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REHABEND 2014

Latin American Congress

CONSTRUCTION PATHOLOGY, REHABILITATION TECHNOLOGY AND HERITAGE MANAGEMENT

April 1-4, 2014
Santander - Spain

Organized by:

Universidad de Cantabria
GTED-UC
GRUPO DE TECNOLOGÍA DE LA EDIFICACIÓN

AIDICO
INSTITUTO TECNOLÓGICO DE LA CONSTRUCCIÓN

tecnalia

REHABEND 2014

CONSTRUCTION PATHOLOGY, REHABILITATION TECHNOLOGY AND HERITAGE MANAGEMENT

(Fifth REHABEND Congress)

Santander (Spain), April 1-4, 2014

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FIFTH LATIN AMERICAN CONGRESS ON CONSTRUCTION PATHOLOGY, REHABILITATION TECHNOLOGY AND HERITAGE MANAGEMENT

REHABEND 2014

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ISBN: 978-84-606-6738-4 (book of abstracts)

ISSN: 2386-8198 (print)

Legal deposit: SA - 132 - 2014

Printed in Spain by Gráficas Iguña, S.A.

Photograph of cover belongs to the Santa María Cathedral Foundation - Quintas Fotógrafos -

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The REHABEND 2014 Congress on Construction Pathology, Rehabilitation Technology and Heritage Management is going to take place in Santander (Spain), from 1 to 4 April 2014. The event is organized by the University of Cantabria, through its Building Technology R&D Group (GTED-UC), the Technological Institute of Construction of Valencia (AIDICO) and a Private Center for Applied Research (TECNALIA Research & Innovation).

REHABEND 2014 continues the series of the four previous REHABEND international events, which have been developed since 2006 in different Spanish cities. In 2006 and 2007 in Santander (organized by University of Cantabria), in 2008 in the Mediterranean city of Valencia (organized by AIDICO) and in 2009 the event took place in Bilbao organized by Tecnalia Research & Innovation. In 2016 REHABEND is going to take place in Burgos, Spain, and in 2018 it will be developed in an American country.

Construction Pathology, Rehabilitation Technology and Heritage Management currently have great importance for construction sector. This prompted the organizers to propose a new technical event about these topics in 2014. This event aimed to collect the advances obtained in the last years in the theoretical knowledge and practical realizations carried out about the referred topics. The Congress met more than 250 technical contributions coming from professionals, academics and specialists, from 17 countries.

Under these premises and the successful previous editions, the Congress was sponsored by the Government of Spain, the Regional Government of Cantabria, the Municipality of Santander, the University of Cantabria, the Menéndez Pelayo International University, Mapei and Sika. In addition, several Universities, Techincal and Professional Associations, Institutes, Foundations and Companies committed their collaboration in order to the success of this initiative.

REHABEND 2014 organizers, University of Cantabria, AIDICO and TECNALIA, would like to thank the multiple received supports: to the sponsoring and collaborating Entities; to the Scientific Committee members for their hard work in the revision of the different technical contributions, ensuring the required level of quality of an international event; to the Speakers of the plenary sessions and to the different speakers for their relevant contributions and, in general, to the people who attended the congress for the confidence shown in the event. Sincerely, Many thanks to all.

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(ordered on the basis of number of papers presented)

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1.2.- Heritage and territory.

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ABSTRACTS

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1.- PREVIOUS STUDIES

CODE: 1.1.03

IMPORTANCE OF PATENTS FOR THE INTRODUCTION OF CONCRETE IN SPAIN: CASE STUDY

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KEYWORDS: Concrete, Patents, Blanc, Alhóndiga.

ABSTRACT

The reinforced concrete as a structural material is introduced into Spain by French influence. This happens in the late nineteenth century, following the model of proprietary systems prevailing in Europe. These systems are based on intuitive ideas, but have little scientific support. Obscurantism on the calculation and design of reinforced concrete structures represents an obstacle to its development and generalization in the early twentieth century, as well as for the lack of knowledge as for a series of relevant accidents. Therefore, during the first decade of the century a number of regulations are enacted in many countries, which will change the design and calculation of reinforced concrete structures. To know the environment of the patent system, the beginning and the circumstances of its application, would allow to understand the conditions of the structures of that time, many of the cultural heritage, as shown in the case of Alhóndiga of Bilbao (1906-1909).

CODE: 1.1.08

STAINED GLASS IN URUGUAYAN ARCHITECTURE CONTRIBUTIONS FOR HERITAGE VALUATION

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KEYWORDS: architectural heritage, stained glass, heritage valuation, conservation.

ABSTRACT

Despite the short history of building development in Uruguay compared to other countries and the consequent young age of the national architectural heritage, it has singular values derived mainly from the application of stylistic and constructive approaches installed in our country through the intervention of engineers, architects, artists and craftsmen from Europe.

For several decades now, it can be seen a sustained process of assessing this heritage that has slowly generated and improved tools for its knowledge, diffusion and preservation. However, some elements have yet been little investigated.

Such is the case of incorporating stained glass art in domestic national architecture, whose greatest boom was made towards the 20s of last century, initially under the influence of European and later national workshops. Indeed, details about its origin, authorship, constructive, compositional and iconographic aspects and its significance in the spatial configuration of these buildings are poorly explored fields.

This scene logically turns difficult its assessment as a cultural heritage, which has been partially set in the heritage inventory of the old part of the capital city, where some stained glass are included, as "significant element", helping to define the degree of protection corresponding to the building in question. This background has unfortunately limited results and does not prevent daily demolition of buildings and their stained glass or its replacement for other enclosures.

This paper describes the characteristics of national stained glass identified, based on the survey and registration completed by the Faculty of Architecture and raises some basic premises for heritage assessment, hoping thereby to contribute to the debate on the relevance of generating instruments for protection and management to promote its knowledge, diffusion and preservation.

CODE: 1.1.09

THE CONTRIBUTION OF THE "BUILDINGS' MASTER PLANS" FOR THE LONG-TERM MANAGEMENT OF BUILT COMPLEXES. THE EXAMPLE OF THE UNIVERSITY OF COIMBRA

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KEYWORDS: Cultural heritage, heritage management, master plans, rehabilitation of classified buildings.

ABSTRACT

The safeguarding and valorisation of the built heritage are two important challenges in the current economic, social, cultural, scientific and technical context. In all cases, it is necessary to reconcile the longevity of these buildings with the preservation of their identity and authenticity, adapting them, yet, in many cases, to new functions and requirements.

In large built complexes, it is never possible - nor even desirable - that the interventions needed for its recovery occur very quickly and simultaneously. Given its size and complexity, these interventions require detailed plans, contributions from a large number of specialties and an extensive debate. The costs involved and funding constraints often determine a sub-division of the intervention.

When it is expected that the works occur over several years, or even decades, the usual management and project tools are not generally sufficient to ensure overall consistency of interventions: the plans are, by their nature, very general, and designs are too detailed and should not be made too far in advance.

Thus, the "buildings' master plan" was created as an intermediate element that, without overlapping the future design options, allows to long-term management of operations, within a general coherence framework of heritage safeguarding through its historical characterization, its core values and spurious elements identification, the simulation / testing of possible functions, intervention strategies and techniques.

During the preparation of the World Heritage Nomination of the University of Coimbra, about two dozen master plans were executed, whose general organization and principles are presented and discussed in this article, which also includes some examples of the extensive work developed.

CODE: 1.1.11

THE HISTORY OF PATHOLOGIES OF THE TOWER OF SINLABAJOS, ÁVILA, (SPAIN): GRAPHICAL AND DOCUMENTARY ANALYSIS

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KEYWORDS: Pathology, graphical documentation, repairs, destabilization, archaeology.

ABSTRACT

Based on the exhaustive survey of the tower belonging to the parochial church of Sinlabajos and on the analysis of the different consecutive layers of its different constructive phases, it has been possible to show a pathological history which determines a series of interventions and repairs throughout the centuries. These interventions have even involved some elements of the adjacent temple.

The thorough study of the changes and repairs of the tower is made clear by the graphical differentiation of the materials employed, both in the original building and in the successive actuations, always leading to secure a building whose problems of stability keep on compromising its integrity nowadays.

As well as the material analysis, the documentary research has permitted to corroborate some of the hypotheses of our work and has enabled us to understand the mechanisms of the urgency interventions over heritage, at least in which concerns to the last three centuries. It has been possible to determine the previously occurred facts just by means of observing the building, which we consider our material source of data.

CODE: 1.1.14

INITIAL STUDIES OF PLANIMETRY AND PATHOLOGY ON FACADES OF A LISTED BUILDING WITH LOW COST TECHNIQUES, PHOTOGRAMMETRY

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KEYWORDS: planimetry, photogrammetry, pathology, UAV (Unmanned Aerial Vehicle).

ABSTRACT

The preservation of a listed building implies that the necessary rehabilitation or structural consolidations are particularly onerous. This high cost is initially generated by the uncertainty of the work done. The initial adoption of good decision about geometric data allows us to assess with a high degree of accuracy necessary actions and avoid own improvisation of these interventions.

Photogrammetry can record own specific characteristics of these buildings, and translate them into plans accurately. This can simplify and cheapen greatly certain jobs, where the type of pathology is advisable to delete any component, later made its structural consolidation; it can be reproduced to continue maintaining the original structural
integrity.

This technique allows us, in addition to the planimetric registration, mapping and geometric study of existing conditions: fissures, cracks or deformation. All these works are made using low cost or semiprofessional cameras, when not so long ago it was necessary to use metric cameras prohibitively expensive for small businesses. Also, expensive photographic process calibration by a specialized laboratory, it is no longer a necessity, being the user who can perform this calibration.

The need to obtain “suitable” photos for the restitution of buildings accurately makes sometimes this work difficult by the restriction of space with the presence of other buildings. It is in these circumstances when a UAV unit is particularly suitable. We currently have low cost UAVs which allow us to take photographic scans for later use with photogrammetric restitution software; something similar to what is beginning to be widely disseminated in the archaeological record.

CODE: 1.1.15

LATE-MEDIEVAL SEIGNIORIAL RESIDENCES IN THE BASQUE COUNTRY: ANALYSIS OF THE EVOLUTION OF CONSTRUCTION SYSTEM AND ITS SINGULAR ELEMENTS

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KEYWORDS: Tower Houses, Palaces, Late-Medieval Seigniorial Residences, Construction Systems, Constructive Historical Study, Cataloging Heritage.

ABSTRACT

From the defensive House-Towers of the fourteenth and fifteenth centuries to the early Renaissance Palaces of the sixteenth century, the construction system of Late-Medieval Seigniorial Residences was evolving during the Middle Ages in the Basque Country, adapting to the needs of the moment. As a result of this process, a wide range of historical value constructive elements was generated.

Unfortunately, the characteristic components of this construction system are at serious risk of disappearing. Currently, most of the architectural interventions are limited only to maintain the skin envelope of these constructions. The structure and the interior space are frequently altered, causing the destruction of many architectural elements.

The paper aims to analyze the evolution of this building-typology, identify its singular elements and, above all, assist in the dissemination of this threatened heritage. Analysis carried out has identified four main evolutionary phases: single House-Towers, House-Towers transformed in Palaces, House-Towers with annexed Palaces and Pre-Renaissance Palaces.

This research is part of a doctoral thesis which aims to study the building-typology and the state of preservation of Late-Medieval Seigniorial Residences of the Basque Country, with the intention of developing a cataloguing and protection model for the Restoration Project.

CODE: 1.1.16

IDENTIFICATION AND DESCRIPTION OF PEDOFEATURES USING MICROMORPHOLOGIC ANALYSIS OF MATERIALS FROM PREHISTORIC SITES: APPLICATION TO THE ARROYO CORRAL I SITE, NEUQUÉN, ARGENTINA

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KEYWORDS: micromorphology, pedofeatures, soil development, Arroyo Corral I, Argentina.

ABSTRACT

Usually the materials from archaeological sites are analysed at microscopic level. The main aim is to achieve the best possible identification of the most important components of these materials and the textural relationships between them. Thin sections studied under a polarized transmitted light microscope are really useful in order to get this aim. This procedure has been applied on the materials of the archaeological site of Arroyo Corral I which is located on Neuquén Province and Rio Negro Province, Argentina. This research is within the studies carried out by the International Institute for Prehistoric Research of the Universidad de Cantabria (Spain) and the Patagonia Museum (Argentina).

Seven samples for micromophological analysis were collected during the prospection survey. These samples represent the different archaeological levels of the site and were studied in order to identify the mineralogical components, to define the textural relationship between them, to identify pedofeatures in the components and to confirm the human occupation levels.

In this paper we present the results obtained in the identification of pedofeatures and moreover in the determination of the weathering depth. These soil components, pedofeatures, are excellent indicators of the soil organization and represent specific fabric units which can be identified and distinguished from the adjacent material using thin sections. The analysis of the pedofeatures allow obtaining an approach to the intensity of the weathering undergone by the materials of the archaeological site. Regarding that weathering modifies the physical and chemical characteristics of the materials, determination of the weathering depth can be the key factor in order to improve the protection and conservation of the human heritage.

CODE: 1.1.18

DOCUMENTATION METHODOLOGY FOR ARCHITECTURAL HERITAGE IN RURAL AREAS

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KEYWORDS: Documentation, survey drawing, Romanesque architecture, architectural heritage, Huesca, Aragon.

ABSTRACT

A methodology is presented to catalogue the architectural heritage in rural areas. It has been based in several field surveys carried out between 2011 and 2012 for the Romanesque Heritage Cataloguing Project of Huesca, developed by the Santa María la Real Foundation and financed by the Spanish Ministry of Culture.

The aim of this study is to optimize the documentation process based on the experience obtained in 13 surveys of architectural heritage in rural areas, having in mind the limitations in both resources and time. They have been established some general steps for this methodology: information search, previous studies, objectives adjustment, field visits, digitization, corrections and delivery of documentation. Each stage is discussed, showing the main difficulties faced in 13 buildings of Huesca, according to their special features and goals of each one.

The result is a basic documentation tool, as a point of departure to enhance the activities related to built heritage, such as conservation, intervention, refurbishment, advocacy, outreach, etc. It is structured in some control charts for the tasks of each stage, which help in technical team working during the documentation of built heritage; establishing a common criteria and an optimized schedule. It is discussed the degree of compliance of this methodology steps among the 13 case studies combined with the detected pros and cons analysis. Finally, some conclusions are presented about the advantages and disadvantages, the applicability and the methodology itself, and they are compared with the current situation of built heritage in rural areas are collected.

CODE: 1.1.19

STUDY AND THREE-DIMENSIONAL SURVEY OF ARCHAEOLOGICAL REMAINS OF DEFENSIVE FORTIFICATIONS IDENTIFIED AT THE PENINSULA DE LA MAGDALENA, SANTANDER

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KEYWORDS: convergent photogrammetry, inverse engineering, peninsula of maddalena, artificial vision, topography, defensive batteries.

ABSTRACT

The present work was developed as part of the collaboration between the Department of Architecture University Federico II, Universidad de Cantabria and the Ayuntamiento de Santander and fits within a larger Thesis project, which aims to establish a theoretical support and graphics, able to promote understanding the historical dynamics of the city, starting from the study of the two main cultural centers in Santander, El Anillo Cultural and Real Sitio de la Magdalena, as a way to deepen and represent the main elements, such as the Ancient Medieval Wall, the Royal Palace and Defensive Batteries, subject of this article. The three-dimensional survey of the archaeological remains of the defensive batteries, proposed by the Ayuntamiento de Santander, is also part of the Plan Director de la Magdalena. The final product of this work is the localization and documentation of all digital 3D defensive batteries, unknown to almost all citizens of Santander, and that existed on the Peninsula de la Maddalena before it converted into the headquarters of the Spanish royal family summer holidays, in the XX century.

CODE: 1.1.20

NEW METHODOLOGY FOR DOCUMENTATION OF ARCHAEOLOGICAL TRIDIMENSIONAL STRUCTURES WITH HIGH DEFINITION, THE CASE OF ARCHAEOLOGICAL SITE OF THE PLAZA PORTICADA IN SANTANDER

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KEYWORDS: archaeology, photogrammetry, reverse engineering, 3D modeling, topography, artificial vision.

ABSTRACT

The archaeological site of the Velarde Square in Santander is located in the southeast corner known as arcaded square and the archaeological work done on it have lasted intermittently from 2006 to 2013. Archeological excavations have allowed many vestiges document structures that formed the Puebla Nueva of the medieval town of Santander, especially the stretch of near the medieval village comprised between Puerta del Mar and Portillo de Don Gutierre plus two tickets to the villa. It has also been able to document the evolution of urban spaces located in that area from the twelfth to the twentieth century with the construction of the first stone structures of the Puebla Nueva in the late thirteenth century, the creation of the Rua Chiquita, posterior Square Prince and the destruction caused by the fire of 1941. There have also been obtained various evidence of occupation of extramural space adjacent to the section of wall in the reservoir villa as well as processing expansion of the city occurred in late from mid eighteenth and consistent in filling sea areas to create new areas of population century.

The work has documented with high precision geometric different structures appearing in this site, getting a high definition and spatial resolution of the various objects and structures appeared during the last phase of the excavation.

CODE: 1.1.22

THE REACTIVATION OF THE RAILWAY HERITAGE: ANALYSIS OF HISTORIC RAILWAY LINES OF THE BASQUE COUNTRY. THE CASE OF UROLA CORRIDOR

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KEYWORDS: Railway Heritage, territorial development, energetic model, mobility strategies, synergy of active resources, reuse and revitalization, self management.

ABSTRACT

The progressive modernization of railway resources has made both active and disused railway lines dispense with a series of emblematic buildings such as train stations, energy-power buildings, depots... and several auxiliary elements whose use stayed obsolete or without the main function they were meant to. They are highly valuable architectural and civil engineering items and some of them represent a great potential to generate active resources for the current society.

From the beginning of the first third of the last century, it was bet on energy policies that made us too dependent on oil. Currently, 94% of European transport depends on its derivatives and 84.3% of it is imported [1]. Furthermore, this is accompanied by thousands of miles of paved roads that, after a handful of decades, have left outdoors railway lines, which once were of great vitality and main arteries of connection. However, now these are presented as a new alternative to an exhausted social, environmental and energetic model.

This statement is included within a doctoral thesis that aims the reactivation of the railway heritage as an active social, cultural and economical resource of the territory. It discusses, among other issues, the potential of disused lines and stations, where new territorial strategies and mobility policies, energetic and social models and the closest potential resources of the environment will play a key role in achieving self-management of the railway "infrastructure-heritage", through the synergy of active resources of its own territory and a new strategic role demanded by the current society.

This paper sets out the progress of theoretical guidelines and it presents an enhancement process and a theoretical reactivation exercise, which is applicable to various disused lines or sections of the Basque Country. This will be focused on the lines with a higher active potential like the Urola Railroad, which will served us as a model of a territorial development tool. Truly, this is model of dynamization and revitalization of the environment that could perfectly be extrapolated to European lines with similar characteristics and become the main facilitator and enabler for the active development of a community or territory.

CODE: 1.1.23

PHOTOGRAMMETRY AND LASER SCANNER SYSTEMS COMBINED WITH TRADITIONAL METHODS TO DOCUMENT THE HERITAGE, OBTAIN A REVERSE ARCHITECTURE AND PRESERVE IT

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KEYWORDS: Advanced graphic expression, scanner 3D, architectural photogrammetry, reverse architecture, 3D printing.

ABSTRACT

The main objective of communication is to value methods or advanced techniques used to document the heritage; through mass trapping with architectural photogrammetry and 3D scanner combined with traditional methods, to get geometric and morphological information about different elements of buildings to document, regardless of its origins. Moreover, in many occasions, it resolves intrinsic problems about geometry of buildings. This information is difficult to obtain with traditional methods of documentation or direct measurement; however it is necessary to preserve or intervene on heritage. Use new technologies based on photogrammetry and scanner, have advantages and disadvantages compared to traditional measurement systems analyzed in this communication, without it suppose new problems. Adopt hybrid solutions to realize inverse architectures, taking advantages of each graphic method, improves process quality and decreases its complexity; in addition, it also means a reduction of time and costs. Finally, technological advancement of graphic methods, based on computer applications, requires more specialization and acquisition of knowledge, but extensive knowledge about computer application is not necessary. In conclusion, the objective is to get the highest quality of projects and processes, economizing and optimizing resources.

CODE: 1.2.01

THE CITY OF AMBALEMA, NATIONAL MONUMENT OF COLOMBIA. AN EXAMPLE OF ARCHITECTURAL AND LANDSCAPED HERITAGE TO BE PRESERVED AND VALORIZED

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KEYWORDS: Colombia, Ambalema, urban restoration, cultural landscape, architectural restoration, traditional building techniques

ABSTRACT

The Ambalema's city in the region of Tolima in Colombia is among the most interesting examples of colonial city that are preserved in the country with an European urban plan but with reconstructed buildings in the early nineteenth century with traditional techniques which give priority to the use of guadua and earth then to the system bahareque. The contribution aims to illustrate the history of this city, National Monument of Colombia since 1980, and to submit the first results of the research and analysis developed at the International Summer School, University of Ibagué, Colombia. This research work in 2013 was included in the Cultural Heritage Program of Tolima, for the promotion of culture and tourism of the Colombian territory.

CODE: 1.2.03

METHODOLOGY FOR RECOVERY, MANAGEMENT AND APPRECIATION OF TERRITORIAL ARCHITECTURE HERITAGE. APPLICATION TO HERDSMEN`S ARCHITECTURE IN THE VALLEY OF ESGUEVA

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KEYWORDS: vernacular architecture, heritage, territory, landscape, livestock track, chozo, dry-stone construction, cultural management.

ABSTRACT

Research in architectural heritage in rural areas must involve the definition of a methodology that ensures, not only its cataloguing, but also its maintenance, management and appreciation. The territory as a field of analysis requires studying these vernacular buildings in a way that transcends the mere constructive scale, linking it to the development of productive activities that are based on historical, climatic, or soil factors.

The proposed methodology, based on fieldwork and the observation of territorial net structures, materializes here in the instance of herdsmen's constructions in the Valley of Esgueva, but it has applications to other geographical areas as well. The controlled development of trashumance for more than six centuries, has bequeathed to us an extensive heritage, mainly in the shape of huts, chozos and corrals, but also fountains, wells and troughs, on the landscape of the Spanish North Plateau.

CODE: 1.2.04

MARTÍN RUIZ DE ÁLBIZ AND SAN JUAN DE ARTEAGA: THE SPREAD OF THE VAULTS WITH FIGURES OF STARS AND THE CURVED-RIB IN LA RIOJA DURING THE LATE GOTHIC

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KEYWORDS: Late Ghotic, curved-rib vaults, Martín Ruiz de Álbiz, San Juan de Arteaga, Castille, La Rioja.

ABSTRACT

In this paper we study, in its context the work of Martin Ruiz de Álbiz, disciple of Simon de Cologne, and of San Juan de Arteaga, Basque architects who were related and worked in La Rioja and Burgos. Both architects could participate in the construction of the convent of Casalarreina (La Rioja), fundamental work of late Gothic in La Rioja and played a major role in spreading the vaults with figures of stars and the curved-ribs in La Rioja. Martin Ruiz de Álbiz introduced this new vaulting system in the church project of Santiago in Logroño (1519). The vault beneath the choir of Zarratón was completed at that date. The building process of the church of Leiva with curved-ribs was almost finished in 1523. Both cousins are responsible for the construction of his masterpiece, the Cathedral of La Redonda in Logroño, that was built between 1523 and 1529, date of the death of both architects.

CODE: 1.2.05

IDENTIFICATION OF MINING AND INDUSTRIAL ABANDONED SITES: THE SAJA-BESAYA CASE

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KEYWORDS: Brownfield, abandoned industrial heritage, mining, degraded soil, regeneration.

ABSTRACT

Restoration of sites known as brownfields is a recurring theme in European Soil and Environment policies within the 2020 horizon. Essentially industrial and mining in tradition, the Low Besaya district has wide abandoned degraded areas, which are a direct result of the cessation of these industrial and mining activities. These brownfields have a broad negative effect in the district, their environmental and socioeconomic transformation into new areas of opportunity being required. Based on previous research, this paper addresses the brownfield concept theoretically, adapting a methodology for sustainable brownfield regeneration, and implementing the first phases in the Low Besaya district. The study also includes an analysis and diagnosis of the physical and socioeconomic environment, with a preliminary identification and characterization of all the abandoned mining and industrial areas and other degraded soils. The result is an inventory of the main areas classified as brownfields in the Low Besaya district, which will serve as a tool and a starting point for the achievement of the next phases of the integrated regeneration strategy.

CODE: 1.2.08

MONITORING THE SPATIALIZATION OF IMMOVABLE CULTURAL HERITAGE IN TERRITORIAL MANAGEMENT PLANS OF THE DEPARTMENT OF SANTANDER. STUDY CASE: MUNICIPALITIES OF THE PROVINCE GUANENTINA

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KEYWORDS: Immovable Cultural Heritage, Territorial Management Plans, Immovable Cultural Heritage on Territorial Management Plans, Department of Santander, Guanentina Province.

ABSTRACT

The project was to track the spatialization of Immovable Cultural Heritage (PCI) within Territorial Management Plans (POT) of the 87 municipalities of the Department of Santander (Colombia). For the study case it was proposed a geographic framework reference circumscribed to the 18 municipalities that constitute the so-called "Provincia Guanentina" or " Guanentá Province" from the department, given its importance within the historical and tourist axis defined in the departmental POT.

The development objective of the project included the following activities: Identify the PCI recognized in POT, analyze the way it is spatialized within POT, establish a methodology for PCI spatialization in mapping and plans of the POT and create a database of technical and ordering information on the Immovable Cultural Heritage of the Department of Santander POT, promoting regulatory specific studies Cultural Heritage.

An descriptive - analytical methodology was applied, where information and existing elements are reviewed to determine their status against the indicators established for measuring, through an instrument designed based on the contents set in Colombian legislation used this topic and moreover the application of the basic principles of thematic cartography of the Geographic Institute Agustín Codazzi (IGAC), the governing body of the subject in the country.

The study result shows that the POT formulated not contemplate the PCI as a structuring element of territory as established by law and therefore lacking in content policy on the issue, proper identification and standardization on it and no there is a specific mapping on it, leading to results require increased vigilance of the Ministry of Culture on the topic of PCI in POT.

CODE: 1.2.09

MANAGEMENT AND REHABILITATION OF SCHOOL HERITAGE: METHODS AND TOOLS

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KEYWORDS: School Heritage, Management and Rehabilitation, Methods and Tools, Building Quality, Indicators.

ABSTRACT

Within the municipal assets is in progress a process of replace of the request of new buildings with the request of quality preservation of the school built heritage; it is a general request of efficient management and maintenance. If it is therefore reasonable to assume that the request for quality of the existing municipal heritage is oriented to expand itself, it seems urgent to prepare policies and tools to optimize the management, the rehabilitation and the maintenance appropriate to anticipate rather than following this market request, or giving to it a governable response after its explication. Today's challenge, that characterizes the government of municipal school asset, is then the research, development and testing of a specific tools for the governance of works on the existing heritage: methods and tools that will be different from programming and management tools for built elements or sub-systems, now consolidated in the culture rather than in practice, and then "how and when to do something". The implementation of an efficient management of these assets means to prepare, first of all, strategic tools for help administrators and citizens "to decide how to decide". The adoption of asset management techniques for the governance of the municipal heritage opens job perspectives for the implementation of appropriate tools towards: the increase of information/decision process (in terms of new forms of knowledge of the assets), the definition of service levels and their measurement through appropriate indicators, the evaluation and control of the results, the evaluation of the inclusiveness of decision-making and operational process in order to define better rehabilitative and/or maintenance interventions.

CODE: 1.2.13

PROTOTYPE 3D CITY: DOCUMENTARY INTEGRATION OF HERITAGE BURIED AND SURFACE WITHIN SANTANDER

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KEYWORDS: 3D City, photogrammetry, machine vision, planning, Santander.

ABSTRACT

From City of Santander has promoted collaboration with the research group Computer Graphics and Geometric Design, University of Cantabria, a project for integrated digital documentation of urban heritage, integrating the heritage area and heritage buried so that involving continuous. The project has been implemented by the Employment Workshop on New Technologies of the City of Santander Group in collaboration with the University of Cantabria. For this study we integrated three-dimensional modeling of the model of the old with the current Santander Santander and Santander with buried, as is the bomb shelter located at the town of Santander. We have simulated 3D modeling an entire city by convergent photogrammetry techniques and ground surveys, so that the integration of the part surface coincides with sub-centimeter accuracy with underground part. The result is a continuum between buildings in surface and underground parts such as air-raid shelter.

CODE: 1.2.16

THE SOCIAL USE AND THE CONSERVATION OF CULTURAL HERITAGE - THE CASE OF THE HISTORIC CENTER OF BOTUCATU – SÃO PAULO

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KEYWORDS: Cultural Heritage, Historic center, conservation, Historic buildings, Botucatu.

ABSTRACT

This article presents the situation of the main buildings in the historic center of the city of Botucatu, São Paulo, accordingly to their conservation and multiplicity of uses. The objective is to verify the relationship and possible influences between the preservation of the cultural heritage of the historic city center as opposed to its social use. The methodological process adopted for this work involved the delimitation of a study perimeter, an iconographic research and a photographic survey of the area and its buildings with the aim of a characterization of past and current uses along with the historic and current condition of its preservation. As a research result, it was seen an intense use of the buildings of the historical center inside the study perimeter that focused preferably uses such as educational, religious and administrative. It was also found that the type of use influenced the type of intervention and conservation of buildings. All information obtained was organized in accessible spreadsheets and the result may be made available to the public administration of the municipality in order to contribute to any projects and future studies about the historical center of the city or other similar historic urban centers.

CODE: 1.3.01

MANAGEMENT AND DECISION-MAKING TOOLS FOR THE SUSTAINABLE REFURBISHMENT OF HISTORIC CITIES

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KEYWORDS: Historic cities, sustainable refurbishment, decision-making, urban management, urban information model.

ABSTRACT

One of the main problems in historic cities, in addition to their physical deterioration, is the loss of urban habitability and quality. One of the key aims of any historic city conservation and management strategy should therefore be that of improving the quality of life of its inhabitants. We need a new approach toward integral, functional refurbishment that can be adapted to current needs (sustainability, accessibility, energy efficiency etc.), in order for the historic city to become an area of opportunity and a model of urban efficiency The creation of innovative methods and management tools that go to make up a systemic, holistic and participative approach with regard to the urban scale can become a key element in this process. Analysis and processing of the information through the use of new technologies is potentially of great help in prioritising and decision-making within management and refurbishment processes. REACT and EFFESUS are research and development projects which focus on the strategies and tools required to confront the conservation challenges we face from a multi-scale perspective. Two platforms are currently being developed which support comprehensive methodologies and offer a 3D Multi-Scale Urban Information Model, based on the international CityGML standard which facilitates diagnosis, decisionmaking and urban management of historic areas, connecting to a strategic urban scale which is operative on a building level.

CODE: 1.3.03a

INTEGRATED URBAN REGENERATION, AN ANSWER TO THE URBAN CRISIS

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KEYWORDS: Crisis, Compact city, Sustainability, Integrated Urban Regeneration.

ABSTRACT

In recent decades, cities have experienced profound changes in their development processes, generating a debate between two urban models: compact versus dispersed cities. In general, compact cities are preferred, actions in consolidated cities being focused in accommodating the new challenges posed by urban sustainability and sustainable cities.

These intervention proposals have been centred on three different areas: architectural adaptation, social integration and urban regeneration, and a preference for processes more related to urban sustainability such as urban regeneration, rather than the classical renewal, reform or urban rehabilitation schemes.

The aims of this study are three: first, to highlight the validity of the concentrated, dense and mixed city model, as an alternative to the urban crisis and as a central element for the recovery of consolidated cities; second, to incorporate the contents of urban sustainability to the processes acting on consolidated cities; and third, to emphasize the concept of integrated urban regeneration as a new essential element in the set of alternatives envisioned to face the urban crisis, highlighting its physical, economic, social and environmental dimensions, and its important role as the backbone of the intervention processes to be undertaken in consolidated and sustainable cities.

To complete the bases of integrated urban regeneration gathered in this article, in another paper presented at this Congress (1.3.3b) we propose a specific methodology and instruments of urban regeneration, selecting the most appropriate ones to intervene in the slums of consolidated cities, and to conduct urban regeneration processes, justifying the suitability of Special Inner Reform Plans.

CODE: 1.3.03b

INSTRUMENTS OF INTEGRATED URBAN REGENERATION. A PROPOSAL FOR TORRELAVEGA (Cantabria)

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KEYWORDS: Urban regeneration, onstruments, planning, internal reform, urban degradation, Torrelavega.

ABSTRACT

This article is the continuation of the one entitled "Integrated urban regeneration, a response to the urban crisis", also presented at this Congress, in which the importance of Integrated Urban Regeneration as an alternative to address the current European urban crisis is addressed. In Spain, integrated urban regeneration has followed the guidelines of other European cities and, since the Toledo Declaration (2010) [1], has become a standard in urban policies, and the engine of many of the alternatives presented to solve the urban crisis. Its importance as a way of intervention in consolidated cities has made it the key element of strategic plans and legislative measures to promote rehabilitation, regeneration and renewal of the urban fabric.

To attain maximum efficiency, these laws, which establish the foundations of the new investment policy aimed at promoting the quality and sustainability of the buildings and the land, must be incardinated with urban planning instruments of slum (the scope of urban regeneration) intervention in force in the respective Autonomous Regions. Therefore, Special Interior Reform Plans accompanied by the necessary measures of urban management, are particularly important as a planning tool.,

The city of Torrelavega (Cantabria) is an excellent laboratory to implement a program of integrated urban regeneration, since there are neighborhoods with high levels of urban decay, social problems and environmental degradation. Actions to improve and reuse the buildings and the existing urbanized land, or further opening the city to the river are part of an integrated proposal for urban regeneration, which must rely on the General Plan and the specific plans aimed at developing it.

CODE: 1.3.12

HYDROLOGICAL REHABILITATION OF URBAN AREAS

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KEYWORDS: SuDS, permeable surfaces, permeable pavements, green roofs, runoff.

ABSTRACT

The progressive growth of urban areas during the last decades has resulted in a massive waterproofing of natural land due to the urbanization processes. This situation has increased the water related problems in urban centres. A bibliographic research was performed in order to analyse the possible application of Sustainable Drainage Systems (SuDS), for hydrological retrofitting processes in urban areas, highlighting permeable pavements and green roof systems. Their hydrological performance and the main factors that condition their application in retrofitting processes were studied, including cost-benefit relation. After an exhaustive review of the available data, both systems show to reduce runoff volumes and peak flows generated by rainfall events in different ways. From the reviewed data it can be stated that green roofs and permeable pavements are techniques with high potential application in retrofitting processes, helping to recover the natural water cycle balance.

CODE: 1.3.13

METHOD TO ASSESS THE ADAPTABILITY OF HISTORIC HOUSES IN FRONT OF NEW USE REQUIREMENTS

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KEYWORDS: assessment method, adaptability, rehabilitation, housing, historic district.

ABSTRACT

Chilean historical housing located in heritage urban areas are often functionally obsolete and very deteriorated from the architectural and constructive point of view, although they have survived the passage of time and the frequent earthquakes and fires. Besides, their owners rarely have resources to maintain them and there is a weak safeguarding legislation and not public policies to recover them: in Chile there is just one law to safeguard the architectural heritage, named “Monuments Law”, which is obsolete in urban issues and does not provide financial resources to protect the heritage values. The safeguarding practice is not understood as a strategy for revitalizing neighbourhoods, as it is in the historic centres of Europe.

In the mentioned context, the research here presented has as a main goal the definition of a comprehensive method to assess the potential adaptability of housing to respond to the demands of current living conditions. Qualitative and quantitative parameters, such as habitability, architectural-spatial, constructive-structural, and safety factor are considered in the method, to generate a reference tool for the development of new instruments of analysis, regulation and guidance of resources for historical housing recovery.

In this paper the partial results of the research will be presented, with emphasis in the process of defining the assessment method and the construction of a model to systematize the digital information. The method has been applied to traditional houses of one of the most important historic neighbourhoods of Santiago de Chile: the ‘Barrio Yungay’, a large residential area with different types of historic houses threatened by an advanced urban renewal process, which means a great challenge in terms of urban revitalization and architectural recovery.

CODE: 1.3.16

STATE AND CHALLENGES OF REHABILITATION OF THE URBANIZATION AND CONSTRUCTION OF INDUSTRIAL ZONES IN MATARÓ: (2013)

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KEYWORDS: industrial zones, industrial rehabilitation, urbanization, mataró, industriability.

ABSTRACT

The perception of continual degradation of technical urban elements in the industrial estates of Mataró (Catalonia, Spain) since 2007, prompted by the start of the severe recession and the endemic gradual abandonment of industrial heritage, has created the need for a methodological tool to provide a rigorous, concise, diachronic (evolution) and synchronic (current state) view. The tool is designed to help make solid decisions on potential interventions, whether they are preventive, palliative or related to repairs.

The paper identifies key parameters that should be considered in evaluations of the current state of technical urban elements and industrial buildings, based on the concept of "industriability". This is related to the conception "prevalence of use" before the relocation of modern industry with its new needs, for which past practices and infrastructure run a serious risk of obsolescence.

The method used in this study was based on implementing the experience gained by the UPC in urban and building renovation of housing developments, and on expanding this to the proposed subject by incorporating new techniques that are currently available in the field. In the first stage of development, the proposal was to use organoleptic impressions as a basis, and then to examine the case in greater depth depending on requirements; using fewer or more complementary media.

Given the nature in Spain of this kind of urban structure, which differs from the residential urban fabric, this study could affect a considerable volume of industrial estates that are in the delicate situation of requiring extensive technical intervention if they are to continue to be suitable for the corresponding activity. This paper aims to lay down guidelines for dealing with them appropriately.

