

University of Cantabria / University of Oviedo

Organizers:



# REHABEND 2024

## Euro-American Congress

CONSTRUCTION  
PATHOLOGY,  
REHABILITATION  
TECHNOLOGY AND  
HERITAGE MANAGEMENT

Gijón (Spain) - May 7<sup>th</sup> - 10<sup>th</sup>, 2024

Sponsor entities:



# **REHABEND 2024**

**CONSTRUCTION PATHOLOGY, REHABILITATION TECHNOLOGY AND  
HERITAGE MANAGEMENT**

*(10<sup>th</sup> REHABEND Congress)*

**Gijón (Spain), May 7<sup>th</sup>-10<sup>th</sup>, 2024**

PERMANENT SECRETARIAT:

**UNIVERSITY OF CANTABRIA**

Civil Engineering School

Department of Structural Engineering and Mechanics

Building Technology R&D Group (GTED-UC)

Avenue Los Castros 44, 39005 SANTANDER (SPAIN)

Tel: +34 942 201 761 (43)

Fax: +34 942 201 747

E-mail: [rehabend@unican.es](mailto:rehabend@unican.es)

[www.rehabend.unican.es](http://www.rehabend.unican.es)

**10<sup>TH</sup> EURO-AMERICAN CONGRESS ON CONSTRUCTION PATHOLOGY,  
REHABILITATION TECHNOLOGY AND HERITAGE MANAGEMENT  
REHABEND 2024**

ORGANIZED BY:



**UNIVERSITY OF CANTABRIA (SPAIN)**  
[www.unican.es](http://www.unican.es)



**Universidad de Oviedo**  
**UNIVERSITY OF OVIEDO (SPAIN)**  
[www.uniovi.es](http://www.uniovi.es)

**CONGRESS CHAIRMEN:**  
**IGNACIO LOMBILLO**  
**ALFONSO LOZANO**

**CONGRESS COORDINATORS:**  
**HAYDEE BLANCO**  
**YOSBEL BOFFILL**

**EDITORS:**  
**YOSBEL BOFFILL**  
**IGNACIO LOMBILLO**  
**HAYDEE BLANCO**

**GUEST EDITOR:**  
**ALFONSO LOZANO**

**INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE:**  
**HUMBERTO VARUM – UNIVERSITY OF PORTO (PORTUGAL)**  
**PERE ROCA – TECHNICAL UNIVERSITY OF CATALONIA (SPAIN)**  
**ANTONIO NANNI – UNIVERSITY OF MIAMI (USA)**

The editors does not assume any responsibility for the accuracy, completeness or quality of the information provided by any article published. The information and opinion contained in the publications are solely those of the individual authors and do not necessarily reflect those of the editors. Therefore, we exclude any claims against the author for the damage caused by use of any kind of the information provided herein, whether incorrect or incomplete.

The appearance of advertisements in these Scientific Publications (Printed Book of Abstracts & Digital Book of Articles - REHABEND 2024) is not a warranty, endorsement or approval of any products or services advertised or of their safety. The Editors does not claim any responsibility for any type of injury to persons or property resulting from any ideas or products referred to in the articles or advertisements.

The sole responsibility to obtain the necessary permission to reproduce any copyright material from other sources lies with the authors and REHABEND 2024 Congress can not be held responsible for any copyright violation by the authors in their article. Any material created and published by REHABEND 2024 Congress is protected by copyright held exclusively by the referred Congress. Any reproduction or utilization of such material and texts in other electronic or printed publications is explicitly subjected to prior approval by REHABEND 2024 Congress.

ISSN: 2386-8198 (printed)

ISBN: 978-84-09-58990-6 (Printed Book of Abstracts)

ISBN: 978-84-09-58989-0 (Digital Book of Articles)

