

CATALOGUE  
CATÁLOGO

INTERNATIONAL ITINERANT EXHIBITION  
EXPOSICIÓN ITINERANTE INTERNACIONAL

**RESEARCH in BUILDING ENGINEERING**  
**INVESTIGANDO en INGENIERÍA de EDIFICACIÓN**

**EXCO'19**



UNIVERSITAT  
POLITÈCNICA  
DE VALÈNCIA

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA DE EDIFICACIÓN

**CATALOGUE**  
**INTERNATIONAL ITINERANT EXHIBITION**  
**RESEARCH in BUILDING ENGINEERING**  
**EXCO'19**

*CATÁLOGO*

*de la*

***EXPOSICIÓN ITINERANTE INTERNACIONAL***

***INVESTIGANDO***

***en INGENIERÍA de EDIFICACIÓN EXCO'19***

**UNIVERSITAT POLITÈCNICA DE VALÈNCIA**

**ETS de INGENIERÍA de EDIFICACIÓN**

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**PUBLISHER**    **Editorial:**

edita.me

**MAKING**    **Maquetación:**

ALBIOL IBÁÑEZ, José Ramón  
MARTÍNEZ BENLLOCH, José Javier

Universitat Politècnica de València  
BYPRINT PERCOM, S.L.

**INTERNATIONAL CURATOR**    **Comisario Internacional**

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**ACKNOWLEDGMENTS**    **Agradecimientos:**



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ISBN 978-84-17098-82-7

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*According to the temporary order of the itinerances:*

**LOCAL CURATORS:**

**VALENCIA (Spain)**

**CEVISAMA – Feria Valencia**

from January 30<sup>th</sup> to February 1<sup>st</sup> 2019

Avinguda de les Fires, s/n, 46035 València - SPAIN

Curator:

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Universitat Politècnica de València

**BEIJING (China)**

**BEIJING YONG SHAN MEDIA CO., LTD, PEKIN**

From 21<sup>th</sup> to 30<sup>th</sup> March, 2019

Building 47, North District. No.2 Yuquan road, Haidian District, Beijing 100143

Curators:

Zhang LING

Beijing Yong Shan Media Co., Ltd, Pekin

ALBIOL IBÁÑEZ, José Ramón

Universitat Politècnica de València

**GLIWICE (Poland)**

**Silesian University of Technology**

From April 26<sup>th</sup> to May 10<sup>th</sup>, 2019.

Akademicka 5, 44-100 Gliwice, Poland

Curators:

DAWCZYŃSKI, Szymon

Silesian University of Technology, Gliwice

GÓRSKI, Marcin

Silesian University of Technology, Gliwice

ALBIOL IBÁÑEZ, José Ramón

Universitat Politècnica de València

**MILAN (Italy)**

**POLITECNICO DI MILANO**

**Scuola di Architettura Urbanistica Ingegneria delle Costruzioni AUIC**

From April 29<sup>th</sup> to May 7<sup>th</sup>, 2019

Via Andrea Maria Ampère, 2, 20133 Milano MI, Italia

Curators:

POLI, Tiziana

Politecnico di Milano

RE CECCONI, Fulvio

Politecnico di Milano

ALBIOL IBÁÑEZ, José Ramón

Universitat Politècnica de València

**SALERNO (Italy)**

**UNIVERSITÀ DEGLI STUDI DI SALERNO**

**Dipartimento di Ingegneria Civile- UNISA**

From 6<sup>th</sup> to 13<sup>th</sup> June, 2019

Via Giovanni Paolo II, 132 - 84084 Fisciano (SA)

Curators:

DI RUOCCO, Giacomo

SICIGNANO, Enrico

ALBIOL IBÁÑEZ, José Ramón

Università degli Studi di Salerno

Università degli Studi di Salerno

Universitat Politècnica de València

**ISTANBUL (Turkey)**

**MIMAR SINAN FINE ARTS UNIVERSITY**

From 2<sup>th</sup> to 9<sup>th</sup> July, 2019

Pürtelaş Hasan Efendi, Meclis-i Mebusan Cd. No:24, 34427

Beyoğlu/İstanbul, Turquia

Curators:

HATTAP, Sibel Onat

ALBIOL IBÁÑEZ, José Ramón

Mimar Sinan Fine Arts University

Universitat Politècnica de València

**ODESSA (Ukraine)**

**ODESSA STATE ACADEMY OF CIVIL ENGINEERING  
AND ARCHITECTURE**

From 24<sup>th</sup> September to 1<sup>st</sup> November, 2019

Didrikhdona St, 4, Odesa, Odessa Oblast, Ukraine, 65000

Curators:

EKSAROVA, Nadia

EKSAREV, Vladimir

ALBIOL IBÁÑEZ, José Ramón

Odessa State Academy of Civil Engineering &  
Architecture

Odessa State Academy of Civil Engineering &  
Architecture

Universitat Politècnica de València

**MATERA (Italy)**

**Ex Ospedale di San Rocco – Chiesa di Cristo Flagellato**

From 22<sup>th</sup> to 29<sup>th</sup> October, 2019

Piazza San Giovanni Battista, Matera

Curators:

GUIDA, Antonella

ANDRISANI, Giuseppe

BERNARDO, Graziella

ALBIOL IBÁÑEZ, José Ramón

Università degli Studi della Basilicata

Università degli Studi della Basilicata

Università degli Studi della Basilicata

Universitat Politècnica de València

**VILNIUS (Lithuania)**

**VILNIUS GEDIMINAS TECHNICAL UNIVERSITY**

From 5<sup>th</sup> to 14<sup>th</sup> November, 2019  
Saulėtekio al. 11, Vilnius 10221, Lithuania

Curators:

ŠLIOGERIENĖ, Jūratė  
VILUTIENĖ, Tatjana  
ALBIOL IBÁÑEZ, José Ramón

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Vilnius Gediminas Technical University  
Universitat Politècnica de València

**OLDENBURG (Germany)**

**JADE HOCHSCHULE University of Applied Sciences**

From 7<sup>th</sup> to 12<sup>th</sup> November, 2019  
Friedrich-Paffrath-Straße 101, 26389 Wilhelmshaven

Curators:

PRIESEMANN, Thomas  
ALBIOL IBÁÑEZ, José Ramón

University Jade Hochschule  
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## **INTERNATIONAL SCIENTIFIC COMMITTEE EXCO'19**

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--------------------	--

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Rafał KRZYWON	Silesian University of Technology, Gliwice

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Sibel Onat HATTAP

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## **PRÓLOGO DIRECTOR ETS de INGENIERÍA de EDIFICACIÓN**

Finalizado el Salón Tecnológico de la Construcción -Exco 2019- y al analizar los resultados del mismo, podemos concluir que, una vez más, hemos superado con creces los objetivos marcados.

