

COMPANY
Airport Authority Hong Kong
China State Construction Engineering
(Hong Kong) Limited

PROJECT
C3801 APM/BHS Tunnels on Existing Airport
Island

LOCATION
Hong Kong International Airport, Lantau,
Hong Kong

TYPE
Infrastructure/Civil

SCHEDULED TIME OF COMPLETION
February 2022

BIM-through 3D, 4D and 5D BIM dimensions to achieve visualisation, collaboration, automation, estimation and simulation

“BIM is having a profound impact on the construction industry and the way the whole industry works together. We are fully utilizing the digital BIM framework throughout the process which leads to effective teamwork between different stakeholders and contributes to data integration and manageability. We believe the current BIM applications will take us to the next level in the delivery of BIM project.”

— Kingsley Chiang

Project Director,
China State Construction
Engineering (Hong Kong) Limited

AUTODESK PRODUCTS USED

Autodesk® 3ds Max®
Autodesk® AutoCAD®
Autodesk® BIM 360® Docs
Autodesk® Civil 3D®
Autodesk® Dynamo Studio
Autodesk® InfraWorks®
Autodesk® Navisworks® Manage
Autodesk® ReCap® Pro
Autodesk® Revit®

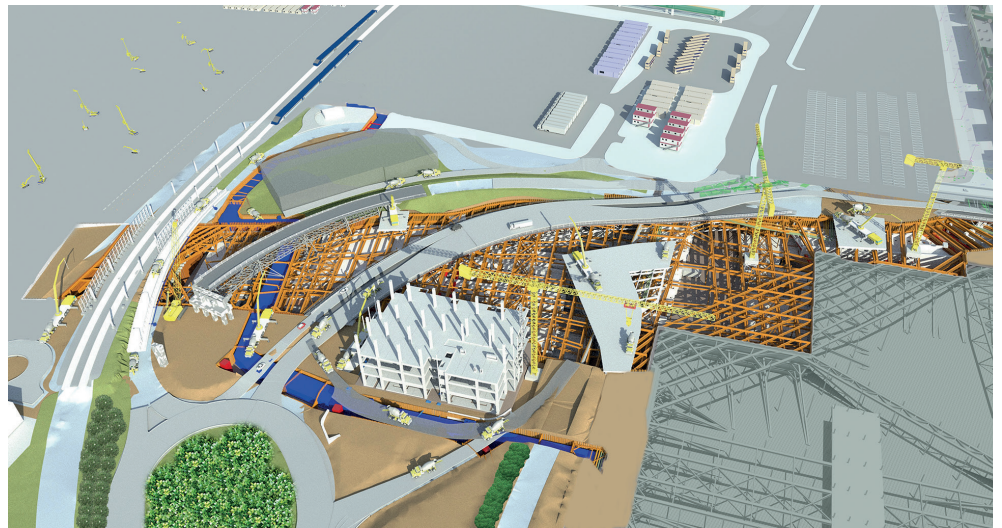
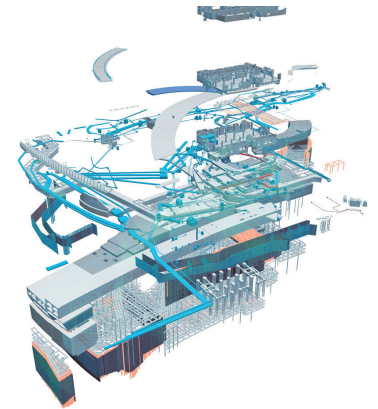


Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited

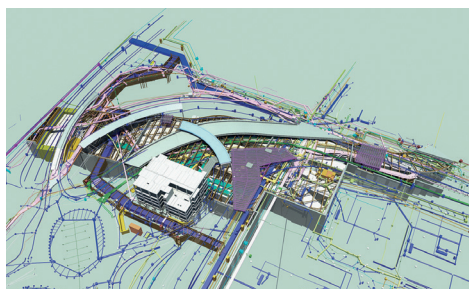
Contract 3801 (C3801) is one of the major Contract of Three-Runway System (3RS) Project of the Hong Kong Airport Authority. As the main contractor, China State Construction Engineering (Hong Kong) Ltd. is undertaking the construction works of C3801 using NEC3 ECC Option D contract. This project is a significant part of the 3RS Project for the connection between Terminal 2 and the newly reclaimed third runway. AAHK and China State are well-positioned to overcome different challenges with the innovative solution of Building Information Modeling throughout the project life-cycle.



