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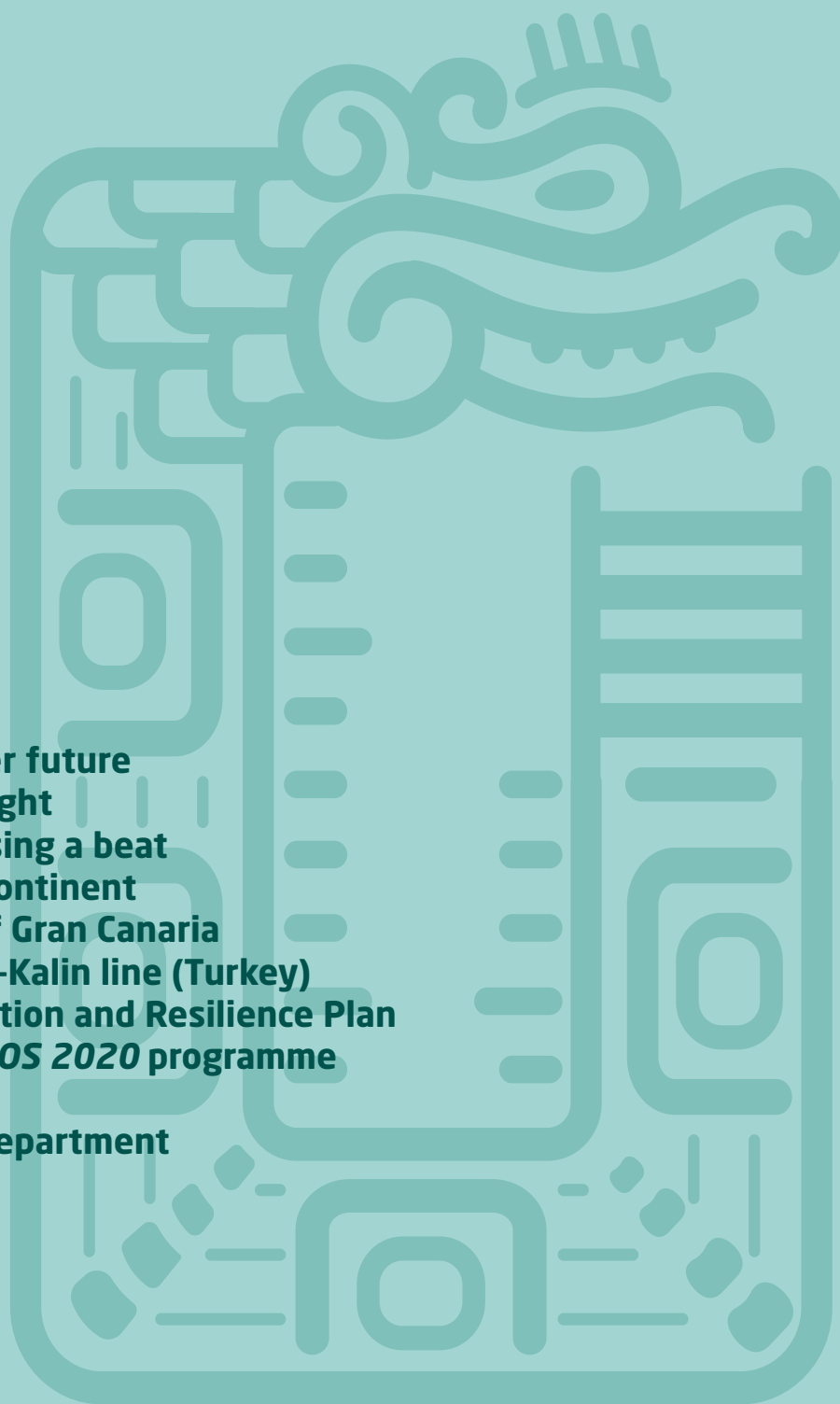
Modernisation of the Samsun-Kalin line (Turkey)

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EDITORIAL

A high level of specialisation to keep moving forward

Within the context of the ongoing global health crisis, we must all play our part in the search for innovative, solidarity-based solutions that will enable us to lay the foundations for a solid and sustainable recovery. To help meet this critical challenge, at the national level, Ineco is firmly committed to aiding the efforts of the Ministry of Transport, Mobility and the Urban Agenda by providing technical support to help implement the Spanish Government's Recovery, Transformation and Resilience Plan.

The main aims of this Plan are to modernise the economy, restore economic growth and create jobs, and as such, it will play a key role in consolidating and boosting the activities of the engineering and consultancy sector, which will have to offer a sound and technologically innovative response to the challenges that are looming in the short and medium term.

These are challenges that our company is tackling head-on, following a positive end to the 2020 financial year and prospects for 2021 that allow us to remain fairly optimistic, based on most solid guarantee of all: the enormous talent of our professionals. The award that one of our team recently received from the Madrid Association of Civil Engineers, along with the development of the innovative EOS project to help make flight procedures safer, are clear examples of Ineco's entrepreneurial and forward-looking response capacity.

At the international level, the contracts we have recently signed - such as the one for the Tren Maya, in Mexico, not only boost Ineco's economic outlook for the coming years, but also reinforce the leading role played by Spanish engineering around the world.

Further examples of our strength and competitiveness include the commission to produce the Master Plan and design for what will become the second-largest airport in Greece, at Kasteli on the island of Crete; and the extension of the renovation works on the rail link between Samsun and Kalin, in Turkey.

This work is the result of the knowledge we have acquired through the projects we have implemented in Spain over recent decades. Among them, the addition of gauge changeovers to the high-speed rail network: a highly successful experience, particularly useful in terms of helping us export our know-how to other countries. At the international level, examples include highly specialised projects such as the development of new rail regulations for the Empresa de Ferrocarriles del Estado de Chile (EFE).

We have also made progress in fulfilling our commitment to the 2030 Agenda and the 17 SDGs: a commitment that continues to encourage us to promote actions and initiatives designed to improve quality of life for society as a whole. This has led us to continue supporting solidarity-based projects such as *IngenioSOS* which has helped to improve essential services in Kenya, Ethiopia, Guatemala, South Sudan, India and Haiti over the course of its two editions.



“

At Ineco we are firmly committed to aiding the efforts of the Ministry of Transport, Mobility and the Urban Agenda by providing technical support to help implement the Spanish Government's Recovery, Transformation and Resilience Plan”

CARMEN LIBRERO
President of Ineco

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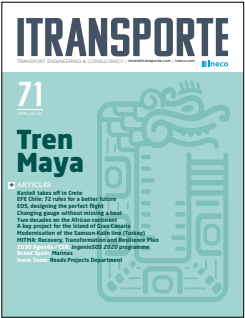
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PHOTO_MITMA

NEW AVE SECTION TO ELCHE AND ORIHUELA PUT INTO SERVICE

On 1 February, the new 54-kilometre section of high-speed track between Monforte del Cid and Beniel—which includes the new stations of Elche Alta Velocidad and Orihuela Miguel Hernández— was opened by the Spanish Prime Minister Pedro Sánchez. He was accompanied by José Luis Ábalos, the Minister of Transport, Mobility and the Urban Agenda, and Ximo Puig, the President of

the Autonomous Community of Valencia (the image shows the three men at the station in Elche along with the mayor, Carlos González, on the right). The minister highlighted the one-hour reduction in the travel time between Elche and Madrid and the two new daily connections between Murcia and the capital. Ineco has worked on all of the high-speed sections in the Levante region (see

IT36 and IT47) and this time provided Adif with a range of services, such as the drafting of plans for safety installations, construction management, technical assistance for platforms and stations, signalling and telecommunications, track assembly, overhead lines, running tests, and supervising and testing the ERTMS Level 2 system. Of particular note in this respect is the technological milestone of the

commissioning of Spain's first handover between different technologies, which took place in the triangle formed by Murcia, the Vinalopó split and Monforte del Cid. The project was implemented by CAF Signalling and makes it possible for RBC systems from two different manufacturers, Hitachi and Alstom, to hand over control of the trains passing through their respective areas of operation.

KENYA
MORE RECONDITIONED TRAINS FOR NAIROBI

Ineco, on behalf of Renfe, has inspected the second batch of reconditioned trains that Kenya Railways acquired in 2019 from the Mallorcan rail operator SFM. The batch comprises six 6100-series diesel units manufactured by CAF, which will join the five units, also inspected by Ineco, that were shipped in late 2020 to serve Nairobi's new network of commuter lines (see IT70).

This second batch completes the total of 11 diesel multiple units and one trailer unit that were acquired by the Kenyan operator. *In the field of aeronautics, Ineco is to begin a new project in Africa: specifically, in Cape Verde, where the company has been working since 2003. The new project consists of a feasibility study for a new airport on the island of Santo Antão.



PHOTO_ICEX KENYA

One of the delivered trains, now in service at Nairobi's new central station, which was opened in November.

INECO JOINS EUROPE'S AMU-LED URBAN DRONE PROJECT

Four European cities – Santiago de Compostela in Spain, Cranfield in the United Kingdom, Amsterdam and Rotterdam in the Netherlands– will serve as test sites for the AMU-LED urban drone project, which forms part of the EU's Horizon 2020 programme and the SESAR (Single European Sky) initiative.

Ineco is a member of the consortium of 16 companies and organisations, led by Everis, that is managing the project, which began in January. Its fellow members include: Airbus, AirHub, Altitude Angel, ANRA Technologies, Boeing Research & Technology-Europe, FADACATEC, Cranfield University, EHang, ENAIRE, Gemeente Amsterdam, ITG, Jeppesen, NLR, Space53 and Tecnalia. Over the next two years, more than 100 hours of



IMAGE_SESAR JUEHANG

flight time will be logged for different types of drones, scenarios and applications, including: air taxis, cargo transport, delivery of medical equipment and goods, infrastructure inspection, police surveillance and

emergency services support. The results will make it possible to evaluate the impact of unmanned vehicles on urban mobility, while providing information that is of great use to regulatory authorities.

SPAIN
FIRST MULTI-NETWORK RAIL OPERATING CENTRE OPENS IN LEÓN



PHOTO_MITMA

José Luis Ábalos, the Minister of Transport, Mobility and the Urban Agenda, opened Adif's new Rail Operating Centre (ROC) in León (picture above left) on 10 December. The new ROC joins the 22 that are already in operation across Spain and represents the country's first multi-network centre, as it incorporates Centralised Traffic Control (CTC) systems for three different rail networks (conventional, high-



IMAGE_INECO

speed and meter-gauge, which in León comprise a total of 1,200 kilometres of track) into a single operating centre. Ineco developed the construction plan (see IT39) for the ROC building itself (above right), which was opened in 2013. It was designed to centralise all of León's rail operating facilities in a single location, although at first it was only used for the conventional lines.

USA
NEW MOYNIHAN TRAIN HALL OPENS IN NEW YORK

Andrew Cuomo, the Governor of New York State, opened the new Moynihan Train Hall on 1 January. The hall is located in the historic and recently renovated Farley building in central Manhattan. It covers an area of 32,000 m² and enlarges the concourse space of Penn Station - one of the country's busiest - by 50%.



PHOTO_FLICKR

Ineco worked on the project in 2018 and 2019, providing Operational Readiness and Transfer (ORAT) services to WSP USA for the new underground train hall (see IT65), which will serve two operators: Amtrak, with 16 medium and long-distance lines, and LIRR, with 10 commuter lines. The work carried out by Ineco included preparing a detailed programme of activities, designing and commissioning the structure, coordinating the various work groups, creating a risk register, identifying and evaluating processes, and preparing the ORAT manual.

SPAIN
STUDY FOR THE
PORT OF MÁLAGA

The Málaga Port Authority has commissioned Ineco to prepare a dedicated study on the condition of the crest wall of the Levante breakwater, and to draw up a plan for its repair. The tasks to be carried out include a comparative analysis of the condition of other crest walls of the same structural type, along with an analysis of the repairs that have been done to them and their current condition. Preliminary studies have concluded that higher than anticipated levels of environmental aggression have reduced the structure's useful life.



PHOTO_FUNDACIÓN MIGUEL AGUILÓ (CQ)

II EQUALITY WEEK: 'THERE IS NO ROOM FOR INEQUALITY'

This is the motto for the second edition of the company's Equality Week, which is one of the actions provided for in the most recent version of the Equality Plan, presented in 2019. The programme of activities for 8-12 March includes the launch of the third edition of the Women IN mentoring programme, the first children's competition titled *The Future of Equality Between Women and Men* for the families

of Ineco employees, and the launch of a corporate volunteering initiative to promote labour integration among female victims of gender-based violence, as part of the programme Horizon. The company has made equality of opportunity and treatment between women and men one of the aims of its Strategic Plan, which also incorporates a commitment to the 17 Sustainable Development

Goals (SDGs) of the 2030 Agenda. SDG 5 corresponds to gender equality. For the first time in its 50-plus years of history, Ineco has a female president: Carmen Librero, an aeronautical engineer. Moreover, a significant proportion of the company's workforce is female. Ineco employs more than 3,000 professionals, nearly 40% of whom are women; a higher than average proportion for technical fields.



SPAIN
RAIL LIVE
2020 AND THE
II AIRPORT
ENGINEERING
CONFERENCE

On 1 and 2 December, Ineco took part in Rail Live, a trade fair for the rail industry. The 2020 edition, which took place online, boasted more than 3,000 attendees, 150 speakers and around 30 exhibitors.

Ineco president, Carmen Librero, gave a presentation on the company's contribution to the modernisation of rail networks around the world. Other speakers included Pablo Ramos, Deputy Director of the Europe Account, who took part in a round table discussion on the sustainable development of high-speed projects; Mario Ferreira, who gave a presentation on the coexistence of Iberian and standard-gauge railways in Spain; and Silvia Domínguez, who talked about the implementation of ERTMS in Europe.

January also saw the second edition -also in virtual format-of the Airport Engineering Conference, which was organised by the Spanish Association of Aeronautical Engineers (COIAE) and sponsored by Ineco. Participants included Rafael Torres, Director of Aviation Business and Digital Administration, who highlighted the Sustainability Plan for Dammam Airport in Saudi Arabia; Ingrid Nicolás, Director of Integration, who explained the concept of a 'digital twin'; and Daniel Sánchez, Manager of the Air Safety Division, who gave a presentation titled *Human Factors: Methodology and Applications*.



The Ineco team at the mouth of the Martorell tunnel.

WORK CONCLUDES ON THE MARTORELL TUNNEL

Ineco directed the construction work and provided technical assistance to monitor and supervise the improvements that Adif is making to the section of track between Castellbisbal and Martorell in Barcelona Province. In the Martorell tunnel, which is 1,065 metres long, the structure was lowered, renovated and reconditioned in order to install the third rail and adapt it to the standard gauge (1,435 mm).



PHOTOS_REFORESTUM

SPAIN
A FOREST TO SHRINK THE CARBON FOOTPRINT

By planting a forest of some 1,600 native tree species in Calahorra de Boedo (Province of Palencia), Ineco will offset 573 tonnes of CO₂ equivalent, which represents 6.12% of its carbon footprint for 2019. The initiative was carried out in January in collaboration with the company Reforestum and enabled Ineco to reaffirm its commitment to the fight against climate change and to Sustainable Development Goals 13 and 15 in the 2030 Agenda.

SPAIN
ADVANCES IN BIM:
USE IN PUBLIC
ADMINISTRATION
AND THE RAIL
SECTOR

Ineco continues to participate in the development and spreading of the Building Information Modelling (BIM) methodology. At the end of January, the company gave an online training course on BIM for the staff at the Development Bank of Latin America (CAF). The course focused on the management of BIM projects by public administrations, and provided insight into different experiences of implementing BIM in different countries in Latin America, Europe and the rest of the world.

In addition, the work group at the Railway Innovation Hub, an innovation-oriented conglomerate of Spanish businesses, has completed the drafting of the BIM classification for the rail sector. Ineco and Grant Thornton have led the group since 2019. For the first time, this new system will standardise and categorise all of the elements in the subsystems of the railway network, so that they can be incorporated into BIM models.

In order to contribute to innovation in the rail sector, the outcome of this collaboration has been placed in the public domain. In addition to Ineco and Grant Thornton, those taking part in the project include Abengoa-Inabensa, Actisa, Akka, Apogea, Ayesa, Azvi, Belgorail, Cemos, Comsa, Dassault Systèmes, Enyse, FCC Construcción, Ferrovial, Ingeniería In Situ, Sdea Solutions, Sener, Siemens, Sistem, the Cetemet and Tecnalia technology centres, and the Madrid Association of Civil Engineers. Nearly 100 companies form part of the Railway Innovation Hub, which is dedicated to promoting innovation in rail services.

