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ineco aniversario 50

63

SPECIAL ISSUE

THE FIRST FIFTY YEARS

50

THE JOURNEY HAS ONLY JUST BEGUN

CONTENTS

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AND THE STORY CONTINUES
EDITORIAL

To celebrate Ineco's 50th anniversary, this special issue of Itransporte is dedicated to looking back on the most important events of the company's history as recounted by some of the key people who participated and witnessed it. Their photographs, memories and perspectives have helped us to put together a summary of everything that has happened over these five decades, a time in which we went from being a small consulting firm with five people on staff to become an international engineering company with over 3,000 employees and a presence in five continents.

Ineco's history is the story of a company that has embraced evolution, always oriented towards the design and modernisation of transport systems and infrastructure, and with a desire to provide solutions without neglecting economic, social and environmental aspects. It is also the story of a large number of professionals who, thanks to excellent training, determination and enthusiasm, have formed teams that have enabled us to achieve our current success.

In the midst of today's digital revolution, looking back on the past has meant remembering all of those who lived through and made these experiences possible. Some are no longer with us. Others are still working with us or in other fields. To all of them, whether or not they are mentioned in these pages, we extend our thanks for making it possible for us to celebrate this anniversary. Special thanks also go to all of those friends and teachers from shareholder companies past and present, namely Adif, Renfe, ENAIRE and Aena, and other Spanish government institutions, who have helped us grow and take part in the building of one of the best transport networks in the world.

The knowledge that we have gained has enabled us to overcome challenges and difficult times. Looking back on our history, from every crisis - and there have been some very significant ones - we have always emerged in a position of strength by taking advantage of opportunities and responding with efficiency, courage and rigour. We have been able to transform and adapt to the times, and we will continue to do so.

If we continue to maintain this capacity for reaction and evolution, we will go far. The journey has only just begun. ■

“Special thanks also go to all of those friends and teachers from shareholder companies past and present, namely Adif, Renfe, ENAIRE and Aena, and other Spanish government institutions, who have helped us grow and take part in the building of one of the best transport networks in the world”

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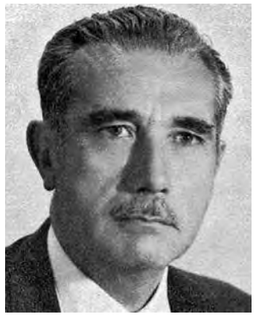
PRESIDENTS

Carlos Roa
1968 | 1971-1983



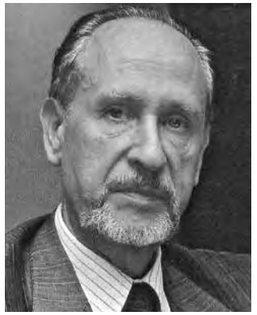
Juan de Arespacochaga
1968-1971

Emilio Magdalena
1983-1988

Pelayo Martínez (TIFSA)
1983-1989

Vicente García
1988-1993

Reyes Fernández (TIFSA)
1989-1999

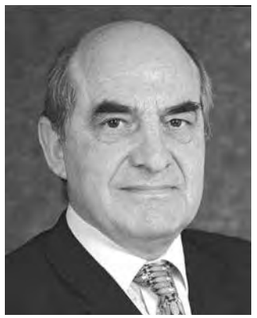


Antonio Alcaide
1993-1996

Antonio Gracia
1996-2000

José Eladio Seco
2000-2002

Antonio Fernández Gil
2002-2004



Juan Torrejón
2004-2009

Fernando Palao
2009-2010

Ignasi Nieto
2010-2011

Pablo Vázquez
2012-2014

Jesús Silva
2014-2017

Isaac Martín-Barbero
2017-present

50 YEARS OF NEWS 1968-2018

From left to right, the company's deed of incorporation; a daily work order from 1975; civil engineer Carlos Roa, first president of Ineco; the first headquarters of the company; and, lastly, Ineco employees in 1977.

20 JULY 1968

INECO FOUNDED

Carlos Roa declares that his intention in promoting the founding of Ineco is "to create a stable and permanent entity that will remain at the highest scientific level and exercise maximum practical wisdom in terms of transport economics and coordination".

1968
FIRST HEADQUARTERS

With the objective of providing services to Renfe and the Latin American railway sector, Ineco, based in Madrid, becomes the first Spanish consultancy specialising in transport consulting, economics and planning. The company is founded with a share capital of two million pesetas and 400 shares, with 160 subscribed by Renfe. Its first headquarters are located at No. 44 Calle Santa Isabel.

1972
NEW OFFICES

In 1972, after a capital increase and changes to the initial shareholders, Ineco overcomes a difficult financial situation; the staff grows from 5 to 26, making it necessary to move to new offices at No. 2 Calle Orense; the following year, a second office opens at No. 12, and finally, the company moves to the 2nd floor of No. 4, where it will remain until 1994.

1976
DEVASTATING EARTHQUAKE DISRUPTS THE WORK OF INECO TECHNICIANS IN GUATEMALA

On Wednesday, 4 February 1976, at 3:01 a.m. local time (9:01 a.m. in Spain), an earthquake measuring 7.5 on the Richter scale strikes Guatemala, with an epicentre located 160 kilometres northeast of the capital city. The tremors disrupt the work of an Ineco team that is in the country working on a railway infrastructure modernization plan, which then becomes a reconstruction plan. None of the technicians are among the 23,000 fatalities or 76,000 injured.

1981 BOGOTÁ METRO STUDY PRESENTED TO THE COLOMBIAN PRESS.

1983
TIFSA CREATED WITH PELAYO MARTÍNEZ REGIDOR AT THE HELM

Tifsa (Tecnología e Investigación Ferroviaria S.A.) is incorporated with an initial share capital of 50 million pesetas, as a result of Renfe's interest in having a subsidiary specialising in the research and development of proprietary railway technology. Its first staff of 17 people, is organised into four areas: Rolling stock, Facilities, Track and New Technologies, with a Structures department added in 1984.

1984 RENFE BECOMES THE SOLE SHAREHOLDER OF INECO AND TRANSFERS ITS PROJECTS TEAM, GENERATING A SIGNIFICANT INCREASE IN ENGINEERING WORK.

1985
CONTRACT WITH THE WORLD BANK

The company signs a contract with Ferrocarriles Nacionales de Colombia (FNC) in Colombia, the first contract led by Ineco to be financed by the World Bank. The company, in association with the Colombian firm Consultécnicos, selected over 20 other consultancies from around the world, wins an international tender valued at 2 million dollars. To the left of the image, Juan Torrejón, from Ineco; in the centre, Tito Rueda, president of FNC; on the right, Emilio Magdalena, president of Ineco.

1986 SPAIN JOINS THE EUROPEAN ECONOMIC COMMUNITY: EEC LEGISLATION PROMOTES NEW PLANNING ACTIVITIES, SUCH AS INFORMATION AND ENVIRONMENTAL STUDIES.

1987
FIRST NATIONAL OFFICE OPENS

Ineco opens its first office in Barcelona and, shortly afterwards, another in Seville, where the company provides quality control services for the construction of the site that will house the Universal Exposition of Seville in 1992. The 1987 financial year closes with a turnover of 2 billion pesetas.

1988 ON 9 DECEMBER, THE COUNCIL OF MINISTERS AGREES THAT ALL HIGH-SPEED LINES SHOULD BE BUILT USING INTERNATIONAL GAUGE. THE GOVERNMENT CONSIDERS EXTENDING THE GAUGE CHANGE TO THE ENTIRE NETWORK, BUT IN THE END DECIDES AGAINST IT FOR TECHNICAL AND BUDGETARY REASONS.

1990 WORK BEGINS ON THE LIBERTADORES PROJECT FOR RAILWAY INTEGRATION IN THE SOUTHERN CONE, PROMOTED BY THE MINISTRY OF TRANSPORT, RENFE AND THE FIFTH CENTENNIAL SOCIETY. THE AIM IS TO INTEGRATE ALL RAIL NETWORKS IN ARGENTINA, BOLIVIA, BRAZIL, CHILE, PARAGUAY, PERU AND URUGUAY, THROUGH SPECIFIC IMPROVEMENT WORKS ON FOUR MAJOR CORRIDORS.

1992
PLANE CRASH IN THE ALPS

1992 begins tragically for Ineco: on 21 January, a flight from Lyon to Strasbourg crashes, killing Jose Mª Guillén Carmona, director of the Signalling Projects and Works department, along with five Spanish engineers and two French technicians. All were on a work trip to investigate automatic driving systems for the Cercanías Móstoles-El Soto line in Madrid.

1994
THE NEWLY CREATED AENA, INECO'S MAJORITY SHAREHOLDER, COMMENCES ITS AERONAUTICAL ACTIVITIES

Aena, a public entity created in 1991, becomes a shareholder of Ineco in a capital increase that begins in October 1993 and closes in January 1994. After a third increase in 1995, it increases its stake in Ineco to 61%. This heralds the end of the company's latest crisis, coinciding with the general recession affecting the country after the events of 1992, from which it will once again emerge in a strong position.

At this time, Ineco has 214 employees and Tifsa, 68. Thus begins a new field of activity: aeronautics. The company moves its offices to No. 138 Calle Doctor Esquerdo in Madrid.

TECNOLOGIA E INVESTIGACION FERROVIARIA, S. A.
TIFSA
Capitán Haya, 1
28020 Madrid

50 YEARS OF NEWS 1968-2018


1


2


3

1. Next to the first Tifsa logo, company president Reyes Fernández Durán on her trip to China (1995).
2. Javier García de Muro and José Mª Mangas, expatriate employees in Colombia (1999).
3. From left to right: Mariola Alcalá, Ana Jiménez and Rosa González in the new offices in the Egeo building (2001).

1995
TIFSA: VISIT TO CHINA

The president of Tifsa, Reyes Fernández Durán, visits a rolling stock factory in China in June as part of a trip to promote the Spanish railway industry. The president of Renfe, Mercè Sala, its international director, Miguel Corsini, the president of Alsthom Spain, Eduardo Montes, and the CEO of CAF also attend. In 1994, the German consultancy De-Consult and the French company Systra become shareholders with 24.5% each.

1995 CARLOS ROA DIES: "HE WAS OUR TEACHER", SAYS JAVIER PÉREZ SANZ, GENERAL DIRECTOR OF INFRASTRUCTURE MANAGEMENT AT RENFE, DURING A MEMORIAL HELD ON 22 FEBRUARY AT THE SPANISH RAILWAYS FOUNDATION.

1996 ON WEDNESDAY, 28 MAY, MADRID'S 'PASILLO VERDE', CONSISTING OF A TUNNEL BETWEEN ATOCHA AND PRÍNCIPE PÍO STATIONS, IS OPENED: THIS IS INECO'S FIRST MAJOR COMPREHENSIVE WORKS MANAGEMENT PROJECT.

1998
NEW INECO HEADQUARTERS

Ineco purchases a building at No. 138 Paseo de la Habana. The new headquarters has room for 500 employees.

1999 INECO BUYS THE GERMAN AND FRENCH STAKES IN TIFSA, 49% OF THE TOTAL, AND THE INECO-TIFSA GROUP IS CREATED. ACCORDING TO ITS PRESIDENT, JOSÉ ELADIO SECO, WITH THIS DEAL, "WE HOPE TO TAKE ADVANTAGE OF OUR POTENTIAL WITH MAXIMUM PERFORMANCE AND HELP CREATE INTERMODAL RELATIONSHIPS THAT ARE UNDOUBTEDLY EXTREMELY ATTRACTIVE".

1999
WORK ON THE RAILWAYS OF COLOMBIA

Ineco provides Ferrocarriles del Norte de Colombia (FENOCO) with operational assistance in its freight transport for the commissioning of the Atlantic rail network concession, involving the relocation of expatriate technical staff.

2000
INECO COMMITS ITSELF TO THE INTERNET AND NEW TECHNOLOGIES

Ineco signs a contract with the public enterprise Retevisión (now RED.ES) to carry out consultancy and technical assistance work on the implementation of advanced telecommunication networks and services with the aim of examining and analysing the development of new technologies.

Despite concerns over the so-called 'millennium bug', the turn of the new millennium passes without the anticipated problems, with the company's computer systems remaining unaffected.

2001
NEW OFFICES IN THE EGEO BUILDING

New offices are opened in the Egeo building to accommodate the company's expanding workforce.

2002 INECO WORKS ON WALVIS BAY AIRPORT IN NAMIBIA; WHILE TIFSA DESIGNS A REFURBISHMENT PROJECT FOR MADRID CHAMARTIN TRAIN STATION.

2003
INECO VOLUNTEERS HELP CLEAN UP 6 TONNES OF OIL SPILLED IN GALICIA

The company pays the expenses for the transport and cleaning materials of a group of 30 volunteers who spend 15 and 16 February in Galicia to help clean up the oil spill from the sinking of the oil tanker Prestige. Over those two days, they are able to remove more than 6 tonnes of oil from the Galician coast.

2005
SPRING PARTY

On 10 June, Ineco-Tifsa Group throws its 3rd Spring Party at an estate on the outskirts of Madrid, attended by some 800 people. Several events take place, including an outdoor meal, mini bullfight and an awards ceremony to hand out trophies to the winners of company football, basketball (in the image, the Alitas basketball team), mus and paddle tennis championships. Despite the rain, spirits are not dampened during activities that included human table football, a wind tunnel, boxing with giant gloves, quads and paintball.

2007
THE CARLOS ROA CLASSROOM CREATED AS A FORUM FOR TECHNICAL DEBATE

The aim, as the general director of Ineco Antonio Monfort explains, is "to create a permanent forum for technical debate in which specialists and experts can freely express themselves". The Classroom is named "in honour of Carlos Roa, the beloved and greatly missed first president of Ineco".

In May of this same year, the first issue of the corporative magazine *ITRANSPORTE* is published, initially on a monthly basis.

2007 TRANVÍA DE TENERIFE, WITH INECO AS A SHAREHOLDER, OPENS ITS FIRST LINE.

2008
INECO, THE MINISTRY OF PUBLIC WORKS' 'IN-HOUSE RESOURCE'

The company's president Juan Torrejón explains that, after the absorption of Tifsa, "conditions are right to expand technological capabilities and use synergies in other modes of transport, such as roads and ports. Adaptation to European and Spanish legislation determines the corporate structure of the company and makes Ineco-Tifsa Group the Government's 'in-house resource and technical service' similar to other European public enterprises".

2008
THE FIRST CORPORATE RESPONSIBILITY PLAN

From now on, the relationship with various NGOs is formalised, with an ambitious collaboration program. Ineco adheres to the United Nations Global Compact and in 2009 it will launch its first Equality and Integrity Plans. In the image, a water supply project supported by the company in Same (Tanzania).

2009
HONOURABLE MENTION FOR SANTS STATION

On 23 April, the team of the project to expand the Sants Station in Barcelona receives an honourable mention at the 2009 Construmat Civil Engineering Awards. In the image from left to right, Marcos Peña, Dragados; Miguel Ferrández, Ineco-Tifsa; Ricardo Franco, Dragados; José Miguel Bueno, Ineco-Tifsa; Javier Dahl and Armando Brigos, Adif; Michael Ashiabor, Ineco-Tifsa; and Carlos Ventura, Adif. •••

50 YEARS OF NEWS 1968-2018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1. Ignasi Nieto, president of Ineco, signing a contract for the expansion of Kuwait Airport (2011). **2.** Javier de Cos, general director of International, signing the technical proposal for the Makkah-Madinah high-speed contract. Behind, from left to right, Juan Luis Monjarás, Manuel Benegas and José Solorza (2012). **3.** The current president of Ineco, Isaac Martín-Barbero, at the Transport Internationalisation Observatory (2018).

2010 INECO AND TIFSA MERGE: THE NEW COMPANY, INECO BOASTS A WORKFORCE OF 3,000 EMPLOYEES.

2010

IN MEMORIAM: JAVIER LÓPEZ DE PABLO, MANAGER OF THE SEVILLE OFFICE

The manager of Ineco's Seville office, Javier López de Pablo (second from the right), dies suddenly at the age of 65. An aeronautical engineer by profession, he joined the company in February 2005 to take charge of the office. In the image, during a meeting of national managers held on 22 July at Ineco's headquarters in Paseo de la Habana. From left to right, Eduard Albors, manager from Catalonia; José Francisco Laguna, from Valencia; Javier López de Pablo, from Seville; and Pascual Villate, from the Basque Country.

2011

CONTRACT SIGNING IN KUWAIT

Ineco signs a project management contract on 14 March for the expansion of Kuwait airport.

2012

A YEAR OF LARGE CONTRACTS

The signing of the Makkah-Madinah high-speed contract, the largest in the history of the company, takes place on 12 January during an official ceremony at the Intercontinental Hotel in Riyadh, in the presence of Saudi Arabian and Spanish dignitaries and representatives from the 14 partners of the winning consortium, of which Ineco is a member.

In Spain, meanwhile, the Figueras-Perpignan high-speed line is opened, representing the final stretch of the Madrid-Barcelona-French border line. This same year, the company is awarded two of its most important international contracts: together with its British partner, Capita, the design of a section of the HS2 project in the United Kingdom, and, in Brazil, alongside the engineering company EBEI, the supervision of works on the final section of the Rodoanel Màrio Covas road project in São Paulo. In the photo, Ineco engineers José Luis Pancorbo and José Isidro Díaz.

PHOTO_ANDRÉ LEMES

2012

ECUADOR'S STRATEGIC MOBILITY PLAN

On 13 December, Ineco presents the president of Ecuador, Rafael Correa, with the final document of the country's Strategic Mobility Plan, which it had been preparing since 2011. In the image, from left to right, team members in Ecuador: Pablo Fuente, Rafael Alcayde, Óscar Díaz-Pinés, Ignacio Alejandre and Javier Gómez, project leader.

2014 IN MAY, AN INECO TEAM BEGINS WORK ON THE ORAT OF ABU DHABI'S NEW AIRPORT TERMINAL.

2015 INECO STAFF SAFE AFTER AN EARTHQUAKE HITS NEPAL ON APRIL. THE COMPANY DONATES TO THE RED CROSS TO RAISE FUNDS FOR VICTIMS AS IT HAS BEEN DOING SINCE 2009.

2015

IMPLEMENTATION OF BIM IN SPAIN

On 15 July 2015, the BIM Commission, headed by Ineco, is set up. In the image, on the left of Minister Ana Pastor, Jesús Silva, President of Ineco, and Jorge Torrico, the company's deputy director of projects.

2016

WORKS SUPERVISION FOR MEXICO CITY'S NEW AIRPORT

An international consortium, consisting of Ineco, Ayesa (also from Spain), Aecom (USA) and Cal y Mayor (Mexico), win a four-year technical and administrative supervision contract for the building of the passenger terminal and air traffic control tower at Mexico City's new international airport. The contract includes the monitoring, supervision and inspection of building works from the pre-construction phase to commissioning. In terms of the contract amount, it is the second largest international contract in the entire history of the company.

2017 ON 20 APRIL, THE AVE HIGH-SPEED LINE TO SEVILLE, THE FIRST IN SPAIN, AND A PROJECT ON WHICH INECO HAD WORKED SINCE THE 1980s, CELEBRATES ITS 25TH BIRTHDAY.

