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HIGH SPEED
25 years of AVE
25 experiences

+ ARTICLES

EDITORIAL

Spain's high speed

The opening of the Madrid–Seville AVE was, certainly, a technological revolution for the world of Spanish railways, a leap forward that put us at the international cutting edge of the technology and construction of track and rolling stock. In a short time, high speed revitalised the railway and changed the modes of transport competing successfully with road and air travel. Through the trust of the Ministry, Renfe, and later Adif, Ineco began to participate in the development of high speed, working alongside many other Spanish engineering and construction firms.

In the start-up of the high-speed line, it was necessary to draw on practically all disciplines of civil engineering and architecture: alignment, geology and geotechnical engineering, structural calculation and design, underground works, hydrology and drainage, environmental recovery, railway infrastructure and superstructure, station design and remodelling, demand and traffic studies, the inspection of bridges, waterways and viaducts, load testing, track inspection and instrumentation, energy and substations, signalling, control centres, operation, etc.

That is why when Spain's first high-speed line (and one of the first in the world) was inaugurated 25 years ago, the 250 km/h journey between Madrid and Seville (471 kilometres in under three hours) was for many people a triumph, a celebration almost as important as Expo '92, the major event with which the inauguration was timed to coincide.

Remembering these dates, we also recall those young Ineco engineers and technicians who, taking Renfe's lead, had the opportunity to participate in this great project. Thanks to these humble beginnings and the expertise, rigour and talent of our professionals, companies in the Spanish rail sector today are more competitive and enjoy a well-deserved international recognition. An example of this is our participation in high-speed projects in Saudi Arabia, the United Kingdom, Turkey and India.

The UN's Habitat III conference in Quito and the future role of transport in cities; the study of Europe's main transport routes; modernisation works for a railway line in Turkey and the latest innovations in improving European air traffic; these are also important themes to analyse, and we hope that our readers find them enjoyable and interesting. ■

"In the start-up of the high-speed line, it was necessary to draw on practically all disciplines of civil engineering and architecture"

JESÚS SILVA FERNÁNDEZ
President of Ineco

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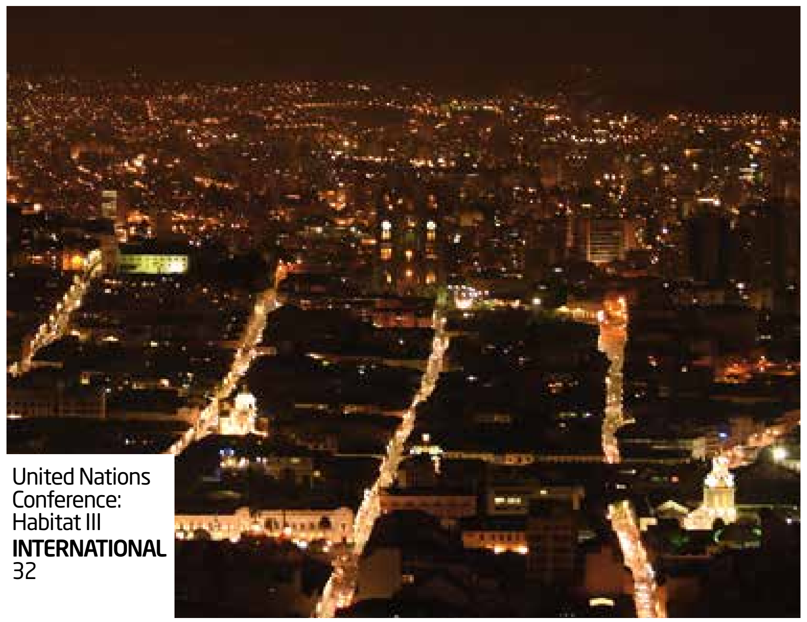

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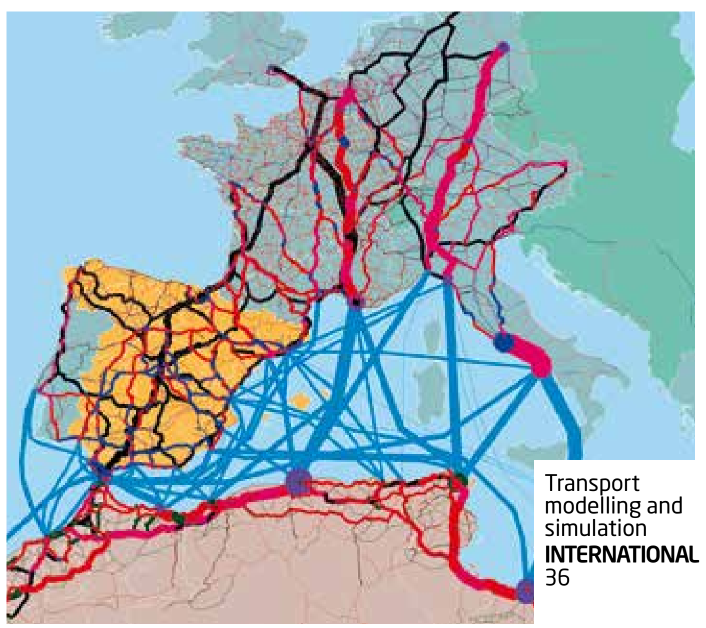

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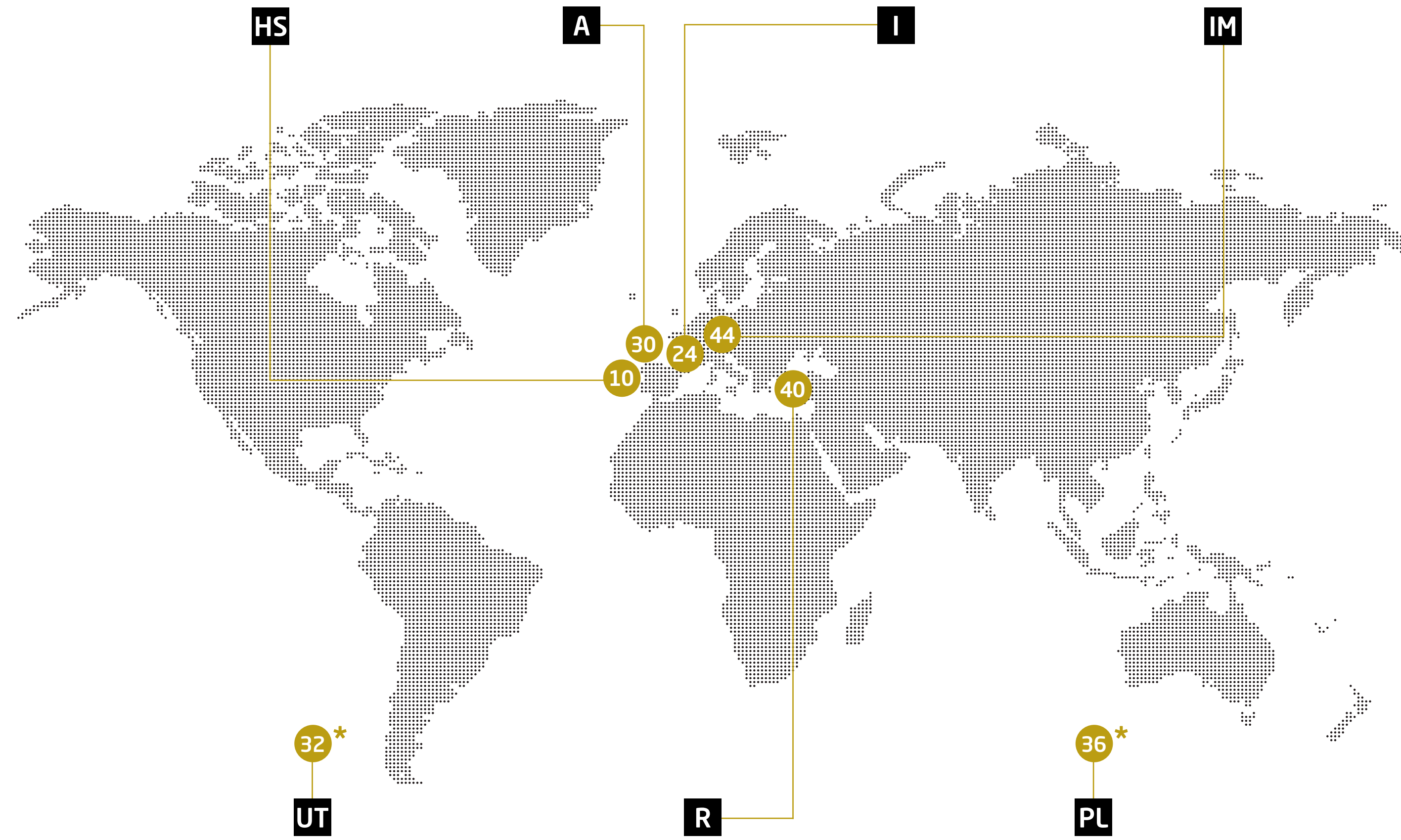

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NEW REGULATORY FRAMEWORK FOR RAILWAYS

An international consortium formed by Ineco, Adif and the Malaysian companies HSS Integrated and Wong & Partners (Baker & McKenzie International) has been awarded the contract to develop Malaysia's new regulatory framework for railways.

The work includes advice for the implementation of a vertical separation model, where the companies responsible for infrastructure and train operation will coexist. Likewise, a legal framework and a range of regulatory policies will be prepared, which will cover passenger and freight transport.

The project, commissioned by the Malaysian public transport commission (SPAD, for its Malay initials), is part of the country's National Land Public Transport Master Plan. The objectives of the Plan, passed in 2013, include improving railway connectivity, accessibility, quality of service, reliability, security and sustainability. With this contract, Ineco is positioning itself in a region which is in continuous growth and has great commercial opportunities, where it has already developed projects including the traffic demand study for the future high-speed line connecting Malaysia and Singapore.

INTERNATIONAL

FAIRS AND CONFERENCES

Ineco has participated in the United Nations Conference on Housing and Sustainable Urban Development, Habitat III, which took place in Quito (Ecuador) from 17-20 October 2016. This event, which is held every 20 years, brings together the greatest authorities from almost 135 countries to lay the foundations for the urban development agenda. Among the event's activities, the former subsecretary of the Spanish Ministry of Public Works, Mario Garcés, and the president, Jesús Silva, participated in a conference entitled *Crises as an Opportunity to rethink urban and housing policies*, in which

Silva underlined the importance of planning and mobility as pillars of sustainable urban development.

The company also participated in two presentations at BIMEXPO, which was held in Madrid last October. The aim of the event is to evaluate the solutions, services and knowledge industry for the professionals involved in the use of BIM (Building Information Modelling) in the design, planning, construction and maintenance process. Ineco is the coordinator of es.BIM, a commission established by the Spanish Ministry of Public Works for the implementation of BMI methodology in Spain.

Ineco was also present as a co-exhibitor at the Microsoft pavilion in the Smart City Expo World Congress, held in Barcelona last November. At the exhibition, Ineco presented the new Cityneco platform and its solutions for mobility, real-time traffic data collection and car-park reserve management.

Ineco also took part in the 2nd International Conference, organised annually by the PPP for Cities forum and held in parallel with the Smart City Expo.

SPAIN

INNOVA AWARDS 2016

At the 2nd edition of its Innova Awards, Ineco seeks to highlight the best innovative internal proposals made during the year 2015. The awards ceremony which took place last December saw prizes awarded for the solutions that generated the greatest value in three disciplines: commercial advantage, efficiency and agility, and profitability. The award-winning projects were a Comprehensive System for the Management of Rail Maintenance on mobile devices (SIMA), an online project administration tool, and the development of methodologies and tools to analyse the impact of obstacles on air navigation systems (IMPULSE).

LOGISTICS PLATFORM IN SANTO DOMINGO DE LOS TSÁCHILAS

Ineco will conduct the feasibility study for the future logistics platform "Zona ILCO" ("ILCO Area"), thanks to a contract recently signed with the Decentralised Autonomous Municipal Government of Santo Domingo de los Tsáchilas in Ecuador. The project boasts the participation of the Inter-American Development Bank (IDB) and the Ecuador's National Development Bank (BDE after its name in Spanish). The study will position this logistics platform as a centre for national and international distribution for the goods produced and consumed in the region, lending the province modern logistical equipment that will contribute to its sustainable socioeconomic development. In the picture, Jesús Silva with Geovanny Benítez, prefect of Santo Domingo de los Tsáchilas.

FIRST HIGH-SPEED LINE BETWEEN TEHRAN AND MASHHAD

The consortium formed by Ineco, the Iranian companies Moshanir and Hexa, and the Italian company Geodata has been awarded the electrification work on the railway line between Tehran and Mashhad, Iran's two major cities. The call for tender was opened by RAI (The Islamic Republic of Iran Railways). This project will take 42 months to complete and will entail the commissioning of the first high-speed line in the Asian country. The new infrastructure, about 1,000 kilometres long, is expected to cut passenger travel time along this route in half and increase freight transport capacity.

PHOTO_HOOCHIE740_FLICKR

View of the city of Tehran.

The contract includes the update of civil work projects, electrification and rolling stock, in addition to the drafting of bid conditions and specifications for the works. Furthermore, the consortium will be in charge of monitoring the line renovation work and updates. Iran has started up a development plan to be completed in 2021. Investments in this plan amount to over 350 billion dollars, of which 40 billion will de allocated to air and land transport infrastructure.

DENMARK

WORKS FOR THE IMPLEMENTATION OF THE ERTMS SYSTEM

The Danish public company Banedanmark (BDK) has commissioned Ineco to complete the operating scenarios in an ambitious renovation programme for the railway signalling of the country. The project has been awarded to Ineco, in collaboration with CEDEX, and includes drafting specifications of the operational trials for the service commencement of the ERTMS (European Rail Traffic Management System) subsystem. It also includes drafting work specifications for the two pilot lines completed by the multinationals Alston and Thales for Banedanmark. The contract was awarded to Ineco on account of its experience in ERTMS, at a national level as well as in the European works in monitoring the interoperability for the ERA (European Railway Agency) and the European Commission.

SPAIN

AWARD TO THE SOTO DEL HENARES STATION

Ineco has received the Award for the Best Municipal Public Project from the Madrid section of the Spanish Association of Civil Engineers. The prize was awarded for the company's participation in the new Soto del Henares halt in Madrid's Cercanías commuter train network at a ceremony presided by the minister of Public Works, Iñigo de la Serna. Jesús Silva, Ineco president, was responsible for receiving the award, which acknowledges the work of Ineco's professionals in the architectural, structural and facilities design of the new station (see *IT56),* as well as the construction management and technical assistance.

The new station is part of lines C2 and C7 of Madrid's commuter train network and is located close to the new Torrejón hospital and the Soto del Henares housing developments.

PERU

IMPROVEMENTS TO VARIOUS AIRPORT PAVEMENTS

Aeropuertos del Perú (AdP) has commissioned Ineco to update the airside surface restoration and improvement programme at the Iquitos, Pisco and Pucallpa airports. The Iquitos airport, named Coronel FAP Francisco Secada Vignetta International Airport, is the fourth most important airport in terms of air traffic in Peru and has a 2,500m runway with a taxiway. The Capitán FAP Renán Elías Olivera Airport, in Pisco, is complementary to the one in Lima, and serves a tourist region close to the Nazca Lines and Paracas Bay, and the Capitán FAP David Abensur Rengifo International Airport, in Pucallpa, serves the jungle region of the country.

Ineco is also collaborating with AdP in the modernisation and enlargement of Chiclayo International Airport together with the Peruvian company Cesel. Aeropuertos del Perú is the concessionary company in the first group of airports located in the northern and central provinces of Peru.

