

Autodesk Hong Kong

BIM Awards 2024



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 **AUTODESK**

SPONSOR



ACKNOWLEDGEMENT



SUPPORTING ORGANIZATIONS



Acknowledgement

Sincere thanks to all the winners – ACCIONA, AECOM Asia Company Limited, Architectural Services Department, HKSAR, Arup, China Harbour Engineering Company Limited, China Railway Group Limited and TYFRON Consultancy Limited, China Road and Bridge Corporation, Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region, CLP Power Hong Kong Limited, DCKJV and TYFRON Consultancy Limited, Digie Engineering Technology Pte. Ltd., Environmental Protection Department, HKSAR, Hip Hing Engineering Company Limited, Keppel Seghers – Zhen Hua Joint Venture, Manly-Tech Engineering Limited, MTR Corporation Limited, Paul Y. - Chevalier Joint Venture, Paul Y. - CIMC - JEC Joint Venture, Sanfield (Management) Limited, Shenzhen Yuegang Technology Company Limited, Strategic Building Innovation (SBI) bimSCORE Limited, Sun Hung Kai Properties Limited, The University of Hong Kong (HKU Business School), Water Supplies Department, HKSAR Government, Huang Cong, Keung Shun Lok, Kwok Helen Hoi Ling, Zhang Jiaying, Zhang Xiao in providing such valuable information and pictures of their projects. Besides, we are extremely grateful for the contributions of the advisor - Dr. Calvin Kam who is profiled in this booklet.

Disclaimer

Autodesk Hong Kong BIM Awards 2024.

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Building A More Resilient World Through Collaboration and Innovation

Is the future such a distant concept, or are we seeing its foundations being laid right now?

As we stand on the brink of 2025, the Architecture, Engineering, and Construction (AEC) industry is poised for transformative advancements, fueled by resilience and sustainability. The Autodesk BIM Awards celebrate the pioneers who not only embrace these changes but also lead the charge towards a more innovative and sustainable future. In recent years, we have witnessed extraordinary waves of change, from extreme weather to economic challenges, underscoring the pressing need for technological innovations

that offer long-term benefits. These advancements not only provide insight into our future but also serve as a beacon of hope for the industry.

Autodesk is always seeking to pave the way for partners and organizations to advance society sustainably, as seen in our latest partnership with the LA28 Olympic and Paralympic Games. The Autodesk Design and Make Platform will support LA28's strategy by adapting existing facilities and developing temporary infrastructure, thereby avoiding the need to construct new permanent venues. Today, we have an exciting opportunity to showcase extraordinary projects in Hong Kong that illustrate how technologies like BIM, AI-powered digital design, and smart construction are empowering us to create a more promising future.

This year's Autodesk BIM Award winners exemplify the seamless integration of resilience and sustainability into the built environment. According to Autodesk's latest State of Design & Make report, 27% of organizations have significantly increased their technology investments to enhance project outcomes in the past three years—more than double the overall investment rate. This trend indicates that the construction industry is on the brink of significant technological change. While AI is perceived as a key player in this revolution, two-thirds of industry leaders believe it will redefine business practices within the next two to three years. This is an exhilarating time for our industry, where vision and leadership will pave the way for fresh possibilities and recognition of exceptional talent.

At Autodesk, we partner with the AEC industry to harness and advance technologies like AI, IoT, and digital twins to design and make anything. These evolving technologies, alongside BIM, are the driving forces in the pursuit of an environment that can withstand changes and challenges. In Hong Kong, we are proud to see BIM solutions applied in groundbreaking projects including infrastructure works that bolster resilience against climate change, building of waste management facilities that prepare us for a more sustainable tomorrow, and public transport and recreational projects essential for urban planning as we strive to build a more livable place for all. By recognizing the achievements of these forward-thinking professionals and educators, we not only celebrate their contributions but also encourage the entire industry to adopt best practices that drive game-changing transformations. They've set the bar high through collaboration and innovation, setting a new standard for all to follow.

As we embark on this new chapter in the AEC industry, it is inspiring to witness our collective efforts turning once-impossible goals into reality. On behalf of the Autodesk Asia Pacific team, I congratulate all the winners for their impressive accomplishments, and let's strive to learn from these exemplary projects. By leading the way, we can unlock a myriad of opportunities ahead. Together, we are building a stronger and more sustainable world.

Hari Chazhiottil

Senior Director, Asia Pacific and Japan Marketing, Autodesk

Autodesk Hong Kong BIM Awards 2024

Congratulations to all the winners!

AWARD WINNERS



HONORABLE MENTIONS



YOUNG BIMER OF THE YEAR

KEUNG Shun Lok

OUTSTANDING STUDENTS

The Hong Kong University of Science and Technology
HUANG Cong, ZHANG Xiao, KWOK Helen Hoi Ling, ZHANG Jiaying

Award Winners



ORGANIZATION

Architectural Services Department, HKSAR
Hip Hing Engineering Company Limited

PROJECT

Design and Construction of Expansion of the Legislative Council Complex



ORGANIZATION

CLP Power Hong Kong Limited

PROJECT

CLP Power's Yuen Long Industrial Estate Substation Project

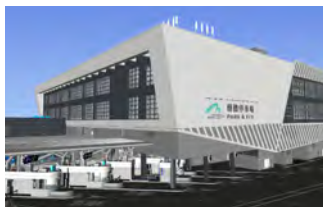


ORGANIZATION

Environmental Protection Department, HKSAR
China Harbour Engineering Company Limited
Keppel Seghers – Zhen Hua Joint Venture

PROJECT

Integrated Waste Management Facilities Phase 1



ORGANIZATION

Paul Y. - CIMC - JEC Joint Venture
Paul Y. - Chevalier Joint Venture
Manly-Tech Engineering Limited

PROJECT

Automated Carpark A and B at HKBCF



ORGANIZATION

Water Supplies Department, HKSAR Government
China Road and Bridge Corporation
Digie Engineering Technology Pte. Ltd.

PROJECT

Construction of Siu Ho Wan Water Treatment Works Extension and Siu Ho Wan Raw Water Booster Pumping Station

COMPANY

Architectural Services Department, HKSAR
Hip Hing Engineering Company Limited

PROJECT

Design and Construction of Expansion of the
Legislative Council Complex

LOCATION

Legislative Council Complex, 1 Legislative Council
Road, Central, Hong Kong SAR

TYPE

Government Offices

SCHEDULED TIME OF COMPLETION

Q2 2026

Prospect Move Forward

"The future of Building Information Modeling (BIM) in architectural design, construction, and manufacturing is poised for transformative growth. I foresee an increasing integration of advanced technologies like artificial intelligence, machine learning, and augmented reality, enhancing collaboration and efficiency across all phases of a project.

BIM will evolve from a static tool to a dynamic platform, facilitating real-time data sharing and decision-making among stakeholders. This shift will streamline workflows, reduce errors, and optimize resource management, leading to more sustainable practices.

Moreover, the role of the BIM will expand to include oversight of digital twins and smart building technologies, ensuring that designs not only meet aesthetic goals but also operational efficiency. As we embrace a more interconnected and data-driven approach, the BIM will be essential in guiding teams through this digital landscape, ultimately delivering innovative solutions that redefine the built environment."

— Brian C Cheung

Assistant Project BIM Manager,
Hip Hing Engineering Company Limited

BIM PARTNERS

Leigh & Orange Limited
WSP Hong Kong Limited
Jangho Group Company Limited
Wing Kei Structural Metalworks Company Limited
Majestic Engineering Company Limited
Young's Engineering Company Limited
China International Marine Containers (Group) Limited
Inhabit Hong Kong

AUTODESK PRODUCTS USED

Autodesk® 3ds Max®
Autodesk® AutoCAD®
Autodesk® Civil 3D®
Autodesk® Docs
Autodesk® Ecotect Analysis
Autodesk® Inventor®
Autodesk® Navisworks® Manage
Autodesk® ReCap® Pro
Autodesk® Revit®
Autodesk® Vehicle Tracking



East Elevation

Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited

Expansion of the Legislative Council Complex: Leveraging Autodesk Software for Efficient Project Execution

The Design and Construction of the Expansion of the Legislative Council Complex is a pivotal project that involves the Addition and Alteration (A&A) of the existing Secretariat Building. This expansion will add 8,500 square

meters of Net Operational Floor Area to accommodate additional legislators. The design aims to harmonise with the existing Legislative Council Complex, the adjoining Central Government Offices, and the Chief Executive's Office. To achieve this, the project's height and massing have been optimised, and the façade will utilise consistent materials and colours to maintain a cohesive appearance.



Elevation

Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



Entrance
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited

A&A Works and Documentation

Accurate documentation of existing conditions is critical to the A&A works. Traditional as-built drawings may not always reflect the true state of the building due to changes over time. The project team employs advanced technologies such as point cloud scanning and 360-degree photography to address this. These methods allow for precise documentation of the building's current state, facilitating better design integration.

The point cloud data can be directly incorporated into design models, allowing designers to quickly identify potential issues and adapt the project to real-world conditions. This level of accuracy is essential, especially when working within the confines of an existing structure.

Design for Manufacturing (DfMA) and Modular in Construction (MiC)

A key innovation in this project is using Modular in Construction (MiC) technology. This expansion marks the first instance where structural steel MiC modules will be installed atop an existing reinforced concrete structure. The project will consist of 286 MiC modules, with the L-shaped portion featuring structural elements and the triangular infill portion comprising non-structural modules.

Each floor in the L-shaped portion will house 15 legislative offices, meeting rooms, restrooms, and pantry areas, with each office covering approximately 60 square meters. These offices are constructed by assembling three modules, which include separate offices for legislators and open-plan spaces for staff.

BIM software plays a pivotal role in the manufacturing process of the MiC modules. Using the design models, our manufacturer could easily import them into Inventor. The team can simulate the performance of these components under various conditions, ensuring that they meet safety and design standards. The ability to run simulations helps identify potential issues before they arise, allowing for adjustments in the design that can significantly reduce risks during construction.

Moreover, Inventor's capabilities for generating detailed fabrication drawings streamline the manufacturing process, ensuring that the modules are built accurately and efficiently in the factory setting. This is particularly important given the Just in Time (JIT) delivery approach adopted for the project, which

minimises on-site storage and optimises logistics.

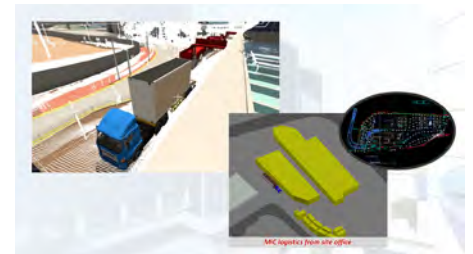
BIM for Site Logistics and Logistics Planning

Civil 3D is another critical tool in this project, particularly for site design and logistics planning. This software assists in analysing the existing infrastructure, which is vital for determining how to efficiently deliver the MiC modules to the site.

One of Civil 3D's notable features is its vehicle tracking capability. This allows the project team to simulate vehicle movements and assess the logistics routes for delivering the MiC modules. By testing various scenarios, the team can identify the most efficient paths for transportation, minimising disruptions and ensuring that deliveries occur smoothly within the limited site area.



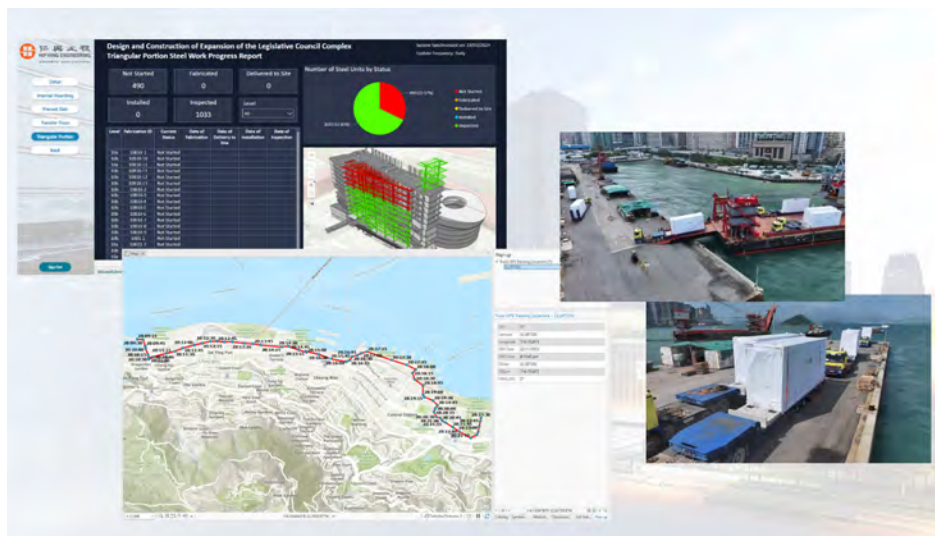
Site Documentation
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



Logistic considerations for MiC Delivery
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



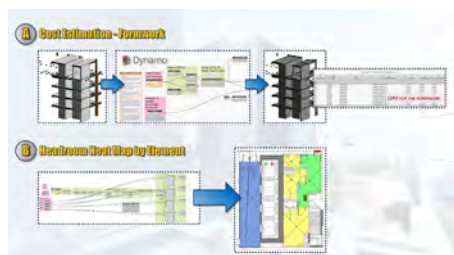
Legislator's Office
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



Hip Hing IIMP
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited

the construction industry. The project team enhances design accuracy, manufacturing efficiency, and logistical planning by leveraging the Autodesk suite, which includes Revit, AutoCAD, Inventor, 3ds Max, and Civil 3D, among others.

Integrating MiC technology and the IIMP further streamlines project execution, improving safety management and progress monitoring. As a result, the project is well-positioned to meet the needs of the legislators while maintaining harmony with the existing architectural context. This approach sets a standard for future developments and demonstrates how innovation can drive efficiency in construction projects.



Automation
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



Site Planning
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited

Integrated Information Management Platform (IIMP)

The Hip Hing Integrated Information Management Platform (IIMP) is a central management tool that enhances project monitoring. It provides project managers with real-time insights and data necessary for effective decision-making. The IIMP dashboard offers an overview of project progress, supported by data-driven workflows and a Geographic Information System (GIS) platform.

The platform visualises data through parametric 3D models and detailed installation statuses, allowing for efficient construction process management. Features such as live monitoring of Permit-to-work status and AI-enabled cameras strengthen safety management on-site. Additionally, smart monitoring sensors provide environmental data, while daily workforce tracking ensures adequate manpower is available.

One of the key features of the IIMP is the integration of the Programme S-Curve, which enhances progress monitoring and allows for timely interventions when necessary. This capability is crucial in a design-and-build project where rapid changes can occur.

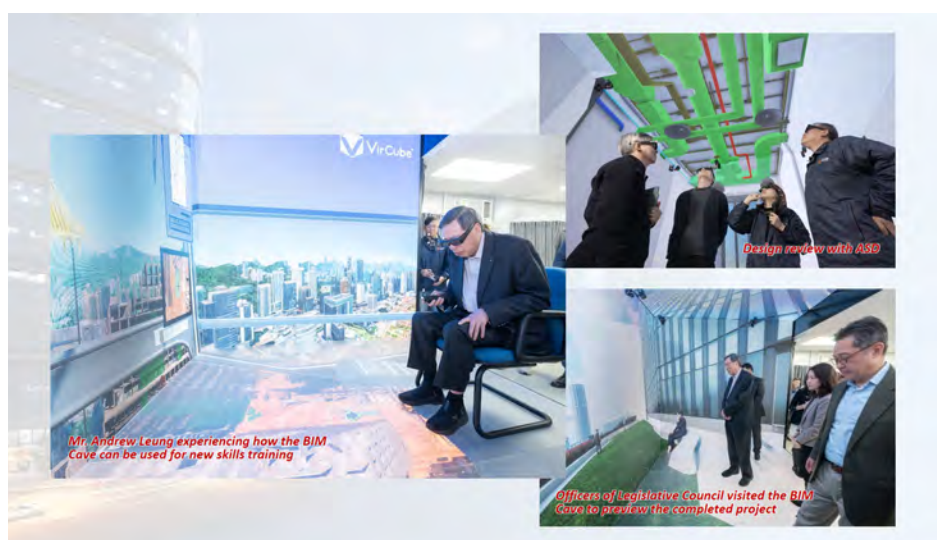
Collaboration and Communication

A Common Data Environment (CDE) is employed alongside the IIMP to ensure all stakeholders remain informed and aligned. This system allows for seamless

information sharing among project teams, ensuring everyone can access the most up-to-date data. The project team achieves efficient cross-platform information exchanges by utilising an online Request for Information (RFI) system and the openBIM approach. This collaborative environment is essential for managing the project's complexities, which involve numerous fast-paced elements. Continuous access to updated information facilitates quick responses to challenges, ensuring the project remains on track.

Conclusion

The expansion of the Legislative Council Complex exemplifies the effective use of modern technology and software in



Collaboration and Design Review using BIM Cave
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



Legislator's Office
Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited

About Architectural Services Department, HKSAR

Architectural Services Department (ArchSD) was found in 1986 serving as one of the works departments under the Development Bureau of the HKSAR Government for the development and upkeep of public facilities. Our aim is to provide efficient and cost-effective professional and project management services for the design, construction, maintenance and refurbishment of government buildings and facilities. We also provide professional and technical advice to the Government and quasi-government organisations. Our vision is to serve and take care of our community by enriching the living environment through high quality professional services; and to promote best practices in the building industry.

About Hip Hing Engineering Company Limited

Founded in 1964, Hip Hing Engineering Co., Ltd. undertakes the design and construction of building and civil engineering works for public sector clients, and it is one of the members of Hip Hing Construction Group ("Hip Hing"). Over the past decades, Hip Hing has grown to become one of the leading contractors in Hong Kong, and has been trusted by our clients to construct many of the landmark buildings which define Hong Kong. Our experience and expertise in the design, procurement, engineering and construction disciplines enables us to provide comprehensive project delivery services. We have also been embracing advancing technologies to take our services to the next level, so as to meet our clients' needs.

COMPANY

CLP Power Hong Kong Limited

PROJECT

CLP Power's Yuen Long Industrial Estate Substation Project

LOCATION

Wang Lok Street, Yuen Long Industrial Estate, N.T. - Y.L.T.L 537

TYPE

Transmission Substation

SCHEDULED TIME OF COMPLETION

June 2025

Unleash Your Potential - One Step, Infinite Power

“CLP Power is dedicated to introducing new technologies to enhance its operational efficiency and performance. One such technology is the application of Building Information Modelling (BIM), which has transformed the approach to our infrastructure projects. By leveraging BIM, our project teams were capable to ensure enhanced precision in every aspect of design and construction. Winning the award highlights CLP Power's commitment to innovation and excellence in providing sustainable and efficient power infrastructure solutions.”

— Chung, Jackson Sai Kit

Manager - Building Information Modelling, CLP Power Hong Kong Limited

BIM PARTNERS

Andrew Lee King Fun & Associates Architects Limited

WSP Asia Limited

Hip Hing Construction Company Limited

Wings & Associates Consulting Engineers Limited

AUTODESK PRODUCTS USED

Autodesk Construction Cloud®

Autodesk® Navisworks®

Autodesk® ReCap® Pro

Autodesk® Revit®

Autodesk® Tandem™

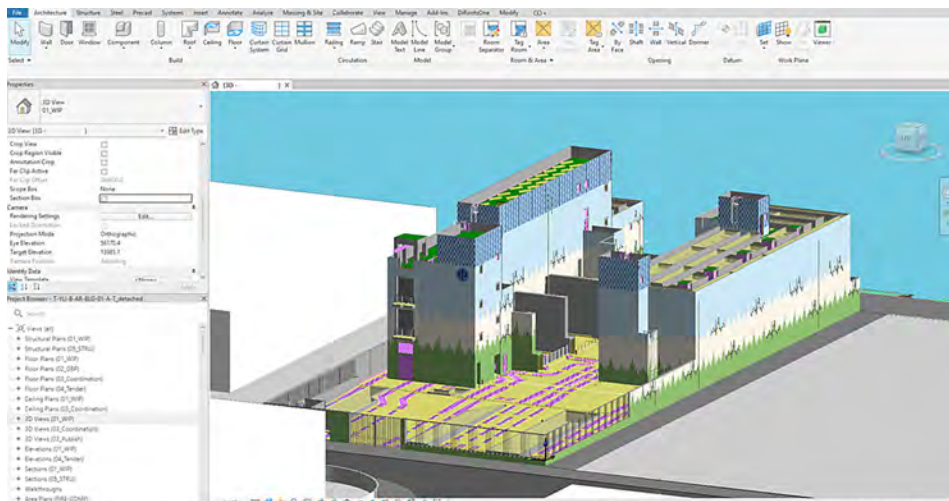


CLP Power's Yuen Long Industrial Estate Substation
Image Courtesy of CLP Power Hong Kong Limited

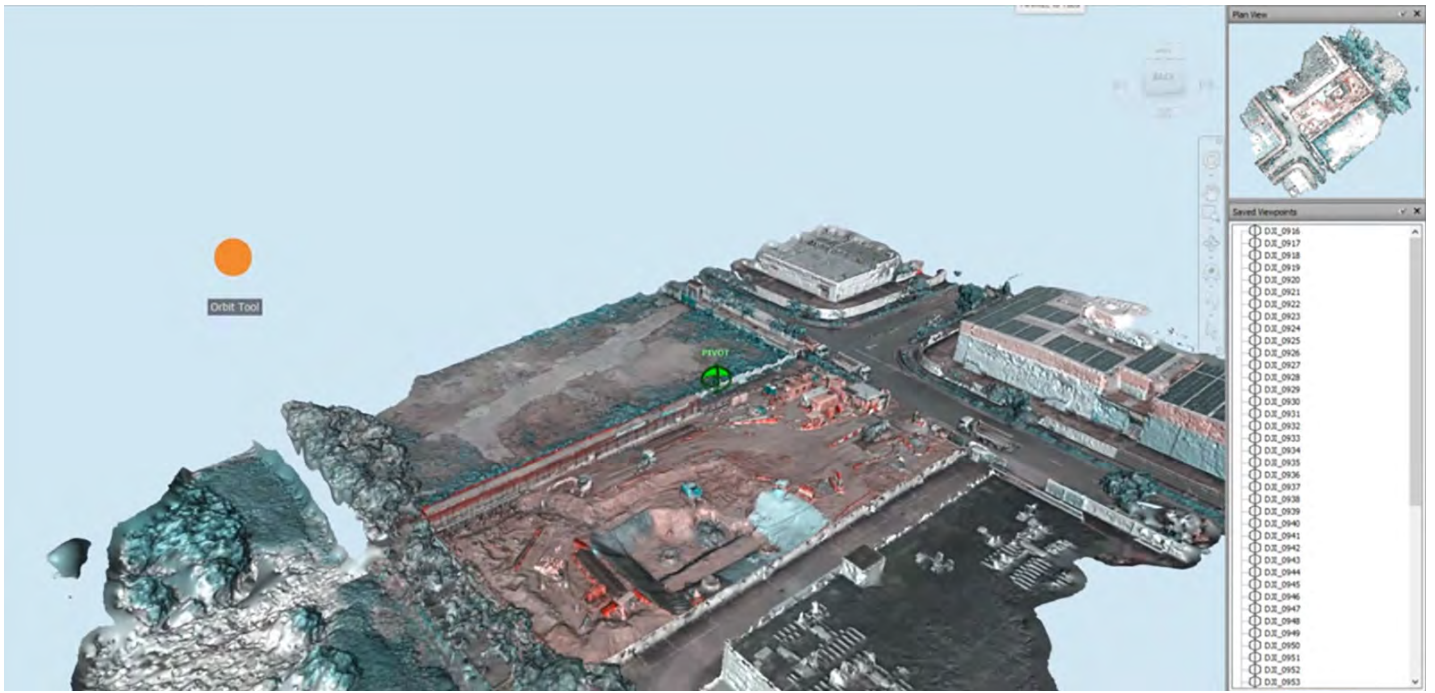
CLP Power's Yuen Long Industrial Estate 132kV Substation is located between Nam Sang Wai and Yuen Long Industrial Estate. This project was initiated to cater for the growing electricity demand arose from nearby urban development and industrial activities. BIM was applied throughout the whole project cycle, including design, coordination, drawing generation, design verification, construction planning, data input and operation.