2017 A SPANISH-DUTCH CONSORTIUM, OF WHICH INECO IS PART, SIGNS A CONTRACT IN AMSTERDAM FOR THE DESIGN OF A NEW TERMINAL AT SCHIPHOL AIRPORT.

2017 ON 30 JULY, WORK BEGINS ON THE PREPARATION OF THE MASTER PLAN FOR DAMMAM AIRPORT, THE THIRD LARGEST IN SAUDI ARABIA, WHICH WILL RUN UNTIL 2027.

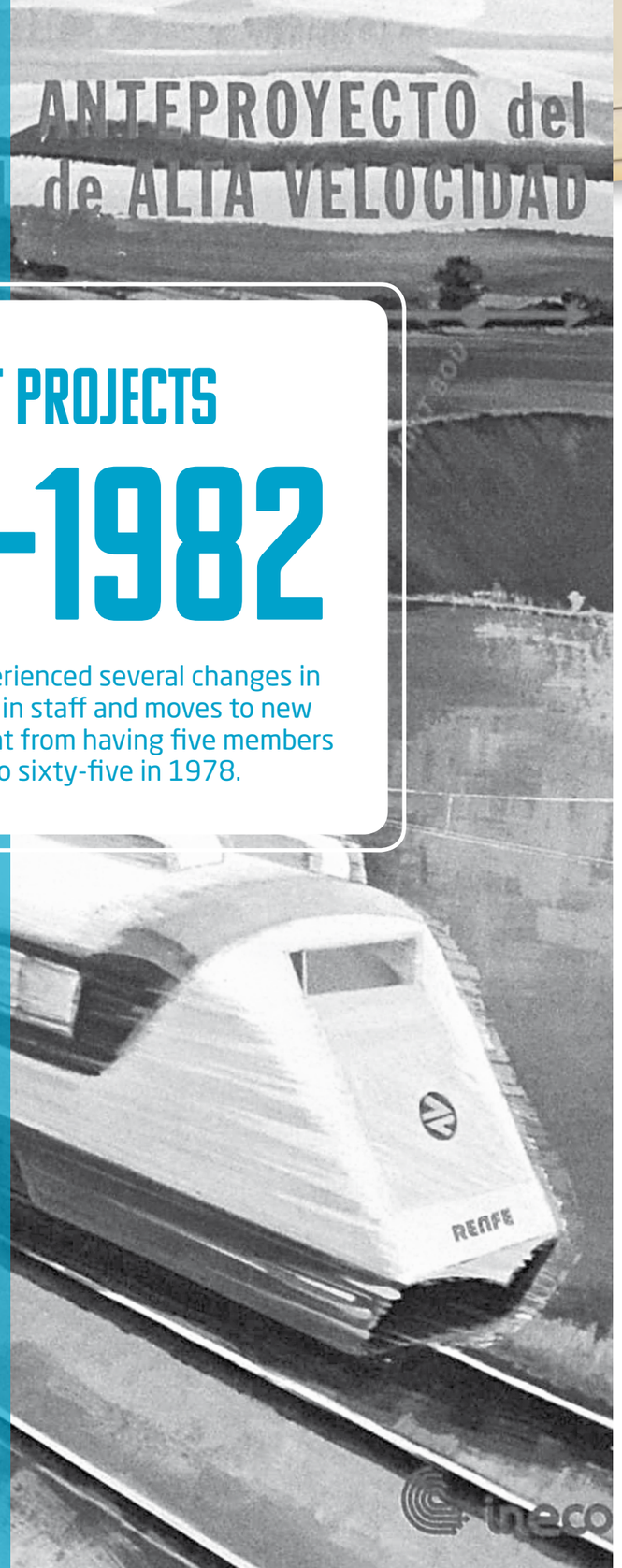
2018 THE MINISTRY OF PUBLIC WORKS HAS LAUNCHED FOR ITS GROUP OF COMPANIES INNOVATION AND INTERNATIONALISATION PLANS, ALL OF WHICH INVOLVE INECO IN THEIR PREPARATION.

2018

FIRST MEETING OF THE TRANSPORT INTERNATIONALISATION OBSERVATORY

On 18 April, the secretary of State for Infrastructure, Transport and Housing, Julio Gómez-Pomar, chairs the first meeting of the Observatory, which is attended by the president of Ineco, Isaac Martín-Barbero; general director of Transformation, Internationalisation and Innovation, Eva Pulido; and director of Internationalisation and Commercial Intelligence, Sergio Navarro. The meeting assessed the first actions of the Transport and Infrastructure Internationalisation Plan 2018-2020, which is coordinated by Ineco and seeks to promote the overseas activities of Spanish transport companies.

On the 6th of the month, the Ministry of Public Works presents a report on the Transport and Infrastructure Innovation Plan 2017-2020 to the Council of Ministers. This report had been drafted and submitted the previous November by Ineco, which is also working on a transport sustainability plan.



50 FERROCARRIL

THE FIRST PROJECTS

1968-1982

In the 1970s, Ineco experienced several changes in shareholders, increases in staff and moves to new offices. The company went from having five members on staff in 1971 to sixty-five in 1978.

THE 1970s

THE MADRID-ZARAGOZA-BARCELONA-PORT BOU HIGH-SPEED LINE AND INTERNATIONAL UNDERTAKINGS

The first work focused on multidisciplinary consulting studies incorporating engineering and involving the execution of preliminary road and rail projects, one of the most important of which was the Madrid-Zaragoza-Barcelona-Port Bou high-speed project.

In 1973 and 1974, planning of the Madrid and Barcelona Cercanías networks began, and this work continues to this day. During those years, research work on mobility at regional level was also carried out, including the master plans for the Canary Islands in 1979, followed by the Balearic Islands, Murcia, Castilla y León and the Basque Country.

During this period, Ineco designed several arterial railway networks, such as those in Valencia, and produced studies and projects for the networks of Santander, Gijón and Vigo (1973), Madrid (1974), Jaén (1977) and Huesca (1978). Particularly notable were projects in Seville, which included the project and functional design of the Santa Justa station, the La Negrilla freight terminal, tunnel works on the line in the city centre and several Cercanías train stops. Numerous freight studies were also carried out for Red Nacional de Ferrocarriles Españoles (Renfe). Julio Bermejo, a civil engineer who spent 22 years at Ineco between 1978 and 2012, explains: "At that time, studies were carried out to optimise the transport systems of large steel plants: Ensidesa, Nueva Montaña Quijano, Sidegasa. For Renfe, in addition to classic passenger corridor and freight focal point studies, work with urban planning was carried out on the arterial railway networks of half of Spain".

NUMEROUS RAILWAY SIMULATIONS WERE CARRIED OUT WITH IBM HOCUS AND GPSS PROGRAMS, INCLUDING THE DAILY OPERATION OF CERCANÍAS MADRID

By that time, technology had already become an important work tool, and the company was starting to develop its own computer programs. Concha Rodríguez-Portugal, an industrial engineer at Ineco from 1972 to 2011, recalls: "One of my first projects in 1974 which I particularly enjoyed and for which we received high praise from Renfe, involved simulations of large freight stations with complex rail operations. At the beginning, we did the simulations manually on scale models of the stations, using buttons for trains and making calculations with mechanical calculators. We were the first to use the HOCUS and GPSS programs on the Renfe computer".

Regarding the first computerised financial programs, Jorge del Fresno, an industrial engineer at Ineco from 1972 to 2010, explains: "We began using the programs, which were written in BASIC, in 1976, with an HP30 4 MB programmable computer, the only one in the company, that cost more than 700,000 pesetas. It was a very simple method that helped us to calculate project costs. Even though by 1982, all accounting had been computerised, the philosophy remained the same". Jose A. Fernández Gago, a civil engineer who has been at Ineco since 2008, highlights that "between the new developments launched by the Americans in the 1960s and the academic research headed up by Mascareñas in Spain in

•••

With a scholarly and charismatic personality, Carlos Roa (in the centre of the image) promoted studies and reports on railways inside and outside the country and undertook the first high-speed study in Spain.

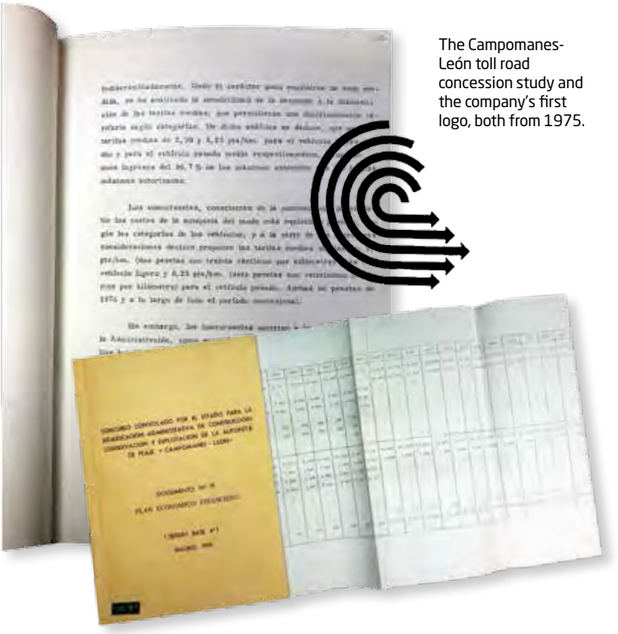
Arterial network planning, Cercanías plans and freight studies were the main work of the time.

"The movement of the urban and suburban masses gives the railway absolute superiority, and, for the great factories and cities of the future, the railway will play a very important role"

Carlos Roa, in an interview for the ABC newspaper on 5 December 1967, one year before the founding of Ineco

“We began using computerised financial programs, which were written in BASIC, in 1976, with an HP30 4 MB programmable computer, the only one in the company, that cost more than 700,000 pesetas”

Jorge del Fresno, industrial engineer



The Campomanes-León toll road concession study and the company’s first logo, both from 1975.

EXPATRIATE EMPLOYEES
In the image, from left to right, Juan Torrejón, Ineco expatriate engineer in Colombia with his children, Jaime Morro from Ineco, Vicente Moreno from Renfe and Antonio Debesa, also an Ineco expatriate employee.

the 1980s, Ineco stands out as the first company in Spain, back in 1975, to carry out economic/financial simulations programmed in BASIC, as part of a León-Campomanes toll road concession viability study”.

THE BEGINNINGS OF HIGH SPEED

In 1975, Renfe presented the first high-speed study in Spain, which was produced by Ineco. It included economic/financial and geological studies, an alternatives analysis and the design of the final alignment. 13 years later, the government prioritised the construction of the high-speed line between Madrid and Seville, meaning that the connection between Madrid and Barcelona did not become a reality until 33 years later, in 2008. In regard to this project, Agustín Giménez, a draftsman at Ineco between 1973 and 2017, recalls: “My first job at Ineco was the Madrid-Guadalajara section, which we designed by hand using plans from the Army’s geographical department, provided to us by Topycar, first with three alternatives at a scale of 1:50,000 and finally with the selected alignment at a scale of 1:5,000”.

INTERNATIONAL UNDERTAKINGS

Ineco’s desire to work internationally materialised in studies and reports on rail and transport in Latin America, fostering the training of its technicians in Spain. Interest in participating in the improvement of infrastructures abroad also took Roa and the Renfe team to Africa, where, in 1975, a feasibility study was carried out in Zaire (now the Democratic Republic of the Congo) for the Kindu-Kisangani railway line.

In the 1970s, Ineco began collaborating with institutions in Bolivia, where a comprehensive transport study was conducted between 1979 and 1980, and in Argentina, Venezuela, Honduras, Chile and Colombia with several different studies and projects to improve transport, working together with Renfe and ALAF. As ALAF’s general adviser, Ineco acted as a consultant for the International Bank for Reconstruction and Development (IBRD), which opened the doors for the company to participate in and win public contract tenders in the first projects in Colombia and Brazil.

It was precisely in Brazil that the first international public project tender, ‘Operations, marketing and IT for Ferrovías Paulistas del Estado de São Paulo (FEPASA)’, put out by the World Bank in 1976, was won and carried out between 1980-1981. Ineco, with staff assigned from Renfe, was awarded this study of railway operations, which involved the company’s entry into the country, where it would eventually, in the year 2000, establish its subsidiary Ineco do Brasil. A number of years later, in 1987, a precursor study for a high-speed line between Rio de Janeiro and São Paulo would be carried out *(Trens rápidos de passageiros de longo percurso Rio de Janeiro-São Paulo)*.

One of the first studies carried out in Argentina was a profitability analysis of the implementation of a CTC system for Ferrocarriles Argentinos in 1978. In 1987, an investigation into the Latin American rail transport market, focusing on the Southern Cone, Brazil and the Andean Altiplano, was carried out. Later, together with Ferrocarriles Argentinos and Renfe, a feasibility study was carried out in 1989 for the joint operation of interurban corridors, and,

ZAIRE
Roa and a Renfe team receive dignitaries from Zaire (now the Democratic Republic of the Congo) in Madrid for the Kindu-Kisangani line feasibility study.

in 1997, a market study was conducted on the Belgrano Norte railway line, commissioned by Ferrovías, the service’s operating company.

In 1972, Carlos Roa and the general director Carlos de Inza, together with Renfe engineers, carried out a ‘Study on the sixth project of Ferrocarriles de Colombia’, a study of recommendations for the improvement of the Carare railway line. This project was financed by the International Bank for Reconstruction and Development, after an agreement was reached by Roa after a trip to Washington in March 1969, paid for by Iberia, then a shareholder of Ineco. In 1981, Ineco submitted a ‘Feasibility and execution study for a public transport system in Bogotá’ to the Bogotá metro –the first international project carried out with its own resources, in conjunction with the French company Sofretu (now Systra) and the Colombian company Consultoría y Sistemas– commissioned by the Mayor of Bogotá. Detailed feasibility and pre-design studies were carried out for the Colombian capital’s metro and its workshops area, with a proposal for a priority line of 21.2 kilometres in length with 23 stations, 35% on the surface and the remainder underground.

CARLOS ROA PROMOTED THE EXPORT OF SPANISH EXPERIENCE AND TECHNOLOGY AND HIS MULTI-MODAL TRANSPORT VISION

Ineco’s presence in Colombia resulted in Ferrocarriles Nacionales de Colombia (FNC) awarding the contract for a feasibility study for a railway upgrade plan to an Ineco-Consultécnicos consortium in 1985. The total budget of the project was 360 million pesetas, financed through the World Bank. Isabel Lacambra, a civil engineer at Ineco since 1987, joined this project: “I was assigned to Ineco from Ferrocarriles Nacionales de Colombia in 1987 to participate in the viability study and also to work on a study for the Buenaventura-Bogotá Corridor. I worked on both projects until 1989 and it was there that I met Juan Torrejón, José Eladio Seco, Antonio Debesa and Juan Canteli, all of them Ineco expatriates, the first two with their families”.

The Buenaventura-Bogotá Corridor feasibility study included an analysis of the construction of a new section to connect the Atlantic Network with the Pacific Network and provided a direct outlet from Bogota to the Port of Buenaventura on the Pacific Ocean. Ineco assigned a total of 260 man-months to this contract over the course of four years. ■

“To calculate demand for Ferrocarriles Nacionales de Colombia, we purchased our first IBM PC in 1985, and used it to develop a railway operation model which we called the Rail Traffic Model”

Juan Canteli, civil engineer

BOGOTÁ METRO
Francisco Fernández, ‘Franchis’, submitted a study for the Bogotá metro in October 1981, after carrying out a supplementary study on the Bilbao metro network for Ineco in 1977.

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A GIANT LEAP FORWARD

1983-1992

Tifsa was founded in 1983; Renfe acquired Ineco and transferred its projects team in 1984; Spain joined the EEC in 1986; and, in the same year, the NAFA project, the future Madrid-Seville high-speed line (1992), began.

THE 1980s

TIFSA, RENFE, NAFA, THE MEDITERRANEAN CORRIDOR AND JOINING THE EEC

Ineco strengthened its engineering and projects area, and applied the latest cutting-edge methodologies and simulation models to transport planning. For Guillermo Vázquez, a civil engineer who joined Ineco in 1972 and continued to be associated with the company for many years, "transport economics studies, in which Ineco was a pioneer, were decisive in the evolution of Spanish infrastructure. They were necessary for all decisions on transport investment to be accompanied by consideration of their economic consequences".

Emilio Miralles, a civil engineer and external adviser at Ineco since 2008, points out that during these years "the Madrid Regional Transport Consortium was the first of its kind in Spain and served as a model for those that would come later. Professionals from Ineco participated in its creation in 1985-86, contributing experience that we later applied to studies such as the regulation of a new railway operation model in Brazil and the Oman Public Transport Master Plan".

TIFSA: THE TECHNOLOGICAL DEVELOPMENT OF RAILWAYS

The creation of the 100%-Renfe-owned Tifsa on 30 November 1983 heralded the beginning of specialisation in research and technological innovation in relation to track, rolling stock, safety facilities, signalling and railway traffic control systems, an area in which the company has stayed on the cutting edge –since 2010 as part of Ineco–. Tifsa's –and later Ineco's– contribution was epitomised by its work on ERTMS validation and verification.

ENGINEERS NOT AFRAID OF HEIGHTS

The renewal of national gauge throughout the railway network marked the beginning of Tifsa's inspection and load-testing work on numerous bridges and viaducts. Carlos Loma, a technical expert on special projects employed at Ineco since 1984, recalls: "When I started at Tifsa in 1984, one of the requirements was not to be afraid of heights. We worked for Renfe on numerous sounding campaigns for metal bridges, some over 100 metres high. A year later, inspection work began on concrete and masonry railway bridges and load testing on the line from Tarragona to Barcelona and France".

Since 1992, bridge and viaduct inspections have been part of the company's usual work. Some of the more notable work on high-speed lines included the monitoring work on the Arroyo del Valle and Arroyo de las Piedras viaducts (2006-2010), and the load testing carried out on the Contreras (2010) and Ulla viaducts (2015) and, more recently, on the entire Chamartín-Torrejón de Velasco section (Madrid, 2017).

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Above: Enrique López del Hierro with Francisco López at Tifsa's offices at No. 1 Calle Capitán Haya in 1999. Centre and from left to right: Fernando Vegas, José Antonio Álvarez, Carlos Loma and José Costales (1984). Below: Mario Jara in 2000.

Leendert de Haan, wearing a harness, inspecting the roof of the Bilbao airport.

"Ineco has inspected more railway bridges in Spain than anyone else, far more than 10,000. It has unique specialisation in the load testing of metal bridges"

Leendert de Haan, civil engineer

ROOFS
In recent years, Ineco has increased its roof-inspection work at stations such as Zaragoza-Delicias (in the image), Atocha, Chamartín and Toledo; airport terminals such as Bilbao and Ibiza; and on other buildings.

TIFSA

Above: Iván Navamuel, Carlos Loma, Elena Jerez and Elena Agudo in 2011. On the right, Pedro Benito, Víctor Duarte and Marisa de la Hoz NAFA engineers.

