METRO

SYSTRA

Metro powering modern, inclusive cities

METRO THAT MOVES CITIES FORWARD: HIGH CAPACITY, FAST, RELIABLE AND SUSTAINABLE

As cities expand rapidly, metros provide safe, fast, reliable, high-capacity mobility that keeps centers accessible, cuts car use, and improve air quality—serving millions efficiently every day. With commercial speeds up to 40 km/h, they meet rising commuting demand while reducing traffic on city streets.

Metros operate in a closed environment with physical separation that protects operations and enhances the customer experience—unlike trams, which face road traffic and surface interactions. With dedicated rights-of-way, grade separation, and advanced signaling, metros eliminate intrusions and uncertainties. This ensures safety, availability and regularity, maintaining short headways and rapid journeys even at peak hours. Fully automated GOA4 systems further optimize capacity and headways while minimizing disruptions.

Metros are more than transport. They link people to jobs, education, and culture, driving equitable growth and more sustainable, livable cities. By shifting trips from cars to collective mobility, metros cut pollution and improve air quality. The move to fully automated systems boosts energy efficiency, regularity, and safety. Each project can renew public space—upgrading plazas and streets, adding safe walking and biking routes, and integrating greenery. With welcoming design, clear wayfinding, and durable materials, stations become local landmarks that fit seamlessly into their neighborhoods.

Ho Chi Minh (Vietnam)

DECISIONS THAT DRIVE LONG-TERM METRO VALUE

Designing a sustainable, resilient metro for dense urban contexts demands clear goals and disciplined, cross-stakeholder decisions. A fast, accessible, city-shaping line begins with early choices that anchor long-term service quality, community benefit, and lifecycle value. As a structuring service, a metro drives trips, activity, and housing; planning must therefore look beyond commissioning to a 30-plus-year horizon. This long view enables the network to adapt to growth, shifting travel patterns, and evolving urban needs.

7 key factors
to design and deliver executable, high-performing programs.


Dubai (United Arab Emirates)

1 — STRATEGIC FIT AND RIGHT-SIZING CAPACITY
Begin with a clear program definition and the metro's role in the wider mobility ecosystem. Identify target corridors and trip generators, position stations to intercept major bus and rail routes, and connect to micromobility and walkable catchments. Translate robust, scenario-based demand forecasts into platform dimensions, train length, fleet size, and an operations plan with reliable headways, dwell times, and turnaround margins—delivering comfort, regularity, and strong commercial speed in peak conditions.

2 — GOVERNANCE, STAKEHOLDER ENGAGEMENT, AND PERMITS
Establish a clear decision framework across transport agencies, city planning, utilities, and emergency services. Engage communities early—especially near stations, ventilation shafts, inter-station drainage and pumping points—so service and ancillary structures meet multiple constraints while maintaining acceptability. Secure timely permits and traffic orders and involve fire services upstream to reduce risk and accelerate approvals.

