SYSTRA SOLUTIONS

Designing and modernising RAILWAY LINES for safe and efficient operations

RAILWAY INFRASTRUCTURE: IMPROVING PERFORMANCE, REORGANISING NETWORKS, CREATING LINES.

As an infrastructure owner or manager, your challenge is to design, modernise and operate infrastructure that can:

- **Ensure** connections between major town centres, including the use of multimodal network.
- **Enable** efficient and highly reliable intercity services.
- **Improve** performance on historical networks, worn down by intensive traffic or loads, which are becoming increasingly susceptible to unexpected service affecting failures.
- **Plan and carry out** major works on lines in service and often in densely built-up areas.

>> **13,500 km**
of railway tracks modernised over the last 60 years (2017 figures)

>> **4,300 km**
of new lines

>> Environmental certification
ISO 14001

>> Certification
Lean 6 Sigma

>> Qualification
1300 SNCF

>> **10 engineering centres**
around the world

>> Our parent companies, SNCF and RATP, have gained more than **100 years** of experience, operating some of the world's densest urban and intercity networks.

CHOOSE SYSTRA
TO GET THE BEST

Denmark, Scotland, Ethiopia, France, Gabon, India, Poland, Canada, USA...

The prospects are good, for a clean, accessible mode of transport to meet rising demand. Backed by 60 years of experience, we share best practices and innovations with our clients.

Our teams take a holistic approach to projects, from the earliest design stage, integrating reliability, availability, maintainability, safety, and asset management. We assist our clients at every stage of the infrastructure's life cycle.

SYSTEM INTEGRATOR

WE TRANSFORM YOUR VISION INTO A PROGRAMME COMPOSED OF PERFECTLY CONTROLLED STAGES, COMPLETED IN BUDGET AND ON TIME

We love challenges, such as modernising major nodes, building new lines to meet a country's growing needs for transport, augmenting capacity and ridership on a line, increasing service speed or optimising a network. Our experts rely upon their experience, gained on a wide range of projects in France and other countries, to offer you the most appropriate and innovative solutions, that fully comply with newest international standards, and takes into account local regulation notably in terms of safety and environment.

1
CREATING NEW LINES,

alignment, track, civil engineering, buildings, stations, signalling, telecommunications, overhead contact system, power supply, RAMS, rolling stock.

2
OPTIMISING EXISTING LINES

Making lines more robust, increasing speeds, carrying more trains and thereby improving their capacity and regularity, require improvement of the infrastructure, especially in densely populated areas, track regeneration and geometry, adjusting the overhead contact system, building passing loops, replacing level crossings and pinch points, relieving congestion at junctions etc.

3
REGENERATION OF RAILWAY SYSTEMS

Passengers' expectations in terms of service quality are rising. Migrating to new signalling systems, installing new systems such as ETCS, GSMR GPRS can increase capacity, and simplify operations on the busiest lines and junctions. Our systems experts design and install systems economically, to suit your operating and financial constraints.

4
WORK ON LINES IN OPERATION

Rapidly deployed solutions, such as plug-and-play, dramatically reduce intervention time.

5
WORKS MANAGEMENT

Our mastery of building techniques from all over the world, continuous learning, optimised work scheduling etc., enable our teams to supervise the work, quality, costs and timetables of contractors, to coordinate all professions, to organise and drive testing activities, and to prepare commissioning, up to and including putting the modernised lines back into service.

SYSTEMS ENGINEERING

The design of complex systems entails integrating multiple technologies. Systems engineering can combine them to deliver optimal performance, guarantee efficient service, and meet your requirements.

Our engineers can draw on their unique expertise and experience, gained on signature projects in France and other countries.

Our teams define and manage your entire transport system, using the tools, processes and methods of systems engineering, at every stage of your project's lifecycle.

Our operation engineering teams analyse and make best use of the existing network, to propose improvements based on capacity studies and performance analyses (journey times and robustness).

