



MOVING  
THE WORLD  
FORWARD

**SYSTRA**

ACTIVITY REPORT 2017



## CONTENTS



### Moving the world forward **INTO THE FUTURE**

p.3

- |   |   |
|---|---|
| p.4 Tomorrow's transport challenges and opportunities | p.11 Engineering design's expanding horizons      |
| p.6 Reinventing the urban landscape                   | p.12 Next-generation rolling stock                |
| p.7 Mobility and climate change adaptation            | p.13 Harnessing data to improve transport systems |
| p.8 The rise of automation                            | p.14 Modernisation of mass transit networks       |
| p.9 New technologies and new entrants                 | p.15 Data-driven asset management                 |
| p.10 Data-driven design                               |   |



### Moving the world forward **IN 2017**

p.17

- |   |  |
|---|--|
| p.18 SYSTRA in numbers                    | p.26 Delivering a safer world for everyone               |
| p.19 CEO's message                        | p.27 Maintaining the highest standards in ethics and CSR |
| p.21 Supervisory Board's message          | p.28 A global framework to support local delivery        |
| p.22 Supervisory Board                    | p.30 The power of digital delivery                       |
| p.23 Executive Committee                  | p.31 A recognised expert in transportation               |
| p.24 A solid foundation for future growth |  |
| p.25 A strong global footprint            |  |



### Moving the world forward **TODAY**

p.33

- |                         |                             |
|-------------------------|-----------------------------|
| p.34 High speed rail    | p.60 Bus network planning   |
| p.40 Heavy rail         | p.61 Roads and highways     |
| p.45 Stations           | p.62 Underground structures |
| p.46 Metros             | p.63 Bridges                |
| p.52 Light rail transit | p.66 Aviation               |
| p.56 Consultancy        | p.67 Financial results      |
| p.59 Urban cable cars   |                             |





Moving the world forward

# INTO THE FUTURE

As the signature team for transportation solutions, SYSTRA anticipates trends that will transform mobility.

Specialist insight gained from decades of experience across every transport mode equips us to help prepare our clients for the future.

# Tomorrow's transport challenges and opportunities

**Economies rely on the seamless, safe movement of people and goods. Transport systems must adapt to complex and rapidly evolving demands.**



Drivers such as urbanisation, population growth and the changing climate are affecting how transportation schemes are planned, designed, maintained and operated. As the signature team for transportation solutions, SYSTRA helps clients prepare for the future. **We see a number of emerging trends that will impact the future of transport.**

## DATA-DRIVEN ENGINEERING DESIGN

Digital models will capture all project lifecycle data in 5D format (3D plus time and cost), becoming vital in design validation and outcome prediction. Increasingly complex client projects will need advanced collaboration skills, strong system integration and technical coordination.

## SAFETY WILL DICTATE THE SPEED OF PROGRESS

Safety will always be paramount. This is all the more important as new transport modes are introduced and automation – both in mass transit and cars – becomes more prevalent. The capability to demonstrate that new transport options meet required safety levels is vital for securing investment and public acceptance.

## THE RISE OF AUTOMATION AND CYBERSECURITY

Automation will spread from metros to other forms of public transport, including cars. Machine learning and artificial intelligence technology will strengthen cybersecurity, improve crowd management and help to spot suspicious or threatening behaviour.

## MODERNISATION WILL IMPROVE SAFETY AND AVAILABILITY

Upgrade projects will improve the safety and availability of existing transport systems, facilitate coordination and control, accelerate the shift to autonomous operation and provide real-time data for travellers. Passenger expectations will rise, including demand for high-speed internet access within transport systems.

## DIGITAL AS THE DRIVER OF CHANGE

Smart infrastructure will coordinate multiple transport and mobility systems and maximise the benefit of automation. Building Information Modelling (BIM), digital simulation, the Internet of Things and artificial intelligence will optimise management of complex interconnected infrastructure. Remote monitoring will support failure prediction and preventative repairs of fixed assets and rolling stock.

## INTERMODAL INTERCHANGES WILL EMPOWER PASSENGERS

Urbanisation and city growth necessitate highly efficient public transport that supports mode switching, handling large passenger volumes without bottlenecks. New solutions will emerge for the first and last mile of journeys. Flexible payment systems and transport apps will help manage demand, updating travel advice in real time.

## MOBILITY AS A SERVICE WILL BE THE NORM

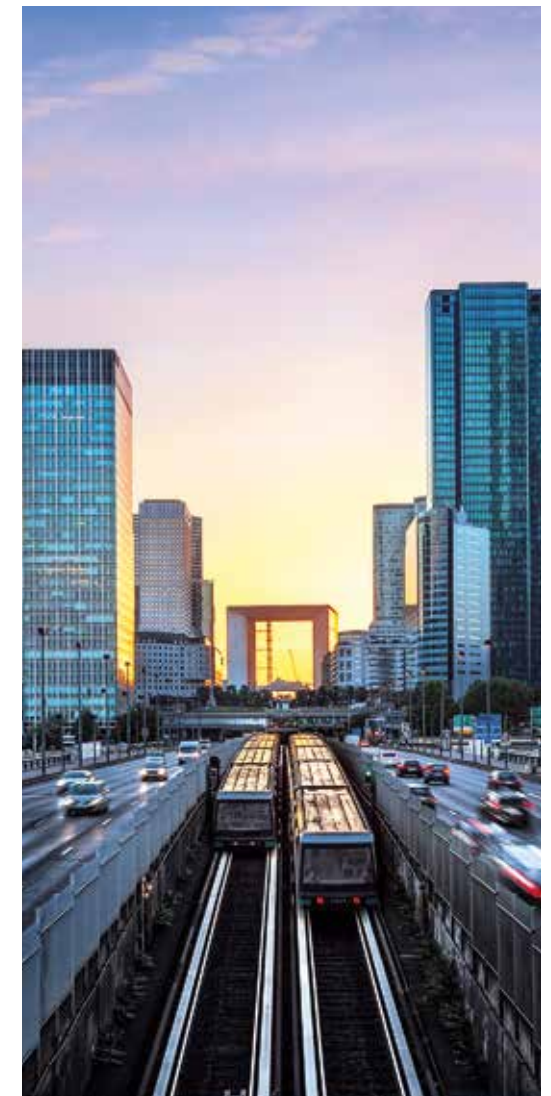
Connected technology will support innovation that disrupts the status quo, potentially accelerating the shift towards on-demand services in place of scheduled services, as well as usage-based pricing. Increased access to real-time information and city-wide route planning will foster rising expectations of service quality.

## SHIFT TO LIFECYCLE COST ANALYSIS

Clients will take a longer term view of CAPEX and OPEX, with a sharper focus on total cost of ownership (TCO). Robust planning for all lifecycle phases including future upgrades will be vital. Tightened finance, rising complexity and compressed timeframes will place huge emphasis on good project management.

## AIR QUALITY WILL SHAPE TRANSPORT DECISIONS

The health impacts of pollution mean more city authorities will make air quality a priority, hastening the switch to zero-emissions technologies as well as shared mobility services. Cities will introduce measures to ban or discourage petrol and diesel vehicles while promoting cycling, walking and efficient urban transit systems.





## Reinventing the urban landscape

Forward-looking city authorities are using transport projects as a force for modernisation and regeneration.

New or improved infrastructure can revitalise districts, stimulate economic growth and bring new employment opportunities. These goals have resulted in landmark projects that SYSTRA is involved in such as Grand Paris Express in France, which aims to expand the capacity and reach of transport networks.

The increasing ubiquity of mobile internet access lets people tailor their journeys and plan routes in unfamiliar cities. Real-time location-aware services are creating more choice and flexibility, from hailing a cab to hopping on a hired bicycle.

### Mobility as a Service (MaaS)

Advances in digital technologies combine real-time transport network data with more flexible ticketless payment systems. MaaS enables payment for all modes of transport with a monthly flat-fee or payment on a per-trip basis. People will no longer have to think about buying individual tickets for each leg of their journey or decide which route to take as a third-party mobility operator would take care of the planning and ensure that each trip booked is fully delivered. This flexibility also extends to transport operators as they are now better able to forecast and manage demand on their existing infrastructure due to intelligent mobility solutions.



**ANDREW PICKFORD**

Technical Director, Infrastructure & Transport Advisory Services, Hong Kong

*"Growing urban populations need interconnected mobility services that boost capacity and increase flexibility."*



### CROSSRAIL: CREATING MORE URBAN TRANSPORT CAPACITY

London is home to more than 8.5 million people, who collectively make more than 26 million trips per day. The population is projected to grow to 10.5 million by 2041, with daily journeys rising to 32 million. Crossrail is delivering the Elizabeth line – a new railway that will increase central London rail capacity by 10% when it is fully complete in 2019.

SYSTRA has played a significant role on Crossrail, working in a consortium as delivery partner. We have provided expertise in railway systems, such as signalling, communications, traction power, track and overhead line equipment, as well as expertise in tunnelling, noise and vibration control, BIM, planning, commercial management, project management and construction site management.

## Mobility and climate change adaptation

Global environmental concerns and poor urban air quality are encouraging cities to favour cleaner public transport.

International agreements on climate change coupled with an increasing awareness of the health consequences of poor air quality are driving the political impetus for action.

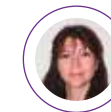
Many cities are responding with measures to develop and improve public transport while simultaneously reducing reliance on petrol and diesel vehicles. Potential policies include low emission zones, proposals to ban or levy charges on fossil fuelled cars, and incentives to switch to cleaner forms of transport – including moves from diesel to electric locomotives.

Vehicle manufacturers are gradually switching to electric propulsion for cars, trucks and taxis, while future autonomous technology may encourage more people to share hired vehicles, particularly in cities. Electric vehicles shift road traffic emissions from tailpipes to electricity grids, bringing benefits in urban air quality as well as overall greenhouse gas emissions.

### Coordinated infrastructure

Transport efficiency is also likely to improve as urban infrastructure joins the Internet of Things. Smart traffic signals collaborating with autonomous vehicles will aim to create 'green waves' of moving vehicles in place of stop-start congestion. Trams and buses will coordinate with metro and rail services to deliver more convenient interconnected services, encouraging more people to switch from private cars, with smart payment removing ticketing hassle from public transport.

From the automation and digitalisation of existing transport services to the creation of the efficient new multimodal stations and interchanges, SYSTRA has the direct experience and deep understanding required to deliver.



**DÉBORAH RONDET-PHILIPP**

Director, Environmental and Sustainable Engineering

*"The issue is no longer which transport mode should dominate another, or even the role of public, private, collective or individual funding. Instead, the question is how best to benefit from the combination of all these options."*

### DRIVING ENVIRONMENTAL INNOVATION

Airports are under increasing pressure to manage environmental issues, from noise and air quality to mitigating the impact of surface traffic. SYSTRA helps clients address these complex evolving challenges. For example, our extensive experience of public consultations has enabled us to develop innovative technology that helps airports demonstrate to communities how aircraft noise could affect them and how it can be mitigated.

## The rise of automation

Driverless technology is already common in metro networks and will soon transform other transport modes.

Fully autonomous vehicles promise new forms of convenience particularly when accessed as a shared service. After taking passengers door-to-door, a shared autonomous car could remove the need to find a parking space simply by travelling onwards to its next booking.

Once integrated into a multimodal urban transport network, autonomous vehicles could serve a large population using dramatically fewer cars, freeing up roads and parking spaces in crowded cities. They also promise to complete the first and last mile of journeys at a lower cost than taxis.

### Mass transit automation

Automation is also a transformative technology in public transport, helping improve the safety, capacity and reliability of services. SYSTRA has been an established leader in transport automation since the early 1980s, after project managing the construction of Europe's first driverless metro in Lille in Northern France.

Today, new metro lines are routinely designed for driverless operation, while modernisation of existing lines frequently involves the adoption of full automation. SYSTRA is a pioneer in this area, with involvement in nearly two-thirds of all driverless metros under construction worldwide.

Automation is now poised to spread beyond metro networks. In the near future we will see more highly automated and driverless tram systems on our city streets.



**DOMINIQUE ROUX**  
System Design & Build Director

*"Artificial intelligence could automate a lot more than driverless vehicles. Machine learning could strengthen cybersecurity, improve crowd management and help to spot suspicious behaviour in busy spaces such as stations."*

### AUTOMATING BRUSSELS METRO

SYSTRA is leading a consortium upgrading Lines 1 and 5 of Brussels Metro to full automation. We are providing intensive support for the design, implementation and commissioning stages.

One goal is to increase the frequency of trains so the lines can carry more passengers, reducing the need for car journeys across the city. Lines 1 and 5 date back to the 1970s and are currently the busiest on the city's network. Infrastructure work is due to be completed in mid-2018.

## New technologies and new entrants

People's desire to connect more easily and efficiently will drive innovative new mobility services and modes of transport.

Digital, connected technology is empowering a wave of new entrants in the mobility sector, offering services from free-floating bikes to ride-hailing and ride-sharing. Attracting people via simple billing and location-aware apps, new services are already challenging established providers.

The shift towards on-demand mobility services can be disruptive for city authorities, introducing unfamiliar variables that make it more difficult to plan and budget for new publicly funded services.

Citizens tend to greet new mobility options with enthusiasm, particularly when new entrants undercut established options. The rapid rise of Uber and dockless cycle hire schemes provide an object lesson for authorities.