PERU

SEMINAR ON AIRPORT DESIGN

Last November, Aeropuertos del Perú (AdP) organised the Airport Design seminar in collaboration with Ineco and the Airports Council International's Latin American and Caribbean office (ACI-LAC). International experts analysed the physical characteristics of the airside (aviation infrastructure), such as visual aids, horizontal signalling and the interaction with the environment. They also dealt with other parameters that affect the land side, such as the design of a passenger terminal and the interaction with the environment. Ineco's engineers, Joaquín Llop and Miguel de Bernardo, and architect Francisco Benítez, collaborator with the company, participated in the conferences.

SPAIN

VISIT OF THE KUWAITI UNDER-SECRETARY OF PUBLIC WORKS

Last October, a delegation led by Awatef Al Ghunaim, Kuwaiti under-secretary of Public Works, visited Ineco's headquarters in Madrid as part of its official visit to Spain. In 2014, the governments of both countries signed an infrastructure collaboration agreement.

During the visit, the secretary of State for Infrastructure of the Spanish Ministry of Public Works, Julio Gómez-Pomar, and the Kuwaiti under-secretary, signed an addendum to the agreement appointing Ineco to provide technical assistance to the construction of the new airport terminal building at the Kuwait International Airport (KIA). During the last five years the company has carried out the Master Plan update and the project management of the enlargement works at the airport *(see ITRANSPORTE 49)*.

In the picture, under-secretary Awatef Al Ghunaim with Jesús Silva, President of Ineco.

PASEO DEL BAJO WORKS IN BUENOS AIRES

The Paseo del Bajo project is one of the most important civil works that are being carried out in Argentina. It will connect Buenos Aires-La Plata and Illia highways creating new green spaces in the El Bajo area of Buenos Aires. Its aim is to relieve congestion in the city traffic and to improve the North-South connections with 12 new lanes measuring over six kilometres in length.

Ineco, in collaboration with its local partner AC&A, will inspect the works for the new Paseo del Bajo road in Buenos Aires, in section B, 'Trinchera semicubierta Sur', a semi- underground road of 4 lanes intended for heavy vehicles traffic. This new access will allow freight traffic to exit the Buenos Aires-La Plata highway, cross the centre without traffic lights and to enter the port and the Retiro bus terminal directly, substantially improving travel times.

Ineco has already worked in Argentina developing studies for the restoration of the line between San Salvador de Jujuy and La Quiaca.

View of Paseo del Bajo

BRAZIL

CONTRACT EXTENSION FOR THE WORK SUPERVISION IN SÃO PAULO RING ROAD

The consortium led by Ineco, together with the Brazilian engineering company EBEI, will continue to support the mixed-capital company DERSA (Desenvolvimiento Rodoviário S.A. in which the State of São Paulo is a shareholder) in the coordination of contracts and the different agencies that take part in the ring road works in São Paulo, known as Rodoanel Mário Covas, which opened in 2002. The conclusion of work on the north section, anticipated for late 2018, will mark the completion of the 177 kilometre ring road around the city which has a daily traffic of 65,000 vehicles.

The last north section, which is 43.86 kilometres long, is the most complex due to its location, since it is limited in the north by the Sierra de Cantareira Forest Reserve and in the south by the residential zones in the São Paulo metropolitan area. The current alignment lies between the hillsides of the Sierra de Cantareira and the borders of the urban landscape of São Paulo. It is designed for a maximum speed of 100 km/h, it has three and four lanes, depending on the area; it has also required the construction of seven tunnels and 111 bridges and viaducts. Among other activities, Ineco coordinates the project planning, expropriations and environmental actions.

In the picture, Ineco engineers José L. Pancorbo and José Isidro Díaz, general coordinator of the consortium office.

25 AVE

25 years of high speed in Spain

This coming 20th April will see the 25th anniversary of the opening of the first high-speed line in Spain, the Madrid-Seville AVE. The date is a landmark in railway history, as it is the day a new system was implemented with advanced technology which enabled new standards of comfort, quality, journey times and safety to be reached that had until then been unthinkable.

By *ITRANSPORTE*
Photographs: **Elvira Vila**

WORK BASE
For 25 years, Ineco has led the technical track and infrastructure assistance on the Madrid-Seville high-speed line, work which is carried out from the three ADIF (Spanish railway infrastructure administrator) maintenance facilities: Mora, Calatrava and Hornachuelos. In the picture, Ineco technicians working on the Mora facility (Toledo) while a Talgo S102 train passes, which covers the routes between Barcelona, Madrid, Córdoba, Seville and Málaga. In the background, concrete catenary posts, a unique feature of the Madrid-Seville line.

The experience gained from those years on has been a starting point and guide for building the backbone of the country, and we now have the second most extensive high-speed network in the world. In this quarter of a century since the first line was opened up to the current network comprising over 3,100 kilometres in service, the experts of Ineco have acquired unique experience in designing and constructing high-speed lines. The level of technology attained by companies of the Spanish railway sector has attracted such worldwide recognition that the specific term AVE (Alta Velocidad Española, or 'Spanish high speed') was coined to refer to the experience brought. This is because the development of this railway technology –a major political objective of the governments of the last 30 years– has involved conditions and challenges incomparable with the histories of the few other countries that have embarked on this project (Japan, France, China, Italy, Germany, Belgium, the UK and, very recently, the USA), and overcoming these has driven Spanish companies to the highest level of expertise. We dedicate this report to the personal experience and memories of those who were with Ineco from the beginning, working closely with Renfe and the Ministry on successfully achieving this large-scale project. ■

FAMILY PHOTO
A group of Ineco engineers and technicians worked to make high speed a reality in the 1980s and 90s. In the picture, a large number of them are at the entrance to Ineco's headquarters in Madrid.

1992-2017: 25 years, 25 experiences

Spain was the fourth country in the world to take on high speed, after Japan (Tokyo-Osaka, 1964), France (Paris-Lyon, 1981) and Germany (Hanover-Würzburg, 1991). When in 1986 the government decided to build a high-speed line between Madrid and Seville, Spanish consultancy and engineering firms gave the best of themselves to make it a reality. In less than six years they managed to cover 471 kilometres in two hours and 50 minutes.

The opening on 20th April 1992 –after a record construction time– was scheduled to coincide with the Universal Exposition of Seville in 1992, and its challenge and aim were the economic development of Andalusia in the south of Spain. In the medium term, the government's objective was much more ambitious: to build a new, modern railway network to be integrated with the future European high-speed network, a decision taken in the Council of Ministers in December 1988. As a product of this effort in innovation, investment and work, Spain ended the 20th century with the greatest transport engineering project, the first step in the radical change that has taken the railway network to the highest levels of efficiency and quality.

The speed with which the line was constructed –the work was performed over four and a half years– was related to the choice of route, which avoided the mountain pass of Despeñaperros, a traffic bottleneck from Madrid to the south of the Peninsula. In the search for alternatives, eight years earlier, in 1984, Ineco had conducted a study for Renfe on the economic and social prof-

1. At the centre of the image, engineer Jorge Nasarre, NAFA Manager from 1986-87, posing with part of his drafting team. **2.** Ineco technicians for the ADIF work base in Mora (Toledo); from left to right: Rubén Antón, Jose Luis Córdoba, Jesús Córdoba and Anastasio Conejo.

3. Ineco technicians for the ADIF work base in Calatrava (Ciudad Real); from left to right: Pedro L. Castillejo, Santiago Andrada, Francisco J. Aranda, Ernesto Giménez and Santos López.
4. Ineco technicians for the ADIF work base in Hornachuelos (Córdoba); from left to right: Alfredo Olivera, Jorge Gago, Francisco Rebollo and Juan Carlos Olivera.

itability of a railway line from Madrid to Seville through Brazatortas-Córdoba. Two years later, on 11th October 1986, the government decided to prioritise the construction of this new railway access to Andalusia, named NAFA, which shortened the total distance by 100 kilometres. That same month Renfe entrusted Ineco with the execution of the preliminary and detailed designs for the main section, the Getafe-Córdoba stretch, 320 kilometres long with a maximum speed of 250 km/h.

In December 1986 a team was formed to carry out the work, creating a mixed office between Renfe, the Ministry of Public Works and Transport, and Ineco, so as to maximise its execution. From then until November 1987, a smaller group of engineers, draughtsmen and computer technicians began a frenetic race to carry out the preliminary and detailed designs for NAFA. Ineco directly completed 215 kilometres, and the best engineering consultants in Spain, such as Euroestudios, Intecsa, Eptisa and Iberinsa, were for the remaining 106 kilometres. All the infrastructure and track projects were undertaken and led by Ineco's civil engineer, Jorge Nasarre y de Goicoechea. French firm Alstom won the contract to make the rolling stock (the trains) and the German consortium AEG Siemens was commissioned to electrify the entire Madrid-Seville railway line.

On 5th October 1987, after delivering the initial projects, work began for the new Brazatortas-Córdoba line, a stretch of 104 kilometres named NAFA Sur (South). By the end of 1987, all remaining projects on NAFA were delivered, tendered and contracted. One year later the projects were modified to adopt the international track gauge, which is different from the Iberian gauge, with the intention that the new developments could be integrated into the European network.

At Renfe's request, from April 1990 until the completion of the work, Ineco took part in quality control for the track to be accepted. The team of fourteen Ineco technicians led by civil engineer Ulpiano Martínez Solares, was advised by two German engineers sent by German firm DE-Consult (now DB), a subsidiary of the German railway company Deutsche Bahn. It is worth mentioning that both movable point frogs and those with a FAKOP solution, as well as the use of dynamic track stabilisers, were novel technologies in Spain. Today, our country is one of the leaders in designing and manufacturing these junctions. On the Madrid-Seville AVE we were able to improve the vertical stability of the track by levelling the land utilising techniques used in road construction. As regards lateral stability, Renfe's technology was perfected by placing a pre-stressed or post-stressed concrete sleeper and elastic fastening, which enabled the rail to be soldered indefinitely. Additionally, using a 36 m basic rail –today, 90 m has been achieved– made it possible to considerably reduce discontinuities in the track in the form of electric welding.

THE OPENING ON 20TH APRIL 1992 WAS SCHEDULED TO COINCIDE WITH THE UNIVERSAL EXPOSITION OF SEVILLE, AND ITS CHALLENGE AND AIM WERE THE ECONOMIC DEVELOPMENT OF ANDALUSIA IN THE SOUTH OF SPAIN

Thanks to the knowledge acquired in the assembly stage, Ineco's railway technicians got involved –after it was put into service in 1992– in track and infrastructure maintenance assistance, forming a team which today continues working for ADIF on the Madrid-Seville line, on the Mora, Calatrava and Hornachuelos work bases. Ernesto Giménez and Santos López (together with Reyes García) continue working today on the Calatrava base; Alfredo Olivera, Francisco Rebollo and Juan Carlos Olivera on the Hornachuelos base; and Francisco Casasola and José María Melero on the Antequera base. Jesús Márquez Sánchez is currently working on the Extremadura high-speed line, Antonio Millán on the Villarubia base of the Madrid-Valencia AVE, and José Luis G. Sarachaga is assigned to the Vilafranca del Penedès base on the Madrid-Barcelona-French border AVE line. Rodolfo Velilla continues at Ineco as Maintenance Manager for the Madrid-Seville line and Manuel Corvo as a Senior Railway Expert.

In December 1991, Ineco collaborated with the Spanish government to prepare the parliamentary appearances of the then Secretary of State Emilio Pérez Touriño on the imminent opening of the line. On 14th April 1992 a maiden trip was made in which part of the government, and representatives of Renfe and the Ministry, the consultancy firms and the Ineco projects drafting team travelled to Seville. The journey lasted two hours and 50 minutes. The success of the operation enabled the first commercial trip on the line to be made on 20th April.

From that year until today, high speed has been an unstoppable force, solving great challenges: the first, the extremely complicated orography of the Iberian Peninsula. With such uneven land, building infrastructure for high-speed trains to circulate on –speeds of 250-300 km/h require tracks with inclines no greater than 3%– involved executing tunnels and viaducts specifically for this kind of traffic, with demanding track platform parameters and rigorous technical specifications. Another remarkable –and no less challenging– aspect of the Spanish case was the use of high-technology equipments from various manufacturers, generating a large capacity for integration and development of various technologies. To this it should be added that the Spanish railway network had been built with the so-called Iberian gauge (1,668 mm), which is incompatible with the standard or international track gauge (1,435 mm) established for high speed and used in most European countries. This made it necessary to seek solutions such as the incorporation of the three rails to make circulation compatible on both gauges, the development of modern, fast variable gauge changeover facilities to change the Iberian to the international gauge, and track assembly adapting elements such as the ballast, slab track, sleepers and their clips, track devices, electrification, fixed installations, signalling, etc. Adaptation of the track gauge to international standards culminated in 2012 with the connection for the first time with Europe by the line between Barcelona and Figueres-Perpignan.

Completing a railway project of this magnitude and the technical disciplines this entails have enabled Spanish engineering and industry to be at the forefront in construction, installation, tune-up and maintenance of high-speed lines. From its technological definition and the first earthworks up to commissioning, a work without precedent was carried out. Practically the entire railway sector has been overturned over decades, becoming a long and complex process that goes from preliminary feasibility studies, informative studies, studies of demand, economic and financial analyses, environmental impact studies and civil engineering, electrification and signalling construction projects, to designs of stations and urban access operations, finishing with the supervision, construction, implementation, exploitation and maintenance of lines and all special works such as tunnels and viaducts.

AS A PRODUCT OF THIS EFFORT, SPAIN ENDED THE 20TH CENTURY WITH THE GREATEST TRANSPORT ENGINEERING PROJECT, THE FIRST STEP IN THE CHANGE THAT HAS TAKEN THE RAILWAY NETWORK TO THE HIGHEST LEVELS OF EFFICIENCY AND QUALITY

The technical and communication differences among European railway networks have been another hurdle to overcome. Isolated from Europe by a different track gauge, Spain was the first country interested in overcoming distances and pursuing interoperability with its neighbouring countries. Today, it is a leader in implementing the ERTMS, the European rail traffic management system that will enable trains to move freely throughout Europe by overcoming the technical and operational hurdles of each system and country through a common language.

The technical and legal expertise of Ineco's technicians has led them to collaborate actively with the EU's ERA agency on the process of harmonising European railway networks. After years of dedication, European signalling systems have been standardised, and signalling control points have been interconnected with this system. This and other services have enabled the acquisition of a high level of know-how in safety systems and communications, on-track detection systems and train protection systems. This experience was complemented by the design and construction of centralised traffic control centres (CRC), from which high- speed tracks are managed using the Da Vinci system, a Spanish patent exported to the United States of America, Morocco and Lithuania and used in the underground rail systems in London and Medellín.

In terms of rolling stock, in Spain there are trains in operation made by various manufacturers, among them those of Spanish companies Talgo and CAF. Consultancy and engineering firms have participated in railway operations with latest generation trains which incorporate high-performance technology, i.e. that which enables speeds of up to 350 km/h. Their implementation involves the participation of experts on circulation, reception of rolling stock and on-board equipment. ■

25 EXPERIENCES

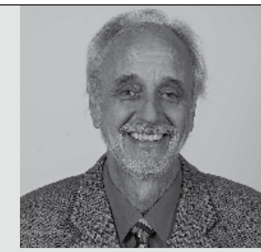
Agustín Barriobero, telecommunications engineer. He has drafted signalling projects for high-speed and conventional lines and was director of Railway Installations and Railway Business.

Juan Barrón, MSc in Civil Engineering. He has been director of Work and Installations at Renfe, general director of Ineco, president of the GIF (National Railway Administration) and assistant sirector and president's Advisor at Ineco.

