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Journal
of transport
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and consultancy

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2011
Issue 2

ROADS
A route to efficiency for Mexico
RAILWAYS
A railway ring for Tenerife
AERONAUTICAL
Expansion of the
Kuwait International Airport
R&D
SIOS, all about the project
SUSTAINABILITY
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Editorial

Following the success of the first issue of our magazine, I am delighted to present the second issue of **itransporte** English Edition. We have added new sections and provided extensive coverage of our latest works.

Our capacity to manage complex projects has enabled us to play an increasingly relevant role on the global market, where Ineco is present in 27 countries. We offer the reader an overview of our latest activities in Spain and abroad, wherever our projects may take us. Our aim is to provide comprehensive, innovative solutions with high added value.

Among other developments, we have reported on what will be a long presence in Mexico, where we are leading a group of Spanish and Mexican companies to direct and implement a new toll road management model. This is a major innovative project, coinciding with the creation of a new subsidiary in Mexico, our third in the Americas after Brazil and Colombia. We will therefore be much more present on a market where we hope to work long term on infrastructure development.

In our aeronautical section, we have provided extensive coverage of the projects signed this year with the aeronautical authorities of Kuwait and Egypt, who have been joined by Oman, Cape Verde and Morocco. These new projects have consolidated our presence on the African continent and in the Arabian Gulf.

We will continue to work with the same enthusiasm to reflect the day-to-day life of the company in our pages. It is our desire to maintain and improve communication with all of our readers, friends and clients. We hope that these pages will spark your interest.

IGNASI NIETO
Chairman & CEO of Ineco

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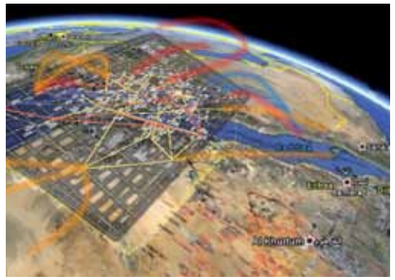

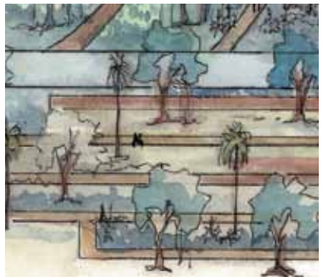

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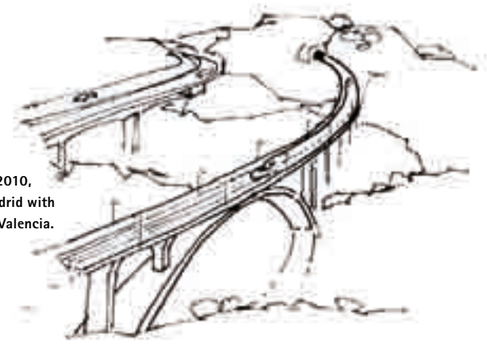

On December 19, 2010, the first 'AVE' left Madrid with passengers bound for Valencia.

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International news

APPOINTMENT

Pilar Morán, new International Relations Manager at Ineco

Pilar Morán, trade expert and state economist, has joined Ineco as International Relations Manager at the Business Development and International Office. Morán has previously worked as General Manager for Foreign Investment and Cabinet Director for the Spanish Government's Economic Office. She has served on the board of institutions such as Metro de Madrid and the Spanish Institute for Foreign Trade (ICEX), and as Spain's delegate to the Organisation for Economic Cooperation and Development (OECD).

MOROCCO

Ineco consolidates its presence in Northern Africa

Ineco signed two new aeronautical engineering contracts and is providing railway consultancy services to Adif in Morocco. The purpose of the first contract is to perform a technical audit of the installations at 24 airports. The client is the public body ONDA (National Airport Organisation of Morocco) and the project will be carried out in collaboration with the English firm Vector Management. The second contract, also with ONDA, involves the preparation of a study of passenger flows through Casablanca's terminal building.

In addition to these contracts, Ineco has been working on two other projects since early this year and is consolidating its position in Morocco. These include a functional study of the terminal building at Casablanca Airport, and another study to reorganise the Moroccan airspace for the country's Civil Aviation Authority.

As far as the railway sector is concerned, Ineco is collaborating with Adif to provide technical support to the Moroccan authorities and construction companies in order to define the conditions for implementing and regulating railway performance at five Moroccan stations. The project includes advising the public railway company ONCF on its station assessment projects, and the preparation of a dossier for the definition and justification of each project.

RENOVATION OF THE 'WESTERN CORRIDOR'

More studies for Bogotá's commuter trains

Ineco is performing an overall technical, economic and operational evaluation of the First Phase of the commuter train network, called the 'Western Corridor', which will run from Avenida Ciudad de Cali in Bogotá to the town of Facatativa. The 31 kilometres of infrastructure to be renovated are located in urban and interurban areas, and are part of the old 'Bogotá Savannah Railway'. In the urban area, there are plans to connect the network to TransMilenio (a mass transport system comprised of articulated buses circulating on dedicated lanes), in the vicinity of El Dorado International Airport.

The purpose of the Ineco studies is to define what type of railway system is most suitable for the mass transport needs of the Cundinamarca Department and its capital, Bogotá. To this end, different analyses have been performed: adaptation of the infrastructure and superstructure, comparison of electric traction railway technology alternatives, comparative study of railway and bus services, structuring proposal for possible contracting, operation and management formulas (public, concession, etc.), as well as a study of sources of funding.

Also analysed were station locations and designs, level crossings and other types of crossings. Ineco reviewed the supplementary studies and functional and urban integration projects for the corridor prepared by the Cundinamarca Government, which it advised during the decision-making process for the technical and operational structuring of the future commuter rail network.

INDIA

Independent engineering for the Mumbai Metro network

The Mumbai Metropolitan Region Development Authority (MMRDA) awarded the project 'Appointment of independent engineering for Mumbai Metro Project Charkop–Bandra–Mankhurd corridor (Metro Line II)' to Ineco, in a joint venture with the Spanish consulting company Prointec and the Indian company Feedback. The project is being executed by an Indo-Canadian consortium under the BOT (Build, Operate, Transfer) regime.

Line II of the Mumbai Metro network will cross the Indian city from north to southeast on a 32 kilometre route featuring 27 stations and one interchange, where it will connect to Line I (Versova–Andheri–Ghatkopar), which is 11 kilometres long. The latter is expected to be completed around the year 2012. The suburban network will have a total of 9 lines and 146.5 kilometres, and should be finished by 2021.

Spain shares its high-speed expertise in California

A Spanish delegation (picture above), with participation from Ineco, shared its high-speed expertise at events held in California (USA). Spain's Ministry of Development, Ministry of Industry, Tourism and Commerce, and ICEX (Institute for Foreign Trade) participated in the organisation of a meeting in San Francisco with members of state and local governments to discuss the development of high-speed rail in California.

Spanish associations linked to the industry, such as MAFEX (rolling stock manufacturers), Tecniberia (engineering) and Seopan (construction), along with representatives from Renfe and Adif (the Spanish administrator of railway infrastructures), showed the attendees the benefits of high-speed rail, and discussed technical aspects in greater depth, such as the accumulated industry know-how of Spanish companies.

THE THIRD TO OPEN IN THE AMERICAS

New subsidiary in Mexico

The new company Ingeniería y Economía del TransporMex, S.A., has recently been incorporated in association with Adif. After Ineco do Brasil and Inecol in Colombia, the Mexican subsidiary is the third opened by Ineco in the American continent. Through this new corporation, Ineco and Adif will share their technical expertise. Ineco is currently collaborating with the Mexican Secretariat for Communications and Transport (SCT) and Banobras (the National Bank for Public Works and Services), responsible for the development and funding of transport infrastructures in Mexico.

The picture shows Pedro Polo, Adif's International Cooperation Manager, with César Sainz, Ineco's representative in Mexico.

International news

SPAIN

A new airport model is underway

The creation and tendering of most of the capital for the concessionaire companies for Madrid-Barajas and Barcelona-El Prat airports has already begun, and will be awarded by the end of the year. During this second half of 2011, work will also progress on the privatisation of 49% of the capital of Aena Aeropuertos. This new company is the world's largest airport manager by number of passengers (around 200 million annually), with a network of 47 airports and two heliports in Spain, in addition to direct or indirect participation in the management of another 27 airports around the world.

→
THE EXPANSION IS EXPECTED TO LAST NEARLY THREE YEARS

Project management at Kosovo's major airport

Ineco has been awarded a €1.45 million contract to provide project management and independent engineering services for 34 months during the expansion of the Adem Jashari International Airport in Pristina (Kosovo). The project includes a 27,000 m^2 new terminal, a new control tower, enlargement of the apron, parking for 1,750 vehicles and remodelling of the access roads. The concessionaire plans to invest a total of €140 million. The airport, managed by a consortium formed by the Turkish construction firm Limak (90% of the shares) and the French company Aéroports de Lyon (10%), is located roughly 15 kilometres southwest of Pristina.

Collaboration with OHL in the United Arab Emirates

The Spanish company OHL received assistance from Ineco and Intecsa for the tender of a new freight line between the cities of Ruwais and Shah, in the United Arab Emirates (UAE). The line is part of a railway network designed to modernise the freight distribution system in the region, linking the country's major ports (main sources of raw materials and industrial centres), in addition to improving passenger transport. The future freight line will specifically enable the transport of sulphates from the mines in Shah, in the country's interior, to the port of Ruwais, a distance of 262 kilometres.

Snow plan for Heathrow International Airport

The British Airport Authority (BAA) has entrusted Ineco, in collaboration with the Spanish company Ferroser, with the preparation of a plan to ensure the operability of London's Heathrow International Airport under adverse weather conditions. The company already prepared a similar plan for Madrid–Barajas International Airport in 2009–2010.
The aim of the project, the first undertaken by Ineco in the United Kingdom, is to plan the actions to avoid a repeat of situations such as the events of last winter, when the problems caused by heavy snowfall forced the airport to close for several days.

New airport terminal in Ibiza

The renovation work at Ibiza Airport (Balearic Islands) is now complete. Ineco provided technical support since the beginning of the expansion project, in which over €70 million have been invested. Ineco was in charge of monitoring and surveillance of the construction work, as well as health and safety coordination. The company also drew up the construction project to expand the building. Still pending is the third phase of the project.

From Guadalajara to Colima: a route to efficiency for Mexico

The toll road is part of the large Manzanillo–Tampico corridor

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Heading a group of Spanish and Mexican companies, Ineco will supervise the 14-year concession of the 148 kilometres stretch of road connecting Mexico's second-largest city to Manzanillo, the most important port on the country's Pacific coast.

Mexico has taken a decisive step in improving its road network, vital for interconnecting the country's vast territory of nearly 2 million square kilometres. The network now covers over 360,000 kilometres, of which nearly 4,000 are toll roads administered by Banobras, the National Bank for Public Works and Services. One of these is the 148 kilometres main road joining Guadalajara, the country's second-largest and populous city, to the town of Colima, and finally to Manzanillo, the most important port on Mexico's Pacific coast.

A new, alternative concession model is being applied to this new toll road, in which, unlike traditional models, operational, management, maintenance and other tasks are divided among different independent companies, monitored by an "administrative and supervisory agent". In February 2011, Ineco, leading a group of Spanish and Mexican companies, won a contract for the total amount of 620 million pesos (roughly €37 million) to perform this supervisory work for the next 14 years.

Two other Spanish companies will be participating: APIA XXI (involved in project supervision and management, structure monitoring and pavement management) and TEKIA (in charge of electronic toll collection and Intelligent Transport Systems, or ITS). They will be joined by three Mexican firms: SEMIC (which will be providing support for instrumentation and control, preparing informative profiles and monitoring standards), the law firm Casares-Castelazo-Frías-Tenorio-Zárate (which will be responsible for legal mattres and consultancy on insurance, easements and administrative processes) and GRADO 3A (which will support the development of the management and monitoring system). ✱

1 A strategic hub

Located in Mexico's Central-Western region, the higway that links the towns of Guadalajara, Colima and Manzanillo runs northeast to southeast, crossing the Mexican States of Jalisco and Colima. An average of 10,000 vehicles travel it daily, of which 28% account for heavy transport, largely from the port of Manzanillo. It has two toll collection points and a four-lane roadway, except for one 58 kilometres section where work has already begun to enlarge the road.

It was built in 1983 and belongs to one of the country's five major logistical corridors, linking east to west with another major port, Tampico, on the Gulf of Mexico. From there, it connects the country to its two major markets in the north: the United States and Canada. Once the five pending sections of main road are completed, the Manzanillo–Tampico corridor will reduce the distance between the two coasts to less than a thousand kilometres.

A fast-growing economy

>GUADALAJARA, AN ECONOMIC POWERHOUSE

Guadalajara, the historic capital of the State of Jalisco, is one of Mexico's economic engines. In recent years, its booming activity and dynamism have given Jalisco the country's third-highest Gross Domestic Product (GDP) per capita, surpassed only by Mexico City and the State of Campeche.

>COLIMA, LAND OF VOLCANOES

The capital of the State of Colima has roughly 124,000 inhabitants and is located in a large, densely populated metropolitan area. Its territory is mountainous and known for its volcanoes, one of Colima's natural attractions. The city is located 97 kilometres from the port city of Manzanillo, the region's economic hub.

MEX

Road network

INTERCONNECTING

360,000 km of roads

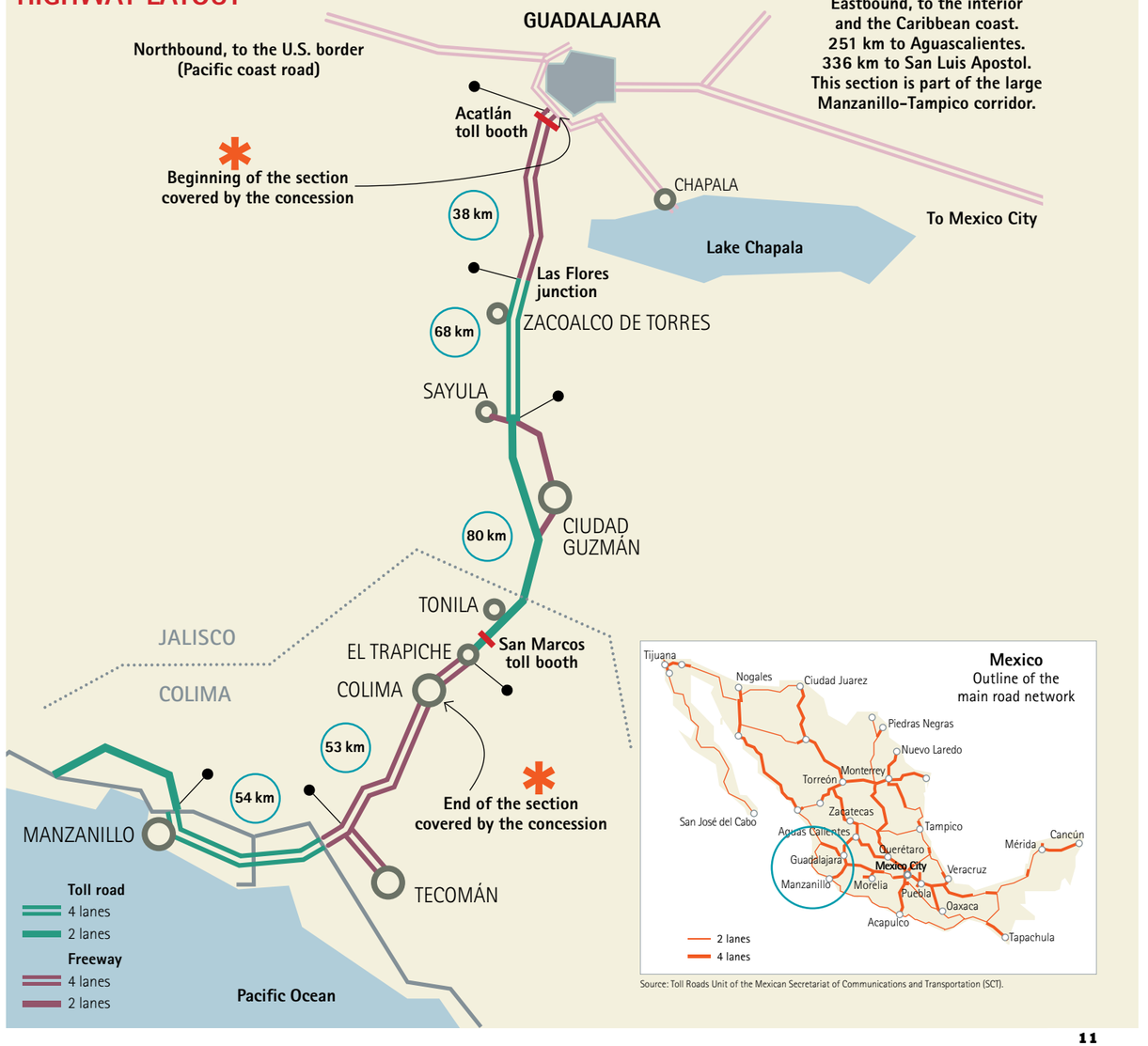
BANOBRAS

4,000 KM OF TOLL ROADS

Management support

➔

HIGHWAY LAYOUT



Source: Toll Roads Unit of the Mexican Secretariat of Communications and Transportation (SCT).

Banobras is applying a new concession model to toll roads, which improves operation and customer service, as well as economic efficiency.

2
The route

The main road connects four major population centers (with over 100,000 inhabitants each) and 20 smaller towns. It starts in Guadalajara, capital of the State of Jalisco and Mexico's second-largest city. Ciudad Guzmán, 139 kilometres to the south, is also located in the State of Jalisco.
The section covered by the concession ends in the State of Colima, in the city by the same name. Another 97 kilometres away is the port enclave of Manzanillo, for which the main road represents an essential communications link. A total of 455,000 people reside in the metropolitan area located around Colima, Manzanillo, Villa de Álvarez and Tecomán, comprising 70% of the state's total population.
The area's economic hub is the port of Manzanillo. Its location gives it a privileged position on commercial routes to Asian markets in the west, the United States to the north and South America to the south.
Its hinterland, or area of influence, extends to 17 Mexican States. According to the SCT (Mexico's Secretariat of Communications and Transportation) data, over 75% of the freight received by the port leaves by road. In addition to its commercial activities, the area is an important tourist center, in demand for its sunny beaches. Since July 2010, the port also has a specialized dock with the capacity to accommodate two cruise ships simultaneously. All of this generates large road traffic flows.


City of Manzanillo.

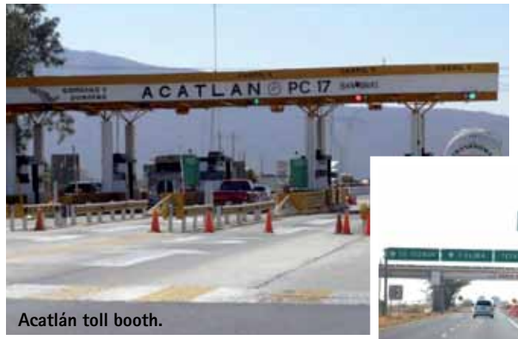
San Marcos toll booth.


Opening of the works.


Beginning of the four-lane section near Colima.

3
Expansion project

The expansion project of the Guadalajara–Colima highway represents a step forward in the economic development of the entire area. In February 2011, the first phase of the work began to enlarge 58 kilometres of the roadway from two to four lanes, with financing from Banobras. This will increase road capacity and reduce travel times.
During this first stage, improvements are being made to the section between Sayula and Tonila. The second phase will start in 2012, on the section running along the Colima volcano, more complicated due to the ruggedness of the terrain.
The project includes additional works, such as the expansion of 17 structures, 12 bridges, four overpasses and one underpass, in addition to the modernization of the two toll booths in Acatlán (at the beginning of the route) and San Marcos. Banobras will invest the equivalent of €240 million during these two phases of the project.



Acatlán toll booth.


Road works.

Roads in the Mexican economy

Road transport plays a vital role in the Mexican economy, one of the most powerful in the entire Latin America region: the International Monetary Fund (IMF) expects the Mexican GDP to grow around 4.6% in 2011. According to the SCT (Mexico's Secretariat of Communications and Transportation), 86% of the country's total domestic freight traffic and over three-quarters of the port freight travelled by road in 2009. Cars are also the preferred mode of travel for passengers, with total vehicle use percentages of 67% to 83%.

>NATIONAL IMPROVEMENTS

ONE OF THE KEYS TO IMPROVING INFRASTRUCTURES IN MEXICO is collaboration between the public and private sectors (an area in which Felipe Calderón's government has invested the average equivalent of 4.5% of the country's GDP over the past four years, through its National Infrastructure Plan 2007–2012). Banobras manages the funds that make it possible to finance multiple projects with participation from private Mexican and foreign companies in the water, telecommunications, hydrocarbon, electricity, railway, port, airport and road sectors.

>PRIVATE INVESTMENT

TO REDUCE RISKS AND STIMULATE PRIVATE INVESTMENT, Banobras is applying a new concession model to toll roads, which improves operation and customer service, as well as economic efficiency. The new model will be implemented on 11 'packages' of roads, with a total of 30 sections in different regions of the country.

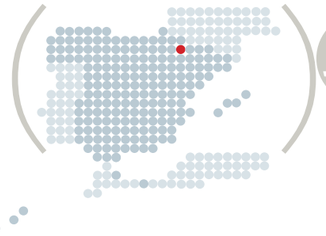
INECO ON THE GUADALAJARA-COLIMA HIGHWAY

The new concession scheme is based on payments to the concessionaire in accordance with the results obtained after measuring performance standards. Ineco is solely responsible to Banobras, the administrator (trustee), and leads the management, operator and maintainer-rehabilitator contracting support tasks. Ineco also monitors and administers the contracts of both, in addition to providing technical and overall management support.

A crucial connection

From the Pyrenees to the Mediterranean

Published in **i**transporte **29**



The A-21, A-22 and A-23 freeways form a high-capacity axis that will link Navarre, Aragon, Catalonia, Levante and France. Ineco is participating in this project, which stretches beyond the Pyrenees and will interconnect an area with great economic potential.

The *Autovía del Pirineo* (Pyrenees Freeway) is a major project affecting several autonomous communities in Spain. It will bring two of the richest and most populous areas on the Iberian Peninsula closer together: the Cantabrian and Mediterranean seas. The section between Navarre and the town of Jaca is part of a route that will run along the southern side of the Pyrenees, and will be known by three names: A-21 (the Pamplona–Jaca section), A-22 (Jaca–Huesca–Lleida) and A-23 (Huesca–Zaragoza–Sagunto).

Ineco has participated from the beginning in the development of several sections of these freeways: in the preliminary studies, environmental impact studies and drafting of the projects, in addition to site management and technical assistance.

In November 1999, the Spanish Highway Authority at the Ministry of Development awarded the company the contract for the Preliminary Study for the *Connection between the N-330 and N-121 in the Northern Ebro Valley. High-capacity road. Comparative study of the corridors in the Northern Ebro Valley for connecting the Cantabrian Hub to the Levante Hub and France via Aragon*, which would become an Informative Study in February 2000. The selected alternative obtained the mandatory Environmental Impact Statement in 2002.

Ineco also drew up the construction projects for some sections of the A-21 and A-23, and is responsible for different supervisory, control, surveillance and environmental management tasks at the A-21 and A-22 construction sites. At the latter, the company performs follow-up, verification and preliminary reports prior to supervision on the southern Huesca bypass (which will join the A-22 and A-23), as well as five other projects on the A-22 and nine on the A-21. ✱

Above: Trumpet interchange. Left: A diagram of the 6.9 km section between Izco and Venta de Judas (one of the projects drawn up by Ineco). Right: Bridge girder placement.

Notable projects in which Ineco has participated

The A-21 crosses two communities: 6 sections in Navarre (46 km) and 9 in Aragon (55.51 km). The Chartered Community of Navarre holds authority for the road network and is responsible for work in its territory, while in Aragon, the Spanish Ministry of Development is responsible. The construction projects and cooperation projects that Ineco has carried out are as follows:

PROJECT Noaín–Monreal (A-21). With a total length of 8,891.23 metres, this freeway section is designed for a specific speed of 120 kph. Three interchanges and 8 structures were built along this section.

PROJECT Monreal–Izco. With a total length of 12,182.82 metres, this freeway section is designed for an specific speed of 120 kph. It includes 3 interchanges and 9 structures. The standard section is similar to the previous one. Due to contracting requirements, it was subdivided into two parts after the project was drawn up. The first subsection is 4,903.48 metres long and runs down to the Salinas–Idocin interchange.

PROJECT Izco–Venta de Judas. With a total length of 7,832.49 metres, this freeway section is designed for a specific speed of 120 kph. It includes 1 interchange and 9 structures, two of which are false tunnels for the reposition of wildlife passages.

TECHNICAL ASSISTANCE, SITE CONTROL AND SURVEILLANCE Barranco de las Colladas–A1601 interchange. This freeway section is 2,850 metres long and quite complicated from a technical standpoint, since it passes through a hydrographic network with multiple ravines and streams due to the softness of the terrain (marlstone). The project consists of the execution of 5 viaducts and 1 overpass, as well as the construction of 8 transverse drainage sites. A trumpet interchange will also be built to connect the A-21 to highway A1601.