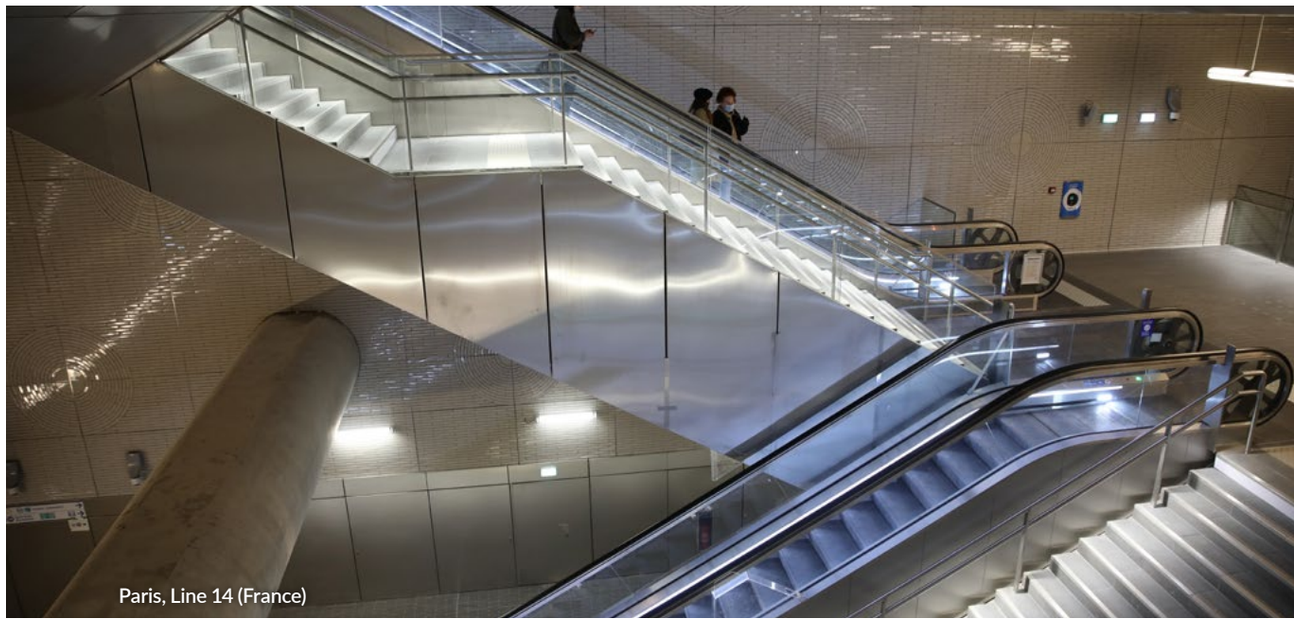
3 — RELIABILITY, SAFETY, AND OPERATIONAL PERFORMANCE
Design safety and resilience by default. Use fail-safe signaling, operational redundancy, and reliability-centered maintenance to sustain short headways and rapid journeys on dedicated rights-of-way and grade-separated alignments. System-wide expertise across rolling stock, power, ventilation, control-command, and fare collection ensures targets for interval and commercial speed are consistently met.

4 — UNDERGROUND WORKS AND TECHNICAL RISK CONTROL
In urban, confined sites—especially tunnels—strong underground engineering is critical. Projects must account for geotechnical conditions, adjacent buildings, sensitive networks (rail, utilities), and protected heritage to ensure stability, safety, and regulatory compliance from day one. Select alignments and station typologies—cut-and-cover or mined; side or island platforms; shallow or deep—based on constructability, capacity, and whole-life cost. Early studies and rigorous utility management reduce environmental and structural risk, enhance buildability, and minimize disruption to the city and stakeholders.

5 — CONSTRUCTION MANAGEMENT IN DENSE URBAN ENVIRONMENTS
In highly urban sites, construction organization is a core success factor. Plan phasing, surface footprints, logistics, and material evacuation to minimize disruption and keep the city running. Coordinate traffic management and access for businesses and services, sequencing works to reduce impacts and safeguard schedule and budget. Where feasible, consider night-time tunnel works as an OPEX-driven cost optimization measure, balancing productivity, community impact, and asset availability.

6 — FIRE SAFETY, VENTILATION, AND EVACUATION
Designing safe, high-performing stations—especially deep ones—requires early planning for smoke control, ventilation, emergency egress, and fire-service access under strict regulations. Where appropriate, incorporate platform screen doors, strong compartmentation, dependable detection, and clear, well-signed evacuation routes. Life-safety systems for tunnels and stations must be fully integrated to protect passengers and staff and keep the network resilient. Deep stations need particular focus on evacuation to ensure reasonable exit times. Overall station performance—spanning safety, ventilation, egress, and accessibility for people with reduced mobility—sits on the critical path to commissioning.

7 — OPERATIONS, MAINTENANCE, AND FUTURE READINESS
Embed O&M requirements from day one: depot seating, access for repairs, standardized components, spares planning, and condition-based maintenance. Optimize energy, ventilation, and station systems for efficiency; specify regenerative breaking and compatibility across traction power and signaling. Design digital system signaling, communications, and fare collection—with open standards and upgrade paths, provide automation readiness if not initial, and use data-driven monitoring for performance, crowd management, and continuous improvement.


