Second International Dam World Conference

PORTUGAL • LISBON • LNEC
April 21-24, 2015

Programme
Organized by

LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

IBRACON

Instituto Brasileiro de Concreto

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Welcome message

Welcome to the second edition of the International DAM WORLD Conference.

This is the second international conference of the series to be convened by the National Laboratory for Civil Engineering (LNEC) and IBRACON - Brazilian Institute for Concrete - after the first one that took place in Maceió, Brazil, in 2012.

Demand for water and energy is steadily increasing throughout the world. In many regions, water and energy availability is critical to any further development above the present unsatisfactorily low level, and even to the mere survival of existing communities or to meet the continuously growing demand originated from the rapid increase of their population and from their quality of life expectations. In these regions we cannot disclaim the contribution to be made by dams and reservoirs.

The aim of Dam World Conference series is to bring together dam experts from all over the world concerned with the scientific and practical challenges of dam engineering. About 40 countries were represented in the Conference. A total of 116 abstracts were submitted and 94 papers were accepted by the Scientific Committee for publication and presentation. The authors come from a variety of backgrounds and the papers cover a wide range of topics related to dam engineering. The interest and the participation on this conference show the renewed importance of dams all over the world, highlighting its contribution to a global sustainable development.

The Proceedings are published in two volumes, the complete papers in digital support, and a book abstracts. The Conference Organisation members would like to acknowledge their appreciation to the authors of these papers for their effort in submitting and preparing their contributions, specially for their willingness to share their research accomplishments. We would like also to express our sincere gratitude to the members of the Scientific Committee who carefully reviewed the papers included in the Proceedings.

Carlos Pina, Conference Chair
General Information

Venue
The Conference will be held at:
Laboratório Nacional de Engenharia Civil (LNEC)
Av. do Brasil 101, 1700-066 Lisboa, Portugal
Tel: +351 21 844 33 61
Fax: +351 21 844 30 26
http://www.lnec.pt
LNEC is located near the city center and close to Lisbon Airport.

Language
English is the official language of the Conference.

Session recording
All sessions held in the Auditorium will be recorded.

Internet
Free access to LNEC's wireless network in the congress center area (select: guest_lnec).

Car park
Car park is available at LNEC Campus to all participants during all Conference events.

Coffee breaks
During the session breaks, drinks are going to be served in the Congress Hall.

Lunch
Lunches will be served near LNEC's Congress Centre, in Cuama Pavilion.

Transportation
Buses will be available to the Conference Banquet and to the Technical Visit.

Mobile phones
It’s forbidden the use of mobile phones in the rooms of the Conference.

Delegates identification
Delegates must use the identification tags during all events of the Conference.

Taxis
Retális: 21 811 90 00
Autocoope: 21 793 27 56
Rádio Táxis: 21 936 21 13
Teletáxis: 21 811 11 00

BUS
731, 783, 744, 717

Subway
Alvalade (700m)

Exhibitors
1 EDP
2 CARPI TECH B.V.
3 AQUALOGUS - ENGENHARIA E AMBIENTE, LDA.
4 GSE Lining Technology GmbH
5 CIMPOR
6 WORTHINGTON PRODUCTS, INC.
7 Geokon, Inc./CÊGÊ
8 JEENE
9 COBA
10 TECANGOL
Conference Themes

Main Themes
T1 - Concrete and Masonry Dams
T2 - Embankment Dams
T3 - Appurtenant Works
T4 - Tailing Dams
T5 - Environmental Issues
T6 - Finance and Economic Aspects
T7 - Regulation

Topics
ST1 - Roller Compacted Concrete Dams
ST2 - Concrete Face Rockfill Dams
ST3 - Methods of Analysis and Design of Dams
ST4 - Dam Foundation
ST5 - Seismic Analysis
ST6 - Stability of Dams and Slopes
ST7 - Dam Monitoring and Instrumentation
ST8 - Safety Assessment
ST9 - Operation and Maintenance
ST10 - Rehabilitation and Dam Heightening
ST11 - Concrete Swelling Processes
ST12 - Risk Assessment
ST13 - Warning Systems
ST14 - Geomembranes for dams
ST15 - Dam Management Systems
ST16 - Design Innovation
ST17 - Modelling and Testing
ST18 - New Materials for Dams
ST19 - Small Dams
ST20 - Joint / Interface Problems at Concrete Dams
ST21 - Sedimentation in Reservoirs and Related Problems
ST22 - Decommissioning of Dams
Opening Ceremony | Auditorium - 21 April, 09h00
Plenary Session | Auditorium - 21 April, 09h30
Forum on Dam Safety

Chair Satoru Ueda | Co-chair Laura Caldeira

KEYNOTE
Satoru Ueda | USA
DEVELOPMENT AND ENHANCEMENT OF DAM SAFETY FRAMEWORK

José Rocha Afonso, J. O. Pedro and Laura Caldeira | Portugal
REVISION OF THE PORTUGUESE DAM SAFETY REGULATIONS

