KEYNOTE SPEAKERS

Congress REHABEND 2018 on

CONSTRUCTION PATHOLOGY, REHABILITATION TECHNOLOGY AND HERITAGE MANAGEMENT

Caceres, Spain, May 15th-18th, 2018

	HOUR	COUNTRY	INSTITUTION	SPEAKER	TITLE
15/05/2018	10h30 - 11h05	BRAZIL	UNIVERSIDADE DE SÃO PAULO	PROF. DR. HOLMER SALVASTANO	DURABILITY ASPECTS OF MORE SUSTAINABLE CEMENT BASED COMPOSITES REINFORCED WITH NATURAL FIBERS
	11h10 - 11h45	SPAIN	INTERNATIONAL CENTRE FOR NUMERICAL METHODS IN ENGINEERING	PROF. DRA. CARMEN ANDRADE	MODELS OF PROPAGATION OF REINFORCED CONCRETE DETERIORATION
16/05/2018	10h30 - 11h05	SPAIN	UNIVERSIDAD POLITÉCNICA DE MADRID	PROF. DR. JUAN MONJO	STRUCTURAL CONSOLIDATION AS A FIRST STEP IN THE RECOVERY OF ARCHITECTURAL HERITAGE
	11h10 - 11h45	PORTUGAL	INSTITUTO SUPERIOR TÉCNICO DE LISBOA	PROF. DR. JORGE DE BRITO	EXPERT KNOWLEDGE-BASED BUILDING MANAGEMENT SYSTEMS
17/05/2018	10h30 - 11h05	URUGUAY	UNIVERSIDAD DE LA REPÚBLICA	PROF. DR. ATILIO MORQUIO	LA MAMPOSTERÍA CERÁMICA EN URUGUAY, LAS CONSTRUCCIONES PATRIMONIALES DE LOS SIGLOS XVIII Y XIX. LA CERÁMICA ARMADA Y LA OBRA DEL INGENIERO ELADIO DIESTE EN EL SIGLO XX. CARACTERÍSTICAS DE LAS MISMAS, SU ESTADO Y SU MANTENIMIENTO
	11h10 - 11h45	ITALY	POLITECNICO DI BARI	PROF. DR. FABIO FATIGUSO	INNOVATIVE TECHNIQUES AND OPERATION PROTOCOLS FOR ASSESSMENT AND CONTROL OF THE BUILT HERITAGE

PLENARY SESSION nº 1: May 15th, 2018, 10h30-11h05 (Room 1)

PROF. DR. HOLMER SALVASTANO

Holmer Savastano Junior got his doctor degree in the field of civil construction (USP, Brazil, 1992).

He has a post doctorate in the CSIRO, Australia (1998-99) and a research visit to UPV, Spain (2009) for studying composite materials.

Holmer has built extensive collaboration with international research groups and with the industry in the field of reinforced cement matrices since 2001.

He coordinates the Research Nucleus on Materials for Biosystems, USP since 2012.

He has published ~140 full scientific papers with more than 1,300 citations (Web of Science), in addition to four inovation patents.

His main interest is on the use of residual and non-conventional resources, sustainable and eco-friendly housing and infrastructure.

One of his main achievements was the contribution for the development of asbestos free fibercement solutions adapted to Brazilian market.

ABSTRACT: **DURABILITY ASPECTS OF MORE SUSTAINABLE CEMENT BASED COMPOSITES REINFORCED WITH NATURAL FIBERS**

This presentation highlights vegetable fibers and their potential for the reinforcement of cementitious materials. Different approaches for the proper preparation of raw materials, improving the processing methods, assessing physical-mechanical performance and durability of non-conventional fiber-cement composites are discussed in a progressive way in order to demonstrate the capability of the vegetable fibers for engineering applications. Starting with the introduction of the vegetable fiber as a material for civil engineering, this talk is divided in three main topics: (i) preparation and characterization of the fibers from nano- to macro- scales; (ii) their application as optimized reinforcement of cement-based composites; and (iii) an overview of the composite behavior after exposure to severe accelerated ageing conditions.

