COMPANY

Paul Y. - Qianhai Joint Venture
Vircon Limited

PROJECT

Additional District Cooling System (DCS) at the Kai Tak Development (KTD)

LOCATION

Kai Tak Development, Kowloon

TYPE

District Cooling System

SCHEDULED TIME OF COMPLETION

Q3 2024

Digitalization in Construction - with full BIM Implementation, DfMA and MiMEP

"BIM is our key to support and drive the digital transformation of the local construction industry. We remain dedicated to enhance our BIM technology and utilize innovative approaches to meet the evolving needs of our clients while contributing to the sustainable development of Hong Kong."

— **Michael Kwan**
Deputy General Manager, Paul Y. Construction Company

AUTODESK PRODUCTS USED

Autodesk® AutoCAD®
Autodesk® Civil 3D®
Autodesk Construction Cloud®
Autodesk Forge®
Autodesk® Navisworks® Freedom
Autodesk® Navisworks® Manage
Autodesk® ReCap® Pro
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Additional District Cooling Plant
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited

Introduction

The District Cooling System (DCS) at the Kai Tak Development is a large-scale centralized and energy-efficient district air-conditioning system which is also the first of its kind, in Hong Kong. It utilizes sea water to produce chilled water in central chiller plants and distributes it to customer buildings through an underground piping network for air-conditioning use. Compared to traditional air-cooled and water-cooled air conditioning systems using cooling tower, the DCS offers electricity savings by leveraging economies of scale and benefiting from efficient operation and maintenance.

Difficulty and MiMEP

In view of the shortage of construction workers, tight construction schedules and safety hazards which may arise

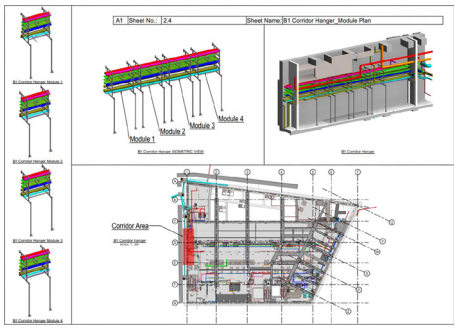
Bird's eye view of Additional District Cooling Plant
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited

from limited space available during the construction of large-scale electrical and mechanical (E&M) Plants and installation of relevant equipment.

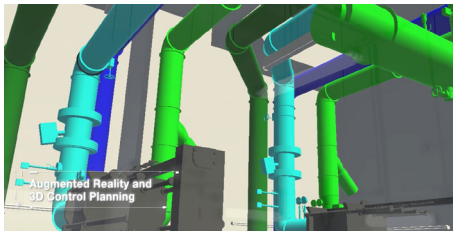
Paul Y. - Qianhai JV (PYQJV) applies an innovative construction method of "Design for Manufacture and Assembly" (DfMA) for carrying out "Multi-trade integrated Mechanical, Electrical and Plumbing" (MiMEP) works in the construction of an Additional Disctrict Cooling System (ADCS) at the Kai Tak Development. The ADCS plant at the Kai Tak Development accommodates large E&M equipment including 15 meter long Travelling Band Screens, integrated Air Handling Units and MiMEP Modules in the corridors. They are prefabricated off-site in a manufacturing plant under the concept of DfMA & MiMEP, with order of magnitude increase in quality control, and safer working environment.

BIM for DfMA & MiMEP

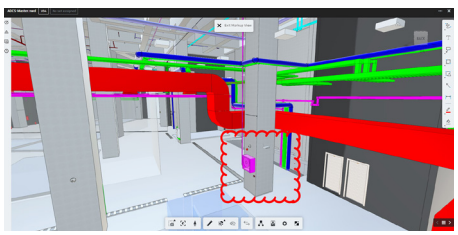
To effectively implement the MiMEP concept, the use of Building Information Modelling (BIM) is crucial. PYQJV has employed Vircon as a BIM consultant to advise on how to implement full BIM into the project. Starting from the design stage, BIM is fully applied by all stakeholders for design, coordination, and communication, including sub-contractors and manufacturers. The prefabricated modules can be designed and coordinated through the BIM platform to achieve a clash-free design, effectively shortening construction time and enhancing overall work efficiency.



