



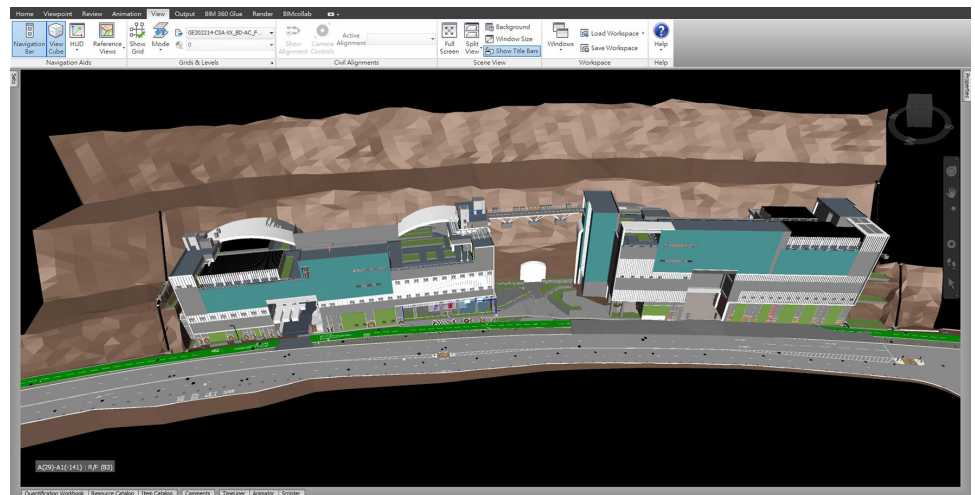
Sr KEUNG Shun Lok
 MSc (Geomatics), CCBM, CCBC, MRICS,
 MHKIS, MCInstCES, MHKInstES,
 MHKICBIM, MHKIBIM

Sr Keung Shun Lok is currently working as a Deputy Survey Manager in China State Construction Engineering (Hong Kong) Ltd. He oversees BIM Implementation, Construction Digitalization and Survey-BIM Integration for three ongoing projects.

Sr Keung is a Chartered Land Surveyor, Civil Engineering Surveyor, CIC-Certified BIM Coordinator and CIC-Certified BIM Manager. He is also a Lecturer (Part-time) at the Hong Kong Institute of Vocational Education (IVE) teaching BIM and land surveying.

Sr Keung holds a Master of Science in Geomatics (Surveying), a Bachelor of Science in Building Surveying (Honours) and a Bachelor of Business Administration in Business Management (Honour). He actively participates as a Committee Member of CICES (HK Region), a Council Member of HKICBIM, an assessor and a counsellor of RICS.

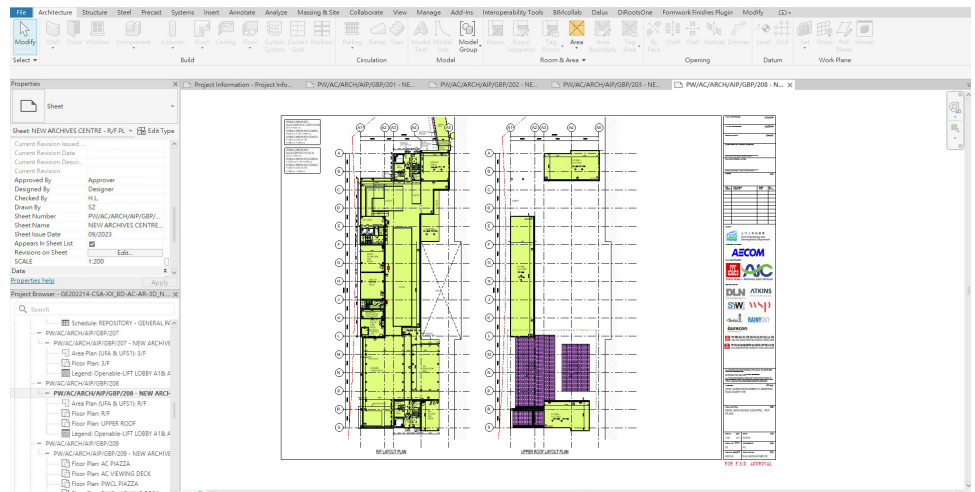
BIM-based Workflow on Design and Build Cavern Development Project at Anderson Road Quarry Site



