Jaume Armengou

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1. PERSONAL INFORMATION

- Date of birth: 11 April 1963
- Nationality: Spanish

2. EDUCATION

- 2005: Advanced Management Program (IESE, Universidad de Navarra (*University of Navar*), Barcelona, Spain)
- 1991: PhD (Doctor Enginyer de Camins, Canals i Ports, Civil Engineering program, Universitat Politècnica de Catalunya (*Technical University of Catalonia*, UPC), Barcelona, Spain). PhD Thesis: "Vertido libre por coronación en presas bóveda. Análisis del campo de presiones en el cuenco amortiguador" (*Free overtopping in arch dams. Analysis of the field of pressures in the stilling basin*)
- 1987: Civil Engineer (Technical University of Catalonia, Barcelona, Spain)

3. PROFESSIONAL EXPERIENCE

- 2016-present: Vice-chancellor for Academic Organization and International Relations. Lecturer. International University of Catalonia.
- 2007-2016: Vice-chancellor for Academic Organization and Teaching Staff. International University of Catalonia. Lecturer (area: structures; School of Architecture)
- 2003-2007: Technical Director and member of the board of Prefabricaciones y Contratas (Precast & Contractors, a Spanish 125.000.000 $ precast concrete company owned by CimentsMolins, an 816.000.000 $ multi-national cement company) and co-founder and member of the R&D committee of CimentsMolins.
- 1990-2003: Freelancer and administrator of a civil engineering consultancy company (JAO Ingenieria Civil)

4. TEACHING

- 1987-1991 (PhD period). Hydraulics (Technical University of Catalonia, Barcelona, Spain)
- 1995-2000 (visiting professor). Hydraulics, structural, architectural and geotechnical engineering (Universidad de Piura (*University of Piura*), Piura, Peru)
- 2006-2007 (associate professor). Project Management (Technical University of Catalonia, Barcelona, Spain)
- 2001-2002 (visiting professor). Ethics in design and project management (University of Navar, Pamplona, Spain)
- 2007-2011. Structures and Ethics. (International University of Catalonia, Barcelona, Spain)

5. RESEARCH

5.1. Projects made through Ciments Molins

- Co-financing the activities of the "Innovation in Concrete Technology" chair of the Technical University of Catalonia
- Involvement in the SOSTAQUA "Technological developments towards a self-sustainable urban water cycle" project (funding from a CENIT programme)
- Adaptation of the calculation program EF CiD (2005) with the Universitat Politècnica de València (*Technical University of Valencia*, UPV). Prof. Adolfo Alonso.
- With the Technical University of Catalonia (2005-2007):
    i. To obtain a concrete with a tensile capacity higher than that of the standard one without bar reinforcement and at a low cost (2006 and 2007). Prof. Antonio Aguado.
    ii. To mechanize the calculation of bridges including time-dependent phenomena, evolutive construction process and dynamic effects (2006 and 2007). Prof. Joan Ramon Casas.
    iii. To launch a new system of wind generator towers. The results are gathered in "Proyecto de lanzamiento de un nuevosistema de torres de aerogeneradores" (*Project for the launching of a new system of wind generator towers*), 2007. Prof. Modest Batlle.
    iv. To program a model of evolutive calculation of reinforced or prestressed concrete and steel sections. The results are collected in the dissertation thesis "Análisis no lineal y comportamiento en servicio y rotura de secciones construidas evolutivamente" (*Non-linear analysis and in-service and failure behavior of*

sections constructed evolutively), 2007. Prof. Antonio Aguado.

v. To test a case of gravel collapse (2006). Prof. Eduardo Alonso.

