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JUNE 2013

STRATEGIC MOBILITY PLAN

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INTERNATIONAL LINK

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LUANDA AIRPORT

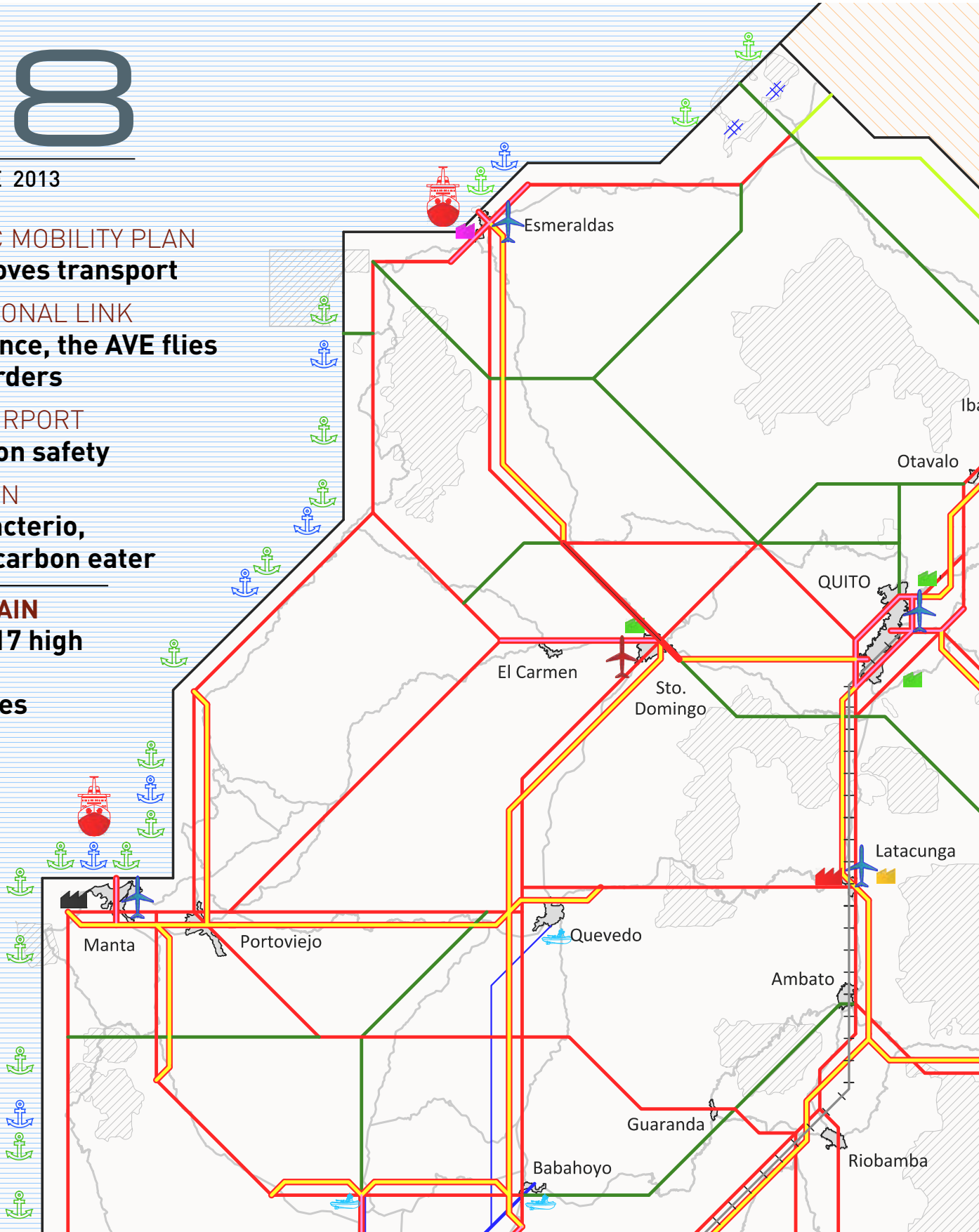
**Spotlight on safety**

INNOVATION

**Project Bacterio, the hydrocarbon eater**

**BRAND SPAIN**

**Tourism, 17 high speed rail experiences**



# Editorial

As a public consulting and engineering firm active in the transport sector and affiliated with Grupo Fomento, since its creation, Ineco has collaborated with the Ministry of Public Works and its subsidiary companies –Aena, Adif and Renfe– in the development of infrastructure in Spain. We have experienced forty-five years of continuous technological progress –particularly strong in the last twenty years– which have helped to place our nation in the privileged position it currently occupies in the world in all modes of transport.

**The skills and experience acquired** allow us to continue striving to fulfil the needs of our shareholders and the rest of our customers while, at the same time, contributing to the well-being of society as a whole.
Our mission as a public engineering firm is to support domestic technology and Spanish companies, ensuring that our comprehensive array of products and services, our technological capabilities and our extensive professional experience are available anywhere they are needed by society, both within our borders and beyond.

**At this time of expansion in the international market**, with stimulating projects in complex markets, we wish to share our knowledge on these pages and thereby contribute to the dissemination and recognition of 'Brand Spain'.

**In this issue we have dedicated an article** to the recent completion of the high-speed rail connection to France, a historic milestone in which Ineco has played a vital role along with Adif. Other reports are also included, outlining our activities in Ecuador, Kuwait, Angola, Colombia, Spain and Saudi Arabia and presenting examples of recently performed work in the aeronautical, rail and road sectors, which we hope our readers will find to be of interest.

**Juan Batanero**
General Business Manager for Public Works

# Contents



COVER IMAGE: Computer Model of the Ecuadorian Strategic Mobility and Transport Plan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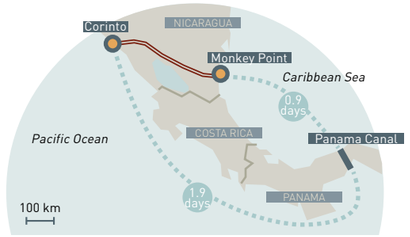
# News

## Chile

### Modernisation of the Santiago de Chile Metro

**Ineco is providing** fleet renewal consultancy for the 49 model NS-74 trains that travel on lines 2 and 5 of the Santiago de Chile Metro. The trains, manufactured by Alstom, date back to the 1970s, and the company wishes to modernise them in order to extend their operating lifespan by another 20 years, as well as to reduce their power consumption and make them more comfortable for users.

The company has completed the first phase of the contract, developing the basic engineering needed for the tender's technical documents to be prepared. These were published in January of this year. Still pending are the support phases for bid assessment and the technical consulting for the design review, which will continue until the prototype trains are validated.«




## Nicaragua

MULTIMODAL RAILWAY CORRIDOR

### Ineco conducts the feasibility study

The line, about 480 kilometres long, will go from Corinto, the country's main port, to the future port at Monkey Point, which will be the first deep-water port on the Atlantic coast. Its construction is of strategic importance for business development and, together with the railway corridor, opens Nicaragua to the Caribbean. The Ineco study includes the alignment and the preliminary designs for the two railway port terminals and the multimodal terminal that will be located near Managua and the adjacent logistics area. Here, near the airport cargo terminal, the rail corridor converges with the Pan American Highway.«

## Ecuador | Uruguay

PABLO VÁZQUEZ, PRESIDENT OF INECO, IN LATIN AMERICA

### Interview with the minister of Transport and Public Works of the Republic of Ecuador

**The President of Ineco, Pablo Vázquez, visited Ecuador in April to meet with the minister of Transport and Public Works, María de los Ángeles Duarte, the national secretary for Water, Walter Solís, and the vicemayor of Quito, Jorge Albán. During this visit, different joint and future Ecuadorian infrastructure projects were addressed, as well as the contribution of Spanish companies to their development.**

### Cooperation agreement on ports signed in Montevideo

**Puertos del Estado (State Ports), the CND (National Corporation for Development of the Oriental Republic of Uruguay) and Ineco signed a technical collaboration agreement on ports in Montevideo last April. The aim is to share experiences and knowledge with the CND for the execution of the Deep Water Port Project (PAP) in La Paloma, Rocha, in Uruguay, which includes collaboration, technical support, studies and specific tasks. The signing ceremony was attended by Adriana Rodríguez, president of the CND, Pablo Gutiérrez, vice-president of the CND, Roberto Varela, Spanish ambassador to Uruguay, José Llorca, president of Puertos del Estado and Pablo Vázquez, president of Ineco. Representing the Interministerial Commission for the Deep Water Port was its president, Pedro Buonomo, and Mr Pablo Genta, undersecretary of the ministry of Transport and Public Works of Uruguay. Since its foundation in 1985, the CND promotes business development with participation from the private sector. The Deep Water Port Project is planned as a multi-purpose port intended for cargo transport.**

## Venezuela

### Renovation of Caracas Metro Line 1

**Ineco has lent its support to the management and integration of the Caracas Metro Line 1 renovation project. This is a collaborative effort with a Spanish JV –Caf, Dimetronic, Cobra and Constructora Hispánica– which is responsible for renovating 22 kilometres of the line, 22 stations and one 25-hectare yard. The project includes the purchase of a new fleet of 48 trains with 7 cars each, the technological modernisation of the control systems, track renewal, purchase of vehicles for track inspection, transport and maintenance and renewal of the power system.**

## Spain | Alicante high speed rail | Port of Valencia

The Spanish minister of Public Works, Ana Pastor, accompanied by the minister of Foreign Affairs and Cooperation, José Manuel García-Margallo, and the president of the Region of Valencia, Alberto Fabra, visiting the future location of the new terminal at Alicante station.

NEW LINK TO THE SPANISH EAST COAST

### High speed rail arrives in Alicante

The commissioning of the Albacete to Alicante section means that the over 600 kilometres distance from Madrid to Alicante can now be covered in little more than two hours. This corridor links the 6.2 million inhabitants of the greater Madrid area with the nearly 2 million inhabitants of the province of Alicante. The line received funding from the EU and the European Investment Bank.

Ineco was involved throughout construction of the whole line, including in drawing up the construction projects, coordination and supervision of the works, environmental, geological and geotechnical studies, expropriation processes and operation studies.«

### Load tests

**For the commissioning of** the high speed railway between Albacete and Alicante, Ineco carried out the load tests for a total of 423 spans on 51 structures. These tests were carried out for Adif over the last two years in two phases: Phase 1, from Caudete to Alicante, and Phase 2, from Albacete to Nudo de La Encina. Work has been performed on over 12 kilometres of bridges and viaducts in total. Ineco has teams specialised in load tests with 25 years of experience both in Spain and abroad.«

**Port of Valencia**

**Ineco has completed the consultancy and design project of Príncipe Felipe Terminal for the Valencia Port Authority. Designing this railway terminal was a significant challenge, as it is the most important container port in Spain and the fifth in Europe. Its remodelling will enable it to be adapted to meet European Standards: 750 metres tracks with UIC gauge.**

# News


## Doha Metro

**Ineco, along with Inabensa and Indra, is part of the consortium led by Bombardier that is bidding for the contract for the signalling, control, telecommunications, power and safety systems of the Doha Metro network in Qatar. The Doha Metro network will comprise 300 kilometres structured in four lines and will link to the country's airports and railway network.**

### Ecuador


## More road work

The minister of Transport and Public Works of Ecuador has hired Ineco to develop the technical, legal and financial framework to convert the stretch of road E-25 between Río Siete and the Tillales fork in the province of El Oro, in the southwest of the country, into a highway. The government of Ecuador highlights that this 25 kilometres road with separate carriageways (two lanes in each direction) and a 10 metres central reservation will facilitate the transport of goods to the ports of Guayas and Bolívar and also promote tourism.«

## Design of flight procedures for Singapore

**Ineco will advise the Singapore Civil Aviation Authority on the review and design of instrumental flight procedures, including those of Changi Airport, one of the most important airports in Asia. This is Ineco's second contract in Singapore, where, along with others, it also acts as a consultant to Civil Aviation on regulatory and financial matters.**

### Oman

MASTER PLAN FOR THE NEW MUSANDAM AIRPORT

## Oman's minister of Transport visited Spain

The president of Ineco, Pablo Vázquez, to the left of minister Ana Pastor and opposite her counterpart in Oman, Ahmed Mohammed Salem Al-Futaisi, during the meeting with the Omani delegation.

A delegation from the Ministry of Transport and Communications of Oman, headed by minister Ahmed Mohammed Salem Al-Futaisi, visited Spain from 21st to 24th February. The delegation met with the Spanish minister of Public Works, Ana Pastor, the regional Transport minister Pablo Cavero and representatives from Aena, Adif, Renfe and Ineco in Madrid. Ineco coordinated the visit.

