The challenge
Extending over 8,500 km², Suzhou urban area lies in an exceptional geographic position on the Yangtze delta, at the axis of major lines of communication and within the sphere of influence of Shanghai, which is less than 80 km away.

Suzhou is a city of historic and cultural importance, famous for its gardens, and the local authority is continually aware of the need to preserve the historic heritage of the city centre. Following a study of the city’s transport network carried out by SYSTRA in 2001-2002, Suzhou City Council accepted the principle of a network comprising two metro lines. Approval for construction of the first line was granted by central government in 2008. Line 2 was approved in March 2009. Forging ahead with its plans, in April 2009, the City Council decided to appoint SYSTRA to revise and up-date the plans for the Suzhou light rail network, with a view to drawing up plans for a 6-line metro system.

Line 1 of the Suzhou metro
With a total length of 25.74 km, line 1 will run entirely underground and cross the city west to east from Ling Tian Road to Jin Xi Jie.

CIVIL ENGINEERING
Excavation of the 23 km long twin tunnels will require 14 tunnel boring machines. Construction of the stations and tunnels will have to comply with Chinese seismic safety standards for a level 6 risk.

STATIONS
The average distance between stations is 1.072 km. Stations will be on two levels with a mezzanine floor and central platform, apart from station 110, which will have two lateral platforms. Platforms will have a usable length of 80 m and be equipped with screen doors.

ROLLING STOCK
Trains will consist of 4 cars in accordance with Chinese standard B2. The two driving motor cars are 19.5 m in length and the 2 trailer cars are 19 m. The cars will be 2.8 m wide. The maximum operating speed will be 80 km/h. The vehicle rolling stock will be manufactured in China by CSR Nanjing Puzhen Rolling Stock CO, LTD, the former Alstom joint-venture, and traction equipment will be supplied by Siemens China.

ELECTRIC POWER SUPPLY
Power supply to the metro is provided by two 110/35 kV high-voltage substations. 9 traction substations of 35 kV/1,500 V DC will supply the rigid catenary with traction power in the tunnelled part and the flexible catenary in the depot-workshops and sidings. Line 1 is also equipped with 24 lighting and power substations of 35 kV/400 V for the stations and two combined substations (for traction, lighting and power) at the depot.

SIGNALLING SYSTEMS, MODES OF OPERATION AND REGULATION
Siemens will supply the ATC, ATO, ATP, and ATS ground and on-board equipment, through the intermediary of the Chinese firm, Nanjing NRIET Industrial Co, Ltd, who are in charge of this lot. Trains will be driver-operated with 3 different modes of control: CTC (Continuous Train Control), ITC (Intermittent Train Control) and IXL (Interlocking).
Equipment for signalling, mode of operation, and regulation will be integrated into a single system designed to manage all aspects of the movement of trains. Regulation and monitoring of trains will be carried out by means of the Siemens ATS VICOS OC 501 system. Each terminus will be equipped with a DTRO (Driverless Train Reversal Operation) system. At its launch, the service is planned to operate at 300-second intervals. This will be reduced to 150 seconds in the medium term and later to 120 seconds.

BUILDING AUTOMATION SYSTEM (BAS)
This system controls the electromechanical equipment: ventilation, air-conditioning, water supply and evacuation, lighting, platform screen doors, escalators and lifts, as well the safety installations. The equipment is controlled and monitored from the main control centre. It can also be controlled from the stations and, in default setting, on the equipment itself. In case of fire, the BAS system gives priority to commands from the fire alarm system (FAS).

FIRE ALARM SYSTEM (FAS)
Monitoring and control of the fire prevention and management system is carried out at the main control centre and in the stations. The FAS monitors smoke detectors, triggers alarms at the control centre, generates predefined scenarios for fighting the fire, depending on the type of fire, and issues the necessary commands via the BAS to all the various equipment (fire pumps, fire curtains, gas extinguishers in some technical areas, fire doors, platform screen doors, ventilation, smoke extractors).

