Thematic Session

TS10. Hypar concrete shells. A structural, geometric and constructive revolution on the mid-20th century

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The proposed thematic session focuses on the construction of shells made of hyperbolic paraboloid (hypar) surfaces, which had their zenith in the 1950s and 1960s. The aim is to study in depth the various aspects that characterize and define this type of laminated reinforced concrete structures (with extremely efficiency given the advantageous structural characteristics of the hypar geometric form), and the conditions that determined its development and diffusion. Analysing and contrasting different points of view will allow us to have a panoramic view of a one of the most surprising construction phenomena of the last century.

Participants are invited to present studies on hypar concrete shell structures, addressing the analysis of relevant aspects in their construction. The following approaches are proposed:

- Analysis methods employed: Everyone who builds must be able to guarantee the safety of the work done. This has been a permanent need in any type of construction performed. The introduction, development and diffusion of any construction technique must be linked to the knowledge of its behaviour, according to the means available at any given time, and to the capacity to demonstrate its safety. For this reason, it is proposed to study the methods of analysis used in each place and at each time.
- Experimental studies: Reduced models. Analytical knowledge of the behaviour of the shells usually led to unapproachable numerical solutions. As an alternative and complement, some technicians developed tests on scale models to demonstrate the sufficient strength and rigidity of the structures, as well as the structural advantages offered by the hypar geometry.
- Construction methods and materials used: Essentially, the shells were made of reinforced concrete poured over continuous formworks. However, other

materials and techniques were also explored, giving rise to local solutions that reached an important development and managed to create remarkable works.

- Relationship with the economic and social conditions: One of the fundamental aspects in understanding the emergence and success of a construction process is to understand the influence of the technical and economic conditions of the environment in which it takes place.
- New materials and new techniques: The designers and builders of shells were faced with a new technique in which they were forced to reuse the technique they had at their disposal and added their own contributions to simplify and improve the final result. These investigations gave rise to different procedures (formworks, scaffolding, prefabricated moulds, sprayed concrete) or materials (concrete of different qualities, pre-stressed sheets, concrete with fibres, plastics, etc.).

Of course, the five approaches we describe do not limit the field of study, but they give an idea of the extent of the proposed topic.