Por lo que respecta a la "Exposición de Tecnología e Investigación en Edificación", su comité científico internacional, seleccionó un total de 117 paneles y 55 artículos, por lo que nadie pone en duda de que estamos ante un certamen que es referente para los investigadores del sector de la edificación, tanto nacionales como de otros países. Una de nuestras principales aspiraciones ha sido su internacionalización y que todas las 37 universidades participantes pudieran mostrar sus investigaciones en la exposición, por lo que, a lo largo de este año, será itinerante por diversas universidades participantes.

Asimismo quiero resaltar la calidad de las conferencias impartidas, el alto nivel de los conferenciantes y el interés de las actividades desarrolladas.

Por último, quiero transmitir, en nombre de la Escuela Técnica Superior de Ingeniería de Edificación de la Universitat Politècnica de València el agradecimiento a CEVISAMA por el apoyo a este evento, al profesor José Ramón Albiol Ibáñez, director de Exco 2019 y a todo su equipo que, con su trabajo y dedicación, lo han hecho posible.

¡¡Exco 2020 nos espera!!

Dr. Francisco Javier Medina Ramón  
Director de la Escuela Técnica Superior de Ingeniería de Edificación

## ***PROLOGUE DIRECTOR ETS of BUILDING ENGINEERING***

*After finishing the Technological Fair of Construction-Exco 2019- and analyzing the results of it, we can conclude that, once again, we have far exceeded the objectives set.*

*With regard to the "Exhibition of Technology and Research in Building", its international scientific committee, selected a total of 117 panels and 55 articles, so no one doubts we are facing a contest that is a reference for researchers in the building sector, both national and other countries. One of our main aspirations has been its internationalization and that all 37 participating universities could show their research in the exhibition, so, throughout this year, it will be traveling by several participating universities.*

*I also want to highlight the quality of the lectures given, the high level of the speakers and the interest of the activities developed.*

*Finally, I would like to convey, on behalf of the Technical School of Building Engineering of the Universitat Politècnica de València, the thanks to CEVISAMA for the support of this event, to Professor José Ramón Albiol Ibáñez, director of Exco 2019 and to all his team, with their work and dedication, they have made it possible.*

*Exco 2020 awaits us !!*

*Dr. Francisco Javier Medina Ramón  
Director ETS of Building Engineering*

## PROLOGUE DIRECTOR EXCO'19

*Once completed The XXXIII CONSTRUCTION TECHNOLOGY EXHIBIT - EXCO'19 within the activities planned in the International Salon CEVISAMA, organized by the ETS of Building Engineering; I am writing to all of you Professors, Director, Management Team, Administration and Services Personnel, Scientific Committee, Organizing Committee, Speakers, Participants, Delegation of Students and Students for the excellent collaboration in EXCO'19.*

*I wish to convey my sincere thanks to all of you who make possible EXCO, projecting in an international event such as CEVISAMA, the technological and human greatness of our Faculty.*

*In this edition the exhibition has been presented by various European and Asian Universities throughout the year 2019, so it will have an international character. In chronological order, exhibitions have been held at the **Beijing Yong Shan Media Co., Ltd. Pekin (China)**, **Silesian University of Technology (Poland)**, **Politecnico di Milano (Italy)**, **Università degli studi di Salerno (Italy)**, **Mimar Sinan Fine Arts University (Istanbul)**, **Odessa State Academy of Civil Engineering and Architecture (Ukraine)**, **Università degli studi della Basilicata Matera (Italy)**, **Vilnius Gediminas Technical University VGTU (Lithuania)**, **Jade hochschule Wilhelmshaven Oldenburg (Germany)**. This is a wonderful experience for all. Thank you for all the effort and dedication they have used to make this exhibition possible.*

*Thank you all for making EXCO possible.*

*All the best for EXCO'19!*

*Best Regards*

**Dr. José R. Albiol-Ibáñez**

*Vice Dean International Relations, Exchange Programs, Communication & Entrepreneurship.*

*Director EXCO'19*

*ETS Building Engineers - Building 1B*

*Camino de Vera S/N 46022 Valencia SPAIN*

*UNIVERSITAT POLITÈCNICA DE VALÈNCIA*

## PROLOGUE DIRECTOR EXCO'19

*Thank you for all the effort and dedication they have realized to make this Catalogue book possible.*

*I want to thank the excellent participation of the collaborating Universities:*

1. *Universitat Politècnica de València, España.*
2. *Nottingham Business School, England.*
3. *Vilnius Gediminas Technical University, Vilnius, Lithuania.*
4. *Universidad de Costa Rica*
5. *Università degli Studi di Basilicata, Matera, Italia.*
6. *Universidad Tecnológica de La Habana José Antonio Echeverría, Cuba.*
7. *Università degli Studi Firenze, Italia*
8. *Università di Pavia, Italia.*
9. *Odessa State Academy of Civil Engineering & Architecture, Odessa, Ukraine*
10. *Politecnico di Milano, Italia.*
11. *Università di Salerno, Italia.*
12. *Silesian University of Technology, Politechnika Śląska, Gliwice, Poland.*
13. *University of British Columbia, Vancouver, Canada.*
14. *Universidad de Alcalá de Henares, Madrid, España.*
15. *Florida A&M University, Florida, USA.*
16. *Mimar Sinan Fines Arts University, Istanbul, Turkey.*
17. *Universidad Mayor de San Andrés, La Paz, Bolivia.*
18. *Universidad de la República (Udelar) de Uruguay.*
19. *Universidad John F. Kennedy, Argentina.*
20. *Universidad de Castilla-La Mancha, España.*
21. *Universidad de Granada, España.*
22. *Università degli Studi della Campania "Luigi Vanvitelli", Napoli.*
23. *Politecnico di Bari, Italia.*
24. *Università degli Studi di Roma "Tor Vergata", Italia.*
25. *Hanze University of Applied Sciences, Groningen. Nederland.*
26. *Jade Hochschule Wilhelmshaven/Oldenburg, Germany.*
27. *New York University, Tandon School of Engineering. USA.*
28. *McGill University, Canada*
29. *Nanyang Technological University, Singapore.*
30. *University of New South Wales, Sydney, Australia.*
31. *Università di Pisa, Italia.*
32. *Universidad de Ibagué, Colombia.*
33. *Beijing Yong Shan Media Co., Ltd. Pekin*
34. *Università degli Studi dell'Aquila, Italia.*
35. *Universitat Jaume I, Castellón, España.*
36. *University of Applied Sciences and Arts of Southern Switzerland*
37. *Institut für Bau- und Infrastrukturmanagement /ETH Zürich*