Carlos Motta Nunes and Josimar A. Oliveira | Brazil
5 YEARS OF IMPLEMENTATION OF THE BRAZILIAN DAM SAFETY ACT: A CRITICAL REVIEW

Jessica T. Castillo-Rodríguez, Adrián Morales-Torres and Ignacio Escuder-Bueno | Spain
A RISK-INFORMED JOURNEY TOWARDS IMPROVED DAM SAFETY GOVERNANCE IN SPAIN

Parallel Session 1 | Auditorium - 21 April, 11h30
Open Forum Discussion on Dam Safety
Chair Carlos Motta Nunes | Co-chair Eliane Portela

António Pinheiro, José Mora Ramos, Laura Caldeira, António Lopes Batista, Eduardo Jossefa and Ângelo Boavida | Portugal / Mozambique
PROPOSAL FOR THE DAM SAFETY REGULATION OF MOZAMBIQUE

Vitor Camilo, Alberto Rodrigues da Silva, Raúl Pereira da Costa, José Barateiro, Eliane Portela and João Fonseca | Angola / Portugal
TOWARDS A DAMS SAFETY MANAGEMENT SYSTEM FOR ANGOLA

Eliane Portela, José Barateiro, Lígia Araujo, André Onzi, Nuno Charneca, Alexandre Anderãos, Fernanda Aquino, Alexis Massenet and Paula Freitas | Portugal / Brazil
THE BRAZILIAN NATIONAL DAM SAFETY INFORMATION SYSTEM (SNISB)

Sergio Salgado, Marcus Oliveira, Eduardo Passeto, Nadia Menegaz, Helber Viana, Josimar Oliveira and Flávia Barros | Brazil
IMPACT OF SMALL DAMS IN BRAZIL IN COMPLIANCE WITH THE RESOLUTIONS OF DAM SAFETY PUBLISHED BY THE BRAZILIAN NATIONAL WATER AGENCY (ANA)

Round Table
Chair Erwin De Nys
Participants: Satoru Ueda (USA), José Rocha Afonso (Portugal), Carlos Motta Nunes (Brasil) e Jessica Castillo (Español), Manuel Quintino (Angola)

Parallel Session 2 | Small Auditorium - 21 April, 11h30
Special Session on Concrete Face Rockfill Dams I
Chair Manoel Sousa Freitas | Co-chair João Marcelino

KEYNOTE
Bayardo Materón  
**EVOLUTION OF ZONING FOR THE CONCRETE FACE ROCKFILL DAMS (CFRD’S RELATED TO THE EXISTANCE OF LOCAL MATERIALS)**

Chair Bayardo Materón | Co-chair Ricardo Santos

Hans-Martin Leitner, Markus Verdianz and Ilhan Bora  
**DESIGN AND CONSTRUCTION OF KAVSAK BENDI CFRD**

R. K. Gupta, R. K. Agrawal and Jagannivas  
**STUNG TASAL DAM PROJECT, COMBODIA CONCRETE FACED ROCK FILL DAM WITH BITUMEN SHEET IN EXPOSE CONDITION AS WATER BARRIERS IN FACE SLAB JOINTS**

Belkacem Moussai  
**NUMERICAL PREDICTION OF THE FACE SLAB DEFORMATION OF A CONCRETE FACE ROCKFILL DAM**

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**Plenary Session**  
Auditorium - 21 April, 14h00

Chair Carlos Henrique Medeiros | Co-chair Laura Caldeira

**KEYNOTE**

Vahid Afsari-Rad  
**ASPHALT CONCRETE CORES FOR EMBANKMENT DAMS (ACED)**

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**Parallel Session 3**  
Auditorium - 21 April, 14h30

**Concrete Dams I**

Chair Domingos Silva Matos | Co-chair António Lopes Batista

**KEYNOTE**

Francisco Ortega  
**IMMERSION VIBRATED RCC. CLOSING THE LOOP BETWEEN CONVENTIONAL AND ROLLER-COMPACTED CONCRETE DAMS**

Chair Francisco Ortega | Co-chair José Piteira Gomes

Marco Neves, Jorge Sousa Cruz and António Sobral Rodrigues  
**CHAFOU HARDFILL DAM: A NEW CONCEPT FOR RCC**

Esperanza Menéndez, Ricardo García-Rovés and Nicanor Prendes  
**DAMAGE ASSESSMENT OF DAMS AFFECTED EXPANSIVE REACTIONS USING STEREOMICROSCOPY AND ELECTRON MICROSCOPY. RELATIONSHIP BETWEEN THE DAMAGE LEVELS DRI AND DL**

