

COMPANY

Drainage Services Department, the Government of the Hong Kong Special Administrative Region
Binnies Hong Kong Limited
China State Construction Engineering (Hong Kong) Limited – Alchmex International Construction Limited Joint Venture

PROJECT

DC/2022/03 Yuen Long Barrage and Nullah Improvement Schemes

LOCATION

Yuen Long

TYPE

Flood Prevention

SCHEDULED TIME OF COMPLETION

March 2028

BIM-Driven, Industry-Empowered, Green-Inspired: Yuen Long Barrage and Nullah Improvement Scheme



“We are proud to present the Yuen Long Barrage and Nullah Improvement Schemes. This project exemplifies how visionary collaboration, powered by integrated BIM and digital innovation, can redefine infrastructure delivery. By uniting multidisciplinary teams through a common data environment, we have achieved unprecedented efficiency, safety, and sustainability—setting a new benchmark for flood resilience and smart construction in Hong Kong and beyond.”

–Clement WONG

Engineer,
Drainage Services Department,
the Government of the Hong Kong
Special Administrative Region

–Thomas CHEUNG

Chief Resident Engineer,
Binnies Hong Kong Limited

–GU Zipeng

Project Manager,
China State Construction
Engineering (Hong Kong)
Limited – Alchmex International
Construction Limited Joint Venture

BIM PARTNERS

ATAL Engineering Limited
AECOM Asia Company Limited
VIRCON Limited
GuangDong Lecong Steel World
Electronic Commerce Co., Ltd

AUTODESK PRODUCTS USED

Autodesk® AutoCAD®
Autodesk® BIM 360® Docs
Autodesk® BIM Collaborate Pro
Autodesk® Civil 3D®
Autodesk® Dynamo Studio
Autodesk® Navisworks® Freedom
Autodesk® Navisworks® Manage
Autodesk® ReCap® Pro
Autodesk® Revit®
COBie Extension for Revit
Model Checker for Revit



Overview for Yuen Long Barrage and Nullah Improvement Schemes
Image Courtesy of Drainage Services Department, the Government of the Hong Kong Special Administrative Region and Binnies Hong Kong Limited and China State Construction Engineering (Hong Kong) Limited – Alchmex International Construction Limited Joint Venture

Project Description

The Yuen Long Barrage and Nullah Improvement Schemes represent a landmark achievement in infrastructure commissioned by the Drainage Services Department (DSD) to significantly enhance Hong Kong's flood resilience.

As one of the largest flood barrages in Asia, the project's scale encompasses a stormwater pumping station, automatic flood barriers, and a master control centre. Beyond flood protection, the project revives Yuen Long Nallah waterway, upgrades and installs new floodwalls, and constructs a dry-weather flow interception system to divert polluted urban runoff into the proper sewerage system for treatment, thereby improving the overall environment in urban areas.

Critically, Building Information Modeling (BIM) was adopted across the entire project lifecycle—from design and construction to future maintenance and operations—creating a digital legacy for asset management. A key to its success was the exceptional collaboration between multi-disciplinary stakeholders, including the client (DSD), supervising consultant (Binnies), the main contractor (China State – Alchmex JV), and all subcontractors, all seamlessly connected through a single, cloud-based Common Data Environment (CDE) on Autodesk BIM 360.

Value of BIM to the Project

Digitization was fundamental to the project's success, greatly enhancing returns and establishing a new benchmark in digital barrage engineering. By employing advanced virtual coordination, many design conflicts were resolved before construction began,

greatly reducing delays and improving coordination speed. Real-time data integration through a unified digital platform enabled highly accurate quantity tracking and significantly improved cost management. Virtual reality safety training and advanced scanning ensured safe and constructible designs prior to work starting.

Industrialization was demonstrated through the implementation of a large-scale modular excavation support system, manufactured off-site using precise digital models. This approach notably shortened the project timeline and greatly improved on-site assembly efficiency, highlighting the advantages of prefabrication in complex infrastructure delivery.

