GENERAL PROGRAMME

REHABEND 2016

CONSTRUCTION PATHOLOGY, REHABILITATION TECHNOLOGY AND HERITAGE MANAGEMENT

(6th REHABEND Congress)

Burgos (Spain), May 24th-27th, 2016

PERMANENT SECRETARIAT:

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6TH EURO-AMERICAN CONGRESS ON CONSTRUCTION PATHOLOGY, REHABILITATION TECHNOLOGY AND HERITAGE MANAGEMENT

REHABEND 2016

ORGANIZED BY:

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The **Euro-American Congress REHABEND 2016** on **Construction Pathology, Rehabilitation Technology and Heritage Management** was carried out in **Burgos (Spain)**, in **May 2016**. The event was organized by fifteen organizations of **ten European and American countries**, and it was co-chaired by the **University of Cantabria**, through its Building Technology R&D Group (GTED-UC), and the **University of Burgos**.

REHABEND 2016 **continued the series of the five previous REHABEND international events**, which had been developed **since 2006 in different Spanish cities**. The previous one, in **2014**, was carried out in **Santander**. In 2014 edition, **more than 270 papers** by Professionals and Researchers of **17 countries** were presented and it became a conference of great interest according to the people who attended the congress.

Construction Pathology, Rehabilitation Technology and Heritage Management currently have great importance for construction sector. This prompted the organizers to propose the **technical event on these topics in Burgos** (a city with an impressive Gothic Cathedral of the 13th century declared World Heritage by UNESCO, and one of the strategic points of the Route of Santiago de Compostela). This event aimed to collect the **advances obtained in the last two years** in the **theoretical knowledge** and **practical realizations** carried out on the referred topics. The Congress met **around 300 technical contributions** coming from professionals, academics and specialists.

Based on previous experiences the Congress **was proposed once again in the Euro-American cultural space**. The **official languages** were **English**, **Italian**, **Portuguese** and **Spanish**. Organizers understand that technical articles and oral presentations, with the support of graphic material and schemes, may be understood by the people who take part in the congress, as it was evident in REHABEND 2014.

Under these premises and the successful previous editions, the Congress was sponsored by the **Government of Spain**, the **Government of Castilla-León**, the **Provincial Government of Burgos**, the **Municipality of Burgos**, the **Chamber of Commerce of Burgos**, **Mapei**, **Sika**, the **University of Cantabria** and the **University of Burgos**. In addition, several Universities, Technical and Professional Associations, Institutes, Foundations and Companies committed their **collaboration** in order to the success of this initiative.

REHABEND 2016 organizers would like to thank the multiple received supports: to the **Sponsor 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**; to the different **Speakers** for their relevant contributions and, in general, to the **people who will attend the congress** for the confidence shown in the event. Sincerely, many thanks to all.

Prof. Luis Villegas

Chairman of the REHABEND 2016 Congress
Full Professor of the University of Cantabria

Prof. Juan Manuel Manso

Chairman of the REHABEND 2016 Congress
Vice-Rector of Infrastructures and New Technologies and Professor of the University of Burgos

The University of Cantabria, through its Building Technology R&D Group (GTED-UC), was the promoter of the REHABEND Congresses on Construction Pathology, Rehabilitation Technology and Heritage Management.

The 1st REHABEND Congress was set in motion in Santander in November 2006. It became established in the 2nd (Santander, 2007), 3rd (Valencia, 2008), 4th (Bilbao, 2009) and 5th Congress (Santander, 2014), all of them carried out in Spanish cities. The ability to convene of the five perfomed editions was prominent, gathering an appreciable number of experts in the topics of the Congress. As a reference, in the 5th edition (REHABEND 2014) took part around 270 speakers from 17 Euro-American countries.

The 3rd edition of the Congress (REHABEND 2008) was organized together with the Construction Technologic Institute of the Valencian autonomous community (AIDICO), and the 4rd and 5th editions (REHABEND 2009 and 2014), in addition to AIDICO, the Congresses were co-organized with TECNALIA Research&Innovation. From the current 6th edition (REHABEND 2016) the congress is going to be co-organized by several entities from different Euro-American countries.

The covers and ISBN of the books corresponding to the performed congresses are attached below. The ISSN of the series of REHABEND books is 2386-8198.

REHABEND 2006 (Book of Papers)
ISBN: 978-84-690-5269-3 (several languages)

REHABEND 2007 (Book of Papers)
ISBN: 978-84-691-3612-6 (several languages)

REHABEND 2008 (Book of Papers)
ISBN: 978-84-692-5650-3 (several languages)

REHABEND 2009 (Book of Papers)
ISBN: 978-84-8873-404-4 (several languages)

REHABEND 2014 (Book of Abstracts)
ISBN: 978-84-606-6738-4 (in English)
ISBN: 978-84-616-8862-3 (several languages)

REHABEND 2014 (CD of Papers)
ISBN: 978-84-616-8863-0 (several languages)

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COLLABORATING ENTITIES

The Collaborating Entities have been presented grouped in countries, following an alphabetical order. As Collaborating Entities have been considered to all that have contributed with more than two accepted articles in the Congress, or that some of its members formed part of the International Scientific Committee of the Congress. Finally, in each country, the Collaborating Entities have been ordered according to the number of accepted articles.

UNIVERSITIES

Argentina-Universidad Tecnológica Nacional

Brazil-Universidade Federal de Minas Gerais

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Chile-Universidad de Chile

Chile-Pontificia Universidad Católica de Chile

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Greece-University of Patras

Ireland-Trinity College Dublin

Italy-Università degli studi della Basilicata

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Uruguay-Universidad de la República

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Argentina-CeReDeTeC Centro Regional de Desarrollos Tecnológicos para la Construcción, Sismología e Ingeniería Sísmica

Argentina-LEMIT- Laboratorio de Entrenamiento Multidisciplinario para la Investigación Tecnológica

Brazil-Instituto Federal Farroupilha

Portugal-Laboratório Nacional de Engenharia Civil

Portugal-Centre of Materials and Building Technologies C-MADE

Portugal-Centro de Estudos de Arquitectura e Urbanismo (CEAU-FAUP)

Spain-Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc-CSIC)

Spain-Tecnalia Research & Innovation

Spain-Fundación Santa María la Real del Patrimonio Histórico

Spain-Instituto Valenciano de Conservación y Restauración de Bienes Culturales (IVC+r)

Spain-Fundación Leonardo Torres Quevedo

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COMPANIES

JOURNALS

Portugal-Cadernosd'Obra Revista Científica Internacional de Construçao

Italy–Revista Esempi di architettura

Spain–Informes de la Construcción

Spain–Hormigón y Acero

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- MSc. Cesar Carrasco. University of Cantabria.
- MSc. Ana María Paredes Núñez. University of Burgos.

1.- PREVIOUS STUDIES	1.1.- Studies of conservation (historical, archaeological, etc.). 1.2.- Heritage and territory. 1.3.- Urban regeneration. 1.4.- Economical and financial policies. 1.5.- Processes of social participation and socio-cultural aspects in rehabilitation projects. 1.6.- Pathology in construction. 1.7.- Diagnostic techniques and structural assessment (no destructive testing, monitoring and numerical modeling). 1.8.- Guides and regulations.
2.- PROJECT	2.1.- Criteria theoretical of the intervention project. 2.2.- Traditional materials and construction methods. 2.3.- Applicable novelty products and new technologies. 2.4.- Sustainable design and energy efficiency.
3.- BUILDING INTERVENTION	3.1.- Intervention plans. 3.2.- Rehabilitation and durability. 3.3.- Reinforcement technologies. 3.4.- Restoration of artworks. 3.5.- Conservation of industrial heritage. 3.6.- Examples of intervention.
4.- MAINTENANCE	4.1.- Construction maintenance. 4.2.- Preventive conservation of built heritage.
5.- DIFFUSION AND PROMOTION	5.1.- Heritage and cultural tourism. 5.2.- Formation. 5.3.- New technologies applied to the heritage diffusion. 5.4.- Accessibility to cultural heritage. 5.5.- Working networks in the cultural heritage. 5.6.- Management of of built heritage.