**MAUD BERNARD**  
Project Manager,  
Consultancy Services

*"Advances in technology will change the way mobility services are planned, managed and used. We are likely to see autonomous cars and buses, new personal mobility devices developed from today's bicycles and scooters, and perhaps even air taxis and flying drones."*

### HYPERLOOP

New technologies such as Hyperloop will change the face of transportation as we know it. SYSTRA is working with Virgin Hyperloop One to develop the homologation process. Our expertise in high speed rail and automated metro homologation was instrumental in this contract award. We have been members of Virgin Hyperloop One's technical advisory board since 2016. As part of our contract signed in early 2017, SYSTRA engineers are performing system safety analysis and assessment work in Los Angeles, as well as assisting with obtaining authorisations.

### FINANCING INNOVATION

Institutional and private funding providers may find the promise of disruptive new entrants more alluring than conventional transport projects, potentially restricting access to capital. Funding streams may also be affected if new mobility services shift consumer habits away from revenue generators such as congestion charging and parking fines. Strategic advisory services that increase investor confidence will be key, particularly in relation to safety, technical robustness and governance, and reducing exposure to risk.

## Data-driven design

Digital models will evolve from capturing detailed design data from the project inception phase, improving collaboration.

Today's engineering projects start life in the digital realm. A digital model is refined during the design process, acquiring layers of detail and information.

Increasingly, these digital models will capture a project's lifecycle data, moving from 3D to 5D format by adding time and cost data. Different construction and usage scenarios can then be explored not only in operation and maintenance phases but all along the V-cycle.

Digital mock-ups will eventually become data repositories, holding information at each stage, from inception, planning, design and construction through to operations and maintenance. They will go far beyond today's BIM to offer many different views of data, while also providing a single point of truth to foster collaboration.

### Testing via simulation

Virtual reality and other forms of simulation will become increasingly important in validating designs, assessing safety requirements and projecting performance, allowing conflicts and incompatibilities to be identified. Testing will begin long before the first shovel breaks ground.

In anticipation of this challenge, SYSTRA is creating bespoke digital tools and processes to tackle tomorrow's complex and demanding projects.

### INNOVATION IN MODEL-BASED DESIGN

SYSTRA aims to be the leader in BIM for rail infrastructure. We already offer unique solutions developed in house such as BIM in One Click, which we designed to enable easier modelling of large-scale infrastructure such as viaducts and tunnels that are built using repeated structural units.

Work to meld BIM and Geographical Information Systems (GIS) data is also progressing. Recent enhancements to BIM in One Click have brought BIM models of tunnels together with 3D geological GIS data, enabling integration of these two closely aligned data sets – a major step in advancing the design approach to underground structures.

3D image of Bogotá Metro station



**SYLVIE CASSAN**

Project Director – BIM Data Management, France

*"Simulation can validate performance, detect interface issues and save time during testing and commissioning. It also supports the elaboration of safety cases."*

## Engineering design's expanding horizons

Tomorrow's projects will require engineering excellence and a diverse array of skills to reflect growing client expectations and spiralling technical demands.

Mobility projects are becoming ever more complex, as technology enables new options and transport services become more sophisticated and interconnected. Increasingly, new infrastructure must support smart, flexible, intermodal travel.

Creating next-generation mobility will require broad and deep technical skills across the entire spectrum of transport systems, as well as collaboration and negotiation skills to deal with a widening array of stakeholders and find optimal multi-criteria solutions.

### Delivering technical excellence

Complex projects put the onus on system integration and technical coordination. Eradicating gaps in knowledge, spotting incompatibilities and integrating diverse technologies will become cornerstones of successful project delivery.

Project goals are also evolving, as clients take a longer term view. The focus is moving from construction cost to lifecycle cost optimisation and total cost of ownership (TCO), even at the bidding stage. With our strong operations and maintenance engineering expertise, SYSTRA is well placed to deliver successful outcomes.

### ENABLING FLUID LINE CONTROL

SYSTRA is working on Eole (East West Link Express), a project to extend Paris's RER E commuter line 55km westward and automate its central section. A new operating system called NExTEO will bring the track and train control functions seen in automated metro networks to rail. The aim is to improve regulation, frequency, responses to traffic disruptions and passenger information. SYSTRA has been leading an integrated team, which included SNCF and RATP, working to define requirements and create new systems engineering methods for this innovative project.



**MARK SCOTT**

Managing Director, Australia

*"Strong system integration and technical coordination will be vital to the successful delivery of tomorrow's transport and mobility schemes. These skills will be essential to completing complex projects on time, on budget and with the required quality."*



## Next-generation rolling stock

Advances in rolling stock will improve services and cut costs, even in the most extreme environments.

Like any business, transport authorities aim to reduce running costs while improving service delivery. These seemingly conflicting goals can be achieved jointly through progress in technology and fleet maintenance management.

Robust planning across the full system lifecycle has become a key facet of transport design, requiring a holistic view in which rolling stock is treated as a key component of interconnected transport infrastructure.

Carriages must become fully digitally connected spaces, supporting both business and entertainment activities. They must also be designed to reflect differing local expectations, executed and delivered on time to meet integration constraints of intensively expanding networks.

SYSTRA supports clients in their investment decisions covering all aspects of transportation networks, including procurement across the full range of rolling stock. Our engineering expertise is also vital to ensuring rolling stock provides passenger comfort and reliable operation even in the world's most challenging locations.



**JOSEPH SARKIS**

Vice President, Rolling Stock,  
North America & International

*"Digital monitoring of trains will provide the real-time data needed for professional, expertise-based predictive maintenance, improving availability, reliability and lifecycle costs."*

### NORTH SOUTH RAILWAY, SAUDI ARABIA

SYSTRA led an international consortium that designed and built the first fast rail link across the Saudi Arabian desert. We also procured heavy rail rolling stock for the 2,400km line. We wrote specifications, evaluated bids, supervised fabrication and oversaw testing and commissioning of rolling stock. The first 200km/h passenger services began in 2017.

The harsh desert offered low humidity, daytime heat and nocturnal cold, dust clouds and wind-blown sand dunes among other natural hazards. Multiple safeguards minimised the risk of breakdowns in remote, geographically challenging surroundings.



## Harnessing data to improve transport systems

End-to-end digitalisation of transport networks throughout the planning, design, build and operational phases will unlock efficiencies.

Like almost all industries, the transport sector can enhance its business activities by improving the way it structures, shares, gathers and analyses data. SYSTRA is at the forefront of digitalisation in mass transit and rail, and we have witnessed the potential of better data at every stage of our activities, from transport planning through to operations and maintenance.

Increasingly, our work results in the creation of a "digital twin" of planned transport infrastructure – a highly detailed digital replica of the asset that can be used to improve collaboration, anticipate problems and experiment with different operational scenarios. Using our accurate digital twin, we can simulate the performance of a new transport system and model its interaction with existing infrastructure well before breaking ground at the physical site.

### Extracting insight from everyday data

Effective analysis of operational data is another key area of development. Gathered across an entire city, operational data will contain vital information that could drive improvements. However, extracting meaning from large sets of complex, fluctuating data can be daunting without smart analysis tools. The right data analytics software can interpret trends and help to answer 'what if' questions, modelling likely outcomes of different interventions.

SYSTRA is developing and deploying a variety of software tools that make smart use of digital information to provide this kind of insight and guidance. Data-based tools can assist with a broad range of tasks, from transport planning to network design, construction supervision and asset management.



**STEVE HIGHAM**

Managing Director, UK –  
Engineering

*"SYSTRA is ideally placed to help clients extract value from their transport data. We combine deep understanding of transport systems with digital skills, and have developed tools to support every stage of the value chain from inception to decommissioning."*

### ITSIM

SYSTRA has developed a web service called ItSim, designed to help optimise transport networks by simulating and visualising the impact of changes. Aimed at transport authorities, service operators and infrastructure managers, the software can help optimise network performance. ItSim is a cloud-based application built around microservices, offering a simple way for customers to feed in and explore their own data.



## Modernisation of mass transit networks

Upgrade programmes will boost the capacity of existing networks, bringing them into the digital age.

Increasing urbanisation and population growth will fuel the need to transport more passengers on existing infrastructure. We will see accelerating demand for modernisation and capacity upgrade programmes that support longer and better trains, more frequent services and improved passenger information.

SYSTRA is expert in this area, adept at leading upgrade programmes and delivering required outcomes, such as increased passenger volumes through stations.

Modernisation will also bring new technology to existing stations, tracks and trains. Measures such as platform screen doors, automatic train control systems and unattended train operation (UTO) can dramatically improve passenger safety, while the transition to digital technology for signalling and network management can transform service reliability and flexibility.

These kinds of improvements can also be achieved in UTO-to-UTO modernisation projects. Existing driverless metros, some built as early as the 1980s, can be upgraded to take advantage of today's digital track and advanced, up-to-date control systems.

Passenger expectations will also rise, from an increased demand for frequent, punctual services through to better on-board facilities such as high-speed internet access.



**ARNAUD VALRANGES**  
Senior Vice President,  
Development & Strategy

*"SYSTRA managed the construction of Europe's first fully automated line in the early 1980s and now we are updating generations of automation implemented at that time so that our clients benefit from the latest UTO technology."*



### THAMESLINK, NETWORK RAIL, UK

London's Thameslink services connect stations north and south of the city. All services pass through a 'core section' in central London that acts as a bottleneck.

SYSTRA has supported Thameslink throughout a project to increase the core section's capacity from 16 to 24 trains per hour in each direction. The project deploys European Train Control System Level 2 technology for radio-based signalling and Automatic Train Operation (ATO) to oversee safe running, including automated traction and braking. Our role includes risk identification and assessment, safety planning and system analysis, human factors mitigation in signalling and control rooms, and approval and standards work.

## Data-driven asset management

Infrastructure will provide deep data for relevant capital planning, efficient operations and predictive maintenance.

Transport systems tend to have long working lives, so it is natural that much of today's infrastructure consists of legacy equipment providing little or no diagnostic data. Regular on-site inspections are needed to keep "mute" infrastructure in a state of good repair.

This approach can be improved through remote monitoring and management. Once centralised data about the condition of assets is available, maintenance and renewal can be driven by actual need rather than rote.

Efficient asset management has become a core goal for new and existing infrastructure. This is a trend that will be amplified in the future.

### Benefits unlocked by data analytics

As a transportation specialist, SYSTRA is uniquely positioned with both the data analytics skills and the experience of maintenance engineering required in this growing arena. The Internet of Things will simplify data collection, but specifying and amassing information is only the first step. Once collected, the right data must be properly analysed and then acted upon intelligently to inform decision-making and achieve business objectives.

As advanced analytics mature, more transport operators will benefit from a digital replica of their assets that brings remote sensing data together with GIS and BIM to give a real-time picture of their condition. Deep data engineering will draw attention to impending issues and provide alerts to allow informed decisions for capital planning and predictive maintenance.



**HARVEY MARKOUR**  
Head of Asset Management

*"The good condition of one asset often depends on others around it: poorly maintained rails will lead to rolling stock degradation, for example. SYSTRA's experience in design, integration and management of systems and sub-systems, means we understand these deep connections."*

### A DATA-RICH DIGITAL TWIN

SYSTRA has been developing a digital platform that will allow Chile's national railway company to manage its infrastructure and rolling stock assets throughout their lifecycle. This solution delivers a digital replica of 2,000km of line and a decision-making tool that defines renewal investments based on assets' actual and prospective condition to achieve performance, risk and cost objectives.





Moving the world forward  
**IN 2017**

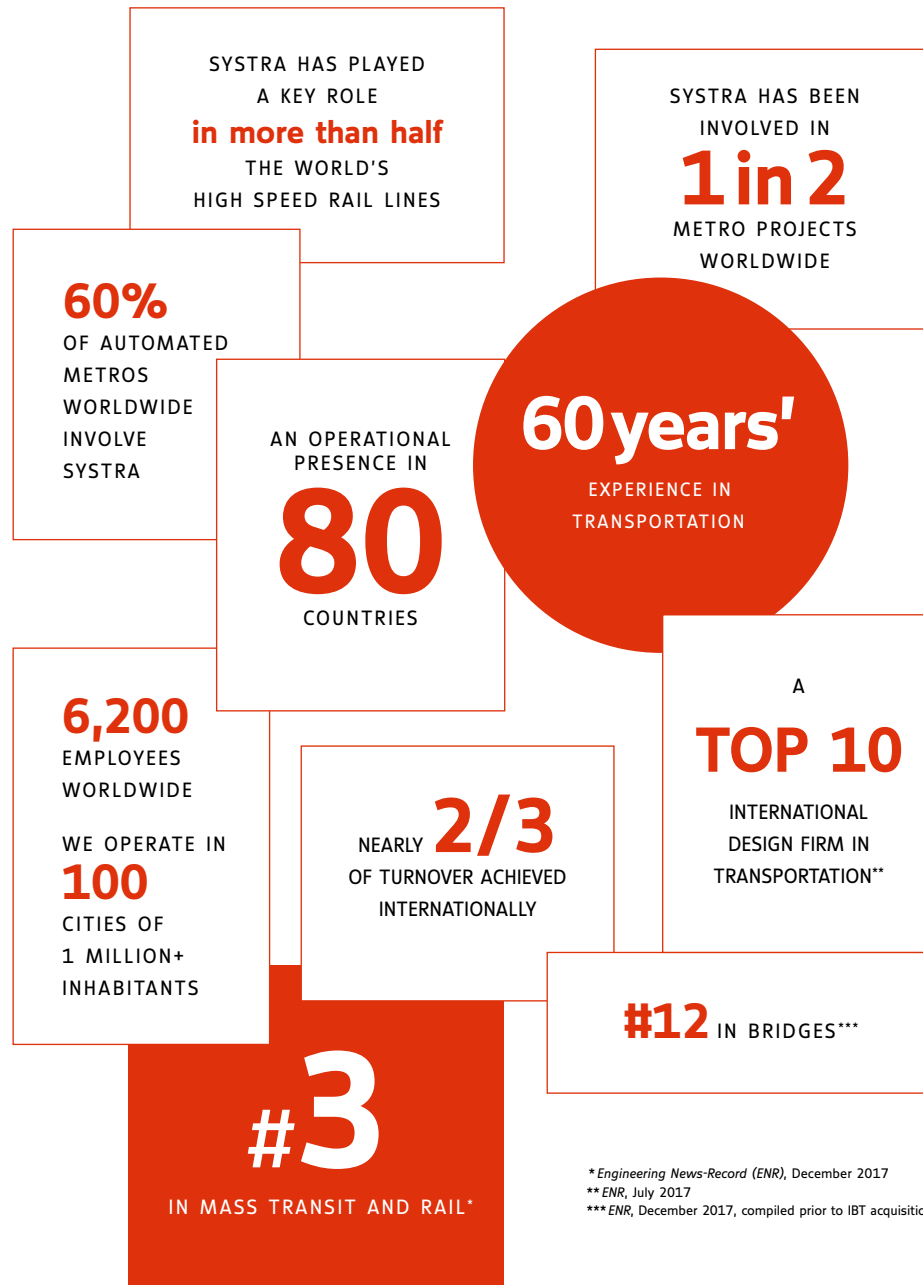
Excellence drives everything we do, working as a connected team for the benefit of our clients.