CODE: 1.5.04

PARTICIPATORY PROCESSES IN RECOVERING HERITAGE OF PUBLIC WORKS

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KEYWORDS: Landscape, Assessment, Participatory Processes, Cultural Heritage, Public Works.

ABSTRACT

The different elements of built Public Works throughout the territory are subject to deterioration. Given its link with it and its special relationship with landscape, the goal is to make people assume ownership over them and permit to appear their bound with them beyond their appearance or everyday use. In other words, to make people to value the Public Works of their immediate surroundings, transforming them into an appealing cultural heritage resource which would generate an increasing flow of visitors attracted by them.

The methodology shall include the following phases: identification of the work, learning about it, assimilation of knowledge and its internalization, and finally, designing of actions and activities for the dissemination of heritage. The learning process construction's author, the motives that prompted its construction, the dates they were built, their functions, types, etc. is a key-mechanism to activate the social memory, a cornerstone of this process. Thanks to this methodology the connection of the public work with the whole system of values that characterizes the identity of a place can be created. Therefore, allowing to assess the dissemination of knowledge, as a vehicle to promote their health and the consequent need of keeping it alive, thus enabling their survival along time.

Given its particular socio-cultural characteristics, this project is located in the region of Cantabria, specifically in the region of Campoo los Valles. This is a logical extension of VAPROP project, which sought, as explained by its acronym, the valuation of the rural heritage of Public Works. This project advocates social action as key elements in the creation and dissemination of heritage.

CODE: 1.6.01

DEUSTO BRIDGE: STUDY AND DIAGNOSIS PREVIOUS TO THE WRITING OF THE REHABILITATION PROJECT

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KEYWORDS: Previous studies, survey, tests, metallic structure, concrete.

ABSTRACT

The present paper summarises the history of the Deusto Bridge (Bilbao) and describes its structure. Additionally the developed research, the inspection and the tests carried out to set the conservation state of the structure, as a previous step of the rehabilitation project, are included in this document.

Deusto Bridge spans the estuary of Bilbao, Botica Vieja shore, Abandoibarra avenue and Evaristo Churruca quay. It connects the expansion district of Bilbao (Ensanche) with Deusto district, close to the Botica Vieja park and the University of Deusto.

The Project was conceived in the middle 1920s. Some years later, at the end of the decade, the industrial engineer José Ortiz de Artiñano and the civil engineer Ignacio Rotaeche were appointed to project the bridge in collaboration with the architect Ricardo Bastida.

The bridge is formed by 27 spans with a total length of 522m. The outline is almost straight, excepting the last spans close to the Ensanche, where it traces a slight turn. The main span, placed over the estuary, riveted metallic structure, is the double leaf bascule span, Scherzer type. The others spans someones made of steel and otherones made of reinforced concrete, are deck over piers/abutments, with spans between 11 and 25 m. The platform is 25m wide.

Between years 2008 and 2012, in collaboration with Ingeniería IDOM, and requested by the Municipality of Bilbao, TECNALIA carried out a detailed analysis of the bridge in order to diagnose the state of the structure, prior step to the development of a rehabilitation project led by IDOM.

CODE: 1.6.03

PATHOLOGY APPLIED TO THE FOUR PHASES OF THE BUILDING PROCESS: THE PARTIAL COLLAPSE OF THE MONASTERY OF DIOMONDI (SPAIN)

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KEYWORDS: monastery, collapse, timber roof, analysis.

ABSTRACT

At the end of 2010, just two years after its rehabilitation, the partial collapse of one of the load bearing walls of the monastery of Diomondi (Spain) occurred.

The paper describes the sinister and the corresponding analysis that had to be developed in order to define the causes of the collapse. And according to the conclusions of the study, the correcting measures that should be taken into account for the reconstruction project are explained.

This work aims to influence the importance of each and every one of the phases that constitute the building process (design, calculation, construction and maintenance), to ensure the stability and durability of any construction.

CODE: 1.6.04

INSPECTION DATASHEETS AS A POWERFUL TOOL FOR THE ASSESSMENT AND DIAGNOSIS OF OLD BUILDING STOCK

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KEYWORDS: old building, appraisal and inspection, building rehabilitation, inspection datasheets, masonry.

ABSTRACT

The survey constitutes the very first task on the evaluation of a building´s condition, involving the identification and recording of its structural and non-structural defects. The building appraisal approach to guide the survey process should be previously selected in function of the building typology, the final objective intended, the detail of the inspection and the scale defined for the intervention. In the particular case of the old buildings, due to the generalized lack of knowledge on the traditional construction materials and techniques, such survey actions are often inadequate compromising therefore the accuracy of the diagnosis and the efficiency of potential rehabilitation or retrofitting measures. In this sense, inspection datasheets have been assumed as one of the first assessment and diagnosis tools for existing constructions, not only to assess structural safety, salubrity and comfort conditions but also to support real estate appraisal at different scales. From the exposed, the present paper discusses the importance of inspection datasheets for the establishment of efficient diagnosis, showing and describing some of the key aspects that should be taken into account. In addition, a case study for which a set of six inspection datasheets were specifically created and applied is also presented and discussed.

CODE: 1.6.09

REVERSAL OF FLOW IN THE COMBUSTION APPLIANCES IN PORTUGAL: EXPERIMENTAL STUDY

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KEYWORDS: air permeability, appliances burning gaseous fuels, dwellings, ventilation systems, flow reversal.

ABSTRACT

Ventilation systems are of great importance in the energy consumption of air conditioning and in the definition of the higrothermal conditions and indoor air quality of buildings. Among other functions, are absolutely necessary to ensure oxygen levels needed for combustion appliances.

In Portugal it is usual to install individual exhaust fans in every kitchen (decentralised ventilation) in multi-family housing buildings with natural ventilation systems. Type B water heating appliances, for space heating or for sanitary hot water, must not be installed in locations where there are exhaust fans. The disrespect of this incompatibility often causes the gas appliances to stop due to the reversal of the flow of combustion products in the exhaust duct.

This paper, evaluates the impact of the operation of the mechanical exhaust fan on the performance of type B gas appliances usually installed in the kitchen. The combination of natural or mechanical ventilation in the kitchen with the exhaust of combustion products of natural gas appliances was tested.

the critical conditions that cause the reversal of the flow of the combustion products in the respective exhaust duct and lead the gas appliances to stop were assessed. One of the main conclusions to draw is that when mechanical exhaust is used in the kitchen, simultaneously with the natural exhaust of combustion products of the gas appliance, an outdoor air inlet is a crucial device to ensure adequate combustion products exhaust. This device may prevent the flow reversal of the combustion products and avoid the gas appliance to stop when air intake is reduced by other means or due to high fan extraction flow rates.. For this purpose, the maximum flowrate of mechanical extractors must also be limited.

CODE: 1.6.12

PATHOLOGICAL EXPRESSIONS IN THE HISTORIC CITY CENTRE OF CUENCA, SPAIN

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KEYWORDS: Heritage, refurbishing, constructive solutions, pathologies.

ABSTRACT

This paper is the synthesis of the research performed on the constructive solutions and the pathologies associated thereto in the city of Cuenca, Spain, which was declared a World Heritage site in 1996. The houses built in the ravine of the river Huécar -known as "the skyscrapers"- were studied due to their acknowledged values and since they largely represent the city's domestic architecture of Cuenca's "High City" or historic city centre. The objectives set are aimed at characterising the constructive solutions implemented in the main elements of those interesting buildings, such as the walls, the leaning structural frameworks or envelopes and the slabs or mezzanines. Upon studying the way those elements were built, a study on the building pathology was performed, identifying the main types of damages and the causes thereof. The study moved through several stages of analysis, synthesis and documentation of the fieldwork, which allowed to obtain reliable results both regarding constructive solutions and pathologies. A monograph was prepared as the main result thereof and same is used as reference material for the degree of teaching Building Engineering in the Polytechnic School of Cuenca, and it is also a modest contribution for the study and conservation of those singular buildings.

CODE: 1.6.17

CRACKING OF PARTITION WALLS DUE TO DEFLECTION OF SUPPORT STRUCTURES: CHARACTERIZATION AND PREVENTION

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KEYWORDS: partition walls, masonry, support, cracking, characterization, prevention.

ABSTRACT

Cracking of masonry partition walls can be caused by dimensional variations of the constituent materials or caused by the deflections of support structures.

Cracking of masonry partition walls has been occurring frequently in Portugal in the last decades. Usually these walls are built on beam-and-block floor systems and are made with clay masonry coated with traditional mortars made with cement, lime or plaster binders.

Cracking of these walls is mainly caused by the incompatibility of deformations between masonry walls and concrete slabs/beams. On the other hand, this aspect seems to be often neglected in the design and in the execution phases, therefore increasing the occurrence of cracking in these walls.
This paper presents a synthesis of traditional building technology in Portugal, a characterization of cracking in partition walls due to its support structures and a literature review about this subject. It is also suggested measures to prevent cracking, in particular regarding design, construction and execution aspects of these walls and of its support structure.

CODE: 1.6.19

REAL CASE SCREEN WALL COLLAPSE IN PHASE EXECUTION, GEOTECNIC INFLUENCE OF STUDY AND ENVIRONMENT VARIABLES IN DESIGN CRITERIA AND SIZING, ACTIONS PERFORMED

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KEYWORDS: pathology, wall screen, intervention plans, structural evaluation.

ABSTRACT

The collapse of a wall display during the execution of the economic and technical means a large-scale impact. In this paper we present the description of the lesions affected the days before the collapse and throughout the collapse. As of that incident corresponds primary objective the assessment of the causes that gave rise to be able to contribute to the non-attendance of these new times.

The methodology to be applicable, in chronological analysis of the parameters involved in the calculation of the dimensioning and execution diaphragm wall are derived manner. The parameters that influence mostly are extracted from the original geotechnical and in this case were scarce and optimistic. From this it is derived that the designer must analyze and properly weigh the intervention of these parameters in later design and calculation of the structure. The geotechnical study reflects average values of the geotechnical parameters, but the designer must consider the characteristic values well or apply rebates.

The latter greatly influences the data entry software. The design of the structure that is, encasing, number of provisional anchors, etc. It is essential to increase safety reserve structure and if this is not successful, makes the probability of collapse increases. The results obtained show that you have considered characteristic geotechnical parameters instead of mean values in the calculations, the safety factors have been sufficient and would have prevented the collapse.

The technical solution to a casualty is complex and laborious high economic cost as well as alters other structural solutions already defined as the foundation, due to the alteration of the surrounding terrain.

CODE: 1.6.21

THE RELIEVING ARCH AS A WAY OF BREAKING UP WALLS ANALYSIS OF THE DIVERSITY

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KEYWORDS: arch, wall, breakage.

ABSTRACT

The paper presented is part of an extensive research study of building stock and its technological support. The basic structures that comprise it include the systems of load-bearing walls, in other words, structural organisations prior to the arcaded system implemented with both metal technology and reinforced concrete.

The purpose of this paper is to demonstrate that when walls break due to a modification of their equilibrium because the base upon which they are sustained gives way or deforms, this break occurs through the relieving arch mechanism, that geometrically depends on different variables, including the material it is made of, the load of the wall or the relationship between it and the rest of the structure.

The method used is based on the analysis of different actual cases of breakage in existing buildings, and on the analysis of diverse archive material of breakages that formed relieving arches. As a whole, it demonstrates a certain coincidence in the proportions of breakage… with some exceptions, in which the geometric constitution of the wall, with respect to the rest of the building, forms relieving arches with a very flat curve.

The results and conclusions are presented as realities that could be taken as elements of discussion and debate.

CODE: 1.6.22

IDENTIFICATION OF PATHOLOGIES IN ROADS CONSTRUCTION IN THE REGION SAN MARTIN, PERU

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KEYWORDS: Pathology, roads, construction, maintenance, management, competitiveness.

ABSTRACT

The research work was conducted in the San Martin region, located in the Peruvian jungle and has to do with the pathologies that suffers road construction (construction, improvement, rehabilitation and maintenance), mainly roads, including the Marginal Jungle Highway (Section Moyobamba - Tarapoto - Juanjui, about 230 km), Highway Tarapoto - Yurimaguas (about 130 km), both the national system and the Marginal Highway - Shapaja - Chazuta (30 km), Marginal Highway - Cuñumbuqui - Sisa (60 km), Marginal Road - Lamas (11 km), the three of departmental system and neighborhood centers of production, whose pathologies were identified from poor or inadequate construction practices that breach of technical specifications, leave us a bad pavement quality, unstable slopes, poor drainage, among others.

Were identified and described the causes of diseases on the roads, watching affect proper operation and scrutiny of the approach of alternatives to improve building and maintenance practices, which was achieved through observation and verification in situ, making contact with reality itself, raising visual and graphical information through video and photographs, crossing it with technical specifications and contrasting it with national road standards set by the regulator, which in this case is the Ministry of Transport and Communications.

The results allow us to determine the parameters of quality control of alignments, earrings, field density and moisture of different pavement layers (subgrade, subbase and granular base, asserted), asphalt, artwork (sewers, bridges, walls), storm drainage, sub-drainage ditches coronation, slope stability, sidewalks, quality materials, signage, environmental impact, they must be handled properly because they determine the competitive road maintenance management to have adequate functionality and sustainability roads.

CODE: 1.6.23

EVOLUTION AND CHARACTERISTICS OF SEISMIC RISK IN SPAIN

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KEYWORDS: Seismic vulnerability, seismic risk, masonry infills, irregular configurations, lateral displacements.

ABSTRACT

The seismic performance of buildings is derived from the combined response of structural and nonstructural elements and their content. Therefore, one of the fundamental requirements of seismic design is to limit the damage.

The threatened elements of each seismic zone grow as does the population and the size of the cities. There are numerous towns of small size that have suffered devastating earthquakes throughout their history and, in recent decades, they have had a significant development: either residential, industrial, or both. However, many recent buildings are more vulnerable than it would be appropriate because of their location regarding seismic hazard. It is a common feature of countries where high intensity earthquakes are associated with media to very long return periods. With all this, it is not surprising that the seismic risk of a significant part of the built heritage of these countries is high, especially regarding the potential level of damage.

In this communication the most common structural characteristics of the Spanish buildings in recent decades and their seismic vulnerability are analyzed, in particular the structures, and their interaction with the structural elements of reinforced concrete. The influence of the horizontal displacements is discussed, as well as the importance of limiting it and how to achieve this purpose.

CODE: 1.6.24

"CALERA DE LAS HUERFANAS", JESUIT CHAPEL. CONSIDERATIONS ON THE CURRENT STATE OF STRUCTURAL CONSERVATION AND FUTURE PROSPECTIONS

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KEYWORDS: architectural heritage, masonry, structural assesment.

ABSTRACT

The National Historic monument, "Calera de las Huérfanas", was one of the largest Jesuits enclaves in Uruguay. It was a ranch dedicated to cattle raising and horticulture production as well as to brick and lime production. These construction materials were used for its own buildings and commercialized throughout the region, particularly to Buenos Aires.

Nowadays it only remains a few buildings placed in the heart of the ranch. One of the most distinguished is the chapel built around 1741in ceramic masonry with solid bricks and lime and sand mortar.

According to historical data, its original vaulted roof collapsed between 1820 -30 after the Jesuits expulsion out of the country. Due to the absence of the roof and the age of the building the masonry has had an intense deterioration process that includes collapses, warping and cracking. This situation puts at risk the stability of the building and therefore its conservation.

With the aim to avoid its structural collapse in 1938 and 1950 some actions were taken, like the incorporation of structural elements, the consolidation of mortar joints and the repair of some cracks with cement mortars.

These interventions, some more effective than others, are currently part of the material reality of the monument but they do not represent a definitive solution, because they do not prevent the direct action of atmospheric agents and they do not eradicate the causes that have led to structure movements.
Given this situation, this paper proposes to take some actions in the short and medium term based on an updated assessment of the structural state of conservation of the building. It is expected to contribute to the preservation of the remained structure and its heritage values and to provide arguments to the debate on the relevance or not of covering the site.

CODE: 1.6.26

CRACKING BY FROST ACTION ICE IN THREE GRANITES USED IN CONSTRUCTION

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KEYWORDS: freeze/thaw, microcrack, granite, decay.

ABSTRACT

The development of microcracks due to decay induced by freeze/thaw (FT) in geomaterials can cause building pathologies that weaken their constructive functions. Three types of granite widely used in the architecture of Madrid (Alpedrete, Cadalso de los Vidrios and Zarzalejo granite) were subjected to 280 accelerated FT test cycles, conducted as stipulated in the European standard UNE- EN 1237:2001 to ascertain their petrophysical response.

Development of microcracks generated under FT action was studied by polarised optical microscopy (PM) and fluorescence microscopy (FM), creating 20 PM and FM micrograph mosaics with 80 micrograph in 0, 70, 140, 210 and 280 FT cycles in order to quantify the type of microcracks which occurred inter-, intra- and trans-crystalline.

The results were completed using non-destructive techniques such as ultrasonic propagation velocity (Vp) to determine internal structural changes during the ageing process.

In three granites microcracking development was different both in number and in their typology. They had undergone some decay, which increased with the number of ageing cycles. During the first cycles there was further development of inter-crystalline microcracks, and in later cycles, more intra-crystalline microcracks developed. The different behavior of each type of granite is due to their intrinsic petrological properties (mineralogical and textural composition). Upon completion of the ageing test, Zarzalejo granite presented a greater number of microcracks and Colmenar Viejo, which ends the ageing test with lower generation of microcracks, showing greater resistance to FT testing due to its texture and especially to its lesser initial cracking.

CODE: 1.6.27

DOCUMENTARY RESEARCH TO SOLVE STRUCTURAL PROBLEMS. CASES STUDIES

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KEYWORDS: estructural problems, documentary research, old standards.

ABSTRACT

Solving structural problems needs a specific methodology clearly different than technical tasks of designing news solutions. It requires at the same time knowing old build techniques and also modern built techniques. It's really difficult to find out both profiles in the same person, especially when university studies are usually focused only to project new solutions. As a first step, it would be always necessary to investigate the reasons why the problem has appeared. The aim of this paper is to explain, so clearly as be possible the key steps in these first researchs. At the same time some cases will be prompted to show the way how this technique, easy and cheap, could help us to face the problem in an efficient way. Concrete problems, old standards, and bad focused projects, with others, are cases to be explained.

CODE: 1.6.30

BEHAVIOUR OF RENDERING MORTAR FOR REHABILITATION OF BUILDINGS SUBJECTED TO RISING DAMP

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KEYWORDS: rehabilitation, rendering mortar, rising damp, capillarity, water permeability, soluble salts.

ABSTRACT

This paper presents an experimental study on the behaviour of rendering mortars used to rehabilitate buildings subjected to rising damp and consequently affected by efflorescence. This study was initiated by the characterization, "in situ" and in laboratory, of rendering mortar used as walls coating of an old building affected by efflorescence. Temperature, superficial humidity, mortar water content and salts content were used as characterization tests. Taking into account the reconstitution of old building rendering mortar composition, four different proportions were proposed to simulate different mortars skeletons and porosities. The mortars binders were composed by cement and three additions, such as hydrated lime, artificial hydraulic lime and quicklime paste. The results of capillary water absorption, soluble salts content and permeability test on masonry panels allowed analyzing the performance of mortars compared to the susceptibility of water rise and formation of salts. From this analysis it was possible to draw some practical recommendations for design coating repair mortar in buildings subject to the problem of rising damp.

CODE: 1.6.31

EXAMPLES OF QUANTITATIVE ANALYSES OF ACTIVE THERMOGRAPHY INFRARED IMAGES FOR THE DETECTION OF MOISTURE

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KEYWORDS: building stone decay, Non destructive techniques, Infrared thermography.

ABSTRACT

Infrared thermography is a contactless non-destructive technique in which the infrared radiation emitted by bodies is transformed into a temperature reading . The presence of moisture changes the heat flow in the material , which can result in a contrast in surface temperature reading obtained by the infrared camera . Usually , the thermographic inspection is performed in a "passive " way ; i.e. the inspected structure is not stimulated with a heat flow prior to taking the images. However, differences in thermal response between areas with and without pathology can be exaggerated if the inspected areas are thermally "excited" heating and cooling by circulating hot air or, even more, by radiant heating with lamps. These techniques where infrared images are taken during the heating and cooling cycles of the material are included within the term "active thermography". From the series of thermal images obtained during a cycle of warming and cooling of the areas inspected , calculations can be performed to improve the discrimination of areas with and without pathologies. Active thermography techniques (e.g. pulsed thermography), were mainly developed in areas far removed from the study of buildings and this application is still long way to go to develop. In this paper a number of cases where quantitative analysis of series of thermal images obtained from a variation of "Step Heating" in which the problem areas are continuously heated for a sufficiently long period of time and allowed to cool , making a series of infrared images at regular intervals from before heating starts to after cooling to the initial temperature. The results allow a critical evaluation of the advantages and disadvantages of the application of this technique in building in relation to applications in other fields.

CODE: 1.6.33

STUDY OF THE EFFECT OF TEMPERATURE ON THE PHYSICAL AND MECHANICAL PROPERTIES OF THE CALCARENITE OF SAN JULIÁN

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KEYWORDS: Fire, elastic modulus, compressive strength, thermal damage, calcarenite.

ABSTRACT

This work includes the results of laboratory tests to study the effect of high temperatures in the physical and mechanical properties of a calcarenite, which has been widely used as construction material in historical buildings and monuments of the Spanish city of Alicante. The objective was to assess the thermal damage that the material suffered after being exposed to different temperatures, and the influence of the cooling process, furthermore the viability of using a non-destructive testing method as a diagnosis tool for the properties loss was evaluated. Cylindrical test samples were cut from rock blocks and different tests were run to characterize the materials properties, such as porosity, P-waves and S-waves velocity, dynamic and static elastic moduli and uniaxial compressive strength. The heating process was made in an electric oven between 105ºC and 600ºC, for 100ºC heating increments. For each maximum temperature (except for 105ºC) ten specimens were heated and cooled by two different means, for a total 55 samples under different heating and cooling conditions. Finally, all characterization tests were run again for the treated specimens, and the different variables were correlated and discussed. Afterwards the main conclusion was the steep decrease of all mechanical properties, but porosity (which obviously was higher), as the temperature increased. This performance loss was much noticed for the samples that were cooled with cold water. Besides the NDT were capable of detecting all the damage produced during the heating-cooling process, just like their destructive counterparts.

CODE: 1.6.34

ANALYSIS OF RESULTS OF DETERMINING CAPILLARITY ABSORPTION OF SOLID BRICK USING VARIOUS TESTS

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KEYWORDS: absorption, capillarity, brick, moisture conservation.

ABSTRACT

It is very common to find buildings of old brick masonry where the base of the walls is much degraded, whereas the rest is in better state of conservation. The process that most influences this deterioration is the capillary rise of water from the ground. To investigate the behavior of brick masonry against moisture of capillary rise it is necessary to properly understand the behavior of the component materials of such walls. As regards to the tests of absorption of water for bricks there are different standards UNE. Norms with diverse procedures because they study from different points of view the water absorption in bricks. It is intended to compare the results of tests carried out on bricks with those obtained in the testing of absorption of water by capillarity of small brick masonry walls, to conclude which of the test procedures for bricks, according to the UNE standards, provides the most similar results as those of brick masonry walls.

CODE: 1.6.35

INSPECTION AND REINFORCEMENT OF WOOD STRUCTURES FOR HOUSING AFFECTED BY THE LOSS OF WATER

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KEYWORDS: wooden structure, water, housing, shoring, reinforcement.

ABSTRACT

The incorporation of concrete structures in implementing housing is relatively recent. The housing with wooden structures is still very large and generally concentrated in the older helmets of our cities, where they often inhabit the lower social classes. This situation means that, often, not enough attention to the care and maintenance of the building is provided, appearing a number of pathologies often caused by the presence of water. Intervening in these buildings is complex due to the lack of financial means, living with its people and its structural geometry, often conditioned by the house itself and the elements that occupy. This is because, in this article, to show experiences and present recommendations address these performances, always from the aspects of the intervention-execution and the condition to building occupants.

As to the first, intervention-implementation issues such as the process of locating the source of the disease, execution and inspection tasting, most common damage and where and how to locate, emergency and most appropriate way to proceed addressed to shoring building, implementation processes reinforcements, etc.

On the second, the condition to potential occupants, this is conditioned by the uniqueness of the performance, the means available and the fact that, in many cases, work and work carried out by sharing physical space with self tenant, although depending on the degree of intervention this part has to reach limit.

The future of our economy is now going through the rehabilitation of buildings, being in number and uniqueness, residential buildings with wooden structure, a field to develop.

CODE: 1.6.38

CONSTRUCTIVE CHARACTERIZATION OF FAÇADES. A CASE STUDY IN THE HISTORICAL CENTER OF ALGIERS

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KEYWORDS: façade, pathology, rendering, molding.

ABSTRACT

During 2012-13 a preliminary study has been carried out about the facades of the old French Quarter of the historic center of Algiers (late nineteenth and early twentieth century) in northern Ben M'hidi-Tanger, which received AECID support and the participation of a team of master's teachers and students of the École Polytecnique d'Architecture et d'Urbanisme d'Argel (EPAU) and professors of the Universidad Politécnica de Madrid (ETSA-UPM). While the focus has been teaching methodological application, preliminary results have provided sufficient information to determine damages either in limestone masonry facades from older late nineteenth century as in brick masonry from the first half of the twentieth, all coated with renderings and hollow and solid moldings. The work methodology consisted of using survey charts of visually data and characterization of samples in the laboratory. These charts collected physical, mechanical, chemical and anthropic damages. The results will allow to set up the guidelines and plans for the rehabilitation of architectural heritage.

CODE: 1.6.42

PATHOLOGICAL STUDY OF FRONTAGES IN HISTORICAL OLD TOWN: THE CITY OF BURGOS

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KEYWORDS: pathology, rehabilitation, historical old town, construction, frontages.

ABSTRACT

The Historical Old Towns of cities have come concentrating in the last years much of the interest in the rehabilitation and restoration of existing buildings in many cases stimulated by the own Public Administrations, through diverse forms of subsidies and grants. Nevertheless, the above mentioned effort has centred principally on a recovery of external aesthetics of buildings, without beginning to value the underlying reasons that originated his deterioration, giving place to actions of makeup with immediate but slightly lasting results, which with the time return to reveal the unsolved problems. In the current economic situation, both at the Administrations and the market itself, the building sector orientates necessarily towards the area of rehabilitation, which leads to the need to learn from past experiences to apply them in the future without falling down in the same mistakes. In this respect, there has been realized a Pathological Catalogue of Buildings of the City of Burgos, centred on the area delimited by the Special Plan of the Historical Old Town, more concretely in the first developments of the city in the right margin of Arlanzón River. Based in a field work that has led to documenting more than 300 buildings, the Catalogue realizes a tour afoot of street, revealing of graphical form the observed injures, analyzing his possible reasons and proposing the most viable solutions to the same ones, through a collection of cards that incorporate in addition the statistical and constructive information of every studied building. This work tries to reveal the relation of certain pathologies with determined typologies used in building, constructive epochs, materials used, maintenance, orientation conditions, exposure of the buildings to the sun, and even rehabilitation criteria employed.

CODE: 1.6.46

VENTILATION TECHNIQUE AS A MITIGATION ACTION TO REDUCE RADON CONCENTRATION AND ITS INVOLVEMENT IN ENERGY EFFICIENCY LOSS

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KEYWORDS: mitigation action against radon, ventilacion technique, energy efficiency.

ABSTRACT

Radon gas is a pathological agent for users of buildings where its presence is manifested, due to radioactive effects in the human organism that increase the risk of lung cancer generation (World Health Organization). Coming from soils with masses of granite or other substrates with uranium content, penetrates through materials commonly used in buildings, as concrete floors, basement walls, etc. This risk in the living spaces with high radon levels leads to perform rehabilitation activities in buildings to reduce the indoor concentration to acceptable levels. The ventilation of the indoor spaces is one of the techniques that are contemplated, easy deployment and low cost a priori. However, several studies have shown high ventilation rates needed to achieve this task. This implies a negative impact in energy efficiency of buildings, due to the loss of thermal comfort in certain climates, both hot and cold. In this presentation, an evaluation of the ventilation and pressurization techniques, in their power of radon reduction, is made, and its implications on the thermal comfort and energy demand are analyzed. The analysis is carried out for a typical home located in a variety climate cases.

CODE: 1.7.01

PRIOR TO INTERVENTION ON HISTORIC MASONRY BUILDING EVALUATION: FROM THE NON-DESTRUCTIVE STUDY BY THERMOGRAPHIC ANALYSIS TO THE A MATERIALS CHARACTERIZATION

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KEYWORDS: Masonry brick, Infrared termography, historic building, materials characterization.

ABSTRACT

The purpose of this work is the study of damage detected in a historic building of the seventeenth century by infrared thermography. The Belfry of the convent of Consolation, a wall structure of ceramic bricks protruding vertically from the rest of the building was analyzed.

For a good detection of defects in the structure, previous to the termographic analysis, the emissivities of the inspected materials were experimentally determined. The thermographic study concludes that significant damage due to the presence of moisture as well as mortar disgregation and brick cracking were detected in the element. The use of complementary analytical techniques such as mercury porosimetry, X-ray diffraction and scanning electron microscopy has allowed to know more about the characteristics of mortar binding and original masonry piecesparts used; comprehensively assess the current state of deterioration and facilitating the choice of new materials to be used in rehabilitation.

CODE: 1.7.02

SEISMIC VULNERABILITY FOR THE MORELIA CATHEDRAL IN MEXICO

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KEYWORDS: historic buildings, cathedral, seismic hazard, vulnerability, capacity spectrum, fragility curves, finite elements, rigid elements.

ABSTRACT

In this paper the evaluation of the seismic vulnerability for the Cathedral of Morelia, Michoacan in Mexico is described by mean of the definition of fragility models and the probabilistic seismic hazard of the site. For this study the building was divided into different macroelements, which depending on their level of geometric complexity were generated using two general criteria; the first was a sophisticated three-dimensional finite element model for towers-façade system, calibrated using a dynamic experimental characterization based on the measurement of ambient vibrations, and the second criterion was based on the construction of two-dimensional rigid elements models for longitudinal the naves. For the seismic considered recurrences of 475 and 975 light damages were observed in the towers, unlike to the naves along the transverse direction, where moderate to extensive damages were obtained primarily on the transverse frames which are outside the transept zone. The frames that define the cruise experience a lower vulnerability observing light damages for the two recurrences involved.

CODE: 1.7.03

DYNAMIC MONITORING OF STRUCTURES WITH OPTICAL FIBER SENSORS

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KEYWORDS: Structural monitoring, non-destructive testing, accelerometers, optical fiber sensors.

ABSTRACT

For the study of the safety and durability of structures, it is useful to explore the detection technologies to identify structural damage and even plan its maintenance. Structural monitoring offers a new paradigm to assess and monitor the evolution of parameters that characterize a structure, combining sensors and monitoring systems with damage identification algorithms. One of the most promising detection technologies for this purpose is based on fiber optic sensors, the use of these devices on structural monitoring has increased significantly in recent years, due to numerous advantages over conventional monitoring solutions, such as immunity to electromagnetic fields, electric insulation, low weight, ability to multiplex multiple sensors on the same fiber optic (avoiding a high number of cables), possibility of long-distance monitoring, etc.

In this paper we intend to somehow summarize and present some of the work done at the Instituto de Telecomunicações – Pólo de Aveiro and University of Aveiro in the context of dynamic monitoring of structures, with traditional sensors like seismographs and with fiber optic accelerometers developed and produced in Aveiro.

It was intended to demonstrate the applicability of optical fiber sensors in various types of structures, with different geometries and materials of construction, in comparison with traditional sensors used simultaneously for comparison of results. The monitoring carried out include: a destructive test of an adobe wall, built to full scale in the Civil Engineering Department of the University of Aveiro; a pedestrian bridge on the University Campus of the University of Aveiro; slender structures, including mobile telecommunications towers; and an elevated water reservoir. The monitoring was accomplished using developed optical fiber sensors and commercial electronic sensors, with similar results in the determination of the natural frequencies of structures, which demonstrate the reliability and applicability of optical sensors in the monitoring of this type of structures.

CODE: 1.7.04

EXPERIMENTAL MODAL IDENTIFICATION TESTS FOR SEISMIC PROTECTION OF HERITAGE BUILDINGS: CASE STUDIES IN PERU

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KEYWORDS: seismic protection, archeological heritage, experimental modal identification, numerical models.

ABSTRACT

In recent decades, the application of experimental modal identification tests in civil engineering structures is gaining interest for various purposes such as model calibration, quality control while construction, damage detection, structural health monitoring, etc. The use of these tests in archaeological sites as well as earthen heritage buildings (which are in general massive) is a novel area of application. The paper presents the results of operational modal analysis tests carried out on archaeological and architectural heritage buildings in Peru as part of an extensive research for assessing their seismic vulnerability. The first case study is related to the tests on one sector of the Chokepukio archaeological site, which dates back to the pre-Inca period of Peru (12th Century). The second case study is related to the tests carried out at the St. Peter Apostle Church of Andahuaylillas (16th Century), which is considered as one of the most representative earthen churches of South America for the beauty of its internal paintings. The paper presents a general discussion of the seismic assessment process and the importance of in situ testing when dealing with existent structures. For the specific case studies, the paper shows details of the tests carried out, data processing results, and a summary of the finite element model updating process.

CODE: 1.7.05

NEW METHODOLOGIES AND POSSIBILITIES IN ACTIVE PHOTOGRAMMETRY FOR RIGOROUS DOCUMENTATION OF BUILDINGS

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KEYWORDS: 3D heritage documentation, 3D data Analysis, 3D topology, pathologies monitoring, decission making.

ABSTRACT:

Nowadays there are various available technologies that record details of sufficient accuracy for most of the engineering 3D tasks such as laser scanner or photogrammetry.

The traditional documentation of buildings is based on 2D and 3D representations of cultural heritage. This type of documentation has begun to be obsolete because the techniques used to obtain these products do not take advantage of the large amount of information recorded and simply idealize o simplify reality. This in historical heritage is often not possible due to the irregularities of the elements present.

On the other hand there has appeared a new branch of computational geometry that exploits the data and relationships between different elements recorded based on the 3D topology.

Treatment and interpretation of this information is to extract relationships and meanings that are embedded in a dataset and express these explicitly. A basic example would be the degree of collapse maps, wall and vault thicknesses or the calculation of the curvature or roughness of a wall, in a continuous manner. This transformation of the data must be processed carefully and are associated with specific places.

This article describes several types of analysis and operating results of the 3D building information presented. This new information can be useful to support decision-making and problem solving in the field of built heritage.

CODE: 1.7.06

LOAD TESTS AS A TOOL OF EVALUATING STRUCTURAL SAFETY IN CONSTRUCTIONS WITH EXPIRED USEFUL LIFE

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KEYWORD: load test, useful life, structural concrete.

ABSTRACT:

When a structure has reached the end of their useful life some dubts appear about which its resistant capacity is, if there is any possibility of its regeneration and the extent to which, if such a regeneration exists, it would be meaningful. Concept of "technical ruin" appears when the cost of regenerating useful life is higher than a new building cost. At that point, one of the evaluation methods of knowing structural capacity is a load test. However, methodologies to use, the way how to do it, and interpretations of results show different lines on which it would be convenient to discuss. This essay analyzes Spanish Standards framework about structural load tests to be used, and also their advantages and disadvantages. A real case of a 50 years old structure in the final step of its useful life is presented to support the arguments wrote before.

CODE: 1.7.08

A STUDY TO EVALUATE CLAY BRICK MASONRY BY NUMERICAL ANALYSIS CONSIDERING A CONTINUOUS DAMAGE MODEL

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KEYWORDS: clay brick masonry, numerical parameters, damage model, boundary element method.

ABSTRACT

This work presents a proposition of structural analysis of clay bricks masonry considering a continuous damage numerical model. The computational program is formulated by Boundary Element Method (BEM), representing the nonlinear material behavior with isotropic damage model. The numerical parameters of solid clay brick and mortar for the damage model are related with the physical properties of masonry components, Young's Modulus and tensile and compressive strengths. The equations which represent the mathematic model are formulated based on the composition of an elliptic and a hyperbolic curves referred to plane stress state. Damage theories are rarely employed in the analysis of masonry structures and this work presents the Boundary Element Method formulation and the examples' results confirm the good performance of the model and the program based on the BEM.

CODE: 1.7.09

OPERATIONAL MODAL ANALYSIS AS AN EVALUATION METHOD FOR STRUCTURAL BEHAVIOUR OF HISTORICAL CONSTRUCTIONS

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KEYWORDS: restoration, historical structures, operational modal analysis, finite element model updating.

ABSTRACT

Evaluation techniques are key tools for the evaluation and restoration of historical constructions, especially non-destructive techniques. NDT's have the advantages of not damaging the analysed structure and making the research quicker and cheaper than destructive techniques. Operational Modal Analysis and Model Updating based on the identified dynamic parameters are NDT's that have been widely used in other fields of structural engineering than architecture. Its application for the analysis of structural behaviour of historical constructions has started recently.

This paper firstly describes briefly the main mathematical expressions for the identification of dynamic properties of a structure based on the measures conducted under ambient vibration conditions. The finite element models may be updated based on these experimental identified modal parameters. The second part of the paper presents two examples of the application of this methodology to the research of the structural behaviour of two historical structures. The first example is the control and prediction of the structural behaviour of the houses built over the remains of the Roman theatre in Cádiz (Spain). This control was carried out during the works targeted to extract the Roman Theatre maintaining the historical district built over it. In the second example the proposed methodology is applied to the evaluation of the structural behaviour of a concrete truss bridge before its repair. The result was used to choose the repair technique that best fitted with the problem.

CODE: 1.7.11

DIAGNOSTIC OF THE STATE OF MASONRY WALLS IN A BUILDING OF THE LATE NINETEENTH CENTURY BY THE APPLICATION OF NON-DESTRUCTIVE TESTING

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KEYWORDS: Heritage building, Evaluation, Ceramic Walls, NDT.