Green Transformation was integrated across all project phases, with digital tools optimizing material usage and reducing waste. Off-site fabrication minimized local disruption and environmental impact, while the facility's energy-conscious design supports broader sustainability objectives, setting a new standard for environmentally responsible urban development.

Internationalization was reflected in the adoption of globally recognized digital standards within a shared data environment. This alignment with international best practices created a transferable model for future projects, reinforcing Hong Kong's leadership in world-class engineering.

Digital Management Strategy

The BIM management strategy for the Yuen Long Barrage and Nullah Improvement Schemes was built on a seamless integration of three key technologies. Autodesk BIM 360 provided the central foundation, acting as the single source of truth where all design and construction data converged. This cloud-based Common Data Environment ensured version control, automated approval workflows, and clash detection, enabling all stakeholders—from designers to contractors—to collaborate using the most current information, which was critical for a project of this scale and complexity.

To bridge the gap between the virtual model and the physical construction site, the project leveraged the C-Smart platform. This tool integrated IoT sensors, RFID tracking, and mobile applications to translate BIM 360 data into actionable field intelligence. It enabled real-time progress monitoring, automated quality inspections, and instant issue resolution directly on-site. This closed-loop digital-physical system ensured that the precision planned in the model was

accurately executed in the field, particularly within the challenging environment of the nullahs, while providing full traceability of materials and activities.

Underpinning the entire process was a foundational commitment to OpenBIM standards using Industry Foundation Classes (IFC) and COBie data formats. This vendor-neutral approach ensured seamless data exchange between multiple software platforms including Tekla, Revit, Navisworks, and the C-Smart system without proprietary barriers or data corruption. The implementation of standardized classification systems and data validation protocols-maintained information integrity across all project phases. This interoperability not only streamlined collaboration among all stakeholders but also future-proofed all digital deliverables, ensuring the data will remain accessible and valuable for the client's asset management systems throughout the infrastructure's entire operational lifecycle, while establishing a replicable benchmark for public infrastructure projects.

Advancing Project Delivery through mELS

The project's innovative use of a modular Excavation Lateral Support (mELS) system, managed through a Full Lifecycle Tracking process, fundamentally transformed a traditionally high-risk construction activity. Designed and precision-fabricated off-site directly from the BIM model, each mELS component was equipped with an RFID tag, creating a two-way binding with its digital twin in the OpenBIM model. This ensured complete traceability and transparent management throughout its journey from factory production and logistics to on-site installation. This shift from manual, on-site welding and assembly to a controlled, tracked manufacturing process significantly enhanced overall quality, consistency, and progress monitoring. The primary benefits included a major reduction in the required on-site workforce and duration for the excavation support phase, which streamlined the critical path of the project schedule. Furthermore, by moving the complex fabrication work to a factory environment, site safety was substantially improved, minimizing workers' exposure to hazardous tasks and heavy machinery operations in the excavation area.

