



What we do

We specialise in **geotechnical engineering**, with a particular emphasis on **dams**, both concrete and embankment. The services we provide include:

Technical support to works construction, collaborating either with the project owner or the contractor in all matters related to the ground: constructive solutions, quarries, ground treatment, deployment of monitoring equipment, designing of in-situ tests, etc.

Design supervision. We have been overseeing the geotechnical design in the projects of the new Spanish high-velocity railway lines since 1998 and in the dual-carriageways since 2000.

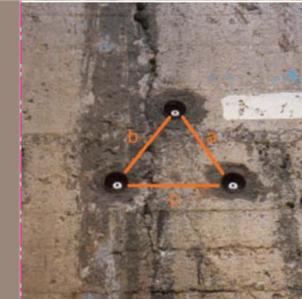
For new projects: Drawing up geotechnical studies, geotechnical annexes to projects, occasionally full project designs, unusual specific studies for difficult foundations, numerical modelling...

Regulation development. The geotechnical recommendations ROM-05-94 (Spanish State Ports) and the Guidelines for the Foundations of Road Works (Highways General Directorate) have been substantially drawn up by us, in addition to our involvement in seismic, dam, building codes...

Forensic engineering and corrective measures design for slope instabilities, structure damage due to ground or wave actions, etc.



24 metre high reinforced earth wall



Who we are

Ingeniería del Suelo, S.A. is an engineering firm that offers consulting services since 1990. Seven civil engineers –five hired and two freelance- cooperate in our Madrid office, assisted by drawing and word-processing staff. From the centre of Spain, we reach our customers all over the country and occasionally abroad.

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Examples of our work (other than dams)

Airports. In addition to several studies at the airports of La Coruña, Vigo, Bilbao, Barcelona (underground highway), we have extensively assisted the contractors of the new Madrid-Barajas expansion: new car park, terminal, runways, access roads, etc.

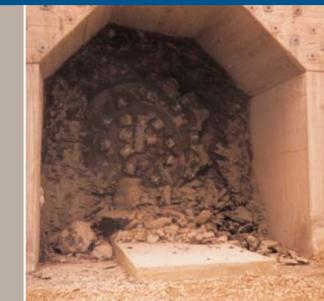
Ports. We have done various studies and designs at El Ferrol, Barcelona, Palma de Mallorca, Algeciras, Ibiza, Las Palmas de Gran Canaria, Cádiz, etc.

Tunnelling. We have provided technical support in various ways for the international Somport tunnel, the 12 km long water-transfer Guadiaro-Majaceite tunnel, several tunnels in the CN-260 at Campo-Ainsa, urban tunnels under María de Molina and at Cuatro Caminos in Madrid, dual-carriageway N-110 under Barajas airport, etc.

Highways, railroads and channels. We have collaborated in a large number of road works all over Spain with embankment design, open cut stabilisation (N-VI at Piedrafita), borrow studies (R-4 motorway), bridge foundations, retaining wall designs (Villartellin-Cereixall dual-carriageway) ... in railway lines, like the line 9 Madrid Underground extension to Arganda, sections of the Madrid-Sevilla high-velocity line, etc. and channels such as Segarra-Garrigues, Navarra...



