COMPANY

Arup & MTR Corporation

PROJECT

MTR Corporation Limited – Shatin to Central Link

LOCATION

Wan Chai, Hong Kong

TYPE

Government-owned Public Infrastructure Project

SCHEDULED TIME OF COMPLETION

2021

BIM Benefits Displayed in Exhibition Station

"Without BIM, this particular project would have been very tough. It helps to minimise design inconsistencies at the start, and problems can be mitigated efficiently."

—**Ir Timothy Suen**
Director
Arup

BIM PARTNERS INVOLVED

TFP Farrells

Langdon & Seah

Image courtesy of Arup

The 3D images of the existing underground facilities of the adjacent area of the Exhibition Station look a very little like an upside-down porcupine with its mass of spines pointing down. These "spines" are pilings, both existing and planned, and their abundance gives some indication of the complexity of the project to design and then construct this new station along the forthcoming Shatin to Central Link.

Exhibition Station will be under north Wanchai, in a harbourfront area that currently includes a public transport interchange, a sports centre and a swimming pool. "The biggest challenge is that there are so many things happening around the site, including Wanchai Development Phase II and a related bypass," says Ir Timothy Suen, Director, Arup. "BIM could help the design, as well as showing the sequence of work and how this relates to other projects in terms of land or work sites availability. For critical paths, with the main risks, we could use the BIM model to find alternatives more effectively if other work could not be done according to plan."

This flexibility is essential given that the station design team is preparing for multi-stages of major traffic diversion schemes, each of which will be very dependent on land being available for work sites. The BIM model helped identify two especially critical junctions at Fleming Road and Tonnochy Road, which are congested with underground utilities, and with modelling the sequences for diversions and related construction, such as diverting drainage pipes, culverts and installing pipe piles and diaphragm wall.

Unforeseen underground problems demand flexibility

"MTRC work is very different to typical BIM projects, involving buildings - as it's mostly underground, and unforeseen conditions make changes unavoidable," says Ir Suen. "With BIM we can find remedies and alternatives, while minimising time impact on the project."

The Arup team built the BIM model from a variety of sources, including record drawings from different utility companies, scans for underground structures and site survey. Yet for underground utilities in Hong Kong, to achieve an accuracy needed for the project, a lot of

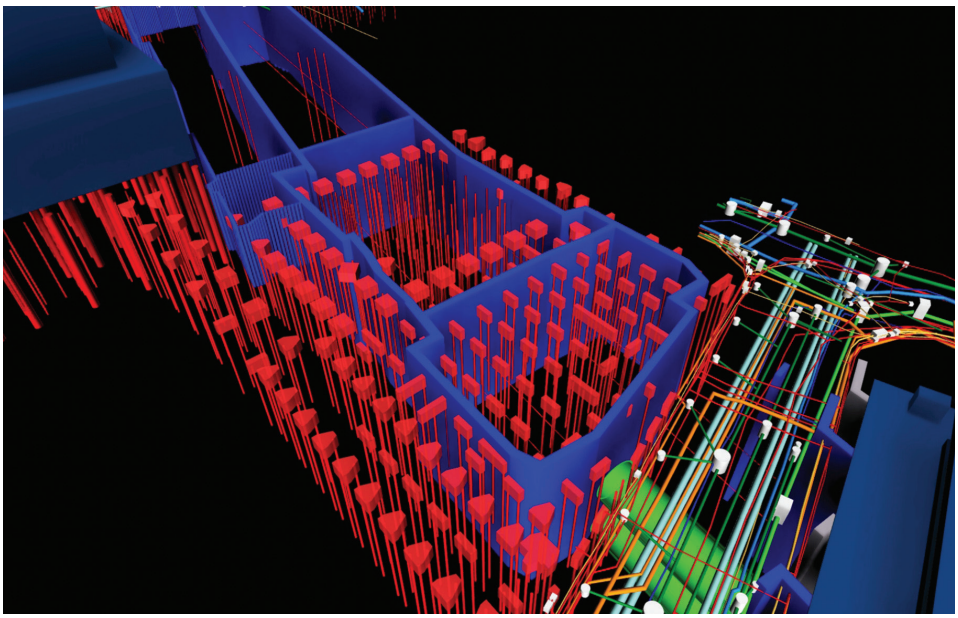


Image courtesy of Arup

sensitive check and "what if" can be done by using the model.

