

COMPANY

Construction Industry Council
Electrical and Mechanical Services
Department, HKSAR Government

PROJECT

Zero Carbon Building – Integration of BIM-AM
(Building Information Modeling – Asset
Management) with IoT

LOCATION

Zero Carbon Park (ZCP), 8 Sheung Yuet Road,
Kowloon Bay

TYPE

BIM-AM System Development for Operation &
Maintenance

SCHEDULED TIME OF COMPLETION

01/2018 - 09/2019

BIM-AM for Smart Operation & Maintenance

“With the successful trial of BIM-Asset Management (BIM-AM) integration in CIC’s BIM Innovation and Development Centre in 2016, CIC has collaborated with EMSD to carry out a more advanced BIM-AM integration project at our Zero Carbon Park (ZCP). With EMSD’s experience in implementing BIM-AM projects, we are pleased to have successfully completed our project at ZCP this year for use as a showcase to promote to the industry the benefits of adoption of BIM-AM.”

—Ir Dr Richard Pang

Director - Industry
Development, Construction
Industry Council

“EMSD and CIC strive to promote BIM to trade and industries in Hong Kong. In 2018, EMSD collaborated with CIC to implement the self-developed BIM-AM System in their Zero Carbon Park (ZCP). That acts as showcase to trade regarding the adoption of BIM for Asset Management in existing buildings to achieve effective workflow during building operation and maintenance stage.”

—Wong Sek Cheung, JP

Assistant Director/1, Electrical
and Mechanical Services
Department

BIM PARTNER

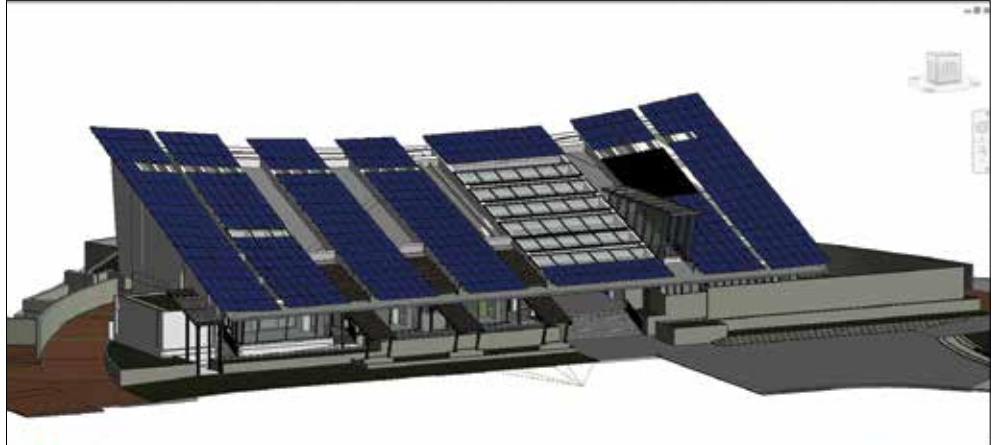
Planon Hong Kong Ltd.

AUTODESK PRODUCTS USED

BIM360

Forge

Revit



BIM model of Zero Carbon Park
Image courtesy of Construction Industry Council & Electrical and Mechanical Services Department, HKSAR Government

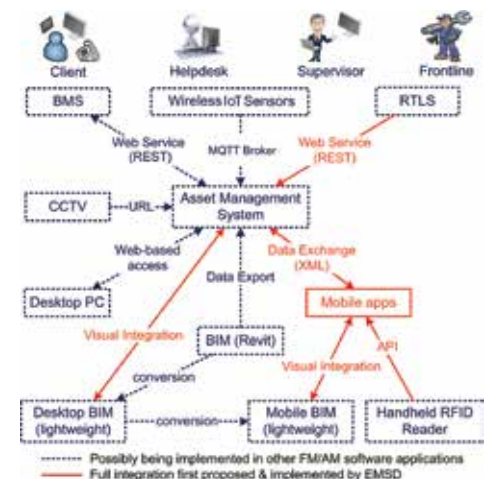
Project Background

Being the largest MEP government maintenance agency in Hong Kong, EMSD currently operates and maintains more than 8,000 government buildings. In 2016, to streamline the fault localization process for Building Operation & Maintenance (O&M), EMSD and CIC developed a tailor-made BIM-AM System in which a novel architecture for managing decentralized building facilities information was proposed, by exploiting the information interoperability and reusability among Building Information Modelling, System Topology, Radio Frequency Identification technology, and real-time data acquisition system interfaces including Building Management System, IoT wireless sensors and Closed Circuit Television system. Cross-platform mobile and desktop systems have been developed based on the proposed architecture. The benefits to O&M was proven with around 15% time-saving compared with the traditional workflow.