From safety and ethics to technical expertise and people development, SYSTRA is committed to the highest standards across our global business.



## SYSTRA in numbers

SYSTRA is the signature team for transportation solutions;  
a world-leading engineering and consulting firm.



## Moving the world forward together

In our 60<sup>th</sup> year, SYSTRA's mission to move the world forward is more vital than ever. The need for safe, sustainable transportation solutions has been amplified by global forces including urbanisation, population growth and climate change.

Since our inception in 1957, we have consistently delivered innovative projects, helping countries thrive in the face of accelerating change. Our iconic transportation schemes have transformed cities, stimulated economies and connected communities. From high speed national infrastructure to urban rapid transit, SYSTRA's work has improved access to education, leisure and employment for millions of people.

In 2017, the world experienced many economic and political challenges, resulting in significant market volatility. Exchange rate fluctuations, variable oil prices, political unrest and economic uncertainty have had an impact on many global companies, SYSTRA among them.

But it was also a year of breakthroughs. Chief among them was our highest ever annual order intake, at €642m; a €100m increase from the previous year. This peak underscores our reputation as the signature team for transportation solutions – a source of specialist expertise trusted by the world's governments, city authorities, transport operators and major contractors. We delivered a gross margin of 29.5%; our best result since 2013. This creates a solid foundation for the future.

In August, we completed our first product line acquisition, with International Bridge Technologies. This world leader in bridges brought specialist expertise in segmental and cable-stayed bridges, complementing our deep knowledge of suspension, truss and arch bridges and viaducts. With 60 percent of the world's new bridges built as part of rail projects, this acquisition was core to our business.

## Winning and delivering iconic projects globally

Our leadership in high speed rail was illustrated in the delivery of not one but three high speed rail projects in France: the South Europe Atlantic line, Brittany-Loire line, and Nîmes-Montpellier Bypass together added 544km to the country's high speed network.

We also won major roles on two of the world's most prominent new high speed schemes, with two contracts on the Kuala Lumpur-Singapore High Speed Rail link, and two contracts on HS2 in the UK.

Our metro business achieved major milestones in 2017. In Chile, Santiago Metro Line 6 opened in November, the city's first purpose-built automated metro line, and SYSTRA's most recent contribution to the network it helped create 50 years ago.

In December, our teams helped the Chinese coastal city of Xiamen gain its first metro line; the same month that Shanghai's Line 17 opened, which included 18km of U-shaped viaduct, 25 years after we invented the structure.

New metro contracts include signalling for New York's 8th Avenue Subway; an expanded role on the Grand Paris Express; automation work on two lines of the Brussels Metro; preliminary design for Turin Metro's fully automated Line 2; and a design role on the first metro in Bogotá, Colombia.

Our progress in light rail has been equally impressive. In December, we helped bring back the tram to the Danish city of Aarhus, after a gap of nearly half a century, and secured a contract to do much the same for Mauritius. We also won a design and build contract in the Philippines to extend Line 1 of Manila's light rail transit system.

## Moving forward into the future

SYSTRA is well positioned for the future. We took key steps this year to bolster our foundations, preparing for growth. We launched our global Safety Leadership programme, rolled out a worldwide HR system and added new ethics procedures. 2017 saw the culmination of our 'SYSTRA 2018' programme, which began five years ago. It has boosted our strength and efficiency as a business, as well as increased our resources and competencies. The programme also contributed to the growth of our international footprint, which now represents 63 percent of our business in terms of revenue.

The road ahead is exciting. As global cities expand, so too will their appetite for urban and multimodal mobility. We are well placed to help countries meet the transportation challenges of the 21<sup>st</sup> century.

SYSTRA's story is, at its heart, about connecting people and places. We apply our technical expertise and specialist insight to bring people closer together. This is how we move the world forward, today and into the future.

**"SYSTRA's work has improved access to education, leisure and employment for millions of people."**

**PIERRE VERZAT**  
Chief Executive Officer

## SUPERVISORY BOARD'S MESSAGE

**A sustainable growth project, driven by international activities and supported by industrial shareholders.**



**PIERRE IZARD**  
Chairman of SYSTRA's  
Supervisory Board; Chief Technology  
& Rail Systems Officer of SNCF



**CATHERINE GUILLOARD**  
Vice Chairwoman of SYSTRA's  
Supervisory Board; Chairwoman  
and Chief Executive Officer of RATP

In a constantly evolving and increasingly complex world, the role of the engineer is more essential than ever to the development of territories and meeting the mobility needs of populations. Founded 60 years ago to "deliver or modernise appropriate transport" outside France, SYSTRA remains faithful to its original purpose: to be an expert serving project owners and contractors, able to offer "a high-quality technical service" that is "independent" and with "its own financial means".

As shareholders we are, above all, involved in an exciting industry project that responds to very varied issues that are at once human, geopolitical and technological. The success of the Group resides in the quality of the people who make SYSTRA what it is, without whom nothing enduring can be built.

Through their work, their technical excellence and their creativity, they inspire confidence in the clients and the populations they serve. In a huge market, driven by increasing mobility needs and facing new environmental and technological challenges, they continue to write SYSTRA's history, supported by two industry shareholders: RATP and SNCF. Today, it is a source of pride for all of us to see SYSTRA offering its services in more than 80 countries.

SYSTRA has a sustainable and profitable growth model that will be even more robust in an uncertain global economy and in the face of increasing competition. Our role is to enable the growth project that SYSTRA has defined and the Supervisory Board has approved so that it has the financial means necessary to implement and achieve its ambitions.



## SUPERVISORY BOARD

SYSTRA's Supervisory Board comprises experienced industry executives and employee representatives.

### PIERRE IZARD

Chairman of SYSTRA's Supervisory Board;  
Chief Technology &  
Rail Systems Officer, SNCF

### CATHERINE GUILLOUARD

Vice Chairwoman of SYSTRA's  
Supervisory Board; Chairwoman and  
Chief Executive Officer, RATP

### GWENDOLINE CAZENAVE

Head of TGV Atlantique, SNCF Mobilités

### MARIE-CLAUDE DUPUIS

Senior Vice President Strategy,  
Innovation and Development, RATP

### JEAN-YVES LECLERCQ\*

Chief Financial Officer, RATP

### AGNÈS ROMATET-ESPAGNE\*\*

Head of International Relations,  
SNCF Mobilités

### GUY TEULIÈRES

Permanent representative of BNP Paribas

### THIERRY SIMON

Permanent representative  
of Crédit Agricole CIB

### PASCAL POIROT EVA RUDIN

Independent members

### SÉBASTIEN ANDRAUD

FABIENNE FAYARD

ERIC PRUVOST

JOSÉ SIERRA

BRIGITTE VERCHÈRE

Employee-elected members

### ALAIN FRYBOURG

Observer, permanent  
representative of Natixis

### PHILIPPE DE VULPIAN

Observer, permanent representative  
of Societe Generale

\*Jean-Yves Leclercq was appointed in place of Alain Le Duc on 29 March 2018.  
\*\*Agnès Romatet-Espagne was appointed in place of Guillaume Pepy on 19 March 2018.



## EXECUTIVE COMMITTEE

SYSTRA's Executive Committee is responsible for setting the Group's long-term strategy, driving growth and monitoring client satisfaction.



Top row, from left to right

### PIERRE GOSSET

Chief Technical Officer

### PIERRE VERZAT

Chief Executive Officer,  
Chairman of the Executive Board

### JEAN-CHARLES VALLERY

Chief International  
& Development Officer

### STÉPHANE BIRIEN

Chief Human Resources Officer

### ARNAUD VALRANGES

Senior Vice President,  
Development & Strategy

Bottom row, from left to right

### DIDIER TRAUBE

Senior Vice President, France

### ANDREW MCNAUGHTON

Chief Operating Officer,  
Member of the Executive Board

### BRUNO SCHMITT

Chief Finance & Administration Officer,  
Member of the Executive Board

### OLIVIER DEZORME

Chief Financial Officer

### MAHMOUD DOW

Senior Adviser  
(not present, retired April 2018)

## A solid foundation for future growth

We achieved our highest ever order intake in 2017, demonstrating our clients' confidence in our ability to deliver their transportation projects.

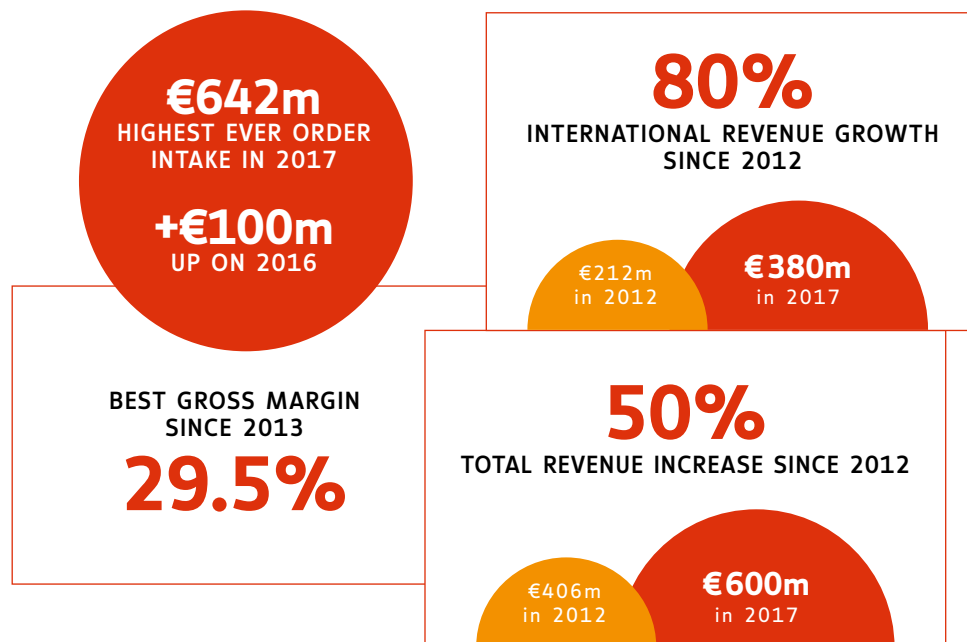
The rising value of the euro against most other currencies, adverse economic conditions in a number of countries and the South Europe Atlantic (SEA) high speed project drawing to a close impacted both our 2017 revenue and financial results. Yet we still achieved two major milestones in 2017: our highest ever order intake and our best gross margin since 2013.

Following five years of sustained high growth and the creation of a strong regional organisation in seven key geographies, our focus in 2017 was therefore on optimising our cost structure. We developed a cash collection programme, which will be rolled out in 2018, with results expected in the first half of the year.



**BRUNO SCHMITT**  
Chief Finance & Administration Officer,  
Member of the Executive Board

*"Our stable gross margin demonstrates our strong operational performance and ability to successfully deliver projects. We enter 2018 with a record backlog, which together with major new contract awards, creates a solid foundation for the future."*



## A strong global footprint

Our international presence grew last year in both revenue and headcount. 2017 also marked our first product line acquisition, spanning multiple countries.