BIM Application in CLP Power

Since 2014, CLP Power has applied BIM to enhance the operational efficiency and performance throughout the project life cycle, aiming to elevate both current and future endeavours. Our BIM journey began with the foundational pillars of Autodesk Revit and Navisworks, quickly progressing to 3D scanning and 4D animation for more realistic visuals.



Combined revit model of Yuen Long Industrial Estate Substation
Image Courtesy of CLP Power Hong Kong Limited



Point cloud image of Yuen Long Industrial Estate Substation construction site and nearby buildings
Image Courtesy of CLP Power Hong Kong Limited

To meet rising quality standards, we later incorporated automation software like Dynamo, improving both accuracy and efficiency. The adoption of a digital twin platform marked a new chapter in CLP Power's asset management, significantly enhancing data accessibility. We will continue to work on unleashing the full potential of BIM applications.

Substation Design Features

In this project, we utilised a range of tools and methodologies to enhance the efficiency and sustainability of the substation design. Our focus was on maximising the utilisation of renewable energy, natural sunlight, and urban greening.

Using the solar study tool in Autodesk Revit, the project team conducted precise sun path simulations to analyse sunlight and shading in relation to surrounding structures and landscapes. This enabled the strategic placement of photovoltaic (PV) panels at optimal angles, maximising solar exposure and resulting in a notable reduction in the

Project Goal

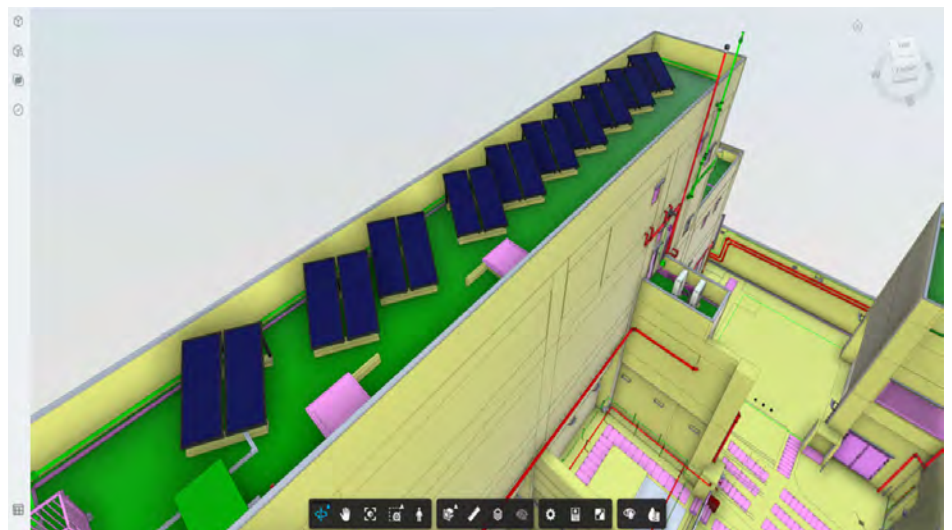
CLP Power cares about its customers and the community, and is committed to minimising environmental impact in its daily operations. Our vision for this development project is to cultivate a sustainable community that blends natural rhythms with modern innovation. By utilising BIM technologies, we enhanced the substation design by integrating the natural landscape of Nam Sang Wai and the industrial aesthetics of the Yuen Long Industrial Estate. We incorporate sustainable development principles and design thinking into both the functional and aesthetic aspects of substation design.



Natural landscape of Nam Sang Wai and the industrial building in Yuen Long Industrial Estate
Image Courtesy of CLP Power Hong Kong Limited



Sapium Discolor and Millettia Pinnata were selected for their climate capability and aesthetic appeal
Image Courtesy of CLP Power Hong Kong Limited



Sun path analysis was performed to maximise solar exposure of PV panels
Image Courtesy of CLP Power Hong Kong Limited

substation's energy usage. Additionally, this approach enhances natural lighting and temperature control, promoting the building's energy efficiency.

Besides, over 20% of the building area will be covered by greenery. Plant species such as *Sapium discolor* (山烏柏) and *Millettia pinnata* (水黃皮) were specifically selected for their compatibility with Hong Kong's climate, resistance to common pests, and aesthetic appeal. The selection and arrangement of colour tiles were also meticulously planned to complement the scenic natural surroundings of the industrial building. This project has been awarded a Provisional Platinum Rating in BEAM Plus New Buildings Version 2.0 certification.

The Yuen Long Industrial Estate Substation not only sets the standard for CLP Power's new substation design, but also serves as a showcase of the company's efforts in technology application and environmental care.



openBIM Model Checker automatically detects missing attributes
Image Courtesy of CLP Power Hong Kong Limited

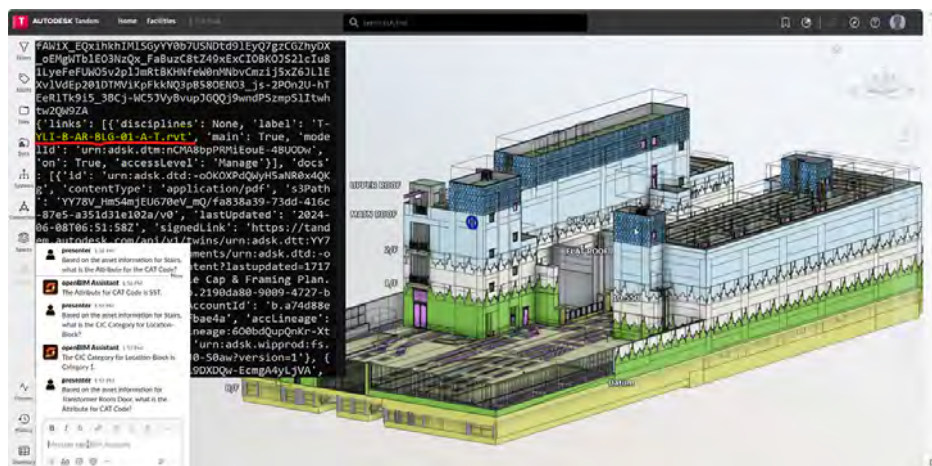


Design verification can be performed by comparing 360 degrees image of actual site and BIM model
Image Courtesy of CLP Power Hong Kong Limited

Smart and Innovative use of BIM

Innovation is often considered vital for addressing future demands in the construction industry. CLP Power is committed to continuous improvement, striving for excellence, and continuously exploring different innovative applications.

A descriptive twin for smart data and document management was created in Autodesk Tandem. It contains construction data that are invaluable for operation and facility management. To facilitate the access to these data for engineers and other professionals, a Tandem-based AI chatbot was created to answer users queries about asset information which extracted from Tandem. The AI chatbot understands natural human language and generates context-aware responses according to the users' search history, preferences and environmental context.



Tandem-based AI Chat Bot answer users queries and generate context-aware responses
Image Courtesy of CLP Power Hong Kong Limited

Furthermore, the manual input of BIM information was susceptible to human errors, potentially compromising the quality of our BIM assets. The team has implemented various Dynamo scripts for automating Revit model processes, as well as data import and export. Additionally, an automatic openBIM model checker has been incorporated to verify the completeness of LOD-I (Level of Development - Information) for individual elements and categories.

Online AR technology, such as OpenSpace was also utilised in this project to overlay virtual BIM elements onto the actual site images, verifying the designs and construction status which enables easy tracking and recording of the site progress.

These innovations have reduced the time required for retrieval of information that is passed from one project phase to another. All project data is defined at a

level of granularity that allows flexible tracking and retrieval of information throughout the project lifecycle, eliminating the need to regenerate the information.

A Greener Future

Care for the environment has always been one of the core values of CLP Power and it was fully demonstrated in the substation project. The Yuen Long Industrial Estate Substation achieves our aim of minimising environmental impact by integrating sustainable development principles and design thinking through the use of BIM technologies. CLP Power will accelerate our efforts to digitalise and decarbonise our operations to promote a greener future.



Over 20% greenery at Yuen Long Industrial Estate Substation
Image Courtesy of CLP Power Hong Kong Limited



CLP Power's Yuen Long Industrial Estate Substation achieved our aim to integrating sustainable development principles and design thinking through BIM technologies
Image Courtesy of CLP Power Hong Kong Limited

About CLP Power Hong Kong Limited

CLP Power Hong Kong Limited ("CLP Power") is the Hong Kong utility subsidiary wholly owned by CLP Holdings Limited, a company listed on the Hong Kong Stock Exchange and one of the largest investor-owned power businesses in Asia. CLP Power operates a vertically integrated electricity supply business in Hong Kong, and provides a highly reliable supply of electricity and excellent customer services to more than 6 million people in its supply area.

COMPANY

Environmental Protection Department, HKSAR
China Harbour Engineering Company Limited
Keppel Seghers – Zhen Hua Joint Venture

PROJECT

Integrated Waste Management Facilities Phase 1

LOCATION

Artificial Island near Shek Kwu Chau

TYPE

Waste-to-Energy Facility

SCHEDULED TIME OF COMPLETION

2025 (Construction) + 15 years Operation

BIM Application in WtE Project under a Design, Build and Operate Contract

“BIM serves as a cornerstone throughout the project lifecycle, aiding in planning, design, construction, and ongoing operation in the IWMF1 project. It plays a crucial role in facilitating effective collaboration within this large scale Design-Build-Operate project. We are committed to adopting innovative approaches to ensure the delivery of a high-quality project.”

— William Chan

Project Manager, Keppel Seghers
- Zhen Hua Joint Venture

BIM PARTNERS

AECOM Asia Company Limited
Asia Infrastructure Solutions Limited
Integrated Design Limited

AUTODESK PRODUCTS USED

Autodesk® 3ds Max®
Autodesk® Advance Steel
Autodesk® BIM 360® Docs
Autodesk® Civil 3D®
Autodesk® Navisworks® Manage
Autodesk® ReCap® Pro
Autodesk® Revit®
Autodesk® Robot™ Structural Analysis Professional



Overview of the IWMF
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture

Project Background

The Integrated Waste Management Facilities Phase 1 (IWMF) project is a Waste-to-Energy (WtE) facility in Hong Kong, aiming to significantly reduce the volume of mixed municipal solid waste (MSW) while recovering valuable resources. With a Design, Build and Operate contract of approximately HK\$31 billion, the facility, located near Shek Kwu Chau island, features marine reclamation, Keppel Segher’s proven incineration technology, and robust pollution control measures. The main processing building houses six moving grate MSW incinerators, ensuring compliance with

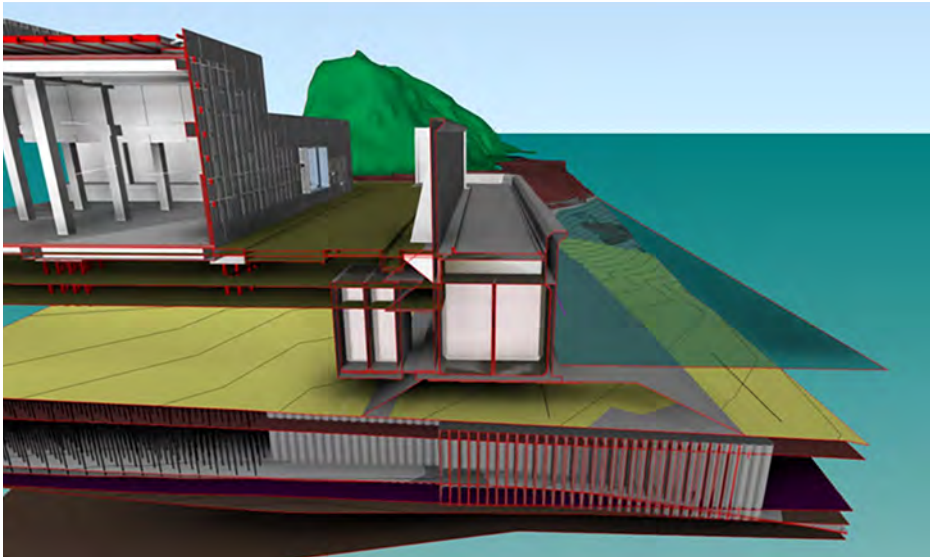
strict emissions standards through chemical scrubbing and activated carbon filtration. The WtE is capable of producing approximately 480 million kilowatt-hours (kWh) of net electricity per year with surplus beyond plant consumption exported to the grid. This green energy will power up 100,000 households and help reduce 0.44 million tonnes of carbon dioxide per year. This initiative will minimize landfill usage, extend landfill life, and support sustainable waste management practices in Hong Kong.

Constraint & Challenges

The IWMF project faces several



Project Site Layout
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture



Project BIM Model
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture

constraints and challenges. The tight 80-month timeline for reclamation and construction complicates project planning and resource management. Its remote offshore location limits land access, resulting in significant logistical difficulties. Additionally, the involvement of international stakeholders from countries like Singapore and Belgium requires a platform for effective communication and collaboration owing to the inability to always have physical meetings. Finally, with over 140 companies from various disciplines – including civil, structural, architectural, and mechanical engineering involved, the project encounters complex management challenges that require careful coordination and oversight to ensure successful execution.

Advantage of BIM in DBO Contract

The adoption of BIM in the DBO contract for the IWMF provides numerous advantages. It ensures a coordinated approach throughout all project phases, enhancing constructability assessments and reducing variations and clashes during construction. Utilizing 3D and 4D components facilitates effective reporting, review, and decision-making. The integration of 6D BIM with Computerized Maintenance Management Systems (CMMS) enhances operational efficiency post-construction. With over 200 stakeholders collaborating through Autodesk's BIM 360 platform, communication and coordination are significantly improved. To resolve the design issues in this mega project, weekly BIM Coordination and CSD/CBWD meetings involve construction and operation team representatives, ensuring designs are suitable for implementation; by Q3 2024, more than 250 BIM Coordination and 130 CSD/CBWD meetings have been conducted. Innovative applications, including 4D planning, quantity take-offs, and virtual reality for public engagement, further

enhance project delivery, reduce risks, and improve lifecycle management.

Innovation Adoption in Maritime Project

While BIM adoption is common in civil and building works in Hong Kong, examples in maritime projects are limited. Our project was initiated in late 2017 and without detailed BIM requirements. We have proposed several BIM applications to minimize onsite issues and ensure effective project delivery, enhancing overall efficiency and coordination.

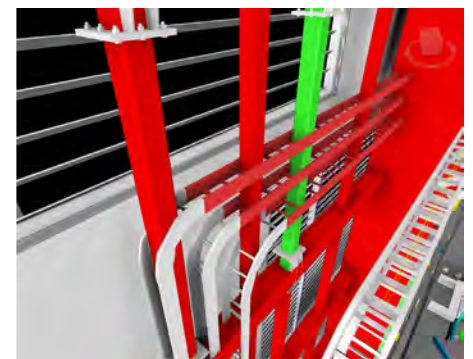
a) Caisson Design and Installation

To initiate the project, we first needed to reclaim an artificial island before constructing the Waste-to-Energy (WtE) facilities. For this project, we

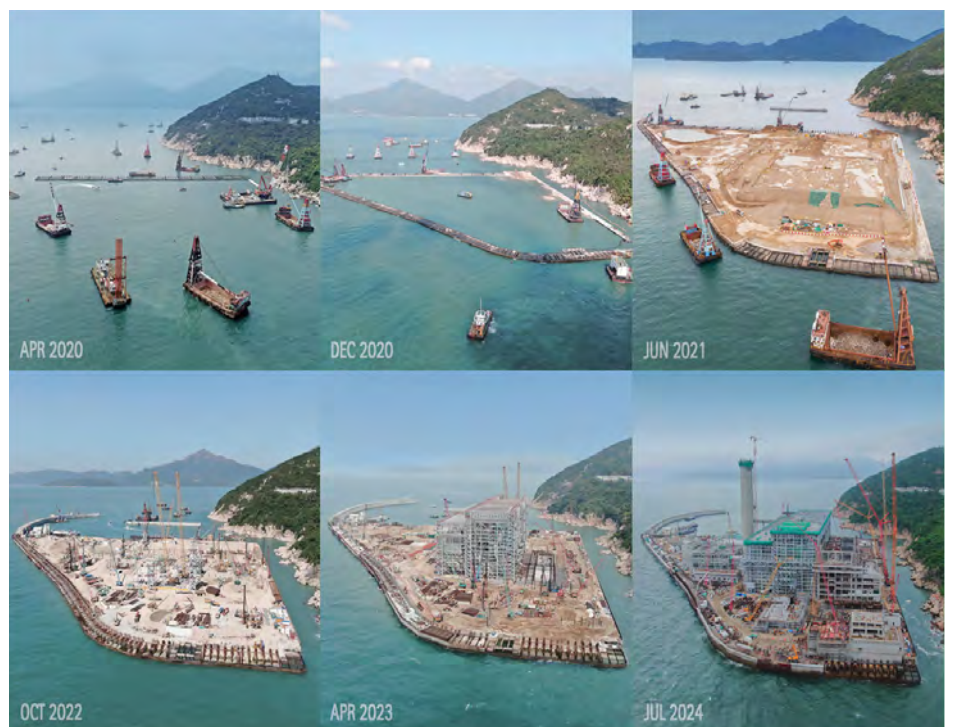
adopted a caisson-type seawall, which were prefabricated in mainland China. We utilized Autodesk Robot Structural Analysis and Revit for the design and modeling of the seawall caisson. Due to the COVID-19 pandemic, site visits to the prefabrication yard in mainland China were not allowed. As a result, we relied on the BIM model to coordinate with the yard, ensuring that the prefabricated caisson conformed to the approved design and minimizing errors caused by insufficient details and sections. Before the caisson's delivery via a semi-submersible barge, we conducted a 3D seabed scan to verify the current seabed conditions. If the seabed level was found to be higher than the design level, we would perform seabed trimming to ensure proper installation of the seawall caisson. This approach enhances safety performance and quality control.

b) Modular integrated Construction (MiC) Approach

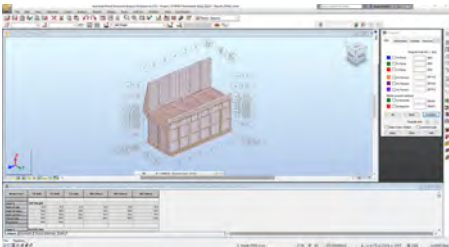
As previously mentioned, the remote location of our construction site presents challenges for on-site building activities. To tackle this issue, we aim to



Clash Analysis
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture



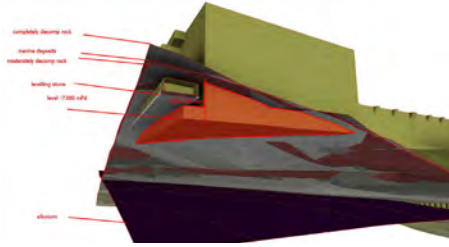
Project Progress Photo
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture



Caisson Design with Autodesk Robot Structural Analysis
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture



3D Scanning by UAV
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture



Caisson Model Review with 3D Seabed Scanning
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture



4D Simulation for MiC unit Delivery
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture

maximize offsite prefabrication. Given the requirement to complete reclamation before starting building construction, we propose adopting modular integrated construction techniques. The equipment within the process building is divided into 17 modules, consisting of 6 boiler modules, 6 flue gas treatment systems, and 5 pipe gallery modules, totalling 50,000 tonnes. These modules include over 110,000 structural components and 270,000 equipment parts, all connected by nearly 2 million bolts. Each module requires approximately one year prefabricating and employs about 500 workers simultaneously during peak periods, making it one of the largest components of its kind in the world.