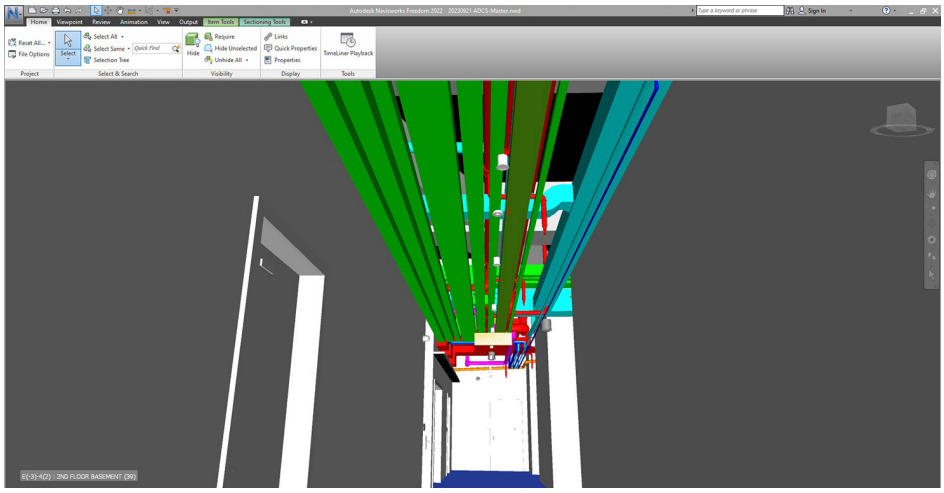
MiMEP module generated from BIM model
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited



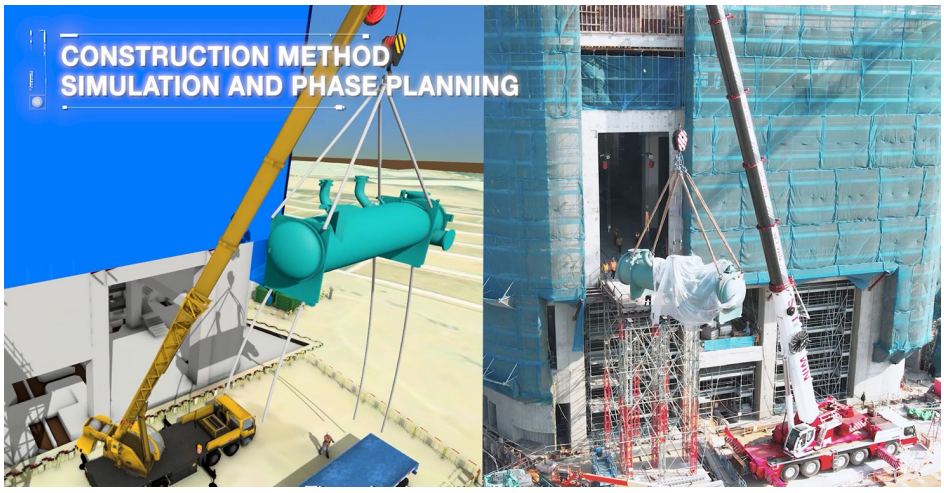
AR technology for on-site overlaying on BIM model
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited



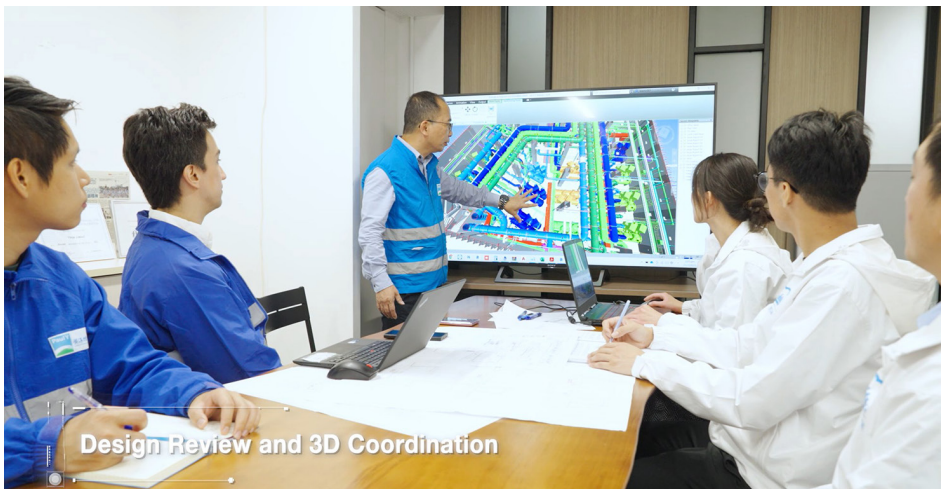
Cloud Collaboration (BIM 360)
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited



BIM Walkthrough – Navisworks
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited



Chiller Delivery - Planned vs Actual
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited



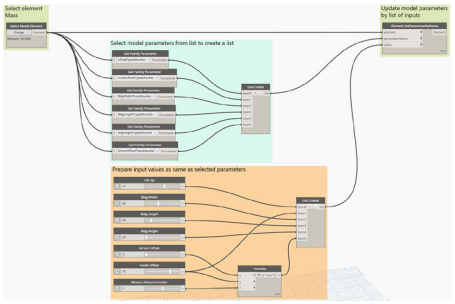
Design Review and 3D Coordination
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited

With the progress of the works, engineers can plan, adjust, and optimize the modules to be built with the BIM models so as to increase the accuracy of the modules for on-site installation. During the early design stages, engineers need to estimate the working and installation space required for the delivery of modules. BIM is used to simulate the delivery process, ensuring that workers can assemble the modules in one go. This facilitates the transportation and assembly of prefabricated modules smoothly while enhancing workers' safety consciousness.