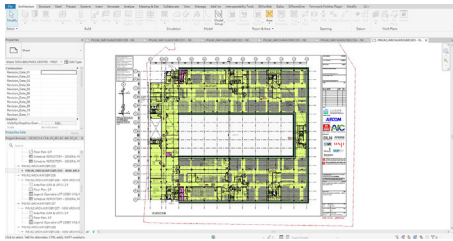
Design Review by Autodesk Navisworks Manage
 Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture

Introduction

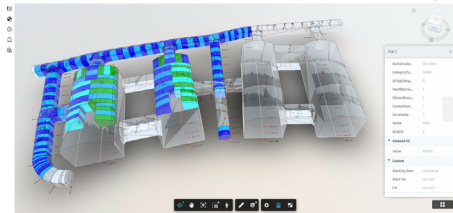
China State - Alchmex Joint Venture used Autodesk AEC Collection and Autodesk Construction Cloud in the design and construction of Joint Cavern Development at Anderson Road Quarry Site (Contract No. GE/2022/14). This is the first time in Hong Kong that caverns are utilized to serve non-infrastructure related facilities. The design and construction of the caverns and buildings were particularly challenging because there was insufficient geometric information, such as alignment data and profile data, available for construction. It was critical to acquire an accurate existing 3D model to facilitate the design of the caverns, adits and buildings. Furthermore, it was necessary to collaborate with cavern drill and blast team and building construction team, with many project stakeholders, to enable on-time project completion.



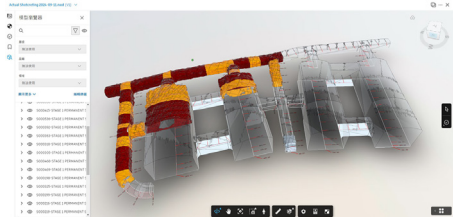
Drawings Generated from Autodesk Revit
 Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture



Drawings Generated from Autodesk Revit
Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture



Progress Monitoring using Autodesk Construction Cloud
Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture



Progress Monitoring using Autodesk Construction Cloud
Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture

Early Design Stage

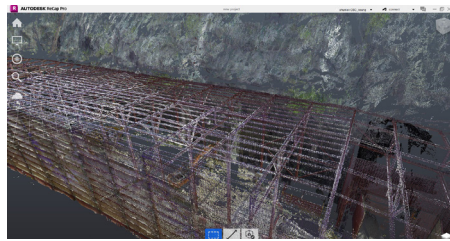
The existing condition model (ECM) has been developed using small unmanned aircraft (SUA) and laser scanning. Concurrently, the first design BIM model was also developed for better collaboration. By combining the ECM and the Design BIM model, the project team could perform better design review and authoring with 3D visualization.

Design Stage

The construction adits and the caverns design were developed through comprehensive analysis with the existing terrain and the design BIM model, and it was validated with swept path analysis using Autodesk Vehicle tracking, after the design of caverns was confirmed, a noise enclosure is going to be constructed to mitigate the noise impact on the sensitive receivers. The design of noise enclosure was modelled using Autodesk Revit and imported into Autodesk 3dx Max for further simulation of the installation sequence and arrangement. Furthermore, Visual programming tool Dynamo with Autodesk Revit was adopted to enhance the efficiency of modelling different options of optical fibers which are important to monitor the stability of caverns. The drawings were automatically generated from BIM models and were subsequently reviewed by the construction team.