The section is contiguous on the east with the section bordering on the province of Huesca–Barranco de Las Colladas, and on the west with the Sigüés Bypass. In addition to being part of the A-21, the project also serves as a replacement road for the N-240, which will be flooded and taken out of service by the expansion of the Yesa Reservoir. Once the A-21 is built, vehicles will only be able to travel on the new freeway. The route crosses the main ravines at Las Colladas, La Fraga and Uñana. These passages were achieved with 8 transverse drainage sites and 5 double viaducts. The viaduct at Barranco de Las Colladas is an isostatic two-span bridge, while the ravines at La Fraga and Uñana are spanned by single-span isostatic bridges. In all three cases, the span between the support axes resting on abutments, or between these and the intermediate piers, is 36.00 metres.

PROJECT Arguis–Alto de Monrepós (A-23). With an average length of 3,400 metres (which differs depending on the lanes), this is a widening of the current N-330 in the area of the Monrepós tunnel. The project includes the construction of a 1,499.74-metre long tunnel, as well as a tunnel control centre for the entire section between the towns of Huesca and Jaca.

Boosting railway freight in Spain

The Spanish government allocates over €7.5 billion for a new Strategic Plan

Published in itransporte 37

The Spanish Ministry of Development aims to double the current market share for rail freight to 8% to 10% by the year 2020.

The Spanish government wants to boost railway freight transport and relaunch it as an efficient option for logistics chains. To that end, it has prepared a package of actions and measures with the year 2020 as its time horizon. The objective is to regain a market share of 8% to 10% for the railways, twice their current share and closer to the average in other European countries, as it was in Spain until the late 90s. Since then, however, the railways have seen their share of the land freight market decrease progressively to around 4%.

What are the reasons for this drop and what can be done to reverse the trend? This is the underlying question that the ministerial team set to the industry in September 2009, at a symposium held in Madrid to launch and implement the Strategic Plan. Public and private railway operators, road haulage companies, technology manufacturers, port authorities and representatives from the administration, among other agents, presented their vision for transforming the industry. *

The diagnosis

In the fourth quarter of 2009, workshops were held with industry agents. These produced proposals that were later debated with the Spanish Autonomous Communities. In addition to the regional administrations, up to 67 different companies and organisations participated in the preparation of the Strategic Plan.

Ineco collaborated with the Ministry of Development during this process, accompanying it during the industry consultation phase, the later analysis of the proposals and the final preparation of the Plan to Boost Railway Freight Transport (PEITFM in Spanish). According to the Ministry of Development data, a loss in the railways' market share has been verified, with decreases of up to 45% in cargo volumes between 1993 and today. This contrasts with a clear upward trend in road haulage, which has slowed down over the past two years due to the financial crisis. The pattern is repeated in international cargo flows: between the Iberian Peninsula and Europe, marine transport accounts for 54% of the total, road transport for 45% and railways for only 1%.

The data leave no doubt about what José Blanco, Spain's Development Minister, described as the "unfinished business" in the transport industry. However, the government hopes to finish this business over the next decade with the participation of the private sector and the Autonomous Communities, investing more than €7.5 billion.

The reasons

The Strategic Plan examines the causes that led to the current situation:

Lack of economic competitiveness, with "inefficient" costs, unable to compete with those of road haulage due to the low use of resources and the lack of specific investments for railway freight transport.

Lack of service quality and reliability, which does not respond to market demands, in addition to a "deficit in the development of intermodality". The Strategic Plan points to the inadequacy of the speed, quality and costs of the current services as "one of the causes, perhaps the most significant", of the progressive decrease in railway freight transport. Thus, consignors do not resort to the railways: they prefer the roads.

Insufficient liberalisation. Private railway companies are also unsatisfied with another circumstance affecting the growth of the sector: the liberalisation of the market, which began in 2005, when the Spanish Railway Sector Law came into effect. At this point, both the Administration and the private operators (13 in total, to date) agree that the liberalisation has been "slow" and "insufficient".

Little collaboration between modes of transport. Another of the causes that the Strategic Plan highlights as responsible for the weakness of railway freight transport is the "lack of collaboration between operators from the different transport modes, which has affected the development of intermodality".

PHOTO BY ANTONIO ALEJO

The objective is for the railways to have regained a market share of 8% to 10%, twice their current share and closer to the average for other European countries.

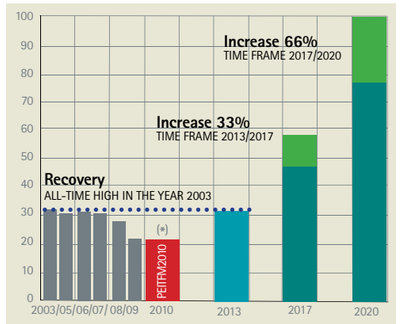
The solutions

The industry and the Administration agree on the guidelines for the actions to be implemented. These are presented based on three strategic lines:

New system management model. In this strategic line, actions are proposed to improve system operation and adapt it to the new reality of the liberalised market. Mixed formulas for the promotion and management of new terminals will be encouraged, as well as coordination with the Spanish Autonomous Communities.

Service quality and efficiency. In order to offer the "quality and efficiency" demanded by all clients for integrating the railways into the logistics chain, the Strategic Plan proposes the use of compatible information systems between agents, the creation of common technological standards, the automation of procedures and a specific programme of aid and incentives to R&D+i projects, focusing on improvements in railway freight transport.

Improving railway infrastructures. To this end, the Basic Freight Network will be defined, lines will be adapted to allow the circulation of trains 750 metres long, lines will be electrified and security and communications installations will be improved. Actions are also planned for eliminating bottlenecks and progressively adapting clearances as it becomes necessary to renew lines. Most of the investments planned will be devoted to improving and modernising infrastructures of both lines and terminals. One of the keys to regaining the potential of the railways is providing rail access to ports, as essential elements in the logistics chains: they receive 83% of the freight entering Spain and ship more than half of the export freight out of the country. However, only 5% of overland port traffic takes place by train.



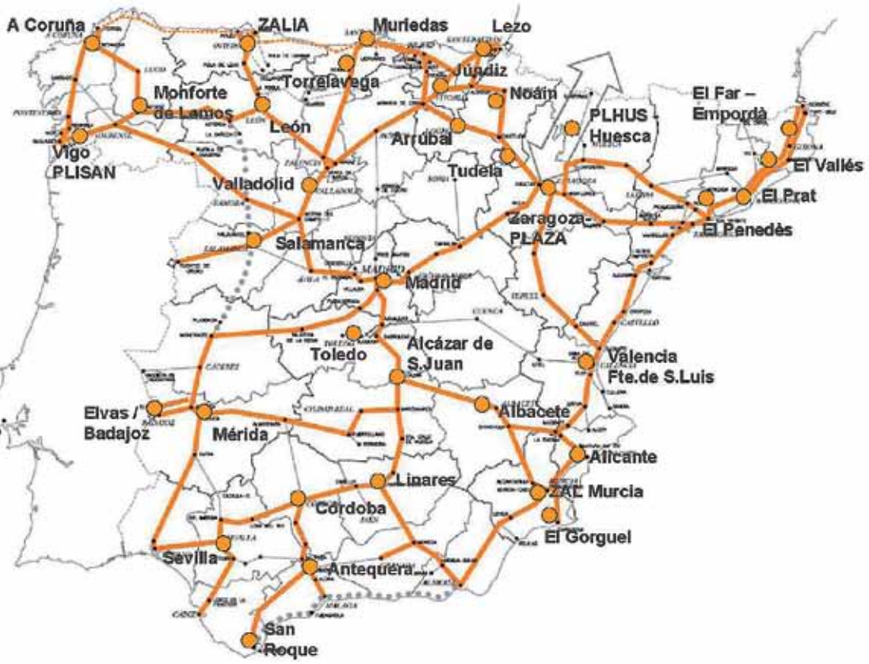
Data in thousands of tons
■ The traffic data includes private companies+Autonomous Communities+FEVE+Renfe
■ Min scenario ■ Max scenario
(*) Estimation for 2010

MISSION AND OBJECTIVES

The graph above shows an estimation of the foreseeable evolution of railway freight transport in Spain: the objective is to double the current market share, reaching 8% to 10% (77 to 100 million tons) and achieve a more competitive system.

Basic Freight Network

Prioritised rail lines and terminals by Autonomous Community.



The keys to the Plan

LONGER, HIGHER CAPACITY TRAINS_With trains up to 750 metres long, operating costs could be reduced up to 40%.

AN OPTIMISED INTERMODAL NETWORK_The Strategic Plan was prepared with consensus from the Autonomous Communities, which defines the 'Basic Freight Network' (specific lines and terminals where the improvement actions will take place).

A NEW BUSINESS MODEL_Industry demands for 'real' liberalisation are echoed in the Strategic Plan with measures promoting the participation of private companies.

Ineco and railway freight transport

The company's experience encompasses all types of engineering and consultancy tasks. Among the most recent are:

>STUDIES AND ANALYSES

Support for the preparation of the Ministry of Development's Strategic Plan to Boost Railway Freight Transport (year 2010). Passenger and freight demand study for the Tenerife's future South Train (2009). Analysis of the operational travel conditions for 750-metre freight trains (2009). Viability analysis for piggyback services on the Iberian Peninsula, with a time horizon of 2020 (2010).

>INTERMODAL NODES

Viability and functional design analyses for the new ZALIA (Asturias) logistics platform (2009). Analysis of logistical areas in Andalusia (2010). Study for the remodelling of the railway freight system in the Madrid region (still in progress).

>LINEAR AND TERMINAL INFRASTRUCTURES

Site management, control and surveillance of the renewal and electrification works on the Bobadilla–Algeciras line (2010). Different works on the Barcelona Castellbisbal–Can Tunis freight line and the addition of a third track on several sections of the line to the French border in order to provide international gauge for freight trains between the Port of Barcelona and Perpignan.

>RAILWAY ACCESS TO PORTS

Legal support to Puertos del Estado (State Ports) for the development of agreements between Spanish port authorities and Adif (since 2005). Participation in the improvement of rail access to ports all over Spain. Agreement with the Castellón Port Authority for the development of its railway network (2009).

>INTERNATIONAL CONNECTIONS

Definition studies for the international section of the Vitoria–Dax binational link (2009).

>ROLLING STOCK

Technical assistance for assuring the project and inspection conditions for the construction of 100 electrical freight locomotives for Renfe (2010).

‘If we want to develop our logistical potential, we will need a more balanced transport system’

Q&A

José Luis Cachafeiro

Secretary-General for Transport, Ministry of Development

How do you think this Strategic Plan can contribute to the Spanish economy?
Logistics now accounts for roughly 7% of the GDP and is clearly defined as a strategic sector for the future. If we want to develop our logistics potential, we will need a more balanced transport system from a modal perspective. With the measures included in the Strategic Plan, we hope to achieve this objective.

Some road haulage companies have expressed certain reservations. Is this fear well-founded?
Absolutely not! The Strategic Plan will not constitute a threat to this sector. Rail freight transport must complement road haulage, which plays, and will continue to play, a predominant role due to its proven efficiency and flexibility. Our objective is to promote intermodality, encouraging the use of each mode of transport wherever it is most efficient.

What changes do you think are necessary for achieving a liberalised market with high private sector participation?
For example, supporting the entry of transport agents, combined transport consignors and operators, unique management of port and rail and border complexes, or boosting mixed formulas for promoting and/or managing new intermodal terminals through public and public-private participation formulas.

Intermodal logistics terminal projects are multiplying all over the country. How will the plan be developed?
Through agreements with the Autonomous Communities and management formulas open to private capital. Railway infrastructure actions will have to meet certain criteria for reducing costs and improving reliability. ✱

PHOTO BY GABRIEL LAGO

‘Our objective is to promote intermodality, encouraging the use of each transport mode wherever it is most efficient’.

A LIFE LINKED TO RAILWAY TRANSPORT

Spain’s logistics sector, and particularly its railway industry, have marked José Luis Cachafeiro’s career, who has always been linked to this mode of transport. Born in the province of Lugo (Galicia), Cachafeiro’s career has covered much of the structure of Renfe and Adif (the Spanish administrator of railway infrastructures).

A railway ring for Tenerife

The South Train will become a reality in 2018

Published in itransporte 31

Tenerife (Canary Islands) will have a railway line all along its coast. The first step is the South Train project, in which Ineco is participating as a strategic partner of the Council of Tenerife (Cabildo). This train will connect the most important population and tourist centres in the southwestern part of the island.

The first train service on the island will cover the 80 kilometres between Santa Cruz de Tenerife and the Costa Adeje Interchange in about 45 minutes, offering the population a new public transport service on the eastern coast. With the future North Train project and the extension from Los Realejos to Icod de los Vinos and Costa Adeje, the ring will be completely closed.

The infrastructure, for which Ineco conducted preliminary studies and drew up the Special Territorial Infrastructure Development Plan for the South Train (PTEOI in Spanish), will be born into an environment with no railway tradition, but with high expectations of achieving a radical transformation of communications on the island.

Local authorities sought to offer a mode of transport that would complement the roads and improve mobility, while also providing a sustainable service, competitive with other forms of transport. Since work began in 2000, implementation of the new infrastructure has been planned as established by Legislative Decree 1/2000 (dated May 8), which approved the revised text of the laws governing territorial planning and natural spaces in the Canary Islands. The uniqueness of Tenerife's territory, both its physical structure and its economy, is the basis for this law, whose central feature is the Island Territorial Development Plan (PIOT in Spanish).

According to the provisions of the PIOT, the South Train was designed to make the best use of the territory from a functional perspective, minimise its impact on the environment and take advantage of the effects induced by the new infrastructure that will run along the south-southeast coast of Tenerife, connecting two of the island's major centres of population and economic activity.

In 2009, a new demand study was undertaken, along with a complementary study of freight traffic. The potential demand for freight by the South Train has been estimated at over 1.4 million tons by 2018, and mainly consists of hydrocarbons and solid urban waste. Transferring such freight by rail would eliminate 500 trips per day by heavy trucks on the TF1 freeway.

Once the possible sites for workshops and railway sheds were studied, the PTEOI indicated a location within the city limits of Fasnia as the most suitable site and reserved a lot located along the corridor route. ✱

Technical characteristics

TYPE	LENGTH (in km)	PERCENTAGE (of the total)
Surface	48.02	60.4%
Viaduct	8.87	11.2%
Underground	22.61	28.5%
Tunnel	*19.38*	*24.4%*
False tunnel	*3.22*	*4.1%*

Work performed by Ineco on the South Train

PRELIMINARY STUDIES PRIOR TO THE PTEOI

- Current traffic estimations.
- Modelling and prognosis of future demand.
- Evaluation of the capturable railway demand.
- Operational hypothesis and calculation of profitability evaluations.

WRITING THE PTEOI

- Analysis of territorial, environmental, socio-economic, technical and legal conditioning factors.
- Selection of the most appropriate route.

DRAWING UP CONSTRUCTION PROJECTS

Support and coordination services for:

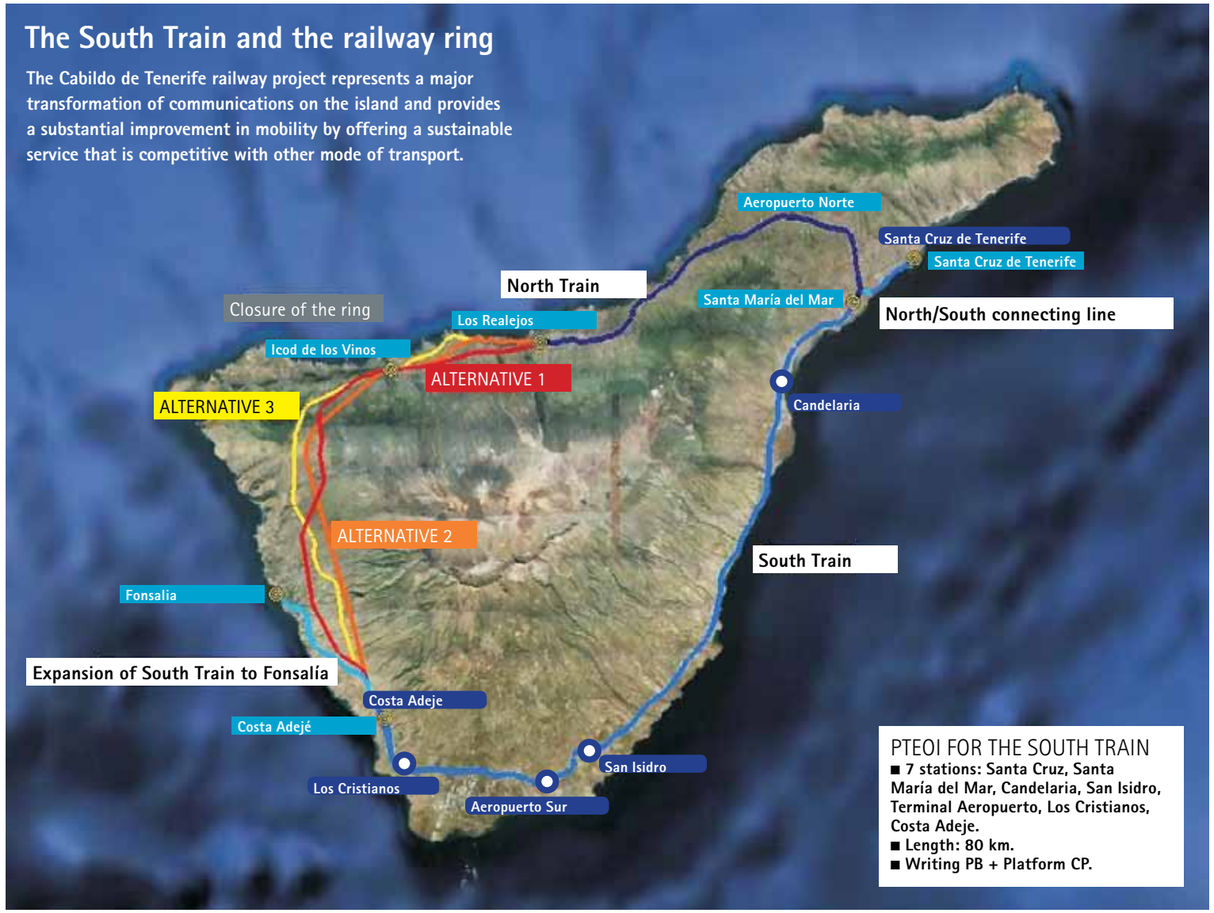
- Cartography and prior geological-geotechnical campaign.
- Process for obtaining the Environmental Impact Statement (EIS).
- Construction projects for platforms and interchanges.
- Projects for workshops and track assembly and electromechanical sheds.
- Quality assurance plan.

SPECIFIC REPORTS

- Viability studies for the execution of tunnels with tunnel boring machines.
- Technical-economic study of the implementation options for the superstructure (slab track).

OTHER WORKS IN PROGRESS

- Freight traffic study for the South Train.
- PTEOI for the Expansion of the South Train to Fonsalía (14 km).
- PTEOI for the North Train (37 km).
- Viability study for the expansion of the rail infrastructure from Los Realejos to Icod.
- Study of possibilities for the closure of the island railway ring.
- Environmental Impact Study (EIS) for the South Train Project.




Guaza Mountain.

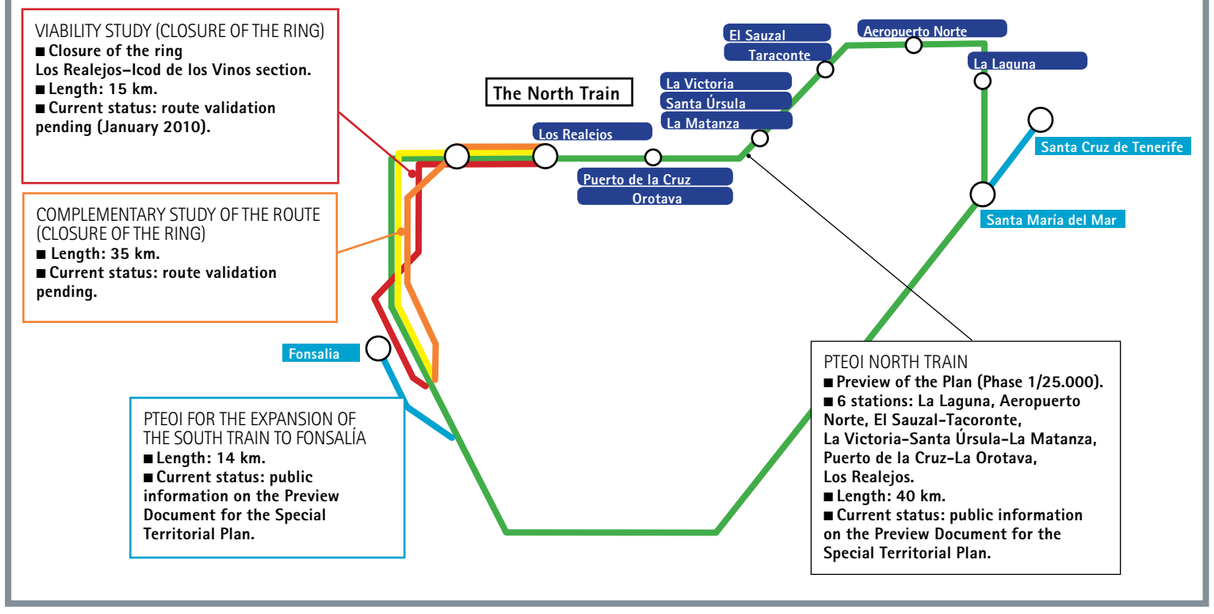

Santa Cruz de Tenerife.


Los Cristianos.


Section parallel to the TF1.

A novel feature of this project are the sub-horizontal surveys that are carried out in the long tunnels. This makes it possible to continuously record the geology of the tunnel.

The North Train and closure of the ring




A complex volcanic nature.


Guaza Mountain Nature Reserve.


Southeastern cost of Tenerife.

Minimising environmental impact

The addition of the railway will make it possible to reduce pollution levels caused by the use of private vehicles.

The South Train route is located between the mid-altitude areas and the southeastern coast of the island, with 12 municipalities fully or partially included on the route (Santa Cruz de Tenerife, El Rosario, Candelaria, Arafo, Güímar, Fasnia, Arico, Granadilla de Abona, San Miguel, Arona and Adeje). The total length of the line is 79.50 kilometres, on an electrified double track between the Bus Interchange (Santa Cruz de Tenerife) and the Costa Adeje Station. It also includes 5 intermediate stations: Santa María del Mar, Candelaria, San Isidro, Aeropuerto and Los Cristianos.

Tenerife's geology differs from that of the Iberian Peninsula and other Spanish island territories, as its volcanic nature produces a multitude of changes in the terrain. For this reason, geological-geotechnical research is particularly important. A novel feature of this project are the sub-horizontal surveys that are carried out in the long tunnels. (such as the one in Guaza Mountain). This makes it possible to continuously record the geology of the tunnel, as opposed to the usual vertical survey method, which provides specific information that must be extrapolated laterally. Moreover, although horizontal drilling is more expensive in unitary terms, it is cheaper in high-coverage tunnels because it reduces the amount of vertical drilling required. This technique is becoming more widespread in tunnel surveys.

Protected areas

The new railway line will have to cross the Guaza Mountain Nature Reserve, one of the most representative volcanoes, at the town of Arona. The route through this protected area will run underground, through a 2,770-metre tunnel that will minimise the effects on the area.

Interchanges

Ineco collaborated in the evaluation of bids during the tendering process for the interchange projects. Once awarded by public tender, the task was to unify those projects.

>CANDELARIA

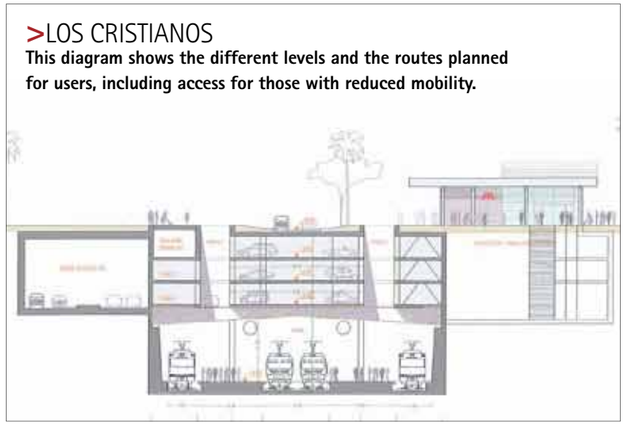
The simplicity of the materials and harmony with the environment can be appreciated in the computer-generated image (right).

>SANTA MARÍA DEL MAR-AÑAZA

Landscape integration was one of the aspects assessed in the projects submitted.

>LOS CRISTIANOS

This diagram shows the different levels and the routes planned for users, including access for those with reduced mobility.



>SAN ISIDRO

The wave-shaped roof and curtain wall are characteristic of the San Isidro Interchange, where the utilisation of the terrain made it possible to locate the platforms outside, with a single change in height from street level, making the installations easily accessible.

Beyond the Danube border

Modernisation of the Vidin–Sofia railway line

Published in itransporte 29

The Vidin–Sofia line is a key element of the hubs connecting northern Europe, the Black Sea, the Mediterranean basin and Asia. Ineco is a partner in the international consortium that developed the improvement project.