PLENARY SESSIONS

Congress REHABEND 2016 on

CONSTRUCTION PATHOLOGY, REHABILITATION TECHNOLOGY AND HERITAGE MANAGEMENT

Burgos, Spain, May 24th-26th, 2016

	Nº	COUNTRY	INSTITUTION	SPEAKER	TITLE
24/05/2016	1	 BRAZIL	UNIVERSIDADE ESTADUAL PAULISTA "JÚLIO DE MESQUITA FILHO"	PROF. DR. OBEDE BORGES FARIA	PANORAMA OF BUILDINGS REHABILITATION IN BRAZIL: LEGAL ASPECTS AND CASE STUDY IN BAURU-SP
	2	 SPAIN	UPV EHU UNIVERSIDAD DEL PAÍS VASCO	PROF. DR. SANTIAGO SÁNCHEZ BEITIA	FIRST APPROACH TO DETECT IN SITU THE LENGTH AND NUMBER OF LITTLE CRACKS ON THE ANALYSIS OF THE LONG TIME BEHAVIOR IN THE HISTORICAL STONEWORK MASONRY CONSTRUCTIONS
25/05/2016	3	 ITALY	POLITÉCNICO DI BARI	PROF. DR. FABIO FATIGUSO	INNOVATIVE TECHNIQUES AND OPERATION PROTOCOLS FOR ASSESSMENT AND CONTROL OF THE BUILT HERITAGE
	4	 PORTUGAL	UNIVERSIDADE DE AVEIRO	PROF. DR. ROMEU VICENTE	RISK ASSESSMENT: FIRST STEP TOWARDS URBAN REHABILITATION PROCESSES?
26/05/2016	5	 MEXICO	UNIV. MICHOACANA SAN NICOLÁS DE HIDALGO	PROF. DR. JOSÉ MANUEL JARA	REPAIR AND RETROFIT CRITERIA OF HIGHWAY BRIDGES
	6	 CHILE	UNIVERSIDAD AUSTRAL DE CHILE	PROF. DR. GALO VALDEBENITO	GEOPHYSICAL METHODOLOGIES FOR THE RESTORATION OF MASONRY PATRIMONIAL STRUCTURES IN HIGH SEISMICITY AREAS

PLENARY SESSION nº 1: May 24th, 2016, 9h00-9h35 (Room 1)

PROF. DR. OBEDE BORGES FARIA

Degree in Civil Engineering (1981) at Faculty of Engineering Bauru (FEB), Universidade Estadual Paulista "Julio de Mesquita Filho" (UNESP);

Master in Architecture and Urbanism - Technology of Built Environment (1993), at São Carlos School of Engineering (EESC), University of São Paulo (USP);

PhD in Environmental Engineering Sciences (2002), at São Carlos School of Engineering (EESC), University of São Paulo (USP);

Assistant Professor II, Department of Civil and Environmental Engineering (DEC), at FEB/UNESP since 1982, teaching courses in the field of construction for the undergraduate courses in Civil Engineering and Architecture and Urbanism; Teacher and supervisor in the Graduate Program in Architecture and Urbanism, Faculty of Architecture, Arts and Communication (FAAC), UNESP (Bauru campus - SP);

Member of ANTAC - National Association of Technology of the Built Environment (Working Group on Sustainability); member of the Ibero-American Network Earthen Architecture and Construction (PROTERRA - www.redproterra.org); member of the TerraBrasil Network Earthen Architecture and Construction with Earth; Reviewer of journals AC - Built Environment (of the ANTAC) and Construction and Building Materials, among others.

ABSTRACT: **PANORAMA OF BUILDINGS REHABILITATION IN BRAZIL: LEGAL ASPECTS AND CASE STUDY IN BAURU-SP**

Although Brazil be considered a relatively young country when compared to European countries, already has about five centuries of existence, but there is a certain national feeling that as a result of this relative youth there is not much to preserve or rehabilitate. In fact, except the main states capitals (some older than 400 years) most large cities have a little over 100 years. The federal capital (Brasilia) has only 55 years of existence. However we need to think about preservation and rehabilitation not only of historical and cultural interest buildings, but also general buildings, even by economic interests within a broader perspective of sustainable development, extending the lifetime of buildings and reducing environmental impacts by reducing the consumption of natural resources for new constructions.

A few sites and historic buildings are toppled by UNESCO as humanity heritage. There are some governmental institutions that are in charge of matters relating to property, mainly in monitoring and safeguarding. The main institution is the IPHAN (Historical and Artistic Heritage Institute), present in all Brazilian states with the mission (somewhat vague) of “promote and coordinate the Brazilian cultural heritage preservation process to strengthen identities, guarantee the right to memory and contribute to the socioeconomic development of the country". The São Paulo state has the CONDEPHAAT (Council of the Defense of the Archaeological Heritage, Art and Tourism) with function similar but restricted on the state level, and some cities has their local corresponding organs. Often, there are conflicts of interest, lack of definition of responsibilities and political issues between this tangle of institutions that combined with disability legislation, results in failures in the preservation, maintenance and rehabilitation of heritage. In this lecture we intend to present a little better this panorama with some examples of successful initiatives (public and private) and a case still unsolved in the city of Bauru (center of the Sao Paulo State) that has 118 years since foundation and about 380 thousands inhabitants.

Vista aérea parcial de Bauru-SP e estação ferroviária central, abandonada

PLENARY SESSION nº 2: May 24th, 2016, 9h40-10h15 (Room 1)

PROF. DR. SANTIAGO SÁNCHEZ BEITIA

Santiago Sánchez Beitia es doctor en Física e imparte clases en el primer y segundo ciclo, así como de Doctorado, en la Escuela Técnica Superior de Arquitectura de la UPV/EHU. El equipo de investigación que dirige es pionero en el análisis de estados de conservación del patrimonio por haber adaptado técnicas de otros ámbitos de estudio para ese fin. Destaca por haber adaptado el método *Hole Drilling*, utilizado para medir tensiones y deformaciones en acero, al estudio del patrimonio arquitectónico.

Sánchez Beitia trabaja en el análisis de estados de conservación de elementos arquitectónicos del patrimonio histórico y elementos inmuebles desde 1991. Entre los elementos estudiados destacan, en España, el Seminario Mayor de Comillas, los pilares de Santa María del Mar, la Iglesia de Santa María del Pi y la Catedral Gótica de Barcelona, la Catedral de Tarazona, la Casa Botines y los arbotantes de la Catedral de Palma de Mallorca; y, en el internacional, la Iglesia de Saint Jacobs de Lovaina, la planta sótano del Museo Altes de Berlín y el acueducto del Sultán al-Ghawri de El Cairo.

ABSTRACT: **FIRST APPROACH TO DETECT IN SITU THE LENGTH AND NUMBER OF LITTLE CRACKS ON THE ANALYSIS OF THE LONG TIME BEHAVIOR IN THE HISTORICAL STONEWORK MASONRY CONSTRUCTIONS**

Top-ranked European research groups have been working for years on the problem of identifying the long time behavior of structural elements under the interaction creep-fatigue in historical masonry structures. All analyses performed to date have been in response to unexpected structural collapses after earthquakes or not in several zones around Europe. These collapses are commonly related with the previous presence of fissures with appreciable dimensions more or less vertical in towers, vaults or pillars. Through the mortar this type of fissures is easily observable before the collapse although the proximity to the failure of the structure is not well defined completely. The paper deals with the presence of another type of fissures confined inside the blocks in a stonework masonry. These are difficult to detect and to observe, whose length sometimes gets to cross the blocks vertically. Several cases in which they have been previously detected are presented. In order to define a method to evaluate them in situ before the collapse some fissures have been generated in some blocks at the laboratory under fatigue conditions. The proposed methodology is based on the procedures used in the field of the quantitative metallography. The relation between both types of fissures is not clear although it is suggested the possibility that ones are the origin of the others. Both types of cracks are originated by long term loads associated to a fatigue phenomenon, that is to say, a fracture by interaction creep-fatigue. The aim of this paper is to analyze the existence of hidden fissures under the surface in a stonework masonry that can be present in a great amount of historical constructions.

PLENARY SESSION nº 3: May 25th, 2016, 10h00-10h35 (Room 1)

PROF. DR. FABIO FATIGUSO

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

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

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

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

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

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

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

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

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

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

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

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

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

PLENARY SESSION nº 4: May 25th, 2016, 10h40-11h15 (Room 1)

PROF. DR. ROMEU DA SILVA VICENTE

Licenciado em Engenharia Civil pela Faculdade de Ciências e Tecnologia da Universidade de Coimbra (FCTUC).

Mestrado em Ciências da Construção pela FCTUC-DEC.

Doutoramento em Engenharia Civil pela Universidade de Aveiro, 2008.

Professor Associado da Universidade de Aveiro desde Janeiro de 2015.

Membro Fundador e Presidente da Internacional Association of Risk and Crisis Communication (Non Govermental Organization-NGO Status), desde maio de 2013.

Membro do Working Commission W120 – Disasters and the Built Environment – of the CIB International Council for Research and Innovation in Building and Construction, desde março 2011.

Membro Comissão Nacional do Eurocódigo 6.

Membro do Board of Studies do programa Doutoral – Analysis and Mitigation of Risks in Infrastructures InfraRisk –.

Membro Individual da Comissão Nacional Portuguesa do Conselho Internacional dos Monumentos e dos Sítios (ICOMOS), desde janeiro de 2010.

Coordenador do Grupo de Manutenção da Sé Catedral de Aveiro, Paróquia da Glória, desde julho de 2010.

Responsável e Formador em Cursos de Reabilitação de Edificado Antigo.

Investigador Responsável de diversos projetos de investigação nacional e internacional no âmbito da Avaliação e Riscos Urbanos e Reabilitação do Edificado Antigo.

ABSTRACT: **RISK ASSESSMENT: FIRST STEP TOWARDS URBAN REHABILITATION PROCESSES?**

The well-being and quality of life in old urban centres constitutes a dynamic goal, always influenced, by social and economic processes, evolution and urban growth and increasing demand over the existing building stock and urban infrastructure.

In the scope of renewal and rehabilitation of old city centres, focusing on the physical building stock, the essential features, such as: structural safety and indoor comfort conditions in an equilibrated and sustainable manner, with the preservation and safeguarding cultural identity, is not merely a maintenance practice, but a fundamental valued action that creates opportunities and roots for successful urban management.

Presently, many cities, throughout Europe are awakening to a culture of risk-integrated management and assessment, not only ate the city level, but at the regional scale. Risk management is a process that encloses a series of actions that support the implementation of measures that reduce the potential of loss in the sequence of a catastrophic event, for example, earthquake. However, vulnerability and risk assessment is a complex net of actions and strategic decisions on urban systems.

