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69

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RAILWAYS

Australia extends Ineco's reach to five continents

+ ARTICLES

High speed to Extremadura

An oasis in Dammam

Vilnius airport

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Aena: The carbon footprint

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EDITORIAL

Growing together

In extraordinary times like these, properly harnessing our potential is also yielding extraordinary results. With our vocation for innovation and the solid capacity to adapt that we have demonstrated since the very beginning, the current situation has allowed us to consolidate the strengths that set us apart, design new services that respond to emerging needs, and offer the best from our primary asset, the team that makes up Ineco. In short, we are moving forward, growing together.

The role and talent of Spanish engineering has meant that, for the first time in the more than 50 years of our history, we are now operating on all five continents. We have made our entry into Australia as part of the technical team that is promoting the modernisation of Sydney's commuter network, drawing on Ineco's extensive experience in the railway sector. In addition to this project, which is a symbolic milestone for all of us, Ineco was also awarded contracts with Rail Baltica and the works for Vilnius airport, both in Europe, the sustainability study for Dammam airport and the integral management of the plan for the Kuwait international airport expansion, in Asia, and the project recently signed in Costa Rica, on the American continent.

In Spain, we continue to focus our work on continuing to grow together with our clients and shareholders, contributing to the maintenance of essential services that seek to guarantee sustainable development, such as the services provided in Spain for Aena related to its carbon footprint and the fight against climate change, the work for ENAIRE, which for the first time successfully tested remote operation of SACTA, and the works and installations for Adif that will enable it to improve the quality of the service and advance in the efforts to bring high-speed rail to Extremadura.

Ineco's commitment to developing its talent has enabled it to continue to grow its position as a ground-breaking transport engineering and consultancy firm in the design of innovative and cutting-edge projects. One clear example of this is the international Special Achievement in GIS (SAG) Award given by Esri, a world leader in software for Geographic Information Systems, which recognises Ineco's ground-breaking work in Spain using the BIM methodology in a GIS environment when designing a new stretch of highway. Accordingly, this edition includes an article on linear infrastructure projects in several countries where we are applying the BIM methodology. We also cover the Innova Award awarded to Ineco for the EOS project, a software product with unique features previously unavailable on the market.

Lastly, within the framework of our Agenda 2030 Plan, we highlight the importance of Ineco's compliance programme, an example of our firm commitment to ethics that forms part of our Atenea Strategic Plan, guaranteeing respect for the law and trust amongst our stakeholders. Compliance is a culture that enables us to continue growing together to continuously improve our company, avoiding risks and producing legal security. ■

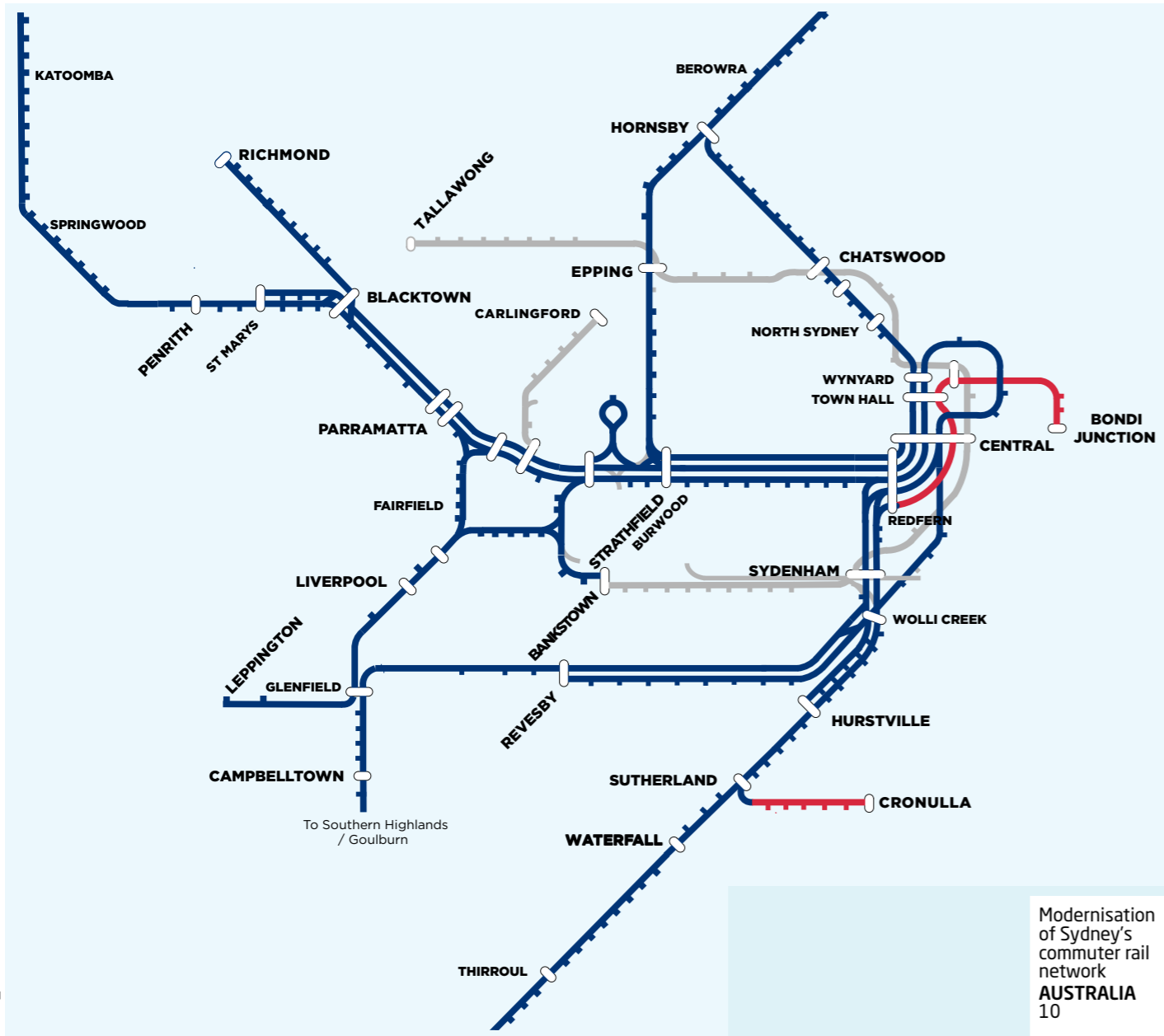


“In extraordinary times like these, properly harnessing our potential is also yielding extraordinary results”

CARMEN LIBRERO
President of Ineco

CONTENTS

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IMAGE_TFN5W

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Editor-in-Chief: BÁRBARA JIMÉNEZ-ALFARO – barbara.jimenez@ineco.com **Editorial Staff:** LIDIA AMIGO – lidia.amigo@ineco.com

Editorial Board: LIDIA AMIGO, JOSÉ M^a BERDOY, JORGE DE SAN JOSÉ, NATALIA DÍAZ, JUAN RAMÓN HERNÁNDEZ, RAFAEL HERRERA, BÁRBARA JIMÉNEZ-ALFARO, DANIEL LATORRE, MÓNICA LAUDA, ADRIÁN LÓPEZ, TATIANA MANCENIDO, ANA PELÁEZ, PATRICIA REY, CELESTINO RODRÍGUEZ, JARA VALBUENA

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06 | NEWS

Ineco to continue managing Costa Rica's PIT through 2023

Successful remote testing of a SACTA function by ENAIRE

Esri Award for BIM-GIS integration in the A-76 Highway project

Ineco returns to Kuwait International Airport to direct its expansion

10 | MODERNISATION OF SYDNEY'S COMMUTER RAIL NETWORK

Australia extends Ineco's reach to five continents

14 | MADRID-EXTREMADURA HIGH-SPEED LINE

New lines for Extremadura

24 | SUSTAINABILITY MANAGEMENT PLAN FOR KING FAHD AIRPORT

A sustainable oasis in Dammam

28 | COMMERCIAL MASTER PLAN FOR VILNIUS INTERNATIONAL AIRPORT

Everything a passenger could need

32 | RAIL BALTICA RAILWAY LINE

A megaproject to unite three republics

36 | LAND TRANSPORT AND SDGS

More efficient freight in the EU

38 | THE CARBON FOOTPRINT OF AENA'S AIRPORTS

Without a trace... of carbon

42 | DIGITISATION OF PROCESSES AND THE BIM METHODOLOGY

BIM and digitisation, keys to the new normal

46 | 2030 AGENDA / CSR

Compliance: The value of the law

48 | BRAND SPAIN

Oceanography: A sea of knowledge

50 | INECO TEAM

ICT department: 100% connected



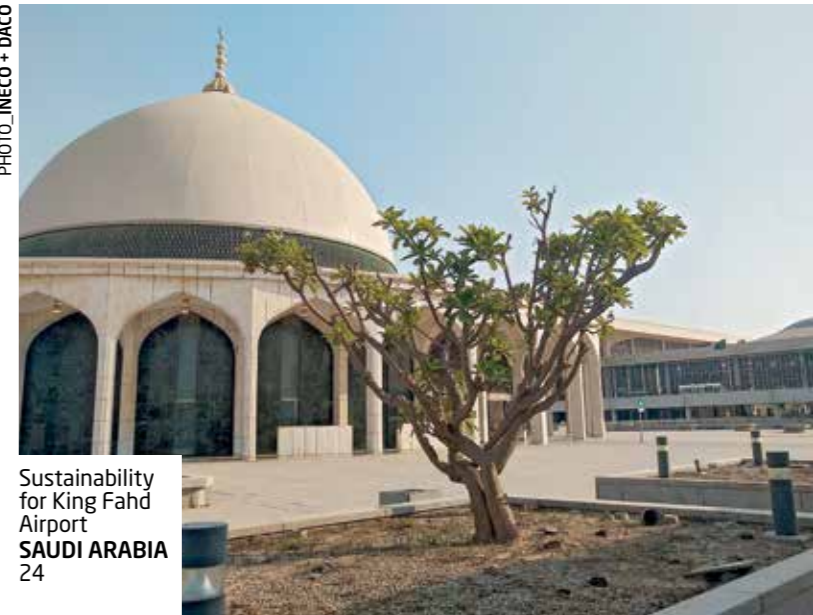
ISSUE 69 COVER
INECO'S ENTRY INTO AUSTRALIA EXTENDS ITS PRESENCE TO THE FIVE CONTINENTS.
ILLUSTRATION PEPE SERRA



PHOTO_INECO FOR ADIF ALTA VELOCIDAD

Madrid-Extremadura high-speed line
SPAIN
14

PHOTO_INECO + DACO



Sustainability for King Fahd Airport
SAUDI ARABIA
24

PHOTO_STEPHEN DOWINES (FLICKR)



Rail Baltica railway line
EUROPE
32

SPAIN

ESRI AWARD FOR BIM-GIS INTEGRATION IN THE A-76 HIGHWAY PROJECT



Ineco has been awarded the Special Achievement in GIS (SAG) Award by Esri, a world leader in software for Geographic Information Systems.

The award acknowledges the company's ground-breaking work in Spain in the development of GIS (Geographic Information System) technology thanks to the integration of the BIM methodology into a GIS environment to

develop a virtual 3D model of the future A-76 Ponferrada-Ourense Highway, for the Spanish General Directorate of Roads.

Every year, different projects around the world in different fields are recognised for demonstrating their capacity for innovation and good use of GIS in solving a variety of problems. (More information on page 42).

SPAIN

SUCCESSFUL REMOTE TESTING OF A SACTA FUNCTION BY ENAIRE

For the first time, the Spanish air traffic control system (SACTA) screens have been used remotely for verification and validation tasks. Since the declaration of the state of alarm and the beginning of the lockdown, ENAIRE implemented a work method so that its engineers could continue the testing at the Experimentation and Develop-

ment Centre remotely. This enabled the ATM Automation and Development areas, as well as the group of air traffic controllers that defined the functionality (the SACTA iTEC Operating Group), to run ENAIRE's first remote validation with the participation of the Ineco engineers who provide service in these areas.



In the image, SACTA display.

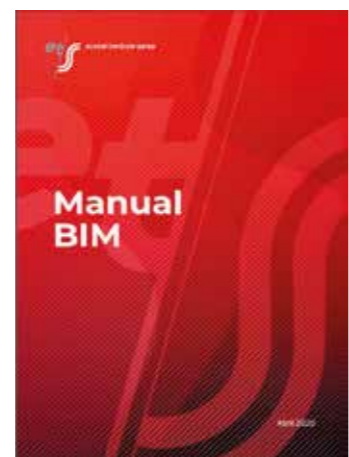


PHOTO: JAVIER GÓMEZ DE MURO (INECO)

TRACK ASSEMBLY IN LEÓN

The works for the underground track assembly in León are well underway and will be completed in the near future. Ineco is supervising assembly works, as well as the quality of the track

and the rest of the installations that form part of the project to move the León through station underground. In the picture, Ineco surveyor Jose A. Diaz, supervising the track construction.



SPAIN

FIRST BIM GUIDE FOR RAILWAYS

Ineco has developed a manual for the correct implementation of the BIM methodology (Building Information Modelling) for the Basque railway manager Euskal Trenbide Sarea in its contracts. Published in April, it is the first BIM guide for the railway sector in Spain, in addition to others related to the ports or building sectors.



PHOTO: INECO

Ineco's Susana Valverde with an engineer from the supervising company, on the bridge over the Higuero River, on the Limonal-Cañas section, Guanacaste.

INECO TO CONTINUE MANAGING THE TRANSPORT INFRASTRUCTURE PROGRAMME (PIT) THROUGH 2023

The Ministry of Public Works and Transport (MOPT) of Costa Rica has extended the contract with Ineco for the administrative, technical, legal and environmental management of the Transport Infrastructure Programme (PIT) for another 32 months, until 2023. The programme, financed by two loans from the Inter-American Development Bank (IDB), for a total of 450 million dollars, includes strategically important actions on roads and ports

(see ITRANSPORTE 62). After winning the international tender held by the MOPT and the IDB in 2016, Ineco is acting as the Programme Execution Unit, in charge of planning and monitoring all of the technical and administrative tasks, in close collaboration with the Ministry. According to the MOPT, the contract has been extended to adjust to changes in the planning of PIT actions, to which it has added three more road projects:

construction of road links in Taras and Cartago, doubling of 2.4 kilometres in La Angostura, in Puntarenas, and extension and rehabilitation of 70.8 kilometres of the Northern Inter-American Highway, between Barranca, Limonal and Cañas. The PIT, which is part of Costa Rica's National Transport Plan 2011-2035, includes seven other projects to improve and expand roads in different parts of the country and three works in ports.

SPAIN

EOS RECEIVES THE 2019 INNOVA AWARD

The EOS project developed by Ineco was chosen as the winner of the 5th edition of the company's Innova Awards. EOS is a unique piece of software on the market, a comprehensive and efficient tool for the design of flight paths and procedures followed by aircraft to safely take off and land at airports. Its development is the result of collaboration between teams of aeronautical, computer and telecommunications engineers.

It uses spatial geometric calculations, integrated with a GIS developed by NASA and a 3D visual interface, for the calculation of safe flight procedures. It complies with ICAO air navigation regulations and is constantly being developed and updated.

Ineco's Innova Awards annually recognise in-house projects for their contribution to the development of new knowledge, encouraging innovative initiatives within the company.

TURKEY

THE RENOVATION OF THE SAMSUN-KALIN LINE, IN THE HOME STRETCH

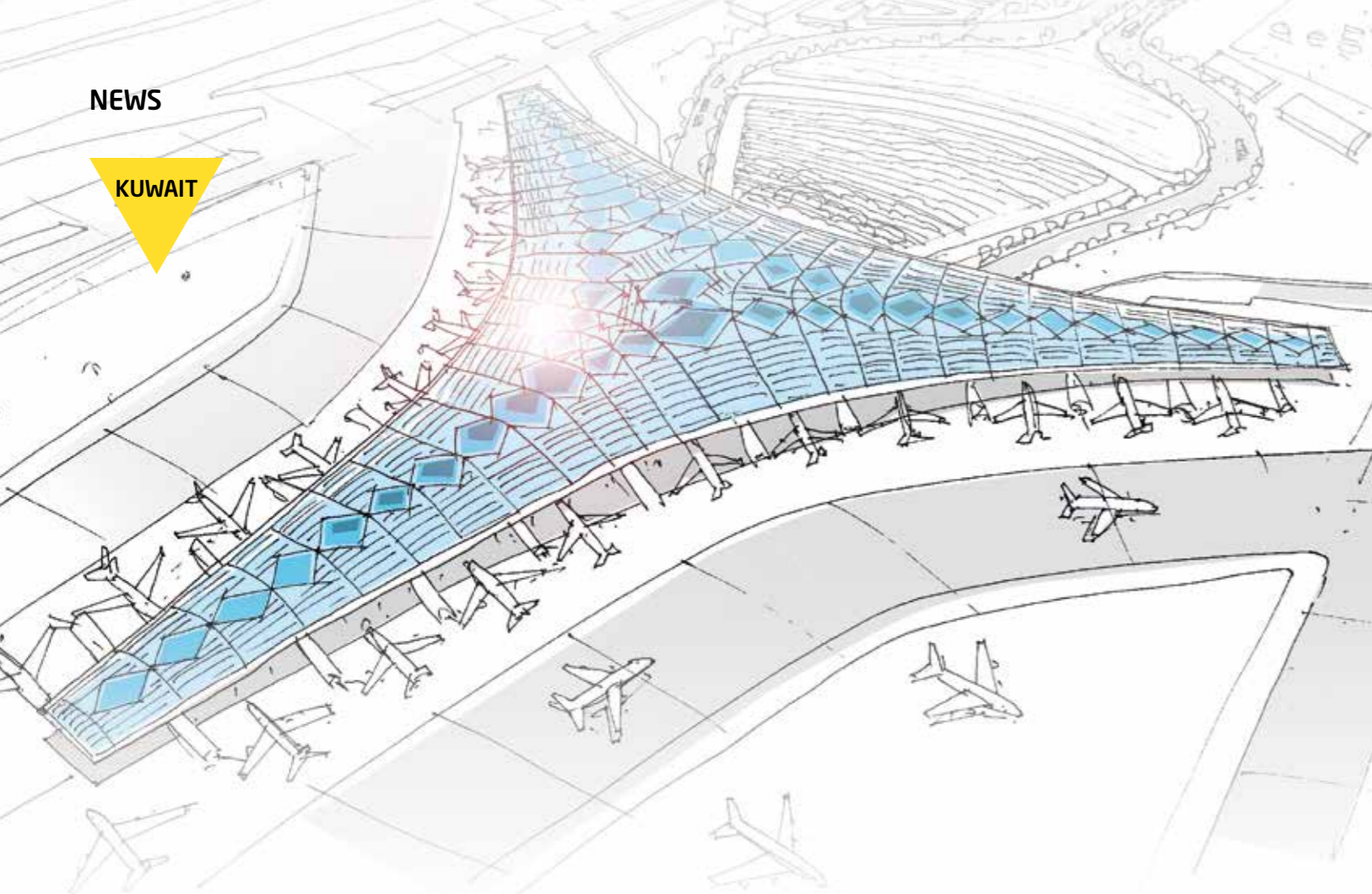
Ineco will continue working until the end of 2020 on the final stage of the renovation of the 377.8 km railway line (in addition to the branch between Samsun and Gelemen, which is just over 10 km long) that links the cities of Samsun, on the Black Sea coast, and Kalin, in the centre of the country, where it connects to the Ankara-Sivas line. After

almost five years, the work is now in its final stages. In 2019, construction work was completed on the entire line, except for the Gelemen branch. Once completed, the fault notification period can begin, with an expected duration of 12 months, followed by the acceptance and commissioning of the line. Ineco's work will last until December 2020.