Pedro Benito, BSc in Civil Engineering. He has participated in high-speed projects in Spain and the UK (HS2) and underground railway works such as those in Gijón and Cercanías (commuter rail) in Málaga.

Jesús Castillo, industrial engineer. He has worked on implementing electromagnetic interference calculation at Ineco.

Luis Colomer, draughtsman. He has participated in high-speed and conventional gauge projects; underground works such as those in Gijón, and HS2 in the UK.



Manuel Corvo, senior railway expert. After several years in high speed and corridor maintenance, he currently works as a senior railway maintenance expert.

Adolfo Cruz, industrial engineer. He has worked at Renfe and, since 1991, in Ineco on both conventional and high-speed lines, and currently on electrification projects on both.

Marisa de la Hoz, BSc in Civil Engineering. She has taken part in the planning and design of almost all high-speed lines in Spain and, recently, in India, the UK and Iran.

Víctor Duarte, MSc in Civil Engineering. He has drafted projects on the Valencia-Castellón, Córdoba-Málaga, Madrid-Valladolid and Antequera-Granada high-speed lines. He is currently Superstructure manager.

“I remember a herculean task of two weeks, weekends included, preparing the railway installations project for the section of the Madrid-Seville line managed by the Ministry of Public Works and Transport. This was my first contact with high speed”

AGUSTÍN BARRIOBERO

“What was in principle one railway line more (Brazatortas-Córdoba) became the source of a new railway and –I would go further– of a new mode of transport: high speed. First, the infrastructure and track projects; then the control: track, catenary, safety installations, and later maintenance, made us a benchmark company on a global scale in this field”

JUAN BARRÓN

“For that project, a member of the draughtsmen team was needed, with the aim of maintaining Ineco's standard in this field. Without thinking twice, I put my name forward for the task: that's how things were done in those days”

LUIS COLOMER

“One of the fundamental advances was the use of geometric auscultation as the basis for global acceptance of the track and for its maintenance. The idea of dynamic auscultation, complementary to geometric auscultation, also began to be developed as a key element of railway maintenance. This conception of maintenance was exported to conventional lines such as the Levante, Mediterranean and Atlantic Axis corridors”

MANUEL CORVO

“Brazatortas –that's what some called NAFA– was a challenge that was going to shape the future of railways. We began in 1986 tracing with templates on the paper map, and we put the finishing touches to it five years later, riding the train on the final test journey the day before opening. The tilting of the surface of the water in a glass on the table indicated to us that we were passing through banked curves. It was now a reality: we were moving at 250 km/h”

PEDRO BENITO

“The Madrid-Seville AVE project on rail traffic command and control was a turnkey project, in which the preparation of the Cerro Negro workshop safety installations project was lacking. After opening in April 1992, the line remained open in Córdoba with the famous level crossing, which closed when this station was moved underground with a safety installations project of Ineco's”

JESÚS CASTILLO

“In alternating current electrification in Spain, nobody had experience of the co-existence of the two systems (25 kVca and 3 kVcc) in a single site or station. With the advances achieved we were able to adjust their operation without leading to functional interference”

ADOLFO CRUZ

“In 1986, I joined the NAFA team. We were very young, with Jorge Nasarre and Santiago Rallo in charge. Thanks to their expertise, we were able to draft the basic and construction projects for 320 kilometres in the record timescale of a year. We based it on the French model, adapting it to Spain's orography and characteristics”

MARISA DE LA HOZ

“From the beginning I took part in drawing up and coordinating the projects for the stretches between Getafe and Córdoba, as well as Ciudad Real and Santa Justa stations. It was a great challenge, as Spain had no legislation on the necessary parameters for trains going at 250 km/h, which was achieved in less than 6 years”

VÍCTOR DUARTE

Santiago Espinosa, railway technician. He has worked on renovation projects in Ethiopia and Argentina, as well as projects such as Barcelona Sants station and HS2 in the UK.

Dulce Galán, geomatics and topography engineer. After 12 years on railway projects, she currently directs AENA's office of airport noise insulation plan management.

Víctor Gándaras, computer technician. He joined Ineco's Engineering Directorate in 1987. He currently manages Provision in the Subdirectorate of Development and Corporate Systems.

Moisés Gilaberte, MSc in Civil Engineering and lecturer, is an expert in infrastructure and tracks. After two years as director of Design for Makkah-Medina, he is now associate director of the ADIF account.

Ernesto Giménez, railway technician. Since 1992, he has been working on the Calatrava high-speed work base, for which he is Unit Manager at Ineco.

Francisco Javier Guerrero, industrial engineer. He has been working at Ineco since 1986 on electrification, management and on-site technical assistance projects. He currently leads international projects as a senior expert.

Rafael Herrera, BSc in Civil Engineering. He has been involved in railway works and projects for over 20 years. He is currently sub-director of the Projects Office.

Jesús Márquez, railway technician. Since 1990, he has worked on maintenance of conventional lines, and high-speed maintenance and construction.

❝I was involved in the design of Puerta de Atocha station, as part of a team responsible for drawing up the projects for the main stations. From those lively years, I remember the technical tools: pocket scientific calculators, templates of all kinds, scales, planimeters, frames, caulking tools, razor blades, etc. Classical draughtsmanship was our leading technology❞

SANTIAGO ESPINOSA

❝It was the first time digitalised mapping was used in Spain, an archaic GIS developed by a Spanish company. Two computers the size of industrial washing machines were used, the power of which was vastly inferior to the most simple smartphone we keep in our pockets today. The thousands of plans that comprise the project were printed on two pen plotters, which operated 24 hours a day as each plan took 50 minutes to print❞

VÍCTOR GÁNDARAS

❝I joined Ineco as an expert in digital mapping for a project that was a big challenge in every way. Many hours of work, the odd sleepless night revising the calculations obtained by the new "programme", headaches and a few nerves were finally worth it when the project succeeded. The best thing was the team and our teachers❞

DULCE GALÁN

❝I joined Ineco –which was called TIFSA at the time– in 1988 with Manolo Guerrero, a wonderful professional, now retired. I found myself an enormous table full of plans of track devices… in German. These were going to be installed on the new high-speed line. We had to go to Germany a number of times to check their production. There were four of us providing technical assistance to Renfe. From then on to this day, lots of tracks, high speed, good experiences and great colleagues, in and out of Ineco…❞

MOISÉS GILABERTE

❝Along with Ulpiano Martínez and Rafael Herrera, we got into the field of superstructure control and new junctions. With the arrival of technicians like Rudolf Trenk from DB Consult, German technology was introduced to the high-speed sector. We visited all the work sites between Getafe and Villanueva de Córdoba; it was non-stop meetings and drillings and track devices. Finally maintenance was achieved and now 25 years have passed❞

ERNESTO GIMÉNEZ

❝In a very short time it was possible to hire and train the entire team of the work bases to undertake a project that until then had not been done in Spain. Initially, we only controlled the superstructure. Then, the other disciplines were gradually included: infrastructure, electrification and safety installations. The bulk of this team remains at Ineco and has expanded its experience to the remaining high-speed lines❞

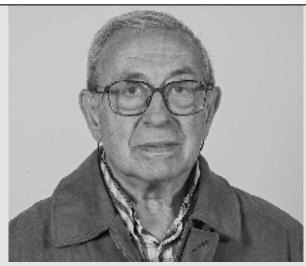
RAFAEL HERRERA

❝A catenary for 250 km/h? Powered with 25,000 volts? What is that? Working on the AVE line to Seville definitely opened the door for us to a part of Europe that was unknown for many of us. Today it is Europe and the rest of the planet who look to Spain as a reference in high speed❞

FRANCISCO JAVIER GUERRERO

❝When we got to Córdoba in 1990, we were entrusted with visiting ballast supplies to check their condition. Subsequently, various tests were performed to check that they met the specifications, which were quite strict, and especially that they passed the Los Angeles abrasion test. Today, I feel proud because the ballast continues to respond perfectly after 25 years❞

JESÚS MÁRQUEZ



Ulpiano Martínez, MSc in Civil Engineering. He has been director of 2nd Area Fixed Installations and sub-director of 2nd Area at Renfe. He has also been Quality Control director at Ineco.

Antonio Millán, railway technician. After the projects in Venezuela and Ethiopia, he is now part of the maintenance team for the east high-speed line in Villarrubia de Santiago.

Jorge Nasarre, MSc in Civil Engineering. He was project manager at Ineco for the Madrid-Seville high-speed line, and is currently director of the Caminos de Hierro Foundation Council.

Juan Carlos Olivera, railway technician. Since 1992 he has been working on the Hornachuelos high-speed work base and is now its Unit manager at Ineco.

Esteban Rubio, BSc in Civil Engineering. He has worked on track assembly and high-speed variable gauge changeover facilities for all lines in Spain.

Roberto Salas, BSc in Civil Engineering. He has been working since 1987 on the construction of conventional and high-speed lines in Spain and abroad.

José María Urgoiti, MSc in Civil Engineering. He was in charge of Works and Maintenance at Ineco for 20 years. After a year directing the Mecca-Medina project, he is now director of National Railway Business.

Rodolfo Velilla, senior technical expert. He is currently in charge of maintenance contracts for the South high-speed lines, Madrid-Seville and Córdoba-Málaga.

“The demands for high-speed precision are to the millimetre. That’s why I was so surprised when with the dynamic stabiliser, the track didn’t lose even a millimetre of levelling and alignment, and yet the ballast remained compacted. I had a lot of experience from working at Renfe and SNCF in the 1960s, but this was something very new, essential for moving at 250 or 300 km/h with no speed limits for stabilisation by loads after maintenance work”

ULPIANO MARTÍNEZ

“I performed progress monitoring work for both the superstructure and track infrastructure, geometry quality drillings, geometric inspection and ultrasonics of aluminothermic welding, installation and control of track devices, etc. The experience I gained from NAFA enabled me to continue in line maintenance subsequently for 14 years”

ANTONIO MILLÁN

“My first significant contact with the Madrid-Seville line was in 1984 from the company Intecsa, where we carried out the platform and track construction projects for Ineco on the stretches between Brazatortas and Villanueva de Córdoba.
This stretch, which was initially designed for 160 km/h, had to be updated to a speed of 250 km/h, which meant all the projects had to be changed completely”

ESTEBAN RUBIO

“There were only 20 of us and we were given the task of drawing up the plan for adapting a few stretches between Córdoba and Seville. My contribution was the assist in measuring the units and scraping plans, which were drawn in ink on tracing paper. Then I worked on other projects, from tunnels to trams, and then again on high speed with the Madrid-Barcelona-French border line, in which I fully participated, and many others in Spain and abroad”

ROBERTO SALAS

“The beginnings of high speed in Spain were a complicated birthing process. These are the words of Elías García González, one of the best railway engineers in Spain in the last third of the 20th century, my teacher, and an irreplaceable technical support (for example, in defining the free section for aerodynamic effects of tunnels) in conceiving the first project (Getafe-Córdoba). The Spanish railway in the 21st century owes much to him and to Ineco’s reduced collaborating team”

JORGE NASARRE

“We started working on monitoring the assembly of the superstructure between Córdoba and Seville in the mid-1990s. There were still structures left to erect and, on some stretches, the ground wasn’t levelled. What we did have, though, was a deadline: April 1992. We thought we wouldn’t have time or we wouldn’t meet the quality standards required to operate at 250 km/h. The general comment, even among lifelong railway experts, was: “I’ll believe it when I see it”. Then April ’92 arrived and we saw it… and we believed it”

JUAN CARLOS OLIVERA

“I took part in quality control for the Córdoba-Seville stretch, which together with the NAFA project and control and supervision of the ballast and junctions, were the precursors to the large operation Ineco undertook on the high-speed lines in Spain and others abroad such as in Turkey, Saudi Arabia and the UK. Its success was based on the working capacity of Ineco’s young engineers and the experience and expertise of Renfe’s technicians, and future success will be achieved by being competitive”

JOSÉ MARÍA URGOITI

“We managed to get that project off the ground with acceptance criteria that were exceptional for that time, such as track inspection vehicles, as well as geometric and ultrasonic control of each and every aluminothermic weld conducted *in situ*. Once the line had opened, Ineco participated in the design, management and development of the high-speed maintenance model, which ADIF continues to use today”

RODOLFO VELILLA

25 IN PICTURES

01. Atocha station (Madrid) undergoing work for the opening of the AVE to Seville. **Renfe (R). 02.** King Juan Carlos I visits the track construction. **(R). 03.** Opening ceremony of the Madrid-Seville AVE at Atocha. **(R). 04.** Renfe advertisement for the AVE, 1992. **05.** Talgo Bombardier S102 train. **Pablo Neustadt (PN). 06.** Curro, the mascot for the Universal Exposition of Seville 92. **07.** Inside a variable gauge changeover facility. **08.** Santa Justa station (Seville). **ADIF (A). 09.** Variable gauge changeover facility. **10.** Zaragoza station. **11.** AVE Valencia rail unloading. **Elvira Vila (EV). 12.** Ineco technicians supervising work. **(EV). 13.** High-speed track and catenary. **14.** Construction of the Abdalajís tunnels (Málaga) **15.** ERTMS marker posts. **16.** Construction of ADIF workshops in Valladolid. **17.** Antequera-Santa Ana high-speed station (Málaga). **18.** Laser scanner for tunnel inspection. **19.** ADIF railway control centre at Atocha. **(PN). 20.** Initial attaching of bars for unloading of rail wagon. **21.** María Zambrano station (Málaga). **22.** Aerial view of the Córdoba-Málaga high-speed line. **23.** Barcelona-Sants station. **24.** High-speed train cabin and driver. **(PN). 25.** Topography work. **26.** Atocha station (Madrid). **(PN). 27.** Camp de Tarragona station. **28.** Ulla viaduct, Galicia. **29.** ADIF logo on building front. **30.** Contreras viaduct (Cuenca-Valencia). **(PN). 31.** Ineco load testing on Ulla viaduct. **32.** Passengers on an high-speed train. **(EV). 33.** Construction of the La Sagrera tunnel next to the Sagrada Familia (Barcelona). **34.** Ineco work on the archaeological site of Lo Hueco (Cuenca). **35.** High-speed line to Alicante. **(EV). 36.** Passengers on the Atlantic Axis, Galicia. **(R). 37.** Valladolid-Palencia-León high-speed line. **38.** Ineco technicians on the high-speed line to Valencia. **(EV). 39.** Sorbas tunnels. **40.** Positioning and squaring of sleepers. **41.** AVE departures board. **42.** Valencia station. **(EV). 43.** Gantry for rail positioning. **44.** Checking the tightening torque of the fastening. **(EV). 45.** AVE driver. **(EV). 46.** Atocha-Chamartín tunnel work (Madrid). **47.** Renfe AVE train and passenger. **(EV).**

PRIORITY MEASURES
The EU considers it a priority to improve European airspace management by increasing the safety and number of operations and reducing the costs and environmental impact associated to each flight.

63 solutions ready for take-off

The major Single European Sky project makes an important step forward with the completion of the first SESAR development phase: seven years of intense work to modernise the European Air Traffic Management system, culminating in 63 solutions.

By **Laura Serrano, José M. Rísquez** and **Ester Martín**, aeronautical engineers

ILLUSTRATION_ANA LAGO

December 2016 saw the completion of the first SESAR research and development programme, with a total of 63 Air Traffic Management (ATM) solutions, all with a shared goal: increasing the number of air operations, increasing safety, and reducing the costs and environmental impact associated to each flight, all priority issues for the EU. This was possible thanks to the combined work of airport managers, air navigation service providers, the aviation industry and airspace users. This was a fruitful collaboration as part of the company SESAR Joint Undertaking (SJU), a public–private partnership bringing together all Air Traffic Management (ATM) R&D initiatives in Europe. Founded in 2007, the company was created by the European Commission (EC) and Eurocontrol to coordinate the growing number of partners and to manage financial and technical resources, with a view to making the Single European Sky project a reality.