To effectively implement this innovative construction method, we resolved all potential clashes during the project's early stages. Once approved, the modules were prefabricated in Zhuhai. Each module, measuring 58x25x50 meters and weighing 6,000 tons, required meticulous planning of delivery routes for the Self-Propelled Modular Transporters (SPMT). Prior to delivery, we conducted a 4D simulation to evaluate the interaction of various on-site activities and mitigate construction risks. We also utilized 3D printing to demonstrate the installation sequence to the management team. Ultimately, all modules were successfully delivered to our site. This innovative construction method enhances production efficiency,

construction quality, site safety, and environmental performance, while significantly improving digital visualization and project management efficiency, leading to a 20% reduction in the construction period.

BIM Adoption in Operation

In the operation phase of the IWMF project, BIM adoption enhances efficiency and asset management. The 6D BIM model integrates operational data with Computerized Maintenance Management Systems (CMMS), allowing for real-time monitoring and management of assets. This integration facilitates predictive maintenance, improves resource allocation, and optimizes operational workflows. Additionally, the BIM model provides a comprehensive visual representation of the facility, supporting training simulations and operational planning. By leveraging BIM throughout the operational phase, the IWMF project ensures sustained performance, reduces downtime, and enhances overall facility management effectiveness.



Actual MiC unit Delivery on site
Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture



Project Artist's Impressions

Image Courtesy of Environmental Protection Department, HKSAR and China Harbour Engineering Company Limited and Keppel Seghers – Zhen Hua Joint Venture

About Environmental Protection Department, HKSAR

The Environmental Protection Department (EPD) of the Hong Kong Special Administrative Region (HKSAR) is the government agency responsible for safeguarding the environment and promoting sustainable development. Established in 1986, the EPD implements policies and regulations related to air quality, waste management, water resources, and noise control. The department aims to enhance environmental quality through various initiatives, including pollution prevention, public education, and community engagement. By collaborating with local and international stakeholders, the EPD strives to address environmental challenges and promote green practices across Hong Kong, ensuring a cleaner, healthier, and more sustainable living environment for current and future generations.

About China Harbour Engineering Company Limited

China Harbour Engineering Company Limited (CHEC) is a leading global construction enterprise specializing in marine engineering, infrastructure development, and urban construction. Established in 1980 and as a subsidiary of China Communications Construction Company (CCCC), CHEC has extensive experience in designing and executing large-scale projects, including ports, bridges, tunnels, and airport facilities. The company is recognized for its innovative engineering solutions and commitment to quality, safety, and environmental protection. With a strong international presence, CHEC has successfully undertaken projects across Asia, Africa, the Americas, and Europe, significantly contributing to infrastructure development and fostering economic growth in various regions around the world.

About Keppel Seghers – Zhen Hua Joint Venture

Formed by Keppel Seghers Hong Kong Limited and Zhen Hua Engineering Company Limited. Established to leverage their combined expertise in Waste-to-Energy (WtE) technologies, this joint venture focuses on the design, construction, and operation of advanced waste management facilities. By integrating innovative engineering solutions and sustainable practices, the partnership aims to address environmental challenges and promote resource recovery. With a commitment to delivering high-quality projects, the Keppel Seghers - Zhen Hua Joint Venture plays a vital role in advancing waste management and sustainable development in the regions it serves.

COMPANY

Paul Y. - CIMC - JEC Joint Venture
 Paul Y. - Chevalier Joint Venture
 Manly-Tech Engineering Limited

PROJECT

Automated Carpark A and B at HKBCF

LOCATION

Hong Kong Boundary Crossing Facilities

TYPE

Statutory Project

SCHEDULED TIME OF COMPLETION

2024/2025

Data-Driven Decisions Making in Project Management with BIM

“Data represents the future of our world, and BIM will serve as the crucial foundation for the next phase in the evolution of our building assets.”

— Marvin Lee

Design Manager, Paul Y. Engineering Limited

— Kelly Leung

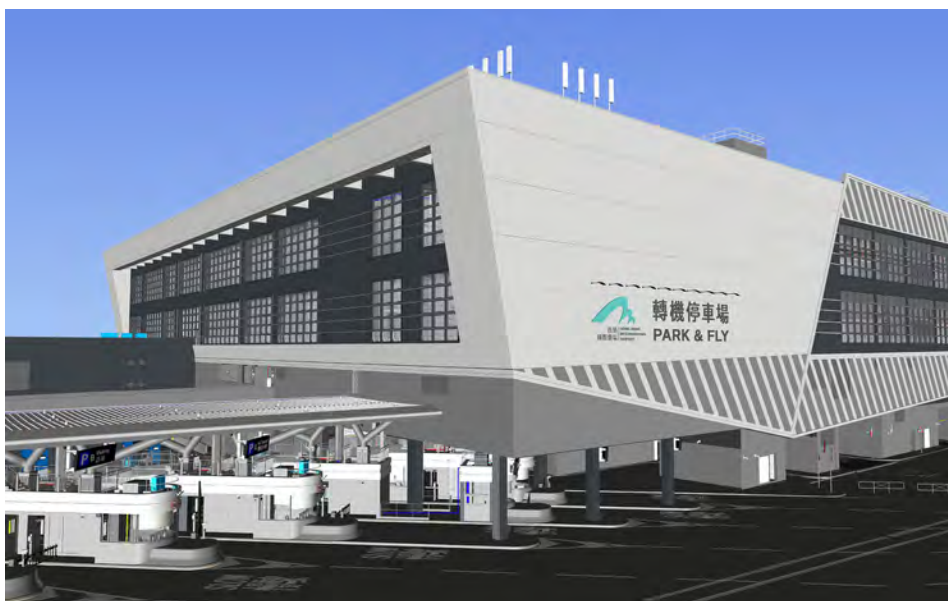
Design Manager, Paul Y. Engineering Limited

— Christopher Wong

BIM Manager, Manly-Tech Engineering Limited

AUTODESK PRODUCTS USED

Autodesk® AutoCAD®
 Autodesk® Civil 3D®
 Autodesk Construction Cloud®
 Autodesk® Dynamo
 Autodesk® Navisworks®
 Autodesk® ReCap®
 Autodesk® Revit®
 Autodesk® Vehicle Tracking



Automated Carpark A Overall View
 Image Courtesy of Paul Y. - CIMC - JEC Joint Venture

The Landmark Project

As mentioned in The Chief Executive’s 2020 Policy Address, “The HKSAR will further leverage the HKIA’s contribution in promoting Hong Kong’s economic development by developing automated car parks on the Hong Kong Boundary Crossing Facilities (HKBCF) Island of the HZMB.” This landmark project has garnered significant media attention.

Under the design-build-operate (DBO)

contract, the JV has been appointed to design and build the automated car park and subsequently operate it for the first few years. This approach encourages us to prioritize the project’s long-term performance from the outset, rather than focusing solely on the efficiency of its construction.

Consequently, we will consider factors such as energy efficiency, maintenance requirements, and lifecycle costs during the design and construction phases.



Automated Carpark A Kiosk
 Image Courtesy of Paul Y. - CIMC - JEC Joint Venture

This comprehensive approach can lead to more sustainable and cost-effective infrastructure in the long term.

Technology-Enabler

The successful implementation of a BIM workflow relies on the use of specialized software tools. For this project, the BIM team utilized a variety of applications to achieve their objectives.

Autodesk Revit and Civil 3D served as the primary design authoring software, enabling the team to create detailed models that accurately reflected the project's requirements. BIM Holoview was employed to conduct feasibility studies, while GAMMA AR was used for site inspections by integrating the models via the Revit plug-in, facilitating effective on-site coordination.

Realistic renderings of the design was then produced for stakeholders to understand the project more easily. Autodesk Recap Pro was used to manage point cloud data captured by laser scanners, ensuring the model accurately represented the physical site conditions.

To further streamline the process, Autodesk Navisworks was used to federate all models into a single environment, offering a comprehensive view of the project's progress. Finally, Autodesk Construction Cloud (ACC) were employed to maintain a single source of information, ensuring stakeholders always had access to the most up-to-date data.

By leveraging these software tools in an integrated manner, the team achieved a highly efficient and effective BIM workflow, resulting in a successful project outcome.

Synergy

Working on multiple teams across two mega projects presents



Automated Carpark B Overall View Rendering
Image Courtesy of Paul Y. - Chevalier Joint Venture

unique challenges. With different teams operating simultaneously, communication gaps, misunderstandings, and conflicting priorities can hinder progress. Establishing effective communication channels and protocols is critical to ensuring that teams can share information and coordinate their efforts efficiently. BIM plays an essential role in facilitating these channels. Regular joint meetings are often necessary to keep all team members up-to-date on project developments and to promptly identify and address issues or conflicts. Joint BIM walkthrough meetings help streamline communication efforts and clarify complex details.

To achieve synergy, it is beneficial for both project teams to adopt a similar approach to BIM management. This ensures that all teams work toward the same objectives using common tools and protocols, reducing the risk of misunderstandings or conflicting priorities.

The Automated Carpark A (ACPA) and Automated Carpark B (ACPB)

projects, located nearby, have many interdependencies. During the design phase, information must be exchanged with other parties for use as reference or background data to aid coordination. Coordination should progress in parallel with design development, addressing both geometric (e.g., spatial) and non-geometric (e.g., performance) aspects. Delays in sharing information can create a ripple effect across the project, impacting teams that depend on it.

To address this issue, the "bridge" function of ACC enables seamless information exchange through folder automation between the 2 projects. For example, project ACPB can retrieve updated and coordinated models from the ACC hub (the CDE) of project ACPA, and vice versa. Once information is deemed suitable for release, authors upload it to the ACC hub in the agreed delivery file format, following processes defined in the project's information production method and procedures. The gateway information check process is then initiated, followed by a review by the discipline task owner (coordinators, engineers, and managers).



Automated Carpark B Driveway Entrance Rendering
Image Courtesy of Paul Y. - Chevalier Joint Venture

To ensure the timely submission of model deliverables, strict adherence to the BIM production schedule is maintained. The model undergoes a series of workflows where it is reviewed by project leaders who either accept or reject it. To maintain consistency and prevent multiple versions of the model and deliverables, the model is sourced from a single source and uploaded to the CDE. Effective workflow management ensures the smooth transfer of the model within the platform and assigns appropriate metadata to the information container. This process not only enhances efficiency but also ensures the accuracy and reliability of the final deliverables.



Automated Carpark A Transfer Cabinets Rendering
Image Courtesy of Paul Y. - CIMC - JEC Joint Venture



Automated Carpark A Lay-by Area Rendering
Image Courtesy of Paul Y. - CIMC - JEC Joint Venture

A Blend of Physical and Digital Worlds

We integrated AR technology with BIM models to enhance site audits, inspections, and installation processes. Quality checks using AR technology were successfully implemented for structural works, architectural features, and the routing of first-fix building services. By overlaying digital models onto the physical environment, construction teams could verify the accuracy of installed building elements in terms of size and location.

Using AR devices, construction workers viewed digital models of building

components in real-time and compared them directly to the physical installation. This innovative approach allowed for the swift identification and resolution of any discrepancies, significantly reducing the risk of errors and delays.

By leveraging BIM models for field installation and inspections, we enhanced both the accuracy and efficiency of the construction process. This methodology minimized the potential for costly mistakes and rework, ultimately contributing to the successful delivery of the project.

An Accurate Representation of Facility Assets

As-built verification is a crucial step in construction projects to ensure that the completed work aligns precisely with the original drawings. To achieve this, we have developed an innovative workflow comprising several key steps.

The process begins with the generation of construction drawings from BIM models. Augmented Reality (AR) is

then employed to monitor both the site works and BIM models in real-time. This enables us to identify any deviations from the design and make immediate adjustments as needed.

Additionally, we utilize laser scanning technology to capture precise measurements and images of the construction site. These scans are compiled into a comprehensive verification report, which is reviewed and signed off by the project manager before submission.

By adopting this workflow, we ensure the creation of an accurate as-built model that meets all employer requirements, delivering a facility representation that aligns with the highest standards of precision and reliability.

Managing Multiple Sources of Information

Managing multiple sources of information is inherently challenging, often leading to inconsistencies, errors, delays, and unnecessary rework. To overcome these issues, we implemented a Common Data Environment (CDE) to centralize and streamline the management of project information.

The CDE allows us to track the source and status of all project data, ensuring transparency and traceability. Additionally, we established clear protocols for uploading, reviewing, and approving information. These protocols have significantly improved the accuracy and consistency of project data, reducing the risk of miscommunication and enabling more efficient project execution.



Automated Carpark A Driver Waiting Area Rendering
Image Courtesy of Paul Y. - CIMC - JEC Joint Venture



Automated Carpark A Segregated Area Rendering
Image Courtesy of Paul Y. - CIMC - JEC Joint Venture

About Paul Y. - CIMC - JEC Joint Venture

The Paul Y. - CIMC - JEC Joint Venture (JV) combines the strengths of three leading firms to effectively manage the Automated Car Park A Phase 1 project. Paul Y. Construction Company, Limited, a renowned local main contractor, leads JV and overseeing the design, build, and operation stages of the project. Shenzhen CIMC Autoparking System Co., Ltd. serves as the designer and fabricator of the automated parking system, while Jardine Engineering Corporation contributes essential technical expertise for key car park operational systems. Their collaborative efforts during the design phase, particularly through the integration of BIM technology, enhance efficiency at each stage of the project. This initiative will provide vital parking and check-in facilities for passengers arriving at the Hong Kong-Macau-Zhuhai Bridge Hong Kong Port for freight transfer to other locations.

About Paul Y. - Chevalier Joint Venture

The Paul Y. - Chevalier Joint Venture (JV) brings together the expertise of these two firms to effectively manage the Automated Car Park B Phase 1 project. Paul Y. Construction Company, Limited, a renowned local main contractor, leads the JV, overseeing the design, build, and operation phases of the project. Chevalier (E&M Contracting) Limited contributes its specialized skills to the initiative. Their collaborative efforts during the design phase, particularly through the integration of BIM technology, enhance efficiency at each stage of the project. This initiative will provide vital parking and check-in facilities for passengers arriving at the Hong Kong-Macau-Zhuhai Bridge Hong Kong Port as tourists.

About Manly-Tech Engineering Limited

Manly-Tech Group of companies is a global BIM consultancy for all construction disciplines and MEP product distribution company headquartered in Hong Kong, having completed many successful BIM projects across a myriad of construction disciplines and building types around the globe - including Hong Kong, China, Southeast Asia, Australia, Europe, the Middle East and Africa. Our numerous awards include the 2023 Hong Kong Most Innovative Enterprise Award, the 2023 Most Innovative Greater Bay Area Award and the 2024 Hong Kong Most Valuable Company Award. We also supported our valued client in achieving The Excellent Building Award of HKIE in 2023.

COMPANY

Water Supplies Department, HKSAR Government
China Road and Bridge Corporation
Digie Engineering Technology Pte. Ltd.

PROJECT

Construction of Siu Ho Wan Water Treatment Works Extension and Siu Ho Wan Raw Water Booster Pumping Station

LOCATION

North Lantau

TYPE

Water Treatment Works

SCHEDULED TIME OF COMPLETION

2025

Full-cycle 2D-7D BIM and Digitalization Implementation in Smart Water Treatment Plant

“Water Supplies Department has adopted Building Information Modelling (BIM) technology in the project of Construction of Siu Ho Wan Water Treatment Works Extension and Siu Ho Wan Raw Water Booster Pumping Station. Having a common goal to utilize BIM for digital project delivery, we integrate data across disciplines throughout the entire project lifecycle in a shared cloud-based common data environment. The data will be also transferred to asset management system for future operation and maintenance of the water treatment plant.”

— **Autonio Chan**

Chief Engineer/Consultants Management,
Water Supplies Department, HKSAR

— **Wang Yanhua**

Chairman and Managing Director, China
Road and Bridge Corporation

— **Yue Qing Hua**

Chairman, Digie Engineering Technology
Pte. Ltd.

BIM PARTNERS

Binnies Hong Kong Limited
Chevalier (Envirotech) Ltd.

AUTODESK PRODUCTS USED

Autodesk® 3ds Max®

Autodesk® Architecture, Engineering & Construction Collection

Autodesk® AutoCAD®

Autodesk® BIM360® Docs

Autodesk® Civil 3D®

Autodesk® Dynamo

Autodesk® Fabrication®

Autodesk® Navisworks®

Autodesk® ReCap®

Autodesk® Rendering

Autodesk® Revit®

COBie Extension for Revit

Model Checker for Revit



Works Completion Renderings of SHWWTW Extension Works
Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.

The Siu Ho Wan Water Treatment Works SHW WTW is a key part of the permanent water supply system for the Hong Kong International Airport, residential development projects in Tai Ho and Tung Chung, Discovery Bay, Hong Kong Disneyland Resort and port development projects in northern Lantau Island. Given the importance of the water treatment works in the water supply deployment, in terms of design, the Siu Ho Wan Water Treatment Works has two raw water sources, one main source and one backup source. The main source is the Tai Lam Chung Reservoir. Raw water is transported from here to the water treatment works through a submarine/onshore water pipe which is about 9 kilometers long with a diameter of 1800 millimeters. The backup water source is the Shek Pik Reservoir, where the water is transported to the plant through a 7-kilometer-long tunnel and a pumping station.



Water Supply of SHW WTW
Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.



Hybrid Reality Centralized Management Platform
Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.

The Siu Ho Wan Water Treatment Works has been in operation since 1996 with a designed water filtration capacity of 150,000 cubic meters per day. With the planned development projects in North Lantau, including the three-runway system of the Hong Kong International Airport and the expansion of Tung Chung New Town, it is anticipated that the existing Siu Ho Wan water treatment plant will be insufficient to meet the future water demand in North Lantau in 2028. The ongoing extension works of the plant will increase the treatment capacity of the Siu Ho Wan Water Treatment Plant from the current 150,000 cubic meters per day to 300,000 cubic meters per day, and correspondingly increase the water transmission volume of the above two raw water supply systems.

BIM Adoption

The project has integrated BIM with innovation and technology throughout the entire project lifecycle. This includes applying ISO-19650-1 & ISO-19650-2 International BIM Standard, and Central Intelligent Information Platform. The extensive use of BIM including 2D Design, 3D Coordination, 4D Simulation, 5D Quantity Take-off, 6D Engineering Analysis and 7D Asset Management and DfMA, MiMEP, MR technology, Reality Platform has the potential to transform and improve performance by reducing inefficiencies, increasing productivity and fostering greater collaboration among project stakeholders.

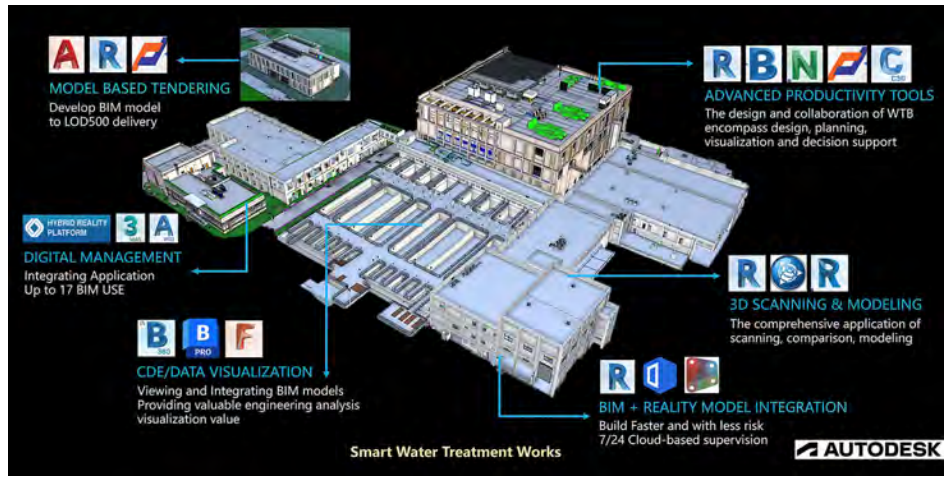


Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd. Project 7/WSD/21 Digital Delivery

Full Cycle

By full-cycle utilizing the BIM technology-BIM visualization, coordination, and simulation, the integration of PIM models allows for effective pre-construction simulations. Digitalization facilitates the more precise approach to the design, construction and operation management of Water Treatment Works, enhancing the overall managing quality throughout the project lifecycle.

The application of BIM technology ensures all stakeholders are promptly informed about the progress, enabling timely 3D coordination and efficient organization and instruction to address the project issues. It greatly improves

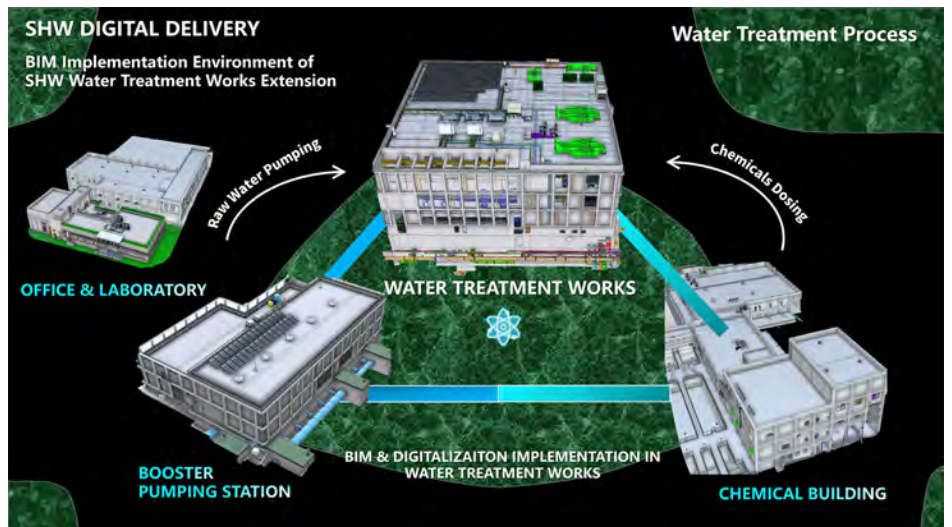
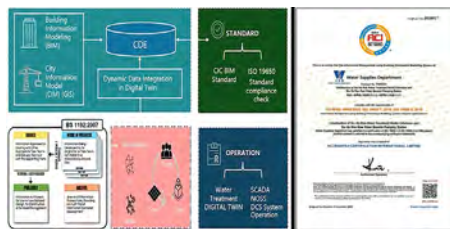


Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd. Project 7/WSD/21 Digital Delivery



ISO-19650 International BIM Standard Procedure and Project ISO Certificate

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.