In the image, a section of renovated track.

PHOTO: TURKISH MINISTRY OF TRANSPORT AND INFRASTRUCTURE



INECO RETURNS TO KUWAIT INTERNATIONAL AIRPORT TO DIRECT ITS EXPANSION

The Kuwaiti Ministry of Public Works has awarded Ineco the contract for the program management consultancy services and operational commissioning and transfer (ORAT) of the enlargement of Kuwait International Airport (KIA).

By **José Ramón Armenteros**, Middle East, Asia and Africa representative

The expansion includes, among other works, the construction of a new 700,000 m² terminal building (the main purpose of this contract, and whose construction began in 2017), the extension of the two runways, the construction of a new third runway, a new control tower, and the construction of the associated infrastructure on the land and air sides of the airport. This award will enable Ineco to participate in one of the most emblematic airport

projects in the Middle East. Ineco, the leader of the consortium, together with its local partners, the Kuwaiti firms KUD (Kuwait United Development) specialising in project management, and the engineering and architecture firm Dar al Jazera Consultants, will coordinate the work of the many consultants and contractors from various countries involved in the works, which will increase the airport's capacity to 25 million passengers, which in a second phase that is being

considered would raise capacity to 50 million in its final stage.

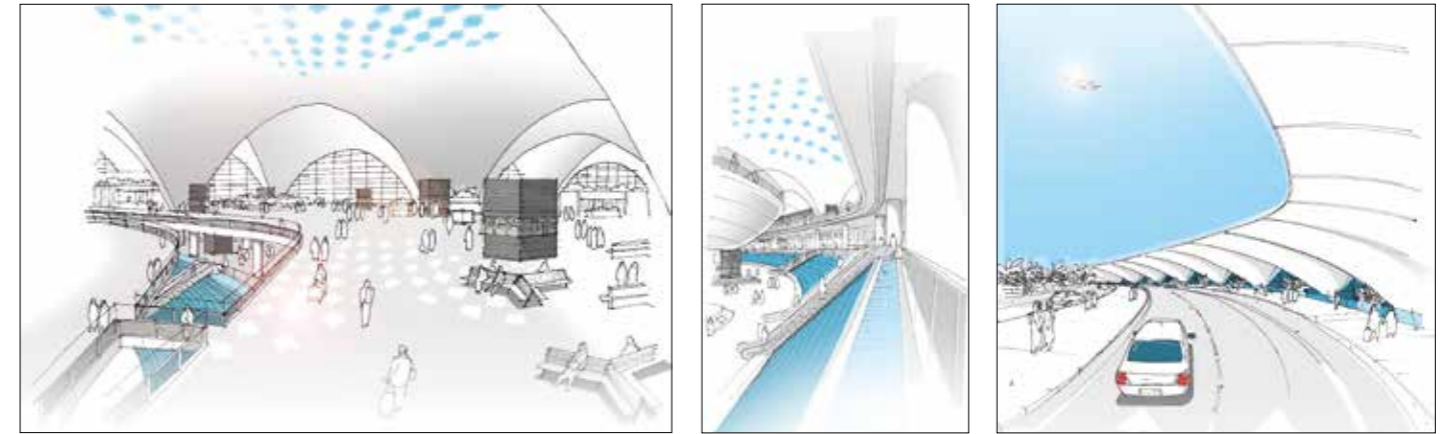
For Ignacio Alejandro, ORAT project manager, "the contract is a major challenge for Ineco. Its complexity and scope will demand the best of the team on the ground and support from all areas of the company." Ineco previously worked at this airport between 2011 and 2016, carrying out project management tasks and updating the 2010 Master Plan for the Kuwait Civil Aviation Authority.

Project head Angel Toro stresses that "in terms of airports, this is one of the most ambitious projects underway in the world today. It will be a highly motivating challenge for a team of between 40 and 50 people, and will enable Ineco to be a key player in the development of this airport."

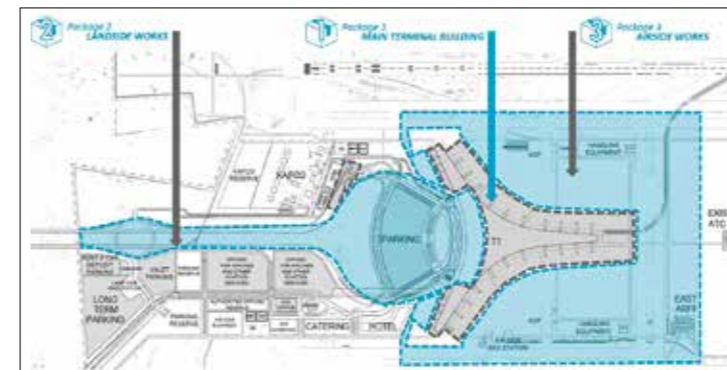
DIVISION OF THE WORKS INTO THREE MAIN PACKAGES

Due to the large number and magnitude of the planned works, the Kuwaiti Ministry of Public Works has divided the works into three main packages, which will be tendered separately: the first package includes the new main terminal building, a central plant building for power and chilled water, another for the water supply and an utility tunnel that will connect the terminal building with the future cargo area of the airport. The second is a car park with 5,200 spaces (a total area 325,000 m²), landscaping, an underground sewage treatment plant, the new access roads and four storm water storage tanks. The third package includes the main apron, new taxiways, several tunnels that will connect the

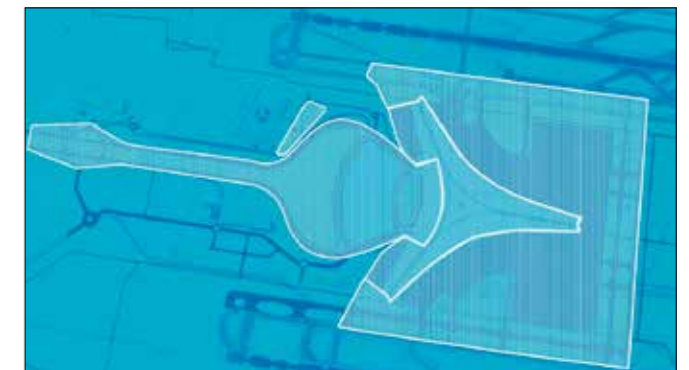
NEW TERMINAL AND EXPANSION PLANNED AT KUWAIT AIRPORT



Illustrations of the new terminal by Roberto Marchán (Ineco) on a design by Foster & Partners.



Images created by Ineco showing the three main construction packages of the tender.



THE EXPANSION INCLUDES, AMONG OTHER WORKS, THE CONSTRUCTION OF A NEW 700,000 M² TERMINAL BUILDING, THE EXTENSION OF THE TWO RUNWAYS AND A NEW CONTROL TOWER, WHICH WILL INCREASE THE CAPACITY TO 25 MILLION PASSENGERS

new terminal with the rest of the facilities and a consolidation centre between the landside and airside, which will include waste management facilities, storage dedicated for the retail shops and facilities for the Ministry of the Interior and Custom Control.

Under this contract, with a completion time of 50 months, Ineco will also provide ORAT (Operational Readiness and Airport Transfer) services for the last two years, which include the planning, validation and execution of live exams called 'trials' of all the systems and procedures for the terminal prior to its commissioning, as well as personnel training, to ensure that the opening of the

new facilities goes smoothly. The company has extensive experience in ORAT in major airports in Spain - Madrid, Barcelona, Malaga, Valencia, Alicante, etc. - and other countries - Abu Dhabi (United Arab Emirates), Newark (USA), etc.

Kuwait International Airport, which went into operation in 1961, is located in Farwaniyah, 16 kilometres south of the capital, Kuwait City. It has two parallel runways of 3,400 and 3,500 metres in length and 11 aircraft parking aprons and two control towers: a main tower, located between the two runways, and an apron movement control tower. The main passenger terminal shaped like an airplane was de-

signed in 1979 by the famous Japanese architect Kenzo Tange. The airport also has other terminal buildings serving Kuwait Airways and Jazeera Airways. The airport

also houses a military base, a general aviation terminal opened in 2008 and a restricted access terminal reserved for the Head of State, the Emir of Kuwait.



Signing of the contract by the Spanish commercial attaché in Kuwait, Francisco J. Medina, on behalf of Ineco.

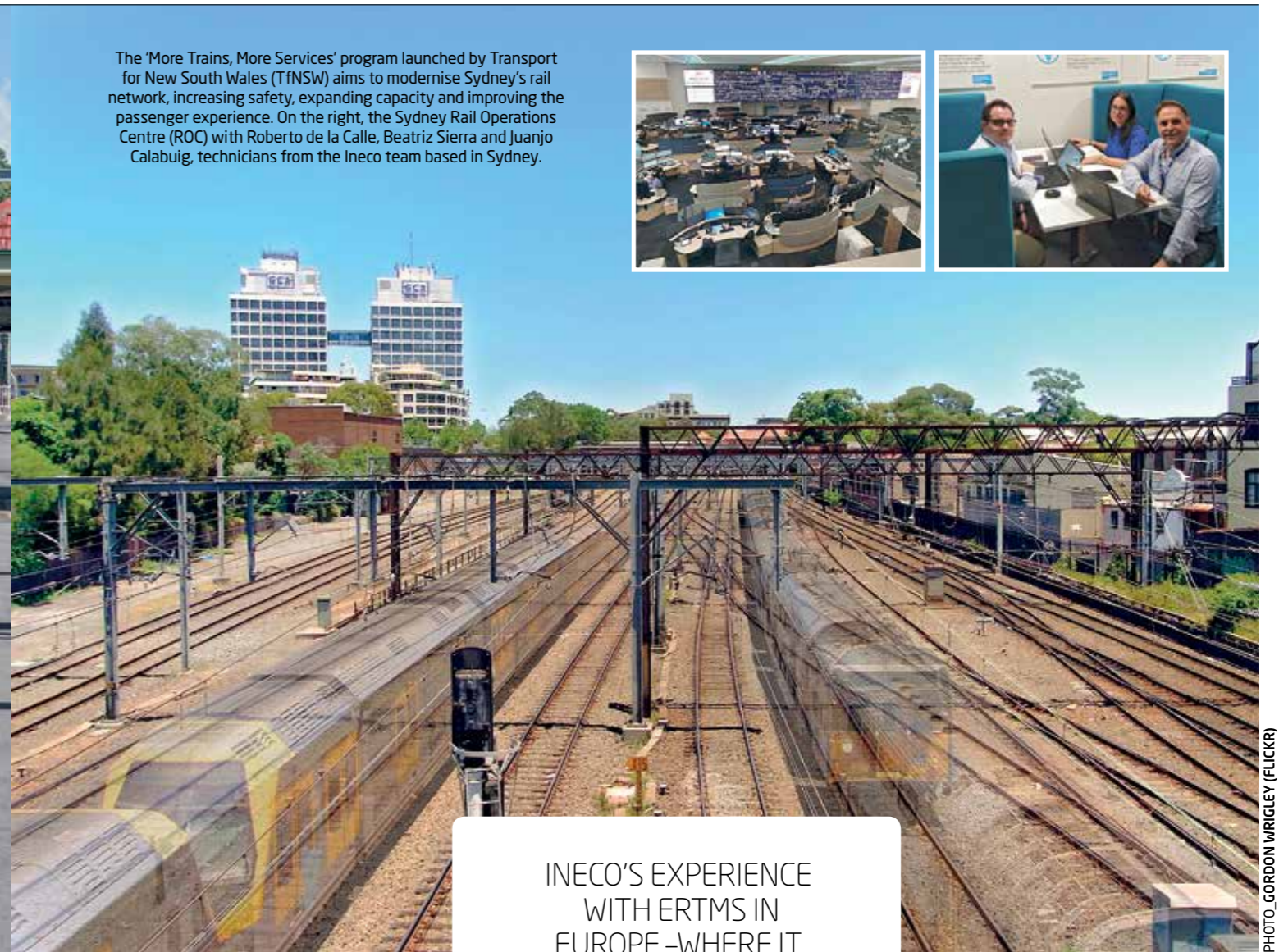


Australia extends Ineco's reach to five continents

Ineco is contributing to the modernisation of the railway systems on Sydney's 815-kilometre commuter network. The contract, which will run until the end of 2020, marks Ineco's arrival in Australia and extends its presence to all five continents.

By Juanjo Calabuig, Roberto de la Calle, Alberto Milanés and Beatriz Sierra, the Ineco team in charge of the project

PHOTO: CORAN HAS (FLICKR)



The 'More Trains, More Services' program launched by Transport for New South Wales (TfNSW) aims to modernise Sydney's rail network, increasing safety, expanding capacity and improving the passenger experience. On the right, the Sydney Rail Operations Centre (ROC) with Roberto de la Calle, Beatriz Sierra and Juanjo Calabuig, technicians from the Ineco team based in Sydney.

PHOTO: GORDON WRIGLEY (FLICKR)

INECO'S EXPERIENCE WITH ERTMS IN EUROPE -WHERE IT COLLABORATES WITH THE EUROPEAN COMMISSION- IS A KEY FACTOR FOR THIS PROJECT

DIGITAL SYSTEMS TO MODERNISE THE NETWORK

In June 2018, the Government of New South Wales announced an investment of \$880 million in technology improvements in order to modernise the Sydney Trains network, including

the development of digital systems, to be delivered in phases and to be brought into service progressively over the coming years. The ultimate goal of this ambitious operation is to enable more frequent and reliable services to meet the needs of Sydney as a growing global city. Digital systems is part of the 'More Trains, More Services' program launched by TfNSW in June 2018, which aims to modernise Sydney's rail network to increase safety, expand capacity and improve passenger experience.

One of the most valuable lessons learned from the implementation of a state-of-the-art signalling system is that the entire process should not be solely about technology.

As the systems integrator, Spanish public engineering firm Ineco will be in charge of supporting TfNSW, as subconsultant of Network Rail Consulting (NRC), in the development, integration and implementation of the new railway systems for the network, together with Acmena and Go-Ahead Group. This is a critical factor in enabling the network to significantly increase its capacity and absorb future demand.

The project, which will run through the end of 2020, is Ineco's first contract in Australia, a country where large investments are being made in infrastructure and where Spanish companies are key players in the sector. Ineco's extensive experience in the field of ERTMS both in Spain and in Europe where, among other things, it is collaborating at the highest levels of the European Commission to implement this system along the continent's core corridors, was the key factor behind NRC's selection of Ineco to carry out the project.

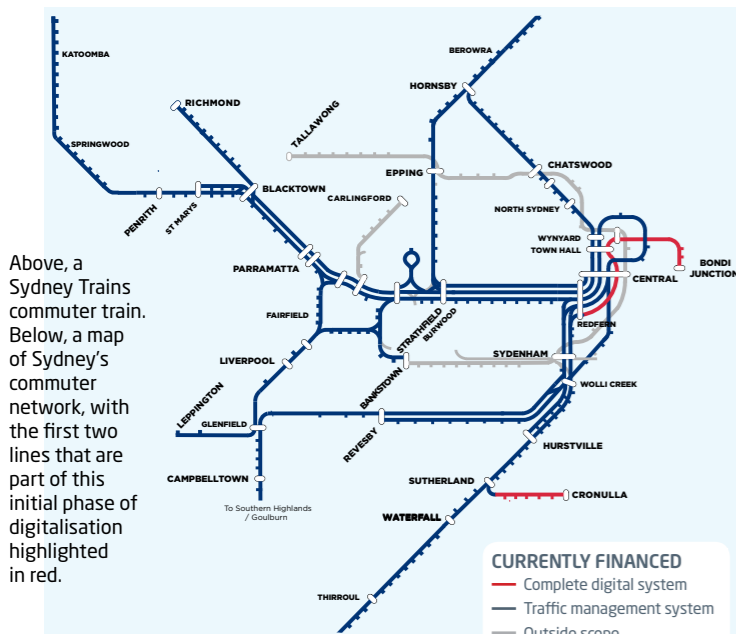


IMAGE: TfNSW

Above, a Sydney Trains commuter train. Below, a map of Sydney's commuter network, with the first two lines that are part of this initial phase of digitalisation highlighted in red.

The elimination of lateral signalling when migrating to ETCS level 2 represents a major change in operational rules. New skills and abilities must be incorporated in order to be able to develop in this technological environment, where new system functionalities require the definition of procedures and the adaptation of the human component in organisations, bringing in new roles and structures. A combination of efforts focused on people, processes and technology is therefore vital to the correct development of this ambitious digitalisation plan, with the human factor being perhaps one of the main focuses of attention in the preparatory work of planning and design.

Transport for New South Wales, located in south-east Australia, tendered the contract for the development and subsequent implementation of a new digital signalling system based on the European ETCS level 2 standard in 2018, as part of the programme for the digitalisation of its railway network. This component of the services is known as the system integrator and will initially address the digitalisation of two lines in the Sydney commuter network. The system integrator's role is especially important, since it not only participates in the design of the solution to be implemented,

but is also responsible for ensuring that the deployment of the new system is perfectly integrated into the existing railway network, in which different suppliers of signalling and control, rolling stock and communications coexist. The contract was awarded in late 2018 to the British company NRC, together with the Spanish public engineering company Ineco as well as Acmena (Australian engineering) and Go-Ahead (a British operator).

The combination of British, Australian and Spanish experience delivers a level of excellence that is essential to the successful integration of digital systems into this commuter rail network, operated by Sydney Trains, which requires upgraded signalling over a length of 815 kilometres.

The programme being carried out by NRC, together with Ineco, Acmena and Go-Ahead Group, is structured along three lines of action: the upgrading of the entire signalling network to ETCS level 2, the implementation of the ATO (Automatic Train Operation) system to assist train drivers, and lastly, the installation of a rail traffic management system (TMS) to increase efficiency in handling of incidents and improve service across the entire network. Ineco has participated in the project since its initial phase, which was developed over the course

of 2019, with the systems integrator defining the system requirements, in terms of trackside and on-board signalling equipment, as well as the fixed and mobile communications, and the unified traffic management system (TMS).