Construction Stage

A 3D cavern model was developed and imported into total station for surveying



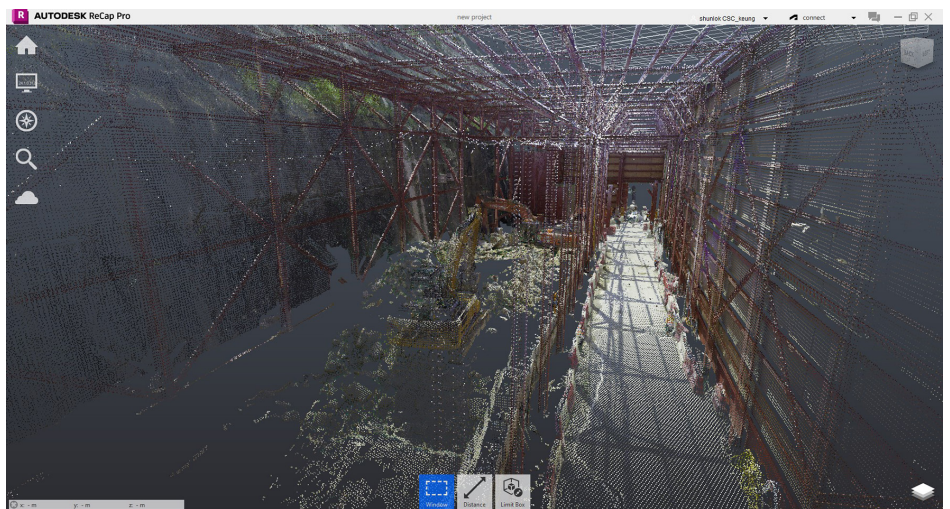
Survey check and measurement of noise enclosure using Autodesk Recap Pro
Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture

works. The survey data used directly from a developed 3D model, enabling the standardization of data, eliminating human error and mistakes, increasing efficiency, reducing time spent inside caverns. In addition, BIM-based progress monitoring was performed with a single source of truth (SSOT) using Autodesk Construction Cloud. The relevant project participants can monitor the blasting progress and shotcreting progress simultaneously. Moreover, BIM has been also utilised in the production of construction method simulation (CMS) and enhanced project quality assurance by as-built/ BIM comparison.

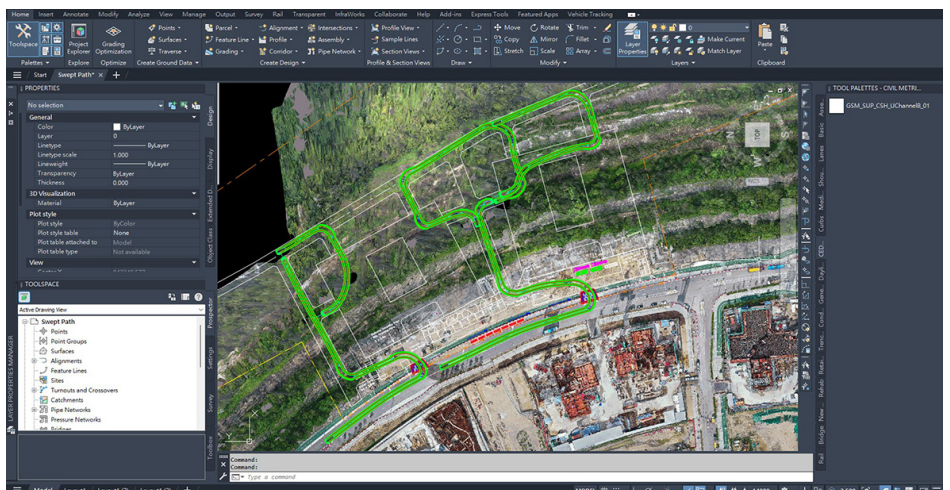
Conclusion

This project is the first time in Hong Kong that caverns are utilised to serve

non-infrastructure related facilities. The project team pledges to fully utilize BIM during the project, a BIM-based workflow is thus established. The adoption of BIM brought many merits to the project team such as better decision-making through the project life cycle, reducing time spent in design stage as well as decreasing cost and duration of construction through better planning. The construction method simulation improves site safety management and education. To conclude, it is proven that how BIM enabled the effective workflow for the construction.



Survey check and measurement of noise enclosure using Autodesk Recap Pro
Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture



Swept path analysis of caverns
Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture