

ICSA 2019

4th International Conference
on **Structures and Architecture**

24-26 July / Lisbon, Portugal

www.icsa2019.com

Conference Chair:
Prof. Paulo Cruz



**STRUCTURES
& ARCHITECTURE**

INTERNATIONAL ASSOCIATION
EDUCATION • RESEARCH • COOPERATION

COVER PHOTO

POETIC COSMOS OF THE BREATH

Picture taken at "Poetic Cosmos of the Breath", Airshow in Gunpowder Park, London, UK, 2007/09/22.

Courtesy the artist; Tanya Bonakdar Gallery, New York; Andersen's Contemporary, Copenhagen; Pinksummer contemporary art, Genoa; Esther Schipper, Berlin.

© Photography by StudioTomás Saraceno, 2007

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Inspired by the work of Dominic Michaelis, an English architect and inventor who came up with the technology for a solar-powered hot air balloon, Poetic Cosmos of the Breath is a time-based, experimental, solar dome that takes flight only under certain climatic conditions. It uses deceptively simple materials: a paper-thin foil accompanied by a few sand bags, and a handful of participants to produce a startlingly ethereal, shimmering effect. Staged at dawn, as temperature conditions naturally shift, air inside the balloon is heated by a greenhouse effect and the lightweight material slowly lifts off the ground completely unaided by machines or electrical power. At the same time, sunlight cast through the material creates a vibrant rainbow-tinged iridescent glow. Firstly commissioned by Arts Catalyst in 2007 as a performative action at Gunpowder Park in Essex, the installation was later presented in 2013 at "Mobile M+:Inflation!", Hong Kong as a temporary event occurring periodically during the show.

WELCOME TO ICSA2019

The foundations for the 1st International Conference on Structures and Architecture, which took place in Guimarães in 2010, were laid in 2007, aiming to present research and developments on the merging of architecture and structural engineering. Following the success of ICSA2010 the 2nd and 3rd editions were held again in Guimarães in 2013 and 2016, respectively.

Since then the conference progressively became the world's leading event bridging the gap between Structures and Architecture. It is worth to mention that there exists a core group of committed colleagues with a background in architecture and in structural engineering who endeavoured to grant the outstanding position that ICSA has nowadays.

After three highly successful conferences in Guimarães, time had come to move ICSA new editions to a further level. Thus, in the closure session of ICSA2016 it was announced that ICSA2019 would be held in Lisbon.

Personally I had the feeling that it was the right moment to constitute an International Association of Structures and Architecture, aiming to explore and to promote the merging of the fields of Structures and Architecture, encompassing all the aspects related with the recent advances in the art, practice and theory of teaching, researching, designing and building structures.

In October 2016 the Association was formally constituted visioning to be worldwide recognized as an exceptional and highly effective organization with a noteworthy contribution in the fields of Structures and Architecture. It is governed by principles of integrity, credibility, plurality and diversity, mutual respect, transparency and accountability, enlarged cooperation and free development of ideas.

The main objectives of the Association are: (i) to foster cooperation among all those involved in the fields covered by the association; (ii) to stimulate the inventive and creative design of architectural structures and to persuade architects and structural engineers to collaborate in this process, exploiting together new concepts, applications and challenges; (iii) to continually encourage the collaboration with other societies and associations with similar objectives.

For this purpose, among other initiatives, the Association: (i) will promote actions aiming at the progress of all aspects of the theory and application of structures and architecture; (ii) will organise the international conference on structures and architecture (ICSA) every three-years; (iii) will co-sponsor or endorse other symposia and conferences.

Structures and Architecture – Bridging the Gap and Crossing Borders contains the lectures and papers presented at the Fourth International Conference on Structures and Architecture (ICSA2019) that was held in Lisbon, Portugal, in July 2019. It also contains a USB flash card with the full texts of the lectures presented at the conference, including the 5 keynote lectures, and almost 150 selected contributions. The contributions on creative and scientific aspects in the conception and construction of structures, on advanced technologies and on complex architectural and structural applications represent a fine blend of scientific, technical and practical novelties in both fields.

ICSA2019 covers all major aspects of structures and architecture, including: building envelopes / facades; comprehension of complex forms; computer and experimental methods; futuristic structures; concrete and masonry structures; educating architects and structural engineers; emerging technologies; glass structures; innovative architectural and structural design; lightweight and membrane structures; special structures; steel and composite structures; structural design challenges; tall buildings; the borderline between architecture and structural engineering; the history of the relationship between architects and structural engineers; the tectonic of architectural solutions; the use of new materials; timber structures, among others.

The interest of the international community in all these subjects has been confirmed by the high response to the call of papers. In fact, more than three hundred abstracts were received at the Conference Secretariat. About forty-seven percent of them were selected for final publication as full-papers and presentation at the Conference.

This set of book and USB flash card is intended for a global readership of researchers and practitioners, including architects, structural and construction engineers, builders and building consultants, constructors, material suppliers and product manufacturers, and other professionals involved in the design and realization of architectural, structural and infrastructural projects.

The Chairman of the Conference and President of the International Association of Structures and Architecture would like to take this opportunity to express a sincere recognition to authors, organizers of mini-symposium and special sessions and participants for their valuable contributions to the Conference. Our special thanks to the members of the International Scientific Committee for their committed work and for the time and effort they have devoted to make of ICSA2019 a successful event. Last, but not least, we would like to express our sincere gratitude to all the sponsors of ICSA2019 for their support and their belief.

Paulo J. S. Cruz
ICSA 2019 Chair

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The International Federation
for Structural Concrete



IABSE

IABSE – International Association
for Bridge and Structural Engineering

INTERNATIONAL INSTITUTIONS



American Concrete Institute
Always advancing

aci – American Concrete Institute



bibm – Federation for the European Precast
Concrete Industry



BTES – Building Technology
Educator's Society



Commonwealth Association of Architects



EUCEET – European Civil Engineering
Education and Training



efca – European Federation of Engineering
Consultancy Associations

LSAA

LSAA – Lightweight Structures
Association Australasia



TensiNet

NATIONAL INSTITUTIONS



APEE – Associação Portuguesa
de Engenharia de Estruturas



GPBE – Grupo Português
de Betão Estrutural



Lab2PT – Laboratório de Paisagens,
Património e Território



Universidade do Minho
Escola de Arquitetura



Instituto de Design de Guimarães





Advanced Ceramics R&D Lab

LISBON MAP



- ★ Calouste Gulbenkian Foundation
- 1 Aeroporto
- 2 Oriente Station
- 3 Casino de Lisboa
- 4 Tagus River
- 5 Alameda (Metro station)
- 6 Saldanha (Metro station)
- 7 São Sebastião (Metro station)
- 8 Praça de Espanha (Metro station)
- 9 Av. de Berna
- 10 Centro Cultural de Belém (CCB)

- A Sana Reno Hotel
- B Jupiter Lisboa Hotel
- C VIP Executive Zurique
- D VIP Grand Lisboa Hotel & SPA
- E Sana Malhoa Hotel
- F InterContinental Lisbon

Metro red line 
Metro blue line 

CONFERENCE ORGANIZATION



**STRUCTURES
& ARCHITECTURE**
INTERNATIONAL ASSOCIATION
EDUCATION • RESEARCH • COOPERATION

CONFERENCE CHAIR

Paulo J. S. Cruz,
School of Architecture, University of Minho,
Guimarães, Portugal

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University of Porto, Portugal
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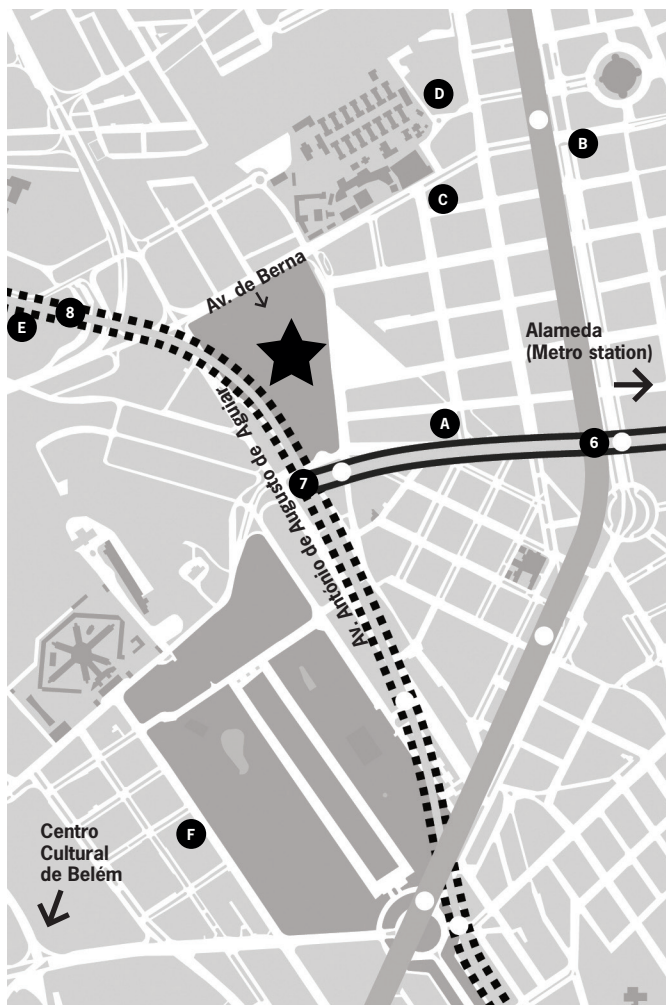
GENERAL INFORMATION

CONFERENCE VENUE





The Conference will be held at the Convention Centre of the Calouste Gulbenkian Foundation in Lisbon, Portugal.

The Calouste Gulbenkian Foundation is located close to Praça de Espanha, inside a 7.5 hectare garden. The main entrance is at Avenida de Berna, 45A. The two closest metro stations to the Calouste Gulbenkian Foundation are São Sebastião (blue and red lines) and Praça de Espanha (blue line).



- ★ Calouste Gulbenkian Foundation
- 6 Saldanha (Metro station)
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Metro red line 
Metro blue line 

PROCEEDINGS

The book of abstracts and a CD-ROM will be distributed with registration's materials at the Conference.

SCHEDULE

An overview of the schedule is provided on the back cover of this program.

ONSITE REGISTRATION

Onsite registration fees are:

- 600 € – IASA Members*
- 700 € – Non Members*
- 350 € – Students**
- 350 € – Accompanying persons***

(*) Fee includes technical documentation, reception, lunches, coffee-breaks and conference gala dinner.

(**) Institutional certification required. Student fee does not include lunches nor participation in the conference gala dinner.

(***) Including reception, social program tours & gala dinner.

OPENING CEREMONY

Time: Wednesday, July 24, 09:00 – 09:30

Place: Auditorium 2

GENERAL MEETING – INTERNATIONAL ASSOCIATION OF STRUCTURES AND ARCHITECTURE

Time: Thursday, July 25, 17:00 – 17:30

Place: Auditorium 2

CLOSING CEREMONY

Time: Friday, July 26, 17:00 – 17:30

Place: Auditorium 2

KEYNOTE LECTURES

Fernando Branco,
“**Design for durability**” (Wednesday, July 24, Auditorium 2)

Olivier Grossetête,
“**Builders of ephemeral monumental constructions in cardboard**” (Wednesday, July 24, Auditorium 2)

Anne Beim,
“**Tectonic ecologies in architecture – a critical perspective in a time of transition**” (Thursday, July 25, Auditorium 2)

Hugo Corres,
“**Architects + Engineers: a very creative and productive collaboration**” (Thursday, July 25, Auditorium 2)

L. Ren & Xin Ruan,
“**Design for future: A new way of storytelling on footbridge**” (Friday, July 26, Auditorium 2)

ICSA2019 MINI-SYMPOSIUM

WeM 1, WeA 1 & WeE 1: **Mini-Symposium on Circular Tectonics: Towards ecological continuity, -means, – relations, strategies and -innovation in architectural practice**

The notion of 'tectonics' has been developed and applied throughout architectural history as a critical means through which to position the discipline in its context; the societal, technological as well as the physical. Today the complexity of contextual relations and challenges that govern architecture are multiplying and governed by an ever more present call for a viable, ecological, human development of the built environment. With the title 'Circular Tectonics', this mini symposium investigates the potential of tectonic architectural theory and method for arriving at ecological continuity, -means, -relations, and -innovation in architectural practice. Hence, we invite critical contributions that discuss, develop, and apply tectonics related to questions such as 'design for disassembly', 're- and upcycling', 'life cycle scenarios' 'transformation versus preservation' etc.

Coordinated by:

Marie Frier Hvejsel, Department of Architecture, Design & Media Technology, Aalborg University, Aalborg, Denmark
Anne Beim, The Royal Danish Academy of Fine Arts School of Architecture, CINARK, Copenhagen, Denmark

ICSA2019 SPECIAL SESSIONS

WeM 4: **Wood: Structure and Expression**

In the current wood architecture, the appearance of wood as a structural element is usually limited to log constructions, where the load-bearing wall is visually present. In most wood constructions, the material is used for the skeleton structure but covered with other materials and not expressed anymore. The goal of this special session is to broaden the perspectives and avoid a limited use of the material. In combining traditional craftsmanship and industrial production, the different speakers are aiming to research on new solutions, which develop new ways for the use of wood in different historical and technical cultures.

Coordinated by:

Jan Helge Siem, Department of Architecture & Technology, Norwegian University of Science and Technology, Trondheim, Norway
Urs Meister, DelInstitute of Architecture & Planning, University of Liechtenstein, Valuz, Liechtenstein

WE 2: **Crafting spatiality: Explorations with components and connections for spatial architectural structures**

Currently digital design tools offer interesting ways of exploring novel structural expressions. Defining and understanding complex geometries through digital tools offers new opportunities for creating novel solutions. Furthermore, advanced fabrication technologies enable complex processing of building components. However, a deep spatial thinking is needed to use the potentials of the many new possibilities of technology in design and fabrication.

This session looks into explorative spatial configurations of components and connections in structures of different scales using precision and the control of complexity to unlock new structural and architectural capacities. Aspects such as:

Which structural and formal qualities of complex spatial arrangements can be unlocked?

How can novel spatial arrangements in connections help to improve their performance and functionality?

Complexity v.s. simplicity: how do we achieve the optimal balance between material/structural efficiency, through fabrication and buildability, leading to novel spatial solutions?