The Omani minister was interested in how Spanish transport systems are organised and visited the stations of Atocha and Nuevos Ministerios –the largest in Spain– and Barajas Airport. He also travelled to Córdoba on the AVE high speed train.«

## Ineco, for its part...

**will carry out a new project in the Sultanate. Along with the Spanish firm GOP and the Omani company Triad Oman Consultants International, in 2009 it was awarded the contract for planning a new airport. The location study concluded in 2010 (see *it40*) and now the second phase of the work will commence, with the drafting of the Master Plan for the future airport of Musandam.**

# Ecuador loves transport

## Ineco has prepared the 2013-2037 Strategic Mobility Plan

With the collaboration of **Javier Gómez**, civil engineer, Project Manager

**The Ecuadorian Ministry of Transport and Public Works has launched a project to modernise its entire transport network in the 2013-2037 period. This project is crucial for achieving a balanced development of Ecuadorian infrastructure. The Ministry has entrusted Ineco with the design and planning.**

With 14.4 million inhabitants and a complex terrain dominated by the Andes mountain range, Ecuador faces the challenge of making better use of its natural wealth to attain economic growth. In the knowledge that the state of Ecuadorian infrastructure –some of which was in derelict condition– was a clear impediment to the country's development, the Ministry of Transport has, since 2007, undertaken a great investment effort and committed itself to an institutional change leading to better planning and management of its infrastructure. The first results of this endeavour are already visible after five years. Investments have been made in bridges, airports, roads and priority works to reactivate key sectors such as the hydroelectric, petrochemical, tourism and agricultural sectors.

Yet the Strategic Mobility and Transport Plan (SMP) designed by Ineco for the 2013-2037 period goes beyond piecemeal plans, instead seeking full consolidation and integration. After the first goal of stopping the deterioration and the worsening imbalance –both in terms of transport modes and geography– the SMP contains a deep analysis of the priorities, pace of work, working methods and system-specific capacities. The scope of the Ineco plan's technical proposal encompasses the whole of Ecuadorian territory and all modes of transport. It is guided by a vision of nation building and the ordered development of a comprehensive transport system. Taken as a whole, this is an ambitious qualitative leap in the structuring of the Ecuadorian transport network.

**Transport network through to 2037**

The plan is envisaged as a guide for developing the transport system through to 2037, the planning horizon for which Ineco's experts have analysed the global infrastructural needs, costs and deadlines. In summary, this will be a unique, holistic, connected, comprehensive and multimodal system that is flexible and neatly complements industrial development.

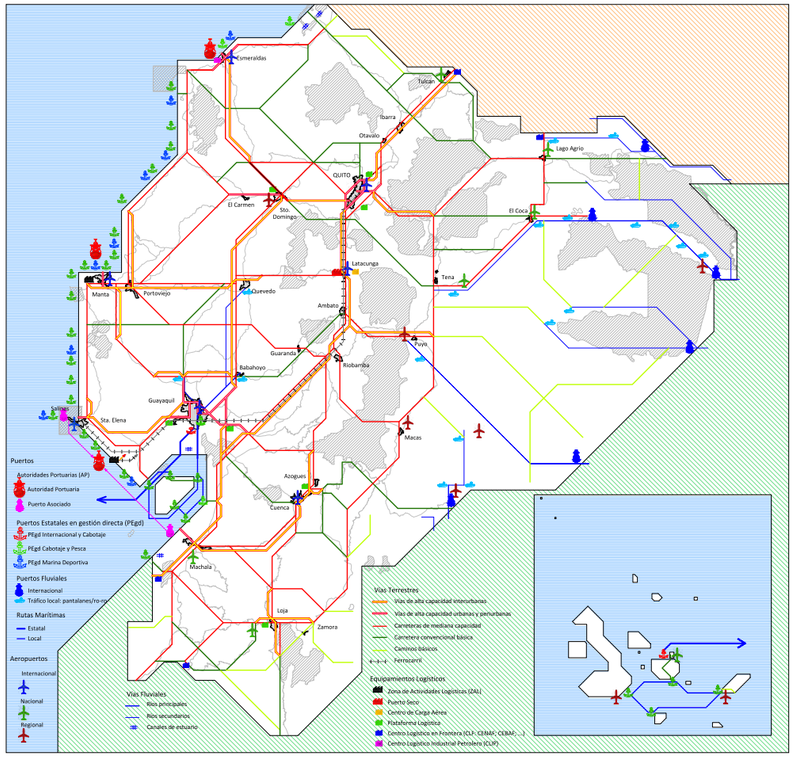
*The proposal encompasses the whole of Ecuador and all modes of transport in order to ensure the orderly development of a comprehensive multimodal system*

The required investments are estimated at over 118 billion US dollars, which the Government of the Republic of Ecuador hopes to raise by means of a public-private partnership. The roads, the urban and metropolitan transport systems and maritime and river transport are, in this order, the areas with the greatest investment needs. In addition, in 2013 the SMP Office will commence operation. This office is responsible for launching the plan and coordinating the new procedures, laws, regulations and management models that will enable its effective execution.«


View of the city of Quito.


Port of Manta.


Road with the Mount Cayambe volcano in the background.





Urban area around the Pan-American highway.

### National Strategic Mobility and Transport Plan (SMP)

**This is a unique, holistic, well-connected, comprehensive and multimodal system which Ineco has designed to achieve consolidation and integration. It is flexible and capable of adapting to industrial development. It represents a qualitative leap from the current system and constitutes a development guide up to the year 2037.**

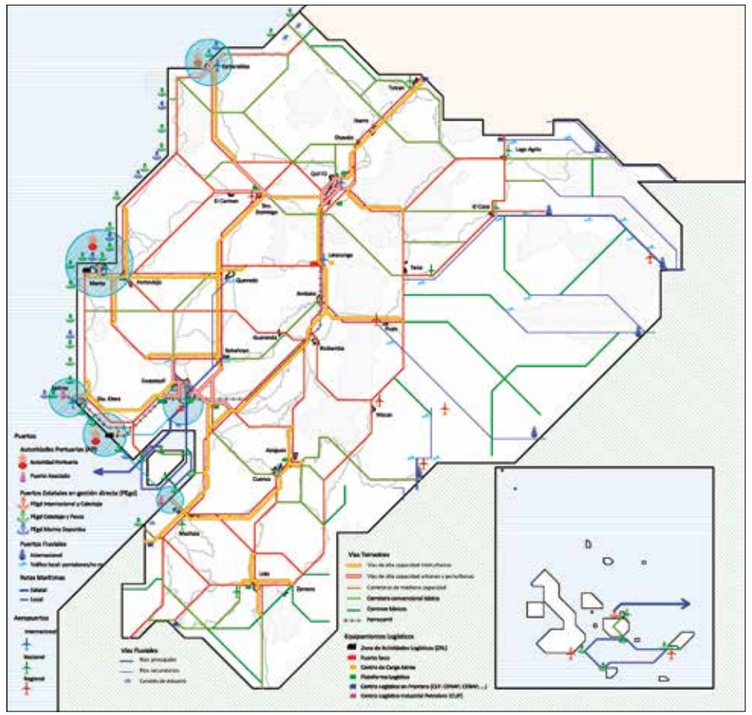

Carondelet Palace, seat of the Ecuadorian Government.

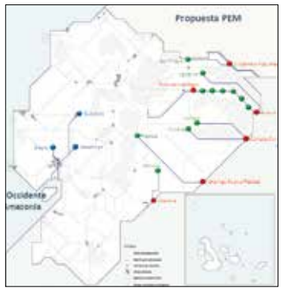

Trolleybus in Quito.

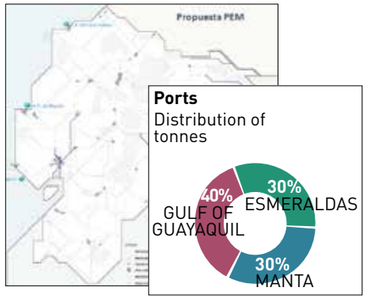
***Ecuador loves life*** is the motto of a campaign launched by the Presidency of the Republic of Ecuador in 2010. It is a symbol present in all its streets, airports and stations through which the Government of the nation intends to convey the motivation and enthusiasm with which the multiple reforms are being undertaken.

**Among the proposals made by the SMP the new ports in Manta and the Gulf of Guayaquil are particularly noteworthy, along with the expansion of the ports of Esmeraldas and Bolívar**

SEA AND RIVER PORTS






## Ports Law

■ **Reorganising maritime and river traffic requires a new Ports Law based on a management model that restructures the activities and functions of the State-run ports, river ports and marinas. The image shows the proposed infrastructure for international and river transport.**

## "A reorganised port system with enough capacity"

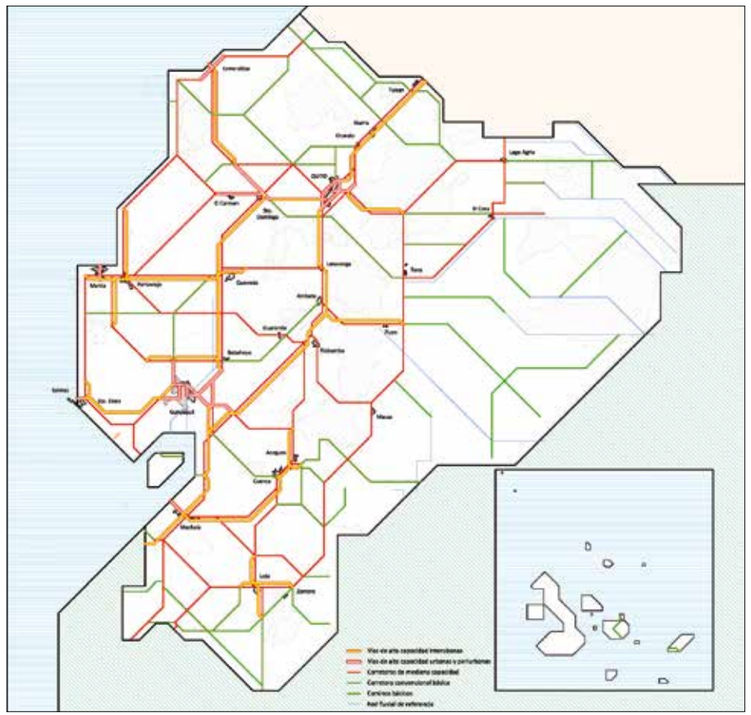
**Ecuador has port facilities** throughout its 640 km of coastline. Guayaquil, Bolívar, Manta and Esmeraldas are of particular note among them. The ports' current capacity to export national wealth such as oil and fruit is already at its limit and the forecast for 2036 indicates that traffic of goods will be 3.5 times what it is today, while container traffic will be four times greater. This forecast shows that current ports have insufficient capacity to deal with short, medium and long-term demand in practically all modes of traffic.
The study approaches the development and structuring of a new sea and river port system with a view to meeting container traffic needs (fruit, oil, vehicles, cereals and minerals). The plan proposes adaptations for servicing large ships crossing the Panama Canal, lines running on the north-south axes of the Pacific coast and lines between South America and Asia. On land, railways will be integrated with the large ports in a multimodal approach and, further inland, connection hubs (Dry Ports) and logistics platforms will be built. Furthermore, the plan includes the development of a modern landlord port model for international ports, strengthening the Ministry's management of the seaport system as a whole.«

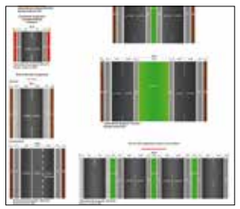
THE RAILWAY

## "From the 21st Century, for the 21st Century"

To become a true alternative to road transport, rail must be developed according to modern technical parameters in the coming years, with a double track, a design speed of 140 km/h and a commercial speed of 90 km/h. In the urban and metropolitan environments it must be designed with view to intermodality and an efficient and high-quality network of infrastructure and buses.«

ROADS





OTHER IMPORTANT CHAPTERS

Work in urban centres, road safety and signage, alignment improvement and preparation of the alignment, including bridges and tunnels, and replacement, conservation and administration tasks are also all important chapters of the analysis performed.