Dora Soares, António Santos Silva, José Mirão, Violeta Ramos, Isabel Fernandes and Esperanza Menéndez  
**ASSESSMENT OF ALKALIS RELEASED BY AGGREGATES. CONTRIBUTION TO THE ALKALINITY INCREASE AND AAR DEVELOPMENT IN CONCRETE**

António Santos Silva, Dora Soares, Isabel Fernandes, Violeta Ramos and Sara Leal  
**IMPROVEMENT IN THE CHARACTERIZATION OF AGGREGATES OF SLOWLY ALKALI REACTIVITY**
**Manuel Vieira**, Bettencourt Ribeiro, Armando Camelo and Emanuel Costa  
*PAC – An Option for Mass Concrete Structures Construction*

**Ahmad Shayan** and Norm Cribbin  
*Concrete Durability Investigation of a Major Hydroelectric Arch Dam*

**Parallel Session 4**  
Small Auditorium - 21 April, 14h30

**Special Session on Concrete Face Rockfill Dams II**
Chair Mateus de Brito | Co-chair João Manso

**Ebrahim Mokhtarpour, Paulo T. Cruz** and Fernando A.M. Marinho  
*Behaviour of Extra High Concrete Face Rockfill Dam in First Filling Impounding - Case Study 315 M*

**Ebrahim Mokhtarpour, Paulo T. Cruz** and Fernando A.M. Marinho  
*Prediction of Zone 3B’S Displacement on Extra High Concrete Face Rockfill Dam in End of Construction - Case Study 315 M*

**Luís Ribeirinho**, Gonçalo Tavares, Manuel Romeiro, Mário Samora, José Mateus de Brito, João Marcelino, José António Boal Paixão and José Cordeiro  
*Design of Montesinho Dam and Embankment Monitoring during Construction*

**João Marcelino**, André Serrano, João Manso and José Boal Paixão  
*3D Analysis of Montesinho CFRD Using Code-Aster FEM Program*

**Parallel Session 5**  
Auditorium - 21 April, 16h30

**Concrete Dams II**
Chair José Marques Filho | Co-chair Luisa Braga Farinha

**Simon-Nicolas Roth, Alexandre Lacombe, Pierre Léger** and Azzedine Soulaimaini  
*Coupled Hydro-Mechanical Cracking of Concrete Arch Dams Considering Drainage Efficiency*

**Nuno Azevedo** and Mariline Candeias  
*A 2D Discrete Particle Model for Concrete Gravity Dams Failure Scenarios Analysis*

**Nuno Azevedo** and Romano Cámara  
*Dynamical Analysis of Concrete Dams: Fluid Structure Displacement Based Interaction Models*

**Rikard Hellgren** and Tobias Gasch  
*Influence of Fluid Structure Interaction on a Concrete Dam During Seismic Excitation*

**Bernhard Mayer** and Miroslav Marence  
*Improving the Seismic Stability of Gravity Dams by Curving the Layout*

**Ivo Dias**, Xavier Oliver, J.V. Lemos and Oriol Lloberas-Valls  
*Advanced Numerical Techniques for Modeling Tensile Crack Propagation in Gravity Dams*
Renato Pereira, António L. Batista and Luís C. Neves  
PORTUGAL  
SAFETY EVALUATION OF CONCRETE GRAVITY DAMS SLIDING CONSIDERING THE VARIABILITY OF ROCK MASS FOUNDATION HYDRAULIC AND MECHANICAL PROPERTIES

Parallel Session 6  
Small Auditorium - 21 April, 16h30  
Embankment Dams  
Chair Terezinha Espósito | Co-chair João Bilé Serra

Ricardo Correia dos Santos, Laura Caldeira, and Emanuel Maranha das Neves  
PORTUGAL  
LABORATORY STUDY ON THE SUFFUSION BEHAVIOUR OF COARSE GAP-GRADED SOILS FOR USE AS POTENTIAL UPSTREAM CRACK FILLERS IN ZONED DAMS

Vanda Malveira, Francisco Gomes and Fernanda Furtado  
BRAZIL  
VALIDATION OF GEOTECHNICAL STRENGTH PARAMETERS APPLIED TO A DAMAGED DAM

Paulo T. Cruz, Bayardo Materón and Manoel Sousa Freitas Jr.  
BRAZIL  
FLOW OF WATER THROUGH DAMS AND FOUNDATIONS

Francesco Federico and Marco Iannucci  
ITALY  
ANALYSIS OF PARTICLE MIGRATION PHENOMENA AFFECTING SOME EMBANKMENT DAMS MATERIALS

Pierre-Yves Hicher, Yinfu Jin, Christophe Dano and Zhenyu Yin  
FRANCE  
A CONSTITUTIVE MODEL FOR ROCKFILLS CONSIDERING GRAIN BREAKAGE AND SIZE EFFECT