New Water Treatment Works Building
Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.



Common Data Environment (CDE)
Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.

collaborative efforts among all parties involved, resulting in a significant enhancement in project quality.

Central Intelligent Information Platform BIM + GIS + IoT

The integrated platform visualizes the project's current status and future scenarios, enabling stakeholders to preview the completed project using BIM technology before construction begins. The platform integrates Project Management Dashboard including RFI status, monthly accident status, and overall progress display screen for digitalization management.

SCADA system can collect data, enabling proactive maintenance and immediate response. IoT devices can be installed in Water Treatment Works to monitor various parameters such as water quality, flow rates, and equipment performance in real-time. It provides quick response to any anomalies allowing for remote monitoring and control of WTW equipments.

BIM Use 3D Design

In the complex MEP design of water treatment plants, Revit 3D forward design has significantly benefited the project. The design team works

in a 3D space within a Common Data Environment (CDE), swiftly receiving feedback from relevant parties. This enables immediate updates to the BIM cloud model, optimizing design outcomes and improving efficiency.

4D Phase Planning

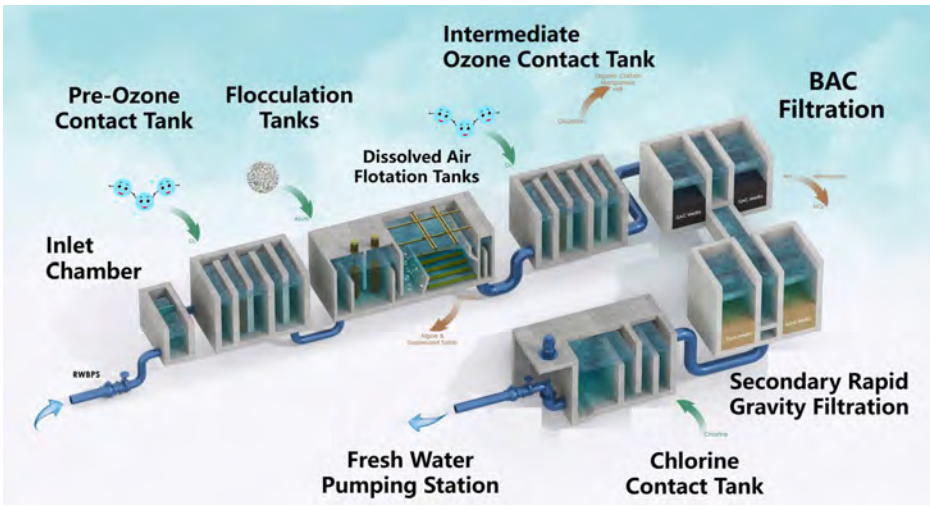
This project includes over 40 specialized construction method statement, such as excavation, MiMEP hoisting, the relocation of outdoor pipelines, etc. Through 4D simulation rehearsals, the BIM team optimizes spatial pathways and clarifies vehicle logistics on-site, effectively supporting the implementation of construction activities.

DfMA & MiMEP

Fully adopting DfMA & MiMEP prefabricated modules aids incost reduction, quality improvement, efficiency enhancement, and better collaboration.

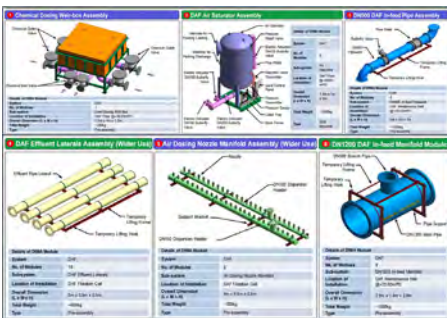
5D Quantity Take-off (QTO)

Through applying BIM 5D QTO in the project, time and cost are integrated into the BIM modeling process, which enables accurate estimates, effective budget management, and optimized resource



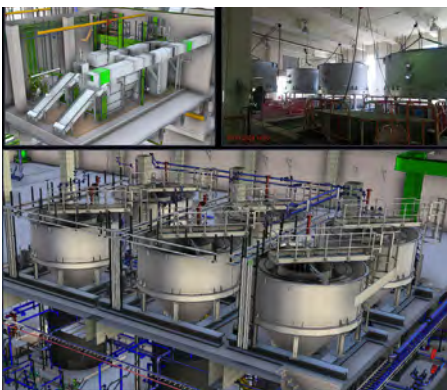
Water Treatment Process

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.



Pre-fabricated MEP Element

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.



MIMEP of Lime Saturator and Lime Dross Recovery Tank

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.

allocation. It enhances collaboration among stakeholders and improves decision-making, thus reducing financial risks.

6D Engineering Analysis

This analysis identifies possible alternatives to improve energy efficiency



MEP 3D Design BIM Environment

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.

realizing Digital Twin. The digital twin platform is able to simulate the entire water treatment process, from the raw water booster pumping station to the final treated water outlet, considering factors such as equipment characteristics, hydraulic behavior, chemical reactions and operational procedures to achieve comprehensive examination. It provides value in simulating the operating principles and daily workload of the water treatment works. It offers training for the operating team, reducing risks and ensuring adequate preparation for their duty, thereby helping optimizing the operational management of the water treatment works.

WSD's Vision in BIM:

BIM enhances the design, construction and project management, and enables all stakeholders to visualise what is to be built in a simulated 3D environment to identify any potential design clashes, construction or operational issues via an efficient digital working platform for relevant modelling works and data sharing.



DfMA & MiMEP Transportation and Installation

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.

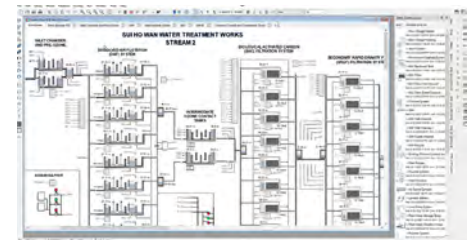
and improve lighting, as well as analyzing the possibilities of incorporating other more efficient forms of renewable energy, such as the use of daylight.

7D Asset Management - NOSS System

The NOSS integrated digital representation of the operation of this project provides historical and current operational behavior of the facilities and carries out predictive analysis in near real-time manner.

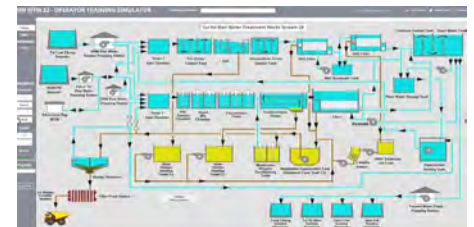
Digital Twin

SHW WTW Extension Works utilizes BIM and digital twin technology. The BIM team input asset codes for a great amount of civil and MEP components in Revit and export COBie spreadsheets. This data is converted through the Asset System to meet the operational requirements. The NOSS System integrates assets, enabling visibility of BIM asset data on the platform and



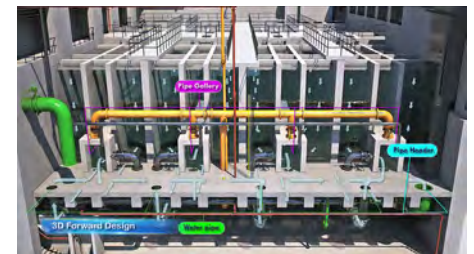
Near-real-time Operation Simulation System (NOSS) Dashboard

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.



Operator Training Simulator of SHW WTW Phase 2

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.



Water Treatment Process Visualization and 3D Design

Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.



Image Courtesy of Water Supplies Department, HKSAR Government and China Road and Bridge Corporation and Digie Engineering Technology Pte. Ltd.

About Water Supplies Department, HKSAR Government

Reliable and quality water supplies are indispensable to the lives and livelihoods of the people in Hong Kong, and are critical for supporting the territory’s sustainable development. The Water Supplies Department (WSD) of the HKSAR Government is charged with the responsibility of maintaining reliable and quality water supplies. From the past to the present, WSD’s management has made unremittingly efforts in sustaining innovations and inspiring technological prowess for the enhancement of water usage, designs and applications in building Hong Kong into a water-smart city.

About China Road and Bridge Corporation

China Road and Bridge Corporation (referred to as “CRBC”) was established in 1979 in the People’s Republic of China. In 2005, CRBC was restructured and became a wholly-owned subsidiary of China Communications Construction Company Limited (referred to as “CCCC”). CRBC mainly undertakes contracting, investment, development and operation of projects, such as road, bridge, port, railway, airport, tunnel, real estate, and industrial park. With branches and offices in nearly 60 countries and regions in Asia, Africa, Europe and America, CRBC has developed an efficient global business market network. CRBC has started its construction business in Hong Kong since 1988 and then expanded its business to Macau in 2002. With its strong presence in both regions, CRBC has successfully completed over 100 major infrastructure projects and undertaken a number of infrastructure investment projects in Hong Kong and Macau. CRBC is committed to developing into a global outstanding enterprise group, being ethical, operation excellent, respected by the public, and popular in the capital market.

About Digie Engineering Technology Pte. Ltd.

Digie Engineering Technology Pte. Ltd. is a wholly-owned subsidiary of Powerchina Huadong Engineering Corporation Limited in Singapore since 2020, specializing in information, digital and intelligent technology services for the international engineering industry, providing customers with professional engineering digital solutions. Powerchina Huadong Engineering Corporation Limited (HDEC) was established in 1954. It is an international engineering company involved in Hydropower & Renewable Energy, Urban & Rural Construction, Ecology & Environment, as well as unique Digital Innovations tailored to meet the clients’ requirements and exceed their expectations.

Honorable Mentions



ORGANIZATION

Architectural Services Department, HKSAR
Hip Hing Engineering Company Limited

PROJECT

Design and Construction of Immigration Headquarters in Area 67, Tseung Kwan O



ORGANIZATION

Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region
AECOM Asia Company Limited
DCKJV and TYFRON Consultancy Limited

PROJECT

Kwu Tung North and Fanling North New Development Area (First Phase)



ORGANIZATION

Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region
Ove Arup & Partners Hong Kong Limited
China Railway Group Limited and TYFRON Consultancy Limited

PROJECT

Tung Chung New Town Extension – Site Formation and Infrastructure Works at Tung Chung Valley, Phase 1 (Contract No. NL/2020/06)



ORGANIZATION

MTR Corporation Limited
Arup

PROJECT

MTR C1601 Kwu Tung Station for Northern Link



ORGANIZATION

Sun Hung Kai Properties Limited
Sanfield (Management) Limited
Strategic Building Innovation (SBI) bimSCORE Limited

PROJECT

Tai Po Town Lot No. 253 and 157 RP, Sai Sha



ORGANIZATION

Water Supplies Department, HKSAR Government
Shenzhen Yuegang Technology Company Limited
ACCIONA

PROJECT

Innovative Asset Management for Building Resilient Water Supply: BIM & AMIS at Tseung Kwan O Desalination Plant



ORGANIZATION

Water Supplies Department, HKSAR Government
Shenzhen Yuegang Technology Company Limited
The University of Hong Kong (HKU Business School)

PROJECT

Digitalizing Smart Water System: STSS for Pump Optimization with AI-Driven BIM and GIS Integration

COMPANY

Architectural Services Department, HKSAR
Hip Hing Engineering Company Limited

PROJECT

Design and Construction of Immigration
Headquarters in Area 67, Tseung Kwan O

LOCATION

Between Po Yap Road and Chi Shin Street,
Tseung Kwan O

TYPE

Government Offices & Specialist/Departmental
Building

SCHEDULED TIME OF COMPLETION

September 2023

BIM the Future: Shaping New Lives in Immigration Headquarter



About Architectural Services Department, HKSAR

Architectural Services Department (ArchSD) was found in 1986 serving as one of the works departments under the Development Bureau of the HKSAR Government for the development and upkeep of public facilities.

Our aim is to provide efficient and cost-effective professional and project management services for the design, construction, maintenance and refurbishment of government buildings and facilities. We also provide professional and technical advice to the Government and quasi-government organisations.

Our mission is to serve and care for our community by enriching the living environment through high quality professional services; and to promote best practices in the building industry.

About Hip Hing Engineering Company Limited

Founded in 1964, Hip Hing Engineering Co., Ltd. undertakes the design and construction of building and civil engineering works for public sector clients, and it is one of the members of Hip Hing Construction Group ("Hip Hing"). Over the past decades, Hip Hing has grown to become one of the leading contractors in Hong Kong, and has been trusted by our clients to construct many of the landmark buildings which define Hong Kong. Our experience and expertise in the design, procurement, engineering and construction disciplines enables us to provide comprehensive project delivery services. We have also been embracing advancing technologies to take our services to the next level, so as to meet our clients' needs.

BIM PARTNERS

P&T Architects and Engineers Limited
Wong Pak Lam & Associates Consulting
Engineers & Architects Limited
J. Roger Preston Limited
isBIM Limited

AUTODESK PRODUCTS USED

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

Project Description

The project involves constructing a new 17-storey Main Administration Tower (T2) with North Wing and South Wing, a 16-storey Enforcement Tower (T1), and 1-storey basement carpark to accommodate the Immigration Headquarters (IMMHQ). This modern government office aims to improve connectivity in the TKO district, with design objectives that include responding to urban planning needs, caring and anti-epidemic design for public areas and facilities, ensuring security and building resilience design, and green and sustainability.

Project Challenges

The Immigration Headquarter project encountered significant challenges in designing and constructing from design to construction stage. There are some major challenges as below

1. Elevated Long-Span Building Structures
2. Multi-Trade Integrated MEP (MiMEP) in various building services system
3. Immersive experience for layman to achieve the design goals
4. First large Scale 3D Metal Printing Pavilion in Asia

To overcome these challenges, the project required new technology and process that leveraged the potential of BIM to drive efficiency and precision throughout the design and construction process. This collaborate approach not only enhances design flexibility but also significantly time, cost and quality, setting a new benchmark for sustainable building practices in Hong Kong.

Solutions for Challenges

To address these challenges, the Immigration Headquarter project employed innovative solutions:

1. The use of advanced simulation review and risk reduction strategies minimized potential hazards.
2. Full digitalization in design and construction process enabled comprehensive evaluation and strict management of environmental impact, quality standards, and costs within tight budget and timeline constraints.
3. Autodesk's products integrated into the project, facilitating accurate and precise execution from design to execution.
4. The implementation of 3D Metal Printing technology utilizing Wire Arc Additive Manufacturing (WAAM) enabled parametric modeling, minimizing deviation between design and actual structures.

These innovative solutions not only addressed specific challenges but also set a new benchmark for sustainable building practices in Hong Kong, demonstrating the potential for collaborative approaches to drive efficiency, precision, and time savings.

How does BIM benefit the project?

The BIM process significantly benefited the Immigration Headquarter project. It enabled clear information exchange among stakeholders, enhancing collaboration and communication throughout the project lifecycle. The use of BIM streamlined construction, saving 2 months and 23% on cost for elevated long span building structures. Simulations ensured safer design and installation outcomes, while reducing MiMEP installation time from 28 days to 14 days and shortening the period from 4 weeks to 1 week. Combining BIM with technologies like VR/MR/BIM Cave and 3D metal printing led to significant cost savings and improved project outcomes, making it a crucial strategy for successful project execution.

Better with BIM

This project demonstrates the transformative power of Building Information Modelling (BIM). BIM could improve collaboration and communication, streamline construction processes, and empowers you to deliver better projects outcome, faster and more cost effectively. To fully realise the benefits of BIM, an integrative project delivery approach is required such as early engagement and expectations alignment with stakeholders, which is reinforced by a Virtual Design and Construction (VDC) mindset and Advanced Manufacturing Integration, such as integrated 3D metal printing with Wire Arc Additive Manufacturing (WAAM) technology.



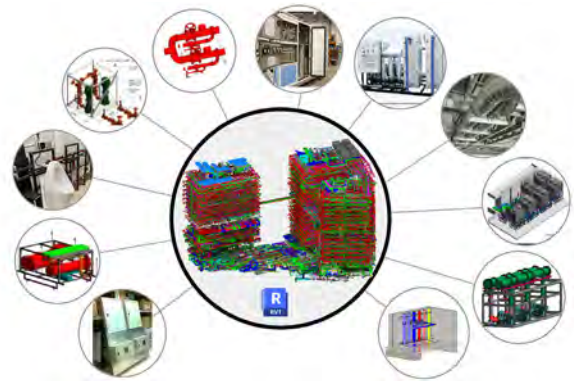
Immigration Headquarters Overview

Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



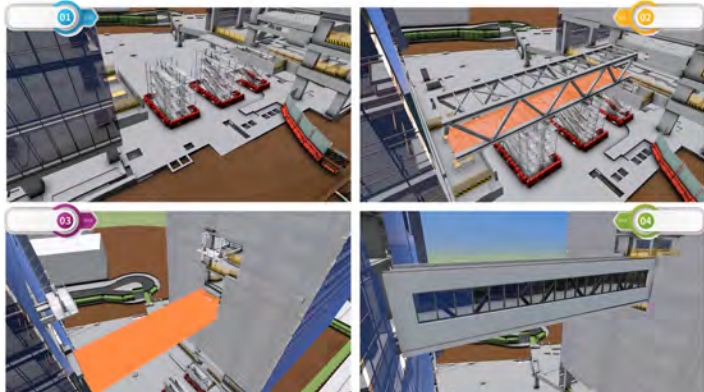
Marriage Hall

Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



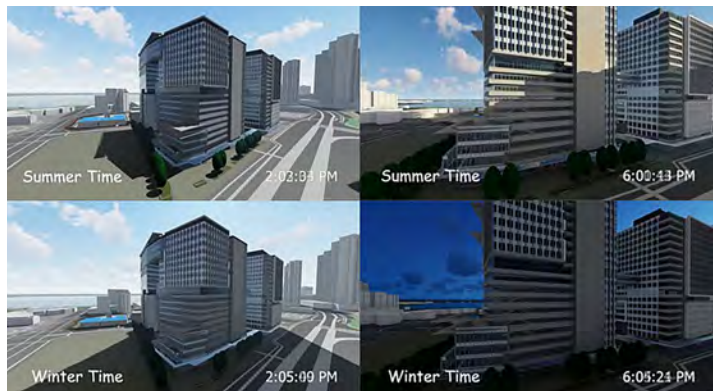
Multi-Trade Integrated MEP (MiMEP)

Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



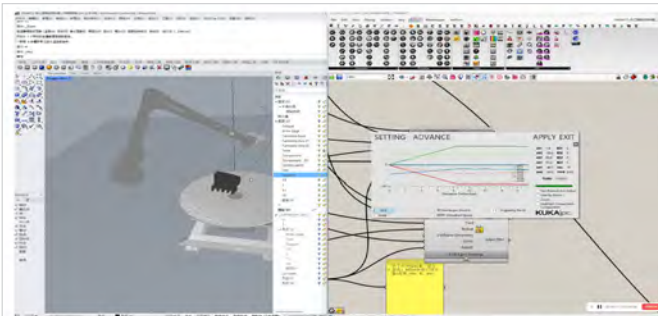
Simulation of Steel Link Bridge

Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited

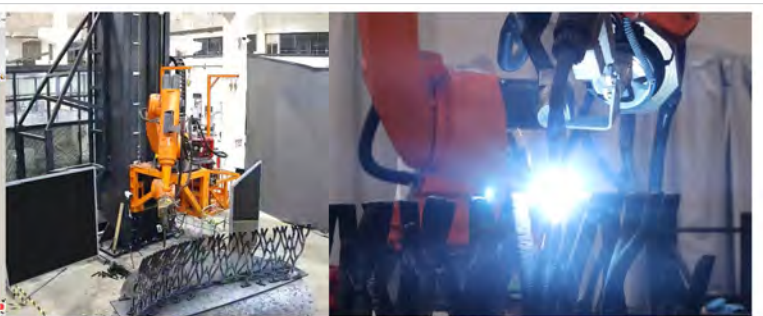


Solar Study Simulation

Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited



Pre-print Simulation



Wire Arc Additive Manufacture (WAAM) Printing

3D Metal Printing - WAAM Technology

Image Courtesy of Architectural Services Department, HKSAR and Hip Hing Engineering Company Limited

COMPANY

Civil Engineering and Development Department,
The Government of the Hong Kong Special
Administrative Region
AECOM Asia Company Limited
DCKJV and TYFRON Consultancy Limited

PROJECT

Kwu Tung North and Fanling North New
Development Area (First Phase)

LOCATION

Fanling Bypass Eastern Section
(Shek Wu San Tsuen North to Lung Yeuk Tau)

TYPE

Infrastructure construction

SCHEDULED TIME OF COMPLETION

Year 2025

BIM for Fanling Bypass Eastern Section (Shek Wu San Tsuen North to Lung Yeuk Tau)



About Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region

CEDD of HKSAR Government is a leading organisation for development of Hong Kong who is committed to provide high quality high civil engineering services to meet its development needs. Its missions include striving for engineering excellence, creating a safe, green and sustainable environment, partnering with the community in infrastructure development and building a caring and motivating working environment for staff.

