Ir. Lee Ming Kiu, Owen

MBA (Distinction), MSc (CPM) (Distinction), BEng (CivE) (Hons), PgDip (Arb & Med), ProfDip(OSH), CCBM, CEng, MICE, MIMMM, FGS, MCIHT, MCInstCES, MCIArb, MHKIE, MIEAust, CPEng, MIES, MASCE, MCSCE, MHKIBIM, MHKICBIM, FHKICAdj, UK RegGEP, Approved Reviewer of IOM3 and RoGEP

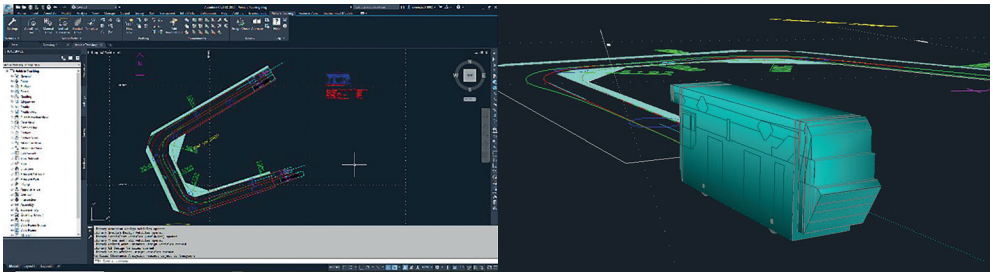
Ir. Owen Lee is currently the Resident Engineer of AECOM Asia Company Limited, leading the digital transformation, BIM adoption and construction innovation of the Sha Tin Caverns Project.

Owen is a Chartered Civil and Geotechnical Engineer, Civil Engineering Surveyor, CIC-Certified BIM Manager, Registered Ground Engineering Professional and Accredited Adjudicator with extensive experience in tendering, construction, engineering design, contract administration and BIM management of mega infrastructure projects.

Owen is also Lecturer (Part-time) at the Technological and Higher Education Institute of Hong Kong (THEi) and the Hong Kong Institute of Vocational Education (IVE) teaching BIM and construction management. He is a member of BIM dispute committee of the Hong Kong Institute of Construction Adjudicators and a professional member of HKIBIM & HKICBIM.

Owen holds a Master of Science in Construction Project Management (Distinction), a Master of Business Administration (Distinction), a Bachelor of Engineering in Civil Engineering (Honours), a Postgraduate Diploma in Arbitration and Mediation and a Professional Diploma in Occupational Safety and Health.

Design for Manufacture and Assembly of Temporary Vehicular Steel Bridge Across A Kung Kok Street of Sha Tin Caverns Project



Swept path analysis of steel bridge deck using Autodesk® Civil 3D
Image Courtesy of Drainage Services Department, HKSAR Government and AECOM Asia Company Limited

Introduction

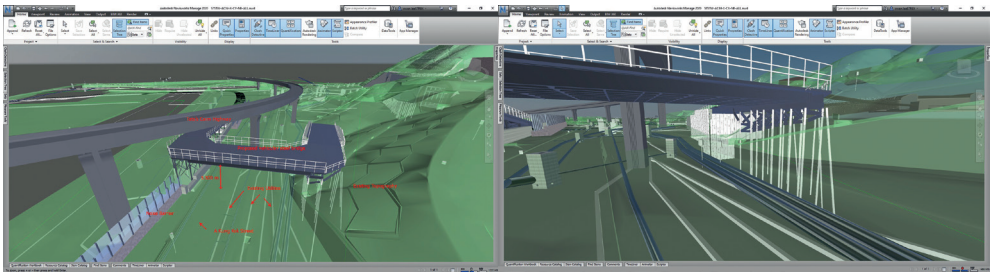
AECOM used Autodesk® AEC Collection and BIM 360 in the design and construction of temporary vehicular steel bridge of Drainage Services Department's Sha Tin Caverns Project. The design and construction of this bridge were particularly challenging because there were design constraints such as existing utilities, topography and bored pile wall and construction constraints such as the closeness of existing Tate's Cairn Highway Flyover and the requirement of maintaining live traffic at A Kung Kok Street during construction.

Bridge Design

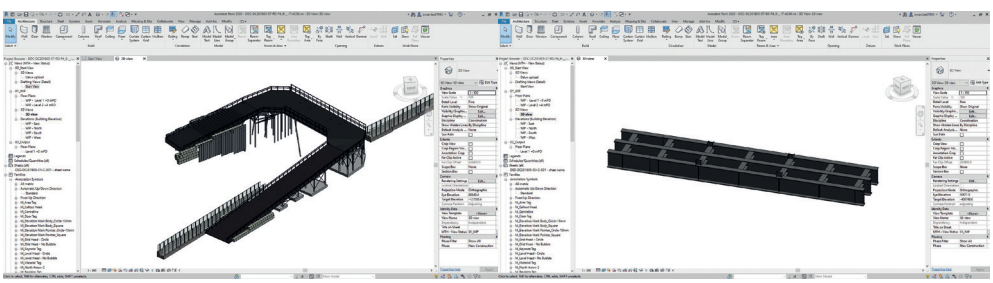
Vehicle tracking was adopted to determine the optimum size of the bridge deck through a swept path analysis. The preliminary design model of the temporary steel bridge developed by Civil 3D was imported to the Revit and further analysed using Robot Structural Analysis. The principles of Design for Manufacture and Assembly (DfMA) and Design for Safety (DfS) were adopted in the design, the bridge deck was divided into segments in consideration of the ease of transportation and lifting as well as minimizing the working at height and on-site welding works.

