

MTR Corporation Limited

Project:

Express Rail Link – West
Kowloon Terminus Building

Location:

West Kowloon District, Hong
Kong

Type:

Infrastructure – Railway
Terminus

Scheduled Time of Completion:

2015

Mega Station Builders Deploy Mighty BIM



The MTR Corporation is making extensive use of BIM during the construction of the West Kowloon Terminus, by far the largest railway station in Hong Kong. The massive, detailed BIM model was originally deployed for modelling the Terminus structure ahead of construction to identify spatial clashes and construction co-ordination issues, its uses have expanded through collaboration with the project teams within MTR Corporation and its contractors. The project team plans to leave a legacy in the form of an ‘as built’ model in addition to the usual as built drawings to the terminus operator.



Huge rail terminus

The MTR Corporation is building the West Kowloon Terminus, as the terminus and immigration border crossing for the Hong Kong section of the Express Rail Link connecting Hong Kong with Guangzhou and various Major cities in the Mainland. This will be by far the largest station in Hong Kong, with 4 basement levels and 15 platforms at lowest basement level, 30 metres below ground; the platforms which accommodate shuttles and long-haul trains are 216m and 432m long respectively. The terminus box is up to 600m long and 250m wide, providing a gross floor area of around 400,000 square metres, compared to around 500,000 square metres for Hong Kong International Airport Terminal. There will be immigration and customs facilities underground, and 2 major underpass structures passing through the basements. North of the

terminus will be a public transport interchange.

“The station has an architecturally inspired roof which will be one of the most complex in Asia – and will be one of its kinds,” says Terry Martin, Senior Construction Engineer – Civil, MTR Corporation. “It has curvilinear free form steel trusses up to 175m in length and 50,000m² of complex curtain walling and cladding comprising individually shaped panels. It also provides an accessible open public area on top with panoramic views across to Hong Kong Island.”

De-risking the structure

In the project’s early stages due to complex geometry, 3D modelling was used for designing the roof structure, including its curtain walling and cladding. As the project neared

construction, there were discussions within the MTR Corporation project team regarding potential application of BIM to model the entire design of the terminus.

“We have a challenging construction process for the whole project with multiple interfaces of many disciplines; we thought of using BIM to interrogate our designs – with the intention of ensuring delivery of a robust design to our contractors, says Terry Martin. “We wanted to de-risk the structure, ensuring it was adequately coordinated.” allowing the contractors to build using the 2D construction drawings with minimal delays due to co-ordination or clash issues.

The MTR Corporation team also decided the right way to proceed would be to own and manage the development of the BIM model. They would start with civil and architectural aspects, progressing to incorporating building services, and allow provision for updating the model during the life cycle of the project, making it useful for operation and maintenance. “We wanted to leave a legacy behind – a fully coordinated model which could be given to the operator of the Terminus,” says Terry Martin.

After reviewing other projects that have used BIM, assessing BIM consultant’s capabilities and resources, and issuing a competitive tender for a BIM consultancy, the Corporation appointed Intellibuild. Initially, the main goal was for them to take 2D drawings, and model what the contractors would build.

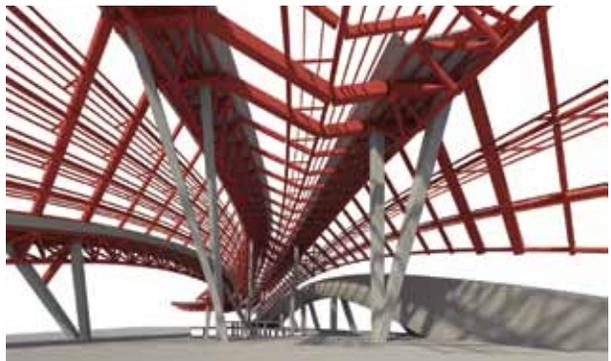
Massive, detailed BIM model

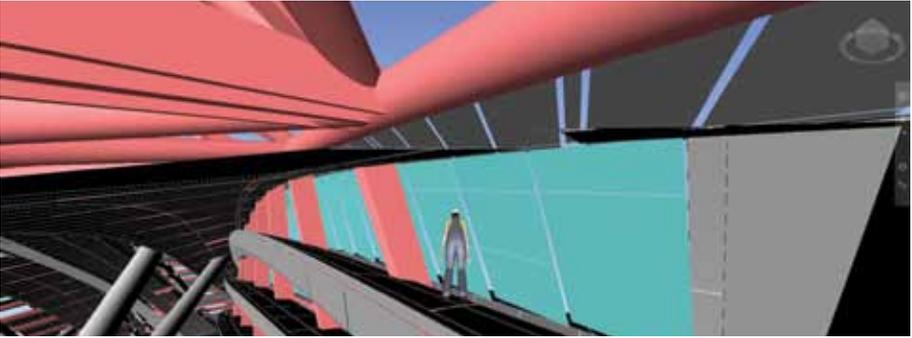
The MTR Corporation issued 15,000 drawings to Intellibuild, together with the roof designer’s BIM model for information. Intellibuild created a model that includes all aspects of the structure and finishes and now has building services being incorporated to allow spatial checks with the reinforced concrete frame and architectural finishes. Building services as small as 50 millimetres in diameter will be modelled. “We’re including anything that has spatial consideration,” says Ir Andrew Wong, Senior Construction Engineer – XRL Terminus, MTR Corporation.

The model now has around 90% of the building completed; it shall be updated with contractor designed elements at a later stage. The BIM model is a massive file which has had to be spilt into discreet manageable files and provides a visualisation of the working documents,” notes Ir Wong.

Extremely effective communication tool

While creating the terminus in virtual reality, the Intellibuild team have collaboratively worked with the Corporation and contractors





to provide solutions to construction issues through 3D visualisation of the design. This has led to early resolution to construction issues at an appropriate time that may have manifested during construction.