According to statements by the EC, SJU has met its expectations. The parties responsible for technological development for the future European Air Traffic Management system presented a total of 63 solutions at the end of 2016, defining standards, operating procedures, technology and pre-industrial components. These solutions were developed with a clear focus on subsequent deployment and implementation.

ENAIRE'S LEADERSHIP

Together with its shareholder ENAIRE (formerly Aena), Ineco began participating in 2000 in the area of ATM in European R&D Framework Programmes, which were co-financed by the European Commission and ultimately replaced by SESAR JU to unite efforts, to avoid the duplication of work and to promote the deployment and implementation of the different developments. Since the development phase got underway in 2008, ENAIRE has participated in 95 projects (the programme includes over 300), taking a leading role in 16 of these. Ineco's contribution to SESAR began in December 2010, with the company ultimately participating in 54 projects. Participation in SESAR has allowed us to keep up to date with the evolution of ATM technology and operations, putting this experience at the service of our clients and shareholders. Regarding this, it should also be highlighted that Ineco, jointly with ENAIRE, led WP6 Airport Operations, diferent kind of operational projects and also Operational Focus Area(OFA) in which projects were grouped assessing the same concept. The company also contributed in the development of operational concepts in the Network, Route, TMA and airport areas and in the coordination and execution of validations (both in fast and in real time) and the subsequent analysis of indicators from different perspectives (for example operations, economics, environment, safety and human factors).

Ineco experts also developed Touch It!, a tablet application enabling measurement of the workload of any human actor in their professional setting, whether this be aeronautics or not.

SESAR DEPLOYMENT PHASE

In order to truly meet the objectives set, conceptual development of solutions is not sufficient. The industry must put these into production, at the same time deploying or implementing them. Similar initiatives in the past have not achieved this. However, there is now a body (the SESAR Deployment Manager) and a budget earmarked for making this happen.

The SESAR deployment phase guides and ensures the deployment of the developed solutions in a coordinated way within the European Union. As part of this, the EC published a regulation in 2014 called the Pilot Common Project, defining the first large-scale actions to be carried out in order that the technologies presented be available and put into operation. This is a mandatory regulation which all providers must put into effect in accordance with the implementation phases. This level of integration and information will also involve on-board equipment, manufacturers, flight personnel, controllers, airlines and the aeronautical industry as a whole.

What are the benefits? In addition to advances in terms of the safety of air operations and reducing fuel consumption, the advantages include interoperability and reduced operating costs. But above all, it is also a political achievement, a shared experience which confirms the movement towards a more united, collaborative Europe, gradually finding supranational systems to bridge the historical borders fragmenting and hindering the dream of a unified territory.

5 ACHIEVEMENTS

The set of solutions generated by SESAR comprises a broad range of actions, in some cases representing a paradigm shift in the way operations have been run until now. In this sense, the new developments make it possible, for example, to change concepts such as the way in which aircraft are separated, the management of civil and military airspace and aerodrome control, which in some circumstances can be done using a remote control tower. In these pages, we highlight five of the 63 solutions developed, giving an idea of the magnitude of the works, the types of activity and their contribution to the Single Sky:

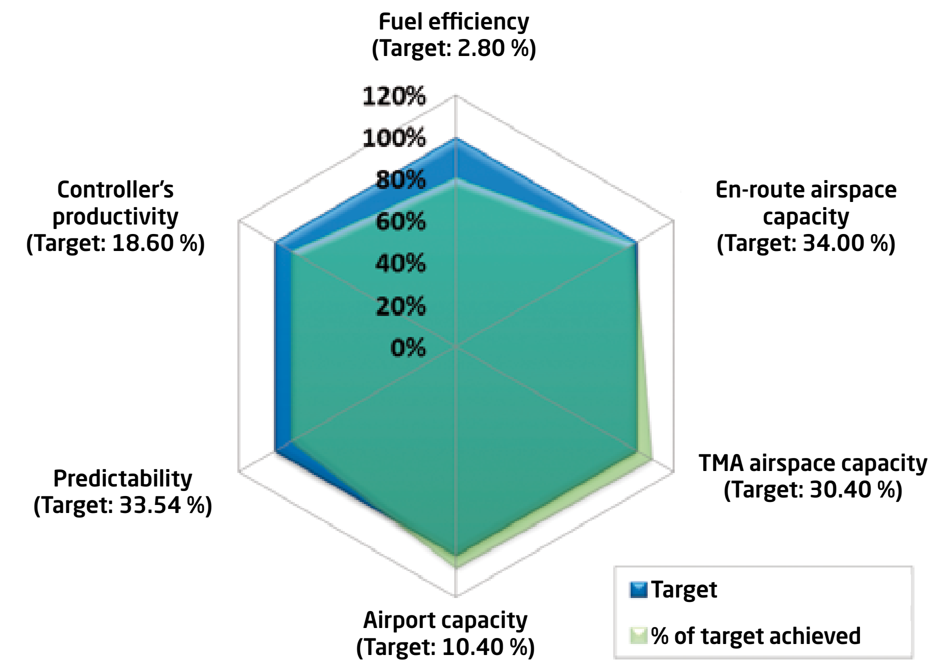
1. GREATER AIRPORT CAPACITY. It has been possible for the first time to separate aircraft on their final approach by time (seconds) instead of by distance (nautical miles). The current distance-based separation of aircraft means the controller will apply fixed values, even in the event of strong headwinds. In these circumstances, a plane will take longer to travel the same distance; resulting in an ostensibly lower number of landings and consequent reduction in the airport's capacity. However, with the new concept of time-based separation (TBS), airport capacity is retained even if there are strong headwinds.

2. FREE ROUTE. At present, airlines are generally obliged to plan their flights following previously published routes, which are not always the most efficient for their interests. SESAR developed the free route concept to enable airlines to design and plan the trajectory that best suits their business model.

3. EVERYTHING IN THE CLOUD: SWIM. Breaking the paradigm of the information exchange between two network actors without the participation of the other actors, system-wide information management (SWIM) is a concept created by SESAR which will allow all the real operational information of all aircraft at any stage (i.e. land or air) to be managed and shared to improve decision-making. It will be possible to upload/update data in real time, with this information being accessible by different user profiles with different access privileges, in this way ensuring the proper levels of confidentiality and safety.

4. REMOTE TOWER. In small airports or airports in areas that are inhospitable or difficult to access, having a control tower can be too costly (due to control and maintenance personnel costs and equipment costs). However, the concept of remote towers makes it viable to manage operations at these airports safely and efficiently. So much so, that they have already been implemented. SESAR has developed reliable, safe technological solutions, including sophisticated cameras that can capture images even in poor visibility conditions. From a remote location, the controller accesses all the information he/she needs and communicates with planes without compromising operational safety.

5. AIR TRAFFIC CONTROL SUPPORT TOOLS. Information on all flights will become more accessible and precise. Sophisticated algorithms will enable controllers to predict further in advance whether any system node (i.e. the airport, airspace sectors) might become overloaded (in other words, whether the number of planes will exceed the recommended maximum for safe operation). Predicting overloading or other issues in advance makes it possible to plan their resolution with minimal impact on the development of air system operations. These systems will offer a catalogue of solutions to facilitate decision-making by the controllers or supervisors responsible for traffic management.



PLANNED OBJECTIVES
The hexagon in the graph above shows SESAR's six proposed performance areas for measuring the success of the works carried out. The blue hexagon shows SESAR's initial targets, with the green one showing the high level of achievement reached by 2015, with a year still remaining for development.

PRESENTATION OF PROJECTS
Form left to right: aeronautical engineers Ester Martín, José Manuel Rísquez and Laura Serrano, who attended the SESAR Showcase event on behalf on Ineco and representing ENAIRE. The event was held in Amsterdam on 30 June and featured presentations on the 63 solutions developed.

THE MEMBERS OF SESAR JU

During the first SESAR development phase, the main actors in European ATM were represented, as were the EC and Eurocontrol, the founding partners. Participating air navigation service providers were ENAIRE, DFS, DSNA, ENAV, NATS and NORACON (a consortium of providers from northern Europe and Austria). Participants from the manufacturing sector of the industry were Airbus, Alenia, Frequentis, Honeywell, the Spanish company Indra and the consortium of the companies NATMIG, Selex and Thales. From the airports sector, the SEAC consortium (BAA, FRAPORT, Munich, Schipol, Zurich and ADP) also participated. Participating as affiliates of ENAIRE were Aena as an airport manager, Ineco and CRIDA. In this second development phase, Airbus, DFS, DSNA, ENAIRE, ENAV, Finmeccanica, Frequentis, Honeywell, Indra, NATMIG, NATS, SEAC and Thales renewed their commitments, and five new partners joined: COOPANS, AT-ONE, B4 (made up of ANSPs from Poland, Lithuania, the Czech Republic and Slovakia), Dassault Aviation and Skyguide.

SESAR 2020: SECOND PHASE OF DEVELOPMENT

Starting in October 2016, a second phase of development, SESAR 2020, is following suit, not only in launching the development of new solutions but also in completing the development of those that began in the first phase. This new programme presents a series of R&D projects, from early conceptual ideas to validation in operational settings for deployment. These projects are grouped into three large areas:

▸ *Exploratory research*, the most innovative part of SESAR, which is subject to open calls for projects.

▸ *Industrial Research & Validation*, where concepts offering significant ATM benefits are refined and validated. Only SJU partners and associate companies can participate.

▸ *Very Large Demonstrations*: projects included in the step prior to industrialisation and/or production, which are oriented towards validated concepts that require European or global coordination.

In the first development phase, there was a separation between operational projects and systems projects. This risk disappears in SESAR 2020, as each project includes a team of both operational and systems experts, with both groups being involved in the entire life cycle and development of the project: concept, requirements, validation, verification, etc. In addition, certain processes have been elaborated to ensure greater involvement from airlines, which are one of the most important actors in the world of ATM as they will be the users of the future ATM system developed by SESAR. ■

Projects in the Industrial Validation and the Very Large Demonstrations areas are categorised into 4 sections, depending on the characteristics of the ATM concept they focus on:

DEVELOPMENT AREA	*INDUSTRIAL VALIDATION* PROJECT	INECO'S PARTICIPATION
High Performing Airport Operations	Pj02 Increased Runway and airport throughput	X
	Pj03a Integrated Surface Management	X
	Pj03b Airport Safety Nets	
	Pj04 Total Airport Management	X
	Pj05 Remote Tower for Multiple Airports	
Optimized ATM Network Services	Pj07 Optimized Airspace User	
	Pj08 Advanced Airspace Management	
	Pj09 Advanced Demand & Capacity Balancing	
Advanced Air Traffic Services	Pj01 Enhanced Arrivals & departures	X
	Pj06 Trajectory Based Free Routing	X
	Pj10 Separation Management En-Route and TMA	X
	Pj11 Enhanced Ground & Air Safety Nets	
Enabling Aviation Infrastructure	Pj14 CNS	X
	Pj15 Common Services	
	Pj16 Controller Working Position /Human Machine	
	Pj17 SWIM Infrastructure	
	Pj18 4D Trajectory Management	
DEVELOPMENT AREA	***VERY LARGE SCALE DEMONSTRATIONS* PROJECT**	**INECO'S PARTICIPATION**
High Performing Airport Operations	Pj28 Integrated Airport Operations (Inc.TBS)	
Optimized ATM Network Services	Pj24 Network Collaborative Management	X
Advanced Air Traffic Services	Pj23 Flexible Airspace Management and Free Route	
	Pj25 Arrival Management	
Enabling Aviation Infrastructure	Pj27 Flight extended to En-Route Airspace Information Exchange	
	Pj31 Initial Trajectory Information Sharing	

In addition to these projects, there are other transversal projects intended to ensure that all work is aligned and consistent with the strategy set out in the European ATM Master Plan.

Welcome Mr. VIP

Ibiza airport launched a new space this summer. Measuring 186 m², the new lounge has received domestic and international VIP passengers visiting the island, of whom there is a growing number year on year: only in July, the airport logged 2,880 private and executive flights, a 14.1% increase compared to the same period in 2015.

With the collaboration of **Roberto Serrano,** aeronautical engineer, and **Amelia Díaz,** architect

The VIP lounge features a passengers' waiting area and restaurant and office areas, with a partitioned space housing the toilets and service areas.

The new lounge, large enough for 40 guests, is located in the terminal's boarding area. The space was launched in response to growing demand for a differentiated service, highly desired on an island accustomed to receiving all kind of artists and personalities who seek privacy during their holidays. The lounge has catering services, international daily newspapers, screens with flight information, a cloakroom, toilet facilities, television, telephones, fax, computers and a free wifi internet connection. According to Aena, its construction involved an investment of 281,586.91 euros, with the management being awarded to Clece, a specialist company that already manages other VIP lounges for Aena.

A PROJECT DESIGNED BY INECO

Ineco designed the plans for the 186 m² lounge, which houses the typical spaces for an installation of this type: a passengers' waiting room, catering and office areas and a partitioned space housing the toilets and service area. The entrance to the lounge is inspired by the traditional construction of Ibiza: a trapezoidal portico, factory-made and clad in lime mortar, giving it a rustic appearance.

Once inside, visitors will find the reception area, behind which is the newly-built "capsule" space containing the toilet facilities and service area of the new lounge. The rest of the space is not compartmentalised, with the different sections being distinguished by the finishes of the materials and furniture.

The waiting area stretches along the airside curtain wall, making it the part that receives the most natural light. This area is distinguished from the rest of the lounge by a differently-coloured floor and furniture. "Islands" of seating are created by grouping together separate individual chairs around low, wooden tables and separating rows of seats, allowing users greater privacy.

In centre of the lounge, the waiting area is divided from the catering area by an office space, where users of the lounge can plug in their laptops and enjoy connections both to the Internet and to mains electricity. The space is made up a "bar" type table, equipped with power outlets and adjustable stools to favour working with computers.

Beside the office area, the back of the lounge contains the catering area, furnished with high and low tables. The office area features a fridge for cold drinks, a wine rack, a microwave and a coffee machine.

ACCESS AND RATES

The lounge is accessible to people with reduced mobility. It can be used by customers of all airlines operating at the airport with contracts to access the lounge, and by passengers who have credit cards or loyalty cards from companies affiliated to Aena's VIP lounges.

The lounges are open to any passenger who makes prior payment at the VIP lounge reception desk or through Aena's website or app *(www.aena.es)*. The current rates are 27.30 euros for adults and 13.15 euros for children older than six with free access for children up to five years old. Opening hours are from 06:00 to 00:30 in summer months and 06:15 to 22:45 in the winter. ■

City lights (and shadows)

Ineco participated in Habitat III, the largest global event dedicated to urban development, which took place in Quito from 17–20 October. The company gave presentations on its experience in transport planning, sustainable mobility and services to the city. It was the third global conference –the first was held in 1976– which this time focused on the challenges faced by an increasingly urban planet threatened by climate change.

With the participation of **Ainhoa Zubieta,** civil engineer, and **Blanca Martín ,** geographer.
Photos: **Earth Science and Remote Sensing Unit, NASA Johnson Space Center** and **Habitat III**

QUITO, HOST CITY OF HABITAT III
Habitat III was held in the capital of Ecuador (large photo) with over 35,000 participants and more than 120 mayors of cities all over the world, including Madrid, Barcelona and Quito itself (bottom image). In the first row, the Ecuadorian Minister for Urban Development and Housing, Ms Ángeles Duarte, the then Secretary General of the United Nations, Mr Ban Ki-moon, and the Executive Director of UN-Habitat, former Barcelona mayor Mr Joan Clos.