## "A full, networked and hierarchical road system"

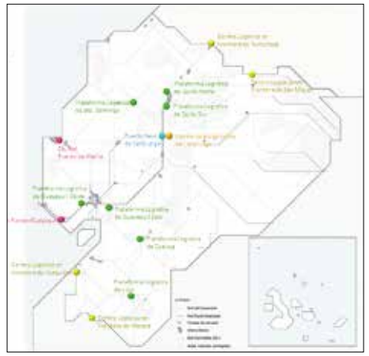
**The State Road Network** of the Republic of Ecuador provides direct service to all urban areas with more than 50,000 inhabitants and to 71% of residents in cities with populations between 5,000 and 50,000, that is, to 82% of the population. Although the geographical coverage is extensive, there are significant areas where state roads are lacking, as the criterion that has determined the design of the network is 'traffic'. This criterion is fundamental, but it should not be the only one. The SMP intends to improve the connections linking the central valleys with the Amazon, the coast and the borders, joining the country as a whole. In addition, different hierarchical models are established with itineraries of general interest, such as port access, airports and centres of particular interest.«

## SMP at a glance

- **13,500 km on state road network**
- **High-capacity network**
  - **2,300 km on intercity network**
  - **550 km of urban and peri-urban roads**
- **6,000 km on medium capacity network**
- **3,100 km of complementary regional connections**
- **1,550 km of basic territorial consolidation routes**

## Raising Ecuadorian air transport capacity is paramount; it will increase from the current capacity of 10 million travellers to 26 million in 2037

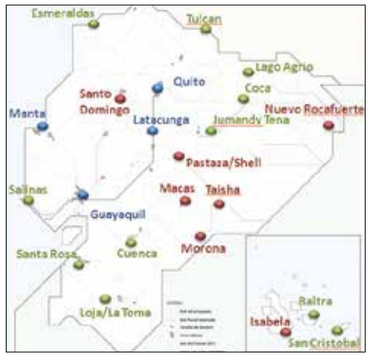
LOGISTICAL FACILITIES

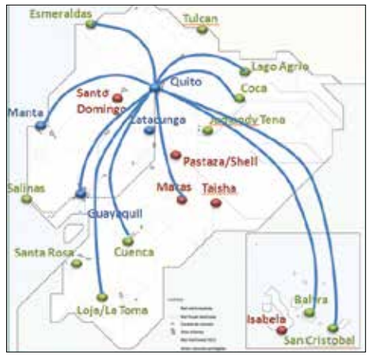


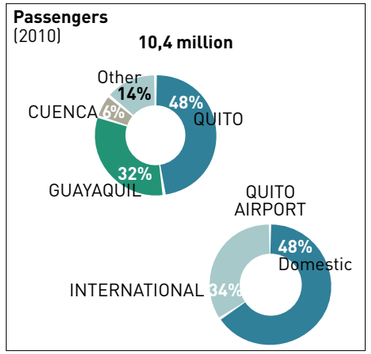
### "A state network of installations to facilitate the carriage of goods"

**The carriage of goods** has a great impact on land traffic and urban quality of life, particularly due to large lorries entering urban centres or moving and delivering goods in ports and stations. The study envisions an effective network of logistics facilities to allow goods to be carried by both international and domestic traffic (intercity and metropolitan).
The study defines the logistical activity zones, dry ports, air cargo centres and logistics platforms.«

AIRPORTS AND AIR NAVIGATION




### "A specialised airport system"

**Passenger transport** in Ecuador's 20 airports is expected to grow from 10 million passengers in 2010 to 26 million in 2037, while cargo transport will grow from 230 to 700 tonnes. Consequently, increasing the capacity of the Ecuadorian air transport system without decreasing its quality is a priority to ensure the sustainable development of an efficient and competitive system.
Ineco presented four programmes in the SMP with 13 interventions in addition to structural reforms affecting the institutional framework and the airport management model, including a review of the legislation, rates and so forth. Connectivity will likewise be reinforced and safety improved. In 2037, the last year in the planning horizon, two more regional airports will be in operation.«

PUBLIC PASSENGER TRANSPORT

### "Professional and economically sustainable services"

**The development of public** passenger transport in urban areas including underground rail networks must be based on full studies considering mobility, infrastructure, operation and financing. This is an ambitious plan which encompasses modernisation, professionalisation, competitiveness and sustainability. To ensure that this plan is feasible, the development of a solid sector is planned along with aid schemes to help with vehicle renewal and corporate reorganisation. Furthermore, communication with the Ministry of Transport and Public Works will be improved. The plan will include work on preferential or exclusive transit corridors for urban public transport (650 km), terminals, interchange stations and stop equipment, signalling and signage systems, operational assistance and access and fee collection control.«

Ineco has also prepared other transport plans, such as the National Transport Plan of Algeria, the National Transport Plan of Costa Rica and the Strategic Infrastructure and Transport Plan of Spain (PEIT).

**ENGINEERING AND CONSULTING EXPERTS**


NEW OFFICES IN QUITO

Since last February, Ineco has new offices in the Torre Boreal building in the Ecuadorian capital. In the photo above, a view of the building from the outside is shown.

MEETING THE PRESIDENT OF THE REPUBLIC

During the presentation of the Plan, Ineco technicians had a chance to speak with Rafael Correa, president of the Republic of Ecuador. From left to right, Óscar Díaz-Pinés, Ángel Galán and Javier Gómez.

# The AVE flies across borders

## International link: a milestone in which Ineco has played an active role

By **Luis Ubalde**, civil engineer (High Speed Line Manager)

**Spanish high speed rail, with its 2,300 kilometres network, has reached a watershed moment in railway history: direct connection to the rest of Europe.**

In December 1844, a Royal Order based on a report by the General Directorate for Roads, Canals and Ports established a gauge of six Castilian feet for Spanish railways, equivalent to 1,672 millimetres, while a gauge of 1,435 millimetres was becoming standard in most European nations. This decision, reasonable enough with a view to improved performance in speed and power for the rolling stock of the day, was nevertheless a differentiating factor that subsequently eroded the potential for transport links between Spain and the rest of Europe.

In this year 2013, it is expected that this differentiating factor will finally be overcome: the North-East High Speed Line from Barcelona to France will be certified as interoperable, opening its 1,435 millimetres gauge track to international services. At a time when political boundaries are increasingly irrelevant, it becomes more necessary than ever before to overcome technological boundaries, creating new relationships between cities.

**North-East High Speed Line**

Since last January, the 131-kilometre-long high speed line between Barcelona and Figueres has been operational, creating a continuous 750 kilometre link between Madrid and Figueres. This is the culmination of a journey that began almost 40 years ago with the first economic feasibility study for a high speed railway between Madrid and Barcelona and its extension to the French border, carried out by Ineco for Renfe in 1974. Since then, there have been a series of landmark achievements. In 1988, the Spanish government decided that the gauge for the new high speed railway would be the European standard gauge of 1,435 millimetres. In 1994, the European Union defined the Madrid–Barcelona corridor as a priority. In 2003, the Madrid–Lleida section was inaugurated. In 2006, the line was extended to Camp de Tarragona. In 2008, Madrid was linked with Barcelona. In 2010, the Figueres station was opened and service began between this town and Paris with TGV Duplex trains.

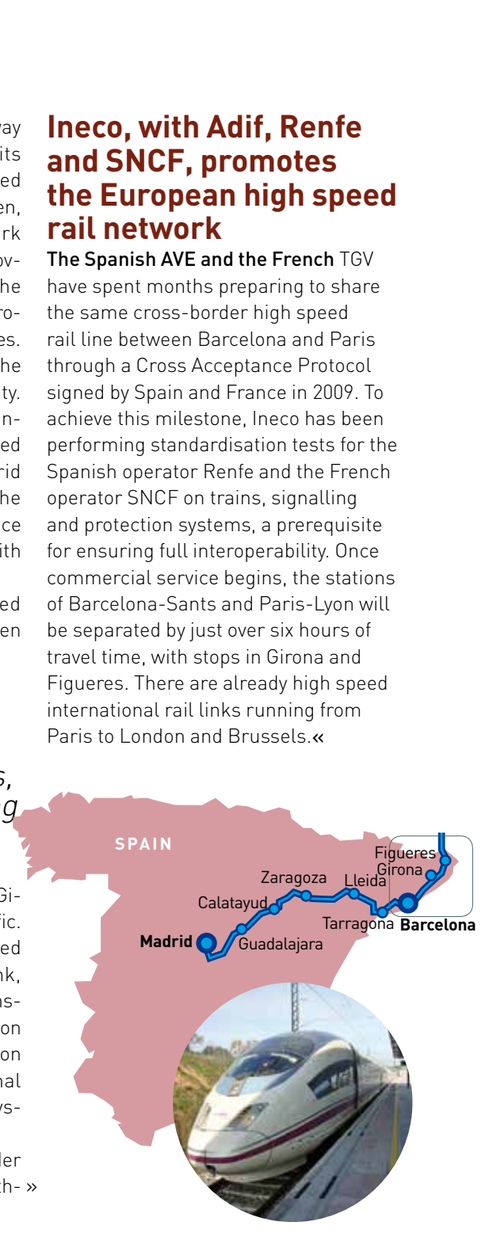
Also in 2010, part of the high speed line that was already complete –between Mollet (a town north of Barcelona) and Girona– was opened for freight train traffic. The port of Barcelona thereby obtained a 1,435 millimetres gauge railway link, avoiding the drawbacks inherent to transloading or performing bogie exchanges on the wagons at the border. This connection also uses stretches of the conventional network, which requires a three-rail system comprising a dual-gauge track.

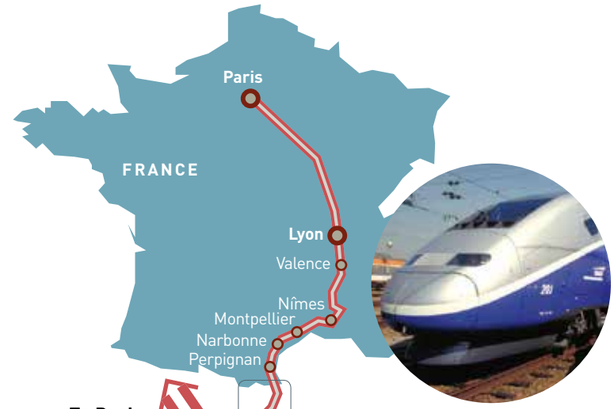
The Madrid–Barcelona–French Border high speed line, also known as the North- »

*Ineco has contributed its extensive experience in standardisation and certification projects, a prerequisite for ensuring full interoperability*

## Ineco, with Adif, Renfe and SNCF, promotes the European high speed rail network

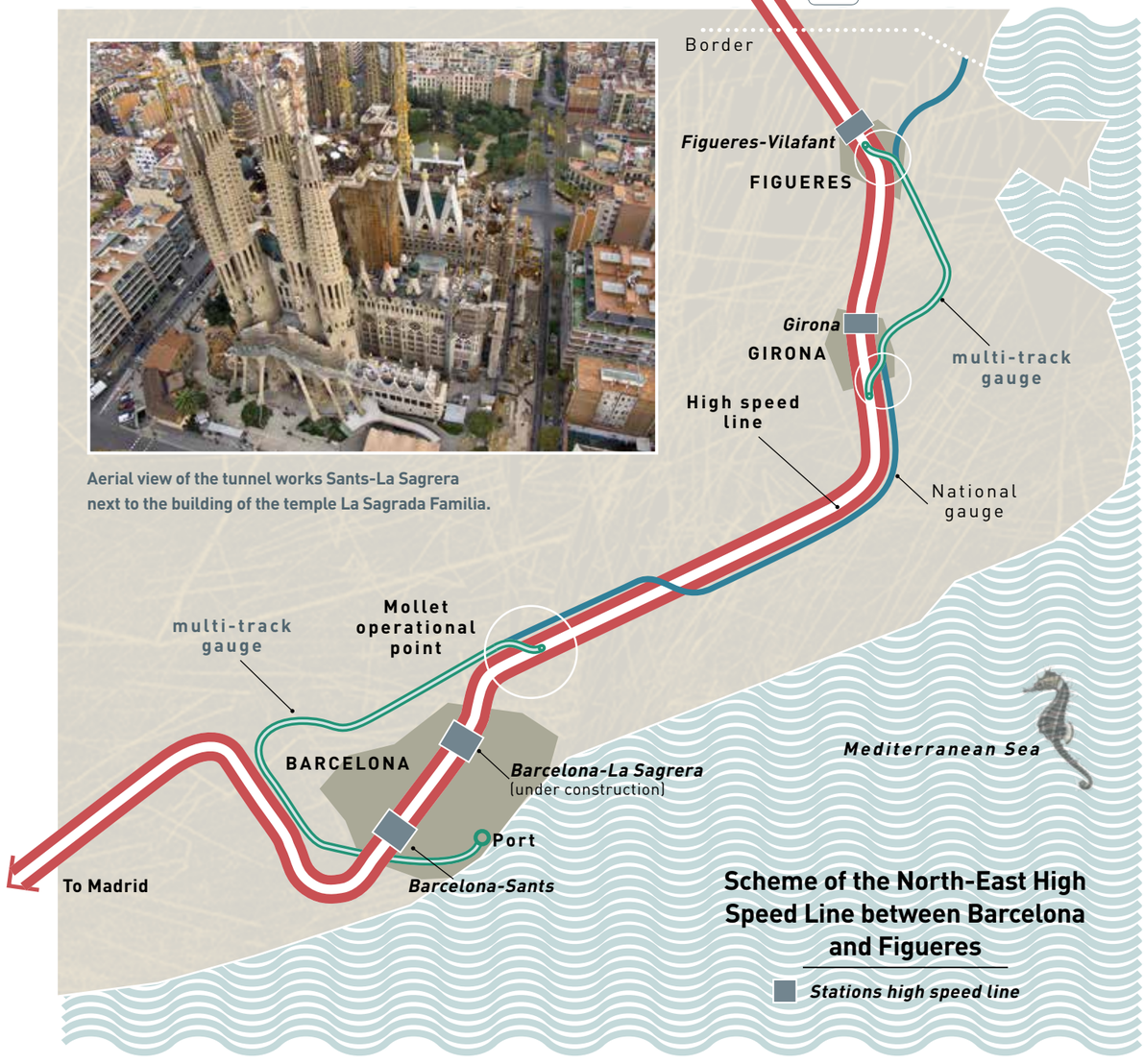
**The Spanish AVE and the French** TGV have spent months preparing to share the same cross-border high speed rail line between Barcelona and Paris through a Cross Acceptance Protocol signed by Spain and France in 2009. To achieve this milestone, Ineco has been performing standardisation tests for the Spanish operator Renfe and the French operator SNCF on trains, signalling and protection systems, a prerequisite for ensuring full interoperability. Once commercial service begins, the stations of Barcelona-Sants and Paris-Lyon will be separated by just over six hours of travel time, with stops in Girona and Figueres. There are already high speed international rail links running from Paris to London and Brussels.«






Aerial view of the tunnel works Sants-La Sagrera next to the building of the temple La Sagrada Familia.