One of the keys throughout this process has been the collaboration among all the players involved, from the client TfNSW and the operators, including Sydney Trains, as well as the technology suppliers, who have worked as part of the project team under the Early Contractor Involvement (ECI) model. This partnership framework is based on the concept that an early agreement is always beneficial for all parties involved.

It is important to note that for this phase of mutual collaboration to be a success, it must be carried out in accordance with high standards of probity that require the entire team to act transparently, responsibly and honestly, monitoring all communications and work meetings and severely penalising any deliberate action that involves preferential treatment towards any of the bidders. The participation of a specialised team on the part of the client has been especially important to this process, not only ensuring compliance with the aforementioned principles, but also providing especially important training and prevention work in the preparation of work protocols.

This ECI process began with a call for tenders from different industry suppliers and ended, in the first four months of 2019, with a short list of candidates who have shared their knowledge and experience in the initial stage of defining the requirements of the final solution to be implemented. The supplier contracts are expected to be awarded in the 2020, when the project team will begin working with them on a preliminary design that will precede the next phase of implementation and commissioning of the system, which is expected to begin the following year.

Integration tests will be carried out in a new technology centre prior to commissioning. This will make it possible to test the technology in a



PHOTO: TfNSW

SYDNEY TRAINS. The installation of a rail traffic management system will improve the efficiency of the handling of incidents and improve service across the entire network.

simulated environment, analysing different situations that could lead to critical incidents that would delay the subsequent commissioning phase. Another function of the centre will be to provide training to Sydney Trains staff in the maintenance and operation of the systems.

CHALLENGING EXECUTION

Ineco's team of 11 engineers and technicians specialised in signalling, railway system integration and communications are working alongside Sydney's transport authorities to replace the existing signalling on their network with more up-to-date digital systems, all managed from a new, modern railway control system. This is an ambitious programme with one clear goal: to make a qualitative leap towards a higher level of safety and operation in order to save on maintenance costs for track equipment and, in return, to be able to offer more and better services for both passengers and freight, which will make it possible to increase the capacity of one of the country's densest and most extensive networks. ■

DIGITAL SYSTEMS IS AN AMBITIOUS DIGITALISATION PLAN IN WHICH THE COMBINATION OF PEOPLE, PROCESSES AND TECHNOLOGY IS KEY, WITH AN EMPHASIS ON THE HUMAN FACTOR IN THE DESIGN AND PLANNING PHASE



At the centre of the image, the Transport for New South Wales and NRC team during their visit to Ineco's offices in Madrid in December 2019.

THE KEY ELEMENTS OF DIGITAL SYSTEM

The introduction of a state-of-the-art signalling system represents a paradigm shift in the operation of the system.



Replacement of traditional signalling systems with the latest 'in-cab' train control technology (ETCS Level 2).



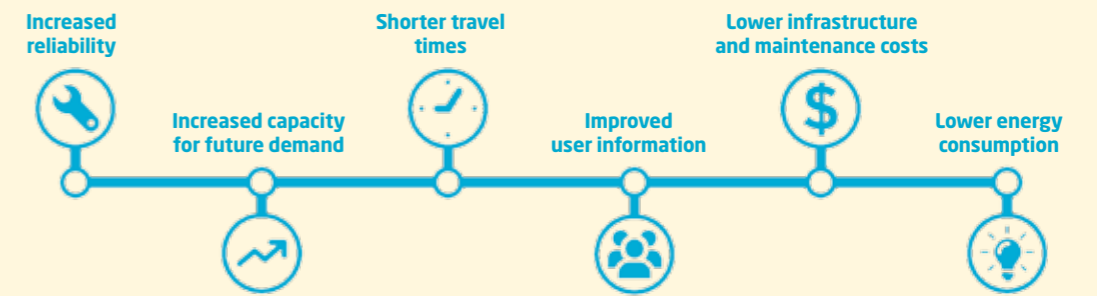
Implementation of the automatic train operation system, which helps train drivers to reduce travel times.



Introduction of a traffic management system (TMS) to help the line recover from disruptions quickly and to manage the entire network as effectively as possible.

THE BENEFITS OF DIGITAL SYSTEMS

The transport strategy of the future is to implement digital systems that will allow for increased capacity across the entire rail network to meet demand and improve the passenger experience with more reliable services, shorter travel times, lower energy consumption and up-to-date, real-time information.



New lines for Extremadura

With the track assembly work almost completed on the Plasencia-Cáceres section, the commissioning of the first phase of the Madrid-Extremadura-Portuguese Border high-speed line is drawing ever closer.

By Eduardo Arnal, project manager, Jaime Blanco, Juan Miguel Figueroa and Agustín Tejedor, construction managers

Ineco's technicians and engineers are working on projects, construction management and the provision of technical assistance for Adif and Adif Alta Velocidad, together with construction companies and other companies in the sector, for the modernisation of the conventional lines currently in operation and for the construction of the Madrid-Extremadura high-speed line, designed for passenger traffic with a maximum speed of 300 km/h and freight traffic up to 100 km/h.

The work is intense. In addition to having designed the Plasencia-Cáceres section, the company has been contracted for the management of platform works, track assembly, electrification, substations, removal of level crossings, noise protection, regulation of the effects on roads of the Regional Government of Extremadura, infrastructure conditioning, etc., all of which is essential for the trains to begin running on the new infrastructure. The doubling of the track between Cáceres and Mérida, the control, command and signalling installations, telecommunications, the electrification of the line and the remodelling of four stations on this route are the latest works in which Ineco is currently involved.

A ROUTE ALONG THE ANCIENT ROMAN SILVER ROUTE

The Plasencia-Badajoz section, with a total length of 144.5 km, is the main axis of Phase 1 of the commissioning of the line. It has been designed with a platform for standard-gauge double track and mixed traffic, except for the Mérida-Badajoz section, which will be put into service with a single track. It passes through a large part of the province of Cáceres, on a route that in the section from Plasencia to Mérida runs parallel to the A-66 highway, the Ruta de la Plata, a modern testimony to a section of the ancient Roman road that crossed Extremadura from north to south.

The Tajo and Almonte viaducts, the latter having received several awards as the world's longest arch-railway bridge, and the Santa Marina tunnel are the most notable individual works in this section. Experts from Ineco directed the work on this tunnel and are managing the works on the Plasencia, Cáceres, Mérida and Badajoz stations, for which they designed the remodelling projects.

CONSTRUCTION WORKS: PLATFORM AND TRACK INSTALLATION

The platform has been completed except for the sections of the Mérida bypass that are not included in Phase 1. In regard to track installation, the Mérida-Badajoz section has been completed, along with the installation of track 1 of the Cáceres-Mérida section, both in single track. The installation of the Plasencia-Cáceres section is more than 90% complete, and construction of Track 2 of the Cáceres-Mérida section began in February 2020.



Track assembly work on the section between Plasencia and Cáceres in October 2019.



The imposing Almonte viaduct (996 m long) is part of the new Madrid-Extremadura high-speed line between Plasencia and Cáceres, passing over the Alcántara reservoir with a concrete arch spanning 384 m, making it the world record holder for railway spans.



PHOTOS: INECO FOR ADIF ALTA VELOCIDAD



THE NEW HIGH-SPEED LINE BETWEEN PLASENCIA AND CÁCERES HAS BEEN DESIGNED WITH A PLATFORM FOR STANDARD-GAUGE DOUBLE TRACK AND MIXED PASSENGER AND FREIGHT TRAFFIC

	PLASENCIA CÁCERES	CÁCERES-MÉRIDA		MÉRIDA BADAJOZ	TOTAL
		TRACK 1	DOUBLING		
Length of double track (km)	58.94	-	-	-	58.94
Length of single track (km)	8.59	41.54	42.83	36.10	129.06
Rail (m)	251,640	82,980	87,410	72,100	494,130
Sleeper (units)	212,028	72,231	76,167	60,288	420,714
Expansion devices ED	26	1	1	2	30
Junctions	12	5	12	2	31

Most significant figures for the new infrastructure.

THE TECHNICAL CONSTRUCTION CHALLENGES

The implementation of electric welding and the new method for rail unloading

Track installation involved the application of techniques that are rarely used in Spain, such as electric welding right on the track using mobile equipment, a procedure used with the high-speed line to Toledo and on the high-speed line between Makkah and Madinah in Saudi Arabia. This system produces higher quality, more durable welds than those produced by aluminothermic welding, aiming to achieve the goal of 'zero maintenance'. The work is completely automated and if executed sequentially with stress neutralisation, both activities can be optimised.

The systematisation of the electric welding procedure with mobile equipment presented a major challenge. After supervising the execution of more than 1,400 welds and the subsequent performance analysis, the information gathered by Ineco made it possible to compare the technical work procedures associated with this activity with existing procedures. This experience could potentially lead to an improvement in projects and technical reference documents, in line with the company's Strategic Plan ATENEA 2019-2022.



In addition to the rail supplied by rail trains in 270-metre bars, rail in 108-metre bars was supplied on conventional platforms consisting of two sextets, which required the development of a new unloading procedure to optimise work performance.



The Santa Marina tunnel was waterproofed using a non-conventional system in order to provide completely watertightness.



The Santa Marina tunnel crosses the regional Alentejo-Plasencia fault, one of the largest on the Iberian Peninsula. Ineco managed the construction of the 3.4 km tunnel that passes through the Los Castaños pass.

UNIQUE INFRASTRUCTURES

Santa Marina, the longest tunnel on the line

The line between Plasencia and Badajoz has two tunnels totalling 4.4 kilometres in length, with 3.4 kilometres corresponding to the Santa Marina tunnel, in addition to its 1.5 kilometres of evacuation galleries. Located halfway between Plasencia and Cáceres, this tunnel crosses the Sierra de Santa Marina and is designed for high-speed double track and mixed traffic.

The tunnel was built using the New Austrian Method, has a waterproofing system that uses PVC membranes and a concrete lining. The waterproofing was done using an unconventional system, with sections of reinjectable double PVC membrane, to provide it with a high degree of watertightness to allow the recovery of the aquifer in the mountain range.

MADRID-EXTREMADURA-PORTUGUESE BORDER HIGH-SPEED LINE

The Plasencia-Badajoz section, with a total length of 144.5 km, is the main axis of Phase 1 of the commissioning of the line.



22 viaducts totalling over nine kilometres

The line has a total of 22 viaducts totalling more than nine kilometres. The most important viaducts are the ones crossing the Tajo and Almonte rivers in the section between Plasencia and Cáceres. The Almonte viaduct holds the world record for arch bridges and the Tajo viaduct is a close second in terms of span, with both representing outstanding feats of engineering.

The Almonte viaduct, awarded the prestigious Gustav Lindenthal Medal, crosses the reservoir using a long concrete arch with an upper deck and a main span 384 m long, making it the world's longest high-speed concrete arch bridge.

Designed by Spanish engineer Juan José Arenas and built by the Spanish-Portuguese consortium FCC Construcción-Conduril, this structure respects the habitat of the Alcántara reservoir, following the measures indicated in the EIS with maximum respect for the surroundings and the environment, including corrective measures to restore the environment and landscape and to facilitate the crossing of the infrastructure by

the fauna. The viaduct also included the installation of innovative bird screens, which reduce wind thrusts on the structure, causing the birds to ascend in flight to avoid colliding with the trains.



In addition to the Almonte and Tajo River viaducts, the Vadetravieso viaduct, 1,596 metres long and crossing the river with the same name, is also worthy of note.



PHOTO: IGNACIO FERRE PÉREZ (FLICKR)

74.1% of the territory of the Region of Extremadura has been declared an Important Bird Area.

WILDLIFE AND ORNITHOLOGY REPORTS

The richness of the natural habitat of the region of Extremadura, its pastureland and natural parks –including the Monfragüe, Cornalvo, and Los Barruecos natural parks– are areas of exceptional beauty and refuge for a multitude of birds and other species. From white storks to protected black storks, golden eagles, griffon vultures, kestrels, grey herons, spoonbills, and bustards, 74.1% of the territory of the Autonomous Community of Extremadura has been declared an Important Bird Area.

The works pass through areas with different degrees of protection: A Special Bird Protection Area (SPA), a Site of Community Interest (SCI) –also known today as a Special Conservation Area (SCA)–, a Habitat of Community Interest and an IBA (Important Birds Area). Studies and preventive and corrective measures for the environmental impact were therefore required, which meant biological stops, population control reports, monitoring of the barrier effect, monitoring of lek mating areas, control of seeded crop areas, etc. Ridges were also built to protect wildlife, which uncovered an archaeological site with a building covering more than 500 square metres, an environment that was studied, catalogued and protected. ■



Works on the AVE to Extremadura uncovered important archaeological sites. In the image, a group of rooms attributed to the Tartessian period, around the 6th century BC, discovered at the top and on the southern side of a hill located 500 m north of the Salor River, 10 km south of the city of Cáceres.

INECO PREPARED MONTHLY REPORTS ON THE BARRIER EFFECT ON WILDLIFE CROSSINGS AND THE EFFECT ON BIRD LIFE IN SENSITIVE AREAS SUCH AS THE LLANOS DE CÁCERES Y SIERRA DE FUENTES AND THE EMBALSE DE ALCÁNTARA SPECIAL BIRD PROTECTION AREAS



The pasture lands and natural parks of the region of Extremadura provide a rich natural habitat. In the image, connection branches to line 530 in the Monfragüe Biosphere Reserve.

Electrification comes to Extremadura

Ineco is leading these works in the Plasencia-Badajoz-Portuguese Border section, the first electrified section in this region, with the process to be continued in the future to connect to Madrid.

By **Pilar Calzada**, construction manager catenary works



The excavation work, installation of rebar and pouring of foundations for the posts, gantries and overhead line anchors represented a milestone in the history of the Extremadura railway.

Extremadura was the only region in Spain without a single kilometre of electrified track; not for metro, tram, or conventional rail, let alone high speed. Work is currently progressing on the electrification of the Plasencia-Badajoz-Portuguese Border section, both on the overhead contact line and its associated systems and on the traction substations and transformer substations.

These works are being carried out on the 125-kilometre stretch between Plasencia and the Peñas Blancas split, approximately 15 kilometres north of Mérida. Approximately 4,200 catenary posts will

THE CATENARY WORKS WERE DIVIDED INTO FOUR AREAS, COVERING A TOTAL OF 125 KM OF TRACK

be erected in this section, covering some 105 kilometres of double track and 20 kilometres of single track, with two railway stations: Plasencia and Cáceres.

In addition, in regard to the conventional network that complements the

high-speed network, work will be carried out on the Monfragüe-Plasencia line (between the Plasencia junction and Plasencia station), Madrid-Valencia de Alcántara (between the junction with the high-speed line section and Cáceres station) and on the Aljucén-Cáceres line (junction with the high-speed platform of the Cáceres-Aldea del Cano section and Cáceres station), as well as the southern branch of Cáceres. This project also includes the electrification of stations, sidings (PAET) and block stations (BP).

In the Plasencia station, tracks 1, 2 and 3 will be electrified, and in Cáceres



The overhead line catenary, designed by Ineco engineers, is an interoperable C-350 type overhead catenary system, suitable for running at 350 km/h, according to the regulations and specifically, the TSI for the energy subsystem and the UNE EN-50119 standard, which means that electric trains can run from Extremadura to Europe. In the image, work laying aluminium cables (negative feeder and return cable) along the 42 km section of track between Cáceres and Peñas Blancas.

station, tracks 1, 2, 5 and 7. The block stations will be electrified at the Terzuelo split and at KM 46/308, as well as at the Aldea del Cano PAET. Work and maintenance of the electric traction substations and auto-transformer substations on the Plasencia-Badajoz section is also underway. This work includes the energy installations required for the 2x25 kV electrification of the Plasencia-Badajoz section, which are mainly the Cañaveral (Cáceres), Carmonita and Sagrajas electricity substations (both in the province of Badajoz). In addition to these substations, there are a total of 12 associated auto-transformer substations.

Meanwhile, Adif has already started the bidding process for the electrification of the section between Mérida (Peñas Blancas) and Badajoz, which requires technical approval once it has passed the environmental procedures. ■

THE OVERPASSES AND TUNNEL ENTRANCES ARE EQUIPPED WITH LOGYTEL FALLING OBJECT DETECTORS (FODS), WHICH TRIGGER TRACKSIDE SIGNALS IN THE EVENT OF AN ALARM



FOD, based on a fibre-optic network that generates an alarm and closes of the nearest trackside signal when it is interrupted.

From phone blocks to Full Supervision

The renovation of the railway installations in the Plasencia-Cáceres and Mérida-Badajoz sections is combined with the implementation of the national network's most efficient and advanced protection and traffic control systems on the new infrastructure in the Plasencia-Badajoz section. Ineco is providing the experience that it has acquired on high-speed lines in Spain to provide technical assistance for the traffic control installations.

By the **Technical Assistance** team of the Construction and Signalling Maintenance Area Management

The ultimate goal of the work on the control, command and signalling installations, for which Ineco is providing technical assistance to Adif Alta Velocidad, is to outfit the Plasencia-Badajoz-Portuguese Border section with the ERTMS Level 2 train protection system, which will make it possible to travel at the maximum commercial operating speed of 300 km/h in the region for the first time.

Previously, Extremadura had a single unelectrified track that still included routes with telephone blocking and

mechanical interlocking, which is why the modernisation of the installations to adapt them to the new standards required on high-speed lines (unifying them with the new platform sections), poses a more than obvious challenge and constitutes the greatest technological leap forward undertaken in the railway sector at a national level.

To guarantee this, an intermediate phase of renovation of the installations has been designed that will allow the Plasencia-Badajoz section to be put into operation under the protection of the digi-

tal ASFA system at a maximum speed of 200 km/h. This initial phase will result in a significant increase in safety, capacity and regularity of operation, since it will have double track along practically the entire route, eliminating telephone blocks and centralising control and management of the line at the Seville control centre.

The signalling installations are based on interlockings, together with their intermediate blocks, which allow the safe movement of the trains through the application of SIL 4 systems. The solution designed for the railway network on the



Signalling equipment, detection systems, energy supply and distribution and telecommunications require specific buildings. This high-speed line has 19 shelters and three technical buildings (Plasencia, Cáceres and Guadiana), which were supervised entirely by Ineco's technical assistance team. In the photo, the technical building in Cáceres.



LED signals.