BIM to Safety

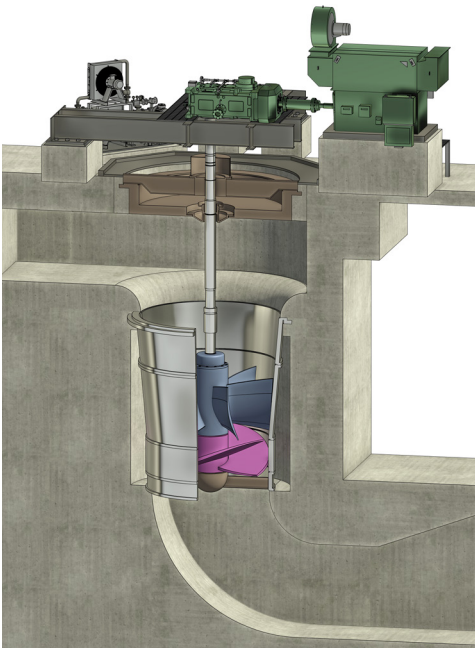
BIM technology was leveraged to proactively engineer safety into the project's planning and execution. The team utilized 4D construction sequencing to create detailed visual simulations of the construction process. This was particularly critical given the project's extreme challenges: working in a heavy rainfall and high flood risk environment, while managing multiple work fronts within a severely limited space and under tight deadlines. The 4D models allowed planners to visually identify and mitigate potential safety hazards—such as water runoff paths, equipment access during storms, and spatial conflicts between concurrent work crews—long before physical work began. This was complemented by immersive Virtual Reality (VR) safety simulations, which provided workers with realistic training in a completely safe environment, familiarizing them with the complex site logistics and emergency procedures without any risk. This proactive, data-driven approach to de-risking these formidable challenges before they could manifest on site was a fundamental contributor to the project's exemplary safety performance and its successful achievement of a zero-accident record.

Conclusion

The project's digital achievements position the Yuen Long Barrage and Nullah Improvement Schemes as a model for future smart infrastructure in Hong Kong, demonstrating how integrated data management can enhance both construction efficiency and long-term operational resilience. The implemented framework ensures that all digital assets are prepared for future integration with the Drainage Services Department's asset management systems, providing a solid foundation for the barrage's role in Hong Kong's ongoing flood protection strategy and climate resilience efforts.



One of the Largest Stormwater Pumping Station in Asia
 Image Courtesy of Drainage Services Department, the Government of the Hong Kong Special Administrative Region and Binnies Hong Kong Limited and China State Construction Engineering (Hong Kong) Limited – Alchmex International Construction Limited Joint Venture



Main Pump Section Details

Image Courtesy of Drainage Services Department, the Government of the Hong Kong Special Administrative Region and Binnies Hong Kong Limited and China State Construction Engineering (Hong Kong) Limited – Alchmex International Construction Limited Joint Venture



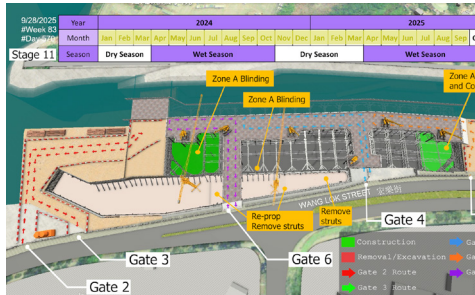
Main Pumping Station's Internal Equipment

Image Courtesy of Drainage Services Department, the Government of the Hong Kong Special Administrative Region and Binnies Hong Kong Limited and China State Construction Engineering (Hong Kong) Limited – Alchmex International Construction Limited Joint Venture



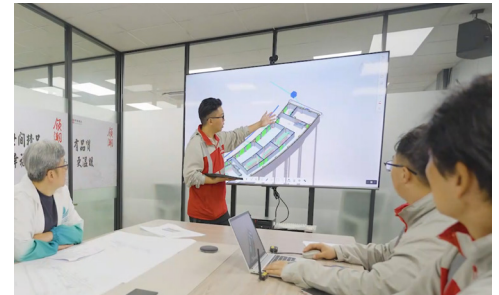
C-Smart Platform for mELS Progress Visualization with OpenBIM

Image Courtesy of Drainage Services Department, the Government of the Hong Kong Special Administrative Region and Binnies Hong Kong Limited and China State Construction Engineering (Hong Kong) Limited – Alchmex International Construction Limited Joint Venture



CMS for ELS installation of Yuen Long Barrage Pumping Station

Image Courtesy of Drainage Services Department, the Government of the Hong Kong Special Administrative Region and Binnies Hong Kong Limited and China State Construction Engineering (Hong Kong) Limited – Alchmex International Construction Limited Joint Venture



Real-Time 3D Coordination via BIM360

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