SYSTRA, ENGINEERING AT THE SERVICE OF METROS THROUGHOUT THE WORLD

PRESS KIT

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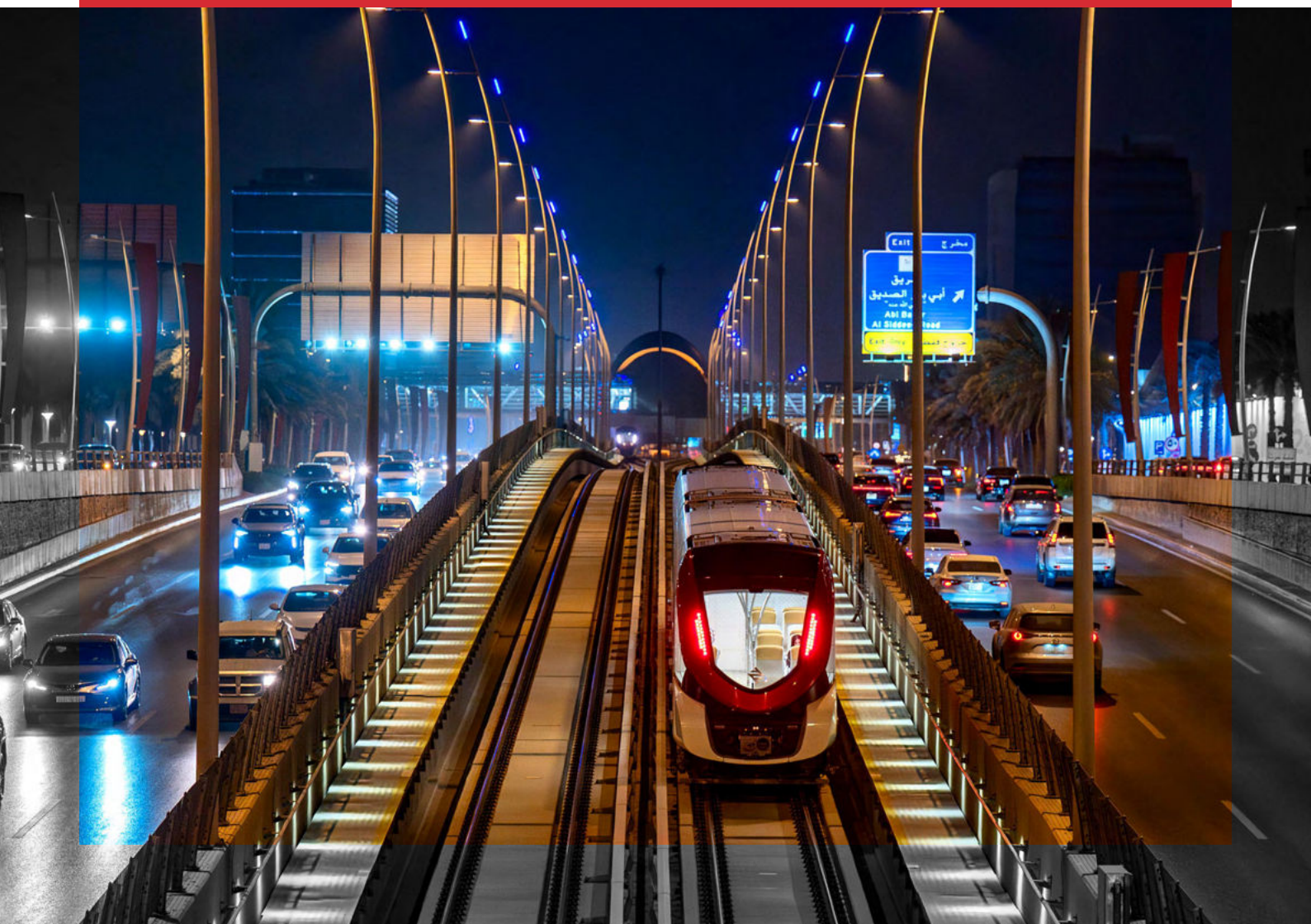


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What do Paris, Dubai, Shanghai, Sydney, Delhi, Cairo, Montreal, Mexico, Santiago, Hanoi and New York have in common? Each of these cities, among the most densely populated in the world, have metro systems that have contributed to their development and have benefited from SYSTRA's expertise. For over 65 years, our engineering teams have been helping cities throughout the world to create and develop metro networks to transform their mobility and increase their attractiveness. Today, SYSTRA is a leading player in the creation of lines and the automation of existing lines, at the forefront of innovation in sustainable transport.