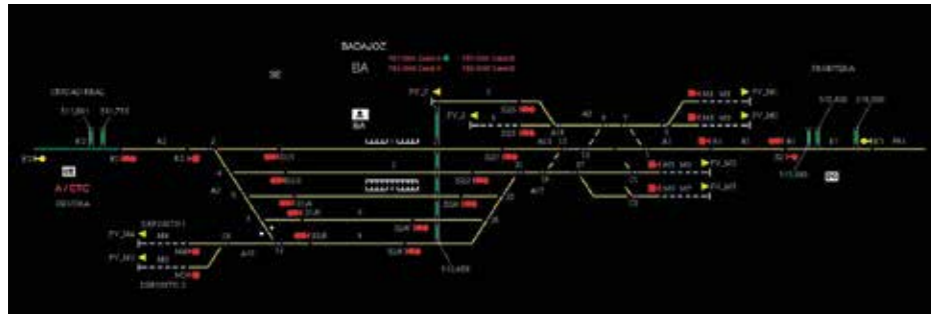
Plasencia-Badajoz section has electronic interlockings based on Alstom's Smartlock technology, with BAB and BLAU automatic block systems. In order to facilitate future maintenance, the interlockings are being upgraded. Some of the interlockings are electrical or even mechanical, as in the case of the Cañaveral or Aldea del Cano installations, which are still operated with a telephone block and will be replaced by a BAU type block. This equipment consists of six electronic interlockings located in Plasencia, Cañaveral RC, Cáceres, Mérida, Guadiana and Badajoz,

supported by train detection systems installed in the field (Bombardier EBITRACK 400 coded audio frequency track circuits and Frauscher axle counters), Modular LED trackside signals from ICF, ASFA digital balises from Indra and Siemens MD2000 single-phase electric point machines to replace turnouts and derailleurs still equipped with manual switch stands, and Thales three-phase point machines for turnouts on the new platform.

Unlike other lines, the energy system designed in this project includes a main supply from the electricity com-

pany at all locations, using the overhead line as a backup system. This solution, combined with the inclusion of medium voltage networks as an alternative supply in certain sections, makes it possible to minimise the number of emergency power generator sets to be installed. This all results in a more stable, efficient and clean power supply, reaffirming the railway's commitment to reducing greenhouse gas emissions.

These unique features, together with the particularly rich and protected environment, add to the complexity of Ineco's



VIDEOGRAPHIC OF THE BADAJOZ STATION. The signalling and communications installations are part of a complex network that enables trains to run on a line with total safety.

work, which ranges from the drafting of the basic projects, environmental and expropriation documentation, inspection and testing of systems in the field, to the final supervision of the process of powering the installations, not to mention providing advice on the legalisation and contracting of the supplies.

As a final complement, the deployment of the Bombardier ERTMS Level 2 system is planned for the installations of the new line between Plasencia, Cáceres and San Nicolás split, as well as on the line between Mérida and Badajoz. This train protection system is managed through two RBCs located in Cáceres and Badajoz, which are in constant communication with the electronic interlockings supported by the GSM-R mobile communications network, and grant movement

authorisations to the trains on the lines that they protect.

The Santa Justa control centre in Seville will provide support for the centralised control and efficient operation of these installations. The Thales CTC will unify the remote control of the interlockings of lines L026 (Plasencia-Cáceres-San Nicolás split), L500 (Monfragüe-Casar de Cáceres triangle) and L520 (Villanueva de la Serena-Badajoz), which was previously distributed between the Chamartín and Manzanares CTCs. A new Bombardier ERTMS central control station will be responsible for controlling this train protection system, and a new Indra remote control for auxiliary detection systems will provide operators with all the necessary information regarding the falling-object detectors. ■

INECO IS PARTICIPATING IN THE DRAFTING OF THE BASIC PROJECTS, ENVIRONMENTAL DOCUMENTATION, EXPROPRIATIONS, FIELD TESTS, LEGAL ADVICE AND FINAL SUPERVISION

MODERNISATION OF CONVENTIONAL LINES

In parallel with the construction of the new line, Adif is also renovating its conventional lines, replacing material in some sections and refurbishing level crossings. The aim is to improve the track superstructure, unifying conditions to adapt them to the rail traffic demands. The work involves the improvement of the reliability, safety and quality of the track, reducing the level of incidents, increasing traffic speed and reducing travel times. In future editions of Ineco's magazine, experts will describe the different conventional-track works being carried out, such as the completed works on the Aljucén-El Carrascalejo section, or the projects in the Monfragüe-Plasencia section that will soon be opened for tenders. Planned works include the renovation of the track superstructure, construction of walls, ballast retaining walls and service walkways, and platform drainage improvements.



NEW FIXED AND MOBILE INSTALLATIONS

Work is currently underway on the Plasencia-Cáceres section. The civil works and laying of the optical fibre in the fixed telecommunications installations have been completed, as well as the civil works and installation of the mobile communications equipment between Cáceres and Badajoz. Other projects to be carried out after the commissioning of Phase 1 include:

- ▶ Renovation of the track between the Monfragüe and Plasencia stations.
- ▶ Doubling of the track between Mérida and Aljucén.
- ▶ Renovation of the track yard and accesses to the stations of Cáceres, Mérida, Aljucén and Badajoz.
- ▶ Connection of the Montijo station to the HSL.
- ▶ Reconfiguration of the splits at La Isla (Mérida) and San Nicolás (Badajoz).
- ▶ Remodelling and sustainable integration of the Navalmoral de la Mata station.
- ▶ Signalling and telecommunications installations on the doubling of the track in the Cáceres-Mérida section, final location of the Mérida bypass and renovation of the track yards at the stations.
- ▶ Logistics platforms in Mérida and Navalmoral de la Mata.



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A FORWARD-LOOKING APPROACH

Sustainability, understood in a broad sense, is one of the pillars of Saudi Arabia's national strategies for a less oil-dependent economic future.

A sustainable oasis in Dammam

Ineco has drafted the Sustainability Management Plan for King Fahd International Airport in Dammam, Saudi Arabia, for the Dammam Airports Company (DACO). Improving waste management and reducing water and energy consumption, as well as prevention of soil contamination, are key concerns.

By **Elena Curto**, biologist, and **Irene Donaire**, industrial engineer

Saudi Arabia, like other countries in the region, is rethinking its future as an economy less dependent on its main natural resource, oil, of which it is a world leader in production and export. Consequently, starting in 2016, the Government has been implementing social and economic reforms such as those contained in the National Transformation Plan and in 'Vision 2030', a national strategy in which sustainable development, understood in the broader sense –to include social, economic and environmental development– is one of the pillars. This is the context of the Sustainability Plan for the country's third airport, King Fahd of Dammam, which Ineco developed in 2019 for the Dammam Airports Company (DACO).

The work consisted of carrying out an environmental assessment, identifying the objectives and proposing the actions and measures to achieve them, in addition to monitoring implementation and supervising the actions. This is Ineco's second project for Dammam airport, following the Master Plan completed at the end of 2018, and it is currently working on an automated baggage-management system. Ineco has extensive experience gained over more than 15 years working in Spanish airports.

In order to develop the Sustainability Plan, Ineco's team's first step was

to gather information, which included visits to the facilities and meetings with both airport staff and other stakeholders involved: airlines, handling companies, cleaning and service companies, etc.

The information collected was used to draw up an assessment of the environmental situation at the airport and to define the key aspects to be studied and the level of risk presented by each one: water and energy consumption, soil contamination, noise and air quality, impact on cultural heritage and the landscape, waste management, biodiversity, etc.

Once all of these elements had been analysed, the five key topics were outlined and the sustainability objectives to be achieved for each of them were defined, with a time horizon of 2030, the same target year as the national strategy 'Vision 2030'. After the objectives of the plan had been defined, the most appropriate actions to achieve them were proposed and planned.

Lastly, the implementation, tracking and monitoring of the plan, which is vital to its success, were planned. The proposed tools to achieve this include a website developed by Ineco and hosted on DACO's systems, which covers the different monitoring indicators of each of the actions, and the creation of several monitoring groups, made up of both technical and management staff. ■

A SNAPSHOT OF KING FAHD AIRPORT

King Fahd International Airport was opened to commercial traffic in 1999. It is the largest airport in the world in terms of surface area, covering a total of 780 km² (although only about 37 km² are used). It sees annual traffic of more than 10 million passengers, almost 111 million kilos of cargo and more than 93,000 flights. It is located approximately 20 kilometres northwest of the city of Dammam. It is the country's third largest airport, behind the airports in Jeddah and Riyadh, the capital.

It has a passenger terminal for public use and another terminal reserved for the Saudi Royal Family, a large cargo area (Cargo Village) of 39,500 m² opened in 2015, a control tower with a height of 85.5 metres and two parallel runways (34R-16L and 34L-16R), each 4,000 metres long, as well as two parallel taxiways and one crossroad.

ENVIRONMENTAL ANALYSIS OF KING FAHD AIRPORT

The following elements, ranked in decreasing order of environmental risk, were analysed:

1. Key points: soil, waste and water

► SOIL

Goal: to preserve soil resources and prevent pollution and degradation of the subsoil and groundwater.

Situation and proposed actions: the King Fahd airport is constructed on ground that is made up of sandy limestone, marl, gypsum and beachrock (a type of sedimentary rock), porous materials that allow pollutants to pass through in the event of a spill. It is therefore recommended that all fuel storage tanks be checked and monitored to prevent any leaks or potential spills.

► WASTE

Goal: to reduce waste generation and improve management.

Situation and proposed actions: for solid waste, increasing the efficiency of storage, collection and separation is recommended, in addition to encouraging waste reduction and recycling. With regard to hazardous waste, the execution of an appropriate inventory of the type, storage, flow and quantity of waste is recommended in order to control and improve the disposal process.

► WATER

Goal: to improve water management and control to reduce consumption.

Situation and proposed actions: the airport is supplied by five wells, each with a capacity of 8,200 m³ per day, one of which is used exclusively for irrigation, drawing directly from the groundwater. The water from the four main wells passes through the Water Treatment Plant (WTP) and is then distributed to all of the facilities via the central pumping station (UBB). According to data provided by DACO, the total consumption of the airport in 2018 was 4.3 million m³, of which almost 3 million m³ was previously treated. With regard to the wastewater, the airport manages this very well through its sewage net which ends at a Sewage Treatment Plant (STP) to treat wastewater for subsequent reuse for irrigation.

One of the airport facilities with the highest water consumption is a large plant nursery covering more than 215,000 m², where all of the plants used for the landscaping of the airport are grown. This nursery is supplied mainly from the STP.

The Plan acknowledges that efficient management of groundwater in arid countries is an important factor in sustainable development and, to this end, recommends monitoring consumption as much divided as possible to control over the use of this resource. DACO is currently working on a new water meter installation project for each facility (phase one has already been completed and phase two is planned and underway).

2. Medium risk: air quality, fauna, energy, climate change and mobility

► AIR QUALITY

Goal: to comply with the air quality limits established in air-pollution legislation.

Situation and proposed actions: the main sources of emissions at the airport are aircraft, auxiliary power units (APUs), followed by ground support vehicles, as well as private cars for employees and passengers. All of these emissions are generated by third parties. Activities carried out by DACO that generate emissions are mainly the emergency power units (which run on fossil fuels), the vehicles used by its staff, and fire training activities. The readings collected by the monitoring stations are verified for the air quality assessment. In the case of King Fahd airport the closest stations are more than 30 kilometres away, so the Plan proposes an air quality monitoring station located closer that would make it possible to collect information that is more representative of the airport.

► FAUNA

Goal: to minimise the impact on natural areas and protected species.

Situation and proposed actions: due to its location in a desert area, the main terrestrial species that live around the airport are camels, birds, reptiles, snakes and lizards. The most recent records provided by DACO, from 2018, regarding the presence of animals within the airport premises include cats and foxes. Since there is a wetland within the airport limits that attracts animals, including migratory birds, the Plan recommends the implementation of a wildlife control service to avoid potential incidents with aircrafts.

► ENERGY

Goal: to increase energy savings and efficiency.

Situation and proposed actions: the approximate electricity consumption of the airport in recent years is 230,000 MWh/year, according to DACO data, with 30% attributed to the cost of the air-conditioning plant. In terms of fuel, the main consumers are the vehicles owned by DACO, power units and fire exercises. The main recommendation of the Sustainability Plan is metering and controlling energy consumption with the installation of individual meters, at least for the largest consumers.

► CLIMATE CHANGE

Goal: to monitor and reduce greenhouse gas emissions.

Situation and proposed actions: in order to combat climate change, it is essential to reduce the greenhouse gas (GHG) emissions generated by the airport's installations and activities.

The Plan recommends measuring energy consumption and monitoring possible refrigerant leaks in air conditioning systems.

► TRANSPORT AND MOBILITY

Goal: expand the mobility options to connect the airport to the city.

Situation and proposed actions: since King Fahd airport can only be reached by private transport or private vehicles, the implementation of some form of collective transport system is recommended, providing significant advantages for passengers and airport staff, as well as generating environmental benefits in terms of air quality and climate change.

3. Low-impact: noise, biodiversity, land use, landscape and cultural heritage

► NOISE, FLORA AND PROTECTED AREAS

Goal: to prevent and reduce damage to human health and ecosystems caused by noise pollution and to preserve flora and protected areas.

Situation and proposed actions: in all three aspects, the environmental risk is considered low since there are no residential areas around the airport; the natural vegetation cover is less than 10% of the surface area and the nearest protected areas (the Jubail marine area and the Bay of Kalij) are located 35 and 96 kilometres away, respectively.

► LAND USE

Goal: to ensure the compatibility of the airport development with urban planning.

Situation and proposed actions: all of the land belonging to the airport is classified as an airport/sea port, so no environmental improvement measures are required.

► LANDSCAPE

Goal: to minimise the impact on the landscape.

Situation and proposed actions: the airport buildings and facilities are well integrated into the environment.

► CULTURAL HERITAGE

Goal: to ensure the preservation of cultural heritage.

Situation and proposed actions: there are no places of cultural interest near the airport, so the airport activity is therefore considered to have no effect on such places. The closest UNESCO cultural heritage property is the Al-Ahsa Oasis, which is located 124 kilometres far from the airport.

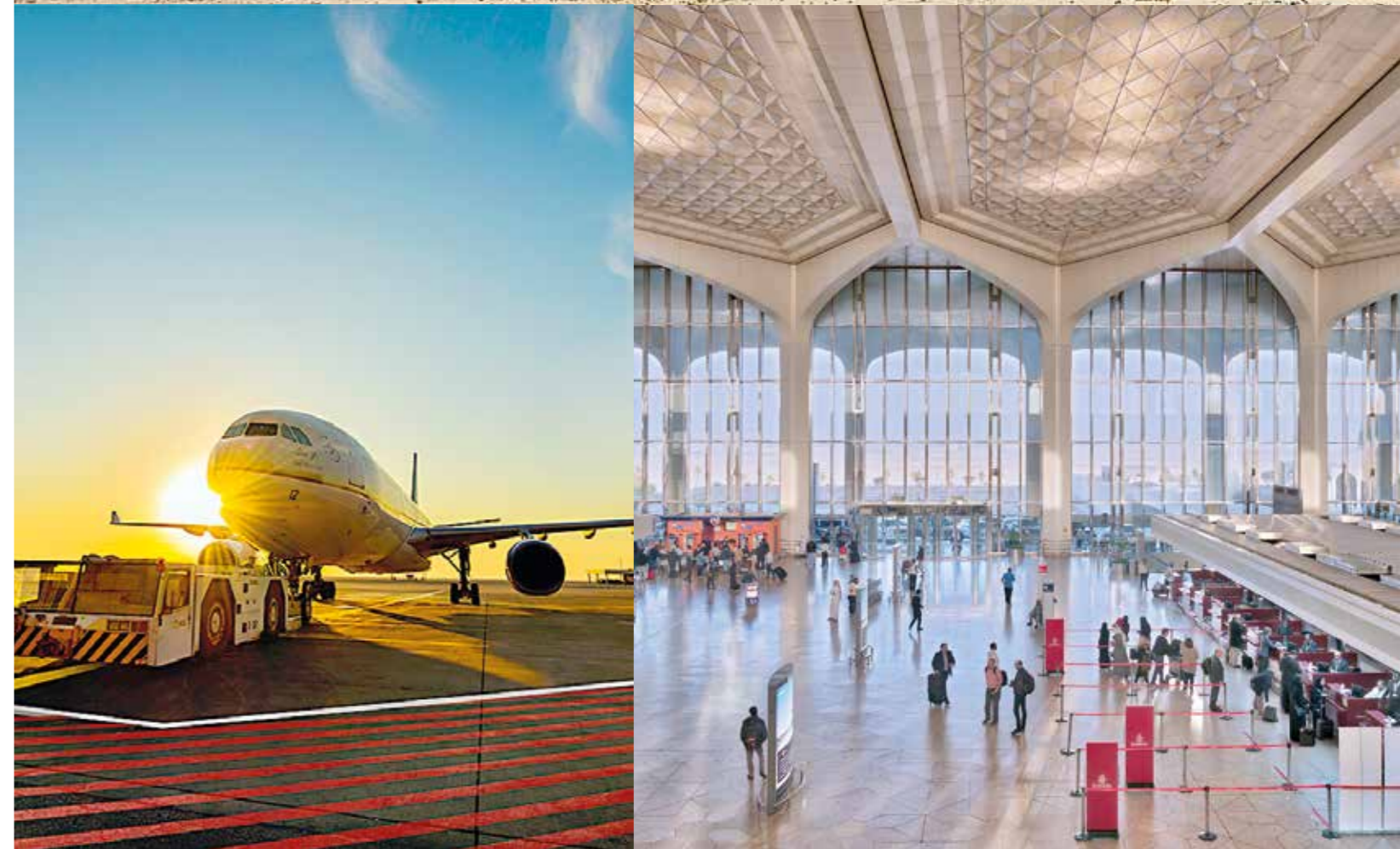


PHOTO_INECO + DACO

A LARGE AIRPORT IN A DESERT ENVIRONMENT

In the photo above, one of the key facilities for the operation of King Fahd Airport: the Water Treatment Plant (WTP), which processes about 3 million litres per year.

In the photos below, runway and interior of the terminal, which handles more than 10 million passengers each year. The Sustainability Plan proposes the implementation of some form of collective transport system to improve connection mobility.



PHOTOS_DACO

Everything a passenger could need

Ineco developed a commercial master plan for the international airport in Vilnius, the capital of Lithuania. The plan provides a proposal for optimising the offering, location and design of commercial premises, which will improve passenger service and have a major impact on the airport's revenues.