*Thank you all for making EXCO possible. All the best for EXCO'20!*

*Best Regards*

*Dr. José R. Albiol-Ibáñez  
Vice Dean International Relations, Exchange Programs, Communication & Entrepreneurship.  
Director EXCO'19  
ETS Building Engineers - Building 1B  
Camino de Vera S/N 46022 Valencia SPAIN  
UNIVERSITAT POLITÈCNICA DE VALÈNCIA*

## 北京開幕

在北京的第一年榮幸地主辦了國際展覽會 EXCO 2019 "建築工程研究"。在我公司的主廳裡可以看到張貼著建築，建築，城市規劃，環境保護，經濟學，文化遺產甚至神經工程等領域的科學作品的海報。如此廣泛的演講主題引起了大學的學生和員工對展覽的極大興趣。在這一點上，應該強調的是，如果沒有巨大的個人承諾來籌備何塞·拉蒙·阿爾比奧爾·伊巴涅斯博士和他的整個團隊，來自瓦萊尼亞大學的波哥大理工大學的原EXCO 2019 José Ramón Albiol Ibáñez 展覽就不可能實現。將戰車交給 Rodolfo Navarro 先生的合作。

Mr. Zhang Ling

## PROLOGUE BEIJING

The first year in Beijing had the honour to host the international exhibition EXCO 2019 'Research in Construction Engineering'. Posters presenting scientific works in such fields as construction, architecture, urban planning, environmental protection, economics, cultural heritage and even neural engineering could be seen in my company main hall. Such a wide spectrum of presented topics resulted in a very high interest of professionals visiting the exhibition. At this point, it should be emphasized that this enormous success would not have been possible without a huge, personal commitment to the preparation of the original EXCO 2019 exhibition by Dr. José Ramón Albiol Ibáñez and his entire team from the Universitat Politècnica de València. Give the Tanks to Mr. Rodolfo Navarro for his collaboration.

Mr. Zhang Ling

## WSTĘP GLIWICE

Wydział Budownictwa Politechniki Śląskiej w Gliwicach już trzeci rok z rzędu miał zaszczyt gościć w swoich murach międzynarodową wystawę EXCO 2019 „Badania w Inżynierii Budowlanej”. W dniach od 26 kwietnia do 10 maja 2019 roku w holu głównym budynku Wydziału można było oglądać postery przedstawiające prace naukowe z takich dziedzin jak budownictwo, architektura, urbanistyka, ochrona środowiska, ekonomia, dziedzictwo kulturowe czy nawet inżynieria neuronowa. Tak szerokie spektrum prezentowanych tematów wpłynęło na bardzo duże zainteresowanie studentów i pracowników Uczelni odwiedzających wystawę. W tym miejscu należy podkreślić, że tego olbrzymiego sukcesu nie byłoby bez ogromnego, osobistego zaangażowania w przygotowanie oryginalnej wystawy EXCO 2019 dra inż. José Ramóna Albiola Ibáñeza oraz całego Jego zespołu z Politechniki w Walencji. A fakt, że z roku na rok wystawa poszerza grono swoich odbiorców, goszcząc w nowych krajach i na nowych uczelniach partnerskich, świadczy o potrzebie organizacji takich wydarzeń, które oprócz celów czysto naukowych mają również za zadanie integrację międzynarodowego środowiska naukowego.

Dr. Szymon DAWCZYŃSKI

## PROLOGUE GLIWICE

*The Faculty of Civil Engineering at the Silesian University of Technology (Gliwice, Poland) for the third year in a row had the honour to host the international exhibition EXCO 2019 'Research in Construction Engineering'. From April 26 to May 10, 2019, posters presenting scientific works in such fields as construction, architecture, urban planning, environmental protection, economics, cultural heritage and even neural engineering could be seen in the Faculty's main hall. Such a wide spectrum of presented topics resulted in a very high interest of students and employees of the University visiting the exhibition. At this point, it should be emphasized that this enormous success would not have been possible without a huge, personal commitment to the preparation of the original EXCO 2019 exhibition by Dr. José Ramón Albiol Ibáñez and his entire team from the Universitat Politècnica de València. And the fact that from year to year the exhibition expands its audience by visiting new countries and new partner universities shows the need to organize such events, which in addition to purely scientific purposes are also intended to integrate the international scientific community.*

Dr. Szymon DAWCZYŃSKI

**PROLOGO MILANO****EXCO and Politecnico di Milano  
By Tiziana Poli\* and Fulvio Re Cecconi\*\***

\* AUIC School, ABC Dept, Politecnico di Milano – Head of Building and Construction Engineering BScEng Degree

\*\* AUIC School, ABC Dept, Politecnico di Milano – Vice-Head of Building and Construction Engineering BScEng Degree

Il Politecnico di Milano con il corso di Ingegneria edile e delle costruzioni partecipa a EXCO dal 2017. Questa iniziativa ha segnato il processo di internazionalizzazione del corso di studi che da questa collaborazione ha tratto un notevole impulso di crescita. Il confronto (e la mostra itinerante è sicuramente il principale riferimento del confronto) tra docenti, ricercatori e studenti sui principali temi di innovazione nel settore della costruzioni per la ricerca e la didattica, è sicuramente un valore aggiunto per la definizione di percorsi formativi condivisi e/o complementari, per l'integrazione delle competenze ad una scala sovranazionale e per porre le basi di una ricerca di alto profilo. I temi e gli ambiti di ricerca attualmente esplorati nel corso di studi di Ingegneria edile e delle costruzioni sono principalmente orientati a:

- l'ingegnerizzazione del progetto, per quanto attiene agli aspetti tecnologici (involucro, strutture, impianti meccanici, impianti elettrici, ...), prestazionali (modellazione e validazione delle prestazioni tra le quali il contenimento dei consumi energetici, il comfort, la sicurezza, ...), operativi e cantieristici;
- l'ingegnerizzazione del processo edilizio che, a partire dal progetto, si sviluppa attraverso l'appalto, la costruzione, il collaudo, la gestione, la manutenzione, la dismissione;
- la gestione dei flussi informativi digitali nel processo edilizio (BIM based);
- la progettazione di materiali e di componenti edilizi innovativi e il relativo controllo del processo produttivo;
- l'attività di supporto alla progettazione architettonica e alla direzione dei processi tecnico-amministrativi.

I differenti approcci alla ricerca mostrati dalle sedi che partecipano a EXCO mettono in evidenza la ricchezza e l'innovazione che contraddistinguono oggi il settore delle costruzioni. Ed è un piacere per il corso di studi IEC del Politecnico di Milano fare parte di questa iniziativa ideata da UPV e coordinata dal Prof. José Ramón Albiol Ibáñez.