5.2. Some papers, books or chapters and contributions to conferences.

- I congreso sobre los caudales ecológicos (*1st congress on ecological flows*). Co-organizer and co-editor. Barcelona, 1999.
- International Congress on Family and Society. Presentation of session II (Família Actual i Canvi Social [*Current family and social change*]).
- "Aspectos éticos de los peritajes judiciales en patologías de estructuras" (*Ethical aspects in legal expert reports on structure pathologies*). Armengou, J., Corcó, J. 2008. ACHE Congress. Valencia, Spain.
- "Sistema integrado de toma de decisiones en proyectos de estructuras prefabricadas" (*Integrated decision-making system in projects with precast structures*). Ormazábal, G., Armengou, J., Aguado, A., Ramos, G. 2002. First national congress on precasting. ACHE.
- "Aplicaciones estructurales del HRF: tubos de saneamiento, paneles de cerramiento y placas de suelo reforzado" (*Structural applications of FRC: drainage pipes, enclosure panels and reinforced-soil plates*), 2007. Publications from the Department of Construction Engineering. Technical University of Catalonia.
- "Gestión Integrada de proyectos prefabricados para obra civil" (*Integrated management of prefabricated projects for civil works*), 2007. Proceedings from the José Antonio García seminar. Department of structural mechanics. University of Granada.
- -Internal publications of the Department of Hydraulic and Hydrological Engineering from the UPC (1987-1991):
    i. –Impact stilling basins
    ii. –Modeling of the failure of a nappe of water overtopping arch dams
    iii. –Proposal for a physical model for testing impact stilling basins
    iv. –Static and dynamic calculation of a methacrylate plate for a scale model
    v. –Design of a scale-model test campaign in order to get to know the pressure field at the floor of free-nappe stilling basins
    vi. –Free-nappe stilling basins: state of the knowledge. Definition of a research project
    vii. –Aeration and atomization of a free-nappe overtopping arch dams. Effects on the stilling basin
- -Reports from the CIRIT, Generalitat de Catalunya (1989-1991):

    i. –Hydraulic energy dissipation at the foot of arch dams
    ii. - Hydraulic energy dissipation at the foot of the dam: numerical modeling of overtopping in arch dams and analysis of a physical-model experience. Comparison with similar studies
- "Mean and fluctuating pressure field in full-width free-nappe stilling basins". Armengou, J. et al. Proceedings from the XXIV IAHR Congress, Madrid, 1991.
- "Measurement and data acquisition of the pressure field in tests carried out on a reduced model of a stilling basin". Polo, J. Castillo, L.G., Armengou, J., Dolz, J. Proceedings from the 4th International Conference "HYDROSOFT '92", Wessex Institute of Technology. 1992.
- "The professional competence of the civil engineer". III National Congress on Civil Engineering, Barcelona. 1999.
- "Excellence in the practice of Civil Engineering". I Symposium on construction research, IccET, CSIC. 2005.
- "Innovations on components and testing for precast panels to be used in reinforced earth retaining walls". de la Fuente, A., Aguado, A., Molins,C. and Armengou, J. Construction and Building Materials. 2010
- "An integrated decision-making methodology for the design of concrete structures". Armengou, J., Aguado, A. and Ormazabal, G. Informes de la Construcción. 2011.
- "Numerical Model for the Analysis up to Failure of Concrete Sections". de la Fuente, A., Aguado, A., Molins, C. and Armengou, J. Computers and Structures. 2011.
- "Factorias de emprendedores" (*Factories for entrepreneurs*). "La Vanguardia", Barcelona, 2009.
- "Hiperpaternidad" (*Hyperpaternity*). "La Vanguardia", Barcelona, 2009.
- "Architectural integration of energy solar collectors made with ceramic materials and suitable for the Mediterranean climate". J. Roviras, V. Sarrablo, M. M. Casanovas, J. Armengou. Informes de la construcción. 2016.
- "Realism and Impartiality: Making Sustainability Effective in Decision-Making". Miquel Bastons, Jaume Armengou. Science and Engineering Ethics. 2016.
- "Sustainability based-approach to determine the concrete type and reinforcement configuration of TBM tunnels linings. Case study: Extension line to Barcelona Airport T1". Albert De la Fuente, Ana Blanco, Jaume Armengou, Antonio Aguado. Tunnelling and Underground Space Technology. 2016.
- "MULTI-CRITERIA DECISION-MAKING TOOL FOR ASSESSING THE SUSTAINABILITY INDEX OF WINDTURBINE SUPPORT SYSTEMS: APPLICATION TO A NEW PRECAST CONCRETE ALTERNATIVE". Albert de la Fuente, Jaume Armengou, Oriol Pons, Antonio Aguado. Journal of Civil Engineering and Management. 2015