Carolina Flórez, Maria Claudia Barbosa, Terezinha Espósito and Julia Gomes Pinto Carapiá  
BRAZIL  
PHYSICAL AND CHEMICAL PROPERTIES OF IRON MINING TAILINGS

António Veiga Pinto and Filipa Sousa  
PORTUGAL  
THE FUTURE HYDROELECTRIC POWER DAMS IN PORTUGAL: AN ANALYSIS IN VIEW DAM CONSTRUCTION GLOBAL TREND

Plenary Session  
Auditorium - 22 April, 09h00  
Chair José Polimón | Co-chair António Tavares de Castro

KEYNOTE  
José Marques Filho  
BRAZIL  
DURABILITY AND PATHOLOGICAL MANIFESTATIONS IN CONCRETE HYDRAULIC STRUCTURES IN BRAZIL

ICOLD Presentation  
Auditorium - 22 April, 09h30  
José Polimón  
SPAIN

Young Professionals Workshop  
Auditorium - 22 April, 09h40

Chair José Mora Ramos | Co-chair Ivo Dias  
KEYNOTE  
José Polimón  
SPAIN  
TRAINING DAM PROFESSIONALS TO CLOSE THE DOUBLE GAP (KNOWLEDGE AND GENERATIONAL)

Programme
Graphical Posters
Chair José Polimón | Co-chairs José Mora Ramos, Ivo Dias and Ricardo Santos

Tanıl Arkış
EXPERIMENTAL AND NUMERICAL INVESTIGATION OF FLOOD PROPAGATION DUE TO TRAPEZOIDAL BREACH IN THE DISTORTED PHYSICAL MODEL OF ÜRKMEZ DAM

Andrea Brito
USE OF SOIL-ROCKFILL MIXTURES (SRM) IN EMBANKMENT DAMS

António Muralha
CANIÇADA DAM COMPLEMENTARY SPILLWAY: PHYSICAL MODEL HYDRAULIC TESTS

Jesica Castillo-Rodríguez
TOWARDS AN INTEGRATED FRAMEWORK FOR MULTI-HAZARD FLOOD RISK ASSESSMENT: INCLUDING FAILURE OF DAMS AND OTHER FLOOD DEFENSE INFRASTRUCTURES

Emílio Santos
DAM MANAGEMENT SYSTEM MODEL BASED ON CONTINUAL IMPROVEMENT PROCESS

Ricardo Santos
LIMITATION OF THE PROGRESSION OF INTERNAL EROSION IN ZONED DAMS

Carlos Serra
EXPERIMENTAL CHARACTERIZATION AND NUMERICAL MODELING OF DAM CONCRETE RHEOLOGICAL PROPERTIES

Miguel Silva
COMPLEMENTARY SPILLWAY OF SALAMONDE DAM. 3D NUMERICAL MODELLING VALIDATED WITH PHYSICAL MODEL RESULTS

Parallel Session 7
Auditorium - 22 April, 11h30
Concrete Dams III
Chair Pierre Léger | Co-chair Nuno Azevedo

Frédéric Dufour, Maxime Tatin, Alexandre Simon, Matthieu Briffaut and Jean-Paul Fabre
THERMAL DISPLACEMENTS OF CONCRETE DAMS: ACCOUNTING FOR WATER TEMPERATURE PROFILE IN STATISTICAL MODEL

Marius Bühlmann, Marco Gerber, David Vetsch, Robert M. Boes
DAM BEHAVIOUR ANALYSIS WITH THE DAMBASE SOFTWARE

Ricardo Pimentel, João Gomes Cunha, Joaquim Figueiras, C. Rodrigues, António Tavares de Castro and Noemi Leitão
EXPERIENCE ACQUIRED WITH THE APPLICATION OF NOVEL FIBER OPTIC TRANSDUCERS TO THE ALTO CEIRA II DAM

Noemi Leitão, António Tavares de Castro and João Cunha
ANALYSIS OF THE OBSERVED BEHAVIOUR OF ALTO CEIRA II DAM DURING THE FIRST FILLING OF THE RESERVOIR

Eloisa Castilho, Noemi Leitão and Carlos Fernandes
THERMAL ANALYSIS OF CONCRETE DAMS DURING CONSTRUCTION PHASE

Sérgio Oliveira, André Silvestre, Margarida Espada, Patrícia Salvador and Romano Câmar
MONITORING THE DYNAMIC BEHAVIOR OF CABRIL DAM
Anthony Simmonds  
VIBRATING WIRE SENSORS FOR LONG TERM MONITORING OF DAMS

Parallel Session 8  
Small Auditorium - 22 April, 11h30

Embankment Dams and Geomembranes
Chair Vahid Afsari-Rad | Co-chair Andrea Brito

Jose Nuno Lima, Vasco Conde and Henrique Candeias  
QUALITY ASSESSMENT OF GNSS WITH SHORT-LENGTH SESSION IN THE DISPLACEMENT MEASUREMENT OF A LARGE EMBANKMENT DAM  
Portugal

