

ME & India: Case Study

Rail Transport - Dubai Metro

Introduction

Atkins Rail Transport expertise is not confined to one location.

Atkins employs around 2,200 staff involved in railway schemes around the world. Our major rail project management, rail systems and civil design work centres are based in Dubai and Sharjah, as well as in London and Hong Kong.

In the Middle East, the flagship transportation project is the Dubai Metro project. Apart from being an architectural and engineering showpiece, it will offer an efficient, environmentally friendly and convenient form of transport in one of the most advanced cities in the world.

The first two lines of the Dubai Metro are being constructed as a Design-Build contract by a consortium of international contractors. Atkins was appointed in April 2006 as the lead designer to the major civil contractor of the DURL Consortium. Our role is to carry out the full multi-disciplinary design and the design and programme management of the civil works necessary to procure, construct and deliver this world class, multi-billion dollar metro project by late 2009.

The scope of the civil works comprises:

- geotechnical and site investigations
- 9.6km of 8.5m internal diameter, twin track, bored tunnel built in 10 tunnel drives (using earth pressure balancing Tunnel Boring Machines)
- six annex shafts for tunnel ventilation and emergency egress with 12 short mined adits to the bored tunnels
- 2.4km of cut and cover approach tunnels in four stretches
- 43km of viaducts and bridges (utilising post-tensioned, segmental bridge construction)
- route alignment verification
- 37 elevated (integral with the trackway viaducts) and at-grade stations and ten underground stations (utilising top down constructed station boxes with diaphragm walls)
- three depots and associated control centres
- additional specialist design services such as fire engineering and ventilation, environmental impact, concrete durability, noise and vibration reduction, and passenger flow modelling.

Our role also includes the design coordination with the rail systems contractor of the Consortium (trackwork, signalling, rolling stock, communications and power) and close working with the contractor to develop construction methodologies that facilitate timely construction to programme.

Outputs we deliver

We have drawn upon our worldwide resource of specialist design expertise in the variety of disciplines needed to produce the complex station, viaduct and tunnel designs.

Our services comprise developing the Client's original design concept into detailed design and tender documentation. This includes site context and station planning, detailed design of internal and external components, including building services, coordination with specialist railway systems, reinforced concrete frame, roof and cladding structures, fire and life safety in addition to overall project coordination.

We offer our Client:

- high calibre project managers and project management teams to formulate the necessary processes and procedures required in complex railway projects - our teams are experienced in the design and delivery of major urban transport projects in heavily built-up areas and have the requisite local knowledge necessary for success in the Middle East
- design resources and design teams necessary for a fully integrated concept or detailed design of railway schemes
- highly experienced master planning and transport planning teams to develop strategic solutions or validate existing solutions
- Locally-based and experienced consents and approval teams for planning, expediting and facilitating the plethora of local approvals and consents required for construction
- requirements management team and process to capture and maintain an auditable trail of all original and changing requirements over the lifetime of a project
- Project controls to undertake programming, cost and change management. This team would structure an appropriate road map and sequence plan for the successful delivery of all phases of a project from concept, design and construction, through to trial running and commissioning. This would provide the client and our project management team with necessary information on progress and key critical areas to identify and focus attention and resources on the essential issues

Our approach

One of the greatest challenges at the project outset was to mobilise swiftly a team of about 400 staff worldwide, bringing together their specialist design knowledge in post-tensioned segmental bridge construction, metro station design and tunnelling, and combine that with our local design management team in Dubai.

Many features of the Dubai design and construction are unique and state-of-the-art.

The tunnel works are notable for:

- first major bored tunnelling and tunnel mining works in Dubai and the UAE
- tunnel driving in sands and extremely weak sandstone rocks with very high permeability
- use of permanent diaphragm walls and top-down construction for annex shafts and cut and cover tunnels
- use of state-of-the-art tunnel ventilation systems to provide emergency control.

With tunnelling being a relatively high-risk activity, a detailed risk management strategy is in place to mitigate risk and handle emergency situations. These might include significant ground movement events or encountered obstacles (e.g. abandoned wells, etc.).

Following completion of geotechnical investigations and design, the first tunnel drive between Union Square and Burjuman Stations, which includes passing below the marine Dubai Creek, is now underway. It is being driven by one of three Earth Pressure Balance Tunnel Boring Machines (EPB TBMs).

EPB TBMs were selected in order to:

- limit damage risk to the many structures and utilities above and adjacent to the drives
- provide rapid advance rates (about 300m/month)
- enable one-pass lining completion

The overground stations will, when completed, be architectural and engineering showpieces. Our underground design team has previous successful experience with the top down method of construction and the method was chosen to limit ground movement in the urban environment. This will minimise the effects on sensitive utilities and buildings, thus reducing risk. Temporary works are also minimised, making early road reinstatement possible.

Overhead launch girders are being used to construct the 43km length of viaduct, lifting the precast viaduct segments and erecting them over the piers. The main advantages of having pre-cast, post-tensioned segmental viaducts are the speed of installation and assembly, as well as the limited impact they have on the traffic disruption in the vicinity of the metro during construction.

Outcomes we deliver to our clients

Winning the design of the Dubai Metro relied on Atkins' ability to mobilise swiftly a pool of 400 specialist design expertise from around the world, enabling our client to progress a project that was well behind schedule.

We proved that with our local knowledge and international rail experience, supplemented by Atkins' vast technical diversity and skill base, we could provide an integrated one-stop solution to successfully deliver Dubai's flagship engineering project.

We brought expertise from Atkins' offices in the U.K., Asia and other parts of the Middle East into Dubai to form a multi-disciplinary team working on the first two lines of the Metro, which include:

- 74.5 km of track
- ten underground and 37 aboveground stations
- three depots

The entire company joined forces to meet the fast-track programme. Off-shore units were encouraged to send staff to Dubai to understand the projects pressures and without exception, all responded magnificently, working extra hours and days to meet deadlines and overcome the mismatch between Middle East and western weekends.

The project challenged all involved to produce economic, constructible and safe designs to provide Dubai with a world-class-railway, the first to its kind in the region. The allocation of work around the Atkins Group enabled technology gains to be made, particularly in the fields of pre-cast segmental viaducts, tunnelling and the depots' design.

The success of the Dubai Metro project proves that large multi-disciplinary assignments can be successful and profitable. It shows we can leverage our integrated expertise to deliver business benefits and by collaborating as one team, we can further stand out from our competitors.