ABSTRACT

This work is part of a project about diagnosis by NDT of ceramic masonry units considered in the architectural heritage of Uruguay. Specifically, it aims to study the "Asilo Damaso A. Larrañaga" building, which was built by the French Architect Víctor Rabú between 1873 and 1875 in Montevideo, Uruguay, with the purpose of serving as the asylum "Orphans and foundling ". It was declared a National Historic Landmark since 1976. The general methodology of assessment and diagnosis of this type of structure is developed and implemented for this case of study. The theoretical foundations of the techniques used for the characterization of materials are exposed, their physical and mechanical properties using different experimental procedures and international regulations relating to architectural heritage are also presented. The experimental results allow to characterize existing materials in the building: understood why, to ceramic masonry and mortar board, after being subjected to a variety of tests. From this structural considerations regarding the status of the existing walls are made. Finally the results together with conclusions and recommendations.

CODE: 1.7.12

INTEGRATION OF METROLOGICAL AND TERMOGRAPHIC TECHNIQUES FOR THE MONITORING AND MEASURING OF THE INFLUENCE OF THE TEMPERATURE IN THE MOVEMENT OF THE CANVAS IN THE SOUTH TRANSEPT OF THE CHURCH OF THE CONVENT OF SAN LUIS IN SAN VICENTE DE LA BARQUERA (CANTABRIA)

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KEYWORDS: structure monitoring, data integration, 3D Terrestrial laser scanner, termography, degree of collapse prediction.

ABSTRACT

The former Convent of San Luis in San Vicente de la Barquera is dated in 1454, according to existing literature, although it was remodelled during the late fifteenth and early sixteenth century.

Currently there are remains of its original structure such as vaulted covers of the apse, choir and the north and south facades.

The collapse of the arches of the cruise ship, eliminated strike the balance between the thrusts of the arches and the countermeasures of the buttresses, but left a canvas to 12.00 m. of height and unable to balance effectively the horizontal actions as the wind pushes.

The instability of the canvas required an accurate monitoring method. Initially the development of a microgeodetic network to which integrate observations from 3D laser scanner. A series of campaigns were conducted at different times. After several auscultation campaigns, chaotic movements between campaigns and some dependence between observations depending on the time they were appreciated. Because of the canvas is under the open sky, it suffers a warming process due to the sun trajectory throughout the day on both sides, what leads a movement. This is why it was necessary to consider the temperature of canvas models.

This paper presents the methodology and results of traditional data integration, 3D laser scanner and thermography in the auscultation of the movement of the canvas during the work.

The method, while providing a precise geometric control, can reach and perform simulations to predict the positions of collapse depending on the temperature of the sides of the canvas.

CODE: 1.7.15

INFLUENCE OF RECYCLED AGGREGATES IN THE RELATIONSHIP BETWEEN NON-DESTRUCTIVE TESTING AND MECHANICAL PROPERTIES OF CONCRETE

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KEYWORDS: Non-destructive testing, recycled concrete aggregates, mixed recycled aggregates, ultrasonic, Rebound Hammer Testing.

ABSTRACT

This research is focused on the influence of the usage of concrete recycled aggregate and mixed recycled aggregates, in the relationship that exists between the results of non-destructive testing and the mechanical properties of concrete (compressive strength and modulus of elasticity), in order to have a better understanding of the influence in the mechanical properties of concrete when recycled aggregates are used and it's relationship with non-destructive testing as well as the method developed to control the evolution of the concrete once it has been casted on site.

In this study, a series of tests was carried out taking as reference concrete type HM-25/B/20/I+Qa. From this reference six new types of concrete have been defined, three of them with recycled concrete and the other three with mixed recycled aggregates, in which their replacement ratios of the natural for the recycled aggregate were 20%, 50% and 100%. After the test were completed the relationship between non-destructive testing versus compressive strength and elasticity modules, were obtained, in both cases in a global and particular level.

CODE: 1.7.16

PREDICTION MODELS FOR UNREINFORCED MASONRY OF HISTORIC AND HERITAGE BUILDINGS

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KEYWORDS: models, masonry, damage, heritage buildings.

ABSTRACT

In Argentina and South America there is a generation of historic and heritage buildings built from 1900. The construction technique used in this building has been unreinforced masonry with great thickness and formed by clay bricks and lime mortar. At the time of construction of these buildings were not available the current level of knowledge about design and seismic analysis, a situation that makes them vulnerable to the occurrence of destructive earthquakes. To evaluate the structural response of unreinforced masonry is necessary to know its behavior, which can be determined with various tests, destructive and non-destructive. However, the study of masonry through finite element models can predict with some approximation the response of the structure under seismic loads. This paper makes a micro-modeling of continuous homogeneous elements, constitutive laws for bricks and mortar is defined. Using the algorithm of Abaqus program, two constitutive models of plasticity and damage were used. The work shows the analysis results for unreinforced masonry under horizontal and vertical load. Responses to horizontal load versus displacement for different constitutive model and different thicknesses were determined. Both constitutive models of plasticity and damage show similar results, particularly in the shapes the response curves, however the loads peaks present variations averages 30%. The results based on the variation of the thickness of walls, the capacity curves exhibit similar shapes but scaled linearly between them.

CODE: 1.7.20

A DIAGNOSTIC APPROACH FOR MODERN ARCHITECTURE REFURBISHMENT: VILLA GINA BY F. FICHERA (CATANIA, ITALY)

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KEYWORD: Modern Moviment, conservation, constructive technique, ND investigation, seismic improvement.

ABSTRACT

Recently there has been a renewed interest in technical and constructional aspects of the architecture of the Modern Movement. However, a hurried reading may tend to homologate this architecture according to structural design, use of materials, functional types. In fact, in analogy with the traditional buildings, also they occur specific questions that must be evaluated in preliminary analysis, especially when the goal we have set is their safeguard.

The delicate transition from traditional yard, with use of load-bearing masonry, to the spread of concrete frame structures makes modern buildings, built in the first 30 years of the twentieth century, like "ambiguous" ones: their structural design can not be assimilated to either frame independet structures; the elements of the envelope are not always simple closings; the materials used to package conglomerates often differ in the composition and installation method.

Becomes essential, therefore, an appropriate level of knowledge to be able to propose conscious conservation of these architectures, particularly as they arise in regions, such as Sicily, by the high seismic vulnerability. A diagnostic protocol properly designed and applied mainly to the structural elements can afford to raise the levels of confidence, allowing to propose a restoration that also knows how to resolve any structural deficiencies.

The case study proposed in this paper, Villa Gina designed in 1929 by the architect. Francesco Fichera, a prominent figure of the Modern Movement in Western Sicily, can be considered an example: the application of magnetometric surveys, combined with the more traditional constructive approach, has allowed us to know intimately the structural elements and then direct to an intervention of seismic improvement respectful of the cultural instance of the object. The conservative intervention thus assumes the value of penetrating knowledge investigation and becomes the more fruitful operative moment in a material history of modern architecture.

CODE: 1.7.22

STRUCTURAL ANALYSIS OF THE MONASTERY OF SAN JERÓNIMO OF BUENAVISTA. SEVILLE

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KEYWORDS: Finite elements, operational modal analysis, monastery of San Jerónimo.

ABSTRACT

The Monastery of San Jerónimo is a piece of heritage that is located in Seville (Spain). The construction of the monastery was initiated in 1414. In 1964, the monastery was declared heritage. Since then it has been subjected to some restorations. Recently, an intervention has been carried out in order to convert the monastery into a civic centre. The intervention consisted of the construction of a new building attached to two wings of the cloister.

The two-storey cloister is constituted of semicircular arches on the ground floor and segmental arches on the second one. Three of the four facades not kept on the second floor the corresponding vaults. The arches and vaults are executed in stone and the back wall in brick masonry.

The structural assessment of the current state of the monastery is being done by means of updating of FE models using OMA, an acceptable tool for the update of numerical models. Through its application, mechanical properties of structural elements, as stiffness or mass, can be obtained with great accuracy. For this reason, some Finite Element models and some dynamic in-situ tests have been done. As a result, a numerical model with similar dynamic behaviour than the observed in-situ has been achieved. This model has been used to evaluate the structural behaviour of the building. A historical analysis of the monastery, the followed methodology and the obtained results are the goal of this paper.

CODE: 1.7.26

DISPERSION CURVES CALCULATION USING BLOCH-FLOQUET BOUNDARY CONDITIONS AND ITS APPLICATION TO NON DESTRUCTIVE TESTING EVALUATION

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KEYWORDS: bloch-floquet, dispersion curves, numerical simulation, nondestructive testing.

ABSTRACT

Acoustic techniques have been used as nondestructive evaluation tool during the last decades. Walls and pillars of historic buildings show dispersive behavior when acoustic waves travel inside them. To obtain the dispersion curves of these systems is essential for experimental data interpretations. However, the calculation of theoretical dispersion curves involves the use of complex numerical algorithms or 2D Fourier transformations.

In this paper, an alternative method using the Bloch-Floquet theory is presented. The theory is used to define certain boundary conditions which allow performing the calculation on a finite domain. The validity of the method is illustrated by comparison with other known methods such as those based on analytical solutions or experimental methods based on 2D Fourier transformations. The results show that the proposed method is an alternative to obtain the dispersion curves. It does not require the use of complex numerical algorithms and can be implemented, directly, in commercial finite element software.

CODE: 1.7.28

APPLICATION OF OPERATIONAL MODAL ANALYSIS AS A MEASURE OF BUILDING STRUCTURAL HEALTH

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KEYWORDS: structures, dynamics, structural identification, maintenance of buildings, technical inspection of damage to buildings.

ABSTRACT

The modal behavior of a structure is defined by its modal parameters, i.e. by its own frequencies and corresponding eigenmodes, which are functions of the distribution of mass and rigidity in the structure, and their boundary conditions. Therefore, a change in any of the modal parameters is caused primarily by changes in the distributions of mass and/or stiffness or by a change of support conditions and to a lesser extent by significant variations in environmental conditions (temperature, humidity, etc.) that produces changes in the modal behavior.

Dynamic tests in a structure performed along the time, under standard environmental conditions, allow to obtain any variations in the modal parameters of a structure, and hence identify, potential structural damage. This type of dynamic tests that require only a statistical knowledge of the dynamic excitation, are conducted under the excitement of environmental action, wind, moving loads of people, etc. giving the actual behavior of the structure. It is also possible to calibrate a finite element numerical model that represents the real behavior of the structure. Finally, these variations can be associated between measurements taken at different time intervals to the evolution of structural behavior. This method has the advantage to reflect an overall behavior of the resistant structure where any future changes that might cause harm need not be associated with the measurement points. The change can be observed in the mode shapes. Further measurements can be performed without induced excitation, using only environmental loads (wind, people, etc.) which do not damage the structure. The described technique has been successfully applied to various structures of bridges. This article analyzes the different characteristics that appear to extend to five equal prior art building structures whose permanent loads are usually unknown (live load) and therefore, unlike the identification of bridges, requires a specific analysis shown in the application of these techniques for monitoring the structural health (SHM) through modal identification techniques using environmental loads (Operational modal Analysis OMA). This procedure is applied to a set of several existing with the same type and different adjacent excavations. One is located near a metro line, other isolated and finally two of them separated by a large underground parking. Differences in the five buildings tested are evaluated. All buildings are next to each other and located in Madrid. One of the buildings will be measured continuously in at least one point to calibrate the frequency variation in environmental conditions, especially temperature between day and night, summer and winter: The results obtained are summarized in the article. It will conclude with the possibilities of this technology applied to the building, especially when this is subject to variations due to renovations or nearby construction that could affect their structural behavior.

CODE: 1.7.29

STRESS-STRAIN EVALUATION OF A SINGULAR SHELL OF REINFORCED CONCRETE LOCATED IN THE ALARIFE'S COURTYARD OF THE EDUARDO TORROJA INSTITUTE FOR CONSTRUCTION SCIENCE

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KEYWORDS: Concrete shell, safety, numerical calculation, creep.

ABSTRACT

An outdoor chapel was built between May and June of 1969 in the Alarife's courtyard of the Eduardo Torroja Institute for Construction Sciences. This structure is a reinforced concrete shell which guideline is a Bernoulli's lemniscate. , that recalls the ribs, that give name to the property where the IETcc is located (Costillares). This shell is about 10 m long and about 6.5 m high.

This paper attempts to compare the solution adopted in the 60s with the reality constructed and the consequences that time has had for the structure. The current geometry of the shell has been raised by topographical instruments, to be able to study the phenomena of creep and to compare it with the results of numerical programs of finite element methods. These deformations are compared with those expected for such structures. Critical sections of the shell were also recalculated to check the safety of this structure.

CODE: 1.7.31

PHYSICAL AND MECHANICAL CHARACTERISATION OF LIME MORTARS USED IN THE REHABILITATION OF HISTORIC BUILDINGS BY MEANS OF NON-DESTRUCTIVE TESTING

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KEYWORDS: Lime mortars, limes, aggregates, carbonation, micro-drilling.

ABSTRACT

Knowledge of the mechanical properties and strength of masonry structures is probably essential in all interventions developed in buildings. This can be assessed in different ways, one of these is through the use of phenomenological or empirical formulas in which it is necessary to know certain mechanical properties of the masonry components. In the case of mortar, due to the small thickness of the joints, it is very complex to obtain representative samples. The mortar characterization is difficult because of lack of information, as a result mortar characteristics are usually assumed with the uncertainties that entails.

The aim of the present study is to contribute to the mechanic characterization of lime mortars of historic buildings through the use of correlations with parameters obtained by non-destructive testing. For this purpose, 8 types of mortar were made using one kind of lime (CL90S), and different proportions of binder:aggregates (1:1, 1:2, 1:3 and 1:5). In addition, two types of aggregates were used, limestone and silica. More than 200 prismatic specimens of 40x40x160mm were made. These specimens were tested from a destructive way (flexural and compressive) at 28, 91 and 180 days of curing, and from a non-destructive way (ultrasound and micro-drilling). Furthermore, the influence of carbonation progress in these mortars was analysed.

CODE: 1.7.33

RADAR INVESTIGATION FOR QUALIFICATION OF MASONRY WALLS AND VAULTS IN HISTORICAL BUILDINGS

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KEYWORDS: Historical buildings, non-destructive investigation, radar scanning.

ABSTRACT

Radar scanning enables the qualification of construction materials and techniques, by detecting the reflection of electromagnetic waves, travelling through a component, due to the variation of the dielectric properties within. In historical structures, it has been widely applied to identify morphology and stratigraphy, to localize voids and cavities, to assess discontinuities, and to characterize previous reinforcement works. The paper is going to discuss some applications of radar scanning, with specific focus on the Customhouse Palace of Molfetta, Bari, South Italy, where different procedures for data acquisition, elaboration and interpretation were developed, taking into account the investigation goals, the operational conditions and the complementary information from direct survey and destructive tests. Based on the overall results, main potentialities and criticalities of radar technique for assessment of masonry walls and vaults in historical buildings are pointed out.

CODE: 1.7.37

REMOTE MONITORING OF HISTORICAL BUILDINGS: METHODOLOGY AND STARTING-UP IN THE MODERNIST CHURCH OF THE COMILLAS SEMINARY

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KEYWORDS: remote structural health monitoring, rich internet application, data acquisition system, RTU architecture.

ABSTRACT

The article aims to introduce the methodology followed for the setting up of remote monitoring of the modernist Church of the Comillas Seminary.

First of all, works relating to the registration of the existing damages in the Church are presented. The purpose was to choose the areas where the damages were higher to install the sensors. Thus, the plotting of cracks in drawings was made from data collection carried out on-site. The damages were reported on planes of arches, buttresses, domes, interior walls and facade walls. Besides, a detailed photographical survey was performed in order to supplement the information contained in the drawings.

Once the areas of greatest concentration of damage were located, both discrete in-situ monitoring and continuous remote monitoring were installed. To perform the continuous remote monitoring 18 sensors were deployed: 7 LVDTs as crack meters, 4 Servo-inclinometers, 3 tape extensometers, 2 thermo-hygrometers, an anemometer and a wind vane. To complement the continuous sensors deployed, and with the aim of providing contrast measurements to the electronic sensors, a total of 22 observation points were installed for discrete in situ monitoring, which in turn limited the cost of the system deployed. Of these, 16 were aimed at evaluation of crack opening/closing through the use of a deformation meter, while the other 6 were inclinometer plates to detect loss of verticality of the walls with the aid of a portable inclinometer.

These sensors are grouped into three stations of data acquisition what, in turn, are connected to an Industrial PC in which measurements are stored. This PC is equipped with two batteries which guarantee the uninterrupted operation of the system during a week in the event of cessation of the electric current. An application based on JavaFX was developed. This application, as well as allowing remote management of data stored on the PC, enables the definition of alarms and other interesting features, all in an intuitive graphical environment. The remote monitoring system installed has made it possible to have a centralized control of the monitored parameters. Finally, by way of example, some of the measurements registered are presented.

CODE: 1.7.38

INTEGRATING ELECTRONIC INSTRUMENTATION SYSTEMS, DATA ACQUISITION AND SOFTWARE DEVELOPMENT FOR REMOTE STRUCTURAL HEALTH MONITORING

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KEYWORDS: remote structural health monitoring, rich internet application, data acquisition system, RTU architecture.

ABSTRACT

The passage of time and environmental factors contribute to the progressive deterioration of buildings. When this is the case of cultural heritage buildings, conservation and maintenance become a critical factor. In those buildings without the proper conservation or maintenance, structural damages leads to expensive rehabilitation plans, where a previous study phase is mandatory, in order to advise on the severity of the developed structural problems.

In this paper, a practical overview about integrating electronic instrumentation systems, data acquisition and software development for the analysis of structural pathological processes in a novel way is presented, allowing the researcher in charge of this phase of study, among others:

- Remotely monitoring of real-time evolution of the data collected by the sensors installed, avoiding the need of continuous travels to the location.
- Continuous recording of the data collected, allowing the generation of evolution graphs or having full raw files to perform several studies.
- Establishment of protocols to systematically evaluate risk factors, and setting of automatic alarms, in case the controlled variables exceeded preset limits values.

This integration is based on the implementation of an RTU architecture in an industrial PC along with suitable data acquisition cards for the type of sensors used, which continuously collect the data the sensors gather, the installation of an application server that periodically communicates with the system, extracting data while guaranteeing persistence, and finally a web server, which provides remote access to both the data and the system configuration, using a client application developed in JavaFX, a novel platform for developing rich Internet applications.

As an example of the integration, the architecture of a system deployed in a Church of the Major Seminary in Comillas, Spain, is shown.

CODE: 1.7.39

ANALISYS OF THE VARIABLES FOR THE PROBABILISTIC STUDY IN CONSTRUCTED BUILDINGS STRUCTURES

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KEYWORDS: building, structural verification, probabilistic methodology, basic variables, reliability rate, failure probability.

ABSTRACT

In the specific área of executed reinforce concrete structures, it is necesary to improve an explicit security value. In this respect, the involved basic variables values take an active role and its variability should be adjusted according to the needs.

This article highlights and shows the importance of the knowledge of the variability of certain basic variables in executed reinforce concrete structures, in order to have, explicity or implicity, a measure of the structural security in the form of failure probability or reliability rate.

On one hand, gathering the JCSS recomendations, Probabilistic Model Code, Leonardo Project and adapting them to the normal situations of the structural building about materials and forces, the article studies the performance faced to simple flexion and shear limit states of the different basic variables, to get the failure probability estimation with the object of the selective knowing of those variables for the constructed structures validation.

On the other hand, are analysed the methodology of the security partial coefficients and forces, in order to explain the relative importance of the variability of such variables about the failure probability; and to find out the aspects on which one should take action to optimize the structural validation process.

CODE: 1.7.40

REDUCTION OF SEISMIC VULNERABILITY AND IMPROVEMENT OF THE CHURCH OF SAN CRISTOBAL DE LORCA AFFECTED BY THE EARTHQUAKE IN MAY 2011 LORCA (MURCIA, SPAIN)

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KEYWORDS: Masonry, Seismical Damage, Auscultation, Analysis & Assessment, Seismic Improvement, FRP composite materials , reinforcing, etc.

ABSTRACT

In this paper the methods of inspection and auscultation used for analyzing the structural condition of the Church of San Cristobal de Lorca, affected by the earthquake in May 2011, are discussed. The level and extent of damage is described and analysed in relation with the seismic behavior of masonry structure under seismic loads.

The used criteria in the analysis and structural assessment, and proposed intervention under a seismic improvement for reducing the vulnerability of the building are showed. In this case, methods have been employed both global and local analysis, based on the limit analysis of kinematic mechanisms and collapse. With the followed methodology, the behavior and the construction response, and also consistency of the analysis performed with the damage caused by the earthquake, are verified . With the survey data, it has been set the intervention criteria and recommendations for repairing damage and minimum necessary reinforcing intervention.

CODE: 1.7.42

NON-DESTRUCTIVE EVALUATION OF REINFORCED CONCRETE BY MEANS OF THE INTEGRATION OF TWO TECHNIQUES: GROUND-PENETRATING RADAR AND ULTRASOUND TOMOGRAPHY

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KEYWORDS: tomography, ultrasound, reinforced concrete, ground-penetrating radar, non-destructive technique.

ABSTRACT

This paper deals with the application of two non-destructive techniques: ground-penetrating radar and ultrasound tomography. These techniques, with their commercial equipment and software, might be capable of providing reliable information for assessing the integrity of reinforced concrete structures. But prior to their use, it is necessary to calibrate them, in order to assess their resolution and limitations for the material under study: reinforced concrete. Therefore the first aim of this study was to analyze the capability of each technique separately. Subsequently the second aim was to investigate the possibility of integrating the results of both techniques, for the material under inspection, in order to configure a single non-destructive procedure to detect possible anomalies in reinforced concrete structures. For that purpose, a concrete block was built with meshes of different sampling and diameters and spherical inclusions of different materials and sizes at specific locations.

Although this study was focused on the application of non-destructive techniques to the study of reinforced concrete, the authors interest was also to develop a working procedure, that allows their application to different structural elements, in which their use would be interesting and even necessary in certain cases; but not only, to monitor the state of the structure, even to locate and assess the dimensions of anomalies. The field of application of this work is the quality control of concrete by monitoring techniques, but it could be clearly extrapolated to other material structures, especially those regarding the cultural heritage buildings, such as bricks or masonry.

CODE: 1.7.44

VALIDATION OF BUILDING STRUCTURES ALREADY BUILT

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KEYWORDS: Checking structures, existing structures, taking structural data, safety factors.

ABSTRACT

On the issue of architectural rehabilitation is increasingly necessary to validate an existing structure in reasonably safe condition. For this, the Technical Building Code has a clearly inadequate response and raises serious doubts in your application. In fact paragraph D.1.2 directly stated: "It is not suitable the direct use of the standards and rules established in this CTE in the structural evaluation of existing buildings ", but does not provide an alternative method.

Validation of an existing structure requires several processes:
• Definition of data collection needed to have sufficient knowledge of the characteristics and condition of the structure.
• Definition of checking structural models adapted to the actual knowledge of the structure.
• Definition of applicable safety standards.
• Checking the structural safety of the items based on the data available and the required safety levels.

In this paper, the authors propose the development of a protocol for validation of built structures. For this, the authors have developed since 2001 a computer program for testing structures, which has been incorporated in 2010 a module for the evaluation of reinforced concrete structures built with previous regulations or even using steels bars with characteristics or different diameters than current ones.

This test program is based on defining the conditions necessary for the calculation to be evaluated as correct. This allows a very simple validation, with few data and very effective it can be a very helpful instrument for checking built structures.

CODE: 1.7.45

SHEAR RESISTANCE OF REINFORCED MANSORY WALLS: PREDICTION AND EXPERIMENTAL RESULTS

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KEYWORDS: Reinforced Masonry, Shear Resistance, 27F 2010 Chile Earthquake.

ABSTRACT

In Chile, much of the park built is based on shear walls reinforced masonry. A significant portion of these constructs showed structural damage after the earthquake of 27 February 2010. The structural evaluation of such structures requires a sufficiently precise analysis that allows technicians to take measures of informed action.

As part of a major research, this paper studies the influence of the main variables involved in the seismic behavior of shear walls reinforced masonry and makes a critical review of formulations available in the literature to estimate the maximum shear strength of reinforced masonry walls. The paper analyzes the main damage observed in reinforced masonry buildings after the earthquake Mw = 8.8 of Chile 2010. Then the paper compares the estimation of the maximum shear strength of walls using different formulations (proposed by regulations and researchers) with a set of experimental results reported in the literature. The experimental data used in this research come from 22 different sources, including experimental information about walls constructed with ceramic brick and concrete block, on condition of partial and complete grout.

The study result shows that the most accurate for prediction of the maximum shear strength expressions are proposed Matsumura (1987) and Tomazevic (1999), ceramic brick masonry and concrete block respectively.

CODE: 1.7.46

THE METHOD OF FINITE ELEMENTS USED FOR THE DIAGNOSIS AND STRUCTURAL INTEGRITY OF OLD BUILDINGS

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KEYWORDS: Structural analysis, expert opinion, structural integrity, finite elements.

ABSTRACT

Structural pathologies present in old buildings require the structural analysis to try to predict what have been the causes that have generated the detected damage. There are different kinds of analysis that allow us to evaluate, more o less exactly, the structural integrity of old buildings.

A real case of a nearly fifty-year-old building is presented, that has multiple pathologies and the purpose of which has been to assess its structural integrity. We have tried to find out what can have been the causes behind these pathologies by carrying out different numerical analysis.

The methodology used has been, in the first place, the examination of the construction project and its verification on the completed building works. Afterwards a simple model was made based on matrix calculation and expert opinion of the different sections. Finally, the study was completed more in detail by using the method of finite elements and the corresponding stress verifications.

The results that we obtained were used as the basis for the designing of a load test and the different interventions carried out on the construction in order to improve the structural integrity.

CODE: 1.7.48

THE DIAGNOSTIC PROCESS OF STONE CLADDINGS: AIMS, METHODS AND TOOLS

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KEYWORDS: stone façades, degradation, diagnostic process, method, tools.

ABSTRACT

The degradation of stone claddings reaches different levels of importance and requires maintenance works with variable incidence. It can regard only the surface layer of the stone, reaching its deep layers, and/or interest the interface between the support and connection system of stone slabs. The maintenance of the stone cladding is an activity that must be carefully planned and managed along the time; for this purpose it is necessary to prepare a careful diagnostic process aimed to identify all aspects of natural and pathological degradation. The complexity of contemporary building systems makes more difficult than in the past the problem of design and construction of reliability of built systems, as well as the diagnosis of degradation, and activates a degradation process often very close to the time of construction. Therefore, it is very important to focus the possibility of developing investigation methods that allow the identification of the causes of degradation and building diseases. The paper, based on experimental experience, describes the framework of goals, methods and tools of the diagnostic process applied to the stone cladding.

CODE: 1.7.49

INFRARED THERMOGRAPHY FOR NON-DESTRUCTIVE TESTING IN BUILDING PATHOLOGY AND REHABILITATION: DOCUMENTED USES

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KEYWORDS: pathology, rehabilitation, building, infrared thermography, bibliography.

ABSTRACT

The use of Infrared Thermography enables us to visualize the emission of infrared light from bodies in accordance with their thermal condition. Visualization of the radiation temperature of a surface is a technique that also permits its digital measurement at a distance without any type of contact. Various authors propose the use of this technique as an early warning system, on the basis of the different heat transference capabilities of each surface in accordance with its physical state. Infrared Thermography is presented to the building technician as a technology with multiple possibilities, the correct application of which reveals itself to be complex. It therefore requires specific training that is also complementary to the knowledge in the university and professional baggage that the technician has acquired in the field of Building Engineering. Some 50 years since the earliest bibliographic references on the subject that we were able to find on our main databases, the present article reviews the development of infrared technology and lends special attention to its applications in the construction industry, thereby contributing to knowledge and the use of this technique. Among the results, there are various proposals on the use of thermography in the fields of structural pathology, and the rehabilitation of historic heritage and its documentation.

CODE: 1.7.52

SCOPE OF INFRARED THERMOGRAPHY IN THE EVALUATION OF TIMBER STRUCTURES WITH NON DESTRUCTIVE TESTS

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KEYWORDS: timber structures, NDT, infrared thermography, density; detection.

ABSTRACT

Infrared thermography has recently joined the group of non-destructive testing techniques to be used in the inspection of historic timber structures. This technique can show the surface temperature of objects remotely and without any contact, which makes it a strictly non-destructive method. In spite of its benefits, it is seldom used to inspect timber structures because of the current lack of technical knowledge.

We analyze the thermodynamic behavior of wood and the physical principles underlying infrared thermography to discuss its potential for nondestructive evaluation of wood. Based on series of laboratory tests, we estimated timber emissivity, which is an essential parameter in this technique. Our observations in this paper lead a new way to physically characterize wood by quantitative estimation of density, and show that infrared thermography is a sound method to detect common subsurface defects.

CODE: 1.7.53

THE CARNIVAL OF SALVADOR AND ITS EFFECTS ON SANTO ANTÔNIO DA BARRA FORTRESS

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KEYWORDS: heritage, monument, vibration, decibels, structure.

ABSTRACT

Old buildings of historic, artistic and cultural interest often suffer serious degradation due, among other causes, vibrations, which can lead to their structural implications. In Salvador, Brazil's first capital, and city with one of the most important and richest architectural collections of Portuguese colonial period, Carnival is celebrated for seven days. People have fun with *trios elétricos* (trucks equipped with an extremely high powerful sound system and a music group on its top that plays for the crowd) that pass through some streets and places on the historical centre and on the seafront. During this period, ancient and modern buildings are influenced by the high sounds, both in its structure and in architectural details. An example is the Santo Antônio da Barra Fortress, original 16th-century construction, which already shows cracks in some masonry and stonework details, due to the occurrence of traditional events in its neighborhoods. This study aims to analyze the influence of the parameters of vibrations resulting from high-decibel issued by *trios elétricos*, during the period of Carnival, in the structure of the building. A comparative analysis of peak velocity values, obtained through the installation of accelerometers in the walls and floors of the Fort, is presented with the acceptable limits established by international technical standards. In this research is emphasized the possibility of correct identification of structural damage, to be administered the appropriate solution, avoiding or alleviating the significant degradation of cultural heritage of the city.

CODE: 1.8.02

BUILDING STANDARDS AND REHABILITATION: ANALYSIS OF PRACTICAL CASES

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KEYWORDS: rehabilitation, building standards, structures.

ABSTRACT

The nowadays unceasing code changing creates many problems to the architect that faces rehabilitation: not only the insecurity situation in which he lives, with changing requirements whose application often escapes the regulators in order to fall on the interpretation of sector experts.

This standards dancing, with increasing documentary requirements, could get to create a new type of injury, the 'documentary pathology' in which the building has no injuries ... but 'does not have the right papers'. This situation stems largely from the malfunctioning of archive systems, resulting in the loss of a previous documentation which could become very valuable.

But to add insult to injury, the specific technical requirements for rehabilitation works have not yet entered the normative world, -or they have gone out of it-, so that technical performances lack any coverage other than the common sense: so modern rules that exclude of their scope old construction methods widely sanctioned by experience, or even advocate solutions that are contrary to the philosophy of the constructive system.

In this sense, there are situations what architects avoid intervening -despite the improvement of the initial conditions of the building that the intervention would get- due to inability to meet standards set by codes: too demanding standards can lead to the worst outcome: no renew.

CODE: 1.8.03

PRONIC CONTRIBUTIONS FOR BUILDING REFURBISHMENT – PROCEDURES AND TECHNOLOGY

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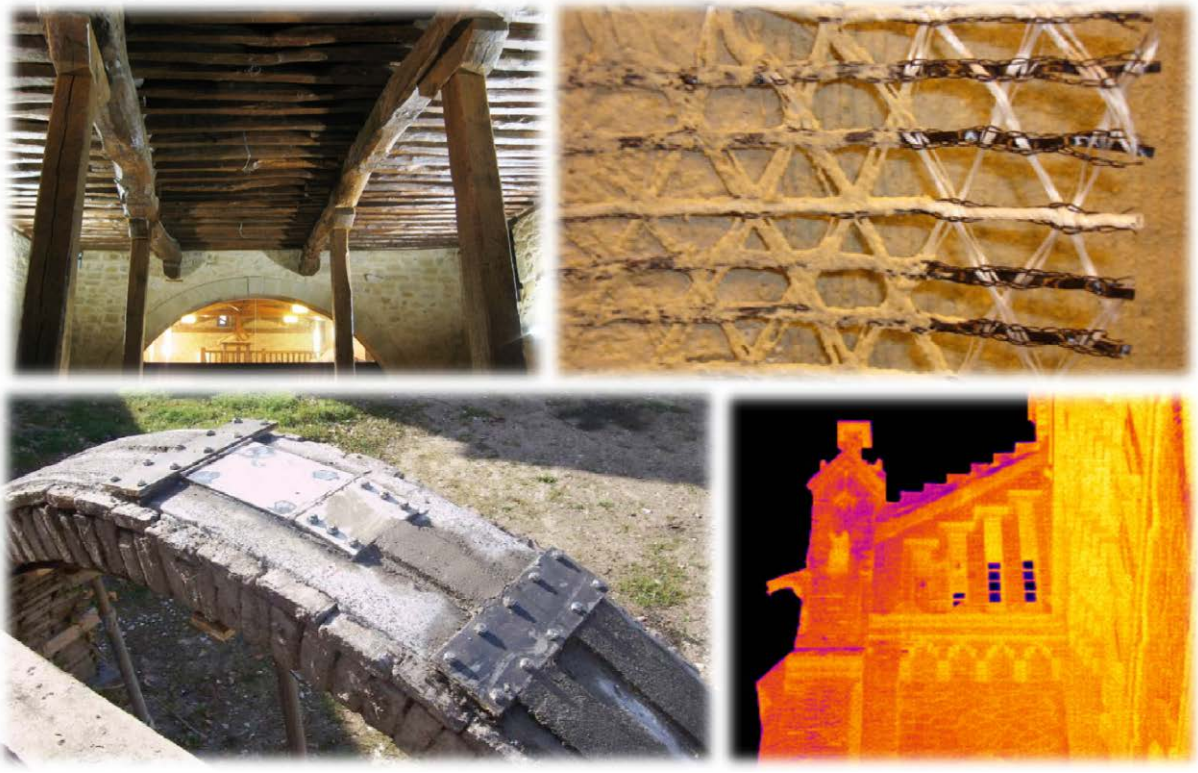
KEYWORDS: standardization, sustainability of processes, information, construction process, systematization.

ABSTRACT

The current economic situation lays a big pressure upon the construction industry. The willingness for investment is much smaller and it is a key assumption that all the work owners shall adopt measures in order to assess more effectively, on preliminary phases, the costs and benefits of the investments to be made.
The forecasts and strategies point to the building refurbishment market and particularly to the interventions on the built heritage as near future development areas.
These operations involve more complexity and singularities. Thus, it becomes even more important the consideration of all the construction process involved costs, as well as the predicted costs of use/operation during the construction life-cycle. These parameters are found essential for the pre-construction economic analysis. Furthermore, it becomes more necessary the organization/systematization of the processes and the knowledge about the specificities of this type of interventions. Compliance with these concerns will only be guaranteed if there are methods and tools able to provide to the construction agents, the data and the mechanisms that they need to have improved setting, management, assessment and decision on the construction solutions to be applied and their inherent cost. Facing this logic, the systematization of information, processes and the link reinforcement between different actors along the construction process phases, arises again as a determinant factor.
ProNIC – Construction Information Standardization Protocol is an initiative that aims to help the professionals on the systematization of procedures and technical information for the correct definition and implementation of construction processes.
It has its roots on a faceted classification information system with improved development in terms of construction works. It can be used in different situations (construction types) and it includes links to price scenarios and technical specifications of works and products. This information was structured to run on a computer application. The interface includes several services/features to be used by different agents. This paper explores the systematization requirements performed during ProNIC development and explores the approach needs and singularities of refurbishment processes.

2.- PROJECT



CODE: 2.1.01

THE COLOUR OF HISTORICAL. TOWNS CONSERVATION AND RESTAURATION OF ARCHITECTURAL FINISHINGS THROUGH A CRITICAL PROCESS

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KEYWORDS: conservation, restauration, historical town, surfaces, colour.

ABSTRACT

Focus of this paper is the existing gap between urban planning, technology and restauration, with specific reference to the interventions on finishing and colours of historical buildings, currently approached as mere "skin" of the buildings. It is felt that to improve the practices of conservative restauration the three disciplines must engage in dialogue and find common theoretical and operational grounds. This project intends to critically analyse such divide and produce a proactive contribution to the current debate.

Looking from the perspective of the founding principlesof conservative restoration, the surfaces of an historical building are integral part of the building itself. The methodological approach of this project involves the integrated interdisciplinary analysis of case studies that appear to have addressed restauration of architectural finishing as separate element of the building.

It is deemed of crucial importance that conservative restoration interventionsare guided by well-defined theoretical concepts and practices. In addition to the historical analysis of the building, the preparatory phase that precedes the intervention will include the study of the materials and the state of conservation of the finishings. Given the importance of the opus antiqua, every intervention will identify the coexistence of present and past significance. The relevance of authenticity of finishing is not limited to their function of aesthetic addition, testimony of the appearance of the past, it is indeed element of texture and appearance of the present.

This research has produced guidelines echoing the principles of critic-conservative restauration.

CODE: 2.1.02

HERITAGE OF HISTORIC BUILDINGS AND POST-EARTHQUAKE RECONSTRUCTION. METHODOLOGY FOR RESTORATION OF SANT'EUSANIO FORCONESE IN THE PROVINCE OF L'AQUILA

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KEYWORDS: restoration, construction techniques, reconstruction, typological models, dry technologies.