Coordinated by:

Mario Rinke, ETH Zürich, Zürich, Switzerland
Olga Popovic Larsen, Royal Danish Academy of Fine Arts, Copenhagen, Denmark

PRESENTATION GUIDELINES

The presentations should take 15 minutes plus 5 minutes for audience questions. This schedule will be strictly enforced.

Each paper session will be attended by a chairman, responsible for monitoring the time and enlightening the author, through a signal, once there are 5 minutes left to the end of the presentation.

Personal Computer (MS Windows) with Power Point will be available at each Session room.

No laptops will be allowed to connect to the LCD projector for making presentations.

Authors are requested to provide their presentation files at the Conference Desk. Please make sure no Asian fonts are used or, if those fonts are necessary, all fonts are embedded in the Power Point file.

SOCIAL PROGRAM

The social program includes the welcome reception and gala dinner for the participants (registration as 'Student' does not include the gala dinner). The registration as accompanying person also includes the participation in several tours.



GARAGEM
SULEXPOSIÇÕES
ARQUITECTURA

Praça do Império, 1449-003 Lisboa



10 Centro Cultural de Belém (CCB)

**Visit to the exhibition "The Bones of Architecture" and Welcome Reception, Wednesday, July 24th, 19:30
Garagem Sul, Centro Cultural de Belém (CCB)**

The construction of Centro Cultural de Belém was decided in 1988 to welcome and accommodate the Portuguese European Union Presidency, in 1992, remaining subsequently as a core facility for cultural and leisure activities.

The building was designed by the architects Vittorio Gregotti (Italy) and Manuel Salgado (Portugal), today has a strong cultural programme and plays important part as a Conference Centre. It has been classified since 2002 as a monument of public interest.

An international architectural competition was held. 6 out of the 57 proposals received have been invited to develop a preliminary project. The selected proposal belonged to the architects consortium Vittorio Gregotti (Italy) and Manuel Salgado (Portugal). They designed the construction of five modules – Conference Centre, Performing Arts Centre, Exhibition Centre, Hotel Zone and Complementary Equipment. Only the first ones were raised, namely, the Conference Centre, the Performing Arts Centre and the Exhibition Centre.

With the project of the two remaining modules of the original plan currently under way, presently the CCB occupies a construction area of 97,000 sq meters, distributed along 60,000 sq meters and separated by two internal streets, connected by a pedestrian way, creating continuity with the Praça do Império outside. This building can be seen as a small city with gardens, lakes, bridges, slopes, and small hidden places, where the nobility of the Museum Square stands out.

Since 2002, the Centro Cultural de Belém has been classified as a monument of public interest, and is included in the Special Protection Area of the Mosteiro de Santa Maria de Belém.

Housed in a former parking garage, Garagem Sul's large space offers a unique atmosphere for the presentation of architectural works and ideas. Since 2012, it has organised a regular programme of temporary exhibitions, either of the work of well-established architects or that explore other fields relevant to understanding architecture as a way of knowing how to transform the world. These exhibitions are mounted in partnership with other Portuguese and international institutions, putting Garagem Sul and Lisbon on the map as part of a global network of venues that present contemporary architecture.

The exhibition 'The Bones of Architecture' examines the cultivation of structures in the service of architecture as developed by diversely different designers who are all active in building practice. These designers – altogether seven European architects and engineers – show their works and approaches, reflecting upon rules, strategies and methods in the design of structures.



Alameda dos Oceanos, n.º 45
Parque das Nações / 1990-204 Lisboa



- ② Oriente Station
- ③ Casino de Lisboa
- ④ Tagus River

Metro red line 

Gala Dinner, Thursday, July 25, 20:00

Casino Lisboa – Restaurante Beltejo

Inaugurated on April 19, 2006, the Casino Lisboa is located near the Tagus River, in Lisbon's modern Parque das Nações, an emerging tourist hub, served by four hotels, surrounded by various infrastructure services and entertainment.

Casino Lisboa occupies the pavilion formerly occupied by the Future Pavilion, one of the main attractions of the World Expo of '98, bolstering a refined, yet minimalist architecture. The building was extensively rebuilt for its new purpose under a project by architect Fernando Jorge Correia. Inside, opal floors and glass walls merge with alluring solutions powered by the latest in multimedia hardware.

There are often major shows at the over-600-seat Oceans Auditorium as well as a variety of performances at the rotating central bar.

Located on the second floor with a stunning view to Tagus Rives, the Beltejo Room is ideal for exclusive events.

ACCOMPANYING PERSON'S PROGRAM

1) Sintra and Cascais (full day tour), July 24th, 10:00 – 17:00

Departure in the direction of the charming Sintra region, once referred to by Lord Byron as his "Glorious Eden". There you will visit the Royal Palace of Sintra, fabulous residence of numerous kings of Portugal, with its precise painted ceiling tiles and an extraordinarily large kitchen.

Leaving the Palace, the clients will have some free time to walk through the streets of Sintra, full of small shops of tiles and ceramics, where they will be able to taste the typical cakes of Sintra, Queijadas and Travesseiros de Sintra. Lunch in a local restaurant. After Lunch visit to Cabo da Roca. The tour will continue with the views of the Tagus to Cascais, Boca do Inferno and Estoril.

Price per person: for a minimum of 20 people € 77,00

Including: Bus transportation starting and arriving at the Venue; Official English speaking Guide; "Palácio da Vila" Entrance; Lunch.

2) Lisbon (half day tour), July 25th, 09:00 – 13:00

An unforgettable journey to of Lisbon's noble areas. Belém featuring iconic buildings from the 15th and 16th century, related to the Portuguese Discoveries.

Explore the beautiful Jerónimos Monastery built in the 1500's (closed on Mondays). The church interior unveils a gorgeous Gothic-Renaissance style altar, as well as the tombs of great Portuguese explorers.

Restore the energy in one of the oldest and most famous pastry shops of Lisbon to taste the delicious Belém Pastry.

Price per person: for a minimum of 20 people € 41,00

Including: Bus transportation starting and arriving at the Venue; Official English speaking Guide; Jerónimos Monastery Entrance; Pastéis de Belém.

3) Mafra and Ericeira (full day tour), July 26th, 09:30 – 17:00

Departure towards Mafra - visit to this ancient village conquered to the Moors in the XII century. Focus on the Mafra Convent - one of the most beautiful Portuguese monuments, with its world-famous carillon, formed by 114 bells. Initially conceived as a small convent for 13 friars, the project for the Real Convent of Mafra is an immense building of about 40,000 m².