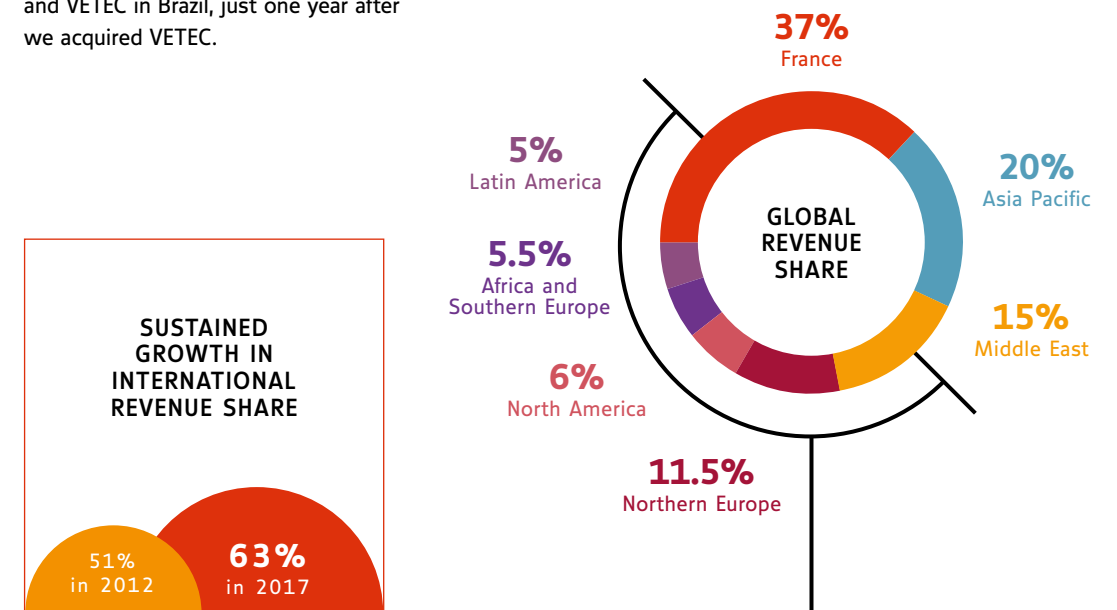
SYSTRA's founding purpose was to be international. Our first contract in 1957 was with Indian Railways, helping deliver the country's first electrified line. Today, we employ 1,700 people in India – one of our highest growth markets. We have enjoyed strong international growth in the past five years, both organically and through acquisitions, and we are proud to employ people of more than 80 nationalities in 80 countries.

In 2017 we made our first product line acquisition: International Bridge Technologies. A world-renowned bridge specialist with offices in San Diego, Montreal and Dubai, this was also our first multi-geography acquisition. Another milestone was the legal merger and full integration of TECTRAN and VETEC in Brazil, just one year after we acquired VETEC.



**ANDREW MCNAUGHTON**  
Chief Operating Officer,  
Member of the Executive Board

*"An international outlook is one of SYSTRA's defining qualities. Our global footprint gives clients extensive experience of international projects and expert knowledge of the local market."*





## Delivering a safer world for everyone

Setting and maintaining the very highest standards in safety is vital to our projects and to how we operate. In 2017 we began a global programme focused on safety leadership.

As the signature team for transportation solutions, SYSTRA views safety excellence as an essential component of technical excellence. This is the DNA of our safety culture. As an engineering company, we also know that our safety culture is shaped by every employee in every country. In 2017 we developed and began the rollout of a global vision and framework to support our employees and their interactions with stakeholders, including clients, business partners, subconsultants and the public. The programme cements a culture of safety leadership at all levels and across all geographies, recognising that safety is about permanent focus and continuous improvement.

### A never-ending mission

We were proud to receive a number of important safety awards from clients in 2017, including for our work on the Eastern Dedicated Freight Corridor 2 in India and Hanoi Metro in Vietnam. This recognition reinforces our belief that, with our clients and business partners, we can together deliver a safer world for all. Our commitment to safety leadership and quest for the highest standards in safety remain a permanent focus.



**FRÉDÉRIC LEGUAY**

Vice President, Group Health, Safety & Security

*"Our safety expertise is relied on by clients, who turn to us for safety risk assessments for their new and ever higher performing modes of public transport."*

### A TRULY HOLISTIC APPROACH



Health, safety and security – which we call 3S – are core to our business. As a global firm, managing 3S is part of our daily operations, in all our decision-making and production processes. Our 3S programme covers the health, safety and security of our people, whether on site or in the office; safety in the systems we design and on the construction sites we supervise; and physical security of our premises and information protection. In 2017 we put in place a new organisation to bridge our entire 3S competencies and spread best practice.

## Maintaining the highest standards in ethics and CSR

We deployed a number of initiatives in 2017 as part of our ongoing drive to adhere to the highest standards in ethics and CSR across the Group.

### Ethics

As a global company with a presence in 80 countries, it is essential that all our employees follow a common set of ethical standards. SYSTRA's goal is to go beyond compliance with the latest legislation and regulatory guidelines. Our approach is to adopt and adhere to the highest requirements and deploy them in every country where we operate. In 2017 we added a business ethics & compliance policy to our ethics procedures and created a number of initiatives in support of Sapin 2, the French anti-corruption law that came into force in June.

### CSR

As part of our corporate social responsibility (CSR) commitments, we rolled out a number of initiatives to embed best practice across the Group. We deployed a minimum set of requirements for every SYSTRA site to maintain a safe, high-quality working environment wherever we operate. We also created an e-learning platform to raise awareness of our environmental responsibilities both on our projects and in our offices. 2017 saw the culmination of our three-year education programme with UNICEF in Togo, Africa.

### DRIVING BEST PRACTICE IN ETHICS

We delivered a range of policies, training modules and procedures to ensure the highest standards of compliance are maintained in all our geographies, including:

- An anti-corruption code of conduct and corresponding e-learning module.
- A business partners due diligence procedure to evaluate those involved in our commercial activities.
- An ethics alert system for reporting ethical risks directly to the Group Compliance Officer, while protecting the whistleblower.
- A network of local compliance managers.



**JÉRÔME HERNOT**

Group Compliance Officer

*"Our business ethics and compliance commitments are core to our strategy."*

SYSTRA IS IN THE  
**TOP 30%**  
OF COMPANIES EVALUATED  
BY ECOVADIS

# A global framework to support local delivery

Our workforce has nearly doubled since 2012. The focus in 2017 has therefore been twofold: deploying our Group HR policy worldwide and creating a shared culture that unites our global teams.



Employees from our combined Brazil operations

Attracting, developing and retaining the industry's most talented people is at the heart of our signature team vision. But creating a sense of belonging among people from different cultures and countries, who are expert in a broad range of disciplines, is equally important. This is why, in our 60th anniversary year, we launched SYSTRA Spirit: a Groupwide programme to create a shared culture and common set of values that unite us all.

As a global company with an operational presence in 80 countries, our HR function must be decentralised. In 2017 we rolled out TalentPlace, a global system that enables regions and countries to define their own recruitment and resourcing strategies, in line with Group HR policy. Regions can anticipate their staffing needs so that clients have access to the most appropriate technical expertise exactly when they need it.

In 2017 the integration and full legal merger of TECTRAN and VETEC in Brazil also took place, with both entities now operating under the SYSTRA brand. This was accomplished just one year after our acquisition of VETEC in December 2016.



STÉPHANE BIRIEN  
Chief HR Officer

*"People are key to our ambition to be the signature team for transportation solutions. A single integrated approach to help recruit, develop and manage our multicultural workforce across our expanded international footprint has been key to our global HR strategy."*

## GROUPWIDE E-LEARNING PROGRAMME

In 2017 we made six e-learning modules available to all Group employees, spanning ethics, 3S (health, safety and security), SYSTRA's integrated management system (IMS), risk & audit, environment and urban transit. We will expand this range in 2018 to include rail, BIM, project management and another 3S module.

Our Groupwide e-learning programme is complemented by a combination of classroom training and courses targeted at specific needs.

## ROLLOUT OF GLOBAL HR SYSTEM

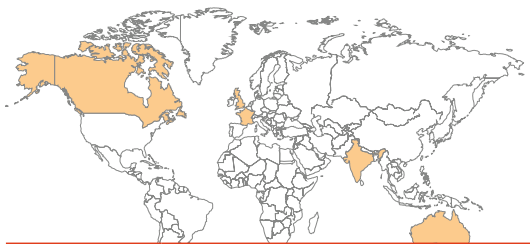
In 2017 we implemented TalentPlace, the backbone of the Group's HR policy. The software lets us develop and manage our global workforce, anticipating resourcing needs so the most appropriate skills are allocated to projects exactly when they are needed. It enables us to map competencies worldwide using a consistent methodology, providing full visibility of our skills and expertise Groupwide. At a local level, regions and countries can systematically conduct competency analyses, headcount forecasts, recruitment planning and training in line with local needs. TalentPlace also gives our staff increased visibility of the different career paths and mobility opportunities within the company.



Tangier-Casablanca high speed line team members

## SYSTRA SPIRIT

International growth has been a byproduct of our success. A quarter of our workforce has joined through acquisitions and two-thirds of our employees are based outside France. As we become more multicultural and more geographically diversified, it is therefore all the more important that we define a common identity and create a sense of belonging. This was the purpose of SYSTRA Spirit, launched in 2017, comprising a Groupwide survey of our workforce, as well as individual interviews and focus groups. The results will shape our shared values, which will be embedded at every level in the business through common working practices that will be rolled out in 2018.



**70%** OF EMPLOYEES WORLDWIDE ARE ON TALENTPLACE

TalentPlace has been deployed in most of our high-growth countries:

- India, UK, US and Canada added in 2017.
- France was cemented in 2017.
- Australia is a priority in the first half of 2018.

## SUSTAINED EMPLOYEE GROWTH





# The power of digital delivery

Our deep digital expertise is vital for both in-house and external collaboration, across the full lifecycle of major projects.

SYSTRA works at the forefront of digital innovation, not just in the projects we deliver but throughout our organisation. Digital technology is transforming the potential of engineering and we are in the vanguard, expanding our own capabilities while delivering exceptional new outcomes for our clients. Internally, 2017 was a year of preparation for the mySYSTRA Digital Workplace, a new, collaborative platform connecting all our employees that we launched in January 2018. It is the cornerstone of our digital transformation, enabling staff to work as a unified team from anywhere in the world on any device. Our people can communicate easily, collaborating on documents in real time, which greatly increases productivity while fostering the sharing of ideas, best practice and innovation.

### 100% BIM

Progress towards our global goal of using Building Information Modelling (BIM) on 100% of our projects gathered pace in 2017. As a transportation industry leader in BIM, we are championing end-to-end digital continuity at every project phase from planning and design to project management consultancy, construction supervision and asset management. This includes mobile BIM to access a project's "digital twin" when making key decisions or specification checks in the field.



PIERRE GOSSET  
Chief Technical Officer

*"Our digital commitment, extensive BIM experience and specialist tools developed in house all amplify our technical expertise. This powerful combination equips us to deliver the industry's most complex transportation projects."*



### AWARD-WINNING EXPERTISE

BIM is fast becoming a key requirement at tender stage, as was the case for the Kuala Lumpur-Singapore High Speed Rail link, a project for which we won two packages in April 2017. For HS2 in the UK we contribute to a global BIM model capturing data across the entire project. In 2017, our expertise was recognised with a BIM d'Argent infrastructure project award for our work on Toulouse Metro.

# A recognised expert in transportation

For 60 years, SYSTRA has specialised in transportation and mobility. Today, we operate at every stage in the project lifecycle across all modes of transport.

Our expertise spans the entire spectrum of transportation. Our story began in rail but this has grown to encompass all transportation sectors. Today we are working on all forms of mobility to move the world forward.

We are experts in high speed and conventional rail for both freight and passengers; urban transit systems including metro, tram, monorail, light rail, cable car and bus networks; buildings and infrastructure provision including roads, bridges, tunnels and stations; maritime and aviation projects of all shapes and sizes; and schemes that accommodate cyclists and pedestrians as well as cars and other vehicles.

We are present from the earliest phases of a transportation scheme, advising city authorities on strategy, policy and planning, through to design, project management, construction supervision, system integration, testing and commissioning, and asset management.

Our specialist services are tailored to the needs of every client, whether a government body, infrastructure operator or owner, contractor or other private sector entity.



JEAN-CHARLES VALLERY  
Chief International & Development Officer

*"The provision of efficient transport is increasingly about intermodal connections. We have specialist insight into the inherent complexities in each form of transport, as well as deep understanding of supporting digital technologies. This enables us to create world-class solutions and the smart interchange hubs of the future."*

AMONG INTERNATIONAL DESIGN FIRMS RANKED BY ENGINEERING NEWS-RECORD (ENR), SYSTRA IS:

Among the  
**TOP 10**  
in transportation  
(July 2017)

**#12** in bridges  
(December 2017, compiled prior to IBT acquisition)

**#3**  
in mass transit  
and rail  
(December 2017)



Moving the world forward  
**TODAY**

SYSTRA's deep understanding of transportation and mobility enables us to lead the industry's most challenging, complex and iconic projects.

We are focused on delivering positive outcomes for the clients and communities we serve.



# Shrinking distances between cities

High speed rail brings people closer, slashing travel time between cities and unlocking a host of economic benefits.

SYSTRA has been a pioneer in high speed rail for more than four decades. We have brought high speed rail to China, France, Malaysia, Singapore, Korea, Morocco, Sweden and the UK. We have worked on every high speed line in France and are involved in more than half the world's high speed lines in operation.

In 2017 we were awarded major engineering contracts for two new high speed lines: in the UK, we won two contracts on the new high speed railway HS2, Phase One of which will run from London to the West Midlands. We also secured two contracts on the new Kuala Lumpur-Singapore High Speed Rail link.