ABSTRACT

After the 2009 earthquake, the urban network of L'Aquila and its founding small villages has been the focal point since the beginning of the reconstruction process.
With small historical towns, that process should be an act of transformation-preservation undertaken within the rules that protect the values, ensuring new practical conditions and adequate levels of safety and comfort.
It seems necessary to determine methodological means capable of considering not only quantitative parameters to do with the definition of performance shortcomings and the various intervention options, but also qualitative parameters tied to the evaluation of the transformability of the operational framework and to the compatibility of the envisaged solutions.
The aim of this paper is to present the results of the experimental planning activity for the reconstruction of Sant'Eusanio Forconese, which are important for the morphology of the settlement structure, variety of building types and structural techniques.
The relationship between type, technology and design is the key to the interpretation of a methodology which, from a multi-level perspective, enables the definition of a:
-"knowledge plan", which allows the identification and assessment of the elements to be retained and the definition of the levels of transformability, depending on the damage.
-"reconstruction plan", which translates the objectives of the performance and functional improvement into actions updating the system of the spatial, environmental and technological requirements.
-"technical plan", which develops, within the dry technologies range, corresponding solutions that guarantee the protection of the historical and identity data of the developed heritage.
From the perspective of active conservation and in the context under investigation, the historic building heritage of smaller towns assumes the role of "available resource", which can be translated into a relevant housing supply capable of activating positive processes with important effects on the settlement-territorial and socio-economic model, ensuring the preservation of a widespread building heritage which is a unique expression between a constructed context and a natural environment.

CODE: 2.1.04

INTERVENTION CRITERIA ON DEFENSIVE ARCHITECTURE. THREE EXAMPLES: THE ISLAMIC FORTIFIED COMPLEX OF CALATAYUD, THE FORT OF CARBAJALES DE ALBA AND THE CASTLE OF ALBA DE TORMES

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KEYWORDS: conservation criteria, conservation methods, defensive architecture, accessibility, didactics.

ABSTRACT

Defensive architecture has specific characteristics that differentiate it from Civil and Religious buildings. It often lacks decorative elements; it usually has long time ago lost the use for which it was designed and, in many cases, it has difficult accesses. As a consequence their condition is generally very poor. However, it excites the imagination of visitors and almost always citizens look at it as a strong identity sign.

Intervention on the remains of Defensive Architecture, following the classical conservation scheme—(1) research, (2) conservation procedures and (3) return to society-, has its specific problems. Accessibility, understanding of the uses for which it was designed and dissemination of research results become crucial.

Three different approaches to recovery defensible space are presented in this paper, with techniques ranging from the reproduction of traditional construction systems to the use of alternative methods to recreate the volumes to help visitors better understand the remains, based on the available historical documentation and the results of archaeological excavations.

Different methods are used in each of the three interventions to achieve the same goal: to preserve cultural heritage for future generations and make it physically and socially accessible.

CODE: 2.1.05

THE ROLE OF NON-STRUCTURAL ELEMENTS ON THE REHABILITATION OF CONVENTIONAL BUILDINGS

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KEYWORDS: buildings, partitions, facades, estructure, forces.

ABSTRACT

With relative frequency it is found that rehabilitation activities of non-structural elements of buildings, partitions and facades triggered damage, sometimes serious, affecting not only the elements themselves but also to the building structure.

Tasks as habitual as a simple redistribution of interior walls of dwelling buildings or demolition of facade wall on the ground floors to suit commercial use frequently causes cracking of other building partitions. In extreme cases may even result in damage to the structure.

All these facts are justify very simply if we take in account the resistant nature of the elements improperly designated as "non-structural". Artificial assignation that responds only to the simple convenience of an inadequate method of project that does not correspond to reality.

In this paper a simple assessment of the effect of the ceramic masonry walls in the stress distribution in the structure is presented, demonstrating its importance and thus justifying the negative effects of careless action on these elements.

CODE: 2.1.06

CONCEPTION ASPECTS TO ATTEND IN PROJECTS DESIGN OF OLD BUILDINGS REFURBISHMENT

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KEYWORDS: refurbishment, project design, intervention works, resources, sustainability.

ABSTRACT

The refurbishment of historical city centre old buildings is a kind of practice expected to increase in Portugal. The number of existing old buildings with repair works needs promote the possibility of reusing existing resources, the revitalization of consolidated urban areas and also contribute to develop the local economy.

It is possible to repair these buildings by applying sustainable management practices to promote better comfort conditions. During the conception phase, it is possible to add several aspects that assist the management and decision-making in refurbishment works. Although part of these aspects is not required by law or regulations support, their implementation gives more economic and environment benefits to the utilization phase. Solutions related to water reuse, electricity production, domestic water heating by solar collectors, energy efficiency, bioclimatic solutions, and natural light, among many other possible solutions, are examples of the mentioned aspects. Within this context, there are many other practices related to material resources reuse, like recognizing their conservation status and pondering materials replacement in refurbishment works.

This article includes part of a PhD study, about a toolkit of parameters developed to be applied during project management. The toolkit is divided in four thematic areas, namely: “Surrounding and location”, "Conception", "Execution of works and building site" and "Costs". All thematic areas aggregate a total of 50 parameters which contribute to assist stakeholders in decision-making related to old buildings refurbishment. Among the toolkit parameters mentioned above, we highlight the ones about the “conception” area, as well as a possible classification of more and less sustainable solutions when compared with frequent or conventional solutions used.

A case study was used by conducting a document review of 7 building refurbishment project designs provided by the Urban Rehabilitation Society Porto Vivo, complemented by interviews with stakeholders. The result obtained shows the recognition of interest in applying these parameters when developing old buildings refurbishment projects.

CODE: 2.1.07

CONSIDERATIONS ABOUT THE PERIOD OF SERVICE OF STRUCTURES IN SPANISH BUILDING CODES

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KEYWORDS: period of service, durability, structure, lifespan.

ABSTRACT

The period of service or lifespan expected is one of the things that needs to be defined during the process of design of a building. This parameter affects the different elements that configure the building, specially its supporting structure. This must claim the compliance of supporting capability and service aptitude during the lifespan. It is necessary to arrange the adequate measurements to assure its durability and to design the elements of structure to support the actions required by Building Codes.

The period of service estimated for the building has an implicit influence to define the characteristic values of the actions to be considered during the design of the structure. In this paper the considerations that structural Spanish Codes make for choosing the lifespan are described. The influence they have on the values of the actions and over durability of materials to withstand the physical and chemical conditions which the structure is exposed is also analyzed. Thus, the election of an adequate period of service of structure must be performed globally considering the complete set of variables that are influenced by this parameter adding intrinsic coherence on design decisions taken.

CODE: 2.1.08

THE STRUCTURAL INTERVENTION OF HISTORICAL BUILDINGS BY MEANS OF AN MULTIDISCIPLINARY APPROACH

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KEYWORDS: Conservation Engineering, multidiscipline, intervention project, complementary analysis approach.

ABSTRACT

This paper presents how the structural engineering must interact closely with other scientific and artistic areas during a restoration process in order to prevent that the structural project affects and modifies the historical memory of the architectural heritage. The “Conservation Engineering” is different from the “Engineering of new buildings” since the first one requires a deep understanding of the construction techniques and materials used in the ancient times. Because of this lack of knowledge, often the historical component has been mutilated or destroyed by engineers who do not recognize this fact, sometimes with the approval of the authorities and other professionals involved. Furthermore, the restoration process is a multidisciplinary field in which various disciplines are involved. However, it is difficult that these disciplines work truly together. Unfortunately, this lack of integration means that, sometimes the structural project does not follow the basic guidelines of conservation. It is clear that the structural project must provide a certain degree of security, but without changing the identity, the history and the cultural and artistic values of the architectural heritage. Thus, this paper proposed a comprehensive methodology for the structural project in order to avoid losing the intrinsic values of the structure. This comprehensive methodology called “complementary analysis approach” is a stepped strategy which must carry three main steps: a) analysis of past conditions, b) analysis of present conditions, and c) analysis of the future conditions. Finally, the proposed methodology is presented by means of a case study.

CODE: 2.1.13

THE OCA 2 PAVILION OF THE UNIVERSITY OF BRASÍLIA: THE PRESERVATION OF MODERN HERITAGE CHALENGES

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KEYWORDS: cultural heritage, modern architecture, brasília, restoration, adaptation.

ABSTRACT

In 1960, Lucio Costa presented the master plan for the construction of the university of Brasilia campus. In 1961, the Decree no 3998 created the University of Brasilia Foundation. In 1962, the classes have begun. Although the main campus buildings were in early stages of construction, the university already had a small number of buildings quickly constructed by the principles of industrialization and prefabrication adopted by Oscar Niemeyer and João Filgueiras Lima, also known as Lelé, e.g. the Central Institute of Sciences, known as minhocão, the buildings of General Services, known as SG's and the residential buildings of the Colina. Among these buildings were the OCA 1 and OCA 2 pavilions, along with a temporary restaurant and the building of the Faculty of Education - FE, these four last buildings formed the initial core of the campus. The prefabricated wood structure pavilions designed and built by the architect Sergio Rodrigues served as accommodation for students and teachers at UnB. They were the first buildings in prefabricated wood structure built in the capital and were not temporary structures they have been built to last. Its architectural proposal were modernist and presented some of the principles of modern architecture proposed by Le Corbusier, like the free plan and the free façade. In the 1970s, the OCA 1 was destroyed by fire leaving only the OCA 2, now in poor condition. With serious structural damages, the building should be restored. What are the principles to be adopted to preserve the OCA 2? To what extent the principles outlined in the conservation theory should be a guide for the intervention in the modern heritage? This article aims to contribute to the discussion and development of the theoretical framework for the preservation of modern heritage, especially that of wood, by assessing not only the physical condition of the property, but also of its spatiality and its architectural design intent.

CODE: 2.1.15

STABILITY OF MASONRY VAULTS AND ARCHES: TRADITIONAL METHODS AND AUTOMATIC CALCULATION

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KEYWORDS: ashlar arches, masonry, collapse mechanisms , graphic methods, automatic calculation, nonlinear analysis.

ABSTRACT

The article discusses masonry arches and vaults within building complexes and introduces procedures for the study of their stability. These procedures may be conveniently used to evaluate the degree of stability of arches and vaults and similarly the level of vulnerability in function of a possible variation of external actions, caused for example by a different use of the building, foundation displacements, or seismic actions. These procedures are applicable both in verification processes and in new design. The article furthermore presents the principle historical theories on the causes of instability of arches and describes the possible collapse mechanisms which may follow. Two procedures, Mery's graphic method and the analytical method proposed by the authors, both based on a specific hypothesis consisting in a behavioural model assumed for arches, are described and compared and inserted in a framework of schools of thought related to possible collapse mechanisms.

CODE: 2.2.01

A COMPARATIVE STUDY OF THE LIME MORTAR USED FOR A XIX CENTURY MASONRY BRIDGE LOCATED IN CALI, COLOMBIA

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KEYWORDS: historic mortar, analytical characterisation, SEM analysis, X-ray diffractometry, fourier transform infrared spectroscopy.

ABSTRACT

Two types of lime mortar (glue and plaster) have been characterized, and these types of lime mortar were used in the construction of masonry bridges, called Puente Calicanto or Ortiz Bridge, which are located in Cali (Colombia) and were put into service in 1845. To this end, the techniques of X-ray Diffraction (XRD), Infrared Spectroscopy by Fourier Transform (FT-IR), Scanning Electron Microscopy (SEM) and Differential Scanning Calorimetry (DSC) have been employed. Using these different techniques, it can be concluded that each of these mortars exhibit differences in the proportion of their constituent materials, and the successful use of empirical knowledge can be demonstrated in the selection of the types of lime used by the builders. XRD characterization is adequate when crystalline phases are present, but for low-crystallinity materials, FT-IR analysis and DSC are more appropriate.

CODE: 2.2.02

CHARACTERISATION OF THE MECHANICAL BEHAVIOR OF TRADITIONAL SCHIST MASONRY

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KEYWORDS: masonry, schist, structures mechanics.

ABSTRACT

The traditional schist masonry constructions are part of the vast built universal heritage. In Portugal mainland, the schist masonry are scattered from north to south of the territory. Although the extensive built heritage, and the undeniable historical and cultural importance of schist masonry constructions, are scarce the studies characterizing the mechanical behavior of this kind of masonry. Thus, it is intended with this study to fill this gap in the scientific knowledge through the detailed characterization of the mechanical behavior of traditional schist walls, allowing the preservation and protection of this heritage.

As part of a larger study of schist masonry constructions were prepared schist masonry columns and walls in the laboratory. The most commonly typology of schist masonry walls was reproduced using traditional construction techniques. Mechanical tests were performed in the laboratory for determining the resistance to the uniaxial and diagonal compressive strength. The obtained results allowed determining the mechanical properties of the schist masonry, as well as interpreting the weaknesses of this type of masonry by analyzing the damage framework. The mechanical properties of traditional schist masonry presented in this study will enable professionals to perform work in traditional schist masonry constructions with less uncertainty and greater security, better protecting the existing cultural heritage.

CODE: 2.2.03

TRADITIONAL COATINGS OF TABIQUE WALLS AND THEIR THERMAL INSULATION CONTRIBUTION

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KEYWORDS: tabique, wall, traditional construction, thermal insulation behaviour, sustainable construction.

ABSTRACT

This research work is focused on studying the thermal behaviour of traditional tabique wall systems. Therefore, different tabique wall samples were built and their thermal behaviour was experimentally assessed in laboratory. In general, a tabique wall system is formed by a timber structure frame which is filled with earth or an earth based render. A tabique wall may be exterior or partition. In both cases, it may have a contribution in the overall structural behaviour of a building. At the same time, the fact that a tabique wall may be exterior increases its pathology likelihood and justifies the application of a complementary exterior coating such as metal corrugated sheets or schist tiles. These were the studied traditional building solutions in terms of thermal insulation behaviour. The wall samples were prepared with materials which were collected from tabique buildings and they were applied according to the traditional techniques. The obtained outputs may contribute for the knowledge of this traditional building technique and they may be helpful in rehabilitation processes of this type of building, in particular, concerning thermal insulation improvement.

CODE: 2.2.04

SCHIST BUILDINGS IN PESO DA RÉGUA COUNTY

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KEYWORDS: Schist, traditional building, rehabilitation, wall.

ABSTRACT

Schist stone is a traditional building material applied in the Peso da Régua County. This County is located in the Northeast part of Portugal related to the Douro region which is UNESCO World Heritage. Dwellings, earth retaining walls and fencings are the most common constructions built with this type of material. They are vernacular constructions which are very well integrated in the local landscape and its maintenance is important to perform. Thus, a set of building details concerning schist dwelling was surveyed in this research work. This paper intends to disseminate the obtained information, in particular, some structural buildings details. In the structural context, schist masonry walls are the main vertical structural elements. Taking into account that the size, the existence of openings (e.g. window or door), the type of corner and the type of lintel of the openings are some building aspects which may influence the structural behaviour of a traditional masonry schist wall, they are highlighted. We believe that this technical information may give some guidance in future studies focused on modelling (numerically and experimentally) the structural behaviour of this type of traditional building element.

CODE: 2.2.05

VAULTS AND ARCHES CONSTRUCTION IN VITORIA CATHEDRAL, SPAIN

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KEYWORDS: cathedral, monument, restoration, integrity, masonry, stone cutting, vault, arch.

ABSTRACT

Integrate new works into architectural heritage is a problem which solution poses in solving the continuity solution on building technology imposed by the introduction of the carachteristically twentieth century new materials and techniques, so are steel and reinforced concrete. This means to return to masonry and timber construction and, specifically, to that of stone arches and vaults. During the restoration works of Vitoria Cathedral a number of this kind of structures has been erected with different objectives and in various construction types, using the modern computer aided design and stone cutting with robotized machines. The structural and material consistency between existing and new work is a mandatory that must be integrated into the current criteria for architectural restoration, as it assures both chemical and physical compatibility, unavoidable in order to assure heritage surviving, and the architectural integrity of the 'new' resulting building. This article shows the intervention processes, from the analysis of the current building to the construction project, in-factory production and on-site placing of different architectural elements.

CODE: 2.2.06

DIMENSIONAL STABILITY OF WOOD IN PRESENCE OF WATER

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KEYWORDS: wood, hygroscopic, dimensional changes.

ABSTRACT

Wood is our most important raw material. It is important not only because it is used for literally hundreds of products, but also because it is a renewable natural resource. Through a carefully and planned use, forests could provide a perpetual supply of wood. All wood in growing trees contains a considerable amount of water as part of the photosynthesis and the growing processes. This water is commonly called sap. The main goal of this work is to study the water movement in wood: first of all, the drying process, which occurs before the manufacture and use as finished wood products, and secondly the gain and loss of water in response to changes in environmental conditions that surround the wood. The moisture content relationship has an important influence on wood properties and performance.

Wood is dimensionally stable when moisture content is greater than the fibre saturation point (MCfs). Below MCfs wood dimensional changes and it gains moisture (swells) or loses moisture in the form of bound water. The level of MCfs depends on the relative humidity and temperature of the surrounding air. Shrinkage and swelling are the cause of many of the problems that occur in wood during drying and in use, therefore, an understanding of them will help minimize such problems. Splitting, warping, and open joints are examples of problems that occur due to uneven shrinkage.

An experimental program was defined with the aim to evaluate the dimensional stability of hardwood and softwood species. The Pine softwood and the Ash hardwood of the North-east region of Portugal will be analysed. A group of thirty specimens were made for each specimens of wood. The assumed geometry for the specimens is 40×40×10 mm, based on NP EN 614 recommendations. Before running the tests, one half of the specimens of each species were dried in an oven at 103ºC ± 2ºC, while the other one half was saturated in a water tank until a constant mass is attained. The tests were carried out in a climatic chamber with a constant internal environment of 20ºC and 60% (RH), during a period time equal to 24 hours or more, until stabilization of dried and saturated specimens. Mass is considered constant when the difference between two consecutive weight measurements, delayed 2 hours, is less than 0.5%.

CODE: 2.2.07

BIOCLIMATIC CONSTRUCTIVE SOLUTIONS EXISTING IN VERNACULAR ARCHITECTURE FROM THE NORTH PORTUGAL AND "CASTELA E LEÃO" (SPAIN) BORDER REGION

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KEYWORDS: preservation, bioclimatic rehabilitation, bioconstruction, sunspace.

ABSTRACT

The traditional architecture is founded as a defining element of the identity of a region, and its essence should be preserved and conserved by means of maintenance and recovery actions. Thus, the best solutions and proposals for intervention should be looked for but this doesn't imply a back to back innovation and at construction progress.

This work is part of the BIOURB project, a cross-border project between Portugal and Spain, which intended to contribute to the change of the current constructive model toward a more sustainable bioclimatic model, both environmentally and economically, reducing the energy consumption of buildings and raising the value of bioclimatic heritage along the border. In order to achieve the study a survey has previously been conducted on the bioclimatic solutions along the border, more specifically between the areas covered by the municipalities of Bragança, Miranda do Douro, Vimioso, Mogadouro, Salamanca, Zamora and, in particular, areas of the natural parks of "Los Arribes del Duero" and "El Sayago".

One of the BIOURB project objectives was to establish guidelines for the conservation and rehabilitation of the vernacular architecture so it includes the description of techniques for maintenance and conservation of bioclimatic solutions found and inventoried in the north of the Iberian Peninsula, with special focus on a unique bioclimatic solution known as Sunspace, whose main advantage is to contribute significantly to the improvement of the thermal performance of buildings. It is also important to recover the historical heritage in a sustainable manner, allowing it to become an engine of development for both urban and small rural centres that exist in the periphery of the bigger cities.

CODE: 2.2.08

MECHANICAL BEHAVIOUR OF HOLLOWED CLAY BRICK MASONRY. INFLUENCE OF CHASE OPENINGS

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KEYWORDS: hollow clay bricks, chases, mortar, compression strength, stress, cracking.

ABSTRACT

For all types of masonry wall construction, brick or block material, the cutting of chases in order to accommodate electrical cabling, piping and other installations is a common practice. In many situations, the cutting of chases in masonry is carried out indiscriminately and with no respect for maximum dimensions and adequate mortar filling. Thus, with this research paper it will be thoroughly evaluated and discussed the mechanical behaviour of hollowed clay brick masonry walls with chase cutting, within the limits of the Eurocode 6. Therefore, an experimental campaign over twelve wall specimens was carried out, in which the shape and direction of the chase openings differs (horizontal, vertical and inclined) all with the same depth and width. After the cutting of the chases, it was placed a ring tube to simulate a pipeline, and later the chase was filled with mortar, leaving one of each specimen type with the chase unfilled. All specimens were fully instrumented and tested under vertical central compression. The results obtained in this experimental campaign for compression strength and cracking are discussed and presented in detail.

CODE: 2.2.09

EVALUATION OF THE ADDITION OF "TERMITE SALIVA" IN PHYSICAL AND MECHANICAL PROPERTIES OF COMPACTED SOIL-CEMENT WITH HIGH LEVELS OF CEMENT

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KEYWORDS: earthen architecture and construction, compacted soil-cement, "termite saliva" DS-328®, compressive strength, water absorption.

ABSTRACT

Among the various construction techniques with earth, rammed earth and compressed earth blocks (CEB) are those that enable greater technological control of the production process, because there are some technical standards in Brazil and other countries. In both techniques, a sandy soil can be stabilized with cement to obtain a material with higher mechanical strength and durability. From 1970 was introduced in Brazil an additive to soil-cement (named DS-328®) used in road works, popularly known as "termite saliva", to improve some characteristics of the material. Since then they have been assigned several advantages for its use also in the rammed earth, CEB and even the adobe bricks, but there are few studies carried out to date for the scientific confirmation of these advantages.

In a previous study, the authors studied the influence of this additive at the rate of 0.1% in compacted soil-cement, produced with a Brazilian sandy soil (76.5% sand) and varying the proportion of cement (relative to the mass of dry soil) between 1% and 3%, noting up a greatly increased of compressive strength and decrease of water absorption. In the present work is done a similar study, however, adopting higher levels of cement (6%, 10% and 15%), as recommended for the production of building materials (bricks and blocks), to check the additive influence in this situation and the possibility of reduction in cement consumption without loss of strength.

The results showed significant reduction in water absorption, however, the influence of the additive was not significant on the compressive strength. Regardless the results, the main contribution of this work is to present a clear and detailed scientific methodology for this type of study, with the expectation that it will be adopted in future works.

CODE: 2.2.10

CHARACTERIZATION OF TYPICAL COATINGS OF BUILDINGS FACADES THAT MAKE UP THE MODERN HERITAGE OF MONTEVIDEO CITY: "IMITATION PLASTER"

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KEYWORDS: modern heritage, coating, “imitation plaster”, characterization.

ABSTRACT

All materials present different alteration processes through their service life. This process is accentuated according to location of buildings; its alteration depends not only on the quality of the materials used and their placement in work, but also on the environmental conditions in which they are exposed.

In Montevideo city, from the 1920s to the 50s the so-called "imitation plaster" was widely used in facade coating. Most of the buildings that make up the modern heritage of that period used this particular finishing plaster. However, despite its widespread use, there is no information regarding its technological features.

In building Conservation work it is necessary to know the composition, elastic - resistant behavior and other characteristics (color, roughness, etc.) inherent to the material to be used in the replacement and/or repair of the damaged sectors.

This paper presents the methodology developed for the characterization of the "imitation plaster" and the experiments carried out for the evaluation of this coating on the facades of some of the modern heritage value buildings of Montevideo city.

The methodology attempts to determine by testing the mortar under study the proportion between binder and aggregates used, the type of binder, size and shape of the aggregates and tries to solve the problem of the color and roughness by "ad hoc" techniques, proving to be efficient in the studied cases.

CODE: 2.2.15

MICROSTRUCTURAL AND MINERALOGICAL CHARACTERIZATION OF ANCIENT PLASTERS

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KEYWORDS: conservative restoration, preservation of exterior finishes, lime plaster, X-ray diffraction analysis (XRD), scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM/EDX).

ABSTRACT

The preservation of the exterior finishes of the historic buildings plays an extraordinarily important role in the safeguarding of cultural heritage. In fact, the maintaining of the integrity of the finish preserves the aesthetic value of the building and protects the load-bearing structures from chemical and physical degradation phenomena. The ancient plasters are complex composite materials. They are characterized by a great compositional variability related to both the site and the period of the building construction. In the last decades in the restoration works it has been used materials with chemical and phisical characteristics different from those of the original materials. This practice in many cases has compromised irreversibly the value of the architectural heritage as it has amplified the existing degradation phenomena or, at best, affected the aesthetic value of the finishes. Therefore it is more and more widespread awareness of the necessity of a conservative restoration performed through the utilization of raw materials, production and technologies as much as possible similar to those originally adopted. The design of the restoration interventions requires a preliminary characterization of the ancient plasters through the use of advanced analytical techniques able to detect the characteristics of each component, the kind of binder, the binder/ aggregates ratio. This paper shows the results obtained from the mineralogical and microstructural characterization of plasters samples taken from the San Peter Church of San Pietro dating presumably the early eighteenth century and located in the old town of Forenza in Basilicata (Italy). The listed building presents widespread degradations and detachments of the finishes caused by the complete absence of maintenance over the time. The plaster samples were tested by the X-Ray Diffraction (XRD) analysis and the observation at Scanning Electron Microscope (SEM) coupled with Energy Dispersive X-ray (EDX) spectrometer. The obtained results have allowed us to identify the morphology, the size and type of aggregate, the binder component and the products of decay or deterioration.

CODE: 2.2.16

REHABILITATION OF BUILDINGS. COMPARATIVE ANALYSIS OF CRITERIA AND CONSTRUCTION METHODS

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KEYWORDS: rehabilitation, historical buildings, construction methods, containment facades, construction of cellars.

ABSTRACT

In project development and construction of buildings rehabilitation, it appears problems to solve and construction technics typical for each building typology or kind of restauration, or it´s possible they are usual to some of them. The conditions of each building, the owner necessities, the designer style and the most usual construction technics of builder can reach main elements of final result.

This paper show briefly some works developed last years over some historical buildings, and others contemporary. It put into practice some specific methods or some general methods.

We analyze works over buildings as Vicente Calderón Stadium, Buen Retiro House, The Prado Museum, Pías Schools of Madrid (headquarter of COAM), Santander Bank Headquarter, National Ballet Headquarter, and less important buildings, but they have needed the application of complex construction methods.

The comparison of used criteria and technics, as well as the obtaining of conclusions is the main paper purpose.

CODE: 2.2.17

REPRESENTATION, ARCHITECTURE AND MATERIALS IN CHINESE TRADITIONAL CONSTRUCTION

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KEYWORDS: heritage, materials, construction, tradition, identity, regeneration.

ABSTRACT

The research starts from the study (graphic-analytical) and from understanding (theoretical-methodological) of traditional Chinese techniques and materials, through the reading and the reshape of architectural parts and elements, through direct survey and bibliographic research.

The intent is to understand and describe shapes, architectural types and changes, ways of living, colors and materials that characterize Chinese towns and villages, through the critical and original instrument of "drawing in travel" in the form of sketchbook.

The millennial Chinese cultural continuity was interrupted today with the emergence of ideas, materials and new techniques. By the time it was abandoned in China a practice that made crafts and skilled labor its foundation, to switch to an architecture that tries with every tools to make use of industry and standardization.

Is rapidly spreading, however, a new method of approach in face off problems of preservation and rehabilitation of historic residential areas, recognized as emergencies to be enhancing and promoting.
The intention of this research project is to start a possible strategy of redevelopment, which can be implemented in respect of preexistence, with the ability to establish a continuity between the materials that you work with and the architectural elements that make up the architecture, a kind of "code of conduct and practice", without denying the features and without producing destruction of historical heritage.

CODE: 2.2.18

CONCRETE QUALITY EVALUATION IN SELFCONSTRUCTED DEPARTMENTS IN JOSE LEONARDO ORTIZ DISTRICT

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KEYWORDS: compression resistance, concrete, apartment.

ABSTRACT

The project evaluates physical vulnerability in apartments built in Chiclayo's suburbs, for which concrete samples have been taken from roof, columns and foundations of 35 building sites, during January and February 2013. In every building, the settlement test was made and samples were taken in cylindrical molds for compression resistance tests, in order to evaluate concrete quality in selfconstructed apartments in the last mentioned district, and verify if the proper resistances in the studied structural elements are according to the minimum resistance that the technical norm requires. Applied methodology consisted in going over the building sites and extract 3 fresh concrete samples (2 cured and 1 without curing), tested after 28 days. The investigation range covers selfconstructed buildings in José Leonardo Ortíz district.

The results have been truly alarming, because none of the apartments present the minimun compression required by norm. These are the results:

f´c concrete average cured after 28 days = 94.81 kg/cm2.
f´c concrete average without curing after 28 days = 64.01 kg/cm2.

Results show a high structural vulnerability of 100% to seismic phenomenon in tested buildings, even more considering that Peru is located in the Pacific Ring of Fire.

CODE: 2.2.19

CHARACTERIZATION OF PLASTER FOR INTERVENTION IN RESTORATION PROCESSES OF DIRT WALLS IN LOJA PROVINCE, ECUADOR

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KEYWORDS: cultural heritage, constructive technology, plaster.

ABSTRACT

During the process of restoration in buildings with dirt construction systems, it is common the problem of the correct dosage and application of plaster or coating technique, Since you should determine the compatibility of materials and contemporary construction techniques in the historical walls; In addition, the problem is aggravated due to lack of raw materials, quarrying and skilled craft workers, in the traditional construction processes of Vernacular architecture.

This research is based on inquiring about the causes, processes and effects of interventions to the built historical heritage , with emphasis on the analysis of the dirt walls and particularly in its lining. The study area is the province of Loja, Ecuador. It is planned as objective to determine the compatibility of materials and contemporary construction techniques in the systems applied to historical building made of dirt walls; and rescue materials and traditional vernacular architecture in construction systems through the identification of raw materials and quarries for its application in the process of restoration with backgrounds that are confirmed in the gotten results during the research process; it is applied and it is confronted mortars techniques as in the case of the "cascajo" detected in “Tablón de Oña” a town that is close to our area of study. It is a geological material with great capacity of sticking together to the ground. The result that we obtained from its application in the historical buildings of the town, it led us to search and identify other sites which describe similar characteristics to gravel, nevertheless we can find them in our province in order to optimize the restoration process and reduce costs.

CODE: 2.3.01

FLEXIBLE AND REVERSIBLE SISTEMS FOR THE REDEVELOPMENT OF THE TWENTIETH CENTURY 50'S AND 70'S SOCIAL HOUSING

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KEYWORDS: renovation; seismic adaptation; functional crossbreeding; spatial flexibility.

ABSTRACT

The writing presents a study about the redevelopment of the housing social building property of the second postwar period, that nowadays is integral part of our towns urban pattern. The changed functional needs and the modification of the seismic risk parameters, occurred in many areas in the last decades, lead to a diffuse request of functional adaptation and seismic resistance implementation, to be searched through sustainable redevelopment proposals. The work, developed through the application to a study (the A.T.E.R. settlement of Preturo, L'Aquila, Italy), is based on the recognition of the correspondence between the blight and collapse conditions and the transformation possibilities of the existing buildings. In other words, the "defective" conditions that make impossible the use and the conservation of the buildings, seems to legitimise new transformation works. To be more precise, it is a matter of buildings with a concrete bearing structure devoid, partially or complitely, of horizontal and vertical partition and with considerable damages in the vertical closures, due to the 2009 strong earthquake.

Our proposal foresees reinforce and upwind works of the bearing structure, compatible with the introduction of flexible closure and partition systems, also able to give an innovation of the housing supply. The safety and usability needs are analysed to propose a project in which the flexible solutions are compatible and integrated with the structural reinforce techniques.

CODE: 2.3.02

USE OF COMPOSITE MATERIALS FOR RECONSTRUCTION ACTIVITIES

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KEYWORDS: composites, polymer matrix, cement matrix, mechanical properties, corrosion.

ABSTRACT

This study shows the advantages and disadvantages of the use of composite materials in reconstruction activities. The aim of the research is the reconstruction of a natural rocky arc exposed to a marine environment. Anchoring reinforcements of two types of stainless steel were analyzed. Also epoxy resins, polymeric, cement based mortars and cement based concrete, separately and in combination, have been studied. Durability, mechanical behaviour, protective effect of mortars and thermal compatibility were studied. The overall conclusion of the research is that polymeric mortars are the most appropriate for the reconstruction and/or rehabilitation of stone structures exposed to highly corrosive environments.

CODE: 2.3.04

BIM REPRESENTATION SYSTEMS IN ARCHITECTONIC REHABILITATION

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KEYWORDS: BIM, Building Information Modeling, rehabilitation, energy performance.

ABSTRACT

Since the widespread application of CAD programs ("computer aided drawing"), perhaps some professionals in the architecture and construction, we have been observed some involution in Graphic Representation of our Architectural Design: lots of graphic information is currently provided in flat support (2D) but unconnected to each other. Because of this overinformation together with the lack of automation in the process of upgrading different documents belonging to the same project, many "discrepancies" are produced and they are difficult to eliminate entirely.

BIM (Building Information Modeling) systems are the currently trend into the AEC (Architecture, Engineering and Construction) field because this kind of software not only “retakes” the overview over a project by their 3D interface, but they aid to solve the problem of the incongruity between documents: building model is unique, independently of the type of documentation generated (elevations, plans, sections, perspectives, ...). In addition, BIM systems add that some developers of such software call nD ("n" dimensions): interoperability, measurements linked with each element, energy data, kind of element (structural, cladding, etc.),...so that any modifications induced in the information associated with each of the elements of the model is automatically updated in the documentation generated from him (energy certification, budget, etc.), just as it happens with the relational databases.

This article tries to show an overview of the application of BIM systems in Architectural Rehabilitation of buildings, by the possibility to update the changes made during the execution of these projects, where changes are usually numerous in this type of intervention and therefore costly if not managed properly.

CODE: 2.3.05

INFLUENCE OF VARIABILITY OF PARAMETERS OF SLUDGE FROM WATER PURIFICATION PLANTS ON THE MECHANICAL PROPERTIES OF CEMENT MORTAR

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KEYWORDS: Construction materials, cement, sludge, mortar, water purification plant.

ABSTRACT

During the process of water purification, the sludge is generated as an inevitable residue, which is discharged directly to surface water bodies, causing a negative effect on aquatic life. Colombian law, Decree 3930 of 2010 regulates this type of waste and also prohibits this disposal in surface waters. Because the accumulated sludge quantities are high, an investigation into their possible application as constituents of hydraulic mortars in order to mitigate their impact on the environment and give added value was performed. The aim of this work was to study the influence of the type of sludge, composition and ages of hydraulic mortars on compressive strength. Two types of sludge, with different physicochemical and microbiological characteristics, which were supplied by two industries in the Northern Region of Colombia were used. The development of the research was carried out in 5 steps: 1. Sampling and sludge drying; 2. physicochemical and microbiological characterizations of sludge; 3. Mashing and sieving of dehydrated sludge; 4. Preparation of mortar cubes (in triplicate), cured (7, 14 and 28 days) and compressive strength test; and, 5. Statistical data processing and interpretation. According to the tests performed, the ratio 0.5: 1 by weight of dry sludge: cement (L: C) using the sludge from industry B, was the one that presented the best mechanical behavior, with a resistance of 11.5 ± 0.2 MPa at 28 days; it should be noted that the amount of fine aggregate in the different ratios remained constant in relation to the amount L: C. Analyzing the estimated production cost of mortars showed savings of 44%. Finally, the chemical compounds in sludge that may have had greater impact on the strength of mortars corresponded to Ca, Al and Mg.

CODE: 2.3.10

POSSIBILITY OF THE USE OF SUGARCANE BAGASSE ASH AS ACTIVE MINERAL ADDITION TO PORTLAND CEMENT IN URUGUAY

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KEYWORDS: agricultural residues, cement, pozzolans, addition Sustainability, materials.

ABSTARACT

The partial replacement of cement by agro-industrial residues, are an interesting alternative to the reduce of energy consumption and environmental impact. This work aimed to the characterization of the Pozzolanic Portland Cements (CPP, by its initials in Spanish for Cementos Portland Puzolánicos), with different tenors of substitution by the selected sugarcane bagasse ash (CBC by its initials in Spanish for Ceniza de Bagazo de Caña). The experimental work was based on the characterization of the CBC "in natura", the improving of it by the second burning and grinding, the characterization as a pozzolanic material and the characterization of the cement as CPP, with different percentages of replacement by CBC. Chemical, physical, and mineralogical tests were performed. The results showed that the CBC has a high percentage of silicon dioxide in amorphous state and confirmed the pozzolanic activity of it. The main conclusions achieved show that would be feasible to use the CBC as active mineral addition for partial replacement of cement, through the improving of it by the com burning and grinding.The bodies of test with substitution containing of up to 25% meet all UNIT regulatory requirements for CPP, whereas with 5% substitution showed a slight increase of resistance.

CODE: 2.3.13

FABRIC-REINFORCED-CEMENTITIOUS-MATRIX (FRCM) FOR STRUCTURAL REHABILITATION: ADHERENCE TO THE SUPPORT

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KEYWORDS: structural rehabilitation, FRCM, adherence, Pull-Off tests.

ABSTRACT

The Europe and Latin America building heritage widely shows the need of structural rehabilitation. The aim of such a strengthening is double: to make longer the building life and to satisfy the last code requirements, for example in the seismic field. Traditionally, FRP (Fiber Reinforced Polymers) materials were used for structural rehabilitation. FRP is a composite material with many positive characteristics, but with some drawbacks caused by the organic matrix it is applied with, in particular in the application phase. Some of these drawbacks were overcome thanks to the introduction of a new kind of composite material based on an inorganic matrix: FRCM (Fabric Reinforced Cementitious Matrix). As for many composite materials, the tensile strength and the adherence to the support are the two main parameters defining the FRCM behavior. In this paper, it is analyzed the adherence to the several supports FRCM was developed for: RC, CMU (Concrete Masonry Unit), clay bricks. Both FRCM made with poliparaphenilene benxobisoxazole (PBO) and with carbon are here analyzed. The adherence was investigated through the Pull-Off test. A Pull-Off test results in the maximum stress and in the failure mode, which can be cohesive, adhesive or at the interface between the two layers of mortars, where the mesh lays. The adherence tests are necessary for the theoretical analysis of an FRCM material, but they can also represent an interesting possibility for checking the material capacity on field. Finally, the adherence tests could be useful for long-period analysis.