The Tren Maya, a path to prosperity for southeast Mexico

For the next three years, Ineco and its subsidiary Inecomex, together with Renfe and DB, will be working on the Tren Maya, a passenger and freight railway line that will run through five states and that the federal government wants to promote as a driver of tourism, social inclusion and employment in the southeastern part of the country.

By Salomé Fernández and Alberto Vascónes, civil engineers

Temple of Kukulkan, the feathered serpent god that inspired the logo for the Tren Maya. The site is located in Chichén Itzá, one of the three great Mayan enclaves along with Tikal and Palenque.



PHOTO © A. VASCÓNES (INECO)

The Mayan civilisation, which flourished for two thousand years on the Yucatan peninsula and in the area that is today Guatemala and Belize, gives its name to the railway project that the Mexican federal government is promoting in the region, located in the southeastern part of the country, through the National Fund for the Promotion of Tourism, FONATUR.

The Tren Maya will be a conventional passenger and freight line more than 1,500 kilometres long, crossing five states –Chiapas, Tabasco, Campeche, Yucatán and Quintana Roo– with the objectives of boosting tourism and the agricultural sector, as well as creating employment in the region by encouraging social inclusion, promoting and safeguarding local indigenous cultures, and protecting and rehabilitating the Natural Protected Areas of the Yucatán peninsula. For the Mexican federal government, this is a “priority” project, with an important social component, and the first section is expected to be put into service in 2023. The government estimates that the new line will reduce passenger travel times by 46% and increase the speed of freight transport by up to 72% compared to the speed of the existing rail tracks.

In December 2020, FONATUR awarded the consortium –made up of Renfe, Ineco, Inecomex and Germany’s DB Engineering & Consulting– a three-year contract as a ‘shadow operator’, or consultant for the operation and supervision of the Tren Maya project in which it will review the basic engineering of the entire project, defining the requirements for the operation and technical specifications of the rolling stock and railway systems. It will also verify that the maintenance requirements are consistent with the approach of the operations plan.

The consortium will also advise FONATUR throughout the tendering process for the acquisition of rolling stock and railway systems (signalling, communications and control posts) from the preparation of the tender documents, support during the tendering process, supervision of the manufacture, delivery and commissioning of the rolling stock, including workshops and depots, to the



SIGNING OF THE CONTRACT
December 2020, FONATUR awarded the consortium made up of Renfe, Ineco, Inecomex and the German company DB Engineering & Consulting, a three-year contract as adviser for the operation and supervision of the project.

PHOTOS: INECO

start-up and commercial operation of the passenger rail transport operation.

A MIXED LINE WITH INTERNATIONAL GAUGE

The Tren Maya will be a conventional mixed-use line linking the region’s main production and tourist centres. It is de-

signed for a top speed of 160 km/h for passenger traffic –long-haul, regular (medium distance) and tourism– and 100 km/h for freight. Virtually the entire route will be built on ballast with international gauge (1,435 mm).

Eighteen stations and 12 stops have initially been planned, although the

federal government has pointed out that “as the train matures and demand conditions increase, additional stations may be added”. Multimodal charging stations are also planned for Campeche, Merida, Cancun and Chetumal.

The project has been divided into seven sections (see map); sections 1 to 5 will be developed by FONATUR, while sections 6 and 7 have been entrusted to the Ministry of National Defence (SED-ENA). The first stage of the project (sections 1 to 4) runs between Palenque and Cancún, and will be electrified between Mérida and Cancún. The second stage (sections 5 to 7) runs from Cancún to Escárcega, bordering the Yucatán peninsula in the south-southeast, and will be electrified between Cancún and Chetumal. Overall, 43.8% of the line –680 kilometres– will be electrified.

A large part of the route will use existing rights of way, and level crossings will be avoided. In order to ensure accessibility to the territory, the construction of 24 viaducts, more than 200 vehicle crossings and some twenty pedestrian walkways is planned, as well as more than 2,700 wildlife crossings.

The route will provide access from the general corridor to places of interest such as Chichen Itzá and Chetumal. An underground branch line has been planned in Mérida under the existing railway line, thus eliminating the barrier effect generated by the existing route.

According to the federal government, the route will be double or single track, depending on demand on each stretch. For the line as a whole, two time horizons have been taken into account: by 2023, more than 66,000 passengers per day and almost 2.5 million tonnes of freight per year are expected, and by 2053, more than 255,000 passengers per day and almost 10.6 million tonnes per year.

RAILWAY SYSTEMS

In terms of track superstructure, the line will be equipped with the most advanced railway systems: ATP (Automatic Train Protection) and ATC (Automatic Train Control). The railway communication systems will be based on wireless technologies, which will allow reliable and continuous communication between the different parties involved in railway operation and between these parties and the public civil protection services.

GENERAL LAYOUT OF THE ROUTE



PHOTO_FONATUR



PHOTO_JOAN NOVA (FLICKR)

The Tren Maya will be a conventional passenger and freight line more than 1,500 kilometres long, crossing five states. Its objectives include boosting tourism and the agricultural sector, as well as creating employment in the region by encouraging social inclusion, promoting and safeguarding local indigenous cultures, and protecting and rehabilitating the Natural Protected Areas of the Yucatán peninsula.

BASIC DESIGN CRITERIA

- ▶ Maximum design speed: 160 km/h for passengers and 100 km/h for freight.
- ▶ Track gauge: 1,435 mm.
- ▶ Rail: continuous welded, 115 RE.
- ▶ Sleeper: monolithic concrete .
- ▶ Anchoring: elastic.
- ▶ Distance between tracks: 5.00 m on double track, 7.60 m on sidings.
- ▶ Track devices: AREMA (American Railway Engineering and Maintenance-of-Way Association) type.
- ▶ Maximum descending gradient: 1.5%
- ▶ Minimum radius for Maximum Speed: 1,750 m
- ▶ Sidings: approximately every 25 km on single track and every 50 km on double track.

Railway operation control will have a Command and Control Centre located in the city of Mérida and several area control centres.

The Tren Maya will have a series of safety systems to detect anomalous events, which will be connected to the Command and Control Centre. The main systems include detectors for hot axle box and hot wheels (HABD/HWD), objects fall, dragging equipment and derailed axles, gauge excess and broken rails.

Stations and technical buildings will be equipped with a high-performance network of fibre optic connections, radio communications, radio infrastructure approximately every 15 kilometres of the route and connections to emergency

2021 IS AN IMPORTANT YEAR FOR INECO, AS IT MARKS 10 SINCE THE OPENING OF THE SUBSIDIARY INECOMEX. IN ITS MORE THAN 20 YEARS OF EXPERIENCE IN MEXICO, THE COMPANY HAS DEVELOPED MORE THAN 40 PROJECTS

services. Subsystems for video surveillance, telephony/intercom, sound and voice, remote indicators, access control and ticketing are also planned.

ROLLING STOCK

The passenger rolling stock will be designed according to the three types of service to be provided: long distance, regular and tourism. The trains will be modular, allowing multiple sets of trains to be coupled together in order to increase capacity as required. The coaches will have two doors each and a passageway between them; they will also be accessible for passengers with reduced mobility. In terms of performance, they will have a maximum speed of 160 km/h, operate in both directions and have a seating capacity of up to 450, which can be adjusted to meet demand. The project is planned for the use of diesel and diesel-electric rolling stock.

The freight rolling stock will use diesel traction with an installed capacity for a maximum speed of 100 km/h and a maximum axle weight of 32.5 tonnes. The maximum length will be 1,500 metres and, when running, sidings will be provided to allow trains to pass each other in the event of a breakdown, emergency or overtaking.

Initially, the construction of three rolling stock depots, seven maintenance bases at strategic locations and nine parking garages to house the trains overnight is planned.

A PROJECT WITH CONSIDERABLE IMPACT

According to the federal government, the new railway line will improve connectivity and tourism development in an area where “economic activities are concentrated in a few distant urban centres, with a population of 7.3 million people living in poverty”, which is why “one of the main objectives of the Tren Maya is to boost the region’s economy” and achieve a “multiplier effect” from the investment.

With regard to the protection of the natural environment and the cultural and archaeological heritage, the govern-

THE 10TH ANNIVERSARY OF THE SUBSIDIARY INECOMEX

By Salomé Fernández, director of Inecomex and of Ineco’s North America Account

2021 is a significant year for Ineco, as it marks 10 years since the opening of the Mexican subsidiary Inecomex. A country in which Ineco has more than 20 years of experience, and more than 40 projects behind it. The route reached its first major milestone in 2006, with the Buenavista-Cuautitlán commuter line for Ferrocarriles Suburbanos de Ciudad de México (see *IT 17*), a project that allowed the company to open a delegation in the country. Ineco participated in the preparation of the tender for the consortium led by Construcciones y Auxiliar de Ferrocarriles (CAF) and carried out the coordination, design, construction supervision and commissioning of the line. In two years, 27 kilometres of line were renovated and new sections of track, six stations and interchanges were built, in addition to the installation of a new electrification, signalling and communications system.

In the airport sector, Ineco began its work in Mexico with Aena Internacional, providing support in the first studies carried out for Grupo Aeroportuario del Pacífico (GAP), starting from 2000 with the drafting of the Master Development Programmes for its 12 airports. Since then, Ineco and Inecomex have continued to work on the periodic updates of the



PHOTOS_INECO

Ineco president Carmen Librero (centre) with Ineco-Inecomex teams from the Mexico City Line 12 extension project (above) and the Guadalajara-Colima highway (below) during their visit to Mexico in 2018.

Programmes, most recently in 2019 for the period 2020-2034 (see *IT 68*). Ineco participated in the project management of the extension works of line 12 of the Mexico City Metro since 2016 (see *IT 66*); and since 2011, it has been managing and supervising the management, extension and maintenance works of the 148 kilometre Guadalajara Colima motorway (see *IT 40, 46 y 52*), including, due to its

technical complexity, the project management of the doubling of the carriageway of the ‘mountain section’ (see *IT 70*), which is currently underway. This 14-year contract led to the opening of the company’s second subsidiary, Inecomex, which is now celebrating its 10th anniversary. The company currently has a team of more than 50 people and offices in Mexico City, Guadalajara and Ciudad Guzmán.

ment stresses that the project strictly complies with existing legislation, as well as considering the scale of the human and material resources for this purpose. In addition, a public consulta-

tion involving more than 10,000 people from indigenous communities in the five states through which the route will pass was held at the end of 2019, resulting in a number of agreements. ■

A 21ST CENTURY AIRPORT
Kasteli will replace the airport in Heraklion, the capital of the island of Crete. It will have a runway 3,200 metres long, a new terminal building with between 85,000 and 90,000 m², a large commercial area covering more than 10,000 m² and 45,000 m² of parking, among other facilities.

Kasteli takes off in Crete

Ineco is designing what will be Greece's second largest airport, after the one in Athens. Located in Kasteli, in the interior of the island of Crete, it will replace the airport in Heraklion. It is one of the most important infrastructure projects for the island and for the country as a whole, providing a boost to the tourism sector, which is vital for the Greek economy.

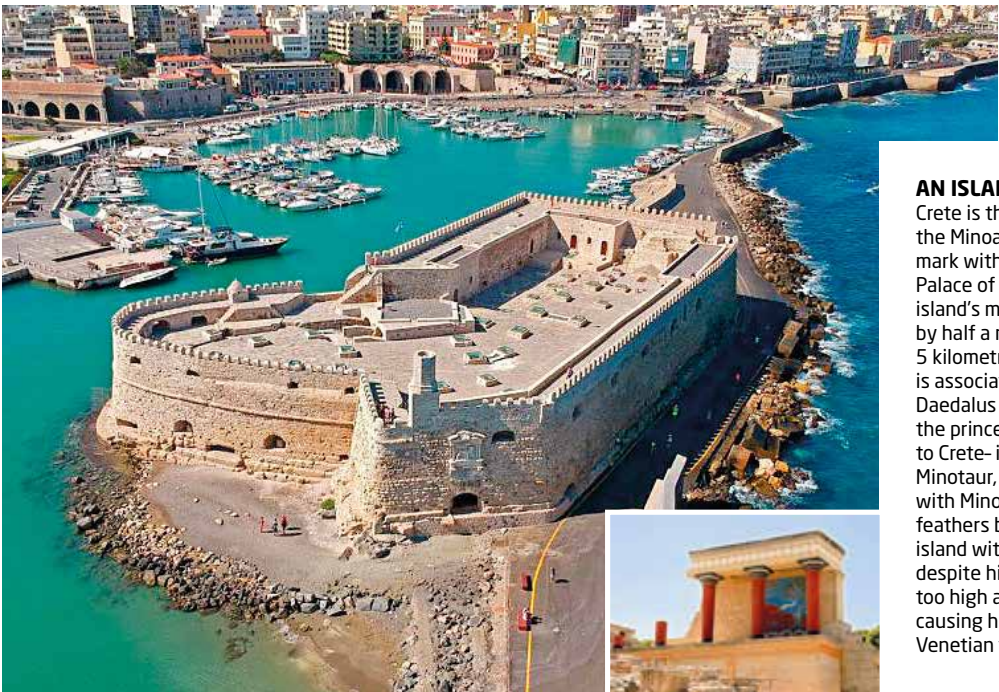
By **Roberto Serrano** and **Rodrigo López**, aeronautical engineers

Following the opening of the new Athens airport, located approximately 30 kilometres from the capital in Spata, in 2001, and the opening up of the remaining airports to public-private management starting in 2015, the next big project for Greek aviation is the construction of the new airport in Kasteli in Crete, which will replace the airport in the capital, Heraklion. With an initial capacity of 8.9 million passengers, it will be Greece's second largest airport, after Athens. According to the Greek government, this new infrastructure project will generate approximately 7,500 direct jobs once completed, plus another 37,000 indirect jobs in the tourism and commerce sectors.

Heraklion International Airport, is a joint venture between the Greek firm GEK Terna and India's GMR Airports Limited (GAL), which were awarded the concession contract in 2019. Ineco is developing the design of the new airport for the construction company Terna, which has a period of five years to carry out the works following the signing of the contract, which took place in February 2020. In addition, during the pre-bid phase, the company also drew up the Master Plan for the future airport, which will occupy an area of approximately 600 hectares.

Air transport generates 457,000 jobs in Greece and contributes 17.8 billion euros to its economy, equivalent to 10.2% of Greek GDP, according to a study by IATA, the International Air Transport Association. It is closely linked to tourism, which also accounts for more than 10% of national GDP. Having weathered a long period of recession, the Greek economy returned to positive growth beginning in 2017, which is reflected in airport traffic, which, according to the Hellenic Civil Aviation Authority, recorded a record 65.4 million passengers in 2019, 3 million more than the previous year, an increase of 5 percent. The total number of flights also increased by 3.7%.

Greece broke its tourism record in 2019, with more than 31.3 million visitors, 18% of whom, more than 5 million, travelled to the island of Crete, the country's largest island and the fifth largest in the Mediterranean. With a population of just over 634,000 inhabitants and covering an area of around 8,500 km², it is one of the five most visited Greek destinations: its thousands of years of history, cultural and monumental heritage, the Mediterranean climate and the island's beautiful landscapes and beaches are its main attractions. It is also an important geostrategic enclave due to its location. The local economy is mainly based on agriculture and tourism.



AN ISLAND OF LEGEND

Crete is the cradle of Europe's oldest civilisation, the Minoan civilisation (7000 BC), which left its mark with the ruins of the partially reconstructed Palace of Knossos (pictured below), one of the island's most important tourist attractions, visited by half a million people every year. Located just 5 kilometres from Heraklion, its complex design is associated with the myth of the maze built by Daedalus for King Minos -son of the god Zeus and the princess Europa, whom he abducted and took to Crete- in order to imprison the bloodthirsty Minotaur, his stepson. In turn, after falling out with Minos, Daedalus devised wings made of bird feathers bound with wax to fly away from the island with his son Icarus. According to the myth, despite his father's warnings, Icarus ascended too high and the heat of the sun melted the wax, causing him to fall into the sea. In the picture: the Venetian fortress of Koules in the port of Heraklion.



The island has three airport facilities, all located along the northern coast: the small airfield in Sitia, and two international airports, Chania, which was used by 2.9 million passengers in 2019 and shares its installations with a military base, and the Nikos Kazantzakis airport in Heraklion, the island's capital and the fourth largest city in Greece, with a population of just over 313,000 inhabitants, in the central area of the island, which is also used for both civilian and military purposes.

