“Precast Concrete Architecture in Spain and Latin America”

Alejandro López - Technical Manager ANDECE
- Spanish Precast Concrete Manufacturers Association
- Founded in 1964
- Represented by 92 precasters (≈ 75% of national precast market) and 5 ad-members (raw materials suppliers, service providers)
- Members of BIBM (European Precast Confederation) as well as other technical and institutional organizations both national and international
More than 500 million of persons in 20 countries

Big differences (among countries and urban/rural areas)

Precast concrete development is linked with economic growth

<table>
<thead>
<tr>
<th>Paraguay</th>
<th>USA</th>
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<tbody>
<tr>
<td>1) Steel</td>
<td>1) Workforce</td>
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<tr>
<td>2) Concrete</td>
<td>2) Steel</td>
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<tr>
<td>3) Formworks</td>
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<td>4) Workforce</td>
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Spain and LATAM

- Level of development in precast concrete construction:
  - ↑↑↑Spain
  - ↑ Chile, Mexico, Panama, Colombia, Argentina and Uruguay
  - The rest
Spain: Nearly any field or construction element is prefabricable in concrete (buildings, infrastructures, pavements,...)

Wide net of companies
Chile, Mexico, Panama, Colombia, Argentina and Uruguay: although prefabrication is not new at all, not many elements are prefabricated (buildings, infrastructures, pavements,...)

Precast concrete is perceived as high quality and performance solution but expensive
Level of development

- Rest of countries: small development of industry
- Only single units are in precast concrete: masonry blocks, kerbs, tiles,…
1942: Francisco Fernández Conde, gets from Eugène Freyssinet the patent of prestressed concrete for Spain and Latin America and produces first precast beams for beam-and-block floor systems
Prefabrication in Spain (evolution)

INDUSTRIALIZATION STAGES

1950 – 1970
• CLOSED SYSTEMS
• MASS PRODUCTION
• EUPHORY
• BUSINESS

1970 – 1980
• CRISIS
• END CLOSED SYSTEMS
• NEW COMPONENTS
• LIGHT PREFABRICATION

1980 – 2000
• DEMOLITIONS
• NEW USES OF PREFABRICATION
• CONSTRUCTION BY COMPONENTS
• HEAVY PREFABRICATION

From 2000
• CONSOLIDATION OF INDUSTRIALIZATION
• CE Marking (↑ QUALITY)

Economic crisis → drastic drop of construction demand
Companies: most have family business origin but turned quite professional (investments in machinery, new facilities, know-how, …)

General context: social barriers. Spain is a “concrete” country but “in situ” use is predominant (90% vs 10%)

Building construction solutions have evolved on the back of constant improvements in technique and the fruitful collaboration of precasters with architects, engineers, laboratories, suppliers and builders.

The most advanced construction materials available were first used in prefabrication (steels, additives, supplementary cementitious materials, etc.)

Internationalization has been the way out for the last few years (focused in Latam)
Most important Precast Companies have developed methods or prefabrication building systems that allows the realization of the whole skeleton (façade and structure) in precast.

<table>
<thead>
<tr>
<th>Field</th>
<th>Share to be covered (up to)</th>
<th>Systems</th>
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</thead>
<tbody>
<tr>
<td>Schools and kindergarten</td>
<td>90%</td>
<td>Structure, facades</td>
</tr>
<tr>
<td>Industrial buildings</td>
<td>100%</td>
<td>Structure, facades</td>
</tr>
<tr>
<td>Commercial buildings</td>
<td>100%</td>
<td>Structure, facades</td>
</tr>
<tr>
<td>Residential buildings</td>
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<tr>
<td>Slabs</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Beams</td>
<td>30%</td>
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</tr>
<tr>
<td>Columns</td>
<td>25%</td>
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<tr>
<td>Facades</td>
<td>30%</td>
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</tbody>
</table>
Façades

- Architectural panels systems (*heavy prefabrication*)
  - Non structural
  - Structural
- Ventilated façade systems (*light prefabrication*)
  - GRC (Glassfibre reinforced concrete)
  - Polymer concrete panels

Urbanisation

- Pavements
- Urban furniture
- Other solutions

Structures

Modular construction
Increasing of cooperation among architects and precasters

The perception has fully changed: from an industrial element to an aesthetic solution with many design possibilities → Architectural design based on precast concrete systems

Precasters propose an optimized façade solution: geometry (repetitiveness as an ideal) and modulation, surface finishes,…for residential, commercial, industrial, etc. buildings

From a single envelope to the full façade section:

- To meet regulatory requirements (energy efficiency, acoustics, waterproof, fire resistance). Ex. sandwich panels including thermal insulation
- Structural resistance and stability (loadbearing walls)
- Including windows or doors from factory
Architectural panels façade systems

- Rubber mold
- Rubber mold
- Sandblast Grey and White cement

Surface retarding

- Painting
Residential building
Arch: Ricard Perich, Rafael Gálvez & Eduard Freixas
Sabadell (Barcelona) 2010
PREINCO

Awarded with Social Housing Prize of Catalonia in 2013
Architectural panels façade systems

The highest building made of precast load panels in Spain (65 m high)

Residential building
Arch: Roberto Tapia & Jorge Calvo
Coslada (Madrid) 2007
INDAGSA
Architectural panels façade systems

National housing prize, 2006

Residential building
Arch: Enrique Herrada & Marta Maiz
PREINCO

Madrid 2004
Architectural panels façade systems

Renaissance Barcelona  Fira Hotel
Arch: Jean Nouvel / Ribas & Ribas

L'Hospitalet (Barcelona), 2011
ESCOFET 1886
Architectural panels façade systems

Casa del Cubo – Pilgrim hostel
Arch: Luis García, Antonio García & Fco. Javier Santamaría
Burgos, 2011
PREHORQUISA
Architectural panels façade systems

Acuario fluvial
Arch: Álvaro Planchuelo
Expo Zaragoza 2008
PRAINSA
Architectural panels façade systems

- RC70 columns, curve facades, HC slabs, double T beams, curve panels

Mall
Arch: Unknown

Huesca 2015
PRECON
One of the few precast concrete segments that has grown for the last years.