CODE: 2.3.15

PERMEABILITY OF STRUCTURAL RECYCLED CONCRETE

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KEYWORDS: recycling, durability, microstructure, physical properties, recycled aggregate concrete.

ABSTRACT

This paper presents the main results on the durability of structural concrete incorporating recycled concrete aggregates. One of the least known aspects of the recycled concrete is related to its durability. Most of the results found in the literature are not comparable due to the heterogeneity of recycled aggregates, different water/cement ratios, cement types used, etc. In this research, the characteristics of 24 different dosages of concrete with partial and total substitution of recycled aggregate have been compared. The physical and permeability to water and oxygen as indicators of durability have been analyzed. The durability of concrete made with recycled aggregate is less than the control of concrete due to the high porosity introduced into by the recycled aggregate and can be the source of some structural damage. These losses of durability decrease with low water/cement ratios.

CODE: 2.3.17

USE OF FINE AND COARSE RECYCLED AGGREGATE ON STRUCTURAL SELF-COMPACTING CONCRETE COMING FROM A PRECAST PRODUCTION FACILITY

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KEYWORDS: fine recycled aggregate, precast, concrete recycled aggregate, self-compacting concrete.

ABSTRACT

The present study analyses the viability of the simultaneous utilization of fine and coarse recycled aggregate coming from the crushing of concrete precast pieces in order to fabricate self-compacting concrete. The replacement ratios of recycled aggregates were set to 0, 10, 20, 35 and 50%. The recycled aggregate was not subjected to any previous sieving process, every concrete composition was adjusted according to the sieve size test in order to have a similar grain size distribution to the control concrete. Workability, density, compressive strength, split tensile strength, modulus of elasticity were studied in every concrete mixture. Subsequently, concrete beams with those replacement ratios were fabricated and flexural and shear tests were performed analyzing the evolution of the displacement in the center of the beams. Results obtained were satisfactory, with an improvement of the mechanic behavior with replacement ratios lower than 20%.

CODE: 2.3.20

EXPERIMENTAL ANALYSIS OF THE PERFORMANCE OF THERMO REFLECTIVE INSULATION

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KEYWORDS: innovative material, thermal insulation, thermal comfort.

ABSTRACT

In recent years there are adopting alternative solutions of thermal insulation, also applicable in the renovation of buildings, which provide for the use of innovative systems, replacing the traditional insulation to reduce energy consumption for heating and cooling, without altering the thermal comfort. In the present work were studied thermal reflective or low emissivity insulating systems realized with thin films of aluminum alternating with layers of air bubbles insulating, interposed between two air chambers, each of a thickness of 20 - 25 mm. It is awaiting the approval of regulatory guidelines that go to regulate the determination of the thermal characteristics of thermo reflective materials; in the absence of these specific guidelines, the study consists of a theoretical estimation of the thermal transmittance and a campaign of experimental measurements in steady state with the aid of a climatic chamber. The method of measurement was employed in accordance with the UNI ISO 9869: 1994, and with the main rules of the UNI EN ISO 8990: 1999. The experimental campaign showed the thermal stationary parameters, transmittance and thermal resistance, equivalent to those of a traditional insulation with a thickness of 6 cm. It can be concluded that the thermal reflective insulation is a valid and innovative solution for thermal insulation respecting the limits imposed by Italian law.

CODE: 2.3.24

STUDY OF INDUSTRIAL METAL FRAMES TO FIRE WITH COMBINED USE OF STEELS

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KEYWORDS: FR Steels, steel structure, intumescent paints, fire resistance.

ABSTRACT

Various portal frames are studied to establish their fire response over various fire exposure times. The frames were assembled with plain carbon steel (S275) and micro-alloyed Fire Resistant (FR) steel (with superior fire-resistant properties). An intumescent fire protective paint was also tested to improve the overall fire resistance of the steel structure.

This study analyzes 462 different cases, they are portal frames spans 35 meters, in which we have studied their behavior to different exposure times against fire (0 ... 90 minutes). Another variable that has been considered is the passive fire protection, which is solved by applying another set of intumescent paint thickness (0 ... 1800 microns). The last variable considered in the study is related to the price of the materials used. This is because the production of these high performance materials are not easily available in the market due to its high cost and therefore has tried to establish its value relative to the cost of steel S275, most used in building. This has been done by a series of coefficients majorization FR steel price versus S275 (1.00 ... 1.50).

The aim is to show that there are cases where it is more profitable to combine the two steels and reasoning the position of each steel within the frames.

CODE: 2.4.01

NEW GLASS TO REDUCE THERMAL DEMAND OF BUILDINGS

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KEYWORDS: thermal demand, active glass, smart glass.

ABSTRACT

Spain is a country with great dependence on foreign energy, where in 2011 over 76% of energy was due to import. By sector, the building is one of the largest consumers; in 2010, residential and business buildings demand reached 14% and 8% of national energy consumption respectively. The energy requirements of buildings are both electrical (appliances, computers, lighting ...) and thermal (HVAC and hot tap water).

One aspect that has great influence on this demand is the building envelope, having great significance in this glass surfaces. These represent positive aspects (favour natural lighting and enhance the habitability of buildings) but also disadvantages (increase energy demand for air conditioning).

In order to reduce the thermal demand of buildings, manufacturers traditionally tried to improve glasses: increasing the thickness, introducing one or more intermediate air or gas chambers and, ultimately, improving quality to reduce radiant heat that passes through. But in recent years different technologies have been developed to produce what are called active or smart glass. This type of glass, due to different physical phenomena, modifies its behaviour regarding the sunlight through, and thus improves its thermal behaviour thereby reducing the heat demand of the building.

In this paper a study of the heat demand in a building is performed through simulation, taking the solar factor of the glasses in different facades as a variable. Moreover, several types of smart glasses that are being introduced in the market are presented. The arrival of these glasses will require some adjustments in the software used to calculate thermal loads and simulate the energy demand to consider its inclusion among the elements of the building, as most software (including those developed by official Departments, e.g. Lider-Calener in Spain) take into account aspects such as placing awnings or other protection systems, but no changes in glass properties.

CODE: 2.4.03

DEFINITION OF NATURAL VENTILATION STRATEGIES TO IMPROVE INDOOR AIR QUALITY OF A BUILDING

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KEYWORDS: retrofit, natural ventilation, indoor air quality, thermal comfort, energy efficiency.

ABSTRACT

The indoor air quality (IAQ) has an important role in health, welfare and productivity of occupants of buildings. Thus, during the definition of a retrofit project it is important to ensure not only the energy efficiency but also the indoor air quality of the building.

This work presents the definition of the ventilation strategies necessary to ensure the indoor air quality and energy efficiency of an office building located in the historical center of Guimarães during the implementation of the retrofit project.

The main problems of the building, related to the indoor air quality and thermal comfort conditions of the occupants, were identified through the measurement of the pollutants concentrations and of the thermal comfort conditions in the building. The occupants' perception of the IAQ and thermal comfort conditions was also evaluated.

The results showed that the thermal comfort conditions are acceptable but the pollutant concentrations, in particular carbon dioxide concentrations, exceeded the maximum values defined in the Portuguese regulation.

Since indoor air quality can be improved by increasing the intake of fresh air, different natural ventilation strategies for the building were studied to ensure the thermal comfort conditions and the indoor air quality, while reducing the heating and cooling needs. Through the analysis of the building performance, using EnergyPlus, it was found that the indoor air quality and thermal comfort conditions of the building could be improved using natural ventilation strategies, particularly with the use of night ventilation.

The study demonstrated that, for both summer and winter, natural ventilation strategies guarantee the air change rates necessary to ensure the indoor air quality, maintaining the indoor temperature at adequate levels and reduced energy needs.

CODE: 2.4.04

EFFICIENCY IN THE CHANGE OF ELECTRICITY DEMAND HOURS

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KEYWORDS: energy, efficiency, technology, electricity demand, demand hours, generation.

ABSTRACT

This study analyses consequences of the sunny hours change to save in electric energy. Electric energy demand data are collected in Spain in last years, especially in 2012. The demand deviation average regarding to the monthly average is + 0.297% in winter, and -0.212% in summer. This oscillation average of 0.509% causes 1.282 GWh of all electric energy in power stations (251 710 GWh). With an annual price of 50 € / MWh, it results 64,090,087 € (this is 0.22% of all the Spanish electric energy debt which is 29,000 million euros).

CODE: 2.4.05

HYDRIC EFFICIENCY MEASURES, WATER REUSE AND RAINWATER USE IN REHABILITATION PROCESSES

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KEYWORDS: hydric efficiency, water reuse, rainwater use.

ABSTRACT

Data from 2001 of the Portuguese Statistics Institute indicates that there are about 10,80% and 18,42% of dwellings whish are not occupied or are seasonably occupied, respectively. Therefore, there are 30% of dwellings available in Portugal. During the last decade this scenario was aggravated. Taking into account this aspect and the actual social and economical Portuguese situation, rehabilitation, instead of new construction, seems to be the wise option in terms of the building industry.

In a rehabilitation process of a building there are simple technical aspects that may result in a substantial economical, comfort and sustainable benefits. Replacing ordinary taps and toilet flushes by alternative ones which are more efficient in terms of water consumption is an example of these technical aspects. On the other hand, providing a building with water reuse and rainwater use systems are two additional aspects that may be considered in a rehabilitation process.

Hydric efficiency results in more sustainable buildings because there is an implicit energy consumption reduction and also a decrease of the amount CO2 emission into the atmosphere.
At the same time, the suggested technical aspects may also be relevant if the increasing tendency of water and energy prices is considered.

Considering that there is still a lack of experience in the application of the proposed systems, this paper intends to present some outputs concerning the application of the above hydric systems in both public and domestic dwellings.

CODE: 2.4.06

ENERGETIC "SUSTAINABLE" RECOVERY AND REQUALIFICATION. THE MONASTERY OF "CAPPUCCINI" IN ALTAMURA (ITALY)

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KEYWORDS: sustainability, recovery, energetic requalification, technological integration, traditional constructive techniques.

ABSTRACT

The issues related to sustainability and recovery of built heritage are one of the most important action of the "anthropical" transformation of the territory.

The research aims to address the functional adaptation of the historic buildings realizing technological interventions that can improve both the living comfort and energy efficiency in full respect of the historical and architectural features of the structure.

Nowadays, in order to reduce polluting emissions, the built heritage requires a significant technological adaptation, in terms of energy and equipments, as well. The potential of energy saving in the construction sector is huge; in fact, it represents about 40% of energy consumption and 36% of greenhouse gas emissions in Europe. If it adds that, in Italy, the 80% of the buildings has more than 30 years, it is clear the widening of the problem.

The topics of the adjustment and/or the functional transformation of a building through adequate energy regeneration, have an experimental application in a case study: the recovery of the ancient Monastery of "Cappuccini" in Altamura (Italy).

In order to recover the whole structure, it has designed a recovery intervention aimed at improving the energy performance, while respecting the values of the building. After a careful structural analysis, it was highlighted the critical aspects of the building energy performance. This led to design a series of recovery interventions that look at a "sustainable" energy improvement of building, through the use of high performance materials and through the right choice of equipment integration. This leads to reinforce the concept of "sustainable recovery" as a process of "integrated conservation" of the building; it can ensure the survival of an historic buildings through a design that aims to guarantee to meet the current living conditions, respecting the characteristic of the building.

CODE: 2.4.07

VERTICAL INTERIOR PARTITIONS ENERGY EFFICIENCY AND SUSTAINABILITY INFLUENCE IN RESIDENTIAL BUILDINGS REFURBISHMENT IN SPAIN

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KEYWORDS: refurbishment and sustainability, interior partition systems, energy efficiency, energy consumption.

ABSTRACT

In the coming years is expected a majority drift reconstruction work, refurbishment and energy improvement of existing buildings and finish. This types of interventions involving the designer such knowledge of the technical solutions that enable that the minimum project actions, optimal results are achieved. This suppose particularly relevant when considering the obligation to adjust the buildings to various regulations existing techniques as well as the requirements and social requirements of sustainability and environmental collected in various EU directives and recently amended the national legislation in this area.

The present research highlights the need for an objective management model of several constructive solutions refurbishment projects in his shed sustainability and energy efficiency. In the recent past, most efforts in this has been focused on the study and optimization of the envelope, having reached a knowledge level that makes complicated and expensive a relevant increase of technical current solutions. In search of greater environmental correction performance of buildings, it is convenient start looking into other construction elements collaborate to integrate effective, avoiding focusing all efforts on the facade. In this regard, the few studies about actual technical characteristics reveal interior partitions that are elements of great influence on the overall behavior of the building, but despite this it has undertaken a depth study of the same.

Regarding such design considerations, a management tool is proposed. This tool is based on a methodology to identify, catalog and provide effective measurement and comparison of different construction systems to solve the interior partitions. Such process will allow obtaining some useful conclusions and project decisions according to different parameters studied. It also works providing a comprehensive document that facilitates the enhancement of the appropriate constructive solutions not only because of their technical properties, but based on the process of placing each system in relation to the peculiarities and specific needs of each building.

CODE: 2.4.09

THE IMPORTANCE OF THERMAL AND ENERGETIC SIMULATION FOR THE REFURBISHMENT OF BUILDINGS OF HERITAGE INTEREST

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KEYWORDS: refurbishment, hygrothermal performance, simulation, heritage.

ABSTRACT

In the last decades, there has been a rapid grown in the use of computational tools for simulation of heat and moisture transfer, both at the building and at the construction element level. Thermal and energy simulation software are nowadays unanimously considered as essential both for evaluating the current performance of buildings and for comparison and selection of construction methods and materials in refurbishment projects.

For the refurbishment of buildings of heritage interest compatibility between unique construction methods and aesthetics restrictions is crucial and special attention must be paid in the design process. In addition, in a period of strong economic restrictions, optimization is the key, including concerns regarding initial investment and operation and maintenance costs. In this context, thermal and energetic simulation tools can provide crucial support for designer.

This paper uses a museum as case study and thermal and energy simulation software EnergyPlus was selected to evaluate its actual performance and to forecast the consequences of closing a cloister with a glazed steel structure.

The research exposed the importance of simulation software, allowing designer to analyse several construction alternatives. However, one should notice that the numerical models are strongly dependent by the specificities of their algorithms.

CODE: 2.4.10

PROPOSED IMPLEMENTATION OF SUSTAINABLE URBAN DRAINAGE SYSTEMS IN THE CONTEXT OF THE ENVIRONMENTAL RECOVERY OF LOWER BESAYA

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KEYWORDS: sustainable, drainage, runoff, greywater.

ABSTRACT

Combined sewer systems present troubles in managing stormwater, both environmental (when mixed "clean" rainwater with raw sewage, and through discharge raw water through storm reliefs) and economic (pumping and treatment costs of higher flow rates). Furthermore, the effects of climate change, with more extreme rainfall patterns, and longer droughts, undertake the hydraulic capacity of the existing drainage systems, whose replacement, in many cases, is not economically viable. One of the targets of the environmental recovery of Lower Besaya (Besaya 2020) is the reduction and better management of urban runoff. To do this, we have analyzed the current techniques in sustainable urban drainage, some of the most relevant national and international case studies and application possibilities in the case of Torrelavega, main conurbation in the study area. Nine sites have been suggested for which specific solutions are proposed, without limitation, and assesses the environmental and economic benefits associated with them, among which are: decreased volume of raw water that is discharged untreated, decreased volume of water to be treated (WWTP), decreased energy expenditure in pumping, reduced water consumption.

CODE: 2.4.11

INTERVENTION LEVELS FOR A ENERGY EFFICIENT RETROFITING OF THE THERMAL ENVELOPE OF BUILDINGS. APPLICATION TO A CASE STUDY

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KEYWORDS: energy retrofitting, monitoring, energy simulation, intervention levels, energy efficiency-cost.

ABSTRACT

Nowadays, because of a large economic crisis, the rehabilitation of buildings in Spain is being viewed as a necessary alternative to reactivate the sector due to the age of the housing stock and to the new goals for energy efficiency in buildings. However, some of the interventions that are being performed are not based on an actual diagnosis of the situation, so that the measures taken are inadequate, are not energy efficient for the problem to be solve since it is not exactly known. The result is the use of more non-renewable resources and more waste production without achieving efficiency improvements.

Therefore, it is essential to establish a methodology for diagnosis and rehabilitation. In the case of a multi-residential building, the study begins with the analysis of the climate, the environment and the construction systems of the building. The selection of the most representative dwellings for monitoring allows us to analyze "in situ" the thermal performance, the thermal transmittance of the envelope (termofluxometry), the air permeability of the envelope (blower door test), the thermal bridges (thermography) and other parameters (temperature and humidity) that define indoor comfort. With the analysis of the data obtained, we can establish the diagnosis of the current state and develop different intervention scenarios, evaluating their efficiency through energy simulations. This allows us to prioritize the measures to achieve greater cost effectiveness in terms of the objectives to be achieved.

An example of application of this methodology to a multi residential building is presented in this paper. The results obtained show how, where and how much to invest in the rehabilitation of the envelope of existing buildings to achieve sustainable environmental and economic rehabilitation.

CODE: 2.4.13

ENERGY REHABILITATION OF HERITAGE BUILDINGS: RENERPATH METHODOLOGY

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KEYWORDS: Heritage, energy rehabilitation, 3D scanning, envelopes characterization, new materials.

ABSTRACT

This article presents the methodology of energy rehabilitation of heritage buildings established in the RENERPATH project, which was developed throughout the 2nd call of the Spain-Portugal cross-border cooperation program (POCTEP). The project was aimed to facilitate the work of energy rehabilitation of this special type of buildings, strengthening the integration of the related procedures with the usual protection, conservation and restoration actions. In addition, it allows the definition and quantification of the most appropriate arrangements of efficiency to be applied in each building considering their particular conditions. With this objective in mind, non-intrusive techniques for characterization are applied, in combination with dynamic simulation tools for the assessment of the actions performed. Given the implementation constraints in heritage buildings, this allows to obtain information without intervention, ensuring successful actions and minimizing the effects on them.

CODE: 2.4.14

THE IMPORTANCE OF THE REHABILITATION OF THE THERMAL BRIDGES IN THE EXISTING BUILDINGS

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KEYWORDS: Energy efficiency, thermal bridges, rehabilitation, linear thermal transmittance.

ABSTRACT

The European Directive 2010/31/UE provides a common methodologic framework for the calculation and minimum requirements relating to energy efficiency in buildings. The implementation of the Directive in Spain affects to the intervention in the buildings envelope. It establishes a basic energy-saving requirements (RD 314/2006) and a methodology for the calculation of the energy rating of buildings (RD 235/2013). One of the requirements to justify is the restriction of the energy demand. In order to limit the gains and losses on heat, a correct design of the building envelope, composed of the opaque enclosures, the voids and the thermal bridges must be taken into consideration.

The thermal properties of the thermal bridges can be determined by simplified calculation methods (ISO 14683:2007) and more detailed calculation methods (ISO 10211:2007). The ISO 14683 defines the required accuracy for the different existing methods, from ±5% for the numerical calculation methods (as the ISO 10211) to a typical accuracy between ±0% and ±50% for the methods where default values are used. The official software tools, LIDER and CALENER, make use of the default values taken from catalogues, although they are conservative and imprecise values. Some of the recognised documents for the energy efficiency rating use this calculation method too.

In the current article it is intended to carry out a study that allow measuring losses or gains on heat of some thermal bridges analyzing the percentage that they will mean in relation to the losses or gains on heat through the whole building envelope. This information will allow us to plan the rehabilitation of existing buildings in an effective way from the perspective of energy efficiency.

CODE: 2.4.16

VENTILATED CLADDING SYSTEMS INNOVATION: TECHNICAL, PERFORMANCE AND ARCHITECTURAL ASPECTS

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KEYWORDS: architectural refurbishment, renewable energy sources, technical innovation, ventilated cladding systems.

ABSTRACT

Architectural, technical and energy refurbishment of existing buildings is becoming a more and more relevant theme, due to its strategic function. In fact, it can play a role in both improving urban environment quality and the achievement of high energy efficiency and environmental comfort standards. For this reason, existing built heritage renewal is quite a relevant issue in pursuing the elimination of energy efficiency problems of the built environment, especially when it is characterized by non performing envelope solutions. The aim of envelope energy efficiency improvement can be pursued by means of innovative technologies and technical solutions, such as ventilated cladding systems.

This paper presents a review on the main strategies for energy, architectural and performance refurbishment of existing buildings and introduces some different ventilated cladding systems characterized by substantial innovation, high energy performance levels, reduced seismic vulnerability and easy integration of renewable energy systems. Some of the proposed façade solutions include: reduced thickness systems (within 10 cm, external cladding included) integrating multilayer radiant barrier insulation, high mechanical resistance systems characterized by low seismic vulnerability, suitable for both lightweight and heavy cladding panels, BIPV façade systems and more in general façade solutions able to combine architectural complexity and prestige with a significantly convenient cost/benefit ratio.

CODE: 2.4.19

SUSTAINABILITY ASSESSMENT OF ENERGY RETROFITTING SOLUTIONS IN HISTORICAL TOWNS

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KEYWORDS: Historical towns, sustainability assessment, energy retrofitting, innovative solutions.

ABSTRACT

Historical towns are frequently not included in energy retrofitting programs, due to the assumption - also at normative level - that improvement strategies of technological performances might conflict with the transformation boundaries of architectural and constructional characteristics. However, the technical and scientific community has commonly recognized that the historical built heritage, due to its extent and relevance, could play a strategic role for the reduction of consumptions and emissions and for the development of environment and energy friendly cities. Consequently, methods and tools for sustainability assessment of compatible retrofitting solutions are highly desirable that might include several aspects, namely technical reliability, constructional consistency, architectural integration, functional impact, as well as life cycle balance of products and processes. Specifically, the present research is going to discuss the preliminary results for the definition of an assessment protocol of energy retrofitting solutions in historical towns, with specific focus on thermal protection and energy production of envelope components. The application to representative case studies is going to show how the protocol is able to deal with the multi-scale complexity of the involved aspects.

CODE: 2.4.20

REHABILITATION OF SOCIAL HOUSING. TRANSMITTANCE AND THERMAL INERTIA IN VERTICAL ENCLOSURES IN BUILDINGS IN MADRID, 1939-1979

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KEYWORDS: rehabilitation, social housing, energy efficiency, façade enclosures.

ABSTRACT

A substantial number of social housing units in Spain and more specifically in Madrid (around 55 % of the total) were built prior to the adoption of the first building code that addressed the thermal characteristics of enclosures: NBE-CT-79. In many of these dwellings, securing minimum comfort levels entails energy costs that a significant number of households cannot afford. Such “energy poverty” is estimated to affect 10 % of Spanish households [1], a figure that is indisputably on the rise at this time.

As the first part of a proposal for rehabilitating these units, the present study attempts to identify the main thermal characteristics of the façades on multi-dwelling social housing built in Madrid between 1939 and 1979, based on the construction information found in architectural design records. The main construction and thermal characteristics of these designs are discussed, analysing to what extent they are representative of the housing erected in Madrid in that period and the elements most pertinent to thermal performance.

CODE: 2.4.21

EXPERIMENTAL AND NUMERICAL STUDY OF THE THERMAL BEHAVIOUR OF A VEGETABLE FAÇADE

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KEYWORDS: experimental tests, numerical study, sustainable design, industrialized constructions and thermal insulation.

ABSTRACT

The aim of this work is to reduce environmental impact using green construction. A manufactured façade, which is ventilated and vegetable, is used in order to reduce the CO2 level as well as improve the bioclimatic behavior of constructions.

Firstly, a botanic study has been developed in order to choose the best plant species for the south façade taking into account the influence of the plants growth on the thermal insulation. An experimental façade has been tested for more than a year using thermal flux, humidity, temperature and solar radiation sensors, as well as a weather station placed in the external laboratory.

Secondly, numerical models have been developed to simulate the thermal behavior of the vegetable façade. Numerical simulations have been compared with the experimental tests and the thermal problem is optimized.

Finally, the numerical and experimental results obtained in this problem have probed the good thermal behavior of the vegetable façade in terms of energy efficiency. These green elements are able to protect the overheating inside the buildings by means of natural ventilation. Furthermore, on the one hand, they are able to reflect the solar radiation during the summer time. And on the other hand, they are a good thermal insulation during the winter time keeping the optimum conditions of heat and humidity inside buildings.

The vegetable facades studied in this work increase the green elements as well as improve the energy savings. This work presents a green solution for urban and industrial environments.

CODE: 2.4.22

SUITABILITY OF THE NEW FUNCTIONS OF BUILDINGS LOCATED AT THE BEGIINING OF MADRID'S GRAN VIA STREET OVER THE LAST 100 YEARS. A STUDY OF SUSTAINABILITY

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KEYWORDS: modernity, intervention, durability, adaptation, sustainability.

ABSTRACT

The social life of the twenties took place in the gracious Gran Via Street and since then 100 years have gone by, but those buildings are still proudly standing. This document analyses the building techniques and constructive methods of the times and whether this design is compatible with the new uses the buildings have been put to, over the last 100 years and finally if we can talk about a sustainable design or not. We have to hand the architects´graphic projects dated from 1910 to 1920 who were involved in their building. I have made some files with information about alterations carried out at the time, propertys.. etc. The analysis shows that they were flexible designs with open plan floors which could be adapted to whatever future use. Reinforced steel profile were added to the original masonry, this is one of the most important innovations. To make the most of the space available, masonry had to be as light as possible and easy to change in case of need. We will study three buildings in particular to reflect the materials, systems, dimensions of architectural elements to prove that those buildings will never be old as long as we keep them well-maintained.

CODE: 2.4.23

FACADE PARAMETERS FOR THE THERMAL REHABILITATION. APPLICATION CASE IN THE EXISTING BUILDING STOCK IN SANTA COLOMA DE GRAMENET (BARCELONA)

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KEYWORDS: Urban regeneration, energy rehabilitation, thermal insulation.

ABSTRACT

Nowadays, in the scope where both a reduction on the energy demand and in the CO_2 emissions are needed, the possibility to carry out energy-efficient upgrades to the existing building stock becomes an opportunity for the construction sector in Spain. One of the most usual interventions in this direction is the refurbishment of the thermal envelope of buildings, resulting in an improvement in the thermal insulation in both roofs and facades. These types of interventions can suppose certain difficulties depending on the building typology and the constructive characteristics of the elements that need to be insulated.

This study presents an approach and global analysis of the totality of constructive solutions in the existing building envelopes in Santa Coloma de Gramenet (Barcelona), and it intends to be an archetypal showcase of the way to build residential urban buildings in the second half of the XX century.

In the present communication the main constructive and geometric parameters that may have implications for the choice of the thermal insulation upgrade technique are presented. The feasibility of an energy upgrade of the existing building envelopes and its consequent urban regeneration is globally studied here. A methodology of study that may be extrapolated to other geographic areas and municipalities is established.

CODE: 2.4.24

COST-EFFECTIVE OPTIMIZATION OF ENERGY RENOVATION SCENARIOS. CASE STUDY OF A RESIDENTIAL BUILDING

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KEYWORDS: energy renovation, energy demand, envelope retrofit, energy conservation measures, energy simulation, cost-effective optimization.

ABSTRACT

The multiplicity of criteria that define the energy performance of a building (climate, solar accessibility and orientation, geometry and construction systems...) makes it very difficult to establish standard solutions to improve the energy efficiency of a building that are really efficient. Therefore, it is necessary to establish a methodology for evaluating the energy improvement from a cost-benefit perspective as required by the EPDB (Directive 2010/31/EU).

First, the inspection and monitoring of the building allow determine accurately the thermal performance and energy efficiency of different elements that have the greatest influence on the energy consumption of the building: opaque and translucent envelope and facilities to establish the baseline and determine the critical points that must be tackled. Second, different energy conservation measures are evaluated in terms of energy demand and end energy by simulation and economically through the study of the economic cost (method of net present value) for the estimated life of the building taking into account the investment costs, maintenance and operation.

A measure or set of measures is considered cost-effective when the cost of implementation is less than the value of the benefits generated over the life of the measure. Future costs and savings are discounted for net present value. To determine which set of measures optimize the relation energy reduction - economic cost is necessary to propose a comprehensive set of measures for the whole building, individual elements or set of elements. However, one must take into account other non-economic factors that constrain the decision making process: improving indoor comfort, maintenance or functionality changes among others.

This methodology is applied to a case study in which the potential of energy reduction through the thermal envelope retrofit and the validity of the proposed methodology for decision making in energy renovation are shown. In this case study, a less intrusive intervention such as insulation of the wall's cavity has a small payback period although the energy saving achieved is low. Replacement windows is not amortized in all cases while other comprehensive interventions in which the thermal performance of several components are improved can be profitable.

CODE: 2.4.25

MONASTERY OF THE CARTUJA DE MIRAFLORES: IMPLEMENTATION OF TO RENEWABLE ENERGY SELFCONSUMPTION

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KEYWORDS: energy efficiency , photovoltaics energy, selfconsumption.

ABSTRACT

In 2007, is promoted with funding from the Regional Energy Agency of Castilla y León the installation of a photovoltaic solar plant in the Monasterio de la Cartuja de Miraflores in order to produce electricity evacuated within its dependencies. The project was drafted with the advice of the authors of this article, as well as the subsequent execution of the work, given the very special features of the site, as it is a National Monument monastery, started building in 1442 reigning Juan II and completed in 1484 during the reign of Isabel the Catholic, and currently been inhabited by Carthusian Monks Closing. Are collected at this work all initial conditions for the development of the project and how they have affected the operation of the facility until today. During the six years of operation has been monitoring the facility in terms of its production and maintenance and evaluated the possibility that the Monastery taps into her own consumption analyzing electricity consumption for this monastery. The result of this evaluation is observed for this type of facility, and the methodology recommended in terms of visual impact and characteristics of civil works and associated masonry, economic viability, environmental and absolute compatibility with the historical heritage and its high potential for replication in other similar buildings.

CODE: 2.4.26

OPTIMIZATION IN THE IMPROVEMENT ACTIONS OF ENERGY EFFICIENCY IN BUILDINGS

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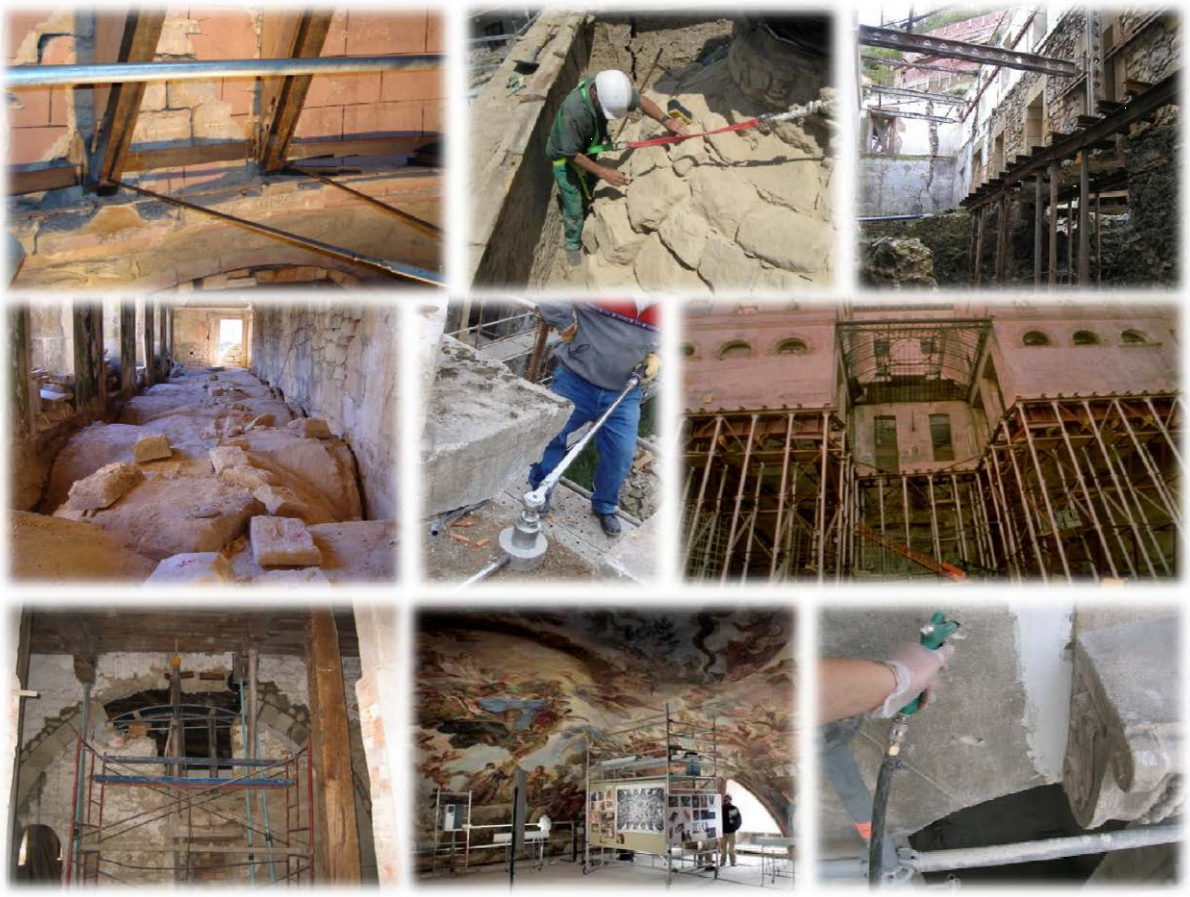
KEYWORDS: Efficiency, load curve, energy management, energy generation mix, marginal cost, effective lifetime, life cycle, useful life, profit-earning capacity.

ABSTRACT

Analyzing the special features of an electric power system and the building current state, energy efficiency is presented as a necessary and interesting solution to the consumer. The present study is focused on the techno-economical optimization in the selection, by the technicians involve in this topic, of the best constructive improvement actions. The main aim is to propose a new methodology of analysis and decision-making, which may be extrapolated to other applications.

3.- BUILDING INTERVENTION



CODE: 3.1.01

STRATEGY OF ARCHITECTURAL INTERVENTION IN HERITAGE BUILDINGS IN DANGER OF COLLAPSE AT HAVANA'S HISTORIC CENTER

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KEYWORDS: MIVES, historical heritage, prioritizing, danger of collapse, emergency actions.

ABSTRACT

The Historical Center of Havana, declared World Heritage Site by UNESCO in 1982, has 2.14 square kilometers of extension and 3.510 buildings which are under permanent natural degradation. In fact, the whole area is under preferential action due to its high degree of physical deterioration. The situation becomes more acute due to the hurricane seasons which last six months (from June through November). Hurricanes and tropical storms cause irreparable damage to heritage buildings.

After a careful inspection of the heritage buildings of the Historical Center, finalized in 2011, it has been possible to identify those edifices in imminent danger of collapse and those whose life could be prolonged if provided emergency actions are implemented. To that end, we have put into practice a multi-criterion instrument based on the concept of MIVES [7] which is aimed at prioritizing-- in an objective and justifiable manner-- the degree of intervention needed. This instrument is based on requirements, criteria and indicators that have been selected, analyzed and approved by a panel of experts that has been expressly created to quantify all the agents that intervene in the chain of value.

CODE: 3.1.03

REFURBISHMENT WORKS DETAILS TO ASSIST IN OLD BUILDINGS PROJECT DESIGN

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KEYWORDS: management, refurbishment, project design, practices, sustainability.

ABSTRACT

Old buildings refurbishment works are treated with similar practices to new construction ones. However, in old buildings refurbishment works there are some constraints and specificities with several differences comparing to new construction works. Some examples of that are the works site limitations, local traffic, neighbouring buildings characteristics, accessibility and mobility conditions, among many others.

On the other hand, there are different issues of interest for the management in the refurbishment works phase which are often overlooked in project design, such as the quantities and rates of skilled labour, technical monitoring needs, possible risks associated with unforeseen events, and many others connected to the occurrence of archaeological works, needs of occupants relocation, construction and demolition waste management, etc. Pondering these issues during project design study, articulating them with old buildings refurbishment real needs, can help several stakeholders during refurbishment works to minimize production losses, reduce deadlines additions and invert frequent cost increasing.

This article shows part of a toolkit developed in a PhD Framework study and it aims to aid stakeholders during old buildings refurbishment works. The toolkit supports several different issues to apply in project design which are connected to four main areas: “Surrounding and location”, "Conception", "Execution of works and building site" and "Costs". These areas contain a set of 50 different parameters with practices and solutions classified from less to more sustainable when compared with current or conventional ones.

The methodology used was a case study divided in two different parts, namely the document review, by consulting 7 building refurbishment project designs provided by the Urban Rehabilitation Society Porto Vivo, complemented by interviews with stakeholders. The results of the study show the relevance of considering practices for refurbishment works in project design and their aid to project management, even without law or regulation compliance impositions. These management practices can help old buildings refurbishment stakeholders and contribute jointly to project management success.

CODE: 3.1.04

THE ACTION PLAN OF THE FORTIFICATIONS IN PAMPLONA: A DRIVING FORCE FOR CONSERVATION AND ENHANCEMENT OF FORTIFIED HERITAGE

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KEYWORDS: conservation, heritage restoration and management, military architecture, walls, pamplona.

ABSTRACT

The fortified complex of Pamplona, mostly built between the sixteenth and eighteenth centuries, is one of the most interesting and well preserved bastioned venues in Europe. A decade ago Pamplona City Council began work in an important strategic Plan for the Conservation and Promotion of the fortified enclosure and improving their environment, aware of its value and potential. In this ambitious project, the Action Plan of the Fortifications of Pamplona, written in 2006, is a key figure that will guide the development of actions to be carried out subsequently.