With a contribution to one in every two metros in service in the world and projects on every continent, SYSTRA has unique skills in metro system engineering. Committed all over the world, our teams make SYSTRA **the only engineering company to master the entire value chain of a metro project, from the preliminary design phases through to commissioning, operation and modernisation.**

"With major projects underway on every continent, SYSTRA continues to write the history of the metro and design it today for the world of tomorrow. Together, we are shaping cities that are more resilient, more connected and more sustainable."

Arnaud Valranges,
SVP Strategy & Growth

THE METRO, AT THE HEART OF SUSTAINABLE MOBILITY

With more than half the world's population living in urban areas, the issue of sustainable mobility is crucial. Metros have become the backbone of major cities, offering a fast, reliable and environmentally friendly alternative to the challenges of road congestion, pollution, and energy transition. As a mass transport solution, they can carry millions of passengers every day, while significantly reducing the carbon footprint of cities.

In a context of accelerating urbanisation, the metro plays a strategic role in ensuring the accessibility of city centres, while helping to reduce the number of vehicles on the roads. With commercial speeds of up to 40km/h and a transport capacity of several thousand passengers per train, it offers an effective response to the increasing commuting needs of inhabitants.

Many major cities have made the development and extension of their metro networks a priority. In 2023, the metro infrastructure market grew by 7%, reflecting the ever-increasing need to adapt urban transport to new social and sustainability needs.

The positive impact of the metro on the environment is undeniable: it reduces atmospheric pollution by lessening dependence on individual vehicles and encouraging collective mobility. In addition, the transition to fully automated metros will optimise energy performance while improving the regularity and safety of service.

Some metro networks are adopting technologies such as the use of recycled materials, integrating renewable energy into powering the infrastructure, or energy recovery systems.

The metro is no longer just a means of transport: it is a key driver for building more sustainable cities.

GLOBAL REFERENCES, FROM RIYADH TO HANOI

With a presence on five continents, SYSTRA has been involved in the creation or modernisation of one metro in two. This strategic positioning makes it a key player in urban mobility.

Thanks to the Group's expertise, more than 50 countries have been able to transform their historic transport networks, such as in London, Barcelona and New York or to build new infrastructures for tomorrow, as in Ahmedabad, Sydney, Riyadh and Dubai. In 2024, metro projects accounted for 19% of the Group's turnover, confirming the strategic importance of this business segment.

Giving shape to new networks

Since 2000, SYSTRA has established itself as one of the leaders in the creation of metro networks worldwide. **In Europe**, its teams are involved in the development of new lines in Paris, Lyon, Copenhagen, Turin, London, Brussels, Bucharest, Cluj-Napoca and Belgrade.

In Asia, SYSTRA is accompanying the growth of Indian megacities, with the Mumbai and Nagpur networks, and the Group is also involved in numerous projects in South-East Asia, such as in Hanoi, Jakarta, as well as Xiamen, Shanghai and Hong Kong. In Bangladesh, the first metro line in the capital, Dhaka, was brought into service in 2022. This network, which will eventually comprise six lines and 112 stations, represents a major step forward for one of the world's most congested urban centres in the world.

SYSTRA's expertise also extends to **Australia**, with three metro lines under construction in Sydney and one in Melbourne, and in **the Americas**, where the Group has participated in the infrastructures of New York, Santiago, Toronto and Montreal. Finally, its presence in the **Middle East** and **Africa** is reinforced with projects in Dubai, Riyadh and Doha, and a longstanding commitment to the Cairo metro.

Adapting metro systems to the new needs of metropolises

Demographic and economic changes in major cities mean that transport infrastructure needs to be constantly adapted. SYSTRA accompanies these changes by modernising and optimising metro networks throughout the world:

In France, at the heart of the emblematic Grand Paris Express project: 3 new metro lines, 200km of track and 68 stations, a revolution for mobility in the Paris region and one of the biggest construction projects on the continent. Since 2011, our teams have been working on all phases and all lines, in project management or project management assistance roles from systems to rolling stock and maintenance infrastructure.

In the United States, with more than ten years of involvement in the modernisation of the New York Subway, thanks to the introduction of the Communication-Based Train Control1 (CBTC) system on three new lines. This major advance will accelerate the automation of the network and transform the experience of millions of passengers. A similar project is underway on the other side of the country, on San Francisco's BART network

[1] The Communication-Based Train Control (CBTC) system, which stands for which means communication-based train control, is an automatic automatic rail traffic control system (train or metro), characterised characterised by continuous communication between the train and the computers computers responsible for controlling the traffic.