Fabrication Detailing

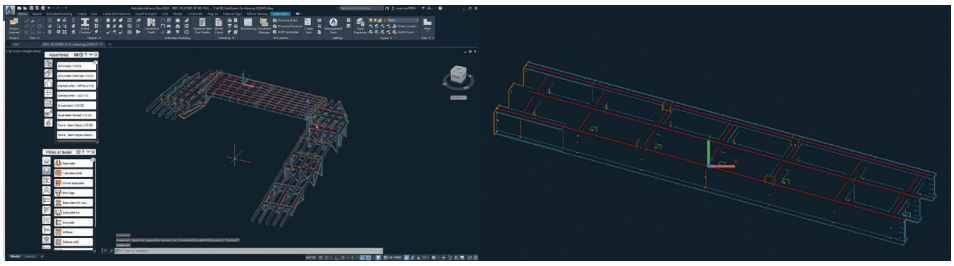
The Revit model of steel structure was subsequently imported to Advance Steel for steel connection detailing. The interoperability streamlined the BIM workflow without the loss of data. Advance Steel offered a library of parametric steel connections that allowed us to model complex steel connections by just entering



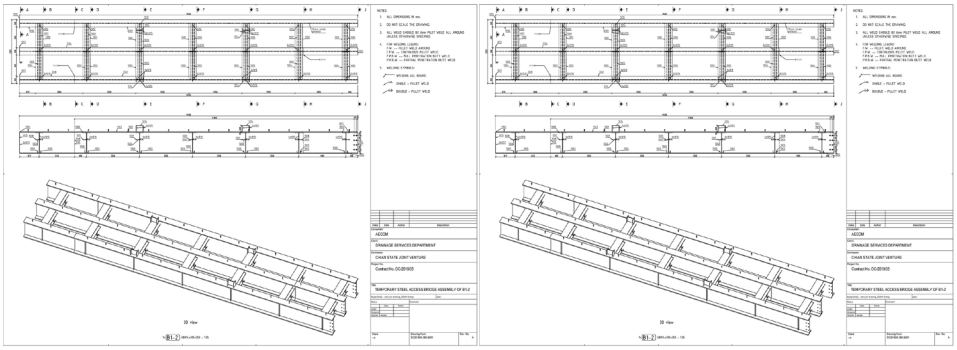
Preliminary design review using Autodesk® Navisworks Manage
Image Courtesy of Drainage Services Department, HKSAR Government and AECOM Asia Company Limited



Detailed design model of temporary steel bridge modelled using Autodesk® Revit
Image Courtesy of Drainage Services Department, HKSAR Government and AECOM Asia Company Limited



Autodesk® Advance Steel Model of the temporary steel bridge
Image Courtesy of Drainage Services Department, HKSAR Government and AECOM Asia Company Limited



Shop drawings generated from Autodesk® Advance Steel
Image Courtesy of Drainage Services Department, HKSAR Government and AECOM Asia Company Limited

Construction simulation of temporary steel bridge using Autodesk® 3ds Max
Image Courtesy of Drainage Services Department, HKSAR Government and AECOM Asia Company Limited

Outcomes and sustainable development

The use of BIM brought many merits to the project team such as facilitating faster decision throughout the project life cycle, reducing time spent in DfMA design as well as decreasing cost and duration of construction through better planning. The ability of BIM application to foster collaboration among the project team, 4D simulation of construction sequence and detection of clash during the logistic planning that eliminated risks and errors during the lifting operation amid constraints of live traffic above and below and two existing piers in the vicinity. To conclude, it is proven that BIM application in temporary steel bridge construction helped in managing the Sha Tin Caverns project effectively in various aspects.

the parameters, leading to substantial time saving when comparing the time required for modelling the same connections in Revit. Since the workflow was bidirectional, in case of any design change, the Advance Steel model of steel bridge could be imported back to the Revit for updating the model of the steel bridge.

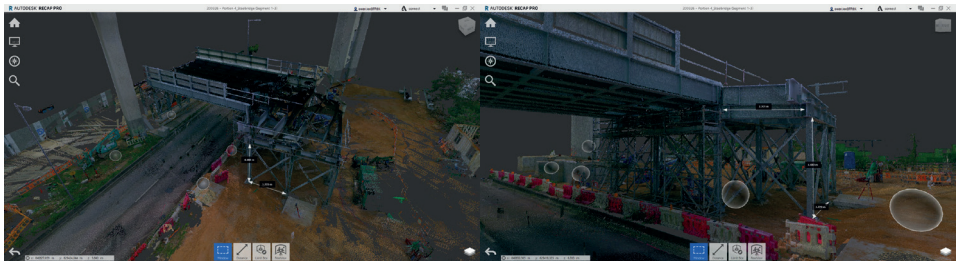
Shop Drawing Production

Shop drawings were automatically generated from Advance Steel by using the Document Manager function. There were several shop drawing styles provided which allowed users to choose their preferred style. The shop drawings generated were subsequently reviewed by the construction team and delivered to the steel manufacturer in Mainland China for fabricating the steel structure.

Lifting & Assembly

The lifting work of the bridge deck segments was challenging because of the closeness of bridge deck and two piers of the existing Tate's Cairn Highway Flyover and requirement of maintaining traffic at A Kung Kok Street. Also, the construction team also needed to compete with time since the team only has two hours to complete the lifting work of three segments.

With the good design and construction planning enabled by BIM and concerted efforts of the project team, all the segments were lifted to the designated installation location according to the lifting plan safely and within the time limit and finally assembled.



Survey check and measurement using Autodesk® Recap Pro
Image Courtesy of Drainage Services Department, HKSAR Government and AECOM Asia Company Limited

Lifting of the bridge deck segments at night and completed steel bridge
Image Courtesy of Drainage Services Department, HKSAR Government and AECOM Asia Company Limited