# The high speed rail line between Madrid, Barcelona and the French Border, also known as the North-East High Speed Line, is 804 kilometres long

East High Speed Line, consists of 804 kilometres including the Zaragoza and Lleida bypasses, which are designed to reduce the travel time of direct rail traffic between Madrid and Barcelona. It runs through the stations of Madrid-Atocha, Guadalajara-Yebes, Calatayud, Zaragoza-Delicias, Lleida-Pirineus, Camp de Tarragona, Barcelona-Sants, Girona and Figueres-Vilafant. A new station is currently being built in Barcelona, in the neighbourhood of La Sagrera. In addition to providing service to the high speed line, this station also aspires to be a standard station for the

*Ineco has provided years of training and work for its engineers, who specialise in all the different developmental stages of high speed rail*

commuter rail lines of the city. The line is fully equipped with ERTMS (*European Rail Traffic Management System*) signalling and powered by 25 kV AC, in accordance with European interoperability criteria. Along with the standard track gauge, this helps break down technological barriers within Europe.

**Mediterranean rail corridor**

The section between Mollet and the French border is part of the Mediterranean rail corridor, mixed-traffic railway infrastructure meant to stimulate the development of the entire Spanish Mediterranean coastline, linking Andalusia, Murcia, Valencia and Catalonia with France and the rest of Europe. Clearly, mixed traffic on »


Screen pile construction beside the Sagrada Familia.


Mediterranean corridor link to the high speed line in Mollet.


Viaduct over the Fluvià river.


Vertical TBM.


President Rajoy, prince Felipe, president Mas and minister Pastor on the AVE.

Figueres-Vilafant station.


Montcada tunnel.

## Years of experience and studies in Ineco

**Ineco has provided** years of training and work for its engineers, who specialise in all the different developmental stages of high speed rail, from preliminary feasibility, demand and financing studies to informative studies and construction projects, both for civil works and facilities and for other systems. Ineco has also participated in the design of the stations and city access ways and in project management, technical assistance, environmental management and construction management, in collaboration with Adif, Renfe and the Ministry of Public Works. For this reason, the success of the commissioning of this high speed line, with due recognition of the contributions made by many other firms, is also a success for Ineco and one that the company should be quite proud of.«

a high speed line is a crucial determining factor in the design of the alignment (particularly ramps), railway operation and track maintenance, as there will be greater wear on the superstructure and greater time restrictions for performing preservation work. Regardless, the mixed-traffic use of part of the North-East High Speed Rail Line is a novelty in the Spanish railway system and follows the precedent set in other European countries such as Italy (Rome–Florence line) and Germany (Hannover–Würzburg and Mannheim–Stuttgart lines).

The challenge of making the high speed of passenger trains compatible with freight train restrictions requires varying the alignment parameters throughout the North-East High Speed Line. Thus, on the Madrid–Barcelona section, where only passenger trains run, the maximum grade is 25‰, except in urban areas, and the horizontal curve radius is generally 7,000 metres. This allows travel at speeds of up to 350 km/h. Nevertheless, in the Mollet–Figueres section, on which both passenger and freight trains run, the aforementioned values will be, respectively, 18‰ and 4,000 metres and passing sidings over 750 metres in length will be added for the stabling and overtaking of freight trains.

These alignment characteristics, significantly conditioned by terrain and environmental conditions, have propelled the execution of highly complex engineering works. The paradigmatic examples of this on the Barcelona–Figueres section include the tunnels of Les Cavorques (3.0 km) and Llogaia (1.7 km), the viaduct over the Fluvià river (920 m) and that of Llinars del Vallès over the AP-7 highway (600 m). Also noteworthy are the three urban tunnels that cut across the areas of Barcelona between Sants and La Sagrera (5.8 km), Montcada (3.7 km) and Girona (2.9 km). In these three cases, the geotechnical features of the soil and the need to reduce ground settlement to imperceptible levels led to the use of the Barcino, Montcada and Gerunda tunnel boring machines, all of which are EPB (Earth Pressure Balance) machines. They were monitored for continuous and rigorous control of the excavation and construction processes. This rigorous execution of the works was complemented with the inspection of over 10,000 reference points in streets and building façades, and the monitoring of homes near the tracks through over 6,300 technical inspections.

Barcelona's case was unique. Tracks

*Mixed traffic on a high speed line conditions the design of its alignment, its operation and its maintenance*

passed right next to monumental buildings that are world heritage sites (Sagrada Familia and Casa Milà) and so construction was supervised by the UNESCO and received international attention. Innovative construction techniques were also used in the works; for example, for the first time in Spain, a vertical tunnel boring machine was used to bore the emergency exit access ways.«

# Shadadiya, a mirror of progress

## An immense industrial complex south of Kuwait City

With the collaboration of **Jonás Casquero**, civil engineer (Department of Intermodal Projects)

**Ineco is acting as a consultant to the *Public Authority for Industry* (PAI), the top Kuwaiti authority for industrial planning and development, to get construction of this immense complex off the ground, located about 25 km southwest of Kuwait City.**

The company has prepared the conceptual design of the industrial area along with all the technical and administrative documentation for the turnkey tender. It has been involved from the start of the prequalification process to the preparation of the tender documents and the evaluation of the offers and the awardee's proposal. In addition, as project manager, Ineco has coordinated Spanish and Kuwaiti partners to carry out the work. The PAI commissioned supervision of the work to the OCCD (Office of Consultation and Career Development) of the University of Kuwait.

The new complex will include logistical centres, warehouses and buildings for

*Ineco, as project manager, has coordinated Spanish and Kuwaiti partners to carry out the work*

various activities, with three main sectors: chemical, food and mixed, the latter including the textile, paper, wood and mineral industries. In total, about 1,000 plots will be developed for both light and heavy industries, a significant challenge for the PAI, which has entrusted Ineco with this quantitative and qualitative leap in the »

## Constant growth

The economic growth of recent years has brought about a significant influx of foreign labour, mainly settled in the suburban neighbourhoods. In a country with over 4.5 million inhabitants and a capital city already close to saturation, the Government of Kuwait has planned the development of new towns to absorb the constant growth of both the Kuwaiti and foreign populations. The jobs that will be generated by Shadadiya when it is fully operational will employ an estimated 28,000 people.«


IMMENSE INDUSTRIAL COMPLEX

Shadadiya is located 25 km from Kuwait City, near the seventh ring road, 12 km from the airport and 18 and 31 km from Shuwaikh and Shuaiba ports, respectively.

THE REASON FOR SHADADIYA

In tandem with the country's population growth, industrial growth requires new and more modern infrastructure and transport systems.

## The project meets energy efficiency and sustainability targets and the environmental impact study takes into account the climate in the area and the type of industrial activity that will be carried out there

planning and design of Kuwait's industrial areas.

The location was selected in consideration of its proximity to Kuwait international airport and the region's main ports, Shuwaikh and Shuaiba. In total, the new industrial complex will occupy a total surface area of 5 km$^2$. It will be served by all manner of public facilities, such as petrol stations, police stations, fire stations, car parks, clinics, restaurants and mosques. The planned facilities will incorporate the modern utilities of an industrial city, including the electrical power supply, telecommunications network, lighting, full water supply including a segregated supply for fire fighting, storm water network and water tank, sewer system and industrial waste water network. It is also proposed that industrial sewage be treated in three separate sewage treatment networks, one for each industrial sector. The storm tank and the sewage treatment facilities will be located in the northwesternmost part of the industrial area. In short, the new Shadadiya industrial area will have everything a small city needs to function.

*The new Shadadiya industrial area will have a total area of 5 km$^2$ with all manner of public services*

In addition, an environmental monitoring centre will be included.

Marketing of the plots is expected to begin during 2013 and 2014. Several phases have been defined through to 2020, with an orderly growth of the spaces, according to the evolution of demand, until they are fully occupied.«

## All services needed for industrial activity

**The project takes into** account the need for drinking water pipes and tanks, rainwater collection systems, a sewage treatment plant, a sewer system and a recycled water irrigation system for the green belt.

**In addition, the premises will be equipped with** an optic fibre network, a heavy vehicle parking area and a 20 hectare technological park. All the designs and projects have been approved by the corresponding administrative authorities and comply with current Kuwaiti legislation. Green areas, street furniture, pedestrian crossings and sidewalks, street lighting and signage, as well as the perimeter wall and the CCTV surveillance of the premises, put the finishing touch on a project that has recently entered the public tender phase.

### REGIONAL SUPPLIER

**Shadadiya will mainly** supply manufactured goods to the population of Kuwait and neighbouring Iraq. Kuwait obtains 93% of its income from oil. It is the second biggest oil producer in the Gulf Area and the eleventh worldwide. It must import almost all raw materials and consumer goods, which arrive by ship or by lorry from Saudi Arabia. In the future, these goods will be handled, manufactured, stored and distributed to the whole neighbouring region, generating significant vehicular traffic.«

FLEXIBLE DESIGN

Shadadiya has been designed with enough flexibility to make both the road layout and the arrangement of blocks and lots adaptable to future needs.

Street hierarchy maps, arrangement of lots and arrangement by lot size (from 1,000 to 10,000 m$^2$). The design of the buildings, with up to two storeys and one basement level, allows their interiors to be adapted for different uses.

### The design of access ways and roads is a priority

■ **Good communication and road connections are essential. The mobility and traffic studies in the Master Plan estimate that, by 2030, Shadadiya will generate a traffic volume of 17,000 vehicles during rush hour. The premises will require construction of a 1.7 km road to link them to the seventh ring road of Kuwait City, which, in the future, will be extended to the southeast. Ineco has conducted a detailed analysis of the road types on the premises, including major collector roads, minor collector roads an plot access roads, and has designed a hierarchical network to ensure that traffic is fluid and safe and heavy vehicles have room to manoeuvre.**

■ **A total of 45 km of roads have been designed: 7 major collector roads, 4 minor collector roads and 34 plot access roads, with twenty roundabouts at the main intersections and about one hundred priority junctions between secondary roads.**

■ **The design also includes the analysis of the earthworks for the road network and the road pavement study in areas designated for traffic as well as the definition of parking, maintenance and refuelling areas for heavy vehicles. Likewise, pedestrian pathways, signage, lighting and the proposal for green areas in the road network are covered. The study also includes the preparation of the technical specifications for all the infrastructure and equipment.**

# Spotlight on safety

## A study by Aena Aeropuertos Internacional

With the collaboration of **José Luis Bermejo** (Department of Infrastructure Planning) and **Ignacio Alejandre** (Project Manager), aeronautical engineers

**With the assistance of Spanish technical advisors, the Luanda airport has been upgraded to improve safety and security in both operations and facilities.**

Airport and navigation safety is the cornerstone of air transport. Data published by the ICAO (International Civil Aviation Organisation) show that, following the slump experienced since 2007, the sector has begun to recover. In 2010, world air traffic grew by 4.5% on average. The growth in Africa, however, was almost twice that, at 9.7%. This is the second highest growth rate in the world, exceeded only by that of Asia and well above that of North America or Europe, despite representing only 3% of total air traffic.

Amidst this backdrop, in 2012, ENANA, the publicly-owned company that manages airports and air navigation in Angola, selected its Spanish counterpart, Aena Aeropuertos, to study and implement improvements in operational safety and physical security in the country's main airport, in the capital city of Luanda. The study is part of a global strategy for modernising Luanda's airport facilities, which, according to ENANA, handled 4.5 million passengers,in 2010.«

## Detection, analysis and improvement

**F or one year**, a team from Aena Aeropuertos Internacional –which included Ineco experts– carried out field work in collaboration with the airport staff and Angolan authorities. Work began with data collection and diagnostics to detect deficiencies in procedures, equipment and infrastructure. Corrective actions were then proposed for each deficiency detected. For example, to resolve the lack of signs on the apron, the absence of different apron areas separated by aircraft and aviation type and the disregard of minimum distances between aircraft, a study on apron signs and organisation was recommended. To improve passenger flow, revision of the criteria for boarding gate and check-in counter assignment was proposed. Documentation of preventive maintenance activities was recommended for fire-fighting vehicles and equipment.