C3801 BIM model explosion
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited

APM/BHS Tunnels on Existing Airport Island

The project involves excavation and construction of a 4-cell reinforced concrete



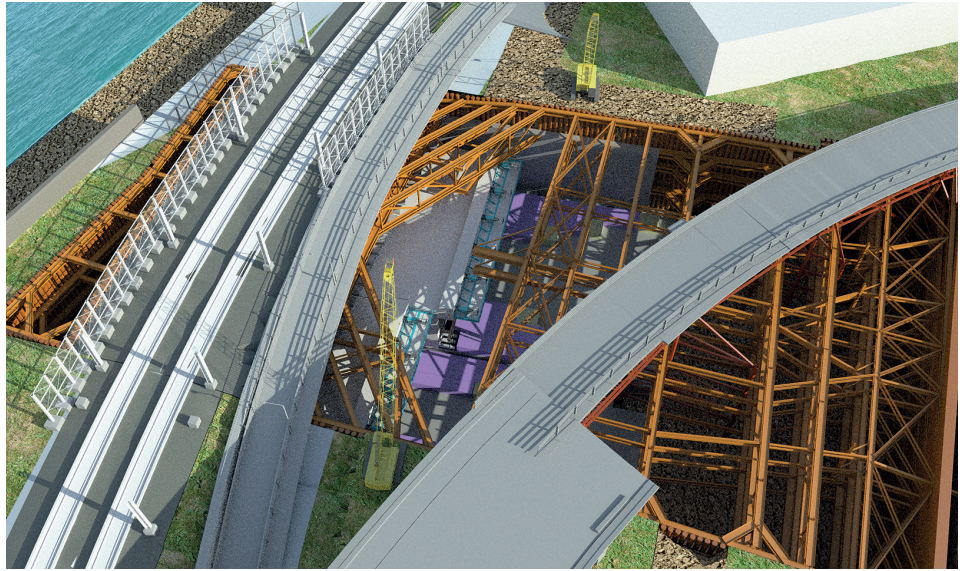
Overview of permanent works and temporary works
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited

Automated People Mover (APM) tunnel, 2-cell Baggage Handling System (BHS) tunnel, box culvert on existing airport island and a section of box jacking tunnel underneath the existing Airport Express Line. The contract also includes all associated road / utility diversions and reinstatement and a series of temporary works.

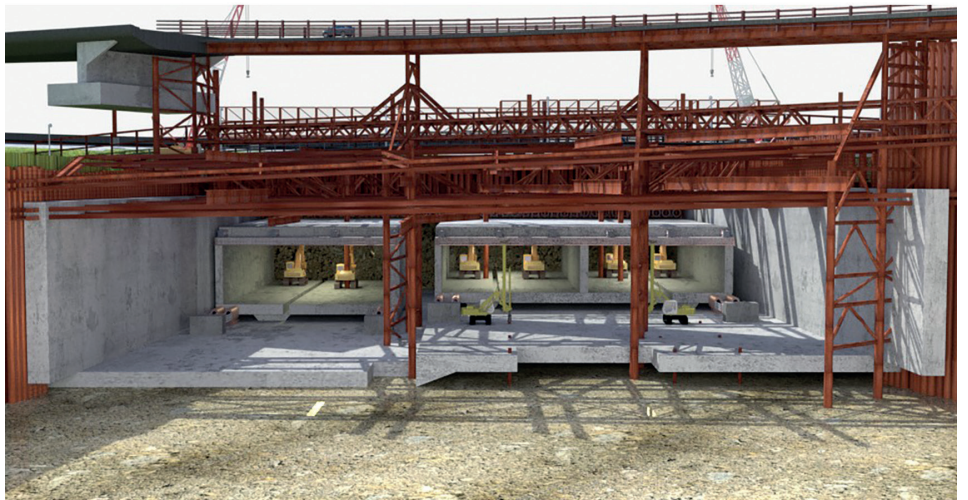
BIM and NEC Collaboration

AAHK and China State understand the paramount importance of collaboration for a high standard of project management. BIM has played a critical role in reforming the information flow and collaboration with the use of Autodesk BIM 360 Docs.

