



INTERNATIONAL



## PROFILE OF THE DUBAI METRO

Supported by a superlative and extensive infrastructure in transportation, telecommunications and finance, Dubai is well endowed to manage some of the world's most sophisticated, remarkable and ambitious projects to date.

As part of its modernity drive, vision and concerns for the environment, the Dubai government commissioned studies to evaluate most efficient and cost-effective solution to combat traffic congestion and its pollution by-product; the recommendation of these studies were the creation and development of a metro for Dubai City.

The government of Dubai has created a Roads

and Transport Authority (RTA) on 1 November 2005. The Dubai Metro is the flagship project of the RTA in terms of its approximately 15,5 billion dirhams' total investment (inclusive of project management fees and utility diversions); state-of-the-art engineering and technological challenges; visibility throughout the city, being an architectural show-piece; and its direct role in providing social benefits.

The Dubai Metro will be a catalyst for improving real estate value, economic development and urban regeneration along its main route and arteries. In addition, it will create an additional source of employment opportunities for the local

population and the region.

The new metro will be a fully automated, driverless railway system. It will be constructed and delivered in two stages, Red Line (Stage 1) and the Green Line (Stage 2). In the congested central areas of the city, the metro lines will be built mainly underground, which will constitute the majority of the Green Line, whereas the Red Line will span along the famous Sheikh Zayed Road, on a viaduct.

### Completion dates

- The Red Line (Phase 1) is planned to be completed and to start generating revenue by September 2009
- The Green Line (Phase 2) is planned to be completed and to start generating revenue before March 2010

## Dubai Metro

# 'Gautrain' in a desert country

DUBAI, BEING ONE of the fastest growing cities on earth, is experiencing at least one of Murphy's laws these days. This is based on the engineering logic that if a city's infrastructure does not keep up with the city's development growth, everybody will sit daily in traffic jams – sometimes for hours.

With an average annual growth of more than 6% and an increase of some 7% in the

number of vehicles, the authorities realised that merely building more roads will not solve all traffic problems.

Initial feasibility studies for a metro system started as early as 1997 and were completed in 2000. The importance of an expanded public transportation system soon became apparent, as well as adapting transport policies that will focus on traffic regulation in and around the city. Further

planning studies were carried out (2000–2002) proposing a major metro rail line along the length of the city, as well as additional circular rail lines within the CBD.

In the period 2002–2005 a sequence of detailed planning studies followed which led to a design and build contract being awarded to a consortium now known as Dubai Urban Rapid Link (DURL). The consortium is made up of international companies including



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the Japanese companies Mitsubishi Heavy Industries, Mitsubishi Corporation, Obayashi Corporation, and Kajima Corporation, as well as the Turkish company Yapı Merkezi. The client for the Dubai Metro is known as the Roads and Transport Authority (RTA), which was formed in 2005 by the Vice-President of the United Arab Emirates (UAE), HH Sheikh Mohammed Bin Rashid Al Maktoum (who is also the Ruler of Dubai). The Dubai Metro has since become one of the flagship projects of the RTA.

### AIMS AND OBJECTIVES

The Dubai Metro will be implemented as an alternative mode of transport with three main goals: to reduce the dependency on car use, to reduce the travelling time in and around the city, and to help reduce traffic-borne pollution. As Dubai is a 'tax free' city, and fuel and cars are cheap compared with many other countries, everybody is driving his or her own car. Also, the desert heat makes public transportation less attractive.

The Dubai Metro will link one end of the city to the CBD and Dubai International Airport on the other end. Provisions will be made for park and ride facilities near some of the main stations. Interlinked bus and taxi routes as well as water bus routes ('abra' boats) will complement the Dubai public transportation network. The objective is the implementation of an integrated transportation system that will give Dubai citizens and tourists the flexibility to travel in and around Dubai with fewer traffic delays than currently experienced. It is hoped that, over time, people will begin to make more use of public transportation – which is already happening in many other countries.