One challenge arose from the existing and planned foundations for the future station. "We will demolish the swimming pool and indoor games hall; and build a station as well as replicate the facilities," says Ir Suen. Because of zoning for the excavation, the diaphragm wall will need to be constructed in plentiful piling; yet removing all foundations before installing the diaphragm wall is not practical. The design team used the BIM model to accurately locate the existing piles and foundations, and plan a diaphragm wall alignment that will avoid them as much as possible. This minimises generation of waste, and will save considerable time and costs.

Value engineering and stakeholder participation

The BIM model has also enabled the team to carry out value engineering throughout the design process. It helps with selecting the most cost-effective schemes to minimise excavation, reduces wastage in abortive works – with thousands of clashes already identified, and enhances resource allocation for unforeseen problems and conflicts.

"Engineers and modellers sit together, and identify clashes and how to resolve them," says Derek Lau, Associate, Arup. "We have workshops, including engineers and architects who find their designs may not match. For instance, there may be problems with levels; perhaps the headroom for a staircase is incorrect. Using the BIM model, these can be resolved straight away. We've been learning a lot."

With complex designs like the station, even experts might find them hard to understand using 2D drawings, and could overlook potential errors. The 3D model, including information, proves a great help. Plus it benefits other stakeholders.

"The vivid 3D images and animations make it easy for people like district councillors to visualise our designs, such as for the re-provisioned swimming pool," says Mr Lau. "We can rotate the images on screen, and show construction sequences. With a better understanding, stakeholders feel ownership and participation in the project."