In India, where strong urban and economic growth means that transport infrastructure must be rapidly reinforced. To date, SYSTRA has been involved in the construction of more than 80% of India's metro networks, with 450km of viaducts and more than 300 stations built in two decades. Recent projects include a new elevated metro line in Kochi which will provide an essential mobility solution for 600,000 residents, while phase 3 of the Hyderabad metro, comprising 100km of new lines, is in preparation. SYSTRA will also be taking part in the construction of a new line in Bangalore, building on its presence since the creation of the network in 2007.

In Taiwan, with the development of the Kaohsiung metro, the country's third largest city, SYSTRA is helping to extend the Red line and the construction of the Yellow line.

In São Paulo, the pioneer city of the South American metro which will soon be extending its monorail line, a first for the continent, and which has proved its usefulness in reducing heavy traffic congestion.

In Santiago, a capital that is banking on suburban railways, with two new lines designed between the capital and its suburbs, to meet the growing needs of its 5.5 million inhabitants.

SYSTRA, PARTNER OF ALL METRO NETWORKS IN FRANCE

Since the

1970s

SYSTRA has worked with all the major French cities in the creation and development of their metro networks. This has been the case since 1974 with its participation in the Lille metro project, a pioneer in automatic systems worldwide.

Since then, SYSTRA's expertise has been further enhanced by the extension and automation of line B of the Lyon metro, the works supervision for line B of the Rennes metro, and, since 2021 the automation of the Marseille metro. The teams are currently involved in project management for the future line C of the Toulouse metro, France's biggest project after the Grand Paris Express.

In the Paris region, SYSTRA is the only engineering company working on all the four new lines of the Grand Paris Express (15, 16, 17 and 18), illustrating its central role in the transformation of this metropolitan network. Its expertise in automation was applied to line 14 of the Paris metro, the the first line to benefit from CBTC, and on line 1, which entered service in 2012. SYSTRA has also been involved in the recent extensions of line 14 to the south and north, and towards Bagneux and Aubervilliers for lines 4 and 12, confirming its commitment to developing the Paris metro into a more modern and accessible network.

RIYADH: AN AMBITIOUS METRO FOR THE SAUDI CAPITAL

This fully automated network, one of the most ambitious in the world, was designed to meet the challenges of a fast-growing city and improve the daily lives of 7 million inhabitants.

The first three lines were put into service on December 1, 2024. They enable more than a million daily passengers to travel on 104 kilometres of automatic driverless lines. These first three lines connect 55 stations and guarantee optimal coverage of the main urban centres. Commissioning of the other three lines of the network has continued in early 2025, making Riyadh the first city in the world to deploy such a vast network in a single phase.

Designed to encourage residents to give up the car for the benefit of public transport, the Riyadh network has integrated four park-and-ride facilities at strategic locations, enabling a modal shift and contributing to improved urban fluidity.

A large-scale project led by SYSTRA

Since 2013, SYSTRA has played a key role in the development of the Riyadh Metro as a member of the Riyadh Metro Transit Consultants (RMTC) consortium, alongside Parsons and Egis. This partnership has made it possible to support the Royal Commission for Riyadh City (RCRC) in the management and supervision of a project without precedent. As PMCM (Project Management Construction Management), SYSTRA has ensured assistance to the project owner, design, supervision of the works and coordination of speakers. The group has mobilised 250 engineers, bringing its expertise in transport engineering and in the management of major projects to ensure the compliance with deadlines and international standards.

Since the completion of this first phase, SYSTRA has been involved in the preparation of the extension of line 2 and is participating in the studies for the future line 7, confirming its long-term commitment to the development of the Riyadh network.

PROJECT FEATURES

6 lines

100%

automatic

- **Line 1 Blue:** 38km, 26 stations (15.7km in tunnel, 15.6km in viaduct)
- **Line 2 Red:** 25km, 16 stations (3km in tunnel, 5.3km in viaduct)
- **Line 3 Orange:** 41km, 22 stations (6.2km in tunnel, 29.5km in viaduct)
- **Line 4 Yellow:** 30km, 9 stations, direct link to the international airport
- **Line 5 Green:** 13km, 12 stations
- **Line 6 Purple:** 30km, 11 stations, semi-circular line

85 stations – Maximum capacity : 3.6 million passengers per day

176km of track

Rolling stock : trains 100 % automatic, driverless

Infrastructure: 5 depots and 19 park-and-ride facilities

HANOI: A NEW METRO LINE TO TRANSFORM URBAN MOBILITY

The Vietnamese capital reached a milestone on 8 August 2024 with the inauguration of line 3 of its metro, the first stage of a project to upgrade the city's transport infrastructure. 8.5km long, this first phase, entirely built as a viaduct, connects Nhon to the city centre by serving six districts, i.e. nearly 20% of the local population.