Alkaline environment is been proved as the main factor for lignocellulosic fibers degradation, and the decrease of the binder alkalinity becomes an approach to this problem. The reduction of portlandite has been satisfactorily achieved by its interaction with pozzolanic materials (such as residual ashes obtained from agricultural wastes) to form additional calcium-silicate hydrates. Another mechanism to reduce binder alkalinity is the replacement of Portland cement by other clinker-free binders (such as magnesium-based cement). As a complementary route, fast curing in modified atmosphere are also effective and viable to stabilize prefabricated components (such as panels, bricks and roofing sheets) reinforced with natural fibers. Additionally, degradation tests are explored for the evaluation of the durability of the resulting materials and components in real applications exposed to tropical environmental conditions. As the main result, this talk aims to show how to achieve properly more sustainable high performance components based on cementitious materials for civil construction and infrastructure.

PLENARY SESSION nº 2: May 15th, 2018, 11h10-11h45 (Room 1)

PROF. DRA. CARMEN ANDRADE

Prof. Carmen Andrade worked as a scientist studying the durability of buildings, with particular attention at the corrosion of steel in reinforced concrete at the Institute of Construction Sciences "Eduardo Torroja" of the (CSIC) of Spain.

She is the author of numerous papers and has been editor of several books.

She has supervised more than 30 PhD theses.

She has participated in and led various Standardization Committees and has been Chairperson of several international organizations related to her specialty (UEAtc, RILEM, WFTAO and Liaison Committee, which brings together associations: CIB, FIB, IABSE, IASS, RILEM and ECCE).

She has awarded Robert L'Hermite Medal (1987) to young scientists from RILEM, "Manuel Rocha" (2002) of the Presidency of Portugal", "ALCONPAT" (2013) for the merits of the whole carrier, R. N. Whitney Prize 2013 by NACE and "ACHE Medal" (2017) for the professional carrier.

She has been General Director of Technological Policy of the Ministry of Education and Science and Advisor to the Secretary of State Universities in the Ministry of Science and Innovation, Spain.

ABSTRACT: **MODELS OF PROPAGATION OF REINFORCED CONCRETE DETERIORATION**

Numerous existing structures located in marine environments manifest premature corrosion of reinforcement. Corrosion propagation modelling is necessary for the prediction of its performance and safety. In present paper the model proposed years ago is illustrated by means of the data collected in some reinforced concrete elements and specimens, with and without 3% admixed chlorides or carbonated, exposed to the Madrid atmosphere during more than 25 years. The instantaneous corrosion rate together with the associated parameters of corrosion potential and resistivity has been monitored periodically. The accumulated corrosion can be considered lineal as the climatic events repeat annually. In the paper is also presented the hydrothermal performance of concrete and its influence on the reinforcement corrosion process. The effect of temperature is double and in opposition because, on one hand it increases the corrosion rate in presence of capillary water but on the other hand, it induces its evaporation and increase in resistivity which decreases the corrosion rate. The evaporable water content of a concrete and not the relative humidity is what is directly related to the risk of deterioration reinforcement corrosion and therefore the most crucial effect is the direct exposition to rainfall or snow events.

Reinforced concrete may suffer rebar corrosion but also other types of attack to the material integrity. When these processes develop actively at significant rate, they usually manifest through cracking of concrete cover, expansions and efflorescences and they are named, for the sake of the service life calculation, as "propagation" periods. The most known generic model is that of reinforcement corrosion published by Tuutti with two time- phases: corrosion initiation and propagation, that is, during the penetration of aggressive substances no damage is produced until achieving the aggressive front the rebar level, where the oxides formed provoke the cracking of the cover. This result into a horizontal line regarding the damage level followed with a continuous increase when the external sign of deterioration are visible. The other most frequent attacks are: alkali-silica reaction or sulfate attack, acid or leaching by pure waters and frost attack. In present communication, although of complex mechanisms as corrosion is, it is shown that all these propagation periods can be linearized in order to be made "generic" and with the possibility to be considered too as a two-period service life model. Some examples are commented, in particular that of reinforcement corrosion which is modelled through a constant rate or with a bilinear trend.

PLENARY SESSION nº 3: May 16th, 2018, 10h30-11h05 (Room 1)

PROF. DR. JUAN MONJO

Architect, Architecture School of UPM - Madrid TECH (1970). Master of Architecture, Univ. of Illinois (1972). Dr. Architect, UPM - Madrid TECH (1976).

University professor since 1982.

Director of the Department of Construction and Architectural Technology of the UPM (1991-1998).

Director of the Master in Restoration, MRA-UPM - Madrid TECH (1997-2007).