Consulting Engineers





Earthworks at La Loteta dam



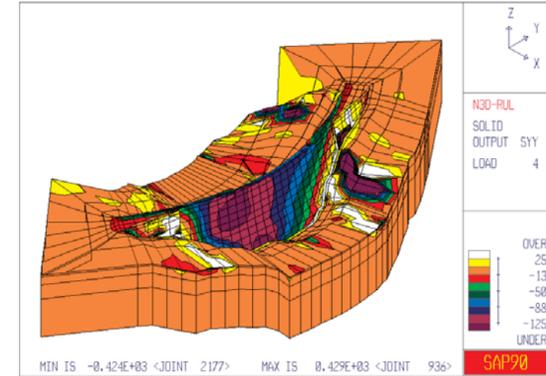
End of tunnelling in Itoiz dam



Borehole cores from Itoiz dam foundation



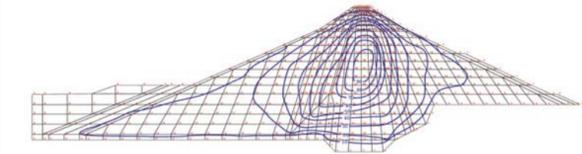
Itoiz dam



Rules dam 3D finite element model



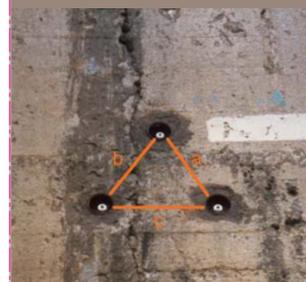
FIGURA Nº 45



Settlement calculation for Giribaile dam



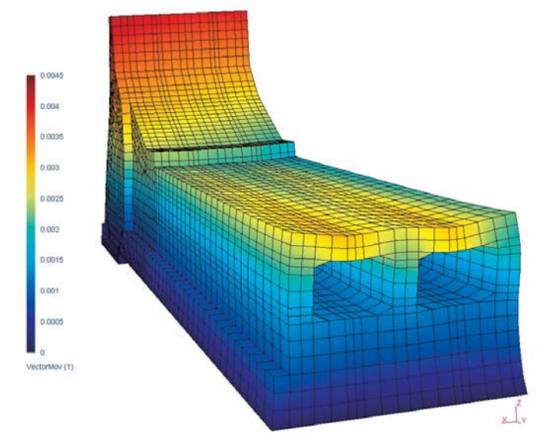
Monitoring graph in Itoiz dam



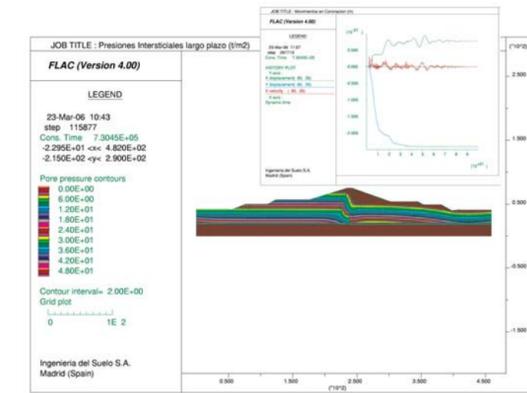
Insert pins for multiple position crack meter



In-situ shear test at Montearagón dam foundation



Tous dam intermediate outlet thermal analysis



Lechago dam seismic analysis



Rialb dam

Our work in dam engineering: Design, construction and operation support.

Since 1990, we have been involved in many of the most important dams built in Spain. In total we have participated in more than sixty large dams projects, from designs at the tender stage to studies for monitoring and repairing ageing dams.

The tasks we develop range from devising and interpreting ground investigation campaigns to 2D/3D numerical modelling of dams and foundations, stability and seismic analysis, identification of suitable materials, filter design, recommendations for monitoring systems, seepage calculations and repair measurements assessment, thermal cracking analysis, design of consolidation and impervious curtain grouting, first impounding plans, old dam rehabilitation studies, monitoring data deciphering and behaviour reports, bank stability assessment and stabilisation, etc.



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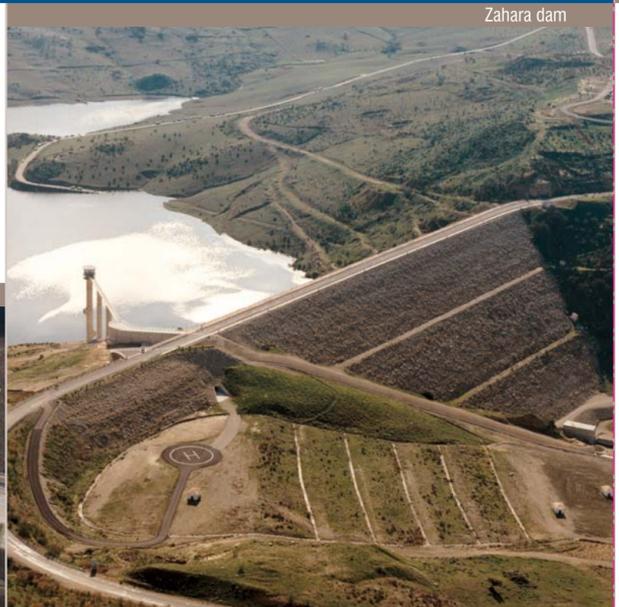
Below, we provide a few examples, from nearly all Spanish Basin Agencies.



Barbate dam



El Atazar dam



Zahara dam

CH del Guadalquivir

In Zahara, Puebla de Cazalla, Giribaile and Barbate dams, we provided geotechnical support in tendering and during construction. Since operation began, we have drawn up regular reports on their behaviour based on their monitoring systems and designed grouting campaigns when needed.

CH del Sur

We participated in the Rules dam design, where we conceived and interpreted in-situ shear tests on the foundation rock, provided assistance during construction and have developed a custom computer program to store and represent the monitoring data.

CH del Júcar

The new Tous, Escalona and Bellús dams were designed and constructed with our support, and their monitoring systems behaviour have been the object of regular reports from us.

CH del Segura

El Boquerón, Puentes, Bayco, El Romeral dams.

CH del Ebro

Montearagón dam has been followed by us from design to operation, as well as Rialb, Itoiz, La Loteta dams, etc. We are currently assisting in the Lechago dam construction.

CH del Tajo

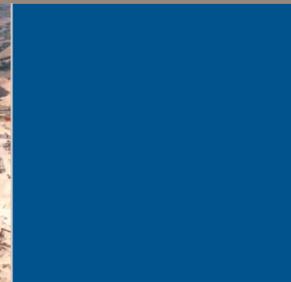
El Atazar dam has been the object of special studies by us: e.g. crack repair, a very large number of behaviour reports and a pendulum movement prediction model that has been operating successfully since 1992.

CH del Norte

Undúrraga and Alfalorios dams have been the subject of studies to decrease their seepage rates.



Construction of Bellús dam



La Loteta dam under construction