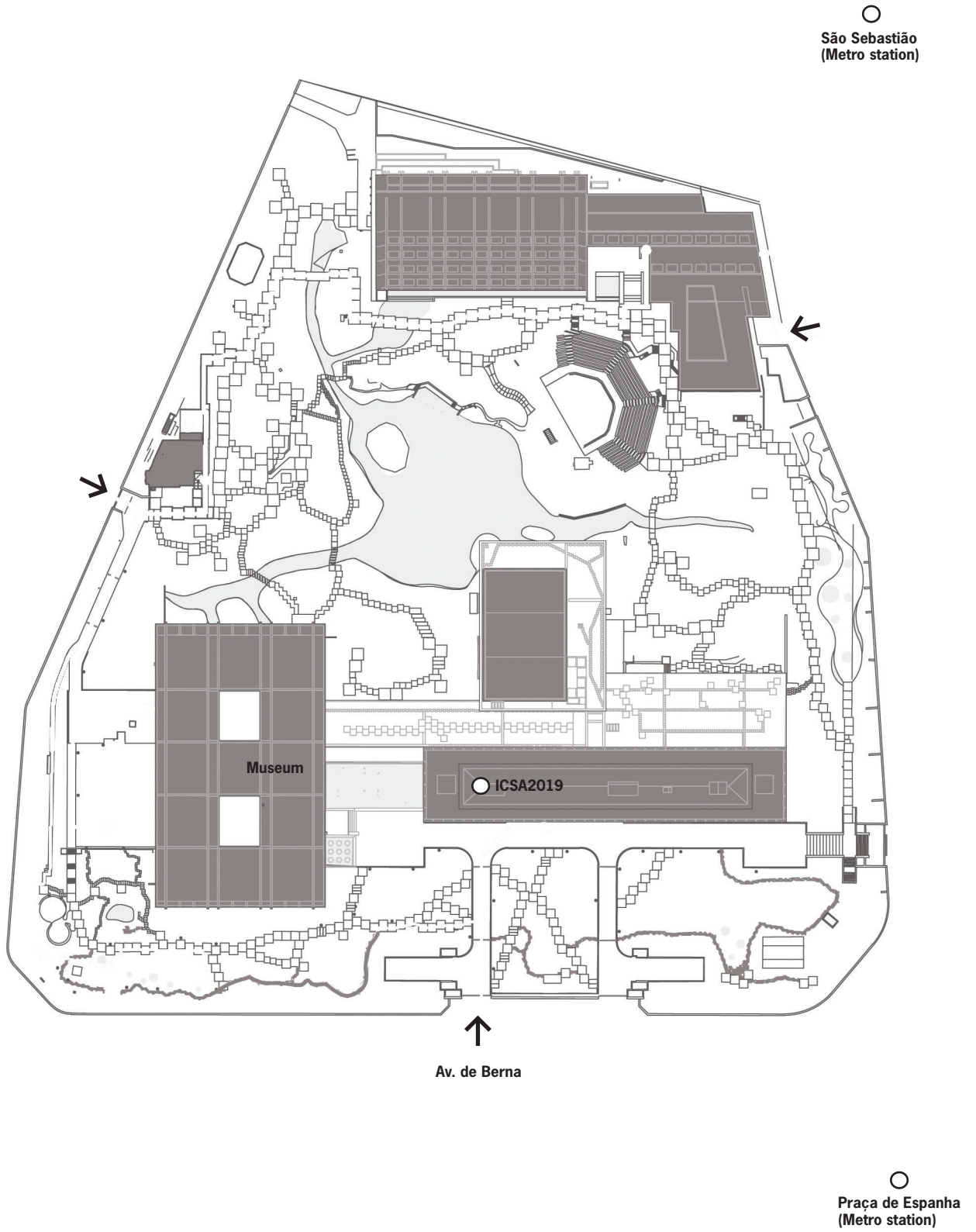
Proceeding to North, we shall stop in Ericeira where we will have lunch in a local restaurant. Ericeira is an old picturesque fishing village, also known as the "Portuguese Mecca of surf", to have lunch. After, before coming back, we can walk around and visit the village with its narrow cobblestone streets, characteristic housing, singular monuments and enjoy the breath-taking views of the ocean.

After lunch, some free time before the departure to Lisbon.

Price per person: for a minimum of 20 people € 72,00

Including: Bus transportation starting and arriving at the Venue; Official English speaking Guide; Mafra Convent Entrance; Lunch.

CALOUSTE GULBENKIAN FOUNDATION MAP



Tuesday, July 23, 2019

15:00 – 19:00 **Conference Accreditation** ICSA2019 Desk – Calouste Gulbenkian Foundation / Congress Centre

Wednesday Morning (WeM), July 24, 2019

08:00 – 19:00 **Conference Accreditation** ICSA2019 Desk – Calouste Gulbenkian Foundation / Congress Centre

09:00 – 09:30 **Opening Ceremony** (Auditorium 2)

09:30 – 10:30 **Keynote Lectures** (Auditorium 2) Chair: P. Cruz
F. Branco “Design for durability”
O. Grossetête “Builders of ephemeral monumental constructions in cardboard” **This lecture will be presented in French. Please pick up your translation device.**

10:30 – 11:00 **Coffee Break**

11:00 – 12:30 **Concurrent Technical Sessions** WeM 1 to WeM 4

WeM 1 – Auditorium 2	WeM 2 – Auditorium 3	WeM 3 – Room 1	WeM 4 – Room 2
Mini-Symposium Circular Tectonics: Towards ecological continuity, – means, – relations, strategies and -innovation in architectural practice (1) Introduction and Concepts	General Session Special structures (1)	General Session The history of the relationship between architects and structural engineers	General Session Wood: Structure and Expression
Chairs: M.F. Hvejsel & A. Beim	Chair: A. Rønquist	Chair: H. Rodríguez-Camilloni	Chairs: J.H. Siem & U. Meister
Circular Tectonics? – A critical discussion of how the architectural discipline can drive ecological continuity M.F. Hvejsel & A. Beim	Parametric description of the movement of reciprocal transformable geometry surfaces, for adaptive environment materialization C. Martínez Arias & J. Anaya Díaz	The 1935 Portuguese reinforced concrete code: Background, sources and authors J.P. Delgado, R. J. G. Ramos & P. Tormenta Pinto	A Universe of wood joinery M. Spaan
	Drie Fonteinen Bridge Brussels-Charleroi; Lessons learnt form a multidisciplinary design process in a digital design era <i>J.E.P. Smits & A.F. Blankenspoor</i>	Steel visions. Fiorini’s “mechanical architectures” <i>R. Morganti, A. Tosone, M. Abita & D. Di Donato</i>	Tectonic in the education C. Rist-Stadelmann
Connecting Ends with Beginnings – Conceptual framework for a circular art of tectonics J. Holst	Expandable bar structures for emergency situations J. Pérez-Valcárcel, M. Muñoz-Vidal, M. Freire-Tellado, D. Gómez-Magide & A. Casa-Rodríguez	The Engineer Emilio H. Baumgart and the Brazilian Architecture in reinforced concrete of the first half of the twentieth-century J.M.M. Sánchez & R.P.da Fonseca	Connected Knowledge B.O. Braaten, J. Siem & A. Gilberg
The Compatibility of Architecture and Circular Economy H. Ejstrup & P. Munch-Petersen	Scale effect and load-bearing behavior of a reconfigurable hybrid structure M. Matheou, M.C. Phocas & E.G. Christoforou	Walter Gropius & Ove Arup: Collaboration, ‘total design’ & the ‘composite mind’ F. Trubiano	Full-scale wood architecture as educational tool <i>J. Siem, B.O. Braaten & A. Gilberg</i>
Dialectical Tectonics – Ontology and tectonic ecology of form, material and form without material K. Usto	Morphological investigation of a tensegrity helicoid for display during the 2018 Biennale Architecture in Venice <i>K.A. Liapi, A. Papantoniou & A. Ioannidi</i>	Arne Johnson’s material research introducing steel frame building in postwar Sweden F. Rosenberg	Optimization and shaping of indeterminate frame structures <i>P. Mayencourt & C.T. Mueller</i>
Sustainable Building Renovation: Towards a holistic tectonics thinking framework in sustainable transformation of the built environment A. Kamari & P.H. Kirkegaard		The original palaces of Brasília: Architectural composition and structural engineering E.G. da Silva & J.M.M. Sánchez	The Aspect of Craftmanship: Innovation and Expression U. Meister