The world is increasingly urbanised, and in just a few decades it will be even more so. Cities only make up a tenth of the world's land, yet today more than 55% of the total population (7,800 million people) live in them. By 2050 this percentage will have reached 70% of the world's population, estimated at 10,000 million. These are the figures handled by UN-Habitat, the United Nations programme devoted to housing and sustainable urban development, i.e. to ensuring that human settlements are adequate and decent for people and that they respect the environment.

The process of urbanisation –with all its social, economic and environmental repercussions– is happening on a global scale, at an increasingly fast pace and spontaneously, giving rise to urban settlements that lack the minimum infrastructure and services to ensure the quality of life and development of their inhabitants. Adequate planning of both urban growth and transport networks –especially in large metropolitan areas– is one of the keys to making cities into habitable environments that are sustainable, safe, fair and friendly for their inhabitants.

We cannot talk of city planning from one sole point of view or one sole model: we have to consider what makes each urban area unique in order to offer effective solutions that respond to specific problems.

For this, we require political will, commitment from all actors (state, private and civilian), as well as availability of economic and financial resources, which will enable policies and actions to be agreed to achieve a sustainable development model.

In the current context of rapid urbanisation, planning has new challenges to confront, such as slowing down climate change, backing sustainability and fighting against growing social inequality. For this, it is necessary to ensure universal access to basic services such as transport, water, sanitation, energy, communications and equipment.

A highly organised urban model with sufficient equipment and public spaces, affordable housing and sustainable mobility offers people more opportunities of employment and training as well as access to essential services like healthcare and education, among others, thus minimising urban imbalances and inequality.

The United Nations Conference on Housing and Sustainable Urban Development, Habitat III, held in Quito, Ecuador, from 17–20 October 2016, brought together over 35,000 participants and covered all these topics through numerous conferences and events in which the various agents debated and presented their proposals to tackle the urban problems of the future. Among its main conclusions were the pursuit of social inclusion and eradication of poverty, sustainable and inclusive urban prosperity, and the assurance of a sustainable, resilient environmental balance through city planning.

> ADEQUATE PLANNING OF BOTH URBAN GROWTH AND TRANSPORT AND SERVICE NETWORKS IS KEY TO ACHIEVE THE PRINCIPLES OF EQUITY, SOCIAL JUSTICE AND SUSTAINABILITY

The result of this meeting, translated into the so-called New Urban Agenda, gathered and took on the conclusions and commitments made by the international community in another two global forums of colossal importance for the planet's development: the historic Paris Agreement on Climate (COP21) in December 2015, in which 195 countries signed the first binding global agreement to reduce global warming and slow down climate change, and the 17 goals of the UN's Sustainable Development Agenda 2030.

MOBILITY FOR URBAN DEVELOPMENT: INECO'S EXPERIENCE

Ineco, as part of the Spanish government's delegation, took part in this global conference, presenting its planning, consultancy and transport engineering experience, a field in which we have decades of experience, as well as in other, more recently developed sectors linked to sustainable development, such as management of water resources and waste or smart cities.

The company has taken on an extensive range of engineering and consultancy work in these fields, to which it takes a comprehensive approach, marrying the interests of public administrations, businesses and society, and always including the environmental and social aspect to products through environmental assessments and socialisation projects.

As such, Ineco has successfully completed projects of all kinds in relation to urban and interurban mobility: from technical, economic, financial, legal and environmental impact feasibility studies (such as those performed on the Bi-oceanic Corridor for the governments of Bolivia and Peru) to drawing up projects and supervising infrastructure construction (conventional and high-speed railway lines and stations in Spain, Arabia, Turkey, India, etc.), airports, highways, access to ports and logistics centres, etc.

Among the studies carried out by Ineco to improve bus transport have been the reordering of buses in Algiers, the Bus Transport Strategic Plan in Oman, and the sustainable technology study for the buses of São Paulo. In metro systems, we have extensive experience in Spain (Madrid, Barcelona, Valencia, Seville, etc.) and in Medellín, São Paulo and Santiago de Chile. In terms of trams and light metros, also in Spain, we have worked on studies and projects in Madrid, Bilbao, Logroño, Zaragoza, León, Tenerife and Alicante, and on new schemes in Belgrade and Kuwait, as well as studies for tram renovation in Tallinn, in Latvia and in Pavlodar in Kazakhstan. Our suburban railway work includes the comprehensive projects between Caracas and the Valles del Tui in Venezuela, the studies for building a railway system in San José, Costa Rica, the Belgrade Light Metro and the Buenavista-Cuautitlán line in Mexico.

Comprehensive strategic, multimodal planning on a national, regional or local scale is another of the company's specialities; for over four decades we have cooperated with the Spanish government to develop their national plans –PITVI (the Infrastructure, Transport and Housing Plan) is the most recent– but also with other governments such as those of Ecuador, Costa Rica, Oman and Algeria. Croatia and Malta, which are also planning their national strategies, commissioned a vital part of their plans to Ineco: that of preparing their national transport models (see pages 34-37) which, in Malta's case, enabled Ineco to take part in the development of the National Transport Strategy, the National Master Plan, and finally the Strategic Environmental Assessment.

On a local level, it is worth mentioning the drawing up of Urban Mobility Plans, management tools to structure mobility policies towards methods for more sustainable movement in municipalities such as Hospitalet de Llobregat (151,000 inhabitants), Logroño (228,000) and A Coruña (244,000), where in addition to optimising public transport we also seek to strengthen non-motorised modes of transport, such as travel by foot or by bicycle.

> THE COMMITMENT OVER THE NEXT 20 YEARS IS FOR CITIES TO ACT AS DRIVERS OF CHANGE AND CONTRIBUTE TO ACHIEVING THE ENVIRONMENTAL AND QUALITY OF LIFE GOALS BY THEIR OWN DESIGN AND MANAGEMENT

For example, in Muscat, the capital of Oman, the starting point was one in which there was considerable presence of private vehicles and absence of railway networks, and it was concluded that a new, well-run network of buses would be the basis for the future public transport network. Ineco designed and presented a plan for the city in 2015 (starting with route proposals towards a new management model based on a single transport authority, among many other aspects) and subsequently the Bus Transport Strategic Plan for national public transport operations. The Omani government acquired a modern, state-of-the-art vehicle fleet to equip new urban and long-distance routes, and has put in place, among other means, a new legislative framework which is transforming the public transport system in the Sultanate (see *IT57*).

TOWARDS THE FUTURE OF THE CITY

Ineco has expanded its activity to planning other public services like water and waste: as such, it prepared the Master Plan for Comprehensive Waste Management in the Metropolitan District of Quito (see *IT58*), based on a circular economy strategy with direct application methods and an effective legal framework; and studies for supervising the National Irrigation Plan in Ecuador with the aim of optimising water resource management, and it is elaborating Panama's National Plan for the Collection and Treatment of Solid Waste, which will set out the means necessary to solve national waste management problems.

For Smart Cities the use of technology enables dynamic, real-time information to be obtained by installing sensors (the "internet of things") and the vast quantity of data gathered via Big Data platforms to be processed. The Smart City model enables the management of multiple services to be optimised, from waste collection to traffic management, with the resulting benefit to the environment of reducing emissions, energy consumption and water, among other resources. It also enables citizen participation and administrative transparency to be increased. In this field, Ineco is working on the development of its platform CityNECO, with a pilot project for Granada City Council.

In short, the company, which presented some of its projects at Habitat (see *News* in this issue), believes in and works towards an urban model planned with an agreed comprehensive approach that is economically, socially and environmentally sustainable, with cleaner air, more space for pedestrians, greater abundance of water and biodiversity, and greater involvement of citizens, at the heart of a more polycentric, fluid urban structure in which information is available to assist people's development and wellbeing. ■

1. Madrid
2. Rome
3. London

4. Mecca and Jeddah
5. Cairo
6. Kuwait City

Top models

Ineco's experts develop transport models which simulate and visually represent future flows of passengers and goods, demand and the development of all kinds of traffic at the local, national and international levels. These simulations are valuable, effective tools for the planning of all kinds of transport infrastructures and networks, improving design and optimising investment.

With the collaboration of **Beatriz de Frutos** y **Ana Olmeda**, civil engineers

The Maltese islands, with their extremely high population density (the highest in the EU and the eighth highest in the world), suffer congestion problems and traffic jams due to the extensive use of private passenger cars. The islands have no railway network, however maritime and aviation are important modes of transport both to and from mainland Europe and between the islands. Croatia, on the continent, is almost 180 times larger than Malta by area, but has a far lower population density. The country's highways, roads and railway lines are currently undergoing a process of renovation and modernisation, as are river transport routes on large inland waterways such as the Danube and the Sava.

There are significant differences between Malta and Croatia in terms of their size and population; however both are currently in the process of planning the future growth of their transport networks, crucial for ensuring the proper working of their economies.

Both countries commissioned the services of Ineco experts, who prepared their respective National Transport Models to support their medium and long-term planning strategies. In Malta, the National Master Plan was also developed.

Using the leading software tools on the market (Aimsun, Legion, Visum, EMME, TransCAD, CUBE, WITNESS, HCS, ArcGIS and Viriato, among others), the transport modelling consultant team of the company develop models which depict reality and enable forecasts to be made, offering a clear, simple representation of complex realities. In this way, governments and transport authorities avail of a highly effective decision-making tool and are also able to compare the possible effects of these decisions in different scenarios and time horizons.

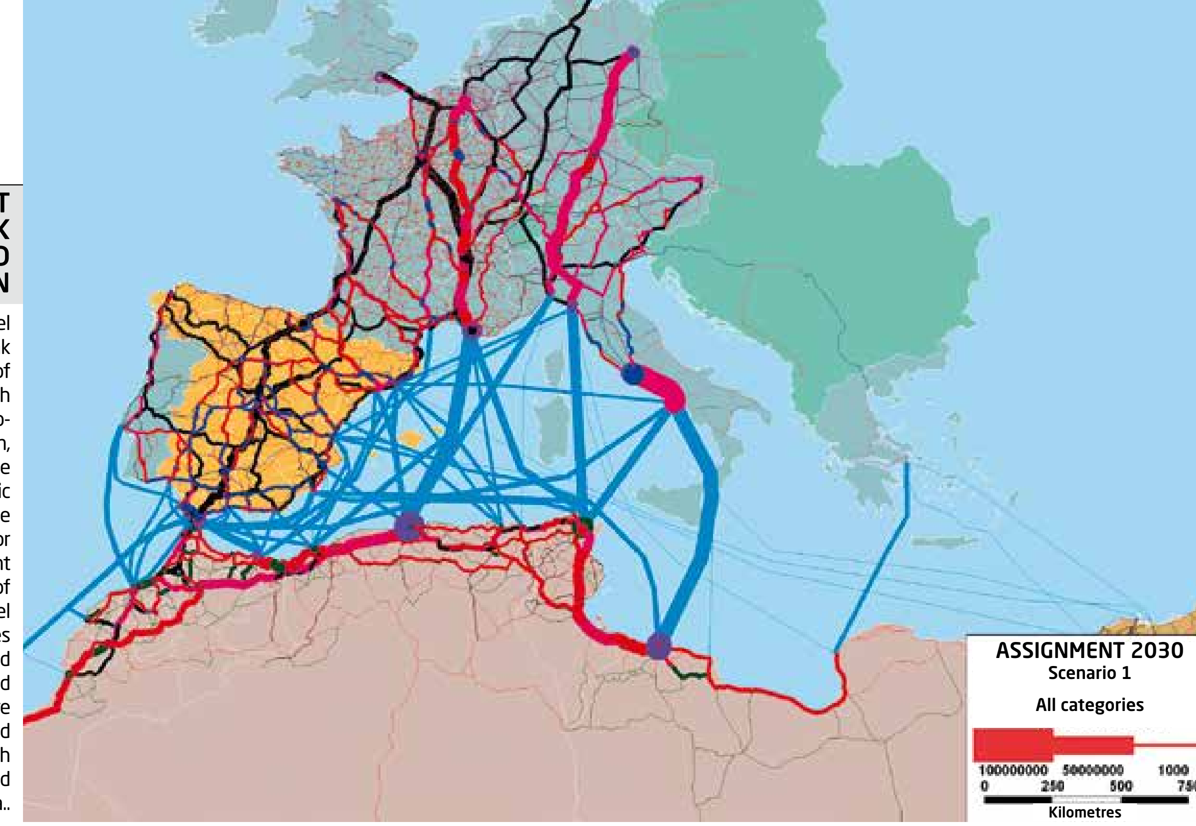
And there's more. Models and simulations can take many different forms and be developed at different scales, from the effects of a new traffic light at a crossroads, to the demand analysis of a new highway or airport affecting an entire region or a country. They can also serve a range of purposes, from estimating traffic or demand to identifying weaknesses in the design of all kinds of infrastructure and public spaces (for example, spaces causing queues or congestion in stations or which prevent the correct operation of ground handling vehicles on airport runways); they can even be used to study the punctuality of a high-speed railway line.

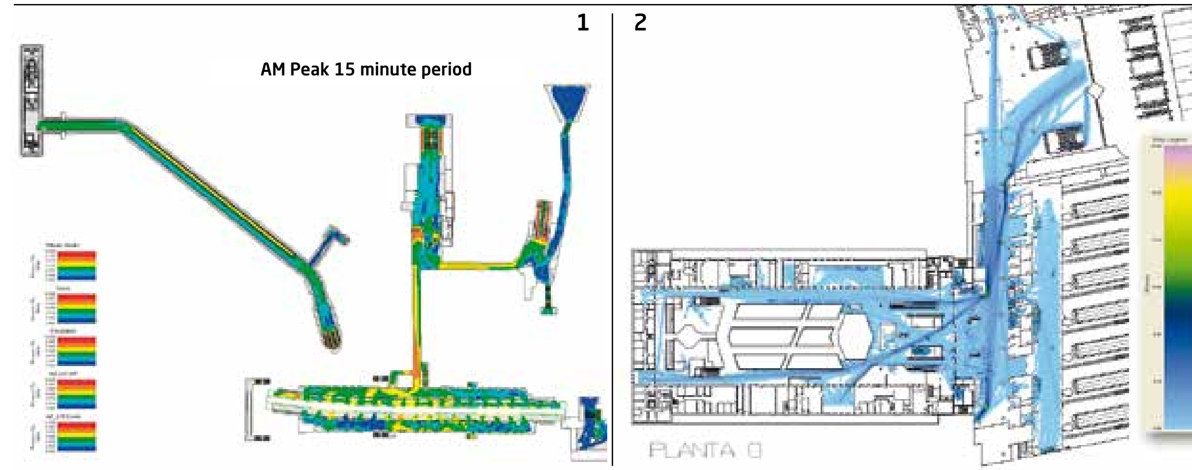
These examples are taken from some of Ineco's real assignments from recent years, which also include "tailor-made" models for specific projects.

MALTA AND CROATIA COMMISSIONED THE SERVICES OF INECO EXPERTS, WHO PREPARED THEIR RESPECTIVE NATIONAL TRANSPORT MODELS AS A CRUCIAL PART OF THEIR MEDIUM AND LONG-TERM PLANNING STRATEGIES. IN MALTA, THE NATIONAL MASTER PLAN WAS ALSO DEVELOPED

TRANSPORT NETWORK MODELLING AND SIMULATION

Traffic forecast model for the fixed link through the Strait of Gibraltar. Created with the TransCAD macro-simulation application, the tool enables the development of traffic demand forecasts for the railway tunnel, both for passenger and for freight transport. The area of influence in the model includes all countries whose goods trade and passenger flows could be affected by the future Strait of Gibraltar fixed connection: Spain, much of the rest of Europe and northern Africa..





PEDESTRIAN SIMULATION

1. Pedestrian model for the Bakerloo-Paddington Station connection (London). Map of the level of service during the morning peak hour.