Bulgaria, located on the shores of the Black Sea and the Danube river, is a strategic crossroads for intercontinental transport connections. Five of the European Union's 10 freight transport corridors cross its 111,000 km² of territory. The EU has also included Bulgaria in two of its transport hubs, comprising what is known as the spine of the eastern European railway network.

The 270-kilometre railway line linking the Danube port of Vidin to Sofia, the Bulgarian capital, is of particular strategic importance. Constructed in the early 80s, before the collapse of the Soviet Union, both its installations and the rolling stock are now obsolete. Added to this is a lack of maintenance and operational incompatibility with the railway network in the rest of Europe, which will be solved with the modernisation project.

Although the Bulgarian economy had evolved very positively from the beginning of the past decade, until the recent worldwide financial crisis, the overall deterioration and inefficiency of the country's transport infrastructures, especially the railways, threatens to slow down the rapid evolution of Bulgaria and its neighbouring countries, particularly Turkey and Greece.

This was highlighted in the economic-financial and viability studies conducted by Ineco for the modernisation project on the Vidin–Sofia railway line, ordered by Bulgaria's National Railway Infrastructure Company (NRIC), an international European consortium made up of a joint venture between five companies: Spain's Iberinsa, Austria's ILF, and Bulgaria's Transsystem and GeoTechnoengineering. The consortium drew up the viability study, the basic project, the strategic proposals for tendering the works and supplies, and the environmental documentation required under European legislation. *

Replacement of the entire catenary is needed.

Level 1 ERTMS will be implemented.

Objective: a faster, safer and more European line

>RENEWAL OF THE INSTALLATIONS

The improvement proposals developed by Ineco involve rehabilitating the six existing substations and building two new ones, in addition to five new distribution points. The project includes equipping all installations with remote control and installing a new catenary. The signalling and telecommunications section suggests replacing the mechanical and electrical interlocks with electronic interlocks. The modernisation project includes the introduction of automatic locking systems, as well as the implementation of Level 1 ERTMS/ETCS (European Rail Traffic Management and European Train Control System), which will be installed at the Sofia Traffic Control Centre (CTC), a new STM-16 transmission system and the GSM-R communications system for voice and data.

>NEW ROUTE

The existing line does not meet the technical and safety specifications required for interoperability with the European network: 48% of its length has a curvature radius under 500 metres, limiting the speed to 40–70 kph on two-thirds of the route. Due to the ruggedness of the terrain, the consortium chose to design a new alignment after assessing 34 different options.

>BENEFITS FOR PASSENGERS AND FREIGHT

The renewal will benefit nearly 2 million Bulgarians by linking the northern part of the country to the capital, located in the southwest, and providing quick and efficient railway transport to one of the most populous areas (7.7 million inhabitants). Once the modernisation is complete, the length of the journey will be reduced from the current 6 hours to 2 hours and 40 minutes on a conventional train, and just over an hour and a half on a high-speed train.

The Vidin–Sofia line is also a crucial hub for freight traffic. At the Danube ports of Vidin and Lom, construction of a number of intermodal centres is planned. Efforts to boost modal interchanges are intended to increase international land freight transport by 15% (agricultural products, metals, minerals and metallurgical products), and port transport by 2% to 3%.

CONNECTING CONTINENTS. The map on the left shows the complete route of the so-called 'priority axis 22' on the Trans-European Transport Networks (TEN-T), to which the Vidin–Sofia line belongs.

Sofia-Sever train station.

Control post at Rebrovo station.

THE ROLE OF INECO

The company's International and Development Area conducted the passenger and freight demand studies, the capacity study and line operation plan, and the cost-benefit and profitability analyses for selecting route alternatives, in accordance with European Commission and the European Investment Bank (EIB) methodology. It also studied possible sources of funding and prepared the documents for requesting European Union cohesion funds, as well as a business model proposal for the line. Ineco's Railway Systems Area performed the tasks related to railway installations, from proposals and evaluation of alternatives to drawing up functional projects for signalling, communications, Traffic Control Centres (CTC), substations and catenary.

A train under the runways

Rail access to the new terminal at Barcelona–El Prat Airport

Published in itransporte 28

A new railway tunnel nearly 3 kilometres long, drawn up by Ineco, will pass under Barcelona–El Prat International Airport, connecting the new terminal, conceived by Spanish architect Ricardo Bofill, to the subway and the rest of the commuter train network.

The aim of the new construction project drawn up by Ineco is to provide commuter train (Cercanías) passengers with access not only to the old airport Terminal T2 (as they have now), but also to the new Terminal T1, inaugurated in June 2009, to which most of the airport's activity has gradually shifted. The project includes a new underground multimodal station at the site occupied by the Terminal T2 commuter train station, where the Cercanías line and Line 9 of the Barcelona subway system (currently under construction) will converge, as well as another train station in Terminal T1 (not included in this project).

The future rail access will start roughly 4.5 kilometres from Terminal T1, at the El Prat de Llobregat station, where the Madrid–Barcelona–French border high-speed line and commuter Line C2 converge. It runs above ground until it reaches the old airport terminals and ends at the Ciudad Aeroportuaria station, 200 metres from Terminal T2. Passengers now access the airport installations via a footbridge, which will disappear with the new project, as will the section above ground. In fact, a total of 3,385 metres of the 4,495 metres of the new rail access will be underground.

With the introduction of the new line, passengers landing in Barcelona will not only be able to take the train to the centre of the Catalan capital or any other point on the Cercanías train network, but will also be able to connect to the high-speed train (AVE) from El Prat railway station.

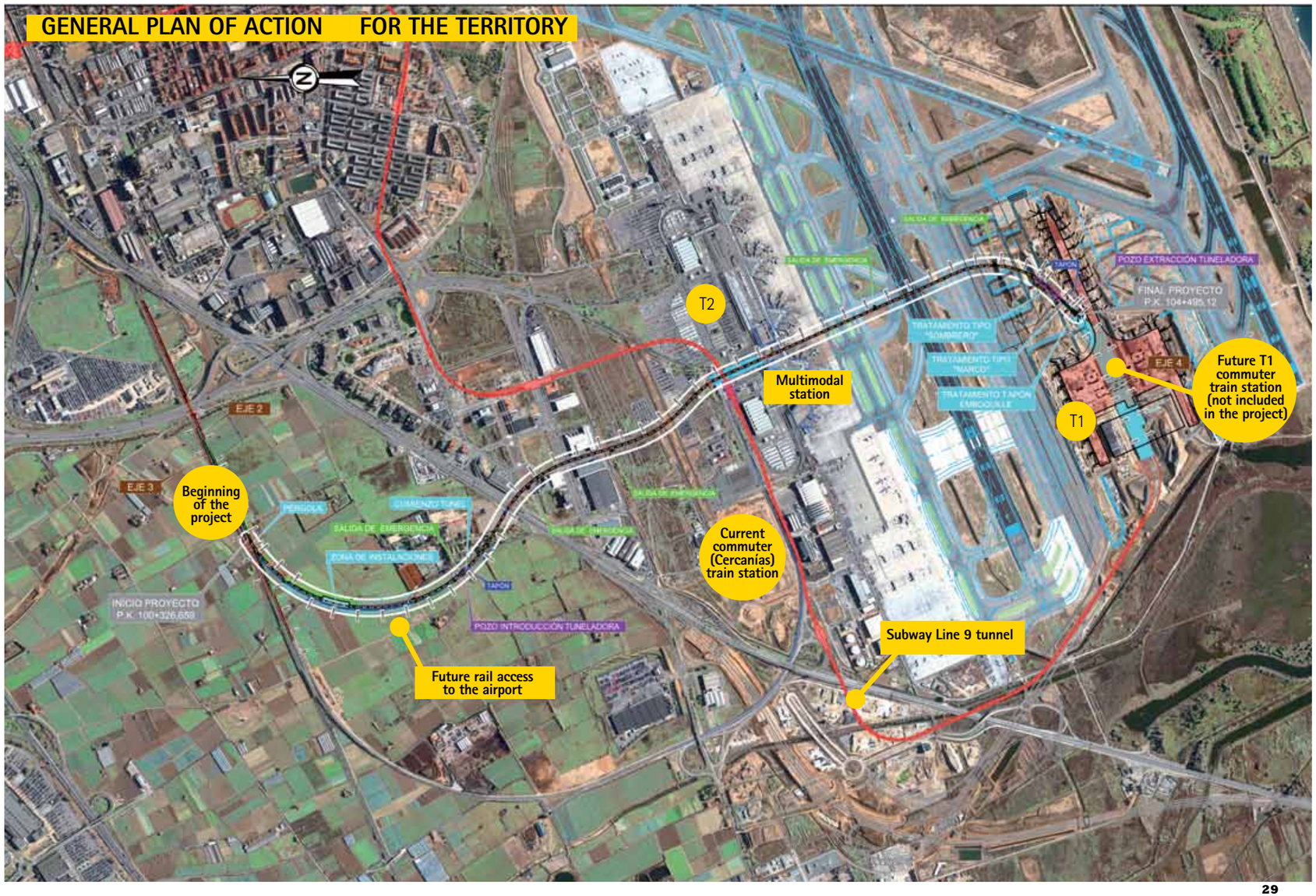
Drawing up the construction project required the participation of an extensive multidisciplinary team from Ineco, with specialists in a variety of fields: railway and airport projects, geotechnics and tunnels, geology and ➔

Environmental protection

With regard to environmental integration, as profiled by the corresponding Environmental Impact Statement (approved in December 2006), the Ineco team developed different measures, notably to protect the area's hydrologic system, and particularly the aquifers in the Llobregat Delta. In addition, the project required a specific hydrological study approved by the Catalan Water Agency in May 2008. Changes were also introduced to reduce land occupation to a minimum in the Baix Llobregat Agricultural Park, a protected area of 2,700 m² devoted to autochthonous agricultural activities. For this reason, the excavated access ramp to the tunnel was replaced by a section enclosed by walls and screens.

>MAIN ELEMENTS OF THE CIVIL WORKS (1)

- **2,830 metres tunnel excavated using an EPB tunnel boring machine.**
- **Screens and walls on the tunnel mouth ramp (785 metres).**
- **False tunnel enclosed by screens (263 metres).**
- **Structure of the multimodal station.**
- **Extension of the existing drainage system and replacement of the affected irrigation ditches.**



The project includes a new underground multimodal station at the site occupied by the Terminal T2 commuter train (Cercanías) station, where Line C2 and Line 9 of the Barcelona subway system will converge.

➔
structures, the environment, etc. The solution consists of a double slab track, 1,668 mm wide, with 3.82 metres between track centres. The track enters the tunnel 1.4 kilometres from the start of the section and will pass under the airport complex, including the runways. In the end, the project excluded the section connecting to the Barcelona–Vilanova–Valls line (along the cost), which was initially considered in the informative study. A single-track, *Iberian* gauge (1,668 mm) section will branch off from this line.

The execution of this project involves considerable technical complexity. Not only will most of the work take place in a tunnel, but the route runs through very soft terrain. It passes right through the Llobregat Delta, next to the main groundwater reserve for the city of Barcelona (the delta aquifers), where the land has a low load-bearing capacity. The tunnel also passes under the airport's runway area, which involves certain conditioning factors that were considered very carefully during the preparation of the project.

In order to combat the ground quality problem and the presence of the water table at a low depth (just over 2 metres), and undertake construction with the utmost safety for buildings and infrastructures, the generalised use of jet-grouting ground improvement treatments is planned.

The improvement treatments planned for the portion to be excavated in the tunnel are: injections using a tube as an impregnation or reinforcement treatment, compensation injections, jet-grouting columns, pile barriers for protecting buildings, conventional and tube-injected micropiles, and contact injections using polyurethane.

The excavation method chosen is an EPB (Earth Pressure Balanced) shield tunnel boring machine, with an excavation diameter of 10.60 metres and an inner diameter of 9.60 metres. The construction project describes its components and the working procedures in detail. Other remarkable aspects of the project are the hydrogeological studies and geotechnical research conducted in order to collect the maximum amount of data on the behaviour and characteristics of the terrain in each section. ✱

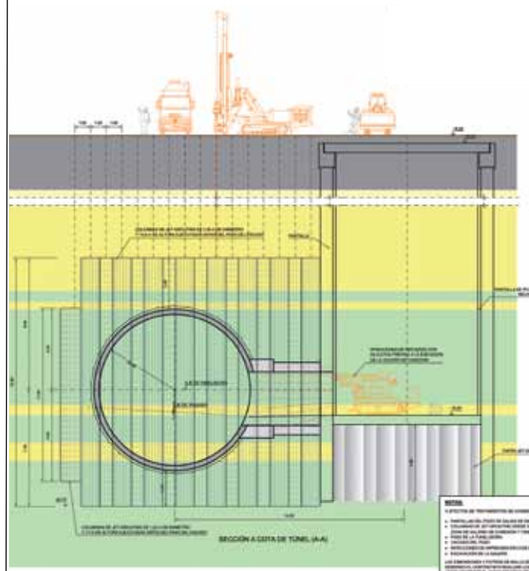
Safety in the tunnel and auxiliary installations

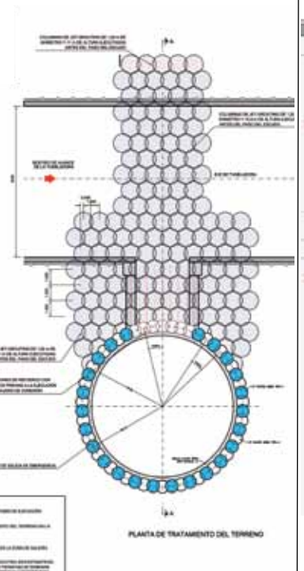
The line tunnel has five emergency exits, three of which will be on the surface located in the entrance pit for the tunnel boring machine, at the Plaça del Pla de l'Estany and Canal de la Vidaleta. The other two, located under the runways, will be added for safety reasons to the future excavation gallery in the bottom part of the tunnel, which was specifically adapted to accommodate them. Moreover, the project defines, although it does not include, the non-railway installations required in the interior of the tunnel, and those in the future evacuation galleries: evacuation signalling, electrical power supply, lighting and current collection systems, fire detection and extinction, gas detection, air quality, pumping and ventilation systems.

>MAIN ELEMENTS OF THE CIVIL WORKS (2)

- **Receiving pit for the tunnel boring machine.**
- **Emergency exits from the tunnel.**
- **Control instrumentation for the structures and ground.**
- **Jet grouting treatments.**
- **Extraction pit for the tunnel boring machine.**
- **Non-railway auxiliary installations (defined, but not included in the project).**

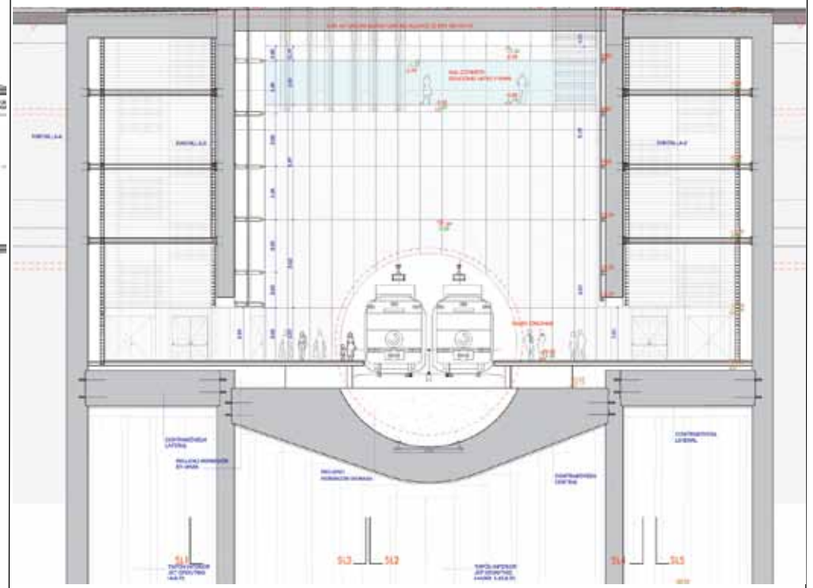
The tunnel under the runways





Before burrowing under the runways, the tunnel boring machine must pass under the Intermodal Building at Terminal T2. Several protective measures have been planned for this process. After this section, drilling under the runways will begin. To ensure that no damage occurs on the surface, different ground reinforcement treatments were planned: in the initial area, horizontal jet grouting will be used, followed by an 'umbrella' of micropiles 12 metres long to ensure proper excavation profiling and adequate stability.
Before starting the excavations, the provisional metal reinforcement structure for the ring of voussoirs will be assembled. The excavations will begin on the leading section, following the Belgian tunneling method. Throughout the construction of the tunnel under the airside, an active crew will be required 24 hours a day to check whether damage requiring emergency measures occurs on the surface. For this purpose, the appropriate auscultation measures are also detailed.
In the area where the project ends, located near the exit at airport Terminal T1 (where the sword-shaped building starts), three ground treatments applied from the surface have been planned: 'hat' type, 'frame' type and the treatment for executing the 'mouth plug'. Finally, the extraction pit for the tunnel boring machine will be constructed. This will affect the apron, specifically positions 224 and 226. Between them is a 'handling' island, where the ventilation grid will be located.

New interchange at Terminal T2



The future commuter train station on Line C2 will be located in the area bound by the current commuter train station and the 'intermodal building', located between blocks A and B at airport Terminal T2. Architects Carles Ferrater, Ramón Sanabria and Josep María Casadevall worked closely with Ineco on the train, subway, taxi and bus interchange. The structure will be built before the tunnel boring machine passes through, and the machine will have to be dragged the 237 metres between the inner sides of the screens bounding the structure. It will have four levels:

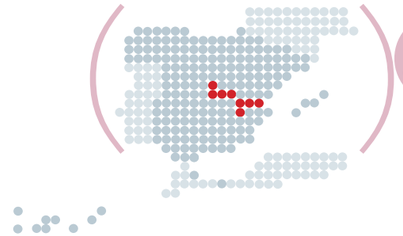
- **Commuter train platform level.**
- **The intermediate level will house the subway station platforms and the bridge over the railway providing access to subway Line 9.**
- **Line 9 hall level. This will have two sectors: the central sector –which receives subway and commuter train passengers, and will have a direct connection to the ground floor– and the sector adjacent to the 'intermodal building' –which will allow commuter train passengers to access the basement of that building.**
- **The deck level, located on the surface, will accommodate the airport roads, and comprises the ground level of the esplanade over the station.**

During the construction work, a provisional station will operate and the footbridge providing access to the airport (roughly 200 metres long) will be demolished. A special bus service will therefore be provided to take commuter train passengers to the terminal.

The AVE reaches Levante

Ineco worked on the new high-speed rail line

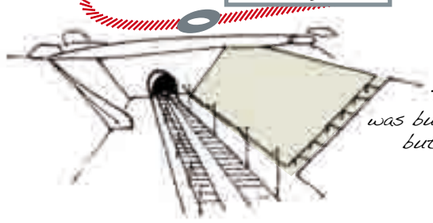
Published in itransporte 36



On December 19, 2010, the first 'AVE' left Madrid with passengers bound for Valencia.

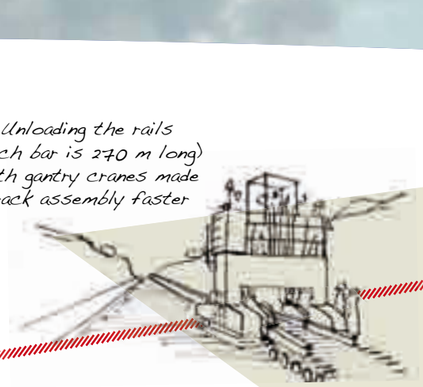
Madrid

Aranjuez



The El Regajal tunnel was built to protect the Ontigola butterfly and moth reserve

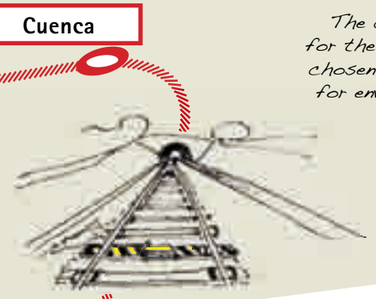
Unloading the rails (each bar is 270 m long) with gantry cranes made track assembly faster

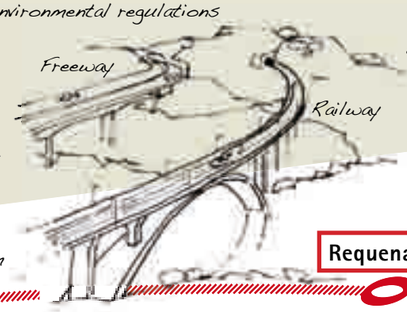


Cuenca

To generate plans for the catenary installation (over 1,200 km), the CATMASTER application was used

The construction system for the Contreras viaduct was chosen with absolute respect for environmental regulations





The tunnel entering Valencia includes three 'tubes': one for the AVE, one for commuter trains and one for cargo

Valencia

Requena-Utiel

With this line, Spain now has over 1,500 km equipped with ERTMS

Motilla del Palancar

Ineco led the project for the new Control and Reporting Center (CRC) in Albacete

Albacete

From the beginning, Ineco's history and experience have been linked to the development of high-speed rail travel in Spain. With this new line, the company's contribution has extended to different phases of construction.

Ineco worked together with Adif (Spain's railway infrastructures administrator) in different areas, from planning and preliminary studies, to supervision and management (through project and site management and technical assistance), environmental protection (through environmental project management), drawing up projects (platforms, tracks and railway installations), and participation in specialised tasks. These included load tests on bridges and viaducts, geological and geotechnical campaigns, and follow-up and supervision of completed campaigns. Of particular significance are those performed in the tunnels at El Regajal and La Cabrera, two of the main technical milestones on the new line.

Site management, project coordination and supervision, technical assistance and surveillance tasks (responsible for compliance with safety standards, documentation control...) were carried out on different sections of the line for platform construction and track assembly, as well as railway installation tasks: electrification (electrical substations, overhead contact lines, operation and control automation, electrical and remote control sizing studies), signalling and train protection (interlocking systems and locks, ERTMS (European Railway Traffic Management System), traffic management centres, auxiliary information and control systems) and communications systems (fixed network, GSM-R).

Teams from Ineco have also been in charge of environmental management for construction on the entire line. They remained in permanent contact with project management and were responsible for ensuring compliance with environmental regulations down to the last detail, and enforcing the restrictions and specifications contained in the Environmental Impact Statement (EIS) at all times. This must be done during the preliminary phase prior to construction, which is essential for avoiding unnecessary costs and damage to the environment, and during project execution.

Among the environmental responsibilities are the supervision and control of tasks relating to archeological findings. There has been no shortage of these on the Levante corridor: over 70 in total, with discoveries ranging from simple ruins and remains from different periods, to dinosaur bones.

In addition, Ineco worked with Adif on different projects involving structures linked to construction, including platforms, tracks and railway installations. For load testing on bridges and viaducts, the company has introduced a novel system for measuring panel deformation that has provided more accurate results than the traditional method. This system has been applied, for example, on the Contreras viaduct. *

A matter of weight

Load tests on the Contreras viaduct

Published in itransporte 32

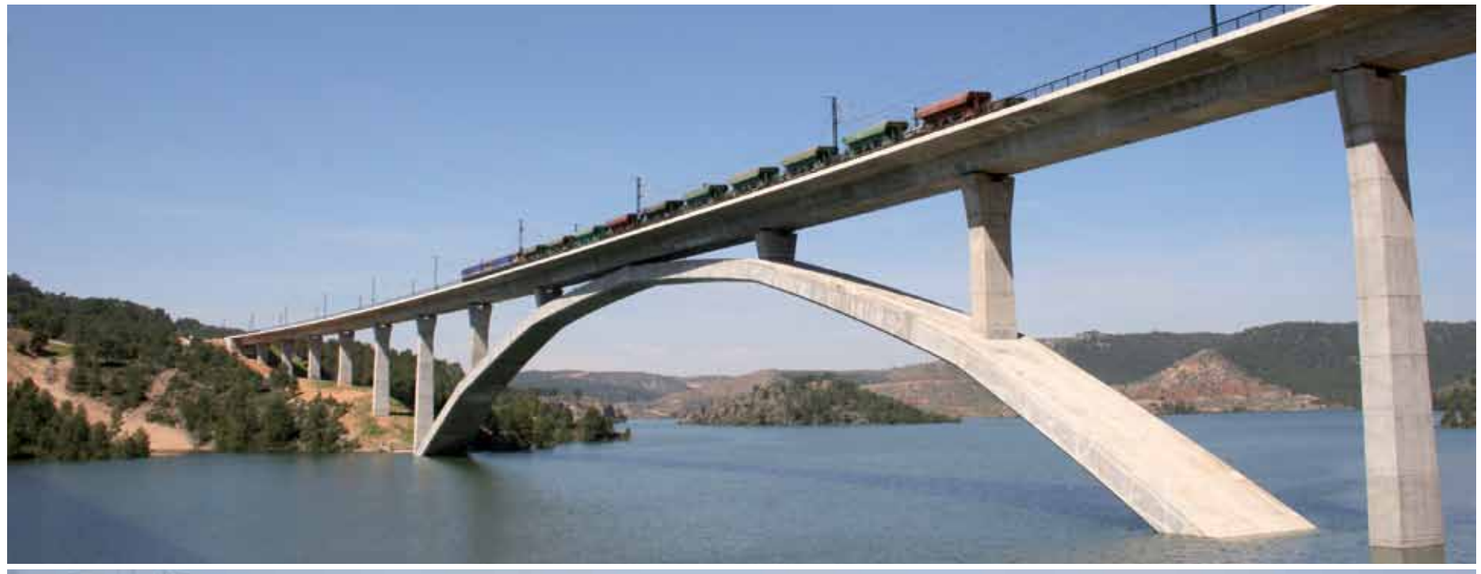
In April 2010, engineers and technicians from Adif and Ineco performed the final resistance tests on the most emblematic viaduct on the new high-speed line to Levante. The company is acquiring broad expertise on the high-precision methods used.