Wednesday Afternoon (WeA), July 24, 2019

12:30 – 14:00 **Lunch Break**

14:00 – 16:00 **Concurrent Technical Sessions** WeA 1 to WeA 3

WeA 1 – Auditorium 2	WeA 2 – Auditorium 3	WeA 3 – Room 1
<p>Mini-Symposium Circular Tectonics: Towards ecological continuity, -means, - relations, strategies and -innovation in architectural practice (2 & 3) Systems & Economics</p> <p>Chairs: M.F. Hvejsel & A. Beim</p>	<p>General Session Innovative architectural and structural design (1)</p> <p>Chair: T. Boake</p>	<p>General Session The use of new materials</p> <p>Chair: F. Veer</p>
<p>Isolating the Tectonics of Insulation</p> <p>H. Ejstrup</p>	<p>Housing experiments of the 1920s fuelling innovation. The multicellular construction system</p> <p>A. Cel Mare</p>	<p>Mycelium-based materials at the dawn of the Anthropocene</p> <p>E. Elsacker, E. Peeters & L. De Laet</p>
<p>A tectonic approach to energy renovation of dwellings – The case of Gellerup</p> <p>S.R. Jensen, P.H. Kirkegaard, G. Postiglione & A. Strange</p>	<p>Modularity in architectural design: lessons from a housing case</p> <p>A.L. Correia, V. Murtinho & L. Simões da Silva</p>	<p>Use and challenges of new concretes in the 21st century</p> <p>G. Rodriguez de Sensale, V. De Lima, J. Borgno & A. Luisi</p>
<p>Transformation of architectural heritage through adaptive modular systems</p> <p>J. Buthke, S.O. Pedersen, N.M. Larsen & C. Bundgaard</p>	<p>Shape of arch – Is it important?</p> <p>E. Järvenpää, A.H. Niemi & J. Tervaoja</p>	<p>Experimental Design and Building of a Cable Reinforced Plastic Brick Arch</p> <p>M. Schneider, S. Tripod, L.T. Houdmont & J. Belis</p>
<p>Building circular economy – Strategies for decoupling in architectural practice</p> <p>L.K. Frederiksen & P. Munch-Petersen</p>	<p>Prefabricated Ultracompact Module for steel framed structures</p> <p>F. Suárez-Riestra & J. Estévez-Cimadevila</p>	<p>Load capacity testing method for non-conventional nodes joining linear structural paper components</p> <p>N. Kiziltoprak, E. Kanli, J. Schneider, U. Knaack & R. Bach</p>
<p>Invisible Tectonics: Nano Materials, Chemical Synthesis, and Human Health</p> <p>F. Trubiano</p>	<p>Rethinking BIM: Non-cartesian geometry through hybrid workflows</p> <p>Y. Zvoleas</p>	<p>Experimental earth composite shells</p> <p>J. Belis, S. Willaert, K. Martens, B. Van Lancker & M. Achenza</p>
<p>Beautiful Tectonics – Corporeal aesthetic in tectonics as sustainable parameter</p> <p>N.B. Andersen</p>	<p>Dynamic shelter structure</p> <p>F. Maden, D. Ölmez, Ş. Gür, M.Y. Uncu & C. Mitropoulou</p>	<p>Vulnerability of earth material to water: A state of the art</p> <p>E. Pauporté & L. Sgambi</p>
	<p>Structural innovation in the architecture of Thomas Jefferson</p> <p>H. Rodriguez-Camilloni</p>	<p>Experimental research and evaluation of the application of selected nanosuspensions on in-situ historical material surfaces</p> <p>K. Kroftová, J. Witzany, D. Škoda & I. Kuriřka</p>

Wednesday Evening (WeE), July 24, 2019

16:00 – 16:30 **Coffee Break**

16:30 – 17:30 **Concurrent Technical Sessions** WeE 1 to WeE 4

WeE 1 – Auditorium 2	WeE 2 – Auditorium 3	WeE 3 – Room 1
<p>Mini-Symposium Circular Tectonics: Towards ecological continuity, -means, -relations, strategies and -innovation in architectural practice (4) Learnings</p> <p><i>Chairs: M.F. Hvejsel & A. Beim</i></p>	<p>Special Session Crafting Spatiality: Explorations with components and connections for spatial architectural structures</p> <p><i>Chairs: M. Rinke & O. Popovik Larsen</i></p>	<p>General Session Glass structures</p> <p><i>Chair: J. Belis</i></p>
<p>The presence of timber – Oral history versus architectural theory</p> <p>U. Groba</p>	<p>Bending-active kit-of-parts systems: Uniformity generating complexity</p> <p><i>S. Brancart, N. De Temmerman, L. De Laet & O. Popovic-Larsen</i></p>	<p>Performance of the compressed pillar made of solid glass bricks in comparison with other materials</p> <p>J. Fila, M. Eliášová & Z. Sokol</p>
<p>Circular Tectonics, Users, and Local Culture</p> <p>J. Johansson</p>	<p>Exploration of spatial structures made from reused elements and the design of optimal kits-of-parts</p> <p>J. Brütting, C. Fivet & G. Senatore</p>	<p>Current analytical computational methods of laminated glass panels in comparison to FEM simulation</p> <p>T. Hána, K. V. Machalická, M. Vokáč & M. Eliášová</p>
<p>Tectonic Learning Ecologies: Elements for a circular architecture pedagogy in the work of Fernando Távora</p> <p>M.F. Hvejsel</p>	<p>Rotational stiffness in timber joinery connections: Analytical and experimental characterizations of the Nuki joint</p> <p><i>D.L. Fang, C.T. Mueller, J. Brütting, C. Fivet & J. Moradei</i></p>	<p>On configuration and structural design of frameless glass structures</p> <p>P.-S. Chen & M.-T. Tsai</p>
	<p>A Tectonic methodology for timber joints. The excellence of detail in the era of technology throughout an experimental investigation</p> <p>L. Catalá Bustos, P. H. Kirkegaard, P.F. Sonne-Frederiksen & J. Buthke</p>	<p>Performance of glass brick wall exposed to fire</p> <p><i>Z. Sokol & M. Eliášová</i></p>
17:30 – 18:00	Presentation of the Associated Event – The Bones of Architecture – An exhibition on design practices (Auditorium 2) – A. Tavares & M. Rinke	
19:30 – 22:30	Visit to the exhibition “The Bones of Architecture” & Welcome Reception (Centro Cultural de Belém)	

Thursday Morning (ThM), July 25, 2019

09:00 – 19:00	Conference Accreditation ICSA2019 Desk – Calouste Gulbenkian Foundation / Congress Centre
09:00 – 10:00	Keynote Lectures (Auditorium 2) Chair: U. Knaack A. Beim “Tectonic ecologies in architecture – a critical perspective in a time of transition” H. Corres “Architects + Engineers: a very creative and productive collaboration”
10:00 – 10:30	Coffee Break
10:30 – 12:00	Concurrent Technical Sessions ThM 1 to ThM 3