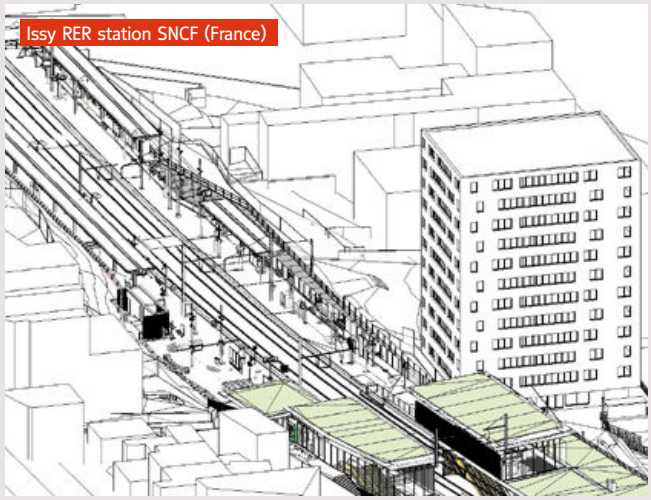
SYSTRA +

- **A HOLISTIC APPROACH TO RAILWAY SYSTEMS** to offer a robust and innovative solution, integrating infrastructure and system constraints, that meets your objectives for reliability, availability, maintainability and safety.
- **TURNKEY ASSIGNMENTS,** from early studies to design, testing and commissioning.
- **AN INTERNATIONAL TECHNICAL ENGINEERING NETWORK** that guarantees access to the best skills worldwide; a collaborative approach that facilitates the sharing of information, tools, practices and processes.
- **WIDE EXPERIENCE** gained on projects of varying scales and significance, conducted on new or in-service networks, all over the world.
- **EXPERIENCE OF MIXED PROJECTS** combining urban railways, tram-trains, passengers, freight etc.
- **COMBINING ECONOMICAL, OPTIMISATION AND HIGH-PERFORMANCE TRANSPORT SERVICES,** to propose improvements for inefficient lines.
- **DEFINING AND WRITING NORMATIVE REQUIREMENTS** for infrastructure owners.

EXPERTISES

Our engineers offer you the best solutions. Our expertise is backed up by 60 years of experience, of feasibility studies, services to restructure networks, design and construction engineering, project management, assistance to the owner, and assistance with concession contracts.

- STRUCTURES
- RENEWAL OF CENTRAL CONTROL ROOMS
- ENVIRONMENTAL ENGINEERING
- RENOVATIONS OF STATIONS, BRIDGES AND LEVEL CROSSINGS
- TRACK ALIGNMENT, DOUBLING, REGENERATION
- SYSTEMS ENGINEERING
- SYSTEMS
- ROLLING STOCK RENOVATION
- INCREASING SERVICE SPEED
- TUNNEL SURVEYS AND INFRASTRUCTURE AUDITS
- ELECTRIFICATION
- OPERATIONS
- WORKS OPTIMISED SPOIL CUBAGE FOR EVACUATION
- RELIEVING CONGESTION AT JUNCTIONS


Issy RER station SNCF (France)

FOCUS

BIM ENSURES RESPONSIVE CONCURRENT ENGINEERING

BIM solutions tailored for railway projects.

Our solutions for all types of structure integrate the lessons learnt internationally about BIM requirements. Our technical application *"BIM in one Click"* for linear railway structures won the Silver BIM award in 2017 (France), for the preliminary studies of the third metro line in Toulouse.

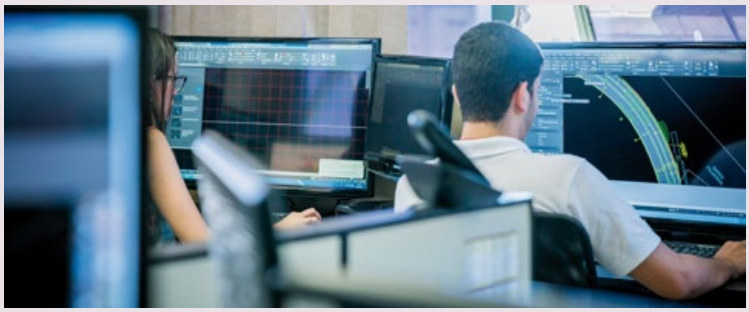
BIM solutions for unimpeded collaboration.

Stakeholders collaborate faster, with a digital model. BIM protects and establishes interfaces for design and construction. It makes a decisive contribution to work on lines in service, especially when combined with our 4D design capacity for task sequencing during works.

