Jaume Armengou

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1. EDUCATION

- 2005: Advanced Management Program (IESE, Universidad de Navarra (University of Navarra), 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).

2. PROFESSIONAL EXPERIENCE

- 2018-present: Secretary General and Lecturer at IESE Business School, Universidad de Navarra.
- 2016-2018: Vice-chancellor for Academic Organization and International Relations. Lecturer (area: structures, project management, ethics; School of Architecture). International University of Catalonia.
- 2007-2016: Vice-chancellor for Academic Organization and Teaching Staff. International University of Catalonia. Lecturer (area: structures, project management, ethics; 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 Ciments Molins, an 816.000.000 $ multi-national cement company) and co-founder and member of the R&D&i committee of Ciments Molins.
- 1990-2003: Freelancer and administrator of a civil engineering consultancy company (JAO Ingeniería Civil).

3. TEACHING

- 2018-present. Lecturer of Managerial Decision Sciences. (IESE Business School, Universidad de Navarra, Barcelona, Spain).

- 2007-2018. Structures, Project Mangement and Ethics. (International University of Catalonia, Barcelona, Spain).
- 2006-2007 (assistant professor). Project Management (Technical University of Catalonia, Barcelona, Spain).
- 2001-2002 (visiting professor). Ethics in design and project management (University of Navarra, Pamplona, Spain).
- 1995-2000 (visiting professor). Hydraulics, structural, architectural and geotechnical engineering (Universidad de Piura (University of Piura), Piura, Peru).
- 1987-1991 (PhD period). Hydraulics (Technical University of Catalonia, Barcelona, Spain).

4. RESEARCH

4.1. 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 program).
- 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). PI Prof. Antonio Aguado.
    ii. To mechanize the calculation of bridges including time-dependent phenomena, evolutive construction process and dynamic effects (2006 and 2007). PI Prof. Joan Ramon Casas.
    iii. To launch a new system of wind generator towers. The results are gathered in "Proyecto de lanzamiento de un nuevo sistema de torres de aerogeneradores" (*Project for the launching of a new system of wind generator towers*), 2007. PI 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. PI Prof. Antonio Aguado.
    v. To test a case of gravel collapse (2006). PI Prof. Eduardo Alonso.
- Adaptation of the calculation program EF CiD (2005) with the Universitat Politècnica de València (*Technical University of Valencia*, UPV). PI Prof. Adolfo Alonso.

4.2. Some papers, books or chapters and contributions to Conferences

- "Approach for sustainability assessment for footbridge construction technologies: Application to the first world D-shape 3D-Printed fiber-reinforced mortar footbridge in Madrid", Pons-Valladares, O., Casanovas-Rubio, MdM., J. Armengou and de la Fuente, A.
- "Sustainability- Driven Decision-Making Model: Case Study of Fiber-Reinforced Concrete Foundation Piles O. Pons, Ph.D.; M. M. Casanovas-Rubio Ph.D.; J. Armengou, Ph.D.; and A. de la Fuente, Ph.D. Journal of Construction Engineering and Management, © ASCE, ISSN0733-9364. DOI: 10.1061/18 (ASCE)CO.1943-7862.0002073. 2021
- Imbernon, Ursula, Casanovas-Rubio, Maria del Mar, Armengou, Jaume and crispí, Marta. "An innovative tool to program exhibitions in museums: Case Study of CaixaForum." MW21: MW 2021. Published January 14, 2021
- "Sustainability-Oriented Model to Decide on Concrete Pipeline Reinforcement". Irene Josa, Albert de la Fuente, María del Mar Casanovas-Rubio, Jaume Armengou y Antonio Aguado. 2021
- "Decision-Making Tool for Enhancing the Sustainable Management of Cultural Institutions: Season Content Programming at Palau De La Música Catalana". Maria del Mar Casanovas-Rubio, Carolina Christen, Luz María Valarezo, Jaume Bofill, Nela Filimon, Jaume Armengou. 2020.
- "Mission-Based Corporate Sustainability: The Aigües de Barcelona Model." Miquel Bastons, Ricard Benguría, Jaume Armengou, Carlos Rey. In book: Responsible Business in a Changing World. 2020.
- "Minimizing the Social Impact of Construction Work on Mobility: A Decision-Making Method." Maria del Mar Casanovas-Rubio, Gonzalo Ramos, Jaume Armengou. Sustainability. 2020.
- "Sustainability of Column-Supported RC Slabs: Fiber Reinforcement as an Alternative." Albert de la Fuente, Maria del Mar Casanovas-Rubio, Oriol Pons, Jaume Armengou. 2019.
- "Decision-making tool for the optimal selection of a domestic water-heating system considering economic, environmental and social criteria: Application to Barcelona (Spain)." Maria del Mar Casanovas-Rubio, Jaume Armengou. 2018.
- "Performance-Based Engineering and Multi-Criteria Decision Analysis for Sustainable and Resilient Building Design." Khalid Mosalam, Hyerin Lee, Jaume Armengou, Umberto Alibrandi. Structural Safety. 2018.