The final instrumentation tasks and load tests on the viaduct spanning the Contreras Reservoir, on the border between the provinces of Cuenca and Valencia, were carried out in April 2010, eight months before the inauguration of the new high-speed line to Levante. Ineco performed a total of 77 load tests for Adif on more than 140 bridges and viaducts on the sections they were awarded.

The Contreras viaduct, a true icon of modern Spanish civil engineering, is 587 metres long and has 14 sections, some of which rest on an arch with a 261-metre span, one of the largest in Europe. The difficult construction process was carried out completely *in situ* using a movable scaffolding system for the decks, a climbing framework for the piers and a complex mixed system of falsework, successive voussoirs, and temporary cable stays for the arch.

The final and definitive checks consisted of resistance tests using a cargo train (with known data) travelling at different speeds (dynamic tests) and at several known positions with null speeds (static tests). The analysis of the results made it possible to issue the appropriate conclusions and recommendations after comparing the values with those resulting from the theoretical calculations performed.

During the test, the structure was subjected to a weight of 2,116 tons (4 locomotives and

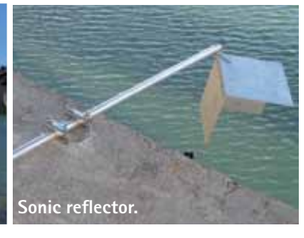



Measurement sensor.


Data acquisition equipment.


Data presentation software.


Georadar.


Sonic reflector.

Ineco actions

Arch deformation was measured using three procedures:

>DECK DEFORMATION

High-precision topographic levelling for monitoring deck deformation on the piles resting on the arch.

>THE ARCH

Topographic levelling of the arch itself using a total station.

>NEW TECHNOLOGY

Automatic recording of 8 points on the arch; the same points as before, but with a new technology (georadar). This is measured statically and dynamically (up to 100 data/seconds) In addition, arch tension is monitored through the placement of 16 extensometric bands. This is completed by placing 12 additional bands on the deck.

It is also worth highlighting the use and development by Ineco of a new system for measuring deck deformation from inside the box girder, using a laser device.

20 hopper wagons). This was the last step following the tests conducted with trucks in June 2009.

Because the arch crosses the reservoir at a deck height of 105 metres from the ground (40 metres from the deck to the water, plus another 65 metres of depth), it is not possible to drop the steel cables that would normally be used to measure descents to the ground. For this reason, a georadar technique was used, an innovative remote sensor for monitoring structural movements and deformations.

It is also worth highlighting the use and development by Ineco of a new system for measuring deck deformation from inside the box girder, using a laser device. This development has been revised and improved using high-precision lasers capable of detecting any deformation with a high level of precision. One of the small photographs on page 35 shows the system developed by the company assembled, with the laser on the tripod and the corresponding cable and weight system. In the actual tests conducted using this system at the Contreras viaduct, it worked even better than expected. ✱

Technical data for the Contreras viaduct

TOTAL LENGTH: **587.25 metres.**

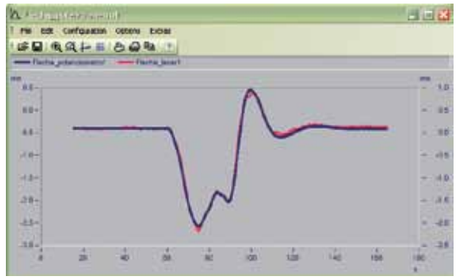
FREE ARCH SPAN: **261 metres, with a rise of 37 metres.**

LOCATION: **Flanked on one side by the exit from the western mouth of the 'Rabo de la Sartén' tunnel, and by the 'Cuesta Negra' viaduct on the other.**

DECK: **Constant box girder cross-section made of post-tensioned concrete, 14.2 metres wide and 3 metres deep, composed of 14 spans (36.2 metres on the end spans and 43.5 metres on the central spans).**

ARCH: **Rectangular box girder cross-section made of reinforced concrete, with variable depth (12×3.40 to 6×2.80).**

PLATFORM: **Double track with UIC 'International' gauge (1,435 mm).**



A comparison

In the image above we can compare the traditional system for measuring deck deformation and the new system developed by Ineco in the 1990s. The red line shows the excellent reliability of the measurements taken with a high-precision laser.

Tests for a common language

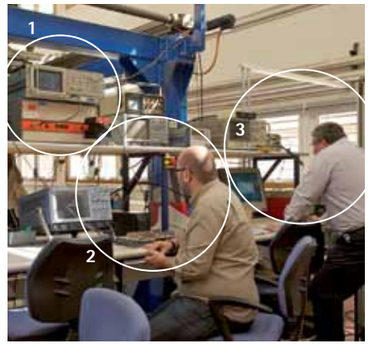
25 years researching the free movement of trains

Published in itransporte 32

Ineco has been working for years on ERTMS (European Rail Traffic Management System) research and validation in Spain through the CEDEX Railway Interoperability Laboratory, a public organisation reporting to the Spanish Ministry of Development.

The Railway Interoperability Laboratory (LIF in Spanish) and Germany's DLR (Institute of Transportation Systems) have recently been joined by the Multitel Research Centre in Brussels (Belgium). The three now share the job of defining the tests which are indispensable for enabling the free movement of trains throughout Europe. They aim to eliminate the traditional barriers of the different systems, equipment and signalling used by different manufacturers, which made it impossible to operate with a common railway language

The Railway Interoperability Laboratory at CEDEX (the Spanish Ministry of Development Centre for Public Works, Studies and Experimentation), located in Madrid, conducts tests and simulations of Eurobalises, EVCs (onboard units), Euroloops and infrastructure data.



An unstoppable reality. The definition of a common language for all trains in the European Union (EU), the ERTMS system, has required over 25 years of effort. Spain's significant role in this chapter of railway history dates back to 1994, when EMSET was implemented on the new Madrid–Seville high-speed line. This would be the first pilot project for validating ERTMS, coordinated by Dr. Jaime Tamarit, a Spanish physicist from CEDEX.

The Spanish Ministry of Development, Renfe and Europe's major railway companies participated in the project. The European Railway Agency (ERA) is now responsible for maintaining and continuing to develop technical standards. ✱

Ineco's participation

EMSET PROJECT. Analysis of complementary field tests on trains and infrastructures.
COMMUTER TRAINS. Complementary laboratory tests for start-up of the commuter train network in the Madrid region.
ERTMS–LEVEL 2. Analysis of the records obtained during the complementary tests of the Level 2 ERTMS installations on the Madrid–Lleida high-speed line.
ERTMS–LEVEL 1. Complementary laboratory tests of the Level 1 installations on the Madrid–Valencia high-speed line.
CERTIFICATION TESTS.

European leader

The Railway Interoperability Laboratory at CEDEX (pictures above), located in Madrid and directed by physicist Jaime Tamarit, has been a leader since the 90s in ERTMS validation for all of Europe –and now also for the rest of the world– in a setting independent from manufacturers.

1. **LEU simulator.**
2. **Chemist Alfredo Arroyo adjusting the signal levels on the LEU simulator.**
3. **Pedro Agudo, physicist, monitoring the antenna positioner for Eurobeacon testing.**

SUPRANATIONAL SUPPORT

For Dr. Jaime Tamarit (above), the ERTMS has been possible thanks to the support of organisations such as the EU and the ERA, the laboratories at CEDEX, DLR, Multitel and RINA, the creators of CITEF tools and the European Rail Software Applications, and support from Spain's Ministry of Development, Adif, Renfe and Ineco.

Slabs gain ground as an alternative to ballast

Europe views ballast-free track as the way forward, but not without controversy

Published in itransporte 26

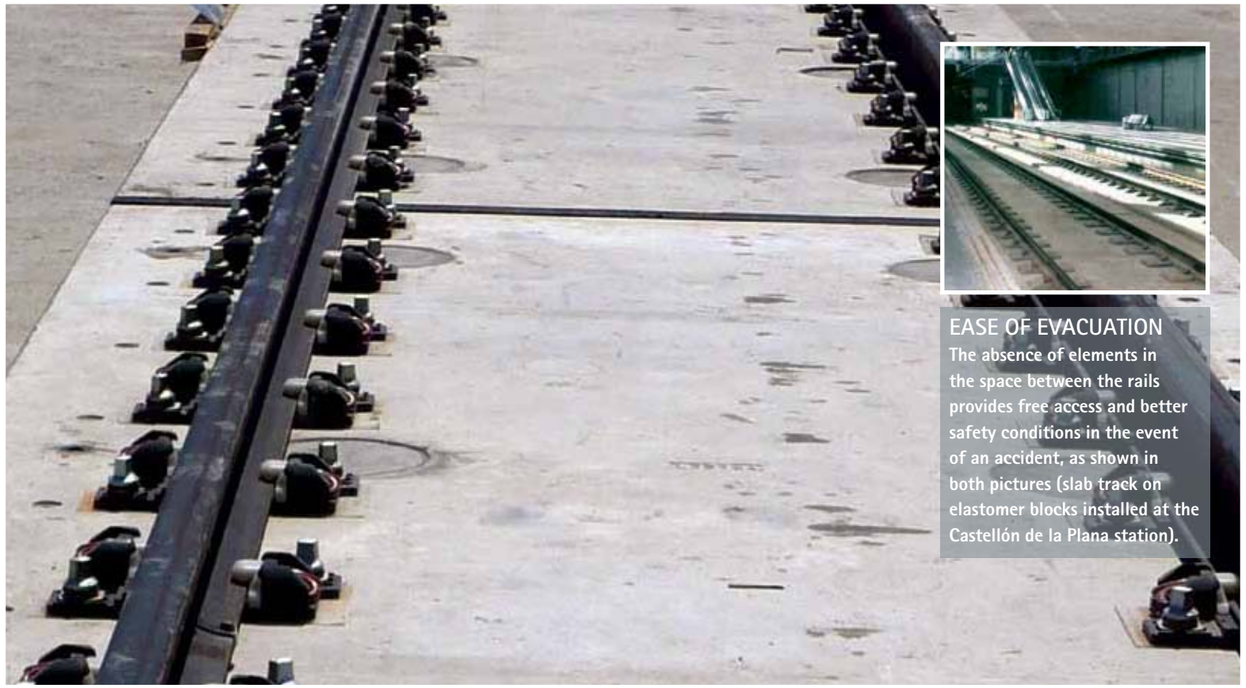
In spite of the numerous studies conducted on the suitability of railway platform installations on ballast (traditional tracks) or concrete or asphalt (slab tracks), the debate remains open. The following is a Track Technology perspective on this issue to facilitate future analyses.

Since the earliest days of railways, ballast has been used as a transition system between the sleepers and sub-base to add elasticity to the track, enable levelling and cant, allow drainage, stabilise the track horizontally and hold the sleepers in place.

In the mid 1960s, the need to increase track performance, create routes with invariable geometry, decrease maintenance costs and increase availability led to Japan's pioneering experience with prefabricated concrete slabs on the Shinkansen high-speed train network. In 1972, Germany also used sleepers at Rheda station, joined by a longitudinal frame and anchored to a concrete slab.

Since then, other European countries, including Spain, have viewed ballast-free tracks as the way forward, but not without controversy. The decision to install slab tracks on different sections or on an entire line must be the subject of a customised study, taking into account all conditioning factors. This complex decision is influenced by multiple factors which, in turn, condition other factors relating to the infrastructure, platform, operation of the line, route, optimum type of slab track, etc. The decision must be taken during the earliest phases of the project, as this choice will condition the later development of platform and track requirements.

Ballast-free tracks are conceived as an alternative to traditional tracks due to their low maintenance needs, which are reduced by nearly 50%. This is possible thanks to their rigid structure and the fixed placement of components. Precise surveys and levelling are required, as repairing any defects at the slab level involves costly work on the concrete. This situation is now being corrected, as it is now possible to graduate the fastening system.



EASE OF EVACUATION

The absence of elements in the space between the rails provides free access and better safety conditions in the event of an accident, as shown in both pictures (slab track on elastomer blocks installed at the Castellón de la Plana station).

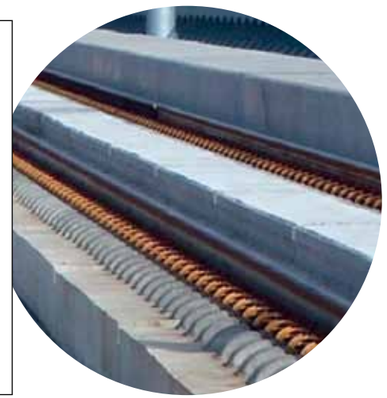
Such tracks cannot have differential settlements. Therefore, if they are built on embankments, these must be roughly 90% settled so that the difference can be absorbed by the fastening elements without compromising the integrity of the concrete slab. This means that the construction of high embankments (elevations over 5 metres are already problematic) and inappropriate foundations make the use of slab tracks inadvisable. As a direct consequence, due to this longer settlement period, the construction performance of slab tracks is much lower than that of traditional tracks.

One point in favour of slab tracks is their capacity to allow rolling stock to travel at faster speeds without damaging it. This occurs at high speeds (around 300 kph) on traditional tracks with what is known as *ballast flight*. This has its counterpoint because there is a lack of systems approved by the different administrations for allowing trains to reach such speeds, as well as systems sanctioned by experience.

The fact that the viability of slab tracks is studied for each section also makes it possible to optimise infrastructures located underground and on structures, as the gauge that →

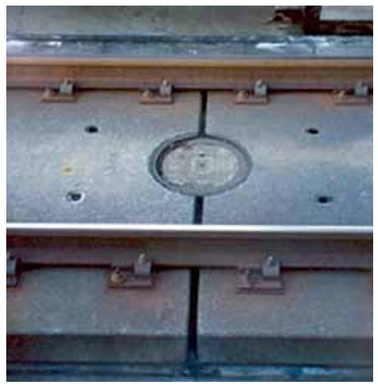
Monolithic with sleeper

This consists of a grid of concrete sleepers inside a load-bearing slab. Its main characteristic is the joint behaviour of the load-bearing concrete layer and the sleepers. The family of monolithic systems with sleepers cast into the concrete slab on site (Rheda 2000 type) is the most widely known for high-speed applications.



Prefabricated slab track

These are prefabricated modules. They trace their origins back to the design of Japan's Shinkansen. There is now a development project by Spain's National Association of Railway Sleeper Manufacturers, conducted jointly with Railtech and Ineco. The product is a multipurpose slab track system. It features two levels of elasticity: an upper level provided by the fastening and a lower level, under the prefabricated slab, that acts as a mass elastically linked to the substrate, provided by the elastomer.

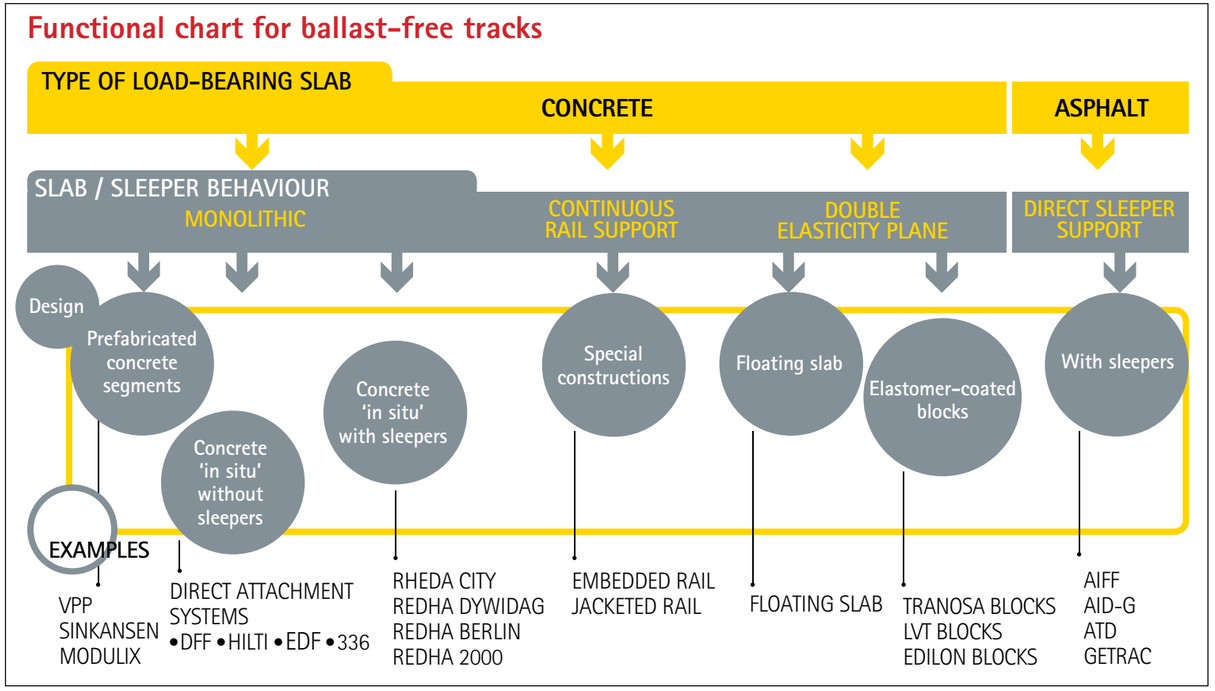


Embedded rail and derivatives

This includes a concrete slab on the track bed, where grooves are made to accommodate the rail, which is joined to the slab by pouring in a material with elastic properties. 'Jacketed' systems are being developed, in which the elastomeric material, rather than being poured, is manufactured in the form of sheets that are adhered to the rail.

The decision to install slab tracks on different sections or on an entire line must be the subject of a customised study, taking into account all conditioning factors.

Functional chart for ballast-free tracks



➔ can be obtained in tunnels is greater, and the dead load weight added by the slab is less than the minimum 35 centimetres of thickness required under sleepers on a high-speed ballast track. This is highly beneficial for applications on bridges.

At this point, it is important to clarify that there are restrictions for implementing slab tracks on viaducts as a result of the limitation of vertical slab settlements, transverse movements and panel rotation, in order to avoid unacceptable variations in the vertical alignment of the track. The absence of ballast on the platform deprives the slab track of its main functions: the granular vibration damping element is lost, as well as the surface water evacuation and drainage functions.

Compliance with regulations. Numerous studies concerning noise and vibrations are being conducted based on these characteristic factors of railway circulation for selecting the type of track to be implemented. Slab tracks are noisier than traditional ballast tracks. There are therefore numerous devices for ensuring compliance with current noise regulations,

TRAMS, A MATTER OF URBAN CLEANLINESS

For urban railway applications, slab tracks are gaining ground and more railway administrations are choosing this system. This is basically due to the cleanliness provided, the quick and safe evacuation of passengers and the ability of some designs to allow transverse traffic permeability, for vehicles and pedestrians, in addition to their undoubtable aesthetic effect.

also used for ballast tracks, that can be implemented on this type of track (screening, greasers, lubricants, etc.)

As far as vibrations are concerned, however, notable improvements can be achieved with slab tracks because elastomeric elements can be interposed at different levels of the superstructure. This makes it possible to act under the rail, under the sleeper and under the slab, gradually obtaining better vibrational responses. It lowers the resonance frequency of the system, but increases its cost. The drainage problem is solved by careful execution of the slab and the placement of drainage elements, both longitudinal and transverse, for collecting water in an intermediate groove (usually on double tracks) or a lateral groove (single track).

To evaluate the economic aspects, we should not make the common mistake of only considering the initial investment required, which is apparently much higher for slab tracks. As suggested by the multiple technical-economic investment analysis studies conducted by Ineco, we should consider how to obtain the lowest long-term diseconomies. Thus, slab tracks will be profitable due to their lower maintenance needs.

There are different options to implement on tracks with low, medium and medium-high commercial speeds, for both metropolitan systems and heavy rail station access. However, the lack of experience in Spain and Europe with the construction of different types of slab tracks for high speeds, particularly on sections subject to differential settlements (earth works), and the fact that there has been little mechanisation developed in this area, means that for the moment there are few alternatives. This causes slab tracks to lose competitiveness compared to ballast tracks. ✱

Blocks

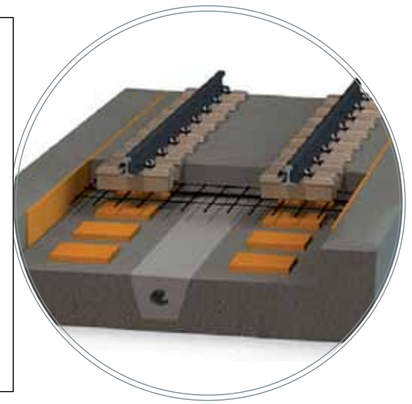
The system has a continuous concrete slab, where the block is inserted, leaving it embedded in and joined to the concrete slab. The block, in turn, is coated in elastomer on the part that is in contact with the concrete, thus reducing the level of vibrations produced by the passage of trains.

Monolithic with direct fastening

On this type, the rail is secured by a fastening in the form of a slab, that joins it to the concrete load-bearing slab by means of steel inserts. The installation requires the use of false sleepers to maintain the width, alignment and levelling of the track before the concrete is poured. However, because no sleepers need to be handled, the logistics and machinery required are simplified, and high performance can be achieved.

Floating slab

This system can be constructed with any of the other systems previously described, except that in this case there is an elastomer sheet between the concrete slab and the track bed, either through discrete supports, in bands or continuously.



Station kit

A pioneering initiative developed by Ineco

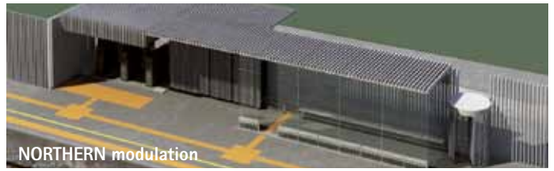
Published in itransporte 30

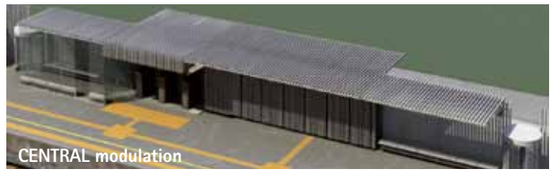
Passenger comfort, sustainability and costs were the three factors considered by Ineco while designing a railway shelter project for Adif.

In 2009, Adif (the Spanish administrator of railway infrastructures) asked Ineco to develop a technical solution for achieving a railway shelter for use in stations handling less than 1,500 passengers a day. This is a pioneering project for constructing a station using modules made of tubular galvanised steel structures, transportable by train, that can be joined together or multiplied according to the needs of each station. Three factors were considered in the design: economy, sustainability and passenger comfort. ✱

THE TARGETED STATION

Las Zorreras commuter train station (picture to the right) on Line C8, located near El Escorial (province of Madrid), served as a model for the introduction of the shelter. With 1,100 passengers a day, this is the type of station targeted by the project.





Adaptation and modulation

■ **STATIONS IN THE NORTH OF SPAIN (500 passengers a day). Contain enclosed waiting areas for weather protection, with one access and installation module for each platform.**
↑ (1) + (✱) (1) + W (9)

■ **CENTRAL SPAIN (250 passengers a day). Offer enclosed waiting areas for protection from cold and wind in the winter, which are opened in the summer.**
↑ (1) + (✱) (2) + W (6) + W (6)

■ **SOUTH OF SPAIN (1,000 passengers a day). Feature open waiting modules, two access modules and a single module for installations.**
↑ (2) + (✱) (1) + W (11)

■ **THE LEVANTE-MEDITERRANEAN REGION (1,500 passengers a day). Contain several open and enclosed waiting rooms. Two access modules are constructed to avoid congestion at peak times.**
↑ (2) + (✱) (2) + W (10) + W (6)

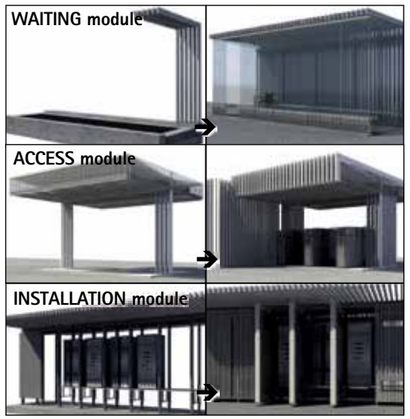
↑ ACCESS / (✱) INSTALLATION / W ENCLOSED WAITING MODULES / W OPEN WAITING MOD.