In France we delivered three high speed lines in one year – a huge achievement. We also helped Africa achieve its record rail speed for the first time on the Tangier-Casablanca line; a project we have been involved in since 2005.

SINCE THE  
**1980s**  
WE HAVE BEEN INVOLVED IN THE DESIGN OF NEARLY  
**6,000km**  
OF HIGH SPEED LINE – LONGER THAN THE DISTANCE BETWEEN PARIS AND NEW YORK

**574.8km/hr**  
**world record**  
ACHIEVED ON A HIGH SPEED LINE DESIGNED BY SYSTRA

IN THE PAST **5** YEARS

WE HAVE BEEN INVOLVED IN THE DESIGN OF

**15**

HIGH SPEED LINES

MORE THAN

**half the world's high speed lines in operation**

INVOLVE SYSTRA

ON **3 continents**

## 2017: a year of high speed innovations



### A RECORD OF INNOVATION

This specialist experience has given us the insight to drive innovation in high speed rail, such as long-span bridges, slab-bed tracks, improved overhead power delivery and safer signalling systems. SYSTRA is committed to making high speed rail both more cost-effective and quicker to build. Our deep understanding of asset management enables us to design solutions that are easier, more efficient and less costly to maintain.

### SLAB TRACK

In 2017 SYSTRA was granted a patent for a new slab track concept. Our innovation can be deployed in high speed, as well as freight and passenger rail, and in both new rail schemes and upgrade projects. It comprises entirely prefabricated components, which speeds up the construction process as no concrete is poured on site. The slab track also incorporates a system for adjusting the track geometry, making corrections easier during the maintenance phase.

### V400 CATENARY

SYSTRA is researching overhead electrical supply technology to support 400km/h trains, with the goal of equalling the durability of today's catenary equipment running at speeds of 320km/h to 350km/h.

### AFFORDABLE HIGH SPEED

We continually strive to cut the cost of high speed rail both in construction and maintenance terms, while sustaining the highest safety and quality standards. For the SEA project, for example, we optimised the line to safely enable a range of maintenance operations without halting services.



## Keeping France at the forefront of high speed

In 2017 SYSTRA teams helped deliver three high speed lines in France.

It was the culmination of a story that began in the late 2000s when France took the decision to create three new high speed lines by 2017. SYSTRA played a major role in achieving this national ambition, which saw three high speed lines – totalling 544km – delivered in the same year.

### SEA: a record for high speed rail delivery in France

South Europe Atlantic (SEA) is Europe's largest high speed rail project to date and SYSTRA's largest ever project in terms of the scope of our role. 302km of new line was designed, built and tested in just six years – a new record for France.

SEA is the first dual-standard signalling high speed line in France, with the new track supporting both French and European signalling standards to accommodate trains from all over Europe.

### Broad scope of work

As a member of COSEA, the design and build consortium for SEA, we were involved at every stage of the project, from civil engineering and railway equipment design to the statistical, dynamic and integration tests. Our services included project management, as well as monitoring and coordinating construction, operations, safety and training.

We were also involved in the track, catenary system, signalling, telecommunications and electrical power. Our land management subsidiary SYSTRA Foncier obtained all rights of way, carried out land acquisition, secured temporary land use and managed land for COSEA.

### An ongoing role for the next 40+ years

Through our MESEA joint venture with VINCI, SYSTRA is providing operations and maintenance services for the next 44 years. Maintenance requirements were integrated at all stages of the project in order to optimise costs and efficiency.



38km of junctions

488 engineered structures

SEA is a new high speed line between Bordeaux and Tours, linking to the existing high speed line between Tours and Paris. Travelling at up to 320km/h, journey time between Bordeaux and Paris is slashed from 4.5 hours to just 2 hours and 4 minutes. The line opened in July 2017 and will carry 20 million passengers per year.

3 HIGH  
SPEED LINES  
DELIVERED  
IN 1 YEAR

IN 10 YEARS  
SYSTRA HAS BEEN  
INVOLVED IN NEARLY  
1,300km OF  
LINE FOR HIGH SPEED  
RAIL IN FRANCE

OVER 4 DECADES, SYSTRA  
HAS PLAYED A KEY ROLE  
IN CONNECTING FRANCE'S  
6 MAJOR CITIES THROUGH  
HIGH SPEED RAIL



## FRANCE'S FIRST NEW MIXED USE HIGH SPEED LINE

CNM, the Nîmes-Montpellier Bypass, is the first high speed line in France designed for mixed use by both freight and passenger trains. Freight services began in December 2017 and passenger services will start in July 2018, cutting 20 minutes from the travel time between Paris and Montpellier. By removing 20 freight trains per day from the conventional rail network, CNM has also sped up regional express train services by as much as 33%.

We led an engineering project management joint venture working for the Oc'Via Construction consortium. We were responsible for integrated project management and construction supervision, as well as technical testing of infrastructure and rail equipment.

SYSTRA also led the signalling, integration and dynamic tests. We then played a major role in compiling the Safety File required for authorisation so the line could open on time.

The project added 60km of new high speed line and 20km of connections to existing lines, as well as two new stations, 11 viaducts and 175 other structures.



## ENSURING BPL OPENED ON TIME

BPL, the Brittany-Loire high speed line, connects the French cities of Le Mans and Rennes. It opened in July 2017, adding 182km to the existing 180km of high speed line from Paris.

SYSTRA provided a variety of services to project owner Eiffage including design reviews of civil engineering and railway systems, as well as checking progress in line with SNCF Réseau's requirements and deadlines.

Our client Eiffage appreciated our role in the dynamic integration tests to ensure the line opened on schedule.



## Designing new high speed lines around the world

SYSTRA's market leadership was cemented with the award of four contracts on two major new high speed rail projects in 2017.

### ACCELERATING LINKS BETWEEN MALAYSIA AND SINGAPORE

In April 2017 SYSTRA was awarded two contracts for the new Kuala Lumpur-Singapore High Speed Rail link by project owner MyHSR Corporation. The contracts cover civil reference design works for two international stations, Bandar Malaysia in Kuala Lumpur and Iskandar Puteri at the southern tip of Malaysia, plus the first 38km of line running south from Kuala Lumpur.

As one of the biggest transport projects in Southeast Asia, the railway link aims to connect seven cities in Malaysia to Singapore, slashing journey time between Kuala Lumpur and Singapore to just 90 minutes.



### HELPING TO DELIVER BRITAIN'S NEW HIGH SPEED RAILWAY

In July 2017 SYSTRA won two major contracts related to HS2; a new high speed railway which is one of Europe's largest infrastructure projects. We are working in a design joint venture with Mott MacDonald for a Balfour Beatty VINCI construction joint venture. The contracts cover two northern sections of the Phase One route, which will run from London to the West Midlands and is set to be completed by 2026. Later phases of the project will see the railway extend to Manchester and Leeds by 2033. In total, the contracts cover 89km, which is over a third of Phase One's length. SYSTRA was one of the first companies to recruit apprentices enrolled in the National College for High Speed Rail, which opened in 2017, and is helping develop their curriculum for specific course modules.



## Bringing high speed rail to new parts of the globe

SYSTRA's history of introducing high speed rail around the world continued in 2017, with progress on major projects on several continents.

### DESIGNING SWEDEN'S FIRST HIGH SPEED LINE

Ostlänken, or East Link, will be Sweden's first high speed line, part of a broader scheme aimed at connecting Stockholm, Gothenburg and Malmö via a 320km/h network.

Working in a consortium, SYSTRA is delivering the basic design on the longest section of the project's first segment. In 2017, a preferred alignment was chosen and introduced to all stakeholders, and a first round of public consultations completed. In 2018, we will develop additional studies, including defining land acquisition requirements.

The basic design phase involves environmental, geotechnical and drainage studies, as well as track alignment, signalling, telecoms, catenary, power supply and landscaping considerations. A key part of our role involves preserving the environment and protecting wildlife habitats along the route.



### DELIVERING AFRICA'S FIRST HIGH SPEED LINE

Africa's first high speed line opened for technical testing in summer 2017, linking Tangier with Kenitra in Morocco. Operating at up to 320km/h, the new 183km line will cut rail journeys between the two ports from 3 hours 15 minutes to less than one hour. Commercial opening is scheduled for the second half of 2018.

SYSTRA's contract covers the initial studies and design phases through to construction and testing. The line uses European safety and signalling protocols, and full speed was reached for the first time during tests in October 2017, setting a new rail speed record for the continent. We have overcome numerous engineering challenges, including seismic risks, to deliver the new route.





## Modernising and designing rail schemes worldwide

Rail is more than a daily transport mode – it is a catalyst for economic growth and regeneration.

SYSTRA's roots are in rail, stretching back to 1957 when we delivered India's first electrification project. Today, we are involved in all phases of modernising and upgrading existing networks, applying experience we have gained through delivering a broad range of rail schemes. We are at the forefront of signalling modernisation, bringing the latest technical standards to both new and existing rail infrastructure throughout Europe.

In 2017 we delivered the North South Railway in Saudi Arabia, modernised three major lines in France and completed the electrification of a large section of Denmark's railway. We won three freight contracts in Guinea, as well as new packages of work on major national passenger rail programmes in our key countries.

Decades of experience enable us to deliver technical solutions ideally matched to operating requirements, while ensuring a high level of safety in the monitoring and management of rail traffic during construction. Our specialist understanding enables us to deliver lines at optimised cost, with operations and maintenance requirements factored into the design stage.

SINCE  
**1957** WE HAVE  
BEEN INVOLVED  
IN THE CREATION  
OR MODERNISATION  
OF NEARLY  
**13,500km**  
OF HEAVY RAIL LINE

### AT THE FOREFRONT OF RAIL INNOVATION

SYSTRA is working with Shift2Rail, a European research and innovation programme. In 2019 we will begin exploring concepts to enhance train control systems, using the latest communications technologies such as satellite positioning, Wi-Fi and 4G. This will enable trains on the network to be precisely located, providing enhanced traffic management while reducing operating costs.

IN THE PAST **5** YEARS

WE HAVE BEEN INVOLVED  
IN THE CREATION  
AND MODERNISATION OF

**34**

HEAVY RAIL LINES

ON **5 continents**

## A global leader in rail



### < A GROWING RELATIONSHIP WITH VIA RAIL IN CANADA

SYSTRA has rapidly gained the trust of VIA Rail, the intercity passenger train operator in Canada, since joining its pool of approved engineering providers in 2015. We are carrying out a feasibility study for High Frequency Rail, one of the company's landmark projects, that will create a dedicated rail link connecting Quebec City, Montreal and Toronto. The new line will deliver an improved service and reduce travel time. We are also assisting in the renewal of rolling stock and helping develop high speed rail standards for Canada, as well as defining interoperability solutions.

### > DELIVERING FREIGHT AND PASSENGER RAIL ACROSS INDIA

In 2017 we cemented our position as a leader in rail project management consultancy (PMC) in India, for both passenger and freight corridors. SYSTRA's PMC role spans almost the entire Eastern Dedicated Freight Corridor. We are also undertaking two major route upgrades that will improve rail services on the North Central and Western Railway zones in India. Construction is being carried out adjacent to active rail lines and we have accrued millions of working hours with zero incidents. Our safety and PMC performance won a number of awards from clients last year.





## Transforming rail in Europe



### DELIVERING FRANCE'S RAIL UPGRADE PROGRAMME

In December 2017 SYSTRA completed the modernisation of three regional express lines in France. The year-long project to refurbish the 83km Brest-Quimper line in Brittany included a switch to continuous welded rails and modernised infrastructure. Over the same period, the capacity of the 16.5km Cannes-Grasse line on the Côte d'Azur was expanded to accommodate longer trains and more frequent services. Meanwhile an eight-month project to improve the 30km line between Le Puy and Firminy in the Auvergne included measures to deal with rock slides.

We managed all three projects within tight deadlines set by SNCF Réseau. Our deep expertise and solid reputation in rail position us for strong growth in this area, as France continues its national programme of network modernisation.



### MODERNISING RAIL IN POLAND

In late 2017 we won a contract to modernise 45km of Poland's Line 143, a nationally important route. We will lead a consortium delivering a full suite of design services and provide technical assistance during tender, construction supervision, approvals and permits. The upgrade programme will improve capacity, enhance safety and reduce environmental impact and maintenance costs, as well as bring the track in line with European standards. Separately, we are acting in a similar capacity to modernise part of the E30 line through the city of Opole, and a section of the E65 between Bedzin and Katowice.



### STANDARDISING SIGNALLING IN SWEDEN

Sweden aims to deploy European Rail Traffic Management System (ERTMS) signalling across its national network by 2025, replacing legacy technology and supporting EU plans to establish a standardised rail corridor between Stockholm and Naples. SYSTRA won a new ERTMS contract in 2017 with Swedish transport agency Trafikverket, covering preliminary design of 250km between Södertälje and Mjölby (part of the 483km Southern Main Line). We completed similar work on another section of the line under an existing contract earlier in the year.



### BRINGING GREENER RAIL TO DENMARK

Danish rail operator Banedanmark aims to electrify 1,300km of its network as part of a plan to increase capacity, reduce journey times and cut CO<sub>2</sub> emissions. In 2013 SYSTRA was awarded a 10-year contract to assist Banedanmark throughout the project from tender strategy to management of contracts. We completed the electrification of 57km of line in April 2017, between Lunderskov and Esbjerg. Work is now underway on the next 60km, the new line between Copenhagen and Ringsted, due for completion in the second half of 2018.