Paris, Line 14 (France)

SYSTEM INTEGRATION: GLOBAL, PROVEN AND OUTCOME DRIVEN EXPERTISE

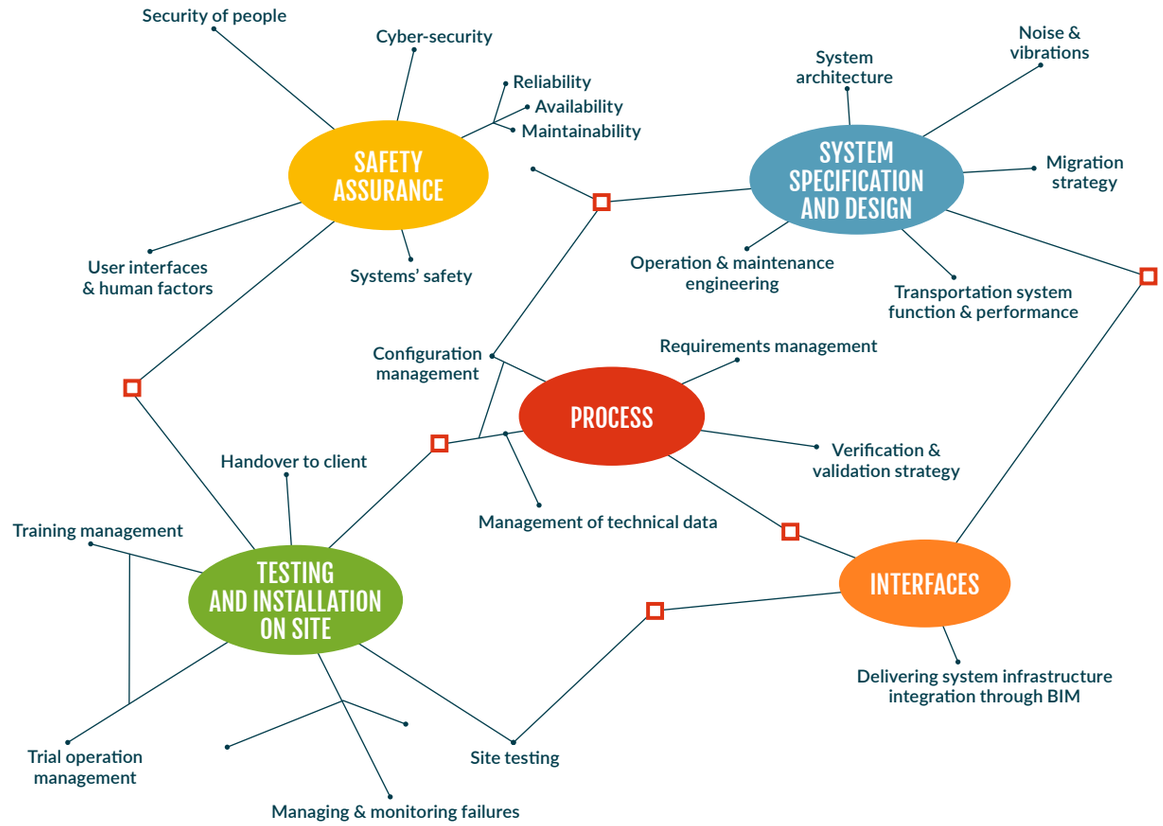
Drawing on landmark international projects and the world's busiest networks, our teams combine deep technical expertise with practical innovation, meeting global standards while respecting local environmental and safety requirements.

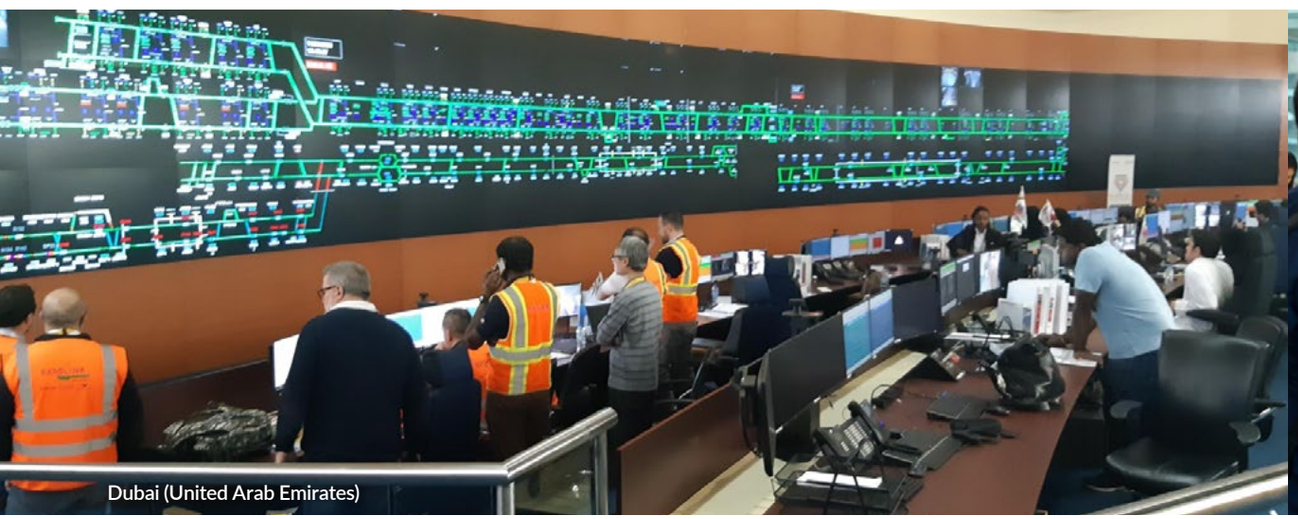
We serve as the overall integrator, coordinating signaling, trains, power, telecoms, platforms, and control systems within a coherent architecture. This end-to-end oversight includes failure tracking, performance monitoring, safety rules, and regulatory compliance, aligning every interface and ensuring a smooth transition from construction to operations. Our comprehensive expertise provides guidance and early warnings on critical issues.