**PROLOGUE MILAN**

*The Politecnico di Milano has been participating in EXCO since 2017 with the course in Building and Construction Engineering. This project has influenced the internationalization process of the course of study, which has gained considerable boost for growth from this initiative.*

*The exchange of views (and the travelling exhibition is certainly the main point of the exchange) among professors, researchers and students on the main themes of innovation in the construction sector for research and teaching, is undoubtedly an added value for the definition of shared and / or complementary training paths, for the integration of skills on a global scale and to provide the basis for a high-profile research.*

*The topics and research areas currently being explored in the course of studies in Building and Construction Engineering are mainly oriented to:*

- *project engineering, with regard to technological aspects (envelope, structures, mechanical systems, electrical systems, ...), performances (modelling and validation of performances including the reduction of energy consumption, comfort, safety, ...), operational and construction aspects;*
- *the engineering of the building process which, starting from the design, develops through tendering, construction, commissioning, management, maintenance and dismantling;*
- *the management of digital information flows in the building process (BIM based);*
- *the design of innovative building materials and components and the related control of the production process;*
- *the support for architectural design and the management of technical-administrative processes.*

*The different approaches to research that EXCO's participating institutions have shown highlight the richness and innovation that characterise the construction sector today. And it is a privilege for the course in Building and Construction Engineering of the Polytechnic of Milan to be part of this initiative conceived by UPV and coordinated by Prof. José Ramón Albiol Ibáñez.*



## **PROLOGO – EXCO UNISA 2019**

È stato motivo di grande soddisfazione organizzare l'EXCO'19 International Exhibition, nel periodo 6-13 Giugno 2019, presso l'Università degli Studi di Salerno. È stata, infatti, la prima volta che EXCO International Exhibition è transitata presso la nostra università, consentendo a ricercatori, docenti, dottorandi e studenti di conoscere ed apprezzare un interessante, ampio ed innovativo panorama di ricerca nel campo dell'industria delle costruzioni. Ciò è il risultato di proficui rapporti accademici e di ricerca che da alcuni anni l'Università degli Studi di Salerno intrattiene con la UPV di Valencia. L'accordo Erasmus+, siglato nel 2016 dal prof. Giacomo Di Ruocco, ha dato il via a scambi accademici tra le nostre università, offrendoci l'opportunità di conoscere colleghi di elevato spessore scientifico quali i proff.ri Luis Palmero Iglesias, Elena Navarro-Astor, Andrea Salandin. In primis corre l'obbligo di ringraziare il Direttore di EXCO, prof. dr. José Ramón Albiol-Ibáñez, personalità di eccezionale professionalità ed efficienza, il quale ci ha offerto l'opportunità di prendere visione dello stato dell'arte della ricerca condotta da colleghi di varie università, leader internazionali nel campo dell'ingegneria edile, nonché di presentare alcuni prodotti della ricerca del personale accademico (ricercatori, docenti, dottorandi) del Dipartimento di Ingegneria Civile dell'Università di Salerno. A seguito del grande interesse scientifico suscitato dall'evento del giugno scorso, saremmo onorati di ospitare, presso l'Università di Salerno, anche EXCO 2020.

Prof. Enrico Sicignano

Prof. Giacomo Di Ruocco

## **PROLOGUE - EXCO UNISA 2019**

It was a great satisfaction to organize the EXCO'19 International Exhibition, in the period 6-13 June 2019, at the University of Salerno. It was, in fact, the first time that EXCO International Exhibition passed through our university, allowing researchers, lecturers, PhD students and students to know and appreciate an interesting, broad and innovative panorama of research in the field of construction industry. This is the result of fruitful academic and research relations that the University of Salerno has had for some years with the UPV of Valencia. The Erasmus+ agreement, signed in 2016 by Prof. Giacomo Di Ruocco, has given rise to academic exchanges between our universities, giving us the opportunity to meet colleagues of high scientific importance such as the proff.ri Luis Palmero Iglesias, Elena Navarro-Astor, Andrea Salandin. First of all, we must thank the Director of EXCO, Prof. Dr. José Ramón Albiol-Ibáñez, a personality of exceptional professionalism and efficiency, who gave us the opportunity to view the state of the art of research conducted by colleagues from various universities, international leaders in the field of construction engineering, as well as to present some products of the research of academic staff (researchers, lecturers, PhD students) of the Department of Civil Engineering of the University of Salerno. Following the great scientific interest aroused by the event last June, we would be honored to host, at the University of Salerno, also EXCO 2020.

Prof. Enrico Sicignano

Prof. Giacomo Di Ruocco

## PROLOGUE ISTANBUL EXCO'19

Mimar Sinan Güzel Sanatlar Üniversitesi, "Geleneksel Türk Evi" dersi ile 2019 yılı başında Exco'ya katılmıştır. Exco ile uluslararası ortak ortak çalışmalar yapma imkanı doğmuştur. Exco gezici sergisi İstanbul'da Üniversitemize gelerek, akademik camia ve öğrenciler için yapı, inşaat ve mimarlık alanlarında yol gösterici olmuştur. Prof. Jose Ramon Albiol Ibanez tarafından verilen iki konferans çevre, ekonomi, nöral mühendislik, miras, teknoloji, şehir planlaması konularında yenilikçi malzeme, üretim için aydınlatıcı bilgiler verilmiştir. Exco ile gelenekselden geleceğe malzeme ile teknoloji, kullanımı irdelemiş, gelecek için mimari ve inşaat sektöründe yeni umutlar doğmuştur. Mimar Sinan Güzel Sanatlar Üniversitesi, Prof. Jose Ramon Albiol İbañez tarafından koordine edilen bu girişimin bir parçası olmaktan mutluluk duymaktadır.

Dr. Sibel Hattap

## PROLOGUE ISTANBUL EXCO'19

Mimar Sinan Fine Arts University has participated Exco at the beginning of 2019 with the course of "Traditional Turkish House". The opportunity of making international collaborations with Exco has cameup. Exco mobile exhibition came to our University in Istanbul and guided the academic community and students in the fields of construction, building and architecture. The two conferences given by Prof. Jose Ramon Albiol Ibanez in thefields of production, environment, economy,neural technology, engineering, heritage and town planning have provideden lightening information about innovative materialand production. With Exco, theuse of material and technology from the traditional to the future has been explored and new hopes have emerged for the sector of architecture and construction. Mimar Sinan Fine Arts University is pleased to be a part of this initiative coordinated by Prof .Dr. Jose Ramon Albiol Ibañez.

Dr. Sibel Hattap

## ПРОЛОГ ОДЕСА

Масштаб и характер международного архитектурно-строительного форума Cevisama содействует эффективному проведению научных конференций и выставок EXCO под эгидой Инженерно-строительного института Политехнического университета Валенсии. За последние 3 года, благодаря руководству проф. José R. Albiol-Ibáñez, количество участников EXCO увеличилось до 37 университетов разных стран, а выставка приобрела активный передвижной характер.

