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25 experiences

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Because behind every great infrastructure there is always a great engineering company.

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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.

“...”

JESÚS SILVA FERNÁNDEZ
President of Ineco
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* International article
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 García, and the president, Jesús Silva, participated in a conference entitled ‘Crises as an Opportunity to rethink urban and housing policies’, in which he 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.

LOGISTICS PLATFORM IN SANTO DOMINGO DE LOS TÁSHILAS

Ineco will conduct the feasibility study for the future logistics platform “Zona ILCO” (“ILCO Area”), thanks to a contract recently signed with the Decentralised Autonomouous Municipal Government of Santo Domingo (Zona de los Táshilas) 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) and 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 of Santo Domingo the logistical edge that will contribute to its sustainable socioeconomic development. In the picture, Jesús Silva with Geovanny Benitez, prefect of Santo Domingo de los Táshilas.

The consortium formed by Ineco, the Iranian companies Shapour Tehran and Hexx, and the Italian company Geodata has been awarded the electrification works on the railway line between Tehran and Mashhad, Iran’s two major cities. The call for tender was opened by RAJ (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 improve freight transport capacity.

Ineco's professionals in the architecture, 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 BIM (Building Information Modelling) in the design, planning, construction and maintenance process. Ineco is the coordinator of esBIM, a commission established by the Spanish Ministry of Public Works for the implementation of BIM methodology in Spain.

Ineco was also present as a co-exhibitor at the Expopavilions 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, organized annually by the PPM for Cities forum and held in parallel with the Smart City Expo.

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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 the Under-secretary of Works, Julio Gómez-Pomar, as the representative of the Spanish party, and the Kuwaiti under-secretary of Public Works, visited Ineco to provide technical assistance to the construction of the new airport terminal of the national Airport (KIA). During the last five years the company has carried out the Master Plan update and the project has been updated to its current state.

The last north section, which 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 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.

The Centro de Formación de la Fundación de los Ferrocarriles Españoles (Spanish Railway Foundation Training Center) offers training ranging from presental, to teletpepresental and online modality.

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EXPERTS

IN TRANSPORT TRAINING

The Centro de Formación de la Fundación de los Ferrocarriles Españoles (Spanish Railway Foundation Training Center) has 30 years of experience in diffusion and transmission of ground transportation. Since 1986, it has provided a wide range of courses and seminars with cooperation from organized congresses and expositions that has resulted in revolutionizing the industry into a center of national and international reference in transports educational issues.

Our training system is self-organized, customizable, and actively works in collaboration with some other entities to perform the following task: Organizing the program, selecting the best professionals in each topic, and supervising the students results. All with the goal of improving qualification of those professionals working in ground transportation sector.

The Centro de Formación del Transporte Terrestre FFE (Ground Transportation Training Center), offers training ranging from presental, to teletpepresental and online modality.

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NEWS

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 Illias 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 ACBA, 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.

Ineco 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.

BRASIL

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 (Desenvolvimento 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 Rodovia Mário Gous, 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.
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.

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.
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 pref-

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.

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

In the picture, a large number of them are at the entrance to Ineco’s headquarters in Madrid.

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in December 1991, Ineco collaborated with the Spanish government to construct the first high-speed line, the Madrid–Seville line. This line was designed to accommodate trains that could travel at speeds of up to 250 km/h. The line was built using the latest technology, incorporating innovative track and infrastructure maintenance techniques. The project involved executing tunnels and viaducts, solving great challenges: the first, the extremely complicated orography of the Iberian Peninsula; and the second, the use of un-even land, building infrastructure for high-speed trains to circulate on –speeds of 250-300 km/h require tracks with inclines no greater than 3%– in volved 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 manufactur ers, generating a large capacity for in tegration 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 of the European system of variable rail 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 use of bi-directional trains to make circulation compatible on both gauges, the de velopment of modern, fast variable gauge changeover facilities to change the Iberian network into the international gauge, and track assembly adapting el ements 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–Pergamino.

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 technologi cal and definitive end the first fruit works up to commissioning, a work without precedent was carried out. Practically the entire railway sector has been over turned over decades, becoming a large and complex process that goes from preliminary feasibility studies, to technical studies, studies of demand, economic and financial analyses, environ mental impact studies, contractual studies and civil engineering, electrifica tion, telecommunication, signalling and construction projects, to designs of stations and urban access op erations, finishing with the supervision, construction, imple mentation and maintenance of lines and all special works such as tunnels and viaducts.

The technical and communication differ ences among European railway networks 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 experi ence was complemented by the design and construction of centralised traf fic control centres (CRC), from which all infrastructures are interconnected to the Da Vinci system, a Spanish pat ent exported to the United States of America, Morocco and Lithuania and used in the integrated railway systems in London and Medelid.

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 engineer ing firms have participated in railway operations with latest generation trains incorporating high-per for mance, and pursuing interoperability with its neighbours. Today, it is a leader in implementing the ERTMS, the European rail traffic management system which 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 signal ing systems have been standardised, and signalling control points have been interconnected with this system. This and other services have enabled the ac quisition of a high level of know-how in safety systems and communications, on-track detection systems and train protection systems. This experi ence was complemented by the design and construction of centralised traf fic control centres (CRC), from which all infrastructures are interconnected to the Da Vinci system, a Spanish patent exported to the United States of America, Morocco and Lithuania and used in the integrated railway systems in London and Medellín.