> "We could not have had better leaders than Jorge Nasarre and Santiago Rallo, who, thanks to their knowledge and vision of the future, enabled us to complete all projects within a record time of nine months"
>
> **Marisa de la Hoz,** public works engineer

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From all of this experience, Leendert de Haan, a civil engineer who joined Ineco in 1998, notes that: "The company has inspected more railway bridges in Spain than anyone else, far more than 10,000. It has unique specialisation in load testing of metal bridges. In 2005, several load tests were performed on special viaducts at 360 kilometres per hour on the Madrid-Lleida AVE, a historic record in Spain. Another milestone was a study carried out in 2016 using 3D models to detect possible flood risk areas along the 2,351 kilometres of high-speed line in operation. The latest innovation that we've introduced is the use of drones to carry out inspections in places that are difficult or dangerous to access".

FROM NAFA TO THE AVE HIGH-SPEED LINE TO SEVILLE

In 1986, Ineco was commissioned by the Ministry of Public Works and Transport to carry out basic and construction projects on the first stretch of the Madrid-Seville high-speed line, between Getafe and Córdoba, a project that was called New Rail Access to Andalusia (NAFA, in Spanish). A team of young engineers from the company tackled this challenge, which was managed by professionals from Renfe. For Juan Barrón, a civil engineer employed at Ineco since 1985 and a former president of GIF, "the transfer of the entire Renfe project team to Ineco was key because a significant increase in engineering was added to the consulting work, in business volume, the most significant. It was a watershed moment".

IN 1988, THE GOVERNMENT DECIDED TO IMPLEMENT THE NAFA PROJECT ON INTERNATIONAL GAUGE: INECO ADAPTED THE SECTION IN LESS THAN A YEAR

One of those young engineers was Marisa de La Hoz, a public works engineer employed at Ineco since 1986: "We could not have had better leaders than Jorge Nasarre and Santiago Rallo, who, thanks to their knowledge and vision of the future, enabled us to complete all infrastructure and track projects within a record time of nine months".

The work included the design of the 320-kilometre alignment and a study of passenger demand on the new line (commercially named AVE, 'Alta Velocidad Española'). Juan Canteli, an engineer who worked at Ineco for 27 years, highlights that "the study brought to light the existence of a significant demand niche between Madrid and Ciudad Real, which is why Renfe implemented regional high-speed services between Madrid, Ciudad Real and Puertollano". Two years later, at a meeting of the Council of Ministers in December 1988, the Spanish Government made the decision to implement NAFA in international gauge, instead of Iberian gauge. Ineco adapted the Getafe-Córdoba section to the new track gauge in less than a year. Regarding those days before the opening of the line in 1992, Pedro Benito, a public works engineer at Ineco since 1986, recalls: "In one of the journeys prior to the opening, we travelled together with members of the Government and representatives from the construction companies. It was a dream come true. We had fulfilled our part of the challenge and there we were travelling the distance between Madrid and Seville on an infrastructure that we knew down to the smallest detail. We monitored the speed by counting the number of overhead line poles that we passed every minute, and the camber of the curves by noting the angle of the surface of the water at the top of a glass on the table".

Making the high-speed network a reality created or boosted new activities in the teams engaged in the construction phase, such as works management and technical assistance of all kinds: track assembly in tunnels, stations, electrification, etc. The first track maintenance work was also started, a task that continues to be carried out throughout the network: "On 21 April 1992, opening day, we began to work with Renfe on the maintenance of the Madrid-Seville high-speed line. There were about 20 of us, including people from the three work bases (Mora de Toledo, Calatrava and Hornachuelos)", says Rodolfo Velilla, a high-speed maintenance expert employed at Ineco since 1988. "We participated in the creation of a maintenance model, first for Renfe and later for Adif, a model that we are currently using for all of the high-speed lines that we maintain for Adif as technical assistance".

THE MODERNISATION OF THE RAILWAY

With Renfe as sole shareholder, a period of railway modernisation began, with the aim of increasing speed. New weldable points were installed and numerous track upgrade projects were drafted. The workforce began to grow: from about 80 people (between Ineco and Tifsa) in 1983, the number would reach almost 300 in just 10 years.

Jose Mª Urgoiti, a civil engineer at Ineco since 1987, currently deputy general director of National Operations, highlights the challenges of that time: "The first steps in what was called 'track quality' were difficult because we started with practically no experience, just with what our teacher Ulpiano Martínez Solares, who came from Renfe, could show us. Our first technical assistance project was in 1989 on the works for the Seville Expo".

About the tools used in the 1980s, Rafael Herrera, a public works engineer at Ineco since 1982 and, today, deputy director of Operations Coordination, recalls that: "The tools were very limited: ball sticks to detect whether or not the track was well consolidated by the sound when the top of a sleeper was struck, rail curve measuring handles to determine correct alignment, width and camber rules and topographic levels to check longitudinal levelling", adding that "with the data from the rail-curve measuring handles, Ulpiano Martínez and Javier Gómez designed a alignment rectification calculation program that became one of Ineco's first technological developments. It was used for years, and ended up being sold to Renfe, which called it RIPER".

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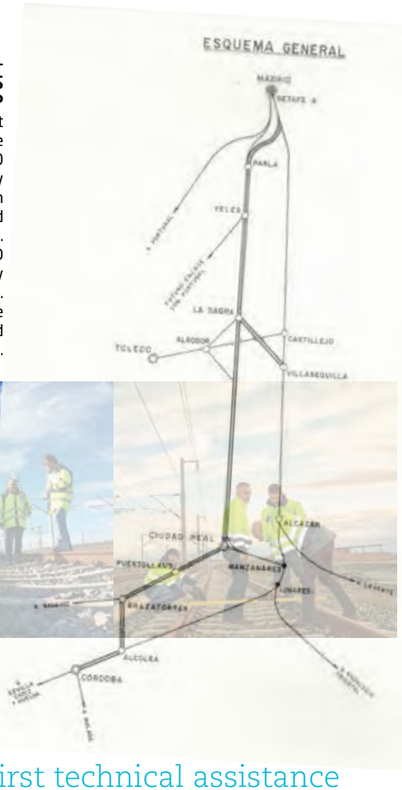

MADRID-BRAZATORTAS MAP
The NAFA project reduced the alignment by 100 kilometres by passing through Brazatortas instead of Despeñaperros. For the first time, 3D digital cartography was used in Spain. Below, staff at the Hornachuelos and Mora work bases.

PHOTOS_ELVIRA VILA

> "Our first technical assistance project was in 1989 on the works for the Seville Expo"
>
> **José Mª Urgoiti,** civil engineer

Ineco opened its Seville office in 1988 as a result of its work on the AVE high-speed line and Expo site, providing quality control services for the works in the five public pavilions and works management of the car parks. A rail access line to the site was also designed and the company provided technical assistance at Santa Justa station.

Watercolour of a Mediterranean Corridor substation.

"The power reinforcement of the Valencia-Vandellós section was the first major power contract we had and it was also orientated towards the high speed. Since then, we have participated in the dimension calculation and design of almost all of the electrification of the Spanish high-speed network"

Ernesto Labarta, industrial engineer

In the image, Javier García de Muro, geological engineer, during Mediterranean Corridor improvement works.

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In the 2000s, this experience led to Ineco's providing Adif with "technical support for the coordination of track renewals and comprehensive station refurbishments, and the construction of new freight and port terminals", says Miguel Solana, a railway expert and surveyor who has been at Ineco since 1990.

THE MEDITERRANEAN CORRIDOR

The best example of increased traffic speed was the Mediterranean Corridor. As explained by Manuel Corvo, a railway maintenance expert employed at Ineco since 1990: "At the end of the 1980s, we began to work on a complex infrastructure because freight, long-distance, regional and suburban trains travelled at different speeds and with intense traffic loads. Adapting conventional mixed-traffic alignments was a milestone and we managed to increase speeds from 160 to 220 km/h".

"In 1995, the Ministry awarded Ineco a power reinforcement project for the Valencia-Vandellós section, which included the refurbishment and modernisation of five traction substations, the construction of eight new ones and the construction of a new 132/20 kV distribution substation and all of the power lines to the substations", explains Ernesto Labarta, an industrial engineer at Ineco since 1997, manager of the Energy Supply, Electromechanics and Overhead Line area. "It was the first major power contract we had and it was also orientated towards the implementation of high speed. Since then, we have participated in the dimension calculation and design of almost all of the electrification of the Spanish high-speed network".

INECO HAS BEEN RESPONSIBLE FOR THE MAINTENANCE OF THE MEDITERRANEAN CORRIDOR SINCE THE MID-1990S

JOINING THE EEC: A SURGE IN PLANNING

Spain's entry into the European Economic Community (EEC) in 1986 and the gradual incorporation of EEC legislation resulted in the need to plan actions and investments. Ineco worked with the Government to prepare plans to lay the foundations for the infrastructure networks –high speed, suburban, motorways, airports, etc.– which would be built or modernised in the following two decades.

Casimiro Iglesias, a civil engineer at Ineco since 2009, summarises what happened during this period: "In the middle of the 1980s, the transport system had major deficiencies in terms of capacity and quality, and this threatened the county's economic development. A number of infrastructure plans were launched, such as the General Roads Plan 1984-1991, the Rail Transport Plan 1987 and the Large City Transport Improvement Plan 1990, all of which started a process of modernisation of infrastructures that has radically changed Spain's transport system. Funds from the European Union were the fundamental catalyst for this process".

PRELIMINARY STUDIES

Spain's integration into the European Economic Community meant that Spanish legislation would need to be aligned with EEC standards, with new environmental and social perspectives being superimposed on the technical aspects. Francisco Cifuentes, a public works engineer, manager of the Public Works, Renfe and Other National account, employed at Ineco since 1988, comments: "Planning became a public process in which the developer enriched proposals with contributions from other public authorities and citizens. Ineco participated in this new concept, which involved the introduction of preliminary studies and environmental impact studies".

Starting in 1989, Ineco began to plan the high-speed network commissioned by Renfe and the Ministry of Public Works and Transport with its first preliminary studies: firstly, those for the Madrid-Zaragoza-Barcelona line, followed by those for other lines, such as new routes to Burgos, Segovia, Valladolid; the Basque Y (1996); Galicia (Peñota bypass) and Asturias (Pajares bypass); the Levante line; Atlantic Corridor: Vigo-Porto; and many others encompassing almost the entire network.

FREIGHT

Throughout the entire history of Ineco, considerable work has been done on freight transport, air cargo, rail access to ports and multimodal transport. The company has produced numerous feasibility studies for new logistics areas for the transportation of freight on land, sea and in the air. In fact, the first job (see photo) –a report signed by Carlos Roa on a study conducted by a French firm (Sofrerail)– concerned the transportation of phosphates in the Sahara (1968). In the 1970s, numerous reports on the transportation of hazardous goods were produced for Renfe.

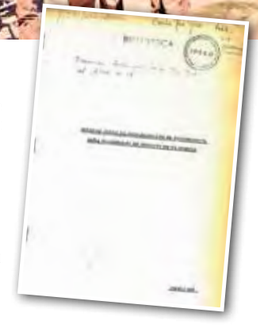
Since then, first for Renfe, Iberia and Transmediterránea, and then for other clients, shareholders and the government itself, as well as in Latin America, Ineco has continued to carry out all kinds of studies concerning the transportation of freight, especially on the railways –with the so-called 'focal points studies' and 'axes' of the 1980s and 90s– but also on roads and by sea, including comparative analyses between modes, and surveys relating to demand, products, train and train car capacity, infrastructures (such as stations, sidings, tracks, etc.), traffic flows, etc. Some recent examples include those of the PLAZA platform and the Zaragoza terrestrial maritime terminal, completed in 2002; the ZAL at the port of Algeciras (2009); and the industrial park of Foronda airport in Vitoria (2010).

There have also been a large number of feasibility studies for new logistics areas for central and regional government in Spain, and later for overseas governments in countries such as Colombia (air cargo study for Santiago Vila de Flandes airport, 2011), Kuwait (Shadadiya industrial area, 2012) and Ecuador (ILCO area in Santo Domingo de los Tsáchilas, 2017). ■

SPAIN JOINS EUROPE
12 June 1985: the then prime minister of Spain, Felipe González, signed the Treaty of Accession to the European Economic Community at the Royal Palace in Madrid.

"Planning became a public process in which the developer enriched proposals with contributions from other public authorities and citizens. Ineco participated in this new concept, which involved the introduction of preliminary studies and environmental impact studies"

Francisco Cifuentes, public works engineer



CATALAN PYRENEES SKI RESORT PLANNING PLAN
The plan, carried out in 1982, was unique because it was one of the company's first land-planning plans. With 11 volumes, this thorough study analysed the situation of ski resorts in municipalities throughout this area. Above in the centre, Antonio Monfort, author of the study, along with Jesús Rubio, also a civil engineer. On the right, Carlos Roa's report on a phosphate transportation study in the Sahara by Sofrerail (1968).

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MAJOR INFRASTRUCTURE

1993-1999

Aena's acquisition of a stake in Ineco in 1993 marked the beginning of a new business activity, airport engineering, with the 'Plan Barajas' as a major milestone and the first air navigation work.

THE 1990s

AENA, THE 'PASILLO VERDE', THE 'PLAN BARAJAS' AND THE BEGINNING OF AIR NAVIGATION WORK

At the beginning of the 1990s, Spain, by then a member of the EEC and in the process of consolidating its recent democracy, undertook a process to expand and renovate its airports, roads and railways. The great events of 1992 –the commemoration of the fifth centennial of the discovery of America by Columbus, the Universal Exposition of Seville and the Barcelona Summer Olympic Games– served as a showcase for the country. Madrid also undertook large works projects in light of these events: the refurbishment of Atocha station to receive high speed and the green corridor ('Pasillo Verde', 1989-1997), Ineco's first comprehensive works management project.

Aena's acquisition of a stake in Ineco gave the company strength and substance: thus began the modernisation Spain's airports, which, at the time, were suffering from serious saturation problems. Aeronautical activities, in both airports and air navigation, began.

TECHNICAL WORKS ASSISTANCE

THE 'PASILLO VERDE'

The aim of the works on the Madrid green corridor ('Pasillo Verde') was to complete the first ring of the Madrid Cercanías network and develop and outfit the land between Príncipe Pío and Atocha stations for railway use. The work included the drafting of projects, analysis and study of bids, and technical assistance for monitoring, management and works management.

According to Roberto Salas, a public works engineer at Ineco since 1987, "with the 'Pasillo Verde', Madrid recovered the southwest of the city. It was the first major urban planning project and also the first time a large tunnel boring machine was used in Spain. This work was followed by the Oviedo 'Cinturón Verde' (1993-1997) and Bilbao Ría 2000, for which we were responsible for works management and technical assistance on the southern bypass (1995-1999)".

For José Mª Urgoiti, a civil engineer at Ineco since 1987, the 'Pasillo Verde' was without a doubt: "An emblematic work that allowed us to create expert teams and opened the door to other major works. At that time, Renfe also commissioned us to carry out an inventory of all of its property, a huge job". Regarding this inventory, Dulce Galán, an engineer specialising in geomatics and topography at Ineco since 1987, adds: "Up to a thousand people participated. We demonstrated that we had the technical and management capability to resolve any challenge".

The first technical assistance on airport works also began. Víctor Pardo, an aeronautical engineer who has been with Ineco for 20 years, highlights that the first of them won in competition was "the refurbishment of Alicante airport (1994-1995). A year later, we went to El Hierro airport (1996-1997) but the one I remember as the most unique was Namibia (2002). We worked as part of a consortium as managers of the project to modernize the country's airport facilities, including the project for the extension of the runway at the Walvis Bay airport and management of the works".

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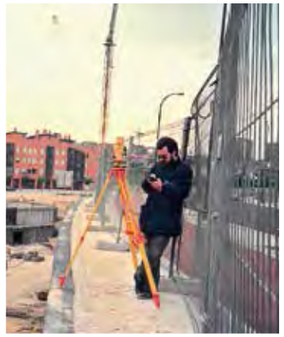
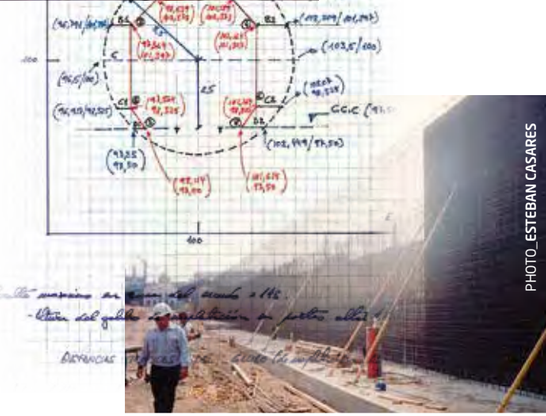
PHOTO_VÍA LIBRE/ LUIS LÓPEZ GARCÍA TRENES DE HOY



Above left, Dulce Galán and Víctor Gándaras working on the Renfe inventory. On the right, surveyor Esteban Casares; below, part of the team and a 'Pasillo Verde' excavation notebook.



PHOTO_ESTEBAN CASARES

Above, Roberto Salas at Príncipe Pío. On the right, works at the Alicante Airport where Ineco took on its first technical assistance project at an airport.

"The 'Pasillo Verde' was an emblematic work that allowed us to create expert teams and opened the door to other major works"

José Mª Urgoiti, deputy general director of National Operations

Aena, a new entity created in 1991 to manage airports and air navigation in Spain, needed to deal with increasing air traffic due to tourism at the beginning of the 1990s which caused saturation problems, especially in Madrid and Barcelona.

BEGINNING OF THE EXPANSION AIRPORTS

Alternative configuration of five runways of the new Campo Real airport included in the ENAM.

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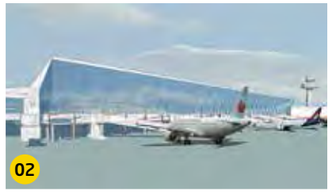

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1. Barcelona airport intermodal building designed by Ineco.
2. Palma de Mallorca airport.
3. Seville Air Traffic Control Centre.
4. Tenerife North terminal.

"In 1999, we undertook one of the most important projects in our history: two new runways at Madrid-Barajas airport"

José Luis Pena, aeronautical engineer

At the end of the decade, the 'Plan Barajas' and 'Plan Barcelona' were approved, works that would continue throughout the first two decades of the century, as would the expansion works on the airports of Palma de Mallorca, Valencia and Alicante ('Plan Levante'), Málaga ('Plan Málaga') and the rest of the network.

"Our first major project was the Tenerife North airport terminal (1996) in collaboration with the Canary Island architecture firm N3. The second was the new Air Traffic Control Centre in Seville, together with the Seville architects Cruz and Ortiz. And in 1999, we undertook one of the most important projects in our history: two new runways at Madrid-Barajas airport, whose numbers far exceeded any other project carried out thus far", explains José Luis Pena, an aeronautical engineer at Ineco since 1996.