Rui Costa, Jorge Sousa Cruz and António Sobral Rodrigues  
GEOLOGICAL AND GEOTECHNICAL STUDIES FOR THE CHERTIOUA DAM PROJECT – ALGERIA  
Portugal

Wan-Huan Zhou and Xu Xu  
COMPARISON STUDY BETWEEN MEASURED AND PREDICTED VALUES OF SHEAR STRENGTH FOR UNSATURATED COMPLETELY DECOMPOSED GRANITE SOIL  
Macau

Sonja Gamse and Michael Oberguggenberger  
ASSESSMENT OF LONG TERM GEODETIC OBSERVATIONS ON EMBANKMENT DAM  
Austria

Maria Sierra  
GEOTECHNICAL PROCEDURE FOR DESIGN OF ITUANGO EARTH CORE ROCKFILL DAM  
Colombia

Maria Sierra and Luis Cárdenas  
LABORATORY AND FIELD ROCKFILL DEFORMATION MODULUS ESTIMATES  
Colombia

Alberto Scuero, Gabriella Vaschetti, Giovanna Lilliu  
GEOMEMBRANE SYSTEMS IN PUMPED STORAGE SCHEMES: CARPI EXPERIENCE  
Switzerland

Plenary Session  
Auditorium - 22 April, 14h00

Chair Túlio Bittencourt | Co-chair José Muralha

Manuel Pinho de Miranda  
PORTUGUESE HYDROELECTRIC DEVELOPMENTS. CURRENT TRENDS OF STRUCTURAL SAFETY CONTROL  
Portugal

Announcement: ICOLD 25th Congress/ ICOLD 83rd Annual Meeting, Symposium Hydropower’15  
Auditorium - 22 April, 14h30

Carole Rosenlund  
Norway

Parallel Session 9  
Small Auditorium - 22 April, 14h40

Dam Foundations
Chair Jorge Vazques | Co-chair Luís Lamas

Markus Verdianz, Selami Güven and Ilhan Bora  
GROUTING UNDER DIFFICULT GEOLOGICAL CONDITIONS  
Austria

João Casaca and Vasco Conde  
QUANTITATIVE INTERPRETATION OF A ROCK MASS DEFORMATION MEASUREMENT  
Portugal
**Rogério Mota**, Jorge Neves and Fernando Santos  
*Portugal*

GEOPHYSICAL METHODS APPLIED TO THE ASSESSMENT OF THE GEOLOGICAL AND GEOTECHNICAL CONDITIONS OF DAM SITES: THE CASE STUDY OF PEDRÔGÃO DAM (PORTUGAL)

**Margarida Espada** and Luís Lamas  
*Portugal*

ROCK MASS BEHAVIOUR ANALYSIS OF THE SALAMONDE II POWERHOUSE

**Isabella Figueira**, Ramon Rivas and Marcos Soares  
*Brazil*

GEOLOGICAL MAPPING AND FOUNDATION GEOMECHANICS CHARACTERIZATION FOR THE IDENTIFICATION PLACES FOR DETAILED MONITORING IN PLANTS MAINTENANCE

**Parallel Session 10**  
Auditorium - 22 April, 14h40

Emergency Action Plan, Risk Assessment, Warning Systems

Chair Alexius Vogel | Co-chair Teresa Viseu

João Cunha, **Adriano Oliveira** and Pedro Vieira Soares  
*Portugal*

THE EMERGENCY ACTION PLANS OF THE BAIXO SABOR DAMS

Dora Roque, Daniele Perissin, Ana Falcão, Ana Fonseca and Maria Henriques  
*Portugal / USA*

DAM REGIONAL SAFETY WARNING USING TIME-SERIES INSAR TECHNIQUES

Flávio Sohler, José Roberto Ribas and Juliana Crenitte Ribas Severo  
*Brazil*

A MULTICRITERIA RISK ASSESSMENT FOR LARGE SCALE HYDROELECTRIC PLANT PROJECTS

Alexandre Melo, **Terezinha Espósito** and Mauro Naghettini  
*Brazil*

QUALITATIVE RISK ANALYSIS APPLIED TO EMBANKMENT DAMS

C. H. de A. C. Medeiros  
*Brazil*

DAM SAFETY CRITERIA MUST INCLUDE RISK FACTORS NON-TECHNICAL

Helber Viana, Eduardo Passeto, **Josimar Oliveira**, Flavia Barros, Sérgio Salgado, Marcus Oliveira and Nádia Menegaz  
*Brazil*

RISK CATEGORY CLASSIFICATION CRITERIA ESTABLISHED BY THE BRAZILIAN DAM SAFETY REGULATIONS APPLIED ON SMALL WATER STORAGE DAMS