By **Eduardo Chércoles**, civil engineer
and **Pablo Egea**, aeronautical engineer

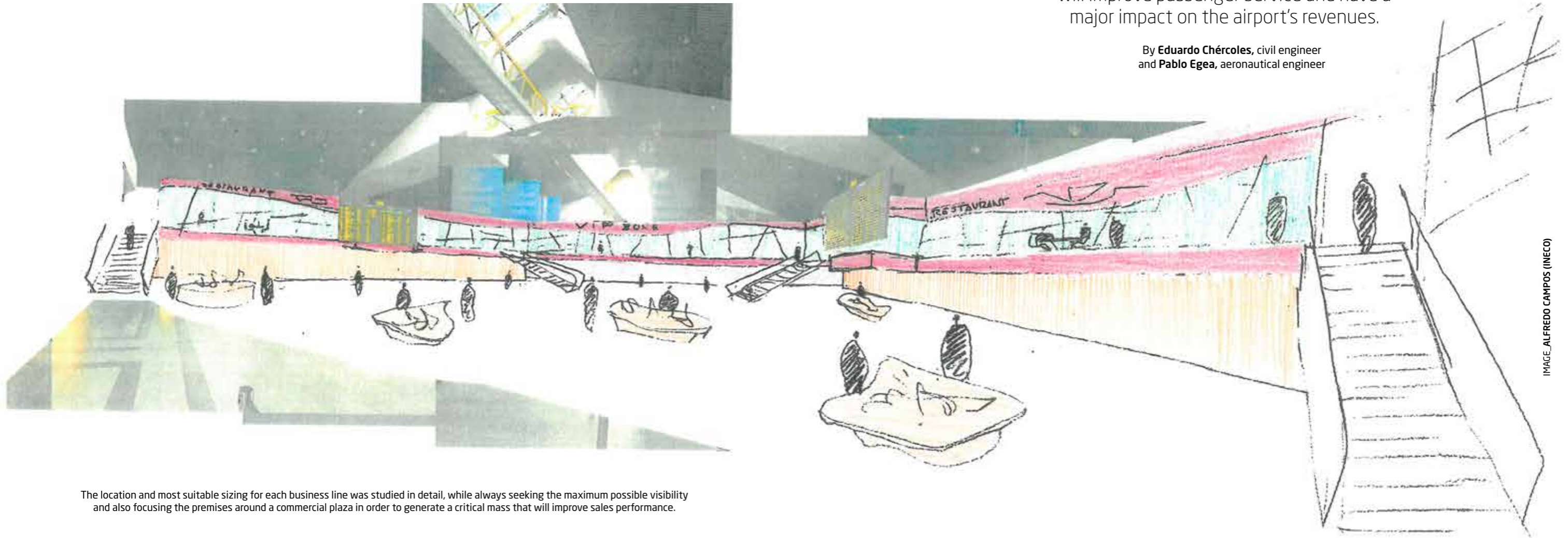


IMAGE: ALFREDO CAMPOS (INECO)

The location and most suitable sizing for each business line was studied in detail, while always seeking the maximum possible visibility and also focusing the premises around a commercial plaza in order to generate a critical mass that will improve sales performance.

Airport shops and restaurants play an important role in providing passengers with everything to meet their basic needs. A varied and large offering, with properly designed and attractive spaces, will make the overall passenger experience more pleasant, which will increase passenger spending and consequently, the airport will see an increase in revenue. Careful planning is required to achieve these objectives.

In 2020, Ineco completed a commercial plan for Vilnius International Airport, demonstrating the company's extensive experience in the development of commercial spaces in airports, the result

of almost two decades of collaboration with the airport manager Aena, and other projects carried out at the Luanda and El Salvador international airports, among others.

The work was developed in three phases, starting with the analysis of the characteristics of the airport such as its passenger profile and an analysis of the existing commercial offering and an initial proposal for commercial sizing. In the next stage, different proposals for the distribution of spaces and the recommended commercial mix were drawn up. All of this ensures compliance with IATA technical recommendations, especially with respect to spaces

in boarding lounges. Lastly, the general guidelines for functional interior design and the homogeneous and attractive façade design were presented, along with the general technical requirements for supplies and services. At this stage, a detailed business plan was presented for each of the commercial premises, including calculations of the necessary investments, operating costs, expected revenues and returns, as well as a proposal for fees and concession periods.

PORTRAIT OF AN AIRPORT

Vilnius International Airport, managed by the state-owned Lithuanian Airports, is the country's

busiest airport. In 2019, it surpassed 5 million passengers and has experienced significant growth in recent years. The terminal is the product of three distinct architectural stages (1954, 1987 and 2007). According to the analysis performed, the three buildings are well integrated architecturally, with a bright interior space and high ceilings. The biggest problem detected was congestion, which is why a third expansion will be carried out in an annexed area, called T4, where the check-in and security processes will be carried out in the future, leaving the entire area of the existing terminal for boarding.

The existing commercial area totals about 3,600 m², which is equivalent to about 724 m² per million passengers. The airside/groundside distribution is 79%-21%, which is considered adequate and within the reference values. This is because passengers spend more time airside. Architectural constraints determine where the passenger flow, which has been studied in detail, will move since this defines the layout of available offerings. In this initial stage, Ineco's consulting team also analysed the airport's operational and socio-demographic profile, the concessionaires and the passengers, 40% of whom travel for leisure, which means that, unlike business passengers, they arrive at the airport earlier and spend more time there. Another factor analysed in phase one of the plan was the sizing of the commercial area of Vilnius airport, calculating the square metres of commercial space per million passengers.

LOCATION IS (ALMOST) EVERYTHING

In the second stage of development of the commercial plan, Ineco's team prepared a design of the distribution of the different spaces or layout, with several alternatives, and a proposal of the most suitable and balanced set of business lines for Vilnius airport, known as the commercial mix. This was done based on the walk-through duty-free stores in Dubai, Sydney, Madrid or Barcelona, among others, and the latest trends in retail and F&B (Food & Beverage) areas at reference airports in European cities such as Amsterdam, Frankfurt or London, and other nearby cities with similar culture such as Copenhagen, Riga or Tallinn. The commercial offering of the city of Vilnius was also studied, where the sale of one of the most typical national products of Lithuania – amber – stands out.

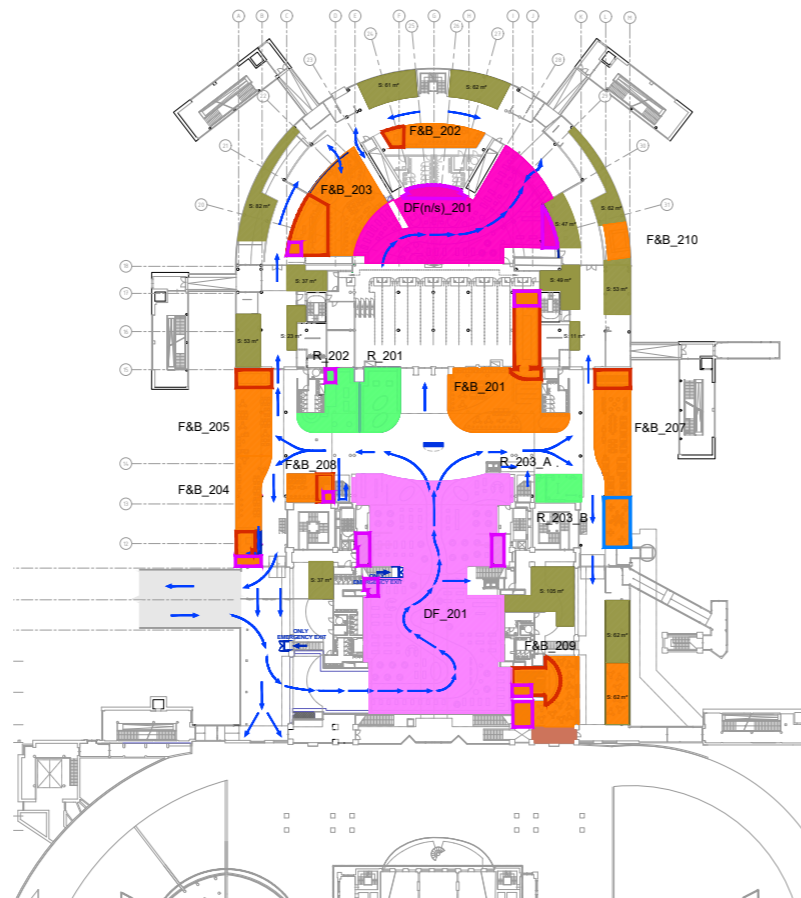
The walk-through store concept has spread to airports around the world and is considered the most commercially effective design. Nowadays, at the Vilnius airport, there is already a quite new and modern duty free walk-through shop, although an inevitable flow split occurs there, which, together with the small size, limits its potential. The proposal is therefore to improve the location and size of the shopping area, increasing it to around 1,500 m². The existing retail offering in Vilnius is minimal, so the proposal is to improve it in terms of variety to enhance the shopping experience. In addition, updating to follow some of the latest trends is also recommended, such as speciality retail shops that encourage shopping by offering a distinctive product: the Ferrari shops in Italian airports, the tulip store at Schiphol or the gold jewellery store in Dubai, for example.

As far as F&B areas are concerned, increasing the passenger's 'perception of choice' is also recommended, since the larger the perceived variety, the greater their satisfaction and therefore the more they will end up spending. Recent restaurant trends that have been studied at major European airports include food trucks, 'local flavours' (branches of popular local restaurants), 'farmer's markets' for local and seasonal products, to-go gourmet meals for in-the-air consumption (grab&go), celebrity chef restaurants, high-tech restaurants equipped with tablets for business passengers, pop-up restaurants and sports bars. There is also a trend towards food-courts, common areas shared between several nearby F&B points, which enhances the perception of variety, especially in terminals with limited space as is the case in Vilnius.

The location and the most suitable sizing for each business line have been studied in detail, while always seeking the maximum possible visibility and also clustering the shops around a commer-

INECO
DESIGNED THE
MOST SUITABLE
LAYOUT AND
COMMERCIAL
MIX FOR THE
ENLARGEMENT
AND REMODELING
OF VILNIUS
AIRPORT

Commercial design of the main floor, with the proposed distribution of retail, F&B and duty free areas, strategically located in the path of the passenger flow.



A COMMERCIAL MIX 'TAILOR-MADE' FOR VILNIUS

In the commercial mix proposed for Vilnius airport, the main recommendations include, among others, the incorporation of 'accessories & fashion' and 'electronic, sports and toys & games' categories in the duty free shop (or as an independent shop in some cases), as well as souvenirs and a delicatessen in the commercial plaza, all of which have high potential demand. The opening of an amber costume jewellery shop, just like those in the most emblematic streets of the city, is also recommended.

The implementation of 'bar/pub' and 'coffee shop' concepts, which are in high potential demand among passengers, is also proposed. The creation of a fast food point in the commercial plaza was also suggested, with an 'anchor', which could be an international burger brand, as well as other points that broaden the existing offerings, such as a Japanese restaurant or a bakery.



Mock-up of the future duty free walk-through, which is currently located in the check-in area. The open space concept, the lighting and the use of wood are the main features of the design, creating a cosy and attractive atmosphere.

ARCHITECTURAL DESIGN OF INTERIORS AND FAÇADES

In the third and final stage of the commercial plan, the interior designs of the commercial premises and a joint vision of the façades of the establishments were developed. Ineco's architectural team developed a façade design with up to eight types of sections, with the aim of homogenising the space and creating a welcoming ambience that will attract customers, in an architecturally integrated space. For instance, the undulating design of the stores avoids the feeling of an 'endless corridor', while in the other areas an open design invites customers who have little time to visit. For interiors, the use of floors that are suitable for intensive airport use, a bright display and clearly visible prices are recommended. In terms of materials, robust materials with high-quality finishes are recommended, and they should follow the same design trends applied in the new expansion, where the use of wood predominates.

Lighting is particularly important, since it helps to highlight the products, guide the customer through the store and create atmosphere. Ceilings are also very important as they serve to conceal conduits and wiring and together with lighting, are essential for creating visual effects. Flooring must be durable and at the same level as the terminal. The plan included design proposals for all of the stores included in the commercial mix.

The three main recommendations for the façades were to maintain the architectural merit of the space, to offer interesting and contemporary designs and to use the exterior as a showcase, taking special care with the front signage. Lastly, the plan includes general recommendations for the technical design in terms of the water and electricity supply, air conditioning, smoke extraction systems, fire protection systems and data connection. ■

cial plaza in order to generate a critical mass that will improve sales performance. The 'anchor' effect or attraction generated by F&B areas and some non-commercial services such as toilets, seating areas, children's playground, currency exchange, etc., which, regardless of their location, attract passengers by covering basic needs, was taken into account in the layout. Synergies between the different establishments were also considered: for example, jewellery shops are good 'neighbours' to perfume shops or upmarket restaurants, but not to toilets, while cafes are a good commercial fit next to establishments such as press or bookshops, as well as next to seating areas.

Another key to efficient commercial design is to maximise the time spent in the commercial area while reducing passenger stress: this is at its highest level just before boarding. Installing flight information screens with boarding notices in this area helps to reassure passengers, which improves their willingness to shop. In addition to this, it has been suggested that the boarding gates be announced at the required time, and not too early, in order to make it easier to remain in the commercial areas.

The leaders of Rail Baltica highlight the important contribution of this project to European industrial and commercial development, the strengthening of intermodal transport, and its contribution to regional development. In the image, a view of the city of Riga.

PHOTO: STEPHEN DOWNES (FLICKR)

A megaproject to unite three republics

The new Rail Baltica line will connect the countries of Estonia, Latvia and Lithuania along 870 kilometres and ultimately connect to the rest of Europe through Poland. Ineco is involved in several projects, including detailed technical design of the main line through Riga and in the North of Latvia.

By **Andrés Estévez, Jesús Galende, Luis Picazo** and **Silvia Sepúlveda**, project managers

THE KEYS TO RAIL BALTICA

- ▶ Largest infrastructure project in the Baltic region in the last 100 years.
- ▶ 870 km for passenger traffic and freight.
- ▶ An electrified line, which is environmentally friendly, and produces less noise and vibration.
- ▶ Top speed: 249 km/h (passengers), 120 km/h (freight).
- ▶ More than 5 billion euros of investment in the region.
- ▶ Part of the EU's TEN-T North Sea-Baltic Corridor.
- ▶ Financed by the EU (ERDF), Estonia, Latvia and Lithuania

The planned substations are similar to this one located in Tábara (Zamora), Spain.



PHOTO: INECO

OPTIMAL ELECTRIFICATION SOLUTIONS

The study of the energy subsystem for the entire line was Ineco's first contract with Rail Baltica. Awarded in consortium with Ardanuy, this is an in-depth analysis to assess the best available technologies and a design aimed at reducing life cycle costs.

The purpose of the study was to choose the optimal technological solutions for the different areas of the energy subsystem (traction, catenary and remote control substations), define how to tender the design and construction and specify the implementation strategy. This work gave Rail Baltica basic knowledge that will make it easier for it to deal with the upcoming design and technical assistance tenders.

ENERGY, STEP BY STEP

- ▶ Energy demand studies.
- ▶ Electricity power analysis and estimate for distribution networks.
- ▶ Traction substations, overhead contact line and energy control systems.
- ▶ Implementation and procurement plan.

A SUSTAINABLE CORRIDOR

The new railway line will bring not only economic benefits, but also significant environmental and social improvements.



Rail Baltica is northeastern Europe's most important project, a high-performance railway line that will extend over 870 kilometres across the three republics, thanks to an investment of 5.8 billion euros and will create nearly 36,000 jobs. The project involves five European Union countries: Poland, Lithuania, Latvia, Estonia and, indirectly, Finland. It will connect Helsinki, Tallinn, Pärnu, Riga, Panevėžys, Kaunas, Vilnius and Warsaw. Described by the Transport Ministers of the Baltic

Republics as the great economic recovery project, the truth is that the implementation of Rail Baltica involves a large part of the European railway engineering and construction sector, including Ineco, which to date has been involved in four projects that, in accordance with EU indications, are aimed at achieving technical compatibility of infrastructure, rolling stock, signalling systems and other systems and procedures for their full integration into the European railway network.



Existing facilities in Vilnius (Lithuania); visit made in February 2019. To the right, Luis Picazo and Manuel Corvo of Ineco.



WHERE SHOULD THE MAINTENANCE BASES BE LOCATED?

Experts from Ineco and Ardanuy carried out a study of the location and development of all the maintenance and assembly bases, in addition to studying the maintenance strategies for the future Rail Baltica line.

The project had four phases. Once the criteria, methods and details of the work had been established, a study was carried out focusing on five alternatives that included the location of the bases and the maintenance strategy for the line. The two best alternatives were selected based on a multi-criteria analysis that considered multiple parameters, including the option of control of the entire line under a single manager. The first alternative considered four bases along the line, and the second alternative, six bases. In both cases, the two alternatives considered a single manager for the entire line above the existing national administrations.

Lastly, the chosen proposals were developed with the intervention of architectural, layout, consulting, maintenance, installation and BIM experts, since all the work had to be implemented and integrated into a BIM model.

Other aspects such as spatial and environmental studies, the work plan and the economic-financial model were also included in the project. The work presented the challenge of designing the maintenance strategy on a high-speed line with mixed traffic in three different countries with different languages.

THE RIGA RING, THE MOST COMPLICATED URBAN STRETCH

The technical design of the 56-kilometres high-speed section through the city of Riga, the capital of Latvia, is the most complex stretch of the line since it passes through several densely populated municipalities and runs parallel to the rail corridor of the Latvian railways. Ineco and Idom were awarded this contract in July 2019.



The Riga Ring passes through the city and 7 of its municipalities along a 56-kilometre stretch.



The new section will improve road traffic in Riga, thanks to the design of higher capacity bridges and road junctions.

PHOTO: STEPHEN DOWNES (FLICKR)

The route is divided into three subsections (Design Priority Sections, DPS): Upeslejas-Riga Central (DPS 2); Torņakalns-Imanta (DPS 1) and Riga-Misa International Airport (DPS 3). Each of these has its own identity and completely different characteristics. DPS 1

is the most urban of the three sections, since it passes through the entire municipality of Riga, as well as areas with great heritage value. The route's only tunnel is located here in DPS 1. DPS 2 passes through Riga and Stopini, which is less urban than the previous stretch.

In this DPS, a major railway viaduct will be built over the Latvian railway circuit. Lastly, section DPS 3, the least urban of all, is characterised by intersections with various motorways generating multiple structures at these junctions. The project includes several improvements, includ-

ing track alignment in order to achieve the highest possible speed in the different sections, as well as improved permeability and safety in the city of Riga by generating more than a dozen pedestrian crossings (in the form of walkways or underpasses) that are suitable for pedestrians, cyclists and people with disabilities. Road traffic in Riga will also be improved, thanks to the design of bridges and road junctions with a higher capacity. The project has a completion time of 24 months and is adjacent to the work recently awarded to Ineco in Northern Latvia.

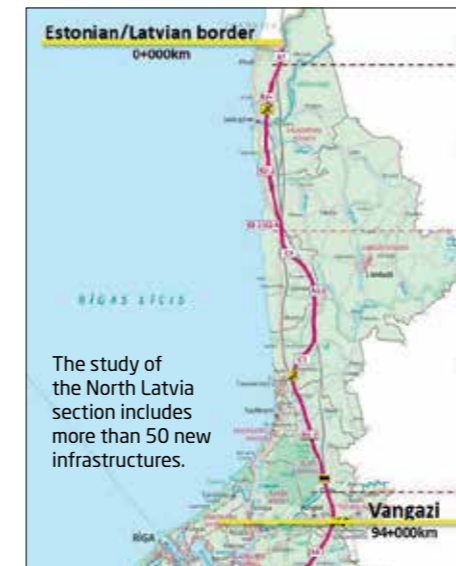
With more than 600,000 inhabitants, Riga is the most populated city in the Baltic States, and its geographical location makes it a strategic enclave for passenger and freight transport. Located at the mouth of the great Daugava River, a few metres above sea level, the city is one of the most important economic and financial centres in the Baltic region. As a result, in addition to the fact that it is a UNESCO World Heritage Site, this city and its surroundings are a major attraction for the population, and the improvement of its railway network is vital for its economic and social development.