Одесские исследователи получили возможность продемонстрировать качественные работы, способные дать экономический эффект, сберечь энергоресурсы, подходы и методы сохранения и преемственного развития архитектурно-исторической среды. Традиционно результаты исследований по инновационным строительным технологиям и материалам EXCO2019 также были представлены в Одесской государственной академии строительства и архитектуры и обсуждены на лекциях проф. José R. Albiol-Ibáñez и проф. Luis Palmero Iglesias.

Групповая динамика и синергия университетов, исследователей дополняют интересные идеи каждого из участников, способствуют поиску нестандартных решений. Передвижная выставка EXCO2019 стала одним из масштабных мероприятий научного обмена, образования, которое обеспечивает благоприятные условия для развития международного сотрудничества и плодотворного общения специалистов в сфере архитектурно-строительного инжиниринга.

Проф. Надия Ексарева  
Доц. Владимир Ексарев

## PROLOGUE ODESSA

*The scale and nature of the international forum Cevisama contributes to the effective conduct of scientific conferences and exhibitions of the EXCO under the auspices of the Civil Engineering Institute of the Polytechnic University of Valencia. Over the past 3 years, thanks to the leadership of Dr. José R. Albiol-Ibáñez, the number of participants in the EXCO increased to 37 universities of different countries, and the exhibition acquired an active traveling character.*

*Odessa researchers were given the opportunity to demonstrate high-quality work that can give an economic effect, save energy resources, approaches and methods of preservation and successive development of the architectural and historical environment. Traditionally, the results of research on innovative building technologies and materials EXCO'2019 were also presented at the Odessa State Academy of Civil Engineering and Architecture and discussed at lectures by Dr. José R. Albiol-Ibáñez and Dr. Luis Palmero Iglesias.*

*The group dynamics and synergy of universities and researchers complement the interesting ideas of each of the participants and contribute to the search for innovative solutions. The EXCO'2019 mobile exhibition has become one of the large-scale events of scientific exchange and education, which provides favorable conditions for the development of international cooperation and fruitful communication of specialists in the field of architectural and civil engineering.*

*Dr. Nadia Yeksareva  
Dr. Vladimir Yeksarev*

**PROLOGO MATERA**

“EXCO 2019 Matera” è stato un prestigioso convegno internazionale che ha fatto riflettere i ricercatori provenienti dai cinque continenti sul concetto di riuso del patrimonio architettonico, urbanistico, industriale e sulla conservazione dei beni culturali. Tutto ciò è stato affrontato in una prospettiva interdisciplinare, scientifica e globale. Il congresso ha affrontato questioni metodologiche, tecniche, accademiche o progettuali inerenti la documentazione, la conservazione, il riutilizzo e il recupero del patrimonio architettonico, urbano o paesaggistico. Una delle attività più importanti è stata l’esposizione di lavori di ricerca internazionali presentati sotto forma di Poster che nel 2017 per la prima volta sono stati esibiti come mostra itinerante in diverse Università estere prendendo il via dall’Università della Basilicata e si è spostato poi in altre università. L’Università degli Studi della Basilicata ha organizzato anche quest’anno “EXCO 2019 Matera”, presso la sede della Chiesa di Cristo Flagellato nella città di Matera durante la giornata del 22 Ottobre 2019 con tema “Arte e Scienza”. Molto spesso arte e scienza colgono insieme, quasi all’unisono, lo “spirito dei tempi” e lo rafforzano. La sincronia talvolta è stupefacente, pressoché perfetta. Matera ha ospitato, quindi, per la seconda volta la mostra itinerante internazionale sui materiali e le tecnologie costruttive “Exco Matera 2019” organizzata dal Dicem (il dipartimento delle Culture europee e del Mediterraneo dell’Università della Basilicata). Si è trattato di un evento che si tiene da più di 30 anni a febbraio, a Valencia in concomitanza con la fiera espositiva ‘Cevisama’, una delle più importanti al mondo sui materiali ceramici, vetri e allestimenti e finiture per gli ambienti interni. Evento coordinato dal Direttore “EXCO 2019” Prof. Dr. José Ramón Albiol-Ibáñez e con la partecipazione, per la prima volta in una sede estera, del Magnifico Rettore dell’Universitat Politècnica de València UPV Dr. Francisco José MORA MAS.

Prof. Antonella GUIDA  
 Prof. Graziella BERNARDO  
 Prof. Giuseppe ANDRISANI

**PROLOGUE MATERA**

*"EXCO Matera 2019" was a prestigious international conference that makes researchers from the five continents reflect on the concept of re-use of architectural, urban, industrial and cultural heritage conservation. All of this has been inserted in an interdisciplinary, scientific and global perspective. The congress deals with methodological, technical, academic or planning issues concerning the documentation, conservation, reuse and recovery of architectural, urban or landscape heritage. One of the most important activities was the exhibition of international research works presented in Posters, in 2017 for the first time they were exhibited as a traveling exhibition in various foreign Universities, taking off from the University of Basilicata and then was moved to other universities . Also this year the University of Basilicata organized "EXCO 2019 Matera" at the Church of Cristo Flagellato in the city of Matera during the day of 22 October 2019 with the theme "Art and Science". Very often art and science gather together, almost in unison, the "spirit of the times" and reinforce it. Synchrony is sometimes amazing, almost perfect. Matera hosted, for the second time, the international traveling exhibition on materials and construction technologies "Exco Matera 2019" organized by Dicem (the department of European and Mediterranean Cultures of the University of Basilicata). This is an event that has been held for more than 30 years in February, in Valencia to coincide with the 'Cevisama' exhibition, one of the most important in the world on ceramic materials, glass and fittings and finishes for indoor environments. Event coordinated by the Director "EXCO 2019" Prof. Dr. José Ramón Albiol-Ibáñez and with the participation, for the first time in a foreign university, of the Rector of the Universitat Politècnica de València UPV Dr. Francisco José MORA MAS.*

Prof. Antonella GUIDA  
 Prof. Graziella BERNARDO  
 Prof. Giuseppe ANDRISANI

## PROLOGAS VILNIUS

2019 m. Lapkričio mėn. Vilniaus Gedimino technikos universitetas (VGTU) antrą kartą surengė tarptautinę mokslo darbų parodą EXCO2019, kurią organizavo Valensijos politechnikos universitetas (UPV). Ši mokslo darbų paroda leido VGTU tyrėjams, darbuotojams ir studentams susipažinti su įvairiausiais statybos (civilinės inžinerijos) ir susijusių sričių tyrimais, kuriuos atliko kolegos iš UPV ir kitų bendradarbiaujančių universitetų.