About AECOM Asia Company Limited

AECOM is the world's trusted infrastructure consulting firm, delivering professional services from planning, design and engineering to program and construction management on projects of transportation, buildings, water, new energy and environment with our technical expertise in innovation, culture of equity and diversity, and commitment to environmental, social and governance priorities. AECOM is a Fortune 500 firm and its Professional Services business had revenue of \$14.4 billion in 2023.

About DCKJV and TYFRON Consultancy Limited

DCK JV is a joint venture of three companies including Daewoo E&C, Chun Wo Construction & Engineering Co. and Kwan Lee Holding Ltd. Daewoo E&C has participated in the construction of major highways in South Korea since 1978 and experienced in the tunnel construction. Chun Wo C&E and Kwan Lee are two Hong Kong local contractors with over 55 years of construction experience. The companies have involved in large-scale infrastructural projects and gained experience in the local practice. The formation of the joint venture enables the project team to adopt foreign technique and knowledge and allows higher degree of collaboration for the success of the project

Tyfron Consultancy Limited is a Hong Kong based BIM and Digitalization Consultant specializes in infrastructural and building works BIM Execution for design and construction stage. Services also include BIM Auditing, 3D Survey and Digital Strategies for construction projects.

AUTODESK PRODUCTS USED

Drawing Generation by Revit
Lighting Analysis through Revit

Project Description

The contract mainly comprises construction of 4km of transportation Networks, including an approximately 2-kilometre-long dual two-lane Fanling Bypass Eastern Section between Shek Wu San Tsuen North and Lung Yeuk Tau comprising viaduct, at-grade road and underpass sections; construction of Lung Yeuk Tau Interchange; construction of a footbridge across Ng Tung River and a Landmark cycle track feature; construction of two sewage pumping stations; reprovisioning of the On Lok Mun Street Playground and sports facilities; road junction improvement works; drainage and sewerage works, waterworks, noise barrier works.

Project Challenges

This project is a complex infrastructure construction project that involves site formation along two main rivers, including the construction of new viaducts, at-grade roads, pumping stations, and the relocation of existing government facilities. Therefore, site utilization must be well organized and frequently adjusted in different stages of construction, involving the diversion of numerous underground utilities for the construction of the underpass section and the Lung Yeuk Tau Interchange area.

Solutions for Challenges

Implementing BIM technologies for this project offers solutions to various challenges. Digitizing existing conditions aids in accurate data representation, facilitating clash detection for streamlined planning. Optimizing site utilization for construction methods enhances efficiency, while visualization tools improve stakeholders' communication. Open BIM applications ensure seamless collaboration among stakeholders. Implementing a Digital Works Supervision System enhances project monitoring. Utilizing an All-in-One BIM platform with photogrammetry enables comprehensive project oversight. Overcoming these challenges through advanced BIM applications ensures enhanced coordination, data accuracy, and project success across the extensive infrastructure development scope.

How does BIM benefit the project?

Leveraging BIM technologies for the skateboard park construction to meet Olympic standards introduces technical complexities. Generating detailed drawings in Revit demands precise modeling of intricate lighting setups and terrain dynamics to ensure optimal performance. Conducting lighting analysis using BIM tools requires accurate simulation for safety and design integrity. Integrating these aspects with the broader infrastructure development, including transportation networks and sewage systems, necessitates seamless data interoperability and interdisciplinary coordination. Achieving a high level of technical integration within a unified BIM environment throughout the entire project in Kwu Tung North and Fanling North New Development Area presents a good application of BIM technology for resolving project challenges.

Better with BIM

Drawing Generation by Revit:

- Combined Services Drawings are developed from the model and preset into Revit drawing sheeting for automatic updating in the drawings.

Lighting Analysis through Revit:

- A skatepark to be built complying to Olympic Games standard, the Architect made use of Revit to visualize the lighting during different time of the day while to cater for the events need.



Lung Yek Tau Interchange Rendered Image from BIM
Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and DCKJV and TYFRON Consultancy Limited



Underpass Underneath Interchange Simulation from BIM
Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and DCKJV and TYFRON Consultancy Limited



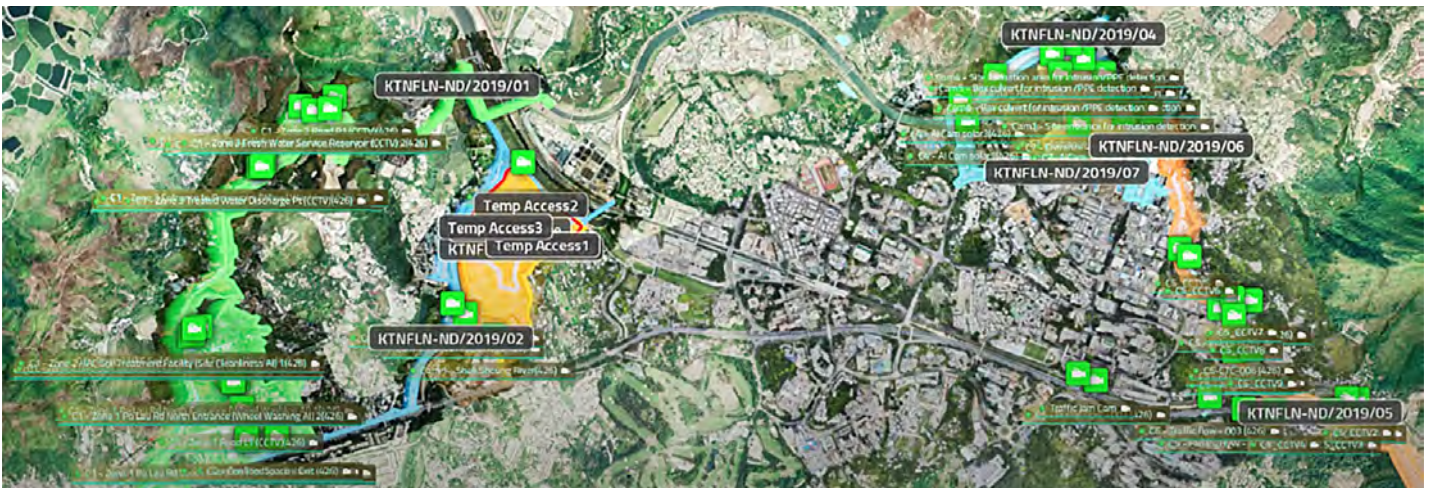
Construction Methodology Simulation for Bridges Construction Adopting Form Traveller
Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and DCKJV and TYFRON Consultancy Limited



Central Management Platform Integration BIM with IoT for Real-time Site Monitoring
Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and DCKJV and TYFRON Consultancy Limited



Skateboard Park Lighting Simulation and Lux Analysis through BIM
Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and DCKJV and TYFRON Consultancy Limited



Collaboration of Common Geospatial and Digital Platform for Project Interface
Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and DCKJV and TYFRON Consultancy Limited

COMPANY

Civil Engineering and Development Department,
The Government of the Hong Kong Special
Administrative Region
Ove Arup & Partners Hong Kong Limited
China Railway Group Limited and TYFRON
Consultancy Limited

PROJECT

Tung Chung New Town Extension – Site Formation
and Infrastructure Works at Tung Chung Valley,
Phase 1 (Contract No. NL/2020/06)

LOCATION

Tung Chung, Lantau, Hong Kong

TYPE

Infrastructure / Civil

SCHEDULED TIME OF COMPLETION

2026

From BIM to Digitalization in Building Sustainable Environment



About Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region

CEDD of HKSAR Government is a leading organisation for development of Hong Kong who is committed to provide high quality high civil engineering services to meet its development needs. Its missions include striving for engineering excellence, creating a safe, green and sustainable environment, partnering with the community in infrastructure development and building a caring and motivating working environment for staff.

About Ove Arup & Partners Hong Kong Limited

Ove Arup & Partners Hong Kong Limited (Arup) is a global collective of designers, engineers, and consultants dedicated to sustainable development. Since 1976, Arup's Hong Kong office has spearheaded urban innovation, shaping the city's infrastructure and skyline with cutting-edge projects and a commitment to environmental sustainability for the future.

About China Railway Group Limited and TYFRON Consultancy Limited

China Railway Group Limited (CRGL) is a leading Chinese construction conglomerate, renowned for its extensive infrastructure projects worldwide.

TYFRON Consultancy Limited is a Hong Kong based BIM and Digitalization Consultant specializes in infrastructural and building works BIM Execution for design and construction stage. Services also include BIM Auditing, 3D Survey and Digital Strategies for construction projects.

AUTODESK PRODUCTS USED

- Autodesk® Civil 3D®
- Autodesk Construction Cloud®
- Autodesk® Navisworks®
- Autodesk® ReCap®
- Autodesk® Revit®

Project Description

The project mainly comprises site formation works for Tung Chung Areas 42 and 46 for public housing development, revitalization of Tung Chung Stream and construction of the first phase of the River Park with a visitor centre, construction of new roads (i.e. Road L29 and L30), road improvement works at Chung Mun Road and Shek Mun Kap Road, construction of a series of public facilities, such as pedestrian and vehicular bridges across the Tung Chung Stream, sewage pumping stations, drainage, watermain and sewage works along Yu Tung Road, common utility tunnel and sustainable urban drainage system and compensatory woodland planting.

Project Challenges

This project faces several challenges, including the need to complete the site formation works in a short period of time for subsequent public housing development and carry out temporary Tung Chung Stream diversion to facilitate the revitalization works. Besides, the construction of the Visitor Centre requires close coordination amongst civil, structural and E&M teams, making real-time updates and effective communication essential. In addition, the site is in close proximity to the existing Tung Chung Stream, which may have flooding risk to workers nearby. The extensive site coverage also increases the challenges in site supervision and monitoring.

Solutions for Challenges

Given the extensive site coverage and diverse engineering works, the project team has implemented innovative technologies to enhance safety, efficiency, and productivity. In congested areas, all the excavators are equipped with a “360-degree Intelligent Monitoring System” to maintain safe clearance between equipment and workers nearby. The 360-degree Project Management Platform with BIM aids in managing site safety and progress. Proximity to Tung Chung Stream necessitated a comprehensive flood warning system with real-time monitoring to predict flooding and alert workers via smartwatches. AI cameras monitor unauthorized entry into danger zones and ensure vehicle wheels are cleaned before leaving the site.

How does BIM benefit the project?

This project involves extensive works with non-gridline and uniform level control elements. Utilizing BIM for design and construction coordination significantly enhances communication efficiency and provided accurate resolutions. BIM also serve as a framework for developing digital construction technologies to resolve fabrication wastage, spatial optimization and most importantly, BIM enables the team to evaluate construction methodologies through dynamic risk assessments. All output are shared with the entire project team, including frontline supervisors and workers, ensuring everyone is aligned and informed. This comprehensive approach facilitates better collaboration and efficiency across all stages of the project.

Better with BIM

Through the good practices and lesson learning from this project, we have systematically integrated BIM at different stages, including design, manufacturing, construction and risk assessment. We will continue with the practice and apply to upcoming civil projects with similar nature. Given the high spatial constraints in the construction industry in Hong Kong, geometrical accuracy is essential to project success. Therefore, BIM accuracy is crucial in this digital construction era, providing a solid foundation for all workflow collaboration. This ensures that all team members, from designers to frontline workers, are aligned and can work efficiently together.



Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and Ove Arup & Partners Hong Kong Limited and China Railway Group Limited and TYFRON Consultancy Limited

Photomontage of Tung Chung River Park and Visitor Centre



Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and Ove Arup & Partners Hong Kong Limited and China Railway Group Limited and TYFRON Consultancy Limited

Photomontage of Revitalization of Tung Chung Stream



DRAINAGE PIPELINE CONSTRUCTION & BACKFILLING

Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and Ove Arup & Partners Hong Kong Limited and China Railway Group Limited and TYFRON Consultancy Limited

Construction Sequence Simulation for Road and River Works



Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and Ove Arup & Partners Hong Kong Limited and China Railway Group Limited and TYFRON Consultancy Limited

BIM Development from Design Stage to Construction Stage



Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and Ove Arup & Partners Hong Kong Limited and China Railway Group Limited and TYFRON Consultancy Limited

Adoption of ACC for Design Coordination

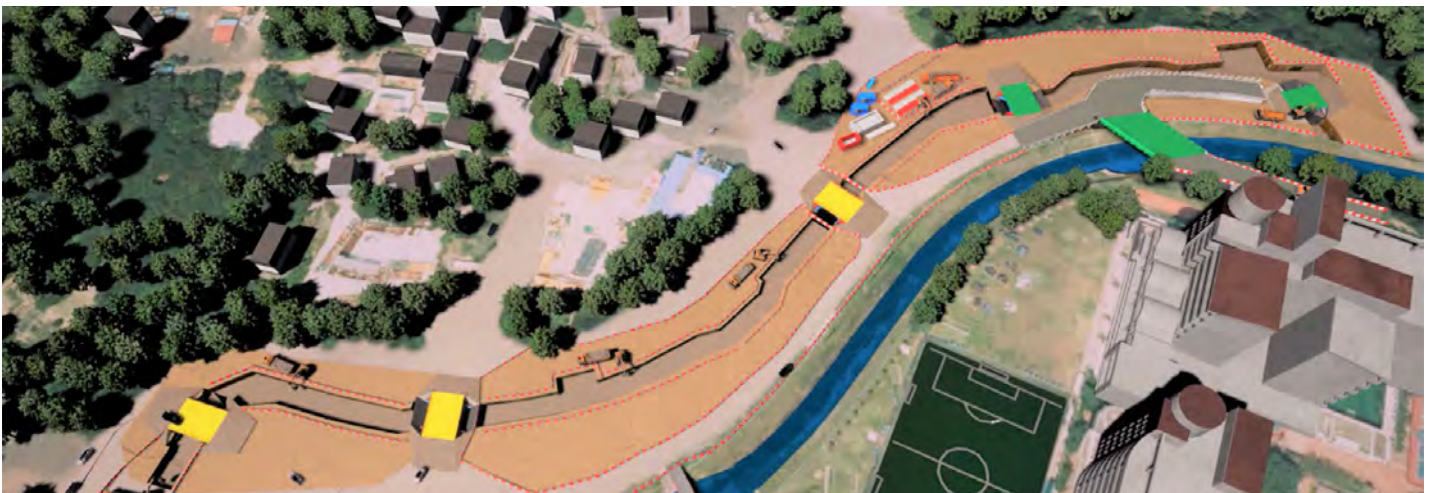


Image Courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and Ove Arup & Partners Hong Kong Limited and China Railway Group Limited and TYFRON Consultancy Limited

4D Phase Planning for Concurrent Works Simulation

COMPANY

MTR Corporation Limited
Arup

PROJECT

MTR C1601 Kwu Tung Station for Northern Link

LOCATION

Ma Tso Lung Road and Ho Sheung Heung Road, which is also the town center of the future Kwu Tung North (KTN) New Development Area (NDA)

TYPE

Public Transport

SCHEDULED TIME OF COMPLETION

Kwu Tung Station for East Rail Line – 2027
Kwu Tung Station for Northern Link – 2034

Construction Challenges Overcame with CDE and BIM in Kwu Tung Station



About MTR Corporation Limited

To Keep Cities Moving, MTR makes encounters happen and rendezvous for a more connected tomorrow. As a recognised world-class operator of sustainable rail transport services, we are a leader in safety, reliability, customer service and efficiency.

MTR has extensive end-to-end railway expertise with 45 years of railway projects experience from design to planning and construction through to commissioning, maintenance and operations. Going beyond railway delivery and operation, MTR also creates and manages dynamic communities around its network through seamless integration of rail, commercial and property development.

With more than 50,000 dedicated staff*, MTR carries over 10 million passenger journeys worldwide every weekday in Hong Kong, Mainland China, Australia, the United Kingdom and Sweden. Together, we Go Smart and Go Beyond.

*includes our subsidiaries, associates and joint ventures in Hong Kong and worldwide

About Arup

Dedicated to sustainable development, Arup is a collective of designers, consultants and experts working globally. Founded to be humane and excellent, we collaborate with our clients and partners using imagination, technology, and rigour to shape a better world. Arup opened its Hong Kong office in 1976, and today it operates as the firm's largest office in East Asia with more than 2,000 people, serving as a creative powerhouse that makes a difference in this part of the world. The Hong Kong office benefits from Arup's global network of offices and draws upon global resources and expertise to solve any problems requiring specialist skills.

BIM PARTNER

Arcadis

AUTODESK PRODUCTS USED

- Autodesk® 3ds Max®**
- Autodesk® Architecture, Engineering & Construction Collection**
- Autodesk® AutoCAD®**
- Autodesk® Construction Cloud®**
- Autodesk® Civil 3D®**
- Autodesk® Dynamo**
- Autodesk® Navisworks®**
- Autodesk® ReCap® Pro**
- Autodesk® Revit®**

Project Description

The Kwu Tung Station is located in the town centre of the future Kwu Tung North New Development Area (NDA), near residential, retail, leisure, and community amenities. It will facilitate travel for residents and help unlock the potential of surrounding areas. The detailed design of Kwu Tung Station on the Lok Ma Chau Spur Line has been completed, with construction starting in 2023 and expected to finish in 2027.

Project Challenges

The Kwu Tung Station on the East Rail Line project requires construction works atop the operating East Rail Line while maintaining daily railway operations, making the construction process extremely challenging. To accelerate and safeguard the overall construction programme and facilitate the development of the Northern Metropolis for Hong Kong, the design period of Kwu Tung Station was greatly shortened. To embrace the digital construction trend, Kwu Tung Station was selected as one of the first projects of MTR to fully adopt CDE and BIM. Over 8700 project drawings were produced from coordinated models and reviewed in the project CDE.

Solutions for Challenges

The compressing timeline doesn't mean sacrificing quality or accuracy. The project team utilised BIM and CDE to explore options in real time to optimise design and enhance safety. Existing conditions such as the supporting tunnel box, topography, trees, underground utilities and site boundaries were first digitalised to facilitate layout planning and justification for the design. Automations were used to generate room names in 3D to facilitate spatial coordination via Autodesk Construction Cloud. The coordinated models formed the base of various engineering designs such as passenger and energy simulations, structural and geotechnical assessments, optimisations for underground utilities, tree removal, MiC, logistic, planning and cost.

How does BIM benefit the project?

Kwu Tung Station is supported by the existing East Rail Line tunnel box structure, which lacks pile support. The design team must maximise the concrete volume of the new station to counteract groundwater buoyancy while also ensuring adequate space for passengers, tunnel air circulation and building services. Located in the centre of the new town, the team needs to coordinate urban planning and civil works, especially underground utilities, to enhance construction efficiency, safety, and public needs. Utilising BIM and CDE ensures a 'single source of truth' across disciplines within the accelerated schedule to manage production of drawings, engineering analyses, and stakeholder engagement materials.

Better with BIM

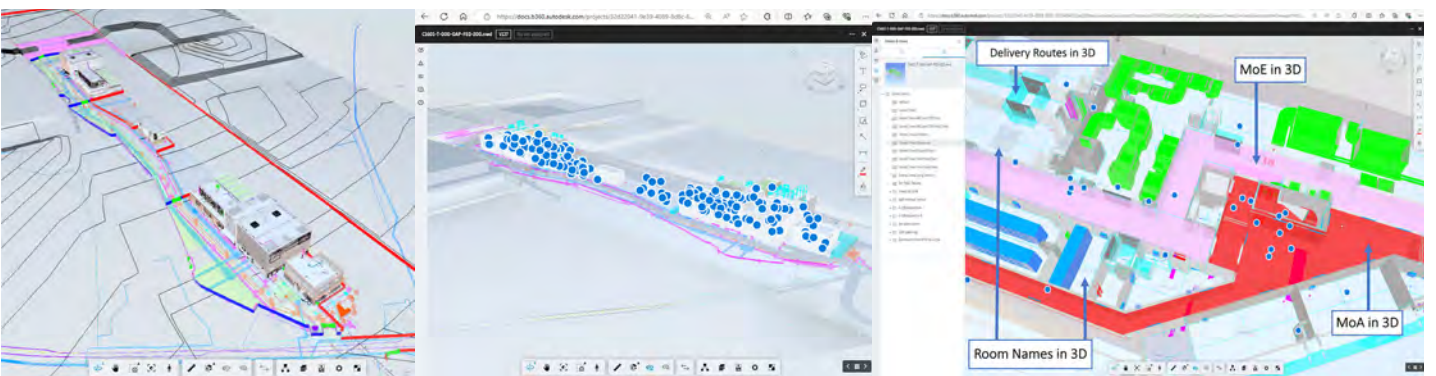
BIM offers significant benefits for the Kwu Tung Station project. It enhances collaboration among stakeholders, improving communication and integration. The 3D models aid in understanding design concepts and facilitate informed decision-making. Coordinated models in Autodesk Construction Cloud enable both the consultant and the owner to early identify conflicts, reducing costly changes during construction. Additionally, BIM allows for efficient planning and resource allocation, leading to potential cost savings. It promotes sustainability by assessing energy efficient options, ensuring regulatory compliance, and enhancing safety by simulating construction processes. The project's CDE provides a centralised repository for accurate records and serves as a foundation for further digital developments.



The Design of Kwo Tung Station
Image Courtesy of MTR Corporation Limited and Arup



Construction Challenges Overcome with CDE and BIM in Kwo Tung Station
Image Courtesy of MTR Corporation Limited and Arup



Model Coordination via Autodesk Construction Cloud
Image Courtesy of MTR Corporation Limited and Arup

COMPANY

Sun Hung Kai Properties Limited
 Sanfield (Management) Limited
 Strategic Building Innovation (SBI)
 bimSCORE Limited

PROJECT

Tai Po Town Lot No. 253 and 157 RP, Sai Sha

LOCATION

Sai Sha, Shap Sz Heung, New Territories

TYPE

Recreation & Sports centre, Welfare centre,
 Residential and Road Expansion

Sai Sha - BIM Everybody Everywhere



About Sun Hung Kai Properties Limited

Sun Hung Kai Properties Limited was publicly listed in 1972 and is now one of the largest property companies in Hong Kong. The Group specializes in developing premium quality residential projects and owns an extensive network of shopping malls and offices as well as a hotel portfolio and sizeable land bank. Over the years, SHKP has earned market recognition and customer loyalty through its unsurpassed quality and belief in Building Homes with Heart.

