The King Abdullah Financial District transit system in Riyadh is a driverless straddle beam monorail system, running in a loop around the brand new area of the city. As the client’s expert advisor on this design-build-operate project, SYSTRA’s role covers every stage: technical specifications, tender process, contract award, design review, construction supervision, testing and commissioning.

The challenge
Currently under construction, the King Abdullah Financial District (KAFD) will be home to Saudi Arabia’s financial sector including the Stock Exchange, banks, accountants and lawyers. The development is a statement of Saudi Arabia’s ambitions to create the leading financial centre in the Middle East.

The 1.6 million square metre site, situated inside the city of Riyadh, will boast over 3 million square metres of floor space, including offices, housing, hotel, women’s spa, conference centre, museum, financial academy and shops. The 3.6 km monorail will run in a loop around the district, with six stations to allow workers, visitors and residents easy access to all parts of the area. It will connect into the new Riyadh Metro via a skybridge into the KAFD Metro Station, which will be an interchange for Line 1 and the terminus of Line 4 and Line 6.

Rayadah Investment Company (RIC), a subsidiary of Public Pension Agency which owns the land, is responsible for developing the KAFD district and is the Client for the monorail project. The construction of the monorail must interface and co-ordinate with the construction of the many buildings and utilities around it.

The design-build-operate contract for the monorail, the first in Saudi Arabia, will see the winning concessionaire run the monorail for ten years. Construction of the system began in 2011, with the start of operation expected in 2016.

In detail
The Monorail system will initially consist of six trains of two cars with a capacity for 3,000 passengers per hour (pph). This capacity can be significantly enhanced in the future by adding more vehicles and reducing the operational headway.

The modern, wide-bodied, lightweight and aerodynamically styled vehicles will benefit from the latest in vehicle technology. Driverless, the monorail will run on a single elevated guide beam for its entire length, using proven radio based signalling technology (CBTC). Thanks to the CBTC system, the trains can be operated from the control centre in both normal and reverse mode.

High levels of performance and comfort are a key requirement for the new system, due to the sophistication of the end users. It will be air-conditioned with onboard security cameras monitored by the control centre during operation.

There will be six elevated stations fully integrated within key attractor buildings; these are cultural venues, aimed to draw people into the district. The goal for the KAFD district is that it becomes a vibrant mixed use community encompassing business and entertainment activities. All air-conditioned, the buildings themselves are linked by air-conditioned footbridges above street level, so that people can move easily from stations to other buildings in the KAFD development.

The guideway is elevated, with precast concrete beams, pre-stressed and post-tensioned with standard spans of around 30 m and long spans up to 50 m. For safety reasons, and in compliance with the latest safety rules, an aesthetically designed emergency walkway is anchored to the bottom of the beams all along the guideway.
KING ABDULLAH FINANCIAL DISTRICT (KAFD) MONORAIL - RIYADH

KINGDOM OF SAUDI ARABIA

The 16 m-high piers have foundations up to 16 m deep. The foundations are generally located inside five-level underground car parks, which is a challenging constraint.

SYSTRA's role

Monorail transit systems are new to the Kingdom of Saudi Arabia, so client RIC needed an advisor who could help inform every aspect of this project: from defining the system to identifying potential suppliers to managing the constraints and risks. There are few monorails around the world and therefore only a few firms who have hands on experience and knowledge of them.

SYSTRA has been involved in several, most recently the Palm Jumeirah monorail in Dubai. “There are not many firms in the world who have a complete overview of monorail systems, from the initial design right through to supervising the construction works out on site,” explains SYSTRA project manager Olivier B. “The practical knowledge and experience gained from supervising the civil works, as we did in Dubai, feeds back into the design process for KAFD.”

SYSTRA has worked for Saudi client RIC on three distinct contracts: tender preparation and contract award; design review of the systems and of the civil engineering works; and construction supervision, installation, testing and commissioning.

In drawing up the tender documents, SYSTRA had to review the existing KAFD transport masterplan with the provision for the monorail; review the feasibility study; create a concept design; and prepare performance and functional specifications. SYSTRA was also responsible for the prequalification of monorail contractors, analysing four bids, both technically and commercially, assisting in negotiations and advising on contract award.

The Design Review contract requires SYSTRA to check both the civil work design and the systems design. SYSTRA has to verify that the designs meet the specification, make sure that all the elements work properly together and provide technical advice to the client. In carrying out this work, SYSTRA takes a proactive approach, proposing solutions to technical issues which arise.

SYSTRA must oversee all aspects of the construction site, including the manufacture of the concrete viaduct elements in a dedicated precasting yard. It must also work in the manufacturers’ factories to verify tests on equipment including signalling, the control centre system, telecommunications, track switches and rolling stock.

The main challenge on this project is managing the very complex environment: more than 30 buildings, car parks, roads, tunnels and utilities are under construction at the same time and in the same areas as the monorail. SYSTRA is involved on a daily basis, dealing with interface coordination and resolving site challenges.

“These are key issues for the project in avoiding delay,” says Olivier B. “We take a very proactive approach in order to find solutions which give the best possible result for the client and which bring the least impact to the contractor.”

SYSTRA’s expertise in civil work and monorail systems specifically, helps with the resolution of day-to-day issues. SYSTRA’s role will continue through testing and commissioning, right until the monorail starts operation.

AT A GLANCE

FACTS AND FIGURES

Length: 3.6 km, all elevated
Stations: 6, elevated
Capacity: 3,000 passengers/hour
Rolling stock: 6 two-car trains, Innovia Monorail 300 from Bombardier
Average commercial speed: 25 km/h

STAKEHOLDERS

Client: Rayadah Investment Company (RIC), a subsidiary of Public Pension Agency
Client’s advisor: SYSTRA

FINANCE

Construction cost: US$ 150 M
Operation cost: US$ 100 M (over ten years)
Finance: financed by RIC

KEY DATES

2009: production of tender specifications
2009/2010: tender process and award
2011: start of design and build
2011/2015: construction
2015/2016: systems installation, testing and commissioning
2016: start of operation