Legal deposit: SA - 132 - 2014

Printed in Spain by Círculo Rojo

<b>Introduction.....</b>	<b>3</b>
<b>Previous Congresses.....</b>	<b>4</b>
<b>Sponsor &amp; Collaborating Entities.....</b>	<b>5</b>
<b>International Scientific Committee.....</b>	<b>9</b>
<b>Topics.....</b>	<b>15</b>
<b>Abstracts of the Congress.....</b>	<b>17</b>
<b>Keynote Lectures.....</b>	<b>37</b>
<b>1.- Previous Studies.....</b>	<b>41</b>
1.1.- Multidisciplinary studies (historical, archaeological, etc.).....	43
1.2.- Heritage and territory.....	58
1.3.- Urban regeneration.....	70
1.5.- Social participation processes and socio-cultural aspects in rehabilitation projects .....	81
1.6.- Construction pathology.....	83
1.7.- Diagnostic techniques and structural assessment.....	98
1.8.- Vulnerability studies and risk management.....	135
1.9.- Guides and regulations.....	142
<b>2.- Project.....</b>	<b>145</b>
2.1.- Theoretical criteria of the intervention project.....	147
2.2.- Traditional materials and construction methods.....	152
2.3.- Novelty products applicable and new technologies.....	174
2.4.- Sustainable design and energy efficiency.....	196
<b>3.- Building Intervention.....</b>	<b>225</b>
3.1.- Intervention plans.....	227
3.2.- Rehabilitation and durability.....	230
3.3.- Reinforcement technologies.....	242
3.5.- Conservation of industrial heritage.....	252
3.6.- Examples of intervention.....	255
<b>4.- Maintenance.....</b>	<b>267</b>
4.1.- Construction maintenance and infrastructures .....	269
4.2.- Preventive conservation of built heritage.....	279
<b>5.- Diffusion and Promotion.....</b>	<b>293</b>
5.1.- Heritage and cultural tourism.....	295
5.2.- Teaching and training.....	308
5.3.- New technologies applied to the heritage diffusion.....	310
5.4.- Accessibility to cultural heritage.....	321
5.5.- Built heritage management .....	325

263	SHEAR BEHAVIOUR OF REINFORCED CONCRETE BEAMS STRENGTHENED BY TEXTILE-REINFORCED MORTAR COMPOSITE <i>Mohamed, Saidi; Aron, Gabor; Amine, Ben-Dahou; Laurent, Michel</i>	247
306	ANALYTICAL FORMULATION FOR THE DESIGN OF STEEL REINFORCED PLASTER <i>Scamardo, Manuela; Cattaneo, Sara; Crespi, Pietro</i>	248
326	THE STRENGTHENING OF FLOOR AND ROOF MASONRY RING BEAMS WITH FIBRE-BASED COMPOSITE MATERIALS: EXPERIMENTAL TESTS <i>Boem, Ingrid; Gattesco, Natalino; Rizzi, Emanuele; Gams, Matija</i>	249
340	DEVELOPMENT OF AN ECO-FRIENDLY LIME-BASED MORTAR SUITABLE FOR INTEGRATED RETROFITTING: THERMOPHYSICAL AND MECHANICAL CHARACTERIZATION <i>Penazzato, Luca; Sakhizada, Mirwais; Illampas, Rogiros; Teixeira, José C.; Imbimbo, Maura; Oliveira, Daniel V.</i>	250
403	STRENGTHENING OF REINFORCED CONCRETE BEAMS WITH EXTERNALLY ATTACHED TITANIUM RODS <i>Corradi, Marco; Costanzi, Marco; Madaro, Michele; Speranzini, Emanuela; Stoppoloni, Daniele</i>	251

### 3.5.- Conservation of industrial heritage.

15	REHABILITATION OF THE RAW MATERIALS WAREHOUSE IN THE LEMONA CEMENT PLANT <i>Ezquerro Andreu, Mikel; Díez Hernández, Jesús; Ijalba Aramberri, Daniel; Egiluz Ellakuria, Ziortza</i>	252
176	THE “PARASITIC” ARCHITECTURE OF THE NEW CULTURAL HUB IN THE EX SUGAR FACTORY OF RIETI. RESILIENT STRATEGIES, REGENERATION AND REFURBISHMENT OF INDUSTRIAL PRE-EXISTENCES <i>Bellicoso, Alessandra; Manna, Stefania; Di Ludovico, Donato; Gunnella, Riccardo</i>	253
318	EVALUATION OF THE EFFICACY OF SURFACE TREATMENTS FOR THEIR SUBSEQUENT USE IN THE RESTORATION OF FACTORIES WITH HIGH PRESENCE OF SALTS. THE CASE OF LAS ERAS DE LA SAL IN TORREVIEJA (ALICANTE) <i>Huesca Tortosa, José Antonio; Spairani Berrio, Yolanda; Spairani Berrio, Silvia; Saura Gómez, Pascual</i>	254