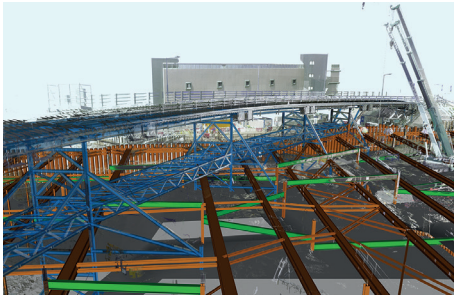
C3801 has set up a Compensation Event Quotation Team, comprising 7 full-time members of BIM engineers, quantity surveyors, engineers and programmer to facilitate the management change throughout the course of works. This team fully utilises BIM as a collaboration platform with AAHK to resolve project difficulties as soon as they were identified, particularly in permanent design optimisation and programme risk reduction associated with interface contracts. BIM also acts as a significant process in quantifying the changes from revised Employer's Drawings and handling the construction sequence issues with the help of 4D simulation.



Jacked box tunnel underneath existing Airport Express Line
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited



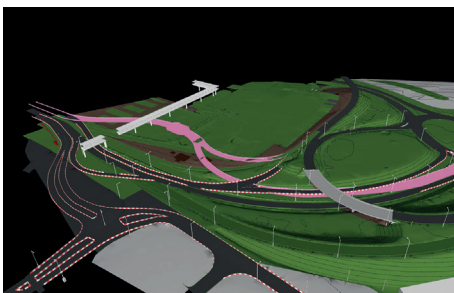
Simulation for construction sequence of box jacking
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited



BIM and point cloud data integration
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited



3D laser scanning technology enhanced the speed and accuracy of data collection from construction sites
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited



Temporary traffic diversion simulation
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited

Complex Temporary Work Design

The BIM provides an accurate digital representation amongst all temporary works in a congested site. It helps design engineers to identify any potential clashes and resolve them during the design stage. Direct data transfer between Revit Structure and load calculation software is adopted in order to accelerate the design coordination process between BIM team and design team.

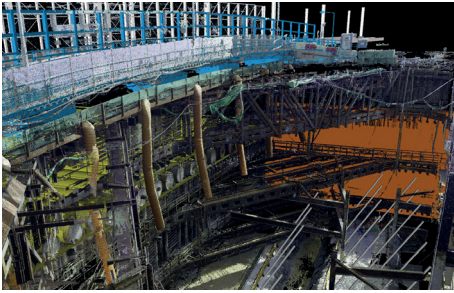
Second Jacked Box Tunnel in Hong Kong

C3801 is the second project to carry out box jacking technique in the Hong Kong construction market. To avoid disruption to the operation of AEL with strict settlement requirement is one of the critical challenges in C3801. With different BIM applications, the project team has taken immense steps forward both in mitigating the working restrictions and bringing forward new ways working.

Unseen underground condition has high level of risk and uncertainty. To address this, geological condition is modeled using Autodesk Civil 3D to visualize the complex geology in box jacking zone. The BIM model offers an all in one visual database for justifying, positioning, foreseeing, analyzing geological condition with other construction tasks to monitor the workflow during deep excavation and box jacking.

Laser scanning technology is also deployed to take accurate point to point measurements of 15m depth cofferdam with 4 layers of ELS. When Autodesk Recap Pro combines with Civil 3D Volumes Dashboard function to perform earthwork balance calculation, it facilitates site logistic and site safety analysis in depth. Total volume in cut/fill between soil and rock can be extracted to the engineers and quantity surveyors for further numerical analysis.

Logistics and hoisting method statements were also coordinated with the use of BIM. Together with the client's



A 3D visualization of BIM with dense point clouds for taking accurate, point to point measurements of existing conditions
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited



BIM and point cloud data integration for 5D earthwork calculation
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited



Augmented Reality (AR) with BIM
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited

representative, manufacturer, logistic contractors, in-house safety and trade engineers, the methodology was clearly communicated and reviewed together using 3D simulation.