Activity has been on the rise in recent years, with a steady increase in traffic reaching 8 million passengers in 2019. Today's installations date back to 1972 and were expanded in 1996 and 2005, although they become particularly congested in summer. In addition to the three civilian airports, 39 kilometres southeast of Heraklion is the Hellenic Air Force base at Kasteli, next to the location of the new airport.

The construction of other major energy and transport infrastructures on the island is also being planned, involving a total investment of more than 3.1 billion euros and with the financial backing of the European Union: the roughly 180-kilometre VOAK highway, which will connect Chania with the town of Agios Nikolaos, and two power supply interconnections with the Greek mainland: Crete-Attica and Crete-Peloponnese. ■

GATEWAY TO TOURISM

Crete is one of the five most visited Greek destinations. Below: Heraklion airport, the largest of the island's three airports.



PHOTO: ROBERTO SERRANO



IMAGES_INECO

HERAKLION INTERNATIONAL AIRPORT

a joint venture between Greek firm GEK Terna and India's GMR Airports Limited (GAL), which were awarded the concession contract in 2019. Ineco is developing the design of the new airport for the construction company Terna, which has a period of five years to carry out the works.



WHAT CRETE'S NEW AIRPORT WILL LOOK LIKE

The designs currently being developed by Ineco include the following general specifications:

1. AIRFIELD

- The runway, class 4E, CAT I, will be 3,200 metres long by 60 metres wide, including margins, plus RESAs (Runway End Safety Areas) at both ends. The existing runway at Heraklion airport has a maximum length of 2,682 metres, meaning that the new facility will be able to accommodate larger aircraft.
- In terms of taxiways, there will be one parallel to the runway, several rapid exit taxiways and connecting taxiways to the nearby military airport. A connection to an isolated post is also included.
- The aircraft parking apron will have five MARS positions connected by boarding bridges from the terminal building for class E aircraft, each including two positions for class C aircraft, one remote MARS for class E aircraft, including two for class C. In addition, there are remote positions for class C aircraft, general aviation stands and helicopter stands. The platform will also have a hydrant network supplying all class C and E stands, as well as 400Hz connection points at each of these positions.
- Pavement will be rigid on the apron, at taxiway intersections and on the first 450 metres from the runway thresholds, and flexible on the runway and taxiways.
- The designs also include the rest of the airfield's infrastructure and associated facilities, such as the fire station building, perimeter road and fencing, hydrocarbon separators, lighting, flood barrier and containment basin, firefighter test platform, etc.

2. LAND SIDE

- The terminal building will occupy an area of between 85,000 and 90,000 m², divided into four floors: basement, arrivals floor, departures floor and a floor for installations and other purposes.
- The terminal's façade will be 200 metres long. The arrivals floor is at apron and land side car park level, while the check-in floor is accessed via a departure deck that is 7.5 metres above ground level.
- The check-in system will include four islands, with around 80 counters. Security checkpoints, passport control stations and contact boarding gates have been designed on the first floor and remote boarding on the ground floor (both for Schengen and non-Schengen flights).
- A large area of more than 10,000 m² has been planned for commercial space, as well as a general aviation hall and another for authorities, among other facilities. The building will qualify for LEED SILVER certification.
- The main part of the control tower, with the beacon housed at the top, will be approximately 45 metres high and will consist of six floors plus the antenna field.
- Auxiliary buildings will also be designed: industrial buildings, such as the power station, the power supply substation, a sewage treatment plant, a clean disposal point, a drinking water plant, an installation maintenance building, a handling building, fuel plant, etc. Other buildings include the police station on the land side and the access control buildings on the air side.
- A surface car park covering approximately 45,000 m² has been planned to accommodate private vehicles as well as taxis and buses.
- In terms of road access, a four-lane commercial artery with two main roundabouts is being designed, which will connect to the new highway linking Heraklion to the airport. All of the airport's internal roads are also being planned.



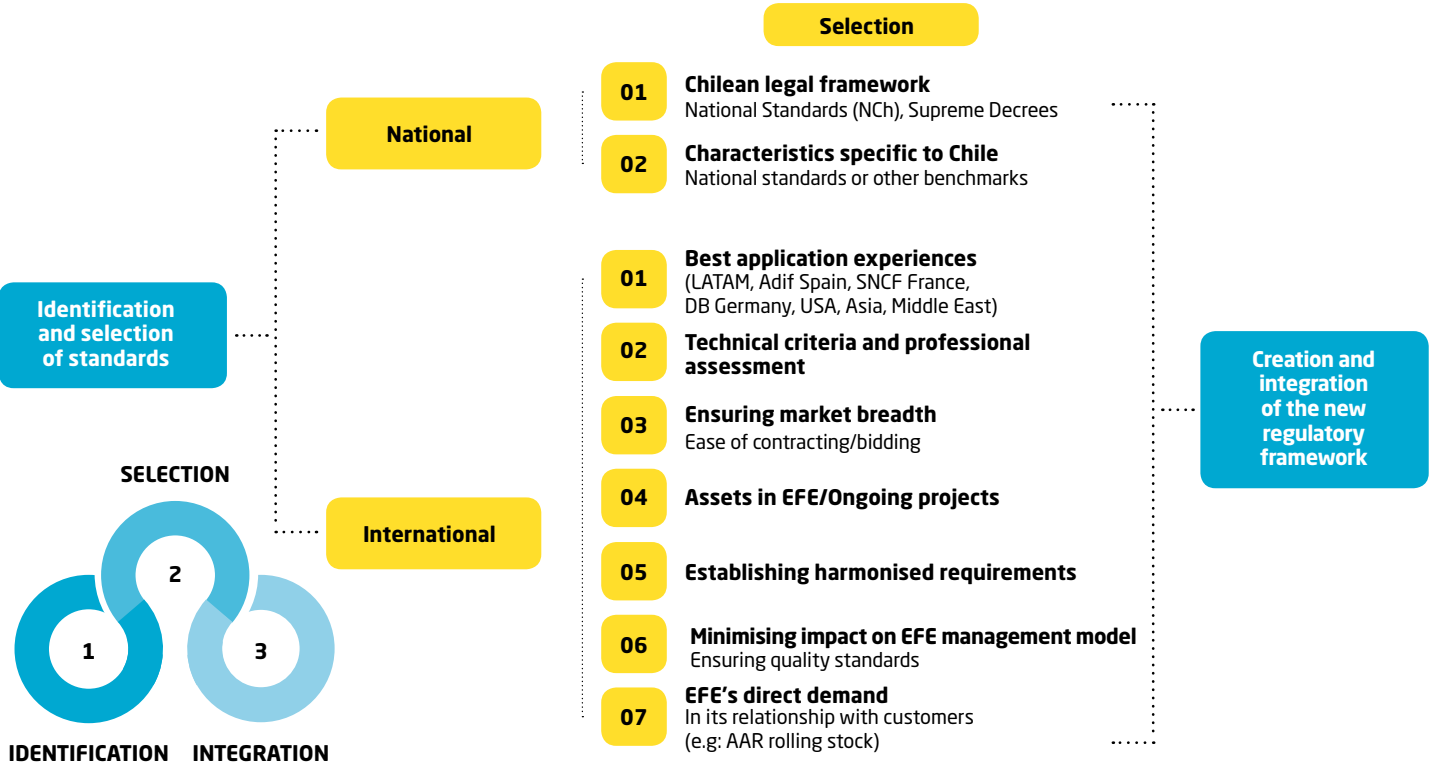
The Chilean government is taking a step forward towards modernisation and improved competitiveness, strengthening the country's railway sector through the legal and regulatory development carried out by Ineco and Louis Berger (WSP).

PHOTO: INECO

EFE Chile: 72 rules for a better future

With the implementation of the new regulatory framework, Empresa de Ferrocarriles del Estado de Chile (EFE) is now on par with the world's major railway companies. Nearly 50 Ineco experts participated in the development of this modern railway standard.

By civil engineers **David Maté**, project manager, **Eneko Quintanilla**, deputy project manager and **Salomé Fernández**, contract administrator



The methodology of the Ineco/Louis Berger (WSP) consulting team was based on defining a decision model and a formula for integrating standards in three stages: identification of the standard, selection of the standard and integration into the regulatory framework.

The new technical railway regulations of the Chilean public company EFE, drafted by Ineco in consortium with Louis Berger (now WSP), with stakes of 80% and 20%, respectively, involves the development of a new technical regulatory framework to regulate the design, construction and maintenance of all the Chilean railway company's assets. The criteria include RAMS (reliability, availability, maintainability and safety) requirements, and cover all of the systems that make up railways: infrastructure, superstructure, signalling, electrification and communications; level crossings; stations and rolling

stock for passengers, freight and auxiliary vehicles; and operation and maintenance. In 2020, EFE's Board of Directors approved a change to this new technical standard that will govern the conduct of all its suppliers and contractors moving forward. The project required the renewal and expansion from the 24 standards that existed in 2019 to the current 72 standards. The Chilean railway network is unique in that it incorporates both its own elements and European and North American technologies, which is why the drafting process was carried out based on both American and European

regulations, taking into account current Chilean legislation, the current state of the infrastructure and routine operations of the EFE Group.

The development of the new regulation was a complex task, since it addresses new standards in all areas of railway activity: more than 50 professionals from Ineco and Louis Berger (WSP), from 15 different specialities, participated in the project over the course of a year. Meetings organised into 17 working groups were held, involving the coordination and input of more than 100 specialists from the EFE group and its subsidiaries: Tren Central, Metro Valparaíso, FESUR and FCALP.

From an operational point of view, the new framework will facilitate procurement processes, define maintenance contracts and make it possible to reduce costs. From a strategic point of view, it ensures greater national and international visibility and diversity in Chilean public procurement.

STRENGTHENING RAIL TRANSPORT IN CHILE

The EFE group manages a network of approximately 2,200 kilometres of track, providing long-distance, medium-distance and commuter services. The EFE network uses

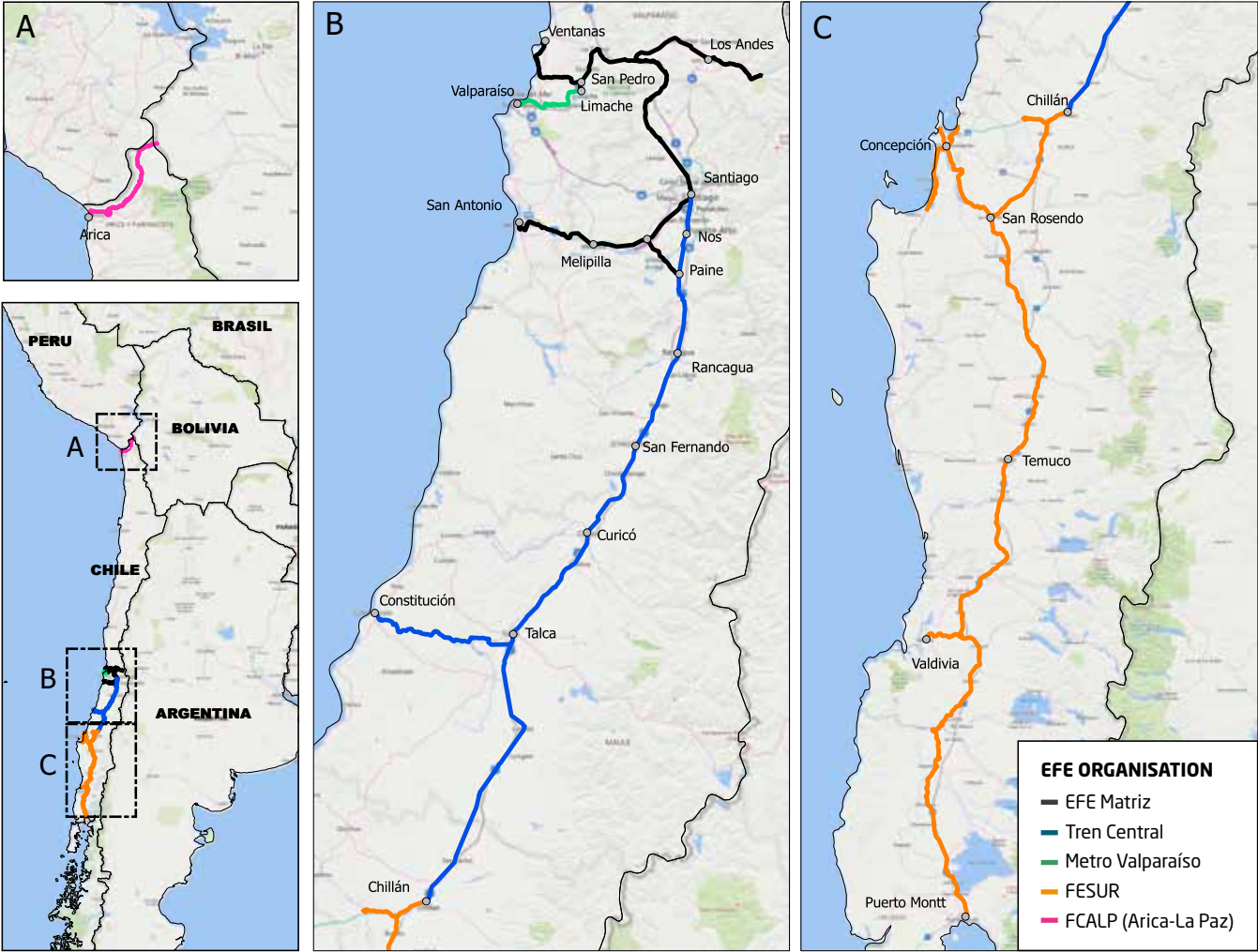
MAIN STRATEGIC PROJECTS

With the development of the new technical regulations, the Chilean authorities are seeking to boost operational productivity and efficient management of the railway infrastructure, with the aim of investing more than five billion dollars by 2027 through the 'Chile on rails' plan. The plan looks to triple the current passenger demand to 150 million, double freight to 21 million tonnes and renew of the entire fleet with new trains.

The main strategic projects included in the plan are:

- 1. **The extension of Metro Valparaíso (Quillota-La Calera):** This includes a 26-kilometre route for passengers and freight, 5 stations and 15 new trains
- 2. **Santiago-Batuco:** A passenger transport service for 5 municipalities in the Metropolitan Region, with 8 stations on a 27-kilometre route and a connection with Metro Santiago lines 5, 7 and 3.
- 3. **Santiago-Batuco:** A passenger transport service for 8 municipalities in the Metropolitan Region, with 11 stations and 61 kilometres and connection with lines 1 and 6 of Metro Santiago.
- 4. **New Chillán-Alameda service:** A long-distance service on the 400-kilometre stretch between the capital of the Ñuble region and Santiago. It calls for the purchase of six BMU type trains with dual traction.
- 5. **Biobío Viaduct:** The construction of a new 1.8-kilometre viaduct with two electrified tracks for mixed use by freight and passenger trains.

The standards will serve as the basis for tenders for new railway sections of EFE and its subsidiaries.



APPROVAL Validity and duration

- EFE General Manager
- Technical Steering Committee

VALIDATION

- Standardisation and Continuous Improvement Unit
- Project Manager
- Technical Managers
- Technical Committee
- Project Manager
- Project management team
- Technical specialists

DRAFTING, REVIEW AND PROPOSAL

- Engineering and Infrastructure Management
- Standards, Control and Environment Management
- EFE Project Management
- Commercial and corporate business management
- Corporate Legal Management
- FESUR
- Metro Valparaíso
- Tren Central
- FCALP
- Management and regulation
- Railway
- Rolling stock
- Civil works
- Stations and workshops
- Signalling
- Level crossings
- Telecommunications
- Command and control
- Electrical systems
- Electromechanical equipment
- RAMS
- Legal

PROJECT STAGES

General Management

Management Committee

Technical Committee

Technical Working Groups TWGs

150 professionals

17 TWGs

The standards will serve as a basis for tenders and will provide EFE technicians with tools to meet the challenges arising from the modernisation of the railway sector in Chile.

mostly a 1,676 mm gauge (very similar to Iberian gauge), with several 1,000 mm metric gauge sections on northern lines. The EFE group can be further subdivided into the parent company EFE (which is responsible for the administration of the infrastructure and exclusive freight lines) and the subsidiaries, which are responsible for the operation of the different passenger services:

- Tren Central, which covers the network from Santiago to Chillán.
- Metro Valparaíso, which covers the metro service between Limache and Valparaíso.
- Ferrocarriles del Sur, between the Biobío region and Puerto Montt.
- Ferrocarril Arica-La Paz, which is responsible for the maintenance and operation of the tracks on the Chilean section between Arica and Visviri.

Meanwhile, freight transport is provided by the private companies Fepasa and Transap.