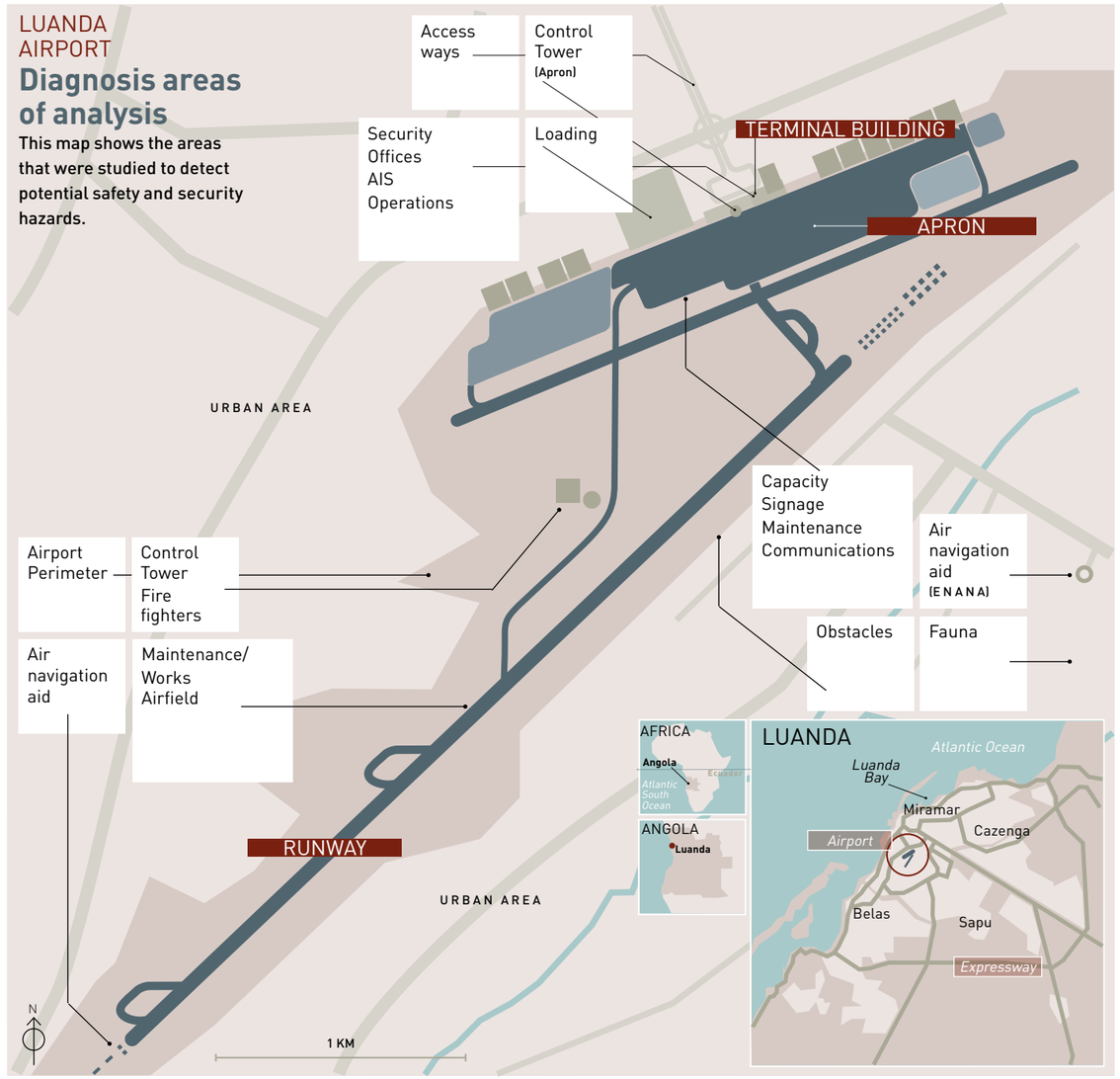
**Other proposals made** included the creation of an airport operations coordination centre and the establishment of an operational safety policy. In all, twenty-one corrective actions were proposed, grouped into seven areas: infrastructure, equipment, airport services, documentation, real-time management, strategy and maintenance of infrastructure and facilities. To implement these proposals and introduce airport staff to what is known as 'operational safety culture', the Aena team designed a special training programme: 196 hours of training spread over 15 courses, with 220 participants. Lastly, a quality assurance plan with metrics was prepared and presented which is similar to that used by Aena in its own airports«


### Quatro de Fevereiro airport

**The Luanda airport, built in the sixties, is located within the city centre and has two runways, one measuring 3,715 x 45 metres and the other 2,600 x 60 metres. Its main market is Africa, which generates about 65% of its traffic, followed by Europe, with a share of approximately 15%. The facilities were expanded in 2009.**

### Spain-Angola partnership

**The ministers of Transport and Public Works from Angola and Spain, Augusto da Silva Tomás and Ana Pastor, signed a technological cooperation agreement for marine transport and salvage. During the Spanish's visit delegation, which included the president of Ineco, Pablo Vázquez, airport collaboration was also discussed.**



**Angola is immersed in the modernisation of its transport infrastructure, a process that will fuel its economic growth-which has skyrocketed since the end of the civil war in 2002**




## Procedures developed

→FOR OPERATIONS

- Airfield notices and alerts
- Maintenance
- Work in the airport
- Management on the apron
- Management of operational safety on the apron
- Supervision of vehicles in the airport movement area
- Weather conditions
- Inspection of the airport's visual aids and electrical systems
- Inspection of the movement area and the obstacle-free zones
- Animal hazard management
- Obstacle surveillance
- Moving of unusable aircraft
- Storage and handling of hazardous materials
- Protection of navigation radio beacon locations
- Rescue and fire extinguishing services

→FOR AIRPORT SECURITY

- Management of credentials and authorisations
- Passenger inspection
- Hand luggage inspection
- Employee and crew inspection
- Vehicle inspection
- Cargo hold luggage inspection
- Inspection of airport supplies and goods
- Security patrols
- Evaluation of the TIP by X-ray operators
- Load inspection

## Spanish experience

**Ineco collaborates with** Aena in the development and upgrading of the operational procedures and certification process for the main Spanish airports: Madrid-Barajas (two new runways and Terminal 4, 2004-2006) and Barcelona-El Prat (Terminal 1, 2007-2009), Málaga, Ibiza and the Algeciras heliport.

Ineco also developed the standard Operational Safety Management System that Aena initially implemented in two trials at Ibiza and Tenerife Sur airports (2004-2005) and subsequently rolled out in the remaining airports of the Aena network (Madrid-Barajas, Barcelona-El Prat). Ineco also does maintenance work in these airports (2007-present).

Since 2009, Ineco provides support to the National Air Safety Agency (AESA) for the authorisation, inspection and certification of publicly used and privately managed airports, for construction projects and the inspection of airfields under restricted use.«

# The fortress of the Caribbean

## Rafael Núñez Airport expansion

With the collaboration of **David Gutiérrez** (Unit Manager and Inspector), **Francisco Puerto**, **Luis F. Parra** (Specialist Managers) and **María Ángeles García-Cuevas** (Department Manager), aeronautical engineers (Airports Subdivision)

This picture shows the appearance of the terminal building after the expansion and modernisation work. To the left are two views of the interior.

**With over two million passengers annually, Rafael Núñez is Colombia's fourth busiest airport. Ineco has coordinated and supervised the remodelling of the terminal building and carried out the functional design. It has also planned the work to be done on the runway and aprons and will supervise its execution until 2014.**

Cartagena de Indias is an old colonial town and currently the sixth most productive industrial city in Colombia. It also happens to be the cradle of Colombian aviation. Its airport is the country's fourth most important by traffic volume. Located within the city proper, it has been expanded to absorb the burgeoning demand linked to the growth in trade, industry and tourism in Cartagena de Indias, which was declared a World Heritage Site in 1984. According to Aerocivil, the official body in charge of civil aviation, in 2012 the airport received over 2.2 million passengers. By 2020, this figure is expected to double.

For this reason, SACSA, the Colombian airport administration company in which the Spanish company Aena Aeropuertos owns a share, is developing an improvement and expansion plan that includes work on both the airfield and the passenger areas, which was executed during 2012 and early 2013. Ineco has been entrusted by Aena Aeropuertos with the management, coordination and supervision of the works and the functional design of part of the terminal building.

The work performed was mainly focused on the runway and the two aprons, in addition to auditing the terminal building works. One of the most relevant issues in this kind of project is minimising the effect on current facilities and their operation, both to reduce costs and to ensure that the terminal remains operational during the construction phase. The proposed architectural solution fulfils all these requirements with minimal investment.

Ineco has also done the studies and designs for the runway and apron overlaying work, as well as a preliminary project for a new general aviation terminal (FBO). In addition, a study was carried out specifically for planning the execution of the works in the aircraft manoeuvring area.

The aim of all these improvements is to raise the airport capacity to 4 million passengers in 2020, improve the service quality and meet international safety regulations.«

WORK HIGHLIGHTS

The overlay of the two aprons and the runway has been calculated to absorb the expected traffic increase until 2020. The passenger areas have also been improved.

## The Rafael Núñez international airport

**The Cartagena de Indias** airport is located in the neighbourhood of Crespo, in the northern part of the city. Since 1996, it has been run by SACSA (Coast Airport Association), in which the Spanish airport administration company Aena Aeropuertos holds a majority share of 37.8%, the rest being owned by 18 Colombian companies. Most of its traffic is domestic, with connections to the capital, Bogotá, and other cities, such as Cali and Medellín. The main international destinations include the United States, Chile, Venezuela and Spain, as well as seasonal destinations such as Ecuador and Brazil.«

## A tourism magnet

**The city of Cartagena de Indias** (pop. 955,000), in northern Colombia, is one of the most popular tourist destinations for domestic and international visitors alike. Founded by the Spaniard Pedro de Heredia in 1533, it was a crossroads of Caribbean trade –and thus also for the pirates that plagued the region– as well as an important military base. Currently, in addition to its status as a prominent tourist centre both for its monuments and its sunny climate and beaches, it is the most important cargo port and fourth largest industrial centre in Colombia, boasting five free trade zones and the country's second largest refinery.«

## The work in detail

➔TERMINAL BUILDING

**— Domestic boarding area: 907 m² with 6 boarding gates, expanded to 3,479 m² and 8 boarding gates. Includes security filters, waiting areas, a shopping and dining area and VIP rooms.**

**— Domestic arrivals area: expanded from 2,092 m² to 2,450 m². A third luggage conveyor belt and a hotel information area have been added.**

**— International boarding area: 880 m² with 3 boarding gates, expanded to 2,625 m² and 5 gates.**

**— International arrivals area: increased from 2,395 m² to 3.947 m² with three luggage conveyor belts.**

**— Renovation of the check-in area.**

➔APRONS AND RUNWAY

**— Main aircraft parking apron (75,000 m²): the damage detected has been repaired, subsequently overlaying with asphalt at a thickness calculated to withstand expected traffic until 2020.**

**— Secondary apron: the paving has been rehabilitated in order to allow parking of general aviation aircraft. Access is via a perimeter access road.**

**— Runway (2,540 m): the surface course has been overlaid to meet the safety requirements of the ICAO; a runway end safety area (RESA) has been built at threshold 01 and the runway turn pad has been enlarged.**

# The path of SIRA

## A system for global maintenance integration

With the collaboration of **David de León**, **Luis Manuel Lozano** and **Teresa Huerga**, telecommunications engineers; **David Sánchez**, computer engineer and **Alberto Gallego**, industrial engineer

**Ineco has been collaborating with Aena since 2007 in the development of SIRA. When it is fully implemented, it will put an end to the inconveniences of managing different pieces of equipment and systems with different software.**

A key issue in current air navigation systems is the need to modernise and standardise the supervision and control of the equipment used to manage air traffic. Until now, multiple digital systems have been used to supervise the functioning of the equipment –one for each machine and brand– which means up to 25 different interfaces. Consolidating these into a single interface will save money, improve safety and facilitate maintenance. To achieve these goals, Aena has decided to develop SIRA (AENA NavAids Integration System) through its Navaids Department, with which Ineco has been collaborating since 2007.

SIRA is based on same technology as SCADA (Supervisory Control And Data Acquisition), a set of open architecture applications that users can customise according to their needs, which are used in different environments to centralise and automate the processing of all kinds of data. SIRA changes the work style by using a single interface instead of each unit's own proprietary software. In addition, it brings together the information from each unit so that everything can be seen at a glance.«

## A single application with multiple uses

**The new system** was developed to integrate the remote control and supervision of the nearly 400 radio navigation aids present throughout Spain. It has also, however, shown a versatility that allows it to manage other systems as well. Thus, signals from auxiliary systems are being added to it, including signals from facilities such as climate control, intrusion protection, fire detection, low voltage panel, UPS, power generator set, communications, etc.«

### Main types of radio navigation aids

➔VOR: *VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE*

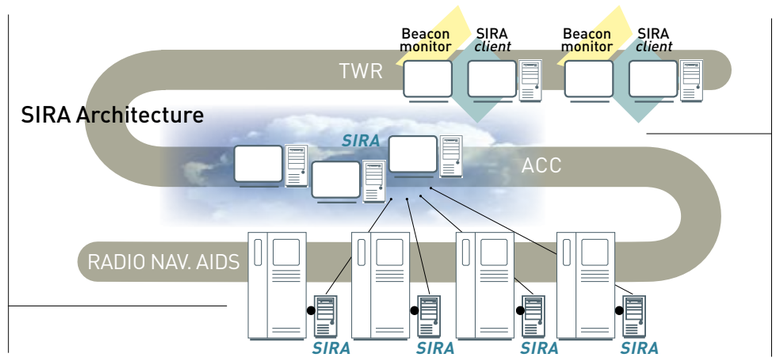
**The guidance information shows the radial on which the receiver is located with respect to a reference bearing, generally the magnetic north of the VOR station.**

➔DME: *DISTANCE MEASUREMENT EQUIPMENT*

**Provides a continuous and accurate indication of the slant distance between aircraft and the ground station.**

➔ILS: *INSTRUMENT LANDING SYSTEM*

**Provides electronic guidance along the "glide path". It combines three subsystems: locator, glide path and radiobeacons or DME.**

**SIRA acts as a platform where each unit's management and supervision software is integrated. In the next phase, it will directly manage thousands of data items**

WHAT ARE SCADA SYSTEMS?

## Applications for managing production processes and infrastructure

SCADA systems are software applications designed to automate, supervise, remotely control and manage production processes and infrastructure. Many SCADA systems are installed today in a wide range of sectors, such as the food, pharmaceutical and automotive industries, water management, transport infrastructure (e.g. airports and air navigation), power generation (electrical plants, nuclear plants), buildings, etc.