- "Human habitat, space and place". Miquel Bastons, Jaume Armengou. Journal of Agricultural and Environmental Ethics. 2016.
- "Moral Legitimacy in Controversial Projects and its relationship with Social License to Operate: A Case Study". Domenec Mele, Jaume Armengou. Journal of Business Ethics. 2015.
- "DETERMINATION OF FLUID LEAKAGES IN THE DIFFERENT SCREW-RETAINED IMPLANT-ABUTMENT CONNECTIONS IN A MECHANICAL ARTIFICIAL MOUTH". D. Martín, M. Molmeneu, M. Fernandez, M. Punset, L. Giner, J. Armengou, F.J. Gil. Journal of Materials Science: Materials in Medicine. 2015.
- "Occupational Risk Index for Assessment of Risk in Construction Work by Activity". Maria del Mar Casanovas, Jaume Armengou, Gonzalo Ramos. Journal of Construction Engineering and Management. 2013

5.3. Collaboration in codes.

- Recommendations for the Project, Execution and Assembling of Precast Elements. School of Engineers. 2005.
- Spanish code of structural concrete: Instrucción de Hormigón Estructural (EHE). Collaboration in the Fiber Reinforced Concrete annex. Spanish Government. 2008.

5.4. Patents (owned, invented or designed, only for Spain)

- 1993: Embocadura prefabricada y desmontable para desagües o drenajes superficiales(*Prefabricated and detachable mouth for superficial discharge or drainage*). 9302412.
- 1994: Embocadura de components prefabricados y ajustables para drenajes (*Mouth of prefabricated and adjustable components for drainage*). 9400868.
- 1994: Perfeccionamientos en la construcción de apoyos para muros de prefabricado (*Improvement in the construction of supports for precast walls*). 9400270.
- 1995: Estructura perfeccionada para la formación de túneles o galerías (*Improved structure for the formation of tunnels or galleries*). 9500549.
- 1995: Marcos prefabricados isostáticos con cimentación in situ (*Precast isostatic frames with in-situ foundation*). 9500891.
- 1998: Perfeccionamiento en la fabricación de muros de contención de tierras mediante tramos horizontals apilados con bandejas escalonadas (*Improvement in the fabrication of earth retaining walls by means of horizontal stretches piled up with step-shaped plates*). 009800533
- 2003: Capitel hueco para construcciones (*Hollow column capital for construction*). 200300811.

- 2006: Panel modular orgánico y proceso para su obtención (*Organic modular panel and the process for obtaining it*). 200601840.
- 2006: Estructura de soporte para dispositivos aerogeneradores (*Support structure for wind-generating devices*). 200603061.
- 2008: Método perfeccionado para la construcción de muros prefabricados (*Improved method for the construction of precast walls*). 200800955

5.5. Stays at other universities for more than one month:

- 1990. University of Glasgow (1,5 months): Hydraulic physical modeling (pre-doctoral)
- 1992. University of Piura (1,5 months): Hydraulic physical modeling

5.6. Assessor

- Referee for the journal "Materiales de Construcción", the Eduardo Torroja Institute for Construction Science (Consejo Superior de Investigaciones Científicas, *Spanish National Research Council*, CSIC)
- Member of some external boards from the Technical University of Catalonia for the granting of post-doctoral grants or applications.
- Member of the examining committee for dissertations at the Technical University of Catalonia and the University of Navar.

6. Application and management.

6.1. Technological design and structural calculation.

- Design, calculation and monitoring of the execution of the firewall and vehicle retaining system from Ronda del Mig (stretch: Plaça Cerdà - Avinguda Diagonal).
- Pontoon for channeling the Roja, Fonollar and Bullidor watercourses at El Prat de Llobregat (first application of invention model).
- Calculation of tunnel mouths (CN-152 and Maresme motorway: first application of the patent for provisional support of precast elements)
- Calculation of several passage pontoons from the L.A.V. near La Secuita and Perafort: first application of the improvement of the previous patent.
- Theoretical study about concrete and mortars without shrinkage.
- Calculation of theburied caisson of the Forum in Barcelona for Auding. Geometrical modeling of helicoidal elements by means of finite elements.

- Design of the traffic protection (sacrificial structure against falling blocks) for the Northern mouth of the Tueiro tunnel (León).
- Structural design of a stretch of the Montserratsewer.Application of corrugated-steel structures with big span as lost formworks.