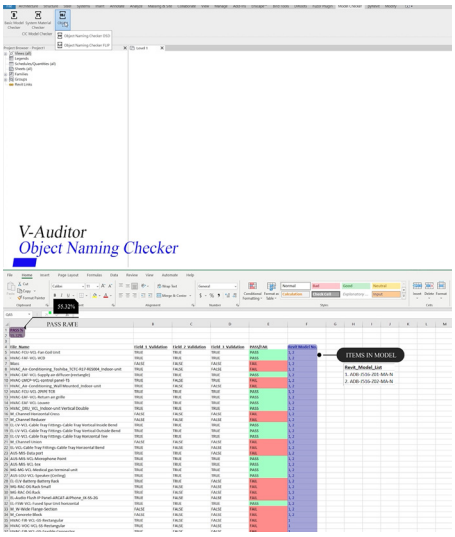
BIM Innovation

Augmented Reality (AR) can be employed during on-site construction by overlaying the BIM model on the actual construction site. This helps engineers and workers to visualize and understand complex modules and structures, reducing the need for physical mock-ups or prototypes and enhancing the understanding.

During the production process, BIM-QTO is applied all modules. Each module



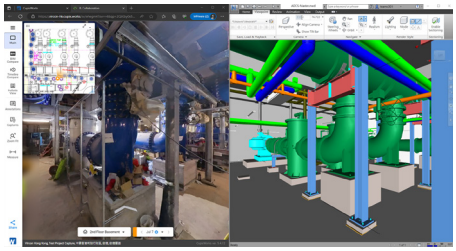
Dynamo - for drawing production
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited



As-built Modelling – BIM Standard Checker
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited

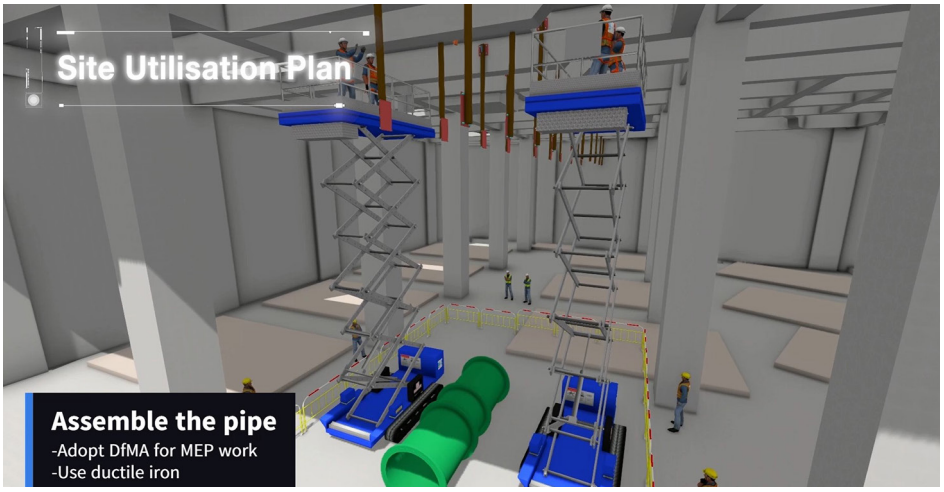
will be affixed with a QR code to record packaging details, logistics and delivery status of the module for engineers to keep track of the status of each module in Cloud server.

Carbon emission calculation is becoming increasingly popular worldwide. To accurately calculate carbon emissions, the BIM model is submitted to a third-party OpenBIM carbon assessment platform called iBEAM Unison. This platform allows us to measure carbon emissions and ensure that our projects are environmentally sustainable. Through the BIM model, technologies such as VR training, CFD simulation, and integrated BMS are implemented into the project. The BIM model is not only used for construction but also for asset management. To ensure accuracy, laser scanning and standard checker (Developed by Dynamo) are performed to verify geometry and information respectively. This enables smooth application of BIM-AM during the operation stage.