Our rigorous way of working brings partners, regulators, utilities, and city stakeholders together, clarifies responsibilities, and resolves issues early to reduce risk and keep programs on time and on budget. We also provide independent advice on technology choices to maximize safety, availability, and lifecycle value. From day one, we embed operations and maintenance needs so new lines and extensions integrate seamlessly and deliver reliable, efficient networks that meet demanding performance targets.

OUR ADDED VALUE

- → Full lifecycle management, operations at the center, O&M from day one, resilience and availability, proven in real conditions.
- → Capacity-led program design, passenger comfort, integrated fire safety, ventilation, evacuation, accessibility, real operating performance.
- → Requirements sharpened by operational experience, lessons from high-demand networks, simplified interfaces, stronger validation.
- → Flexible, impartial roles: client advisory, PMC, contractor support, design-build, contracting expertise.
- → Pragmatic advanced technology, coherent network across extensions and new lines, on schedule, on budget, upgrade planning, independent technology advice.




Dubai (United Arab Emirates)


Hanoi (Vietnam)

MODERNIZING EXISTING METROS: SAFER, SMARTER, HIGHER-PERFORMING NETWORKS

Upgrading and automating existing metro lines is one of the most effective ways to improve safety, regularity, punctuality, capacity, and energy efficiency while extending the value of long-established assets. Brownfield automation programs are technically demanding because they must transform live railways without compromising service continuity, operational safety, or passenger confidence. Success depends on a clear migration strategy, rigorous interface management, and end-to-end control of both onboard and trackside systems.

CBTC is a key enabler of this transformation. Combined with high-performance automatic train supervision (ATS), it improves train regulation in real time, supports shorter headways, stabilizes operations, and increases network resilience under demanding operating conditions. Automation also helps reduce electrical consumption through optimized driving profiles, smoother traffic management, and better use of regenerative braking.

SYSTRA's approach starts with defining safety, performance, and functional requirements, then translating them into robust technical requirements grounded in more than 65 years of metro experience. We integrate signaling, ATS, rolling stock, telecoms, power, SCADA, platform systems, and cybersecurity within a coherent migration roadmap adapted to each network. Our teams prepare testing, phased commissioning, operations readiness, change management and safety cases from day one—so operators can modernize with confidence, maintain safe passenger service during works, and deliver lasting gains in reliability, capacity, and lifecycle performance.

MODERNIZATION

BROWNFIELD UPGRADES

STUDIES, DESIGN AND/OR CONSTRUCTION PHASES last 5 years

COUNTRIES	CITIES
8	15

Brussels Metro (Belgium)

OUR MAJOR PROJECTS OVER THE LAST 5 YEARS

For over 60 years, we have delivered high-performing metros in 86 cities by integrating systems end to end and understanding each component in depth. As a trusted leader—designing one in two automated metros worldwide—our partner-engineering approach enables on-time commissioning across multiple lines with strong system performance.

OUR KEY FIGURES

ENGINEERING NEWS-RECORD (ENR) RANKING 2025

→ **#6** TRANSPORTATION

→ **#2** MASS TRANSIT & RAIL

→ **1 METRO OUT OF 2** IN SERVICE WORLDWIDE DESIGNED BY SYSTRA

→ PROJECTS IN **28 COUNTRIES** AND **57 CITIES**

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