Amongst many pursued objectives in the scope of urban planning and management, in particular for the case studies presented, risk assessment is approached in four fundamental domains: Earthquake and Structural Safety, Urban Fire, Comfort and well-being (climate change) and architectural and cultural safeguarding. At the urban scale and in the specific domain of structural safety, earthquake and fire vulnerability and risk, lead to severe consequences that are unfortunately part of the collective memory of communities. The consequences in the case of these events are motive for the strong valuing of prevention and preparedness strategies, mitigation and planning measures that reduce the physical, economical and social consequences and allow a continued actions of improvement, since a "zero" risk environment is impossible to attain.

In respect to well-being and comfort conditions, the adaptability of the old building stock is a challenge in terms of new uses and functionality, proportionating improved thermal and acoustic conditions, promoting the longevity and maintenance, if in use. The cultural and architectural value of old urban centres of acknowledged heritage value, is not exclusively due to singular and monumental buildings, but also to old building aggregates. Moreover, rehabilitation and renewal actions only are consequential if taken at the building quarter or aggregate level, when in the case of the urban scale.

Presently it is debated that urban rehabilitation, as a drive for the progressive improvement of living conditions of old buildings, safeguarding of cultural identity and sustainable development of old urban city centres. However, before intervening or defining retrofitting or refurbishment strategies for the building stock, the assessment of urban risks is crucial, formulating the question: is Risk Assessment, the first step for successful urban rehabilitation.

PLENARY SESSION nº 5: May 26th, 2016, 10h00-10h35 (Room 1)

PROF. DR. JOSÉ MANUEL JARA

José Manuel Jara es egresado de la Facultad de Ingeniería Civil en la Universidad Michoacana de San Nicolás de Hidalgo, con estudios de Maestría y Doctorado en la Universidad Nacional Autónoma de México.

Ha sido conferencista Magistral en congresos de México, Colombia, India, Portugal y Brasil.

Investigador visitante en Yugoslavia, Italia, Estados Unidos y Portugal.

Es coautor de cuatro libros relacionados con ingeniería sísmica, vulnerabilidad de puentes y del uso de dispositivos de control en estructuras.

Es también autor de más de 120 artículos publicados en revistas técnicas y congresos nacionales e internacionales.

Actualmente, es Profesor-investigador de la Facultad de Ingeniería Civil de la Universidad Michoacana de San Nicolás de Hidalgo, donde imparte cursos de ingeniería estructural e ingeniería sísmica y ha dirigido más de 50 tesis de licenciatura y de posgrado.

ABSTRACT: **REPAIR AND RETROFIT CRITERIA OF HIGHWAY BRIDGES**

An important number of short and medium span bridges built before the 1980's decade are spread all over the world. A typical structural configuration of these bridges consists in a concrete deck on multiple simply supported precast girders. Most of them are RC structures designed with low seismic forces and out-of-date codes. Moreover, during their useful life several increments of dead and live load amplitudes are usually presented.

Most countries have periodic inspection programs to evaluate, and based on the results, to decide rehabilitation actions for bridges. It is common to find pathologies that require detailed studies before deciding the type of intervention in each bridge or family of bridges. After selecting a group of bridges that need to be rehabilitated or retrofitted, the decision of the best technique and a prioritization process must be decided.

This study aimed at analysing the most common bridge pathologies, rehabilitation and retrofit techniques, and discusses the most important parameters to be considered in a decision-making framework. Finally, the results of the vulnerability assessment of several bridges located in prone seismic areas and the retrofit alternatives are presented.

PLENARY SESSION nº 6: May 26th, 2016, 10h40-11h15 (Room 1)

PROF. DR. GALO VALDEBENITO

Galo Valdebenito nace en enero de 1970 en Santiago de Chile. Es Ingeniero Civil de profesión y Doctor en Ingeniería Sísmica y Dinámica Estructural por la Universidad Politécnica de Catalunya (Barcelona).

El Dr. Valdebenito comienza su carrera académica como profesor adjunto en la Universidad de Temuco en 1997, y como académico de planta en el Instituto de Obras Civiles de la Universidad Austral de Chile desde 1999 a la fecha.

En el ámbito docente imparte la cátedra de Taller de Diseño Estructural para la carrera de Ingeniería Civil en Obras Civiles, y realiza docencia de postgrado en el Magister en Ingeniería para la Innovación, dictando los cursos de Sismología Aplicada y Análisis y Diseño Avanzado de Estructuras Sismorresistentes.

Sus principales áreas de investigación son la Evaluación de Riesgo Sísmico a Escala Urbana, la Determinación de la Demanda Sísmica en Estructuras, la Auscultación de Estructuras Mediante Métodos Geofísicos No Invasivos y la Instrumentación Sísmica y Geofísica de Suelos y Estructuras.

Como investigador, ha publicado varios artículos en revistas científicas, congresos nacionales e internacionales, y monografías científicas. Así mismo, ha realizado y desarrolla actualmente importantes proyectos de investigación aplicada en el área de ingeniería sísmica y geofísica aplicada, siendo colaborador para diversas instituciones públicas y privadas.

Ha sido profesor invitado de la Escuela de Ingenieros de Caminos de la Universidad Politécnica de Catalunya (Barcelona), miembro de varias Asociaciones Científicas, editor y referee de revistas científicas nacionales y extranjeras.

Su fuerte compromiso institucional lo ha llevado a liderar importantes proyectos de extensión y vinculación con el medio relacionados con sus investigaciones, así como a gestionar importantes iniciativas institucionales y a participar de múltiples comisiones universitarias.

En el ámbito profesional, y con más de 18 años de experiencia, es Director de Proyectos de la Empresa Arko Consultores Ltda desde el año 2002, empresa dedicada a la Ingeniería Sísmica, Auscultación Estructural y Geofísica Aplicada, en donde ha desarrollado proyectos de Cálculo Estructural, estudios de ingeniería sísmica y estructural para obras patrimoniales, diseño de estructuras viales, estudios de geofísica aplicada, estudios de instrumentación y auscultación sísmica y estructural y estudios especiales de Vulnerabilidad, amenaza y riesgo sísmico en Chile y el extranjero.

Actualmente se desempeña como Vicedecano de la Facultad de Ciencias de la Ingeniería de la Universidad Austral de Chile.

ABSTRACT: **GEOPHYSICAL METHODOLOGIES FOR THE RESTORATION OF MASONRY PATRIMONIAL STRUCTURES IN HIGH SEISMICITY AREAS**

The increasing tendency for the use and application of non – invasive strategies for structural inspection mainly on patrimonial buildings, has permitted the development of several geophysical techniques and methodologies.

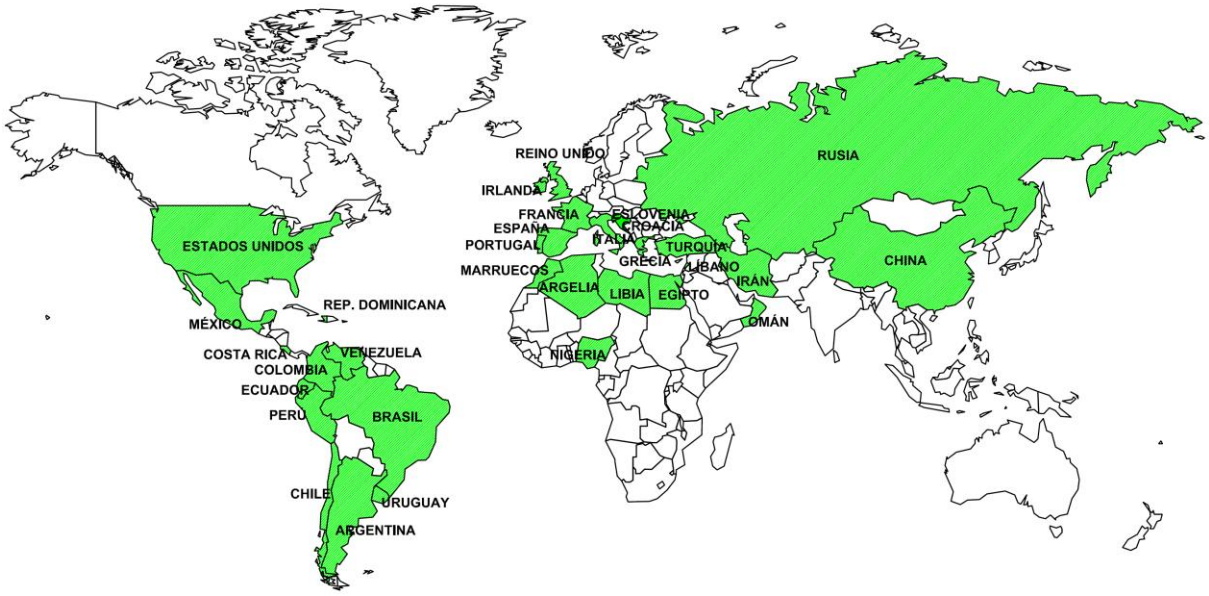
Current geophysical techniques, normally require a post-processing of the collected data, in which interpretation is usually not direct or trivial, and as a consequence, require experience, calibration of the results, and dedication. Of course, traditional invasive methods normally provide direct results, however, normally this kind of strategies for patrimonial structures is not desirable or not permitted, which is one of the best advantages of non invasive geophysical surveys.