A BIM solution for managing the entire life-cycle of your infrastructure. This consists of a virtual representation of the infrastructure and all of its items. Such a digital twin can be used alongside the physical infrastructure. Maintenance conditions and costs can be optimised, particularly in high usage situations. In combination with predictive maintenance solutions, BIM helps you deploy your asset management policies effectively.

FOCUS

DESIGN AND BUILD PROJECTS

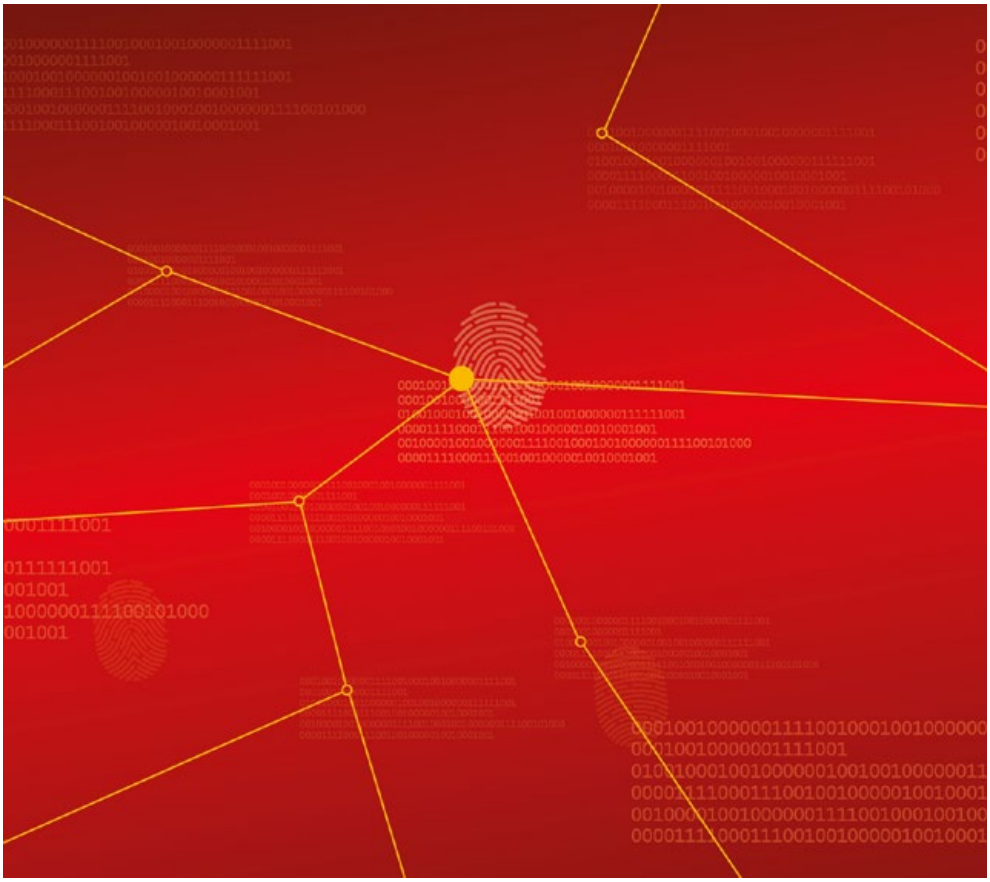


Innovative contractual frame that allows faster projects deployment.

More and more public authorities and network managers are transferring risks to private enterprises, and delegating their projects to firms that carry them forward, from building, to operating and maintenance, while proposing solutions to fund their work. As a result, major manufacturers are becoming our clients and partners. This is changing our relationships, the scale of our assignments, everything except the attention that we at SYSTRA pay to our clients' needs, and our unwavering belief that steadfast partnerships are founded upon trust.

SYSTRA provided integrated project management for the design-and-build consortium composed of Colas Rail, Colas and Fondasol, to regenerate the Niort-La Rochelle line. The project aimed to raise the commercial speed to 200 km/h along this 62 km line.

ZOOM INNOVATION



PREDICTIVE MAINTENANCE AND THE INTERNET OF THINGS

Safety, efficiency and cost control are among the advantages derived from the Internet of Things applied to public transport. SYSTRA can define, install and control networks of interconnected temperature, pressure, voltage and acceleration sensors, on track, signalling equipment and rolling stock. SYSTRA can analyse the resulting data in real time, to optimise your operations, maintenance and economic results.