72 STANDARDS ACROSS MORE THAN 15 SPECIALITIES
The complexity of drafting all the regulations stems, to a large extent, from the wide variety of systems and proprietary architectures of the different EFE subsidiaries and their unification into one standard for each system. To develop them, Ineco's experts used general documentation, equipment and system specifications, inven-

tory lists, meetings and visits to EFE's facilities in Chile, as well as benchmarking to define the most appropriate international standards to be considered in each speciality. Thanks to the 17 work groups of Ineco, Louis Berger (WSP) and EFE and its subsidiaries, a diagnosis was made, standardisation needs and requirements were identified, and, lastly, standards were drafted for validation by the EFE group.

THE VOICE OF THE EXPERTS IN...

- **Track:** Ineco's track specialists participated in the review and drafting of 12 technical standards for the design, construction and maintenance of the superstructure. In this area, says **Francisco Javier García**, six standards were drafted to regulate important aspects such as the criteria for the design and construction of the track superstructure, as well as the supply of track elements (ballast, sleepers, anchors, etc.). A specific standard for maintenance work was also included.
- **Level crossings:** Both at vehicle and pedestrian level crossings, **Amador Quintana** highlights EFE Chile's sensitivity to the protection of level crossing users and universal accessibility to these installations. He also noted that it was right to base its approach on well developed European regulations on level crossings and to focus on proper maintenance, which is key to ensuring safety.
- **Civil works:** The civil works speciality includes railway platform works, which are divided into separate

PRIORITISATION OF THE IMPLEMENTATION OF NEW STANDARDS

Priority 1 (2020)

- Works of art
- Crossings and parallelisms
- Enclosures
- RAMS
- Track - Alignment
- Systems - General
- Signalling
- Command and control
- Communications (non-critical)
- Scales

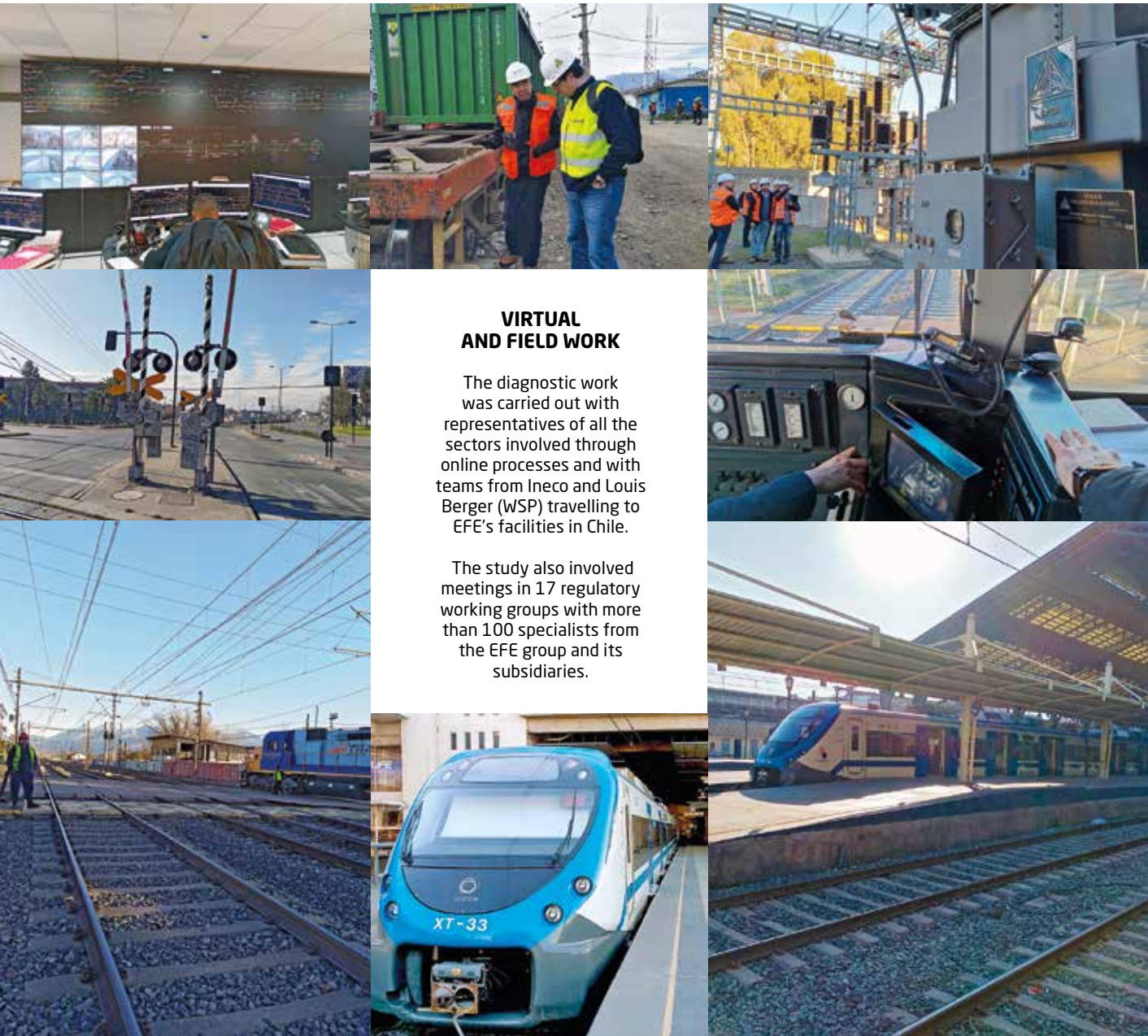
Priority 2 (2020- 2021)

- Tracks
- Level crossings
- Pedestrian crossings
- Bridges
- Tunnels
- Stations
- Workshops/depots
- Rolling stock (passenger, auxiliary)
- Electrical systems (high voltage)
- Electromechanical equipment
- Communications

Priority 3 (2021- 2022)

- Tracks - Maintenance
- Rolling stock (freight)
- Electrical systems (substations and overhead lines)
- Bridge design
- Tunnel inspection and maintenance

As the graph shows, the new policy framework was developed through an AS-IS/TO-BE ('where we are and where we want to be') approach. The implementation plan developed by Ineco and Louis Berger (WSP) defined how to gradually implement the new set of standards.



VIRTUAL AND FIELD WORK

The diagnostic work was carried out with representatives of all the sectors involved through online processes and with teams from Ineco and Louis Berger (WSP) travelling to EFE's facilities in Chile.

The study also involved meetings in 17 regulatory working groups with more than 100 specialists from the EFE group and its subsidiaries.

packages: bridges, tunnels, cuts and embankments, works of art, crossings and parallelism, drainage and enclosures. **Javier Rodríguez** and **Ricardo Rico**, of Louis Berger (WSP) highlight the joint effort that went into the development of the new regulatory framework through the working groups formed by EFE and consortium specialists. This has made it possible to integrate the expertise of the EFE network, the country's experience and international best practices into the new standards.

Most of the standards were newly created, as in the case for tunnels, which include aspects of design, construction and maintenance to address the management of EFE's network, which has more than 30 tunnels in operation, some of which are quite old and with a variety of different tunnel types.

In the case of bridges, EFE already had a regulatory framework that had been in place since 2006. More than 12 years after their creation, these standards were updated, including standards to facilitate the maintenance, operation and inspection of bridges.

► **Stations:** In the development of the technical standard for stations, Chilean national decrees and manuals were used as a reference, although, as **Beatriz Asensio**, points out, when deemed necessary, international documents were used, such as the US *Transit Capacity and Quality of Service Manual. Chapter 10: Station Capacity*. In total, four standards were developed for stations, covering construction elements, accessibility and safety, and three new standards for workshops.

► **Electromechanical equipment:** In regard to this equipment, which includes lifts, escalators, forced ventilation and water pumps, among other components, **Ángel Sánchez** and **Manuel Benedicto García** highlight the obligation to comply with Chilean regulations, regardless of the fact that it was sometimes necessary to supplement them with EU regulations, such as Spanish UNE standards. In some cases, the presence of US standards was more noticeable, as in the case of fire protection systems in buildings, since much of this equipment is developed in the US.

► **Electrification:** Seven regulations were developed for the design, construction and maintenance of the entire traction power supply structure, consisting of high-voltage lines, electrical substations and overhead lines. In all of these projects, says **Jaime Peñalba**, regulations were adapted to the existing energy supply system and in some of them, in addition to Chilean and international regulations, Ineco's experience was a key factor.

► **Signalling:** As **José Antonio Jiménez** points out, within the speciality of signalling, which includes the interlocking, blocking, signalling, train detection and protection, and track device operation systems, it was necessary to draw up new technical standards based on the international standards already tested, which will represent a positive step forward in EFE's railway network, improving operability and increasing safety.

► **Command and control:** For command and control systems, standards were developed not only for railway

systems, but also for control centre operators. Ineco also developed regulations on the ergonomic standards that furniture and equipment must comply with in order to reduce risk caused by human error. According to **Ángel García Luengo**, a common videographic representation has also been developed in synoptics, videowalls, SCADAs, etc., so that the operator can clearly identify the elements on which to operate.

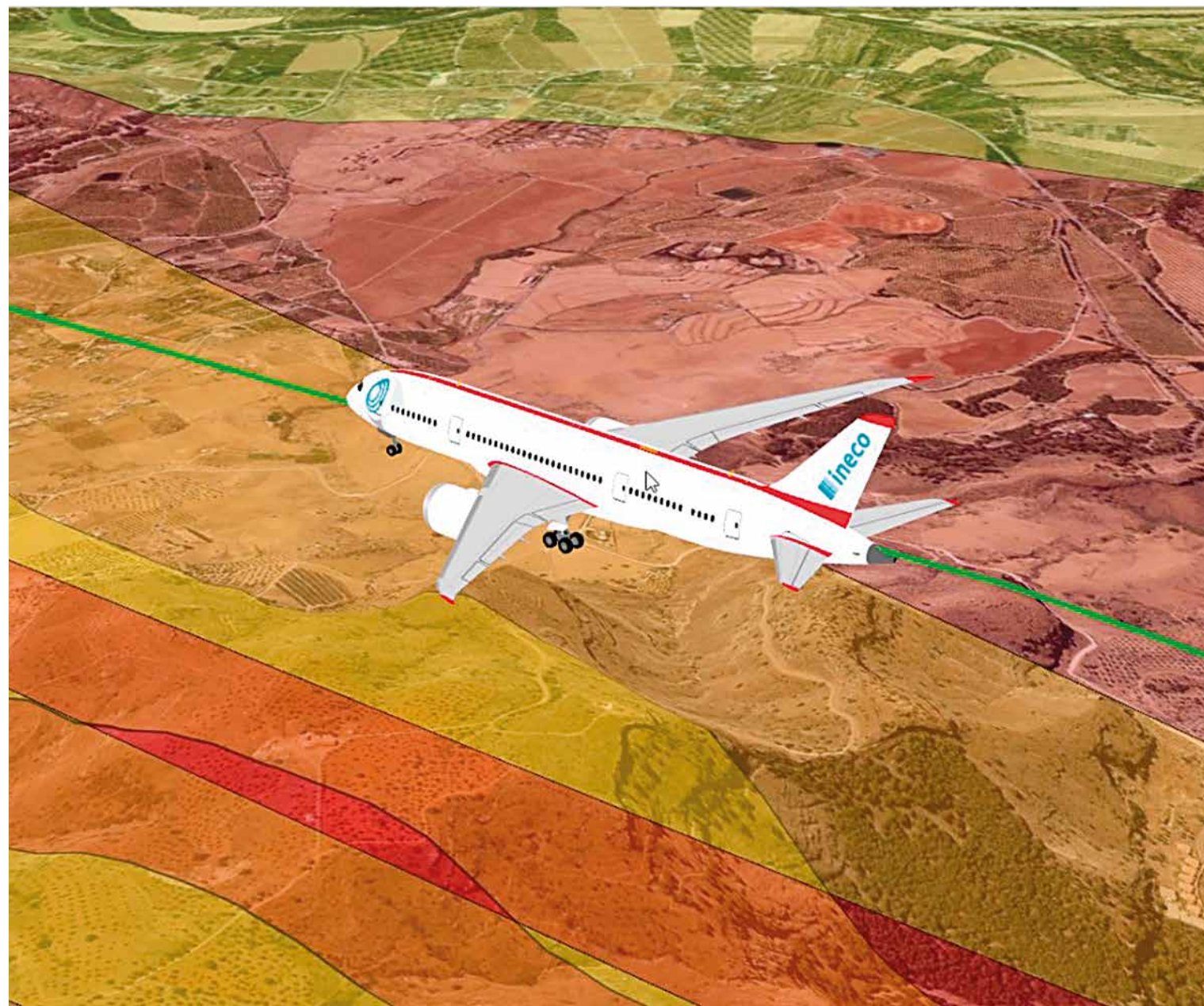
► **Land-based telecommunications:** Standards were applied for each of the systems: video surveillance, access control and anti-intrusion access, administrative and operational telephone systems and passenger information and sound systems. **Rafael Gutiérrez** explains that the standard was developed for the radiocommunications systems that implement both the CSV (Virtual Signalling System) and the TKBC (weighbridge toll system), the complexity of which lies in the different technologies incorporated into it, such as: NXDN (UHF/VHF-based open standard for public land mobile radio systems), GNSS (global navigation satellite system), AEI/RFID (automatic equipment identification/radio frequency identification), MMOO (microwave), public operator mobile networks and SATCOM (satellite communications) for communications between driver/vehicle and the Telecommunications Control Centre and/or Centralised Control Centre.

THE STANDARDS WILL SERVE AS THE BASIS FOR TENDERS FOR NEW RAILWAY SECTIONS OF EFE AND ITS SUBSIDIARIES

► **Information Technology (IT):** In this area, **Antonio Urbez** stresses that consultancy work was carried out proposing international regulations affecting IT in two fundamental aspects: governance and means of payment, with the proposal to introduce international regulations such as ISO 14443 (standard related to cards and electronic security devices for personnel identification).

► **RAMS:** Standards were drawn up for the application of requirements for the recently created RAMS department within EFE, applying, according to **Tatiana Rueda**, the CENELEC, EN-50126, 50128, 50129 standards, a global benchmark.

► **Rolling stock:** Due to the requirements of the rolling stock running on the EFE network, **Álvaro Jiménez Mellado** highlights the development of a set of *ad hoc*, standards, with criteria and requirements from North American standards for freight rolling stock, and European and North American standards for passenger trains (locomotives, coaches, etc.). These rules will make it easier for EFE to put the new equipment into service and will serve as a basis for international tenders for the purchase of new trains. ■

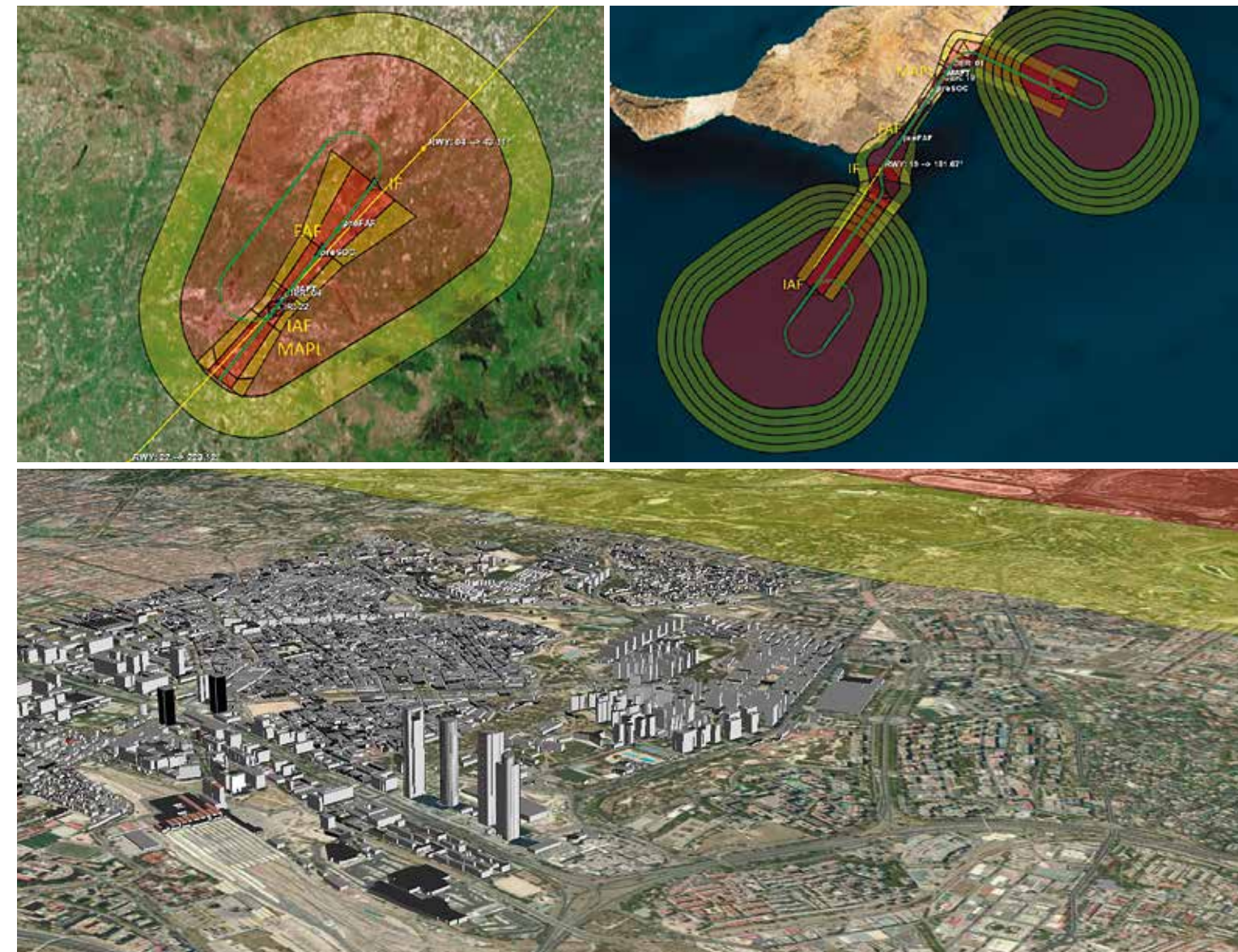


IMAGES_INECO

EOS, designing the perfect flight

Ineco has developed EOS, its own software for designing instrument flight procedures, which are used to analyse the possible obstacles that an aircraft may encounter in flight and guide it to avoid them.