José Melo, Lígia Araujo, Manuel Oliveira, Tiago Martins, Mário P. Pinto and Paula P. Freitas  
*Portugal / Brazil*

HAZARD POTENTIAL CLASSIFICATION OF DAMS USING A SIMPLIFIED METHODOLOGY

Antonio Lambertini and **Teresa Viseu**  
*Brazil / Portugal*

DOWNSTREAM VALLEY HAZARD CLASSIFICATION OF ITABIRA MUNICIPALITY DAMS

**Parallel Session 11**  
Auditorium - 22 April, 16h30

Concrete Dams IV

Chair Manuel Pinho Miranda | Co-chair Jorge Pereira Gomes

Ana Marcelino, **José Calixto**, Adriana Gumieri, Maria Ferreira, Marcos Silva and Anna Costa  
*Brazil*

A METHODOLOGY FOR TARGETING SULFUR COMPOUND LEVELS IN CONCRETES FOR HYDROELECTRIC DAMS

Armando Camelo, **Vanessa Gaspar** and Pedro Ferreira Da Silva  
*Portugal*

THE CONCRETE QUALITY CONTROL IN EDP HYDROELECTRIC SCHEMES

Carlos Serra, António Batista and Nuno Azevedo  
*Portugal*

COMPREHENSIVE ANALYSIS OF CONCRETE DEFORMABILITY TEST RESULTS OF PORTUGUESE LARGE DAMS
**Maria Henriques** and Pedro Ramos  
**Thermal Imaging of Concrete Dam Walls to Support the Control of the Evolution of Pathologies**  
**Maria Henriques** and Dora Roque  
**Unmanned Aerial Vehicles (UAV) as a Support to Visual Inspections of Concrete Dams**  
Joaquim J. M. Sousa, Milan Lazecky, Ivana Hlavacova, Matus Bakon, Gloria Patricio and Daniele Perissin  
**Satellite SAR Interferometry for Monitoring Dam Deformations in Portugal**  
Juan Mata and António Tavares de Castro  
**Assessment of Stored Automated Measurements in Concrete Dams**  
João Custódio, António Ribeiro and António Santos Silva  
**Alkali-aggregate Reaction, AAR – Dealing with AAR in Large Concrete Structures**

**Parallel Session 12**  
**Small Auditorium - 22 April, 16h30**

**Appurtenant Works, Environment Issues, New Materials, Management**

Chair Felix Hernando | Co-chair José Falcão de Melo

M.Ş. Güney, G. Tayfur, T. Arkis, and G. Bombar  
**Experimental and Numerical Investigation of Flood Propagation Due to Trapezoidal Breach in the Distorted Physical Model of Ürkmez Dam**

Elsa Alves, Felix Hernando and Rafael Chacón  
**DaiVões Dam Spillway: A Novel Solution for the Stillling Basin**

Cuneyt Yavuz, Ali Ersin Dincer, Kutay Yilmaz and Samet Dursun  
**Head Loss Estimation of Water Jets from Flip Bucket of Cakmak-1 Diversion Weir and Hepp**

António Muralha, Lúcia Couto, Manuel Oliveira, José Dias Silva, Teresa Alvarez and Ricardo Sardinha  
**Salamonde Dam Complementary Spillway. Design, Hydraulic Model and Ongoing Works**

Nima Tavakoli Shirazi  
**Investigating the Variation of Geometrical Parameters in Rubber Dams Due to Changes of Internal Pressures**

Miguel Silva, Sérgio Costa and António H. Cardoso  
**Slit Check-Dams for Stony Type Debris Flows Mitigation. Experimental Study to Evaluate Sediment Control Efficiency**

Dora Roque, Ana Fonseca, Nuno Afonso, Maria Henriques and José Muralha  
**Visual Inspection Aided by Digital Photography: Application to the Slopes of FOZ Tua Dam**

**Experimental and Numerical Study of a Chute Spillway**
Book Signing Session

**Date** 21st April - 16h00  
Congress Hall, next to the Exhibition area  
Second Edition Release: Concrete Faced Rockfill Dams  
Authors: Paulo Cruz, Bayardo Materón e Manoel Freitas  

Book Signing

**Date** 21st April - 16h00  
Congress Hall, next to the Exhibition area  
Second Edition Release: Concrete Faced Rockfill Dams  
Authors: Paulo Cruz, Bayardo Materón e Manoel Freitas

Visit to Lnec’s Shaking Table and Hydraulic Lab

**Date** 22nd April - 9h40  
**Meeting point** Congress Hall, next to the Secretariat  
Please, register at the Secretariat until 21st April 16h30

Social Programme

**Welcome cocktail**

**Date** 20th April – 18h30-19h30  
**Venue** LNEC Congress Centre  
Accompanying Person ticket € 15,00

**Lunch - Cuama Pavillion**  
Accompanying Person ticket € 15,00

**Conference Banquet**

**Date** 22nd April – 19h30-22h30 (buses will leave LNEC 19h00)  
**Venue** Ópera ship (located at “Doca do Espanhol”, in Alcântara, Lisbon)  
Delegates must collect their invitation at Secretariat until 22nd April, 12h00 am  
Accompanying Person ticket € 65,00 (available until 22nd April, 12h00 am)

Buses will leave LNEC at 19h00 to the harbour, and they will bring participants back to main Hotels (see map).