- "Self-construction in informal settlements: a multiple-criteria decision-making method for assessing sustainability of floor slabs in Bucaramanga, Colombia." William G. Caballero Moreno, Inés Alegre, Jaume Armengou, Antonio Aguado. Journal of Housing and the Built Environment. 2018.
- "Decision –making tool for the optimal selection of a domestic water-heating system considering economic, environmental and social criteria: Application to Barcelona (Spain)." María del Mar Casanovas-Rubio, Jaume Armengou. Renewable and Sustainable Energy Reviews. 2018.
- "Towards the Sustainability in the Design of Wind Towers." Jaume Armengou, Antonio Aguado. Energy Procedia. 2017.
- "Theory of Resemblance and Academic Governance." Jaume Armengou. 2017. Dissertation of the joining ceremony of the Royal Academy European of Doctors.
- "Sustainability and Human Habitat." M. Bastons, Jaume Armengou. Proceedings. Second International Conference on Concrete Sustainability. 2016.
- "Sustainability Analysis of Steel Fiber Reinforced Concrete Flat Slabs." A. Blanco, Albert de la Fuente, Jaume Armengou, Antonio Aguado. Second International Conference on Concrete Sustainability. 2016.
- "Design for Safety in Construction Work." María del Mar Casanovas, Jaume Armengou, G. Ramos. Second International Conference on Concrete Sustainability. 2016.
- "Architectural integration of energy solar collectors made with ceramic materials and suitable for the Mediterranean climate." J. Roviras, V. Sarrablo, Maria del Mar Casanovas-Rubio, Jaume 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.
- "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." Domènec Melé, Jaume Armengou. Journal of Business Ethics. 2015.
- "Formation and Regression of the Ebro Delta: Ethical Implications of Human Intervention (Tree Cutting and Dam Construction) in the Natural Environment." Jaume Armengou, S. Albareda, M. Bosch, J. Corco. Indian Journal of Research. 2015.
- "The Accreditation Processes in Higher Education Institutions: Chile, Spain and other Latin American countries." 2015.