FROM FSAM TO THE 'PLAN BARAJAS'

Air traffic in Barajas continued its unstoppable growth. According to the legislation, an in-depth study of alternatives was required before any expansion could begin: this was the FSAM (Future Madrid Airport System) that Ineco drafted for the DGAC between 1997 and 1999. This complex analysis, a milestone for both the company and the airport consultancy, resulted in the large-scale expansion covered in the Master Plan approved in 1999 and prepared by Ineco. That year the 'Plan Barajas' began, with Ineco providing technical assistance for nine years, until 2006. At the same time, a study began to examine the viability of a second airport, to be located in Ciudad Real: the ENAM (Studies for the New Airport of Madrid) project, an exhaustive technical, financial, and environmental study carried out in three phases (2000-2005). In the meantime, the large-scale works began at Barajas that would continue until the middle of 2000: two new runways, two towers, the terminals T4 and T4S, connected by a driverless underground train (people mover), two new aprons, six car parks, an automated baggage handling system (ABHS), a VIP lounge, rerouting and paving works on a road (M-111) and new access roads. An enormous project about which José Luis Pardo de Santayana, an aeronautical engineer at Ineco since 1997, comments: "40 of us started and, by the end, 100 of us were working on the basic engineering and design of the airfield expansion. We considered so many alternatives for the location of the terminals that our Aena colleagues told us that we should just put wheels on them". For Javier de Cos, a civil engineer who spent 30 years at Ineco between 1973 and 2013: "Our Madrid airport system (FSAM) studies for the Barajas airport Master Plan and that of a new airport in Campo Real (ENAM) not only enabled the expansion of Barajas and long-term planning, but also created a large team of experts that made Ineco an internationally recognised airport consultancy company".

Above, an aerial view of Madrid-Barajas airport with the two new runways designed by Ineco's airport Projects team and, on the right, the team in the company's Calle Potosí offices in 2000.

Rafael Torres, an aeronautical engineer and airports account manager at Ineco since 1999, summarises: "The expansion of Barajas for Ineco, it not only meant a consolidation of our knowledge of airport projects and works, but also an opportunity to develop new capabilities in relation to the integrated management of projects, operation, planning, commissioning and operational transition".

THE 'PLAN BARCELONA'

After expansions in 1968 and 1992, in 1999, the Barcelona-El Prat airport began its third major expansion that would transform it into what it is today: the country's second airport. "We mainly participated in airport construction", says Gabriel Díaz-Roncero, an aeronautical engineer employed at Ineco since 1997, "involving us in planning, design, construction supervision and commissioning of the most significant actions in T1 and T2".

MASTER PLANS, AN AIRPORT MILESTONE

The start of Ineco's support to assist Aena in preparing and updating the Master Plans - implemented by law in 1996 - marked another milestone for the company and for airport plans in Spain. According to Miguel de Bernardo, an aeronautical technical engineer at Ineco since 1998: "Ineco began to participate in the drafting of master plans in 1997. The application of this experience abroad with Aena International or other companies has led us to planning airports in countries such as Italy, Poland, the United Kingdom, the Netherlands, Saudi Arabia, Kuwait, Oman, the United Arab Emirates, Iraq , Colombia, Costa Rica, Peru, Argentina, Brazil, Panama, Mexico, Jamaica, Morocco, Angola, Uganda and Kenya".

"The studies carried out for the Barajas expansion project brought together a great team of experts that brought us international recognition in consultancy"

Javier de Cos, civil engineer

AIR NAVIGATION

In parallel with the growth of air traffic, the company's activities in air navigation also increased. The first projects – initially for Aena and now for ENAIRE– started around 1995. Fernando Gómez Comendador, an aeronautical engineer at Ineco between 1995 and 2012, recalls that: "At the end of the 1990s, flight progress strips were the main source of information. It was a manual job which started with a literal copy of the information in the control tower early in the morning. The automation of operational information management processes contributed by Ineco represented a great breakthrough".

Although Ineco now develops its own methodologies and software, in the early years "runway occupancy times were taken with a stopwatch from the tower, we digitised the terrain with a tablet from paper maps, and we didn't have simulators", explains Mª Luisa Fernández, an aeronautical technical engineer at Ineco since 1995.

Since the end of the 1990s, Ineco has provided specialised engineering and technical consultancy projects in relation to ATM (air traffic management) and CNS (communications, navigation and surveillance) systems and has been involved in the modernisation of hundreds of facilities in the network. "Today, we are able to provide specifications, commissioning and radio simulation system services in any country of the world", confirms Víctor Gordo, an airport engineer at Ineco since 1998.

In the mid-1990s, Ineco expanded its road activities with its first works maintenance, monitoring and supervision projects, work that has provided the company with expertise in design, maintenance, accessibility studies and road safety.

THE EXPANSION OF THE NETWORK IN SPAIN

ROADS

In the 1970s and 80s, with the process of building the national road network in full swing, feasibility studies were carried out on new roads and the location of bus stations, customs stations and other services. At the end of the 1980s, traffic studies were carried out to assess future exploitation or improve flows, such as those carried out in the cities of Valladolid and Burgos, or to determine the location of bus stations, such as those in Madrid and Santander. The company also worked on numerous asphalting projects, new car parks, supplementary reports on the removal of level crossings throughout the national network and projects for the building or widening of new road access routes across the network.

However, it was not until 1995 that a Roads department was incorporated into Ineco's Engineering division and this sector was strengthened to cover all modes. It was in this same year that the company won its first public tender for a Ministry road contract, namely a preliminary study for the N-420 from Córdoba to Tarragona via Cuenca, specifically the section between Puertollano and Ciudad Real. In terms of technical assistance, the company's first projects were sections of the A92 highway (1994); the bypass on the Puerto Lumbreras-Baza highway (1995-97); and maintenance and exploitation of the Mediterranean Highway (bypass on the Adra-Cuesta Colorá section) (1995-1999), which was subsequently renewed for 15 years.

The road network, which in Spain in 1993 consisted of just over 7,400 kilometres of high-capacity roads, was improved and modernised, reaching almost 14,700 kilometres of highways in 2008.

About this period, Miguel Vila, a civil engineer employed at Ineco since 1994, highlights that: "Respect for the environment has always been present in our work. By 1994, we had already begun using plastic waste from greenhouses for bituminous mixtures on the surfacing work of the A92-N highway, in which we were responsible for the technical assistance in conjunction with L.P. Murcia and Chirivel (Almería). A few years later, I directed the works of a project carried out by Ineco for the Regional Government of Andalusia, which received an award from the International Road Federation for its respect for the environment. The work took place inside Alcornocales Natural Park, home to Europe's largest cork oak forest".

PHOTO_PABLO NEUSTADT

Above, road works in the Canary Islands. On the left, noise arrangement designed for the M-40 (Madrid). Below, the company's roads office in Paseo de La Habana in 1999.

MAINTENANCE, ACCESS AND REPORTS

During this decade, Ineco began its first works maintenance, monitoring and supervision for the Ministry, work that has led to the company gaining experience in various aspects such as incident management and coordination with the Civil Guard and Civil Protection, accessibility studies and road safety reports, winter viability, maintenance of energy supply facilities, lighting, ventilation and monitoring of tunnels, variable signalling, traffic lights and communications. The company also worked with private companies on drafting projects for concessions, housing developments, due diligence on motorways for financial institutions such as AGF and Banco Espíritu Santo, and technical assessments for disputes with teams of lawyers.

FROM 1993 TO 2008, THE ROAD NETWORK WENT FROM 7,400 KM OF HIGH-CAPACITY ROADS TO ALMOST 14,700 KM OF HIGHWAYS

Ignacio Gálvez, a civil engineer employed at Ineco since 1995, talking about this period, highlights that: "Throughout the second half of the 1990s and the beginning of the 21st century, we participated in the complex work of designing new access roads to the Madrid-Barajas airport, including projects such as the renewal of the Eisenhower node and all connections with the M-40, N-II, access to exhibition sites, M-12 and tunnels. This experience was applied in work on the access roads of other modernisation projects for airports in the Aena network".

The M-12 tunnel designed by Ineco won the award for best and safest tunnel in Europe in 2006, awarded by the prestigious EuroTAP (European Tunnels Assessment Programme). In 2006, the project for the 2nd stretch of the Alcarria highway was drafted, and consulting and technical assistance work was carried out for a preliminary study of the connection between the Trujillo-Cáceres highway (A-58) and other works and preliminary studies for the Regional Governments of Castilla-La Mancha and Madrid.

MORE THAN 2,000 KILOMETRES OF HIGHWAYS

The General Highway Plan (1984-1991) gave non-toll highways a strong push forward, transforming the roads, and drastically shortening travel times. It was initially decided to carry out widening works, and gradually to build new roads with characteristics comparable to non-toll highways.

In 2007, Ineco began to participate in the First Generation Highway Renewal Plan, work in which, as José Luis Mangas, a civil engineer at Ineco since 2007, explains, "we produced the Inspection Manual for concession contracts, carried out follow-up of preliminary projects, studied bids, supervised more than 120 construction projects and monitored the concession contracts that would extend until 2026. The Plan involves the complete overhaul of 2,125 kilometres of highway in the most important corridors of Spain's road network". ■

PHOTO_PABLO NEUSTADT

Ineco participated in the European road safety projects RIPCORD-ISEREST (2005-2007) and PILOT4SAFETY (2010-2012).

Engineer Elena Puente, a roads expert, in 2000. On the left, a map of phases 1 and 2 of Spain's highway renewal plan.

"From the 1990s to the beginning of the 21st century, we participated in the complex work of designing new access roads to Madrid-Barajas airport"

Ignacio Gálvez, civil engineer

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THE NEW MILLENNIUM

2000-2007

Ineco grows in Spain and abroad, creating new areas such as geotechnics and environment, and works on commuter and metro lines, airports, ports and high speed, which reached Barcelona in 2008.

THE EARLY 2000s

TUNNELS, ENVIRONMENT, DEMAND STUDIES, PORTS, AIRPORT EXPANSION, METROS, HIGH SPEED, STATIONS, INTERNATIONAL

During these years, both state and regional Spanish governments had the same clear objective: the modernisation of all transport infrastructures, both urban metro and commuter lines, and long-distance, with the expansion of airports, ports and the high-speed network, which would reach Barcelona in 2008.

The company worked on all of these projects from its headquarters at No. 138 Paseo de la Habana in Madrid, where it is still located today.

UNDERGROUND CHALLENGE: TUNNELS

Spain's rugged geography "has been a huge challenge for the execution of high-speed lines, with the need to build special, enormously complex infrastructure", points out Emilia Lastra, a civil engineer who has been with Ineco since 2007. "Ineco has worked on the design of tunnels and viaducts, the drafting of geological and hydrogeological studies, the supervision of other companies' projects and works management and technical assistance projects, experience acquired with Adif that has enabled us to take part in design and technical assistance work on road and rail tunnels in different countries".

The first railway tunnel repair and refurbishment work dates back to the 1980s; since then, the company has participated in 150 projects on different conventional lines. In 2004, a specific geotechnics and tunnels area was created, and the first tunnel works management project was also carried out on an access route to the Seat factory in Martorell.

SPAIN'S RUGGED GEOGRAPHY HAS REQUIRED THE BUILDING OF HIGHLY COMPLEX SPECIAL INFRASTRUCTURE

Starting in 2004, the company began working with Adif on the design and construction management of high-speed tunnel projects, some of the most important of which included major tunnels in Guadarrama (2002-2007), San Pedro (2003-2007), Pajares, Abdalajís and Sorbas (2009-2011) and those on the Ourense-Santiago (2004-2011) corridor. Noelia Alonso, a civil engineer at Ineco since 2004, elaborates: "All of these required highly exacting studies, with extremely detailed surface geology and subsurface analysis, numerous surveys, geophysical prospecting work and modern structural analysis techniques, not to mention knowledge of conventional and TBM excavation". The company also worked with Adif on the national gauge tunnel works, which included work on Line 3 of FGV's Valencia metro in Alboraya (2011). In terms of urban tunnels, notable projects included the

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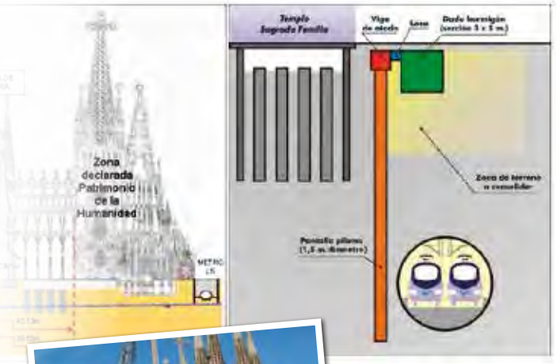
"The Guadarrama, Pajares, Abdalajís and Sorbas tunnels required highly exacting studies, detailed surveys, structural analysis and knowledge of conventional and TBM excavation"

Noelia Alonso, civil engineer

PHOTOS_ELVIRA VILA

High-speed tunnel between Atocha and Chamartín, Madrid, for which Ineco managed the works and provided assistance in soundings and geotechnics. Above: Emergency shaft. Centre: Álvaro García Tapia and Juan Martínez working on signalling in 2017. Below: TBM receiving shaft in Atocha, 2011.

PHOTO_PABLO NEUSTADT



The Sants-Sagrera tunnel in Barcelona was opened in 2013. It was excavated without affecting architectural gems like the Sagrada Familia. Below, the Burata tunnel in Galicia.

Train testing in the Guadarrama tunnel in June 2007 (above). Below, excavation of the Abdalajís tunnels (Córboba-Málaga HSL) with TBMs (2006).

The Pajares tunnels, the second longest in Spain, consisting of a total of 24.6 kilometres.

PHOTO_**PABLO NEUSTADT**

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works carried out in Gijón (2003-2007) and Pío XII, Madrid (2004-2005). In 2011, the excavation of the Atocha-Chamartín dedicated high-speed tunnel, directed by Ineco, concluded and, in 2013, the Sants-Sagrera tunnel was opened in Barcelona, with the company's know-how in tunnel instrumentation playing a crucial role, because, as Ramón Banegas, a civil engineer at Ineco since 2004, explains: "It passed through a densely populated urban area containing buildings such as the Sagrada Familia and Casa Milá, both UNESCO World Heritage Sites, without affecting any of them. In addition to the treatment of the terrain in the surrounding area, an extremely thorough soundings campaign was conducted and numerous buildings were inspected on both sides of the works".

INECO'S KNOWLEDGE OF TUNNEL INSTRUMENTATION WAS CRUCIAL TO ENSURE THAT BUILDINGS SUCH AS THE SAGRADA FAMILIA WERE NOT AFFECTED

At the same time, the company carried out innovation projects such as PROTAV (2006-2007) and Monitoring (2017); work was also done to optimise radio coverage inside and improve safety methodologies, which were later applied in projects such as the Reforma tunnel in Mexico City.

In terms of safety and maintenance, for Daniel de la Hera, a civil engineer at Ineco since 2003, the most interesting jobs were: "The waterproofing of the Guadarrama tunnels, the inspection and monitoring of pathology evolution in the Regajal tunnel, the pathology and thermography studies in the San Pedro tunnels, the study of structure gauges and thermography in the Lilla tunnel and the inspection of several tunnels in Girona". Carmen Vecino, a civil engineer at Ineco since 2009, adds that: "Actively participating in the drafting of Spanish and European railway gauge regulations has given us national and international recognition as a leading company in this area".

ENVIRONMENT

In 1999, the Ministry of the Environment gave its approval to the first airport-planning study that included environmental aspects: the FSAM (Future Madrid Airport System), drafted by Ineco. The following year, a specific Environment department was created under the management of Sebastián Milanés, a civil engineer who worked at Ineco between 2000 and 2011, who points out that: "The importance and uniqueness of the FSAM was that, for the first time in Spain, an airport planning study was going to include all environmental aspects in their entirety, in all stages of the process of developing and evaluating alternatives, and not just in the final stage".

SINCE 1999, INECO'S ENVIRONMENTAL ACTIVITIES HAVE MULTIPLIED; THE CHALLENGE IS NOW CLIMATE CHANGE

Ineco, which had already been providing technical assistance to Aena in the management of the Office of the Barajas Acoustic Insulation Plan since 1997, extended its activities to include noise footprints and all kinds of studies and acoustic analyses such as: "Strategic noise maps and action plans, acoustic easements and high-speed acoustic protection studies on projects such as the Galician Atlantic Corridor, the AVE high-speed line to Murcia and the second phase of HS2 in the United Kingdom", explains Ruth Ballesteros, a biologist who has worked at Ineco since 2004.

In parallel, Ineco has also drafted numerous environmental impact studies and assessments for all kinds of transport infrastructure, expertise that has been exported abroad, as Ana Lorenzo, an Environmental Sciences graduate at Ineco since 2007, explains: "The environmental assessment of the feasibility study for the Cairo-Luxor-Hurghada high-speed line in Egypt; the Mumbai-Nagpur section in India; and Lot 2 of phase 2B of the HS2 high-speed line in the United Kingdom", and others such as a study on the Bioceanic Corridor in Bolivia (2015), and a 2014 analysis of alternative propulsion systems for buses in São Paulo, Brazil.

In 1999, environmental management and technical assistance projects on all kinds of works also started: airports, railways, roads, etc., including management and protection of natural and archaeological heritage for important high-speed projects. Between 2015 and 2016, two urban waste management plans were carried out in Panama and Quito (Ecuador).

In terms of innovation, some of the more important projects included European projects such as OPTA-In in the aviation field (2012-2014) in relation to continuous descent approaches (CDA), and LIFE MINOx-STREET (2013-2018) to "study the real capacity of photocatalytic materials to reduce NOx pollution in the urban environment", as explained by Belén Seisdedos, a civil engineer with Ineco since 2002.

In relation to climate change, Ineco, which in 2016 carried out a research project and institutional campaign entitled 'A million for climate', on the occasion of the Paris Summit, has drawn up "the 'Transport and Infrastructure Sustainability and Climate Change Plan' to enable companies in the Public Works Group to contribute to reducing their impact on climate change", says Virginia Fuentes, a forestry engineer who has worked at Ineco since 2006.

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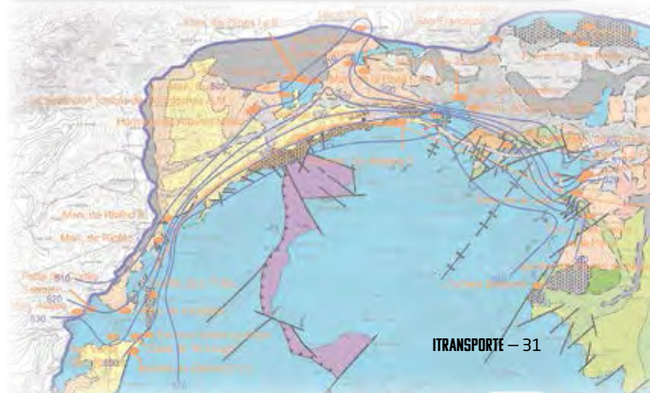
"The importance of the FSAM was that, for the first time in Spain, an airport planning study included environmental aspects of the entire process, and not only of the final stage"

Sebastián Milanés, civil engineer

On the left, excavations at the Lo Hueco (Cuenca) archaeological site in 2007. Below, renewal of the Ronda-Algeciras line in a protected area (2010); Madrid-Barajas airport noise footprint (2011); and a hydrogeological study on the Loja bypass (2010).



Above, Ineco survey interviewers in Costa Rica. On the right, a questionnaire for a study on the Transport and Traffic Master Plan in the Rabat-Salé-Témara metropolitan area (2008), for which 6,200 household surveys were filled out.