Ignacio Fernández-Cuenca, managing director of Ineco, on the left, next to executives from Idom and Rail Baltica at the signing of the Riga Ring contract.

NORTH LATVIA, A LONG ROUTE THROUGH FORESTS AND WETLANDS

Ineco, in consortium with Ardanuy, will lead the design and supervision of the design during the construction of a 94-kilometre European-gauge stretch, which connects the city of Vangaži, northwest of Riga, and the border between Latvia and Estonia, in a contract worth almost 14 million euros.



The study of the North Latvia section includes more than 50 new infrastructures.



Image of the field study where the large railway viaduct over the Gauja River is to be located.

The recently-signed North Latvia contract is one of Rail Baltica's major railway projects and Ineco's fourth for this ambitious new infrastructure in northeastern Europe, which will integrate the Baltic States into the Trans-European Transport Network (TEN-t).

The preliminary estimates for this section include, in addition to three stations, large and complex new infrastructure such as 36 road viaducts, 3 ecoducts and 16 railway bridges, including the viaduct over the Gauja River, the largest of all of the lines, with a total length of approximately 1.5 kilometres and more than 150 metres wide, for which the consortium will be joined by the firm Carlos Fernández-Casado SL, which is renowned

ALL THE WORK THAT INECO IS CARRYING OUT FOR RAIL BALTICA IS BEING DONE WITH BIM TECHNOLOGY

for the design and supervision of large bridges and specialises in structures, some of which are among the longest in the world.

The scope of the work is divided into two phases, the design stage, with an estimated duration of 30 months, and the construction supervision stage, with an estimated duration of five years. Ineco

will lead the project with the development of the entire railway section, in addition to the complete design of roads and geotechnical works. The entire project will be carried out with BIM, from the initial phases to study solutions and optimise the route, to the detailed design phases that will facilitate the execution of the civil engineering project. ■



More efficient freight in the EU

Land freight transport can play a key role in the UN's Sustainable Development Goals. For this reason, the EU recently approved measures aimed at promoting more efficient and sustainable transport with lower emissions.

By Carlos Bejarano and Francisco Ortiz, civil engineers

On 25 September 2015, 193 countries committed themselves to achieving the 17 UN Sustainable Development Goals (SDGs) by 2030. These SDGs are based on the values of responsibility, equality, sustainability and resilience, among others. Land freight transport could play a key role in achieving these objectives, since this is a sector that contributes to employment and the economy, connecting and enabling world trade, exchange between

consumers and producers and is closely linked to the economic development of countries.

The way in which this transport is developed is another key factor in achieving the SDGs, because transport services themselves, and the necessary infrastructure, can be directed towards more energy-efficient, lower-carbon emissions, more reliable vehicles and means of transport, and accessible and resilient infrastructure.

Within the framework of the European Union (EU) and in the railway sector, one example of measures and actions in alignment to help achieve the SDGs is the implementation of the Trans-European Transport Network (TEN-T). Its roll-out involves planning interoperable infrastructures that will eliminate existing inter-country connectivity problems arising from differences in technical specifications in each country, such as track gauge.

Specifically, Regulation 1315/2013 requires that infrastructure be electrified, have a standard track gauge of 1,435 mm, and allow trains with a minimum axle load of 22.5 tonnes, as technical requirements on the TEN-T Core Rail Network by 2030. At the same time, in the field of road transport, the EU recently approved a reduction in CO₂ emissions from lorries, which means that beginning in 2025, new lorries will be required to emit an average of 15% less than in 2018, with a reduction of up to 30% starting in 2030.

According to the latest available figures from the Observatory for Transport and Logistics of Spain (OTLE), the land freight transport market has a significant presence, accounting for 75% of the freight transported in and out of the country in 2018. The share in terms of tonnes of the land mode varies significantly depending on the area in question; in the case of international journeys, it drops to 20%, with maritime transport playing a more significant role.

In Spain, 96% of tonnes of freight are transported by road, the predominant mode of transport, as opposed to rail, which in 2018 accounted for less than 2% of freight and 4.3% of net tonne-kilometres for all modes of transport. However, rail freight transport is almost five times more energy efficient than road, in regard to the energy consumed with each tonne-km transported, according to data from OTLE.

The share of the rail transport mode in land freight transport in Spain has been decreasing since the second half of the previous century, when the conditions of the means of transport and road infrastructures improved significantly, leading to a loss of market share for railways that has continued until today. Similar declines, albeit to a more limited extent, have also occurred in neighbouring countries. In 1991, the tonnes-km of rail freight accounted for 10.7% of total demand, dropping to 6.8% in 2001.

Given the current situation of the railways, measures are being taken in terms of infrastructure and the updating of regulations, in line with those issued by the EU, as part of a global effort to promote efficient and sustainable means of transport. These include the construction of the Mediterranean Corridor, improvements to the conventional

IN SPAIN, 96% OF TONNES OF FREIGHT ARE TRANSPORTED BY ROAD, THE PREDOMINANT MODE COMPARED TO RAIL, WHICH MOVED LESS THAN 2% IN 2018

network and the development of a new gauge changeover system.

The Mediterranean Corridor is part of the trans-European corridor between Algeciras and Stockholm. It is 3,500 km long, covers 54% of the population of the EU and 66% of the GDP. It will enable the movement of people and freight by rail, generating opportunities and economic growth. In Spain, it runs through the Regions of Catalonia, Valencia, Murcia and Andalusia, connecting with European railway lines, including high-speed lines, and with the main Spanish ports on the Mediterranean arc, making it one of the

THE CHALLENGES OF THE RAILWAYS

In Spain, there was a 60% drop in the market share of the tonne-km transported by rail between 1991 and 2018. Several aspects were responsible for this significant decline:

► **The geographical location of the Iberian Peninsula**, outside the EU's major freight corridors.

► **The lack of large centres of consumption and production**, except for the automobile industry, that require modes of mass transport such as the railways. This is why, in the case of fruit and vegetable exports, for example, which amounted to 13.5 million tonnes in 2019, 93% were destined for EU countries (according to FEPEX data), and were largely transported by road, due to the geographical isolation of the origins and destinations and the perishable nature of the cargo.

► **A reduced rail presence in all the ports**, although rail is present in 14 of the State's ports, only five of these handle 70% of port rail demand. Other factors include **the state of the infrastructure**, with routes not suitable for efficient trains of longer than 700 metres, a common measure in EU countries, as well as **stretches with steep gradients and traffic restrictions**.

most important railway routes on an economic and commercial level. The new infrastructure consists of 14 sections, 5 of which, the ones closest to the French border, have been completed, with the remainder under construction or currently being planned. It is scheduled to be completed in 2025, although it could run beyond that date.

When the high-speed network is put into service, passenger traffic will be transferred from the Iberian-gauge conventional network to the standard-gauge HS network, which will create free lines that can be used by freight trains without having to be shared with passenger trains. Works are being carried out to improve freight transport, including new electrified sections, such as the Bobadilla-Algeciras section, which is within the actions of the Mediterranean Corridor, and the Salamanca-Fuentes de Oñoro section on the Portuguese border, which forms part of the Atlantic Corridor, and which is expected to be completed in 2021 to connect the ports on the Atlantic coast with the centre of Europe.

One of the factors most often used to justify the limited use of rail for international trade has been the difference in gauge between mainland Spain and the European network. In an attempt to address this problem, various procedures have been applied, from the transshipment of freight to the changing of axles and bogies of wagons and carriages, along with a competition in 1966 to have rolling stock that would automatically change gauge. The finalists were the systems from Seville-based OGI and Vevey in Switzerland, with the latter chosen as the winner but later rejected for failing to meet the technical requirements.

In 2011 and 2013, the decision was made to develop the OGI system, a mandate that has been carried out by the companies Adif, Azvi and Tria. Following homologation of the gauge changeover system in 2019, the State Railway Safety Agency authorised the entry into service of the MMC3 container wagons and LTF vehicle carriers. In principle, the availability of the new wagons should increase rail transport, although this type of material will be limited to specific relations, since due to its specific characteristics it will have to make mainly round trips outside the Iberian Peninsula. ■

PHOTO_PABLO NEUSTADT (INECO)

Without a trace... of carbon

Ineco is collaborating with Aena to prepare the carbon footprint of its airports, an annual calculation of their greenhouse gas emissions that is required to obtain the Airport Carbon Accreditation (ACA), the only accreditation available in this area. To date, eight Spanish airports have already received this certification.

By **María Carpio**, **Carlos Rubio**, chemical engineers, and **Elena Curto**, biologist

ALMOST 300 ACCREDITED AIRPORTS
The Airport Carbon Accreditation (ACA), was created in 2008 and today covers 297 airports around the world. The eight accredited airports in Spain include the Adolfo Suárez Madrid-Barajas (pictured) and the Josep Tarradellas Barcelona-El Prat.

PHOTO_PABLO NEUSTADT (INECO)

Every activity, both individual and collective, regardless of whether it is the manufacture of a product, the provision of a service or the operation of an organisation, generates a measurable impact on the environment due to its greenhouse gas (GHG) emissions: this is what is known as the 'carbon footprint'. Specifically, GHG emissions are the cause of global warming and, therefore, of climate change,

which is why the 13th objective of the United Nations Sustainable Development Agenda 2030 is Climate Action. The first step is to measure these emissions and, from there, to define and implement the necessary actions to reduce or offset the emissions, all in accordance with the methodologies established by international organisations.

According to 2019 data from the Ministry for Ecological Transition, the transport

sector is responsible for 26% of greenhouse gas emissions in Spain, with 3.5% of those emissions attributed to aviation. In the current situation, and despite the inevitable impact of the pandemic on the air sector and tourism, the need for connectivity still remains. Airports are planning to begin the recovery gradually and will have to adapt to the new demand, without losing sight of environmental factors in airport management.

At the 29th Annual Congress and General Assembly of the Airports Council International Europe (ACI Europe), held in June 2019 in Cyprus, most European airport operators formally committed to the goal of zero carbon emissions by 2050 and to work towards accelerating the decarbonisation of the aviation sector. Aena, Spain's airport operator and one of the largest in the world, also joined this initiative, called NetZero2050. This

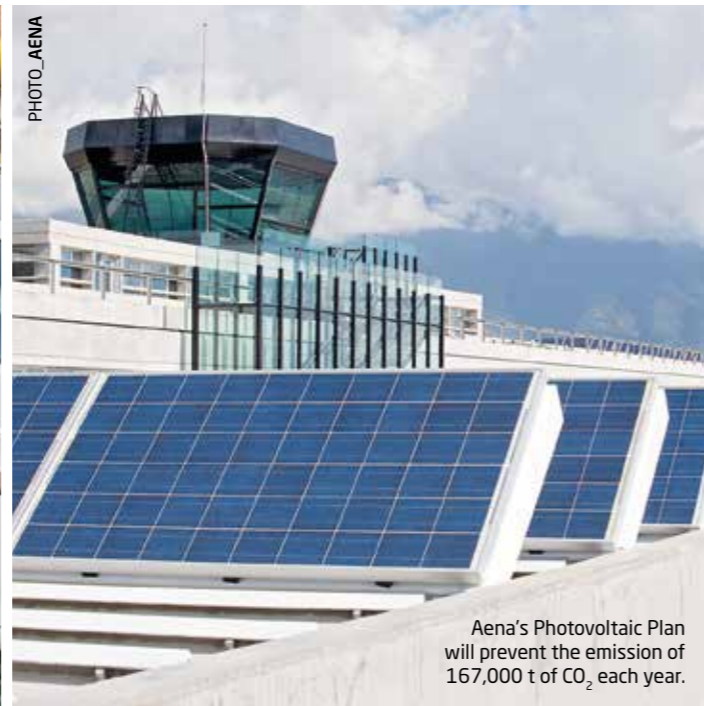
agreement marks a significant milestone in the actions that airports are taking to combat climate change, and requires the aviation sector to set ambitious targets for emission reduction. These targets, in line with the ones established in the Paris Agreement, must support the EU's climate change strategy, which is aiming for carbon neutrality by 2050.

ACI Europe issues the only existing certification in the airport field dedicated

to the recognition of voluntary efforts to reduce CO₂ emissions, the Airport Carbon Accreditation (ACA), created in 2008 and with a total of 297 airports around the world currently accredited. Ineco is carrying out the carbon footprint calculation and verification work for Aena in order to obtain this accreditation, which to date covers eight Spanish airports, including the two with the largest number of passengers: Adolfo Suárez Madrid-Barajas



Electric vehicles at Madrid-Barajas airport.



Aena's Photovoltaic Plan will prevent the emission of 167,000 t of CO₂ each year.



The use of renewable energy reduces the carbon footprint.

(for which only the verification is being carried out) and Josep Tarradellas Barcelona-El Prat.

Four levels of accreditation have been established within the ACA programme, from the lowest to the highest level of action on an airport's emissions: level 1 'inventory'; level 2 'reduction'; level 3 'optimisation' and level 3+ 'neutralisation'.

Currently, the airports in Alicante, Menorca and Santiago de Compostela have renewed their level 1 'inventory' certification; and Madrid, Barcelona, Lanzarote and Palma de Mallorca have renewed their level 2 'reduction' certification.

Level 2 accredited airports have implemented a Carbon Management Plan with measures to reduce their CO₂ emissions, which in turn forms part of the framework of Aena's Climate Change Strategy. These measures include the Photovoltaic Plan, which will make it possible to generate 70% of the energy for self-consumption by the network starting in 2026. According to Aena, the percentage will avoid the emission of 167,000 tons of CO₂ into the atmosphere each year.

The purchase of energy from renewable sources and other actions to improve energy efficiency, together with the offsetting of the remaining emissions,

AENA AIMS TO MAKE THE MADRID AND BARCELONA AIRPORTS CARBON NEUTRAL BY 2030, GIVING THEM THE HIGHEST LEVEL ACCREDITATION: 3+

will make the main Spanish airports, Adolfo Suárez Madrid-Barajas and Josep Tarradellas Barcelona-El Prat, carbon neutral by 2030, giving them level 3+ accreditation, the highest level of the ACA. Ineco is collaborating with Aena on the preliminary studies to achieve this objective.

In practice, this accreditation indicates that the airport that has obtained it has managed to neutralise its carbon footprint, both by reducing its emissions as much as possible and by offsetting any remaining emissions. This requires investment in carbon sequestration or reduction projects.

HOW THE CARBON FOOTPRINT IS CALCULATED

The carbon footprint must be calculated according to international standards. In order to obtain the ACA accreditation, emissions must be calculated using the

GHG Protocol (Greenhouse Gas Protocol) methodology developed jointly in 1998 by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI), together with companies, governments, and environmental groups around the world. This methodology complies with the requirements of the UNE EN ISO 14064-1 standard, for the quantification and declaration of greenhouse gas emissions and reductions.

Emissions accounting is performed on the activities included within the organisational boundaries based on the criteria of the GHG Protocol. In the case of Aena's airports, this refers to the activities over which it has authority to introduce and implement its operational policies.

Three scopes are defined based on the limits of the organisation, the operations it carries out, and its influence on those limits.

Scope 1 includes direct emissions such as stationary combustion, mobile combustion and process emissions such as leakage of refrigerant gases from air conditioning equipment.

In this approach, direct emission sources include those for which the airport management is responsible: stationary combustion, which includes generators, portable generators, boilers

and fire extinguishing service (FES) drills; mobile combustion, which includes both light and heavy vehicles belonging to the airport itself; and lastly, processes, which include emissions from possible leakage of refrigerant gases from air conditioning equipment and emissions from water treatment.

Scope 2 comprises emissions deriving from the generation of the electricity acquired and consumed by Aena at each airport.

Scope 3 includes emissions that correspond to third parties, or in other words, the remaining indirect emissions. These include, among others, the emissions produced by airline aircraft operating at the airport during the LTO cycle (landing and take-off cycle); vehicles and machinery providing handling or assistance services to passengers and aircraft; energy consumption by concessionaires, ground access and employee work travel, among others.

Once the calculations have been completed, a final carbon footprint report is generated, containing all the results, factors used, activity data, etc. According to the GHG Protocol, all data provided must be documented and calculations must be made in accordance with recognised methodologies. The report must be certified by an external entity and include proposals for improvement. ■

SOME KEY QUESTIONS

What is the carbon footprint? The carbon footprint of an organisation measures the total direct and indirect emissions of GHG (represented in carbon dioxide equivalent, CO₂e) generated by the organisation's business activity.

What is it for? The carbon footprint is used to measure the impact of human activities on the environment. Once an organisation's carbon footprint has been determined, it provides data that can be used to plan steps to reduce it, making it a useful method to quantify, reduce and neutralise carbon dioxide (CO₂) emissions and contribute to the mitigation of climate change.

What are GHGs (greenhouse gases)?

According to the Kyoto Protocol, greenhouse gases are: carbon dioxide (CO₂),

methane (CH₄), which comes in 61% from agriculture and livestock, about 31% from waste and about 8% from fuel combustion; nitrous oxide (N₂O), which comes in 74% from agriculture, 16% from fossil fuel combustion and 4% from the chemical industry and wastewater management; hydrofluorocarbons (HFCs), which are generated entirely by refrigeration, air conditioning and fire extinguishing equipment; perfluorocarbons (PFCs), which originate 100% from the production of aluminium and fire extinguishers; sulphur hexafluoride (SF₆), which is produced by electrical equipment; and nitrogen trifluoride (NF₃), which is generated during the manufacture of semiconductors, LCDs and photovoltaic cells.

Of these, the most important is CO₂, because its contribution to the greenhouse effect is greater

than that of other gases emitted directly by human activity. The tonne of CO₂-equivalent is the universal unit of measurement that takes into account the global warming potential or GWP of each of these gases.

How are the calculations made? After the activities to be studied have been selected, and the data has been compiled and the period of time for the analysis defined -usually the calendar year immediately prior to the year being calculated- the data for each activity (for example, electricity consumption) is multiplied by its corresponding emission factor (adjusted periodically in official sources). This factor indicates the amount of CO₂ produced by the activity.