Coordinator of the SC-8, of the CT-41 of AENOR since 2001.

Director of the Instituo de Ciencias de la Construcción Eduardo Torroja, of the CSIC (2003-2008).

Director of the Master of Pathology MPE-UPM - Madrid TECH since (2008-2017).

Researcher in charge of the AIPA Research Group, of the UPM - Madrid TECH (2009-2017).

Author or co-author of more than 20 books, among them, *Introduction a la Arquitectura Textil* (Madrid, 1991); *Patología de cerramientos y acabados arquitectónicos* (Madrid, 1994); *Tratado de Rehabilitación*, 5 volumes (Madrid, 1998-99); *Patología y técnicas de intervención en estructuras* (Madrid, 2001); *Tratado de construcción. Sistemas* (Madrid, 2001); *Dicionario de arquitectura y construcción* (Valladolid, 2001); *Tratado de construcción. Fachadas y cubiertas* (Madrid, 2003); *El ldetalle constructivo en arquitectura* (Madrid, 2007); *Fibrous and composite materials for civil engineering applications* (Oporto, 2011); *Fabric Structures in Architecture* (UK, 2016).

Author or co-author of more than 30 articles in specialized journals.

Author or co-author of more than 60 papers and presentations at conferences and technical lectures.

Research lines: *Construction systems*; *Building Pathology*; *Intervention techniques in the architectural heritage*; *Textile architecture*.

ABSTRACT: **STRUCTURAL CONSOLIDATION AS A FIRST STEP IN THE RECOVERY OF ARCHITECTURAL HERITAGE**

The intervention of the architectural heritage must ensure the fulfillment of the Vitruvian triad in the recovered building.

Firmitas. We must ensure its stability and integrity. We have to ***repair***.

Utilitas. We must ensure its functionality. We have to ***rehabilitate***.

Venustas. We must preserve its historical-artistic values. We have to ***restore***.

The three actions (*repair*, *rehabilitate* and *restore*) must be carried out simultaneously, but the first one that has to occupy our attention is to ensure *firmitas*, that is, the stability and integrity of the monument.

As an example, let's see the **consolidation of the Episcopal Palace of Tarazona**, as the first step of its recovery, after the execution of a previous diagnosis that allowed understanding the structural and integrity problems of the built-up complex.

The intervention was carried out by three members of the AIPA research group (Analisis e Intervención en el Patrimonio Arquitectónico): Rosa Bustamante, Juan Monjo and Pilar Rodríguez-Monterverde.

The previous diagnosis showed us the most important problems that affected stability:

South façade of the Tarazona Episcopal Palace, Spain

- **Set of buildings from different times**, from the 1st century to the 18th century.
- **Types of materials of the different walls**, stones, bricks and mortars.
- **Moisture**; capillarity, at the base, and filtration in the central courtyard.
- **Sliding**, of the south façade.
- **Settlement** of the central zone.
- **Opening**, of the top line of the facades.

As a consequence, the intervention has tried to:

1. **Reduce the effect of capillarity** and **prevent filtration** through the patio.
2. Interrupting the sliding with the **anchoring of the facades to the central rock.**
3. Tie the set of buildings with **anchorages in both directions.**
4. **Tied up of all the top lines** of the buildings.
5. **Anti-fall mesh on the south facade** to contain possible detachments.

PLENARY SESSION nº 4: May 16th, 2018, 11h10-11h45 (Room 1)

PROF. DR. JORGE DE BRITO

Jorge de Brito is a Civil Engineer, Master in Structural Engineering and PhD in Civil Engineering, all at Instituto Superior Técnico (IST), University of Lisbon, Portugal, where he is presently Full Professor in the Department of Civil Engineering, Architecture and Georresources.

He is presently the Head of the research center CERIS (Civil Engineering Research and Innovation for Sustainability), with over 200 post-doctoral researches and nearly 300 PhD students.

He is the Director of the FCT Doctoral Program Eco Construction and Rehabilitation since its beginning.

He is also Editor-in-Chief of the Journal of Building Engineering from Elsevier.

He is member of the following scientific international commissions: W80 (CIB) / 100-TSL (RILEM); TC RAC (RILEM); W86 (CIB); W115 (CIB); WC7 (IABSE).

He participated in 20 research programs (4 international), five of which as Principal investigator.

His main scientific areas of research are building and bridge management systems, service life prediction, life cycle assessment and green materials.