Key elements

WAITING MODULE_This consists of a structure 90 cm wide, comprised of tubes measuring 150 x 50 mm made from galvanised steel and placed in an L shape. The plinth and seats are made of perforated sheet metal. The module is closed using sheets of glass. Its versatility makes it possible to build an open or closed waiting area, with a roof made of glass or anodised aluminium panels.

ACCESS MODULE_The entrance to the station has a galvanised steel roof. There are two reversible turnstiles under the roof, accessible to persons with reduced mobility. When the station is closed, these are hidden behind an automatic mesh rolling shutter. Accessibility is one of the most important factors.

INSTALLATION MODULE_A third roofed structure is built to house the station controls. Under this, a cabinet is placed to accommodate the ticket vending machine, the electrical panels and the different control racks. These expandable cabinets are equipped with access control to ensure security, and are accessible from both sides.



Transport and assembly sequence

The 90 cm dimension chosen for dividing the waiting shelter makes it possible to store it in boxes manageable enough to be transported in standard freight cars, saving time and costs.

TRANSPORT TO THE STATION_The train convoy arrives at the station and parks on the track accessible from the platform. The concrete foundation must first be laid. After unloading the boxes containing all elements necessary for assembly (L-shaped galvanised steel structure, anchor plates and framing), assembly can begin while the train continues its journey.

ASSEMBLY OF THE MODULES

■ **WAITING MODULE. The main structure, assembled at the factory, is screwed to the foundation. The roof, composed of 'sandwich' panels with the lighting already inserted, is installed. The 'tramex' is added to cover the trays of installations, the seats are anchored in the foundation, the flooring with in-floor radiant heating is added, and the remaining closures and finishes are completed.**

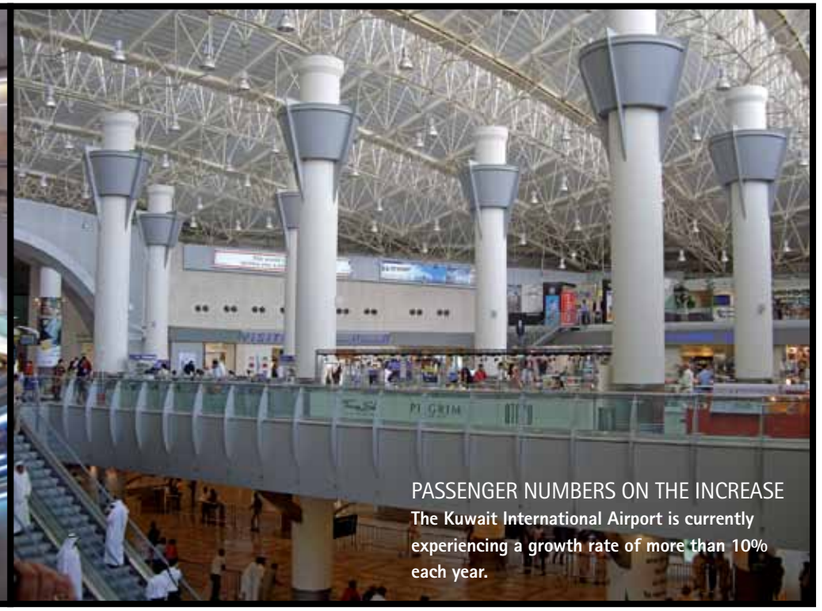
■ **ACCESS MODULE. The main tube structure is raised with the secondary framing that will support the 'tramex' box, the lighting and the remote-control rolling shutter. The 'sandwich' panel roof is installed. The station signs and logos are anchored to these profiles. Finally, the access turnstiles are installed.**

■ **INSTALLATION MODULE. The main structure is built using 150x50 mm tube framing. Next, the cabinets that will contain the equipment are assembled. The roof will be made of 8+8 safety glass in the overhanging areas to allow the station's artificial lighting to pass through. The cabinet doors are made of steel with welded plates. Finally, the equipment and ticket dispenser will be installed.**

Ineco to manage and oversee the expansion of the Kuwait International Airport

The contract awarded is worth €26.5 million

Published in itransporte 39



PASSENGER NUMBERS ON THE INCREASE

The Kuwait International Airport is currently experiencing a growth rate of more than 10% each year.

The contract recently awarded to Ineco for managing and overseeing the entire project is worth over €26.5 million. A complete redevelopment will increase the airport's capacity from 6 million to 20 million passengers per year by 2016.

The Kuwait International Airport, which is operated by the Directorate of Civil Aviation (DGCA), is located 16 kilometres from Kuwait City and currently welcomes some 9 million passengers through its doors.

Kuwait is an Emirate located in the Arabian Gulf, with more that 2.5 million inhabitants. It borders Saudi Arabia to the south and Iraq to the northeast. Its main economic income is from petroleum. The recent increase in air passenger traffic led the Kuwaiti authorities to develop an expansion program for airport infrastructure, which will allow the country to welcome twice as many visitors and convert it into a large commercial and financial hub. The initial investment is expected to be some 2,800 million Kuwaiti dinars (approximately €1,000 million), in which different specialized companies will participate.

The goal of the projects awarded to Ineco consists of supporting the DGCA during the airport expansion program with the help of a multidisciplinary technical project management team. All of the projects are financed by the country's government and some of them will be managed directly by the DGCA. Another group of projects will be managed privately using the B.O.T. (Build, Operate and Transfer) formula, both during their execution and subsequent operation.

The main projects which are covered by the Master Plan include the construction of a new runway and the expansion of the two existing ones, the apron and the taxiways. A particularly important activity is the construction of a new terminal building (with capacity to handle 13 million passengers a year), the design of which has been entrusted to Foster+Partners. A car park over several floors, an administrative building and another building for fire and rescue crews will also be built. Finally, the project will also include the construction of a new hotel, as well as facilities for freight, fuel and hangar maintenance.

Exhaustive management and tracking. The services provided by a project management team are essential for large-scale infrastructure projects. The number of persons involved in this project requires exhaustive management and follow-up to achieve optimum coordination and to reach the goals set for quality, expenditure and deadlines.

The responsibilities included in this service are wide-reaching and varied, and can cover the whole life cycle of each project. Basically, they are responsible for the following tasks: risk management, design management, cost management, environmental management, deadline management, purchasing management (procurement), license management, construction management, operations, resource and quality management, communications and documentation management, and operations and maintenance (facility management). However, contracts are generally not awarded for the management of all phases; they usually only cover certain stages of the whole process, and this is the case in the expansion of the Kuwait Airport. ✱

The goal of the projects awarded to Ineco consists of supporting the DGCA during the airport expansion program with the help of a multidisciplinary technical project management team.

Work management and monitoring

A critical aspect of project management from the point of view of the tasks to be carried out is to establish a suitable information system when starting on the tasks. It is essential to know who is involved and what they are supposed to be doing in a project of such magnitude, as well as every individual's responsibilities, how the information flow is distributed, what the global and task-specific program should be, the operational procedures and the large number of companies and bodies involved. Organizing and managing this information requires the design of a computer tool specifically developed to help manage and follow up on these tasks. Among the features of the system are the generation of information on the control and monitoring of the planning stages, budgetary controls (including the fees for the different certifications required for each project), the volume of investment for each stage, information on contracts currently in the bidding process, budgetary issues for the projects and managing all of the documentation arising from the complete life cycle of all projects.

Ineco's experience in project management

A project with these characteristics requires a company that can specifically manage each stage and coordinate all of the bodies and companies involved in achieving the set objectives. This requires a great deal of experience in this kind of project. Ineco has been able to share its broad knowledge of airport expansion plans thanks to the projects it has worked on over the last few years in Spain and in which it played an important role:

>INVESTMENT HISTORY

- Barajas project: €6,200 million
- Malaga project: €1,200 million
- Canary Islands project: €1,051 million
- Levante project: €710 million
- Fuerteventura Program: €166 million

A MULTIDISCIPLINARY TEAM

Ineco, which has joined up with the local company Kuwait United Development (KUD), is providing a multidisciplinary team made up of more than 25 technicians in different fields. The different professionals will join the team as the work progresses over the lifetime of the project, initially planned at five years.

ONE MILLION MAN-HOURS

This was Ineco's contribution to the expansion of the Madrid-Barajas Airport, in which it developed an information and monitoring system for a structure consisting of more than 25,000 activities, which enabled it to manage the investment, contracting and deadlines for all of the construction projects.

A historic moment

Ignasi Nieto, chairman and CEO of Ineco (third from the right), attended the contract signing on March 14. Alongside are (from left to right): Bader Boutaiban, president of the Kuwait Civil Aviation Authority; Mohammad Mohsin Al Bousairy, Kuwaiti Minister of Communications; Manuel Gómez de Valenzuela, Spanish Ambassador to Kuwait; Sawsan Dashti, president of KUD, and Dr. Hussain Al-Sayegh, Ineco representative in Kuwait. During the event, which had major media exposure, Ineco presented the project, which is 'of great importance to the country', in the words of Mohsin Al Bousairy.

The most important tasks Ineco will be undertaking

>RISK MANAGEMENT

Targeted at identifying any risks which may arise and analyzing the most sensitive variables at every step in order to assess their likelihood of occurrence with the help of probabilities. Analysis of this study will determine what measures should be taken to eliminate or minimize the risk, and contingency plans in case the incident should occur. Poor planning in the risk management stage of complex projects can lead to them going over budget or being delayed. Ineco has IT tools which identify, manage, monitor and close incidents.

>DESIGN MANAGEMENT

Includes the coordination of all agents involved in drawing up the projects covered by the expansion plan, reaching a consensus among all the different parties involved in order to bring them in line with the needs of the client, and passing these onto the planners so they can produce the most suitable design. Once the plans have been completed, the design management team also reviews them in order to ensure that all of the requirements have been fulfilled. This stage of the process is fundamental, as accurate plans will avoid having to modify details later in the projects or in the construction work.

>COST MANAGEMENT

Involves the follow-up of amounts invested, certification of the contracts, the investment volume currently being executed and deviations from the budgets. The aim is to reduce the risk of exceeding the budget.

>DEADLINE MANAGEMENT

This activity is also fundamental, bearing in mind the repercussions that changes in airport operations might have during the course of the project and the economic impact of delays. This requires continuous monitoring of the planning of the expansion program. Efficient deadline management provides certainty with regards to the time needed to complete the activities, and a constant overview of the progress of each project.

>CONSTRUCTION MANAGEMENT

Complements the work carried out by the engineering companies working on construction management and supervision. These companies focus on concrete tasks which fall within their responsibilities, whereas the project management team maintains a global overview of the entire expansion project. The powerful tools used in this activity are the responsibilities matrix and the procedures manual, which are to be used at the different construction sites.

>QUALITY MANAGEMENT

Consists of developing the most suitable form of planning, organizing, leading and managing the resources of an organization so that each participant can comply with their obligations, ensuring that no mistakes occur and that the most appropriate technologies and designs are used to complete the project. The aim is to set suitable procedures to help deliver the projects with optimum quality.

>COMMUNICATION AND DOCUMENTATION MANAGEMENT

Involves defining who issues and receives the documentation for the project, its objective and distribution format. The goal is to ensure that all parties involved have the right documentation, and the right version, at all times.

SESAR, the future of European ATM

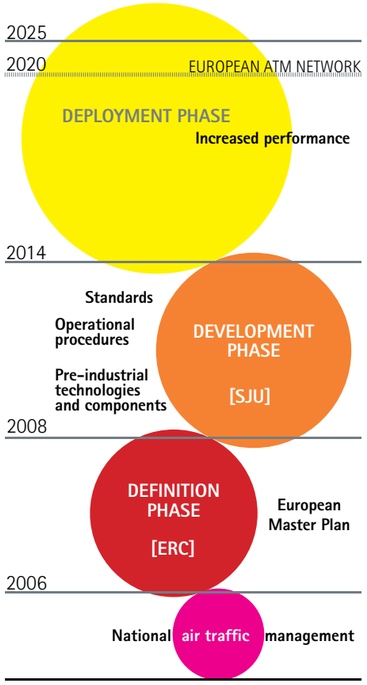
Ineco broadens its presence in the common airspace project

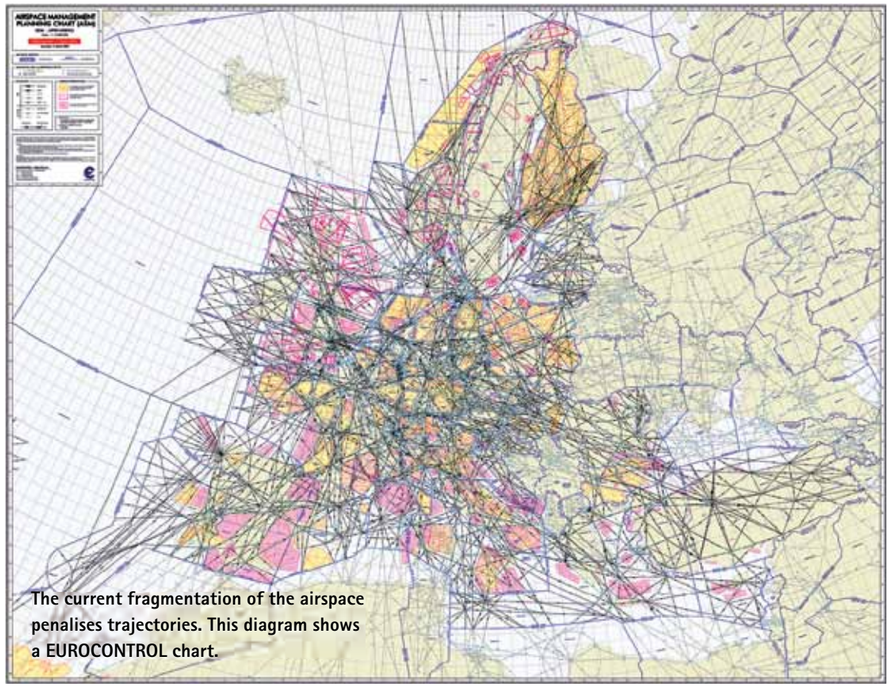
Published in itransporte 38

By 2020, Europe aspires to triple the capacity of its air traffic management system. The SESAR programme, with participation from Ineco, will make this possible.

The participation of Ineco, as an affiliate of Aena, in the development phase of the Single European Sky ATM Research programme (SESAR) since late 2010 represents an achievement in the field of air navigation. Ineco participation in the programme not only covers operational projects, but also includes system and transversal projects in areas such as the environment, cost/benefit analysis, safety and human factors, among others.

Ineco thereby contributes the experience acquired through continuous cooperation with Aena on operational issues and through its leadership and technical contributions to European R&D projects, such as GIANT or TITAN. The company is present in 37 projects, valued at over €10 million, 50% co-financed by SJU (SESAR Joint Undertaking). Aena is participating in 93 of the 296 projects in progress. ✱





The current fragmentation of the airspace penalises trajectories. This diagram shows a EUROCONTROL chart.

What is SESAR?

SESAR represents a paradigm change in European ATM. It is based on the 'business trajectory' concept, in which the trajectory represents the intentions of the airspace users and evolves out of a layered planning proccess by agreement with the Air Navigation Service Provider. SESAR is based on the following conceptual pillars:

- **The ATM network operation plan, which will facilitate the process of reaching agreements through a continuous update of the 4D trajectories.**
- **The integration of airport operations into the ATM network from the long-term planning phase. This means including the aircraft turnaround process in the different planning phases, among other considerations.**
- **Trajectory management, which makes it possible to dynamically adjust the airspace (e.g., in the event of restrictions due to military use of certain areas of the airspace).**
- **New separation modes.**
- **Collaborative decision process based on the principle of sharing information (e.g. between airlines in the event of a sudden unexpected drop in airport capacity).**
- **Intense enhancement of automation while humans remain at the core of the operation.**

To meet the objectives developed in the definition phase of SESAR (2006-2008), SJU was created in 2007 to bring together all European R&D initiatives in the field of ATM and to manage the current 'development phase'.

SESAR'S KEY PERFORMANCE TARGETS FOR 2020 ARE:

- **To enable a threefold increase in capacity.**
- **To improve safety by a factor of 10.**
- **To reduce the environmental impact per flight by 10%.**
- **To cut ATM costs by 50%.**

SESAR JOINT UNDERTAKING

'Today's partners for Tomorrow's aviation'

Projects in which Ineco is participating

AREA	PROJECT ID	PROJECT TITLE
Operational	4.2	Consolidation of operational concept definition and validation, including operating mode and air-ground task sharing
	4.7.1	En-Route Complexity Management
	4.7.3	Use of PBN for en-route separation purposes
	4.7.4a	ATSA-ITP Pioneer Trials
	4.7.4b	ASAS-ASEP oceanic applications
	4.7.7	Implementation of Dynamic Capacity Management in a high-density area
	4.8	En-route and TMA ground and airborne safety nets
	4.8.3	Ground-airborne safety net compatibility
	5.6.2	Improving vertical profile
	5.7.2	Development of 4D trajectory-based operations for separation management using RNAV/PRNAV
	5.7.4	Full implementation of PRNAV in TMA
	5.9	Usability requirements and human factor aspects for the controller working position
	6.3.1	The airport in the ATM environment
	6.3.3	Full integration of airport planning and execution
	6.6.2	Integration of airport/airline/ground handler ATC processes in ATM
	6.7.2	A-SMGCS routing and planning functions
	6.8.3	Separation minima reductions across flight phases
	7.2	Coordination and consolidation of concept definition and validation
	7.5.2	AFUA
Systems	10.1.9	ATC systems supervision
	10.2.1	ATC trajectory management design
	10.4.1	Enhanced tools for conflict detection and resolution
	10.8.1	Complexity Assessment and Resolution
	10.9.2	Multiple airport arrival/departure management
	10.10.2	iCWP human factors design
	12.3.3	Enhanced Surface Routing
Transversal	B.5	Performance analysis of the ATM target concept
	B.4.3	Development of the high-level logical system architecture and technical system architecture
	C.2	Deployment/Performance planning and reporting
	3.3.1	Validation Platform Architecture Definition
	3.3.2	Validation Platform Development
	16.1.2	Ensuring ATM with SESAR is kept resilient
	16.3.1	Development of the SESAR environmental validation framework
	16.4.1	Evolution from an ATM HF Case to an HP Case Methodology for SESAR
	16.5.2	Trade-off between planning and flexibility
	16.6.5	Human performance support and coordination function
	16.6.6	Business case maintenance, support and coordination

‘I would not want to sound smug, but I am quite satisfied with SESAR’s progress so far’

Q&A

Patrick Ky

Executive Director of SESAR Joint Undertaking (SJU)

By the end of 2011, we will have the first programme deliverables. What benefits will they bring to the European air transport community?

The first release will include benefits for airlines, for example. They will start saving time and money through smoother, more direct airport approach procedures.

The year 2011 will bring improvements in the operational procedures for Precision Area Navigation (P-RNAV), aimed at increasing capacity and reducing environmental impact in complex terminal areas. Incidentally, Aena will conduct this project in Madrid. Airports will start to become better integrated into European network operations and the working environment of air traffic controllers will begin to improve.

Could you take stock of the SESAR programme’s progress so far?

I would not want to sound smug, but I am quite satisfied with SESAR’s progress so far. Getting the programme up and running with such a large number of partners (public and private organisations, non-European players, competitors, the military, scientists and even staff associations) was certainly not an easy task.

With the first SESAR Release, we will present the first tangible achievements of the SESAR programme. AIRE is moving ahead with more partners and more elaborate projects, and we will soon submit a regulatory proposal to the EC for improved aircraft tracking in oceanic and remote low-density airspace within the framework of the OPTIMI project.

So much has happened in the year and a half since the programme was first launched. However, everyone on board needs to keep working hard to deliver, deliver, deliver!

‘With our members, Aena and Indra, we have two major Spanish aeronautical players on board’.

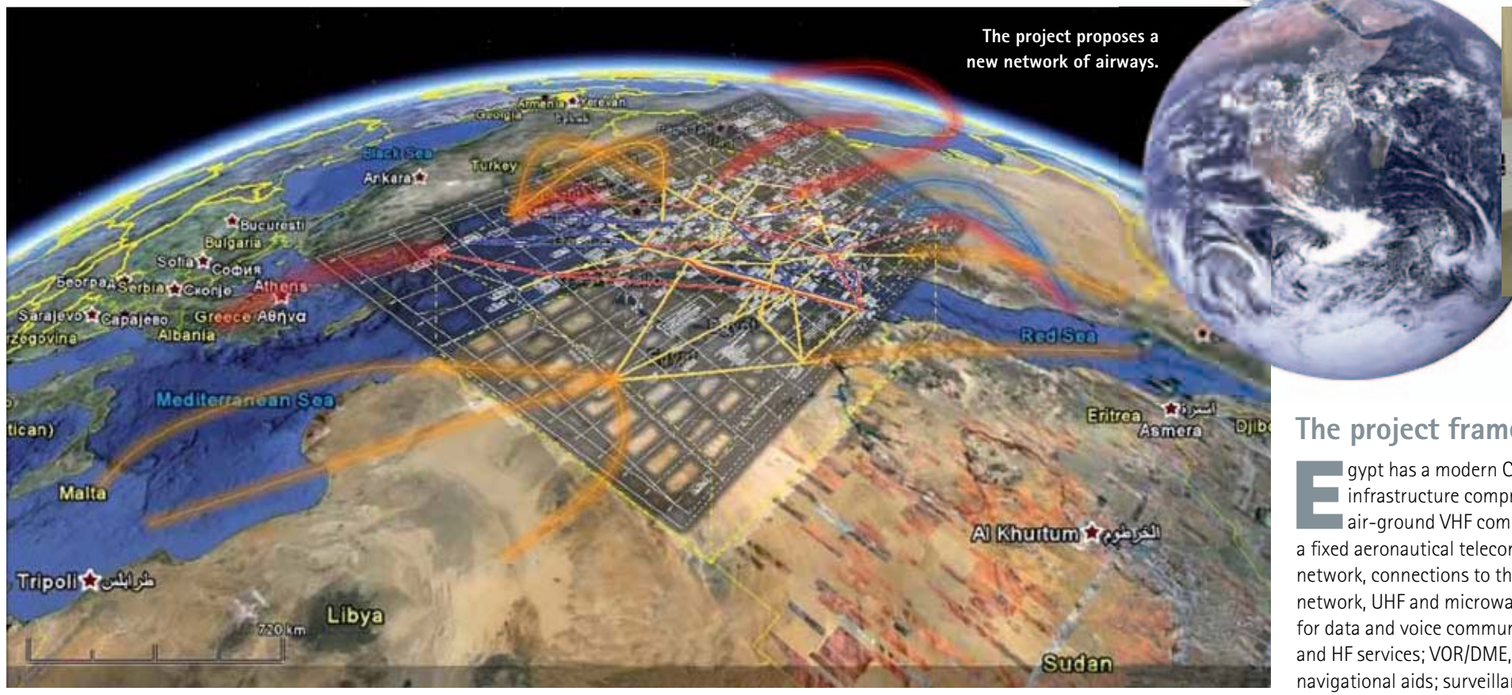
How would you assess Spain’s participation in the SESAR programme?

With our members, Aena and Indra, we have two major Spanish aeronautical players on board. We also signed a framework contract with Iberia and are glad to have Ineco involved in AIRE I and AIRE II, as well as in OPTIMI. As leader of Lot 5, dealing with recommendations and the OPTIMI business case, Ineco performed very well. ✱

An air navigation plan for Egypt

Ineco's first project in North Africa's largest air transport market

Published in itransporte 40



The project proposes a new network of airways.

From left to right: Javier Cos, Ineco's General Manager for Development and International; Magda Moussa, PMU Manager for EHCAAN; Francisco Olmedo, Ineco's CNS Systems Manager, and Raouf Moharran and Tarek Abd-Elhady, both from EHCAAN.

Ineco is preparing a strategic civil aviation plan for Egypt, which includes a reorganisation of its airspace and the design of a new network of airways.

Egypt is the most populous country in North Africa and the region's most powerful air transport market. To ensure its future development, the country has undertaken a process to modernise its more than 20 airports, as well as its airspace. To this end, the Egyptian Holding Company for Airports and Air Navigation (EHCAAN) launched an international invitation to tender in 2010. The contract to prepare a modernisation strategy for the country's air navigation systems was awarded to Ineco. The project, entitled *Development Strategy of Air Traffic Control Infrastructure and Management*, is the first that Ineco has developed in Egypt. Its main objectives are to analyse the country's CNS/ATM infrastructure, propose a new network of airways for its airspace and write the specifications for a new air traffic control system for the Cairo Control Centre. ✱

The project framework

Egypt has a modern CNS/ATM infrastructure comprised of air-ground VHF communications, a fixed aeronautical telecommunications network, connections to the V-SAT satellite network, UHF and microwave connections for data and voice communications and HF services; VOR/DME, ILS and NDB navigational aids; surveillance based on MSSR (S mode) radars, L and S band radars (multi-tracking processors) and other approach radars with mono-tracking capacity at remote aerodromes; flight and radar data processors with recording and playback capability and data analysis centres, and operational and technical supervision with backup and training capacity.

What is a Strategic Air Navigation Plan?