**The main feature** of these computer systems is that they have an open architecture. This means that any systems integrator with the necessary licences can easily update them without relying on systems integration companies or manufacturers. Another of their vital features is scalability, which is to say that they can be easily adapted for use

*Many SCADA systems are installed today in a wide range of sectors*

with many or few elements. This is an advantage when continual expansion, improvements or updates are needed, as in this case, and provides an option superior to proprietary remote systems. Moreover, they are easy to program, simplifying their maintenance.

**Aena and Ineco's team** have used Wonderware IAS technology to design a specially tailored system, following a methodology oriented toward software security. This system is based on a detailed technical model and on development standards that make full use of its benefits.

**The SIRA project** has been divided into three phases: a preliminary design phase, an initial deployment phase with the implementation of the basic functionalities and, lastly, a final phase with full management of all radio navigation aids.

Currently, 50% of the units spread throughout Spanish territory have already been integrated into SIRA and it is expected that phase 1, deployment, will

*The know-how involved in this joint Aena-Ineco project is applicable to sectors other than air navigation*

be complete by late 2013. It is projected that the implementation of phase 2, full management, will be concluded by late 2014.«


COLLABORATION BETWEEN INECO AND AENA

Since 2007, Ineco has worked with the NavAids Department of Aena on the design and implementation of the SIRA (AENA NavAids Integration System) project. In the photo, from left to right: Alberto Gallego,Teresa Huerga, Luis Manuel Lozano and David Sánchez.



AERONAUTICAL | **COLOMBIA** | Alfonso Bonilla Aragón airport

# Paving the way

## Overlaying of the Cali airport runway

With the collaboration of **Miguel Medrano**, aeronautical engineer (Department of Infrastructure)

Runway of Alfonso Bonilla Aragón international airport in Colombia.

Overlaying work.

**Ineco has supervised the works on the runway at Alfonso Bonilla Aragón international airport in the region of Cali. This is the first paving renovation work in Colombian airports performed in accordance with ICAO standards.**

The works were executed between January and March 2013 and managed and supervised by Ineco. Much of the work was carried out at night to ensure the lowest possible impact on airport operations. It consisted in pouring 7,000 cubic metres of asphalt mixtures over the runway, which is 3,000 metres long and 45 metres wide.

This is the first Colombian airport to have runway paving made with BBTM-11A uneven mixture, which provides the surface friction and texture characteristics specified by International Civil Aviation Organisation (ICAO) standards.

Ineco's supervision included the management of technical, environmental, financial, administrative and health and safety factors as well as of the planning and execution of the works.«

### Ineco in Colombia

■ **In addition to overlaying the runway, Ineco is currently preparing a new design for the terminal building and a Master Plan (full plan for future development) for Alfonso Bonilla Aragón airport.**

**The company is also working in other Colombian airports, such as Eldorado Airport in Bogotá, and Rafael Núñez airport in Cartagena de Indias.**

# Island in motion

## The Las Palmas-Maspalomas line is meant to promote intermodality

By **Regina Díaz**, civil engineer and **Paloma Bautista**, architect (Superstructure, Infraestructure and Pavements)

**Since 2009, Ineco directs and coordinates the planning of the future railway line in the east of the island of Gran Canaria. Along 58 kilometres and 11 stations, it will link Las Palmas de Gran Canaria to the island's main towns, the airport and the tourist areas in just 25 minutes with the 'express' service and in 45 minutes with the other services.**

The island of Gran Canaria has the greatest population density of the Canary Islands –545 inhabitants per km²– and holds just over 40% of the archipelago's total population. According to data from the Canarian Statistics Institute, as of 1 January 2012 the island of Gran Canaria is home to 852,225 residents, of whom approximately 80% are concentrated in the island's east coast towns, including the capital city, Las Palmas de Gran Canaria 85% of the island's economic activity is also generated in this corridor. Thus, Gran Canaria has developed a rail transport project capable of handling the high rate of mobility registered throughout the eastern part of the island. A modern line, approximately 58 kilometres long, will connect the city of Las Palmas in the north to the tourist hub of Maspalomas in the south. It will be served by 11 stations and, in addition to the capital city of Las Palmas, will link the towns of Telde, Ingenio, Agüimes, Santa Lucía and San Bartolomé de Tirajana.

### Initial demand of 14.6 million travellers

To bring this project to fruition, in 2009 the company Ferrocarriles de Gran Canaria (FGC) was created, which is dependent on the Cabildo (the local Government). In the same year, FGC signed a framework agreement with Ineco through which the latter was put in charge of planning, coordinating and supervising all tasks prior to the tender for the works and of the superstructure, operation, feasibility and demand studies. According to the demand study done in October 2011, in 2018, the projected first year of service, the estimated demand on the line will be 14.6 million passengers. By 2028, the last year in the planning horizon, it will rise to 20.8 million.

### Sustainable mobility

One of the basic goals of the future line is to improve the quality and sustainability of the public transport service in the island's main artery, which currently suffers from a high level of traffic congestion. A means of transport is thus proposed that is fast, comfortable, reliable and safe, while at the same time saving time and money by using renewable energy.

Another goal is to increase the presence of public transport along the corridor and to promote its use between the main population centres, as well as between the capital city, the airport and the two main tourist hubs on the island.

In short, the overall aim is to promote intermodality. The railway will therefore link with complementary collective transport systems (e.g. buses) and will have interchange stations in the air terminal and the cruise ship harbour. The rail stations are planned to be very close to the centres of demand. They are designed with pedestrian access ways and accessible to persons with reduced mobility. They will also have for bicycle access and parking, taxi stands, park and ride and quick stop points for passenger drop-off and pick-up.

This is a conventional high-performance line with a design speed of 160 km/h, double track along 50 of its 58 kilometre length and single track at the line ends.

*The basic goals of the project are to improve mobility with a comfortable, efficient and sustainable public transport system and to encourage intermodality*

Nearly 60% of the alignment will run through a tunnel and the line will cross 17 viaducts with a total length of 5 kilometres. The rest of the line is at ground level, along the GC-01 highway. Slab track will be used for the superstructure due to its low maintenance cost.«


# The 11 stations on the line are conceived as true mixed-mode systems meant to enhance north-south mobility along the corridor

Cross sectional view of Santa Catalina station.

## From the city to the beach, by train

**The 11 stations on the line** are conceived as true mixed-mode systems meant to enhance north-south mobility along the corridor. The projects for nine of these stations are currently in their final stages and the remaining ones (Jinámar and Telde) are expected to be put out to tender in 2013.

**1**

The line starts in the urban area of Las Palmas de Gran Canaria, with the stations of Santa Catalina and San Telmo. The former is integrated into the current bus interchange station and into the cruise ship harbour of the port of La Luz. It is also very close to Santa Catalina park. This is a strategic point due to its convenient connections to the public transport network and the port and to its location, which provides service to a large swath of the capital and direct access to administrative services, shopping and areas of touristic-cultural interest.

**2**

Between Santa Catalina station and the next one, San Telmo, the alignment runs through a tunnel under the Avenida Marítima. This section will be executed using an EPB tunnel boring machine, as it is beneath the water table. The line will have a single track until San Telmo station, where there are four tracks. The railway station will be located in the bus interchange station, close to the historic town centre and the shopping area of Triana, and so is expected to have the highest passenger demand. It is envisioned as an urban milestone and a way to bring the city closer to the sea.

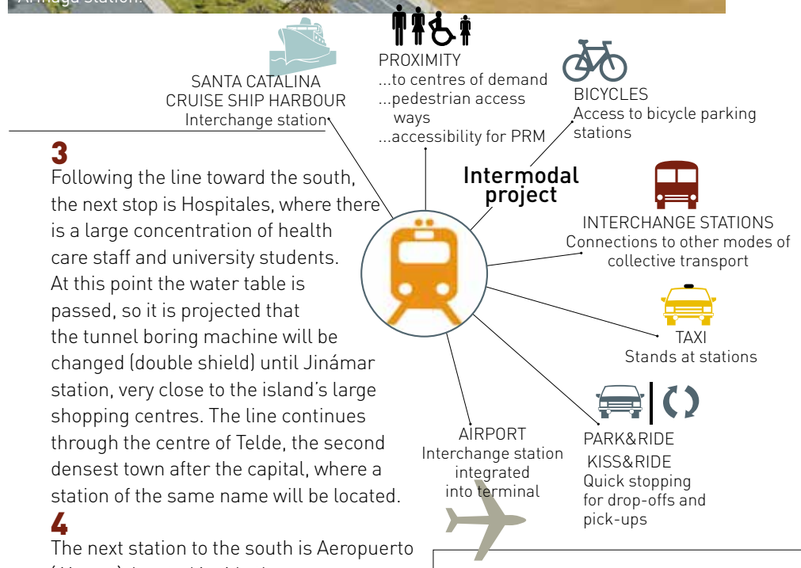
San Telmo station.

Airport station.

Playa del Inglés station.



Arinaga station.




**3**

Following the line toward the south, the next stop is Hospitales, where there is a large concentration of health care staff and university students. At this point the water table is passed, so it is projected that the tunnel boring machine will be changed (double shield) until Jinámar station, very close to the island's large shopping centres. The line continues through the centre of Telde, the second densest town after the capital, where a station of the same name will be located.

**4**

The next station to the south is Aeropuerto (Airport), located inside the passenger terminal. The airport of Las Palmas de Gran Canaria is the fifth busiest out of Spain's 47 airports, both in terms of passengers (9.8 million in 2012) and operations (over 100,000). Aena participated in the technical monitoring committees with Ferrocarriles de Gran Canaria to reach a consensus on this complex project.

**5**

Next comes El Carrizal, following which the railway emerges onto the surface and the alignment runs along the Southern Highway (Autopista del Sur), or GC-1; it then crosses the industrial park of Arinaga on a viaduct, upon which Arinaga station will be built. The line continues on to the town of Vecindario, where another station will be placed and where the workshops and sheds will be built.

**6**

The two last stations are located in the island's two great tourism magnets: Playa del Inglés, above ground, and Meloneras, integrated in the bus interchange, near station the Maspalomas lighthouse.

✱

**The line will have be built to** standard or international gauge (1,435 mm), mounted on slabs and have double track along nearly its entire length, with the exception of two sections: the initial Santa Catalina-San Telmo section and the final Playa del Inglés-Meloneras section. Two types of service are planned: 'Island FGC', with stops at all stations and a total travel time of 45 minutes, and 'FGC Express', with a travel time of 25 minutes and three stops: San Telmo, Aeropuerto and Playa del Inglés.«

## Ineco's work

**According to the framework agreement with FGC (Ferrocarriles de Gran Canaria), Ineco, which has offices in the city of Las Palmas, is responsible for the following tasks as of 2009:**

- **COORDINATION AND SUPERVISION OF ALL TASKS PRIOR to the public tendering of the works (corridor mapping, preliminary study of materials, geology and geotechnics, basic projects and construction projects for the roadbed, the 11 stations and the workshops and sheds, electromechanical projects and track installation).**
- **PREPARATION OF THE DOCUMENTS for all the tenders for drawing up projects and the evaluation of bids, in collaboration with FGC.**
- **TECHNICAL MANAGEMENT of the contracts.**
- **COORDINATION OF THE DIFFERENT INSTITUTIONS AND ADMINISTRATIONS involved (local and state governments, city councils, Renfe, Aena, etc.)**
- **HIGHLY SPECIALISED RAILWAY WORK: studies of the superstructure, demand, operation and economic feasibility.**
- **Supervision and management of the workshops and sheds, with the collaboration of Renfe.**

# Project Bacterio, the hydrocarbon eater

## Ineco and Bio-Iliberis have patented a biological decontamination solution

With the collaboration of **Roberto Serrano**, aeronautical engineer (Department of Building and Architecture)

**Simple, affordable and ecological. These are just a few of the advantages of using living microorganisms to eliminate fuel waste on-site. Ineco and Bio-Iliberis have developed a project that can be used in airports as well as petrol stations, workshops and other facilities.**

In addition to conventional urban waste, an airport generates waste classified as 'toxic and hazardous', such as electronic devices, oils, antifreeze, fuel, vehicles and power generator sets, which are processed according to environmental regulations. The waste generated during maintenance operations is carried away by the rain. This rainwater is consequently contaminated with alkanes (hydrocarbons, hydrogen-carbon compounds) and must be treated before returning to the sanitation system. Airports belonging to the Aena network have specific facilities for this purpose called separation plants, that filter and separate solids in suspension –fats, oils and hydrocarbons– from water. These solids are then stored in tanks and periodically collected by an authorised waste manager. According to the regulations in force, all waste management costs are borne by the waste generator, in this case Aena.

**Objective: to cut costs**

The goal of the Bacterio project is to reduce these costs, eliminating most of the pollutants before they are collected. This is done using living microorganisms capable of 'devouring' hydrocarbons, a technique known as bioremediation. It is more environmentally friendly than other techniques, such as incineration, inertisation or simple dumping. The bacteria are poured into the contaminated water –attached to small pieces of plastic– where they float, creating a surface for bacterial growth (biofilm).