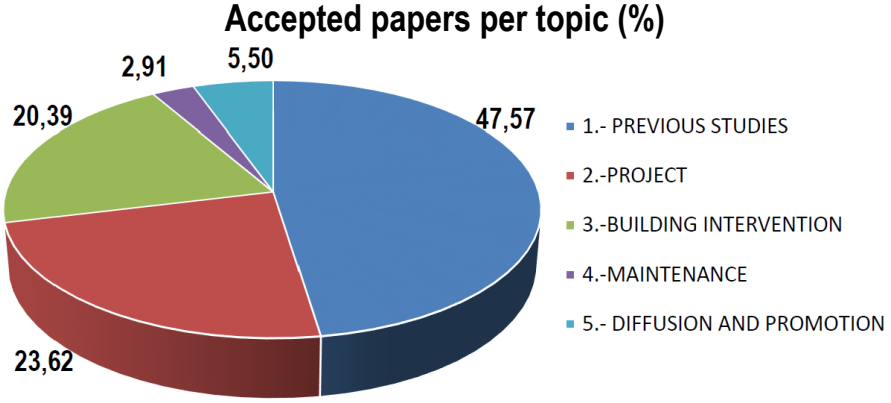
In this prsentation, the main geophysical methodologies for structural surveys are showed and explained, and specially, those requeird for masonry structures in seismic areas. Some real cases are shown for masonry patrimonial structures in southern Chile.

ABSTRACTS / ACCEPTED PAPERS (309 from 32 countries)

Country	Abstracts	Accepted articles	% Articles / Country
Spain	198	141	45,6%
Brazil	112	52	16,8%
Portugal	49	29	9,4%
Italy	67	28	9,1%
Mexico	17	11	3,6%
Argentina	15	5	1,6%
Chile	6	4	1,3%
Colombia	9	4	1,3%
Peru	5	4	1,3%
Egypt	9	3	1,0%
Uruguay	9	3	1,0%
USA	7	3	1,0%
Ireland	2	2	0,6%
Dominican Rep.	3	2	0,6%
Turkey	4	2	0,6%
Argelia	5	1	0,3%
China	3	1	0,3%
Costa Rica	1	1	0,3%
Ecuador	5	1	0,3%
Slovenia/Croatia	1	1	0,3%
France	2	1	0,3%

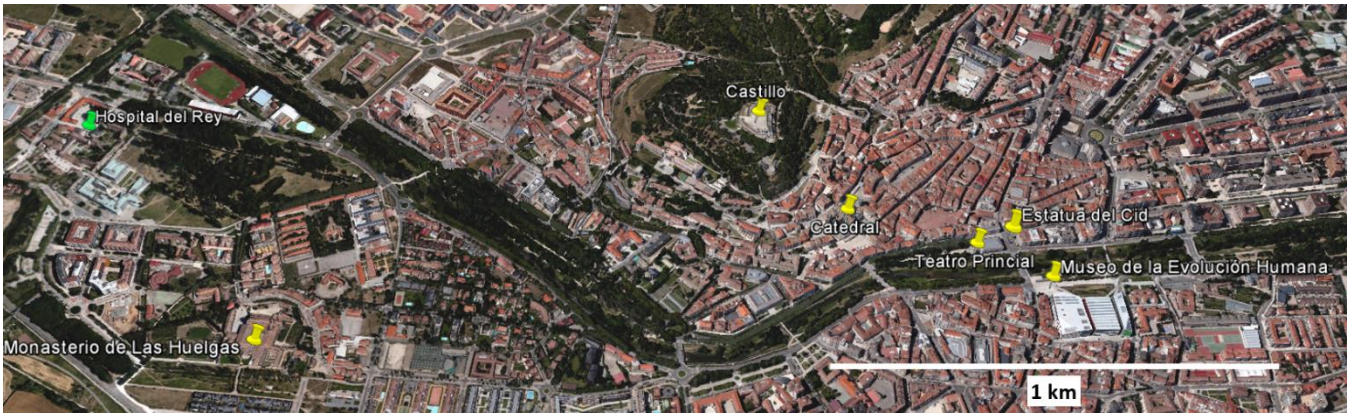
Country	Abstracts	Accepted articles	% Articles / Country
Greece	1	1	0,3%
United kingdom	3	1	0,3%
Iran	1	1	0,3%
Lebanon	1	1	0,3%
Lybia	1	1	0,3%
Morocco	2	1	0,3%
Nigeria	1	1	0,3%
Russia	1	1	0,3%
Oman	2	1	0,3%
Venezuela	3	1	0,3%
Czech Republic	3	0	0,0%
Hungary	2	0	0,0%
Angola	1	0	0,0%
Bangladesh	1	0	0,0%
Bolivia	1	0	0,0%
Cuba	1	0	0,0%
Finland	1	0	0,0%
Latvia	1	0	0,0%
Malasya	1	0	0,0%
New Zealand	1	0	0,0%
Total	**558**	**309**	**100,0%**





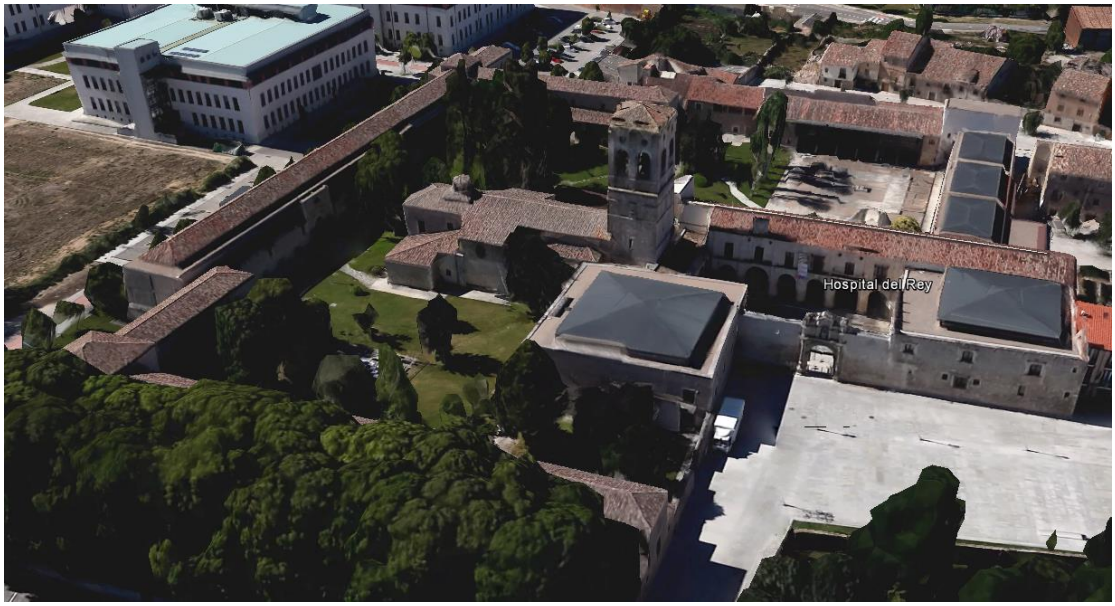
Day / Hour	Tuesday May 24th	Wednesday May 25th	Thursday May 26th	Friday May 27th
8h30	DOCUMENTATION DELIVERY	PARALLEL SESSIONS	PARALLEL SESSIONS	
9h00				POST-CONGRESS TRIP (Optional // It is required a mínimum of 20 people) The medieval village of Covarrubias http://www.covarrubias.es/turismo-y-ocio Santo Domingo de Silos Abbey http://www.abadiadesilos.es/ Ducal Village of Lerma http://www.citlerma.com/
9h30	PLENARY SESSIONS 1 & 2			
10h00		COFFEE BREAK	COFFEE BREAK	
10h30	COFFEE BREAK	PLENARY SESSIONS 3 & 4	PLENARY SESSIONS 5 & 6	
11h00	OPENING			
11h30		PARALLEL SESSIONS	PARALLEL SESSIONS	
12h00				
12h30	LUNCH	LUNCH	LUNCH	
13h00				
13h30				
14h00	PARALLEL SESSIONS	PARALLEL SESSIONS	PARALLEL SESSIONS	
14h30				
15h00		COFFEE BREAK	COFFEE BREAK	
15h30	TECHNICAL – CULTURAL TRIP Burgos Catedral Human Evolution Museum Miraflores Charterhouse	PARALLEL SESSIONS	PARALLEL SESSIONS	
16h00				
16h30		BREAK	BREAK	
17h00		PARALLEL SESSIONS	PARALLEL SESSIONS	
17h30				
18h00		ORAL PRESENTATIONS Burgos and its Heritage / Univ. of Burgos (Room 1, Hospital del Rey)	CLOSING	
18h30				
19h00				
19h30		WELCOME RECEPTION IN CHARGE OF THE MAJOR OF THE CITY OF BURGOS		
20h00				
20h30				
21h00			CLOSING DINNER	

Hidden in the past between lush forests, currently, the *Hospital del Rey* is located in the outskirts of Burgos. His remains have been restored and transferred to the University of Burgos hosting part of its buildings: the Rectorate, the Faculty of Law and the old Library.



General location of the 'Hospital del Rey' and other points of interest in Burgos

It was founded in 1195 by King Alfonso VIII, the same king who established the Cistercian order in the abey of *Santa María la Real de las Huelgas*, on the St. James's Way (in Spanish *Camino de Santiago*), on the banks of the Arlanzón river. The *Hospital del Rey* constituted a great hospitable centre of pilgrims to Santiago de Compostela and other people. Nowadays, the complex of buildings form part of the Heritage of Cultural Interest belonging to Spanish heritage organization *Patrimonio Nacional*.