ThM 1 – Auditorium 2	ThM 2 – Auditorium 3	ThM 3 – Room 1
General Session Comprehension of complex forms & Concept architectural buildings	General Session Innovative architectural and structural design (2)	General Session Other & Lightweight and membrane structures
Chair: B. Figueiredo	Chair: K. Dong	Chair: K. Liapi
Complex Geometries of Environmentally Sensitive Forms	Configuration and mechanical characteristics of 1.5-Layer Space Frames	The performance standard – NBR 15575 and the architectural and structural designs
M.G. Fineout	P.-S. Chen	M.A.S. Hippert & O.C. Longo
Multi-dimensional form finding: structure, construction and sustainability	Innovative daylight structures for airport terminal and concourse buildings	A case study of structural monitoring as a control tool in the restoration process of heritage structures: The strengthening of the Vistabella Church's Tower
<i>D. Parigi & L. Damkilde</i>	<i>W. Place, M. Salamati & J. Hu</i>	R. Señis
Materials science, spanning the divide between architecture and structural engineering	Deployable structures of reciprocal crossed arches	Modular housing for situations of humanitarian catastrophe
<i>F.A. Veer, L. van Ellen & M. Nazari</i>	<i>M. Muñoz-Vidal, I. López-César, J. Pérez-Valcárcel & F. Suárez-Riestra</i>	J. Aragón Fitera, S. Muñiz Gómez, V. Hermo Sanchez, E. Mosquera Rey & A. Casal Rodriguez
Digital Fascinations Versus Constructed Reality: Towards Achieving Excellence in Execution, A Practical Approach	Innovative bridges over Bega	Inflatable structures and digital fabrication
T.M. Boake	<i>L. Toduđi, E. Meteş, E. Petzek, M. Toduđi, G. Ispășoiu & B. Zaha</i>	<i>O. Iuorio & H.S. Matharou</i>
	Flex Skin: Developing a material system based on interlocking wooden panels	Deployable structures with straight bars: Design, manufacturing and assembly
	<i>F. Fotouhi, M. Hudert, G. Kayo & T. Kotnik</i>	O.F. Avellaneda Lopez

Thursday Afternoon (ThA), July 25, 2019

12:30 – 14:00 **Lunch Break**

14:00 – 15:30 **Concurrent Technical Sessions** ThA 1 to ThA 3

ThA 1 – Auditorium 2	ThA 2 – Auditorium 3	ThA 3 – Room 1
General Session The tectonic of architectural solutions (1)	General Session The borderline between architecture and structural engineering (1)	Special Session Tall buildings
Chair: P. Trovalusci	Chair: E. Gomes	Chair: D. Oakley
The construction of the Porto School <i>E. Fernandes</i>	Historic timber roof structures: Value and influence on the seismic behaviour of heritage buildings <i>A. Keller & M. Mosoarca</i>	High-rise building modelling: numerical and analytical approaches <i>L. Sgambi & B. Sato</i>
The tectonic structures of Sverre Fehn <i>J. J. Ferrer Forés</i>	From AgwA to Oversize: From design practice to a pedagogic and research project <i>B. Burquel, H. Fallon & B. Vandenbulcke</i>	Towards a design framework for the structural systems of tall buildings that considers embodied greenhouse gas emissions <i>J. Helal, A. Stephan & R.H. Crawford</i>
Temporal Reciprocities of Building and Site: Structural Patterns for Resilient Future-Use Structures <i>M.M. Laboy</i>	Multi-criterial vulnerability assessment for Timisoara city, Romania <i>I. Onescu, E. Onescu & M. Mosoarca</i>	Design-to-live or Design-to-build? The impact of delegated design responsibility in Melbourne's high-rise residential buildings <i>G. Marfella & A. Martel</i>
Low Impact Spans: Toward Emission-Based Structural Optimization <i>M. Mayer & L. Echevarría</i>		From form-finding to space-making in highrise designs <i>C. Bañón</i>

Thursday Evening (ThE), July 25, 2019

15:30 – 16:30 **Concurrent Technical Sessions** ThE 1 to ThE 3

ThE 1 – Auditorium 2	ThE 2 – Auditorium 3	ThE 3 – Room 1
General Session The tectonic of architectural solutions (2)	General Session The borderline between architecture and structural engineering (2)	General Session Educating architects and structural engineers (1)
Chair: E. Fernandes	Chair: F. Suárez Riestra	Chair: G. Mircea
1956. American background in Spanish Experimental Housing <i>N. Cervero Sánchez</i>	Partnering without boundaries: Integrating structures, architecture, practice, and education <i>K. Dong & T. Fowler</i>	It's all structural: Teaching construction logic with parametric modeling <i>A.C. Harfmann</i>
A new approach to the concept of tectonics <i>N.S. Yordanova</i>	From architectural competition to built reality: Predictable failures and serendipitous successes <i>J. Rey-Rey</i>	Draw First, Ask Questions Later: The Value of Manual Sketching in Elementary Architectural Structures Education <i>D.J. Oakley</i>
Fake Structures–Real Architecture? From the Parthenon in Athens, Greece to the Parthenon of Banned Books in Kassel, Germany <i>A.-C. Schultz</i>	Assessing architectural heritage: Identifying and evaluating heritage values for masonry and cast-iron buildings and structures <i>S. Eberhardt & M. Pospíšil</i>	Structures and architecture integration in a best use of wood design competition studio <i>D. Arm Priest & C. Manrique</i>
Computational Optimization in Architectural Design and Constructive Issues. A case study: the canopy of a waste collection center <i>P. Trovalusci & R. Panei</i>		SIXXIGames: Serious games to educate young architects and structural engineers <i>T. Iori, I. Giannetti & G. Capurso</i>
16:30 – 17:00 Coffee Break		
17:00 – 18:00 General Meeting International Association of Structures and Architecture (Auditorium 2)		
20:00 – 23:00 Gala Dinner (Casino de Lisboa – Restaurante Beltejo)		

Friday Morning (FrM), July 26, 2019

09:30 – 17:00 **Conference Accreditation** ICSA2019 Desk – Calouste Gulbenkian Foundation / Congress Centre

10:00 – 10:30 **Keynote Lecture** (Auditorium 2) Chair: A. Chen
L. Ren “Design for future: A new way of storytelling on footbridge”