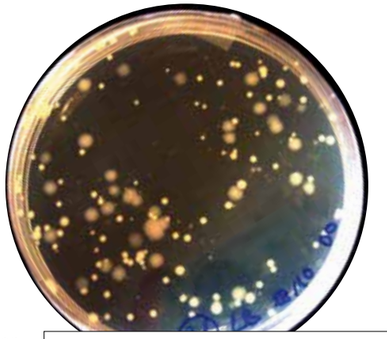
The main limitation of this method is that hydrocarbon chains may be too long and too difficult to break down for most microorganisms. To help bacteria 'digest' the compounds, the Bacterio project involves the use of complementary techniques prior to the bioremediation treatment, such as advanced oxidation, which breaks the hydrocarbon chains into smaller segments that are more easily degradable. Another problem that had to be overcome was the scarcity of non-pathogenic microorganisms able to degrade alkanes attach themselves to a plastic surface.«

*Bioremediation use living microorganisms capable of 'devouring' hydrocarbons*


PHASES OF THE BACTERIO PROJECT
The top photograph shows a tank filled with polluted water;
the bottom left shows sampling at the Granada airport separation plant;
the bottom right shows the addition of the biofilm surface.

## Promising results

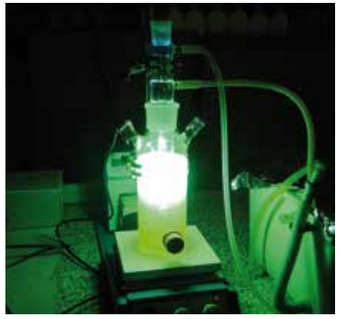
After the laboratory trials, on-site tests were performed at the Granada airport achieving hydrocarbon reductions of over 90%. These promising results have led to an application for what will be Ineco's first patent. The treatment is not only applicable to airports, it can be used in any facility where fuel is handled: car parks, petrol stations, workshops, etc. In fact, the Spanish rail administration company Adif is planning a trial run in Seville.«



## Main project milestones

■ **After an initial selection of 81 types of microorganism, researchers ruled out almost half of them due to their pathogenic nature. Ultimately, a total of five were selected that fulfilled the necessary conditions. Some of these were cultured using samples obtained in the separation plants at the Granada and Málaga airports, as it was considered that they would be better adapted to the different fuel types typically present in an airport. Others came from strains owned by Bio-Iliberis or from other sources unrelated to airport activities. The fuels used for testing were gas oil, petrol and jet oil, as well as marine gas oil, due to its higher sulphur content.**

■ **Three tests were performed with biological treatments that reduced hydrocarbon levels by as much as 90%. Fourteen physico-chemical pretreatments were performed to help the bacteria do their job by breaking down the alkane chains. Three different combinations of oxidisers were tested: hydrogen peroxide (oxygenated water), ultraviolet radiation and ozone, with results ranging in effectiveness from 50 to 95%. Of the three, the peroxide treatment was chosen for on-site tests due to its lower cost and ease of use.**



■ **After the preliminary physico-chemical treatments, it was observed that the bacterial consortium formed by the five selected microorganisms –two strains of the genus Pseudomonas, one of Bacillus, one of Rhodoccocus and one of Acinetobacter– reduced the presence of hydrocarbons in the aqueous phase by up to 90%. As a prerequisite for obtaining a patent for the entire process, samples of the selected strains have been deposited in the Spanish Type Culture Collection (CECT).**

# Raincoats for tunnels

## Groundwater poses a great challenge to engineers and builders

By **Noelia Alonso**, civil engineer and **Arturo Muñiz**, mining engineer (Tunnels Area)

**Tunnels interrupt the flow of groundwater, which tends to try to find a way through. For this reason, waterproofing systems are thus essential for ensuring tunnel safety. Ineco has 14 years of experience in this kind of work.**

Piercing through the heart of a mountain is often the only way to carve out a path for roads and railways, particularly in mountainous areas. This task involves a tough fight against the terrain, which protects itself with its natural defences: hard or fragmented rock that hinders the passage of people and machinery or, conversely, materials so soft that they cannot support their own weight. Groundwater, however, may well represent the most complex challenge facing engineers and builders, as it tends to ignore all barriers placed in its path and tries to pass through them.

Consequently, it is vital to consider the presence of water both when designing a tunnel –to avoid damaging any aquifers that supply water to people or crops– and during tunnel construction. Effectively preventing water from entering a tunnel depends on the excavation method.

**In tunnels excavated with** the NATM, waterproofing and drainage is achieved with two slotted PVC pipes, one on each side of the side wall, which collect the water that seeps through the shotcrete. These pipes are connected to a side ditch running along the tunnel walkways which, in turn, is linked to a central collector. If freight traffic is expected to pass through the tunnel, a separate drainage system is installed placed in the roadbed.

Waterproofing is generally provided by 'face panels'. One geotextile panel and one waterproof panel (made of PVC or a similar material) are placed in contact with the geotextile fabric and outer concrete layer. When it is necessary to protect the aquifer, the tunnel is designed to be watertight and the excavation cross section is thus generally made as circular as possible. The waterproofing elements used can be bentonite strips in the construction joints and *waterstop* joints, as well as geotextile fabric and PVC panels.

For complex geometries, waterproofing with injected styrene acrylic resins is possible. This system can be overlapped with conventional face panels.

**In an excavation with a tunnel boring machine**, the waterproofing of the tunnel is performed immediately after excavation with injections of mortar or grout behind the ring. Rubber gaskets are placed between segments and, in highly saturated terrain, a cord of hydrophilic material is added. In such terrain, it is also advisable to create waterproof barriers, using resins or similar products, before the excavation. When these barriers fail and seepage occurs, it becomes necessary to resort to waterproofing injections, which are usually complex and costly«

PABLO NEUSTADT

# Green light for transport

## Ineco analyses the carbon footprint of different infrastructures

By **Natalia Saiz**, industrial engineer (Department of Consultancy, Sustainability and Climate Change)

**Carbon footprint studies allow greenhouse gas emissions to be identified and their impact on the environment to be measured, opening to door to subsequent emissions reductions for more sustainable transport.**

Greenhouse gas (GHG) emissions, and particularly $CO_2$ emissions resulting from human activity, are one of the leading causes of climate change and global warming. Since the entry into force of the Kyoto Protocol in 2005, numerous regulated organisations have been required to provide annual inventories of greenhouse gas emissions. Thus emerged the concept of *carbon footprint*, defined as the amount of greenhouse gases, expressed in terms of equivalent $CO_2$, that are directly or indirectly generated in the course of an activity or during the life cycle of a product or service.

**Regulation and sustainable mobility**

The activities involved in widespread sectors like transport have not yet been specifically regulated, but each signatory

*Sustainable mobility is a priority, because transport is an important source of gas emissions*

nation to the Kyoto Protocol has agreed not to exceed certain annual emission targets. Should those targets be breached, it entails the purchase of emission rights, with the resulting economic and environment harm. Sustainable mobility is thus a priority goal as transport is an important source of power consumption, and therefore of gas emissions to the atmosphere.

Ineco has worked with Aena for several years and, more recently, with the Fundación Ecología y Desarrollo (Ecology and Development Foundation, or ECODES), on the performance of carbon footprint studies for transport infrastructure. These studies involve quantifying the emissions generated by each activity or service annually. More knowledge is thereby gained of the starting situation and the areas for improvement, enabling better management with a view to reducing GHG emissions.«

HIGH SPEED RAILWAY

### Calculation of $CO_2$ emissions for high speed rail

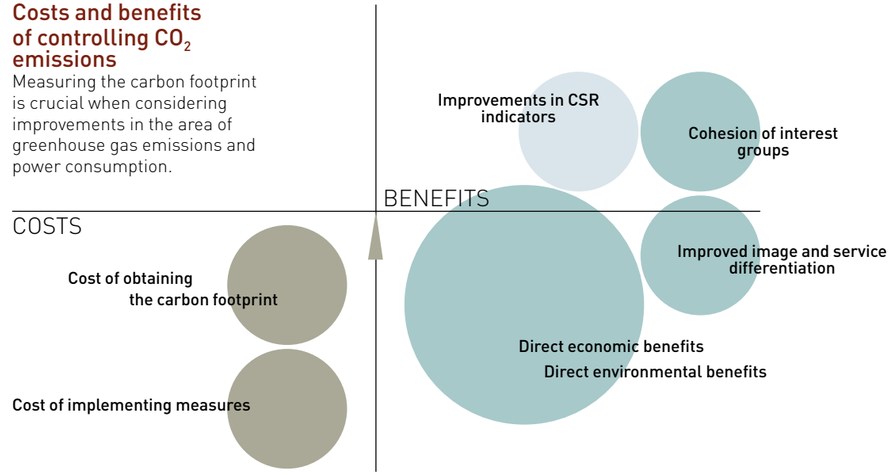
■ **Ineco, in collaboration with the ECODES Foundation, has developed a carbon footprint calculation methodology suited to the construction phase of high speed railway lines. This collaboration is dedicated to the fight against climate change and part of Ineco's corporate social responsibility plan.**

■ **The report includes a study of the most polluting activities and provides the emission factors ($CO_2$ per km) that can be used to calculate the carbon footprint for railway infrastructure in domestic and international projects. The work focused on direct GHG emissions (calculated as equivalent $CO_2$) generated during the construction of a high speed railway line. The most relevant construction phases have been taken into account, as well as the work units and the most widely-used machinery.**

■ **Furthermore, the methodology is complemented by the calculation of indirect emissions generated by obtaining and/or manufacturing the railway line construction materials.**

### Costs and benefits of controlling $CO_2$ emissions

Measuring the carbon footprint is crucial when considering improvements in the area of greenhouse gas emissions and power consumption.




LANZAROTE AIRPORT

### Saving the environment of an island paradise

→BACKGROUND

**Aena Aeropuertos has launched the 'Green Airport' project in Lanzarote and, as part of the work involved, has commissioned Ineco to calculate the airport's carbon footprint and provide assistance in the ACA (Airport Carbon Accreditation) certification process.**

→GOALS

**Calculation, reduction and voluntary compensation of the carbon footprint, with the development of specially tailored projects to minimise power consumption and $CO_2$ emissions until a carbon neutral or 'green airport' certification is obtained.**

→RESULTS

**Lanzarote airport was the first in Spain to receive the ACA Level 1 (Mapping) certification, followed by a list of other airports including of Barcelona-El Prat, Málaga, Palma de Mallorca and Madrid-Barajas (Level 2).**

VISION FOR THE FUTURE

### The carbon footprint as a tool for more sustainable transport

Considerable progress has been made in past years in improving environmental management and responsible use of resources, but more needs to be done. Any activity that requires the consumption of significant amounts of energy, whether directly in transport or throughout an extensive supply chain, should invite an evaluation of the risk posed by its energy and associated climate change policies.

**Calculating the carbon** footprint is the best place to start. This measurement is essential for considering the potential for reducing emissions and power consumption. Knowing the carbon footprint of each of the different stages of the infrastructure life cycle (planning, construction and operation), it becomes possible to reduce GHG emissions and improve energy efficiency for more sustainable transport.«

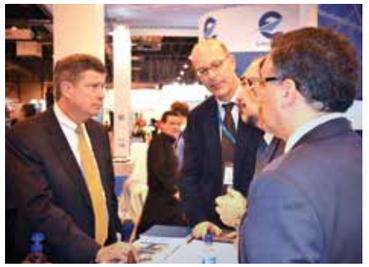
# Meeting point 2013

**Big trade fairs revitalise the transport sector. ATM-CANSO in Madrid, Passenger Terminal in Geneva, Rail Solutions Asia in Kuala Lumpur and Mobility & City Transport Exhibition, organised by the UITP, in Geneva, are the main events in which Ineco has played an active role.**

By **Irene Thomas**, audiovisual communication graduate (Communications Department)

## World ATM Congress

**Madrid hosted the World Air Traffic Management Congress**



Above, Pablo Vázquez, president of Ineco, Carmen Librero, general secretary for Transport, and Ana Pastor, the Spanish minister of Public Works, talking to Javier Pérez Diestro, Ineco deputy director for Air Navigation. On the right, John Porcari, US deputy secretary of Transportation, with Pablo Vázquez, Javier Pérez Diestro and Manuel Sauca, Ineco's Aeronautical Business director.

The World ATM Congress was held in Madrid from 12th to 14th February under the slogan "Moving to a Transformed Global ATM System". The event included exhibitions, workshops and conferences to present the latest trends and developments in air traffic control and analyse the biggest challenges in the industry today.

**During the opening** of the Congress Pablo Vázquez, president of Ineco, accompanied Spanish minister of Public Works Ana Pastor and United States deputy secretary of Transportation John Porcari to the company's stand.

**Among the Congress' activities** , Ineco engineers José María Berdoy and Javier Murcia gave speeches titled *Smooth Operational Transitions in ATC Facilities* and *GNSS Advanced Operations for the future ATM Concept*, focused on the FilGAPP, a project financed by the European Union.

**The Congress was a resounding success** , in view of the participation of over 150 companies from the aeronautical sector and most air navigation suppliers.«



■ **The Spanish Association of Manufacturers and Exporters of Railway Material, Equipment and Services (MAFEX), organised the joint Spanish participation in the prestigious Rail Solutions Asia (Kuala Lumpur, Malaysia, 17th-19th April) and UITP World Congress and Mobility & City Transport Exhibition (Geneva, 26th-30th May).**

## Rail Solutions Asia | M&CTEx

**Ineco attended these two exhibitions with MAFEX**

The **Rail Solutions Asia** trade fair brought 1,000 participants, 100 delegations and 10 Asian rail operators together in the capital of Malaysia –which will soon have a high speed rail link to Singapore. Fair-goers who visited Ineco's stand were interested in the company's high speed rail experience. Ineco was represented by Alberto Fernández, delegate for the Asia-Pacific region, and the engineer Celso Prados, who gave a conference on the interoperability of rail systems.«


Alberto Fernández, delegate for Asia-Pacific, and Celso Prados, from the Systems Engineering Department .