About Sanfield (Management) Limited

Sanfield (Management) Limited is a wholly-owned subsidiary of Sun Hung Kai Properties Limited. It keeps pace with today's constantly rising construction standards and requirements by leveraging innovative technologies as well as establishing a safe and rigorous construction system.

About Strategic Building Innovation (SBI) bimSCORE Limited

Strategic Building Innovation (SBI) bimSCORE Limited is an international team that helps government, asset owners and their supply chain to work more efficiently and integrate new technologies into their existing workflows.

BIM PARTNERS

- Zaha Hadid Architects
- P&T Group
- LWK + PARTNERS
- theOOQ Limited
- Sun Hung Kai (A&E) Limited
- AECOM Asia Company Limited
- J. Roger Preston Limited
- Lik Kai Engineering Company Limited
- Sun Yu Chau Engineering Company Limited
- Everlight Engineering Company Limited
- Pyrofoe Engineers Limited
- Chun Lee Engineering Company Limited

AUTODESK PRODUCTS USED

- Autodesk® AutoCAD®
- Autodesk® BIM 360® Docs
- Autodesk® Dynamo
- Autodesk® Navisworks® Freedom
- Autodesk® Navisworks® Manage
- Autodesk® ReCap®
- Autodesk® Revit®

Project Description

The Tai Po Town Lot No. 253 and 157 RP development is a transformative endeavor that aims to revitalize the Sai Sha region of Hong Kong, encompassing a recreation & sports centre, welfare centre, residential part, and road expansion. This integrated development combines sustainable construction practices, the creation of sports and recreational facilities, and the integration of nature and modern design.

Project Challenges

The project faces two main challenges. First, its large scale involves numerous stakeholders, leading to extensive information exchange. We need to establish clear data standards to ensure the reliability of the information shared among all parties. Second, the project includes many freeform designs, making it a significant challenge to translate these designs into detailed drawings and execute precise construction. Addressing these challenges is crucial for the project's success and efficiency.

Solutions for Challenges

In this project, we utilized a Common Data Environment (CDE) as the single source of truth, establishing clear project standards to ensure the accuracy and reliability of data exchange, and identifying clear roles and responsibilities of different stakeholders. Additionally, we developed automation programs to facilitate data conversion and optimization of models. This approach allows us to transform complex designs into the necessary construction drawings and information. Meanwhile, by integrating advanced technology for precise positioning and installation, we aim to enhance overall efficiency and streamline the construction process.

How does BIM benefit the project?

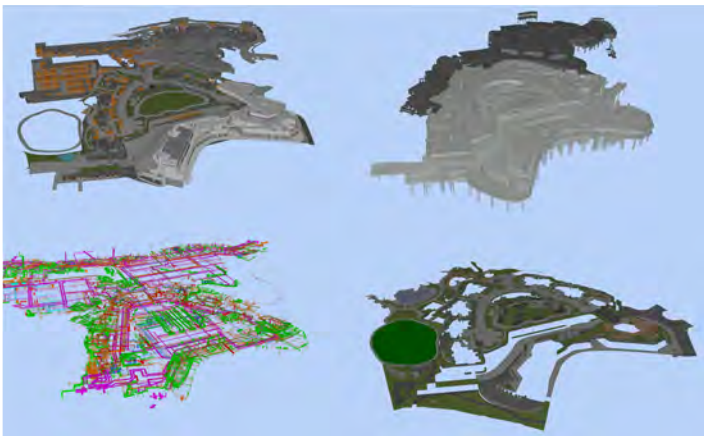
The project team established a comprehensive performance evaluation framework to monitor the outcomes and benefits of BIM implementation. They utilized BIM to track design changes, identify potential issues, and ensure alignment between as-built conditions and original designs. This digitalization led to a significant reduction in rework, achieving a 90% decrease in opening reworks, which allowed construction to proceed smoothly without delays or compromising design integrity. Additionally, the use of RTS, laser scanners, and drones optimized workflows and enhanced productivity on-site. As a result, the project experienced notable improvements in labor productivity, ensuring timely delivery while maintaining high construction quality.

Better with BIM

During the installation of M&E systems, BIM effectively addressed design coordination and clash issues in advance, enabling multiple construction teams to work simultaneously and significantly improving efficiency over traditional methods. The involvement of various stakeholders, including consultants, was streamlined through a 3D model, which served as a common platform for communication and collaboration, helping to identify design discrepancies and construction challenges. Additionally, the project utilized many prefabricated components, such as external and interior walls, which required careful coordination of mechanical and electrical designs. By leveraging BIM, these steps were completed upfront, allowing for factory production and efficient on-site installation.



Site aerial image
Image Courtesy of Sun Hung Kai Properties Limited and Sanfield (Management) Limited and Strategic Building Innovation (SBI) bimSCORE Limited



BIM coverage of residential part's podium
Image Courtesy of Sun Hung Kai Properties Limited and Sanfield (Management) Limited and Strategic Building Innovation (SBI) bimSCORE Limited



Technology adoption - Robotic Total Station
Image Courtesy of Sun Hung Kai Properties Limited and Sanfield (Management) Limited and Strategic Building Innovation (SBI) bimSCORE Limited



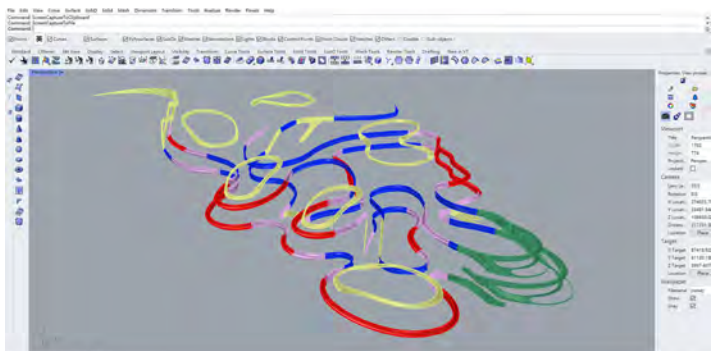
From fabrication to Production
Image Courtesy of Sun Hung Kai Properties Limited and Sanfield (Management) Limited and Strategic Building Innovation (SBI) bimSCORE Limited



Sai Sha Go Park
Image Courtesy of Sun Hung Kai Properties Limited and Sanfield (Management) Limited and Strategic Building Innovation (SBI) bimSCORE Limited



Image capture from BIM 360
Image Courtesy of Sun Hung Kai Properties Limited and Sanfield (Management) Limited and Strategic Building Innovation (SBI) bimSCORE Limited



Quantity take-off of Go Park glass reinforced concrete
Image Courtesy of Sun Hung Kai Properties Limited and Sanfield (Management) Limited and Strategic Building Innovation (SBI) bimSCORE Limited

COMPANY

Water Supplies Department, HKSAR Government
Shenzhen Yuegang Technology Company Limited
ACCIONA

PROJECT

Innovative Asset Management for Building
Resilient Water Supply: BIM & AMIS at Tseung
Kwan O Desalination Plant

LOCATION

Tseung Kwan O

TYPE

Water Works

SCHEDULED TIME OF COMPLETION

December, 2023

Innovative Asset Management: BIM, GIS, and IoT Integration for Water Supply Resilience in Hong Kong



About Water Supplies Department, HKSAR Government

The Water Supplies Department is responsible for operating and maintaining fresh water and flushing water supplies and distribution systems to ensure reliable water supplies to customers. The fresh water supply system covers a total of 99.99% of Hong Kong's population, while the seawater supply network for flushing covers about 85% of Hong Kong's population.

About Shenzhen Yuegang Technology Company Limited

Shenzhen Yuegang Technology Company Limited has contributed to the Digital Transformation initiative of the Water Supplies Department since 2019 by implementing its suite of smart water technologies and systems to support various smart water projects of WSD.

About ACCIONA

ACCIONA is a leading Spanish company known for innovative infrastructure solutions in water and energy. ACCIONA has applied its expertise to design, build, and operate Hong Kong's first reverse osmosis (RO) desalination plant, the Tseung Kwan O Desalination Plant.

BIM PARTNER

Summit Technology (Hong Kong) Limited

AUTODESK PRODUCTS USED

Autodesk® AutoCAD® Plant 3D

Autodesk® Civil 3D®

Autodesk® Navisworks®

Autodesk® ReCap® Pro

Autodesk® Revit®

COBie (Autodesk® Revit® Add-ins)

Project Description

Commissioned in December 2023, the Tseung Kwan O Desalination Plant (TKODP) utilizes state-of-the-art reverse osmosis technology to convert seawater into potable water. With an initial production capacity of 135,000 m³/day, expandable to 270,000 m³/day, this project is pivotal in enhancing water supply resilience amid climate change challenges. The ultimate design will provide approximately 10% of Hong Kong's fresh water needs. The integration of BIM within the Asset Management Information System (AMIS) ensures efficient asset management throughout the plant's lifecycle.

Project Challenges

The TKODP project marks Hong Kong's inaugural large-scale desalination plant utilizing reverse osmosis to convert seawater into potable water. The project encountered numerous challenges during both the construction and operation phases. To address these, advanced tools such as BIM, GIS, IoT, and SCADA were employed to digitize the entire infrastructure assets. Industry-standard systems like AMIS were integrated to ensure seamless interoperability among these tools. Moreover, aligning with WSD's BIM standards and ensuring timely access to accurate information was essential to prevent risks and enhance asset management. Robust systems were required to manage data, thereby preventing risks and minimizing rework.

Solutions for Challenges

To address these challenges, the project analyzed business processes and implemented a streamlined BIM-AM workflow, enhancing data interoperability with openBIM formats such as IDS, IFC, BSDD, and COBie. A comprehensive and systematic asset register was developed to transfer useful asset data into the Asset Management Information System (AMIS) according to WSD's well-predefined Asset Hierarchy Structure, ensuring seamless data exchange. The adoption of a centralized asset repository within AMIS enabled timely access to accurate information, supporting the implementation of the Reliability Centered Maintenance (RCM) strategy. The application of mobile devices for real-time data capture further streamlined the maintenance processes, ensuring accurate and up-to-date information sharing across all stakeholders.

How does BIM benefit the project?

Integrating BIM with AMIS has provided the TKODP project with a robust platform for managing complex asset data throughout the asset lifecycle. This synergy ensures seamless data transfer and interoperability, enhancing real-time visualization and monitoring of assets. The integration facilitates a 'cradle-to-grave' approach to asset management, thereby reducing downtime and optimizing asset performance. Furthermore, BIM supports informed decision-making by linking real-time sensor data to asset management processes, significantly improving the efficiency and reliability of water supply operations.

Better with BIM

The integration of BIM within AMIS has revolutionized asset management at TKODP, establishing a comprehensive digital platform for real-time data capture and lifecycle management. The SCADA system, combined with real-time sensor data, facilitates the formulation of maintenance strategies. This integration fosters collaboration among stakeholders by providing a single source of truth for asset information, minimizing risks and streamlining operations throughout the asset lifecycle. The result is not only substantial cost savings but also a marked improvement in operational efficiency. By leveraging mobile devices for real-time data capture synchronized with BIM models, AMIS ensures proactive asset maintenance, thereby reducing errors and enhancing overall performance.



Overall View of the Tseung Kwan O Desalination Plant BIM Model
Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and ACCIONA



Visualization of the Reverse Osmosis (RO) Building in AMIS
Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and ACCIONA



Utilizing BIM in AMIS for Asset Management
Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and ACCIONA

Innovation of the BIM project

IoT : ONLINE ANALYSERS AND DASHBOARD

TKODP online analysers Dashboard

online analysers

IoT Online Analyzers and Dashboard at TKODP
Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and ACCIONA

INNOVATIONS : AMIS

INSPECTION :Routine Inspection with BIM

Inspection data recorded via mobile devices can be easily viewed and synchronized with BIM components. Equipment inspection records are directly linked to the BIM model, facilitating seamless integration and management.

Inspection route

Routine Inspections with BIM in AMIS
Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and ACCIONA

openBIM Application : AMIS

Geospatial GIS and BIM Plug-in

AUTODESK REVIT
AUTODESK AUTOCAD PLANT 3D
AUTODESK CIVIL 3D
AUTODESK RECAP PRO
AUTODESK NAVISWORKS

API and conversion tools

TKODP BIM Model in AMIS

Geospatial GIS and BIM Plug-in in AMIS
Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and ACCIONA

Asset Life Cycle Management

Tseung Kwan O Desalination Plant → Develop BIM Model → BIM Information System

Work Request, Task Scheduling, Job Dispatching, Site Work, Maintenance Cycle, Maintenance Strategy, Maintenance Records, Maintenance History, Maintenance Optimisation, Water Installations Asset Register, AMIS with BIM/GIS functions

Comprehensive BIM Workflow from BIM to RCM
Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and ACCIONA

COMPANY

Water Supplies Department, HKSAR Government
Shenzhen Yuegang Technology Company Limited
The University of Hong Kong
(HKU Business School)

PROJECT

Digitalizing Smart Water System: STTSS for
Pump Optimization with AI-Driven BIM and GIS
Integration

LOCATION

Dongjiang Raw Water Trunk Transfer System

TYPE

Water Works

SCHEDULED TIME OF COMPLETION

June 2023 - May 2025

Optimizing Raw Water Transfer Systems through AI and BIM-GIS Integration



About Water Supplies Department, HKSAR Government

The Water Supplies Department is responsible for operating and maintaining fresh water and flushing water supplies and distribution systems to ensure reliable water supplies to customers. The fresh water supply system covers 99.99% of Hong Kong's population, while the seawater supply network for flushing covers about 85% of the population.

About Shenzhen Yuegang Technology Company Limited

Shenzhen Yuegang Technology Company Limited has contributed to the Digital Transformation initiative of the Water Supplies Department since 2019 by implementing its suite of smart water technologies and systems to support various smart water projects.

About The University of Hong Kong (HKU Business School)

The University of Hong Kong (HKU Business School) has contributed to data analysis for this project. Their focus is on identifying the optimal pump operation combinations to ensure the supply of drinking water in Hong Kong while considering various constraints. Data will be integrated with the smart water technologies and systems to enable digitalization.

BIM PARTNER

Summit Technology (Hong Kong) Limited

AUTODESK PRODUCTS USED

- Autodesk® Civil 3D®
- Autodesk® Navisworks®
- Autodesk Platform Services
- Autodesk® ReCap® Pro
- Autodesk® Revit®
- Autodesk® Vault
- Infowater Pro

Project Description

The Smart Trunk Transfer Support System (STTSS) by the Water Supplies Department (WSD) of Hong Kong integrates BIM, GIS, AI, and IoT technologies to optimize energy management, reduce carbon footprints, and enhance climate resilience in raw water supply networks. The system features an Integrated System Performance Dashboard, offering real-time and offline monitoring, predictive maintenance, and advanced asset management. This revolutionary approach to water infrastructure management benefits Hong Kong's 7.5 million residents.

Project Challenges

The Water Supplies Department (WSD) of Hong Kong faced significant challenges in ensuring a reliable water supply amidst climate change-induced uncertainties, such as erratic rainfall and prolonged droughts. Traditional supply and control systems limited operational efficiency, energy management, and situational awareness, resulting in labor-intensive processes and difficulties in accessing comprehensive spatial and asset data. Additionally, the need for robust predictive maintenance and optimization to reduce energy consumption due to rising energy costs and enhance service level resilience was a critical challenge that necessitated innovative technological integration.

Solutions for Challenges

The Smart Trunk Transfer Support System (STTSS) effectively addresses these challenges by integrating cutting-edge technologies such as Building Information Modeling (BIM), Geographic Information Systems (GIS), Artificial Intelligence (AI), and the Internet of Things (IoT). The system's Integrated System Performance Dashboard offers real-time monitoring and advanced visualization in both 2D and 3D modes, providing comprehensive situational awareness and proactive asset management. AI algorithms optimize pump and valve scheduling, significantly reducing energy consumption and operational costs. The seamless integration of BIM and GIS data enhances the accuracy and completeness of asset information, streamlining maintenance processes and improving overall system resilience and sustainability.

How does BIM benefit the project?

Building Information Modeling (BIM) significantly enhances the Smart Trunk Transfer Support System (STTSS) by providing a detailed, realistic 3D model that integrates both geospatial and asset data, offering a comprehensive view of the water distribution network. This integration empowers the Water Supplies Department (WSD) to identify assets, monitor asset health, identify potential risks, and enhance decision-making processes for further optimization. BIM's interoperability with Geographic Information Systems (GIS) and Artificial Intelligence (AI) enhances operational efficiency and pump optimization through real-time SCADA data and predictive maintenance analytics. The result is an efficient and reliable AI dashboard platform, characterized by ISO 50001 energy management and reduced energy and operational costs.

Better with BIM

Building Information Modeling (BIM) significantly enhances the Smart Trunk Transfer Support System (STTSS) by providing a comprehensive "one picture overview" of the entire raw water supply network. This integration combines geospatial data, hydraulic models, dynamic 3D GIS visualization, and operational insights into real-world applications. Coupled with our specially designed AI-driven analytics platform, Galaxy, which includes rainfall and reservoir storage level predictive capabilities, this approach enables advanced optimization of pump and valve operations, resulting in substantial energy savings and improved operational efficiency. The seamless integration of BIM with GIS ensures that both vertical and linear asset data are perfectly aligned. This alignment facilitates enhanced collaboration and informed decision-making among project stakeholders.



Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and The University of Hong Kong (HKU Business School) Overall View of Muk Wu Pumping Station BIM As-built Model



Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and The University of Hong Kong (HKU Business School) Muk Wu Pumping Station BIM Model at STSS



Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and The University of Hong Kong (HKU Business School) Real-Time Monitoring of Dongjiang Water Mains at STSS

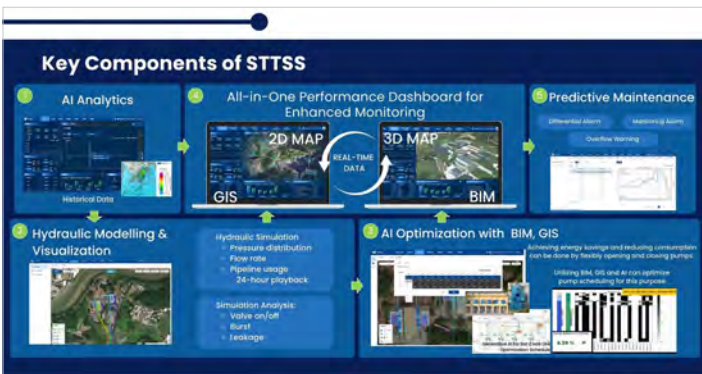


Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and The University of Hong Kong (HKU Business School) Key Components of STSS



Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and The University of Hong Kong (HKU Business School) AI Optimization Strategies Implemented in STSS



Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and The University of Hong Kong (HKU Business School) Utilizing BIM and GIS for Hydraulic Visualization of Dongjiang Water Mains in STSS

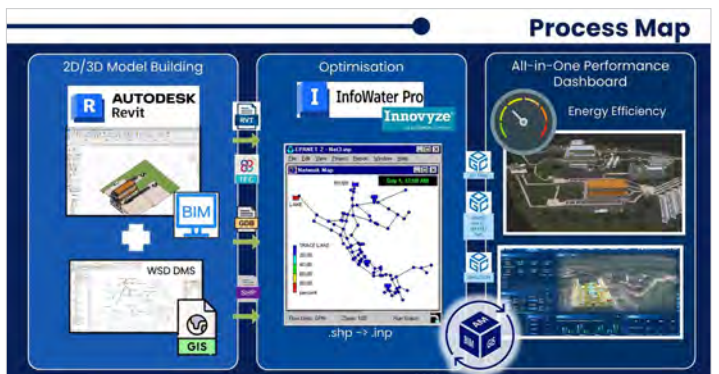


Image Courtesy of Water Supplies Department, HKSAR Government and Shenzhen Yuegang Technology Company Limited and The University of Hong Kong (HKU Business School) Process Map for BIM and GIS Integration in STSS

Advisors' Comments – Introduction

We would like to express our sincere gratitude, once again, to the local organizations that have supported us and the international BIM advisors who have been instrumental in guiding us on this year's Awards. The advisory panel, comprised of esteemed leaders from local supporting organizations, has generously granted us their time to discuss and review the shortlisted projects, and provided us with valuable insights vital for future growth and success. Inspired by the sharing and experiences of the international advisors, we will continue to innovate as we stride toward a more sustainable future.

Advisory Panel



Dr. Calvin K. Kam
FAIA, PhD, PE, LEED AP, CCBM
Founder and CEO,
Strategic Building Innovation · bimSCORE
(Advisor)



Ryan Leong
Director,
Architects Association of Macau



Simon J Gallagher
Chairperson,
Chartered Institute of Architectural Technologists,
Hong Kong Centre



Ar Prof Ada Fung, BBS
President,
Hong Kong Alliance of Built Asset & Environment
Information Management Associations
(The Hong Kong Chapter of buildingSMART International)



Ir Henry Cheung
Council Member,
Hong Kong Information Technology Joint Council



Dr Francis Chan
Chair of External Affairs,
Hong Kong Institute of Project Management



Ir Ng Chun Keung
FHKIE, FHKIUS, MICE, NEC PM, CCBM
Past President, Hong Kong Institute of Utility
Specialists



Mike Chan
Group Admin,
Hong Kong Revit User Group



Ir Steven Lai
Vice Chairman,
Institution of Public Private Partnerships



H F Wong
Executive Vice Chairman,
The Association of Hong Kong Professionals



Kelvin Choi
Hub Chair, The Chartered Institute of Building
(CIOB), Hong Kong



Kelvin Kuo
Chair of BIM Sub-Committee,
The Chartered Institution of Civil Engineering Surveyors
(Hong Kong Region)



Ar. Chan Wing Kai, Aaron
Chair, BIM & Smart City Committee,
Board of Practices,
The Hong Kong Institute of Architects



Nick Chan
Board Member,
The Hong Kong Institute of Building Information
Modelling



Michael Leung
Head of BIM Affairs,
The Hong Kong Institution of Engineering Surveyors



Ir Raymond Lui
Committee Member,
The Hong Kong Institution of Engineers
(IT division)



Edison Lai
President,
The Macau Institute of Engineers

Advisory Panel - Award Winners



Architectural Services Department, HKSAR
Hip Hing Engineering Company Limited

Project: Design and Construction of Expansion of the Legislative Council Complex

The Design and Construction of the Expansion of the Legislative Council Complex involves expanding the complex by adding 8,500 square meters of space to accommodate more legislators, with the goal of harmonizing the design with the existing complex and the adjoining government offices.