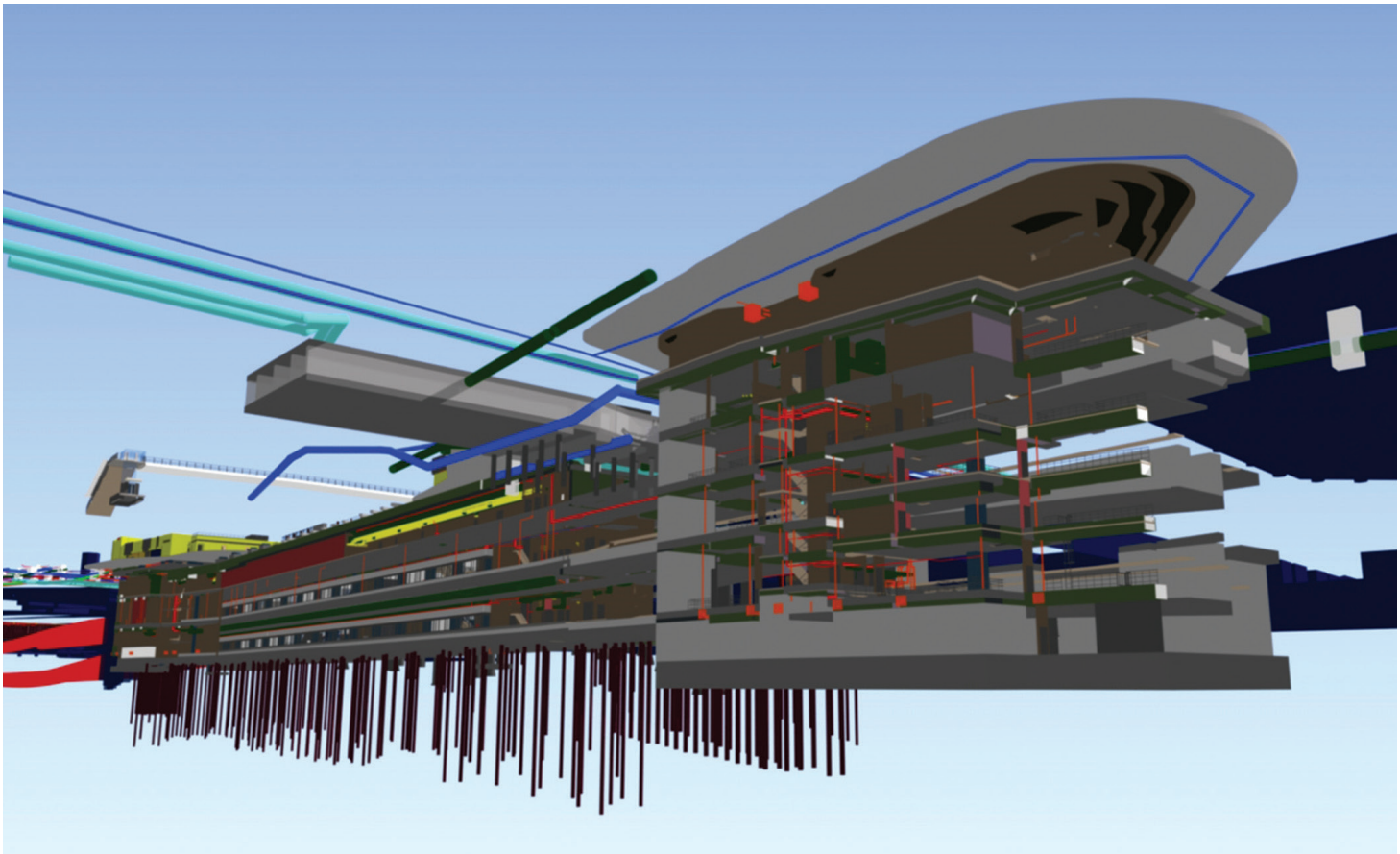


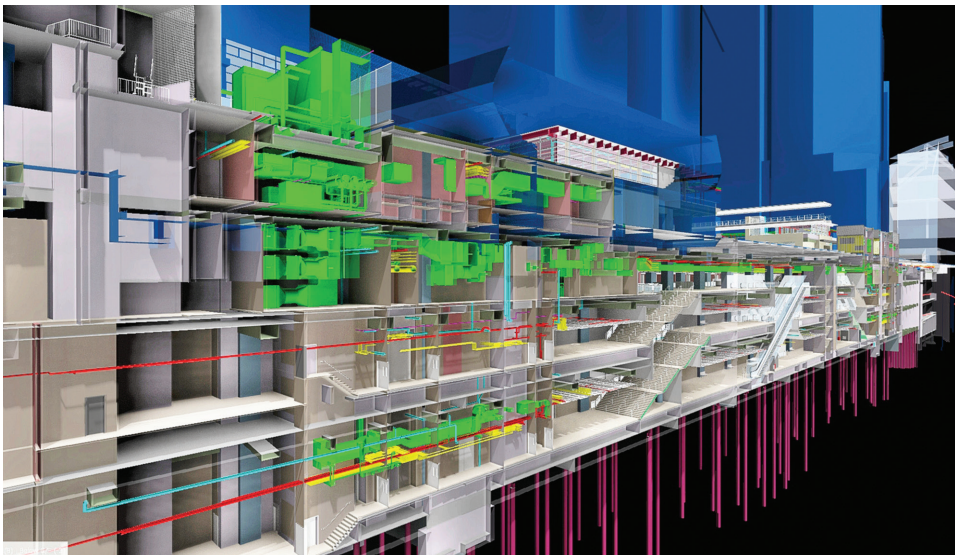
Image courtesy of Arup

Training crucial for transition to BIM

Arup aims to be at the forefront of technological advances, notes Ir Suen, and now wants to utilise BIM as much as possible in their projects. In fact, Arup has been working with MTRC in fostering the transition to BIM, with the first detail design project developed in 2010 as MTRC's pilot scheme for using BIM. He likens the changes underway to when AutoCAD came into the market during the 1980s, as engineers made a switch from drawing on boards to computer aided design. "We believe that we need designers - architects, along with MEP, civil and structural engineers - doing their own BIM," he says. "We need more training for designers, and we're training modellers to do some design and resolve clashes."

Once the design process is completed, the BIM model will be passed to the contractor, and then developed further so it can be used for construction and facilities management.

"Without BIM, this particular project would have been very tough," says Ir Suen. "It helps to minimise design inconsistencies at the start, and problems can be mitigated efficiently. Even if work reveals changes in the geology, we can include these too."



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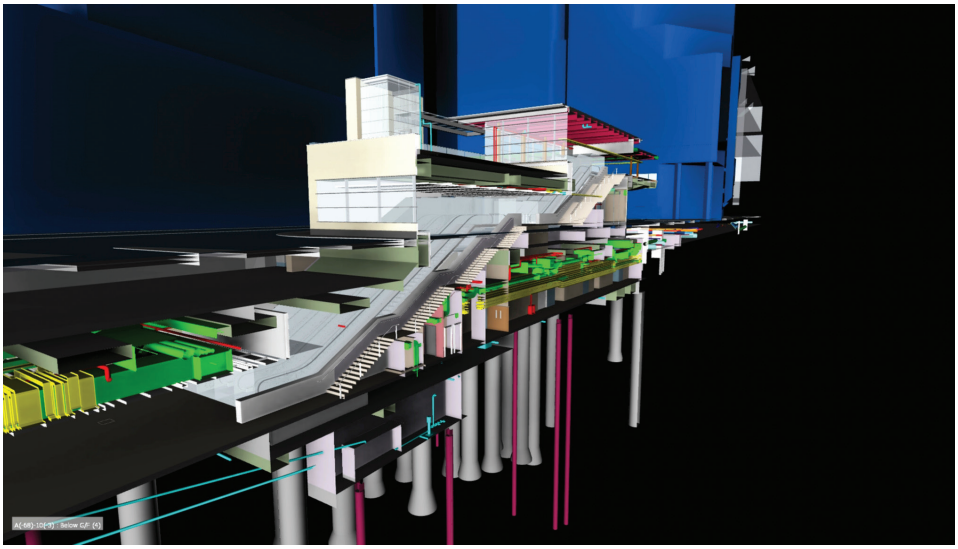