Aerial view of the complex of buildings of the University of Burgos in *Hospital del Rey*

The main access to the campus is the 'Door of Pilgrims'. It was built in 1526 by the artist Juan de Salas.

Main access to the campus through the 'Door of Pilgrims'

Inside the courtyard, opposite the main façade, the 'House of the Old Code' (in Spanish '*Casa del Fuero Viejo*') is located. Here it was where King Pedro I gave the Spaniards the Old Code of Castile. To the right is the 'House of pilgrims', a building that still keeps the taste of the classrooms of the first Spanish universities. To the left of the same courtyard is the 16th-century Renaissance portico attributed to Juan de Vallejo.

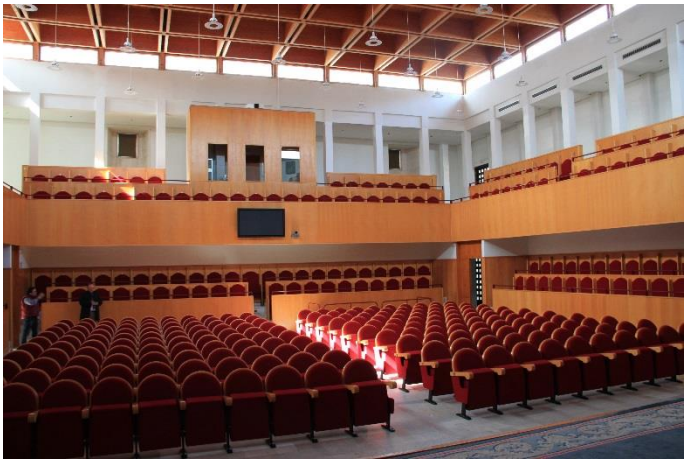
The Tower of the Church stands out in the complex of buildings of the *Hospital del Rey*. The 17th-century Baroque Church was built by Francisco de Pontón and Bernabé de Azas. Its main door was carved by Juan de Valmaseda.

Tower of the church and 16th-century Renaissance portico

Interior space of the complex of building

The academic complex is formed by the seat of the Rectorate of the University of Burgos, two large lecture room buildings (East and West), departments building, library, administrative offices and a large cafeteria-restaurant.

Part of the interior gardens

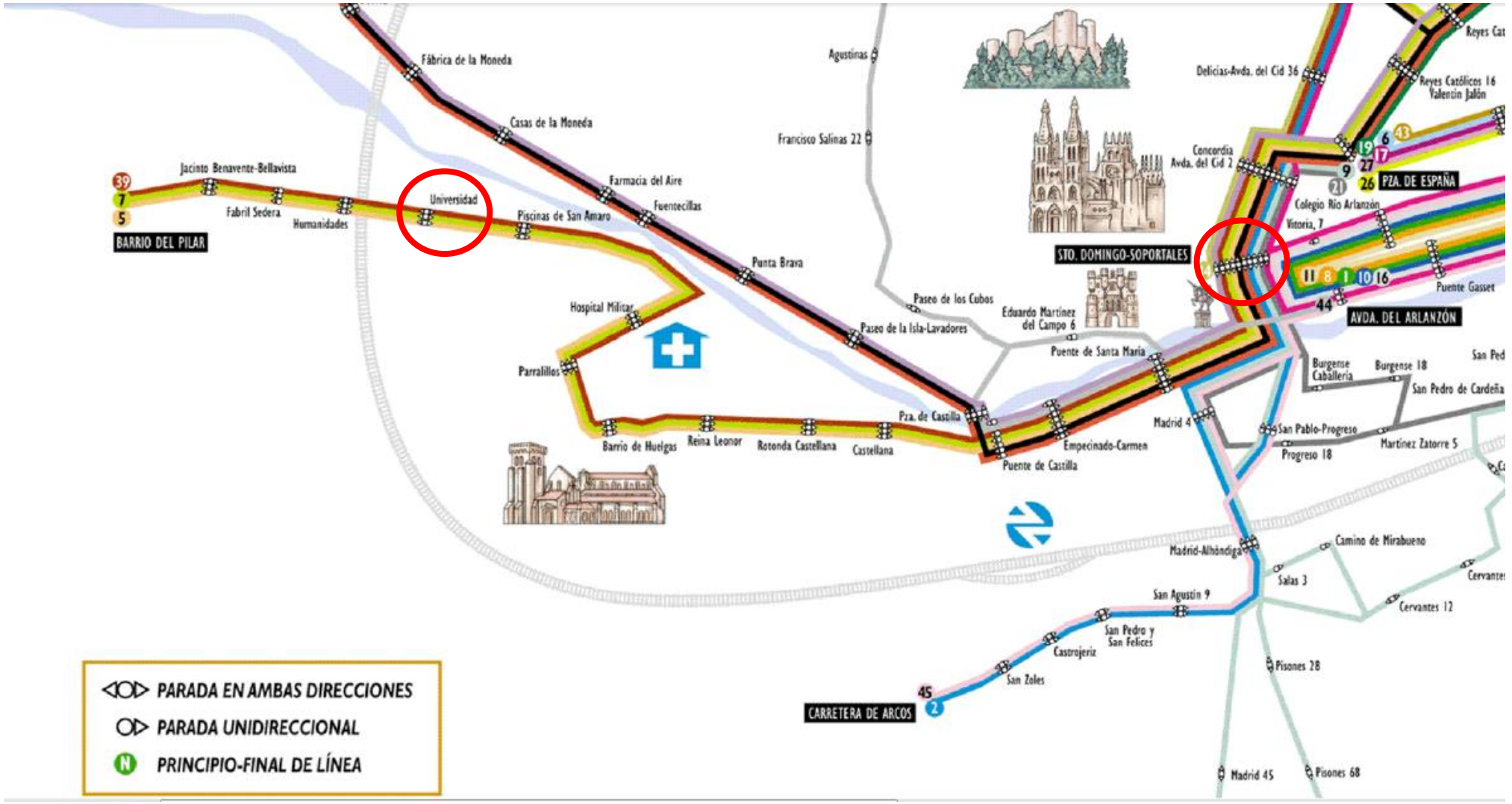


Main hall

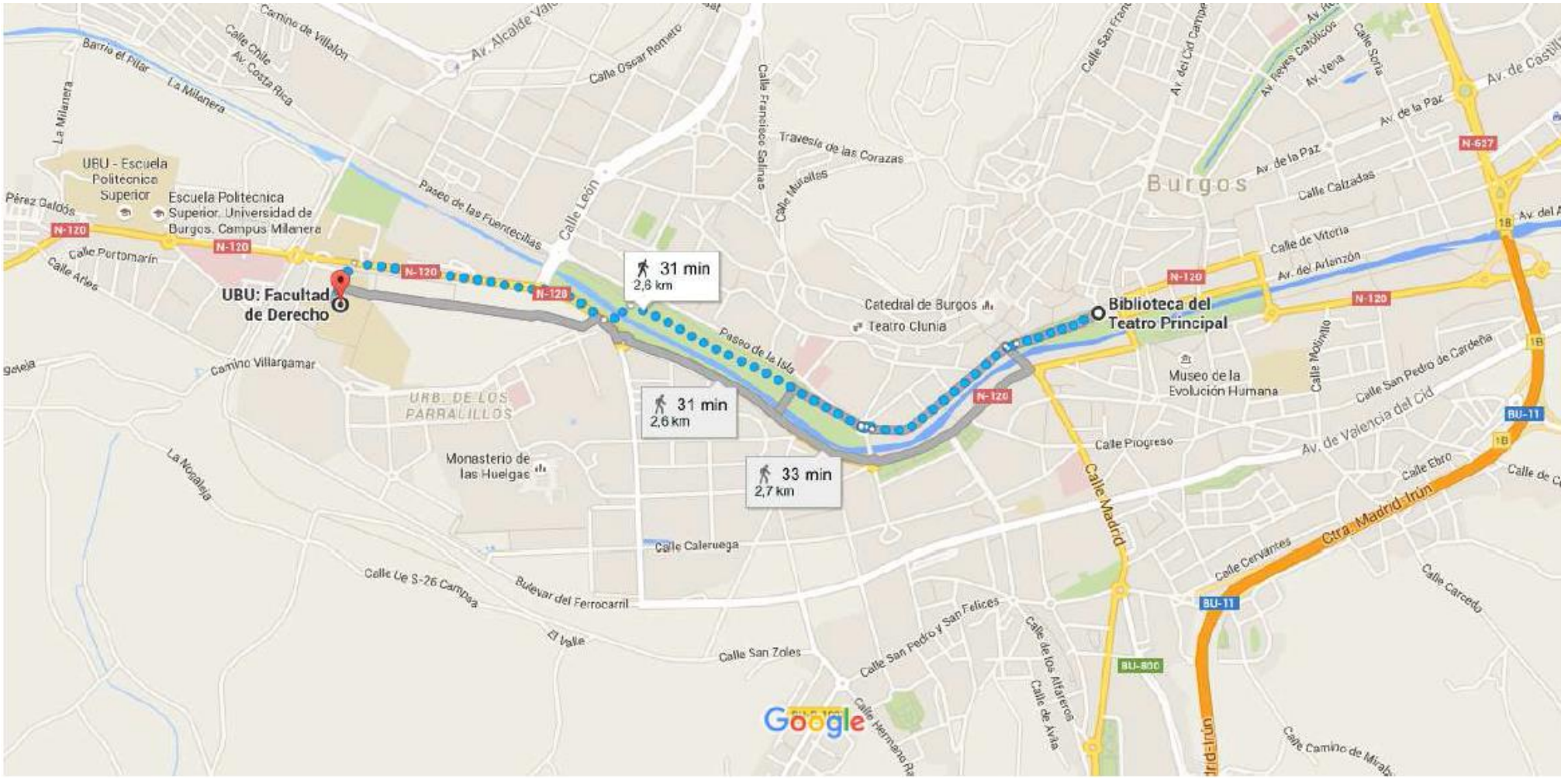
The spaciousness, the buildings stonework and the ornamental gardens beauty make up a complex of buildings with real academic character.