The Expansion of the Legislative Council Complex project impressively used BIM for a significant Addition and Alteration (A&A) project while the property remained in use. The project demonstrated the effective use of laser scanning, AR, and various BIM tools, in which BIM technology was also effectively utilized to create a “digital twin” of the site, enabling efficient management of the new construction and its integration with the existing building structure.

The project showcased the innovative use of 4D simulation technology to provide a visual representation of the construction process. This approach not only minimized errors but also offered a captivating implementation of BIM with clearly defined objectives. The project’s robust integration of design collaboration, open BIM, MiC, QTO, and VR fully demonstrated the potential for significant impact and success, leading us to a more innovative future.



CLP Power Hong Kong Limited

Project: CLP Power’s Yuen Long Industrial Estate Substation Project

CLP Power’s Yuen Long Industrial Estate 132kV Substation project caters to the growing electricity demand from nearby urban development and industrial activities. The project team has applied BIM throughout the project cycle, acting as an outstanding example of the successful integration of BIM and various digital technologies across the entire lifespan of the building.

The widespread implementation of BIM technologies played a pivotal role in resolving conflicts and overcoming project hurdles. Additionally, the multifaceted use of BIM technologies for tasks such as design review, coordination, code verification, simulation, and data transfer to AIM was truly commendable. Additionally, the utilization of Autodesk Tandem for FM data management stood out as a particularly impressive aspect of the project.



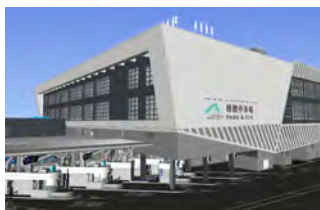
Environmental Protection Department, HKSAR
China Harbour Engineering Company Limited
Keppel Seghers – Zhen Hua Joint Venture

Project: Integrated Waste Management Facilities Phase 1

As Waste to Energy facility with the mission of reducing mixed municipal solid waste and recovering resources, the Integrated Waste Management Facilities (IWMF) project is a vivid example of how BIM brings transformative advancements to a project.

The facility features incineration technology and pollution control measures, and the overall initiative not only minimizes landfill usage but also supports sustainable waste management practices in Hong Kong in the long run. The project team has made extraordinary demonstration of how effective use of BIM and modelling in the design phase empowered all stakeholders to collaborate on construction sequencing and clash management, as well as enabling solid use of LOD to control the BIM level for maintaining project quality and ultimately, the project delivery, particularly with MiC and enhanced interface management. Considering the substantial scale of this project, its exceptional use of 4D and VR technology to effectively manage construction sequencing was particularly impressive.

Advisory Panel - Award Winners



Paul Y. - CIMC - JEC Joint Venture

Paul Y. - Chevalier Joint Venture

Manly-Tech Engineering Limited

Project: Automated Carpark A and B at HKBCF

This design-build-operate (DBO) project focused on the design, building, and operation of the Automated Carparks at HKBCF for the first few years. Instead of focusing on short-term benefits, the project team prioritizes long-term performance, while factors such as energy efficiency, maintenance requirements, and lifecycle costs during the design and construction phases are well taken care to create a sustainable and cost-effective facility, which is important to make our world more resilient and sustainable.

On top of that, the project showcased numerous innovative features, particularly in its integration capabilities for future development including how it effectively utilized BIM, MiC, and MiMEP throughout the design and construction phases. Also, advanced technology including 3D scanning for site condition verification, twin CDE and data flow system integration, engineering analysis, IoT integration, and post-occupation sensor system were heavily incorporated into the BIM system, making it easier to manage project activities, reduce risks, and improve efficiency. The complexity of this project and the smart use of BIM technology gave us a clear vision of the strong potential of digital twin.



Water Supplies Department, HKSAR Government

China Road and Bridge Corporation

Digie Engineering Technology Pte. Ltd.

Project: Construction of Siu Ho Wan Water Treatment Works Extension and Siu Ho Wan Raw Water Booster Pumping Station

The Siu Ho Wan Water Treatment Works is vital for supplying water to the Hong Kong International Airport, residential areas, and other important projects. It is connected with two raw water sources: Tai Lam Chung Reservoir and Shek Pik Reservoir with pipes and tunnels to transport the water to the treatment works.

Throughout the project, BIM technology was utilized effectively for the construction of Water Treatment Works, from smart integration of BIM with the real-life use of CFD to optimize flow rates, to the comprehensive implementation of BIM from 2D to 7D. In addition, the use of digital twins with BIM is also proven to be advantageous for operators in achieving chemical and energy savings, apart from other impressive achievements in the implementation of MEP coordination, engineering analysis, AIM data transfer, and DfMA applications.

Advisory Panel - Honorable Mentions



Architectural Services Department, HKSAR

Hip Hing Engineering Company Limited

Project: Design and Construction of Immigration Headquarters in Area 67, Tseung Kwan O

The project involves the construction of a new 17-storey Main Administration Tower with North and South Wings, a 16-storey Enforcement Tower, and a 1-storey basement car park for the Immigration Headquarters (IMMHQ), with the goal of improving connectivity in the TKO district while incorporating urban planning, care and anti-epidemic design, security, resilience, and sustainability.

With the well-defined goals in mind, the use of BIM in fabricating the freeform metal frame was particularly intriguing, making the project stand out for its utilization of large-scale 3D printing in conjunction with BIM for a complex structure like this. Being a project involving design and construction of multiple facilities with different functions, this project showcased the effective application of BIM for a Design & Build project, as it excellently demonstrated the utilization of BIM from the design phase through to construction. The seamless integration of BIM to incorporate MEP for DfMA and MiMEP also leads to reduction in unnecessary waste and resource usage in building services, which prepares us for a more sustainable tomorrow.

Advisory Panel - Honorable Mentions



Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region

AECOM Asia Company Limited

DCKJV and TYFRON Consultancy Limited

Project: Kwu Tung North and Fanling North New Development Area (First Phase)

Designed as a 5km transportation network, the project covers the 2km dual two-lane Fanling Bypass Eastern Section, a footbridge across Ng Tung River, a Landmark cycle track feature, two sewage pumping stations, and various road infrastructure and facilities.

Effective integration of contract management and BIM played a critical role in the successful management of this project. For example, the Kwu Tung North and Fanling North New Development Area project effectively utilized BIM and IoT, and included a traffic safety audit, demonstrating strong integration with IoT/GIS. This integration also provided all stakeholders with real-time updates on project progress, paving the way for increasing adoption of IoT technology in future construction projects.

The all-in-one site system platform was also proven to be an effective tool for project management, integrating the essentials of clear objectives, appropriate BIM applications, a complex project team structure, and an ambitious CDE approach. While the detailed and precise simulation and modelling of the construction process was also achieved with strong implementation of BIM in site planning and logistics. What's more, there was impressive use of cross-project CDE and effective implementation of DWSS, which optimized the integration of government 3D mapping data and site constraint simulation.



Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region

Ove Arup & Partners Hong Kong Limited

China Railway Group Limited and TYFRON Consultancy Limited

Project: Tung Chung New Town Extension – Site Formation and Infrastructure Works at Tung Chung Valley, Phase 1 (Contract No. NL/2020/06)

The Tung Chung New Town Extension project involves site formation for public housing development, revitalization of Tung Chung Stream, construction of the River Park, new roads, road improvements, and various public facilities including bridges, sewage pumping stations, and woodland planting.

The all-in-one site system platform, with its effective facilitation of this project type, was an asset and BIM was appropriately leveraged and integrated into the project. The use of an integrated platform for site management and safety monitoring was impressive and the comparison between virtual reality and actual conditions and the use of CDE was commendable. The beauty of this project is how it incorporated practical and meaningful KPIs, which were crucial for accurately assessing project progress and implementing enhancements. In addition to the effective use of BIM for coordination and management, the innovative application of IoT devices for floods and habitats monitoring makes this project a game-changer that other industry players can learn from, especially sustainability is the priority of our future projects.



MTR Corporation Limited

Arup

Project: MTR C1601 Kwu Tung Station for Northern Link

Located at the heart of the future Kwu Tung North New Development Area (NDA), the Kwu Tung Station is expected to become a hub of residential, retail, leisure, and community facilities, so it is crucial to design and build with the future potential of the surrounding areas in mind.

Though the project is currently in the design phase, extensive use of BIM was demonstrated in meticulous project planning. The forward-thinking team had fully embraced BIM technologies across various aspects since the early stages, with target completion dates set for 2027 and 2034. As a project with such a long project span, the terrific use of BIM technology becomes a powerful tool for crowd simulation, code checking, and site feature mapping. Its innovative use of BIM in energy, particularly with Open BIM, certainly raises the bar for the industry when it comes to resilience and sustainability with BIM.

Advisory Panel - Honorable Mentions



Sun Hung Kai Properties Limited
Sanfield (Management) Limited
Strategic Building Innovation (SBI) bimSCORE Limited

Project: Tai Po Town Lot No. 253 and 157 RP, Sai Sha

The Tai Po Town Lot No. 253 and 157 RP Development aims to revitalize the Sai Sha region of Hong Kong, covering a recreation and sports center, welfare center, residential area, and road expansion, with an emphasis on sustainable construction practices and integration of modern design with nature.

To achieve such goals more effectively and comprehensively, the project team showed a strong commitment to integrating BIM technology into the project, and best of all, it becomes a success showcase in establishing a repository for future reference. By leveraging BIM technology for quantitative measurements like regular assessment of KPIs, the team could significantly enhance project efficiency by monitoring critical aspects of quality, which is equally important for project success. This also is a promising approach that warrants further exploration in the construction sector. The innovative utilization of BIM in the manufacturing process, on-site installation, and assessment of material waste presented exciting opportunities to drive innovation in the construction industry. As we march into a new era, the comprehensive integration of BIM across various stages of the construction process would significantly drive innovation, improve project outcomes and enhance overall industry standards.



Water Supplies Department, HKSAR Government
Shenzhen Yuegang Technology Company Limited
ACCIONA

Project: Innovative Asset Management for Building Resilient Water Supply: BIM & AMIS at Tseung Kwan O Desalination Plant

To achieve the goal of providing about 10% of Hong Kong's freshwater needs, the Tseung Kwan O Desalination Plant (TKODP) expected to use reverse osmosis technology to convert seawater into drinking water, with an initial capacity of 135,000 m³/day, expandable to 270,000 m³/day.

In this project, BIM was successfully applied to project and asset management. While the integration of GIS-based technology with BIM provided stakeholders with an optimal and comprehensive solution, BIM supported effective asset management and ensured a digitalized workflow in the daily operation of the facility. What's more, the project successfully implemented AIM data control and broader data integration under the client department's management, making it easier to manage data collected from multiple sources. Empowered by open BIM and other Autodesk technology, a tailored project management platform was also created, enabling the project team to better manage the overall progress of this community-focused project.



Water Supplies Department, HKSAR Government
Shenzhen Yuegang Technology Company Limited
The University of Hong Kong (HKU Business School)

Project: Digitalizing Smart Water System: STTSS for Pump Optimization with AI-Driven BIM and GIS Integration

Water is fundamental to our everyday life. When building the Smart Trunk Transfer Support System (STTSS), the team strived to balance the needs of optimizing energy management, reducing carbon footprints, and enhancing climate resilience in raw water supply networks.

The project's use of digital twins, MIC, and BIM to achieve energy savings and system performance improvement was particularly intriguing. It differentiated itself from other submissions through its detailed elaboration on the use of BIM, IoT, monitoring sensors, and centralized platforms to enhance system performance.

Thanks to the project team's vision and dedication, the project showcased a practical application of predictive analytics and hydraulic modelling, along with a seamless integration of GIS and BIM. BIM enabled the innovative system development, while GIS and BIM for operations were successfully implemented, presenting the potential of such groundbreaking integration. The specialized STTSS system, incorporating BIM, AI, GIS, and other technologies, provided real-time data on energy consumption, water supply forecasts, and operational efficiency. With this unique approach to informatization, this project focused on transforming an as-built facility into a hub for facility management and daily operations.

This innovative project marks itself as a compelling example of a Smart City application, effectively demonstrating the value of BIM in an as-built facility, serving as a foundation for authoring information containers and showing synergy with other digital applications. Most importantly, the adoption of BIM technology in this project ensures better management, higher energy efficiency and a more sustainable operating model to serve the city's 7.5 million residents.

Dr. Calvin Kam

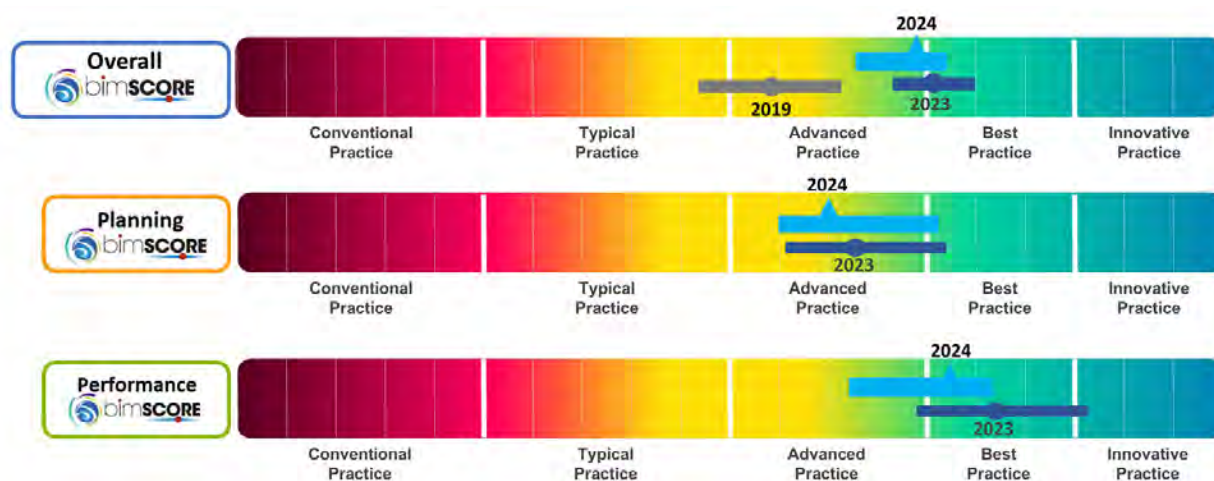
bSI Fellow, FAIA, PhD, CCBM

Overview

The **2024 Hong Kong Building Information Modelling (BIM) Awards** witnessed diverse projects showcasing innovative and creative use of BIM and openBIM®-enabled technologies, ranging from building projects including the Legislative Council Complex to infrastructure projects including the Water Treatment Works Extension. Some of the past Hong Kong BIM Award winners from 2018 to 2023, including ArchSD, Hip Hing, and CLP, continued to excel in technology application and integration such as **Artificial Intelligence (AI), Modular Integrated Construction (MiC), and BIM-based Excavation Quantity Take-off (QTO)**.

Our international management consulting team at Strategic Building Innovation · bimSCORE (SBI) has developed an **evaluation framework** for a **preliminary assessment** of the candidate projects. Projects were benchmarked against the global knowledge base representing hundreds of projects from over 16 countries, and categorized into five maturity tiers ranging from “Conventional” to “Innovative” Practices [as shown in the image below]. Generally aligned with 2023, the 2024 winners fall between “**Advanced**” and “**Best**” Practice tiers per the global context.

The winning projects were further analysed in four evaluation areas: Planning, Performance, Adoption, and Technology. Data shows that this year’s winning projects exhibited a tighter range of scores with an overall decrease in average scores compared to the previous year.



**** Projects were evaluated based on the materials submitted by the applicants without interviews.**

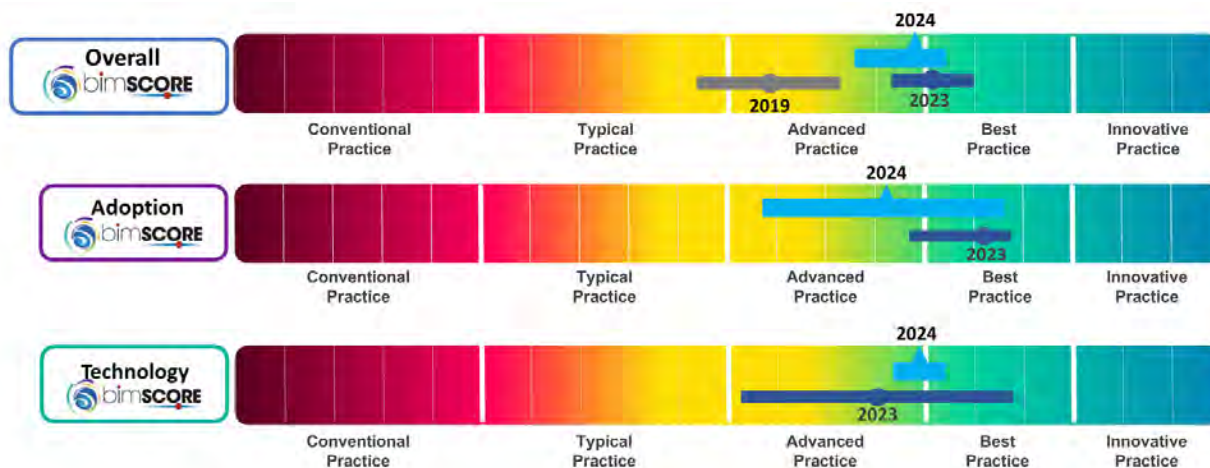
Planning and Performance

Planning for BIM implementation involves setting clear objectives with quantitative and qualitative performance targets, supporting teams to success with tools, training, and standards, and fostering collaboration among project teams. **Performance** monitoring is enhanced through BIM and automation for tracking project metrics to inform design and project management decisions. It's encouraging to note that all the award-winning projects have been following **ISO 19650 series** for more standardized and consistent information exchange processes. They also explored BIM & openBIM supported by new technologies to address project objectives and achieve positive quantitative results, such as:

- Architectural Services Department and Hip Hing (project: Design and Construction of Expansion of the Legislative Council Complex) identified project objectives, established metrics on required MiC/DfMA adoption for different building blocks, and recorded a time **reduction of 90% on QTO for formwork** by Dynamo for cost estimation.
- CLP Power Hong Kong Limited (project: Yuen Long Industrial Estate Substation) achieved time savings of **25% for consultants, 20% for contractors**, and forecasted **50% for operators**.
- Water Supplies Department, China Road and Bridge Corporation and Digie Engineering Technology (project: Construction of Siu Ho Wan Water Treatment Works Extension and Siu Ho Wan Raw Water Booster Pumping Station) impressively documented an **economic benefit of HKD 7.6 million**, and a **120-day time reduction**.

In formal bimSCORE evaluations, Performance score records qualitative responses of stakeholders (such as user emotion) and 3rd party auditing of performance figures. In collaboration with organisations including the Hong Kong Development Bureau (DEVB), SBI formulated BIM KPIs and recommended a BIM Measurement Framework to track and report BIM adoption. Since these measures were not included in award application packages, the confidence level of the Performance scores is relatively low. Performance assessment showed variations among projects in the qualitative and 3rd party auditing aspects. ***SBI encourages organisations to more proactively establish BIM-based objectives with targeted measures of success, and track these with input**

mechanisms that include quantitative and qualitative metrics reported by multiple stakeholders. This approach will produce performance reporting and analysis that can be used for management decisions, demonstrate progress, and drive advancement.



** Projects were evaluated based on the materials submitted by the applicants without interviews.

Adoption and Technology

Adoption of BIM is measured across the project lifecycle and with various stakeholders to gauge the degree of BIM implementation. **Technology** measurements consider an informed selection of BIM and related tools that support interoperable information exchanges and information-rich models. It's exciting to witness increasing levels of sophistication in technology implementation this year. Award winners implemented Common Data Environment (CDE), further leveraged integrated technologies such as **BIM + GIS + IoT, AI**, and continued to explore Multi Trade Integrated Mechanical, Electrical & Plumbing (**MiMEP**), **DfMA** supported by openBIM solutions such as **BCF (BIM Collaboration Format)-based issue management** for more productive information exchanges and workflows.

- Environmental Protection Department, China Harbour Engineering Company and Keppel Seghers – Zhen Hua Joint Venture (project: Integrated Waste Management Facilities Phase 1), Paul Y. - CIMC - JEC Joint Venture, Paul Y. - Chevalier Joint Venture and Manly-Tech Engineering (project: Automated Car Park A at HKBCF (Phase 1) and Automated Car Park B at HZMB HKP (Phase 1)) both defined organisation structure with specific **roles and responsibilities** for stakeholders.
- Architectural Services Department and Hip Hing (project: Design and Construction of Expansion of the Legislative Council Complex) implemented **AI-empowered** Autodesk Forma for detailed model analysis, and **AI-empowered** EvolveLAB Veras for a more effective rendering process.
- CLP Power Hong Kong Limited (project: Yuen Long Industrial Estate Substation) adopted **IFC-based** Clash Detection and LOD-I checking, and leveraged **Revit + ArcGIS** for sunlight analysis.