By **José Antonio Acedo**, industrial engineer and **Eva G. Moreno**, aeronautical engineer



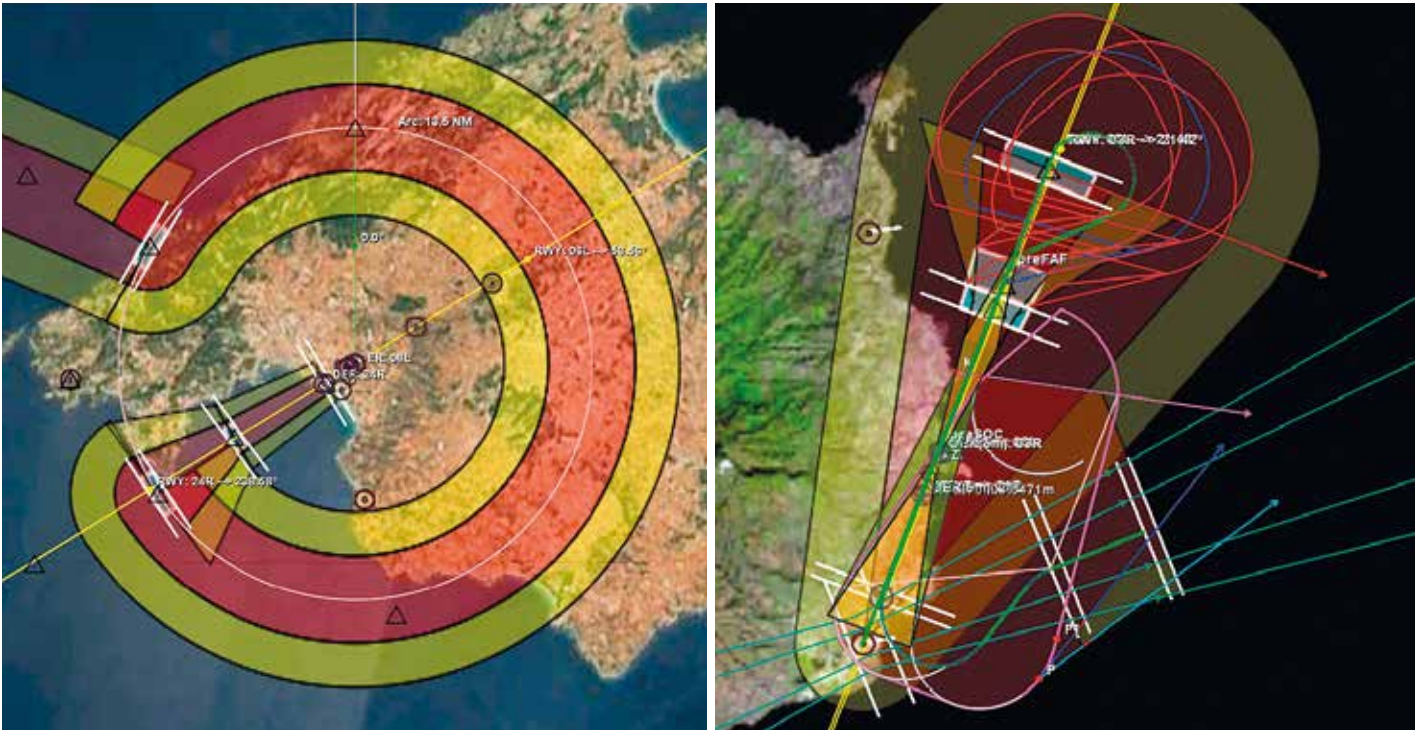
In the large image on the left, EOS shows the trajectory of an aircraft in flight. Above, an example of a conventional VOR approach with a runway (top left), RNAV LNAV approach with a depiction of the approach and missed approaches (top right), and a 3D visualisation of the buildings of the city of Madrid outside the corresponding protection areas.

An Instrument Flight Procedure (IFP) sets out the manoeuvres and trajectory that an aircraft must follow to safely enter and exit airports, avoiding obstacles.

The International Civil Aviation Organisation (ICAO), which is responsible for promoting the safety, efficiency economics of international air transport, considers instrument flight procedures to be an essential component of the aviation system. It is therefore essential that these procedures be designed to meet strict quality requirements, such as those contained in the *Quality Assurance Manual for the design of flight procedures*. The European Commission, within the framework of the Single European Sky, has also

published a specific regulation, ADQ (Aeronautical Data Quality) which complements and reinforces the requirements defined in ICAO Annex 15.

In order to meet all of the quality requirements of international standards, specific software tools are required, in order to automate the design process and ensure the accuracy, precision and integrity of the aeronautical information on which air navigation depends. This is the context for EOS, a new software product developed entirely by Ineco as a corporate tool for the design of flight procedures. Following the completion of the development and internal validation phase in December 2019, EOS is ready to be put into production flight procedures



An example of a conventional approach with a guidance section based on a DME arc (left image) and the geometric aids to support the construction of the protection areas (right image).

based on area navigation (RNAV) as well as on conventional navigation.

WHAT IS EOS?

In order to design an instrument flight procedure, a set of areas and surfaces associated with the nominal track of an aircraft are defined, where existing obstacles and terrain are assessed with an appropriate Minimum Obstacle Clearance (MOC).

EOS reliably and efficiently performs these spatial geometric calculations, combined with a GIS and a 3D visual interface. The application is also capable of assessing whether terrain obstacles and elevations could affect the flight safety of an aircraft following that associated nominal trajectory. These trajectories may be those corresponding to departure manoeuvres (SID), arrivals (STAR), approaches (APP), ATS routes and holding procedures.

It is a desktop application, developed in Java within the NavTools suite also created by Ineco, for the management and use of digital terrain models (DTM), and is compatible with other proprietary tools for the study of rights of way, radio conditions and CNS systems in the airport environment. It is supported by the GIS developed by NASA, (NASA WorldWind) using highly accurate digital terrain and surface models to recreate each scenario.

PROJECT DEVELOPMENT

EOS was developed as an internal innovation project by a multidisciplinary team, made up of aeronautical, telecommunications and computer engineers,

with extensive experience in IFP design spanning more than 10 years.

In very broad terms, air navigation, since its origins, has evolved from being strictly visual to relying more and more on technology as it evolved, making instrument navigation possible. At the start of the 21st century, the multiplication of specifications, systems and equipment, as well as increasing airspace congestion, made it necessary to move towards the unification of standards.

Consequently, area navigation or RNAV has given way to a new concept promoted by ICAO since 2008: PBN, or performance-based navigation, as opposed to sensor-based navigation, i.e. physical equipment (VOR, DME, ILS, NDB, etc.). PBN has been increasingly used by air navigation service providers around the world for the development of new instrument procedures because it facilitates their design and enhances the utilisation of aircraft capabilities.

As the specifications for the design of flight procedures were developed along with the PBN concept, shortcomings in the commercial tool in use at Ineco became apparent. This led to the development of a new proprietary tool, EOS, which, in addition to providing new features, allowed for a faster implementation of changes.

The project was implemented and managed using the software development methodology implemented at Ineco, CMMI level 3. It complies with the ADQ (Aeronautical Data Quality) since it is based on the AIXM 5.1.1 standard (aeronautical information exchange model, see IT 70) that is required internationally. ■

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Changing gauge without missing a beat

The technology that allows trains to run on tracks with different gauges has overcome one of the major obstacles to the further development of rail transport in Spain, and it provides a model that can be adapted to other countries facing the same issues.

By **Francisco José Jiménez**, Bsc. technical engineer and **José Ignacio Sánchez**, civil engineer

ALBACETE GAUGE CHANGEOVER INSTALLATION
The horizontal dual gauge changers (TCRS2), like the one shown in the picture, make the two technologies of the rolling stock manufacturers Talgo and CAF compatible. The Albacete facility was commissioned in 2012 for the Madrid-Alicante high-speed line.

PHOTO: INECO

Gauge changeover installations are a fairly new development in the history of railways, providing a solution to the strategic, economic and technical decisions of the past, when lines with different gauges were built in each country, making it difficult for trains to run between them: in Europe alone, there are four different main gauges: 1,000 mm (narrow), 1,435 mm (European standard), 1,520 mm (Russian gauge) and 1,668 mm (Iberian gauge). The inability of trains to change from one line to another with a different gauge has historically caused operational and travel problems, since it meant that passengers had to change trains, resulting in inconvenience, costs and wasted time.

IN JUST A FEW MINUTES, THESE AUTOMATIC SYSTEMS ALLOW TRAINS TO CHANGE THEIR GAUGE. WITH THIS VERSATILE AND COST-EFFECTIVE SOLUTION, SPAIN IS CONTRIBUTING TO THE INTEGRATION OF EU MARKETS BY REDUCING INFRASTRUCTURE BOTTLENECKS.

Spain's case is particularly complex, as three types of track gauge coexist: the Iberian or conventional gauge, which is shared with Portugal, the metric gauge of the former Ferrocarriles de Vía Estrecha (FEVE) lines, and the European standard gauge, which was adopted for high-speed lines. These are just three of the many gauges that exist in the world, making this technology exportable to other countries with similar characteristics, as is the case of the Baltic countries that currently have Russian gauge and are develop-

ing their Rail Baltica high-speed line in the European standard gauge. All of the countries of the former Soviet Union are in a similar situation.

A GROUND-BREAKING DEVELOPMENT

The departure of trains from Spain to France and the other countries of Europe that use a different gauge has been a constant challenge that has led to the development and improvement of gauge changeover technology. Until the late 1960s, border crossings were done by lifting the carriages and replacing the axles or bogies of one gauge with those of another gauge. The first use of ground-breaking technology that allowed gauge changeover by directly modifying the axle gauge as it passed through a pit took place in 1968 with the first test run of a Talgo Madrid-Paris train using the changeover installation installed at the Irún-Hendaye border; in 1969, the changeover installation was installed at Portbou-Cerbère, which was already in commercial service. These facilities allowed towed Talgo trains to run on routes between Spain and France in much less time.

Two decades later in 1992, with the opening of the first high-speed line – Madrid-Seville, designed with standard or international gauge– Spain made the decision to extend high-speed trains to other regions, planning the installation of gauge changeover facilities at different strategic points of its railway network. The Atocha, Córdoba and Majarabique changeover installations were built, enabling the Barcelona-Seville and Madrid with Málaga, Algeciras, Cádiz and Huelva connections to be established.

Automatic gauge changeover technology consists of a variable-gauge axle system installed on the trains and a fixed installation on the track where the locks that prevent the wheels from moving sideways are released as the train passes through. The wheels then meet converging or diverging rails that move them to their new position before locking again.

THIS TECHNOLOGY CAN BE EXPORTED TO OTHER COUNTRIES WITH SIMILAR CHARACTERISTICS; THIS IS THE CASE OF THE BALTIC REPUBLICS, WHICH CURRENTLY USE RUSSIAN GAUGE AND ARE DEVELOPING THEIR RAIL BALTICA HIGH-SPEED LINE ON THE EUROPEAN STANDARD GAUGE

The first changeover systems did not allow the modification of the traction units, so the traction unit with the initial gauge had to be uncoupled, running the cars through the changer by gravity, and then coupling the traction unit with the second gauge. Likewise, all of the trains with gauge-changeover capabilities were manufactured by Talgo until 2001, which is when Renfe acquired new variable gauge trains with CAF technology from the Alstom-CAF consortium.

Because they use different technologies, dual-type changers are required, so that both technologies can be made compatible in the same installation. Two types of changeover installations are currently used in Spain, corresponding to the two manufacturers of rolling stock: the Talgo type and the CAF type. In just a few minutes, these automatic systems enable the train, which is equipped throughout with movable axles, including the traction unit, to change gauge at a low, controlled speed of up to 15 kilometres per hour without having to stop.

In the early generations of dual changers, the gauge-change platform needed to be switched. The first, TCRS1, folded the platforms vertically, and subsequently TCRS2 moved them horizontally. Then, in 2009, Adif began the design and construction of the first TCRS3 prototype, which combines the CAF and Talgo technologies into a single platform that modifies its parts to adapt to

PALENCIA
The **TCRS2** model, like the Palencia model, switches between the Talgo and CAF changeover systems with a horizontal movement, so that the two platforms arranged in parallel are attached to the same structure, which moves horizontally. Movement is also achieved by means of a hydraulic system, but it is much simpler than vertical movement. Due to its larger pit width, this technology is used in places where space is not an issue.



PHOTO_INECO



PHOTO_INECO

ANTEQUERA
The Antequera **TCRS1** vertical dual changeover installation switches between the two systems by folding down the changing platforms. Movement is achieved by means of a hydraulic system equipped with a series of cylinders that ensure the position of each platform. This technology is used in places where space is limited and the horizontal type does not fit.



PHOTOS_INECO

LEÓN
The two **TCRS3** changeover installations located in León merge the two gauge changeover systems. There is no longer a platform as such; instead it is the guides of each system that are moved separately. Movement is achieved by means of electric motors and the position is secured using hydraulic latches.



The company has been involved in the design of the different generations of changeover installations since the early 2000s and has been providing maintenance services to Adif since 2008.