From	To	Mode of transport	Approx. cost (€)	Approx. time (minutes)
City Center	Hospital del Rey (Headquarters)	Public bus (lines 5,7 and 39)	1	15
Hospital del Rey (Headquarters)	City Center	Taxi	8	10
		Walking	-	30
Hospital del Rey (Headquarters)	Hotel NH Collection (Closing Dinner)	Public bus (lines 5,7 and 39)	1	12
		Taxi	7	8
		Walking	-	25
Bus station	Hospital del Rey (Headquarters)	Taxi	8	10
Hospital del Rey (Headquarters)	Bus station			
Railway station	Hospital del Rey (Headquarters)	Taxi	12	20
Hospital del Rey (Headquarters)	Railway station			

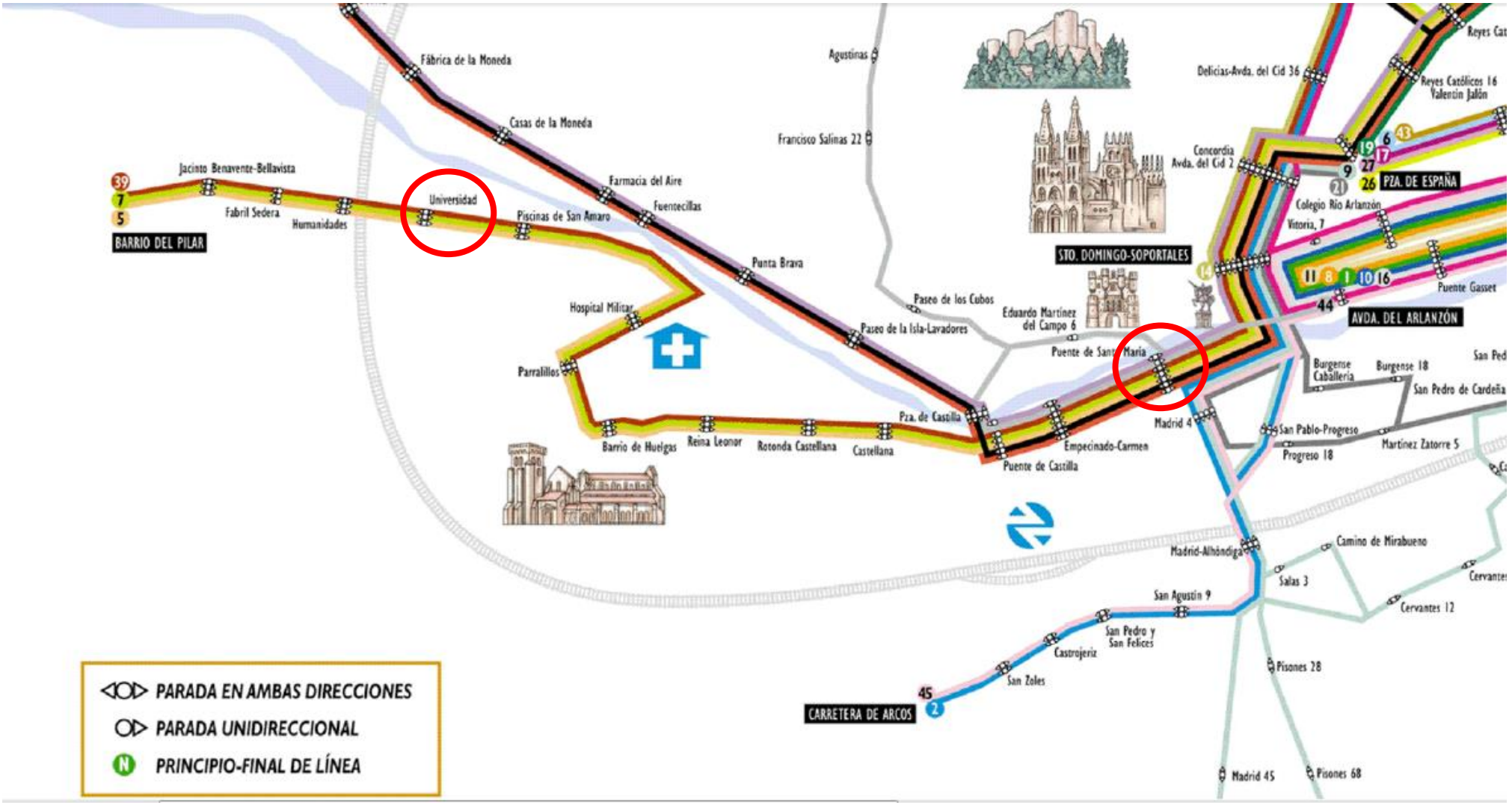
From City Center to Hospital del Rey (Headquarters) or viceversa → Public buses (lines 5, 7 and 39)



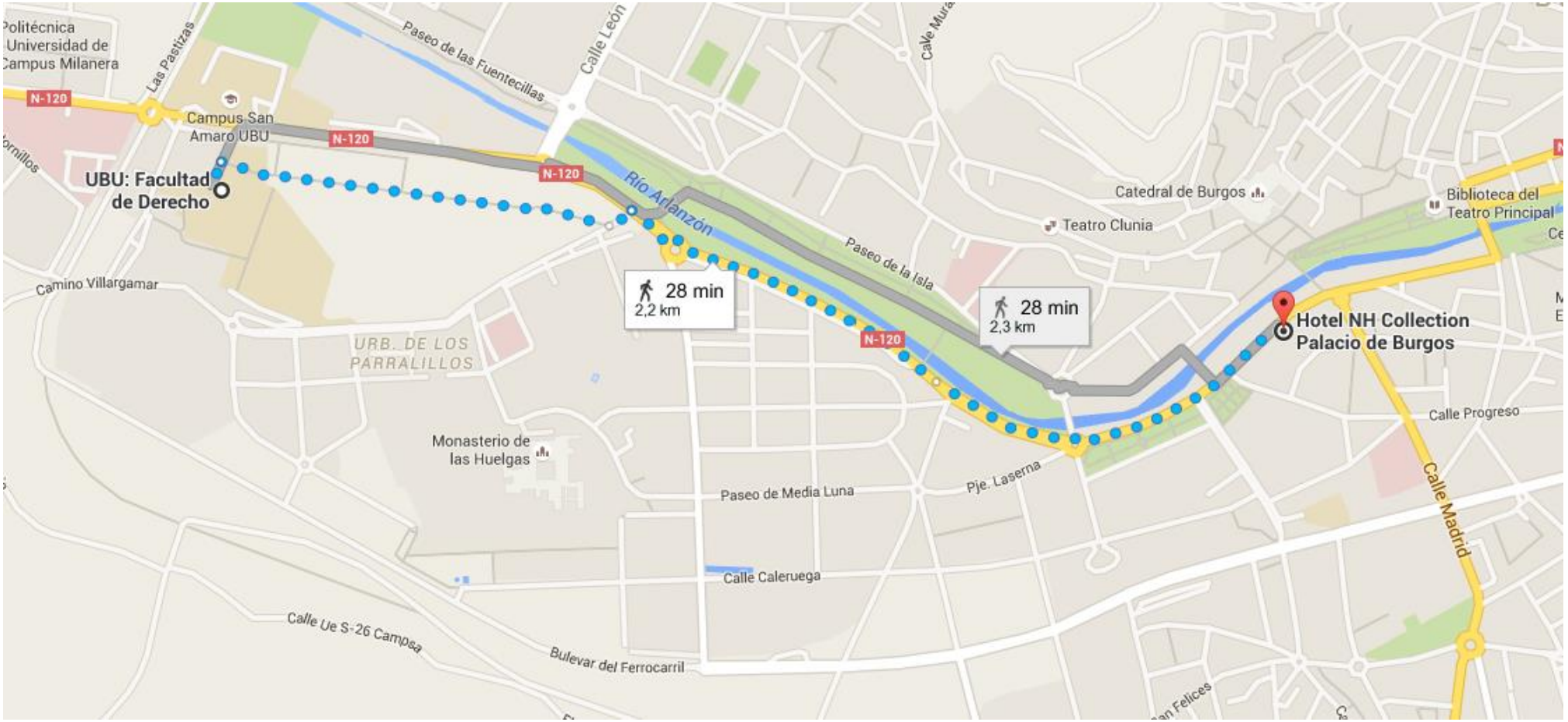
From Hospital del Rey (Headquarters) to City Center → Walking



From Hospital del Rey (Headquarters) to Hotel NH Collection (Closing Dinner) → Public buses (lines 5, 7 and 39)



From Hospital del Rey (Headquarters) to Hotel NH Collection (Closing Dinner) → Walking