THE CONTINUOUS GROWTH in air traffic makes it necessary for air navigation service providers to develop strategic plans so that the airspace and supporting infrastructures can evolve as efficiently as possible, with optimum utilisation of the available resources, in order to accommodate future traffic. A strategic plan includes the study of the following:

- **Air traffic prognosis and allocation to different routes and different origin and destination airports.**
- **Analysis of the capacity required to cover the demand.**
- **Evaluation of the performance of existing CNS (Communications, Navigation and Surveillance) systems, which include aeronautical communications stations, navigation aids, radars, etc.**
- **Definition of the new operational concept, i.e., the operating modes for the airspace, and redesigning the airway network.**
- **CNS and ATM (Air Traffic Management) infrastructure needed to support the new airspace.**
- **Transition plan to new technologies (satellite navigation, data links, etc.)**
- **Progressive implementation plans for the systems and concepts identified in the previous stages.**

THE FINAL PRODUCT is the modernisation plan, which includes the new organisation of the airspace and the technical infrastructure necessary to support it, considering current and future communications, surveillance and navigation systems, ATC systems, sites, human resources, etc. In other words, the current and possible future resources and how they should be managed in the medium and long term.

Why a Strategic Air Navigation Plan?

In ground transport, highways are capable of absorbing a certain amount of traffic before they become saturated and traffic jams occur. In this situation, the only solution is to expand the highway's capacity.
Similarly, an airway is capable of supporting a maximum number of planes while maintaining the required safety levels. After that point, flight delays occur and operational safety can suffer. In such cases, the possibility of establishing new routes must be analysed, taking into account the existing communications infrastructure, navigation aids and radars, and the capacity of on-board aircraft systems to follow the airway.

BASED ON THE ABOVE, the main reason to develop a Strategic Plan is to adapt the air traffic management capacity to the growth in passenger, operation and freight demand. However, there are other reasons, such as the following:

- **Improving the efficiency of the air navigation system, in terms of optimising the available resources, saving operating costs, optimising the route network, etc.**
- **Increasing the safety of air traffic operations, particularly in airspaces with high traffic density.**
- **The objective of a Strategic Plan can also be to implement operational systems and procedures in accordance with international standards. It is therefore necessary to restructure the airspace and modernise the supporting CNS/ATM infrastructure, but also to consider the ICAO standardisation guidelines for transition procedures to satellite navigation systems and implementation of the associated PBN concept.**

Competing against proposals from six countries, Ineco's project won the tender called by the Egyptian aeronautical authority (EHCAAN).

PROJECT STRUCTURE

The structure of the project resembles a clockwork mechanism in the sense that each part ("work package") interlocks with the others, creating dependencies between them, and all are driven by proper project management and control (clock picture above). If we look more closely at each part of the clockwork mechanism, we find it structured as follows:

>ANALYSIS OF THE CURRENT AIRSPACE

Responsible for analysing the strengths and weaknesses of the current airway network through in situ data collection, and analyse using advanced Fast Time Simulation (FTS) techniques, modelling the airspace and using different traffic samples. This must lead to a Recommendation Plan that takes into account the reduction of possible incidents affecting air safety, variations in TMA (terminal manoeuvre area) sectors and boundaries, reorientations of traffic flows, and modifications in the route structure.

>ANALYSIS OF THE CURRENT CNS/ATM INFRASTRUCTURE

Responsible for preparing a detailed description and collecting the necessary information. The analysis includes a study of the coverage and performance of the different systems at the main flight levels. Redundancy is evaluated in order to ensure continuity and availability.

>DESIGN OF A NEW AIRWAY NETWORK

Responsible for proposing the future route network to handle the forecast traffic demand and solve the weaknesses detected in the initial analysis. The development of the airspace and airway structure takes place at the same time the operational concept is being improved (capacity planning, air traffic flow and capacity management, decision process integration, new procedures, etc.).

>ANALYSIS OF OPTIONS FOR THE NEW GENERATION OF CNS/ATM SYSTEMS

Responsible for reviewing the options for the new CNS/ATC infrastructure . Using the major worldwide programmes as a guide: SESAR and NextGen, this package determines the objectives, operational concept, state of the technologies and convergence with projects in neighbouring countries, and a time frame. It also considers the expected traffic and the new airway network proposal in order to suggest the best technologies. The current and future fleets of the airlines operating in Egypt play an important role in these deliverables.

>RECOMMENDATIONS FOR THE NEW INFRASTRUCTURE

Responsible for establishing recommendations for the modernisation and integration of the CNS/ATM infrastructure. This begins with a detailed evaluation of the previous packages and a Detailed Modernisation Plan. This plan includes en-route and terminal surveillance, CNS/ATM systems and its regional integration, navigation aids in approach areas, the operational and technical requirements for each technology, and the interoperability and integration of each one, with the possibility of upgrades and maintenance.

>NEW AIR TRAFFIC CONTROL SYSTEM FOR CAIRO

Responsible for providing the specification for the modernisation of the ATC infrastructure for the Cairo FIR. Through an analysis of the new operational concept (en-route and TMA), the options and recommendations for modernisation and integration describe the requirements for the new control system and evaluate and provide a list of possible suppliers and manufacturers.

>PROJECT MANAGEMENT

Responsible for establishing and implementing the appropriate mechanisms to complete the project on time, with the required quality and ensuring proper coordination with the other parts. This includes the process of reporting to the client, with the Project Management Plan, progress reports and a final report as deliverables.

A new airport at the mouth of the Gulf

The Omani government has entrusted Ineco with the studies for Musandam

Published in itransporte 40

Ineco has just concluded for the Sultanate of Oman the first phase of the studies for a new airport at the strategic enclave of Musandam: the search for a site.

In recent years, the Sultanate of Oman is implementing a very active policy to develop and modernise its airport and air navigation infrastructures. These actions are part of a much broader plan for regional, tourism and business development. Ineco is planning one of these new airports, to be located in the peninsula of Musandam. In July 2010, the company concluded the first crucial phase of the project: choosing the site.

The country currently has two main airports: Muscat International Airport (in the capital city) and Salalah Airport (in the southern province of Dhofar). Both are prepared for international traffic, which the government plans to expand. The new terminal at Muscat International Airport will be completed by 2014 and will have the capacity to handle 12 million passengers annually. Oman also has five military aerodromes, one of which is open to civilian traffic: Khasab, in the Musandam region.

A total of five new regional airports will also be built to connect the different regions of this extensive country to Muscat. These will be Sohar, Ras Al Hadd, Ad Duqm, Adam and Musandam, all of which are at different degrees of development. While the preliminary studies for the first three were announced and launched in 2006, the ones for Adam had to wait until 2008, and those for Musandam until 2009.

In June 2009, the Ministry of Transport and Communications of Oman launched, through its civil aviation authority (Civil Aviation Affairs), an invitation to tender for the consulting services to plan a new airport in the peninsula of Musandam. The contract was awarded to a consortium led by Ineco, which also includes the Spanish company GOP and the local company Triad Oman Consultants International.

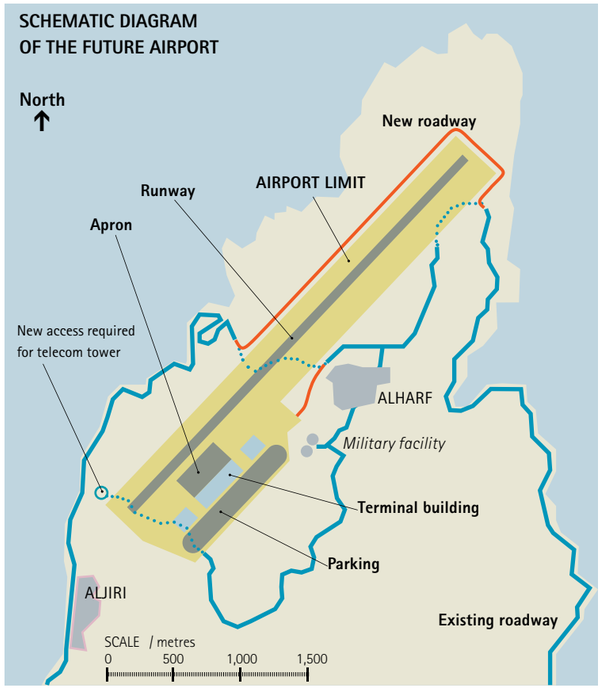
The project has been divided into three parts: the search and selection of the site for the new airport (which took place between April and July 2010, and has already concluded), the drafting of the Master Plan and the preparation of a Financial Plan to establish its economic viability.

The first phase, the site search and selection study, was extremely complex, mainly due to the rugged mountainous terrain of the peninsula of Musandam. The starting point was an analysis of the characteristics of the region, Oman's airport network and its air navigation system. Based on this information, an air transport demand forecast was prepared and the infrastructure requirements were defined. Once these data were collected, the search for possible sites began. *

This satellite image of the peninsula of Musandam shows its rugged relief.

STRATEGICALLY IMPORTANT

The Sultanate of Oman, on the southeastern Arabian Peninsula, occupies 310,000 km² and has 2.8 million inhabitants. Separated from Oman's main territory is the peninsula of Musandam, which extends into the sea across from the coasts of Iran, forming the Strait of Hormuz. Its geographic situation makes it strategically important as a gateway to the Arabian Gulf and the obligatory passageway for the region's maritime oil transport routes.



How to choose a location for an airport

Five phases were implemented to select the site:

A SEARCH FOR SITES throughout the region: 13 were found that met the initial requirements.

GENERAL EVALUATION AND FIRST ELIMINATION. After a first study, five locations were ruled out.

SECOND ELIMINATION. The eight remaining sites were evaluated, taking into account aeronautical aspects, such as interferences between the terrain and the obstacle limitation surfaces and basic ILS and OAS, which protect the manoeuvres. A first evaluation was also conducted to determine the volumes of earth that would need to be moved to construct the new airport. As a result, four possible sites were selected for a more detailed study.

DETAILED EVALUATION of the finalist sites. Eight sectorial studies were performed on the four preselected sites: airspace, air navigation procedures, meteorology, construction projects, accessibility and land uses in the airport environment, environmental impact and cost analysis.

FINAL SELECTION. Before choosing the definitive site proposal, other SWOT analyses were performed and a multicriteria matrix was applied to each of the four finalists, with qualitative and quantitative assessment of several indicators, making it possible to reach a final decision.

The last step, in July 2010, was the presentation in Muscat of the final document containing the selected site proposal. Recommendations on other aspects were also included, such as the requirements the airport must meet to respond to the forecast growth in tourism, all intended to minimise the risks of the decision and propose an economically viable airport.

Panama takes flight

Establishing lines of action to optimise the operation of the aviation sector

Published in itransporte 28

Ineco has drawn up a Strategic Plan for airport development for Panama, a country where air traffic has grown by over 12% on average in recent years.

Air transport in Panama is evolving at a dazzling rate: it has experienced an annual growth rate of 12.3% over the past 5 years. This outstanding progression could be even greater if the forecasts in the national Master Plan for Tourism are met, which expects, among other things, the arrival to the country of over 2.5 million tourists by the year 2020.

The Government of Panama, with financial support from the Inter-American Development Bank (IDB) and technical support from its own Ministry of Economy and Finance (MEF) and Civil Aviation Authority (AAC), hired Ineco in March 2009 to prepare the Strategic Airport Development Plan. The company was asked to diagnose the aviation situation in Panama from four different perspectives: institutional, infrastructures, operational and economic. This analysis would be the basis for later defining a medium-term and long-term development strategy for the country's aviation sector, and for immediately establishing lines of action to optimise the operation of the sector.

The work was initially divided into phases. During the first one, a diagnosis of Panama's airport system was performed, in order to later prepare the Strategic Plan based on the data obtained (second phase). Finally, a workshop was conducted to present the strategy to the persons designated by the MEF and AAC. ✱

A COUNTRY BETWEEN TWO OCEANS

With barely 75,500 km² of surface area and roughly 3.5 million inhabitants, Panama is one of the countries with the highest density of aerodromes. Its geostrategic importance, straddling two oceans, places it in the sights of the major world economic powers.

The Albrook Airport (in the picture) is located in Panama City and handles domestic, commercial and private flights.

Summary of the proposals in the Strategic Plan

I. REDEFINE THE LEGAL FRAMEWORK FOR AIRPORTS AND AVIATION

- **Strengthening the Civil Aviation Authority (AAC) as the regulating entity and transferring the rest of its functions to two new bodies, one responsible for air navigation and the other responsible for public airports, and creating a National Aviation Policy Commission for coordinating administrations.**

II. DEVELOP AN AIRPORT SYSTEM TO DRIVE TOURISM AND THE ECONOMY

- **Reorganising traffic at the airports in Panama City: closing Albrook, operating commercial domestic traffic out of Tocumen, and executive flights, air taxis and government flights out of Howard.**
- **Increasing the capacity of the country's major airports, which would require the creation of master plans. Expansion of the runway at David was suggested, as well as adaptation of Howard and Bocas del Toro.**
- **Constructing a tourist airport in the centre of the country, for which a possible site has been studied.**

III. GUARANTEE A SAFE AND EFFECTIVE AIRPORT SYSTEM

- **Adapting the facilities to International Civil Aviation Organisation (ICAO) regulations through adequate inspection and evaluation, and later performing the necessary work.**
- **Improving airport operability: performing an inventory of installations, resources and maintenance plans, and implementing an Operational Safety Management System.**
- **Monitoring and promoting the territorial integration of airports into the surrounding areas, and creating urban planning regulations.**

IV. OPTIMISE THE OPERATING MODEL

- **Developing the concept of Airport of General Interest, and creating a National Airport Network to enable the different administrations to identify investment priorities, standardise services and systems, and increase professionalism in airport activities.**
- **Modernising airport management, for which the creation of a public corporation was suggested: the Airports of National Interest Corporation (Sociedad de Aeropuertos de Interés Nacional, or SAIN), with characteristics similar to those of the existing Tocumen, S.A. (manager of the Tocumen International Airport). It would be less dependent on the political structure, have more independent management and may or may not include Tocumen, S.A.**
- **Drawing up a Regularisation Plan for the aerodromes not included in the National Network.**

V. ESTABLISH THE MECHANISMS FOR THE AVAILABILITY OF ECONOMIC RESOURCES FOR THE SECTOR

- **Allocating resources to the AAC, for which a needs plan and a complete budget would be prepared.**
- **Establishing an investment plan and improving resource generation by the airports themselves, with an accounting system that identifies costs and expenditures, and serves to identify cost reductions and income generation.**
- **Seeking alternative sources of financing for major investments, for which the promotion of public-private partnership (PPP) formulas was recommended.**

New infrastructure for Cape Verde

The boom in tourism boosts air traffic

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The archipelago's strategic location between Europe, Africa and America has driven the growth of commerce and tourism, and therefore air traffic. Ineco is contributing to the expansion and improvement of the country's airports.

Cape Verde, due to its location off the coasts of Senegal and Mauritania, has historically been a point of reference for maritime and air navigation. The country is an archipelago of volcanic origin, made up of 10 islands, seven of which have airports (four of them classified as international: Sal, Praia, Boavista and São Vicente). They are all managed by the public company responsible for air infrastructures and navigation, *Aeroportos e Segurança Aérea* (ASA).

The boom in tourism drove the construction of new airports, such as the ones in Praia (the capital), Boavista (the city now spearheading the development of tourism) and São Vicente (a major population centre). All of these have joined Amílcar Cabral, on the island of Sal, which was the country's only international airport before 2005. According to the latest data provided by ASA, the number of passengers at Cape Verde's airports grew by 11% in 2010.

In response to the growing tourism demand, the country's airport model has been transformed over the past few years. Infrastructures such as the Boavista-Rabil Airport, inaugurated in 2007, are being expanded and improved, and all of the projects were drawn up by Ineco. There are also plans to improve the airports on the islands of Maio (which will become an international airport) and São Nicolau. ✱

ASA expects Boavista-Rabil to become the country's first profitable airport.

Boavista-Rabil handles roughly 25 international flights weekly.

>BOAVISTA-RABIL INTERNATIONAL AIRPORT

INECO DISEMBARKED IN CAPE VERDE IN 2004 with the expansion of this airport. The company was responsible for follow-up and technical support for the three actions included in the project: expansion of the runway area, the new terminal area and the bridge over the river. Ineco is working on new improvements, such as the expansion of the apron by 25,000 m² (from 2 to 5 positions). For this project, the company provided technical support and drew up the construction and detailed projects, as it did for the new 4,300 m² cargo terminal. Ineco also helped to create the Master Plan, which projects the needs for expansion of the passenger terminal until 2030.

New boarding gates in the remodelled passenger terminal at Amílcar Cabral.

The textile membranes of the 'oasis'.

Domestic arrivals.

>AMÍLCAR CABRAL INTERNATIONAL AIRPORT (SAL)

■ EXPANSION AND REMODELLING OF THE PASSENGER TERMINAL (OASIS DE SAL). These actions, all on the ground floor, encompass the expansion (3,400 m²) and renovation of the shopping area and arrival halls. For this purpose, the existing building has been extended towards the airside (an additional 1,950 m²), which will be the new international departure area. The airside facade is also being extended northwards.

■ THE OASIS. The most emblematic part of the project is a patio surrounded by the new international boarding building, which will join the existing building and the newly constructed area. This space, which will be covered with textile membranes, is conceived as an 'oasis' inside the building, where water, vegetation and daylight are a fundamental part of the overall setting.

■ FULL RENOVATION OF THE CHECK-IN AREA. Replacement and modernisation of the hold baggage inspection system, to adapt it to the 100% baggage inspection requirement.

■ IMPROVEMENTS TO THE AIR CONDITIONING in the passenger terminal concourse hall.

■ NEW WASTE WATER TREATMENT PLANT.

Francisco Mendes International Airport.

>FRANCISCO MENDES (PRAIA)

ASA ENTRUSTED INECO WITH the construction project for the renewal of the bituminous pavement on the runway, where the aggregate was crumbling.

OTHER WORKS IN PROGRESS

With the recent expansion of the runway, the service provided by the control tower at São Pedro Airport (on the island of São Vicente), located on top of the old terminal building, is now insufficient. ASA asked Ineco for assistance in order to prepare a location study and construction project for a new control tower. The tower has a total height of 23.4 metres and consists of a 65 m² observation deck with an equipment room located underneath. At the foot of the tower, there is a 100 m² building with facilities for control personnel, installation rooms and a maintenance room.

Ineco, Air Navigation Service Provider

La Gomera, El Hierro and Burgos, the first airports to receive service

Published in itransporte 34 and 38

Years of ATC experience back Ineco's certification as the leading air transport and aerodrome service provider, after Aena, following the liberalisation passed in Spain in April 2010.

At around half past nine in the morning of July 29, 2010, Binter 651 landed at La Gomera airport without incident, just as it had on the preceding days, weeks and months. However, on this occasion, the flight made headline news across Spain as the first passenger flight to receive Aerodrome Flight Information Service (AFIS), an air traffic service established under national and international guidelines over two decades ago, but unknown to Spanish travellers until last summer.

Although public interest focused strongly on this fact, the same flight was also a first for another reason: the first to receive service from an Air Navigation Service Provider (ANSP) other than Aena, Spain's state-owned ANSP and airport infrastructure organisation. Whilst AFIS grabbed media attention, the real news was that the process had begun to restructure air navigation in Spain.

Ineco has continued to develop and increase its capacity, implementing Aerodrome Control and AFIS at two additional airports, El Hierro and Burgos, with the aim of doubling this number in 2011. This success would be the culmination of two years of intense effort by a team of engineers and ATS personnel from Ineco's Aeronautical General Directorate.

This project will consist of two main work streams: Air Traffic Management and Air Traffic Service. The former was launched in late 2009, aimed at establishing a structure in which AFIS could be offered at a variety of airports where Aena was providing ATC services. Not only would such a structure have to prove the sufficiency, safety and sustainability of the proposed service, but also guarantee Ineco's operational and management capability, for the company to provide the service at a later date:

- Aena carried out aeronautical studies on a group of low-density airports where they currently provide ATC services.
- Six airports were identified as candidates, based on sufficiency studies prepared by Aena.
- Ineco began the certification process, aimed at achieving ANSP status under the supervision of AESA (Agencia Estatal de Seguridad Aérea), Spain's aviation safety agency.

This last point would require six months of effort by a dedicated team of Ineco engineers to produce some 60 documents, ranging from high-level strategic declarations to methodologies, plans, procedures and instructions that would finally prove the future unit's capability to provide safe, secure and efficient air traffic services. This complex, fast-track approach was complicated by a regulatory framework built over the years to serve a single ANSP and airport manager. For this reason, and in parallel with Ineco's efforts, several other organisations reporting to the Spanish Ministry of Development were undergoing similar processes.

Both AESA and the Dirección General de Aviación Civil (Spain's civil aviation authority) had to modify the regulatory framework to provide a platform from which Aena could launch the liberalisation of the control tower

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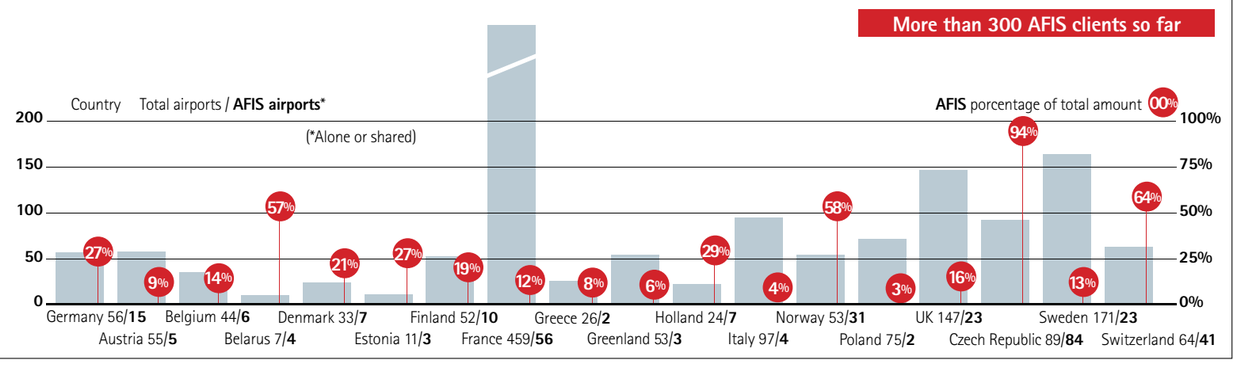
PHOTOS BY ELVIRA GÓMEZ

Capacity and experience

Ineco has created a specific Air Traffic Services area (DSA). Its Manager, Matthew Cornwall (right), describes its mission as 'facilitating safe, efficient, expeditious and economic flight operations in the airport environment, through the provision of ATS services with sufficient capacity to accommodate the demand. These services must satisfy the requirements of all users of the aerodrome and associated airspace with equity, respecting all applicable environmental requirements and contributing to the development of air transport'.

AFIS in Europe

- **According to the European AIS Database, EAD-EUROCONTROL, there are currently more than 300 public and private aerodromes around Europe, spread across more than 19 countries, in which AFIS services are provided, in many cases supplementary to Control Services.**
- **The implementation of this service in Europe is in strict accordance with current European Union regulations.**



The lessons learned during the implementation phase have provided Ineco with valuable experience and proven ability at the European level in both ATM and ATS.

market, which is now in full flight. Evidence of this profound change can be seen in the volume of new legislation released during 2010, which now regulates ANSP licensing, ATS training, ATCO licensing, relief and rest periods, and many other aspects relating to the sector. In spite of this constantly developing scenario, the company reached its first key milestone on June 11, 2010, achieving AESA certification as an Air Navigation Service Provider for AFIS.

The second work stream, Air Traffic Services, began its activities around Christmas 2009-10 with the first of two courses for training Aerodrome Flight Information Officers. Given the nature of the proposed change from ATC to AFIS, great emphasis was placed on the training provided to students. The course, designed by SENASA, was based on a standard aerodrome control course, in accordance with EUROCONTROL Common Core Content, and adapted to AFIS phraseology and practices.

Special attention was also devoted to the candidates selected for the course, 95% of whom already held commercial pilot licenses. The standards were so high that only 20 of the initial 36 candidates achieved certification, of which a group of seven AFISOs were selected to complete the staffing of the newly created Air Traffic Services Division. Over the following months, this new division would develop and implement transition plans, together with the required unit training plans, all in accordance with the newly certified processes and within the framework of Ineco's ATS Safety Management System.

The two work streams converged with the arrival of Binter 651. However, before this event, work had already begun to designate Ineco as an ANSP for the airport on El Hierro (Canary Islands). This was achieved with the inauguration of AFIS on September 23. But the scenario would change once again, requiring Ineco to adapt both its ATM and ATS processes.

Shortly after the implementation of AFIS at El Hierro, the airport was designated for both AFIS and aerodrome control, and Aena requested that Ineco provide the combined service. This required extending ANSP certification to include Aerodrome Control, as well as an ATC Training certification. This process was undertaken immediately in order to complete the dual certification and implement the new combined service. Whereas AFIS requirements were regulated by a single Royal Decree, ATC service provision required compliance with a broad range of new legislation, still at the implementation phase in the rest of Spain. Similarly, staffing requirements had to be met. Once again, the initial training requirements established for AFISOs were vindicated when eight of Ineco's AFISOs passed the initial ATCO training programmes with flying colours, receiving ADI & ADV Ratings.