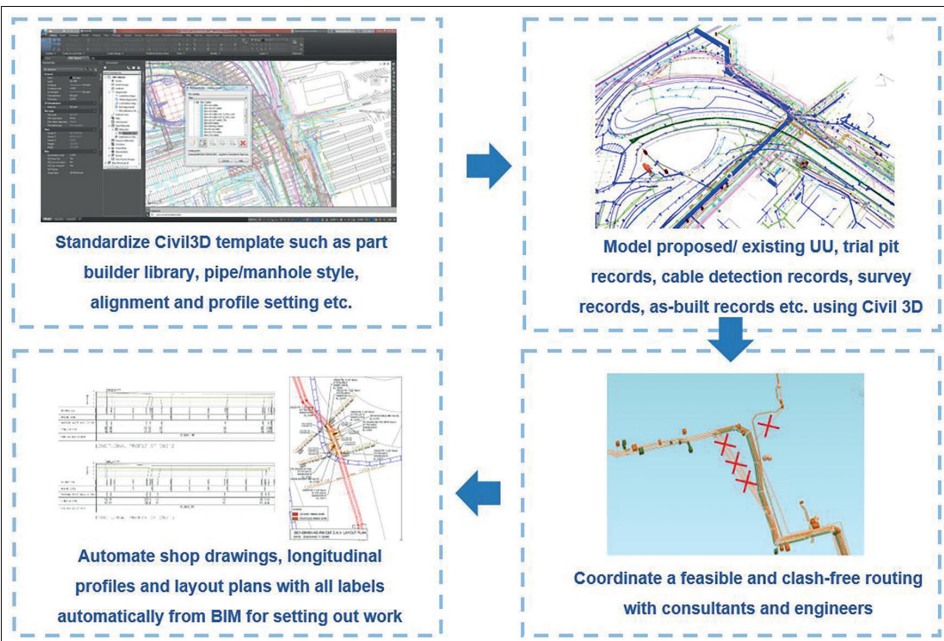
BIM-based Underground Utilities Management System

Managing 13 disciplines of underground utilities within the construction site is a critical challenge for C3801. In order to minimise disturbance, a BIM-based underground utilities management system is developed. Compared with traditional methods, this management system shall be performed during early stage of identifying design uncertainties. The procedures are starting from Civil 3D model establishment, design optimization, site construction and