Designed to reduce traffic congestion and offer a reliable alternative to commuting, line 3 is part of the capital's move to sustainability, in response to the acceleration of urbanisation and the increase mobility needs.

In a second phase, the line will be extended to Hanoi Railway Station, the main multimodal hub of the city. Excavation works were launched in July 2024, and the commissioning of this section is planned for 2027.

Comprehensive support from SYSTRA

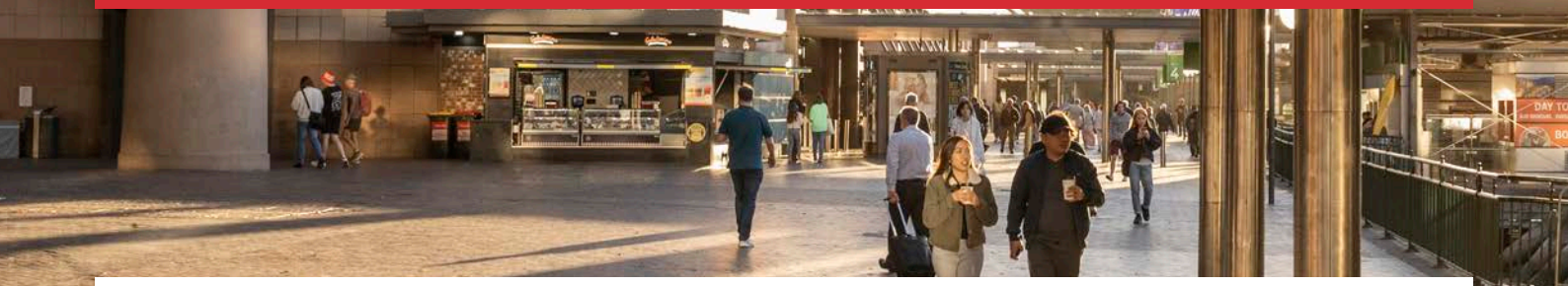
Since 2007, SYSTRA has been supporting the authorities in the development of this strategic infrastructure. As Project Implementation Consultant, SYSTRA is responsible for the management of civil engineering packages and systems, providing technical and operational oversight of the project.

But its role does not stop there. As Shadow operator, SYSTRA also trained and assisted the operator in the implementation of the commercial service of the line. For one whole year, the SYSTRA teams are supporting the operation of the network, guaranteeing an efficient and secure service for users.

The technical challenge of this line also lies in its underground extension. To limit the impact on the dense urban area, the tunnels will be dug in two distinct tubes, ensuring greater resilience of the network. This new section will ensure a connection with metro line 1, thus strengthening intermodality in the capital.

INNOVATION AND TECHNICAL EXCELLENCE AT THE SERVICE OF CITIES

Thanks to its 65 years of history, the SYSTRA Group benefits from a unique knowledge of transport systems and their technical challenges. It thus has supported metropolises around the world in the design, modernisation and automation of their metro networks, offering them solutions adapted to the contemporary challenges of mobility.



Manage the entire lifecycle of a metro

Whether it is the creation of new networks, the extension of existing lines, or the transformation of ageing infrastructure, SYSTRA masters all the expertise necessary for a metro project. The engineers of SYSTRA intervene at all stages of the project lifecycle, thus ensuring optimal transport solutions.

Design high-performance and integrated systems

To combine capacity, comfort, safety, and optimisation of operating costs, experts work alongside cities and operators to define the most suitable technical solutions:

- Stations: platform sizing, integration of platform screen doors and passenger flow management,
- Rolling stock: choice of trains according to the required capacities, speed, braking performance and passenger comfort,
- Infrastructure: route and alignment of roads, location and management of deposits,
- Signalling: integration of automated systems, flow supervision and traffic optimisation.

Manage complex projects while respecting deadlines and budgets

From the initial study phase to the start of operation, SYSTRA mobilises cutting-edge skills in engineering and project management. Coordination of the various stakeholders and the mastery of interfaces between technical systems are key elements in ensuring the fluidity of operations.