PHOTOS_INECO

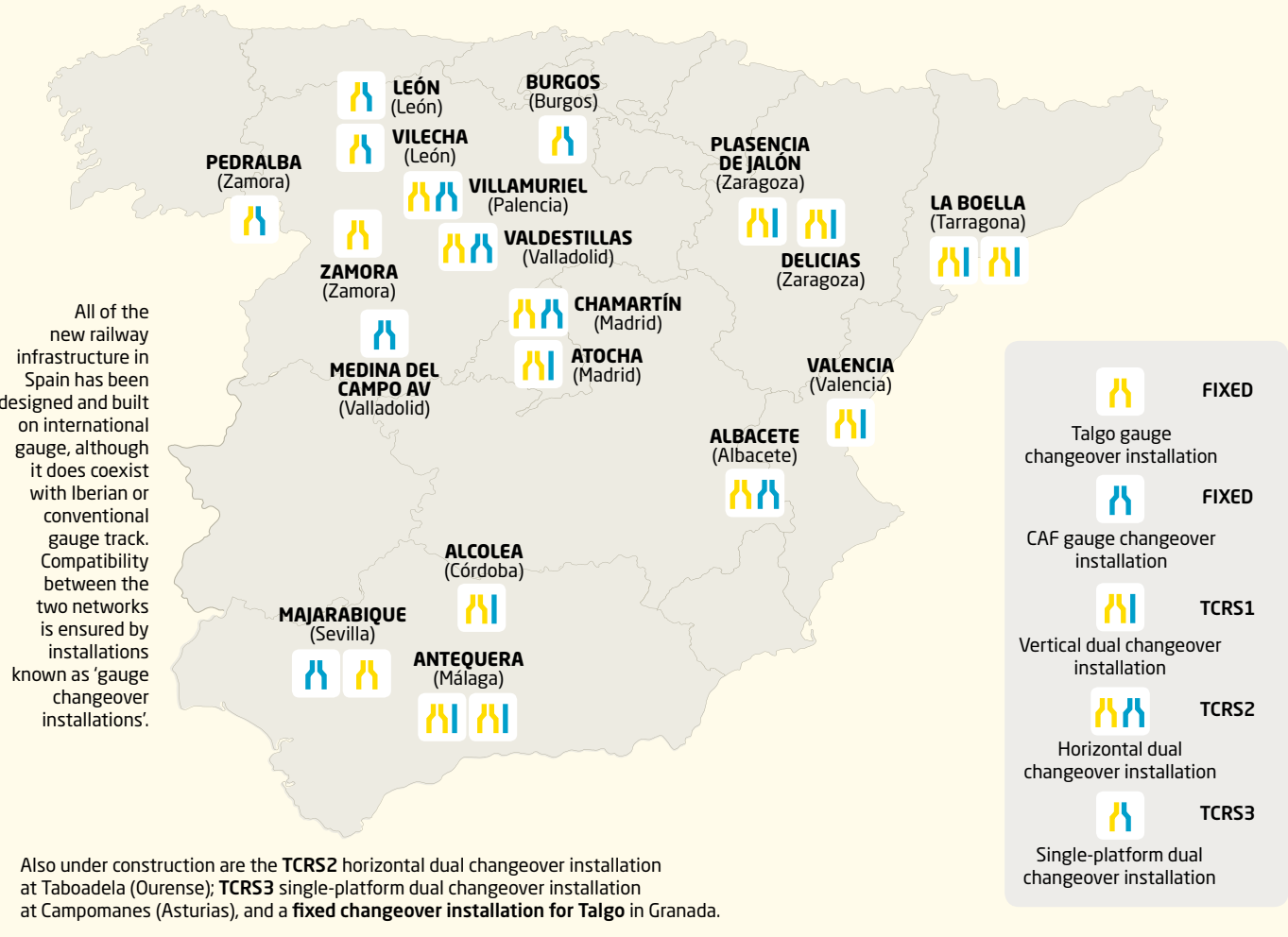
INFRASTRUCTURE WITHOUT BARRIERS

With this versatile and cost-effective solution, Spain is contributing to the integration of the markets by reducing infrastructure bottlenecks. It is therefore in line with the objectives of the European Commission, which is promoting the development of the major European corridors and considers freight rail to be a priority transport activity, setting the objective of increasing its market share to 30% by 2030 (Directive 2012/34/EU).

Since the early 2000s, Ineco has participated in the design of the different generations of changeover installations and has provided services to Adif, the Spanish railway infrastructure administrator, and to the manufacturers in different aspects of development and implementation: project drafting, technical assistance, project management and maintenance and operation of more than twenty automatic gauge changeover installations throughout Spain. As a result, Ineco has acquired particularly useful know-how when exporting the system to other countries, providing assistance throughout the process, from the planning of the itineraries to be developed, to the implementation, operation and maintenance of the systems.

EXPERTS IN CHANGEOVER INSTALLATION MAINTENANCE SINCE 2008

The functions of Ineco's maintenance team include technical assistance to the changeover installations in operation and newly built ones; manoeuvrability, troubleshooting, and the reception and commissioning of new installations. With more than 50 people in the team, assistance is provided to 18 gauge changeover installations, of which 16 are for passenger services, with 2,500 changeover manoeuvres and 26,000 control points per month. The company operates in the following gauge changeover installations:



Two decades on the African continent

Ineco has contributed and continues to contribute to the improvement and modernisation of airports and air navigation in several African countries, including Cape Verde, where the company first landed in 2003.

By **José Ramón Armenteros**, Middle East, Africa and Asia Pacific delegate

Africa was the location of one of Ineco's first projects abroad: in 1975, the company, then a small consultancy firm made up of a small group of engineers from Renfe, was preparing a feasibility study for the Kindu-Kisangani railway line in the former Zaire, now the Democratic Republic of Congo. Ineco, which began its aeronautical operations in Africa in the early 2000s, has carried out projects to improve and expand airport infrastructure, navigation systems and airspace management in various countries across the continent. One particularly noteworthy example, due to its condition as a group of islands, is Cape Verde, where Ineco has carried out numerous projects.



Members of the Ineco team at the opening of the new Boa Vista airport terminal (2007).

A study of the procedures and modes of operation at the São Filipe aerodrome on the island of Fogo is currently underway. Ineco is preparing a review of obstacles and safety in relation to the introduction of night opera-

tions and instrument flight conditions, and is designing the instrument flight procedures. Another recent project in the archipelago was a study, carried out in 2019, for the installation of an ILS (Instrument Landing System) at São Vicente's Cesaria Évora airport, one of the country's four international airports.

The first projects in Cape Verde date back to 2003, with the project and management of the new Boa Vista international airport, which opened in 2007. Since then, a large number of studies, projects and supervision of subsequent improvement works have been carried out. These include the review of the master plans of Sal, Boa Vista, Praia and São Vicente, in 2012,



CAPE VERDE
Boa Vista airport terminal, designed by Ineco using materials and architectural design in the country's traditional style. The company also managed the works.

easement studies, technical and economic feasibility analysis of night operation in Boa Vista and São Vicente. In 2014, ASA also commissioned Ineco to draw up the master plans for three domestic airports: Maio, São Nicolau and Fogo, and between 2015 and 2018, the management of the expansion of the passenger terminals at the international airports of Boa Vista and Sal.

Ineco has also carried out its aeronautical activity on the African continent in a half-dozen other countries. In 2015, it worked on updating the air traffic management system for the state-owned Airports of Mozambique (ADM). The company provided support services for the design of ATM systems in the specification of equipment and systems and also provided support for their subsequent deployment.

In 2012, as a result of an intergovernmental collaboration agreement between Spain and Angola, Ineco formed part of the Aena Internacional team that, over the course of a year, developed physical and operational security procedures for the airport of Luanda, the country's capital. Airport staff were also trained and a quality assurance plan was introduced using indicators, similar to the one applied by Aena at its airports.

In Morocco, between 2011 and 2012, Ineco was part of the consortium that carried out the *Study, analysis and reorganisation of Morocco's airspace* project that was included in the country's Strategic Plan to boost its tourism industry. At the same time, the company carried out a capacity study for the Moroccan Directorate General of Civil Aviation for the Mohammed V airport terminal building in Casablanca.

Ineco's first project in Egypt was awarded in an international tender in 2010, when the Egyptian Company for Airports and Air Navigation (EHCAAN) selected the company to develop a strategic plan for the country's civil aviation. The plan included an analysis of the CNS/ATM infrastructure, the proposal of a new airway network, the definition of a modernisation plan for navigation systems and the development of specifications for a new air traffic control system for the Cairo Control Centre.



THE POTENTIAL OF THE AFRICAN MARKET

Now well into the 21st century, air transport, linked primarily to the growth of tourism, has proved vital to many African economies. In November 2019, the ICAO noted "the crucial importance" of air transport liberalisation in Africa for the achievement of the sustainable development goals of the UN 2030 Agenda, as well as its role as a driver of employment, capable of generating "9.8 million jobs by 2036", although already in 2018 it estimated that "due to the recent and effective liberalisation of air transport globally, many airport hubs in Africa will be saturated by 2020". It further noted that "the growth of air traffic in this continent can only be sustainable if the aviation infrastructure in the region is optimised".

Even with these challenges, the potential of the African aviation sector, which was already showing positive signs before the health crisis, is strong. Forecasts by organisations such as the International Monetary Fund suggest that from 2021 onwards, in emerging and developing countries, which have suffered a "less severe" economic impact from the pandemic, GDP will grow by more than 5%, more than the averages for the world and the large advanced economies.

In 2009, in Kenya, the company reviewed and updated the expansion project of the Jomo Kenyatta airport in Nairobi. Due to the strong growth in traffic volume up to that point, the airport operator had to revise its planned expansion project. This plan was opened to international tender and awarded to Ineco in 2008. Works included a traffic demand forecast through 2030, the computer simulation of passenger, baggage and aircraft flows –both of the airport's current situation and future forecasts– and the assessment and proposal of recommendations to optimise the capacity and functional, economic-financial, architectural and operational safety viability of the expansion project.

In 2009, Ineco designed the improvement and extension of the airfield at Walvis Bay airport for the Namibian Ministry of Transport and Infrastructure, for which it also drafted the basic project for a new passenger terminal. ■

A key project for the island of Gran Canaria

The completion of the Las Palmas ring road in 2021 will complete the circle of roadways around the capital, substantially improving the city's connections with other parts of the island.

By Víctor Manuel Camino and Íñigo Ortega, civil engineers

Work on Phase IV of the Las Palmas de Gran Canaria ring road is progressing at a good pace: after 14 years of work and several interruptions in its execution, the main section of Phase IV is scheduled for completion in 2021. The construction of this phase of the highway, which includes the Tamaraceite-Tenoya-Arucas-Costa section, will connect Phase I with the GC-2 regional highway, linking the island's capital with the inland municipality of Arucas and providing dual access from the northeast to Las Palmas de Gran Canaria.

Phase IV of this highway is part of the road agreement signed in the 1990s between the government of the Canary Islands and the former Ministry of Public Works. Its conclusion will mean the completion of the Las Palmas ring road, which was started in 1997, which will relieve traffic congestion in the city, and also improve accessibility, providing a dual entrance to the north-eastern access.

The Ministry of Public Works, Transport and Housing of the government of the Canary Islands estimates that some 60,000 vehicles will use the new section every day, which will reduce traffic congestion at key points in the city such as Plaza de América, the Julio Luengo tunnels and the Torre Las Palmas interchange, improving traffic in the vicinity of the capital,

THE GOVERNMENT OF THE CANARY ISLANDS ESTIMATES THAT APPROXIMATELY 60,000 VEHICLES WILL USE THE NEW STRETCH OF ROAD EVERY DAY.



PHOTO: UTE ARUCAS

Aerial view of the works for the connection between the GC-3 highway, in which Ineco has been involved since 2007, and the GC-2 Northern highway.



In the picture, Ineco engineer Víctor Manuel Camino, head of the unit for Phase IV of the Las Palmas de Gran Canaria ring road, supervising a construction site in the municipality of Arucas.

PHOTO_UTE ARUCAS

with a reduction in travel distances, waiting times and the resulting pollution, a positive effect already noted after the partial opening of a new section of Phase IV in 2016 as far as the Semi-interchange-2 in the municipality of Arucas.

In addition to the technical difficulties inherent to a linear project running between ravines and mountains, there are also those inherent to a semi-urban environment. All this, together with the economic crises experienced in recent years, has delayed the construction of this highway and has also meant an arduous technical task owing to several changes in the types of the interchanges and the construction of pedestrian walkways requested by local residents. These changes, which were not planned in the original project drawn up in the 1990s, made it possible to adapt the project to the demands of the island residents over the years, with the total budget for the works exceeding 125 million euros.

The Arucas joint venture, in which Ineco and Grusamar each have a 50% stake, is providing technical assistance for the monitoring and supervision of the works on the Las Palmas de Gran Canaria ring road, specifically Phase IV of the Tamaraceite-Tenoya-Arucas-Costa section. With a budget of more than 6 million euros, the contract includes, among other activities, the analysis of the work in its updated environment; an analysis of the impact on areas of potential archaeological interest or those affecting historical heritage; the status of expropriations; a study of the repositioning of rights of way; a study and monitoring of road safety; work quality control; health and safety; and the drafting of the necessary alternatives or modifications to the original project.

A ROUTE THROUGH RAVINES

The route of the main section of the highway, with a total length of 7,350 metres, starts at the intersection of the GC-3 (Phase I of the Las Palmas ring road) with the GC-21 (Teror-Tamaraceite) and will end at the interchange between the GC-2, the GC-20 (Arucas-Costa) and the GC-3. Construction works in Phase IV have affected more than 500 properties in the municipalities of Arucas and Las Palmas de Gran Canaria.

THE LATEST MODIFICATIONS INCLUDE SEVERAL CHANGES TO THE TYPES OF INTERCHANGES AND THE CONSTRUCTION OF PEDESTRIAN WALKWAYS REQUESTED BY LOCAL RESIDENTS

OPEN-AIR COVERED WALKWAYS, VIADUCTS AND OTHER UNIQUE POINTS ON A COMPLEX ROUTE

- ▶ 6 overpasses.
- ▶ 4 viaducts:
 - A 160-metre-long viaduct that crosses the Barranquillo de Tenoya.
 - A 528-metre-long viaduct over the Barranco de Tenoya, with a height of over 120 metres.
 - A 370.5-metre-long viaduct spanning the Barranquillo de la Dehesa.
 - A 150 metre-long viaduct over the Barranco de Arucas.
- ▶ 3 underpasses.
- ▶ 3 metal footbridges.

From its start at the Tamaraceite interchange, where the two branches connecting with the future highway are aligned, the route winds for 850 metres following the existing GC-21, heading in a north-westerly direction and running between Mesas Bajas and Tenoya, where interchange 1 (KM 1+490) is located, giving access to both towns. From this point onwards, the terrain becomes more rugged and the Barranquillo de Tenoya (KM 1+800) is crossed by a 150-metre-long viaduct (1.7), the Barranco de Tenoya (KM 2+400) with another 520-metre-long viaduct (2.1), the Lomo Grande through a cut (KM 2+725) and the Barranquillo de la Dehesa (KM 3+300) by means of a 380-metre-long viaduct (3.1).

THE ARUCAS JOINT VENTURE, IN WHICH INECO AND GRUSAMAR EACH HAVE A 50% STAKE, IS PROVIDING TECHNICAL ASSISTANCE FOR THE MONITORING AND SUPERVISION OF THE WORKS

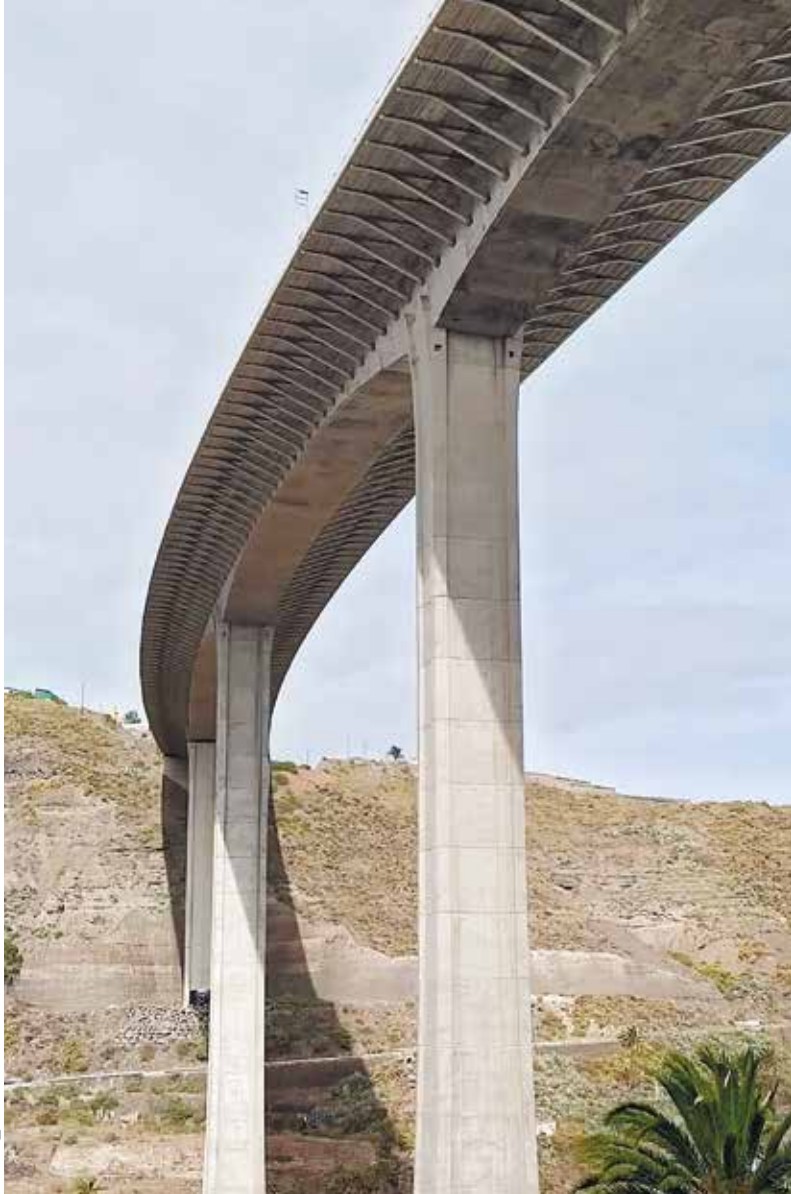


PHOTO_UTE ARUCAS



PHOTO_UTE ARUCAS

The highway runs through a semi-urban environment, but crosses deep, wide ravines that are characteristic of the rugged terrain of the island of Gran Canaria. In the picture, overpass 5.6 and the Trasmontaña roundabout.