TELECOMMUNICATIONS
The metro's telecommunication systems comprise the following: remote transmission system, radio, public telephones, direct telephones, fax, on-board train telephones, CCTV, video conference call system, sound system, synchronised time systems (Master clock), station information etc.

INTEGRATED SUPERVISION CONTROL SYSTEM (ISCS)
The ISCS (Integrated Supervision Control System) manages, either from the stations or the main control centre, supervision and control of power, electrical and mechanical systems (E&Ms), FAS and BAS equipment, platform screen doors, anti-flooding doors, the sound system, CCTV, passenger information system (PIS) and Automatic Fare Collection system (AFC). It also manages the interfaces with movement and regulation of trains using the ATS (Automatic Train Supervision) signalling system.

TICKETING
Single tickets are stored on magnetic cards or on recyclable cards without magnetic contact. The city flexible transport ticket, the “Suzhou Tong” can be used in the metro.

THE MAIN CONTROL CENTRE
The building housing the control centre for the 4 metro lines is located close to Guang Ji Lu Station, in the city centre.

DEPOT AND MAINTENANCE WORKSHOPS
The depot and maintenance workshops are located beyond the western terminus. A test track will be used to carry out dynamic testing on trains using virtual stations.
**SYSTRA’s Role**

Planning studies for the Suzhou transport network carried out by SYSTRA in 2001-2002 led the city to approve the construction of a first metro line. In September 2003 the metro company appointed SYSTRA as the consultant for the different design phases: feasibility study, pre-project and detailed summary, design criteria as well as detailed designs and monitoring of progress during construction.

From 2003 to 2005, services consisted mainly in checking the designs drawn up by the Chinese Institute n°4 and its sub-contractors and providing feedback and technical recommendations for 22.67 km line and 20 stations. The designs covered civil engineering, rolling stock, systems and equipment, interfaces and operation. Checking enabled:
- corrections to the designs to improve the feasibility of the project and implementation of operating and safety functions,
- optimisation of the timing and cost of construction,
- inclusion of new innovative technology.

In March 2005, the contract was suspended pending official approval of the project by the Chinese central government.

In December 2007, SYSTRA resumed its activity at the request of the client SRTC (Suzhou Rail Transit Co.). As the line had been extended and its route modified, SYSTRA reviewed the specifications which had previously been drawn up, as well as the construction schedules and plans for the station.

SYSTRA is assisting in drawing up tender documents and is participating in meetings to assess the offers for construction of the tunnels including the tunnel-boring machines, rolling stock, signalling, ISCS, platform screen doors, telecommunications and tolls.

SYSTRA is taking part in technical reviews and in particular is monitoring the progress of civil engineering works and technical negotiations for the electrical and mechanical equipment such as rolling stock, signalling and systems interface.

**AT A GLANCE**

**FACTS AND FIGURES FOR LINE 1**
- Length: 25.7 km
- Number of stations: 24
- Number of trains: 24
- Passenger traffic: 130,000 passengers/day
- Commercial operating speed: 35 km/h

**ORGANISATIONS INVOLVED**
- Owner: Suzhou City Council
- Project Manager and Operator: Suzhou Railway Transport Company (SRTC)
- Consultant: SYSTRA
- Project manager for Design Studies: Institute n°4
- Subcontractors for the project manager: Institute of Beijing, Institute of Shanghai

**COST**
- Estimated total cost: 12.6 billion RMB ($1.840 million)

**FINANCE**
- Bank loans and direct contributions from local authorities in areas served by the line

**KEY DATES**
- November 2003: completion of feasibility studies
- March 2004: completion of overall designs
- September 2007: completion of preliminary studies
- December 2007: start of works
- March 2008: call for tenders for E&M contracts
- 28 December 2011: trial runs
- 28 June 2012: commercial operation with passengers