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**25 EXPERIENCES**

- **Agustín Barriobero**, tel-communications 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 minister 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 projects such as those in Córdoba and Cercanías (commuter rail) in Málaga.
- **Jesús Castille**, 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 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 1993, in Ineco on both conventional and high-speed lines, and currently on electrification projects on both.
- **Marisa de la Hoza**, BSc in Civil Engineering. She has taken part in planning and designing 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**

**“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.”**

**PEDRO BENITO**

**“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.”**

**JESÚS CASTILLO**

**“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**

**“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 HOZA**

**“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**

**“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**

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**VÍCTOR DUARTE**
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

“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

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

“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

“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

“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

“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

“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
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 after maintenance work. 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

The beginnings of high speed in Spain were a complicated birthing process. These are the words of Elias 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

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

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 URGÖITI

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

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

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 VEILHA
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).
12. Ineco technicians supervising work. (EV).
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).
37. Valladolid-Palencia-León high-speed line. 38. Ineco technicians on the high-speed line to Valencia. (EV).
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).
INNOVATION | EUROPE

Single European Sky

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.

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. Ríosquez and Ester Martín, aeronautical engineers

63 solutions ready for take-off
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 with 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 2000, the company was set up 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.

**INAERI'S LEADERSHIP**

Together with its shareholder ENAIRE (formerly Aena), INAERI 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. INAERI'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 evolving concepts 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, different 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 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, economies, environment, safety and human factors).

Ineco experts also developed TouchIT!, 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 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 Air Traffic-preferred to be available and put into operation. This is a mandatory regulation which all providers, manufacturers and supervisors responsible for traffic management.

**What are the benefits?**

In addition to advances in terms of the safety of air operations and reducing fuel consumption, the advances include improved 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.

**PRESENTATION OF PROJECTS**

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

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<th>INDUSTRIAL VALIDATION PROJECT</th>
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<td>PJ03a Integrated Surface Management</td>
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<td>Enabling Aviation Infrastructure</td>
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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.
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.

**Welcome Mr. VIP**

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 kinds 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)

Inco 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 Zubiri, civil engineer, and Blanca Martín, geographer.

Photos: Earth Science and Remote Sensing Unit, NASA Johnson Space Center and Habitat III

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 imbalances and inequality, and the assurance of a sustainable and inclusive urban prosperity.

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 colonial importance for the planet's development: the historic Paris Agreement on Climate (COP21) in December 2015, in which 195 countries gathered and took on the conclusions of 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 urban railway work includes the comprehensive projects between Caracas and the Valle del Vii in Venezuela, the studies for building a railway system in San José, Costa Rica, the Belgrade Light Metro and the Bue navista-Cuautitlán line in Mexico.

Critical comprehensive, 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.

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 public transport system would be the basis for the future public transport network. Ineco designed and presented a proposal 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 Oman 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).
Top models

Ineco’s experts develop transport models which simulate and visually represent future flows of passengers and goods, demand and 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

T

he 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 vital for private passenger cars. The islands have a 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 railway 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 Plans 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 can use highly effective decision-making tools 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 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.

Transport network models and simulation

Traffic 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 Spain for the planning of the Bus Transport Strategic Plan for Me casual, the public transport operator (see IT75).

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, frustration, dissatisfaction etc.) related with the design of platforms, entrance halls, staircases, 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, Malaga 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 systems that are progressing over time. An example of the application of these kinds of projects is the breath model developed by Ineco for the analysis of punctuality of the Madrid-Barcelona high-speed line (see IT28).
PLANNING | INTERNATIONAL

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, and so is the density of the 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 transportation 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 time-frames. 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.

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 PMZ, 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 transport, 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 assignment 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 specifially 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.
Modernisation of the Samsun–Kalin line

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.

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 (Instruments 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.

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 will be 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 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 320 km/h, up from the current 70 km/h.
Spain connected to Europe from port to door

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, such as 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° 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, 326 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—infrastucture 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%.

By Esther Durán y Carolina Sanz, civil engineers
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 1.9% of the population of Europe and contribute 1.7% 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, which affect the section between Castellón and Almería, are currently in progress as 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 last critical lack of capacity in the border crossings between countries, especially between Spain and France (Figueres-Perpignan), France and Italy (Lyon-Turin) and Italy and Slovenia (Trieste-Otava). 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 Pantea. PwC is the consortium leader and is responsible for maintaining an up-to-date list of projects worked on by Italy, Slovenia and Croatia. SETEC and Pantea 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-Almeria and Almeria-Ántequera-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 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 is sought is to enable goods to travel by rail 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 Commission highlighted the port fronts of Europe to have the infrastructure and logistics terminals necessary to assume the load of the Panama and Port Panaman 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 their rapid distribution to the population and industrial centres in the interior. At the same time, the EU28 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 Spanish toy industry began to take off in the first decades of the twentieth century (01) in the Comunidad Valenciana (Valencian Community) and Catalonia (Catalonia), where today more than 70% of the country's toy manufacturers are located. More recently, globalization, 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 60% 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 doll 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, Germany and the United States.

Another success story is of Imaginarium (02), a company founded in Zaragoza in 1992, that 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.

“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.

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.
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PROJECTS
- Airport ORAT, Abu Dhabi
- 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
- OITM 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-Kaín 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 Modellín Metro, Colombia
- Tram line 4 in Tallinn, Estonia
- Coordinating works on the Mário Covas bypass highway, Brazil

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- Egypt
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- Namibia
- Uganda

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