PHOTO_VÍCTOR CAMINO

The new highway crosses several mountains and ravines. Above, the viaduct over the Barranco de Tenoya, with a total length of 528 metres spread over five spans, with a height of over 120 metres is the highest viaduct built in the Canary Islands.

After this ravine, the route passes through the area known as La Herradura on an embankment, where Semi-interchange-2 has been built at KM 3+800, which provides access to the villages of Cardones and Santidad.

After passing this interchange, the highway runs along a slight cut 250 metres long until it reaches the Barranco de Arucas ravine, which is crossed by means of a 150-metre-long viaduct at a maximum height of 45 metres above the bottom of the ravine (4.1). At this point, the route turns in the northerly direction, running to the east of the town of Arucas, and at KM 4+400 it passes interchange 3, which gives access to the town via the GC-20. After passing the interchange, the route runs along a cut parallel to the left-hand side of the GC-20. The P.S.-5.6 overpass is planned at the interchange of the GC-301 road with the highway, which will connect the villages of Cardones and Trasmontaña with the GC-20.

For the final 1,200 metres, the route continues to run on a cut parallel to the GC-20 until it connects with the GC-2 road at KM 7+350, where the last interchange of the project, Semi-interchange-5, is located which, in combination with the existing interchange, allows all the movements of the aforementioned road with the planned highway. ■

ERTMS from the Black Sea to the centre of Turkey

Turkey's Ministry of Transport and Infrastructure has extended the contract with the UBM-Ineco-Mott MacDonald consortium for the supervision of the modernisation of the Samsun-Kalin line until the end of 2021.

By **Francisco Ramos**, telecommunications engineer



PHOTOS: INECO

FUNDED BY THE EU

The renovation work on the Samsun-Kalin line includes Ineco's supervision of the signalling, communications and power supply works.

The line from the Black Sea port of Samsun to the city of Kalin is one of six rail routes in Turkey that have been selected to improve connections between the Mediterranean and the Black Sea, to promote the development of regional transport and to reduce road accidents. This is a 377.8 kilometres railway line (plus the branch between Samsun and Gelemen, which is just over 10 km long) that links the cities of Samsun, on the

THE INSTALLATION OF THE ERTMS L1 SIGNALLING SYSTEM WILL INCREASE THE MAXIMUM SPEED FROM 70 KM/H TO 120 KM/H ON THE ENTIRE LINE

Black Sea coast, and Kalin, in the centre of the country, where it connects to the Ankara-Sivas line

The project, run by the Turkish Ministry of Transport and Infrastructure, is funded by the European Union as part of its Instrument for Pre-Accession Assistance (IPA). The scope of the project consists of modernising a conventional line, which was completed in 1932 on single track without electrification and without signalling. This is a

very long line running through a mountainous area: it has 29 stations and 47 tunnels, the longest of which is 556 metres long, for a total of 7,259 metres.

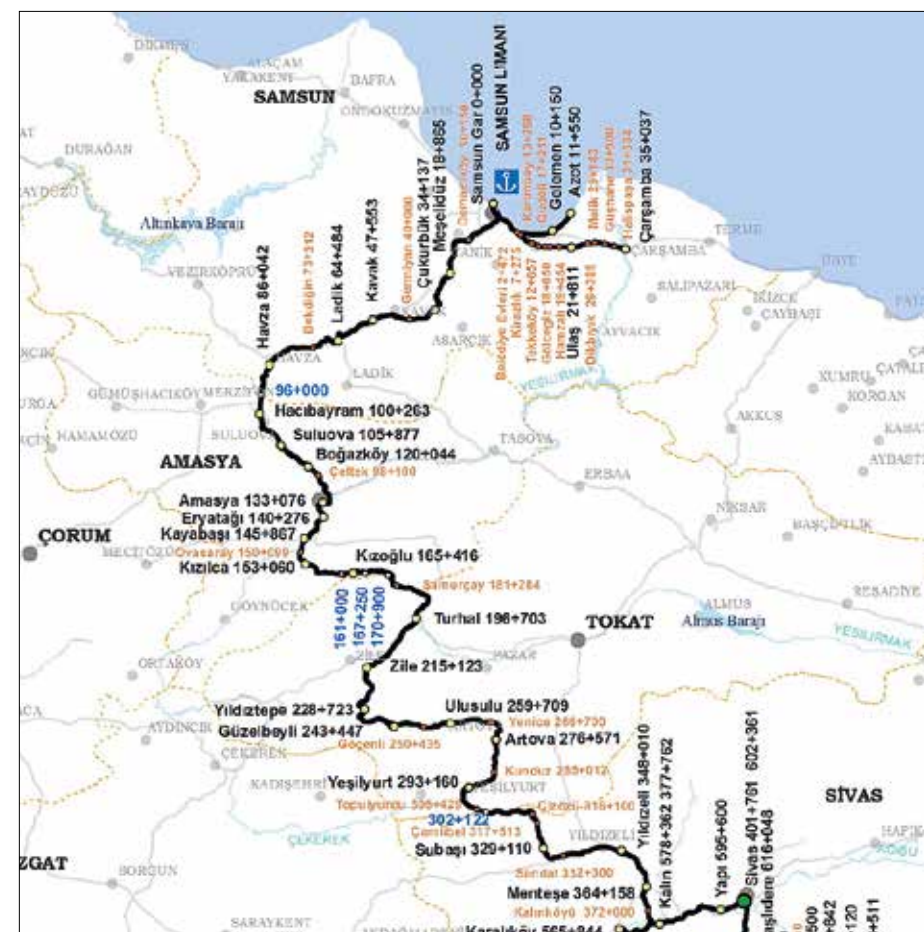
The work of the consortium in which Ineco is involved includes the monitoring and control of the modernisation of the infrastructure, superstructure and installations. Within the consortium, the Ineco's main role has been to supervise the signalling, communications and power supply works, as well as coordinating the electromechanical installations team.

Other activities carried out by the consortium include track extension supervision, tunnel renovation, platform and station upgrades, and new signalling and train protection systems, including the ERTMS Level 1 system.

THE LINE, WHICH RUNS BETWEEN THE MEDITERRANEAN AND THE BLACK SEA, WAS SELECTED TO PROMOTE THE DEVELOPMENT OF REGIONAL TRANSPORT AND REDUCE THE NUMBER OF ROAD ACCIDENTS

Ineco will continue to provide technical assistance in 2021 to complete the signalling and telecommunications work on the line, a necessary step to reduce travel times and increase speeds. The ERTMS L1 train protection system installation will increase the maximum speed from 70 km/h to 120 km/h on the entire line. The new system will be able to perform train traffic operations at 5-minute intervals.

Provisional acceptance of the works took place in December 2019. Over the course of 2020, runs with test trains and track-side signalling were planned, as well as the completion of the installation and testing of the ERTMS L1 system. These plans were delayed due to the impact of COVID-19, so this work will continue in 2021. ■



29 STATIONS

With a total length of 378 kilometres, the line was built in the first half of the 20th century; it runs through a mountainous area and has 29 stations and 47 tunnels.



The implementation of the ERTMS Level 1 signalling system along the entire line will increase the maximum speed from 70 km/h to 120 km/h.



SPAIN CAN

In the picture, the President of the Government, Pedro Sánchez, during the presentation of the 'Spain Can' Plan in Comillas, Cantabria, on 4 December 2020.



PHOTO: OFFICE OF THE PRESIDENT OF THE GOVERNMENT

A high-impact plan

The Recovery, Transformation and Resilience Plan is the Spanish Government's commitment to modernising the economy, recovering economic growth and creating jobs, a firm initiative in response to the coronavirus crisis and the challenges of the next decade with the support of the *Next Generation EU* recovery instrument.

By the **Ministry of Transport, Mobility and Urban Agenda (MITMA)**

The Recovery, Transformation and Resilience Plan, 'Spain Can', will guide the implementation of 140 billion of European funds through 2026, thanks to the *Next Generation EU*, recovery instrument, of which, approximately 80 billion will be spent in the form of transfers and the rest through loans.

The effort to mobilise the nearly 80 billion euros in transfers will be concentrated in the first three years (2021-2023), maximising their impact on the rapid reconstruction of the economy, before using the loans to supplement the financing of ongoing projects.

The ultimate goal of the Plan is to contribute to repairing the economic and social damage caused by the coronavirus pandemic through calls for proposals, public-private partnership projects and direct investments governed by European guidelines.

The Plan is structured around 4 guidelines, 30 components and 10 urgent lever policies: the urban and rural agenda and the fight against depopulation; resilient infrastructures and ecosystems; fair and inclusive energy transition; Administration for the 21st century; modernisation and digitalisation of the industrial fabric and SMEs; recovery of tourism and promotion of an Entrepreneurial Spain; a pact for science and innovation; reinforcement of the capacity of the National Health System; education; new care economy and employment policies; promotion of the culture and sports industry; and modernisation of the tax system.

According to the Spanish government, the mobilisation of such a large volume of resources opens up an extraordinary opportunity for the country. It will not only allow us to overcome the crisis and recover jobs, but will also facilitate the modernisation of our economy, enabling a green, digital, inclusive and social recovery.



JOSÉ LUIS ÁBALOS

**Minister of Transport,
Mobility and Urban Agenda
(MITMA)**

The Recovery, Transformation and Resilience Plan 'Spain Can' is the result of hard work and intense dialogue and cooperation, inside and outside the government. Most importantly, however, it is the product of a clear mission to face the challenges of mobility, infrastructures and urban actions of the next decade, and to lead the way forward.

The three components of the Plan in which we are involved as a Ministry are crucial for the rapid recovery of our economy and for the real transformation that Spain needs. We are responsible for directly or indirectly managing more than 20% of European aid, as well as its impact on key sectors such as engineering, construction and transport, which together account for more than 20% of GDP.

The Plan makes it possible for the Ministry and MITMA Group companies to activate their capacity to invest remarkably quickly, and so we will make a significant contribution to containing the impact of the pandemic on GDP and employment, which is of vital importance at this time. However, we cannot be content with deploying counter-cyclical muscle; we must make an effective contribution towards decarbonising and digitalising economic activity, promoting increased social and territorial cohesion and equality in our country.

There is so much we can do by moving towards lower-emission, more modern, socially and technically modern mobility and logistics, as well as friendlier and more sustainable housing, buildings and neighbourhoods. Fortunately, in the Ministry and in the sector as a whole, we have been preparing ourselves for years, so the prospect of success is a realistic one if we believe in our own capabilities.

Of course, this is not just a challenge for the government. We in the Ministry take responsibility for providing the funds for the transformative approach that our country and our times demand. But it is up to all of us, professionals, the private sector, the academic sector and public administrations as a whole, to seize this opportunity for the future of Spain. I am convinced that we will succeed.

NEXT GENERATION EU, AN UNPRECEDENTED INNOVATION EFFORT

The Next Generation EU funds are the response to the COVID-19 crisis, which has been a challenge of historic proportions for Europe. The EU and its Member States have had to take emergency measures to protect the health of citizens and prevent the collapse of the economy. This has required an unprecedented effort and an innovative approach that will drive the alignment, resilience and transformation in the European Union.

THE PLAN IS INSPIRED BY THE 2030 AGENDA AND THE UN SUSTAINABLE DEVELOPMENT GOALS, REPRESENTING AN OPPORTUNITY FOR THE SPANISH GOVERNMENT NOT ONLY TO OVERCOME THE CRISIS AND RECOVER EMPLOYMENT, BUT ALSO TO MODERNISE THE ECONOMY

years, until the end of 2026. The portion corresponding to repayable loans must be repaid by 31 December 2058.

CHALLENGES FOR THE MINISTRY OF TRANSPORT

The Plan contains actions in the areas of transport, mobility and the urban agenda for the period 2020-2023, including direct implementation actions and aid programmes.

The MITMA is expected to manage three specific components of the Plan related to transport, mobility and the urban agenda:

- **Component 1:** Shock plan for sustainable, safe and connected mobility in urban and metropolitan environments..
- **Component 2:** Implementation of the Spanish Urban Agenda with the Urban Rehabilitation and Regeneration Plan.
- **Component 6:** Sustainable, safe and connected mobility.

To guarantee the effectiveness of the Plan and ensure efficiency in the development of the different projects, last February the MITMA launched the first calls for expressions of interest in order to achieve a more detailed definition of its components, through the knowledge of the real interest of the market in the proposed measures and the incorporation of the needs of the sector with a high impact on the ecological and digital transformation, efficiency and economy. In the words of government Minister José Luis Ábalos, *“we must take advantage of the momentum of the recovery and European funds to face the challenges of digitalisation and sustainability in mobility, housing, building and infrastructures in the coming years and modernise our productive fabric”*.

Ábalos has stated that within these programmes, autonomous communities, local entities and companies will be involved, through lines of aid for issues within their jurisdiction, such as housing, town planning and transport.

Accordingly, in the transport and mobility components, the Plan seeks to accelerate the implementation of low-emission zones in municipalities with more than 50,000 inhabitants or provincial capitals; to promote the transformation of transport towards zero emissions; to reduce the use of private vehicles in urban and metropolitan areas, prioritising collective public transport and active mobility, thus contributing to the objectives of modal shift and, finally, to promote the digitalisation of the activity of public transport services. A sustainable and digital transport support programme for businesses will also be launched.

In terms of housing, the minister announced the renovation of homes in metropolitan and rural areas during the Plan period, as well as the promotion of the renovation of public buildings and the local action plans of the Spanish Urban Agenda.

The aim of all this work is to finance projects that will enable a rebalancing of the modal split of national transport towards more sustainable modes, reduce the sector's high share of pollutant emissions and make use of available digital and technological advances. According to the National Greenhouse Gas Inventory, in 2018 transport was responsible for 27% of total greenhouse gas emissions in Spain, making it necessary to promote multimodal transport that contributes to reducing environmental impacts. Another cornerstone to work on is improving the competitiveness of Spanish companies through advances in digitalisation, artificial intelligence, big data and e-commerce.



PHOTO_ELVIRA VILA (INECO)



PHOTO_PABLO NEUSTADT (INECO)



PHOTO_ELVIRA VILA (INECO)



PHOTO_ELVIRA VILA (INECO)



PHOTO_PABLO NEUSTADT (INECO)

LEVER POLICIES LED BY MITMA

Of the ten leverage policies that make up the National Recovery, Transformation and Resilience Plan of the government of Spain, MITMA leads policy I. Urban and Rural Agenda. Territorial Cohesion, and II. Infrastructure and Resilient Ecosystems.

I. Urban and Rural Agenda. Territorial cohesion.

Within section, the actions promoted by MITMA include:

- ▶ Low Emission Zones.
- ▶ Transformation of urban and metropolitan transport.
- ▶ Improvement of the quality and reliability of the Cercanías network.
- ▶ Energy and comprehensive rehabilitation of public and private buildings.
- ▶ Programmes for the regeneration of neighbourhoods and construction of subsidised housing.

II. Infrastructure and Resilient Ecosystems.

Within the framework of Lever II, MITMA will give a decisive boost to:

- ▶ European corridors and the rest of the projects included in the Trans-European Transport Network.
- ▶ Promote intermodality and logistics.
- ▶ Support program for sustainable and digital transport, mainly of goods, aimed at the private sector.



PHOTO: AYUNTAMIENTO DE BARCELONA



PHOTO: ELVIRA VILA (INECO)



PHOTO: PABLO NEUSTADT (INECO)



PHOTO: AENA

A BIG OPPORTUNITY FOR THE INFRASTRUCTURE, TRANSPORT AND HOUSING SECTOR

The Recovery Plan is vitally important for the infrastructure, transport and housing sector. It is a lever that will enable the challenges of digitalisation and the sustainability of mobility, housing, building and infrastructures to be addressed in the coming years, modernising Spain's productive fabric. To this end, it is vital to ensure effective implementation measures in order to facilitate the achievement of the Plan's objectives. For this purpose, MITMA has created a Technical Support Office for the Plan in which Ineco collaborates by providing expert advisory services.

The Office has a multidisciplinary team of professionals who will advise and oversee the management, monitoring and coordination of the development of the programme and will provide the means needed to carry out the management of the grants, optimising them as much as possible.