The Ineco team José B. Zarzuelo, Jorge Cruz, Mª Jesús Gimeno, Pilar Valiente and Roberto Vílchez in the port of Valencia.

"Of the more than 80 jobs carried out for Valenciaport, some of the most notable were technical assistance on the works of the connection between transversals for intra-port traffic, the replacement of the berthing line and the extension of the eastern breakwater"

Pilar Valiente, public works technical engineer

STUDYING DEMAND

Since its inception and using its own resources, Ineco has carried out numerous demand studies, with activities ranging from designing and conducting surveys to data processing and producing final reports. José Luis Gion, who worked at Ineco for 40 years between 1975 and 2015, highlights projects such as: "Canvassing of Cercanías passengers for Renfe which began in 1990, first in Madrid, then in the rest of the country, and continues today with the same methodology", and, outside Spain, "the demand study carried out in 2008 in Morocco for the Transport and Traffic Master Plan in the Rabat-Salé-Témara metropolitan area, which was one of the most complex; we completed 6,200 household surveys in French and Moroccan Arabic with a hundred canvassers, and collected travel information on 30,000 people". In terms of large general-purpose surveys, those that stood out were household surveys on mobility in Madrid, which was commissioned by the Regional Transport Consortium in 1987, and in Valencia, the Balearic Islands and Galicia. Also notable in Madrid were studies on the use of travel cards and the classification of Cercanías demand for the Transport Consortium between 1993 and 2006.

IMPORTANT DEMAND STUDIES INCLUDED CERCANÍAS SURVEYS AND THE RABAT-SALÉ-TÉMARA MASTER PLAN (MOROCCO)

Regarding air travel, the EMMA airport mobility surveys (1998-2015) were noteworthy, as were those conducted to measure perceived quality levels (AEQual), which were conducted annually between 2002 and 2011, both commissioned by Aena. Another notable project was a study of quality on interurban road transport that was carried out every two years between 2000 and 2008.

PORTS: THE PORT OF VALENCIA

Throughout its history, Ineco's principal port projects have been related to railway access routes and the improvement of their networks, consultancy studies on freight transport, railway logistical areas, dry ports, etc.

Some of the more important purely maritime projects were the nearly 80 projects carried out for Valenciaport, which manages the ports of Valencia, Sagunto and Gandía. Pilar Valiente, a public works technical engineer who joined Ineco in 1994, explains that the company began by working on the port's southern railway access routes, after which, "we continued with the rail access route to the eastern breakwater and its railway yard, the regulation of the special intersections of the railway network with the road network and the extension of the railway yard of the eastern breakwater". She adds that the most important truly port related works were the "connection between transversals for intra-port traffic and the replacement of the berthing line, which included a tunnel and 550 metres of new roads, many of which were built six metres below sea level in an area enclosed by 30-metre-deep screen walls; and the two phases of extension of the eastern breakwater, which represented 55,000 m² of land reclaimed from the sea and 575 metres of berthing line".

Ineco supervised the integration of architecture and engineering into the works of Barcelona T1 (2009).

PHOTO_PABLO NEUSTADT

"Important airport expansions included Burgos, Huesca and, above all, Málaga, where, from 2004, we ran the 'Plan Malaga' Office for Aena and drafted the main project for the second runway"

José Ángel Higueras, aeronautical engineer

AIRPORT EXPANSION

As a result of the process to expand and improve the Aena network, in which Ineco began to participate from 1995-96, by 2010 the Aena network had grown from 38 to 46 airports, after the building of six new ones –La Gomera, León, Logroño, Albacete, Burgos and Huesca-Pirineos– plus two heliports: Ceuta and Algeciras (opened in 2004 and in 2010), in which Ineco also participated.

Throughout the first decade of the new millennium, Ineco continued working on the expansion of Barcelona-El Prat airport. 2004 saw the opening of a third runway; 2007, a new tower; and, 2009, the T1 terminal, designed by Ricardo Bofill. Ineco supervised the integration of architecture and engineering and collaborated with the Transfer Office. Subsequently, T2 was also redesigned. Ineco also drafted projects for a new platform control tower, common commercial areas and a new underground Cercanías station under the airfield.

In Málaga, a new terminal, T3 (opened in 2010), was built, along with a second runway, the project for which, among other functions, was drafted by Ineco, which also provided the environmental management of the works and the operational transfer. José Ángel Higueras, an airport engineer who has been at Ineco since 2000, highlights the expansion works on the airfields of the airports in "Burgos, Huesca and above all, Málaga, where we began to collaborate with Aena in 2001, in order to run the 'Plan Málaga' Office (2004-2013), which supervised and coordinated the execution of all of the works and drafted the main project for the second runway".

THE AENA NETWORK WENT FROM 38 TO 46 AIRPORTS, AND EXPANSION PROJECTS CONTINUED IN MADRID, BARCELONA, MÁLAGA AND PALMA DE MALLORCA

Other airports, such as Zaragoza and Vitoria for cargo and Reus, Girona, A Coruña and Menorca for low-cost airlines, were also expanded. In terms of airport construction, some of the most notable projects were León's new terminal and the expansions of Valencia, Ibiza and Palma de Mallorca. Other significant work during these years included the design of commercial spaces at airports such as Barajas, El Prat, Alicante, Valencia and Mallorca.

Since 2009, Ineco has been supporting the State Air Safety Agency (AESA) in the authorisation, inspection, and certification of airports for public use under private management. In 2014, AESA authorised the company to perform aeronautical inspections.

Operational transfer (ORAT) in Málaga: tests with role players in 2010, shortly before the opening of the new terminal (above).

Below: the first transfer team of T4 at Barajas, in May 2002. Including engineer Ana Belén Cantos, director of Communication, Services, and Strategy, Rafael Molina, and general director of Development and Sustainability, Ignacio Fernández-Cuenca.

In large cities, urban and interurban transport networks were expanded. Ineco was involved in the design and construction of metros and light railways in Spain, such as those in Madrid, Bilbao and Seville, and tram systems in Alicante and Tenerife, and abroad, in Belgrade and Algiers.

URBAN RAIL TRANSPORT

METROS

One of its first projects was a supplementary study of the Bilbao metro network (1977) for the Ministry of Transport. Francisco 'Franchis' Fernández Lafuente, a civil engineer who worked at Ineco from 1973 to 1983, remembers that: "This study opened the door to allows us to create a similar one for the Bogotá metro, which I presented in October 1981 with Antonio Debesa to the mayor at the time, Hernando Durán. 25 years later, Ineco drafted the construction project for the Casco Viejo-Bolueta section of Line 1, based on the initial concept".

In terms of technical assistance on metro works, one of the first was a branch of Line 8 of the Madrid metro on the Mar de Cristal-Campo de las Naciones stretch (1994-1998). Later, the company supervised the works to extend the line to Barajas airport's T4. In 2001, work was carried out on the Cuatro Vientos depot on Line 10.

Among the most significant projects were works on Line 11 of the Madrid metro between 2003 and 2007, about which Francisco Gimeno, a civil engineer at Ineco since 2001, comments that: "It was certainly the most complex metro work that we had undertaken. 2.7 kilometres of tunnel and three new stations were built under Carabanchel Alto. I remember that the TBM had to pass through an area below agricultural land, where there were various shafts. One of these shafts was located in a convent, and the nuns got quite a scare when a large amount of foam from the additives used to treat the excavated earth began to come out of one of them".

Between 2003 and 2007, the company was involved in various metro and tram projects in Spain, such as those in Palma de Mallorca, Roquetas de Mar, A Coruña, Vélez Málaga, Murcia (metro-train), Alboraya (train line covering works), Valencia and Alicante.

In Madrid, work included studies for a light railway in Valdemoro, and the project and technical assistance on a light railway from Colonia Jardín to Pozuelo de Alarcón, about which Carlos Cubillo, a civil engineer at Ineco since 1999, comments that: "It was cutting-edge work in the

PHOTO_B. RUNNER

Map of the supplementary study of the Bilbao metro (1977), which opened the door to the Bogotá metro project, presented in 1981.

Region of Madrid, which we started to draft in 2004. The final alignment, 8.6 kilometres long with 14 stops, two of which were underground, was the result of an intensive design process. After the start of the works, different circumstances forced us to rethink the project on the fly, which we integrated into the design in record time".

TENERIFE METRO

In June 2007, Line 1 of the Tenerife metro, in which Ineco participated as a shareholder, was opened, and according to José Manuel Alonso, a civil engineer at Ineco since 1995, it represented: "A milestone in terms of the degree of participation in its construction. In addition to being a shareholder, we provided comprehensive technical assistance from civil works to workshops, systems and rolling stock for approximately 15 years".

In 2008, the construction project for Line 3 of the Seville metro was drafted, following Ineco's earlier work providing technical assistance for Line 1. For the Barcelona metro, since 2009, the company has been responsible for independent technical audit consulting for financial entities in the Line 9 concession, about which David Maté, a civil engineer at Ineco since 2003, comments that "this was the beginning of this type of consulting, for which we now have a technical, legal and financial team that specialises in public procurement, business plans and public-private partnerships".

METROS AND TRAM SYSTEMS ABROAD

Outside Spain, Ineco's metro experience was applied for the first time in 2006 in conjunction with Alsthom on the Algiers tram system, for which Ineco designed the alignment, substations and maintenance depot; and provided project coordination with the works. Juan Antonio Martínez Barcala, a public works engineer at Ineco since 2004, recalls that: "The Algiers tram system had been paralysed since the 1970s. As it was a troubled period and there were many attacks, for the eight months that we were there, we ate every meal at the hotel. One night, we met Buteflika, the president of the country, who, when he heard us speaking in Spanish, came to our table and thanked us for participating in the civil works for the tram system. The work went well and three years later it was opened".

Other notable works during this period included the feasibility study, design and project coordination of the first light railway in Belgrade (Serbia) between 2004 and 2007; and in 2008, in Italy, the company, as part of a consortium, was involved in a layout project for the first metro line in Bologna, renewal of the Milan-Limbiate tram line and expansion of a depot (workshops and sheds) in Gallaratese (Milan).

In the following decade, work would include technical assistance on the works for Line 2 of the Bombay metro in India; a modernisation project for the Tallinn tram network (Estonia), both in 2011, and another similar one in Pavlodar, Kazakhstan (2015). More recently, the company has worked on Mexico City's suburban network and, since 2016, on Line 12 of the city's metro. Ineco is currently conducting an independent safety assessment (ISA) on Lines 1 and 2 of the Panama metro. Since the early 2000s, Ineco has supervised the manufacture and commissioning of new trains for the metros systems of São Paulo (Brazil) and Medellín (Colombia), and the modernisation of existing metros in cities such as Santiago de Chile.

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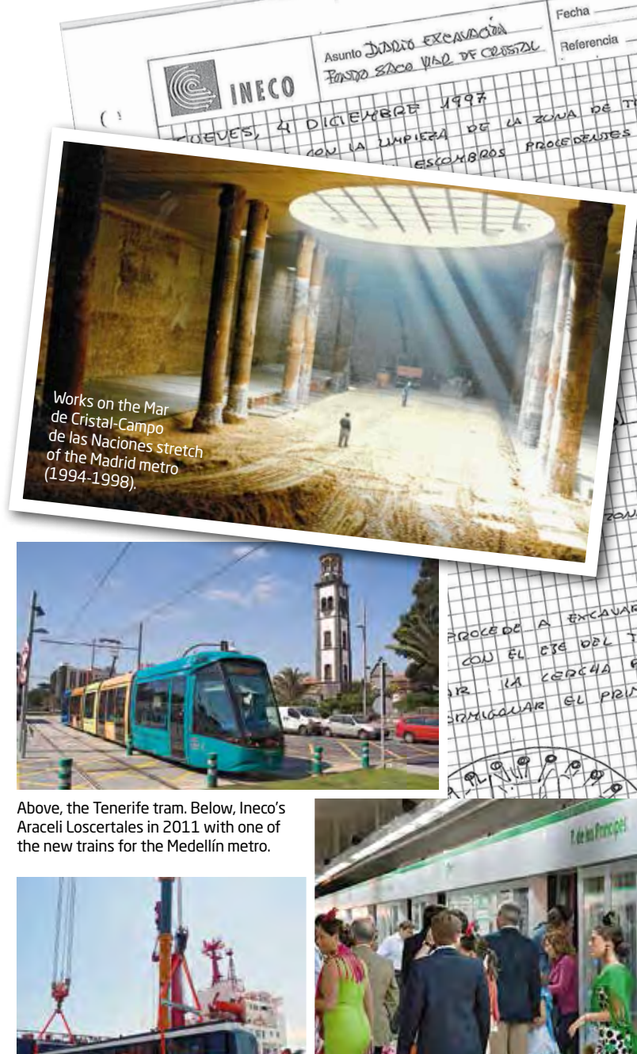


Works on the Mar de Cristal-Campo de las Naciones stretch of the Madrid metro (1994-1998).

Above, the Tenerife tram. Below, Ineco's Araceli Loscertales in 2011 with one of the new trains for the Medellín metro.

Ineco has worked on metro and tram systems throughout Spain, including the system in Seville (above right).

Belgrade's ight railway first line (2004-2007).

"Line 11 of the Madrid metro was certainly the most complex work of its kind that we had undertaken. 2.7 kilometres of tunnel and 3 new stations were built. In a convent, the nuns got quite a scare when foam from the additives used to treat the excavated earth started coming out of one of the closed shafts"

Francisco Gimeno, civil engineer

After the opening of the AVE high-speed line to Seville in 1992, it would take 11 years for the Madrid-Lleida section to be opened in 2003. During this decade, Spanish high speed, which reached Toledo, Córdoba, Málaga, Valladolid and, finally, Barcelona, in 2008, with the intensive participation of Ineco and Tifsa, was technically defined.

THE NETWORK EXPANDS

HIGH SPEED

From left to right, variable gauge changeover installation; Ineco has designed a large number of these and is responsible for the maintenance of 16 throughout Spain. Víctor Duarte, a civil engineer, in 2003 on the works of the Córdoba-Málaga line.

> "We used the Madrid-Lleida section as a laboratory; all kinds of tests had to be carried out on the overhead line: on junctions, sectioning, etc. On paper, everything added up. Everything had to be tested and adjusted, like an enormous prototype"
>
> **Javier Guerrero,** industrial technical engineer

Between 1988 and 1990, Ineco began to draft preliminary studies for the Madrid-Barcelona line and the first superstructure construction projects began to appear in 1998. In that year, the GIF (Gestor de Infrastructura Ferroviaria, or Railway Infrastructure Manager) commissioned Tifsa to carry out the technological definition of the elements of the superstructure, a contract that, according to the director of Railway Operations Moisés Gilaberte, a civil engineer at Ineco Tifsa since 1988, represented: "In terms of volume and importance, a milestone of special significance. Characteristics and specifications were designed and defined, and the regulations that still apply today were drafted. Since then, the company has provided support to the Government in terms of monitoring manufacturing, logistics and quality control of all materials installed on high-speed lines, making us a European benchmark in track technology".

THE GIF COMMISSIONED TIFSA TO DEFINE THE TECHNOLOGY FOR HIGH SPEED, WHICH IS STILL IN PLACE TODAY

In 1999, technical assistance contracts began for track assembly, traffic, materials supply, track devices, etc., between Zaragoza, Huesca and Lleida, where electrification works management also started. That same year, Ineco carried out its first environmental construction management on this section. In 2005, the structure inspection team carried out a load test on a viaduct for the first time, located in Vinaixa, at the unusual speed of 360 km/h. "The GIF commissioned us to draft the technical specifications for the electrification and later, to undertake the construction management of Madrid-Lleida", says Javier Guerrero, an industrial technical engineer at Ineco since 1986, "we used the section as a laboratory; all kinds of tests had to be carried out on the overhead line: on junctions, sectioning, etc. On paper, everything added up. Everything had to be tested and adjusted, like an enormous prototype".

In 2001, it was decided, for the first time in Spain, to award a concession contract for the construction and operation of a high-speed section, the Figueras-Perpignan line, which would provide a connection with the French border and open in 2010. For Ineco, it represented "our first experience in an international high-speed consortium", as explained by Fernando Portillo, a civil engineer at Ineco since 1999. "We participated in the tender with the GIF, the Spanish railway infrastructure manager, its French counterpart RFF and the French consultancy SETEC, in the Ferromed consortium. In the end, the concession was awarded to another consortium, TP Ferro". In 2003, the Madrid-Lleida section opened and in 2008 high speed reached Barcelona; it had also reached Toledo in 2005, Córdoba, Antequera and Málaga in 2006-2007 and Segovia-Valladolid in 2007.

Above, the Madrid-Lleida line: installation of overhead lines (left) and the arrival of the first high-speed transformer at Peñalba station in 2001 (right). Below, works on the Madrid-Valladolid line in 2007 (left) and Ineco's Traffic team in 2017 (right).

Ineco carried out all kinds of work on all of these sections, from preliminary projects to environmental and construction management, technical assistance, and since 1992, it was also responsible for the maintenance of the entire network. In addition, as Pedro Asegurado, a railway specialist, points out: "Ineco's Traffic team had been carrying out high-speed train tests on all lines in Spain since 2006", the year in which the company drafted its first electrical dimensioning construction project, for the Valdestillas-Valladolid section, which was followed by many others on all lines, both civil works and facilities.

INECO-TIFSA WORKED ON THE NEW ERTMS SYSTEM, WHICH WAS IMPLEMENTED FOR THE FIRST TIME ON THE MADRID-LLEIDA SECTION

Since 2000, Ineco-Tifsa has also participated in the development of technological solutions and the systems and equipment that a new railway system as demanding as high speed would require: among them, the ERTMS, which was installed for the first time on the Madrid-Lleida section; the implementation of real-time remote control with the Da Vinci platform, developed by Indra for Adif; and all new track and train protection systems, etc.

In addition to the new developments, there was also the challenge of making two track gauges compatible: the Iberian (1,668 mm), on the conventional network, and the standard (1,435 mm), on the high-speed line. To do this, two unique technological solutions were deployed: the three-rail track (or multi-track gauge) and the variable gauge changeover installations. Esteban Rubio, a public works engineer at Ineco from 1984 to 2012, summarises: "In total, we designed more than 50 variable gauge changeover installations. The first one was tested on an abandoned line between Olmedo and Medina, followed by Lleida and many more. At first, we installed two platforms horizontally, then vertically and finally, the dual system". Today, Ineco has a team of 40 people responsible for the maintenance of 16 of these installations. In this same test section, Ineco carried out the trials and technical definition of the three-rail track, which has been installed in the Mediterranean Corridor and the high-speed line to Castellón, opened in 2018.

As one of the significant milestones in this period, Juan Batanero, a civil engineer at Ineco (Tifsa) between 1984 and 2013, highlights that: "In February 2004, Tifsa was the first Spanish engineering company to obtain ENAC (the national certifying entity) accreditation to inspect railway rolling stock, work that began on the Madrid-Seville line".