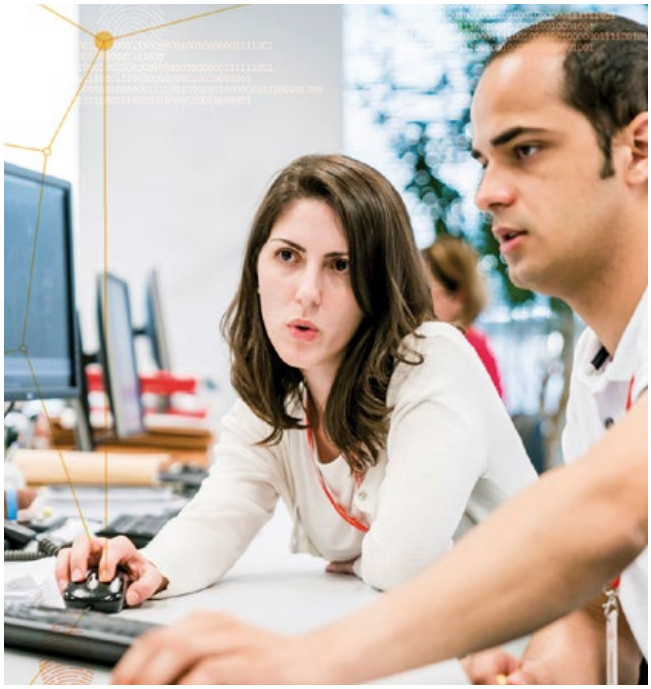
DIGITALISATION AND CYBER-SECURITY

Safety awareness is deeply rooted in the DNA of network and railway operators. However the advent of new systems and networks requires us to change our attitude, to identify and manage these new risks.

Many digital systems offer little or no security, and are increasingly connected to the Internet.

Meanwhile, the development of new 4G/LTE mobile networks is generating new risks. They are nevertheless considered indispensable to the deployment of train control and passenger information systems.

We can help you choose the most relevant surveillance systems to detect, locate, analyse and visualise any attacks on your systems, and to organise appropriate defences.



THE TRAIN OF THE FUTURE

Transport is reinventing itself, and so is the train

In addition to pioneering projects, trains have to meet three challenges:

>> **Reduce their energy footprint, by:**
- cutting down energy consumption through the use of alternatives to diesel, such as hybrid or hydrogen traction;
- optimising acceleration and braking profiles in operating plans, to reduce energy consumption.

>> **Join the digital revolution, by offering hyper-connected trains.** The revolution relies on connectivity, both for deploying 5G, to enable optimal traffic management in real time across the network, service to passengers while on board, as well as efficient, relevant passenger information before and after their trip.

>> **Increase automation** to further improve overall system efficiency. The objectives are to make trains safer, closer to passengers' expectations, at minimal cost, by limiting the use of track-based equipment. SYSTRA is working in partnership with SNCF, Alstom and IRT System X, on automation of drivers' observation duties using an enhanced environment-observation system based on modelling the data collected by sensors such as radar, LIDAR and cameras.

MODERNISATION OF THE SERQUEUX-GISORS LINE, FRANCE

The challenge: to restore freight and passenger services along a line disused since 2008, and to create an alternative to the mainline between Le Havre and Paris.

OUR SOLUTION

To consolidate the technical programme and manage the entire project to regenerate the double track, with a mind to limiting future maintenance duties.

KEY FIGURES

50 km of line, 5 stations

20 km of road and 15 structures

Renewal of signal boxes and replacement of level crossings

GSM-R and ETCS level 1 systems

MODERNISATION OF THE CALAIS–DUNKIRK LINE, FRANCE

The challenge: to complete the coastal line serving the region's three main ports, Boulogne-sur-Mer, Calais and Dunkirk.