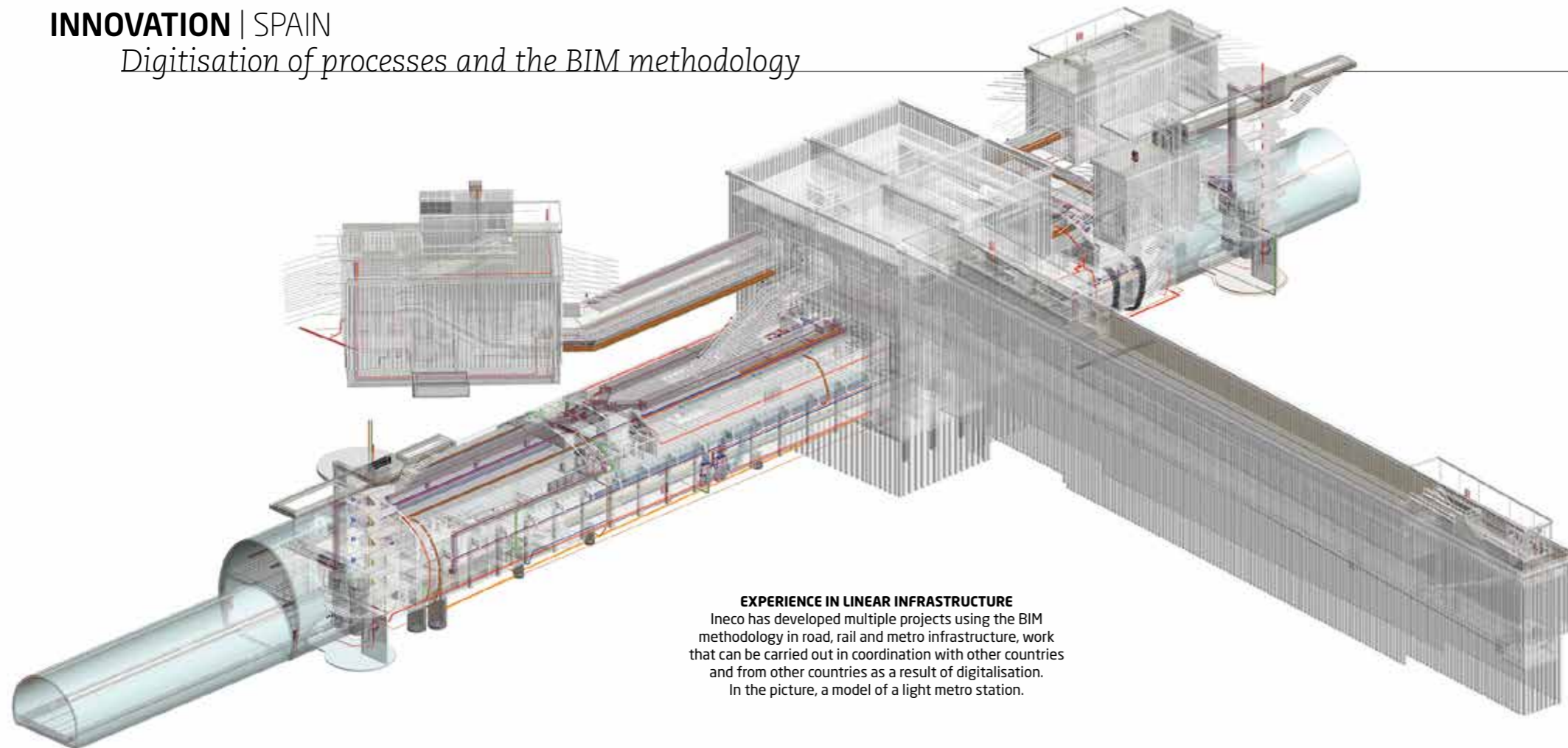
The result of this formula is a certain amount (usually tonnes) of carbon dioxide equivalent (CO₂e).

Sources: Guide for calculating the carbon footprint and for drafting of improvement plans organisations (Ministry for Ecological Transition of Spain); Aena.



CARBON-FREE HORIZON: 2050

Image of the 29th Annual Congress of ACI Europe, held in 2019 in Cyprus, where the NetZero2050 initiative was born and which has been taken up by airport operators, including Aena. The aim is to completely 'decarbonise' the aviation sector by 2050.



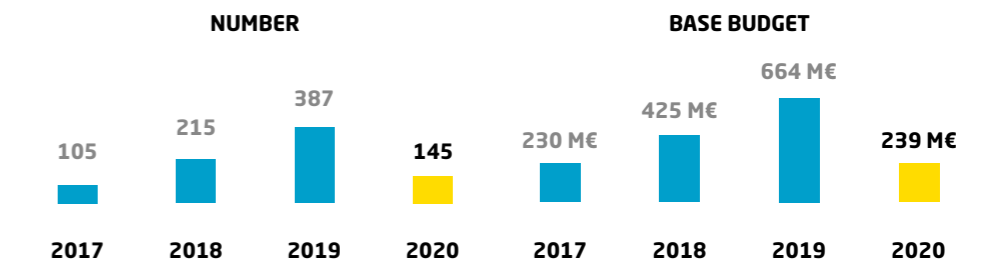
EXPERIENCE IN LINEAR INFRASTRUCTURE
Ineco has developed multiple projects using the BIM methodology in road, rail and metro infrastructure, work that can be carried out in coordination with other countries and from other countries as a result of digitalisation. In the picture, a model of a light metro station.

types of projects, ranging from metro or high-speed lines to roads, and applied to various stages of the life cycle, in line with a methodology that aims to address that whole life cycle. Significant progress has been made during this period in areas where the application of BIM methodology faced the greatest challenges:

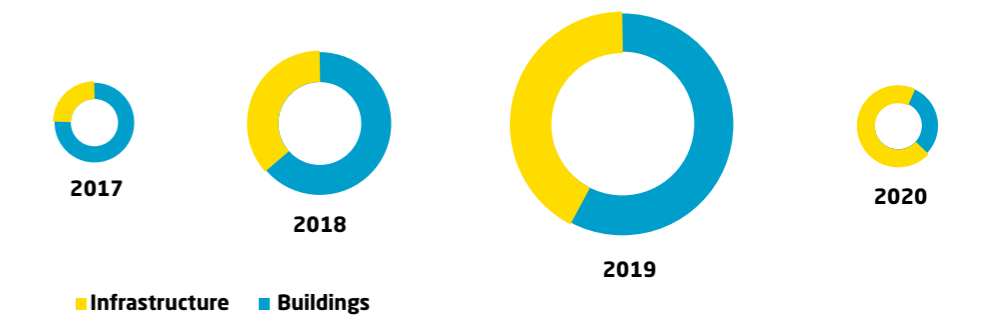
► **Modelling tools:** digital models are generated by these tools, which are beginning to incorporate exchange formats designed for linear infrastructure.

► **Standards:** the publication of the EN-19650 standard establishes the definitions and information flows in BIM processes and makes it possible to move beyond the stage in which its absence led to the use of rules obtained from international standards.

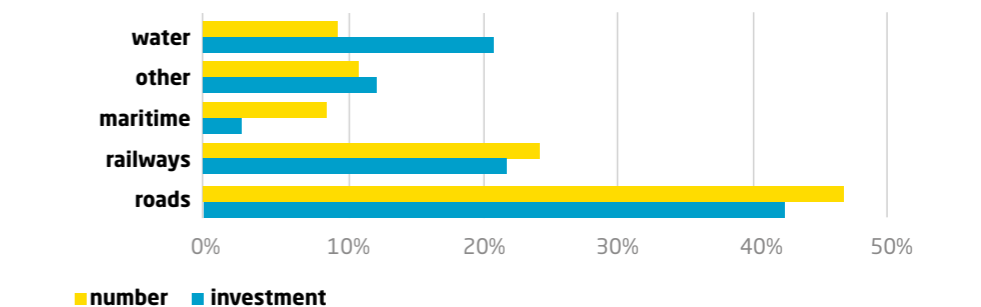
► **Interoperability:** the publication of the IFC 4.3 open standards (alignment, bridges, road and rail) is an important step forward in establishing the open exchange standard for infrastructure, eliminating the need to resort to formats developed for construction.



BIM OBSERVATORY. Lastly, public tendering with BIM requirements in the infrastructure field has also taken a major step forward: according to data obtained from the BIM Observatory, the number of tenders continues to grow at a significant rate.



BIM PUBLIC TENDERING. The sequence of graphs shows how the building/infrastructure distribution has evolved in BIM public tendering. In 2017, the methodology was generally aimed at management of building construction; the current distribution and trends indicate a completely different scenario.



BIM SECTOR DISTRIBUTION. In terms of sector distribution, rail and road infrastructures stand out, especially in the construction stage.

BIM and digitisation, keys to the new normal

The digitisation of processes and the use of collaborative tools combined with an appropriate technological infrastructure are helping to improve the resilience of companies in situations such as the COVID-19 pandemic. The application of the BIM methodology is one of the key elements, especially in infrastructure projects where it is not yet well established.

By Jorge Torrico, civil engineer

In companies, digitisation has been aimed at increasing productivity, which is also the goal of BIM implementation in Spain. However, the recent COVID-19 pandemic has shifted the focus to resilience and maintaining productivity in the face of adverse situations, in short, maintaining the business. This objective is clearly reflected

in the pillars of the BIM methodology, which focuses on digital information management –with the reduction of paper-based processes, common data sources and process automation– and collaboration, i.e., the use of collaborative tools, digital exchanges, synchronised access and the use of cloud storage. The new scenarios generated

by this pandemic, such as the promotion of remote work (teleworking), the reduction of contact between workers through the establishment of shifts and social distancing, require the increased digitisation of processes in order to ‘work digitally’.

Ineco’s experience in this field has enabled it to ensure the continuity of

work and to fulfil its commitments during this period, although it is necessary to continue developing this methodology for its generalisation as a working standard. As part of this process, a body of documentation is being created to contribute to the success of this endeavour through specific manuals, guides, process automation tools, etc. These actions are complemented by the creation of a digital community of practices that will serve as a meeting point for all those interested in the application of the methodology within the company, people from different fields and with different visions that contribute to establishing and prioritising needs.

BIM IN INFRASTRUCTURE PROJECTS

Although BIM, as a methodology or set of processes, does not distinguish between areas, over the last year Ineco has developed various linear infrastructure projects with BIM as the work methodology. These are very different



BIM-GIS DISPLAY ON A HIGHWAY. Image of the BIM-GIS integration display, which offers an overview of the 'digital twin' of the slip road between the future A-76 motorway and the A-6.

AWARD GIVEN FOR BIM-GIS INTEGRATION ON A HIGHWAY PROJECT

Some of the more important areas of innovation related to broadening the horizons of the application of this methodology are those involving integration with GIS, which recently received the Special Achievement in GIS (SAG) Award given by Esri, a world leader in software for Geographic Information Systems. This work aims to integrate digital information from different sources and technologies into a common environment that encourages and maximises its use, is accessible to as many parties as possible and facilitates decision-making in project implementation.

The award acknowledges the company's ground-breaking work in Spain in the development of GIS technology thanks to the integration of the BIM methodology into a GIS environment to develop a virtual 3D model of the future A-76 Ponferrada-Ourense Highway, on the Villamartín section of the Abadía-Requejo stretch for the General Directorate of Roads, part of the Ministry of Transport, Mobility and Urban Agenda (MITMA).

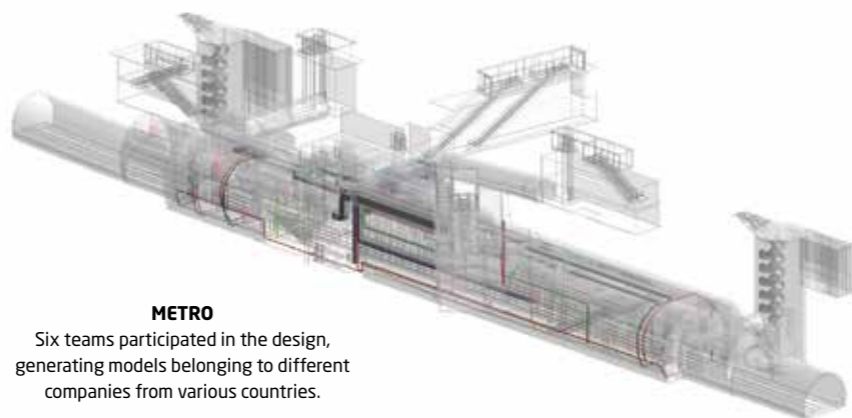
The Special Achievement in GIS Awards are international awards given to organisations around the world that Esri Inc. uses to show its appreciation for the use of its technology in addressing some of the world's most important challenges. Every year, different projects around the world in different fields are recognised for demonstrating their capacity for innovation and good use of GIS in solving new problems.

3 NOTABLE PROJECTS

A technical solution for a light metro.

This is an international project designed as a technical solution for the building design of a light metro, just over 2 kilometres long, to be connected to an existing external line. The design comprises a 2 km tunnel with three access points, an evacuation tunnel and three underground stations, involving numerous infrastructure disciplines at the same time. The route has very demanding occupation requirements, which means that the coordination and implementation of the infrastructure is especially important.

Six teams were involved in the design, generating models belonging to different companies and countries, which is



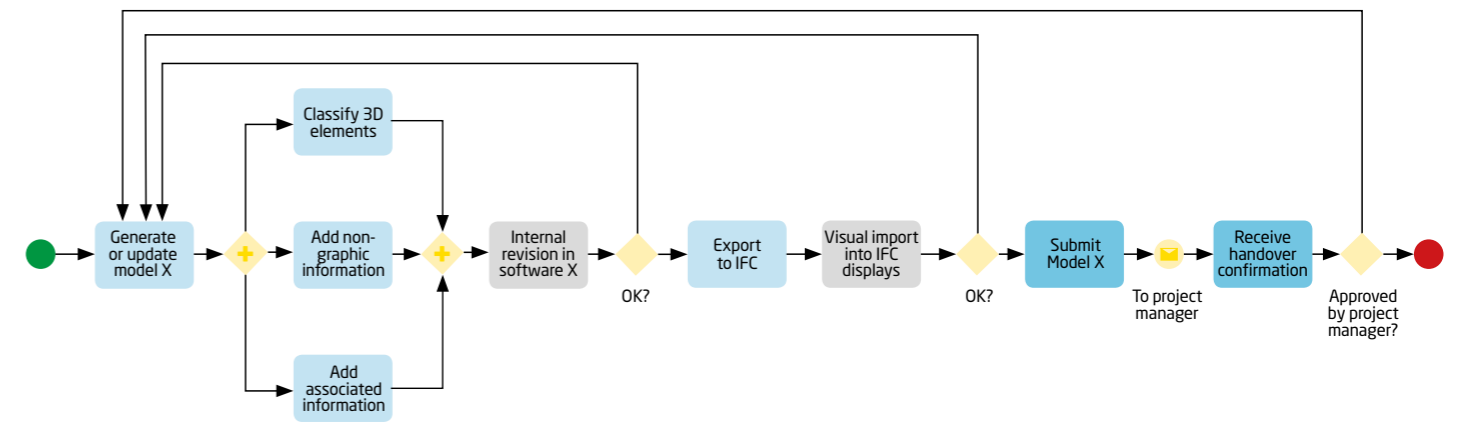
METRO
Six teams participated in the design, generating models belonging to different companies from various countries.

why collaboration between them is also a key aspect, using two common data environments. The BIM uses that were applied included 3D coordination and generation of 2D documentation and quantity take-off.

Three-dimensional models for a highway in Costa Rica.

Normally we think of the sequential development of the generation of BIM models in the design stage (project) and their use in subsequent construction and maintenance stages, but in certain cases and under certain circumstances, BIM can be applied in more advanced stages even if it has not been executed in initial stages. This involves digitising the project documentation and converting the drawings into three-dimensional models with all of the associated information. The objective is to use it to monitor the work, simulate construction, obtain quantities for certification and generate 'as built' information.

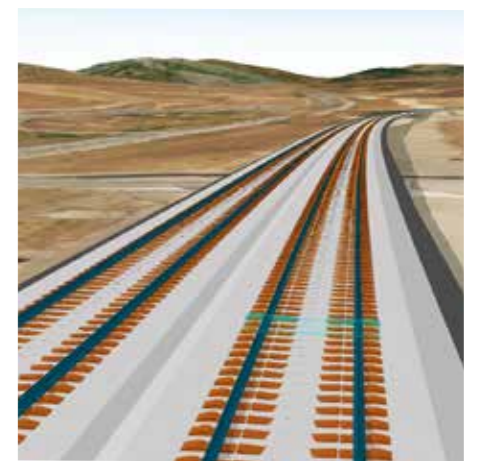
This was the case for the San Gerardo-Barranca stretch of the Pan-American Highway in Costa Rica. The project was carried out in the 'traditional' way, obtaining the usual documents: design report, annexes, plans, specifications and the bill of quantities. Based on this documentation, Ineco generated the digital models that represent the entire section and all its disciplines: earthworks, pavement, structures, drainage, signs, etc. The digitisation of the project documentation allows the detection of inconsistencies between disciplines. The three-dimensional visualisa-



QUALITY CONTROL MODEL. A common data environment is essential for sharing information between site office teams and the design office.



ROADS. San Gerardo-Barranca stretch on the Pan-American Highway in Costa Rica.



RAILWAYS. Modelling of a high-speed railway section in the access points to Extremadura.

tion alone makes this detection possible. In addition, the linking of construction elements and budget quotes, a number of inconsistencies in quantities and the bill of quantities were detected. A filtering analysis by relevance was then carried out, determining the inconsistencies that were actually relevant for the work stage and which would need to be taken into account.

Currently, we are waiting for the beginning of the works in order to start the monitoring work to be connected with the actual construction plan.