The Action Plan is based on an thorough research: planimetric survey, historical studies, searches on photographical image archives, characterization and performance of masonry materials, flora and fauna, the state of preservation of each defensive element. Then the criteria, objectives and priorities for action are established; the temporal and economic development of each wall segment is valued; some uses for enclosed areas and revitalization of its environment are proposed, and various activities for cultural dissemination of its historical and architectural values are targeted.

In light of the results obtained, methodology, objectives, scope and implementation of this Plan are described and analyzed, drawing conclusions that allow us to move forward in the conservation and the enhancement of this cultural heritage.

CODE: 3.1.06

INTERVENTION PROPOSALS FOR THE RECOVERY OF "LA MERCED" CHURCH IN THE OLD TOWN OF THE CITY OF PANAMA

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KEYWORDS: architecture, restoration, architectural intervention and applied criteria, timber structures etc.

ABASTRACT

This paper introduces the used intervention criteria in the proposal for the restoration of the temple of La Merced located in the Old Town of the Panama City. The presented work deals with the different considerations: aesthetic, and conservation techniques that they were considered for the proposed restoration of "La Merced" Temple

CODE: 3.1.10

STUDIES AND STRUCTURAL CONSOLIDATION PROJECT FOR THE RESTORATION OF THE CHURCH OF "LA MERCED" IN THE OLD TOWN - PANAMA CITY

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KEYWORDS: masonry, seismical behavior, auscultation, diagnostic, analisys. assessment, seismical improvement. demand-capacity, push-over, frp composite materials, timber structures, etc.

ABSTRACT

In this paper, the previous studies of inspection, auscultation and structural assessment for the Restoration of "Monumental Site of La Merced", in San Felipe district, Old Town of the Panama City, are exposed. Also, it has been exposed the structural damages, the intervention philosophy and the proposals for the reducing seismic vulnerability ,structural interventions and consolidation works for the structural consolidation of the Restoration Project.

CODE: 3.2.01

CONSOLIDATION AND STRENGTHENING OF ANCIENT STONE MASONRY WALLS. GROUT INJECTION

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KEYWORDS: rehabilitation, mansory, injection, grouts.

ABSTRACT

The stone masonry walls are present in many historical buildings and monuments, with an important cultural and patrimonial value, but also in old housing buildings both in Portugal and in Europe. Most of these buildings lying in a high state of degradation by requiring urgent intervention. This requires the identification of deficiencies and the application of appropriate intervention techniques. In the particular case of interventions in old buildings, the first option to consider should be the conservation of materials, making specific repairs if possible, or consolidation procedures, while preserving the building's integrity.

One of the possible techniques for structural consolidation of stone masonry walls is the injection of grouts. This technique is a passive technique that restores the integrity of the building and improves its load capacity. One of the problems of this technique, in addition to the reversibility, is the choice of injection mortar or grout to use. Commercial products for this purpose have in the technical data sheet different information, which complicate the direct comparison. In addition, in some of them, the available information is limited whereby commercially available grouts have been applied without full knowledge of their properties. The decision to choose is based on the product application experience in similar cases, ease of acquisition and transport, or even most of the time in economic factors.

We present in this paper the behavior characterization of four commercial grouts for injection in old masonry in terms of rheological and mechanical properties, obtained by carrying out experimental tests in the laboratory. The knowledge of these results is certainly a great help at the time of choosing one or other product and writing, for example, a set of specifications.

CODE: 3.2.03

NEW PASSIVITY INDICATORS BASED ON NON-DESTRUCTIVE TECHNIQUES FOR MONITORING ELECTROCHEMICAL CHLORIDE EXTRACTION TREATMENT IN CONCRETE STRUCTURES

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KEYWORDS: Reinforcement, repair, Electrochemical chloride removal (ECE), Non destructive electrochemical techniques.

ABSTRACT:

Since the construction of reinforced concrete structures was initiated early last century, corrosion of steel reinforcement has been one of the factors that affect most negatively on the durability of buildings, being the cause of costly repairs to maintain functionality, aesthetics and safety of structures.

Although the application of repair techniques is essential to ensure adequate service life of these structures, many uncertainties regarding the effectiveness of the repair techniques currently used to mitigate corrosion, and guarantees that can ensure effective re-passivation for a period of time are still under discussion. The problem is further aggravated when it comes to advanced techniques.

Even though at the moment it is not very popular in Spain, the increasing application of electrochemical chloride extraction (ECE) in concrete in other countries during the last years a has aroused great interest in the understanding of the mechanisms involved in this technique. There are many gaps remaining to be filled in relation to the processes taking place at the electrodes and how to detect the moment in which the rebar is re-passivated, as well as possible damage caused in the rebar due to hydrogen generation during the treatment.

The objective of this work is to determine by non-destructive electrochemical techniques the passivity state of the reinforcement and the mechanisms leading to this during the electrochemical chloride extraction treatment. In this way we can monitor the state of the rebar during treatment and confirm its effectiveness.

CODE: 3.2.07

NON-STRUCTURAL CONCRETE REPAIR

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KEYWORDS: repair, non-structural, concrete, UNE EN 1504.

ABSTRACT

Virtually all the concrete elements that form part of residential or industrial buildings are exposed to external agents that may reduce their service life. The aggressive environments, the carbonation of the concrete cover, the poor execution or other factors could lead to a rapid deterioration of the concrete structures. As a result of these conditions, many concrete elements cannot achieve their design lifetime unless additional repair works are carried out.

The products which form the non-structural concrete repair systems are intended to repair the damages to the concrete elements, restoring their original forms and protecting them to prevent future damage. The products used in the non-structural concrete repair have to meet the requirements of UNE-EN 1504-3. This standard sets minimum values for a number of properties of these products and allows manufacturers labelling the repair products as R1 or R2.

The standard UNE-EN 1504-3 sets out the methods that must be followed for the replacement and restoration of the concrete with non-structural mortars. These methods describe the product application manually, by fillings or by projection.

CODE: 3.2.09

STUDY OF PERMEABILITY IN CONCRETE AND ITS EFFECTS IN DURABILITY

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KEYWORDS: concrete, permeability, compression, durability, tensile strength.

ABSTRACT

During its working life period, structures must be able to withstand environmental exposure in which they are, ensuring their durability in the period they were designed for. In the case of reinforced concrete durability loss is caused by actions that can degrade the concrete or reinforcement. The occurrence of extraordinary and not considered actions in the design can cause the appearance of stresses in the concrete that cause pressure values, still remain below its resistance and therefore not representing a risk for structural safety a priori, which can induce concrete microcracking that increase the permeability to external agents reducing the durability of the structure. In this paper, the results of research conducted to study the evolution of concrete permeability in different pre-compression processes are described, based on water penetration tests.

To that end, an experimental test plan on concrete samples which are previously compressed at different load levels and then tested for permeability has been performed. Also, in order to investigate the influence of microcracking induced by fatigue on the concrete permeability, the applied compressive load is maintained at the established level during different periods of time. From the results, it follows that the implementation of previous below resistant to failure values compressions on concrete, causes microcracking processes in concrete that increase its permeability and therefore may leave the structure out of service due to the breach of durability limit state.

CODE: 3.2.11

EARLY CRACKING, CURING AND SUSTAINABILITY OF CEMENTITIOUS OVERLAYS

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KEYWORDS: cementitious overlays, high performance concrete, plastic shrinkage, early cracking, internal curing, durability, sustainability.

ABSTRACT

It is very usual the construction of thin and large area concrete elements. Sometimes they are new works, such as concrete pavements or concrete for complete monolithic sections with prefabricated elements. In other cases they serve to maintain, repair or reinforce already constructed elements: floors or pavements overlays, patched of concrete, masonry walls overlays (formwork or projected), etc.

Cementitious overlays are very prone to cracking when the material is in the plastic state. This trend has augmented with the increasing use of high performance concrete. The two main causes of this condition are plastic shrinkage and plastic settlement. The plastic shrinkage depends on endogenous and exogenous variables. Between the first are the concrete mixture, the nature and characteristics of the components and the use of chemical additives or mineral additions; among the latter, those related to water mixing evaporation and curing.

Early cracking increase the concrete permeability, which may reduce the durability. Consequently, curing of overlays can be crucial to the quality and sustainability of construction. In this study the mechanisms that cause plastic shrinkage cracking, the variables on which it depends and the curing methods are analyzed; in particular, the so-called "internal curing", technique whose application has acquired an accelerated development in the XXI century.

CODE: 3.2.13

REHABILITATION MORTARS WITH CERAMIC RESIDUES

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KEYWORDS: replacement mortars, lime, ceramic residues, characterization, optimization.

ABSTRACT

Aging and environmental agents act in a very particular way in exterior coatings, especially rendering mortars, usually urging the need for their rehabilitation. Considering its required protection role, it is easy to understand the relevance of a proper conservation/rehabilitation work.

The urgency to solve problems that extend through time and continue to deteriorate the walls lead, most of the times, to less proper interventions with inadequate solutions that, instead of solving the problems, worsen them.

Old renders were essentially air lime based ones and their rehabilitation/substitution must be performed with compatible mortars not only to restore their protective behaviour but also to keep the integrity of the whole wall-rendering system and the aesthetic appearance of the building. Current mortars that are likely to be more compatible with this type of requirements are air lime and natural hydraulic lime based ones.

As it is known many old mortars included in its composition high amounts of ceramic residues, namely in Portugal, Spain and other Mediterranean countries. As so, in an attempt to combine the awareness on the reuse of ceramic residues, reducing the considerably large amounts that are usually disposed into landfills, with the technical benefits they can provide to new substitution/rehabilitation mortars, an experimental research has been developed in the University of Coimbra, with the cooperation of Nova University of Lisbon, on the behaviour of lime mortars with the incorporation of ceramic residues.

This article intends to present the most recent developments on the experimental characterization of these mortars.

The obtained results allowed to evaluate the impact of the amount and type of ceramic residues in mortars' mechanical and physical behaviour and results were considered quite acceptable.

CODE: 3.2.14

PROPOSED RESTORATION OF ROOF OF HIGH SLOPE ON WOODEN STRUCTURE

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KEYWORDS: restoration, roof, tile.

ABSTRACT

On the covers of tiles on structures of formation of slope of wood and support, with a high slope chillas tables, usually occur two injuries: one, due that shingles will slide along the apron near the Ridge there are areas where the parts do not overlap and rainwater can enter go inside. And another, caused because shingles that go by sliding into the apron, stop at the area of the restraint, just over the wall, and they prevent rainwater drainage by eaves causing water entry from the top of the wall, where the slope of wood structure, is supported and are injured structure and the wall.

The law of the Spanish historical heritage has as one of its purposes "..." guarantee the conservation of the Spanish historic heritage" but without altering the good of cultural interest which indicates that they have to keep materials and constructive solutions and the image. If you add materials or elements necessary for its stability or maintenance, must be recognizable and reversible intervention. To get a roof, not well resolved constructively, to protect the building from the entrance of water keeping the external appearance uncommon materials and constructive solutions, when rose that construction, can be used, and which are not detectable and complying with its constructive role, in this case, the impermeability of the cover.

This article is an analysis of lesions that can be found in tiles covers high slope in heritage buildings, describes some of the causes thereof and a constructive proposal is made to resolve these covers without altering its image abroad.

CODE: 3.2.15

MATERIAL CHARACTERIZATION OF FABRIC REINFORCED CEMENTITIOUS MATRIX (FRCM) COMPOSITES

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KEYWORDS: fabric reinforced cementitious matrix; FRCM; reinforcement technology; mechanical characterization.

ABSTRACT

Fiber reinforced cementitious matrix (FRCM) composites may be considered as the evolution of ferrocement where the steel reinforcement mesh is replaced with man-made textile reinforcement, consisting of a sequence of one or more layers of cement-based matrix reinforced with dry fibers in the form of open mesh (fabric). FRCM composites represent a viable alternative to conventional FRP materials as external strengthening systems of concrete and masonry structures. This composite maintains the flexibility of ferrocement and its thin profile, and also offers advantages over FRP composites due to improved performance at elevated temperature and humidity, and, in the case of fire exposure, due to the inherent non-combustibility of the cementitious matrix, and better compliance with the substrate. An experimental study is presented, with the objective of investigating the mechanical and durability properties of two new FRCM systems, where a carbon fabric and polyparaphenylene benzobisoxazole (PBO) fabric were used, respectively The results presented include the tensile characteristics of the materials at controlled ambient conditions as well as after exposure to aging environments of freeze-thaw, seawater, alkalinity, and 100% relative humidity at a high temperature. The bilinear behavior includes the tensile modulus of elasticity of both uncracked and cracked coupons, the transition point, and the ultimate point. The main failure mode was by slippage of the fibers indicating the importance of bond strength in the performance of these materials. . The results of the durability tests indicate that there is no degradation of mechanical performance of the material. The material characteristics obtained are used for the development of design procedures for retrofit and reinforcement of concrete and masonry structures.

CODE: 3.2.16

CORRUGATED STEEL REINFORCEMENT BEHAVIOR SUBJECT TO DIFFERENT LENGTHS AND CORROSION DEGREES

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KEYWORDS: corrosion, ductility, lengthening, tensile strength test, corrugated steel.

ABSTRACT

An analysis of the influence of the corrosion effects on strength behavior, elongation capacity and steel ductility has been carried out in numerous research studies, using rebars with different steel diameters and undergoing different types of accelerated corrosion tests. This work shows the consequences of corrosion on the mechanical properties of small diameter bars and varied lengths corroded at different degrees.

In order to do so, 8mm diameter steel rods have been embedded in slabs of mortar, to which calcium chloride has been added at the kneading process. After curing , rebars have been externally short circuited and they have been subjected to a process of accelerated corrosion, exposing them to varying power amounts. Subsequently, the rebars were extracted and they were tested to tensile strength until fracture. This enabled us to establish the resistant characteristics and to compare them to the reference rebars which had not suffered any corrosion process. The results obtained show the influence of the length tested and its corrosion degree regarding the resistant and ductile behavior.

CODE: 3.2.19

REHABILITATION OF HYDRAULIC INFRASTRUCTURES

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KEYWORDS: rehabilitation, cracking, WWTP, activated sludge, pathologies.

ABSTRACT

It has been observed that several hydraulic infrastructure related to wastewater treatment and to treatment of water supplies, have sometimes several constructive pathologies.

In this article, we present a "case study" on a WWTP built in 2001, on the right bank of the Mondego River, near the city of Coimbra, where over time have been appearing several pathologies. We present is the description, the analysis and diagnosis, the solutions for their resolution, the performed intervention and the results obtained.

It is a WWTP to 4000 equivalent population essentially composed of a treatment system by activated sludge, complemented with means for the removal of nitrogen and phosphorus and removal micro-organisms.

The main pathologies refer to existing cracks and crevices in the walls of the biological treatment tank that present large width causing high loss of effluent. Cracks also appeared in other areas, although of smaller dimension. The detected pathologies are mainly due the bad foundation conditions and project deficiencies.

The aim of this paper is to present a comparative analysis of different structural rehabilitation solutions taking into account the observed pathologies, their causes and the technical and economic aspects involved, as well as present the solution adopted, as a result, mainly, of the prevailing economic constraints

CODE: 3.3.01

MASONRY VAULTS STRENGTHENED WITH COMPOSITE MATERIALS BASED ON INNORGANIC MATRIXES

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KEYWORDS: masonry, strengthening, composite material, basalt, steel, mortar.

ABSTRACT

Nowadays, the use of fibres reinforced polymers (FRP) for structural retrofitting is widely spread. These materials provide the structures of greater resistance to tensile in exchange for a minimum weight increase. However, some disadvantages can be highlighted as their brittle behaviour and lack of water vapour permeability, which does not help in the conservation of the structures that are part of the cultural heritage.

This paper presents an alternative composite material comprising an inorganic matrix that allows solving the problems derived from organic matrices. As the resistant core of inorganic matrix, long steel fibres are used, resulting in a steel reinforced mortar-based composite (SRM). Firstly, SRM mechanical characterization was carried out, both of its individual components and of the resulting composite material. Secondly, in order to demonstrate the mechanical effectiveness of this composite material, un-strengthened and strengthened real-scale (2.98 m span, 1.44 m high and 0.77 m deep) brick masonry vaults were tested up to failure. Finally, a comparison between SRM and steel fibres embedded in a polymer matrix (SRP) was performed by means on additional real scale vault testing.

The experimental campaign demonstrated that SRM is an alternative reinforcement, physically compatible with masonry structures, easy to apply and effective in the case of the reinforcement of brick vaults.

CODE: 3.3.02

SEISMIC BEHAVIOUR OF MASONRY ARCHES AND EFFECTIVENESS OF STRENGTHENING SYSTEMS

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KEYWORDS: masonry, arches, seismic retrofitting, strengthening, pushover, dynamic analysis.

ABSTRACT

Arches and vaults are one of the most vulnerable elements in existing masonry buildings, and their dynamic behaviour is difficult to model. The classical mechanism method leads to elegant formulations under either pulse or sine base motions, but not under earthquakes inputs. Distinct elements, nonlinear 2D or 3D finite elements generally require high computational efforts and are strongly sensitive to the constitutive parameters of the material.

In this work, an approach for the seismic analysis of masonry arches with fibre beams is shown. The method allows for an accurate description of the mechanical properties of masonry and for the representation of the interaction between axial force and bending moment in the cross section of the arch. At the same time, the computational efforts are limited, thanks to the intrinsic simplicity of the frame model. A suitable representation of the inertial forces arising under earthquake load is identified through the comparison between dynamic analyses under natural accelerograms and push over analyses with different loading profiles. Buttresses and seismic retrofitting devices, such as steel-tie bars and externally bonded reinforcements with composites, are also considered.

CODE: 3.3.03

STUDY OF THE EFICCIENCY OF DIFFERENT STRENGTHENING TECHNIQUES FOR SOFT-STOREYS BUILDINGS

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KEYWORDS: RC buildings, masonry infill walls, soft-storey mechanism, seismic vulnerability, strengthening techniques.

ABSTRACT

The evaluation and strengthening of existing RC buildings, with the main objective of guarantee their safety to seismic loadings, is a topic of high importance and urgency, as proved in recent earthquakes around the world, and particularly in southern European countries. Thus, it is recognized that should be given attention to the investigation in the analysis and strengthening of existing buildings. Some architectural solutions adopted in the decade of 70 associated with the structural design practice adopted in that period, resulted in many of these structures that are now associated with high seismic vulnerability, and may suffer considerable damage if requested by an earthquake.

The main objective of this work is to study the efficiency of different strengthening techniques applied to an existing RC building with masonry infill walls and potentially conditioned by soft-storey behaviour. In the first phase was analyzed the influence, already proven in previous studies, of the infill panels' presence in the building response when subjected to seismic actions, and then evaluated the seismic vulnerability. After, it was adopted, in the numerical model, different strengthening techniques, namely: RC column jacketing, the addition of RC shear walls, and addition of steel braces with and without dissipation energy device. The results of the strengthened buildings' response were compared with the respective results of the original structure, with the purpose of evaluate the improvement of the structural performance with each strengthening technique studied.

CODE: 3.3.04

REHABILITATION AND RETROFIT OF BRIDGES' RC DECKS

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KEYWORDS: bridges, damage, structural capacity, rc decks.

ABSTRACT

An important percentage of the highway bridges build around the world are continuously subjected to important increases of the live loads that run along them, in comparison to the ones considered during their design process. These load increments directly have an effect on the bridges' superstructure, causing on the reinforced concrete (RC) decks important deflexions and cracks. The aim of the present work is to develop a methodology to select the most economic and easy to implement methodology for the rehabilitation and/or retrofit of bridges' RC decks. This work studies the efficiency of over decks built on voided deck slabs, solid slab decks supported on AASHTO type girders and solid slab decks supported on situ RC girders. The results lets us define the parameters that have more influence on the efficiency of the retrofit or rehabilitation technique for each of the studied cases that lets us conclude in which cases is convenient or not to implement a reinforcement methodology.

CODE: 3.3.05

DISPLACEMENT DEMANDS IN BRIDGE PIERS RETOFITTED WITH RC JACKETS

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KEYWORDS: bridges, seismic capacity, jacketing, capacity spectrum.

ABSTRACT

We evaluate the displacement demands in bridges with one column RC substructure. The methodology consists in assessing the seismic capacity by using non-linear static analyses (Push-over) and the seismic demand with response spectra. The seismic records belong to a subduction seismic source in the Pacific coast. We use capacity spectra to join the bridge capacity and demands in one graph; the intersection allow us to assess the expected pseudoacceleration and displacements. The study evaluates the ATC-40 methodologies that are based on equivalent damping and periods to determine the non-linear demands in the bridges. To avoid the use of equivalent damping, we propose instead, uniform ductility spectra to characterize the seismic demands. As a result we compare the performance point with the ATC-40 methodologies and with the proposal of this paper. Some of the analyses showed important differences. The implications of the different results in the expected bridge behavior are discussed.

CODE: 3.3.06

ASSESSMENT OF DIFFERENT TECHNIQUES FOR RETROFITTING BRIDGE PIERS

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KEYWORDS: bridge piers, retrofitting, concrete confinement, fiber composite jacketing, external prestressing.

ABSTRACT

Many existing bridges are vulnerable to strong ground motions since most of them have been built before current seismic design guidelines were established; consequently, when bridges are subjected to seismic loading sever damage may be expected, as observed in major earthquakes. Therefore economical and effective techniques for retrofitting existing bridges are needed. The damage and hysteretic energy dissipation in bridges during ground motions are basically concentrated on the piers. The main deficiencies encountered in reinforced concrete piers are the inadequate concrete core confinement on the plastic hinge region and low flexural and shear capacity. An improved form of confinement and the increment of the ductility and shear strength at the ends of columns may be achieved by wrapping prestressing wires under tension around a column, and by fiber composite jacketing. Both retrofit strategies are assessed in this study by comparing the capacity curves obtained with a non linear static analysis, using a concentrated plasticity model. It was observed an important increment of the strength capacity with both techniques, especially when the external prestressing steel was considered. In contrast, a major flexural ductility capacity was achieved with fiber composite jacketing.

CODE: 3.3.08

STRUCTURAL REHABILITATION OF RUBBLE STONE MASONRY WALLS. EXPERIMENTAL EVALUATION

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KEYWORDS: ancient building; rubble stone masonry; structural rehabilitation; experimental study.

ABSTRACT

According to official data, there were in Portugal at the beginning of the XXI century more than three million buildings, in which the masonry buildings were preponderant in relation to reinforced concrete ones, for buildings of one and two floors, and the reverse, for buildings over four floors. Most of the historic centers have ancient buildings of traditional stone masonry walls (rubble stone masonry or ordinary masonry), many of them hundred-years-old, and, in some cases, with multiple anomalies requiring a suitable diagnosis and rehabilitation, so that the rehabilitation solution can be effective (with materials as compatible as possible with existing ones). Besides, Portugal is located at a high seismic hazard zone, near the confluence of African and Eurasian tectonic plates, which is the cause of moderate to strong magnitude earthquakes, the last one in 1755.
This paper refers to the research study on rubble stone masonry walls, held at the Civil Engineering Department of Faculty of Sciences and Technology, Universidade NOVA de Lisboa, for which several experimental specimens (wallets) were built, for axial compression and shear-compression testing, after the application of different structural strengthening solutions, being here presented results obtained under axial compression testing.

CODE: 3.3.10

WOODEN "INSERT" WORKS FOR THE STRUCTURAL RETROFITTING AND THE FUNCTIONAL REDEVELOPMENT OF THE STONEWALLS

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KEYWORDS: rehabilitation, reuse, historical memory, technological innovation, seismic improvement, reversibility.

ABSTRACT

The writing presents a study oriented to the rehabilitation of the stonewall buildings having significant lacks of technological units (with particular reference to the territories that, in last years, underwent seismic events). To be more precise, the objects of the study are the buildings constituting the Caporciano (Aq) municipality old town, which have an "in chorus" enhancement need. In the study it is considered that building patrimony that suffered the collapse of the horizontal partition or of the roofing, as well as the damage or the partial collapse of the internal vertical partitions.
For the buildings rehabilitation, we propose the "conjugation" of the "building on the building" principle. In this sense, we will subsidize the selective partial demolition processes through new volumetric inserts, respecting eventual existing elements of morphological and cultural identity. According to this viewpoint, the reversibility and the possibility of recognizing the light and dry stratified inserted systems, correspond to the guarantee of a sustainable conservation of the residual buildings as well as of new and appropriate spatial-functional and technical- performance levels.
To the "inserted" works, mainly wooden buildings, it is given the double role of structural reinforce and completion of the technological and environmental systems.

CODE: 3.3.13

DEVELOPMENT OF RETROFITTING SOLUTIONS: REMEDIAL WALL TIES FOR MASONRY ENCLOSURE BRICK WALLS – EXPERIMENTAL CAMPAIGN

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KEYWORDS: instability; masonry walls; retrofitting; remedial wall ties.

ABSTRACT

An experimental campaign has been described to evaluate the effectiveness of including remedial wall ties as an intervention technique (CemenTie and Dryfix from HELIFIX®) used in the retrofitting of hollowed fired clay brick masonry building facades. Initially an experimental campaign was undertaken to carry out tests on 120 isolated specimens using some post and some pre NP EN 771-1 clay bricks. A second campaign was carried out on wall specimens built with dimensions of 1.20 by 1.20 m in order to represent a more realistic situation and evaluate slippage effects of the retrofitting solutions. Thus, this experimental work aimed to: i) assess the retrofitting technique in the laboratory environment; ii) to evaluate the efficiency of the retrofitting solution on specimens represented by post and pre NP EN 771-1 clay bricks; iii) evaluate the influence of different features of the retrofitting technique (sleeve introduction and grout injection) over the pull-out test results; and iv) describe and catalogue the types of failure and behaviour of both techniques. All results for both retrofitting techniques are thoroughly presented and discussed.

CODE: 3.3.20

ON THE USE OF CAPITALS AND TUBULAR STEEL PROFILES IN REINFORCED CONCRETE COLUMNS STRENGTHENED BY STEEL CAGING

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KEYWORDS: reinforced concrete columns, strengthening, experimental study, steel caging.

ABSTRACT

Among the different strengthening techniques for reinforced concrete columns, the use of steel caging (steel angles and strips) is a common method for strengthening square and rectangular columns, widely used over the world, and which has shown to be effective, economical and easy to apply. One important point regarding the structural behavior of this strengthening technique is the beam-column joint area. This paper presents a series of experimental tests in order to study two ways of solving the beam-column joint area: a) using capitals, welded to the end strips of the strengthening, and in contact with the beam-column joint; and, b) fitting tubular steel profiles linking the steel cage located at both sides of the beam-column joint. Experimental tests are full-scaled and simulate the beam-column joint area of a typical building frame. For each type studied, both the behavior under axial loads and axial and bending loads is analyzed.

Results shown that fitting capitals is an easy and economical procedure, which provides ductility to the column as well as increases its resistance. Regarding the use of tubular steel profiles, their implementation leads to a behavior similar to that observed in a composite steel-concrete element, reaching high ductility and resistance, but has the disadvantage of implying a complex execution, being necessary to drill holes in the slabs or beams.

CODE: 3.3.21

REAL CASE OF UNDERPRESSURE IN SLAB FOUNDATION BUILDING AND BASEMENTS DECOMPENSATED INCIDENCE ON THE STRUCTURE AND REINFORCING THE SAME

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KEYWORDS: Pathology in construction, Foundation, Structure, Technology.

ABSTRACT

The present study was carried out following the uplift pressures produced under the foundation slab of a residential building and hotel, as well as the joint basements annexes, due to the communication of ground water table caused by deficient execution whose walls underrun on screen clays were insufficient. The stratigraphy of the area responded to a layer of gravel or near the river "Arlanzón" alluvial. The foundation over gravel and communication of the water table hydrostatically impinged on the bottom of the foundation slab. Although he had a drainage network connected to an extraction pump continuous operation during execution, it was not enough to reduce this negative pressure.
The cause of the pathologies, flooding in the basement and last movements were evident, since both permanent and variable actions of Annexes basements were clearly lower than the hydrostatic pressure acting below the foundation.

The methodology was to conduct comprehensive data takes lesions produced by the movements produced by the non-compensation charges. Basements at points where movements manifested as partitions, columns, beams, floor levels and gauges to measure the suppression under the slab were implemented. In order to justify the possible actions, new geotechnical study due to difficulties had to make a Geophysical Prospecting for Electric Tomography was performed. The building is also discretized to analyze the possible stabilization.

With all previous data several solutions were prepared from the possibility of condemning the last basement through a permanent concarga up to injections under ground.

The final solution was stabilized by micropiling structural foundation slab by reinforcing wire mesh embedded therein, which allowed taking advantage solution of the last basement.

CODE: 3.3.26

SLAB REHABILITATION IN GAUDI HOUSE MUSEUM IN PARK GÜELL

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KEYWORDS: lightweight self-compacting fiber reinforced concrete, slabs, rehabilitation, park güell, gaudi house museum.

ABSTRACT

Gaudi House Museum is located in Park Güell in Barcelona, which is a site listed as World Heritage by UNESCO. The floor structure or slabs of the building were built using metallic and wooden beams with ceramic vaults (revoltón) between the beams and backfilled with concrete. Recently, it was determined that the slabs of the Gaudi House Museum required rehabilitation in order to improve the monolithic behaviour and to increase the rigidity of the structure. Otherwise the number of visitors should be limited.

However, given the circumstances of this particular building, several aspects needed to be taken into account. Firstly, the strict deadline to perform the rehabilitation due to its condition of tourist attraction. Moreover, the structure of the building was not conceived to bear significant additional weight. Hence, the rehabilitation solution should not imply a long period of time to be finalized and nor should increase the weight of the slab.

For these reasons, a solution of lightweight self-compacting fiber reinforced concrete (LSCFRC) was considered, which represents a pioneer development in the rehabilitation of buildings. The main objective of this study is to present the case of rehabilitation conducted in the Gaudi House Museum with this material, describing the construction procedures employed, detailing the connection of the several structural elements with the LSCFRC and providing feedback on how to ensure an adequate mechanical performance of the previous elements and the new solution.

CODE: 3.3.27

BEHAVIOR OF UNREINFORCED MASONRY WALLS STRENGTHENED WITH FRCM COMPOSITE UNDER IN-PLANE LOAD

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KEYWORDS: fabric -reinforced cementitious matrix; shear loading; URM walls; reinforcing.

ABSTRACT

Recent world events have exhibited that sustainability of masonry wall systems subject to extreme in-plane loads is an ever growing concern. Un-reinforced masonry (URM) walls have proven to have low shear strength to withstand in-plane loads caused by earthquakes. Retrofitting masonry walls with novel materials such as fiber-reinforced composites has shown to increase the in-plane shear capacity of the walls and minimize the damage of failure by enhancing pseudo-ductility. In this study, a new fabric-reinforced cementitious matrix (FRCM) composite system is applied to URM walls to determine its feasibility as an externally retrofitting technique. The experimental program consists of testing a total of 18 wall specimens under diagonal compressive forces, made from clay bricks and concrete masonry blocks; where two FRCM strengthening reinforcement schemes are applied to the specimens to further understand the behavior under extreme strengthening limits: namely one and four plies fabric. The experimental results demonstrate the effectiveness of FRCM strengthening on improving the structural performance in terms of shear capacity of masonry walls. The analytical model calculating the shear capacity of strengthened masonry walls with different strengthening levels is compared with experimental database.

CODE: 3.3.28

EXPERIEMNTAL INVESTIGATION ON THE SHEAR BEHAVIOR OF REINFORCED CONCRETE BEAMS REINFORCED WITH FRCM (FABRIC-REINFORCED-CEMENTITIOUS-MATRIX)

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KEYWORDS: reinforced concrete, shear, strengthening, composites, FRCM.

ABSTRACT

In the past few decades the interest in retrofit/rehabilitation of existing structures has been dramatically increased due to the need to repair infrastructure and buildings and/or the introduction of more stringent design requirements. Among all the externally bonded strengthening systems presently available, the attention of the following paper has been focused on a new set of material system under the name of Fabric-Reinforced Cementitious Matrix (FRCM) composite material. The system is made by a sequence of one or more layers of cement-based matrix reinforced with dry fibers in the form of open single or multiple meshes, disposed along two orthogonal directions and bonded to the concrete surface. As compared with traditional Fiber Reinforced Polymer (FRP) FRCM composites offer a higher fire resistance capacity, a higher compatibility with the substrate and an equivalent long-term durability. Moreover, its application has a high reversibility, which is important for applications in historical buildings. The main purpose of this paper is to evaluate the behavior of reinforced concrete (RC) beams strengthened in shear with a U-wrap FRCM system. A set of 9 RC beams, 1800 mm long, was tested to evaluate the strength enhancement in the extreme conditions of use. Hence, two fibers amounts, one ply and four plies, were analyzed together with a set of three unreinforced beams (control beams). The results obtained show a considerable strength enhancement proportional to the number of plies installed. An extensive description of the different failure modes based on the number of plies applied, is provided in this paper. Design considerations are also addressed on the basis of the predicting models adopted by the ACI guidelines.

CODE: 3.3.29

DIFFERENT FRP REINFORCEMENT SCHEMES EFFECTIVENESS EVALUATION OF GLULAM BEAMS

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KEYWORDS: Reinforcement, glulam, composites, damping, ductility.

ABSTRACT

This paper analyses the effectiveness of different reinforcement schemes with composite materials in glulam beams (Picea abies). Each specimen was 3040 mm long, with a cross section 80 mm wide and with a depth of 160mm. The experimental program is focused on the behavior of unidirectional wooden slabs, and the main objective is to fulfil the ultimate limit state under stresses for bending. Different typologies of reinforcement were evaluated into FE model: reinforcement on the lower side of the beams, reinforcement on the half of the beams, reinforcement on beams completely wrapped, etc… To select the best typology of laminate, experimental optimization of the laminates was made by combining different variables (glass or carbon fibers and fiber/resin dosage). To calibrate the numerical models, mechanical parameters such elastic moduli and Poisson's coefficients were experimentally determined both using static and dynamic techniques. Finally, the selected criteria for choosing the best reinforcement schemes was based on changes of the natural frequencies, stiffness, ductility and ultimate shear and bending stress.

CODE: 3.3.31

REINFORCEMENT OF A RAILWAY BRIDGE USING THE COMPOSITE CEMENTITIOUS SYSTEM PBO-FRCM

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KEYWORD: reinforce concrete, structural reinforcement, durability, FRCM, PBO.

ABSTRACT

The following article describes the criteria adopted for the design of structural reinforcement of a reinforced concrete railway bridge 1950s heavily degraded.

The bridge deck is made up of main beams, stiffening stringers and upper slab. The bridge has no intermediate supports and rests on two massive unwired concrete shoulders.

The design of the reinforcement system was preceded by a broad investigation campaign in order to know the geometric structure and to evaluate the mechanical properties of materials.

Shear and bending strength of the reinforced concrete elements was increased placing an innovative reinforcing FRCM (Fabric Reinforced Cementitious Matrix) system consisting of a mesh of PBO fibers (Poliparafanilenbenzobisoxazol) embedded in a fiber reinforced cementitious matrix. The choice of a FRCM system was suggested, among others, to ensure the durability over time of the strengthening system and to minimize the interferences with railway service. In addition to technical aspects, it must be observed that thanks to the use of the technology proposed the overall cost of the intervention has been reduced by half compared of the initial assumption which envisaged the demolition and subsequent reconstruction of the bridge.

The safety of the structure was evaluated taking into account the previous experiments carried out on FRCM reinforcement systems, which are also compared with traditional FRP systems based on polymer matrices. The results showed the efficacy and advantages of FRCM as reinforcement systems of reinforced concrete structures.

CODE: 3.3.34

CHARACTERIZATION OF THE ADHESION OF COMPOSITE MATERIALS FOR THE STRENGTHENING OF MASONRY STRUCTURES

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KEYWORDS: masonry, bond, composite materials, shear test.

ABSTRACT

Fibre-reinforced composite materials have become, in the last years, one of the most popular solutions to strengthen and repair also masonry structures, especially in seismic areas where the behaviour against typically brittle failure mechanisms should be improved.

In particular, the application of Externally Bonded (EB) composite materials, made of fabrics embedded in epoxy resin, can increase the performance of masonry, providing tensile resistance and avoiding or retarding certain collapse mechanisms. The effectiveness of those solutions, however, are closely related also to the transfer of bond stresses at the interface between reinforcement and substrate.

Based on an extensive experimental campaign carried out at the University of Padova, Italy, this paper discusses the main aspects that influence the adhesion of EB Fibre-Reinforced Polymers (FRP) to brick masonry substrates. The work deals with the evaluation of the bond strength of EB FRP applied to single solid clay bricks, and then investigates the adhesion in presence of mortar joints perpendicular to the reinforcement axis.

Various test methods and setups were adopted and compared, in order to identify adequate procedures to characterize the adhesion by means of shear bond tests, and to obtain results aimed at improving the calibration of design parameters.

Overall forty single-brick specimens and thirty masonry prisms (i.e. samples with mortar joints) specimens were tested, and four types of unidirectional reinforcements, namely carbon (CFRP), glass (GFRP), basalt (BFRP) and steel (SRP), were applied to them. Single-lap and Double-lap setups were adopted for brick specimens, while all prism specimens had a Single-lap layout. In order to deepen the investigation of the role of mortar joints, the bonded length for GFRP prism samples varied from 65 mm (corresponding to one brick and one mortar joint) to 195 mm (three bricks and three mortar joints), while the bonded length of brick specimens was kept constant and equal to 160 mm.

CODE: 3.3.38

DETERMINATION OF PARTIAL SAFETY FACTORS IN STRENGTHENING OF BRIDGES PIERS WITH COMPOSITE MATERIALS CFRP

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KEYWORDS: composite Materials, CFRP, strengthening, partial safety factors.