	Tuesday May 24th	**Wednesday May 25th**	**Thursday May 26th**	**Friday May 27th**
Morning	Companions: **Free Time** (shopping, etc.)	Companions: **Free Time** (shopping, etc.)	**9h30 – 12h50** Trip (only for the companions) ***The Abbey of "Santa María la Real de Las Huelgas" and Saint Peter of Cardeña Abbey***	**9h00 – 19h30** **Post-congress trip** ***"From Middle Ages to the Spanish 17th century: The medieval village of Covarrubias, Santo Domingo de Silos Abbey, and the Ducal Village of Lerma"*** (Optional)
Afternoon	**15h30 – 20h00** **Technical–Cultural trip** ***"A general view from Prehistory to the Castilian Middle Ages: the Human Evolution Museum, the Burgos Cathedral and the Miraflores Charterhouse"***	**18h00–18h45** Oral dissertations: ***"Burgos and its Heritage"*** and ***"University of Burgos"*** **19h15–20h30** ***Welcome reception to the city*** hosted by Mayor of the City of Burgos	**21h00** ***Closing Dinner*** **at NH Collection "Palacio de Burgos"**	

Tuesday, May 24th

A general view from Prehistory to the Castilian Middle Ages: the Human Evolution Museum, the Burgos Cathedral and the Miraflores Charterhouse

For Delegates (full inscriptions, not student inscriptions) and Companions

15:30 Departure from the congress headquarters (Hospital del Rey)

In the trip several places of Burgos city will be visited:

THE HUMAN EVOLUTION MUSEUM

The *Human Evolution Museum*, MEH, is the centerpiece of the Human Evolution group of buildings designed by architect Juan Navarro Baldeweg. **The building has received over 40 national and international architectural awards.** Since its opening in July 2010 is the most visited museum in Castile and Leon, and one of the most visited in Spain.

The project is linked to the need to **preserve, inventory and disseminate the remains from the Archaeological Site of Atapuerca (World Heritage Site since 2000)**. The museum constitutes an international reference in relation to the evolutionary process of human in his ecological, biological and cultural aspects under a chronological sequence. In addition, the interior landscaping project recreates the scenery of the Atapuerca Mountains.

The Museum is organised on four floors:

Floor -1 is conceived as the heart of the museum, forming a single exhibition space where is located the archaeological and paleontological remains from the Archaeological Site of Atapuerca. The visitor can find a reproduction of the '*Sima de los Huesos*' (the pit of bones), as a three-dimensional teaching model. Inside the first room is located the '*Homo Antecesor*' and the archeological sites of '*Gran Dolina*' and '*Sima del Elefante*' (the pit of elephant).

Ground Floor is devoted to the Evolution Theory of Charles Darwin and the history of human evolution. On this floor we will find ten hyperrealistic reproductions of human ancestors by the French sculptor Elisabeth Daynès. Besides, it can be found a reproduction of the stern of the HMS Beagle, the ship in which Charles Darwin developed his famous voyage of almost five years around the world.

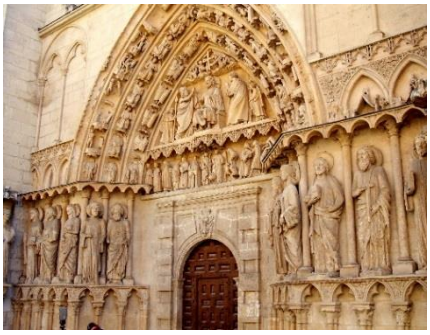
Meanwhile, the floor +1 reviews the different milestones in the evolution of culture, and on the floor +2 the three main ecosystems of human evolution are recreated: the jungle, savannah and tundra-steppe of the last glaciation.

THE BURGOS CATHEDRAL (World Heritage Site since 1984)

The Burgos Cathedral is one of the most beautiful Gothic monuments. It was declared World Heritage Site by UNESCO in 1984. Previously, it had been declared National Monument in 1885.

Its construction was initiated in 1221 by King Ferdinand III of Castile and Mauricio, the English-born Bishop of Burgos. It was consecrated in 1260. It underwent important modifications in the 15th and 16th centuries: the construction of the spires of the principal façade, the Chapel of the Constable and the cimborio of the transept, these elements of advanced Gothic give the cathedral its distinguished profile. The last works of importance (the sacristy and the Chapel of Saint Thecla) occurred during the 18th century, period in which the Gothic statuary of the door of the principal façade was also transformed.





The design of the principal façade is related to the French gothic style of the great cathedrals of Paris or Reims, meanwhile the interior elevation is similar to the cathedral of Bourges. The main façade of the cathedral consists of three stories topped by two lateral towers on square plans terminating in octagonal spires covered with open stonework traceries. These spires, of German influence, were built by the master builder Juan de Colonia.

The South side's Sarmental façade, the North side's Coronería façade (with the Golden stairs from Renaissance by Diego de Siloé), both of them from the 13th century, and the East side's Pellejería façade, with Renaissance–Plateresque influences of the 16th century, are also outstanding.



Although the style of the cathedral is Gothic, it has in its interior several Renaissance and Baroque decorations. The architectural, sculptural and pictorial treasures, masterpieces of extraordinary artists, are numerous. Between others, it should be highlighted:

- The Gothic - Plateresque dome, cimborio of the transept, was raised first by Juan de Colonia in the 15th century and rebuilt by Juan de Vallejo in the 16th, following plans by Juan de Langres.
- The Chapel of the Constable, with Elizabethan Gothic style, by the Colonia family (Juan, Simón and Francisco), and the sculptors Diego de Siloé and Felipe Bigarny.

- The Spanish-Flamenco Gothic altarpiece, by Gil de Siloé, in the chapel of Santa Ana.
- The numerous Gothic and Renaissance tombs.
- The devotional statue of the *Santísimo Cristo* of Burgos.
- The tomb of the *Cid* and his wife *Doña Jimena*.
- The Papamoscas (Flycatcher), an articulated statue which opens its mouth upon the sounding of the bells every hour.


MIRAFLORES CHARTERHOUSE (Heritage of Cultural Interest, 1923)

The Miraflores Charterhouse (in Spanish, Cartuja de Miraflores) dates from 1442 when King John II of Castile gave a palace (built in 1401 for Henry III of Castile) to the Carthusian Order in order to make into a monastery. In 1452 the palace was damaged by fire and its reconstruction started in 1454 under the direction of the architects John and Simon de Colonia. The restoration was finished in 1484 during the reign of Isabella I of Castile (Isabella the Catholic).

For centuries it was a summer residence of the Spanish monarchy and is one of the most important Gothic buildings of Spain. It should be highlighted the church, with the main façade built in Elizabethan Gothic style and decorated with the blazons of its founders. The temple consists on a single nave with lierne vaults, lateral chapels and a polygonal apse.

Between others works, it should be referred: the main altarpiece by Gil de Siloé, polychromed and gold-colored by Diego de la Cruz. The mausoleum of King John II of Castile and his wife, Isabella of Portugal, and the funeral monument of Alfonso, son of John II and brother of Isabella I of Castile, both works in alabaster by Gil de Siloé. Finally, in addition to the Gothic and Renaissance choir stalls, it is neccesary to highlight an Annunciation by Pedro Berruguete.


20:00 Arriving to the congress headquarters (Hospital del Rey)

Wednesday, May 25th
Welcome reception to the city hosted by Mayor of Burgos
For Delegates (full inscriptions), Students and Companions

On Wednesday, May 25th, 2106, from 19:15h, it is going to be carried out a **welcome reception sponsored by the City of Burgos Town Hall** and **hosted by its Mayor**. This event will consist on a **welcome to the congress participants to the city of Burgos** by the highest political authority of the city.

The social event will take place in the **Main Theatre of Burgos**, which is full equipped for this kind of events and has sufficient capacity to accommodate the large number of participants of REHABEND 2016.

The construction of this great building began in 1843 by the architect Bernardino Martínez de Velasco, under the direction of Francisco de Angoitia, and was opened in 1858. The building had a rectangular plan and its main façade, open to the San Pablo square, and the lateral ones, to the Arlanzón riverside and to the *Espolón*, have arch-shaped openings in the two stories below. The inner perimetral galleries constitute an interesting architectural solution which contribute to harmonize the interior atmosphere.

From its inauguration to 1956 it hosted many concerts and shows. In the same building was the socalled *Salón de Recreo* which still preserves all of its splendor.

After the refurbishment in 1997, developed under the direction of the architect José María Pérez González, *Peridis*, the building has recovered a wide activity of dance, theatre and music. It depends on the Municipal Institute of Culture of the City of Burgos. In addition, the Symphonic Orchestra of the City of Burgos usually offers concerts.

In the same building there is a library, an exhibition hall and a conference room (the *Sala Polisón*).

Thursday, May 26th: The Abbeys of *Santa María la Real de Las Huelgas & San Pedro de Cardeña*

Only Companions

09:30 Departure from the city center

10:00 Visit to the ABEY OF *SANTA MARÍA LA REAL DE LAS HUELGAS* (Heritage of Cultural Interest belonging to Spanish heritage organization *Patrimonio Nacional,* 1931)

The Abbey of *Santa María la Real de Las Huelgas* is a monastery of Cistercian nuns. The abbey was founded in 1187 by King Alfonso VIII of Castile. But it was his wife, Eleanor of England, daughter of Henry II of England and Eleanor of Aquitaine, who most firmly pushed to get this foundation in order to enable women to achieve the same levels of command and responsibility than men, at least within the monastic life. The abbess of Las Huelgas had so high autonomy and power that only depended on the pope and was above the episcopal curia. However, all the privileges remained intact through the centuries until the 19th when they were abolished by Pope Pius IX.