With the addition of a third airport, Burgos, to its portfolio, Ineco now has a platform from which it can reliably offer a variety of new services. The lessons learned during the implementation phase have provided the company with valuable experience and proven ability at the European level in both ATM and ATS. Ineco is now capable of offering the following:

- Unit training and instruction.
- Implementation and transition planning.
- Consultancy for ANSP Certification.
- ATS Operations.
- Turnkey solutions from conception to operations. ✱

The first graduating class

Six pilots and one university graduate (four women and three men) make up the team selected to work in La Gomera (in the photo, along with Ángel García, Training Manager for the AFIS course, SENASA). They all had to pass the demanding initial training provided by SENASA. La Gomera Airport (Canary Islands) was designated by the Ministry of Development as the first to use this Aerodrome Flight Information Service, which has been the norm in Europe for years. Seven AFIS service professionals began this new activity, offered by Ineco, on July 29, 2010.

Specialists in ORAT

Over a decade of experience 'fine-tuning' airports

A

Preliminary test

Published in itransporte 30 and 39

Ineco has been cooperating with Aena on Operational Readiness and Transfers (ORAT) projects since 2001. Preliminary tests are vital to ensuring that everything operates perfectly.

Aena's Operational Readiness of Expansions and New Airports Office was created in 2001, after the enlargement of the Madrid-Barajas International Airport began operation. It continued with the airport enlargements in Barcelona, Málaga, Valencia, Zaragoza, Menorca, León and, most recently, Alicante, which opened its new terminal building on March 24. It also worked on the heliports in Algeciras and Ceuta, and participated in the commissioning of new airports, such as La Rioja, Burgos and Huesca-Monflorite. The Office is currently involved in the expansion, renovation and improvement of other airports.

From the beginning, the Ineco teams present at the Madrid-Barajas ORAT project have continued to share their experience with Aena in order to conduct and implement the four key points described on the right: management, procedures, training, exploitation tests and physical transfer logistics. The objective is to reproduce the airport's main operational processes as realistically as possible in order to detect and correct the greatest number of anomalies and dysfunctions before operation begins. These tasks represent the final phase in a long process that begins several years before the opening of the new facilities. ✱

PHOTOS. Several moments during the dummy runs. (1+2) Passengers waiting to check in at the desks of the new airport terminal. (3) Simulation of a passenger with impaired mobility at the automatic check-in machine.

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2

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Four key points in the ORAT process

>MANAGEMENT AND OPERATION MODELS

>NEW PROCEDURES

>TRAINING AND FAMILIARISATION OF ALL PERSONNEL WITH THE NEW INFRASTRUCTURE

>EXPLOITATION TESTS AND PHYSICAL TRANSFER LOGISTICS

BASIC_The systems, equipment and installations are tested. Workers from Aena, the airlines and handling companies, technical support personnel and officers from the State Security Forces all participate in these differents tests in order to ensure the best results.

GLOBAL_These tests are performed on complete airport processes (passengers, baggage and aircraft), with the participation of extras playing the role of passengers, who simulate multiple incidents.

FINAL PHASE

The final phase in the process is the physical transfer of furniture and equipment days before the airport begins operation, which culminates the night before. If everything goes well, as it did in Alicante, the desired result will be achieved: everything will operate completely normally.

National leaders in research and development

Ineco has participated in eight projects or activities

Published in itransporte 34

The Framework Programmes are the main instruments for channelling European funding for different research and development projects since 1984. Ineco is one of the companies that participate and lead a larger number of projects.

The 7th Framework Programme is designed to give continuity to the achievements of the previous Framework Programme towards the creation of a European research space, and to take it even further, to the development of a knowledge economy and society in Europe. Up to this edition, their duration was 5 years, but the current 7th Framework Programme will last 7 years: starting in January 2007 and ending in 2013.

With a budget of over €50 billion, the main objectives of this 7th Framework Programme have been divided into four major categories: cooperation, ideas, people and capacities. For each type of objective, a specific programme has been established, corresponding to the EU's main research policy areas.

The specific programme for cooperation supports all types of research activities conducted by different scientific entities in transnational cooperation, and aims to achieve or consolidate leadership in key areas of science and technology. The ideas, people and capacities programmes focus on scholarship programmes and the creation of research infrastructures.

The cooperation programme is divided into 10 topics, covering all areas of research: health, food, agriculture, fishing and biotechnology, information and communication technologies, nanotechnology, energy, environment, transport, socioeconomic sciences and humanities, security, and space. It is precisely in the area of transport (with a budget of over €4 billion) that Ineco is most active, although it has also participated in other areas.

As part of their job monitoring the Framework Programme and supporting the Spanish participants, the CDTI (Centre for Industrial Technological Development) recently published a statistic on Spain's contribution to the 7th Framework Programme during the first three years, regarding the rate of return obtained, i.e., the funding received. Specifically for transport, Spain ranks seventh in Europe, with a return of €60 million, in a statistic led by Germany, France and the UK. With an average success rate of 24% of the proposals submitted, 144 Spanish entities have had activities approved, either as participating partners or consortium leaders or coordinators.

The national statistics are, in turn, led by Ineco, which has participated in eight projects or activities, leading the consortium in four cases, which is even more significant. This level of project leadership has been achieved due to the trust the partners place in Ineco, based on the company's management experience and sector knowledge, as well as its position of "neutrality" towards industry, but closeness to users. *

IT IS IMPORTANT to highlight that many of these projects received support from Aena and Adif. It is worth mentioning the return achieved by the Polytechnic University of Madrid (UPM, in Spanish), with whom Ineco has a close relationship. The UPM has participated in 14 activities, but not as a coordinator.

FAMILY PHOTO
In April 2010, the Conference on the 7th Framework Programme in Spain was held in the city of Valencia. This picture portrays the Spanish coordinators, including Ineco's Luis Chocano and Álvaro Urech, along with Juan Tomás Hernani, General Secretary for Innovation.

SEVENTH FRAMEWORK PROGRAMME

Specific Ineco projects

The company is participating in or leading a variety of projects during this first half of the 7th Framework Programme/Transport.

>TITAN **(Turnaround Integration in Trajectory and Network)**
Aeronautical project coordinated by Ineco, with participation from Aena, CRIDA, Jepessen, RWTH and other partners.
The aim is to develop and validate an improved operational concept for the aircraft turnaround process, optimising its predictability.

>GIANT-2 **(GNSS Introduction in the Aviation Sector–2)**
Satellite navigation project coordinated by Ineco, with participation from Aena, Gestair, Rockwell-Collins, Dassault and other partners.
The aim is to progress in the use of GNSS in general and business aviation.

>GRAIL-2 **(GNSS–based Enhanced Odometry for Rail)**
Satellite navigation project coordinated by Ineco, with participation from Adif, Ansaldo, TAS-I, Renfe and other partners.
This project aims to validate the use of EGNOS for an improved odometry application on high-speed lines.

>ACCEPTA **(Accelerating EGNOS Adoption in Aviation)**
Satellite navigation project coordinated by Ineco, with participation from Aena, Rockwell-Collins, NATS, Air Nostrum, Net Jets and other partners.
The aim is to facilitate airline equipment and procedure availability to accelerate the use of EGNOS in aviation.

>AAS **(Integrated Airport Apron Safety Fleet Management)**
Aeronautical project in which Ineco participates as a partner along with FAB, ANA, Globe Ground, Inform and other partners.
The project is developing an optimisation tool for handling vehicles based on GPS vehicle location.

>STANDARDS / SUGAST **(Standardisation and Reference Documentation Support / Support to Galileo Standardisation)**
Satellite navigation projects (one is a continuation of the other) in which Ineco participates as a partner along with FDC, TAS, GMV, NATS and other partners.
The aim of this project is to progress in the standardisation of satellite navigation applications, where Ineco is responsible for application to railways.

>INESS **(Integrated European Signalling System)**
Railway project in which Ineco participates as a partner along with UIC, Adif, Network Rail, UNIFE and other partners.
It will define the functional and technical specifications for a new generation of standard European interlocks, in line with ERTMS.

>TRIOTRAIN **(Trio – Total Regulatory Acceptance for the Interoperable Network)**
Railway project composed of three other projects (PANTO TRAIN, DINO TRAIN and AERO TRAIN), in which Ineco participates as a partner along with UNIFE, Adif, Renfe, RSSB and other partners.
The aim is to establish a methodology for the virtual certification of rolling stock, to make it better, faster and cheaper, while preserving safety levels.

SIOS, all about the project

An Ineco product for special projects

Published in itransporte 40

From the metres excavated each day by a tunnel boring machine, to a satellite image of a railway line: SIOS brings a multitude of web-accessible and real-time data together in a single application.

Large infrastructure projects generate a huge volume of information from different sources and with very diverse characteristics and formats: drawings, graphs, photographs, progress and follow-up reports, job sheets, incident reports and technical data. In addition, the recipient profiles are anything but homogeneous, ranging from companies that participate in the project, providing construction or technical support services, to ordinary citizens visiting offices or information points.

SIOS Solutions respond to these information exchange and management needs through a single, web-accessible application. The system represents the establishment of a standardized methodology and a common workspace for all tasks, where all participating companies in a project report their activities daily. Its versatility, analytical capacity and daily updates make SIOS a useful technical and managerial decision-making tool. SIOS Solutions provide a competitive advantage in terms of quality and efficiency in the monitoring of the construction process. ✱

TECHNOLOGY AND COMPETITIVENESS

The use of new technologies to manage information has become an essential factor for company competitiveness, as it saves costs and enables companies to provide higher-quality, more efficient services to their customers. Ineco, through its Innovation area, has undertaken a variety of software development projects, including SIOS, to provide support, manage information and optimize the monitoring of large transport infrastructure projects.

(TOP). Screen capture of the SIOS 3D graphic interface to Google Earth, showing the newly inaugurated high-speed tunnel between Atocha and Chamartín (Madrid). (ABOVE). Screen capture of the SIOS 3D graphic interface to Google Earth, showing a view of how the viaduct over the Jauto river (Almería) will look (South high-speed Line).

What SIOS offers

SIOS Special Projects provides different functional modules:

- GIS geographical interface integrated with Google Maps/Earth, including Street View, 3D buildings and structures, and a longitudinal profile viewer for the route.
- Document manager.
- Workflows and daily production reports for underground works and structures, by different construction methods.
- Event manager.
- Connection interface to the tunnel boring machine for real-time data acquisition.
- Underground and surface auscultation module.
- Building behavior monitor.
- Citizen Advice Service at the Citizen Information Points.
- Interface for queries, searches and data import and export.
- Graph and report generation utilities.
- Automatic notifications and warnings.
- Integration with mobile devices.

Use of SIOS

>IMPLEMENTATON

LINKS TO MAJOR HIGH-SPEED INFRASTRUCTURES_The origin of SIOS is linked to major high-speed infrastructure projects, such as the Guadarrama tunnels in Madrid and those on the Pajares Bypass, between León and Asturias. The uniqueness and complexity of these projects highlighted the need to develop a purely technical software solution to manage and update the large volume of information generated on a daily basis. Ineco therefore developed a specific application for Adif, the organization responsible for the project, which was initially called 'Sistema de Información de Obras Subterráneas' ('Information System for Underground Works'). The results were so positive that its use was extended to other lines.

Following its use in the urban tunnel construction projects in Barcelona and Girona, the need arose to develop new modules designed for predominantly urban projects, where surface monitoring is essential. In this way, SIOS began to diversify and increase its functionality, such as monitoring building work, auscultation and public information service.

SIOS also includes a module for monitoring the construction of structures (bridges, viaducts, pergolas, etc.), which may be extended to leveling and grading projects. The use of SIOS was gradually extended to Spain's major high-speed railway projects, monitoring over 120 structures and 50 tunnels. It was therefore renamed 'Sistema de Información de Obras Singulares' ('Special Project Information System'), without changing the Spanish acronym.

>NEW DEVELOPMENT

SIOS SOLUTIONS DIVERSIFY_Among the system's new independent but integratable applications are SIOS Management and SIOS Inventory. The former was designed for the integrated internal management of multiple tasks (technical support, project monitoring and surveillance, coordination, etc.) for conventional railway projects, as well as high-speed rail, airports and roads. It includes issues ranging from health and safety to economic and administrative mattres, as well as all types of procedures, quality control, testing, materials, etc.

On the other hand, SIOS Inventory focuses on railway applications, and specifically the management of updated inventory and maintenance on the platforms, tracks and installations of railway lines currently in service. Ineco is now studying new functionalities aimed at transport infrastructure operation and management at the international level, specifically for roads. Some of the ongoing lines are integration with an event manager application and boosting mobile device interfaces.

>AN INNOVATIVE PRODUCT

FROM INFORMATION TO KNOWLEDGE_SIOS is an innovative product, using open-source software in order to incorporate commercial solutions, such as the document manager, report generation tools, and a graphic interface integrated with Google Earth (see pictures above). However, the most relevant innovation is that SIOS provides a common, easily accessible working environment adapted to each user profile, with a standardized methodology and virtually real-time information.

Leading green approach initiative

The RETA-CDA 2 project is being developed within the European AIRE framework

Published in itransporte 30

Ineco's expertise in planning, designing and applying new flight operation procedures is backed by its involvement in the most innovative activities in Spain and Europe, targeting the development, evaluation and implementation of continuous descent operations.

Approximately 3,500 flights have been scheduled to perform green approaches to Madrid-Barajas International Airport during 2011. The initiative is led by Ineco, with participation from Aena (the Spanish operator of airport services and air navigation), three major Spanish operators (Iberia, Air Europa and Vueling) and CRIDA (Centro de Referencia de Investigación, Desarrollo e Innovación ATM - Air Traffic Management).

Between February and August 2011, flights operated by the aforementioned airlines arriving in Madrid-Barajas at night (from 23:00 hours to 06:00 hours) will be able to perform Continuous Descent Operations (CDO) from the Top of Descent (ToD). The engines will remain idle during most of the descent. Current approach procedures require aircraft to descend in a series of steps (level segments), which need power from the engines in order to maintain the required altitude. These test flights will be used to collect the necessary data to calculate actual fuel and carbon dioxide (CO_2) savings.

The initiative is the core activity of the European-funded project RETA-CDA 2 (Reduction of Emissions in Terminal Areas using Continuous Descent Approaches 2). The project is being developed within the AIRE (Atlantic Interoperability Initiative to Reduce Emissions) framework, launched in June 2007 as a result of the agreement between the European Commission (EC) and the US Federal Aviation Administration (FAA), which aims to reduce CO_2 emissions and accelerate the pace of change by taking advantage of ATM best practices and capitalising on present aircraft technology.

AIRE is an important part of the green component of the SESAR programme and the SJU (SESAR Joint Undertaking) is responsible for its management from a European perspective. Enhancing the ATM system has the potential to reduce CO_2 emissions to 10%, as shown by RETA-CDA.

Within this first AIRE framework, a former RETA-CDA project performed similar trials at Madrid-Barajas International Airport with the aim of reducing CO_2 emissions and optimising fuel consumption. Data from over 1,000 Iberia flights were analysed between June and September 2009 (see graph at the bottom of the page).

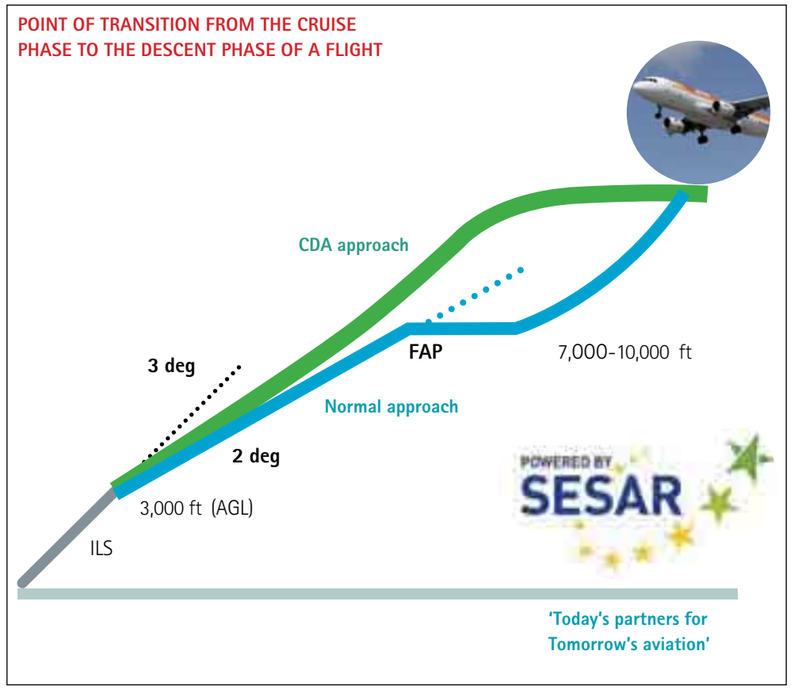
The outcomes from the RETA-CDA project showed huge benefits for the airlines, who reduced their fuel consumption and CO_2 emissions (leading to savings on emissions permits), for airport neighbourhoods (where noise was significantly reduced) and for the environment.

The project itself was welcomed by pilots and air traffic controllers, who reiterated their support for the implementation of such procedures. In fact, the results from this project have encouraged Aena to continue its National Implementation Plan for CDA procedures at other Spanish airports. RETA-CDA gave Ineco the opportunity to support Aena in the design of these CDA procedures for Madrid-Barajas. The company will continue to support Aena in the design of new procedures for different airports in the future.

In response to the positive results obtained within the AIRE framework, a second AIRE initiative (AIRE 2) was launched to continue the funding scheme for new collaborative projects. This is the case of RETA-CDA 2, a continuation of the RETA-CDA project.

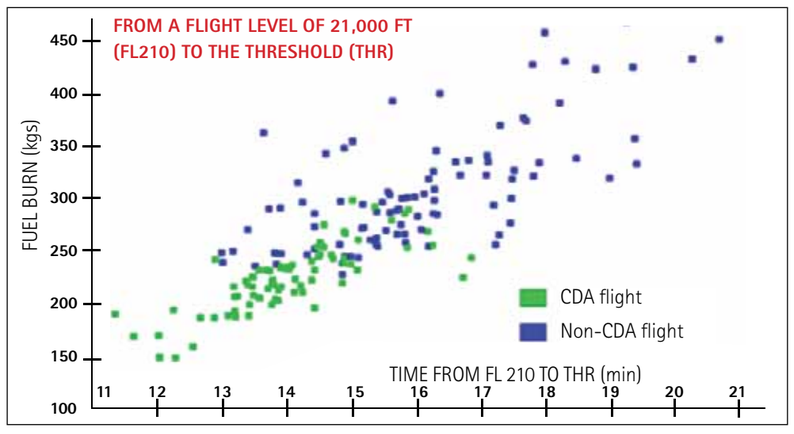
Unlike the first RETA-CDA project, this continuation project will also analyse aircraft time deviations between planned and actual crossing times for specific waypoints during descent (4D trajectories). This will help improve air traffic management by reducing wait times for landing during busy hours. In these situations, aircraft are often required to fly in circles until they are cleared for landing, increasing fuel consumption and CO_2 emissions. RETA-CDA 2 will also be analysing a wider variety of aircraft, including planes from the world's top manufacturers (Boeing and Airbus).

This project is another example of the many ATM environmental studies undertaken by Ineco, not only in Spain, but worldwide. ✱



DATA FROM OVER 1,000 IBERIA FLIGHTS

The graph on the right shows the fuel consumption (vertical axis) and descent time (horizontal axis) required by each flight to cover the distance. Green dots represent Continuous Descent Approaches (CDA) and blue dots indicate normal landings. The commercial fleet included short/medium and long-haul aircraft.



Expected results of RETA-CDA 2

>An understanding of the limits to the predictability of CDO approaches from the aircraft's perspective.
>An evaluation of the range of achievable environmental benefits.
>Familiarisation with Flight Management System Estimated Times of Arrival. Analysis of deviations at specific points (terminal airspace entry, merging points, runways).
>Characterisation of CDO performance windows for a range of aircraft, which could be used by future Air Traffic Control management tools.

>Training experience in the processing and management of estimated aircraft data and Flight Operations Quality Assurance (FOQA) data processing.

PUBLICATION OF THE RESULTS

On average, Continuous Descent Approach (CDA) flights require 13% less time for descent and consume 15% less fuel, saving up to 260 kilos of fuel (roughly €120) and 0.82 tons of CO_2. The results of the project will be published by the end of 2011. A workshop for the dissemination of the results is planned for this coming November at Madrid-Barajas International Airport facilities. The exact date and venue will be announced.

Testing GSM-R networks

A European standard specific to the railway industry

Published in itransporte 31

Ineco has developed ArQoS, a method for validating GSM-R networks using software and hardware tools. Supported by the Adif Telecommunications office, this project was one of the R&D+i proposals selected for 2009.

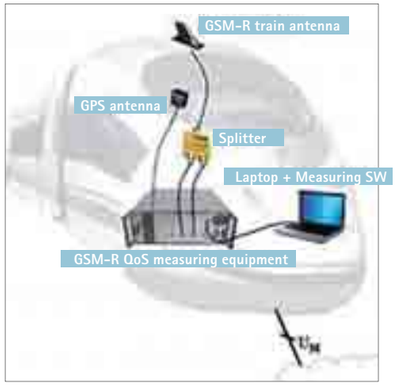
The GSM-R mobile communications system has been implemented on Adif's (Spain's railway infrastructures administrator) high-speed lines (Madrid–Seville, Madrid–Barcelona, etc.) It is a European standard specific to the railway industry, developed in accordance with EIRENE/MORANE specifications and is based on the GSM radio communications system (900 MHz), with a bandwidth of 4 MHz on sub-band 876-880/921-925 MHz.

The latest in safety installations, and specifically the signalling systems implemented on all high-speed lines with ERTMS/ETCS Level 1 and Level 2 –and soon at Adif's commuter train (Cercanías) hubs– also features the design, installation and validation of a GSM-R mobile communications system, with the reliability and availability to ensure both voice and data communications.

In this sense, ArQoS was born in October 2008 to meet the need to objectively validate the quality and service of the GSM-R mobile communications systems to be implemented on the different lines. Ineco acted as an independent evaluator, checking, validating and accepting the installations, in line with the parameters specified under current regulations.

This project, supported from the start by the Adif Telecommunications office, involved analysing the quality of service (QoS) parameters of GSM-R mobile communications networks in order to determine their validation processes and services.

ArQoS studies the behaviour of the quality of service parameters on Adif's GSM-R network, investigating the possible causes of sources of noise and/or degradation of the quality of service. Measurement campaigns and the exhaustive analysis thereof provide information on the state of the network independently of the supplier and system validation, as GSM-R technology is becoming increasingly important in the railway industry. ✱



Installation of on-board equipment

The system installed consists of the following elements:

- **QoS measuring equipment (MTB 14 with 2 KAPSCH MT2 modems).**
- **Laptop with measuring and post-processing software.**
- **Call answering and RBC simulation equipment.**

Methodology

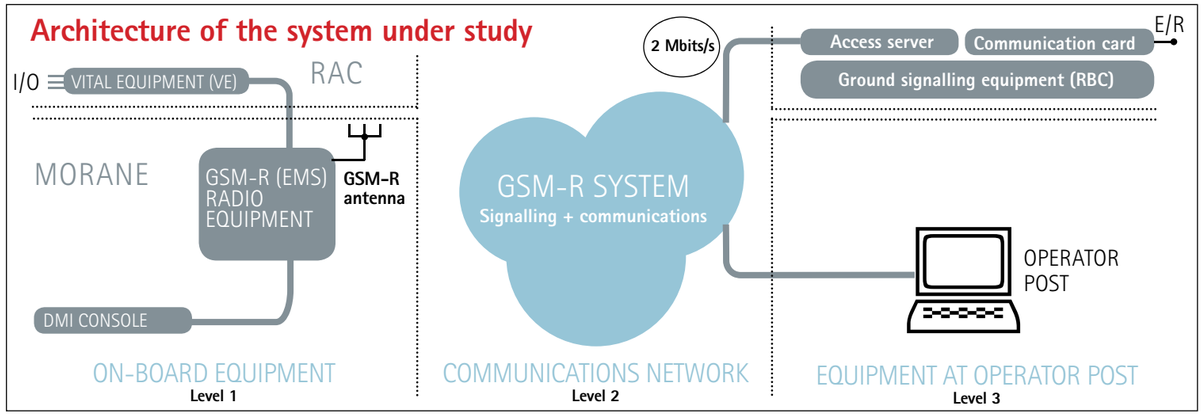
To carry out this project, it was necessary to find measuring equipment that met the requirements by studying both the optimum equipment configuration and Adif's needs in this regard. For this purpose, an analysis was performed of the equipment involved in the rolling stock (manufacturers of Cab radios, modems, installed software versions, etc.) on the different high-speed lines, as well as the equipment on the GSM-R network (NSS Subsystem & BSS Subsystem).