The **Mobility & City Transport Exhibition,** organised by the UITP (International Association of Public Transport) is the biggest event in the world dedicated to public transport and urban mobility. For the fifth time, MAFEX coordinated the joint Spanish participation in this event, which had previously been held in Rome, Helsinki, Vienna and Dubai. Ineco also had a stand in the Dubai edition, held in April 2011.

Ineco representatives exhibited the company's experience in mobility and urban transport studies. MAFEX, as on previous occasions, enjoyed the support of the Spanish Foreign Trade Institute (ICEX).«

## Passenger Terminal

**The airport industry's leading trade fair celebrates its 19th year**


Ineco's stand at the fair.

This trade fair celebrated its nineteenth anniversary edition over 9th, 10th and 11th April in Geneva (Switzerland). Over 180 exhibiting companies from more than 85 countries were present. Representatives from airport and civil aviation operators, architectural, engineering and consulting firms, manufacturers and construction companies visited Ineco's stand at the fair. Our company was represented by Javier Cos, general manager for Business Development, Manuel Sauca, Aeronautical Business director, José Ángel Higueras, deputy director for Sales in Latin America and Sergio Navarro, sales delegate for Central Asia.«

# Haramain's brain

## The Spanish-Saudi consortium and the SRO inaugurate a new building in Jeddah

By **Jaime Faraco**, architect (Department of Building and Architecture)

**The consortium building the high speed railway from Madinah to Makkah has opened a new operational headquarters in Saudi Arabia, a modern 11-storey building located in Jeddah that has been outfitted by a team of Ineco architects and engineers.**

The 12 Spanish companies participating in the Spanish-Saudi consortium will share the 10,000 $m^2$ of office space with the project developer, Saudi Railway Organization (SRO), and the supervisors Dar Al-Handasah and DBI. The new headquarters is located about 9 kilometres from Jeddah's international airport and about 13 kilometres from the city centre, on Prince Sultan Street. These facilities will allow for better coordination of the construction work on the Haramain High Speed Railway, the first high speed railway to connect the holy cities of Makkah and Madinah, in Saudi Arabia.

Ineco architects and engineers have designed and outfitted the new building (divided into 11 storeys above ground and one basement level). It is equipped with state-of-the-art IT and communications systems. The headquarters has everything that is needed to equip, manage and maintain all 450 kilometres of one of the most ambitious railway projects in history with the highest standards of quality and comfort for the next 12 years.

*The new building will provide for improved coordination of the construction work on the Haramain High Speed Rail*

The daily progress of the work, the delivery deadlines and the financial supervision will be coordinated from this new headquarters. This is a complex process in which 88% of the tasks fall under the purview of the Spanish share of the project, encompassing Renfe Operadora (in charge of business operations), Adif (in charge of technological integration, maintenance management, stations and rail traffic), Talgo (train manufacturer), Ineco and Consultrans (engineering and consulting firms), the construction firms OHL, Copasa and Imathia (responsible for the civil works), Dimetronic (signalling, train protection systems, centralised traffic control and switches), Indra (telecommunications network, control centres, safety, remote surveillance and ticketing), Cobra, Inabensa and OHL (power supply, installation of high voltage equipment and overhead contact lines).«

NEW HEADQUARTERS IN JEDDAH
The building is located about 9 kilometres from the airport and some 13 kilometres from the city centre. The project will be completed when the corporate logo is placed on the façade. The building will be decorated with large vinyl decals displaying the Haramain HSR logo and the image of the Haramain Railway.

## Cutting-edge facilities

Ineco carried out the renovation and rehabilitation project for the first seven office floors, the second mezzanine and the car park (basement), as well as the installation of all IT and communications infrastructure (local network, intranet, etc.). The eighth floor houses the offices of the local partner Al Shoula.«

## International team of experts

**The Ineco team in Jeddah is comprised of, over 30 technicians** specialised in diverse skills: engineers, geologists, architects, economists and lawyers. During the first phase, it is essential to define and approve each line of work in the project, as well as the economic, legal and financial supervision and the planning.«

**IN THE PHOTO,** one of the coordination meetings on the 6th floor of the consortium offices. On the right, members of the Saudi Railway Organization.

## Specialised railway engineering and consulting

**In order to monitor** and supervise the works, specialised software is used for planning this type of railway construction. Ineco has extensive experience with this platform. The main tool being used to plan and supervise the works is the software program Primavera P6. It is a comprehensive application that manages everything from production to costs. In addition, experts on tracks and facilities have been stationed in Saudi Arabia to closely supervise the project's development.«

**IN THE PHOTO,** Ineco, Adif and Indra team members stand on the future platforms of the high speed railway station in Madinah.

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TOLEDO


VALENCIA


VALLADOLID


ZARAGOZA

The network of AVE-linked cities, **AVExperience**, with the participation of city councils, autonomous communities and Renfe Operadora, is promoting its rich offering of tourist destinations with travel and leisure packages at special rates. Renfe is offering foreign visitors a rail pass that can be used to travel along different routes between the 17 cities linked by the Spanish high speed rail network:

➔ **Barcelona** is a city open to the Mediterranean. The historical and cultural heritage of Barcelona stretch from Ancient Roman times through to the modernistic treasures of Gaudí like the Sagrada Familia – declared a World Heritage Site by the UNESCO. The Rambla, the Boquería market and the Teatro del Liceo are other must-see attractions.

➔ On the banks of the Jalón River, **Calatayud**, in Zaragoza, affords visitors enjoy its Mudéjar Gothic monuments, such as the Collegiate Church of Santa María, or climbing routes for the more adventurous.

➔ **Ciudad Real** is the capital of the vast region of La Mancha and the home of Don Quixote. It is famous for its wines and cheeses.

➔ **Córdoba** is a World Heritage Site thanks to its Mosque (8th-and 12th Centuries) and this enchanting city has recently contributed its emblematic Andalusian patios to the World Intangible Heritage list. Each May these patios are decorated with flowers and opened to the public.

➔ **Cuenca** features the 'Hanging Houses' on the rocky outcroppings of the Huécar and Júcar Rivers as well as a Gothic Cathedral and a unique Museum of Abstract Art. Typical local cuisine includes game dishes such as *morteruelo*

➔ **Lleida**, in Catalonia, is part of the Knights Templar route *'Domus Templi'*. It has cultural centres such as the La Panera Art Centre or the Theatre of l'Escorxador. Snails, barbecued meat and the wines are among the highlights to be found on Lleida's menu.

➔ **Madrid**, the capital of Spain, is a top business and shopping destination. It hosts a veritable multitude of cultural venues, like the Reina Sofía, the Prado and Thyssen Museums. The Old Town houses the Plaza Mayor while Enlightenment Madrid includes the Retiro Park and iconic monuments such as the Puerta de Alcalá and Cibeles. Its main culinary speciality is a local stew known as *cocido madrileño*.

➔ **Málaga**, the birthplace of another renowned Spaniard, Pablo Picasso, is home to his Museum. For fun in the sun, head to the beaches and have a delicious bite of fried fish.

➔ **Puertollano**, between Madrid and Seville, conserves its old industrial complexes in the Mining Museum. Its signature dish: the *tiznao*.

➔ Another World Heritage Site is **Segovia**. The old Alcázar over the river and the Roman Aqueduct are two of the symbols of this city's identity. Segovia is known throughout Spain for its *cochinillo* dish.

➔ **Seville**, a city situated on the banks of the Guadalquivir River, was the destination of the first Spanish high speed rail line, which was completed to coincide with the Universal Expo of 1992. Its April Fair, which attracts a million visitors every year, is one of the main tourist attractions, along with the Reales Alcázares, the Cathedral and its Steeple, the famous *Giralda*, the General Archive of the Indies (a World Heritage Site) and the neighbourhood of Santa Cruz.

*Spain is the fourth country in the world by number of tourist and boasts the eighth highest quality railway network*

Its bullring, La Maestranza, is considered, along with Las Ventas in Madrid, the 'cathedral' of bullfighting.

➔ **Tarragona**, the ancient Roman city of Tarraco, conserves a rich archaeological heritage (a circus, a praetorium and an amphitheatre...), and is also a World Heritage Site. For a delicious meal, try the fish in romesco sauce, made with nuts.

➔ Only 71 kilometres from Madrid we find **Toledo**, with its inimitable and monumental Old Town above the Tajo River, its proud heritage left by the 'three cultures', Jewish, Muslim and Christian and its glorious past as an imperial city. It has been a World Heritage Site since 1987. Its rich culinary legacy includes marzipan.

➔ **Valencia** is host to an important Gothic heritage, including the Lonja de la Seda and the Cathedral. Its traditional celebration, Las Fallas, held in March, has gained worldwide fame, as has *paella*, one of the most well-known Spanish dishes.

➔ In the heart of Castilla, **Valladolid** houses the National Sculpture Museum and is an outstanding destination for wine tourism.

➔ **Yebes**, in Guadalajara, offers visitors a chance to enjoy its Roman archaeological sites, large parks and a modern golf course. The *tortilla de collejas*, an omelette made with local herbs, is its most typical dish.

➔ **Zaragoza,** (Aragón). Its examples of Mudéjar architecture have been declared World Heritage Sites. Of particular note are the Islamic Palace of Aljafería and the Baroque Basilica.«

INTERVIEW

## Irene from Renfe

*"You can purchase Renfe tickets anywhere in the world"*

Irene is literally the face of Renfe Operadora. She is a virtual assistant who attends user queries on the company's website and has her own Facebook and YouTube accounts. As she herself explains, she works "from sunrise to sunset" to answer any and all questions on rates, offers and schedules, but she is "well taken care of and constantly taught new things". Despite her youth ("I'm four years old, I was born in Madrid in 2009"), she can speak and write in 20 languages, including Chinese, Arabic and Swedish.

**Good morning, Irene. Can I ask you a few questions?**

A pleasure to meet you. Good morning!

**What is Renfe Spain Pass?**

Renfe Spain Pass is a pass that allows non-Spanish residents to travel around our country. It is valid for 6 months from the date of purchase and for 1 month from the date it is used for the first trip. It is individual and non-transferable, requiring identification with a passport.

**Can I buy AVE tickets from abroad?**

You can purchase them on the Internet from anywhere in the world. There are international sale points in Germany, Argentina, Belgium, Brazil, Chile, China, France, Israel, Italy, Japan, Mexico, United States of America, Portugal, United Kingdom, Russia, Taiwan and Uruguay.

**http://consulta.renfe.com/renfe270/index.jsp**

## ineco Solutions

# Experience, competitiveness and technology at the service of society

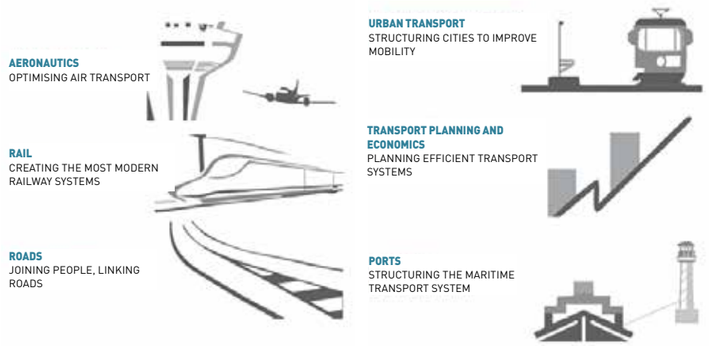
**Ineco has extensive experience in transport engineering: 45 years planning, designing, managing, operating and maintaining airports, railways, roads, ports and urban transport systems throughout the world.**

Ineco is a global Spanish transport engineering and consultancy firm. Since its creation in 1968, it has specialised in the development of transport systems that help improve people's mobility. For 45 years, Ineco has served investors by developing transport infrastructure. With over 2,500 professional experts, Ineco uses its technological capabilities and capacity for innovation for society's benefit, structuring territories and promoting environmental sustainability.

**Our experience and competitiveness** has led us to execute projects in over 40 countries on four continents. The numerous international contracts in recent years demonstrate Ineco's ability to work abroad.«

### 43 COUNTRIES

**High Speed Railway between Madinah and Makkah | Master Plan for Kuwait International Airport | Railway between Istanbul and Ankara | Guadalajara–Colima Highway in Mexico | Control Tower in Eldorado, Bogota | Strategic Plan for Railway Freight Transport in Spain | Airports Plan in Nepal | National Transport Plan of Algeria | Aena Airports, Spain | Improvement of the Railway Network in Lithuania | Snow Plan for Heathrow Airport | Road Improvement in Ecuador | Master Plan for Sangster Airport, Jamaica | Coordination of the São Paulo Ring Road | Improvements to the Moroccan Air Navigation System | New Industrial Complex in Shadadiya, Kuwait | Studies for the High Speed Railway between Haldia and Howrah, India | Tram Line 4 in Tallinn, Estonia | Transport Plan in Costa Rica | Consultancy for Luanda Airport...**

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|---|---|---|---|---|
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