- "Multi-criteria Decision-making tool for assessing the sustainability index of wind turbine support: application to a new precast concrete alternative." Albert de la Fuente, Jaume Armengou, Oriol Pons, Antonio Aguado. Journal of Civil Engineering and Management. 2015.
- "Moral Legitimacy in Controversial Projects and its relationship with Social License to Operate: A Case Study". Domenec Melé, 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. Fernández, M. Punset, L. Giner, Jaume Armengou, F.J. Gil. Journal of Materials Science: Materials in Medicine. 2015.
- "Assesment of Occupational Risk and Design for Safety in Construction Work." María del Mar Casanovas, Jaume Armengou, G. Ramos. 2014.
- "Evaluation of the Labour Risks in Construction and its Consideration in the Project Designs and in the Decision Making." María del Mar Casanovas, Jaume Armengou, G. Ramos. 2014.
- "Anidolic Day-Light Concentrator in Structural Building Envelope." Khalid M. Mosalam, Nuria Casquero-Modrego, Jaume Armengou, Aashish Ahuja, Tarek I, Zohdi, Baofeng Huiang. 2013.
- "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.
- "Multi-criteria Methodologies for decision-making in Project management: the integration of the agent managers as indirect benefit." Jaume Armengou, Antonio Aguado. 2012.
- "An integrated decision-making methodology for the design of concrete structures". Jaume Armengou, Antonio Aguado, Gaizka Ormazabal. Informes de la Construcción. 2011.
- "Numerical Model for the Analysis up to Failure of Concrete Sections". Albert de la Fuente, Antonio Aguado, Ciments Molins, Jaume Armengou. Computers and Structures. 2011.
- "Innovations on components and testing for precast panels to be used in reinforced earth retaining walls." Albert de la Fuente, Antonio Aguado, Ciments Molins, Jaume Armengou. Construction and Building Materials. 2010.
- "Factorias de emprendedores" (*Factories for entrepreneurs*). "La Vanguardia", Barcelona, 2009.
- "Hiperpaternidad" (*Hyperpaternity*). "La Vanguardia", Barcelona, 2009.
- "Aspectos éticos de los peritajes judiciales en patologías de estructuras" (*Ethical aspects in legal expert reports on structure pathologies*). Jaume Armengou, J. Corcó. 2008. ACHE Congress. Valencia, Spain.

- "Structrural Aplications of Fiber Reinforced Concrete." Antonio Aguado, Jaume Armengou and 10 more. 2007.
- "Integrated Management of Prefabricated Projects for Civil Works." Jaume Armengou, Gaizka Ormazábal, Antonio Aguado. 2007.
- "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.
- "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.
- "Excellence in the practice of Civil Engineering". I Symposium on construction research, IccET, CSIC. 2005.
- "Cervera, Santa María Camí (A-2) Highway." Benito Romero Robles, Javier Ainchil Lavín, Jaume Armengou. Cemento Hormigón. 2005.
- "Recommendations for the Project, Execution and Assembly of Prefabricated Elements." Capítulos 5 y 6. More than 10 authors. 2004.
- "Sistema integrado de toma de decisiones en proyectos de estructuras prefabricadas" (*Integrated decision-making system in projects with precast structures*). Gaizka Ormazábal, Jaume Armengou, Antonio Aguado, G. Ramos, 2002. First national congress on precasting. ACHE.
- "The Ecological Flow: ¿sustainable development?" Jaume Armengou, Lorenzo Correa, Ingrid Rodo. 2001.
- "1st Congress on Ecological Flows." Jaume Armengou y 13 authors more. 2000.
- I congreso sobre los caudales ecológicos (*1st congress on ecological flows*). Co-organizer and co-editor. Barcelona, 1999.
- "The professional competence of the civil engineer". III National Conferences on Civil Engineering, Barcelona. 1999.
- International Congress on Family and Society. Presentation of session II (Família Actual i Canvi Social [*Current family and social change*]).
- "Nuevas Medidas para Minimizar Impactos: Falsos Túneles, en Papeles del Centro EIA". 1995. *New measures to minimize Impacts: False Tunnels, in Papers of the EIA Center.*
- "Measurement and data acquisition of the pressure field in tests carried out on a reduced model of a stilling basin". J. Polo, L. Castillo, J. Armengou, J. Dolz. Proceedings from the 4th International Conference "HYDROSOFT '92", Wessex Institute of Technology. 1992.
- 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". Jaume Armengou, et al. Proceedings from the XXIV IAHR Congress, Madrid, 1991.