Nautical route (3 hours)

Alcântara – Belém – Cristo-Rei – Terreio do Paço – Santa Apolónia – Alcântara
On the 20th April, 2015 it was organised by Laboratório Nacional de Engenharia Civil two One-Day Courses and one Seminar

One-day Course 1

**Internal erosion in embankment dams and foundations**
Phenomenological and experimental standpoint

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**Course description**

Internal erosion, alongside overtopping, is one of the most hazardous issues that can affect the safety of embankment dams.

Internal erosion in soils involves very complex hydromechanical phenomena, whereby a large number of factors (some of them as yet unknown in all probability) play an important role. It is thus natural that the research so far on internal erosion is predominantly of an empirical nature and experimentally based.

Over the last decades there has been a growing interest at finding ways to estimate the probability of failure by internal erosion, as a part of risk assessment for dam safety. To this end, the internal erosion process leading to dam failure is usually broken in smaller events. These are more easily understood and simpler to estimate probabilities.

This one-day course aims at improving the knowledge and understanding by the participants about the process of internal erosion in embankment dams, in a dam safety context.

The emphasis is placed on the phenomenological and experimental standpoint. The main factors influencing each step of the internal erosion process are presented. The most relevant laboratory tests/empirical studies for the study of the likelihood of occurrence of the various phenomena involved are also indicated.

Filters are the first line of defence against internal erosion. Thus, some best practices concerning the design and construction of filters are indicated.

**Speakers**

Emanuel Maranha das Neves, IST, Portugal
Laura Caldeira, LNEC, Portugal
Alexius Vogel, Risk Assessment International, Austria
Ricardo Correia dos Santos, LNEC, Portugal
On-day Course 2

Failure assessment and emergency preparedness of dams

Course description
Effective Emergency Action Plans (EAPs) at high hazard potential dams is a key issue to reduce loss of life and property damage from dam failure. Dam risk mitigation is achieved by increasing dam safety, reducing potential consequences of dam-break floods and improving the preparedness of dam owners and operators, dam safety managers, emergency officials and the people at risk in the downstream valley.

This one-day course is designed to provide a comprehensive understanding of the most important aspects of dam safety evaluation and failure, dam-break flood risk assessment and emergency planning. It is developed by geotechnical, structural and hydraulic experts and comprises four modules: i) risk-based dam safety evaluation; ii) risk mitigation and emergency preparedness planning; iii) detection and classification of anomalies and causes of dam failure and iv) dam-break flood risk assessment.

The purpose of the first module is to provide an overview on risk-based dam evaluation. It begins with the presentation of the lessons learned from case histories and is followed by the description of current methods and tools available for estimating the likelihood of dam failure, including fault tree construction and evaluation and Failure Mode and Effects Analysis (FMEA) method. This module ends with the presentation of methodologies to estimate consequences of dam failure, analyzing scenarios to determine dam failures and assessing potential consequences, including economic, social, institutional and environmental damages.

Speakers
João Marcelino, LNEC, Portugal
Laura Caldeira, LNEC, Portugal
Teresa Viseu, LNEC, Portugal
David Bowles, Utah State University, USA
Luisa Braga, LNEC, Portugal
João Fernandes, Laboratory of Hydraulics, Hydrology and Glaciology of the ETH Zurich, Switzerland
José Melo, LNEC, Portugal
Manuel Oliveira, LNEC, Portugal
Tiago Martins, LNEC, Portugal
Seminar

Modelling of concrete dams
Analysis of structural and foundation behaviour and safety assessment

Seminar description
Numerical modelling of concrete dams is, due to the potentially disastrous consequences associated to failure of these large structures, a very important field of application. Moreover, the structural analysis and safety assessment of concrete dams comprises a multiplicity of modelling tasks which demand from the engineer extensive knowledge on diverse fields of different phenomenological nature.

The seminar aims to address the most important topics related to the modelling of the behaviour of concrete dams and their foundations, offering to the participants the opportunity of improving their understanding and knowledge on this field, with particular reference to the recent developments of numerical techniques.

The program addresses the general aspects and design issues, the finite and discrete element methods applied to the structural analysis of dams and foundation under static and dynamic load, concrete constitutive models, monitoring of dynamic behaviour, modelling of rock mass foundation, thermal analysis, roller-compacted concrete dams, long term behaviour, swelling processes due to alkali-aggregate reactions, etc.