He has supervised 36 PhD and 160 MSc students.

He has co-authored 4 books, 24 book chapters, around 350 papers in international journals and over 200 papers in international conferences.

ABSTRACT: **EXPERT KNOWLEDGE-BASED BUILDING MANAGEMENT SYSTEMS**

Buildings have a limited period of time in which they completely fulfil their minimal performance requirements. However, the service life of a building can exceed an expected durability if maintenance operations are adequately planned and carried out. Whether maintenance operations consist of proactive (preventive and predictive) or corrective actions, an inspection is necessary to assess the actual maintenance needs. Inspection procedures should be as objective as possible in order to obtain a reliable diagnosis and support rational decisions.

At Instituto Superior Técnico (IST), University of Lisbon, a set of inspection systems has been developed to collect in situ data on different non-structural and structural building elements. Such systems intend to minimize the subjectivity of information, identifying and describing the degradation phenomena that may occur during the service life of a building element, based on specialized literature. Each of the developed systems is composed of: classification lists of defects, probable causes, advised diagnosis methods and adequate repair techniques; correlation matrices defining the relationship between defects and probable causes, different defects, defects and diagnosis methods and defects and repair techniques; detailed files of defects, diagnosis methods and repair techniques; and an inspection form to fill with information on the building, the building element, environmental exposure information, previous maintenance information and on the defect itself.

Systematically collecting information according to these parameters enables the standardization of inspection reports, as well as the creation of pathology databases. The IST research team has already developed inspection systems for: flat roofs waterproofing systems, adhesive ceramic tiling, epoxy resin industrial floor coatings, masonry walls, wood floorings, natural stone claddings, pitched roofs' claddings, gypsum plasterboard walls, gypsum plaster coatings, wall renderings, painted rendered walls, ETICS, window framing, architectural concrete surfaces, concrete road bridges, expansion joints in concrete road bridges and support bearings in road bridges. A way forward for the IST team's research is the development of a global computed inspection system that integrates the partial systems developed so far in a comprehensive analysis perspective.

PLENARY SESSION nº 5: May 17th, 2018, 10h30-11h05 (Room 1)

PROF. DR. ATILIO MORQUIO

Docente en las Facultades de Medicina., Arquitectura e Ingeniería. Desde 2008 Profesor Titular en la Facultad de Ingeniería de la Universidad de la Republica, Montevideo, Uruguay.

Ingeniero Civil, Master y Doctor en el área de Estructuras por la Universidad Federal de Río Grande del Sur (Porto Alegre) Brasil.

Director del Instituto de Estructuras y Transporte (2005-2007), Jefe del Departamento de Estructuras (2009- 2017), Director de la Carrera de Ingeniería Civil (2009-2013), y Comisión de postgrado de Ingeniería Civil desde 2006. Consejero de la Facultad (1994-1999 y 2010-2012).

Pro-Rector de Gestión de la Universidad (1999-2007).

Par evaluador del sistema de acreditación de carreras Arcosur.

Integra desde 2012 el Consejo Consultivo para la Enseñanza Terciaria Privada del Ministerio de Educación y Cultura.

Autor de 40 publicaciones arbitradas. Orientador de cinco tesis de doctorado y maestría.

Integra el Comité Científico de la Asociación Sudamérica de Ingeniería Estructural. Presidió el Comité Organizador de las XXXVI Jornadas Sudamericanas de Ingeniería Estructural realizadas en 2014.

Ha realizado un conjunto de asesoramientos sobre estructuras, que incluyen edificios, plantas industriales, centros educativos, estadios, puentes, silos, presas, torres metálicas y muelles.

Dirigió (2013-2015) el proyecto "Evaluación y control de estructuras del patrimonio arquitectónico nacional en mampostería cerámica aplicando técnicas no destructivas".

Participa del proyecto de la *Getty Foundation* "Creation of conservation, management plan and administration system for Cristo Obrero Church, Atlántida", obra realizada por el Ingeniero Eladio Dieste en los años 50.

ABSTRACT: **LA MAMPOSTERÍA CERÁMICA EN URUGUAY, LAS CONSTRUCCIONES PATRIMONIALES DE LOS SIGLOS XVIII Y XIX. LA CERÁMICA ARMADA Y LA OBRA DEL INGENIERO ELADIO DIESTE EN EL SIGLO XX. CARACTERÍSTICAS DE LAS MISMAS, SU ESTADO Y SU MANTENIMIENTO**.