GRC façade systems as the precast concrete solution facing other material competitors (ceramics, aluminium, masonry), including refurbishment works.

Two main configurations: sandwich panels (1+x thermal insulation) and incorporated frame.

Incoming performance: decontamination (Nox,…) by use of photocatalytic technology.
GRC ventilated façade systems

Residential building
Arch: MVRDV & Blanca Lleó
Madrid, 2005

DRACE EDIFICACIÓN
GRC ventilated façade systems

Ciudad de la Justicia
Arch: AYESA & MECANOO
Córdoba, 2016
PREHORQUISA
Polymer concrete ventilated façade systems

- Very few manufacturers
- Material also addressed for other purposes in façades (copings, lintels, jambs, gargoyles,...)
- Expensive solution in general (customized) but appropriate to refurbish/renovate facades
Polymer concrete ventilated façade systems

- Both designer and precaster convince the housers to invest on the renovation (IRR = 6.7 years)
Structures within industrialized architecture

- High compatibility between architecture and prefabricated structure:
  - Making an assumption of the existence of sags in floors
  - Presence of brackets and support mechanisms
  - Relevance of the cross section of pillars and supports
  - Minimization of overhangs and structural continuities
  - Minimization of particular solutions
  - Minimization of holes for specific facilities
  - Concentration of vertical communication cores and installations holes
  - Preference for orthogonal geometries and regular plant
Structures: industrialized architecture

Maritime Station
PREVALESA

Denia, 2012
Structures: industrialized architecture

Residential house
Arch.: ENSEMBLE ESTUDIO

Las Rozas (Madrid), 2005
PRAINSA
Structures: industrialized architecture

Pedestrian bridge (48 m)
Designer: Structural Research PRAINSA

Awarded with best Spanish precast practice. BIBM Congress. 2005

Pamplona, 2004
Modular construction

- The whole system is able to fulfill all the requirement as well as guarantee of closed costs, tight deadline

- Total industrialization → increasing demand
Precast concrete architecture in Latin America

- Precast concrete solutions are much more used in civil engineering works

- And the architectural version of precast concrete elements?
  - Increasing use of GRC ventilated facade systems in commercial or office buildings
  - Pavements are usually exempt of aesthetic requirements
Industrial buildings: frame + facade with small aesthetic component
Unique definition of “concreto arquitectónico” in Latin America as “aquél que queda expuesto como superficie interior o exterior dentro de la estructura terminada que contribuye definitivamente a su carácter visual y está diseñado especialmente como tal en los planos y especificaciones del contrato”
Precast concrete architecture in Latin America

- Research Centre ARGOS. Combined use of GRC and solid reinforced concrete panels. Medellín (Colombia). 2015 ARGOS
- Convention Centre. GRC. Lima (Peru). 2014 MANUFACTURAS DEL CEMENTO
- German School. GRC. Chicureo (Chile). 2015 ULMA ARCHITECTURAL SOLUTIONS
- Cinemar Megaplaza. Panels + frame. Lima (Peru). 2016 PREANSA
New trend: from a simple manufacturer which produces a range of precast concrete elements, to a “designer”

Company can advice and accompany the architect or urban planner in the whole process of design and development of the product, since the initial study to the work management, or if prefer, any of the phases:

4. Work management
We take charge of the start-up and follow-up of the work, as well as of the realization of the corresponding decontamination studies.

It covers:
- Star-up of the execution project
- Exhaustive follow-up of the constructive process
- Data acquisition and real decontaminating studies
Urbanisation: pavements
Urbanisation: furniture

- Products: under catalogue (furniture) or customized (streetscapes)
Urbanisation: furniture + pavements
Urbanisation: precaster as designer
Challenges to be faced

- Increasing demand of precast concrete solutions (marketing)

- Continuous development in materials, software (BIM), designs, facilities and machinery, etc.

- Sustainability as factor to increase the competitiveness industry (less waste, thermal mass, faster, more quality and durability,...)
Precaster role

- Work = design (new approach) against work ≠ design (wrong approach)

- Need to define the project as precast from the initial stages and not changing an evolved project based on in situ systems

- Industrialized architecture must promote such an multidisciplinary approach in which all the construction agents are closely linked the success of the work
Precaster role

- Design on precast forces to a greater rationalization, greater standardization of typologies and better integration of different uses within the same structural typology

- Design is essential (BIM and industrialization): it’s (the only) way to ensure the success of the project, controlling construction units, schedule, costs, etc.

- Every precast company has its own solutions → more cooperation / communication

- Precast concrete construction is a way of engineering outsource
Thanks for your attention
Any question?

alopez@andece.org
www.anndece.org