In this regard, Minister Ábalos highlighted the steps already taken towards "streamlining public procurement and management, in accordance with European law and the unwavering commitment in the fight against corruption". Furthermore, he pointed out that "we are counting on the autonomous communities and local city councils. We envisage the co-management of European funds, consistent with the aims of the Plan".

The Technical Support Office, through the MITMA, will provide support in the coordination, integration of all information, management of competitive calls for grants, monitoring and control of direct management grants, document management and communication with the outside world, including the Office of the President of the Government of Spain and/or EU authorities, among others. Specialists from a variety of disciplines, mainly engineers, architects, economists and lawyers, as well as administrative staff, will be involved in the different areas of development. Its role includes supporting the Secretariats-General of the MITMA in the areas of transport and mobility, infrastructure, urban agenda and housing. ■

THE MITMA HAS CREATED A SUPPORT OFFICE FOR THE RECOVERY PLAN, COMPRISING A MULTIDISCIPLINARY TEAM OF EXPERTS WHO WILL ADVISE AND OVERSEE THE MANAGEMENT, MONITORING AND COORDINATION OF THE DEVELOPMENT OF THE PROGRAMME

23,000 reasons to help

Kenya, Ethiopia and Guatemala are the countries in which the projects of the second edition of Ineco's *IngenioSOS 2020* corporate volunteerism programme are being developed, directly benefiting 23,000 people. The company presented the programme at a meeting on CSR in public companies organised by Forética.

By **África Jiménez**, deputy director of Institutional Relations and **Beatriz Vázquez**, CSR area manager

As a transport engineering and consultancy with more than 50 years of history, more than 3,000 highly qualified professionals and a multidisciplinary scope of action spanning five continents, Ineco carries out thousands of engineering, consultancy and building projects every year for all modes of transport.

A few of these stand out: the charitable projects developed by the participants of the *IngenioSOS* programme and financed entirely by the company. In 2020, in its second edition, it has three new proposals led by as many NGOs, all of them with the Fundación Lealtad seal of transparency. A total of 12 volunteers, professionals in engineering, architecture and computer science, together with one member of the management staff per project, work with a clear objective: to improve the living conditions of different groups of people in communities in Kenya, Ethiopia and Guatemala, with a special focus on children. These projects will directly improve quality of life for more than 23,000 people, and indirectly improve the lives of almost 200,000 people.

A DETAILED LOOK AT THE 2020 PROJECTS
The design and implementation of an online coordination and monitoring system for work with clubs and schools against female genital mutilation (FGM) in Kenya, led by the Kirira Foundation. Established in 2007, this Foundation is dedicated to cooperation for development, the defence of human rights, the promotion of volunteering and the care of people at risk of social exclusion, especially in countries where female genital mutilation is practised.

The project on which Ineco is collaborating is being carried out in the Kirira Foundation's intervention areas in Kenya: Tharaka, Tangelbei and Abakuria. It

INECO AND THE SOCIAL COMMITMENT OF PUBLIC COMPANIES

Celestino Rodríguez, director of the Office of the President, presented the *IngenioSOS* programme at the November session of the Action Group on Sustainability and CSR in Public Companies of the Forética platform. In his speech, he underlined the high degree of involvement of all the company's teams in charitable actions and the increased effort made by the company to this end over the previous two years. He also highlighted engineering's key role as a tool for social transformation and aid to the most disadvantaged.

For Ineco, which presented its first corporate social responsibility plan almost fifteen years ago, contributing part of its human and economic capital and technical knowledge to charitable actions is a key issue. It has therefore integrated the Sustainable Development Goals of the 2030 Agenda as one of the six strategic objectives of the organisation in its Atenea Plan.

This is the context of the *IngenioSOS* corporate volunteerism programme, which began in 2019 with three projects that benefited a total of 22,000 people: a community centre in Rascola, India, led by the NGO Itwillbe, which is currently still underway. The other two projects were recently completed: the renovation of a maternity and paediatric ward at the Bor Hospital in South Sudan, with Médecins du Monde; and the improvement of access to water and sanitation at the Moulin community health centre in Gros Morne (Haute Artibonite, Haiti), led by Cesal.

To select the three charitable projects on which the company collaborates each year, a request for applications is made through Fundación Lealtad and then a vote is held by a multidisciplinary panel. Each project is assigned an institutional volunteer selected from the company's management professionals to support the teams.

consists of the design and development of a mobile management and monitoring application, suitable for tablets and computers, to be used by the anti-FGM clubs of the 86 participating schools and the local partner. Ineco also finances the purchase of mobile devices and advises the NGO on how to provide internet connection to schools.

The project for *energy supply for the Meki maternal and child health clinic in Ethiopia, which is run by the Pablo Horstmann Foundation*, created in 2007, has already concluded. In Ethiopia, the foundation runs a maternal and child health clinic, a children's home, a kindergarten and a scholarship programme for orphans. The project in which Ineco is involved has been developed in Meki, a rural town south of Addis Ababa, where the maternal and child health clinic is located, providing care for 18,271 children and 1,166 women. The clinic was opened in 2012 and was upgraded in 2019 with a new maternity and neonatal care unit.

The aim of the project has been to guarantee the electricity supply, which is essential for incubators, monitors, laboratory equipment, cold storage of medicines and vaccines, through the use of a generator. Ineco has prepared a study to improve the energy efficiency of the centre and will provide advice and supervision of the entire process of implementing improvements. The company has also financed the purchase, installation and commissioning of the appropriate generator and the shed that houses it,

THE 15 VOLUNTEERS OF 2020

Clean water and sanitation conditions for indigenous children in the Las Rosas community. El Quiché, Guatemala, led by the Educo Foundation.

1. Lucía Esteban (project manager)
2. Rafael Aguilar
3. Estrella de la Carrera
4. Daniel Latorre

The design and implementation of an online coordination and monitoring system for work with clubs and schools against female genital mutilation (FGM) in Kenya, led by the Kirira Foundation.

5. Mónica Ruiz (project manager)
6. Cristian Cano
7. Rafael Gutiérrez
8. José Antonio Álvarez
9. Jesús Vázquez
10. Ana Rojo

Energy supply for the Meki maternal and child health clinic in Ethiopia, which is run by the Pablo Horstmann Foundation.

11. Natalia Terrón (project manager)
12. Montserrat Luna (project manager)
13. Miguel Sánchez Risueño
14. Alejandro Rodríguez
15. Celestino Rodríguez

and has made an additional donation for the acquisition and installation of photovoltaic panels.

The third project of the *IngenioSOS 2020* is *Clean water and sanitation conditions for indigenous children in the Las Rosas community. El Quiché, Guatemala, led by the Educo Foundation.* Since 1994, this NGO has been involved in cooperation for development and humanitarian action for children, especially in the field of education. It is active in Spain and in 12 countries in Africa, America and Asia.

Guatemala is one of the most underdeveloped countries in Central America. The project consists of rehabilitating and improving the sanitary infrastructure of the school in the village of Las Rosas, with a population of just over 1,000. The school, with

160 students, does not have adequate hygiene facilities (washbasins, toilets, wells, etc.), which leads to the spreading of diseases, forcing children to miss classes on a regular basis.

Ineco's collaboration consists of the design and financing of the project, as well as the drafting of the terms and conditions of the tender for the works and the technical specifications, the hydraulic design of the greywater treatment system and the review of the budget and proposals for materials and equipment. The Educo Foundation, meanwhile, will select the contracting company and provide basic hygiene materials and training sessions for the children aimed at reducing common communicable diseases. ■



The youngest children are those that benefit most from the projects in Ethiopia, Guatemala and Kenya. On the left, the Meki maternal and child health clinic, in Ethiopia; on the right, the Las Rosas community, in Guatemala.



BRAND SPAIN | MARINAS

PUERTO BANÚS
The luxurious marina of Puerto Banús is a hub for tourist activities and enjoys an outstanding location thanks to the exceptional climate of Marbella (Málaga Province).

LARGE YACHTS: GENERATORS OF WEALTH

The vast majority of leisure crafts in Spain are between 6-8 metres long, according to registration records. However, Spanish marinas, and particularly those on the Mediterranean, are highly sought-after by users in a segment whose small size belies its enormous economic impact: large yachts, of which there are around 10,000 worldwide. Under Spanish law, 'superyachts' are those that are 30-60 metres long; 'megayachts' are those up to 90 metres; while those that are even larger are dubbed 'gigayachts', many of which are used for charter services.

These enormous vessels, which usually winter in the Mediterranean and head to the Caribbean in the autumn, require highly specialised facilities and services that also have a high level of added value. The ports of Palma de Mallorca, Barcelona and Tarragona boast specialised shipyards, while the 3,000 or so berths in the marinas in the Balearic Islands are among the most exclusive and sought-after in the Mediterranean. Of particular note is Marina Port Ibiza, which has 1,400 berths for leisure craft. Some 85 of these berths are suitable

for large yachts. The marina in Palma de Mallorca boasts luxurious facilities and more than 200 berths for yachts of up to 50 metres, while some 20 kilometres away in Calviá Bay, the ultra-modern Port Adriano - designed by Philippe Starck, can accommodate even larger yachts (up to 100 metres) and is notable for its range of fine dining options and fashion boutiques.

On the mainland, Puerto Banús in Marbella and Sotogrande in Cádiz (whose 1,100-plus berths make it the largest marina in Andalusia) are hotspots for

megayachts. The Province of Barcelona is home to 24 of the 44 marinas on the Catalan coast. Of these 24, the three largest are found in the city of Barcelona: Port Vell, Port Fòrum and Port Olímpic. The growth in demand has driven projects such as the new marina for megayachts at the Port of Málaga, which will have 31 berths for vessels between 30 and 100 metres and offer every type of service. It will create more than 800 jobs and the economic impact of the project is estimated at around 100 million euros.

Coastal beauties

The 300 or so marinas with 130,000 berths that adorn the Spanish coast are not only centres for nautical services: they are also hubs that attract tourists and generate economic activity.

By **ITRANSPORTE**

Spain boasts nearly 8,000 kilometres of coastline and offers sea-lovers an enormous variety of nautical installations and activities, from basic services in small harbours, to exclusive luxury marinas equipped with every amenity imaginable. According to data from the Spanish Federation of Marinas and Tourist Associations (FEAPDT), Spain is currently home to around 300 marinas, which offer a total of 130,000 berths. The largest number are concentrated in the Mediterranean region, particularly in Catalonia and the Balearic Islands, although Valencia and Andalusia are also popular locations and, together with Galicia, they account for approximately 78% of the total.

Over half of Spain's marinas are small, with fewer than 300 berths, while those in areas such as the bays around Palma de Mallorca and Cádiz, the Alicante coast and the county of Maresme in Catalonia each boast around 1,500 berths.

Almost eight out of ten marinas are managed by private companies via concessions, or by sailing clubs: non-profit organisations with a focus on sporting and leisure activities. The rest are publicly owned, in full or in part, by either the national, regional or local government.

The seven islands that make up the Canary Islands archipelago have a long-standing maritime tradition owing to their strategic location and the influence of the trade winds. They have 40 well-equipped marinas, ranging from large facilities, such as Las Palmas marina in Gran Canaria, with over 1,000 berths; Pasito Blanco in the south, in the tourist district of Maspalomas; and Puerto Calero in Lanzarote, down to the very smallest on the island of El Hierro, with just 120 berths, although it can accommodate vessels of up to 30 metres. Also of note are Tazacorte in La Palma, Los Gigantes in Tenerife (located next to the cliffs of the same name) and El Castillo in Fuerteventura.



PORT OF BARCELONA

In absolute terms, the record is held by the marina at Empuriabrava (Province of Girona), a resort town on the mouth of the River Muga that has 14,000 homes, 23 kilometres of canals and 5,000 berths. It was built in the 1960s, when the Spanish tourist industry was starting to take off.



EL ROMPIDO MARINA



EMPURIABRAVA



BENALMÁDENA MARINA



PUERTO MOGÁN



PORT DE LA SELVA



IBIZA MARINA



PORT FÒRUM BARCELONA



SANTANDER MARINA



PORT OF PALMA DE MALLORCA

In Murcia, one of the best-known marinas is Tomás Maestre in La Manga del Mar Menor, which has space for 1,800 vessels up to 30 metres in length and two quays for superyachts. The region is also home to the Yacht Port in Cartagena.

Spain's northern and north-western coasts, bordering on the Cantabrian Sea and the Atlantic Ocean, offer a number of attractive installations such as the Marina del Cantábrico in Santander, with 1,300 berths, as well as smaller harbours such as Laredo and Santoña. In Asturias, the largest marina is in Gijón, with almost 800 berths, while the largest facilities in the Basque Country are those at Getxo and Hondarribia. In Galicia, marinas of note include Sanxenxo and Baiona in Pontevedra and Sada in A Coruña, all of which offer 300-400 berths. Since 2016, North Marinas, the association of marinas for northern Spain, has offered the opportunity to do the Camino de Santiago by sea. However, pilgrims must only use sails,

travel a minimum of 100 nautical miles, and walk the last 10 kilometres to the Cathedral on foot. The *credencial*, or pilgrim's passport, can be stamped in all of the marinas.

The Spanish coast is filled with charming ports: in Menorca, for example, there is a marina in Ciutadella's historic quarter and another in Mahón, which at six kilometres long is one of the largest natural harbours in the world. Mogán, in Gran Canaria, is known as "Little Venice" for its many canals, while El Rompido marina in Cartaya (Huelva Province) is an unusual river harbour located inside a natural park. Puerto Marina in Benalmádena (Málaga Province) is characterised by its picturesque architecture that blends Indian, Arabic and Andalusian styles; the marina at Combarro in Pontevedra stands out for its traditional *hórreos*, or granaries; while Port de la Selva (Girona Province) is a natural harbour lying below a quiet, whitewashed seaside town in the heart of the Costa Brava. ■

Awards to keep the ball rolling

The Madrid Branch of the CICCIP (Professional Association of Civil Engineers) has awarded civil engineer Juan Antonio Martínez Ortega the 2020 Outstanding Young Engineer Award for his extensive work in spreading and communicating content related to the profession.



In the front row, Juan Antonio Martínez with representatives of the 180 professionals of Ineco's Roads Project Management Department, at the company's headquarters in Madrid.

“It's really important to spread information and make the whole world aware of our activities as civil engineers across a wide range of areas”

JUAN ANTONIO MARTÍNEZ ORTEGA,
civil engineer at Ineco

Recently elected Councillor Representative of Young Members of the Professional Association of Civil Engineers (CICCIP), Juan Antonio Martínez has worked at Ineco since 2015, holds a Master's Degree in BIM Management for Civil Engineering, Infrastructures and GIS, and is a Railways Specialist for the Madrid Branch of the CICCIP and Adif. In 2018, he was the winner of the competition *Engineering in 200 seconds*, organised by the Association of Civil Engineers and the CICCIP, which also recognised his contribution to increasing

awareness of engineering. For the company, this award follows others received for projects related to roads development such as EuroTAP in 2004 and 2006, or the more recent Ponle Freno 2019 and Esri 2020. Roads Projects Department, with a team of 180 people, is involved in some of the most important projects in Spain and supports the General Directorate of Roads of the MITMA (Ministry of Public Works and Transport) in different contracts, not to mention the 20 specialists from the Department team working in Mexico, Costa Rica and Latvia.

ROADS-RELATED AWARDS TO CELEBRATE

1 GIVEN TO THE JUNTA DE ANDALUCÍA FOR THE A-381 HIGHWAY PROJECT (INTERNATIONAL ROAD FEDERATION) IN 2004.

2 FROM THE EUROTAP (EUROPEAN TUNNEL ASSESSMENT PROGRAMME), FOR THE BEST AND SAFEST TUNNEL IN EUROPE M-12 IN 2006.

3 GLOBAL ROAD ACHIEVEMENT AWARD TO INECO-UPM FOR THE PROJECT FOR THE DEVELOPMENT OF THE 2ND GENERATION OF HIGHWAYS IN POLAND (INTERNATIONAL ROAD FEDERATION) IN 2006.

4 SDGS TO THE RONIN TOOL (RAFAEL DEL PINO FOUNDATION AND SPANISH GLOBAL COMPACT NETWORK) IN 2018.

5 ESRI FOR THE BIM-GIS INTEGRATION IN THE A-76 HIGHWAY PROJECT TOGETHER WITH THE BIM TEAM IN 2019.

6 OUTSTANDING YOUNG ENGINEER AWARD TO JUAN ANTONIO MARTÍNEZ IN 2020.

PHOTO: ELVIRA VILA



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