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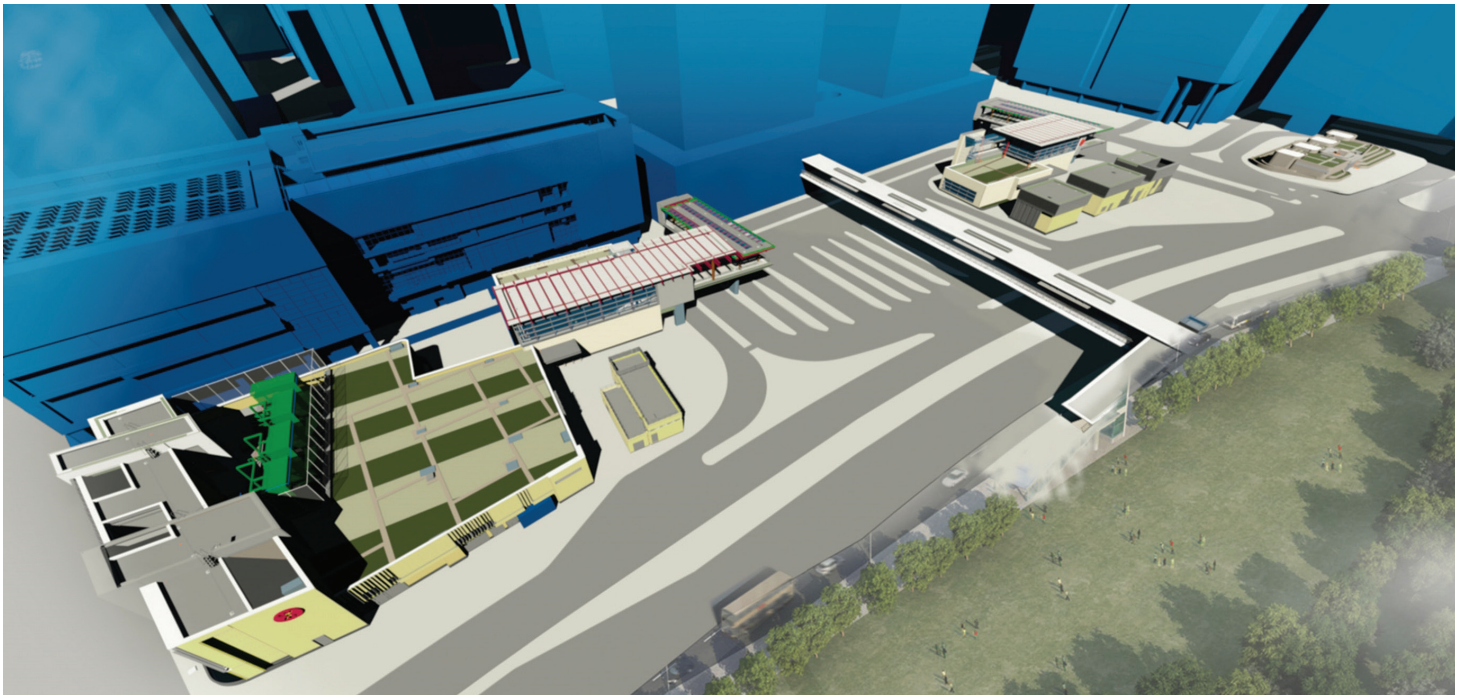

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About Arup

Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. We offer a broad range of professional services that combine to make a real difference to our clients and the communities in which we work.

We are truly global. From 92 offices in 40 countries our 12,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion.

Founded in 1946 with an enduring set of values, our unique trust ownership fosters a distinctive culture and an intellectual independence that encourages collaborative working. This is reflected in everything we do, allowing us to develop meaningful ideas, help shape agendas and deliver results that frequently surpass the expectations of our clients.

The people at Arup are driven to find a better way and to deliver better solutions for our clients. We shape a better world.

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