4.3. Collaboration in codes

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

4.4. Patents (owned, invented or designed, only for Spain) and Computer Programs

- 2019: Patent. Aparato electromecánico portátil para manufactura aditiva de objetos tridimensionales aplicables en calzado o vestimenta. (Portable electromechanical device for additive manufacture of tridimensional objects applicable in footwear or clothing). 201930661.
- 2018: Utility Model. Piso para Calzado. *(Shoe sole).*
- 2008: Patent. Método perfeccionado para la construcción de muros prefabricados (*Improved method for the construction of precast walls*). 200800955.
- 2007: Computer Program. Diseño y Cálculo de Muros de Suelo Reforzado. *(Design and Calculation of Walls of Reinforced Soli-Walls)* Ramón Ribó, Jaume Armengou.

- 2007: Computer Program. Tableros de Vigas, 1. *(Decks of Precast Beams)* Lluís Callís, Jaume Armengou.
- 2006: Patent. Panel modular ae y proceso para su obtención (*Organic modular panel and the process for obtaining it*). 200601840.
- 2006: Patent. Estructura de soporte para dispositivos aerogeneradores (*Support structure for wind-generating devices*). 200603061.
- 2005: Computer Program. L-shaped Walls. Lluís Callís, Jaume Armengou.
- 2005: Computer Program. Buttressed Walls. Lluís Callís, Jaume Armengou.
- 2003: Calculation Software of Burried Galeries. B-08030-16.
- 2003: Patent. Capitel hueco para construcciones (*Hollow column capital for construction*). 200300811.
- 2003: Programa registrado de Rutinas Programadas para FLAC. Terraplenado de galerías. *(Registered Computer Program of Programed Routines for FLAC. Gallery Terracing)* B-0908-16.
- 2003: Programa registrado de Cálculo de Estructuras en Cajón. *(Registered Computer Program of Calculation of Structures in Drawer).* B-0907-16.
- 2003: Programa registrado de Cálculo Hidráulico de Obras de drenaje. *(Registered Computer Program of Hydraulic Calculation)* B-0906-16.
- 2003: Computer Program. Cajón. *(Drawer)*. Lluís Callís, Jaume Armengou.
- 2002: Patent. Perfeccionamientos en el Apoyo para Muros de Prefabricado. *(Perfectioning in the Support for Prefabricated Walls)*. 200002998.
- 2000: Program. Vigas Prefabricadas. *(Prefabricated Beams)*. Lluís Callís, Jaume Armengou.
- 1998: Patent. 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.
- 1998: Program. Vigas Peraltadas. *(Cambered Beams).* Lluís Callís, Jaume Armengou.
- 1995: Utility Model. Marcos prefabricados isostáticos con cimentación in situ (*Precast isostatic frames with in-situ foundation*). 9500891.
- 1995: Patent. Estructura perfeccionada para la formación de túneles o galerías (*Improved structure for the formation of tunnels or galleries*). 9500549.
- 1994: Patent. Perfeccionamientos en la construcción de apoyos para muros de prefabricado (*Improvement in the construction of supports for precast walls*). 9400270.

- 1994: Patent. Embocadura de components prefabricados y ajustables para drenajes (*Mouth of prefabricated and adjustable components for drainage*). 9400868.
- 1993: Patent. Embocadura prefabricada y desmontable para desagües o drenajes superficiales (*Prefabricated and detachable mouth for superficial discharge or drainage*). 9302412.

4.5. Stays at other universities for more than one month

- 2012. University of California, Berkeley (12 months): Building sustainability and energy efficiency.
- 1992. University of Piura (1,5 months): Hydraulic physical modeling.
- 1990. University of Glasgow (1,5 months): Hydraulic physical modeling (pre-doctoral).

4.6. Advisor

- 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 Navarra.