## A major force in rail across Africa



### MAJOR FREIGHT CONTRACTS WON IN GUINEA

SYSTRA won three new contracts with longstanding client Compagnie des Bauxites de Guinée in the second half of 2017. The first and largest, signed in September, is an engineering, procurement and construction management contract to expand the Boké railway line serving mines in Guinea, raising annual capacity from 26 to 51 million tonnes of bauxite by 2020. The two subsequent contracts cover the construction of a new rail yard, storage area, passing sidings and access roads, and a project to upgrade rolling stock for quicker loading and unloading.



### BUILDING ETHIOPIA'S SECOND RAILWAY

In 2017 work began on Phase 2 of the Awash-Kombolcha-Hara Gebeya line in Ethiopia, which will add 120km to the 270km built in Phase 1. This new line was created to carry both freight and passengers between economic centres in the north and east of the country. SYSTRA is supervising construction, administering contracts and reviewing designs on behalf of the Ethiopian Railways Corporation.



### DAKAR'S FIRST REGIONAL EXPRESS TRAIN

Construction has begun on the first regional express line in the Senegalese capital, due to open in phases from 2019. The 55km line will serve 14 urban and suburban stations as well as Dakar's Blaise Diagne International Airport. Part of the route will resurrect the former Dakar-Bamako line. SYSTRA has been providing project management services to APIX, the Senegalese infrastructure agency, since 2015.

## Enhancing the passenger experience

Stations have become popular retail and leisure destinations.

Stations are now designed to maximise the passenger experience and the business opportunities created by footfall. SYSTRA has worked on more than 1,000 stations on six continents, from metro and light rail through to bus, cable car, heavy rail and high speed stations.



### HISTORIC STATION MODERNISATION

In May 2017 we completed a three-year renovation of the Grande Halle Voyageurs at Bordeaux Saint-Jean station, ahead of the arrival of high speed rail services. Dating back to 1898, the station was registered as an historic monument in 1984 and was last modernised in the 1970s. The project included renovations to Europe's largest glazed canopy, measuring 300m long, 56m across and 26m tall. SYSTRA led the entire programme, delivering project management, overseeing quality and undertaking safety assessments for the work – all carried out while the station remained open.



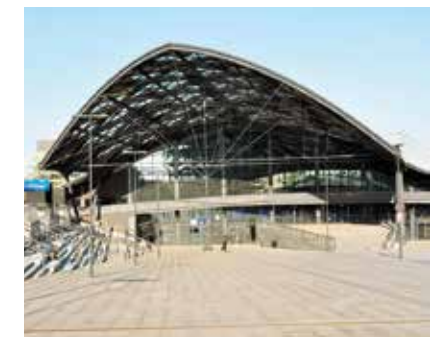
### MULTIMODAL STATION CONSTRUCTION IN PARIS

In August SYSTRA signed a contract with SNCF Réseau to project manage the construction of Bry-Villiers-Champigny station, a new multimodal hub connecting the future Line 15 of the Grand Paris Express to RER Line E and Transilien Line P in eastern Paris. The project will create a new passenger building for tens of thousands of people per day, new platforms, a signalling post and underpass, and will also require track construction and widening work on infrastructure.



### POLISH STATION REOPENS AS MULTIMODAL HUB

After a five-year closure for major upgrades, Łódź Fabryczna station in the Polish city of Łódź was up and running again in 2017. SYSTRA provided initial designs for the modernisation, including the station concept. The station now serves up to 200,000 passengers per day – up from 10,000 per day before modernisation – and is a multimodal hub. It connects national, regional and local public transport lines, and is ready for future high speed services.





# Keeping global cities moving

SYSTRA is the force behind many of the world's busiest metros.

Metro is in SYSTRA's DNA, with our roots stretching back to 1961. We brought metro systems to Santiago, Montreal, Mexico City and Cairo, and today we are doubling metro capacity in the French capital through our deep involvement in Paris Grand Express and other projects.

The world's metro operators rely on SYSTRA, which is why we have been involved in over half the world's mass rapid transit lines. In India alone, we are currently working on 11 metros across the country, delivering new lines in the nation's major cities and extending existing lines.

In 2017, we won metro contracts in New York, Brussels, Bogotá and Turin. We also delivered metro lines and extensions in Santiago, Lucknow in India, and Xiamen and Shanghai in China.

We are the recognised world leader in automated metro systems and we have worked on nearly two-thirds of the world's automated metros.

We have delivered a number of significant global firsts, including the world's longest driverless line in Dubai and the world's busiest metro line, carrying 72,000 passengers per hour in the Holy City of Mecca. We have worked on the metro systems of every major city in France.

Our expertise covers a number of specialist fields, from general design studies to project management, design engineering, owner assistance, audit and expert inspections, as well as signalling and passenger information.

SINCE THE  
**1960s**  
WE HAVE BEEN INVOLVED  
IN THE DESIGN OF NEARLY  
**1,350km**  
OF METRO NETWORKS

WE HAVE PLAYED A ROLE  
**in more than half**  
THE WORLD'S METROS

WE ARE INVOLVED IN NEARLY  
**2/3** OF THE WORLD'S  
AUTOMATED METROS



Cairo Metro



## NEW METRO LINES FOR CHILEAN CAPITAL

Line 6 of the Santiago Metro opened in November 2017, becoming the first fully automated line in Chile.

A second new automated line, Line 3, will open in 2019. SYSTRA has worked on both lines from initial studies through to testing and commissioning, across all systems including rolling stock.

Line 6 provides 15.3km of underground track and 10 stations, connecting with several existing metro lines as well as Santiago's suburban train network. Line 3 will be 22.1km in length with 18 stations, similarly connecting with other lines including Line 6.

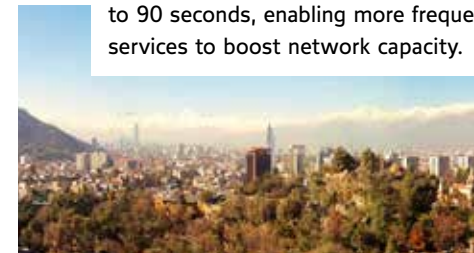
Both new lines adopt state-of-the-art technology with an Unattended Train Operation (UTO) CBTC system, overhead power delivery and platform screen doors for passenger safety.

SYSTRA is also working on systems design for an extension to Line 2 that will add 5.1km and four new stations.

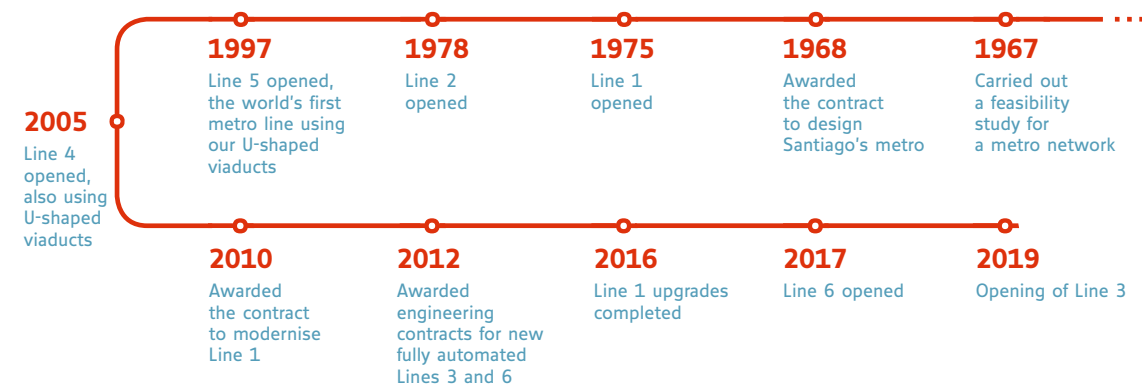
## 50 YEARS OF SYSTRA IN SANTIAGO

We have developed a strong relationship with Metro S.A., Santiago's state-owned metro authority, over five decades. More than 75% of all engineering studies across the network have been signed off by SYSTRA.

As recently as July 2016 we completed modernisation work on Line 1, equipping it with Communications-Based Train Control (CBTC) automation to close the gap between trains from 120 to 90 seconds, enabling more frequent services to boost network capacity.



## SYSTRA AND THE SANTIAGO METRO





## Expanding access to major cities in France



### DOUBLING PARIS'S METRO CAPACITY

Grand Paris Express is Europe's biggest urban infrastructure project, set to double the capacity of the Paris Metro and dramatically increase its use of automation. SYSTRA has been involved in the project since 2013, contracted to provide vital engineering expertise from preliminary studies through to design, construction supervision, testing and commissioning.

Four new fully automated lines, 15 to 18, and extensions to four existing metro lines will establish new routes across the city and its suburbs, with capacity for two million daily commuters.

A total of 68 new stations and 200km of new track will open in phases between 2020 and 2030. SYSTRA has won work on all lines and all stages, with a broad spectrum of responsibilities in each contract.

SYSTRA has a project management and engineering role on Line 15 South, where earthworks began in 2017 ahead of digging the first tunnels in 2018. We are also carrying out design work, including BIM modelling, on Line 15 South and West, the maintenance site at Vitry, and station links between Line 15 and the RER network in Issy, southwest of the city. We are also responsible for providing project management for systems, as well as design and supervision for rolling stock and signalling on Lines 15, 16 and 17.

Last year also saw excavations begin on Line 4, where we have a project management and engineering role. Tunnelling continued on Line 14 North, where we undertook studies and design work and are now supervising construction.



**DIDIER TRAUBE**  
Senior Vice President, France

*"We work at the forefront of metro development, improving urban transit to bring outskirts and city centres closer together."*

### EXPANDING TOULOUSE METRO

In 2017 SYSTRA delivered preliminary designs for the Toulouse Metro Line 3 project; work that won a BIM d'Argent infrastructure project award in September. The new 27km automated Line 3 will serve 20 stations and carry more than 200,000 passengers per day when it opens. It will connect with five rail stations, the existing metro lines A and B, the tramway and the bus network, including Linéo. It will also improve services to Toulouse's Blagnac international airport and central Matabiau rail station.

We began working with the Toulouse transportation authorities in 1985 on Line A, the city's first automated metro, in design and project management roles. From 1991, we led preliminary design work for Line B and then supervised construction of its civil works from 1998 to 2007.



### MODERNISING LYON METRO

SYSTRA is project manager for several schemes to modernise Lyon Metro, which opened almost 40 years ago and today comprises four metro lines. We are currently working on the Avenir Metro project that covers the renovation of rolling stock on Lines B and D, as well as the transition to integrated automation on Line B and then Line D. We are also project manager on the 2.5km extension of Line B southwards with two new stations, due to open in 2023.

### DELIVERING A SECOND LINE FOR RENNES METRO

Line B, the second metro line in the city of Rennes in Brittany, is due to open in 2020. The fully automated line will serve 15 stations along a 13km track roughly perpendicular to Line A. SYSTRA has provided technical assistance to project owner Semtcar since 2012 and will continue through to commissioning.



## Mobilising cities around the world

### > DELIVERING XIAMEN'S FIRST METRO LINE

Line 1 of the Xiamen Metro opened in December 2017. The first metro to serve the Chinese coastal city is 30km long with 24 stations, running on Xiamen island as well as the mainland via a 2.8km viaduct. SYSTRA supervised tests on a wide variety of systems including automation, signalling, power supply, tunnel ventilation and platform screen doors.



### ✓ RAPID BUILD FOR LUCKNOW METRO

Lucknow Metro opened in September 2017, following just three years of construction work – a record pace for India. A priority 8.5km stretch, Phase 1A, now links Lucknow's central rail terminal with eight elevated stations, while Phase 1B will add 9.5km elevated and 5km underground sections, connecting to the city's airport. SYSTRA's role spanned concept design to commissioning, including detailed design and construction support. The project requires four major spans: balanced cantilever spans of 255m and 177m, and two 60m steel arch spans.



**HARI SOMALRAJU**  
Managing Director, India

*"We are playing a pivotal role in India's major metro construction programme."*

### ✓ SHANGHAI'S LINE 17 BUILT WITH U-SHAPED VIADUCTS

The opening of Line 17 of the Shanghai Metro in December 2017 marked another milestone for our patented U-shaped viaducts. We carried out preliminary and detailed design for the viaducts throughout an 18km elevated section of the 35km line. The new line connects the Hongqiao high speed station to the western suburbs of Shanghai, with four underground and nine elevated stations.



### ✓ A NEW METRO LINE FOR TURIN

A SYSTRA-led consortium was awarded a contract to deliver the preliminary design and feasibility study for Line 2 of the Turin Metro in 2017. Line 2 will serve 23 stations across 14.5km, running mostly underground. Like Line 1, it will be fully automated, though the technical requirements for the new line are more challenging. Our involvement with Turin Metro dates back to 2006, when we carried out detailed design and supervision of works for Line 1.



### ^ INCREASING METRO CAPACITY IN NEW YORK

We won a major systems engineering contract in 2017 to deploy CBTC on the 8th Avenue Line of the New York City Subway. We will provide consultancy services for design, procurement and construction support for CBTC, and auxiliary signalling systems for the line. Our work is part of a broader modernisation programme across the network that will enable trains to run more frequently. MTA New York City Transit is a longstanding SYSTRA client and we are currently working on 11 projects across its network, including CBTC installation on the Queens Boulevard Line.