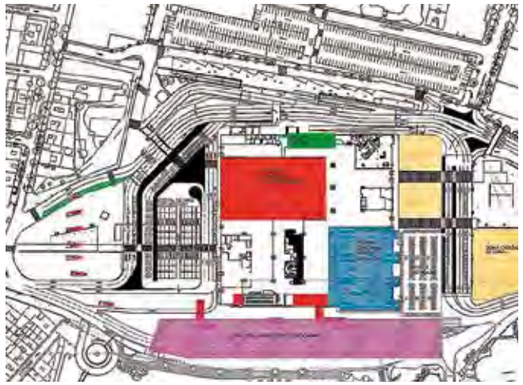
•••

Throughout this first decade of the new millennium, Ineco worked on numerous station projects of all kinds, including collaborations with renowned Spanish and foreign architects. The commuter rail networks of large cities were transformed and stations and workshops were adapted to the growing high-speed network.

RAILWAY CONSTRUCTION

THE STATIONS

The landscaped roof of the new Logroño station (2009), in collaboration with architect Iñaki Ábalos. On the right, Atocha station.



The redesign of Sants station in Barcelona (2009) took three years and included doubling the size of the concourse and building seven platforms with fourteen tracks - six high-speed and eight conventional.

The major redesign of the Atocha railway complex between 1985 and 1992 converted it from a rail stop into Spain's largest Cercanías station, and, as Francisco Fraile, an industrial engineer at Ineco between 1984 and 2015, recounts: "It was one of Ineco's most important projects. We were responsible for all of the electrification, working shoulder to shoulder with the designers of the station, the Rafael Moneo team".

Beginning in 2000, Renfe and Adif implemented several modernisation and improvement plans in stations throughout Spain, and Ineco played an important role. Out of all of these plans, Marisa Guillamot, an architect at Ineco since 1992, highlights, among others: "Llamaquique Cercanías station in Asturias; Miribilla in Bilbao, built 50 metres deep; and Málaga airport and Alboraya, both of which are also underground. In total, more than 160 projects and works for Adif and Renfe". As for modular stations in Madrid, particularly notable were Las Zorreras, Las Margaritas-Universidad and the Soto del Henares stop, which won an award for 'Best Municipal Public Works.' In terms of technical assistance, the new Sagrera-Meridiana Cercanías station in Barcelona (2010) stands out. Important projects abroad included the feasibility studies for metro stations in Belgrade and suburban stations in São Paolo, and the modular designs for Bogotá's Western Corridor.

HIGH-SPEED STATIONS

The company boasts a long list of projects ranging from construction management to the drafting of architectural projects: Puente Genil and Antequera-Santa Ana (2007); Camp de Tarragona (2006); and Vigo-Guixar on the Galician Atlantic Axis. Ineco has managed numerous works throughout the network to adapt stations to high speed.

Gregorio Navarro, a public works engineer who has been at Ineco since 1988, also highlights the major railway line tunnel works that were executed in Logroño (2006-2009), which represented "a profound transformation of the environment,

PHOTO_PABLO NEUSTADT

Among the maintenance workshops, Valladolid stands out (above). In 2009, Ineco collaborated with architect Rafael Moneo on the refurbishment of Atocha station (below) to receive the Valencia high-speed line.

"Particularly notable were the Cercanías stations in Llamaquique, Miribilla, Málaga airport and Alboraya. In total, more than 160 projects and works for Adif and Renfe"

Marisa Guillamot, architect

and involved the drafting of several projects in a joint venture with Sener and the architect Iñaki Ábalos. It was a case in which engineering and architecture were brought together, an experience that Ineco also had with Rafael Moneo at Atocha".

The construction of the Madrid-Barcelona line required the adaptation of the stations at both ends. Although Atocha was chosen in the end, it was initially thought that Chamartín would be the terminal, as Enrique López del Hierro, an industrial engineer, recalls: "In 2002, Renfe Estaciones commissioned Tifsa to undertake the basic project to adapt Chamartín station to high speed, a job that we carried out with the architects Lamela, Luis Vidal and Juan Antonio Ridruejo, and which was the first high-speed integration study". At the other end of the line, "work at Sants station in Barcelona was carried out without affecting the hotel above it", explains the project's head of technical assistance, Michael Ashiabor, a public works engineer at Ineco since 1991. "It involved adapting the station to high speed and, at the same time, providing it with intermodal characteristics, such as connection to the Barcelona metro and the bus station, in addition to making it a business, shopping and leisure centre". Atocha station, the largest in Spain, was redesigned again in 2009 to receive the new Valencia high-speed line. Ineco undertook the engineering work in collaboration with Rafael Moneo's architecture studio. Alfonso González, an architect at Ineco since 1998, points out that: "The new Atocha railway complex was built in a well-established area of Madrid. The final layout was more than one kilometre long and 400 metres wide, featured numerous entry points from city to railway, and provided convenient access to the high-speed network". Ineco is currently working on two stations that are preparing for the arrival of high speed: Abando in Bilbao and Ourense's new intermodal station, which was designed by Norman Foster's architecture studio and local architect Juan Carlos Cabanelas. The co-authors of the project, civil engineer Tomás Mañas (at Ineco since 1998) and architect Roberto Marchán (at Ineco since 2011), explain that the planned actions include: "A new passenger terminal and a pedestrian footbridge to connect two neighbourhoods that are currently separated, a new road and a roof slab to cover the tracks".

MAINTENANCE WORKSHOPS

In addition to stations, railway operations also require maintenance workshops. Ineco has participated in workshop design, works management and technical assistance for high-speed trains abroad (Algiers, Milan, Mecca, Medina) and in Spain: Malaga-Los Prados, Barcelona-Can Tunis, and Antequera (Granada); and in Madrid, Cerro Negro, Santa Catalina and Fuencarral, "which will soon be expanded, also with the involvement of Ineco,' explains Vicente Ortis, a civil engineer at Ineco since 2004, who adds that 'participation in its construction has been the biggest challenge and the greatest satisfaction of my professional career". Particularly notable was the large Valladolid workshop, about which Javier García Martín, a civil engineer at Ineco since 2002, highlights that: "The challenge was multiplied by the need to meet high performance requirements, from simple inspection and cleaning to secondary maintenance, which involved disassembling and reassembling old vehicles piece by piece".

Since 2000, Ineco has maintained its presence in Brazil, Venezuela and Colombia, and has started operations in new countries such as Kuwait and Mexico. It also works in Europe and Africa, where airport works started in Cape Verde and continue to this day.

ENTRY INTO MEXICO AND KUWAIT

INTERNATIONAL

Above: Buenavista-Cuautitlán commuter line (Mexico) and the engineers J. L. Pena and A. Higueras at a ceremony to lay the cornerstone of the new Boa Vista terminal (Cape Verde). Left: first job in Kuwait (2006).

Planning experience translated into projects abroad, "such as the two railway plans that we designed for Kuwait in 2006 and the national plans for Algeria in 2009 and Costa Rica and Ecuador in 2012", highlights José María Llorente, a civil engineer and deputy director of Tenders, at Ineco since 1999. "The extensive experience we acquired in national plans in Spain, such as PEIT and PITVI, singles us out as an expert company in this field".

LATIN AMERICA

In Brazil, as a continuation of the work begun in the 1970s, a viability study of the railway connection between São Paulo and Campinas was carried out in 2004. For CPTM, Companhia Paulista de Trens Metropolitanos, work was carried out on the implementation of new lines and the modernisation of existing ones. In 2007, technical assistance was provided for a new line between São Paulo and Guarulhos airport, with connection to the commuter network.

In Venezuela between 2004 and 2008, the then Ineco-Tifsa Group and Renfe were commissioned by Venezuela's Instituto Autónomo de Ferrocarriles del Estado (IAFE) to put a new 41-kilometre suburban stretch into operation between Caracas and Cúa in Valles del Tuy, allowing "500,000 inhabitants of the region to reduce average travel times by an hour and a half", explains Ángel Serna, a civil engineer at Ineco since 1989. "For Ineco, it was a great achievement because, in just two years, we were able to put a modern railway into operation", he concludes. One year later, in 2009, Ineco provided support for the refurbishment of the Valencia metro and Line 1 of the Caracas metro.

In Colombia, in 1994, a study was carried out on bypass alternatives for Bogotá's Arterial Railway Network for the state railway company Ferrovías. In 1995, the company provided advisory services for the national rail network concession process. The following year, Ineco drafted renewal projects for the Medellín-Puerto Berrío and La Caro-Lenguazaque sections. Between 1999 and 2003, it provided Ferrocarriles del Norte de Colombia (FENOCO) with operational assistance for its freight transport. In 1999, it produced a suburban train feasibility study for La Sabana de Bogotá and a master plan for Ernesto Cortissoz airport in Barranquilla.

In Mexico, 2006 marked a milestone with the opening of a new office and the start of an emblematic project: technical assistance for the construction and operation of the Buenavista-Cuautitlán suburban railway, as Emmanuel Gómez, a geologist and civil works technician at Ineco since 2005, explains: "In just two years, the 27 kilometre line was renewed with new stretches, six stations, transfer stations and a new electrification, signalling and communications system".

In Argentina, Ineco, together with Alstom, produced the Rapivía study in 2002, and later, a tender for a future high-speed line between Buenos Aires, Rosario and Córdoba.

CARACAS-CÚA PROJECT (VENEZUELA)
Above, from left to right, Antonio Millán, José Andrés Maroto, Ángel Serna, Jesús Mateo (Adif), Isabel Lacambra and Ramón Conde.
Below, in the centre of the image, Carmen Araújo with local staff at Caracas station in December 2005.

"The great experience we acquired in national plans in Spain, such as PEIT and PITVI, singles us out as experts in this field"

José María Llorente, civil engineer

In 2005, it carried out a master plan for the port of Comodoro Rivadavia and redevelopment of the port of Santa Fe. Between 2007 and 2010, a study was carried out for the renewal of the line between San Salvador de Jujuy and La Quiaca. The person in charge of the project, Santiago Espinosa, a railway technician at Ineco since 1988, recalls that the terrain was so inaccessible that "if we wanted to carry out inspections, we had to travel much of the 298 kilometres between Salvador de Jujuy and La Quiaca on horseback or by bicycle. The section, abandoned in 1993, was extremely deteriorated and had slopes that exceeded 6%". Ineco has recently returned to working in the country with inspection of the Paseo del Bajo works in Buenos Aires, among other projects.

Other works in Latin America include those carried out in Costa Rica, where, in 1984, Ineco drafted a preliminary project for the Pavas-Curridabat tram line; and in 1992, a railway network master plan pre-feasibility study. In Chile, it drafted a project for a second runway at Santiago airport, and, in 2007, a study of seven Andean airports for the Corporación Andina de Fomento (CAF).

EUROPE

Ineco carried out work for Eurocontrol and directed the expansion of Turin-Caselle international airport in Italy (2005); in 2006, the company received an international award for its study of motorway financing in Poland, and worked on the Belgrade metro project (2004-2007).

JUJUY, 2007
Rosino Cortés, far left, and Santiago Espinosa, far right.

AFRICA

Since the year 2000, Ineco has been carrying out airport modernisation works in different African countries, including Namibia (extension of the Walvis Bay runway) and Mali (expansion of the passenger terminal at Bamako-Sénou international airport).

Some of the most important projects were done in Cape Verde and continue today: in 2004, Ineco began drafting refurbishment and expansion projects for Boa Vista airport, including a new international terminal that opened in 2007. The company has subsequently continued its work on the modernisation of other airports in the islands, for which it has prepared master plans and other work (night operation studies, easements, GNSS air navigation procedures). "Since 2004, Ineco has been a *parceiro* (partner of confidence) for the airport and air navigation services operator in Cape Verde, Aeroportos e Segurança Aérea (ASA), providing technical support and enabling the unprecedented growth of its airport and airspace network", says Ángel Toro, an airport engineer who has been with Ineco since 1999 and has headed the Cape Verde office for nine years.

In 2006, Ineco worked on the Algiers tram system, and, in 2007, together with the Italian company SPT, managed and technically assisted the renewal of the 800-kilometre railway between Ethiopia and the Republic of Djibouti, a project funded by the EU. ■

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CREATING BRAND SPAIN

2008-2018

In 2008, Ineco became the government's 'in-house resource' and in 2010, merged with Tifsa, reaching a total of 3,200 employees. In Spain, it continued working on the AVE network and abroad it was awarded the largest contracts in its history.

2000: 2ND DECADE

PASSENGERS AND FREIGHT, EUROPEAN NETWORKS, AVE, AIR NAVIGATION, CONTROL TOWERS, LARGE PROJECTS AND TECHNOLOGY

PHOTO_EUROPEAN GNSS AGENCY

In the second decade of 2000, the company exported its high-speed experience to Saudi Arabia, the United Kingdom, India and Egypt. Activity continued in Latin America and extended to Asia and the Middle East, where it was awarded the largest international aeronautical contracts in its history (Kuwait, Abu Dhabi). In Europe, it worked on the implementation of ERTMS, the Galileo system and Trans-European corridors. Ineco also incorporated digital transformation in its activity, with the same focus on innovation that it had 50 years ago when the company was created.

PASSENGERS AND FREIGHT ACROSS THE EU

Ineco continued to work on passenger and freight transport planning, which focused increasingly on intermodal and transnational transport, with the TEN-T corridors as the clearest example. Carolina Sanz, a civil engineer at Ineco since 2006, points out: "From the very start, Ineco participated in the development of preliminary studies, in addition to railway connections between Vitoria-Dax, San Sebastián-Bayonne and Figueras-Perpignan, as well as the studies of the Atlantic Corridor and the Mediterranean Corridor", in regard to which, Esther Durán, a civil engineer working at Ineco since 2004, notes: "Ineco has played a decisive role in the definition of projects. In the 2014 study, for example, 300 projects were identified, of which 44% were railways and 20% were ports".

CONNECTIONS TO THE NORTH AND SOUTH

The Iberian Peninsula is still seeking solutions for its north and south connections to cross the Strait of Gibraltar to Africa or the Pyrenees to France. Since 1971, Ineco has completed a series of studies on the construction of a link between Spain and Morocco across the Strait of Gibraltar, producing more than twenty technical and economic reports. Ineco continues this line of work and in 2017 supported an innovation project on a Hyperloop system between Spain and Tangier across the Strait.

The border crossing with France through Canfranc, Huesca, was also studied. Regarding the 2009 project, Miguel Rojo, a civil engineer at Ineco between 1974 and 2012, says: "I have a clear memory of the study involving the reopening of the Zaragoza-Canfranc-Pau railway line, which was closed down in the French section of Béarn in 1970 after an accident. The Spanish government, especially the regional government of Aragón, showed an interest in reopening it, and the latter actually asked us to take on the project. Since the track was closed on the French side, we asked SNCF for assistance. The Bearnese and Aragonese people congratulated us for managing to convince the French railwaymen, who had no interest in reopening the line, to step on the track for the first time since the accident, and they were nice enough not to charge us anything.

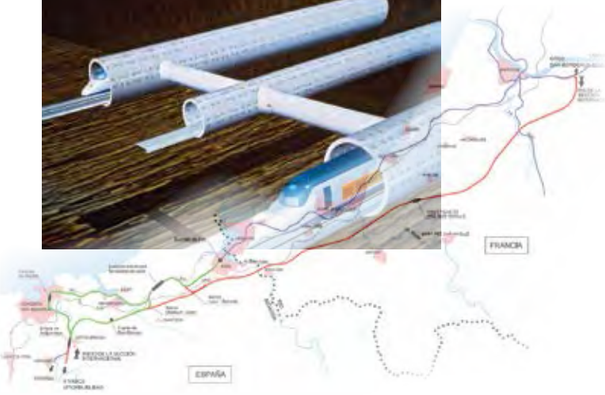
Outside Spain, Ineco has developed studies related to mixed transport and freight, including the Central Bi-Oceanic Railway Corridor, which will link Bolivia (environmental study, 2014), Peru (pre-investment study, 2016) and Brazil; Nicaragua (Corinto-Monkey Point multimodal corridor, 2013), Jujuy (Argentina, 2010), and Antioquia (Colombia, 2011).

Ineco participated from the outset in the development of Trans-European TEN-T corridors, including the Atlantic and Mediterranean (map) and studies of rail connections such as the Vitoria-Dax, San Sebastián-Bayonne and Figueras-Perpignan links.

"I have a clear memory of the study involving the reopening of the Zaragoza-Canfranc-Pau railway line, which was closed down in 1970 after an accident. They congratulated us for managing to convince the French, who had no interest in reopening the line, to step on the track once again"

Miguel Rojo, civil engineer

Some of the most important studies include the reopening of Canfranc (2009) and the TRATAR project (1990), for the Strait of Gibraltar tunnel management company (SECEGSA/SNED).



Ineco's experience in high-speed lines was consolidated with the arrival of the AVE to Barcelona in 2008, and it has applied this experience to all of the lines built since. In this second decade of 2000, the network also reached Valencia and Alicante, the Galician coast; and in 2013, the French border.

3,000 KILOMETRES OF AVE

PHOTO: ELVIRA VILA

PHOTO: PABLO NEUSTADT

From left to right: Madrid-Levante line; and Atocha station.

The opening of the Madrid-Barcelona AVE in 2008 marked the opening of a new stage was opened in high-speed lines: the beginning of technological maturity and increased involvement of the Spanish railway sector. As stated by the executive director of Systems Engineering, Javier Gallego, with a PhD in industrial engineering, at Ineco since 1991, "Madrid-Barcelona set a milestone as the first line with ERTMS, a system that Tifsa had already worked with in 1997. This was also the first line to use this high-speed track technology; and the entire process of validating, testing and commissioning trains was developed for rolling stock".

The recession in 1993 slowed down the work on this line, which was put into service in stages: first, Madrid-Zaragoza-Lleida, opened in 2003; followed by Lleida-Tarragona (2006); Barcelona (2008); Figueres-Perpiñán (2011) and in 2013, the Barcelona-Girona-Figueres connection, one year after the drilling of the Sants-Sagrera railway tunnel in Barcelona. This line is currently the longest in the country, with 749 kilometres of track. "Since 1999, we have provided technical support to the GIF, now known as Adif, collaborating in all technical instructions, specifications and high-speed standard pricing," says Jorge Rincón, a civil engineer, at Ineco since 1997. "Since then, we have been supervising all sections except Zaragoza-Lleida, Córdoba-Málaga and Orense-Santiago, where we developed the projects". Víctor Duarte, a civil engineer at Ineco since 1986, emphasises the complexity of "the construction project for the section between Arroyo del Salado and Herrera, which included the complete design of the platform with two sections of double track in UIC gauge, each 10 kilometres long, and four large viaducts up to 1,500 metres high".