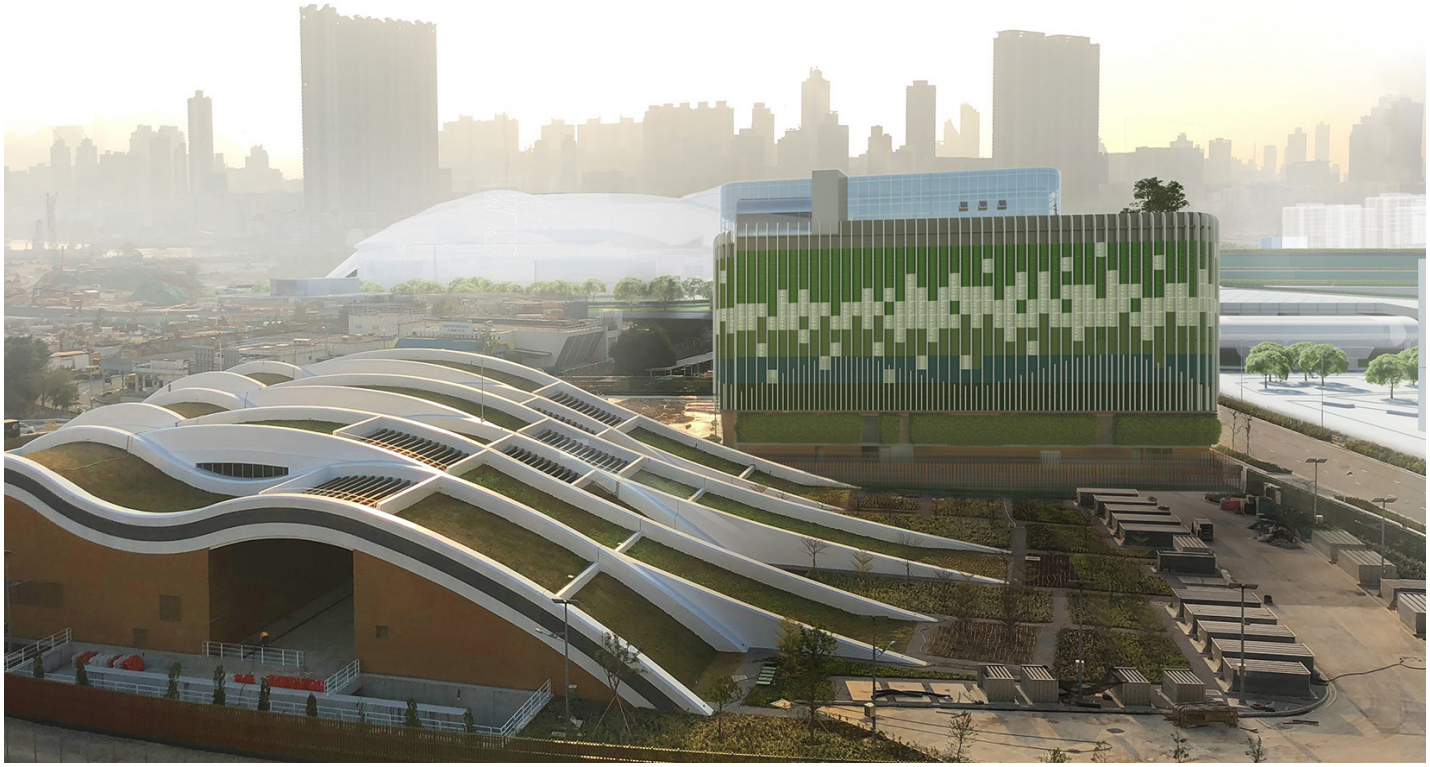


As-Built Modelling – Automatic on-site BIM Model Checker
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited

4D simulation for Installation
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited



Simulation for Prefabricated pipe module Installation (Developed by Dynamo)
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited



Overall view of Additional District Cooling Plant at the Kai Tak development
Image Courtesy of Paul Y. - Qianhai Joint Venture and Vircon Limited

About Paul Y. – Qianhai Joint Venture

Paul Y. – Qianhai Joint Venture (PYQJV) is a joint venture formed by Paul Y. Engineering Group and Qianhai Energy Technology Development Co., Ltd., providing solid and professional services of District Cooling System construction and operation.

About Vircon Limited

With over 20 years of experience, Vircon Limited is an ISO 19650 certified Hong Kong's premier Digital Twin & BIM solution provider. We have successfully implemented 500+ local and international projects. Vircon is dedicated to providing high quality services and products, customer satisfaction, and continual improvement of our processes. Our Digital Consultants and BIM Specialists help clients to improve safety, optimize production, reduce costs, and mitigate risk throughout the Building Life Cycle. We pride ourselves on supporting innovation, sustainability, and social impact.

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