### PROJECT DESCRIPTION

The Dubai Metro will be constructed in two phases. The first phase (called the Red Line) will be the link from the south end of the city (towards the capital Abu Dhabi) along the



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length of the city towards the Dubai CBD. The Red Line runs next to the main highway, Sheikh Zayed Road, which forms the main traffic artery of Dubai. (This highway is basically the equivalent of South Africa's Ben Schoeman freeway.)

The Red Line covers a length of approximately 52 km, and most of it is elevated. There are 23 elevated stations along this rail line with one station at grade and four stations underground. The elevated sections consist of single and multiple pile foundations, single piers and pier caps which are linked together with pre-cast rail segments. The Red Line is planned to be completed by September 2009.

The second phase (called the Green Line) will form a semi-circular route within the Dubai CBD. The Green Line will have elevated as well as underground sections. The total length of the Green Line is 23 km, of which about 8 km will be underground. The underground section is constructed using tunnel boring machines (TBMs) and cut-and-cover construction methods. The elevated section will have 12 stations while the underground section will include eight stations, including two intersection stations. The completion date of the Green Line is March 2010.

1 Artist's impression of the completed metro rail along Dubai's main highway

2 Metro map

The maximum speed of the trains will be about 90 km/h. By 2010, a total of 79 trains (five-car as well as three-car trains) will be in operation – 62 on the Red Line and 16 on the Green Line. Trains will be driverless and air-conditioned. Some of the train car compartments will be earmarked for exclusive use by women and children as well as VIPs (first class) to allow for the cultural uniqueness of this Arabic city. The trains will all run on the standard 1,435 m rail gauge.

The total cost for the two phases is estimated to be around R30 billion.

### CHALLENGES AND INNOVATIONS

Ironically, one of the main problems being encountered during construction is traffic congestion. In a city of traffic jams it is a major challenge to build diversion roads to accommodate construction. Limited space and relocation of main services and utility lines complicate matters even further. To add to this, all service authorities in Dubai require a no objection certificate (NOC), which gives formal permission to relocate services. The process of obtaining NOCs



leads to bureaucratic paper work delays that add in no small measure to the pressure of completing the project on time.

A project for temporary traffic management (TTM) was awarded to South African company Africon to provide traffic management plans (TMPs) for these diversion works. The TMPs involve the study of current traffic conditions to find possible diversion roads, or the implementation of temporary roads that will limit the impact of construction activities

in and around Dubai.

The importance of proper TMPs became clear for the underground cut-and-cover construction sections, particularly in the CBD where major intersections were planned to become huge holes in the ground (or rather, sand). As a result Africon's team looked at geometric solutions as well as traffic engineering solutions. Various options were tested for each area under construction. Where a reduction in capacity was expected,

traffic modelling and analysis became imperative in order to predict the impact of construction on traffic diversions.

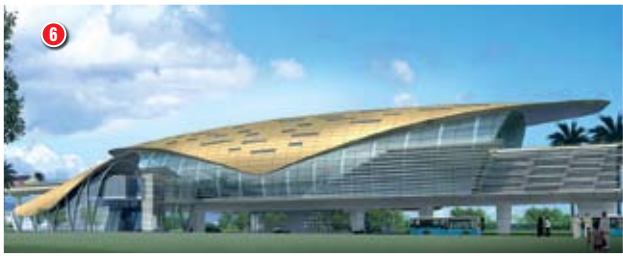
The influence of major diversions and other traffic restrictions in the current road network was analysed by using the Regional Transportation Demand Model for Dubai. Classified 24-hour electronic traffic counting formed part of the process to ensure accuracy in modelling.

From the traffic modelling and analysis the expected traffic flows during the metro

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construction for the diversion works could be determined by using traffic engineering software such as Vissum/Vissum, Sidra and Synchro. Output from these software packages helped to develop the mitigation measures required to re-establish acceptable levels of service and operating conditions. These included upgrading alternative routes, restricting certain routes (by implementing one-way systems or reversing traffic flows), closing roads and building new diversion roads.