Prieš keletą metų, kaip „Erasmus“ mainų programos dėstytojai, lankėmės UPV, kur turėjome neįkainojamą galimybę pamatyti vykdomus tyrimus ir sužinoti apie unikalią EXCO programą, kurioje dalyvavo aukšto lygio mokslo institutai civilinės inžinerijos srityje.

Didžiulis „EXCO“ komandos ir jos direktoriaus prof. dr. José Ramón Albiol-Ibáñez indėlis ne tik suburia įvairių universitetų tyrėjų, bet ir sukuria naują, unikalią erdvę bendradarbiavimui. Tai prisideda prie mokslo tyrimų populiarinimo ir matomumo, suteikia puikią platformą pristatyti savo institucijos mokslininkų darbus ir pamatyti kolegų iš kitų aukščiausių pasaulio mokslo institucijų vykdomą veiklą, susirasti mokslo partnerius ir prisistatyti jauniems tyrėjams.

DR Jūratė ŠLIOGERIENĖ

DR Tatjana VILUTIENĖ

## PROLOGUE VILNIUS

*In November 2019, Vilnius Gediminas Technical University (VGTU) hosted for the second time the international scientific exhibition EXCO2019, organized by University Polytechnic Valencia (UPV). This exhibition of scientific works allowed VGTU researchers, staff and students to get acquainted with a wide range of research in construction (civil engineering) and related fields performed by colleagues from UPV and other cooperating universities.*

*A few years ago, as an Erasmus exchange teacher, we visited UPV, where we had an invaluable opportunity to see ongoing research and learn about the unique EXCO program involving high-level research institutes in civil engineering.*

*A tremendous amount of work by the EXCO team and its Director prof. dr. José Ramón Albiol-Ibáñez not only brings together researchers from different universities, but also creates a new, unique space for collaboration. This contributes to the promotion and visibility of research, and provides an excellent platform for presenting the work of scholars in your institution, and see activities carried out by colleagues from other top-level scientific institutions in the world, find partners in science, and introduce themselves for young researchers.*

DR Jūratė ŠLIOGERIENĖ

DR Tatjana VILUTIENĖ

## **EXCO and Jade University of Applied Sciences, Oldenburg**

**by Thomas Weßels (Lecturer) and Thomas Priesemann (Vice Dean)**

**Department of Civil Engineering Geoinformation Health Technology**

Die Jade Hochschule in Oldenburg, Fachbereich Bauwesen Geoinformation Gesundheitstechnologie, nahm in 2019 erstmalig an der EXCO teil. Im Anschluss an die Einladung durch den Koordinator der EXCO, Prof. Dr. José Ramón Albiol Ibáñez, wurde im Fachbereich festgestellt, dass das Konzept der EXCO nicht nur perfekt in die Internationalisierungsstrategie des Fachbereichs passt, sondern auch vielfältige Schnittstellen für eine Zusammenarbeit bietet. Dabei sind insbesondere folgende Aspekte hervorzuheben:

- Unter dem Dach der EXCO findet sich eine breit gefächerte Auswahl an Themen zu Kernaspekten des Bauingenieurwesens wie auch benachbarter Fachdisziplinen. Diese Themenvielfalt bildet sehr gut die Themenvielfalt in der Lehre an der Jade Hochschule wider, weshalb Synergieeffekte zu erwarten sind.
- Die Jade Hochschule ist immer an Forschungsthemen mit fachlicher und gesellschaftlicher Relevanz interessiert. Die unter dem Dach der EXCO präsentierten Themen geben vielfältige Ansatzpunkte für zukünftige Forschungsvorhaben und ermöglichen einen Vergleich mit anderen Hochschulen.
- Forschung und Lehre werden auch in Zukunft an Internationalität gewinnen. Das internationale Konzept der EXCO unterstützt den Aufbau von internationalen Kooperationen.

Grundsätzlich ist die EXCO eine Konferenz, die einen breiten Überblick über die Themenvielfalt im Bauwesen zu Beginn des 21. Jahrhunderts abbildet. Die Jade Hochschule betrachtet es als ein Privileg, zu dem Kreis der teilnehmenden Institutionen gehören zu dürfen und dankt der UPV und dem Koordinator der EXCO für ihre Initiative.

### ***PROLOG OLDENBURG***

*The department of Civil Engineering Geoinformation Health Technology of Jade University of Applied Sciences, Oldenburg, took part in EXCO for the first time in 2019. Following an invitation by the co-ordinator of EXCO, Prof. Ph.D. José Ramón Albiol Ibáñez, the department realized that the concept of EXCO is not only fitting perfectly into the department's strategy of internationalization but also offering diverse interfaces for collaboration. Especially the following aspects are to be highlighted:*

- *The roof of EXCO covers a diverse range of topics from civil / building engineering and related disciplines as well. This diversity reflects the broad range of topics in education at Jade University of Applied Sciences, thus synergy effects are expected.*
- *Jade University of Applied Sciences is always interested in research topics with professional and social relevance. The topics presented under the roof of EXCO are offering many starting points for future research projects and a comparison with other universities.*
- *Education and research will gain internationality in the future. The international concept of EXCO supports the implementation of international co-operations.*

*In general EXCO is a conference that offers a broad overview on diverse topics in civil / building engineering at the beginning of the 21st century. It is a privilege for Jade University of Applied Sciences to be part of it and thanks UPV and the co-ordinator of EXCO for organizing it.*

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*CHAPTER 4*

# ***HERITAGE***

*CAPÍTULO 4 PATRIMONIO*

**IL VILLAGGIO MEDIEVALE "IL CASALE" DI ARMENTO (BASILICATA,  
ITALIA): UN ARCHETIPO DELLA SOSTENIBILITA' DEGLI AMBIENTI  
COSTRUITI**

**THE MEDIEVAL VILLAGE "IL CASALE" OF ARMENTO (BASILICATA,  
ITALY): AN ARCHETYPE OF THE BUILT ENVIRONMENT  
SUSTAINABILITY**

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**Abstract**

The research activity is aimed at the recovery and enhancement of the medieval village "Il Casale" of the Municipality of Armento in one of the poorest inland areas of Basilicata with high seismic vulnerability and at risk of landslides and flooding. The village, founded by the Basilian monks between the tenth and eleventh centuries, stands on a conglomerate cliff overlooking the valley of Fiumara of Armento in an environmental context of remarkable beauty. After the earthquake of 1980 and a series of landslides, the village has been completely abandoned and its integrity is severely compromised by landslides and damage. The analysis of the built environments of the village, used as dwellings and places of agricultural production, has shown a wise use of local resources and living spaces that is inspired by the most modern principles of sustainable development and design of minimum living spaces. The artificial terraces for the urban gardens adjacent to the houses served to consolidate the landslide slope on which the village stands. The use of stone from the alluvial debris of Fiumara for the construction of the walls guaranteed the cleanliness of the riverbed and the natural course of water in torrential regime with the mitigation of the risk of flooding. The particular construction technique known as "civate" used for the reconstruction of environments damaged by the earthquake of 1857 is an example of reuse of rubble from demolition and strengthening of the walls with the inclusion of stones and debris of small bricks for filling the spaces of the masonry stone of irregular shape and bound with mortar of poor quality for the high clay fraction. The project for the recovery and enhancement of the village must be based on construction technologies compatible with the original ones and naturalistic engineering works able to reduce the vulnerability of the area and reconstruct the ancient link of the inhabited centre with the natural resources of the river valley.