Optimise operation and maintenance

Thanks to decades of experience and references worldwide, SYSTRA has acquired unique expertise in anticipating issues related to the operation and maintenance of metro networks. It is possible to model the operating costs over 25 years and to offer modernisation solutions adapted to the economic and demographic development of big cities.

A world leader in automatic metros

SYSTRA is now a key player in the field of automatic metros, with 60% of the lines in service, under construction or in operation. From the 1970s, engineers developed the first automatic driving systems, in particular with the VAL in Lille, then with the implementation of CBTC technology on line 14 of the Paris metro.

SYSTRA has an in-depth knowledge of the technical solutions offered by manufacturers, component characteristics, as well as the principles of network operation and maintenance. This helps optimise the performance of the metros by introducing more flexibility and efficiency in train operations.

The U-shaped viaduct: an optimised and patented solution

Aware of the economic and environmental issues related to the construction of metros, SYSTRA patented in 1992 the U-shaped viaduct, an innovative solution for elevated metro networks. This concept combines efficiency and aesthetics while enabling rapid and economical construction. Thanks to the standardisation of elements and the use of prefabricated structures, the U-shaped Viaduct optimises concrete consumption, reduces the number of rotations, and speeds up construction times. This solution has already been implemented on nearly 1,000km of networks, including in Shanghai, Dubai, Jakarta, Delhi, Mecca, Hanoi and Taipei, with spans ranging from 30 to 90m between pillars.

The future of the U-shaped viaduct is ever more sustainable installations, with the use of high-performance fibre-reinforced concrete to further reduce material consumption, solar panel installation to capture photovoltaic energy, and the integration of sound walls called 'S-Rack' to absorb and reduce noise levels.

INNOVATIONS BY SYSTRA

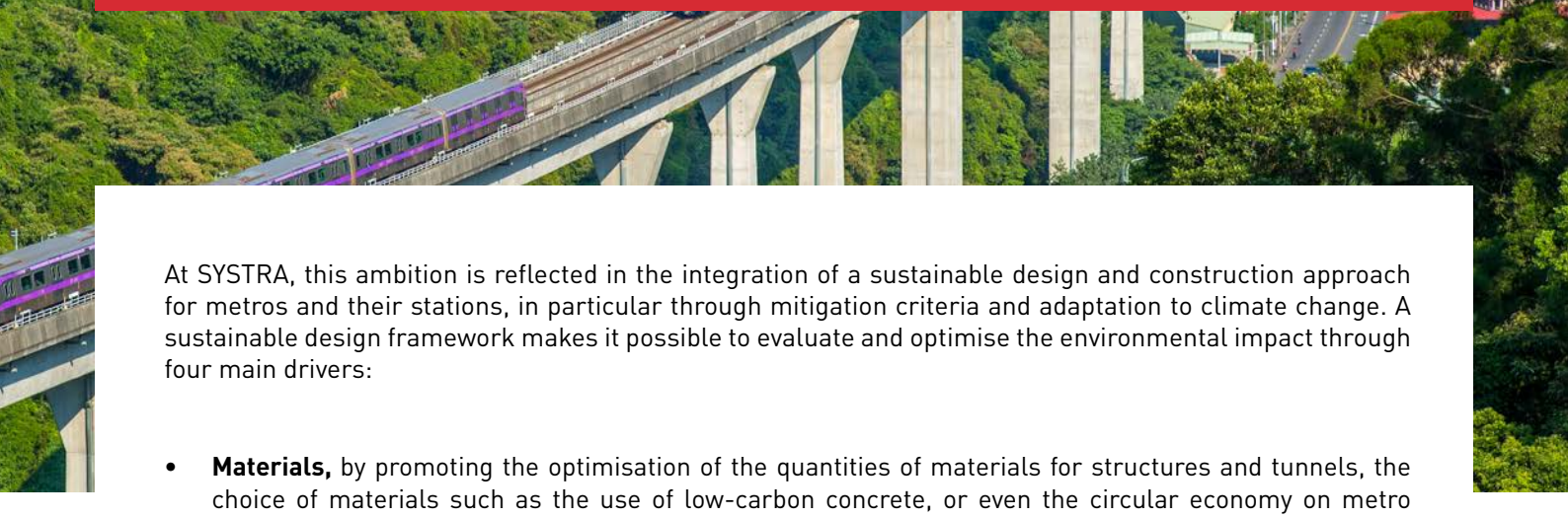
In the Chennai metro in India, the **tunnel ventilation s**ystem has been optimised, reducing the spatial footprint by 40% and investment costs by 50%.