Compared to the 2023 awardees, the 2024 winners displayed a narrower spectrum of technological implementation, ranging from higher “Advanced Practice” to lower “Best Practice”, with a better outcome on average. ***SBI encourages project owners to clearly define team roles and responsibilities, and strike a balance between the breadth and depth of BIM use based on project and client goals, team capabilities, and market dynamics. Emphasizing organisational processes, involving stakeholders, providing appropriate tools and training, and supporting teams to success across all project stages are all vital elements contributing to successful BIM adoption.**



Dr. Calvin K. Kam
bSI Fellow, FAIA, PhD, CCBM

Founder and CEO,
Strategic Building
Innovation-bimSCORE

Adjunct Professor
Center for Integrated
Facility Engineering,
Stanford University

Dr. Calvin Kam is the Founder of Strategic Building Innovation (SBI) and bimSCORE.com – the “GPS Navigator” for any enterprise or project team charting courses for construction innovation. Dr. Kam teaches undergraduate, graduate, and professional courses and leads research as an Adjunct Professor at Stanford University’s Center for Integrated Facility Engineering, where he partners with industry members in areas such as Building Information Modeling, Virtual Design, and Construction as well as Smart and Sustainable Developments. Calvin was a former National Chairman of the Center for Integrated Practice and the Technology in Architectural Practice Knowledge Community (supported by 10,000+ professionals) with the American Institute of Architects (AIA), for which he had also served on the Board Knowledge Committee.

Dr. Kam has worked with the Construction Industry Council, Development Bureau, English Schools Foundation, Hong Kong Housing Authority, Lands Department, Sun Hung Kai Properties, University of Chicago, and Walt Disney Imagineering, and was invited to present and facilitate at both the 2014 and 2015 APEC workshops and to author two APEC publications. In 2011, the Singapore government’s Building & Construction Authority appointed Calvin as an international expert to advise its construction productivity and BIM roadmap. In 2015, Calvin was appointed an Expert Advisor to the Shanghai government’s BIM advancement centre.

Calvin is honoured by elevation to the title of Fellow in both buildingSMART International and the American Institute of Architects. He is a recipient of many awards including ENR’s “20 under 40” and BD+C’s “40 under 40”. Calvin is a Registered Architect, Professional Engineer, and LEED AP in the USA with a Ph.D. from Stanford University. Dr. Kam has presented at 100+ industry events/universities across 18 countries and regions and published several book chapters and journal publications. Calvin has also served as an Expert Advisor for the Hong Kong AIAB BIM Awards since 2008.



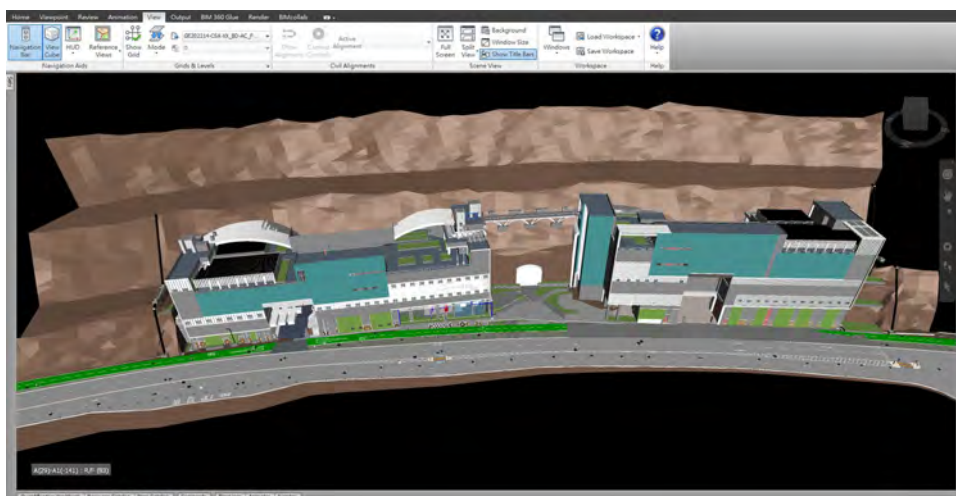
Sr KEUNG Shun Lok
 MSc (Geomatics), CCBM, CCBC, MRICS,
 MHKIS, MCInstCES, MHKInstES,
 MHKICBIM, MHKIBIM

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.

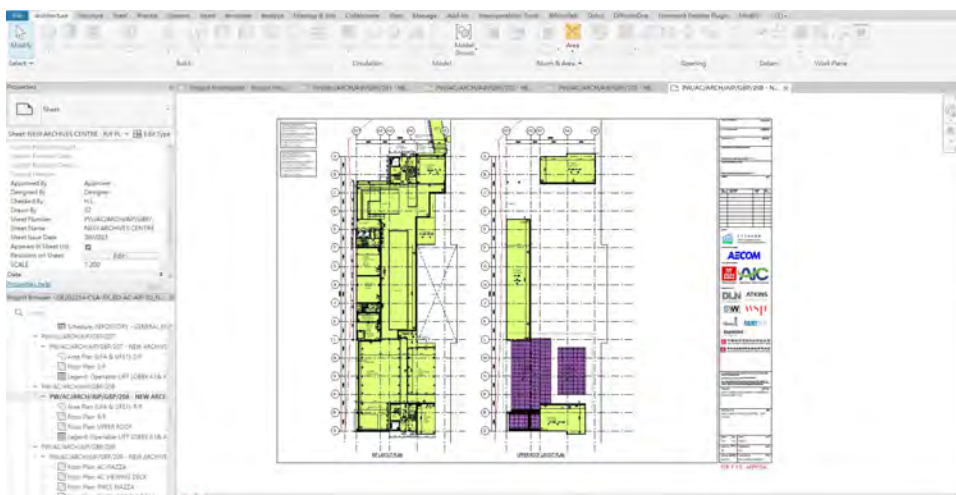
BIM-based Workflow on Design and Build Cavern Development Project at Anderson Road Quarry Site



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

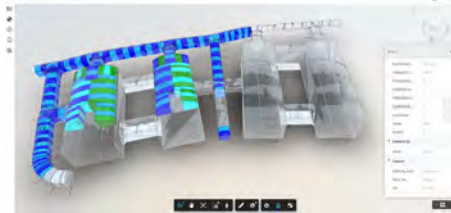
China State - Alchmex Joint Venture used Autodesk AEC Collection and Autodesk Construction Cloud in the design and construction of Joint Cavern Development at Anderson Road Quarry Site (Contract No. GE/2022/14). This is the first time in Hong Kong that caverns are utilized to serve non-infrastructure 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



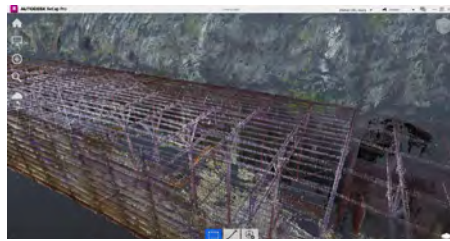
Drawings Generated from Autodesk Revit
Image courtesy of Civil Engineering and Development Department, The Government of the Hong Kong Special Administrative Region and AECOM Asia Company Limited and China State - Alchmex Joint Venture



Progress Monitoring using Autodesk Construction Cloud
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Progress Monitoring using Autodesk Construction Cloud
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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.

Early Design Stage

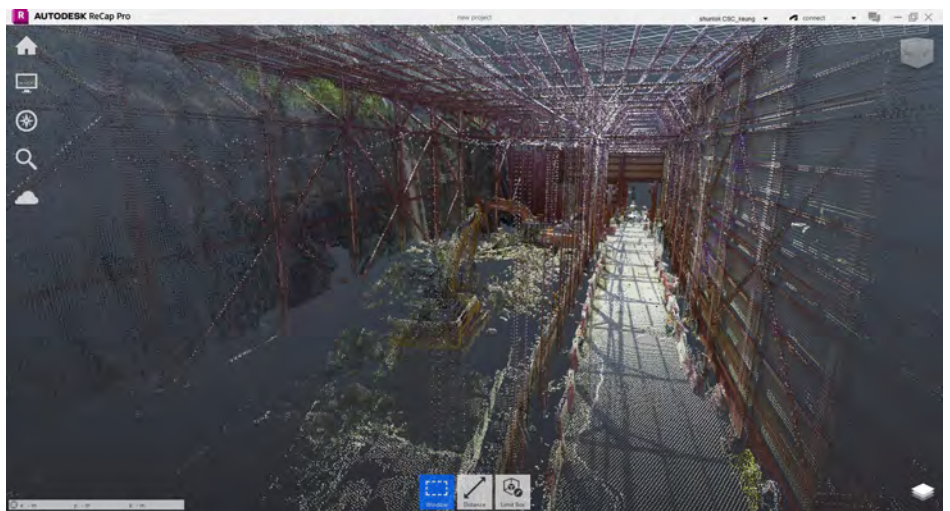
The existing condition model (ECM) has been developed using small unmanned aircraft (SUA) and laser scanning. Concurrently, the first design BIM model was also developed for better collaboration. By combining the ECM and the Design BIM model, the project team could perform better design review and authoring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

Design Stage

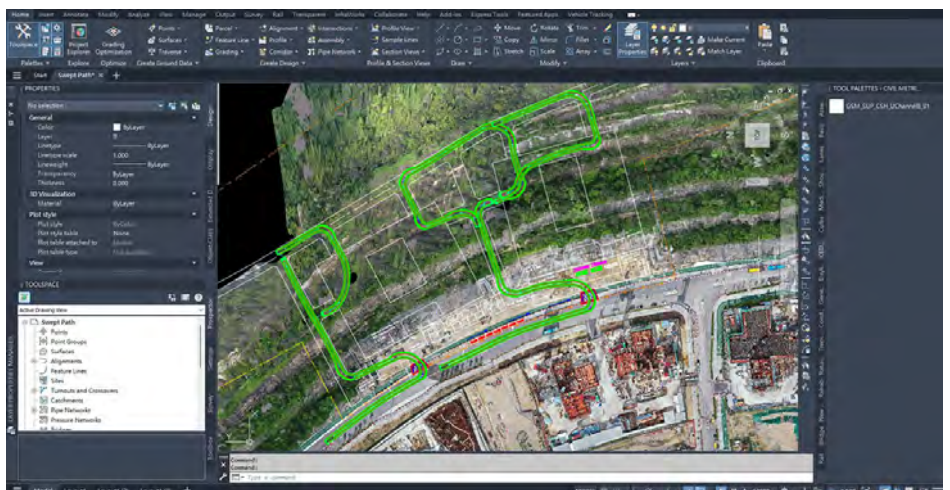
The construction adits and the caverns design were developed through comprehensive analysis with the existing terrain and the design BIM model, and it was validated with swept path analysis using Autodesk Vehicle tracking, after the design of caverns was confirmed, a noise enclosure is going to be constructed 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



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



HUANG Cong



ZHANG Xiao



KWOK Helen Hoi Ling



ZHANG Jiaying

INSTITUTION

The Hong Kong University of Science and Technology

PROJECT NAME

Digital Twin-based ESG Platform for Property and Facility Management Industries

PROJECT LOCATION

Yau Tong, Hong Kong

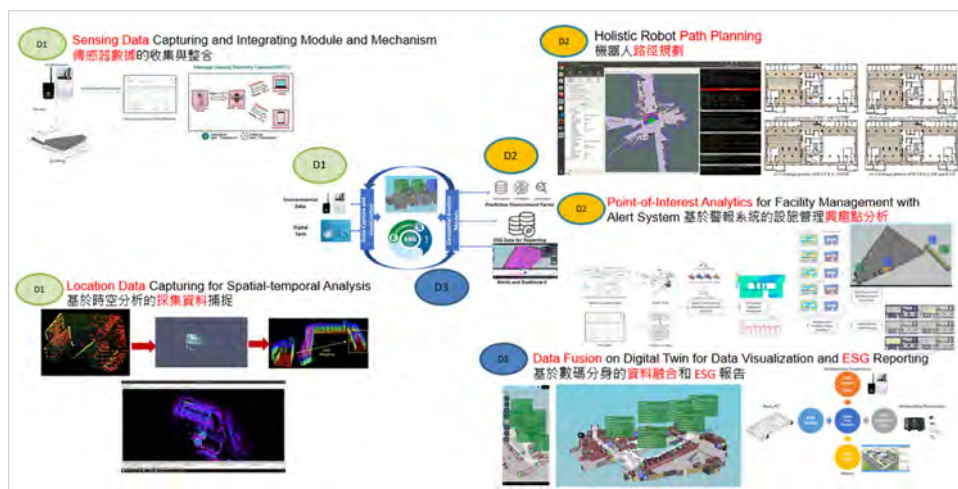
TYPE

Digital twin platform for ESG management

AUTODESK PRODUCTS USED

- Autodesk® AutoCAD®
- Autodesk Construction Cloud®
- Autodesk® Forma
- Autodesk® Revit®
- Autodesk Viewer

Digital twin-based ESG Management in Built Environment using BIM, Robotics and AI



BIM-based Digital Twin IAQ Robotic Platform for ESG
Image Courtesy of The Hong Kong University of Science and Technology

Project Background

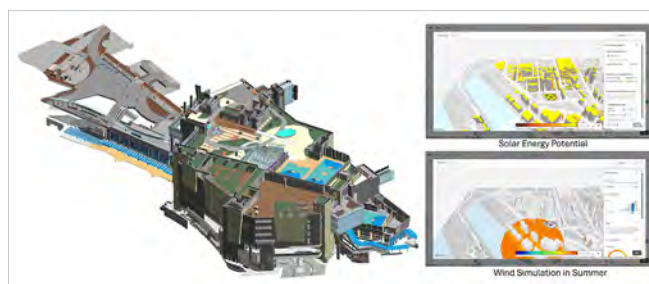
Environmental, social, and governance (ESG) initiatives push upgrades in the property and facility management industry. There are increasing concerns about indoor air quality (IAQ) from occupants. However, there is a lack of manpower and expertise to conduct regular on-site inspections and monitor IAQ. This project aims to develop a digital twin-based ESG platform, based on BIM, robotics and AI technologies to support ESG reporting and environmental monitoring. International IAQ standards and workflows specific to building operations are considered when integrating building system data, sensor data and location data from the robots with the digital twin platform.

Project Challenges and Solutions

The first challenge is that path planning capability of robots in the market cannot meet high and constant demands in conducting on-site inspections and IAQ monitoring. The holistic path planning framework for UGV is proposed to improve IAQ monitoring coverage, as well as to predict and avoid collisions in an indoor environment. Robot localization methodology and a protocol to establish stable communication for continuous location extraction of UGVs are developed. Secondly, the existing digital twin systems focused on data visualization, which is insufficient for decision-making in building control. An environmental monitoring framework using digital twin and robotics technology is developed. Spatial-temporal analytic models for Point-of-Interest (PoI) analytics and IAQ monitoring are developed to identify hotspots and problem areas and to set up an alert system for regions with poor IAQ. A data integration framework to support dynamic IAQ data display and evident-based ESG analytics on openBIM-based digital twin platform.

How does BIM help for your project?

BIM technologies are used for visualization, analysis, simulations, monitoring and collaboration. Firstly, as-built models are not up-to-date from facility management perspective. Scanning may not be reliable as MEP equipment is hidden above false ceiling. We first to inspect the MEP system using AutoCAD and conduct site inspection for checking. Then, we update the as-built BIM model based on the inspection results using Autodesk Revit. Secondly, we need to conduct multiple analysis and simulations. Utilizing Autodesk Construction Cloud, BIM model is served as single source of truth for accuracy and consistency for multiple simulations, which includes conducting site analysis Using Autodesk Forma and crowd simulation using Anylogic. Lastly, as



BIM Model of Domain Shopping Mall and BIM-based site analysis using Autodesk Forma
Image Courtesy of The Hong Kong University of Science and Technology

this project involves multiple parties, reliable collaboration mechanism is required for both internal and external parties. We use Autodesk Construction Cloud for internal BIM model sharing and Autodesk Viewer for sharing to external parties for review.



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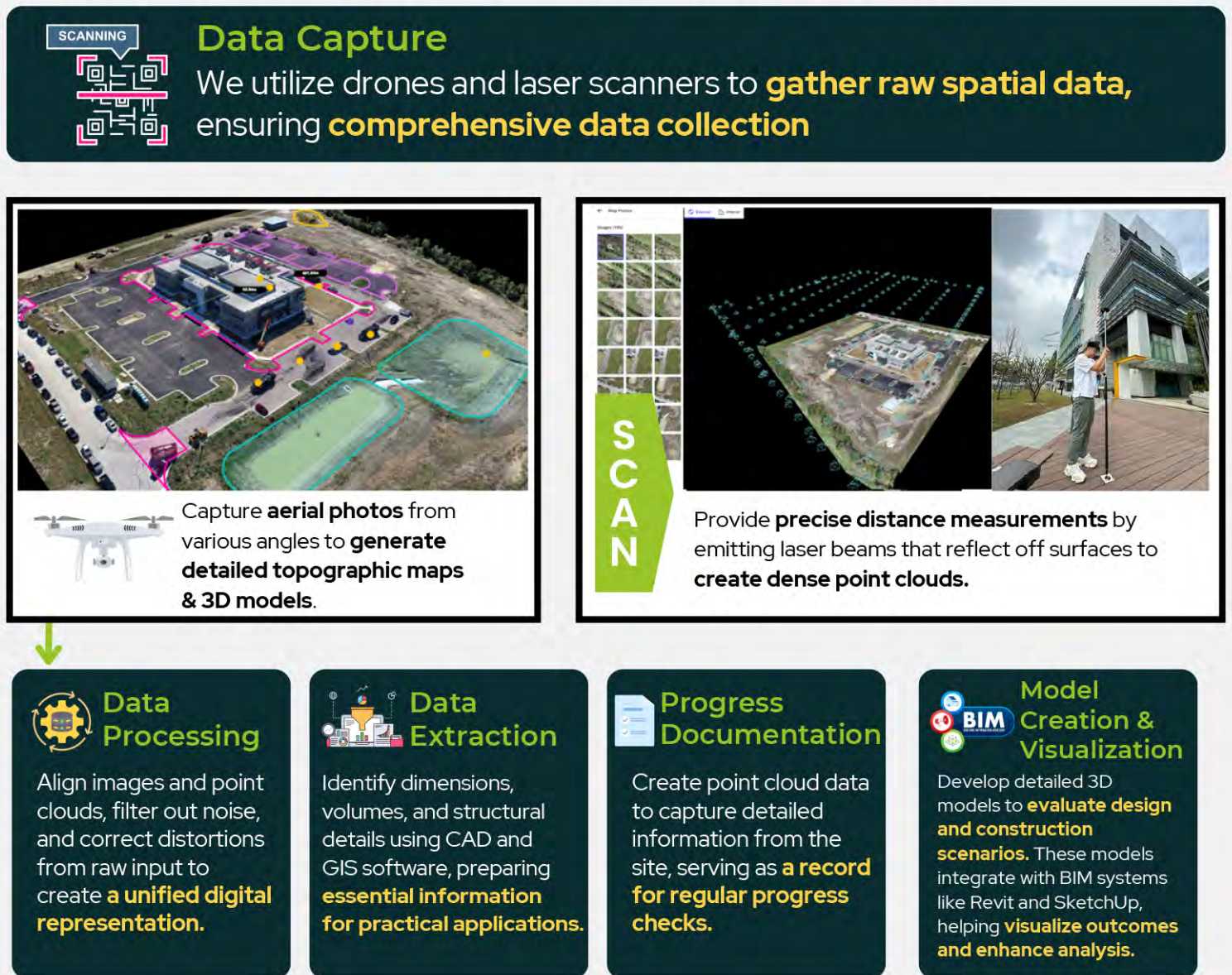
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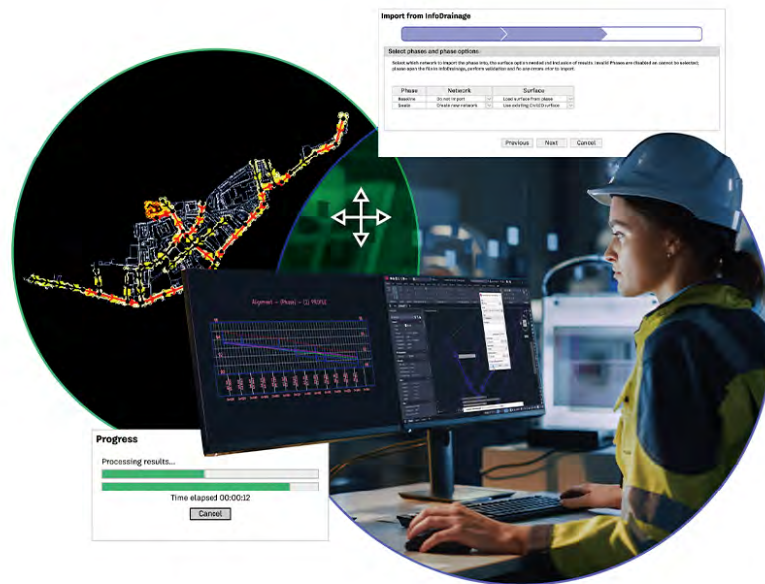
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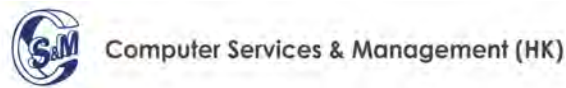
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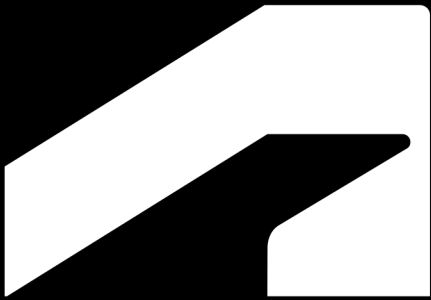


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