“The BIM model is an extremely effective communication tool,” says Terry Martin. “We have held collaboration workshops with design consultants and our design managers, visualisation of problems from 2D drawings alone was not always possible. We displayed the model on a screen, and worked out solution to issues. It became very clear to all just how powerful BIM is.”

The model will be used for communication with the project contractors and other stakeholders. For instance, the project team will carry out

walk through visualisations of key areas of the terminus such as passenger flow through the immigration facilities and on to the departure platforms.

Other benefits

Use of Navisworks software has allowed people without intimate knowledge of BIM to understand design and construction in the 3D world, significant people development and new skillsets have been achieved opening a new mind set of what can be achieved by new technology and developing ideas for its application and use.

Some maintenance issues are also being addressed using the BIM model. For instance, a walk through helped show operation and maintenance staff how maintenance access



doors in the roof will help gain access to Building Services within the roof space.

“There is always opportunity evolving from the BIM model,” says Terry Martin. “For example, we are looking at methods of getting railway tracks down to basement four – using BIM for flow path analysis which will depict the spatial constraints of this important part of the project.”

Later, a walkthrough in Navisworks will be used to provide 3D visualisation and a walk through of the vast quantity of signage.

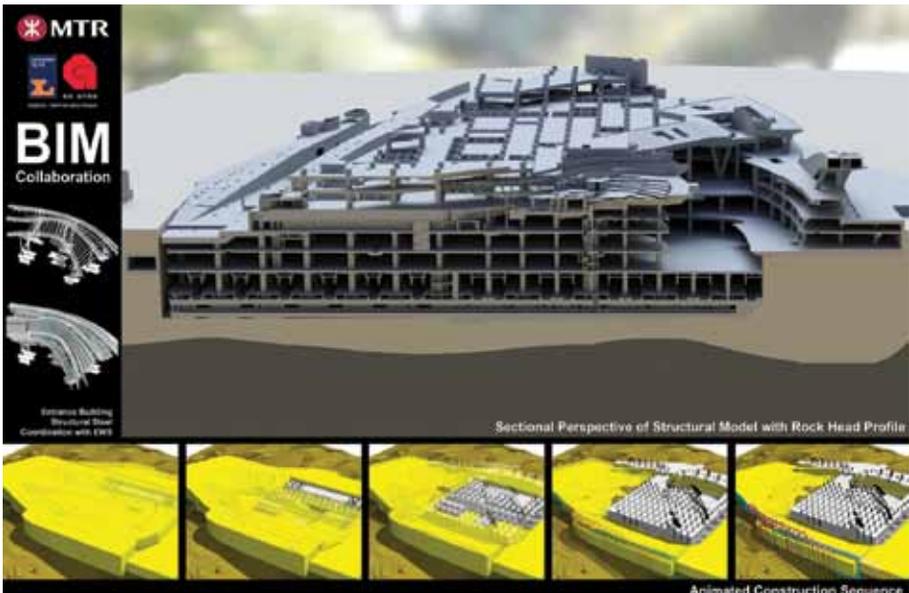
Terminus project enhanced by BIM

The terminus BIM model began with a small core of people within the MTR Corporation project team, and has since grown and continues growing. “We are sharing the model with contractors,” says Terry Martin. Contractors can use the model in their construction planning and provide their staff

with 3D previews of the constructions works, development of method statements and to enhance understanding of construction safety issues that may arise. There are possibilities for them to look at the models in 4D – including time, and perhaps to use BIM in assessing quantities, helping to minimise wastage and enhance productivity.

“The true value of BIM is difficult to quantify, however consideration to the potential time saved and avoidance of abortive works is paramount,” reflects Terry Martin. “We know the project is much better with BIM than without it.” As well as delivering benefits such as minimising clashes and abortive works, the terminus BIM project is providing on-the-job training in 3D technology for both MTR Corporation and the contractors’ construction project staff– and helping the MTR Corporation move towards increasing deployment of BIM.

** All images in this article are provided by MTR Corporation Limited*





ABOUT MTR CORPORATION LIMITED

Carrying an average of 4 million passengers every weekday, the MTR is regarded as one of the world's leading railways for safety, reliability, customer service and cost efficiency.

The MTR Corporation was established in 1975 as the Mass Transit Railway Corporation with a mission to construct and operate, under prudent commercial principles, an urban metro system to help meet Hong Kong's public transport requirements. The sole shareholder was the Hong Kong Government.

The Company was re-established as the MTR Corporation Limited in June 2000 after the Hong Kong Special Administrative Region Government sold 23% of its issued share capital to private investors in an Initial Public Offering. MTR Corporation shares were listed on the Stock Exchange of Hong Kong on 5 October 2000.

The Corporation marked another major milestone on 2 December 2007 when the operations of the other Government-owned rail operator, the Kowloon-Canton Railway Corporation, were merged into the MTR, heralding a new era in Hong Kong railway development.

Other than bringing more efficient and competitively-priced services to local rail passengers, the merger brings new growth opportunities to the MTR Corporation's businesses in and outside of Hong Kong.

The merged rail network comprises nine railway lines serving Hong Kong Island, Kowloon and the New Territories. In addition, a Light Rail network serves the local communities of Tuen Mun and Yuen Long in the New Territories while a fleet of buses provide convenient feeder services.

The Corporation also operates the Airport Express, a dedicated high-speed link providing the fastest connections to Hong Kong International Airport and the city's newest exhibition and conference centre, AsiaWorld-Expo.

From Hong Kong, passengers can travel with ease to Guangdong Province, Beijing and Shanghai in the Mainland of China using the MTR's intercity railway services.

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