For the extension of line 12 of the Paris Metro, a **technique involving freezing the ground** with nitrogen at -196°C was used to stabilise the ground and ensure watertightness during excavation work near the water table.

On the Red Line of the Dubai Metro, **drones** are used to inspect infrastructure.

ENGINEERING AT THE SERVICE OF ENERGY TRANSITION

The metro is now an essential driver for energy transition. As a high-capacity mode of public transport, it makes it possible to desaturate metropolises while limiting greenhouse gas emissions. A metro can carry up to 60,000 passengers per hour, a volume unmatched by other modes of transport. As cities adapt to climate challenges, it is becoming essential to design more resilient, more economical infrastructures in terms of energy and respect for the environment.



At SYSTRA, this ambition is reflected in the integration of a sustainable design and construction approach for metros and their stations, in particular through mitigation criteria and adaptation to climate change. A sustainable design framework makes it possible to evaluate and optimise the environmental impact through four main drivers:

- **Materials,** by promoting the optimisation of the quantities of materials for structures and tunnels, the choice of materials such as the use of low-carbon concrete, or even the circular economy on metro construction sites;
- **Resilience to climate change,** by anticipating changing climatic conditions and adapting the design and construction of infrastructure to make it less vulnerable;
- **Air quality,** by reducing particle emissions and improving the ventilation of stations;
- **Water management,** with rainwater harvesting systems and water-saving solutions;
- **Biodiversity,** by limiting the artificialisation of land on the routes and by integrating vegetated solutions into the development of stations and forecourts.

EXEMPLARY PROJECTS IN TERMS OF SUSTAINABILITY

DUBAI: A LEED GOLD CERTIFIED METRO, A WORLD FIRST

The Dubai metro is a global benchmark in terms of urban sustainability. Thanks to a design which meets the most demanding environmental standards, it has achieved LEED v4 BD+C Gold certification for its seven stations, a world first.

Among the innovations implemented:

- 22% energy savings thanks to smart thermal control systems;
- 50% reduction in water consumption in outdoor areas.

NAGPUR: THE GREENEST METRO IN INDIA

In India, the Nagpur metro is recognised as the most environmentally friendly in the

country. It runs 60% on energy renewables, including through the integration of solar panels on the infrastructure, photovoltaic engineering previously tested in the United States, in Pennsylvania, for power supply to the signalling system of four regional lines.

The Nagpur Metro is also equipped with a rainwater recovery system in each station, contributing to the preservation of water resources.

Innovations to accelerate energy transition

SYSTRA develops technological solutions to support its clients towards a more sustainable and efficient mobility:

Carbontracker: a digital tool for measuring, optimising and managing emissions at every stage of a project and across the lifecycle, in order to guide choices towards

more sustainable designs. Carbontracker was used on the Grand Paris Express Line 15 East project, among others;

S-Rack: a noise mitigation system designed to reduce the acoustic impact of infrastructures, with a positive impact on the ecosystems and for local residents.

A WORD FROM THE EXPERT

"At SYSTRA, we take a global view of infrastructures, considering both their potentialities and their impacts, not only on the project, but throughout their lifecycles. Optimising the sustainability of a metro means anticipating its environmental footprint from the design phase, integrating the interactions between the infrastructure and its ecosystem.

In this way, we are committed to minimising carbon emissions by proposing suitable technical solutions of our projects by offering techniques, particularly in the choice of materials and construction methods.

This approach is not limited to the construction phase: We also make sure to optimise the operation and maintenance of infrastructures, by integrating more energy-efficient systems and smart buildings that can regulate their consumption."

Christelle Chichignoud,
Sustainability Vice President

THE METRO IN FIGURES

1863
The London Underground
becomes the first metro in the world

14,000 km
Total length of all the metro lines in the world

40 years
Average technical life of a metro train.
This is almost 4 times longer than the average life of a car in Europe (11 years)

25 to 40 km/h
Commercial speed at which the metro transports passengers

1 metro in 2
SYSTRA has contributed of the development of half the metros in circulation in the world

1974
SYSTRA participates in the deployment of the world's first automatic metro in Lille

204
Number of metro networks in operation in the world

60 %
SYSTRA is the world leader in automatic metros with 60% of the automatic lines in service, under construction, or being automated

20 milliards
SYSTRA has contributed to the construction of historic networks in more than 50 countries (Chicago, Paris, Cairo, Santiago) or more recently (Ahmedabad, Sydney, Riyadh, Dubai), enabling 20 billion passengers to be transported each year

SYSTRA

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