Speakers
Pierre Léger, E.P. Montréal, Canada
Domingos Silva Matos, EDP, Portugal
José Oliveira Pedro, Consultant, Portugal
José Vieira de Lemos, LNEC, Portugal
António Lopes Batista, LNEC, Portugal
Noemi Leitão, LNEC, Portugal
Sérgio Oliveira, LNEC, Portugal
Jorge Pereira Gomes, LNEC, Portugal
José Piteira Gomes, LNEC, Portugal
Nuno Azevedo, LNEC, Portugal
Ivo Dias, LNEC, Portugal
Technical visit - Foz Tua dam

**Technical Visit Fees - € 120,00**
Foz Tua dam is located in the Tua river, a tributary of the right bank of the Douro River, about 1.1 km from the confluence of these two rivers.
The Douro valley is one of the world oldest wine regions and a UNESCO world heritage site. In 2014, it was one of the destinations of Fodor’s Go List 2014 being classified as “The most beautiful wine country in the world” by this important travel publisher.
EDP is the Foz Tua dam owner and they will be hosting our Technical Visit. Foz Tua dam is a 108 m height concrete arch dam. Its hydroelectric power plant will have two reversible generators with a total output of 260 MW. The investment estimated for the construction of the plant and its water infrastructure is about EUR 370 million.

Programme

**Day 1**  
23rd April 2015 (Thursday)

07h30  Transfer Lisbon - Foz Tua
12h30  Lunch
14h30  **Technical briefing** about Foz Tua Dam  
       **Technical visit** to Foz Tua Dam  
       **Transfer** Dam site - Vila Real

18h30  Bus leaves the Hotel to Quinta de São Domingos
19h00  **Dinner, Quinta de São Domingos, Peso da Régua**
**Venue** Quinta de São Domingos, Peso da Régua

The dinner will be held in a singular Quinta located in the Douro demarcated region, classified by UNESCO as World Heritage.

A guided visit to the cellar, located in the Quinta, will present a bit about the history of the Port wine.

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

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**Day 2  24th April 2015 (Friday)**

08h15  Bus leaves the Hotel to Hotel in Vila Real - Peso da Régua

09h00  *Douro River cruise*  
Lunch served on board

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16h00  **Transfer** Pocinho - Lisbon
A Special Issue of the Dam Engineering Journal was published with a selection of the five Best Papers presented in the Second International DAM WORLD Conference (DW2015). The following papers were selected:

<table>
<thead>
<tr>
<th>Paper title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>A constitutive model for rockfills considering grain breakage and size effect</td>
<td>Pierre-Yves Hicher, Yinfu Jin, Christophe Dano, Zhen-Yu Yin</td>
</tr>
<tr>
<td>Coupled hydro-mechanical cracking of concrete arch dams considering drainage efficiency</td>
<td>Simon-Nicolas Roth, Alexandre Lacombe, Pierre Leger and Azzeddine Soulaimani</td>
</tr>
<tr>
<td>The concrete quality control in EDP hydroelectric schemes</td>
<td>Armando Camelo, Vanessa Gaspar, Pedro Ferreira da Silva</td>
</tr>
<tr>
<td>Dynamic analysis of concrete dams: fluid structure displacement based interaction models</td>
<td>Nuno Azevedo and Romano Câmara</td>
</tr>
<tr>
<td>Experimental and numerical investigation of flood propagation due to trapezoidal breach in the distorted physical model of Urkmez dam</td>
<td>M.Ş. Güney, G. Tayfur, T. Arkis, and G. Bombar</td>
</tr>
</tbody>
</table>

A selection of five papers presented in the Second International DAM WORLD Conference (DW2015) will be published in the Water Power & Dam Construction Journal. The following papers were selected:

<table>
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<tr>
<th>Paper title</th>
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</thead>
<tbody>
<tr>
<td>Analysis of particle migration phenomena affecting some embankment dams materials</td>
<td>Francesco Federico and Marco Iannucci</td>
</tr>
<tr>
<td>Concrete durability investigation of a major hydroelectric arch dam</td>
<td>Ahmad Shayan and Norm Cribbin</td>
</tr>
<tr>
<td>Daivões dam spillway: a novel solution for the stilling basin</td>
<td>Elsa Alves, Felix Hernando and Rafael Chacón</td>
</tr>
<tr>
<td>Influence of fluid structure interaction on a concrete dam during seismic excitation</td>
<td>Rikard Hellegren and Tobias Gasch</td>
</tr>
<tr>
<td>3D analysis of montesinho cfrd using code-aster fem program</td>
<td>João Marcelino, André Serrano, João Manso, José Boal Paixão and Laura Caldeira</td>
</tr>
</tbody>
</table>
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