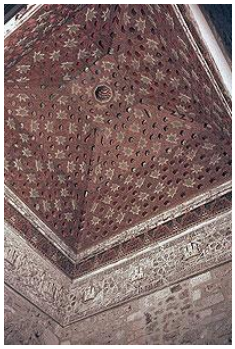
Historically, the monastery has been the site of many weddings of royal families, both foreign and Spanish, including that of Edward I of England to Eleanor of Castile in 1254, for example. The defensive tower of the Abbey is also the birthplace of King Peter I of Castile.


The building complex, with aspect of a fortress, is spacious. Several constructions (traditional houses of the servants and the priests, houses for the administration and school) were added over the centuries. The whole area was enclosed for fortified walls and two doors are still preserved. The oldest part is the Romanesque cloister known as the *Claustrillas*. Subsequently in time, it was built a Cistercian church and a Gothic cloister (in Spanish, the *claustro de San Fernando*) with Mudejar plasterwork vaults.


During the Middle Ages in the abbey were developed important ceremonies of crowning kings and knighting. Among the knights, before becoming kings, it should be referred Ferdinand III of Castile (Fernando III el Santo), Edward I of England, Alfonso XI of Castile and Leon, Pedro I of Castile and Juan II. The kings who were crowned in the abbey were Alfonso XI and his son Henry II of Trastamara. The abbey also had great importance as nobility and royal pantheon,

with magnificent tombs.





Las Huelgas stockpiles materials of great value, including some of the oldest stained glass in Spain. The monastery houses the *Museo de Ricas Telas*, a showcase of medieval textiles taken from the many royal tombs in the convent. Also on display is the tapestry that covered the tent of the Almohad Caliph Al Nasir during the Battle of *Las Navas de Tolosa* in 1212. Finally, it is necessary to highlight that the abbey preserves a 14th-century music manuscript, the Codex Las Huelgas. It contains monophonic and polyphonic music which is assumed to had been performed by the nuns. It is one of the most important polyphonic resources of the *Ars Antiqua* of Europe.

11:00 Journey to San Pedro de Cardeña Abbey

11:15 Visit to *SAN PEDRO DE CARDEÑA* ABBEY (Heritage of Cultural Interest 1931)

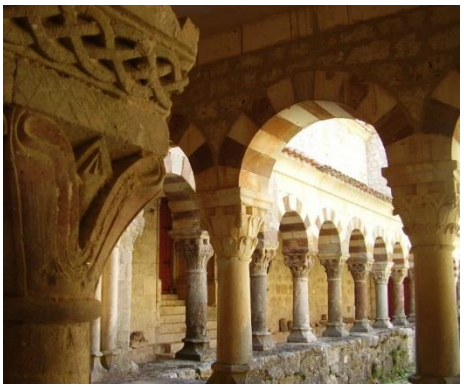
San Pedro de Cardeña Abbey is located in Castrillo del Val, 10 km from Burgos downtown. It was declared Heritage of Cultural Interest belonging to the National Artistic Treasure in 1931.

According to documentary resources, the abbey was founded before 902. Its construction has undergone numerous refurbishments, coexisting various styles. It should be highlighted the following architectonic elements: the robust Romanesque bell tower; the cloister of the Martyrs, where the monks, known as the "Martyrs of Cardeña", were buried; its originally Romanesque church with three naves, subsequently rebuilt in the 16th century and its annexed Chapel of *the Cid* where this historical celebrity was buried (nowadays his mortal remains rests in the Burgos Cathedral).

It is also noteworthy that the abbey preserves the oldest Romanesque cellar in Spain currently in commercial use.

The prosperity of the monastery in the late Middle Ages is reflected in the quality of its scriptorium where extraordinary works were performed. Amongst these is "*El Beato de San Pedro de Cardeña*" developed between 1175 and 1180, with 290 pages and 51 polychrome miniatures, whose pages can be found in museums like the National Archaeological Museum of

Madrid and the Metropolitan Museum of Art of New York.


12:00 Cofee-break

12:30 Return to Burgos

12:50 Arriving to Burgos

Thursday, May 26th
Closing Dinner at NH Collection "Palacio de Burgos"
For Delegates (full inscriptions, not student inscriptions) and Companions

The closing dinner is going to be developed at 21:00h in the masterful 16th-century cloister of the NH Collection Hotel "*Palacio de Burgos*". This building, previously known as *Palacio de la Merced*, is located in Burgos downtown, close to the Arlanzón riverside and a few minutes on foot of the Burgos Cathedral.

The **building, protected by UNESCO**, is a **magnificient Gothic construction** erected in **16th and 17th centuries**.

The **restaurant** of the hotel has been qualificated as **one of the best of the city of Burgos** by the renowned *Guía Repsol*. Its cuisine is based on the traditional regional gastronomy using ingredients of the best quality.

Friday, May 27th: Post-congress trip (Optional)
From Middle Ages to the Spanish 17th century: The medieval village of Covarrubias, Santo Domingo de Silos Abbey, and the Ducal Village of Lerma

9:00 Departure from Burgos to Covarrubias

9:45h Visit to the VILLAGE OF COVARRUBIAS (Heritage of Cultural Interest as a whole, 1965)

Numerous cultures – Paleolithic, Celtiberian, Roman, etc. – settle down on the fertile valley in which Covarrubias is located. From all of these cultures it has been found remains. The first known settlers were the *Turmódigos*, a pre-Roman Iberian tribe extended over most part of the region of Burgos, but the origin of this village is medieval. It was founded in 17th century by the Visigoth King *Chindasvinto* over the remains of a Roman fort. The former fortified walls outlasted until around 737.



After the Visigoths, the village was invaded by the Muslims. Then, Fernán González, the 1st Count of Castile, joined the Castilian territories. In the 10th century the referred Count and his son, García Fernández, convert Covarrubias into the seat of government of the Covarrubias Appanage (in Spanish, the *Infantado de Covarrubias*) and one of the most importants monastic states. Its territory covered most part of the current regions of Burgos, Cantabria, Álava, La Rioja and Palencia. For all of the referred comments Covarrubias is known as "La cuna de Castilla" (the Castila birthplace).

Thousand of stories could be told about the history of the village and its historical significance, but, undoubtedly, the best way for savouring the history, the art and the legend of the village is walking along its tortuous streets.



In addition to well-preserved urbanism, the village stands out for treasuring a wide range of monuments, among others: the Tower of Fernán González (the only Spanish fortress remains prior to the 11th century), its fortified walls, the collegiate church of St. Cosme and St. Damian, the parish church of St. Thomas, the main door of the Archive of *Adelantamiento de Castilla*,

the house of *Doña Sancha*, the Bishop's house and the palace of Fernán González.

11:15h Visit family winery with a wine tasting

12:30h Visit to SANTO DOMINGO DE SILOS ABBEY (Heritage of Cultural Interest)
In this town it is internationally known the Santo Domingo de Silos Abbey. Some researchers have suggested that this Benedictine abbey is linked to the history of the *Cid*, because Rodrigo Diaz de Vivar (the *Cid*) and his wife *Doña Jimena* donated some of their lands to the monastery in 1081, year in which the *Cid* was banished.



As early as the Visigoths period there was a monastery dedicated to St. Sebastian, which was refurbished and expanded by Count Fernan Gonzalez. Around 1042 the building underwent another deep refurbishment under the initiative of a monk of La Rioja named Domingo. This monk, Prior of *San Millán de la Cogolla* Abbey, took refuge in Castile while escaped from the king of Navarra. Domingo promoted the religious community, commissioned by King Ferdinand I, undertaking a magnificent Romanesque building, which only the cloisters and the Door of the Virgins (in Spanish, the *Puerta de las Vírgenes*) are preserved. The rest of the building dates from the 18th and 19th centuries, basically in Neoclassical style, involving to, among others, the Master Ventura Rodríguez.

The capitals (topmost member of the columns) of the cloister are magnificent. In them, a vast iconography was developed with outstanding examples clearly rooted in Andalusian art.

Among the monastic spaces, there is also a 18th-century pharmacy, with a beautiful collection of Spanish pottery, and a museum, where are exposed: Mozarabic and Romanesque sculptures, remains of the old abbey, metalwork, porcelain enamels, etc.

The abbey is also famous because the monks are one of the best exponents of Gregorian chant.


14:15 Lunch

16:30h Journey to Lerma

17:00h Visit to the DUCAL VILLAGE OF LERMA (Heritage of Cultural Interest as a whole, 1965)

The history and urban development of the village is linked to the sponsorship of *Francisco de Sandoval y Rojas*, 1st Duke of Lerma and favorite of King Philip III.

The village is well known as the main example of Herrerian architecture in Spain.

The Ducal Village is also famous for having three convents that house more than one hundred

of nuns of three religious orders: The Carmelites, the Dominicans and the Clarisses (*Iesu Communio*).


The Main Square (in Spanish, *Plaza Mayor*), with 6,862 square meters, is one of the largest in Spain. Within the civil architecture it should be hihglighted the Ducal Palace of Lerma, the Prison Door and the fortified walls.


From a religious architecture point of view, it should be referred the collegiate church of St. Peter (it is very interesting to contemplate the tomb of Bishop *Don Cristobal de Rojas y Sandoval*), the convent of St. Blaise, the Convent of St. Teresa, the monastery of the Ascension of Christ, the monastery of the Virgin (in Spanish, the monstery of *Madre de Dios*), and the convent of St. Francis *Regis* (in Spanish, the convent of *San Francisco de los Reyes*).



19:30h Arriving to Burgos

Price: 80€ per person

It is required a minimun of 20 people to carry out post-congress trip.

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