Similarly, a methodology capable of verifying and even improving system operation was established. Broadly speaking, the methodology developed by the ArQoS project consists of:

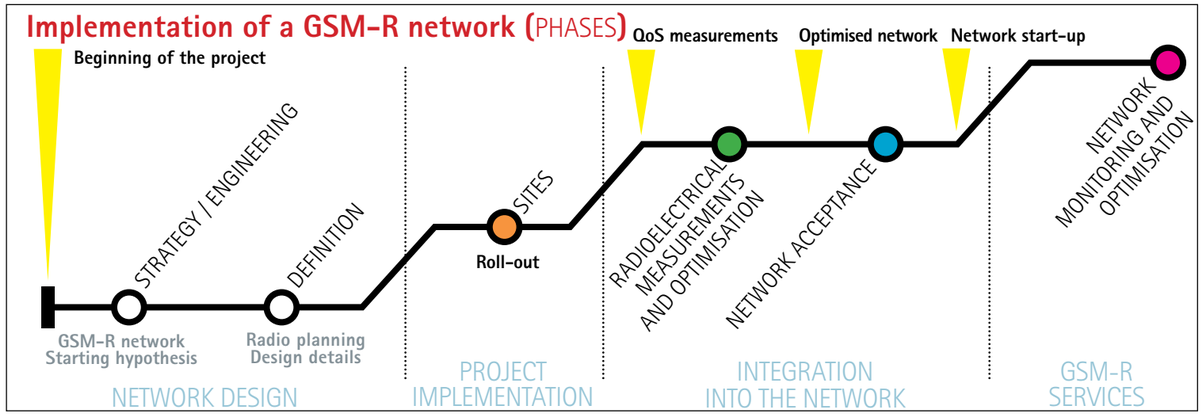
- **Initial analysis of data, functionalities and test planning.**
- **Campaign to measure the quality and service of the GSM-R system.**
- **Analysis of the radioelectric spectrum.**
- **QoS parameters: RxLevel, RxQual, KPI (Key Performance Indicators or Quality and Service Indicators), etc.**
- **Analysis of the results.**

The software application for the measuring equipment includes a predictive positioning system without GPS, based on a database in which all elements of the line under study have previously been entered.
Once the measuring campaign is completed, Adif needs to carry out such activities on all newly constructed high-speed lines and commuter train hubs in order to validate the communications system implemented during the start-up phase.

Architecture of the system under study



Implementation of a GSM-R network (PHASES)



Prevention is better than cure

Innovation to reduce environmental impact

Published in itransporte 36

Ineco has been participating in the Vulcano Project since 2008, a novel methodology for reducing the incidence of fires related to electrical and railway lines.

Official statistics divide the causes of ignition into different groups. According to these data, 50% of fires are caused by negligence and accidents, 20% are intentional and barely 8% are due to natural causes. The overhead and surface assets of electrical and railway companies, included in the percentage of fires caused by accidents, are elements that can release energy. They are often cited as the installations that start, transmit or are connected to forest fires. This includes fires produced by sparks released by machines or caused by friction, defective braking systems on the tracks, lines falling onto vegetation, trees falling onto lines and even fires caused by sparks in situations where the installations cannot support peak demand. This mainly occurs because most installations were designed and constructed based solely on technical design criteria, when the line requirements, the demand for electrical power and the conditioning factors associated with railway routes were very different than they are today.

This situation, along with the age, linearity and limited technological innovation of the networks, not to mention matters of technology, rolling stock and handling habits, cause numerous uncontrolled conflicts in the coexistence between electrical and railway lines and the surrounding natural environment. The invasion of cables and assets by the natural environment causes service quality to deteriorate and makes line maintenance difficult, considerably decreasing efficiency and notably increasing the risk of fire.

Factors with the greatest incidence. One of the factors with the highest incidence, from the perspective of the natural environment, is the climatology of each area or region. It is essential to consider the fact that high-voltage lines can locally modify the distribution of lightning strikes on the terrain, by acting as a sort of atmospheric lightning rods and concentrating such strikes.

The incidence of lightning on high-voltage lines and railway electrification lines is associated with a series of negative effects, such as insulator flashover (which can generate short-circuits), damage to conductors that can cause marks on (or even breakage of) metal, overvoltages in the electrical network or dangerous pass-through and contact voltages near overhead line supports.

However, high-voltage lines do not cause a greater number of lightning strikes, as these depend solely on atmospheric, orographic, geomagnetic and telluric variables. Thus, in the absence of the electrical lines, the lightning would strike the terrain directly, with consequences that could be serious, such as a fire or the death of animals caused by direct impact.

Preventive measures are therefore vitally important for reducing the risk of fire. Of these, forestry actions are becoming increasingly relevant, such as clearing, underbrush removal, etc. These require a lower budget than the amounts invested in extinction, help to improve the quality of forest stands and increase their economic value, boosting the social/rural fabric.

Evaluation and risk prevention. Due to the technical, economic and organisational complexity of the issue, in 2008 the decision was taken to form a consortium of companies to address the Vulcano Project. The aim was to develop a methodology for evaluating and preventing fire risks and conflicts of coexistence between electrical and railway lines and their environment, creating a mechanism based on the development of simulation, risk evaluation and action prioritisation algorithms, supported by an integrated GIS geographical information system.

The Vulcano Project is being developed by a business consortium made up of the Spanish companies Iberdrola Distribución (project leader), Red Eléctrica de España, Adif (Spain's railway infrastructures administrator) and Ineco. Also participating in the project, as collaborators, are universities, technology centres and other specialised companies: University of Alcalá (Department of Geography), LEIA Technology Centre, ITAGRA Agricultural and Food Technology Centre, Institute of Electrical Technology (ITE), Tecnorail, Incodat and Apas.

The Vulcano Project, which began in November 2008 and is expected to finish in June 2011, falls within the National Programme for Experimental Development Projects, within the framework of the National Plan for Scientific Research, Development and Technological Innovation 2008-2011, and is co-financed by the Spanish Ministry of the Environment and Rural and Marine Affairs. ✱

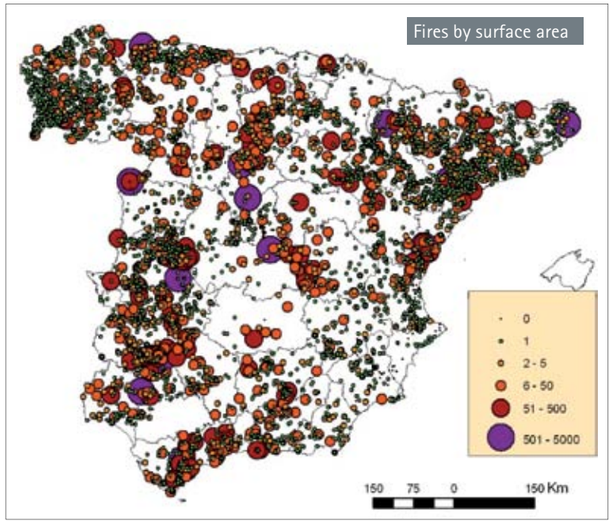
Clearings free of vegetation around high-voltage lines.

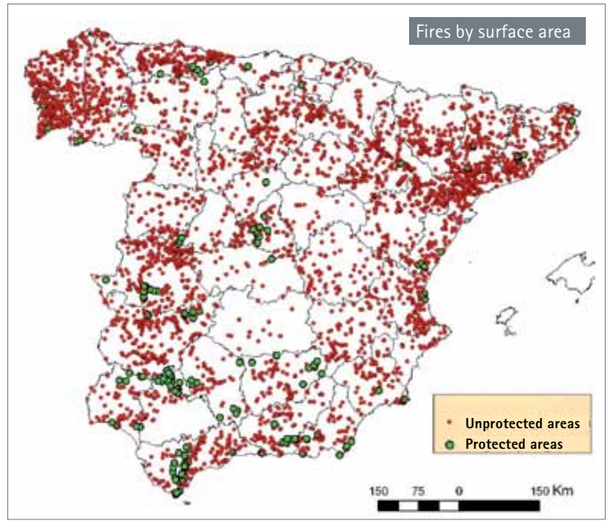
Firefighters at a training drill.

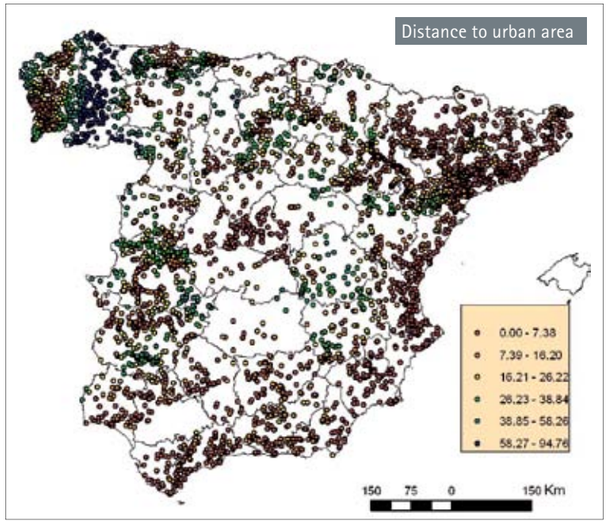
Objectives of the new methodology

This new methodology developed by a consortium of Spanish companies will make it possible to reduce the risk of fires related to electrical and railway lines, reducing the environmental impact associated with the overhead and surface assets of electrical and railway companies, and improving the environmental sustainability of their networks. These measures will also increase the safety of such networks and installations, while improving the integrity of the installations and their safety for people and cargo. The nature of this project is significantly novel in that no similar methodology or system exists at the national level.

To perform an overall study of all fires, it is not sufficient to analyse their location and cause. Rather, an extensive study of the environment surrounding each ignition point is needed.







Pruning, brush clearing and chemical de-weeding using an herbicide spray train are examples of preventive actions in the environment surrounding railway lines. Measures are also implemented to reduce the sources of ignition, such as checking catenary elements and high-voltage electrical lines.

Project phases

During the Vulcano Project, a database has been compiled to document the occurrence of variables relating to the electrical and railway aspects between 1999 and 2008. The characterisation of electrical line and railway installations with regard to technical and environmental aspects –establishing the distances from the incidents to the structures– and the determination of risk indices by section were the other two objectives achieved. The work has taken place in three phases.

During the first phase, a study was conducted of the installations and their environment, until a reliable map of the Iberian Peninsula was achieved, with data on the fires occurring on electrical and railway lines. This serves as a basis for studying the conflicts and risks resulting from coexistence. The current situation was also analysed, along with the associated risks and history of incidents. In addition, an analysis and characterisation were performed of the electrical and railway lines and their surrounding environments.

To determine the reliability of the recorded fire data associated with electrical and railway lines, it was necessary to perform a detailed study of the orography and other characteristics of each area to ensure that the fires were actually caused by those installations, as well as the degree of risk at each point. Such reliability was achieved by turning to collaborators, who provided different visions of each fire included in the database. This analysis made it possible to define the environment or setting where each event took place while determining the land use, which often does not coincide with lower-scale maps. Thus, it was possible to analyse the consistency between the recorded cause and the reality deduced from the orthophotos in the field. Moreover, to analyse the probability of fire, a comparative analysis was conducted between the recorded points of occurrence and a random selection of points where no fires have occurred (non-occurrence), located in the vicinity of electrical and railway lines. This analysis determined the variables with the highest incidence of causing fires.

To perform an overall study of all fires, it is not sufficient to analyse their location and cause. Rather, an extensive study of the environment surrounding each ignition point is needed in order to obtain danger indices based on the factors deemed appropriate for study.

During this phase, a survey was taken to find out more about public perceptions of service companies, including the partners in the Vulcano Project. There was special interest in the perceptions of two specific groups: on the one hand, the general population receiving the services provided by companies in the electrical and railway sectors and, on the other, the technicians responsible for fire prevention and extinction for the Administration of each Autonomous Community. The survey shows a positive opinion of the services provided by electrical companies –particularly Iberdrola in towns with over 500,000 inhabitants and Red Eléctrica de España in rural areas. As far as railway companies are concerned, 73% of those surveyed assessed their activities as good or very good. It is worth highlighting that over 60% of the population does not link electrical infrastructures to fires and over 80% does not link railway infrastructures. A fire risk evaluation and prevention model was also developed within the scope of the project.

Vulcano indices

In order to obtain a Vulcano risk index, it is necessary to collect vulnerability information. In other words, sectors must be identified where a fire can produce the most damage. Different factors have been considered for this purpose, such as protected areas, population density, natural resource value and agricultural value (see maps above).

In the second phase, which started in July 2010, the process of defining the preventive actions on the electrical and railway lines began at both the environmental and technical levels, along with the prioritisation criteria for these actions.

Finally, the third phase of development of the risk evaluation system has already begun, during which action prioritisation algorithms will be specified. During this stage, a website was created for the project, and work began to design an GIS-supported integrated information system based on the partial results from previous phases. Development is now in the preliminary phase and will need to continue evolving as the first and second phases of the project are completed.

Landscapes with distinction

Ineco has created a specific team of professionals to deal with landscaping issues

Published in **itransporte** **31**

The major works required for the construction or expansion of an airport, road or railway transform the surrounding area. To enrich it by integrating the new infrastructure is the challenge of Ineco's landscape specialists.

The study and protection of landscapes, both existing ones and the changes they might undergo due to infrastructure projects, is just beginning to develop in Spain. Europe has the only international treaty in the world devoted specifically to this concept: the European Landscape Convention (ELC), adopted in the year 2000 and in force in Spain since 2008.

The ELC states that the landscape is "an essential component of people's natural and cultural heritage", understood as "any part of the territory as perceived by the population, whose character is the result of the interaction of natural and/or human factors", including natural, artificial, urban and rural landscapes.

Transport infrastructures transform the territory where they are located and Ineco's work with regard to landscape fits into this context. Thus, within its Environmental Area, a specific team of professionals has been created to deal with landscape issues, for the studies and reports included in the mandatory environmental processes as well as specific landscape projects at airports, train stations and other sites.

The goal of these construction projects goes beyond mere environmental recovery of the areas affected by the works or the decoration of certain facilities. The objective is to give the infrastructures and surrounding areas a specific image, in harmony with the surrounding territory. To that end, based on a study of the preexisting landscape, a new environment is designed taking into account the history, cultural traditions, ecosystems unique to each territory, etc. The projects consider all of these components on which the new landscape will be based, and plan the different actions.

A landscape project must be developed by harmonising two types of criteria: conceptual and technical, i.e., those derived from the peculiarities of the infrastructure (an airport, train station or road). For example, the maximum height of the trees at an airport must meet the limitations imposed by aviation easements, and the creation of new plant masses that could attract birds must be avoided. In an airport setting, birds are hazardous due to the risk of collisions with aircraft. However, adequate distribution of the vegetation to be used and an appropriate choice of species (for example, sterile varieties that do not produce edible seeds) can prevent such risks.

The different landscape elements must also be adapted to the particular climate and soil characteristics at the site: it would make no sense from an economic or environmental perspective to use plant species requiring large amounts of water in a predominantly dry setting, or vice-versa. At the same time, the need to optimise maintenance later must be considered, taking into account aspects such as resistance to pests or nutritional requirements. In artificially created environments, there is also a risk of natural invasion, which could be avoided by choosing autochthonous species. *

AN AIRPORT BY THE SEA IN MALAGA

These dune plants at Malaga International Airport evoke the sea and sand, while the stately trees are linked to the concept of the heavens.

Small gardens

In addition to landscape integration, Ineco is also developing another type of project, known as 'environmental integration annexes', for infrastructure construction projects. In these 'annexes', all of the small green areas are designed in a unified manner on the land surrounding airport terminals or train stations, or on the access routes and surrounding areas, which would otherwise be neglected during the construction process. The picture to the right shows how a proper choice of vegetation can evoke a certain landscape, such as the Castilian plateau.

THE AESTHETICS FACTOR

Naturally, aesthetics are an essential factor. Landscape design, while subject to all of the conditioning factors previously described, is based on the use of elements from the environment to create certain perceptions in the users: creating a pleasant atmosphere in rest areas and beautifying key areas, such as access routes, in order to produce a positive visual impact or to emphasise unique architectural elements.

VIP

Q&A

‘Latin America has weathered the crisis better than the West’

Carlos Solchaga

Economist and international consultant

Published in itransporte 39

Solchaga was Minister for the Economy and Finance, and later Minister of Industry for the Socialist governments of Felipe González in the 1980s and early 1990s. In this interview, he gives an expert analysis of the importance of the Latin American markets for Spanish companies, with particular emphasis on engineering companies.

What would be your evaluation of the 10 years that you spent at the head of the Euroamérica Foundation and the relationship between the EU and Latin America?
Over that time, things have been improving continuously and the situation is much better now than it was 10 years ago, but there is still a long way to go. As Latin America shares the same cultural roots as what we used to call “the West” and because both sides share common interests from a political and economic point of view, it is only natural that the relationship should be closer.

The engineering sector has been looking to broaden its horizons abroad for some time now due to the decrease in projects in Spain. Keeping that in mind, how has the crisis affected Latin America?
The crisis has had more of an impact in the more advanced countries, which is completely unheard of, because if we look at the past, it has always been Latin America that has been more unstable. On the one hand, their banks have been contaminated by risky operations, such as subprime mortgages and derivatives, to a lesser degree. On the other hand, these countries have been diversifying their foreign markets and working more closely with emerging Asian countries, meaning that their economies were not so dependent on the United States and Europe as was the case a decade or two ago.

This is why it makes sense that Spanish construction and engineering companies are now starting to look into moving into these markets, not only because the needs there are so great, but also because these countries are now financially sound, have the purchasing and debt capacity, and their public debt is low. Furthermore, they are evolving rapidly and need to develop their infrastructure as quickly as possible to ensure that growth in Latin America is not held back.

Which are the countries that are experiencing the most solid growth and what are the underlying risks in the region?
There is one widespread risk in the Latin American region: that the economic growth is based entirely on increases in the price of the raw materials these countries export (mainly to China and India), and that they do not take advantage of the situation to invest in structural changes.

What is true is that things are much better than they were just a few years ago; economic policy management is more orthodox and the financial situation is infinitely better. Of course, there are significant differences between the countries. Brazil, Chile, Peru and Colombia are, for example, nations undergoing solid and constant growth. The economic prospects nowadays on the continent are much more encouraging, and that means we should start to consider that we might be entering a new, much more favorable, period of economic growth.

Is there general interest across the continent in attracting foreign investment or are there differences between countries?
There are differences, of course. Countries such as Chile, Brazil, Peru, Colombia or Mexico are clear leaders. Others, such as Argentina, Venezuela, Bolivia or Ecuador do not have, or at least do not seem to have, active policies for attracting foreign capital.

How would you assess the process of ‘internationalization’ of Spanish companies since your time as Minister for the Economy and Finance?
I think there has been a very positive evolution over time, despite the fact that we still have shortcomings in our education system, particularly with regards to foreign languages. However, today’s mentality is completely different than it was in 1985, just before Spain joined the EU. Even small and medium-sized companies are now looking into bigger markets without any kind of inferiority complex.

How do you think that engineering companies can improve their participation in external markets?
First, they have to be much more proactive. I think they need a more active, aggressive commercial policy. Spanish engineering companies are some of the best in the world, but one of the problems they have in selling themselves abroad is that they are simply not so visible on the international market, meaning that they are less well-known than they should be.

And how could small and medium-sized companies, which have much more limited resources, also access these markets?
Small and medium-sized companies have always had the same problem: the fact that their size limits the extra costs they can take on. A perfect example of this is trying to enter the Latin American market. With that in mind, I think the best thing they could do is cooperate as suppliers, subcontractors, etc. on projects with larger companies. Once they have a foothold in those countries, they could then investigate the possibilities they have (either alone or with local partners) for setting up more permanent operations there. ✱

Important links between Ineco and Latin America

Ineco has been working for several decades now in different Latin American countries, such as Mexico, where the Spanish company has just signed an important contract and has set up a trading business in conjunction with Adif (the Spanish administrator of railway infrastructures) to bid for infrastructure contracts. This new company in Mexico is called Ingeniería y Economía del TransportMex. Ineco also has an established presence in Brazil and has worked in Ecuador, Argentina and Peru. It is currently working on projects in Costa Rica, Panama and Colombia (for more information, please see other articles in this issue of the magazine).

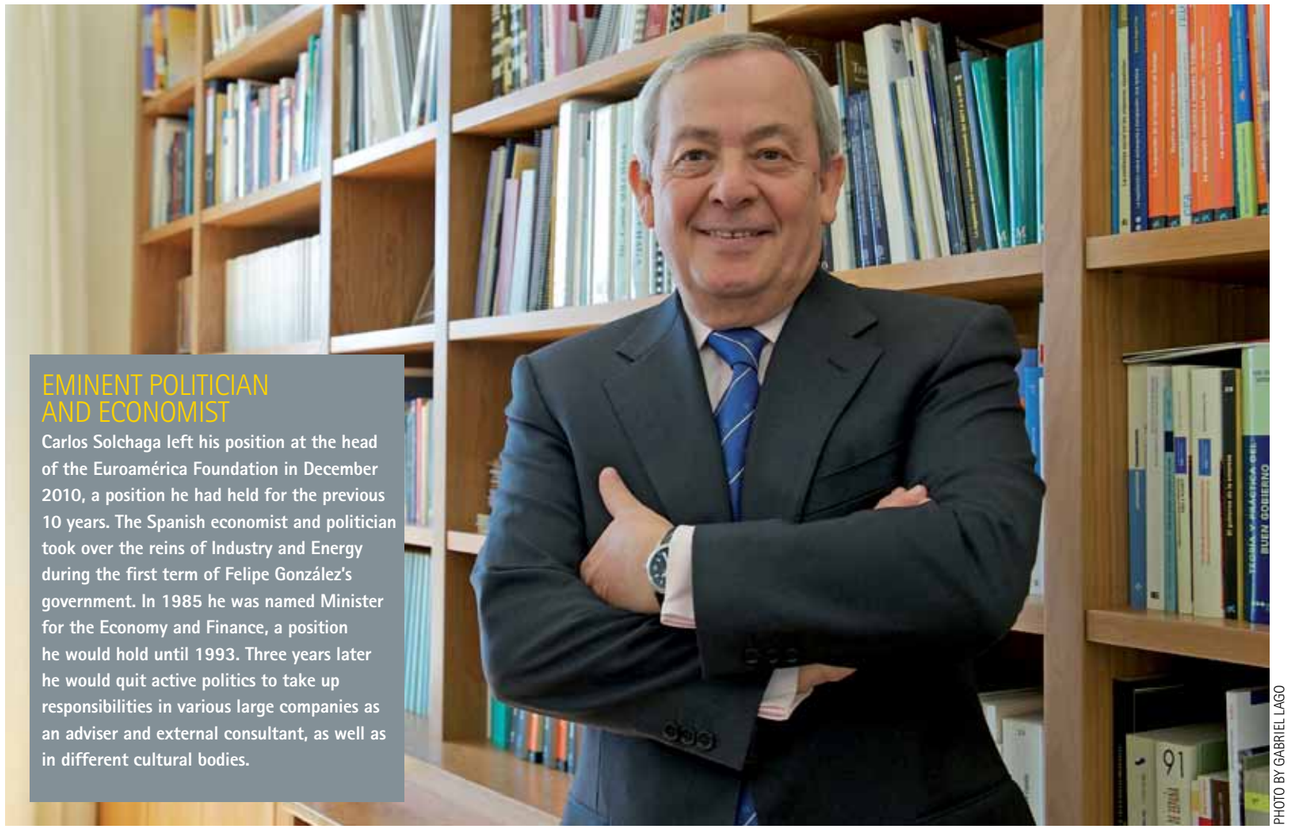


PHOTO BY GABRIEL LAGO

EMINENT POLITICIAN AND ECONOMIST

Carlos Solchaga left his position at the head of the Euroamérica Foundation in December 2010, a position he had held for the previous 10 years. The Spanish economist and politician took over the reins of Industry and Energy during the first term of Felipe González’s government. In 1985 he was named Minister for the Economy and Finance, a position he would hold until 1993. Three years later he would quit active politics to take up responsibilities in various large companies as an adviser and external consultant, as well as in different cultural bodies.

A final glance

CONTROL TOWERS

La Gomera Airport (Canary Islands)

Training new ATC- AFIS service professionals

SERVING PASSENGERS

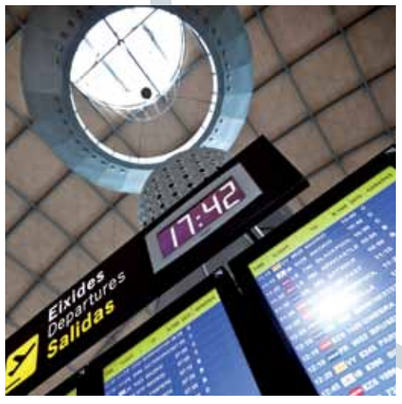
Service for passengers traveling by train

Spain's high-speed railway stations welcome passengers

MAN'S WORK

Railway track construction and maintenance

A high-speed tunnel successfully crosses the city of Barcelona



EFFECTIVENESS IS PUNCTUALITY

Alicante International Airport

The inauguration of the new terminal went like clockwork thanks to the ORAT project

ADVANCED TECHNOLOGY AND HUMANISM

A high-speed train cab

Ineco has over 35 years of high-speed experience

a leader in transport engineering for sustainable mobility

Ineco, an engineering consultant company with more than 40 years of experience all over the world, undertakes services in all transport projects at all stages: consultancy and expert interventions, design and construction engineering, organization, planning and coordination, training and technical assistance.

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