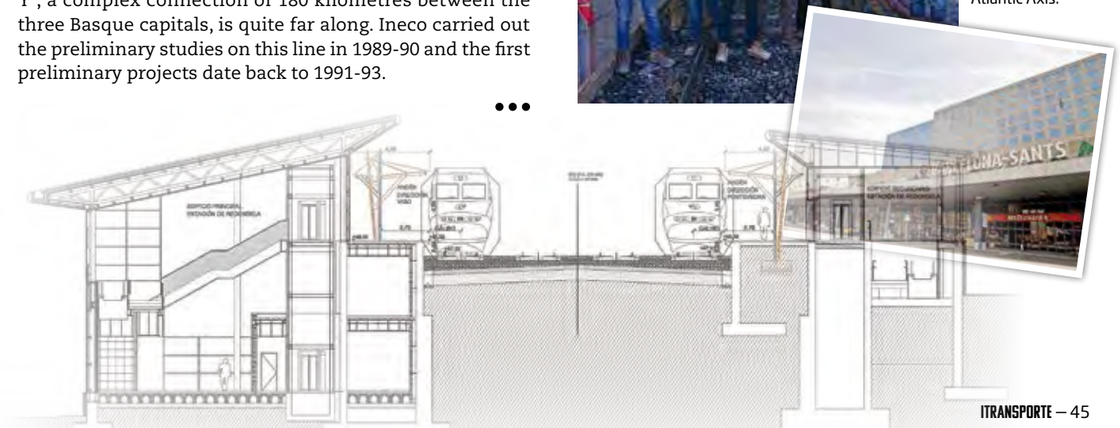
> "We drafted the construction project for the section between Arroyo del Salado and Herrera, which included the complete design of the platform with two sections of double track in UIC gauge, each 10 kilometres long, and four large viaducts"
>
> **Víctor Duarte,** civil engineer

Ineco participated in all of the HS sections: above, Ulla viaduct on the Atlantic Axis (2015). Below, a team from Ineco in Cuenca in 2009 and work to extend the high-speed line to Alicante (2012).

The high-speed radial network –all lines depart from the capital, except the Atlantic Axis in Galicia– has been extended to over 3,100 kilometres today; across the centre and south (Toledo, 2005, Córdoba-Málaga, 2006-2007, Segovia-Valladolid, 2007, Palencia, León, 2015); Levante (Valencia, 2010, Alicante, 2013 and Castellón, 2018); and to the north and northwest of Spain, the most mountainous and complex regions, with sections that are currently at different levels of completion. The Galician Atlantic Axis (A Coruña-Santiago, since 2009, and Santiago-Vigo, since 2015) and the Santiago-Orense connection have been in operation since 2011. The connections between Madrid and Galicia and with Asturias and Cantabria are still under construction; construction of the 'Basque Y', a complex connection of 180 kilometres between the three Basque capitals, is quite far along. Ineco carried out the preliminary studies on this line in 1989-90 and the first preliminary projects date back to 1991-93.

SINCE 2008, THE AVE NETWORK HAS BEEN EXTENDED TO OVER 3,100 KILOMETRES, THE SECOND LONGEST IN THE WORLD

Above: aerial view of the Córdoba-Málaga line, in 2007. Left: Ineco staff in the Gaintxurizketa tunnel, on the Basque Y (2017). Below: Sants station, in Barcelona, and designs of stations in the Galician Atlantic Axis.



During this period, the company increased and extended its collaboration with ENAIRE in different projects to improve Spanish and European airspace; it began to provide air navigation services and civil aviation consulting in other countries including Egypt, Morocco, Oman, Colombia or Taiwan.

OVER 200 EXPERTS AND SPECIALISTS IN AIR NAVIGATION

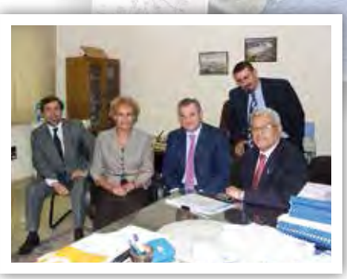
On 29 July 2010, flight NAY 8651 from Tenerife Norte landed at La Gomera airport, following the information provided by Ineco AFIS operators from the control tower, making Ineco the first company besides ENAIRE to provide air-traffic services in Spain. According to Luis Negrete, a technical aeronautical engineer, deputy director of Operational Systems, at Ineco since 1996, "becoming an air traffic service provider was a huge qualitative leap forward. Ineco has been a key player in the deregulation of the air navigation sector, paving the way for other companies". In the past 25 years or so, the air navigation team has grown from a small group of people, "to more than 200 specialists and experts -said Juan Carlos Ceballos, an aeronautical engineer at Ineco since 1995- remembering that "between 2008 and 2011 we prepared basic and qualified training for 500 maintenance technicians".

PHOTO_ELVIRA VILA

INECO WAS A KEY PLAYER IN THE DEREGULATION OF THE SECTOR

Some of the more important work in collaboration with ENAIRE includes the design of advanced flight procedures, and the track research programme (PICAP). Work was also done on the ongoing evolution of the SACTA air-navigation control system, on a global scale. José Mª Berdoy, an aeronautical engineer at Ineco since 2001, explains how "the climax, after months of effort to prevent anything from going wrong, was the final night when air control was first monitored using the new SACTA version. That night was very intense, because service cannot be interrupted and the system must successfully pass the trial by fire during peak traffic in the early hours of the morning". Collaboration with ENAIRE on the development of the future automated air traffic control system (iTEC) continues today. Among the works abroad, Francisco Olmedo, an aeronautical engineer, at Ineco since 1998 and director of the ENAIRE Account recalled above all "the strategic plan for Egyptian civil aviation, awarded in a public tender in 2010, which involved restructuring airspace and modernising the CNS/ATM infrastructure with ICAO guidelines." Other important projects included airspace reorganisation in Morocco (2010-2014), Oman (2013-present) and Cape Verde (2013-2017); the work at Bogotá airport (2011-2012) and analysis of the impact on airport systems of the cranes in Kaohsiung Harbour (Taiwan) (2015-2017).

In international projects, it participated in the SESAR (2004-2016) programme, and currently in SESAR 2020 and Horizon 2020, and in research projects related to drones such as TERRA and IMPETUS.



Above, an AFIS operator from Ineco. On the left, Javier de Cos and Francisco Olmedo, from Ineco, signing the contract with the Egyptian civil aviation authority (2010).

CONTROL TOWERS

These towers are equipped to provide the tools and technical means to control air traffic, and Ineco supplied the architecture and building equipment together with specialists in air traffic management (ATM) and in control, communications, navigation and surveillance systems (ATC/CNS).

The first control tower designed was at the San Javier airport, Murcia, in 2001, although the first to be put into service, in 2003, were the NET and SAT towers at Barajas airport. Ineco collaborated with Aena and architects Richard Rogers and Lamela on the planning and design of the two towers, located in terminal 4 and its satellite building. Projects were also carried out to install air navigation systems in the NET towers at Barajas, Málaga airport (2001) and Palma de Mallorca airport (2002). Later, control towers were planned for the Boa Vista, Cape Verde (2007) and the Barcelona-El Prat airports, designed together with architect Ricardo Bofill (2008). Draft projects were also developed for the airports in Tikrit (Iraq), Chiclayo (Peru) and Crete (Greece).

The Eldorado tower was an engineering challenge due to its height, design and location.

"The specification of CNS/ATM systems for Eldorado was a technical challenge as it covered all advanced tower systems and all project phases, from basic design to technical requirements for the bid"

Víctor Quiñones, aeronautical engineer

On the right, the NET control tower at Barajas airport. Below, the Eldorado control tower, Bogotá.

ELDORADO: AN ARCHITECTURAL ICON

In 2011, Colombia's civil aviation entity commissioned Ineco and architect Bruce Fairbanks to design a new control tower with a concrete shaft surrounded by two steel spirals, which became an architectural icon for the city of Bogotá. For Roberto Serrano, an aeronautical engineer at Ineco since 2000, "the Eldorado tower posed several engineering challenges due to the fact that it is 80 metres high and to the complexity of its design, as well as the difficulty of the land and the seismic activity in the area". For aeronautical engineer Víctor Quiñones, at Ineco since 1999, "the specification of CNS/ATM systems for Eldorado was a technical challenge because it covered all advanced tower systems and all project phases, from basic design to technical requirements for the bid".

Ineco was awarded its major contracts during this decade: the high-speed Makkah-Madinah line, in Saudi Arabia, the HS2, in the United Kingdom, the supervision of the new airport in Mexico, and the ORAT in Abu Dhabi, in addition to other major projects in Kuwait, Peru and Brazil.

MAJOR INTERNATIONAL PROJECTS

INTERNATIONAL

On the left, the Ineco Traffic Control team that carried out the Haramain tests in November 2017. Below, company staff at the offices of the Al Shoula consortium in Jeddah, Saudi Arabia, in 2014.

Spanish firms are seeking to establish and expand their leadership in the foreign market and the companies of the Fomento Group and the Spanish private sector have joined forces to embark on large-scale infrastructure projects. For the director of Internationalisation and Commercial Intelligence, Sergio Navarro, an aeronautical engineer, at Ineco since 2009, "in this second decade, we have positioned ourselves in new strategic markets thanks to major international contracts, not only for Ineco but also for the Spanish infrastructure and transport sector. These include the Haramain and HS2 high-speed networks, the Abu Dhabi, Mexico and Schiphol airports or the Galileo satellite project".

The global economic crisis and recession in the internal market in 2008 marked a turning point for Ineco, explained the director of International Projects, Juan Ramón Hernández, a civil engineer, at Ineco since 2004: "In the past decade, the paradigm has changed. We know how to use our experience to the greatest advantage; we either join forces or compete with the best in the world. We rid ourselves of our complexes and, together with Spain's large construction and engineering firms, helped change the country's image abroad".

HIGH SPEED IN THE DESERT

On 12 January 2012, the contract for the second phase of the construction of the high-speed line between Makkah and Madinah (the Haramain project, which means 'two holy cities'), awarded to the Spanish-Arab consortium Al-Shoula, which included Ineco, was signed in Riyadh, the capital of Saudi Arabia. "This contract award", says Ignacio González, telecommunications engineer and deputy general director of Special Projects, "is the explicit acknowledgement of Ineco and the technological level of Spanish companies in terms of high-speed lines. Ineco's participation as the company responsible for the design, quality, technical assistance and rail traffic management during construction, was critical".

The company's experts, Michael Ashiabor, a public works engineer and Salomé Fernández, a civil engineer, considered that "the design took into account the profile of the passengers and the high demand during pilgrimages, and solutions were provided in the design of the track and the systems to take climate and environmental factors into account. Finally, civil engineers Juan Luis Monjarás and Javier Pulido point out: "Ineco mobilised a multidisciplinary team consisting of engineers from more than 10 countries for the Haramain project. The extreme environmental conditions and the magnitude of the project, 450 kilometres long, required our teams to live in camps in desert areas and to adapt to the demanding project conditions". Ineco will continue to provide its experience in the management of line maintenance for the next 12 years.

> "This contract award implies the explicit acknowledgement of Ineco and the technological level of Spanish companies in terms of high-speed lines"
>
> **Ignacio González,** telecommunications engineer

THE PILGRIMS' TRAIN
A Talgo train during the dynamic tests managed by Ineco's Traffic Control team.

EXPERIENCE GAINED IN SPANISH AIRPORTS HAS BEEN IMPLEMENTED IN THE ORAT OF THE NEW ABU DHABI TERMINAL

ORAT IN ABU DHABI

The awarding of the Midfield Terminal Complex (MTC) project at Abu Dhabi international airport in 2014 was an acknowledgement of the exceptional work done by Ineco and Aena in previous years and positioned them both as leading companies in ORAT (Operational Readiness and Airport Transfer) projects. Aeronautical engineer Antonio Martín, at Ineco since 2001, reminded us that "everything began with the expansion of the Madrid-Barajas airport and continued with Barcelona-El Prat, Málaga and Alicante. Our ORAT methodology was implemented, including the design and execution of the operating tests that make it possible to detect and correct anomalies before commmissioning. In the 15 years or more that we have been working with Aena, this methodology has been improved progressively, and it is now fully established and consolidated".

Ineco staff working in Abu Dhabi in 2014.

A team of experts from Ineco and Aena are working on putting the new installations into operation for the commissioning of the MTC in Abu Dhabi. Ignacio Alejandre, a civil engineer at Ineco since 1999, summarises it as follows: "The new MTC terminal will receive more than 30 million passengers per year and will have 79 aprons, more than 4,800 parking spaces and a baggage handling system with a capacity of 19,200 suitcases per hour. It is an enormous project and we have to make sure everything is ready and working perfectly when 'D-Day' –when it goes into operation– comes. Operating tests are aimed at testing airport operations as a whole: infrastructure, processes, systems and facilities... and ensure that all staff in all of the organizations involved are familiar with everything and that the procedures work properly. In Abu Dhabi, we are applying a methodology that is a result of the experience we have gained".

> "The paradigm has changed: we either join forces or compete with the best in the world, helping to change Spain's image abroad"
>
> **Juan Ramón Hernández,** civil engineer

KUWAIT AIRPORT Some twenty people worked in Kuwait for four years. In the picture, Carlos Amigo, head of the project, in 2013, with the president of Kuwait's Civil Aviation Authority.

TURKISH HIGH-SPEED LINE. Worksite sign for the Ankara-Istanbul line, with the names of the contractors, and below, those of Ineco and its local partner, UBM.

Félix Zapata and Javier Sancho (on the right), in 2016, during the drafting of the Delhi-Kolkata HS corridor study.

"We have positioned ourselvesas a global engineering companyin new strategic markets thanks to the award of historic contracts"

Sergio Navarro, aeronautical engineer

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KUWAIT AND FUJAIRAH

In 2010, in Kuwait, Ineco undertook the revision of the Master Plan for the industrial area of Shadadiya, and in 2011, was awarded its most important contract ever in the region: project management of the Kuwait International Airport (KIA) expansion, with the project to update the Master Plan added in 2013. For Carlos Amigo, an aeronautical engineer, at Ineco between 1999 and 2016, "it was the company's first large-scale expatriate experience, and on top of that, in a non-Spanish speaking country. With the Kuwait project, the company had to manage the needs of expatriate workers, the difficulty of their connection with the company, the complicated line between family and work situations, and other problems. This defined the framework for other expatriate experiences in Saudi Arabia, Abu Dhabi, and Nepal, just a year or two later. Ineco switched over to non-centralized management of projects, enabling them for the first time to quantify the extent to which project management, more than anything else, is people management".

Ineco was awarded another project management contract in March 2016, for the expansion of the Kuwait airport. The company's presence in the Middle East extended to the Sultanate of Oman, including projects such as the design of flight procedures for the Muscat and Salalah airports (2013-2015) and the Muscat Strategic Bus Transportation Plan (2014). Work is also underway, in collaboration with WorleyParsons, to update Qatar's 2006-2026 Transport Master Plan and in 2018, the Master Plan of King Fahd international airport in Dammam, Saudi Arabia.

HS IN ASIA: TURKEY AND INDIA

The new century marked the company's entry into new countries, although in some cases, with some prior experience: this was the case in Turkey, where, in 1998, work was done on the electrification of an 80-kilometre railway line in Izmir. In 2009, together with a Turkish partner, Ineco began to supervise the work on the adaptation to high speed of the Inönü-Köseköy section of the Ankara-Istanbul line (2009-2019). In 2016, similar work began with supervision of the modernisation of the 378-kilometre line between Samsun and Kalin, which will continue until 2019. In 2015, in Kazakhstan, a feasibility study was carried out on the Pavlodar tramway, financed by the European Bank for Reconstruction and Development.

In India, work was carried out on Line 2 of the Mumbai subway (2011) and the company executed feasibility studies on the high-speed lines between Haldia-Howrah (160 km), Delhi-Kolkata (1,500 km), the company's longest study, and Bombay-Nagpur (800 km); and in 2017, the study of a 90-kilometre commuter corridor between Delhi and Meerut. Between 2012 and 2015, the Civil Aviation and Airspace Restructuring Plan for Nepal was carried out. For Javier López-Villalta, a civil engineer, at Ineco since 2011, "in a competitive, dynamic and physically and culturally distant market like Asia, we have managed to achieve an important position thanks to the know-how provided by Ineco. Some of the more important projects in recent years include India's high-speed system, Malaysian regulatory framework and Singapore, Taiwan and Nepal's air navigation and civil aviation projects".

HS2: BRITISH HIGH SPEED

In 2012, Ineco and the British firm, Capita Symonds, were selected for the HS2 London-Birmingham high-speed stretch in the United Kingdom. This contract was followed by another, awarded in 2016. Pablo Ramos, a civil engineer at Ineco since 2002, and director of the Northwest European Account, explains it: "We started by participating in the development of the most ambitious European high-speed project, HS2 (High Speed 2), in 2012, designing a preliminary stage of Phase 1 between London and Birmingham, together with the British company, Capita. In this project, we resolved a complex railway node, which led to a second contract in 2016 to carry out the preliminary civil engineering design and the environmental impact studies of another section of Phase 2, together with the American company, Aecom, and the British company, Capita. This project allowed us to export our knowledge in high-speed projects in Spain and enrich it with the application of new design technologies such as BIM applied to linear works under the highest worldwide project management standards".

GALILEO: SATELLITE NAVIGATION

In 2016, the European Global Navigation Satellite Systems Agency (GSA) awarded the 10-year contract for the operation and maintenance of the entire European satellite system, Galileo, to the European company, Spaceopal. As part of this contract (for a total of 1 billion euros), Ineco, supported by INTA (National Institute of Aerospace Technology) and Isdefe, is responsible for the management, operation and maintenance of the GNSS Service Centre (GSC).

Air navigation activities at Ineco started around the year 2000, with technical support for Aena. Luis Chocano, a civil engineer, at Ineco since 2004, summarises as follows: "The company has been working on satellite navigation for over 20 years. Since 2002, European projects like GIANT and GRAIL have been used to develop aeronautical and railway applications. With GIANT, we achieved the first satellite-guided approach in Europe with a commercial aircraft without the need for a ground-control infrastructure. With the ACCEPTA project (2010-2014), we consolidated our position as a leading European company in this area, coordinating 40 partners and achieving satellite-based landings at airports in 14 countries".

Above, Delta-Junction node. Below, part of the Ineco HS2 team.

Work on satellite navigation began in 2005. On the right, Luis Chocano during a test flight in 2011, and below, other team members, in 2017.

"The HS2 Phase 1 contract, in which we resolved a complex railway node, led to a second contract in 2016 to carry out the preliminary civil engineering design and the environmental impact studies of another section of Phase 2, together with Aecom and Capita"

Pablo Ramos, civil engineer

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IN EUROPE, PROJECTS INCLUDE GALILEO, ERTMS, AND THE DESIGN FOR THE NEW AMSTERDAM AIRPORT TERMINAL

SCHIPHOL AND ERTMS

Other major contracts in Europe include the control and monitoring of the deployment of ERTMS on the continent's nine main railway corridors, signed in December 2014 with the European Commission and the contract signed in 2017 for the comprehensive design of the new terminal at Schiphol airport in Amsterdam, which will be completed in 2023. Other work carried out from 2008 onwards included the design of the Odessa airport terminal in Ukraine (2011-2013); the Tallinn tramway improvement and modernisation strategy in Estonia (2011) and planning studies in Malta (2014) and Croatia (2014-2016).