### 3.6.- Examples of intervention.

46	EXAMINATION OF INTERVENTIONS ON REINFORCED CONCRETE SYSTEM ON HISTORIC BUILDING – CASE OF TURKEY <i>Çakır Uzelli, Hatice Yasemin; Güntepe, Sinem</i>	255
57	ERMITA DE LA SANG IN CASTALLA (ALICANTE, SPAIN): ARCHITECTURAL ACTIONS (2019-2022) <i>Mira, Juan Antonio; Giner, Jaime Manuel</i>	256
134	REHABILITATION OF THE MONUMENT TO THE VIRGEN OF “LA ANTIGUA” IN ORDUÑA (BIZKAIA) <i>Marcos, Ignacio; San Mateos, Rosa; Díez, Jesús; Egiluz, Ziortza; Laraudogoitia, Esteban</i>	257
175	IMPLEMENTATION OF TIMBER GRAFTING TECHNIQUE FOR BEAM REPAIR AT ZABALA PALACE IN ORDIZIA <i>Benito-Ayúcar, Josu; González-Serna, Pablo; Luengas-Carreño, Daniel; Uribe-Rus, Ekaitz</i>	258
177	STRUCTURAL REHABILITATION WITH TIMBER-TIMBER COMPOSITE FLOORS IN ITSASO TOWN HALL <i>González-Serna, Pablo; Benito-Ayúcar, Josu; Luengas-Carreño, Daniel</i>	259
235	THE APPLICATION OF LEAN CONSTRUCTION SOLUTIONS IN SITE WORKS OF RESIDENTIAL REFURBISHMENT PROJECTS: AN OVERVIEW <i>Missaoui, Ahmed; Abreu, M. Isabel; Oliveira, Rui A. F. De</i>	260
272	DESCENT OF UNIDIRECTIONAL FLOOR WITH SYNCHRONIZED HYDRAULIC JACKETS WITHIN A GLOBAL REFURBISHMENT PROJECT <i>González Ramos, Francisco; Fernández Montes, David Constantino; Serrano Corral, Álvaro</i>	261
343	THE (RE)CONSTRUCTION OF THE DEBA MASONRY BRIDGE <i>Lorenzo, Isabel; Orfeo, Benedetta; León, Javier; Jaime, Iñaki; Todisco, Leonardo</i>	262
363	OPPORTUNITIES AND CRITICALITY RELATED TO TAX INCENTIVES FOR BUILDING ENVELOPE ENERGY EFFICIENCY. AN OPERATIONAL PROCEDURE APPLIED TO A RESIDENTIAL BUILDING <i>Marchionni, Chiara</i>	263
364	BUILDINGS WITH HIGH ARCHITECTURAL VALUE - TWO EXAMPLES OF RESTORATION AND SEISMIC REINFORCEMENT <i>Lemme, Alberto; Iovinella, Ivano</i>	264
381	COMPREHENSIVE REHABILITATION OF THE PUNTA DEL ESTE SHOPPING CENTER AFTER A FIRE INCIDENT <i>Pereyra, María Noel; Leez, Álvaro; Bonjour, Hugo; Vila, Patricia</i>	265

**CODE 363****OPPORTUNITIES AND CRITICALITY RELATED TO TAX INCENTIVES  
FOR BUILDING ENVELOPE ENERGY EFFICIENCY. AN OPERATIONAL  
PROCEDURE APPLIED TO A RESIDENTIAL BUILDING****Marchionni, Chiara<sup>1</sup>**

1: University of L'Aquila, DICEAA Department

e-mail: [chiara.marchionni@univaq.it](mailto:chiara.marchionni@univaq.it); web: <https://www.univaq.it/rubrica.php?id=1101&docente=on>**KEYWORDS:** Building envelope energy upgrading; Tax incentives; Decree Law No.34/2020; Operational procedure; Insulation materials.**ABSTRACT**

The existing building stock accounts for approximately 40% of final energy consumption, due to the high energy requirements, related to heating, cooling, lighting, and domestic hot water production, coupled with limited use of renewable energy sources. In this context, Italian legislation, in compliance with the European Directives on environmental sustainability, has enacted many regulatory measures in order to reduce emissions and incentivize energy efficiency in existing buildings. However, there appears to be a widespread lack of procedural and regulatory guidance regarding construction technologies and materials, especially on non-bonded and non-historic buildings, but nonetheless characterizing the established building fabric of cities. This research focuses attention on the issue of energy upgrading of the opaque envelope of apartment buildings related to the exploitation of tax incentives. Specifically, it addresses strategic choices and material selection, with particular regard to those that comply with the Minimum Environmental Criteria (CAM).

The paper illustrates a case study of a condominium that took advantage of the tax incentives under Decree Law No.34/2020 (commonly known as “Superbonus 110%”). The building underwent a global redevelopment focused on energy efficiency, downstream of an in-depth cognitive process and the subsequent process of compatibility between the different design choices deemed compliant.