The Japanese construction companies are using another innovation: mobile launching gantries are used to construct the elevated viaduct rail segments. The gantries can move forward between two piers while the pre-cast segments are lifted in place for linking, glueing and stressing. With these launching gantries, viaduct spans can be assembled in two days.

Two pre-cast yards were built to complete the task of making thousands of piers caps and viaduct segments. All the pre-cast segments are usually hauled to site in the early morning hours to limit the impact on day-time traffic.

### PROJECT STATUS

At present approximately 7,5 km (15%) of the elevated viaduct rail sections have been completed. This includes pile foundations, piers and pier caps linked together with the elevated pre-cast rail viaduct segments. About 90% of the viaduct pile foundations and about 55% of the piers have been completed. The construction of the stations is also proceeding well, with 20 of the 24 elevated stations

3 and 4 The elevated viaduct rail structure consisting out of the substructure piling foundations followed with the piers, pier caps and the segments for the rail structure spans

5 Example of a Type 1 elevated station

6 Example of a Type 2 elevated station

7 and 8 Some of the areas where the elevated Red Line will pass. Many of the elevated sections are constructed within limited space and construction is made even more challenging by existing roads and services

9 Dubai International Airport Metro Station



substructure foundations completed (70% of the piling work).

### CONCLUSION

The future of city travel lies in the increased use of integrated public transportation systems. These need to be planned and refined to make it more feasible to use public transport. But this will only happen when the level of user-friendliness is such that people will voluntarily switch to public transport. If the system does not provide a proper level of flexibility, people will switch back to individual car transport, which enables them to individualise route planning and timing.

### PROJECT TEAM

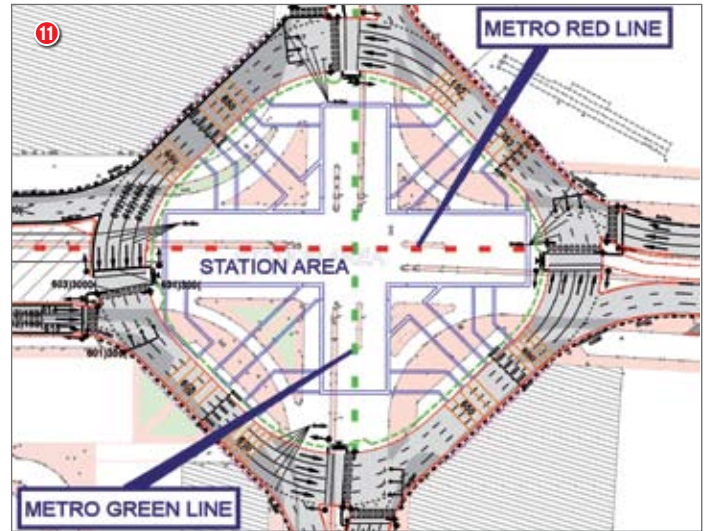
Like any other similar metro line construction, the teams involved can be numbered in the hundreds and even thousands of skilled people. The Roads and Transport Authority (RTA) Rail Agency under the management of HE Eng Mattar Al Tayer (chairman of the board and executive director of RTA) form the management team from the client's side and Systra-Parsons are the engineers. On the contractors' side the main parties involved are Mitsubishi Heavy Industries, Mitsubishi Corporation, Obayashi Corporation, Kajima Corporation and Yapi Markez. This does

not include the numerous subcontractors and consultancies.

► MORE INFO

Please visit [www.rta.ae](http://www.rta.ae)

- 10 Work area for gantry assembly
- 11 Traffic management by implementing a traffic circle around the cut-and-cover construction area: Bur Juman Station
- 12 and 13 Launching gantries are being used to assemble the rail spans. Pre-cast segments are hauled to site and lifted into place one segment at a time. Single-span construction can be done within two days
- 14 Pile cap construction along Sheikh Zayed Highway
- 15 Construction of rail segments with launching gantry



Source:

[http://www.saice.org.za/downloads/monthly\\_publications/2007/CivilEngSept2007/#/0](http://www.saice.org.za/downloads/monthly_publications/2007/CivilEngSept2007/#/0)