2. Pedestrian model of Puerta de Atocha station (Madrid). Map depicting Space Utilisation, and reveals how much space is being used within the station.

OPTIONS FOR EVERY NEED

▶ Transport network models and simulation
Transport models that can encompass countries, regions, cities, districts, etc. They are used in studies to estimate demand on transport services and infrastructure, traffic studies for concessions and the evaluation and comparison of different demand scenarios for planning at the international, national, regional and local levels. Noteworthy examples among Ineco's projects are the national transport plans for Costa Rica, Ecuador, Algeria and Malta, the Croatian national model (see *IT51),* and the model developed in Oman for the planning of the Bus Transport Strategic Plan for Mwasalat, the public transport operator (see *IT57).*

▶ Pedestrian simulation
Knowing how people move through public spaces, buildings and different facilities makes it possible to develop safe, effective plans while saving costs and time. Pedestrian traffic simulations are used to analyse the flow of people under normal conditions or in emergency situations, enabling evacuation times to be calculated for railway stations, airports, etc. They also make it possible to determine level of service for pedestrians and the experience of the user (discomfort, frustation, dissatisfaction etc.) related with the design of platforms, entrance halls, stadiums, etc., in order to compare different scenarios, determining the most appropriate alternatives from the pedestrian's point of view and identifying design weaknesses and vulnerabilities and low-comfort areas for pedestrian flows. The company has developed these types of simulation for enlargement works at the high-speed railway stations of Atocha and Chamartín in Madrid and for Paddington Station-Bakerloo link in London.

▶ Microsimulation
Highly detailed simulation of transport networks, showing the dynamic and individual effects of vehicles and the interaction between different elements of the environment (traffic lights, crossings, roundabouts, etc.). They are used to assess the functioning of traffic in urban areas (intersections, traffic lights, tram crossings), and access roads for points of interest (airports, railway stations, etc.). Models were developed for Madrid-Barajas, Málaga and Rome-Fiumicino airports to study the effect of ground handling vehicles (supporting aircraft) on airside operations and possible fleet requirements.

▶ Tailor-made models
On many occasions, transport models need to be developed *ad hoc* for adaptation to the customer's specific needs, either by building on the functionality of commercial software or by developing original solutions. These are used to design, analyse and optimise processes and for systems that are progressing over time. An example of the application of these kinds of projects is the *Witness* model developed by Ineco for the analysis of punctuality of the Madrid-Barcelona high-speed line (see *IT29).*

▶ MALTA

On the Maltese archipelago, which is made up of five islands (Malta, Gozo, Comino, Cominotto and Filfla, of which only the first three are inhabited), the most widely used form of transport is the private car. The level of car ownership in the country, at 759 vehicles per thousand people, is one of the highest in the European Union, as are the density of its road network, at 762 kilometres per 100 km², and its population density, at 1,325 people per km², compared to the European average of 117. And all of this in a territory of just 316 km².

In such a unique context, the Maltese government established the islands' need for short, medium and long-term transport planning, which would require thorough preliminary analysis. In 2014, the through transport authority, Transport Malta, the government ran a public tender to carry out the analysis. The winning bidder was the consortium made up of Ineco and the Italian company Systematica with the support of the Maltese firm ADI Associates, tasked with developing the strategic environmental assessment of the proposed measures.

The consortium's first task was the development of a model, using the specialised CUBE software. The model served as the support for the National Strategy and the Transport Master Plan 2025. All modes of transport (land, maritime and aviation; public and private) were analysed in different scenarios, "do-nothing" and "do-minimum", within a range of timeframes. The reference points used were the years 2020 and 2025, with 2050 also being used to provide a long-term view; a comparison was drawn between the effects of various changes to the transport network and services. The model particularly illustrates the effects of the tested measures on congestion, modal split and the external impacts of traffic (accidents, GHGs and pollutant emissions).

The laborious process of creating the model has assisted in accurately quantifying the issues currently affecting the different modes of transport and has provided understanding of their causes. The results are shown in the Transport Master Plan 2025 and the medium and long-term objectives of the National Transport Strategy 2050. The Plan compares four possible scenarios: "do-nothing", "do-minimum" and the "do-something" scenarios "1" and "2". The "do-something" interventions consist in measures to restrain the use of private cars and increased support public transport and alternative modes (walking, cycling, etc.), with the first proposing moderate restraints and the second being stricter. The purpose of these scenarios is to assess the combined effect of various measures on Malta's transport system as a whole.

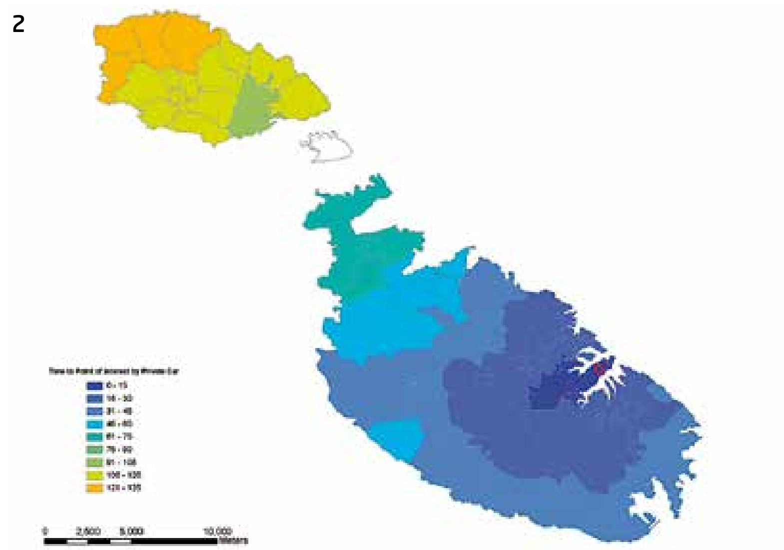
For example, data analysis reveals that congestion, especially on the five radial roads connecting the capital Valletta with the rest of the island, would be most greatly reduced in "do-something 2" scenario, the most restrictive option.

1

MALTA

1. Ineco's Alberto Milanés, Beatriz de Frutos and Marta Vilaplana alongside Transport Malta and Systematica staff during the latest visit to Malta. **2.** This map, generated for the model, shows private transport accessibility to Valletta. **3.** Traffic volume on roads in 2025 under "do-something 2" scenario.

2



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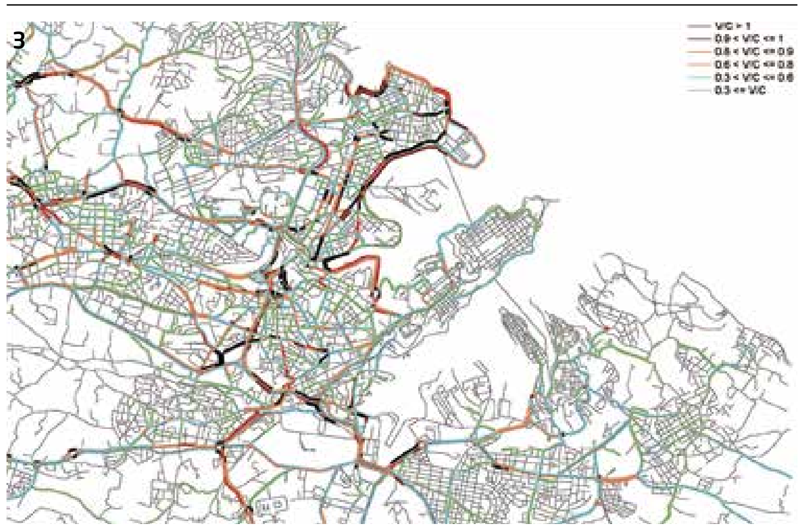
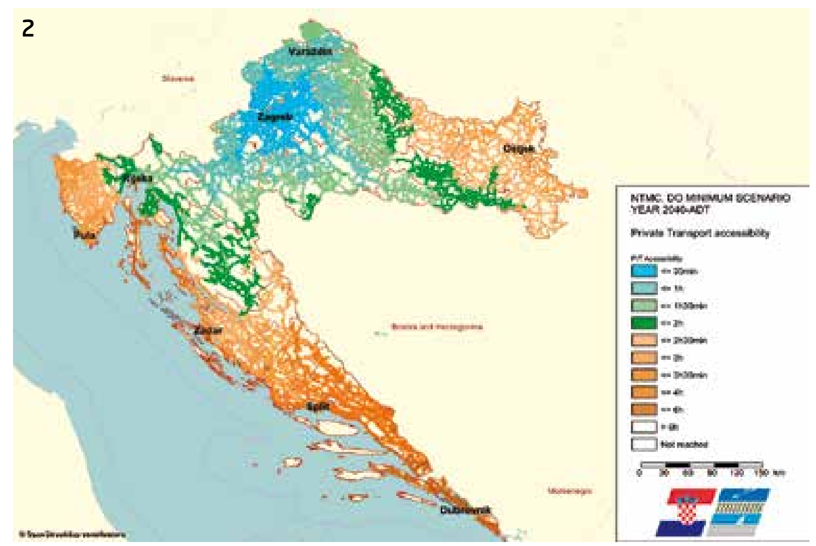


1

CROATIA

1. Part of the international team made up of five companies: PTV Group, PNZ, Ineco, Promel and the University of Zagreb. **2.** Private transport accessibility map for the city of Zagreb (in 2040) under a "do-minimum" scenario, dependent on the quality and development of the road network. **3.** Public transport accessibility map for the city of Zagreb in 2040 under "do-minimum" scenario.

2



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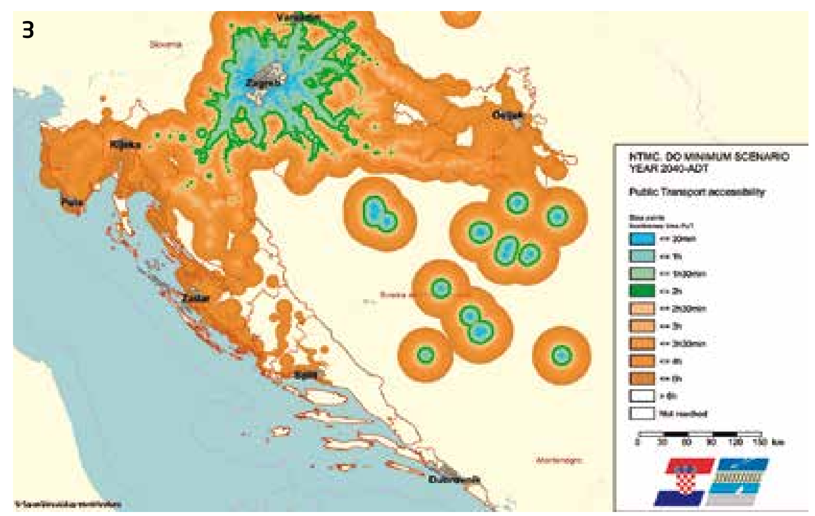


▶ CROATIA

After joining the European Union in July 2013, Croatia undertook to review and update its long-term transport plan, which dated from 1999. To that end, an international consortium of five companies (PTV Group, leading the consortium, and PNZ, Ineco, Promel and the University of Zagreb) was commissioned to prepare the National Transport Model for the Republic of Croatia, intended to accompany and support the development of the new National Transport Strategy.

The Croatian government, through its Ministry of Maritime Affairs, Transport and Infrastructure, would therefore possess a valuable tool supporting medium and long-term decision-making, for planning connections to the rest of the European Union and domestic transport. Work began in 2014 and the model was developed over the following 24 months. Using 2013 as a base year and with three forecast time horizons (2020, 2030 and 2040), all modes of passenger and freight transport (road, rail, public road transprot, non-motorised transport, maritime, inland waterways and air transport) were analysed under different scenarios with and without implementation of transport strategies, measures and projects in the transport network.

A multi-modal 4-step model with generation, distribution, mode choice and assignmet on the network for passenger and freight traffic was developed. Different approaches for both passenger and freight traffic were used to better represent and model their particular characteristics. The simulation was fed with data such as the costs and travel times for different modes, socio-economic data, road network capacity and passenger behaviour information, obtained through a household survey carried out specifically for the project in 2015. The survey revealed, for example, that different parts of the country have different travel behaviour patterns. On account of this, the model incorporated a distinction between the Continental and Adriatic regions.

For freight transport, the complexity and heterogeneity of the sector were taken into account. For this reason, a highly disaggregated approach was used to calculate freight volumes, based on the origin and destination of homogenous commodity types. The main input data were the transport network data, socio-economic data, the national production of each commodity, import and export data and operational and cost parameters, among others; models were developed for both domestic and external freight flows (including import, export and transit).

Once the model was calibrated and validated, the different timeframes of 2020, 2030 and 2040 were simulated in two scenarios: "do-minimum" scenario to point out the bottlenecks and gaps in the transport system, and "do-something" scenario including the measures proposed in the National Transport Strategy. Obtaining results such as traffic flows in the different networks, the volume/capacity, indicators of accessibility to major cities, etc. made it possible to assess, formulate and prioritise the influence of different strategic measures for effective and sustainable traffic development on the country. ■

SAMSUN-KALIN LINE
The aim of the project, under the Turkish Ministry of Transport, is to improve the connections between the interior of the country and the Black and Mediterranean Seas. The image shows the Ineco project leader Francisco Ramos (right) supervising the execution of the crossings for laying cables, together with İlhan Kök, UBM technician, and Ümit Terzan, TCDD (Turkish State Railway) technician, on the stretch opposite Suluova station in October.

Journey to the 21st century

A consortium of which Ineco is a member will supervise the restoration work on this 377.8 km-long railway line, which connects the centre of Turkey with the Black Sea, until 2019. Built in the first half of the 20th century, it will be completely renovated and equipped with modern signalling systems.

With the participation of **Roberto López,** civil engineer and **Francisco Ramos,** telecommunications engineer

In 2015, Ineco in collaboration with consultancies UBM and Mott MacDonald, won the contract to supervise and direct the modernisation works on the 377.8 kilometre-long railway line (and the branch line between Samsun and Gelemen, of just over 10 km) which links the cities of Samsun, on the coast of the Black Sea, and Kalin, in the centre of the country, where it intersects with the Ankara-Sivas line.

With this project, Turkey continues to work on modernising its railway network, for which it receives funds from the European Union via the IPA (Instrument for Pre-Accession Assistance), aimed at financing economic development projects in candidate countries for EU membership.

The aim of the project, under the Turkish Ministry of Transport, is to improve the connections between the interior of the country and the Black and Mediterranean Seas. Its construction was completed in 1932 and it is a conventional, single-track, non-electrified, non-signalled, international gauge line running through a mountainous area. It has 47 tunnels –the largest of which is 556 metres long– which add up to a total of 7,259 metres and 29 stations.

INECO WILL SUPERVISE THE SIGNALLING AND COMMUNICATIONS AND ENERGY SUPPLY WORKS FOR 46 MONTHS AND COORDINATE THE ELECTROMECHANICAL INSTALLATIONS TEAM

As part of this consortium, Ineco will supervise the signalling and communications and power supply works for 46 months and coordinate the electromechanical installations team.

The ERTMS/ETCS-L1 signalling system will be implemented over the entire line, which will increase the maximum speed from 70 to 120 km/h. The new system will be capable of conducting train traffic operations with intervals of five minutes.

As concerns the works on the track infrastructure, the alignment and drainage will be improved and the ground stabilised; the platform expanded; the bridges, viaducts and overpasses restored, as well as the retaining walls and structures.

In terms of the superstructure, the ballast, track and sleepers will be renovated, as well as level crossings –of which there are more than 124– and turnouts will be replaced. As regards stations, 40,800 metres of track will be restored and another 800 built, as well as new platforms at Turhal, Zile and Kizoglu stations.