10:30 – 12:30 **Concurrent Technical Sessions** FrM 1 to FrM 3

FrM 1 – Auditorium 2	FrM 2 – Auditorium 3	FrM 3 – Room 1
General Session Timber structures	General Session Concrete and masonry structures	General Session Educating architects and structural engineers (2)
Chair: J. Manoel Sánchez	Chair: J. Pérez Valcárcel	Chair: V. Murtinho
Active bending in timber structures: Case studies in design, development and construction <i>P. Tidwell</i>	Concrete Masonry Units: Innovation design strategies through architecture and building technology integration <i>C. Manrique, D. Armpriest, S. He & G. Florenca</i>	Experience-Based Learning in Construction Education. Testing the Effectiveness of the Product-Oriented Learning Situation <i>I. Vrouwe & L. Luyten</i>
Can timber lower the environmental impact of tall buildings? <i>C. De Wolf & C. Fivet</i>	Rehabilitation of Trumpeters’ Tower of the Saint Margaret Evangelical Church of Medias <i>V. Ungureanu, M. Georgescu & L. Gligor</i>	MERGE: Exploring new paradigms for educating architects, engineers and builders <i>J. Kansler & J. Doerfler</i>
Timber T-section beams: From pre-tensioning to self-tensioning <i>J. Estévez-Cimadevila, D. Otero-Chans, E. Martín-Gutiérrez, F. Suárez-Riestra & J. Vázquez-Rodríguez</i>	A Platform of Design Strategies for the Optimization of Concrete Floor Systems in India <i>M.A. Ismail & C. Mueller</i>	The Structural Depth of the Masonry Antidome and Ambidome <i>L. Luyten & E. Jannasch</i>
Paper and cardboard as a sustainable building materials <i>J.F. Łatka</i>	A prototype for precast covers. An optimal solution by Torroja <i>J. Antuña & B. Orta</i>	From abstract construction to community integration <i>L.H. Hansen</i>
Making-of Pringle: Hybrid structure from equitangential, bending active, wooden frame and minimal surface robe-net <i>G.H. Filz</i>	Research into the response of segmental masonry barrel vaults to dynamic loading effects <i>J. Witzany, R. Žigler, T. Čejka, J. Karas, J. Kubát, M. Pirner & S. Urushadze</i>	Integrating design science and systems thinking for active learning <i>M.M. Laboy</i>
Case studies on spatial timber constructions in modern architecture and public art <i>Y.T. Shi & L.Y. Wu</i>	The Sorolla Institute of Valencia (Spain). A project by J.R. Azpiazu <i>E. Fenollosa, I. Cabrera & B. Serrano</i>	Teaching Reflection: The Unrealized Potential of Log Construction <i>J.X. Zhu, P. Ghelichi & R.S. Diederling</i>
The process of rocking CLT into a HOT cabin <i>L.D. Houck, J. Dodson, S. Melville, W. Pearson & T. This</i>	Masonry tectonics: Craft, labor, & structural innovation in architectural education <i>F. Trubiano, J. Dessi-Olive & R. Gentry</i>	Education on Structural Glass Design: Redefining glass through the design of innovative, full-glass structures <i>F. Oikonomopoulou, T. Bristogianni, C. Louter, F.A. Veer & R. Nijse</i>

Friday Afternoon (FrA), July 26, 2019

12:30 – 14:00 **Lunch Break**

14:00 – 15:30 **Concurrent Technical Sessions** FrA 1 to FrA 3

FrA 1 – Auditorium 2	FrA 2 – Auditorium 3	FrA 3 – Room 1
General Session Building envelopes (1)	General Session Steel and composite structures & Structural design challenges	General Session Educating architects and structural engineers (3)
Chair: G.H. Filz	Chair: R. Póvoas	Chair: O. Iuorio
Strategies for the refurbishment of heritagelisted post-war facades <i>I. Sørensen & F. Mähl</i>	Symbol and technique of steel domes in Italy <i>R. Morganti, A. Tosone, M. Abita & D. Di Donato</i>	Parametric design and analysis of building structures in the Architecture School of A Coruña <i>J. Vázquez-Rodríguez, D. Otero-Chans, J. Estévez- Cimadevila, E. Martín-Gutiérrez & F. Suarez-Riestra</i>
Wrapping up and weaving buildings: handcrafted techniques in contemporary architecture <i>I. Curiel Peraza</i>	Structural aluminium in architecture – The history and future of aluminium as a structural material <i>S.H. Dyvik, B. Manum, J. H. Mork & M. Luczkowski</i>	Structural integrity and functionality of form; exploring relations of load-bearing elements and architectural form in the education of engineers <i>A. Rønquist, B. Manum & N. Labonnote</i>
A Hybrid Adaptive Composite Based Auxiliary Envelope <i>I.W. Foged, A. Pasold & T. Pelosini</i>	The ephemeral robustness: Structure for temporary constructions <i>A. Bernabeu-Larena, J. Gómez-Mateo & J. Bernabeu-Larena</i>	Transforming structure: The metaphorical construction process and structural design <i>E.V. Ellis & D.A. Kratzer</i>
Structural adhesive connections for building façade applications <i>K.V. Machalická, M. Vokác, M. Zikmundová & M. Eliášová</i>	From Repetition to Chaos: Complex Fabrications in Contemporary Steel Structures <i>T. M. Boake</i>	Teaching Construction Thinking in Architecture through Materiality and Craftsmanship <i>M. Rinke</i>
	<i>Structural Comparison of Scissor-hinge Linkages</i> <i>F. Maden, Y. Akgün, K. Yüçeturk, E. Aktaş, M.Y. Uncu & C. Mitropoulou</i>	<i>Adaptation of a monument building for accessibility of disabled persons, a case study</i> <i>C. Bocan, D. Bocan & A. Keller</i>

Friday Evening (FrE), July 26, 2019		
15:30 – 16:00 Coffee Break		
16:00 – 17:30 Concurrent Technical Sessions FrE 1 to FrE 3		
FrE 1 – Auditorium 2	FrE 2 – Auditorium 3	FrE 3 – Room 1
General Session Building envelopes (2)	General Session Computer and experimental methods	General Session Educating architects and structural engineers (4)
Chair: M. Eliášová	Chair: D. Parigi	Chair: J.F. Łątka
Good looking and safe: “heavy” Façades in Seismic Zones M. Roik	Conceptual design in the years of the numerical revolution: risks and perspectives <i>L. Kubiak & L. Sgambi</i>	Timber tectonics in the digital age: Interdisciplinary learning for data-driven wood architecture <i>M. Riggio & N.Y. Cheng</i>
Energy efficiency study applied on a monument building D. Bocan, C. Bocan & A. Keller	Self-supporting ceramic wall system: Challenges of additive manufacturing of architectural ceramic components <i>J. Moreira, L. Ferreira, B. Figueiredo, P.J.S. Cruz, A.M. Sampaio, R. Gonçalves & A.J. Pontes</i>	Research Initiatives: Structural Application into Design Process M. Callahan, S. Shadravan & Y. Obasade
Fastening technology as an interface and integration element of architectural, structural, and building engineering P. Spyridis	Design exploration of architectural geometries and structural performance for sports arenas based on SOM-clustering and structural performance simulation W. Pan, Y. Sun, M. Turrin, C. Louter & I. S. Sariyildiz	Aspects of the integral teaching of Structures and Architectural Design <i>M. Blenkuš & T. Krušec</i>
	Experimental dynamic behavior of an of an historical thin shell structure in concrete: the Paraboloide of Casale Monferrato <i>E. Lenticchia, R. Ceravolo & S. Invernizzi</i>	Advanced structural integration collaborative model for architecture students T. Fowler & S. Rihal
		Exploring experimental methods on teaching structures for architects: first results of a new course at FAUP <i>E. Brito & R.F. Póvoas</i>
17:30 – 18:00 Closing Ceremony (Auditorium 2)		