HIGH SPEED IN EGYPT

In Africa, in addition to the intense activity in Cape Verde, during the second decade of the century, work was also done in Kenya (traffic studies for the Nairobi airport, 2008); Morocco (Casablanca Mohammed V airport, in 2011); Mauritania (extension of the pier and improvements in the port of Nouadhibou, 2009-2011); Algeria (National Transport Plan, 2011), and Egypt. In 2017, the feasibility study of the 1,200-kilometre high-speed Cairo-Luxor-Aswan-Hurghada corridor was completed in this country. In 2012, safety studies were carried out in Angola, in collaboration with Aena Internacional for the 4 de Fevereiro airport in Luanda. In 2015, a National Airport Plan was developed in Uganda.

MEXICO'S NEW AIRPORT

After conducting a sign study on three highways in Mexico, in 2011, a 14-year contract with Banobras to serve as the Administrative Agent and Supervisor (AAS) of the Guadalajara-Colima highway was awarded. For Ineco's representative in Mexico, Alberto Váscones, a civil engineer who has been with the company since 1994, this contract "consolidated Ineco's presence in Mexico, constituted the development of a new management model that served as a benchmark for all other highways, and resulted in the opening of our subsidiary, InecoMex, in May 2011. Since 2016, Ineco and InecoMex have been supervising work on the New Mexico City International Airport (NAICM), one of the largest airport projects in the world, and management of the extension of Line 12 of the Mexico City metro, which makes us one of the benchmark engineering companies".

SÃO PAULO RING ROAD

In the case of Brazil, the director of the South American Account, José Batlles, a civil engineer at Ineco since 2006, highlights the contracts "for management and supervision of CPTM lines and trains for the São Paulo Metro and the feasibility study of 50 regional airports for Brazil's Secretariat for Civil Aviation, along with the management, together with EBEI, of the odoanel Mário Covas (São Paulo's ring road) for DERSA, (2012-2019). All these were milestones during our time in Brazil. I would also add the study of new railway models and waterway costs done for EPL (Planning and Logistics Company) for which we have been developing a National Transport and Logistics Observatory since 2017".

PHOTO_ELVIRA VILA

Above, part of the team of the company that developed the feasibility study on the Cairo-Luxor-Hughada high-speed corridor (2016-2017). On the right, a recreation of the Luxor station.

> "Contracts such as the Guadalajara-Colima highway, the new international airport (NAICM), and metro line 12, have made us one of the leading engineering companies in Mexico"
>
> **Alberto Váscones,** civil engineer

PROJECTS IN MEXICO
Above, works on Mexico City's New International Airport (NAICM). On the right, the InecoMex team in 2018.

MEDELLÍN AND LIMA

As for Colombia, in addition to the supervision of the CAF trains for Metro de Medellín, other important projects include the study for the reopening of the old Antioquia railroad, renamed the 'Multipurpose Railway System of the Aburrá Valley', (2009); work on the commuter rail of the 'Corridor of the West' in Bogotá, which included the design of eight stations (2011) and in 2012, the expansion of the Traffic Management System. In these years, we also updated the management plans of the airports in Barranquilla (2008) and Cali (2010), where the terminal building was remodelled; studies for a cargo area at Flanders airport (2011); management of the work and the design of the new terminal at the Cartagena de Indias airport (2012-2013) and supervision of work on the runway at the Cali airport (2013).

INECO CURRENTLY OPERATES THROUGHOUT LATIN AMERICA: MEXICO, BRAZIL, PERU, COLOMBIA, ARGENTINA AND PANAMA

Ineco's representative in Latin America, Félix Ortega, a civil engineer, at Ineco since 1989, points out: "Metro de Medellín is one of the company's success stories, both commercially and technically: we have been working for them continuously since 2010". Important recent work in Latin America also includes "the Ecuador Strategic Mobility Plan (2013), work at the Chiclayo and Jorge Chávez airports in Lima and the Bioceanic Corridor in Peru; the Santiago metro in Chile, and most recently in Argentina, the Paseo del Bajo, in Buenos Aires".

In addition to these large projects, since 2003, Ineco has been working on planning the 12 airports of Grupo Aeroportuario del Pacífico (GAP), owned by Aena. Rodrigo López, an aeronautical engineer, at Ineco since 2008, points out that: "Together with GAP and Aena, we have developed the Master Development Programmes for 2005-2019, 2010-2024 and 2015-2029, which we are also updating for 2020-2034. We also developed different functional terminal designs, such as Puerto Vallarta and Tijuana".

Central America and the Caribbean include countries such as Jamaica, where the company began working in 2008 with the updating of the Sangster airport Master Plan. This project was followed by others such as the rehabilitation of the runway (2010) and redesign of the check-in area (2017). In Costa Rica, highlights include the railway system in San José for Incofer (2013); the National Transport Plan and the Strategic Civil Aviation Plan, and recently the administrative, legal and environmental management of the IDB-financed Costa Rican Transport Infrastructure Programme (PIT). In Panama, the strategic plan for airport development was prepared in 2010 and since 2014, the Independent Security Assessment (ISA) of the expansion of Line 1 and the new Metro Line 2 of Panama City. ■

Above, Eduardo Marcos and Javier Gallego, in 2011, with the planning engineer for Metro de Medellín, Diego Ricaurte.
Below, in the centre, Víctor Pardo, and on the right, José Ángel Gómez with personnel from the local partner, Cesel, at the Lima airport, in 2014.

> "Metro de Medellín is one of the company's success stories, both commercially and technically: we have been working for them continuously since 2010"
>
> **Félix Ortega,** civil engineer

The commitment to being on the forefront of technology dates back to the founding of both Ineco and Tifsa. In 1968, Carlos Roa explained that the objective was "to create a stable and permanent entity that will remain at the highest scientific level with maximum practical wisdom in terms of transport economics and coordination".

ON THE CUTTING EDGE OF TECHNOLOGY

ERTMS: IN TWO DECADES, WE HAVE GONE FROM THE FIRST RESEARCH PROJECTS TO SUPERVISION OF THE IMPLEMENTATION OF THE SYSTEM THROUGHOUT THE CONTINENT FOR THE EUROPEAN COMMISSION, AND HAVE EXPORTED THE EXPERIENCE IN SPAIN TO OTHER COUNTRIES SUCH AS DENMARK

The first ground-breaking work dates back to the 1970s, when, after purchasing the first programmable computer –the HP30–, simulation programmes were developed. Tifsa started operating in 1983 in railway research and technology and contributed this wealth of knowledge to the company.

EUROPEAN PROJECTS

When Spain became a member of the European Union, it began to participate in large research projects promoted by the EU Framework Programmes. Since 2006, Ineco has played a leading role in the development of the 6th and 7th Framework Programmes –such as the TITAN, GIANT and GIANT 2 projects; GRAIL 2, CREDOS, BOSS and ACCEPTA– and other European R&D initiatives such as the SESAR, AIRE or EUROMED Programmes, to improve cooperation in civil aviation safety; and in road safety, with programmes such as SEROES (2007), to reduce traffic accidents; and Pilot4safety (2012), to train road safety inspectors and auditors. Some of the most important projects in the current programme, Horizon 2020, include the TERRA and IMPETUS projects, aimed at identifying information requirements and ground systems required for the operation of low-altitude drones.

PIONEERS IN ERTMS

A key technological development in the field of railways is ERTMS (European Rail Traffic Management System), the common European railway signalling system. In two decades, the company has gone from the first European research projects carried out by Tifsa, to coordinating and supervising ERTMS implementation on the nine main corridors of the continent until 2021, after being awarded a contract by the European Commission.

In the early 1990s, the European Commission began to push for a new system to ensure interoperability between the different European rail networks, each of which operated under its own system. To do this, a consortium of signalling companies called UNISIG was formed.

Above, the European ACCEPTA project promoted the use of of satellites in aviation. Ineco's first PC (right) and below, Eurocontrol approach chart.

The European Union subsidised pilot applications to test and adapt the system in each country. In Spain, the Ministry of Public Works called for a tender in the year 2000 to install and test ERTMS level 1 in the Albacete-Villar de Chinchilla pilot section; Ineco was awarded the contract to monitor and supervise the works, which was extended until 2005, and in 2001, was awarded another contract for the same stretch, for level 2 of the system.

For Pablo Casado, a technical telecommunications engineer, at Ineco since 1992, "it is a great honour to have led the Ineco team that participated in the initial development and implementation of ERTMS in Spain", which proposed "certain changes in the specifications and development of the so-called national functions that allowed trains to travel without amending the regulations. It is important to note that UNISIG and the European Commission itself were responsible for many of these changes".

In 2006, the new system began operation for the first time on the Madrid-Lleida high-speed line, with Ineco providing technical assistance to the GIF. In the years that followed, the company continued to participate in the implementation of ERTMS on the high-speed and conventional network throughout Spain.

At the same time, since 1994, the company has been collaborating with the Railway Interoperability Laboratory (LIF) of the CEDEX (Center for Studies and Experimentation of Public Works) and the Ministry of Public Works on different research projects for high-speed and commuter lines.

In 2018, the Ministry of Public Works approved the National Deployment Plan for the ERTMS system in Spain. Industrial engineer Beatriz Sierra, at Ineco since 2002, stresses that the experience gained in Spain was also implemented in other European countries, "such as Denmark, a complete network deployment where we collaborated on the system validation strategy and performed laboratory tests". Silvia Domínguez, a telecommunications engineer,

On the left, Francisco Mayoral, Miguel López (CEDEX), Alfonso Martínez and Beatriz Sierra, in Copenhagen. Below, Javier Gallego (first left), Silvia Domínguez and Beatriz Sierra (centre), with other Spanish participants at the World Conference on ERTMS held in Stockholm in 2012.

"We are proud to have led the Ineco team that participated in the first development and implementation of ERTMS in Spain. It is important to note that changes were proposed by the European Commission"

Pablo Casado, technical telecommunications engineer

Ineco's BIM projects: terminal designs at the airports in Odessa (Ukraine) and Boa Vista, Cape Verde. Below, Jorge Torrico, (fourth on the left) at the 5th meeting of the BIM commission, in 2017.

PHOTO_ELVIRA VILA

"As the main benefits of BIM, I would essentially highlight improvement in quality, transparency, traceability and reduction of risks and uncertainties throughout the project life cycle"

Jorge Torrico, civil engineer

SIOS (Emblematic Works Information System) was launched in the year 2000.

at Ineco since 2006, adds that: "ERTMS is at the centre of the modernisation and digitisation of railways, and Ineco is the benchmark and the engineering company entrusted to implement this system by the European Union Agency for Railways (ERA) and the European Commission".

FROM BASIC TO BIM

Throughout its history, Ineco has not only made use of commercial technological advances, but has also customised them and developed a wide variety of its own software tools for all types of tasks and in all areas of transportation. It has also created and managed databases and websites, such as the Aena website, and more recently, others, such as the Observatory for Transport and Logistics of the Ministry of Public Works or the 'A million for climate' campaign for the Paris Agreement (2016).

Ineco's first technological developments date back to the 1970s, with the first programs for calculating alignment rectification, such as those used in the study of the Madrid-Zaragoza-Barcelona-Port Bou line and later in the NAFA and the Madrid-Seville line. During those same years, railway traffic ('speed diagram') and economic-financial simulations began.

A large number of railway tools were rolled out in the 1980s and 1990s. These included the MTF (Rail Traffic Model) application, in 1986, which estimated the future evolution of traffic; MIDAS, a database for railway installations that was also used to draw up the Renfe Real-Estate Inventory between 1990 and 1993; POSTES, PÓRTICOS and TENDIDOS, to calculate structures; SIMTREN, to estimate energy needs; GESTRANS, launched in 1998 during an electrification project in Turkey to calculate the location of posts, overhead lines, etc.

In the year 2000, SIOS (Emblematic Works Information System) was created based on work done in the tunnels Guadarrama and Pajares tunnels, and was also used later with high-speed lines; as well as georeferenced high-speed applications such as SFINGE (2002), for inventory; INGRID, for track assembly; SITRAS, for maintenance; SIOF, an alarm system or COPERNICO, the Renfe's rail operating system (2005).

In the field of aeronautics, programs include TITÁN, an emergency and self-protection plan for Aena's airports; ICARO, for aerodrome and heliport management, and HERMES, for the documentary control of airport reports. One of Ineco's most successful developments is the COVER tool suite (2005) for air navigation simulations. HELIOS is a georeferenced platform created to facilitate the preparation of navigation easements in the vicinity of airports; the PISTA econometric model, on the other hand, was designed for air traffic forecasts at Aena, with which Ineco also collaborates on the implementation of the SIRA system, which is part of the different radio-aid management software programmes. Other developments include the GETRAM model, for the functional analysis of service roads in airports, and GESTROL, the tool used for maintenance of airport road surfaces.

In 2010, Ineco began working with a BIM (Building Information Modelling) methodology, a system used to represent and model information for all areas of a building project. Ineco implemented BIM in the design of the new Odessa airport terminal (2013), the Abu Dhabi airport passenger traffic flow analysis (2014) and the HS2 Delta Junction rail node in the United Kingdom, for which it received the Be Inspired Awards 2013 prize awarded by Bentley Systems. Cristina Palmero, an architect and BIM expert, at Ineco since 2009, comments that "since using BIM, we have expanded our field of action, ranging from the creation of European standards, supporting the Administration, to applying BIM innovation in projects such as the design of the new Schiphol airport terminal and circular economy (2017)".

SINCE 2015, INECO HAS SUPPORTED THE MINISTRY OF PUBLIC WORKS IN THE IMPLEMENTATION OF BIM IN SPAIN AND REPRESENTS IT IN THE EUROPEAN WORK GROUP, EU BIM

Since 2015, Ineco has supported the Ministry of Public Works in the implementation of BIM in Spain and represents it in the European work group, EU BIM, as part of the steering committee. Civil engineer, Jorge Torrico, the secretary of the ES.BIM Commission and director of BIM at Ineco, explains that: "As the main benefits, I would essentially highlight improvement in quality, transparency, traceability and reduction of risks and uncertainties throughout project life cycle".

ICT AND INTELLIGENT MOBILITY

In the year 2000, the Public Business Entity Red.es entrusted Ineco with technical assistance (concluded in 2002) to manage the registration of country domains (.es). Ineco also designed and implemented the first Early Alert Centre for Computer Viruses in Spain. The same team launched Aena's website in 2002. Ineco has been responsible for maintaining and developing the site ever since.

The arrival of the new millennium and with it, the growth of the Internet and digital society boosted activities relating to information and communication technologies (ICT), implemented not only in the world of transport but in other areas as well. The director of Information Technology and Digital Transformation at Ineco, Ignacio Martínez, cites high-impact ongoing projects such as "the digitisation and modernisation of the Justice System", for the Ministry of Justice. Ineco has been collaborating with the State Secretariat for the Information Society and Digital Agenda since 2016 on the National Plan for Smart Cities, including international promotion of the plan.

In the area of smart cities, IT engineer and expert in IT consulting and new technologies, Jesús Vázquez, highlights Ineco's proprietary development "the Cityneco platform, for the integration of information on the different services offered by the city (mobility, environment, etc.). We were also involved in the study and optimisation of smart mobility in cities, creating real-time simulation and prediction environments".

Ineco's IT and innovation team presenting the Cityneco platform at the Smart City Expo 2017 congress in Barcelona.

"Technology has always been a part of Ineco's trajectory, with the goal of 'maintaining the highest scientific level' as stated by its founder 50 years ago. Ineco not only implements these developments in its studies and projects, but also promotes many of them, representing and providing technical support to the Ministry of Public Works and to its shareholders, ENAIRE, Adif and Renfe, in different national and international organisations"

Rocío Viñas, deputy general director of Cooperation and Innovation of Ineco

THE FUTURE LIES IN INNOVATION

In November 2017, the Ministry of Public Works presented the Transport and Infrastructure Innovation Plan 2017-2020, drafted by Ineco, which aims to integrate and coordinate all innovative work performed by companies and institutions involved in the Public Works Group. "We set out a roadmap for three years and a strategy based on digitization, the Internet of the future, intermodality and energy transformation", explains Rocío Viñas, a law graduate with a Diploma in Business Sciences and deputy general director of Cooperation and Innovation, at Ineco since 2017. ■

Throughout its history, Ineco has executed original works that demonstrate its technical capabilities and the adaptability of the company's professionals.

UNIQUE AND OUT OF THE ORDINARY

According to Javier Pérez Sanz, former general manager of Renfe and member of the first team of Ineco, where he worked from 1973 to 1986, for Carlos Roa, founder of Ineco, the important thing was not so much the object of the work but the work itself: "He always insisted that the ultimate goal was not just to make money and look good, but to deliver an excellent study".

Ineco has carried out a wide range of different projects, which include directing the construction of a prison (the A Lama prison in Pontevedra in 1995)**(1)** and schools in Colombia (2016-2019), to designing university buildings, such as the campus of the University of Guadalajara or the expansion of the IESE in Madrid; and bank buildings, such as the headquarters of Barclays Bank in Zaragoza **(2)**. Between 2000 and 2002, the company also supervised real-estate developments in Spain for Renfe. Also in 2002, the company was in charge of the project and supervision of the restoration of the gardens at the Fernán Núñez Palace in Madrid –Ineco's first headquarters–; and after the inauguration of the AVE to Seville, maintenance of the Tropical Garden in Atocha Station **(3)**. Another unique project was the economic valuation study on the curing and drying of Spanish jamón ibérico in Teruel 1994 **(4)**, which was carried out by the branch office in Seville.

In some cases, the uniqueness of a project is the result of the need to resolve collateral issues that come up during the execution of a project, such as the design and execution of the self-propelled trolley **(5)**, which was used in the early 1990s to measure the geometry of the overhead line during electrification tests to increase travel speed on the Mediterranean Corridor to 220 km/h. In other cases, it was the project itself that held surprises, such as archaeological sites discovered during high-speed works: During its environmental management of works, Ineco has supervised the excavation and scientific documentation of no less than 272 archaeological sites throughout Spain, which include Lo Hueco, in Fuentes (Cuenca) **(6)**, where the remains of 23 giant sauropods dating back 80 million years were unearthed in 2017, along with 8,000 other fossils.

MULTIDISCIPLINARY ADVISERS

Specialised technical support for Spain's Central government, which Ineco has provided from the very start, also included a very wide range of work for almost all ministerial departments. In the field of building, real-estate inspections of consulates, chancelleries and Spanish embassies in 16 countries in the Americas (2015) or, that same year, the supervision of rehabilitation of the headquarters of the Ministry of Economy **(7)**; and is Foreign Affairs, started in 2016 and expected to last 42 months. On the other hand, starting in the mid-2000s onwards, the company did work related to information technology, such as the modernisation of the Justice Administration and support for the National Smart Cities' Plan, among others.

Since 2015, Ineco has provided support to the Ministry of Public Works in the development of the innovative procurement process known as Public Procurement for Innovation; in this particular case, to solve the problem of persistent fog on a stretch of road in Lugo. In regard to ports, Ineco has provided support to the public agency Puertos del Estado to prepare specifications for new port services and renew public concessions (2016), and collaborated on the Lighthouses of Spain project **(8)**, aimed at studying new complementary uses of these facilities. ■


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El viaje no ha hecho más que empezar

The trip has only just begun

GOBIERNO DE ESPAÑA

MINISTERIO DE FOMENTO

Conectados al futuro

ENAIRE

Enhorabuena a INECO por **50 años** alcanzando metas

Congratulations to INECO for **50 years** achieving targets