El patrimonio arquitectónico existente en Uruguay se origina en el siglo XVIII. El mismo está fuertemente relacionado con la mampostería cerámica estructural. En esta Conferencia se describen las más importantes construcciones de los siglos XVIII y XIX existentes en el país, su estado actual y los estudios realizados por las Facultades de Ingeniería y Arquitectura de la UDELAR para evaluar su estado mediante la utilización de ensayos no destructivos.

En la segunda mitad del siglo XX surgen en Uruguay las estructuras de cerámica armada del Ingeniero Eladio Dieste que se caracterizan por su diseño artístico, por las formas flexibles y esbeltas, y por su naturaleza estáticamente optimizada. La conferencia incluye una descripción de las mismas, de su estado actual y de los principios que guiaron a su autor para su diseño. En forma mas detallada se presentan los estudios que se desarrollaron en la Iglesia Cristo Obrero de Atlántida para diagnosticar su estado y valorar posibles medidas para su conservación.

Iglesia Cristo Obrero de Atlantida

PLENARY SESSION nº 6: May 17th, 2018, 11h10-11h45 (Room 1)

PROF. DR. FABIO FATIGUSO

Civil Engineer and PhD in "Building Engineering", is Associate Professor in "Architectural Engineering" at Department DICATECh of Polytechnic of Bari. He holds the National Scientific Qualification as Full Professor for the sector 08/C1 Technological Design.

He lectures "Building Refurbishment and Conservation" and "Architectural Engineering" within the MsC in Building Engineering at the Polytechnic of Bari, "Building Refurbishment: Theory and Practice" (Module M805 Design and Sustainability III) within the MsC in European Construction Engineering.

He is Coordinator of the MsC in Building Engineering at the Polytechnic of Bari, Scientific Responsible of the Laboratory of Building Technologies at Department DICATECh of the Polytechnic of Bari, President and Founder Member of academic spin-off "B.Re.D. Building Refurbishment and Diagnostics s.r.l.", member of CIB W86 Committee "Building Pathology", as well as of member of the Committee for Architectural Quality and Landscape of the Municipality of Matera (European Capital of Culture 2019).

It has been Member of the Scientific Board of several international conferences and Member of the Editorial Boards and Reviewer of several journals.

He is author and co-author of five books and more than seventy articles and papers in international journals and proceedings.

Concerning the technology transfer, he has submitted three patents and he has been Scientific Consultant for several refurbishment projects in the Sassi di Matera (included in UNESCO World Heritage List).

His research and scientific activity relates to building refurbishment and maintenance, with particular reference to material, technological and functional aspects, in terms of compliance to current standards actual codes and fulfilment of quality levels, as well as to techniques and technologies for diagnostics and control, in terms of methodologies and procedures for damage assessment and diagnosis. Specific research fields concern the refurbishment and conservation of Mediterranean traditional dwellings in ancient towns, as well as of historic school buildings, particularly with reference to sustainable practices and energy efficiency solutions.

ABSTRACT: **INNOVATIVE TECHNIQUES AND OPERATION PROTOCOLS FOR ASSESSMENT AND CONTROL OF THE BUILT HERITAGE**

The process of investigation, assessment, monitoring and control for the integrated conservation of the built heritage relies on methods and techniques, which are widely studied and tested by the scientific and technical community.

However, they are still challenging research fields, due to continuous normative evolution – such as for energy efficiency, seismic protection, quality of products and processes – and to increasing development of advanced systems and devices – with prominent HW-SW issues within data acquisition and elaboration.

Consequently, different backgrounds and disciplines should merge into a comprehensive process, oriented to the analysis of material, constructional and technical characteristics and the diagnosis of state of conservation and residual performances. This is still more significant in the case of the historical built heritage.

The paper offers a review about the abovementioned topics and it focuses on the some most current challenging research lines, such as: i) correlation methodologies for data from different sources, as decision-making support throughout assessment, diagnosis and intervention; ii) operation protocols for onsite investigation, in order to achieve meaningful and reliable results and preserve integrity and functionality; iii) development of innovative techniques for "contactless" detection and "augmented reality" representation by enabling ICTs.

The final goal is to point out how assessment and control of building characteristics, obsolescence mechanisms and performance levels result from specific, integrated and coordinated tools.