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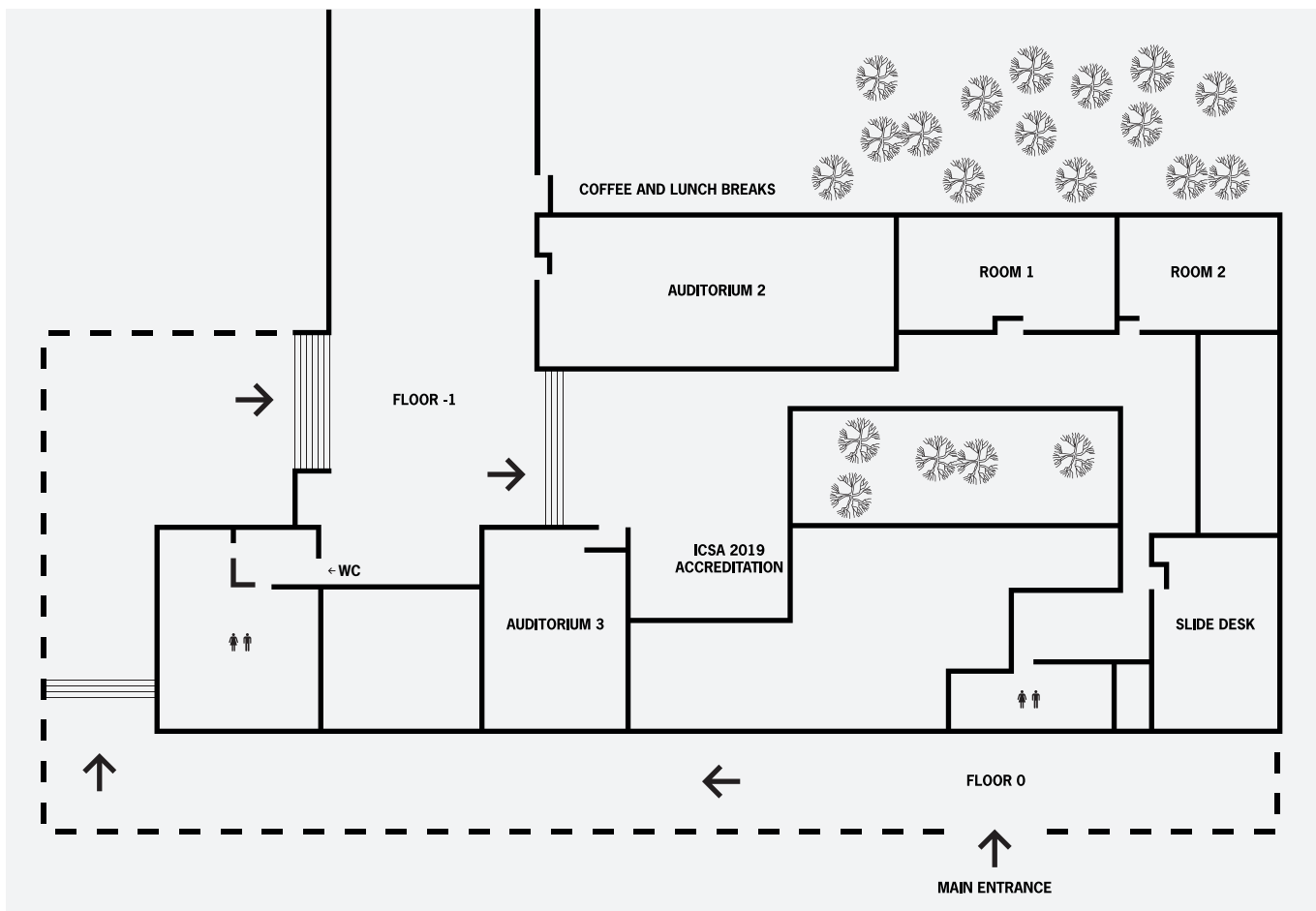
Zaha, B. ThM 2-A3
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ICSA2019 SHORT PROGRAM

Tuesday, July 23, 2019				
15:00 – 19:00	Conference Accreditation ICSA2019 Desk – Calouste Gulbenkian Foundation / Congress Centre			
Wednesday, July 24, 2019				
08:00 – 19:00	Conference Accreditation ICSA2019 Desk – Calouste Gulbenkian Foundation / Congress Centre			
09:00 – 09:30	Opening Ceremony (Auditorium 2)			
09:30 – 10:30	Keynote Lectures (Auditorium 2)			
10:30 – 11:00	Coffee Break			
11:00 – 12:30	WeM 1 Mini-symposium Circular Tectonics (1)	WeM 2 General Session Special structures (1)	WeM 3 General Session The history of the relationship between architects and structural engineers	WeM 4 Special Session Wood: Structure and Expression
12:30 – 14:00	Lunch Break			
14:00 – 16:00	WeA 1 Mini-symposium Circular Tectonics (2 & 3)	WeA 2 General Session Innovative architectural and structural design (1)	WeA 3 General Session The use of new materials	
16:00 – 16:30	Coffee Break			
16:30 – 17:30	WeE 1 Mini-symposium Circular Tectonics (4)	WeE 2 Special Session Crafting Spatiality	WeE 3 General Session Glass Structures	
17:30 – 18:00	Presentation of the Associated Event – The Bones of Architecture – An exhibition on design practices (Auditorium 2)			
19:30 – 22:30	Visit to the exhibition “The Bones of Architecture” & Welcome Reception (Centro Cultural de Belém)			
Thursday, July 25, 2019				
08:30 – 19:00	Conference Accreditation ICSA2019 Desk – Calouste Gulbenkian Foundation / Congress Centre			
09:00 – 10:00	Keynote Lectures (Auditorium 2)			
10:00 – 10:30	Coffee Break			
10:30 – 12:00	ThM 1 General Session Comprehension of complex forms & Concept architectural buildings	ThM 2 General Session Innovative architectural and structural design (2)	ThM 3 General Session Other & Lightweight and membrane structures	
12:30 – 14:00	Lunch Break			
14:00 – 15:30	ThA 1 General Session The tectonic of architectural solutions (1)	ThA 2 General Session The borderline between architecture and structural engineering (1)	ThA 3 General Session Tall buildings	
15:30 – 16:30	ThE 1 General Session The tectonic of architectural solutions (2)	ThE 2 General Session The borderline between architecture and structural engineering (2)	ThE 3 General Session Educating architects and structural engineers (1)	
16:30 – 17:00	Coffee Break			
17:00 – 17:30	General Meeting – International Association of Structures and Architecture (Auditorium 2)			
20:00 – 23:00	Gala Dinner (Casino de Lisboa – Restaurante Beltejo)			

Friday, July 26, 2019			
09:30 – 17:00	Conference Accreditation ICSA2019 Desk Calouste Gulbenkian Foundation / Congress Centre		
10:00 – 10:30	Keynote Lecture (Auditorium 2)		
10:30 – 12:30	FrM 1 General Session Timber structures	FrM 2 General Session Concrete and masonry structures	FrM 3 General Session Educating architects and structural engineers (2)
12:30 – 14:00	Lunch Break		
14:00 – 15:30	FrA 1 General Session Building envelopes (1)	FrA 2 General Session Steel and composite structures & Structural design challenges	FrA 3 General Session Educating architects and structural engineers (3)
15:30 – 16:00	Coffee Break		
16:00 – 17:30	FrE 1 General Session Building envelopes (2)	FrE 2 General Session Computer and experimental methods	FrE 3 General Session Educating architects and structural engineers (4)
17:30 – 18:00	Closing Ceremony (Auditorium 2)		

CONFERENCE VENUE





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