ABSTRACT

The continuous deterioration and/or damages caused in concrete structures during their lifetime have led to the development of new composite materials used for the structural reinforcement. In bridges with durability problems, damaged by external causes or with a likely change in its use or with an increase of the design load, the traditional strengthening methods frequently have disadvantages like the increase of the weight of the structure, the corrosion of the steel and its high cost of manipulation and positioning. More specifically referring to the reinforcement of bridge piers, in recent years the use of fibre reinforced polymers (FRP) has increased as an element of confinement of concrete elements subject to compression due to its excellent mechanical and chemical properties, increasing the resistance and ductility of the piers. However, due to the lack of codes and standards and the lack of experience in the long term behaviour, uncertainties exist in the calculation bases along the dimensioning of this reinforcement and more precisely in the partial coefficients of safety to be adopted. The paper describes the reliability-based calibration of partial safety factors to be used for the confined concrete in the design of strengthening to axial-bending forces using CFRP. The reliability-based procedure is developed based on a theoretical model whose statistical parameters were obtained from a data base of 126 laboratory tests.

CODE: 3.3.39

USE OF CARBON FIBER REINFORCEMENTS IN THE REHABILITATION OF LOW QUALITY JOISTS OF PINUS PINASTER AIT

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KEYWORDS: timber structures; reinforced wood, pine, carbon fiber, resistant Classes.

ABSTRACT

This paper presents the reinforcing of beams of Pinus pinaster Ait. rejected for structural use according to the Spanish standard UNE: 56544: 2010. We worked with 160 beams (1200 x 60 x 40 mm) divided into 3 groups: 55 pieces of solid wood, 55 pieces of duo type beams (epoxy adhesive), and 55 pieces of type duo beams reinforced longitudinally with a carbon fiber plate (SikaWrap -230 C / 45) located at its center and parallel to the parts' faces. The three groups were tested according to EN-408: 2011 to determine following properties: density, modulus of elasticity (MOE) and bending strength (MOR).

The results show an important increase in the strength properties of the fiber reinforced beams, with increases above 25% in the MOE and almost 90% in the value of MOR in comparison to the original solid wood.

CODE: 3.3.41

FRG STRENGTHENING SYSTEMS FOR MASONRY BUILDING

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KEYWORDS: FRG, Masonry , strengthening.

ABSTRACT

A large part of tuff buildings in the Mediterranean area are of historical and artistic relevance. These buildings are placed in seismic areas and, due to their age, have been subjected to environmental deterioration. For this reason, in the last decades, interest in the strengthening of historical tuff masonry structures has significantly grown especially towards techniques that allow properties such as reversibility, compatibility, and sustainability of the intervention to be combined.

The present paper resumes the latest tests carried out by the University of Naples on several masonry panels tested under diagonal compression.

Experimental campaign investigated preliminarily on the basic material properties from the bricks to the reinforcing mortar.

The experimental results have confirmed the effectiveness of the investigated strengthening technique to increase the panels shear strength and showing the effectiveness on different kinds of masonry.

CODE: 3.5.01

CURRENT STATE, PATHOLOGICAL PROCESS AND REHABILITATION OF OLD SILOS OF THE INTRA (GIJÓN - SPAIN)

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KEYWORDS: silos, concrete, NDT´S, pathology, rehabilitation.

ABSTRACT

Old silos of INTRA (Institute of Labor Social Sciences) were built in the early 50´. They were located next to the Labor University of Gijon complex. However, for various reasons that are irrelevant, never became operational. Because of this and the consequent lack of maintenance, until 2010 the silos were in a complete state of abandonment.

Fortunately, given its proximity to the Science and Technology Park of Gijón, a leading medical technology company decided to contract their rehabilitation, in order to set there the headquarters of the group.

According to this, it was essential to determine the pathological processes that affected the building, as well as estimate the state of the concrete structure. And based on the results of the inspection, define the necessary actions that should ensure the safety of their different construction elements.
The text reflects the most significant injuries, and the results of non-destructive tests conducted on reinforced concrete structural elements corresponding to the buildings that make up the old silos of INTRA. Besides the paper shows and justifies the scope of the intervention carried out on the building.

CODE: 3.5.03

THE INDUSTRIAL CITY – REHABILITATION AND RENOVATION OF IDENTITY CASE STUDY: TINTURARIA PETRUCCI – COVILHÃ

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KEYWORDS: industrial heritage, city, conservation, reconversion, design project.

ABSTRACT

From an early age the city of Covilhã, located in the inner center of Portugal, revealed a strong industrial sense regarding the occupation, growth and development of its territory. This article is presented as a base for a survey which intends to analyze the industrial course and influence with strong territorial, architectural, and social marks, clearly demonstrated in the current city state.

The first stage is addressed to study the relations between the city and industry, as well as the fluctuations of the place regarding the built environment and its inherent needs at the time. This analysis is complemented with further investigation on the organization, growth and urban layout of the city, emphasizing the involvement / importance of the epithet city-factory which the city of Covilhã has been associated.

The second stage of the survey is focused on the safeguarding of the built heritage, as well as to define new strategies and new materials which can restructure and recover old and obsolete industrial buildings into new functions. In this phase, it is presented a case study of a design project of rehabilitation and reconversion of an old dyeing of textiles, the Tinturaria Petrucci, built in 1930's. The concept of the design project is focused on the importance of the object in the urban structure and on its capability to adapt according to integration, cooperation, and functional unity models.

CODE: 3.5.07

REHABILITATION OF DISUSED PRODUCTION AREAS . EXAMPLES OF TOBACCO FACTORIES RECOVERY IN BASILICATA AND CAMPANIA

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KEYWORDS: industrial heritage, Rehabilitation, Recovery, Sustainable intevention.

ABSTRACT

The valorization and recovery of "industrial sites", that are today an abandoned and forgotten architectural heritage embedded in the urban or suburban areas of the city, requires an integrated design approach. The rising development of technology and science has made us understand that the culture also is the industrial one and that the working places, which have marked our production past, are containers of science, technology, intellectual expertise and work, where the humanity works with immense effort and transforms the life and the society of man. Therefore these artifacts, as an inheritance of the past and signs of a collective memory to perpetuate, can legitimately become part of the monuments to be preserved. Their importance is determined by the close relationship between the factory and the labor force who worked there, the landscape in which these elements formed part, the media and the work pace. In the South of Italy the artifacts related to the industrial archeology have a significant importance as material evidences of the difficult and painful socio-economic locally development. These factories, although they have lost the functions for which they were designed, preserve the original architectural features and some of the machines.

The topic of this research is the recovery and the valorization of some factories by means specific actions of interventions in order to revitalize and re-use these architectural complexes that have lost their original role.

The preservation and the valorization of a historical evidence and of its surrounding environment are the goals of the project of reuse of the tobacco factories Centola Pontecagnano (SA) and ESAB Palazzo San Gervasio (PZ), performed by structural, technological and energy investigations.

The research objective is not merely that of maintaining an architectural heritage, but that of ensuring its fruition in a long time, through the knowledge of the characteristic features of the activities of the territory in which it is inserted in order to preserve the culture produced by the activity of the factories and give back to the community parts of the city.

CODE: 3.5.13

REHABILITATION OF THE OLD ALCOHOL FACTORY OF RIBEIRA GRANDE FOR USE OF THE CONTEMPORARY ARTS CENTRE OF AZORES

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KEYWORDS: industrial heritage, insularity, structural analysis, seismic retrofitting, low-intrusive techniques.

ABSTRACT

This communication describes the Rehabilitation Project of the old alcohol factory of Ribeira Grande, where the new Contemporary Arts Centre of Azores will be located, in an investment promoted by the Regional Government. The Architectural Project was developed by the Consortium "João Mendes Ribeiro – Menos é Mais, Arquitectos" and SOPEC integrated the Design Team in the areas of Structural Design, Plumbing and Acoustics.

The old alcohol factory group of buildings represent an iconological construction from the late 19th century Industrial Architectural Heritage. The buildings were previously abandoned and in an advanced state of degradation. The total construction area to rehabilitate is about 5.000m2, including a basalt stone masonry chimney of 31 meters tall.

The buildings location was very important for the design options, either because of the island's location in a strong seismicity zone, associated to active tectonic faults in the surrounding of the archipelago; but also due to its strong exposure to the North Atlantic front, requiring a careful selection of materials and construction systems. The use of traditional techniques and endogenous regional materials was strongly valued, especially in structural solutions, coatings and in the concrete's composition, thus ensuring the compatibility and close dialogue between the new and the existent.

The work methodology valued the previous acquisition of information about the building, from simple visual inspection works to non-destructive techniques of dynamic identification of the structures, thus ensuring key information for the structural analysis and the evaluation of safety factors. For that purpose, three-dimensional finite element models were developed to understand the global behaviour of the structure, complemented by isolated security checks.

The structural design options seek to improve the building's global behaviour to the seismic actions and to the new acting loads, using low-intrusive reinforcement solutions and respecting the architectural value of the buildings.

CODE: 3.5.14

EFNOB / BAURU KM 0 - RESTORATION OF THE OLD STATION SOROCABANA

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KEYWORDS: industrial heritage, railway, railway station, restoration, preservation.

ABSTRACT

This restoration work was motivated by scientific research sponsored by **FAPESP** , called Railroad Northwest Brazil / Bauru Km 0, (EFNOB/BAURU KM 0) that generated a significant accumulation of data and technical information about the existing rail complex in Bauru, city located in the central-western state of São Paulo, Brazil. The Company Pateo Bauru, to enable a real estate development around the railway terrace was offset, required by the City, the implementation of a restoration project and re- use of the small station of Sorocaba, located next to the proposed works in the center of city. This project was commissioned in 2012, the architect , author of this article and principal investigator for the project EFNOB / BAURU KM 0.

Down the steps of work and complete methodology, which summarize freely in this article:
A - Framework History:
In this part are studied the city's history and its relationship with the railroad, particularly with Sorocabana, making clear the relevance of the Company in attracting other railway undertakings, in particular the EFNOB, whose tracks are born in Bauru. The analysis covers the history of the building, inaugurated in 1905, coming to the present day.
B - Framework Projetual:
At this stage through surveys "in loco" old images and testimonies, we analyze the architecture of Sorocabana building in all its details: facades, roofing, indoor, construction methods and conservation status. Through the diagnosis pointed out the fundamental points to note in the restoration project.
C - Projetual Proposal Restoration:
At this stage, from the studies made on the existing building, architecture analysis and interventions, and the new needs of program is made to restore proposal along with their justifications, the complete design and prospects.
The work should be carried out soon with the launch of the project proposed by the Company.

CODE: 3.6.02

RETROFITTING OF THE WOODEN STRUCTURE OF THE TOWN HALL OF BERASTEGI (GIPUZKOA) BY TIMBER-CONCRETE COMPOSITE SLABS

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KEYWORDS: rehabilitation, reinforcement, wood, fire, xylophagous.

ABSTRACT

The paper describes the process of characterization, structural assessment, design of the retrofitting solution and follow-up of the rehabilitation works of the oak wood structure (2.500 m2) of the Town Hall of Berastegi in Gipuzkoa. Built 300 years ago, this building is declared "Monument" in 2009 by the Basque Government.

The project of the building rehabilitation established, as essential requirements, among others, the adaptation of the structure to use "Public turnout"(use loads of 500kg/m2) and the fire resistance of the structure R90 (90 minutes).

As result of the diagnostic and structural assessment, it was noted that the structure did not comply with the project requirements, both fire resistance and load bearing capacity.

The reinforcing slabs made of timber - concrete allowed to maintain the structural function of the original wooden structure, increasing its load bearing capacity up to levels required by the Project, while it allowed to leave the wooden structure at sight, regardless of fire protection systems, providing an aesthetic improvement and economic savings to the original project.

In addition, as a result of the project loads increase, the reinforcement of the joints girder – pillar was necessary. These reinforcements consisted of various metal fittings which were projected hidden, being the wooden structure responsible for protecting them from fire.

Apart from the mentioned reinforcements, it was necessary to intervene in two of the three main pillars on the ground floor, due to the degradation produced by Xestobium rufovillosum. Since after the surface detection of degradation by Xestobium rufovillosum there were made several resistographic test arising in the results the inside pillars degradation. After cleaning and hole cutting two separate metal reinforcements were placed inside of the wooden pillars. Once again, the wooden structure protects metal from the action of the fire.

CODE: 3.6.04

RESTORATION OF MASONRY HERITAGE BUILDINGS IN HIGH RISK SEISMIC AREAS: APPLICATION TO THE MUSEUM OF CONTEMPORARY ART OF VALDIVIA, CHILE

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KEYWORD: restoration, heritage building, masonry, earthquake.

ABATRACT

The Museum of Contemporary Art (MAC) of the Universidad Austral de Chile, is a heritage building protected by the National Monuments Council of Chile. It is located in the city of Valdivia, Chile, an area characterized by high seismicity of subduction origin.
MAC infrastructure corresponds to the ruins of an industrial brewing facility dating from 1885. It's an underground structure, built in ceramic brick masonry, steel and concrete.
The property presents mainly associated damage over time, where the action of moisture and water have played a vital role in approaching the end of its useful life. If we also consider the seismic events occurred and regulatory changes, it is understandable that the system requires relevant interventions in its structural system.
This paper presents the process that generated the proposed MAC structural intervention that aims to repair and improve the current condition of the museum. To this end, there have been a number of actions, which can be grouped into 5 stages: visual inspection, structural survey (supplemented with GPR), field trials and laboratory invasive test and noninvasive test, vulnerability study and calibrated numerical modeling.
The results of laboratory and field campaigns show that the materials have suitable properties for structural use, acceptable levels of corrosion and the soil gives the system a high lateral stiffness. Similarly, the potential of using noninvasive Ground Penetrating Radar in structural monitoring techniques was demonstrated and there is an excellent calibration between the developed model and the experimental results microvibrations environmental campaigns.
The restoration includes repair of cracks; thicken walls with excessive shear; reinforcement of walls in high flexion-compression demand; anchor walls in tensile and improved metallic joints.

CODE: 3.6.07

CASE STUDY OF REHABILITATION STRUCTURAL BUILDING HOUSES WITH OBTAINING THE DENENNIAL INSURANCE

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KEYWORDS: rehabilitation, construction techniques, treatment of wood.

ABSTRACT

In the rehabilitation of residential buildings tend to reuse the existing building system. The most common operations such actions are consolidation, repair and reinforcement of the original structure by underpinning foundations, walls repair and reinforcement, recovery and replacement of existing slabs.

All these actions aim to improve safety conditions, habitability and comfort of the building, adapting to the requirements of the regulations. Most of the buildings are mostly pathological conditions caused by a missing or poor maintenance.

The first thing to do in a rehabilitation is to know in depth the state of the building, which involves verifying the four main parts that make up a building: structure, walls, partitions and floors, and facilities.

This paper describes the rehabilitation carried out in a building declared bankrupt, not including the ground floor, occupied by two shops in operation.

All the supporting structure of the building was carried by timber-framed load-bearing walls of brick. Modifying the distribution of plants and facilities are designed, without altering the morphological characteristics of the container, or affect structural elements. The new distribution hosted seven houses in each of the five plants.

In this paper the scheme of action is described in the process of rehabilitation and consolidation of the building, the construction techniques used and the treatment given to the wood. Likewise, tests were also collected to verify the effectiveness of treatments.

All the solutions met the requirements of the regulations, performing a new structural calculations to validate or strengthen existing sections and obtaining the required "Ten Sure, by the supervisory intervention of a Technical Control Agency (OCT)

CODE: 3.6.11

STRUCTURAL REINFORCEMENT IS UNDER CONSTRUCTION ON A SUB-PRESSURE VARIATIONS OF WATER TABLE

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KEYWORDS: pathology, reinforcement, structures, foundation, under-pressure.

ABSTRACT

In 2012 an intervention structural reinforcement of a building, located in Gondomar (Pontevedra-Spain), consisting of two separate volumes, separated by a public space to street level, and two basements continuous below ground for parking is made.

The pathology of this building was a multiple cracking derived from vertical periodic motion, caused by a strong variation of the water table pressure, being the original foundation improperly anchored by a slab piles without adequately considering the characteristics of complex foundation soil, adjacent to a river channel variable.

The target of the intervention was definitely stabilize the building, by improving its foundation and subsequent repair of structural and constructive elements affected.

The basic methodology passed through a movement control up / down the building during a period of one year, in both rainy and dry period; also the water table, soil permeability, slope of the pillars of the basement and the evolution of the main crack was controlled. The result endorsed a maximum vertical variation of the building of 23 cm caused by oscillations of up to 6.90 m of water table.

The end result is to design a system based structural reinforcement net pre-stressing steel anchors, of variable depth, in the underlying rock soil, together with the increasing section of existing foundation slab.

CODE: 3.6.18

PARQUE DE LA ISLA. PAVEMENT, ANOTHER ELEMENT TO RENOVATE

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KEYWORDS: rehabilitation, stabilized pavements, landscaping, i.pro Stabex.

ABSTRACT

The purpose of this work is the evaluation, two years after. The premises that were fixed in the project of Parque de la Isla´s rehabilitation for pavements, through constructive solutions and materials used.

With an approximate area of 68,000 m2, of which 16,000 m2 correspond to soil pavements, that solutions had produced mud and puddles in winter and dust in summer. Therefore it was proposed as consistent landscaping solution to the rehabilitation of the monuments present the implementation of a soil stabilized to impose a "soft pavement" as part of the park and durability conditions, emphasizing its operation and results obtained through of selected check points that have allowed us to evaluate it.

We look for natural solutions and materials with permeable capacity but with certain cohesion degree that would withstand pedestrian and vehicular traffic that would be subjected. The choice selected was a material composed of a mixture of aggregates with size 0 to 6 mm. stabilized with "i. Stabex pro ", keeping the main performances of the material, allowing its composition and firm without without affecting conditions of natural ground.

After more than two years in use, we carried out the study of this soft pavement to verify that the characteristics for which it was designed are kept, testing that this is a measure applied and recommended to gardens and walks with historical elements as combines aesthetics with practical operation, allowing a suitable environment on the horizontal level.

CODE: 3.6.20

PROBLEMS OF THE BUILDINGS REHABILITATION FOR HOTEL ESTABLISHMENTS IN SANTIAGO DE COMPOSTELA. SOME EXAMPLES

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KEYWORDS: rehabilitation, wood; pathology, reconstruction, structural rehabilitation.

ABSTRACT

In recent years, due to strong demand generated by the "Camino de Santiago", has emerged the need for capacity of hotel rooms in the city of Santiago de Compostela.

By other side and apart from the big chains have emerged small hotels, many of which have been established in the historic center of the city, producing a recycling of uses, from the hitherto usual, the apartment for rent for students.

This is normally historic buildings, with varying degrees of protection. In our practice we have had to deal with some of these small hotels and its varied and always unique problems.

Thus we find the need, for example, than to act structurally in buildings where it is not possible access to higher or lower floors, being of another property; having to settle and adapt acoustic or sanitary these structural typologies constructive measures, taking into account the hospitality sector regulations, among many others.

We can not forget the uniqueness of implementation, usually in the historical district and pedestrian streets that make it difficult and often condition the solutions to materialize.

In this paper some of these cases, with their problems and shown concrete resolution, both from a structural point of view, as constructive. It analyzes, relationships with heritage and archeology, administration, implementation and operational on site, structural pathology, etc. This exemplified in actual cases.

CODE: 3.6.23

REHABILITATION AND EXPANSION OF THE "LA ADUANA" PALACE FOR THE MUSEUM OF MÁLAGA. MÁLAGA, SPAIN. (2006 – 2013)

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KEYWORDS: historial building, volumetric recovery, reactivation of building and urban spaces, museum, architecture projects.

ABSTRACT

After various restorations, demolitions and recontructions, the La Aduana Palace in Málaga has undergone and completed a new intervention, this time a thorough and complete project throughout the building.
In this occasion, in order to define the project it was decided that it would be the building which express ed itself: that it should tell us how it was and how it is today, its singular and most special values, both constructive and compositional, about where it is and what it means for the city. In this way -and after a profound moment of observation- this latest intervention in the La Aduana Palace was established. The intent was to "awaken" a work of architecture from a deep slumber, whose historical, architectural and geographical values assure us that this is the proper subject for such an objective.
We began our strategy by making our way in, emptying out and eliminating the added structures, recovering original forms and spaces to which all the necessary elements were later included. The palace's original image of sloped roofs was recovered (volumetric recovery), as were its spatial possibilties in addition to linking and integrating the building into the pattern and fabric of the city, offering in this way a new hall with the opening of the interior patio.
It could thus be said that the proposal was "predetermined" by the very palace and its history.
On the exterior, the profile was recovered; on the interior, the architecture presents and describes itself, then opens itself to allow inside the elements of the surrounding city: the Palace of La Alcazaba, the Roman Theatre, the Málaga City Park and the Cathedral all extend a visual bridge connecting them to the Museum.
The sea, is seen reflected in the grand window of the Assembly Hall.
Or perhaps, with Picasso eyes it gazes at the city, crosses the bridges and encases the Palace's neighbors in imaginary glass cabinets. The open spaces act as lenses focusing on and placing these places on exhibition, in some cases offering up their most singular elements -such as the grand staircase or the patio- as a part of the city.
In the resulting image one sees a box of collections being opened up to the city to join the rest of the collection on the outside.
Aerial points of view are also offered from the Gibralfaro Castle and La Alcazaba (Figure 1). From there one can see the so-called fifth façade: the new intervention is expressed in the new roof recovering its profile: this inclusion of volume determines the complete and global image of the building, simultaneously sculpting the interior spaces which house the palace's collections.

CODE: 3.6.26

REHABILITATION OF AGRICULTURAL MARKET MONTEVIDEO AND ITS INFLUENCE ON THE RECOVERY OF GOES DISTRICT

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KEYWORDS: market, steel structure, restoration, plastering.

ABSTRACT

The Agricultural Market was inaugurated in 1913 in the populous district of Goes, in Montevideo, occupying an entire block. Its model of wholesale trade slowly declined as well as the district itself, leading the market to the brink of extinction. It went through severe alterations in composition and degradation processes in facades, structure and covers. The market rehabilitation is now focused on urban and social regeneration of the district, through the change of business model to a retail trade and the implementation of socio-cultural activities. The works and previous studies conducted in several phases have made visible in the district and in the rest of Montevideo the heritage that Goes means, being an intervention that transcends the purely technical issue. The rehabilitation of the market along with the interior fittings can not be understood without the economic and social impact in the district. Without these complicities, it would have not been possible to activate the will and the resources of the various Uruguayan public administrations and the international cooperation agencies for the rehabilitation of the market.

CODE: 3.6.27

RESTORATION CRITERIA AND RECOVERY OF URBAN IMAGE OF THE IMMACULATE CONCEPTION CONVENT IN MADRID

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* We thank MINECO financing HAR2011-28023 Research Project, which this communication is part.

KEYWORDS: Madrid, restoration, convent church, urban landscape, traditional plaster.

ABSTRACT

For the restoration project of the Convent of the Immaculate Conception Chuch in Madrid, a thorough analysis of its history and its urban environment easy was performed. The building, BIC since 2012, has the maximum protection at present, but not at the time of the study. Still, in its restoration prevailed criteria based on the recovery of traditional techniques facade and interior finishes consistent with the building's history and the desire for the enhancement of their perception from the street, being a convent which had lost much of its original size and had not been respected his image in previous interventions.

The objectives of restoration were inside, due to unfortunate previous works, filling gaps in finishes and dome; and outdoor try to recover the original state of the facade and its value, looking for property urban image of the baroque convents insert in the streets and squares of the historic town.

The following works were performed: removing enamel painting of carved granite base; repair of damp and cracks in dome and craft and decorative lighting; crushed the stone cladding to revoke in “Catalan” style, padding with plinth and brightener yellow-ocher finish by "martillina" and recovery of the granite base.

The use of special materials is effective for conservation and environmentally recommended; and also, ultimately, it is the recovery of the original materials. The advantages are many: support building methods and ancient materials, chemical, structural and mechanically; deformities adaptation to the support; the breathability of the walls, etc. When using traditional techniques, we are also contributing to the recovery of the cultural memory of the image and perception of the building in the city.

CODE: 3.6.31

INTERVENTION AND USAGE OF CULTURAL HERITAGE BUILDING FOR TEMPORARY EVENTS

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KEYWORDS: Intervention in heritage development of heritage, Casa Cor Rio de Janeiro.

ABSTRACT

This article talks about the appropriation of preserved spaces for temporary events by analyzing and describing these interventions regarding the preservation of cultural heritage buildings. In this issue, we chose to study the showcase Casa Cor Rio de Janeiro, since it is an annual event on the city´s design agenda and that in recent years has been installed in heritage buildings.

In order to identify which values lead event organizers to choose these properties to hold their shows, as well as verify the motivations of it´s owners, once aware of the restrictions that preserved spaces require attending to the compatibility of these interventions with issue of preservation of cultural heritage.

Lastly, it was ascertained how and in which way the appropriation of heritage contributed to the promotion and preservation of the property the show took place.

CODE: 3.6.33

STRUCTURAL INTERVENTION TYPOLOGIES DEPENDING ON THE PATHOLOGY AND RISK OF COLLAPSE

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KEYWORDS: structural pathology, structural integrity, collapse, reinforcement, refurbishment.

ABSTRACT

Old structures that have practically exhausted their service life usually have structural pathologies in different areas. It is neccesary to carry out structural calculations and expert reports that allow us to understand what really is their resistant capacity and, therefore, its safety coefficient.

Depending on the pathology and the results obtained from calculations and expert reports, the objective is to design a typology of intervention that ensures structural safety at all times. If damage is minor the renovation and regeneration of the section will be enough, and if damage is severe the design of some reinforcement will be needed.

The methodology followed in the design of different interventions made on the analysed structure was the following: A research on the existing documents, detected pathologies inventory, structural calculations and expert reports of the sections, and the design of the intervention to be carried out.
A real case of a structure with its useful life expired is presented, where a series of interventions have been made designed solely to enhance structural safety and not its regeneration.

CODE: 3.6.35

CATHEDRAL OF SANTO DOMINGO DE LA CALZADA: FLOORING REHABILITATION WITH UNDERFLOOR HEATING INCORPORATION AND SANDSTONE

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KEYWORDS: historical heritage, rehabilitation, underfloor heating, sandstone.

ABSTRACT

The purpose of this paper is to present works relating to the paving inside the Cathedral of Salvador, located in Santo Domingo de la Calzada, La Rioja (Spain). The Cathedral's architectural influences are late Spanish Romanesque, pure Baroque, and Gothic Naves.

This historic building has undergone numerous interventions throughout the modern age, some as a result of natural catastrophes, including landslides, and some as a result of the change of requirements and fashions of each historical era.

The building consists of three main naves, each with detached chapels. At the head of the Cathedral there are openings to an array of radial chapels, and a small central absdiolo.

Prior to the paving works the Cathedral had a polished concrete floor, incompatible with the historic nature of the building. This dated from the 70s and had multiple imperfections [faults] due to moisture from the ground.

Concealed beneath this 70's concrete flooring were original sandstone pavement slabs of approximately 10 cm thick. The possibility of retaining the original paving was considered but dismissed in favor of the proposed new paving works which can improve the current thermal performance of the building through insulation of the flooring and installation of a system of Malla Heating. This allows also the removal of existing exposed wiring, the resolution of the existing damp problems, and reinstatement of historic integrity through the installation of Luna® sandstone slabs, which is noted for its clear and homogeneous gray finish.

CODE: 3.6.39

CRITERIA AND TECHNIQUES IN RESTORATION OF THE ALCAZABA DE OF BADAJOZ WALLS

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KEYWORDS: protection of the Patrimony, architectonic Restoration, intervention techniques, tapial (rammed earth).

ABSTRACT

The Alcazaba wall area of Badajoz was built the almohades in the XII century, although it has its origin in the fortification, rammed earth and bricks mortar, which Ibn Marwan built to settle on Badajoz in the IX century. There is a apart of the wall remains from 913 which was built with rammed earth wall, from 103 o with stones and lime and with bricks and rammed earth wall from 1169. At present restoration work is being carried out in different phases.

This work shows the results of the restoration work, specially about the tapia wall, proposing the objective to go deep into the constructive technique of the rammed earth wall which supposes to get knowledge about both the building process level and the rammed earth wall technical of intervention one.

The methodology used is rested supported on a global strategy of intervention which has a fundamental role from the previous studies, based on the adornment texts which include stratigraphic studies and typographical structural texts.

The singularity of the intervention comes from the methodology with which the scheme was done and the originality of the material to be restores, as a result a reflexion about the intervention techniques on the construction of the rammed earth wall and the possibility to carry out a protocol of action on rammed earth wall structures.

CODE: 3.6.42

THE PECULIAR FORT OF SAN FERNANDO DE BOCACHICA, COLOMBIA

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KEYWORDS: spanish fortifications, lancet vaults, masonry, structural instability, sustainable consolidation.

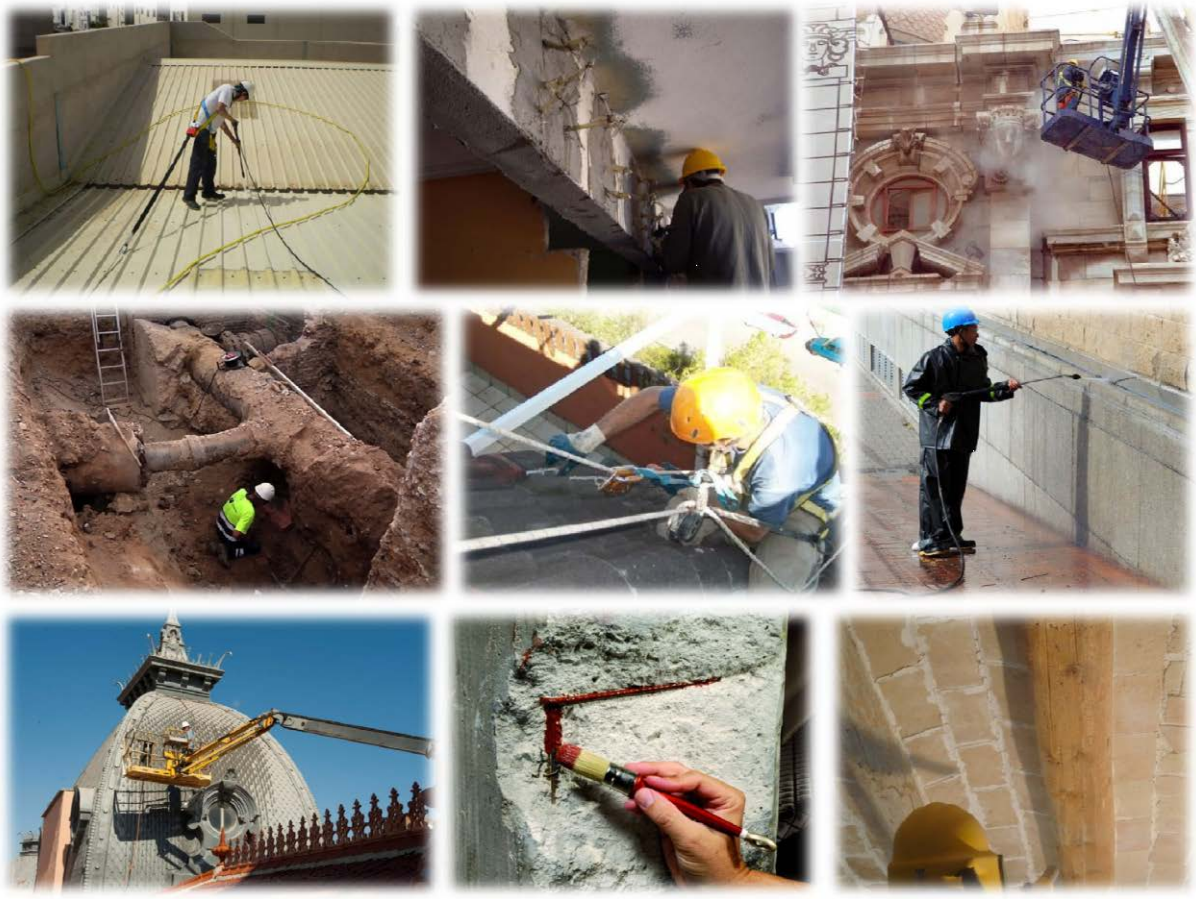
ABSTRACT

This paper presents Fort San Fernando de Bocachica, a Spanish construction of the colonial period, situated on the island of Tierrabomba and built to defend the city of Cartagena de Indias, Colombia.
The paper describes the singular shape of the fort and compares it with others in order to provide Â the starting point for possible future research on the genesis of this particular construction. We present the current state of the building, with its major structural and degradation problems. The structural analysis is based on a geometric model derived from an accurate survey campaign carried out by the authors and from the material given by architects A. Samudio and A. Diaz Herrera.

San Fernando was built by engineers who mastered the technique of vaulted masonry systems.Â Our hypothesis is that all the fallacies are derived from external factors rather than from manufacturing imperfections. The fort is in relatively good condition but presents serious problems in some localized areas overlooking the sea. For this reason we believe there is an urgent need of consolidation works and widespread interventions for the safety of the most damaged parts.

4.- MAINTENANCE

4.1.- CONSTRUCTION MAINTENANCE.
4.2.- PREVENTIVE CONSERVATION OF BUILT HERITAGE.



CODE: 4.1.01

THE ROOF OF THE PRADO NATIONAL MUSEUM. CURRENT STATE OF THE MAINTENANCE AND REPAIR PLAN

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KEYWORDS: rehabilitation, roof, prado national museum.

ABSTRACT

The roof of the Prado National Museum has suffered many alterations along its history. Nowadays it is solved with different solutions which are all covered with lead sheets.

The important intervention that has recently taken place on most of the roof has required the implementation of a maintenance and repair plan, which is the result of the collaboration between the Museum and the Eduardo Torroja Institute for Construction Sciences (IETcc-CSIC).

The main goal of this plan is to extend the useful span life of the roof by firstly guaranteeing the adequate state of the roofs via the renovation of those parts in which no intervention has previously been done and the constant monitoring of them all, and secondly preserving the current appearance of the roof, from the respect to the Villanueva building, main container of the art collection.

This article presents the current state of the implementation of the maintenance and repair plan of the Prado National Museum roof, including results of the monitoring.

CODE: 4.1.03

INSPECTION OF PAINTED WALLS SUPPORTED ON VIRTUAL REALITY TECHNOLOGY

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KEYWORDS: Pathology, Inspections, Maintenance, Virtual Reality.

ABSTRACT

In a building, the interior walls paint coating has an aesthetic purpose and plays a protective role. A roof is exposed to the degradation agents concerning the house use, so it requires regular assessment of its conservation status. The implemented application supports the periodic inspection activity based on Virtual Reality (VR) technology. While executing an inspection in the real building, the VR device allows to consult a database with the anomalies, usually associated with the painted coats, linked to their causes and the most advised repair methodologies. It also allows the registration of photographs taken in place of the observed pathologies. The use of Virtual Reality (VR) technology allows the user to interact with the 3D model of the building in inspection, and to link to each model component the characteristics related to the type of applied material and recommended refinishing periods. As well it allows liking observed anomalies to the VR model, its degree of deterioration and the corresponding repair process. Thus, the inspection records are held in a visual, direct and very intuitive way. Additionally, the model allows the association of colour to each monitored coating element, based on the relation of a chromatic scale with the degradation degree of the coats material. The VR device constitutes a positive contribution for the use of innovative technology tools, with interaction and visualization capability in the field of construction, supporting the establishment of maintenance and repair plans.

CODE: 4.1.05

MAINTENANCE OF ROOFS SUPPORTED IN VIRTUAL ENVIRONMENT

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KEYWORDS: maintenance, inspection, roofs, virtual reality.

ABSTRACT

The roof of a building plays an important role in the protection of its interior, against surrounding environmental actions. The text presents an application oriented to the maintenance of sloped roofs covered with ceramic tile, based on Virtual Reality (VR) technology. During an inspection, the computer tool allows the user to interact with the three-dimensional (3D) model of the building, in a way he/she can identify in model an element of the roof and associate to it information concerning the observed anomaly in the real place. The VR device supports building inspection activity consulting a database created with the information collected regarding anomalies, causes and repair processes, available by VR application. It allows, as well as, the registration of the selected anomalies in an inspection sheet. Additionally, the application has the ability to assign colors to elements analyzed according to the severity of the observed anomalies.

CODE: 4.1.06

MAINTENANCE ON THE SURFACE TREATMENT OF MATERIALS USED IN RESTORATION

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KEYWORDS: restoring, pathology, materials, maintenance, aging.

ABSTRACT

A lot of materials presented as a solution to the own pathology of the building are used in any restoration of surface coating in an architectural intervention during restoration. These materials, by their physical and chemical characteristics, have a protocol performance when applied. If the protocol is not followed, final alterations can result which changes to unforeseen problems. The support on which it is applied will determine the material choice, whether it is traditional or commercial pre-dosed product. Due to composition and conditions of the support, these products can develop in a different way eventually presenting a non expected or not covered complication during the intervention.

Over recent years, lots of materials and products with chemical compounds that solve adhesion problems, consolidation, waterproofing and other necessary requirements of the coatings have been used. The right development and behavior of these treatments determine the success in the election and its correct application for each particular use. This paper establishes the main problem in implementing these treatments and programming maintenance. The aim and final result is that such restoration can develope and aging for over the years within the expected behavior in their projective planning.

CODE: 4.1.07

CONTRIBUTIONS TO THE INTEGRATION OF MAINTENANCE IN THE ARCHITECTURAL PROCESS OF BUILDINGS REHABILITATION: DECISION SUPPORT MODEL

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KEYWORDS: Buildings Maintenance, Architectural Process, Interventions Strategies, Buildings Rehabilitation, Decision Support System (DSS).

ABSTRACT

The awareness of the importance of the permanence of our legacy assets in the cities as a mark of our identity and the need to maintain and protect these spaces of a growing aging, reveal the importance of the issue of the Buildings Maintenance.