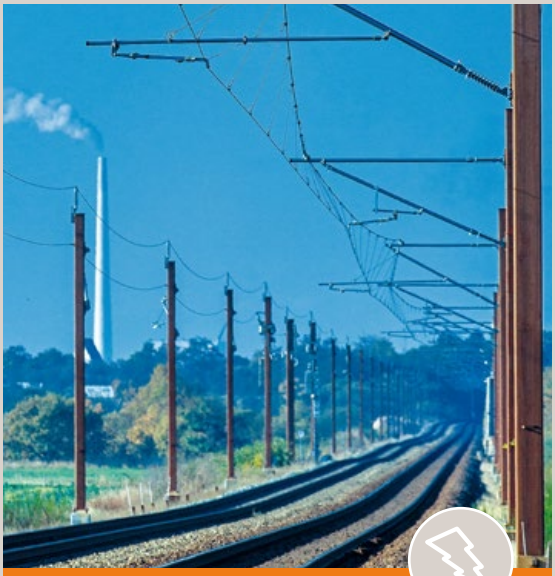
OUR SOLUTION

To manage the overall project for modernising the entire line, including track, civil engineering, signalling, telecommunications and power supply systems.

KEY FIGURES

46 km of track
(including 34 km of single track)

60 km/h commercial speed



NETWORK ELECTRIFICATION, DENMARK

The challenge: to electrify existing lines, improve railway services, make them greener, and shorten journey times.

OUR SOLUTION

To assist the owner with the electrification programme for 1,300 km of line, including:

- installing the overhead contact system and the infrastructure needed to supply power from the grid;
- modifying, dismantling and rebuilding road overbridges, to allow sufficient space for the overhead line equipment;
- insulating technical installations.

KEY FIGURES

1,300 km of existing line

NORTH-SOUTH RAILWAY, SAUDI ARABIA

The challenge: to design a line crossing the Kingdom of Saudi Arabia, from North to South, to carry passengers, freight, bauxite and phosphate ore.

OUR SOLUTION

Feasibility studies, detailed plans, work supervision and rolling stock procurement, for the first 2,400 km of mixed line (passengers and freight) across Saudi Arabia.

KEY FIGURES

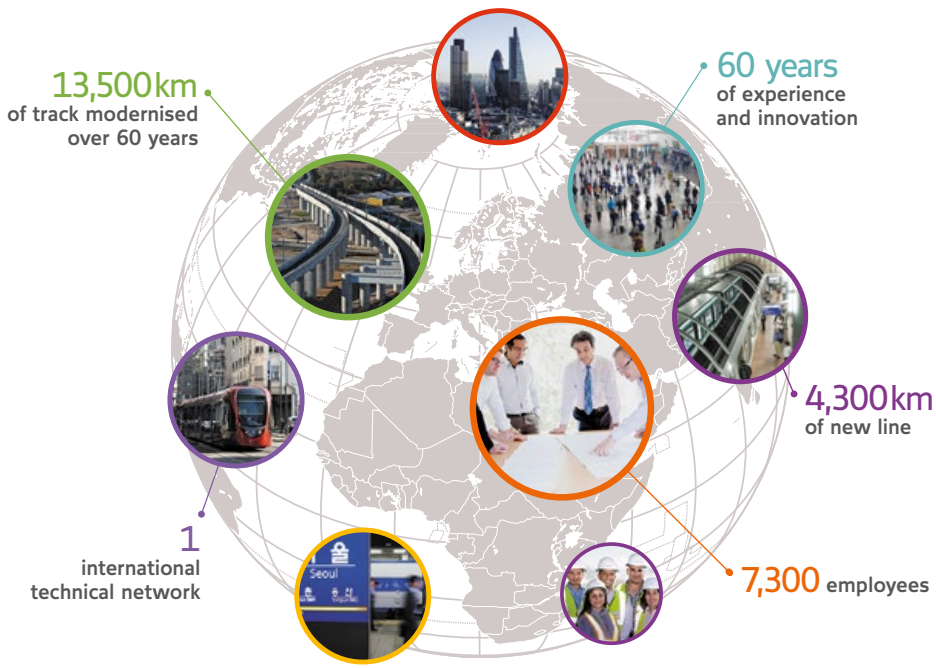
2,400 km of new line

6 stations

2 depots

CONFIDENCE MOVES THE WORLD

The Group accompanies growing towns and regions that need clean, reliable, fast transport systems, to make a lasting improvement to the quality of the life of their residents.



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