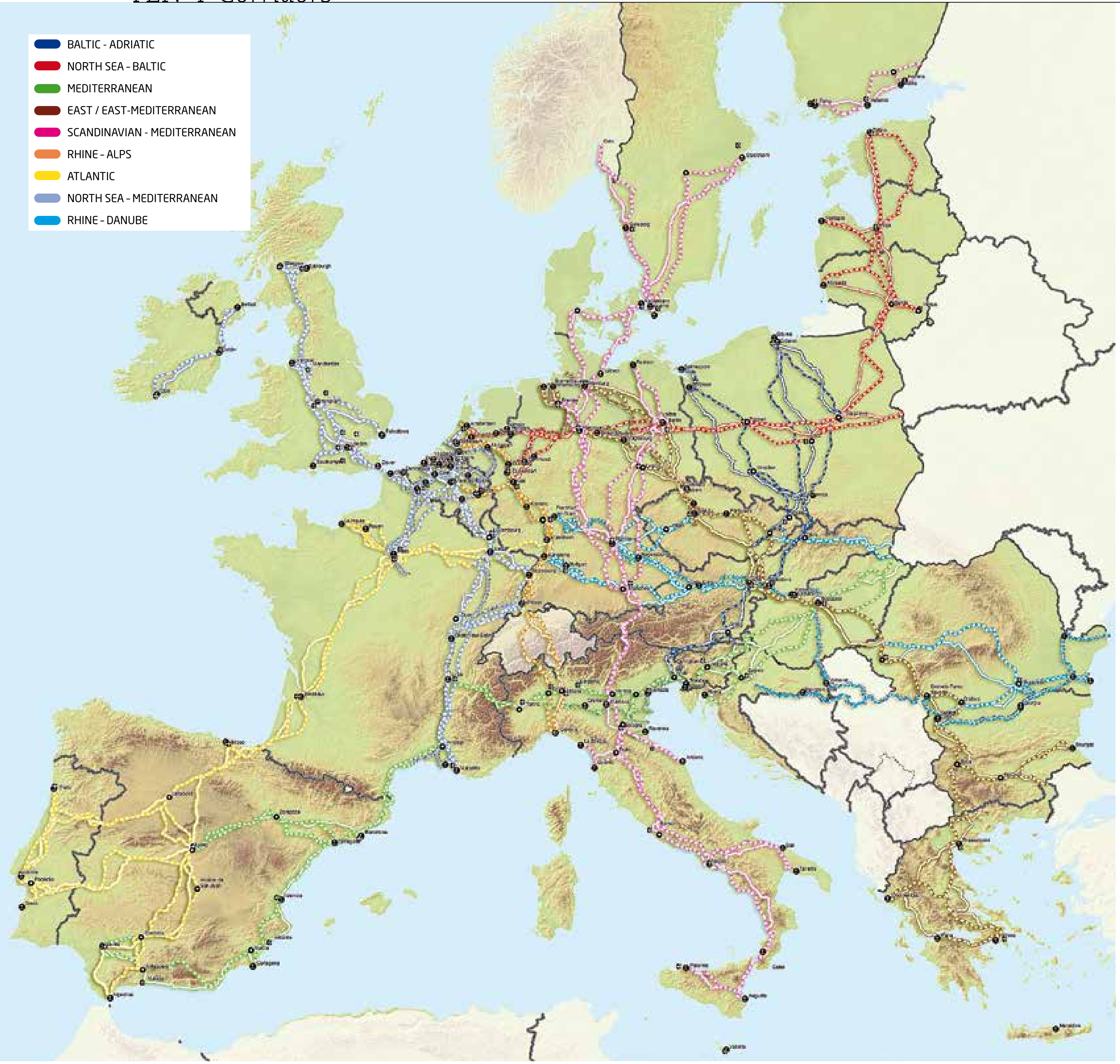
In 2010, Ineco won another similar contract to supervise the high speed adaptation of the Inönü-Köseköy stretch at the centre of the Ankara-Istanbul line (see *IT46* and *IT51*). ■

Ineco, in collaboration with the consultancies UBM and Mott MacDonald, are supervising and directing the modernising works on the Samsun-Kalin railway line (1). The alignment (2) and drainage will be improved and the ground will be stabilised (3); the platform will be expanded; the bridges (4), viaducts and overpasses restored, as well as the retaining walls and structures (5). In terms of the superstructure, the ballast (6), track (7) and sleepers will be renovated, as well as level crossings, and turnouts will be replaced. As regards stations, 40,800 metres of track will be restored and another 800 built, as well as new platforms at Turhal (8), Kizoglu and Zile (9) stations. Finally, new signalling and communications systems will be installed –such as ERTMS/ETCS level 1 (10)– in order to modernise the existing ones (11), which will increase the maximum speed to 120 km/h, up from the current 70 km/h.

Spain connected to Europe from port to door

Member States seek methods to make progress in putting the Atlantic and Mediterranean corridors in place. Two large routes for transporting passengers and goods, linking the main ports and urban nodes of southwest Europe with the large industrial centres on the continent.

By **Esther Durán** y **Carolina Sanz**, civil engineers



Improvement of transport routes has been, since ancient times, a constant quest for the survival, wealth and development of peoples. With the creation of the European single market, having an interoperable transport network became one of the basic foundations to make economic relations between member states possible. The aim was to have modern infrastructure for the transportation of passengers and goods, held together by common legislation and technology that would exceed the simple juxtaposition of national roads. Thus began the trans-European transport routes, called TEN-T corridors, which comprise transport by road and railway, including waterways and seaports, as well as the airport network. Also in this category are smart transport management systems, like Galileo, the European system of satellite radionavigation (see *IT 17*), or the European Rail Traffic Management System (ERTMS).

In the 1980s, the EU began to establish which priority routes where greatest management and financial efforts would be directed, with the aim of facilitating communications, mainly between the main seaports and the large industrial areas and logistics centres of EU countries. On the basis of the studies conducted came the nine major Core Network Corridors (CNC) which structure Europe. Due to Spain's outlying geography within the European continent, two of the nine corridors run through it: the Atlantic Corridor and the Mediterranean Corridor.

Subsequently, European Union Regulation N.º 1315/2013 established the specific alignments and nodes that make up each corridor, as well as the technical requirements necessary to have a solidly structured, homogenous, multimodal network that provides the backbone of European mobility in place by 2030.

The studies on the Core Network Corridors, conducted by consortia of consulting companies in the Member States, include analysis of demand, traffic forecasts, identification of improvements to transport networks and services, environmental impact analysis, innovation methods, etc. The analyses of these studies enable the projects and means necessary to meet the technical requirements set out in European law to be established. This must be implemented by Member States under the supervision of the European Commission.

STUDIES AND WORK PLANS FOR EACH CORRIDOR

In 2014, a total of 265 projects were identified for the Atlantic Corridor, of which approximately 40% were railway projects, 24% were ports and 23% intermodal. In the case of the Mediterranean Corridor, in the 2014 study, 300 projects were identified, of which 44% were railway projects and 20% involved ports.

Since 2015, the EU has promoted the preparation and implementation of new work plans with specific actions to give impetus to the Atlantic and Mediterranean corridors, two projects considered to be top priority, in which Ineco has participated very actively since the origins. Proof of this is to be found in the previous studies on the EU corridors, as well as studies of the Vitoria-Dax, San Sebastián-Bayonne and Figueres-Perpignan railway connections, and the current studies of the Atlantic Corridor and the Mediterranean Corridor up until the end of 2017.

When the lists of projects and methods of each corridor are drawn up and the targets set out by the European Commission are met, they must be put up for political consensus among the various Member States, central governments and the regions, as well as cooperation and understanding between the various state and private agents involved. This is why the *Corridor Fora* and *Working Groups*, regular meetings that take place at the European Commission's headquarters in Brussels, to which all stakeholders are invited, are very important. In the *Corridor Fora*, the consultants present the main progress from the corridor studies and open debate is held on the most important issues, offering attendees the possibility to respond or make comments. In the case of the *Working Groups*, specific technical issues are discussed, for example border matters, aspects relating to urban nodes, ports, logistics terminals, etc. in sessions with fewer participants, directed solely to the agents involved in each case. Both in the *Corridor Fora* and the *Working Groups*, the role of the consulting teams is fundamental, as they are coordinators and integrators to ensure that the studies are conducted holistically, prioritising the objectives of the corridor over individual interests.

PROJECTS AND EUROPEAN SUBSIDIES

The projects selected for each corridor and the European subsidies awarded to them are decisions of key importance both for the actors involved in international trade –infrastructure managers, shippers and logistics operators– and for the economic development of the Member States. Good evidence of the interest surrounding this is provided by the 2,800 transport companies and the 22 European ministers who attended the TEN-T Days 2016 conference, held in Rotterdam in June. The European Commission's actions have objectives in the short (2020), medium (2030) and long term (2050), and 2050 is the final year of development, by which goods transported by land are projected to increase more than 50%.

THE MEDITERRANEAN CORRIDOR

From the port of Algeciras to Budapest

The Mediterranean Corridor comprises more than 3,000 kilometres, which connect the eastern half of the Iberian Peninsula with the Mediterranean side of France, north of Italy, Slovenia, Croatia and Hungary, before finishing at the border with Ukraine. According to official data in 2014, the regions along the Mediterranean Corridor comprise 18% of the population of Europe and contribute 17% of gross domestic product.

Functionally, one of the most significant challenges of this corridor is efficiently connecting the main seaports of the Spanish Mediterranean coast (Barcelona, Tarragona, Valencia, Cartagena and Algeciras) with central Europe. As such, the aim of the most important activities is to connect Spain's ports with an international standard gauge of 1,435 mm, alter the rail network so that trains of up to 740 m can run, and remove bottlenecks. Many of these actions, those which affect the section between Castellbisbal and Almería, are currently in progress and/or the project preparation stage, in which Ineco is also participating actively.

Another key aim is to build an east-west multimodal transport axis. Additionally, the construction of an east-west multimodal transport axis has been planned to benefit and enable economic relations in southern Europe, where some of the most important urban centres are located: Madrid, Valencia, Barcelona, Marseille, Lyon, Turin, Milan, Venice, Ljubljana, Zagreb and Budapest. To make this east-west axis come to fruition, the major projects centre around eliminating the current lack of continuity in border crossings between countries, especially between Spain and France (Figueres-Perpignan), France and Italy (Lyon-Turin) and Italy and Slovenia (Trieste-Divaca). The future high speed Lyon-Turin section involves building a 57-kilometre base tunnel, which will be one of the longest railway tunnels in the world. Base tunnels are one of the largest European investments to ensure the railway's competitive advantage over travel by road and consequently a road-rail modal diversion in especially sensitive areas like the Pyrenees or the Alps, geographical obstacles that strongly condition this corridor.

The consortium commissioned to conduct the Mediterranean Corridor study comprises PwC, Ineco, SETEC and Panteia. PwC is the consortium leader and is responsible for maintaining an up-to-date list on projects worked on by Italy, Slovenia and Croatia. SETEC and Panteia are responsible for French and Hungarian matters, respectively. Ineco shares responsibility for keeping an up-to-date list of Spanish projects with PwC Spain, providing its railway and air transport experience. Spain is a key player in the Mediterranean Corridor, as 45% of the railway corridor traverses our country, spanning the Algeciras-Madrid-Barcelona-French border, Barcelona-Valencia-Almería and Almería-Antequera-Seville sections. Ineco also leads the part relating to innovation in task 3b of the study, in which expansion of the list of Mediterranean Corridor projects is analysed, paying attention to more cross-cutting aspects.

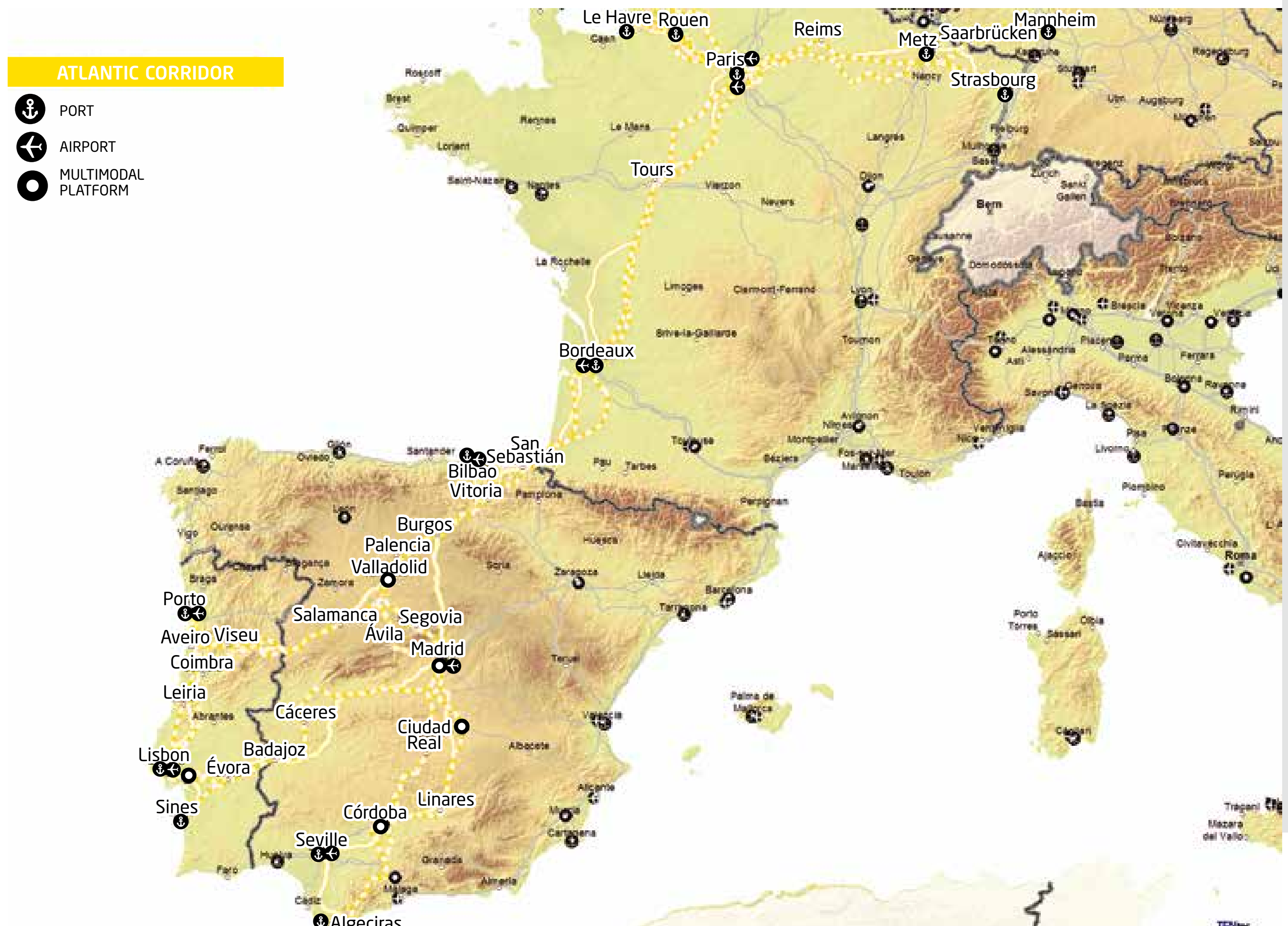
Since in the first studies presented in 2014, 300 projects were identified, the aims of the Mediterranean Corridor consortium members centre on defining, prioritising and estimating the most essential activities, among which what is sought is to enable goods to be transported by railway rather than by road. It is calculated that, with total implementation of the corridor in 2030, 40 million tonnes of goods could be transferred from road to railway.