### > AUSTRALIA'S FIRST FULLY AUTOMATED METRO

The AU\$8.3 billion Sydney Metro Northwest project is the first stage of Sydney Metro, Australia's biggest public transport project. The 36km line opens in the first half of 2019 with 13 metro stations, extending in 2024 into the Sydney city – altogether 31 stations and a new 66km line. Sydney Metro is Australia's first fully automated metro railway. SYSTRA is providing independent certification services as part of a joint venture, certifying around 600 technical packages for operations, trains and systems works.





## Light rail for a new era

Trams are a clean, efficient mode of urban transportation, reducing pollution and easing congestion.

SYSTRA has been leading the tramway revival trend for nearly four decades. We have been involved in trams in 120 cities in over 50 countries. From Manila to Montreal, we have helped our clients seamlessly integrate systems in the heart of their cities. From rebuilding old networks to designing new routes, light rail is a vital part of our 60-year heritage.

We specialise in light rail transit systems that do not use overhead power lines – adding elegance and numerous practical benefits for modern cities. In the 2000s we delivered the world's first catenary-free tramway line in Bordeaux, bringing the ultimate mobility experience to one of the world's most beautiful cities. We hold the world record for the most tramway lines constructed and for managing the most light rail projects.

SINCE THE LATE  
**1970s**  
WE HAVE  
BEEN INVOLVED  
IN THE DESIGN  
OF OVER  
**600km**  
OF LIGHT RAIL  
NETWORKS

WE HAVE PLAYED  
A KEY ROLE  
in over  
**80%**  
of tram networks

IN **France**



## A major force behind the tram renaissance



### < BRINGING TRAMS BACK TO AARHUS, DENMARK

In December 2017 trams returned to the Danish city of Aarhus for the first time in 45 years, with the start of services on a 7km section of the Line 2 tramway. In 2018 Line 2 will gain another 5km and services will begin on Line 1, an existing 103km light rail system newly adapted for tram-train operation. SYSTRA provided studies covering power supply, track, signalling, telecommunications and maintenance, and undertook a detailed design review. We also supervised construction, testing and commissioning alongside our client, public-owned tram company Aarhus Letbane.

### > LIGHT RAIL REBORN ON MAURITIUS

SYSTRA will return rail to the island of Mauritius after a gap of more than 50 years. A new 26km light rail line will run inland from the capital Port Louis, with the first 13km section due to open in 2019. In 2017 we were awarded a design & build contract with the construction firm Larsen & Toubro. Our role spans civil works and systems design including viaducts and bridges – two of 19 stations will be elevated – as well as depots, track works, power supply and traction systems, plus communications and ticketing systems.





## Delivering light rail around the world



### < **T11 TRAM-TRAIN OPENS IN PARIS**

The first 10.6km phase of the T11 Express tram-train service opened in July 2017, serving seven stations in the northern suburbs of Paris. SYSTRA undertook preliminary studies in the early stages of the project, helping to define the choice of the tram-train system, and also planned and coordinated testing prior to the completion of Phase 1. We also supported SNCF in the project management for the deployment of the line's telecommunications systems.

### > **CONSTRUCTION COMPLETED ON OUARGLA TRAM**

SYSTRA has completed seven years of work on the Ouargla Tram in Algeria, the tram line at the gateway to the Sahara. Comprising 16 stops over 9.6km, the line links Ouargla's new town, old town and city centre, and is expected to support 34 million journeys each year. We were responsible for project management, engineering and construction management throughout the design and build on behalf of Entreprise du Métro d'Alger. In 2017 we managed the completion of works and oversaw the start of testing ahead of inauguration in March 2018.



### < **RECORD DELIVERY ON CASABLANCA TRAM MILESTONE**

SYSTRA is project manager on two extensions to the Casablanca Tramway, which will increase the current network by 16.5km and serve 22 additional stations. When it opens at the end of 2018, the tramway will comprise two lines that cross twice. In August 2017, during a line closure lasting only nine days, work was completed to alter the track, catenary, electric power and signalling systems at the site of future crossings between the two lines.

### > **DUBAI TRAM EXTENSION PROGRESSES**

Under our tender development contract for Phase 2 of Dubai Tram, we delivered a pre-contract programme covering transport planning and preliminary design in 2017. Phase 2 will add 6.5km and nine new stations, and will integrate the latest innovations, optimise sustainability and create new links with Dubai's metro networks.

SYSTRA worked on Phase 1 from 2006 to 2014, delivering a major depot, 11km of line, 11 trams and 11 stations. It was the world's first entirely catenary-free tramway with full ground-based power delivery, the first tramway to use Automatic Train Protection and Operation, and the first with platform screen doors.



# Delivering specialist consultancy services around the world

Our global network of consultants plan and deliver projects in all corners of the globe.

SYSTRA's deep experience across the entire mobility spectrum gives us the specialist insight needed to tackle tomorrow's transport challenges. Our consultants understand the relationship between transport and urban form, delivering a broad range of services from strategic advisory and socio-economic studies to profitability projections and passenger forecasts.



## PASSENGER PREFERENCES IN HONG KONG

In late 2017 we won a project to assess public opinion about potential changes to light rail services in Hong Kong. SYSTRA used a survey and focus groups to capture representative passenger views. The study examined rationalisation options to reduce service variability and waiting times, ease overcrowding and optimise route overlaps. Efficiency is vital in a city where public transport supports over 90% of daily journeys – the highest rate in the world.



## FORECASTING ELECTRIC CAR CHARGING NEEDS

During 2017 we worked for UK advisory body the Committee on Climate Change (CCC) to develop recommendations for electric vehicle charging infrastructure, published in a report in January 2018. CCC believes that 60% of newly registered cars and vans should be electric by 2030 if the UK is to meet its emissions goals. Our aim was to forecast the kind of charging network needed to support that level of uptake. Our analysis factored in likely advances in technology and changes in consumer attitudes, drawing on our broad expertise in modelling transport schemes and influencing passenger behaviour.

## ADVISING ON PORT EXPANSION IN BRUNEI

In 2017 we won a contract to provide technical advice to a Brunei sovereign investment holding company on plans for the partial privatisation of Muara Port, and to secure the sustainability and profitability of this strategic asset. Teams from Hong Kong, Brazil and France are helping shape the long-term business plan for the port with market demand forecasts, operations review, port process modelling, cost assessments and the development of financial reports.



## MOBILITY FOR A SMART CITY

In 2017 we won a contract to help the Indian city of Chandigarh create a smart mobility plan. The work involves identifying suitable corridors for future mass transit, defining the transport systems best suited to each route and developing economic feasibility studies and risk analyses.

## REDUCING CROWDING AT THE LOUVRE

The Louvre museum in Paris is the world's most popular art gallery, attracting 8.1 million visitors in 2017 – a big rise from five million visitors 20 years ago. Congestion has proven problematic for staff and visitors alike but SYSTRA, an expert in crowd management in stations and other venues, used statistical analysis and flow modelling to create improvements and review the ticketing system, drawing visitors to less busy areas of the museum.



## IMPROVING AIR QUALITY IN THE NORTH OF ENGLAND

SYSTRA is providing project management support to two urban authorities in the UK as they develop measures to improve local air quality. Like many other cities in England, Sheffield City Council and Rotherham Metropolitan Borough Council need to take urgent action to bring nitrogen dioxide levels within statutory limits and must submit their plans to the government's Joint Air Quality Unit by early 2019. We are involved in all aspects of the feasibility study including technical modelling to assess potential solutions.



## Integrated transport planning around the world



### ECONOMIC AND ENVIRONMENTAL IMPACT

In 2017 we delivered two transport planning projects in Bandung, Indonesia. We delivered a study of Bandung Central Station and the development of plans to improve its accessibility, economic prospects and potential as an intermodal hub. Separately, we developed a sustainable mobility plan for the city to improve transport efficiency while reducing congestion, pollution and carbon emissions.



### TRANSPORT PLANNING AT A NATIONAL LEVEL

We played a major role in the National Integrated Transport Masterplan for the Democratic Republic of the Congo in 2017. Our work addressed the mobility needs of people and goods at a local, regional and national scale out to 2040. We provided insights into urban mobility, rail and air transport, integration with other countries and environmental impact.



### TRANSFORMING A CITY REGION

SYSTRA was awarded a contract to create a transport plan for Nouméa, capital of the South Pacific territory of New Caledonia in 2017. The integrated plan will address passenger and freight transport, road traffic and parking for the city and its region.

## An aerial solution for urban transport

Urban cable cars are a graceful addition to the skyline of our bustling cities.



### FRANCE'S LONGEST URBAN CABLE CAR

SYSTRA is part of a consortium that in 2017 began work on a design, construction and maintenance contract for a 3km urban cable car system in the city of Toulouse. It will be the longest urban cable car system in France, transporting up to 1,500 passengers per hour in both directions, with one gondola every 90 seconds during the rush hour. The cable car will integrate with Toulouse Metro and bus services, serving the Rangueil Hospital on a hillside that is one of the city's highest points.



### CONNECTING A NEW DISTRICT TO A STATION

Early in 2017 we won a design, build and maintain contract for a new cable car system in the French city of Orléans, which is due to open in 2020. The fully automated service will span 350m across multiple railway tracks to create a direct link between the new Interives district and the Fleury-les-Aubrais train station. Two gondolas will each carry up to 56 passengers. SYSTRA's role includes design and construction supervision of pylons and two stations, as well managing safety-related services.



## Boosting the impact of bus networks

From global cities to rural communities, buses are the lynchpin of public transport.

Even cities with well-developed metro and tram systems still rely on buses to provide comprehensive coverage and intermodal connections. SYSTRA is planning, designing and delivering bus rapid transit (BRT) and bus network optimisation projects all over the world.



### OPTIMISING THE BUS NETWORK IN QATAR

Public transport in Qatar is undergoing a rapid expansion, with tram and metro networks due to open in 2019 and 2020. In 2017 SYSTRA was appointed by the Qatari Ministry of Transport and Communications to reorganise the bus network, not only to support the new transit options but also to encourage more people to travel by bus. At present, Qatar's network of 300 buses running on 50 routes is underused, and we are proposing route changes and other measures to expand uptake by 2021.



### CREATING BUS CONNECTIONS ALL OVER THE WORLD

2017 was a busy year for our BRT and bus network optimisation teams. In Brazil, we won a project management contract for a 15km BRT scheme in the city of Belém and a detailed design project for a new bus terminal in Belo Horizonte, the country's sixth biggest city. Our design and project management roles continued on Belém's BRT and on 50km of BRT to the east of São Paulo, Brazil's largest city. We also began work on a bus depot in Yeka, a district of the Ethiopian capital Addis Ababa, providing various project management services for the city's transport authority. In the city of Medina, Saudi Arabia, we were awarded a contract to deliver a preliminary study for two major BRT lines. In France, SYSTRA is helping the city of Limoges transform its bus network with the creation of two BRT lines, while in Mayotte, a French archipelago in the Indian Ocean, we are developing plans for a bus network on the islands' 93km road network.



## Enhancing the performance of roads

Roads and highways are vital assets relied on by people and commerce.

SYSTRA has a thriving roads business, with expertise spanning all stages of the project lifecycle and specialist design centres in Europe, Brazil and India.



### ROAD WIDENING WITHOUT CLOSURES IN FRANCE

In 2017 construction began on a project to widen a 21.5km section of the A13 motorway in northern France, upgrading from two to three lanes in each direction. We are leading a consortium serving as project manager on behalf of SAPN, operator of the Paris-Normandy motorway. Construction also began on a separate project to widen a 4.5km section of the A406 motorway. SYSTRA is leading a consortium that will project manage the work on behalf of APRR (Autoroutes Paris-Rhin-Rhône). For both projects, widening will be completed without road closures.



### IMPROVING BRAZIL'S ROADS

We won a contract with the São Paulo state roads authority in 2017 for fixed and mobile weighbridges, which tackle overweight trucks that cause structural damage. We were also awarded a contract to supervise 870km of highways in the Bauru region covering inspections, engineering services and 24x7 incident response. Separately, we secured three contracts with the São Paulo state transport authority for supervising privatised toll roads. We continue to deliver specialist engineering services on the north segment of the Mário Covas ring road around the city of São Paulo, ring roads in Caraguatatuba and São Sebastião in São Paulo state, and country roads in the state of Bahia. We are also managing the delivery of a road network in Belém, in northern Brazil.



**ETTORE BOTTURA**  
Engineering Director, Brazil

*"SYSTRA's road engineering capabilities have expanded with the acquisition of VETEC."*



## Subterranean solutions

Over the past 60 years we have designed and delivered underground structures in some of the world's most challenging conditions.

From below mountains to below the sea, from rail to road, our specialists understand the vital role of tunnelling in transportation projects.



### SAFETY UPGRADES FOR ALPINE TUNNELS

In the French Alps, we completed modernisation of the Tunnel du Chat, a 1.5km single-tube road tunnel built in 1932, used by up to 11,500 vehicles per day. We supervised excavation of a parallel pedestrian tunnel to allow safe evacuation of the road tunnel in emergencies. Separately, we also completed project management of civil works on a second tube for the 13km Fréjus Road Tunnel between France and Italy. Excavated between 2009 and 2014, and due to open in 2019, the second tunnel will improve safety by separating northbound and southbound traffic.



