</tbody>
</table>

DATE AND PLACE

Workshop trip
The Workshop trip begins in Lisbon, after the closure of the International Congress, visits Mérida and Trujillo and finishes in Madrid. In the following map, those cities can be seen.
Technical Session
The Technical Session of the Workshop will be held on the 14th of July 2007 at CEDEX Conference Room in Madrid (Spain), in c/ Alfonso XII 3, Madrid. Map: CEDEX location

CONTACTS
TILESA OPC
Londres, 17 - 28028 Madrid. Spain
Tel. +34 91 361 2600 - Fax: +34 91 355 9208
email: isrm2007w3@tilesa.es

SOCIEDAD ESPAÑOLA DE MECÁNICA DE ROCAS
Laboratorio de Geotecnia (CEDEX)
C/. Alfonso XII, 3
28014 Madrid (Spain)
Tel.: +34 91 335 73 24 / 51
Fax.: + 34 91 335 73 22
E-mail: semr@cedex.es
More information:
www.isrm2007w3.tilesa.es
www.semr.es

REGISTRATION AND ACCOMODATION FORM
Registration can be made on line (www.isrm2007w3.tilesa.es)
NAER – Novo Aeroporto, SA, has been responsible for the preparatory work leading up to an international tender to build a new Lisbon airport since the year 1998. According to the publication of the Government decision of February 2007 (RCM n.º 20/2007), the tender will also include the privatization of ANA – Aeroportos de Portugal, SA.

The new airport’s capacity will be 23 million passengers per annum, at opening day in 2017, with the possibility of expanding up to 50 million passengers in 2050.

Expansion of the current Lisbon airport

The current airport infrastructure will be expanded to meet the expected rise in demand over the next few years until the new airport is ready.

Therefore, between 2006 and 2011 capacity will be raised from 15 to 17 million passengers per annum. The current passenger terminal will be expanded, a new one will be built, aircraft parking positions increased and a new cargo terminal will also be built.

Besides using runway capacity to its fullest potential, the airport’s ability to process passengers, cargo and luggage will rise. Service quality will also improve through better ground access, circulation within the terminal, centralized security, more retail areas and greater comfort.

Institutional Sponsors

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Coffee Break Sponsor

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Aud. II – 400 Pax
Aud. III – 125 Pax
Aud. IV – 125 Pax
Aud. III+IV – 250 Pax
Aud. V – 400 Pax
Aud. VI – 400 Pax
Aud. VII – 300 Pax
Aud. VI+VII – 700 Pax
Aud. VIII – 400 Pax
Map of Lisbon