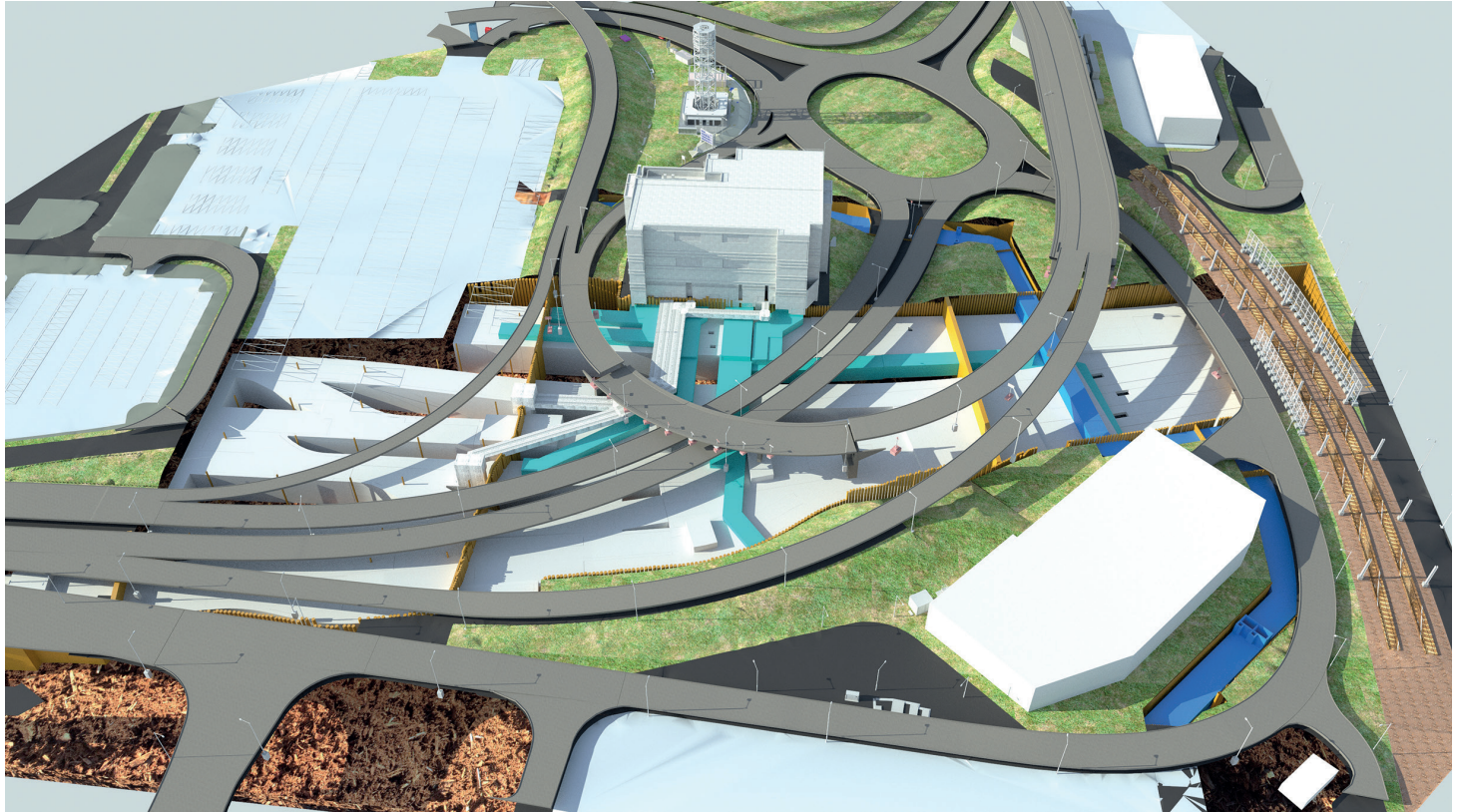
as-built recording. The engineers use this BIM-based system to brief the site worker before digging. AR technology is applied to superimpose BIM models into actual location of the verified or the proposed underground utilities with layering of the underground utilities. It is effective in reducing risk for abortive work and damage of existing underground utilities. BIM has a profound impact on the way the project team works together and handles with different information.



Virtual three-dimension models with physical reality for avoiding underground utilities damage
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited



BIM-based underground utilities management system
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited



BIM model of C3801
Image Courtesy of Airport Authority Hong Kong and China State Construction Engineering (Hong Kong) Limited

About Airport Authority Hong Kong

The Airport Authority Hong Kong is a statutory body wholly owned by the Hong Kong SAR Government established in 1995. It is responsible for the operation and development of Hong Kong International Airport (HKIA), aiming to strengthen HKIA as the leading international aviation hub and a key engine for the economic growth of Hong Kong. Currently, the Company is committed to the Three Runway System (3RS) Project, which is the largest complex infrastructure development in Hong Kong. The 3RS project comprises 650 hectares of reclamation, a new runway and concourse, expansion of T2, new Automated People Mover system and Baggage Handling system, and other related facilities. Upon commissioning, it enables the capacity of HKIA to increase to over 100 million passengers and 9 million tonnes of cargo by 2030, catering for the long-term air traffic demand in Hong Kong.

About China State Construction Engineering (Hong Kong) Limited

China State Construction started its construction business in Hong Kong since 1979. It is a vertically integrated construction powerhouse, engaging in building construction and civil engineering operations as well as foundation work, site investigation, mechanical and electrical engineering, highway and bridge construction, ready-mixed concrete, pre cast production and infrastructure investment. In July 2005, China State Construction was listed on the Main Board of The Hong Kong Stock Exchange (stock code: 3311). China State Construction is amongst the largest construction contractors in Hong Kong to deliver Buildings, Port Works, Roads and Drainage, Site Formation and Waterworks. Currently the Company is one of the biggest NW2 contractors for Hong Kong Housing Authority projects.