### TUNNEL BREAKTHROUGH IN EGYPT

SYSTRA is project managing the construction of twin road tunnels under the Suez Canal at Port Said in Egypt, which will connect the cities of the Nile Delta to the planned areas of economic development in the northern Sinai Peninsula. In December 2017 the first of two tunnel boring machines completed its 3.8km dig, with the second tunnel following suit in early 2018. We will continue to manage the tunnel project through its fit-out and testing and commissioning phases.



### RAIL TUNNEL LINKING FRANCE AND ITALY

A SYSTRA consortium has won a contract for Tunnel Euralpin Lyon-Turin (TELT), an ambitious project to create a new 57.5km high speed rail link running under the Alps between France and Italy. Due to open in 2030, the twin-tube tunnel will cut the four-hour train journey between Lyon and Turin in half. We are project managing civil engineering of Lot 2, two parallel single-track tunnels 22.1km in length.

## A major force in bridge design

In 2017, SYSTRA acquired International Bridge Technologies, a world leader in its field. Together, we deliver the full range of bridge design services.

International Bridge Technologies (IBT) marked our first product line acquisition, doubling our geographic footprint in bridge design. Through joining forces we created a global network of bridge specialists in dedicated design centres in the US, France, Canada, India, Korea and Dubai.

We have deep technical expertise across the full spectrum of bridge design:

- Segmental bridges
- Cable-stayed bridges
- Suspension bridges
- Metro and high speed rail bridges and viaducts
- Truss and arch bridges

### Design & Build

Over three-quarters of our bridge projects are design & build contracts. We offer the winning combination of high-end technical expertise in bridge design and high-quality production capacity, which can be rapidly mobilised to meet clients' needs. Our extensive design & build expertise enables us to help contractors be more competitive in terms of cost, time, constructability and delivery.

### A quarter century of U-shaped viaducts

2017 marked 25 years of SYSTRA's U-shaped viaduct, an innovation patented in 1992. The unique design combines a neat and aesthetically pleasing shape with speedy, inexpensive construction. It also integrates a parapet, drainage system and an S-Rack system that 'traps' the sound of train wheels, curtailing the noise of elevated metros. We have developed "big U" and "small U" varieties catering for single or dual tracks. An ultra high performance fibre reinforced concrete option allows U-shaped viaducts with long spans between piers for graceful aesthetics or easier positioning in crowded urban settings. We have also adapted our design to include solar panels to generate renewable electricity.

MORE THAN

**30**

CABLE-STAYED BRIDGES  
DESIGNED WORLDWIDE

WE HAVE PLANNED AND DESIGNED  
NEARLY **1,000km** OF U-SHAPED  
VIADUCTS IN 17 COUNTRIES,  
HALF OF WHICH ARE IN SERVICE  
OR UNDER CONSTRUCTION

**#12** in bridge design

Engineering News-Record (ENR),  
December 2017, compiled prior to IBT acquisition

## BRIDGES



### CONTINUED PROGRESS ON MAJOR D&B PROJECTS

Work continued on two major design and build contracts during 2017. With a 36km-long main link and 12.6km Doha link, Kuwait's Sheikh Jaber Al-Ahmad Al-Sabah Causeway will rank among the longest maritime causeways in the world. When construction ends in November 2018 it will link Kuwait City, Subiyah and the Doha area across Kuwait Bay. SYSTRA was responsible for all design work on the causeway main link.

Meanwhile in Chile, we completed detailed design of the Chacao Channel Bridge in February 2018, with final design approval expected in summer 2018. When complete, the 2.7km crossing will be the longest suspension bridge in South America, with two main spans of more than 1km. SYSTRA is leading a joint venture that is delivering the full detailed design of the bridge.



### US INTERSTATE BRIDGE OPENS FOR BUSINESS

In the first week of 2017 commuters began using the Lewis and Clark Bridge, a new road crossing linking the US states of Kentucky and Indiana over the Ohio River northeast of central Louisville. Measuring 695m overall with a 365m central span, the multi-lane toll bridge features a segregated path for pedestrians and cyclists. The 38m-wide deck is supported by two planes of cable stays that spread in semi-fan patterns from diamond-shaped pylons. SYSTRA IBT provided bridge design and construction engineering services on the project.

### INDIA'S FIRST AXIAL CABLE-STAYED BRIDGE

The Chambal River Highways Bridge was opened by Indian Prime Minister Narendra Modi in August 2017. SYSTRA undertook all design work for the six-lane structure, from the preliminary studies through to the construction phase. The 1.1km-long bridge in the state of Rajasthan is the first cable-stayed axial suspension bridge to be built in India. It comprises a 350m main span supported by two axial pylons, as well as two approach viaducts measuring 370m and 30m. Piles were set outside the river to preserve a wildlife sanctuary.

## BRIDGES

### A track record of world-first designs



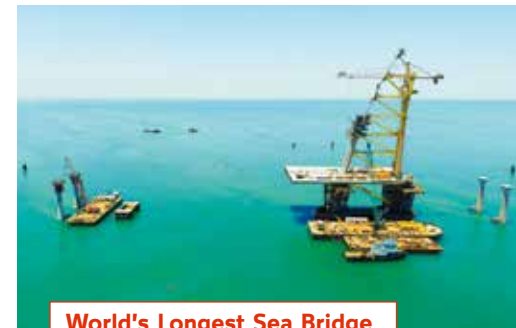
### World's Longest Floating Bridge

Evergreen Point Floating Bridge, Seattle, US



### World's Longest Concrete Span

3<sup>rd</sup> Panama Canal Crossing, Panama



### World's Longest Sea Bridge

Sheikh Jaber Al-Ahmad Al-Sabah Causeway, Kuwait



### World's Fastest Design and Construction Supervision on any Metro Project

Mecca Metro, Saudi Arabia



### World's Longest Double Suspension Bridge

Chacao Bridge, Chile



## Longstanding aviation experience

**SYSTRA's understanding of complex interconnected transportation systems is an asset to clients in the aviation sector.**

Safety, predictability, high performance, quality design and operational readiness are all critical in aviation. Our aviation services span masterplanning, design and systems engineering, as well as expertise in route forecasts, baggage handling systems and people movers.



Athens Airport

### A trusted aviation partner

It is a little known fact that SYSTRA has been operating in the aviation sector since the early 1990s. We have delivered masterplanning and engineering design services for the Airport Authority Hong Kong; airport planning and multimodal integration for Brazil's airport operator Infraero; and project management services for London City Airport and Groupe ADP, which owns Paris's airports. Other projects include passenger forecasts for surface access to New York's JFK airport; a surface transport study for Scotland's Glasgow Airport; and a luggage system in Medina Airport, Saudi Arabia.



Brussels Airport

### Continued momentum across Europe

We won a number of new aviation contracts in 2017. We are helping Athens Airport reduce forecourt congestion and improve revenue from landside operations. We are also delivering transportation consultancy advice on landside facilities for Brussels Airport and providing advice on the third runway at Heathrow Airport.

SYSTRA HAS  
BEEN WORKING  
IN THE AVIATION  
SECTOR FOR  
MORE THAN

**25 years**

WE HAVE  
DELIVERED  
AVIATION  
PROJECTS ON

**4 continents**



**OLIVIER DEZORME**  
Chief Financial Officer

*"Groupwide, we continued aligning our finance teams more closely with operational entities, while in the UK we continued deploying our financial management system, which includes new cash management functionality. Progress will continue in 2018."*

## BALANCE SHEET

(at December 31, 2017)

CONSOLIDATED ASSETS (IN € THOUSANDS)	2017	2016
Intangible, tangible assets and goodwill	171,699	132,640
Non-current financial assets and equity method investment	1,002	22,227
Other non-current assets	31,952	31,325
<b>TOTAL NON-CURRENT ASSETS</b>	<b>204,652</b>	<b>186,193</b>
Other current assets	424,818	402,232
Cash and cash equivalent	57,983	105,103
<b>TOTAL CURRENT ASSETS</b>	<b>482,801</b>	<b>507,335</b>
<b>TOTAL ASSETS</b>	<b>687,454</b>	<b>693,528</b>

CONSOLIDATED EQUITY AND LIABILITIES (IN € THOUSANDS)	2017	2016
Equity attributable to owners	137,311	181,641
Non-controlling interests	3,165	3,097
<b>TOTAL NET EQUITY</b>	<b>140,476</b>	<b>184,738</b>
Long-term provisions	19,939	13,302
Non-current financial liabilities	86,124	83,853
Deferred tax liabilities	4,774	805
<b>TOTAL NON-CURRENT LIABILITIES</b>	<b>110,837</b>	<b>97,960</b>
Short-term provisions	21,443	2,889
Current financial liabilities	90,830	56,784
Other current liabilities	323,868	351,157
<b>TOTAL CURRENT LIABILITIES</b>	<b>436,141</b>	<b>410,830</b>
<b>TOTAL EQUITY AND LIABILITIES</b>	<b>687,454</b>	<b>693,528</b>

## FINANCIAL RESULTS

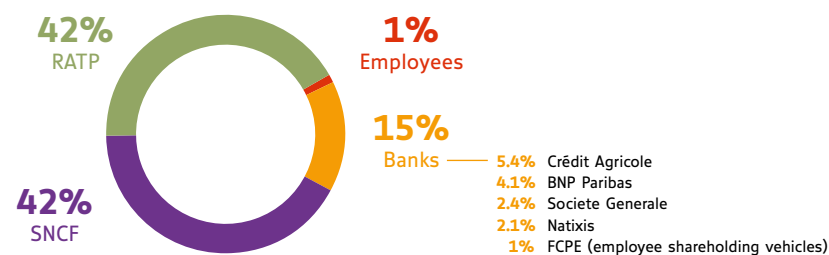
### FINANCIAL INDICATORS

INCOME STATEMENT (IN € THOUSANDS)	2017	2016
Consolidated revenue	596,922	610,596
<b>TOTAL OPERATING INCOME</b>	<b>596,922</b>	<b>610,596</b>
Operating expenses	-565,727	-569,851
<b>EBITDA</b>	<b>31,194</b>	<b>40,746</b>
Amortisation, depreciation and provisions	-23,209	-13,724
Share of profit (loss) from investments in joint ventures and associates	-21	-128
<b>OPERATING PROFIT</b>	<b>7,964</b>	<b>26,893</b>
Net financial income	-28,475*	-4,455
<b>INCOME BEFORE TAX</b>	<b>-20,510</b>	<b>22,438</b>
Income tax expenses	-12,199	-9,904
<b>CONSOLIDATED NET INCOME</b>	<b>-32,709</b>	<b>12,534</b>
<b>NET INCOME - NON-GROUP SHARE</b>	<b>-167</b>	<b>1,134</b>
<b>NET INCOME - GROUP SHARE</b>	<b>-32,543</b>	<b>11,400</b>

\*After a provision taken for a single non-recurring event related to a legacy contract that is subject to an ongoing legal process.

SALES INDICATORS	UNITS	2013	2014	2015	2016	2017
Order intake	€m	487	632	609	542	642
Order book as months of revenue	Months	25	23	19	18	18

### SYSTRA'S SHAREHOLDER STRUCTURE



© May 2018, SYSTRA Group Communications

Photo credits: Thibault Savary, ©A.Meyssonier\_©CAPA, iStockphotos\_Nikada, iStockphotos\_shansekala, iStockphotos\_MarcelloLand, ©Crossrail Ltd, SYSTRA, STIB-MIVB, Empresa Metro de Bogota, Financiera de Desarrollo Nacional, Jean-Baptiste Vetter, Grenade - Architecte Jean-Marie Duthilleul, Tom Hewitt, Peter Alvey, iStockphotos\_Baona, ©Johnny Yim / YouLoveWords, Ivan Almeida, MyHSR Corporation Sdn Bhd, iStockphotos\_MIAOYUN, Pascal Le Doaré, Alex Profit, SNCF, Yannick Brossard - Oc'Via, Gaël Arnaud / Eiffage, ©HS2 Ltd., hoc : CAPA Pictures, Shutterstock\_Brian Kinney, iStockphotos\_Serjio74, Harsha Vadlamani, iStockphotos\_Fotonen, Robert Attermann / RED STAR, Compagnie des Bauxites de Guinée, ©Alstom\_APIX, AREP - Richez Associés, Société du Grand Paris / Laurent Villeret, Alstom/Design&Styling-RCP, iStockphotos\_Gwengoat, iStockphotos\_Mizoula, Transport for NSW, iStockphotos\_Sergey Kelin\_Nellmac, Aarhus Letbane I/S, Larsen & Toubro, Christophe Recoura, P. Thebault, Hywell Waters ©Panos-Rea, iStockphotos\_zhuyufang, iStockphotos\_MarekSlusarczyk, iStockphotos\_Starcevic, iStockphotos\_Zarnell, Agence Tisséo-SMTC/SMAT/GroupementPOMA - SYSTRA, Sergio Capasso - architecte Jean-Marie Duthilleul, Raphael Olivier/CAPA Pictures, Régis Bouchu / Actophoto, TELT-ALEDIM, AAS-Jakobsen-SYSTRA, Jacobs, ©Hyundai, WSDOT, VINCI, HDEC, Athens International Airport (AIA), Tom D'Haenens, Getty Images.

Design and production: agence **arnstophane**



**SYSTRA**

72-76, rue Henry Farman  
75015 Paris - France  
Tel.: +33 (0)1 40 16 61 00  
[contact@systra.com](mailto:contact@systra.com)  
[www.systra.com](http://www.systra.com)