The issue of rehabilitation is mainly absent during the architectural design phase, in large part supported by the wide variety of options with which the project´s author is facing, preventing him from optimizing its decisions without using multicriteria studies. This possibility will enhance the effectiveness of solutions designed for buildings rehabilitated.

The aim of this study is to develop a guiding methodology to the architectural design process, referencing the behavior of buildings in service. For this purpose it develops in the field of multicriteria analysis a "Decision Support System - DSS" that allows the project´s author be aware for the implications of maintenance of the different solutions. The method consists of a subdivision of buildings in elements source of maintenance - ESM, through technological characterization of existing solutions and referencing of each solution by the application of the developed model. It appeals to the characterization of the opinion of several leaders of project identified randomly and to the development of decision making chains weighted on the basis of the relative importance of the decision factors. The model validation and results are translated into graphs easily perceivable. The results obtained allows to clarify the importance of the role of maintenance in the preliminary architectural design stages of the project and also to allows the project´s author to get a tool to aid in decision making on matters that affect the building behavior design for a particular service life.

The decisions thus supported are crucial to ensure the permanence of the work of architecture in time and to the preservation of the building heritage value.

CODE: 4.2.01

APPLICATION OF THE MOBILE INSPECTION UNIT "SITEGI" FOR THE ANALYSIS AND CONSERVATION OF HYDRAULIC HERITAGE. A CASE OF STUDY IN THE ROMAN BRIDGE OF LUGO

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KEYWORDS: preventive conservation, built heritage, diagnosis and structural assessment techniques, heritage and territory, additional studies in conservation.

ABSTRACT

Infrastructures present conservation and maintenance needs that should be attended efficiently, especially in scenarios with limited economic resources as the present day, prioritizing the investments with mechanisms that facilitate the decision-making based on objective criteria. The current infrastructures inspections have significant limitations regarding technification and quality of information supplied, mainly based on visual approaches. The SITEGI project, developed by the University of Vigo together with some construction companies such as EXTRACO, S.A. and Misturas, S.A., provides a novel system for the management, analysis and inspection of linear infrastructures, also applicable to hydraulic heritage (bridges, aqueducts, etc.). The system introduces an automated data acquisition and presents in an all-in-one Mobile Inspection Unit, endowed with the latest technologies for the acquisition of quantitative and qualitative data of analyzed infrastructure and the inner building materials: 3D mobile laser scanning, GPR, profilometer and thermographic cameras. The information gathered is all together integrated in a management expert system that will help to prioritize the infrastructure maintenance and conservation activities required. Among all the cases studied, it is highlighted the Roman Bridge of Lugo, rehabilitated by Misturas, S.A. in 2012.

CODE: 4.2.02

WIRELESS SENSOR NETWORKS FOR A PREVENTIVE CONSERVATION OF ARCHITECTURAL HERITAGE

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KEYWORDS: preventive conservation, monitoring, decay assessment, climate, humidity, solar radiation.

ABSTRACT

This paper sets out a strategy for assessing the buildings conservation through the deployment of wireless sensor networks. A monitoring methodology is established to characterize the decay agents affecting detected pathologies for a preventive conservation of cultural heritage.

Wireless sensor networks are minimally invasive techniques to detect the presence of harmful compounds and decay agents such as damp in the walls, solar radiation, activity inside buildings and so on. This paper presents a wireless deployment that analyzes the variation of the different parameters, both outdoors and indoors. Memsic platform (Mica2) was used for detection of cyclic phenomena (temperature and relative humidity) as solar radiation inside the walls and the building and Libelium platform (Waspmote) was used for the study of microclimatic conditions indoors (CO, CO2, O3, temperature, relative humidity, pressure) and outdoors and the effect of weather conditions in the materials (rainfall, wind action…).

Thanks to the development of the presented wireless technologies, a study of them has been developed, in order to establish the suitability deployment and operation of each one for the demanding field of architectural heritage. Memsic platform had better reception of messages with CTP topology than with XMESH topology, in spite of being the communications ranges and reception better for Libelium platform which uses DigiMesh topology. These minimally invasive techniques require processing tools and physical accessibility which only wireless technologies are able to address, with the objective of selecting appropriate intervention guidelines.

CODE: 4.2.03

THE ACCESS ISSUE FOR MAINTENANCE OF HERITAGE

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KEYWORDS: Heritage, Maintenance, Preservation, Accessibility, Project.

ABSTRACT

The attention for the access of the technics to the heritage usually trends to cover only the restoration works in execution phase. In fact, this problem is tackled in a disperse way in a few articles, done by professional associations and assurance companies, without the real preservation project authors participation. The purpose of this essay is to promote the inclusion in the projects of effective measures encouraging the accessibility of maintenance personnel without distorting the integrity of the monuments. Not only while the works are going on, but in a definitive way. Samples of solutions already done, and in use, are shown in this draft, especially the designed for diary use for a long term ones. Those solutions have been designed for interventions in historic areas like transit openings, stairs and integrated handrails in fabric, redefining maintenance schedules and recovery of disassembled or unused items due to previous interventions. An improvement in the daily access to the areas susceptible to fail in a renovated building such as two-pitch roof deck, backfill material of vaults, cornices and cavity wall, will facilitate the surveillance, monitoring and plan of inspection points which have been defined in the building's handbook. Following this proposal would avoid the need to undertake major reparation works.

CODE: 4.2.07

KNOWLEDGE APPLIED FOR CONSERVATION. THE BUILDING FACADES OF THE HISTORICAL CENTER OF CATANIA (ITALY)

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KEYWORDS: restoration, historical center, building facades, construction techniques, stone materials, pathology.

ABSTRACT

The conservation of historical buildings presupposes technical and scientific actions to prevent or limit the onset of degradation, which in the most serious cases could lead to the damage of material of documental and figurative value. In other cases, it could imply the degradation of artistic expression. The paper presents both the morphological analysis and the analysis of construction materials of these components, which with their double role: functional and ornamental, finish off the facades of buildings creating the image of a historical city. However, the perception of the urban context might be also influenced by some pathological manifestations since the original architectural design is compromised by alterations caused by the interaction of building with the surrounding environment.

Hence, the study proposes an analytical method in order to carry out the phase of knowledge in a correct manner. It is necessary to apply critical judgment, not only of the intrinsic values, but also of the relation between building and its context. This method was applied to the case-study whose subject was the building overlooking two streets in Catania historical centre (via Etnea and via Umberto). The task to obtain was to identify the techniques of construction and correlations between them and the related degradation. For this purpose, thematic maps and survey schedules were created.

The research revealed problematic aspects and the strong points of the method applied. In fact, the relevant normative references (UNI 11182/2006) proved to be insufficient and too broadly defined to analyse specific case-studies. However, the success of the survey should be noticed. It allowed us to estimate the degradation rate.

In conclusion, the result of the research allowed to identify variant and invariant aspects both morphological and technological and the most frequent cases of pathologies and their mutual correlation.

CODE: 4.2.08

REGISTRY AND MANAGEMENT OF THE INFORMATION AND ITS DEVELOPMENT AS A TOOL FOR THE SUSTAINABLE CONSERVATION OF HERITAGE RESTORATION OF THE SANTA MARÍA CATHEDRAL IN VITORIA-GASTEIZ

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KEYWORDS: database, photogrammetry, geomatics, GIS, IDE, digitisation, cathedral.

ABSTRACT

The restoration of the Santa María Cathedral in Vitoria-Gasteiz (Araba/Álava, Basque Country, Spain) is a project that integrates culture, tourism, scientific divulgation, economy or the urban regeneration of the environment.

The aim of the documentation of the building was to carry out a diagnosis that was as exhaustive as possible of the cathedral and its surroundings. The tool chosen for the geometric record of the temple and its excavations was photogrammetry, producing a three-dimensional model that allows us to analyse the cathedral stone by stone. Using the drawings derived from this model as the foundation, several studies have been made that are put together with relational databases and offer the possibility of managing, in addition to the alphanumerical information, digital archives in video format, raster images, vector images and complete documents. The restoration process has entailed the generation of new documentation and provides vital information for its conservation. From a geometric point of view a variety of tests, analyses and probes have been georeferenced. Likewise, information related to the restoration project has been added to the data model, the worksite records, reports, etc. In addition, the time dimension has been added to the geometric information and the pathologies detected and the treatments carried out are included over time.

The Monument Information System (MIS) is in charge of the full management of the geometric and thematic data, and has evolved from an approach where the MIS was a reflection of the state of the building to a proactive approach in the task of sustained conservation and maintenance of the monument.

CODE: 4.2.09

CURRENT AND FUTURE STATE OF THE MAINTENANCE AND RENOVATION OF HORIZONTAL SERVICE INSTALLATIONS IN HOSPITAL BUILDINGS

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KEYWORDS: horizontal service installations, maintenance, restoration, replacement, hospitals.

ABSTRACT

The aim of this study was to optimize the maintenance, renovation and replacement of horizontal service installations along corridors in large hospital buildings, in terms of their efficiency, reliability and environmental impact.

To achieve this, we carried out an in-situ analysis of the current state of horizontal service installations in a sample of large hospital buildings, and drew up a summary for each of the cases analysed. The summaries described the main technical characteristics of these building elements from the perspective of maintenance, renovation and replacement.

We assessed the current state of 15 services in 4 hospitals. Each element in the sample was selected to represent a particular construction period, an area of influence on the region, and different management bodies.

In the hospital building, the difference between the useful life of the service installations and the useful life of the rest of the building as a passive support was clearly shown. This is due to the constant technological development of service installations, their heavy use, and the relevant regulations.

The conclusions of this study have served as the basis for establishing the current problems encountered in this kind of construction elements, which are highly characteristic of healthcare buildings. In addition, they contribute to the evaluation of strategies prior to developing future building systems that enable the renovation of these building elements and the subsequent expansion of services.

The study described here is part of a final project for the Master's Degree in Architectural Technology at the UPC, which can be consulted at: http://upcommons.upc.edu/pfc/handle/2099.1/16190

CODE: 4.2.10

PREVENTIVE MAINTENANCE CONSTRUCTION MATERIALS AND TECHNIQUES COFFEE CULTURAL LANDSCAPE OF COLOMBIA

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KEYWORDS: materials, construction, traditional, maintenance, preventive.

ABSTRACT

In the mountains of the Colombian Andes, in western center of the country, a large area framed by the Magdalena River, at the east, and Cauca by the west, remained uninhabited during the three centuries of Spanish colonial and corresponds to the south area of the Antioquian province. By the last eighteenth century a migration of Antioquian peasants fleeing poverty caused by the exploitation of gold mines began. In the mountainous south, amid large forests, settled to found new populations that exceeded the number one hundred, throughout the nineteenth century to the early twentieth century. To make their houses they used raw land and timber from the region in the techniques of rammed earth and adobe, which is then covered with clay tiles. In the nineteenth century came the coffee, which began to grow, benefit and commercialize with great success, producing a large boom, wealth and development. In 2011, UNESCO declared World Heritage Site the so-called "Coffee Cultural Landscape", consisting of 47 of these populations. This new urbanism and these constructions where done adapting the Spanish heritage to the difficult topography of the ridge.

Objectives: Identify the diseases that affect materials and traditional construction techniques to produce a handbook of preventive maintenance to the owners of these buildings.

Methodology: Through field work, go over the region with a group of experts to gain information from the mouth of builders and similar.

Scope: Sort out the damage and pathologies of traditional materials and construction techniques from the foundations to the ridge and give simple solutions for preventive maintenance.

Results: produce a user-friendly manual, through drawings and texts that can be easily used by the owners for preventive maintenance of their buildings.

CODE: 4.2.12

RAMMED EARTH: MEMORY- REMEMBRANCE AND REHABILITATION

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KEYWORDS: wealth building, restoration works, rammed earth.

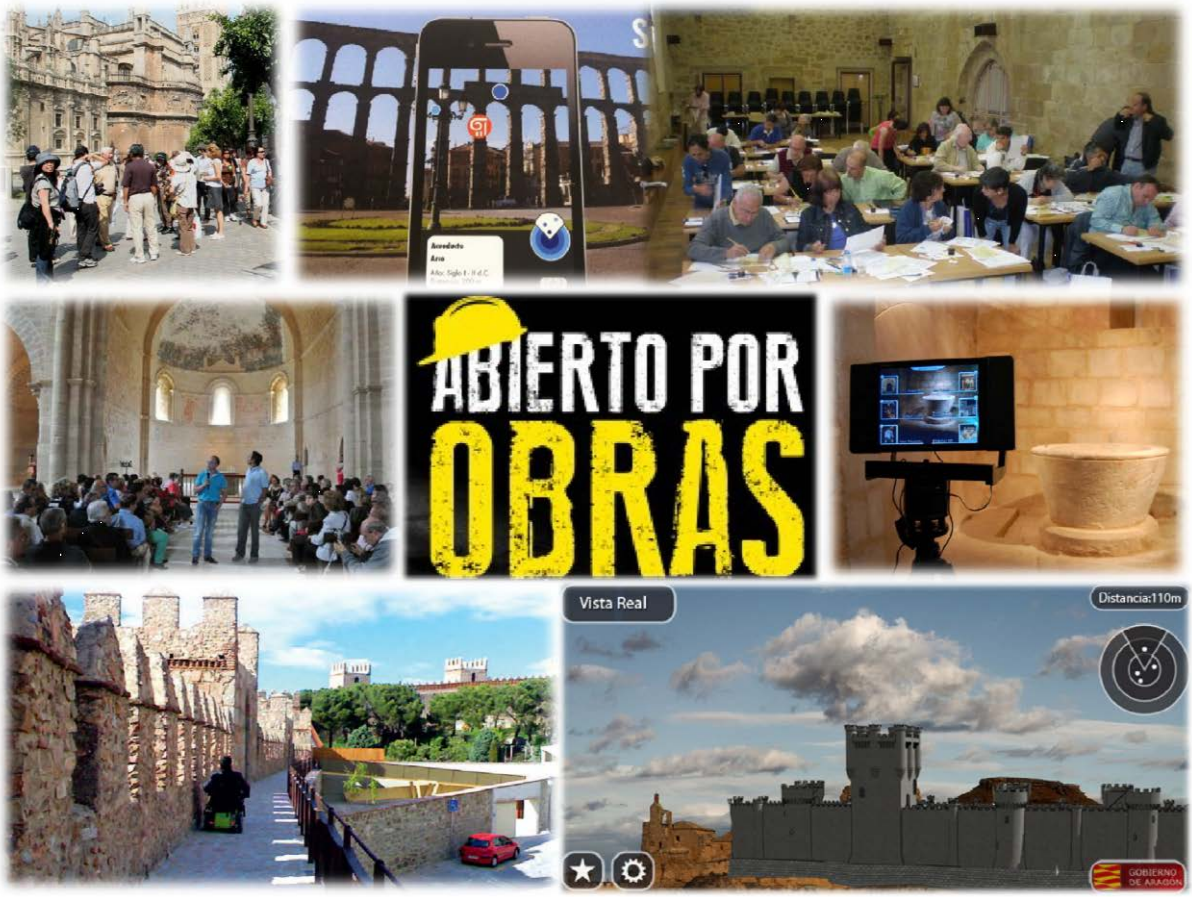
ABSTRACT

Over the years, the changing weather and factors such as climate, earthquakes and improper intervention in the buildings, the built heritage of cities and towns is affected; knowledge is erased, techniques disappear and thus history. This work collects an ancestral knowledge and graphically and textually recovers part of the constructive knowledge that has identified our towns from the Spanish colonization: the RAMMED EARTH.

This document establishes a reference on the process of the rammed earth, the history in some municipalities of Colombia, definitions, terminology, performance of rammed earth and building in general. In addition to recommendations for its implementation , it contains material to support the processes described and offers information about different procedures.

This text is the result of contributions provided in a training event aimed at rescuing knowledge, recover knowledge about the RAMMED EARTH and recognize techniques of practice with experts in the use, who at the time were named “living treasures in cultural memory of the Rammed Earth “. A primer was performed as a supporting document for the works developed in the system, in the intervention and specially in the works using this technique. This document makes special recognition to those who participated and that supported the proposal with their work, dedication and performance and that made real the idea. To the COLOMBIAN ASSOCIATION OF SEISMIC ENGINEERING, wich authorized the use of part of the MANUAL FOR HOUSING REHABILITATION BUILDING IN ADOBE AND RAMMED EARTH, as chapter of support and to the Regionals of SENA that welcomed the proposal and turned it into reality.

5.- DIFFUSION AND PROMOTION



CODE: 5.1.03

THE UNIVERSITY OF COIMBRA WORLD HERITAGE NOMINATION: CHALLENGES AND STRATEGIES OF MANAGEMENT AND SAFEGUARD

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KEYWORDS: cultural heritage, heritage management, rehabilitation of classified buildings, regulations, urban rehabilitation.

ABSTRACT

In the scope of the World Heritage nomination of the "University of Coimbra - Alta and Sofia", the University and the City accept all cultural responsibility to safeguard, promote and valorise a Property of exceptional architectural and heritage value, with physical expression in buildings and spaces that house - for more than seven centuries - a unique history of education, production and dissemination of knowledge throughout the world.

The intervention in the historic architectural heritage of the University of Coimbra has been based, over time, by actions that attempt to respect the concepts, methods, techniques and architectural rehabilitation practices in force in each time, making use of its best knowledge.

Besides the final outcome, how often susceptible to constructive and reasoned criticism, the process that leads to decisions must be taken into account, within an interdisciplinary perspective and great exigency to guarantee that the object to be intervened is known, the different possible approach strategies are included and that is possible to evaluate and balance the advantages and limitations of the solutions to adopt.

In this paper, we describe the process of World Heritage nomination regarding over 100 acres of historic buildings and over 2000 buildings in the buffer zone, which coincides with the old city center.
The architectural heritage, its characteristics and state of conservation are portrayed - including some examples of projects and interventions already implemented - and, in addition, it is described the Property management model and the legal and technical instruments specifically designed to ensure its safeguarding, promotion and valorisation.

CODE: 5.1.04

INDUSTRIAL HERITAGE AND ENGINEERING – A RAILWAY CASE STUDY

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KEYWORDS: heritage, technology, engineering, railway.

ABSTRACT

The nineteenth century industrial revolution introduced profound transformations in our world. Some of its major examples are the wide manufacturing facilities and the communication infrastructures. Their construction was possible due to the application of leading technologies and, in some situations, as result of the development and testing of others. Engineering, and in particular the civil engineering, took a leading role. Many of the achievements were deeply innovative for the time, and some still maintain that status.

One of the greatest expressions of these changes was the railway. In Portugal, it is possible to state that the railway construction was performed very quickly. The imposed pace forced the involvement of national and foreign companies and technicians. The railway construction led to remarkable infrastructure examples, ranging from station buildings, workshops and warehouses to bridges, viaducts, tunnels and deposits. Its configuration varies according to the different companies and it extends generally from the 50's of the nineteenth century to the first half of the twentieth century.

Many of these infrastructures, some of them still in service and without big changes, can be considered industrial heritage. It is urgent its identification, preservation and dissemination. In these actions, the participation of engineers is essential. Based on a case study, this paper aims to disclose and promote the singularities of the railway facilities. It has also the intention of outlook strategies to enhance their revelation and recognition.

CODE: 5.1.05

EXPRESSO TURÍSTICO LUZ – PARANAPIACABA: REFLECTIONS ON THE TOURISTIC USES OF THE CULTURAL ASSETS AND HISTORICAL REMAINS OF THE SÃO PAULO RAILWAY COMPANY (SÃO PAULO/BRASIL)

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KEYWORDS: industrial heritage, tourism, railways, São Paulo.

ABSTRACT

The construction of a railway line between Santos and Jundiai in 1867 was a major point in the development of the São Paulo state, Brazil. Integrated into the Metropolitan Transportation System, part of this trackhas been also operated by the Expresso Turístico (Touristic Express) from 2009 onwards, under the management of the Companhia Paulista de Trens Metropolitanos – CPTM (São Paulo Metropolitan Railways). Based on the official reports of this company, our article aims to reflect on the relation between the historical remains of the railway and the touristic offer in the Luz-Paranapiacaba line. Furthermore, we cross the bibliographical and archival information with the data from fieldwork and from our interview with the spokesperson of the CPTM. As a result, the Expresso Turístico is defined like a different product in relation with other touristic trains that are operated by somepreservation associationsin the state. In our case studythe heritage works like a background, since the objectives of the Expresso Turístico are different from the restoration of there mains and the service is fully integrated into the transport policies and tourism plans of the Government of São Paulo.

CODE: 5.1.06

THE WORK OF ARCHITECTURE. SPACE-TIME MESSAGE

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KEYWORDS: architecture, maintenance, building heritage

ABSTRACT

Buildings and urban sets heritage protection and rehabilitation are today a full activity and interest in architecture as maintenance and/or uses in new cycles.

Although from the mid 19th century, there are documented history in protection and/or restoration of architecture (as the works of Eugene Viollet le Duc applying new concepts, materials and techniques to the gothic style produced by the industrial revolution), it is only after World War II, as consequences and reconstruction needs, the experimental stage of policies, plans and ways in rehabilitation.

Adding needs, fundamentals and valuations appear: the transcendence (history, collective memory, symbols, etc); the environmental value (relation landscape - architecture); and / or tourist- economic reasons (diffusion, reuse of spaces) creating inclusive visions, methods and theoretical - practical actions on the topic launching a specialization in our profession that requires maximum levels of knowledge and research.

My experience from academia and professional practice, allow me to answer to the specific requirements by integrating creativity, science and technology. Also to systematically consolidate the specialization, it is necessary to develop a technical dossier of the under analysis topic. This requires previous tasks such as deep, meaningful and accurate reading of the case, recording reliable and sustainable results to conclude the diagnostic phase.

CODE: 5.2.04

IS SUFFICIENT KNOWLEDGE RELATING TO REHABILITATION OF BUILDINGS TAUGH BY UNIVERSITY TO STUDENTS OF CIVIL ENGINEERING?

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KEYWORDS: construction rehabilitation, construction conservation, cultural heritage, university, civil engineering.

ABSTRACT

The University should adapt to the cyclic changes that rule in society. At present, the construction sector is experiencing a real decline in many countries due to numerous factors by which, in many cases, the option of the construction rehabilitation should be strengthened at university education. The concept of rehabilitation is really wide: it ranges from restoring the habitability of ordinary buildings to interventions in buildings of great historical value whose maintenance and rehabilitation should be a moral obligation in order to guarantee its use to current and future generations. Unfortunately, in the Civil Engineering Schools, very little attention is devoted to the principles, motivations and protocols in the rehabilitation of buildings. Previous works carried out by the authors of this article thus have reflected it.

In what follows, the current situation of the teaching of this subject in Civil Engineering Schools from different countries of the world is briefly referred. Besides, the paper appeals to consider the rehabilitation of buildings within the university education, at bachelor degree level, provided to our students of Civil Engineering. To do this, with base on the research carried out, a guideline course is proposed.

CODE: 5.3.01

TRIDIMENSIONAL DOCUMENTATION OF HERITAGE THROUGH HYBRIDIZATION TECHNIQUE OF ARTIFICIAL VISION AND REVERSE ENGINEERING: THE MAGDALENA PALACE IN SANTANDER

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KEYWORDS: drone, photogrammetry convergent, reverse engineering, palacio de la magdalena, artificial vision.

ABSTRACT

This work arose within the ongoing collaboration between the Research Group Computer Graphics and Geometric Design, University of Cantabria, Employment Workshop New Technologies of the City of Santander and Urban / Eco Institute Università Degli Studi di Napoli - Federico II - Italy. The project, proposed by the city of Santander, was to provide a new methodology of work, much more in line with the current crisis, seeking a substantial reduction in the costs of digital documentation of historical heritage. Besides functioning as support work cataloging, preservation and restoration of the architectural heritage of the city of Santander, providing photographic and graphic documentation of building "Palacio de la Magdalena" by hybridization of photogrammetric techniques with techniques from the field of artificial vision . The work has been framed within the Master Plan for Magdalena Palace.

We can consider this collaborative project, as a research project with a major component of technological transfer to society. The final product of this work is the digital documentation of a building considered a historical heritage, so that its fortuitous collapse or demolition does not prevent re-build power precisely as if it were a replica. It is very important that there were no previous plans or elevations of the building, beyond the original hand drawings of the architects of the building and some approximate levels of internal reform in the 90s, so we have proceeded to document this building metrically reverse engineered so that measures all the architectural elements of the building are taken accurately.

The work was created with the intention to be the prototype for a new work methodology, combining different techniques of image processing and 3D modeling objects close range, hybridizing with photogrammetric techniques and other techniques from the field of computer vision.

CODE: 5.3.02

LANDSCAPE AND HERITAGE OF PUBLIC WORKS SPREAD BY ICT

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KEYWORDS: cultural heritage, public works, landscape, rural heritage, dissemination, ICT.

ABSTRACT

Studies on landscape and heritage of public works are relatively recent in Spain. Until quite recently, the results have been spread using traditional media as books, guides, maps, etc. Nowadays, new technologies allow a quicker and more efficient communication. The M. Aguiló Foundation Spanish researchers, through the VAPROP pilot project, have created a database (with location, description and territorial context) and a mobile application to provide access to this information. The App has been designed so that each user could customize an itinerary according to his interest, time available, accessibility, etc., from mobile devices (cellular phones, tablets, laptops, etc.) and feedback the database with information and personal experiences, in form of text, pictures, drawings, sounds, etc. In this work, we show that this application operates as expected, in particular, it improves accessibility to sites and its information, behaving as an internet portal. Public works can be observed taking into account its environment, giving cultural value to the landscape.

CODE: 5.3.03

ALL THE HERITAGE FOR ALL. THE PROJECT "ONTOLOGY OF CANTABRIA HERITAGE 3.0" AS EXPERIENCE OF THE DEMOCRATIZATION OF THE CULTURAL HERITAGE

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KEYWORDS: heritage, information, ontology, democratization, Web 3.0.

ABSTRACT

The project "***Heritage of Cantabria 3.***0 " aims to put all the information about the heritage of a region available to everyone through the use of Web 3.0, in an initiative that started within the framework of the Campus of Excellence International of the University of Cantabria, led to the formation of a digital portal promoted by the Marcelino Botín Foundation and the University of Cantabria which aims to digitize and put online powered by the most advanced, a vast corpus of the heritage of historical, artistic, archaeological, territorial, ethnographic, scientific-technical, bibliographic and documentary of the Autonomous Community of Cantabria. Thanks to the knowledge previously stored in an "Ontology", agents can extract data, combine them automatically and draw conclusions.

CODE: 5.3.04

INDUSTRIAL ARCHAEOLOGY BETWEEN KNOWLEDGE AND DEVELOPMENT. THE "PALMENTI" AND THE "BODEGAS"

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KEYWORDS: Vernacular architecture, landscape, recovery, typologies, materials.

ABSTRACT

The variety of climatic and morphological conditions of the Mediterranean makes it the cradle of an ancient civilization that founded in the "Bioclimatic Architecture" its inspiring principles. Humans have used more or less extensive underground cavities, naturally or artificially constructed to live and preserve agricultural products. Especially in southern Italy and in the Iberian Peninsula, there are still some examples of vernacular buildings, significant becasue of homogeneity and extension and of construction and formal landscape.

One of the most significant examples is constituted by the excavated wine cellars that form architectural complexes made by distinctive features, located just outside the urban centers and in places with a slight inclination to facilitate the excavation.

The research is focused on their typological and material analysis , through the study of the wine cellars located in the area of Pietragalla (Basilicata), which are called "Palmenti", and in the area of the Ribera del Duero (Spain), where they are known as "Bodegas ".

In the Lucan town there is a grouping of about two hundred tufa cavities harmoniously spread over several levels that make up a productive settlement half way between the urban and rural landscape.
In the provinces of Burgos, Valladolid, Leon and Zamora, instead, popular constructions coexist with the new industrial constructions related to the production of wine. The traditional "bodegas" feature from being excavated in clay soils, easy to work with simple tools.

Only through the study of these tufa and earth buildings , their integration into the landscape, the climate functioning and their state of conservation you can advance hypotheses on strategies for recovery and redevelopment.

The process of enhancing the industrial archaeological heritage must use instruments, digital techniques and effective communication models, perhaps integrated into one single interactive reality, in order to attract a wider audience to cultural content.

CODE: 5.4.03

THE OCA 2 PAVILION OF THE UNIVERSITY OF BRASÍLIA: THE MODERN HERITAGE ADAPTION TO THE UNIVERSAL ACCESSIBILITY EXIGENCES

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KEYWORDS: cultural heritage, modern architecture, Brasília, accessibility, authenticity.

ABSTRACT

The OCA 2 pavilion built in 1962 is part of the initial core of the University of Brasilia – UnB and was built just one year after the creation of the university. The pavilion, along with other similar building, the OCA 1 (burned), sheltered teachers and students of the first courses. Its wood pieces were prefabricated according to the architect Sérgio Rodrigues plans. The building was part of a precursor project initiated by Oscar Niemeyer and João Filgueiras Limas, the Lelé, for the construction of the main buildings of the campus, especially the emblematic Science Center Institute, the ICC or minhocão. Despite of being a pioneer experience in terms of constructive system the building received in these more than 50 years no significant maintenance. Change of use were the major source of damage that generated overcharging and additions in conventional brick masonry that altered the aesthetic features and the form of the building and introduced serious diseases, such as infiltrations. The OCA 2 has structural problems as differential foundation settlements and attacks by termites and wood-destroying insects as well as pests such as rats. Nowadays the building is the headquarters of campus security, which in 2005 called for the abandonment of the building because of its poor conditions. Currently waiting for restoration work and adaptation to a new use -the modern furniture museum-, the pavilion gives us the opportunity to discuss key issues of preservation of modern and recent heritage. Adapting to new uses requires compliance with safety and accessibility standards. However, how to make adjustments without hurting the principles that guide modern architecture and therefore its authenticity. To contribute to this discussion, this article presents a study of the use of methodological assessment tool applied to the building, the Matrix of Authenticity and Accessibility, whose goal is to collect information and qualify the building, providing an insightful framework for intervention.

CODE: 5.6.02

ARCHITECTURAL HERITAGE MANAGEMENT AND PROMOTION IN COOPERATION FOR DEVELOPMENT PROJECTS AND THE NECESSITY OF USING INDICATORS TO STATE THEIR CONTRIBUTION: AECID COMAYAGUA COLONIAL PROGRAMME CASE

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KEYWORDS: Cooperation, Development, Architectural heritage, Evaluation, Indicators.

ABSTRACT

The Program Comayagua Colonial (PCC) started in 2006 as a Spanish cooperation pilot programme in the framework of the Spanish Ministry of Foreign Affairs and Cooperation AECID. PCC proposes monitoring the results using a system based on indicators in order to analyze and highlight the impact of the management and promotion in the architectural heritage in the historic downtown district of Honduras city. The three main objectives of the program were: firstly, to evaluate the actions taken in place; secondly, to provide a basis for future actions inside the PCC; and thirdly, to exploit the model in other projects dealing with architectural heritage in Spanish cooperation activities. In this work, we tested the validity of 75 indicators defined in the PCC to evaluate if the project activities have reached the objectives and to identify their contribution to the creation of human development. Using the information provided by the indicators, it is possible to ensure the viability of other projects of cooperation. The methodology employed for the analysis is based on the aspects of the project to be evaluated. The characteristics that each aspect much achieve is defined for verification. Furthermore, an analysis card was designed to apply the 75 indicators. The information provided by each card allows the complete analysis of the indicators. The designed analysis cards enables the statistical processing of the data defined by each indicator, which makes easier to obtain the results. From the results, it is worth to highlight that: (1) A great number of the proposed indicators measured aspects were not directly-related with the results of the project. (2) There was not a uniform distribution between the indicators and the measured aspects. (3) This non-uniform distribution gets worse when the verification source technique is taken into account.

CODE: 5.6.04

HYBRIDIZATION 3D MODELING TECHNIQUES AND GIS FOR THE MANAGEMENT OF UNIVERSITY BUILDINGS: THE CAMPUS OF THE UNIVERSITY OF CANTABRIA

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KEYWORDS: 3D modeling, convergent photogrammetry, GIS, heritage management.

ABSTRACT

Within the research group Computer Graphics and Geometric Design, University of Cantabria, has raised the prototyping of a management system built heritage of a University, and has chosen the most symbolic building today for University of Cantabria, is digitally documented and has modeled in 3D by means of reverse engineering, and was entered in a database, implementing a GIS [1], so as to allow the management and conservation of the building. The system is based on that you have all the data in the alphanumeric database connected to the graphics, so we have documented campus in three dimensions, both in plan and elevation of the building and by extension all campus.

This system will document all the pathologies of various buildings and manage them from Geographic Information System that will serve as an approach to 3D GIS.

CODE: 5.6.05

PMBOK IMPLEMENTATION METHODOLOGY AS MANAGEMENT TOOL IN THE REHABILITATION OF BUILT HERITAGE IN SPAIN

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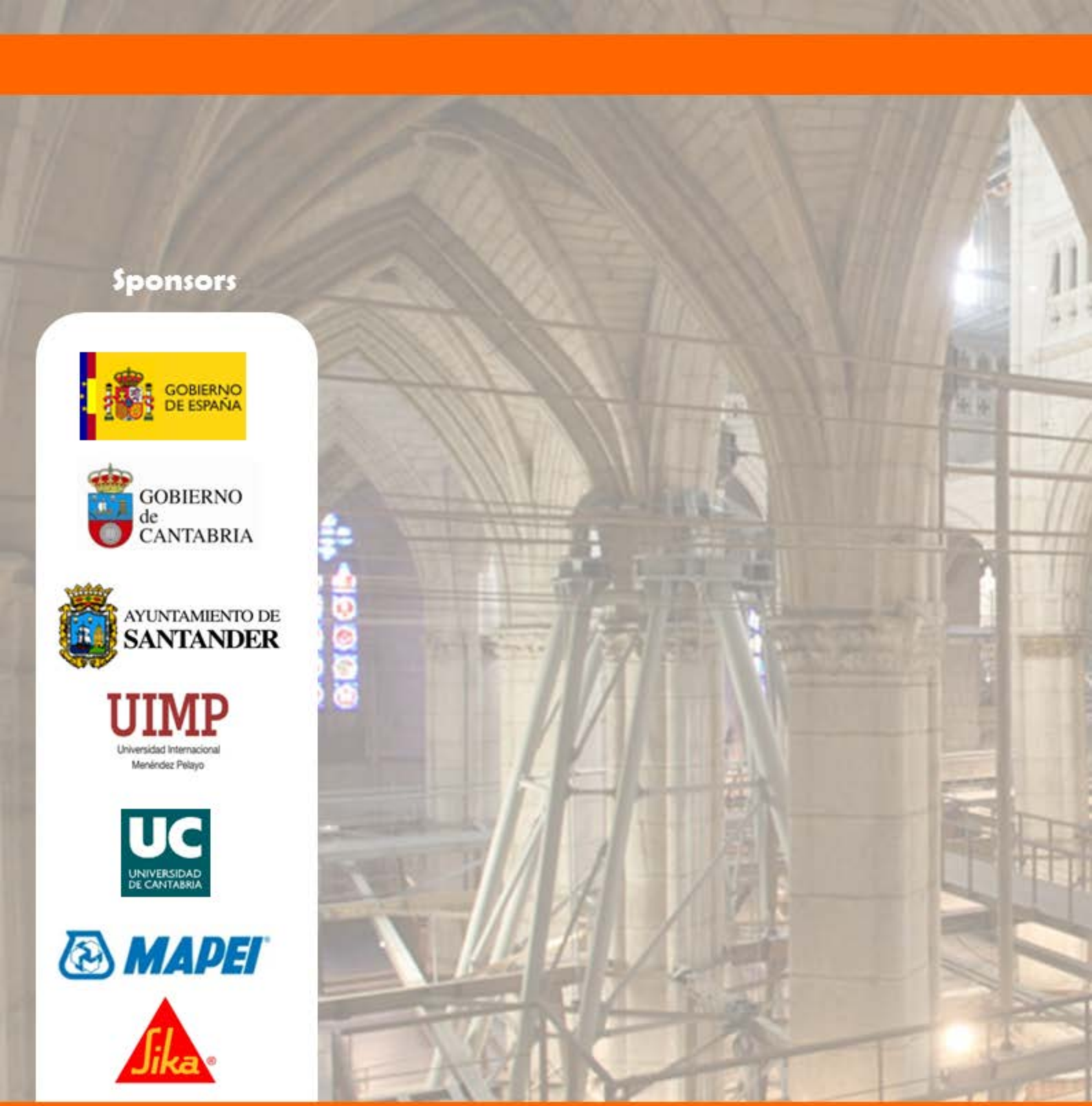
KEYWORDS: Project Management, Rehabilitation, Pmbok.

ABSTRACT

One of the most widely used worldwide for the development of Project Management reference documents is the PMBOK. It is an internationally recognized standard that lists and develop a set of best practices for project management, applicable to a wide range of industries and sectors.
The high quality finish projects having fulfilled the extent requested, on time and within budget. The relationship between these three factors is such that any change in one will affect the other unambiguously. The set of existing risks in a project is an uncertain condition that leads to positive or negative effects on the objectives of the project.
The current economic climate of recession and its impact on the real estate business, is causing other than the construction of new buildings enhance markets, such as the rehabilitation of built heritage. However, there are management processes adopted to the peculiarities and differences of this type of action and whose application ensure the end result of the actions carried out.
In the rehabilitation or repair of buildings, control the entire process through a specific methodology will make the final result does not deviate from initially pursued. It generates a need for searching and applying methodologies to ensure process control and achieving goals, seeking the certainty of uncertainty, which in rehabilitation actions cause a deviation in the initial objectives in much greater extent than in the development of the new work.

Therefore the aim of this research focuses on:
1.- Take the PMBOK as a reference in the management of processes for the creation of a specific management methodology in rehabilitation / repair of buildings in our country



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