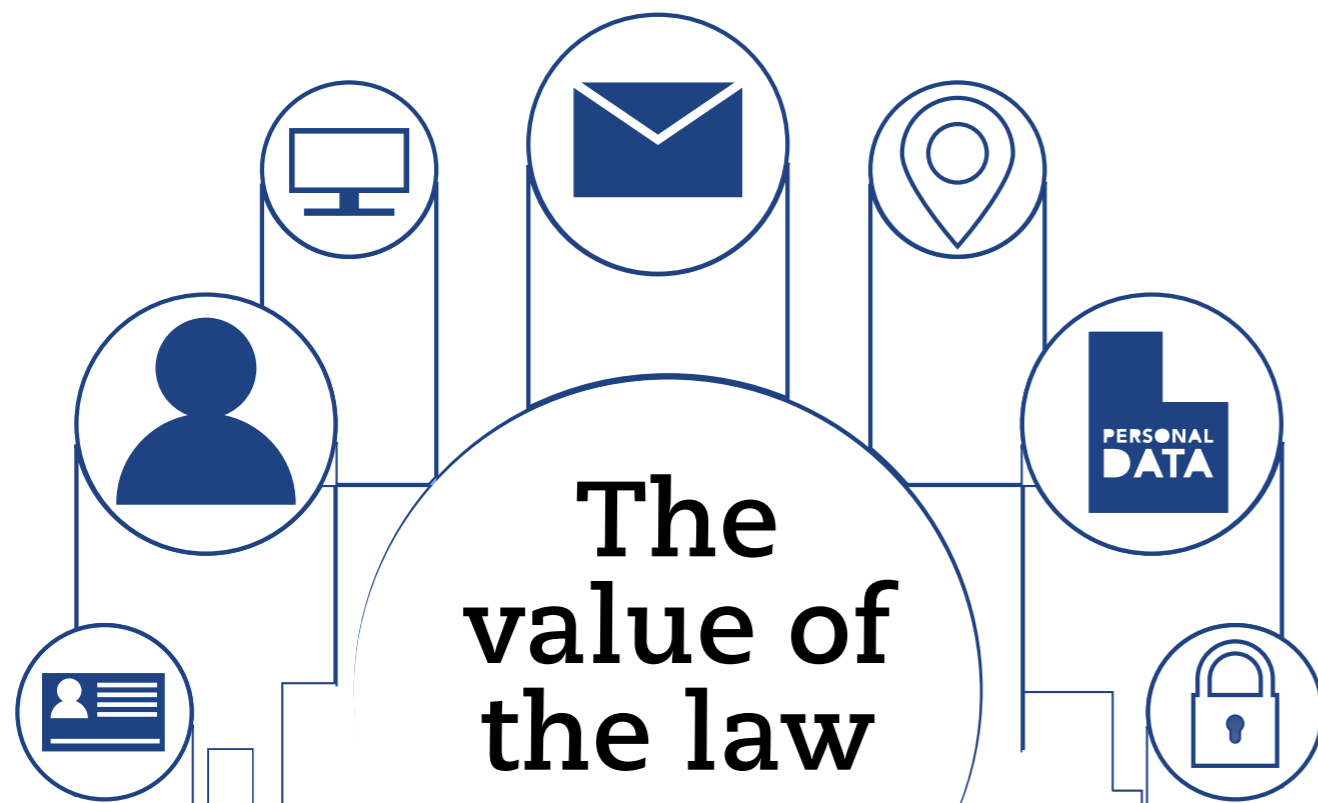
A digital twin to manage a railway construction site.

As in the previous case, a high-speed railway section at the access points to Extremadura has been modelled for use in the construction stage, in this case a track assembly site. The objectives are as follows:

- ▶ To study the application of the BIM methodology in track installation works.
- ▶ To contribute to the improvement of collaboration and communication between different parties.
- ▶ To generate a digital twin of the work in order to facilitate management of the work in later stages.
- ▶ To monitor the execution of the work in terms of costs and deadlines.

The work includes the installation of 55.1 kilometres of double track on ballast, as well as some smaller sections of single track on ballast on a double track platform (around 400 metres) and slab track (around 3.7 kilometres). In this case, the complexity arises from the length of the section involved and the need to identify the basic objects to be introduced in the digital models. Before work began, the corresponding

BIM Execution Plan was drawn up, which included the definition of the level of graphic information to be included in the models, taking into account the disciplines involved in a project of this nature (surface treatments, ballast, sleepers, rail, welding and track devices); specific tables were also included for the non-graphic information for each type of element. In the absence of a standardised classification system that includes these type of elements, an *ad hoc* system was created. The Execution Plan also defined the common data environment, which is essential for sharing information between the site office teams and the design office. Lastly, the quality control model was designed according to the arrangement shown above. In total, 38 route and track models were generated, taking into account the section divisions of the project. ■



PICTURE_FREEPIK. BUSINESS PHOTO CREATED BY RAWPIXEL.COM

Regulatory compliance allows companies to detect and manage the risks of non-compliance with the law and, therefore, of being criminally charged. For Ineco, this is more than a set of procedures and mechanisms for legal security: it is a fundamental value and an ethical commitment.

By **Laura Marín**, Law graduate

The amendment of the Spanish Criminal Code means that legal entities, such as Ineco, can be held criminally liable for certain criminal offences, for those actions or omissions in the course of their business carried out by any of their employees, managers or members of their Board of Directors, on its behalf and for its direct or indirect benefit. In order to prevent criminal proceedings from being brought against the company or any of its employees, the company, in accordance with its Standards of Integrity, Transparency and Commitment, has implemented a Programme for the Prevention of Criminal Accusations, or Compliance Programme, the aim of which is to guarantee the duty of vigilance and control in the company, as the only way of protecting itself from

possible criminal charges in the event of irregular conduct.

Compliance is the specific function that enables companies to detect and manage the risks of criminal non-compliance with the internal and external regulatory obligations of their business sphere, mitigating the risks of criminal charges and possible penalties or sanctions arising from non-compliance. This function is carried out by means of a series of appropriate procedures and the establishment of policies of actions in certain areas, making it necessary to implement a series of rules and internal controls in the company.

The Organisation and Management Model provides a structure for prevention of infractions through the creation of the Regulatory Compliance Committee (CCN), as well as an obliga-

tion to report or denounce, through the creation of the Compliance Channel for complaints or inquiries and a training programme on compliance. The CCN is made up of six members appointed by the Board of Directors, and is the body responsible for resolving all doubts or queries raised by employees, as well as for investigating complaints about possible prohibited conduct. They operate in confidentially and independently. All members have undergone compliance training in order to enable them to perform their duties more effectively.

THE COMPLIANCE CHANNEL

Ineco has a Complaints and Queries Channel (Compliance Channel) available on its intranet, where employees can report to the CCN any events or conduct of which they are aware that

are suspected to fall outside of the company's ethical standards and could constitute a criminal offence. Since the implementation of the Compliance Programme, 100% of the staff has been invited to take part in the training programme, Plan for the Prevention of Criminal Accusations, which is compulsory for all members of the company, including workers, managers and members of the Board of Directors, as well as temporary staff. Specific training has also been introduced for the staff of subsidiaries and branch offices. This Organisation and Management Model applies to Ineco, as a legal entity, as well as to the following individuals: company directors and managers; executives, either individually or as members of a professional association; and workers, regardless of their position or the type of employment contract, including interns and staff provided to the company by temporary employment agencies. In addition to the above, the Organisation and Management Model for the Prevention of Criminal Offences has been extended to Ineco's suppliers, through the

publication on the corporate website of the company's Catalogue of Prohibited Conduct, and a responsible statement that all suppliers must sign and submit as part of the administrative documentation of each procurement dossier.

Ineco is firmly committed to ethics, and creating a genuine culture of compliance is part of the company's DNA. Ineco's Compliance Programme has a dual value: it guarantees respect for legality and trust in its stakeholders, and it is a mechanism for exonerating or mitigating the company's criminal liability if certain criminal offences are committed by members of the organisation. In its desire for ongoing review and improvement, and within the scope of the objectives set out in the Atenea Strategic Plan, the CCN has proposed two new actions: the implementation of anonymous reporting in the Compliance Channel and the preparation of a statement of responsibility.

Compliance is a culture that not only avoids risks and creates legal certainty, but also helps to improve the company. Ineco is compliance. ■



COMPLIANCE AT INECO

The company's Compliance Programme consists of the following:

- The identification of activity and risk scenarios.
- The creation of an Organisation and Management Model for the prevention of criminal offences.
- The approval of a Catalogue of Prohibited Conduct and a Code of Conduct.
- A Zero-Tolerance Policy for Corruption.
- The appointment of a Regulatory Compliance Committee (CCN) to be contacted as soon as a possible risk situation is detected or if there are doubts regarding what should be done.
- The creation of the internal communication and reporting channel (Compliance Channel).

CHARITABLE INITIATIVES

► Challenge charity race

More than 350 Ineco participants recorded their progress in the Indoor Charitable Challenge via an app between 10 June and 10 July, totalling 6,600,000 steps, the equivalent of 5,000 kilometres, so that the NGO Action Against Hunger can deliver 500 nutritional kits to those most in need.

► Renewal of the agreement with the Red Cross

On 19 May, the company renewed its agreement to be part of the Spanish Red Cross' Emergency Assistance Fund, which it originally signed in 2009. Under the agreement, Ineco is allocating 6,000 euros to the Red Cross RESPONDE Plan, which aims to help more than 2.4 million people affected by the pandemic.

► Pequeñecos

During the months of April and May, the children and grandchildren of Ineco's employees completed a variety of creative challenges, and Ineco has responded by donating 16 tech devices to 8 foster homes of the NGO Nuevo Futuro in Madrid, Andalusia, Castilla y León, the Basque Country and the Valencia Region. This provided 144 children with the means to complete the course remotely.

► Conectad@s

Ineco, thanks to contributions from the company and its employees, donated tablets to 85 nursing homes throughout Spain -covering 100% of the requests received- with 6,500 elderly people benefiting from the initiative. The aim of the campaign, launched in March, was to make it easier for people to communicate with their families.

► #ferrosolidarios

Railway workers from different companies in the sector, including Ineco, Adif and Renfe, promoted the initiative #ferrosolidarios, launched in May, with the aim of creating an emergency fund for the purchase of 15,000 kg of food.

► #Innovaciónfrentealvirus

The company collaborated on the mentoring of 8 projects in this international initiative to respond to the consequences of COVID-19. Four of these were finalists and one took second place in the Best Start Up category.



PHOTO_CSIC

A sea of knowledge

The study of the oceans and marine resources is vital for a peninsular country like Spain, with a powerful fishing industry that is facing the global challenges of climate change.

By ITRANSPORTE



18-day-old tuna. Photo: IEO Murcia.



Winning photo in the 17th edition of FOTCIENCIA (CSIC/FECYT). Photo: Lucía Sánchez-Ruiloba / Miquel Planas IIM Vigo.



55-day-old octopus paralarva at the IIM in Vigo. Photo: Álvaro Roura and Alexandra Castro (CSIC).

With three coastal areas –Cantabrian, Atlantic and Mediterranean– and more than 7,900 kilometres of coastline, Spain ranks 14th in the world and 3rd in Europe in terms of kilometres of coastline, thanks to its geographical location and its two archipelagos, the Balearic and the Canary Islands. The so-called ‘blue economy’ is especially important for Spain, the leading fishing producer in the European Union with 20% of production and almost a quarter of its fleet. In terms of aquaculture, Spain ranks 20th in the world, according to 2019 data from the Spanish Aquaculture Business Association, APROMAR. Today, in the face of the global threat of climate change, overexploitation of marine resources and pollution of the seas and oceans, research and protection of the marine environment are more vital than ever.

The main oceanographic research centres in Spain are organised around two large public institutions at the national level: the Spanish Institute of Oceanography (IEO), created in 1914, and the Spanish National Research Council

(CSIC), which was founded in 1939 as the state agency for scientific research and technological development, which deals with marine research in the field of Natural Resources.

With more than one hundred years of history, the Spanish Oceanographic Institute has its headquarters in Madrid, in addition to nine research centres located in A Coruña, the Balearic Islands (Palma), Cadiz, the Canary Islands (Tenerife), Gijón, Málaga, Murcia, Santander and Vigo; five aquaculture experimentation plants, 12 tide measurement stations, a satellite image reception station (in the Santander oceanographic centre) and a fleet of some twenty vessels. It also has an unmanned submarine capable of operating at a depth of over 2,000 metres, the ROV (Remote Operated Vehicle) LIROPUS 2000. The Institute represents Spain at the majority of international scientific and technological forums and is the Government’s official advisor on fishery. It carries out its research in three areas: fishery resources, aquaculture and the study and protection of the marine envi-

ronment, and it currently has more than 270 projects underway.

The IEO’s aquaculture plants have achieved ground-breaking milestones, such as the world’s first successful breeding of the common octopus in captivity, at the Vigo Oceanographic Centre in 2018. The Murcia Oceanographic Centre, located in the town of Mazarrón, includes a scientific facility classified as “unique” by the Spanish government: the Infrastructure for Atlantic Bluefin Tuna Aquaculture (ICAR), the only one in the world for this species. It consists of the Aquaculture Plant and the Installation for the Control of the Reproduction of Atlantic bluefin tuna (ICRA). The plant in the Canary Islands focuses on the cultivation of marine fish and cephalopods, while the El Bocal plant in Santander is the largest facility in Spain dedicated to the cultivation of algae for human consumption.

On the other hand, the Spanish National Research Council (CSIC), within its field of Natural Resources, has several different Institutes, which operate in an

autonomous and decentralised manner, and the Marine Technology Unit, which manages and provides support to the oceanographic fleet and Spain’s two polar bases.

The Institute of Marine Science of Barcelona, the largest marine research centre in Spain, is one of the CSIC’s most important institutes. Two research groups from this centre are taking part in MOSAIC, the largest scientific expedition in the Arctic in history. The project, promoted by a German institution, was launched in September 2019, with researchers from 20 countries participating aboard the German icebreaker Polarstern, to spend a year studying global warming. Vigo is also the headquarters of the CSIC’s Institute for Marine Research, which among its recent achievements has managed to successfully breed the endangered seahorse in captivity.

Other CSIC centres in Spain include the Institute of Torre de la Sal in Torrelblanca, Castellón, and the Institute of Marine Sciences of Andalusia, in Cadiz, specialising in aquaculture; the Centre for Advanced Studies of Blanes, Girona, and the Mediterranean Institute for Advanced Studies (IMEDEA) in Mallorca, a centre run jointly with the University of the Balearic Islands to research ‘global change’ (the impact of human activity on the biosphere) and develop instruments

for marine research. It also participates in another unique element of scientific infrastructure, the SOCIB or Balearic Islands Coastal Observing and Forecasting System, which collects and provides valuable data for maritime rescue, among other applications.

In 2010, the CSIC led the largest Spanish oceanographic expedition up to that point. Named Malaspina in honour of Spanish Navy frigate captain Alejandro Malaspina (1754-1810), it covered 75,000 kilometres in nine months, with more than 250 researchers on board the oceanographic vessels Hespérides and Sarmiento de Gamboa. The project researched different phenomena that affect the marine environment in deep waters and in three oceans (warming, acidification, deoxygenation, pollution, marine microorganisms, fish population, etc.) and collected more than 200,000 samples, some from depths of up to 4,000 metres, with almost 20,000 of these forming part of a bank that will remain sealed for 30 years for future study.

In addition to the research centres, since 2016, Spain has also had the innovative infrastructure of the Canary Islands Oceanic Platform (PLOCAN), managed by a consortium formed by the central government and the Regional Government of the Canary Islands. Located in Telde, Gran Canaria, it is one

of the largest installation of its kind in Europe. Its main facility is an ocean platform located one and a half miles from the coast, in a reserved area of 23 km² that is used as a test bed. It is equipped with marine drones and other state-of-the-art equipment, and is currently carrying out, among other things, projects related to marine renewable energy, climate change, water desalination, use of coastal resources, cetacean conservation, marine noise pollution, and robotics and innovation for marine research. ■

SPAIN’S OCEANOGRAPHIC FLEET

Since 2013, Spain has unified the management of its oceanographic research fleet (attached to the IEO or CSIC) under the FLOTPOL unit. Part of this fleet is classified as Unique Scientific and Technical Infrastructure (ICTS). It is made up of a total of 10 oceanographic vessels, including the Spanish Navy’s Hespérides, which is 82.5 metres long. Based in Cartagena (Murcia), the vessel was put into service in 1991 and was completely overhauled between 2003 and 2004. It has completed more than 120 campaigns in the Antarctic, in the Arctic and in the Pacific and Atlantic oceans, and collaborates on the support for Spain’s two Antarctic bases. Its scientific equipment is managed entirely by the CSIC’s Marine Technology Unit.

- **The CSIC fleet:** the main vessel is the Sarmiento de Gamboa, 70.5 metres in length, which was launched in 2006. It is equipped with advanced navigation technology (such as dynamic positioning) and was the first Spanish oceanographic vessel capable of working with remotely operated vehicles at great depths. In addition, the CSIC has two regional vessels, the García del Cid, based in Barcelona, which operates in the Western Mediterranean, the Iberian Atlantic area and the Canary Islands, and the Mytilus, launched in 1997, based in Vigo and operating mainly on the Galician coast.

- **The IEO fleet:** The twin oceanographic vessels Ramon Margalef and Angeles Alvaríño, 46 metres long, delivered in 2011 and 2012, are two of the most remarkable of the twenty or so vessels in the fleet. The Francisco de Paula Navarro, meanwhile, is a multi-purpose ship based in Palma de Mallorca that is used mainly in the Mediterranean. This fleet will be joined by a new oceanographic vessel nearly 90 metres long and global range, which will be based in Cadiz and is expected to be operational starting in 2023. The project is funded by the European Commission.

- **The Balearic Islands Coastal Observing and Forecasting System (SOCIB)** has a 24-metre catamaran that is used in rapid response to oil spills and in studies for the conservation of bluefin tuna and jellyfish proliferation.

SPAIN’S BASES IN ANTARCTICA

The two Spanish bases at the South Pole are located in the South Shetland Archipelago and are only operational during the four months of the southern summer. The Spanish Polar Committee coordinates their activities, while logistics is the responsibility of the Marine Technology Unit of the Spanish National Research Council. The Juan Carlos I Base, opened in 1988, is located on the Hurd Peninsula of Livingston Island, about 20 miles from the Spanish base Gabriel de Castilla, which opened in 1989. Located on Deception Island, it is under the responsibility of the Spanish Army and the CSIC for scientific management. Both bases conduct research on geology, biology, glaciers, atmosphere, chemistry, human impact, communications engineering, meteorology, climate change, volcanology, geodesy, hydrography and oceanography.



PHOTO_CSIC

The oceanographic vessel, Hesperides.



Spain’s Juan Carlos I Antarctic Base.

PHOTO_CSIC

100% connected

Ineco's ICT department enables the connection and transmission of 10 TB of data per day between its more than 3,500 employees and its clients around the world.



For more than two decades, Ineco has been strengthening this area, which currently has 420 virtual servers, 44 physical servers and more than 2.5 PB (petabytes) of storage capacity, with more than 1,600 GHz of processing and a management system focused on responding to user needs.

The ICT department has revolutionised the procedures for sending information within the company. Its employees stay connected using a wide range of tools aimed at optimising productivity: project management, personal area, online courses and other collaborative work systems.

“COVID-19 has transformed the work station; we have gone from a where to a when”

JUAN MANUEL HORTALÁ

Ineco's presence on all five continents is only possible thanks to information technology: distance is no longer a barrier to communication and the development of activities between people located in remote physical spaces. In addition, company users, shareholders and

customers demand a high degree of confidentiality. The ICT team strives for security in the transmission, access and processing of information, ensuring communications and blocking threats. Meeting the needs of each of our customers in terms of security, which means covering a wide range of solutions and policies. ■

KEY POINTS

- 1 A TEAM OF 23 PEOPLE.
- 2 MORE THAN 300 DAILY SUPPORT REQUESTS. 370 PIECES OF HARDWARE INSTALLED DURING LOCKDOWN.
- 3 24H SERVICE TO USERS AND CUSTOMERS ON FIVE CONTINENTS.
- 4 OVER 23,000 TB OF MOBILE DATA PER YEAR.
- 5 PROVIDING MAINTENANCE FOR MORE THAN 200 APPLICATIONS.
- 6 AN EFFECTIVE PROTOCOL OF ACTION TO DEAL WITH INCIDENTS. THREAT BLOCKING. OVER 400,000 ATTEMPTED BREACHES PER MONTH.



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