4.7. *Some Research Projects*

- Obtención, por medio del reciclaje del caucho de neumáticos de material para ortopedia personalizado mediante impresión 3D. *(Obtention, through rubber recycling of personalized orthopedic material through 3D printers).* Montserrat Bravo Godó. 2018-2019.
- Seguridad en Aplicaciones Estructurales de Hormigón Reforzado con Fibras. MEC. 2016-2019.
- Singapore-Berkeley Building Efficiency and Sustainability in the Tropics (SinBerBEST), Singapore National Research Foundation. 2012-2017.
- Laboratori d'Innovació Tecnològica en Edificació Industrialitzada i Sostenible (LITEIS). Generalitat de Catalunya. 2014-2016.
- Proyecto CENIT Sostaqua. Projecte CENIT. 2007-2010.
- Obtención de un hormigón con mayor capacidad de tracción que la estándar, sin armadura en barra y con bajo coste. *(Obtention of a concrete with a higher traction capacity than the standard one,*

without bar reinforcement and with low cost). Ciments Molins. 2006-2007.
- Mecanización del cálculo de nudos húmedos en estructuras prefabricadas de edificación. *(Mechanization of the calculation of wet knots in prefabricated building structures).* PRECON. 2003-2004.
- Evaluación del estudio de factibilidad de drenaje pluvial de las urbanizaciones de El Chiclal, Ignacio Merino, Japón, Piura, Perú. Municipalidad de Piura (Perú) *(Evaluation of the feasibility study of rainwater drainage in the urbanizations of El Chiclal, Ignacio Merino, Japan, Piura, Peru. Municipality of Piura, Peru*). 2001.
- Fenómeno de Acorazamiento en ríos de fuerte pendiente y granulometría extendida. *(Harborage phenomenon in rivers with steep slopes and extended granulometry)*. Universidad de Piura. 1998-2002.
- Erosión en la Bocatoma de la Central Huampani, Rio Rimac. *(Erosion at the Central Huampani Intake, Rimac Rive* Empresa de electricidad de Perú. 1995.
- Investigación en modelo hidráulico Puente Cincel de la Central Carcani V. Arequipa. Empresa de electricidad de Perú. 1991. Aplicación de nuevas técnicas hidráulicas (modelos físicos y numéricos) al proyecto y explotación de aprovechamientos hidroeléctricos. Plan de Investigación electrotécnica. *(Research on hydraulic model Chisel Bridge of the Central Carcani V. Arequipa. Electric company of Peru. 1991. Application of new hydraulic techniques (physical and numerical models) to the project and exploitation of hydroelectric developments. Electrotechnical Research Plan*). 1987-1991.

4.8. *Artistic and architectonic Works*: Proyecto de la Autopista Sitges – El Vendrell (denominada "Pau Casals") *(Highway Sitges-El Vendrell, called "Pau Casals").*

5. APPLICATION AND MANAGEMENT

5.1. 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).
- Culvert 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 culverts from the L.A.V. (High Speed railway) near La Secuita and Perafort: first application of the improvement of the previous patent.
- Theoretical study about concrete and mortars without shrinkage.
- Calculation of the buried 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 Montserrat sewer. Application of corrugated-steel structures with big span as lost formworks.

5.2. 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.

5.3. 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.

5.4. 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).

5.5. 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.

5.6. 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.

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

There are plenty of assignments which 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.

5.8. Management

- Secretary General at IESE Business School and member of the Executive Committee, in charge of Corporate Information Unit, Academic Secretary, Corporate Development, Corporate Marketing and Communications, Financial Aid Unit, Alumni, Library, Corporate Social Responsibility and Historical Archive.
- Management of my own company (JAO INGENIERÍA CIVIL).
- Technical director of PRECON and member of its board, 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 temporary factories (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 and international relations.

6. SOME ACCREDITATIONS AND OTHER MERITS

- Numerary member of the Royal Academy European of Doctors.
- Honorary member of the Consejo Superior Europeo de Doctores.
- Accreditations by ANECA: Assistant Doctor, Private University Professor, Hired Doctor.
- Accreditations by AQU: Lector, Recerca.
- Research tracks by AQU: 1995-2000, 2001-2006, 2007-2012.
- Research tracks by CNEAI: 2013-2018.