Both the Atlantic Ocean and the Mediterranean Sea have enabled distances to other continents to be shortened thanks to their sea routes, made possible by large engineering works such as the Panama and Suez Canals. The European ports of both port fronts compete to have the infrastructure and logistics terminals necessary to assume the load of the Panamax and Post Panamax vessels which transport goods containers from Asia, Africa and America.

To manage this entire potential load, the ports require installations, technology and the land connections necessary for its rapid distribution to the population and industrial centres in the interior. At the same time, the EU created the concept of "highways of the sea", short-distance maritime routes between ports that assist in decongesting roads. Finally, the corridor work plans seeks to gradually implement the use of clean energies and fuels that enable pollutant gas emissions to the atmosphere to be reduced. ■

THE EIGHT KEYS OF THE EUROPEAN CORRIDORS

1. Removing bottlenecks.
2. Building cross-border connections.
3. Promoting intermodal integration and interoperability.
4. Integrating rail freight lines.
5. Promoting clean energy.
6. Applying technologies for better infrastructure use.
7. Integrating urban areas into the Core Network Corridors.
8. Enhancing safety.



THE ATLANTIC CORRIDOR

The Iberian Peninsula connected with France and Germany via Irun

The Atlantic Corridor links the Iberian Peninsula ports of Algeciras, Sines, Lisbon, Leixões and Bilbao with Paris and Normandy, and continues to Strasbourg and Mannheim. It would therefore be an efficient export route for goods bound for eight seaports of the Core Network (Algeciras, Sines, Lisbon, Leixões, Bilbao, Bordeaux, Le Havre and Rouen) where the large global trade ships arrive from America and Asia (via the Panama Canal) and Africa and Asia from the Mediterranean (via the Suez Canal and the Strait of Gibraltar). Additionally, the cities and logistics centres on the Atlantic Corridor route or its environs would benefit from the service of this corridor, enabling and stimulating their importance in international trade.

Ineco currently participates in the study of the Atlantic Corridor for the European Commission in a consortium led by Portuguese consultancy TIS together with the companies EGIS, Panteia, M-FIVE and BG21. In addition to providing the information relative to Spain, Ineco has a lead role in defining the list of Atlantic Corridor projects, a job that requires identifying and analysing corridor projects in progress or being planned, gathering information from the agents involved in the projects (in the case of Spain, we might highlight the Ministry of Public Works, ADIF, Puertos del Estado (Spanish State Ports), AENA, the Autonomous Regions, private agents, etc.) on the projects' scope, timeframe and investment needs, a key aspect to specify and establish subsequently the prioritisation of activities in the corridor.

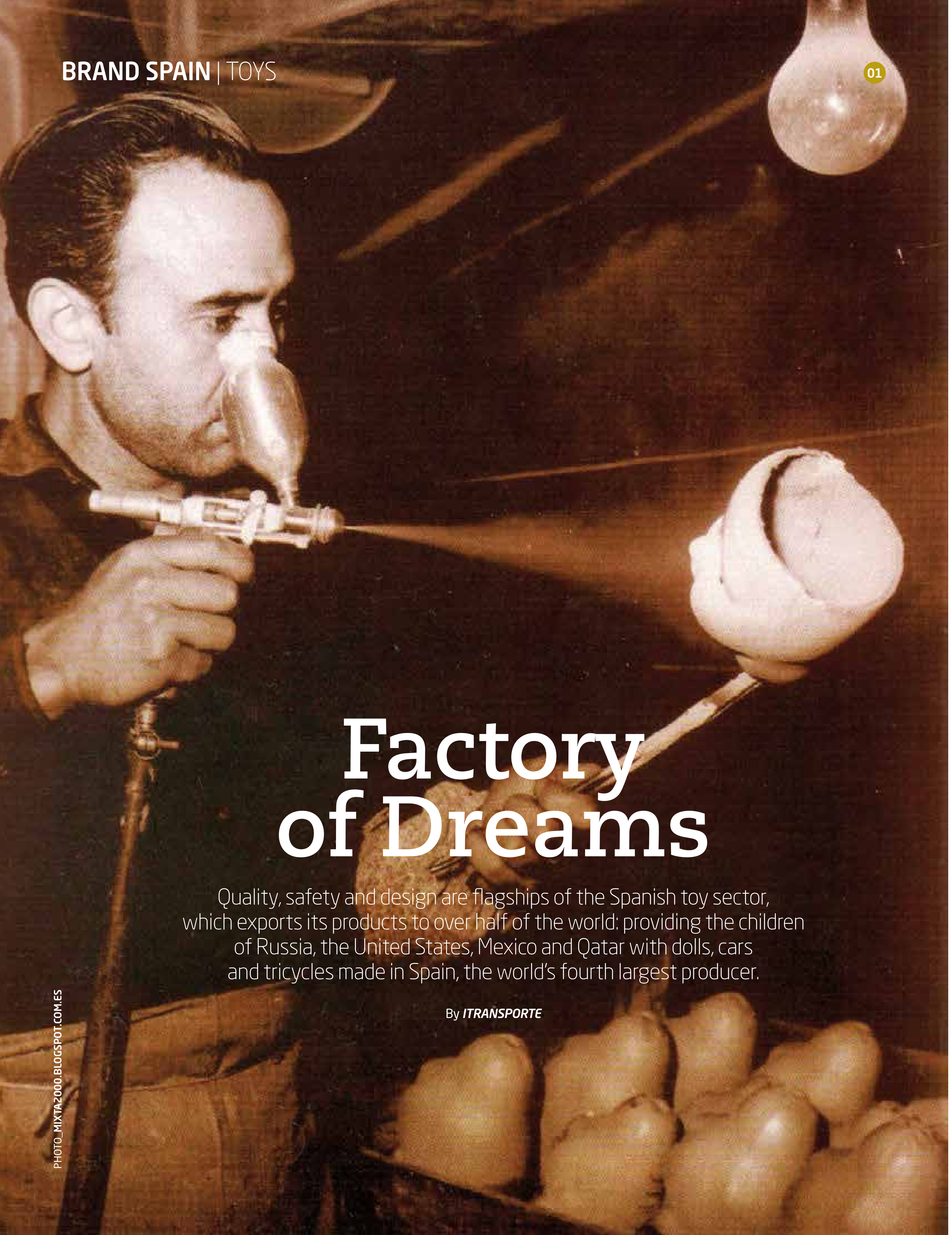
The Atlantic Corridor has an excellent network of roads, which are almost all highways. There is partial interoperability of the system of road tolls, with various projects underway to fully implement them in the corridor.

As for rail transport, some aspects such as single-track lines, the lack of electrification, or Spain and Portugal's distinct track gauge and its alteration to match the international standard gauge (1,435 mm), are significant obstacles to the development of goods transportation. Also worth noting as other hurdles to climb in the corridor's railway network are the partial absence of the ERTMS and the need to adapt infrastructure to allow trains of up to 740 m.

The European Commission has emphasised the need to solve access from ports to other modes of transport, particularly the railway. At the port of Algeciras -the largest of the entire corridor by volume- reports underline the essential importance of the electrification of the line and alteration of tracks and terminals to admit the aforementioned 740-metre freight trains.

Other proposals are the improved navigability of the River Seine between Paris and Benelux and access to the railways from all airports along the corridor.

Only Paris-CDG (Roissy) Airport meets all the requirements of Regulation (EU) N.º 1315/2013 and has a long-distance railway link. Paris Orly and Madrid Barajas Airports link to the suburban railway and metro; those of Porto and Lisbon only with the metro; and Bilbao and Bordeaux do not have railway links.



01

Factory of Dreams

Quality, safety and design are flagships of the Spanish toy sector, which exports its products to over half of the world: providing the children of Russia, the United States, Mexico and Qatar with dolls, cars and tricycles made in Spain, the world's fourth largest producer.

By ***ITRANSPORTE***

PHOTO_MIXTA2000.BLOGSPOT.COM.ES

The Spanish toy industry began to take off in the first decades of the twentieth century **(01)** in the Comunidad Valenciana (Valencian Community) and Cataluña (Catalonia), where today more than 70% of the country's toy manufacturers are located. More recently, globalisation, competition with products imported from China, the economic recession and the emergence of electronic toys have been major challenges for a sector that has put quality and product design as its international forefront.

QUALITY VS QUANTITY

Committing to a well-designed and high-quality product has proved to be the most effective way of competing with China, the world's largest toy manufacturer. 95% of the Spanish toy industry is composed of small and medium companies. It has managed to place its products in markets across the world, which account for 40% of its sales on average, however some companies substantially exceed this percentage.

As such, 60% of the sales from companies such as Famosa come from exports to more than 50 countries. It manufactures the leading dolls in the Spanish sector and top-sellers abroad such as Nenuco or Nancy, and brands such as Feber, dedicated to battery-powered vehicles, baby walkers, playhouses and slides, and has subsidiaries in Portugal, France, Italy, Mexico, Puerto Rico and China. IMC Toys products, especially the licensed small toys, as well as own brand products reach 72 countries, with an international turnover of 80%; like Injusa, a specialist in large wheeled and outdoor toys. Educa Borrás, the oldest company in the Spanish sector –formed in 1894–, dedicated to educational games and puzzles, exports 45% of its production to 90 countries.

Even smaller companies –some whose products are practically handmade– have reached international markets. For example, in the case of Muñecas Arias, which sells its products to 25 countries across America and Europe, or Trompos Space, a family business located in Domeño, a small village in Valencia: established in 2005, it has turned the traditional wooden spinning top into a sophisticated design toy that includes accessories such as rotating tips or fluorescent ropes and is sold in Holland, Poland, Germany and the United States.

Another success story is of Imaginarium **(02)**, a company founded in Zaragoza in 1992, it doesn't have factories but does have its own brand and design that is sold in its shops, of which more than half are franchises. It currently trades at more than 380 retail locations in almost 30 countries and is listed on the Spanish alternative investment market. It is possible to find Imaginarium shops in Bahrain, Hungary, Qatar and Hong Kong. ■

> "The Spanish toy industry, 95% of which is composed of small and medium companies, has managed to place its products in markets across the world"

PHOTO_FAMOSA

INFORMATION ABOUT THE SECTOR

▶ Spain is the world's fourth largest producer of toys, and the third largest in the European Union.

▶ In total, and according to information from the trade association representing the sector, there are currently more than 180 toy manufacturers in Spain, where 9 out of 10 are small or medium size.

▶ The sector directly and indirectly employs 4,000 and 20,000 people respectively. 7.5% of the employees work in R&D.

▶ 66% of the companies export their products. External sales represent around 40% of turnover on average, but in some cases it is as high as 80%.

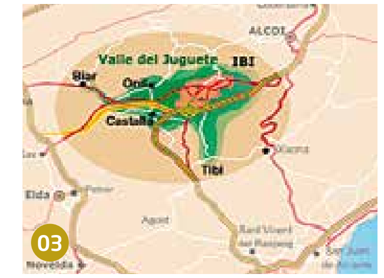
▶ Although during the economic recession some companies moved part of their production to China, an increase in transport costs and the dedication to quality has meant that production has partly returned to Spanish territory.

▶ Dolls, tricycles, scooters and pedal cars are the top export products.

FOTO_MOLTÓ

02

PHOTO_IMAGINARIUM



03

A 'SILICON VALLEY' OF TOYS

Spanish toy manufacturers, traditionally exporters, are investing in marketing and R&D to compete in the international markets. Thus, the Instituto Tecnológico del Juguete (research centre specializing in toys), promoted by the manufacturers' association, can be found in the same place where the first car and doll production workshops started in the 50's. It is located in Ibi **(03)**, in the province of Alicante, that together with the municipalities of Onil, Biar, Tibi and Castalia form part of the so-called "Valley of Toys", due to the concentration of toy manufacturing firms in the region.

At the centre, which covers 4,500 m^2, 70 experts in various fields analyse and test all kind of products, to not only guarantee that they are safe but that they fulfil their function: to entertain the customer. In fact, one of the available services is a playroom with guided visits for families, where children can play... and try the products.

The Institute also offers a comprehensive set of services to the Spanish toy industry and other related sectors, from the development of prototypes to mechanical and chemical trials, market studies, technical advice, graphic and industrial design, new technology applications, environmental and electronic management, industrial engineering and training. Additionally to the headquarters in Ibi, there is a trade delegation in Hong Kong and an office in France. And it is no coincidence that the European Union, the world's second largest producer of toys after China, is also the main destination for Spanish toy exports, particularly Portugal and France and further afield, the United Kingdom, Germany and Italy. Outside of Europe, the United States has become the main customer of Spanish toy manufacturers, doubling its purchases in the last five years.

Experience, competitiveness and technology at the service of society

Ineco has extensive experience in transport engineering: over 45 years planning, designing, managing, operating and maintaining airports, railways, roads, ports and urban transport systems throughout the world.

Ineco is a global leader in infrastructure engineering and consultancy. With a presence in more than 50 countries, it has an expert team of 2,500 professionals and has for more than 45 years contributed to the development of projects in all areas of transport: planning, airports, air navigation, railways, urban transport, roads and ports. Its activities extend to the environmental sector, architecture and construction.

Ineco offers comprehensive solutions in all phases of a project, from preliminary feasibility studies to commissioning, including making improvements to management, operation and maintenance processes.

Its high level of technical capability allows it to bring the most advanced ad innovative developments, both for the public and the private sector, anywhere in the world. ■

MODES

Aviation

Urban Transport

Railways

Ports

Roads

PROJECTS

- Airport's ORAT. **Abu Dabi**
- Airport Expansion Project Management. **Kuwait**
- Modernisation of the airport network and reorganisation of airspace. **Spain**
- Spanish High-Speed network. **Spain**
- HS2 high speed. **United Kingdom**
- High Speed Makkah-Madinah. **Saudi Arabia**
- CPTM lines, São Paulo. **Brazil**
- Supervising Agent Guadalajara-Colima highway. **Mexico**
- Strategic Mobility Plan **Ecuador**
- Lima international airport expansion. **Peru**
- ERTMS deployment in **Europe**
- Muscat's Public Transport Plan. **Oman**
- National Collection and Treatment of Waste Plan 2016-2026. **Panama**
- Irrigation and Drainage National Plan. **Ecuador**
- Modernisation of the Samsun-Kalin railway line. **Turkey**
- Expansion and improvement of the Spanish railway stations. **Spain**
- Transport Infrastructure Programme Management and National Transport Plan. **Costa Rica**
- Technical supervision of the new trains at Medellin Metro. **Colombia**
- Tram line 4 in Tallinn. **Estonia**
- Coordinating works on the Mário Covas bypass in São Paulo. **Brazil**

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AMERICA
Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Jamaica, Mexico, Nicaragua, Panama, Peru, Venezuela

ASIA
India, Iraq, Jordan, Kazakhstan, Kuwait, Malaysia, Nepal, Oman, Philippines, Qatar, Saudi Arabia, Singapore, Taiwan, UAE

EUROPE
Bulgaria, Croatia, Denmark, Estonia, France, Greece, Italy, Lithuania, Malta, Norway, Poland, Portugal, Russia, Serbia, Spain, Turkey, Ukraine, UK

OCEANIA
New Zealand, Samoa

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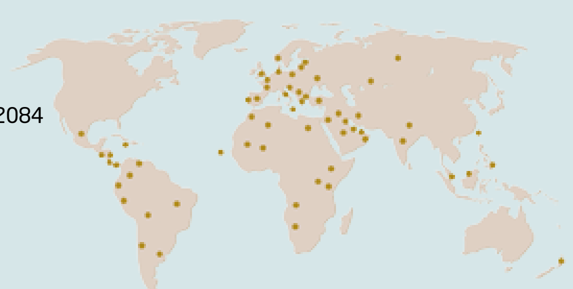


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