6.2. Hydraulics and Hydrology. Maritime Engineering.

- Design and management of several scale models at several laboratories (Technical University of Catalonia and University of Piura).
- Several applications of vaults and caissons, together with their intellectual protection, at drainage sites and sewers.
- Calculation, design and monitoring of the execution of the piers at the Port Esportiu in Premià. Precast concrete with polyurethane fillings to achieve floatability.

6.3. Geotechnics.

- Design, calculation and monitoring of the execution of the security gallery of the Joanet tunnel, at the Eix Transversal. First application of patent for galleries with controlled cracking.
- Design, calculation and monitoring of anchored (precast or non-precast) walls in Cunit (earth retention under a deposit), La Seu d'Urgell (earth retention under a leaking channel), La Riba, Monistrol (consolidation of rocks under buildings), Arboló (unstable earth retention) and the A-7 highway in Bellaterra (lowering the level of a slope in order to accommodate a road under a bridge). The precast application is a novelty which provides aesthetic improvements and safety at work.
- Design of the perimeter wall of the cellar from Bodegas y Bebidas in Logroño. Novelty: solution with light buttresses and wall drilling in order to accommodate the girders.
- Design and monitoring of the execution of the headwall in Avinguda Vallbona (Barcelona). Application of the patent for piled-up walls.
- Design of the reinforcement of a broken wall in Ciutat Badia by means of anchorage to the ground. The extraction material was used during the drilling in order to adjust the design of the anchorage.

6.4. Road layout.

- Informative study about the Lleida-Girona dual carriageway (Eix Transversal): Calaf-Aguilar de Segarra and Aguilar de Segarra-Rajadell stretches.
- Project (together with three other designers) of the Pau Casals highway (Sitges-El Vendrell).

6.5. Computing and numerical calculation (FORTRAN programming).

- Hydraulic and structural calculation program for galleries of the "ARCO pipe" type. Expert system for the selection of optimal solutions for matters of transversal drainage in linear infrastructures.
- Calculation and reinforcement program for buried arch structures and their foundations.
- Programming of the pre-process for the calculation of vaults by means of the FLAC (Fast Lagrangian Analysis of Continua) system.

6.6. Environment. Environmental impact and corrective measures.

- Study of the environmental impact of the project for "the development of the N-152 road from P.K. 95 to P.K. 105". This was one of the first studies to incorporate tunnel fronts.
- Design of noise barrier walls by means of a conventional concrete and porous concrete "sandwich" for COPREMESA.
- Design and management of the execution of the "Torrent Mitjà" and "Calçada Romana" tunnels at the turnoff of the C-153 road for landscape restitution and elimination of the barrier effect of the layout. These date back to the time when the application of the cut-and-cover tunnel was extended as a corrective measure.
- Design of corrective measures (fauna passages) at the turn-off in Sant Quirze de Besora.

6.7. Control and surveillance. Audits and expert's reports.

There are plenty of assignmentswhich originate from my being included in the list of experts from the demarcation of the School of Civil Engineering of Catalonia for structural, environmental and hydraulic matters, or else from the inclusion of JAO INGENIERÍA CIVIL in the list of external consultants of FCC.

- Study of the causes for the collapse of a sewer in Igualada.
- Study of the causes for some slopes becoming instable in Olesa de Montserrat.
- Study of the causes for the collapse of a bridge in Cardona.
- Study of the ecological flow to be maintained at a small power station in Son del Pi.

6.8. Management.

- Management of my own company (JAO INGENIERÍA CIVIL)
- Technical director of PRECON and member of its direction committee, with all that it entails (management of directly and

indirectly dependent people, management and monitoring of software providers, management of the integrated management manual –quality, environment and workplace safety, economic monitoring of the company's production, risk management and project monitoring, etc.)

- Member of the R&D&I committee of Ciments Molins, constituted in 2006 with the aim of boosting the research activities within the group and generating improvement processes.
- Launching and monitoring the implementation of in-situ precasting (Oviedo, Los Bérchules, Terol, Caravia): team management.
- Four terms as Provost at the International University of Catalonia: in charge of teaching staff, curricula, language service, linguistic normalization service, project development and post-graduate service, quality services, international relations.