**Keywords**

Architectural heritage, Mitigation of natural hazards, Local resources; River stone masonry, Minimum living spaces

# IL VILLAGGIO MEDIEVALE "IL CASALE" DI ARMENTO (BASILICATA, ITALIA): UN ARCHETIPO DELLA SOSTENIBILITA' DEGLI AMBIENTI COSTRUITI

## THE MEDIEVAL VILLAGE "IL CASALE" OF ARMENTO (BASILICATA, ITALY): AN ARCHETYPE OF THE SUSTAINABILITY OF THE BUILT ENVIRONMENT

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### Introduzione

La Basilicata, nota anche con l'antico toponimo di Lucania, è una regione dell'Italia Meridionale che ha una varietà di paesaggi di straordinaria bellezza in un territorio di soli 9.992 km<sup>2</sup>. Le aree interne della regione sono state sin da epoche antiche un crocevia di popoli grazie anche alla navigabilità di un tempo dei quattro fiumi che sfociano sul Mar Ionio (Fig.1). In questi territori ricchi di bellezze paesaggistiche vi è anche un notevole patrimonio architettonico diffuso quasi del tutto sconosciuto e non valorizzato. La grande vulnerabilità ad eventi catastrofici (sisma, alluvioni, frane) unitamente alla mancanza di infrastrutture di collegamento e all'assenza di sviluppo economico hanno determinato il loro spopolamento e isolamento.

### Introduction

Basilicata, also known by the ancient name of Lucania, is a region of Southern Italy that has a variety of landscapes of extraordinary beauty in a territory of only 9,992 km<sup>2</sup>. The inland areas of the region have been since ancient times a crossroads of peoples thanks to the navigability of a time of the four rivers, which flow into the Ionian Sea (Fig.1). In these territories rich of landscape beauties, there is also a remarkable diffused architectural patrimony almost completely unknown and not valorized. The great vulnerability to catastrophic events (earthquake, floods, landslides) together with the lack of connecting infrastructures and the absence of economic development have determined their depopulation and isolation.

### Obiettivo della ricerca

L'attività di ricerca è finalizzata al recupero e alla valorizzazione dell'antico villaggio "Il Casale" del Comune di Armento nel territorio della Valle dell'Agri (Figg.1,2). Il lavoro presenta i risultati preliminari ottenuti dalla ricerca storica e dall'analisi del contesto ambientale e architettonico.

### Research objective

The research activity is aimed at the recovery and enhancement of the ancient village "Il Casale" of the Municipality of Armento in the territory of the Agri Valley (Figg.1,2). The work presents the preliminary results obtained from historical research and analysis of the environmental and architectural context.

### Il Casale di Armento

Il villaggio si sviluppa a sud del centro abitato come un nucleo urbano a sé stante lungo la sommità di un'altura, a circa 500 m sul livello del mare, da cui si domina la valle della Fiumara di Armento, affluente in sinistra idraulica del fiume Agri (Fig.3). Lo sviluppo del nucleo abitato, di probabile origine Romana secondo la tradizione verbale locale, risale al X e XI secolo quando i monaci Basiliani San Luca e San Vitale giunsero in questi posti ricchi di acque sorgive e piante selvatiche edibili e adatti alla vita ascetica (Figg.4,5). Le costruzioni, utilizzate come dimore e luoghi di produzione, erano circondate da orti urbani costruiti su terrazzamenti che assolvevano anche alla funzione di opere di sostegno del versante conglomeratico (Fig. 6). I materiali utilizzati per le costruzioni provenivano dalla Fiumara che era anche un importante risorsa per la produzione agricola del villaggio. Dopo il sisma del 16 dicembre 1857 che fece perdere gran parte delle testimonianze materiali dell'originario abitato, le abitazioni furono ricostruite con una particolare tecnica costruttiva, detta "civate", per la caratteristica disposizione delle pietre: una grande posta al centro di tanti sassolini, quasi un nido, dove il genitore imbecca ("ciba" o "civa") i piccoli (Figg.7,8). Gli ambienti interni delle abitazioni di piccolissime dimensioni (<10-15 m<sup>2</sup>) erano dotate di pareti attrezzate per le funzioni della vita quotidiana (Fig.9). Il sisma del 1980 e una serie di eventi franosi hanno determinato il completo abbandono del villaggio che subisce continui crolli e danneggiamenti con il rischio della sua completa distruzione.

### Il Casale of Armento

The research activity is aimed at the recovery and enhancement of the ancient village "Il Casale" of the Municipality of Armento in the territory of the Agri Valley (Figg.1,2). The village develops to the south of the inhabited center as an urban nucleus in its own right along the top of a hill, at about 500 m above sea level, from which it dominates the valley of Fiumara di Armento, a tributary on the left of the hydraulic river Agri (Fig.3). The development of the inhabited centre, probably of Roman origin according to the local verbal tradition, dates back to the 10th and 11th centuries when the Basilian monks San Luca and San Vitale arrived in these isolated places, rich in spring waters and edible wild plants and suitable for ascetic life (Figg. 4,5). The buildings, used as dwellings and places of production, are surrounded by urban gardens built on terraces that also served as support works for the conglomerate side. The materials used for the buildings came from Fiumara, which was also an important resource for the agricultural production of the village. After the earthquake of December 16th 1857, which caused the loss of most of the material evidence of the original settlement, the houses were rebuilt with a particular construction technique, called "civate", for the characteristic arrangement of the stones: a large place in the center of many pebbles, almost a nest, where the parent imbeccures ("ciba" or "civa") the little ones (Figg. 7,8) The interior of the houses of very small size (<10-15 m<sup>2</sup>) are equipped with walls for the functions of everyday life (Fig.9). The earthquake of 1980 and a series of landslides have determined the complete abandonment of the village that, without any kind of conservation intervention, suffers continuous collapse and damage with the risk of its complete destruction.



Fig. 1 - Mappa della Regione Basilicata con l'indicazione dei quattro fiumi che la attraversano, dei due capoluoghi di regione, Potenza e Matera, e del Comune di Armento

Fig.1 - Map of the Basilicata Region with the indication of the four rivers that cross it, the two regional capitals, Potenza and Matera, and the Municipality of Armento

Fig. 4 - San Luca di Demenna sullo stemma del Comune di Armento

Fig. 4 - Saint Luca of Demenna on the coat of arms of the Municipality of Armento

Fig. 5 - Nibbio Reale (Milvus Milvus) simbolo della Lucania consacrato a San Vitale protettore di Armento

Fig. 5 - Royal Kite (Milvus Milvus) symbol of Lucania consecrated to San Vitale protector of Armento

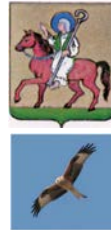


Fig. 2 - Sviluppo dell'abitato lungo il crinale roccioso da cui si domina la valle della Fiumara di Armento

Fig. 2 - Development of the settlement along the rocky ridge overlooking the valley of the river Fiumara di Armento



Fig. 3 - Vista dal Casale della Valle della Fiumara di Armento

Fig. 3 - View from Il Casale of the Fiumara Armento Valley



Fig. 6 - Dimore contigue a terrazzamenti adibiti ad orti urbani

Fig. 6 - Houses bordering on terraces used as urban vegetable gardens

Fig. 9 - Pareti attrezzate A) Forno per la cottura del pane B) Camino per la cucina e ripiani incavati per gli utensili da cucina C) Lavabo per la pulizia e ripiani incavati per oggetti di uso comune D) Nicchia per gli oggetti di culto

Fig. 9 - Equipped Wall A) oven for baking bread B) Fireplace for the kitchen and hollowed shelves for kitchen utensils C) Washbasin for cleaning and hollowed shelves for everyday objects D) Niche for cult objects

### Conclusioni

- Il villaggio Medievale Il Casale è un archetipo del modo di abitare i luoghi in simbiosi con il contesto ambientale.
- La vulnerabilità dei territori ai rischi naturali può essere mitigata dagli ambienti costruiti in funzione dell'utilizzo sostenibile delle risorse locali.

### Conclusions

- The medieval village Il Casale is an archetype of the way of living the places in symbiosis with the environmental context.
- The vulnerability of the territories to natural risks can be mitigated by the environments built according to the sustainable use of local resources.



Fig. 7 - Tipologia costruttiva con arco ribassato in pietra di fiume e tetto in legno a doppia falda

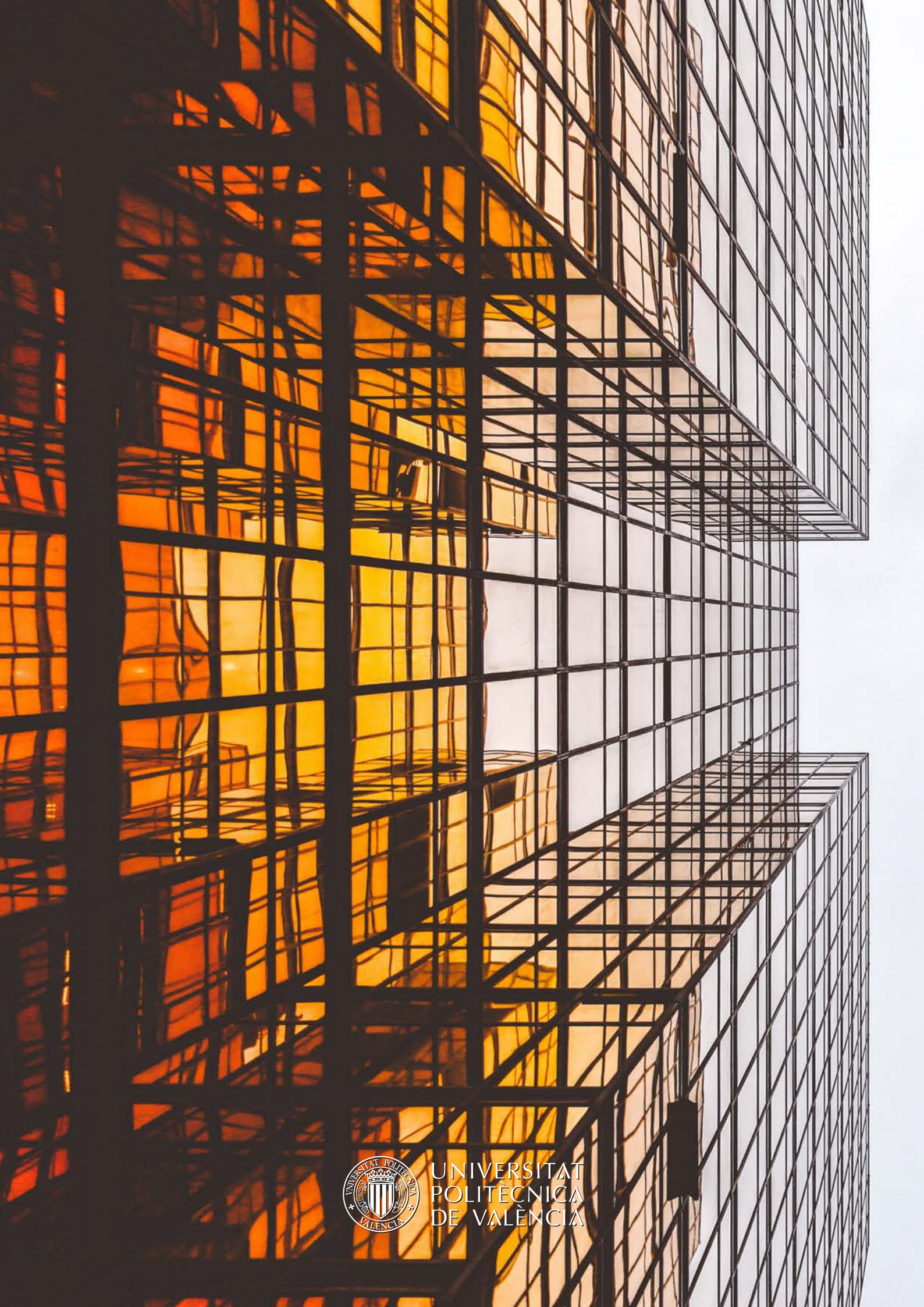
Fig. 7 - Type of construction with low arch in river stone and wooden roof with double pitch



Fig. 8 - Palazzo Terenzio dimora del senatore Terenzio Lucano (II a.C.) secondo la tradizione verbale locale

Fig. 8 - Terenzio Palace residence of Senator Terenzio Lucano (II B.C.) according to the local verbal tradition





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