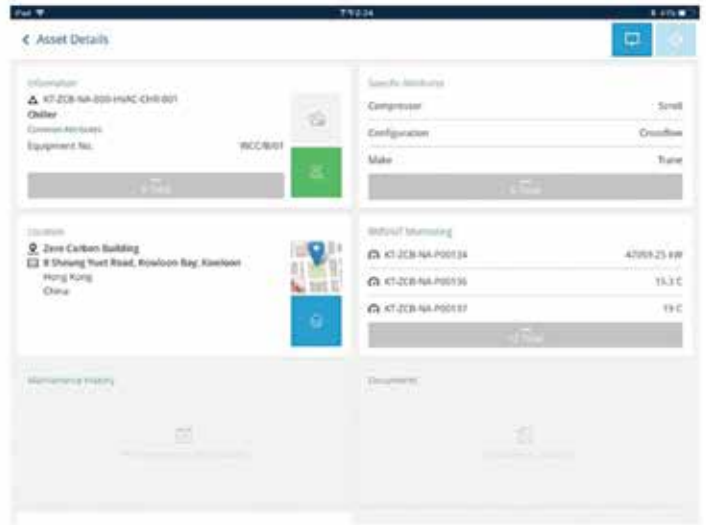
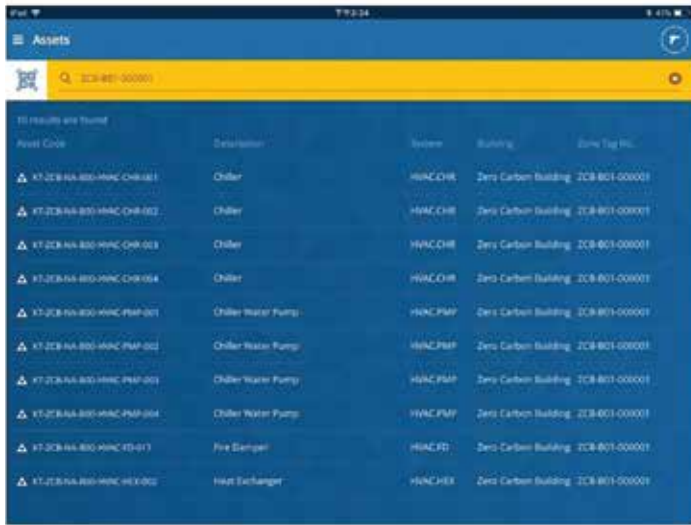
Digital twin by the integration of BIM-AM and IoT sensors will be the next generation of E&M operation and maintenance. This assists to analyze spatial, resources and energy optimization opportunities to augment O&M effectiveness. In 2019, EMSD completed the trial to integrate BIM and LoRa technology through BIM-AM platform. With this integration, IoT sensors such as occupancy sensors and air quality

sensors were deployed for smart facility management. IoT technology supplements the information which is not covered by the existing building management system to further optimize the system operation according to actual usage in real time basis to achieve better resources utilization and higher end user’s satisfaction.

The BIM-AM System with the integration of IoT achieves smart facility management and smart E&M system O&M in building facilities, that acts as a microcosm of smart city infrastructure. Moving forward, the BIM-AM System will be integrated with GIS platform for viewing the building data



The BIM-AM System Architecture
Image courtesy of Electrical and Mechanical Services Department,
HKSAR Government



The User Interface (UI) of BIM-AM System on mobile device
Image courtesy of Electrical and Mechanical Services Department, HKSAR Government

on a city-wide landscape. The outdoor IoT sensor data such as underground water flow and seashore flood monitoring water level data could also be visualized on the same BIM-AM-IoT-GIS platform to form the digital twin for better city management.

Award BIM Project

The New Opportunity of BIM Application

The use of BIM should not be limited to building design and construction processes, but also be extended to O&M stage by seamlessly conveying the necessary asset information from an as-built BIM models. Hence, EMSD has established its own BIM-AM platform by integrating the BIM models and Asset Management System in order to extend the use of the BIM for O&M stage over entire building lifecycle.

EMSD also developed an Asset Information Input Tool (AIIT), which

is a web-based system, to manage, verify asset information and create asset relationship for BIM-AM. It makes use of the COBieLite to exchange the information between BIM models and Asset Management System. Besides, the asset relationship created via the AIIT facilitates remote fault diagnosis.

CIC's Works on BIM-AM

With the first trial of BIM-AM integration in CIC's another premise – BIM Innovation and Development Centre in 2016, CIC started to examine the possibilities to carry out a more advanced BIM-AM project in the ZCP. It was known that EMSD had fruitful experience in implementing BIM-AM System since 2014. Therefore, CIC engaged EMSD to implement BIM-AM at ZCP, where is the first non-government venue with 14,700 square meters complying with the EMSD's BIM-AM Standards and Guidelines.

ZCP acts as a showcase of using BIM to facilitate the E&M O&M over the entire building lifecycle.

In this project, BIM models of ZCP and its Heating, Ventilation and Air-conditioning (HVAC) system were developed by EMSD in-house staff for the implementation of the BIM-AM System, which integrated with various electronic systems such as the IoT sensors,



The BIM-AM Standards and Guidelines V1.0 & V2.0 published by EMSD
Image courtesy of Electrical and Mechanical Services Department, HKSAR Government

Building Management System (BMS), Radio Frequency Identification (RFID) technology and Closed-Circuit Television (CCTV) systems.

Features of BIM-AM System

It is common for the facility management to manage multi-standalone systems to get useful asset data and real time E&M equipment operational status. The BIM-AM System provides a common platform to facilitate the building operation by integrating with IoT sensors, BMS, RFID/QR code and CCTV system. Therefore, the facility management are able to manage all information in a single platform.

- With the aid of the integration of the RFID technology and QR codes, the BIM-AM System would facilitate frontline staff to efficiently and effectively locate critical equipment even if the equipment is hidden above a false ceiling or underneath a raised floor. QR zone codes are provided for each functional area. By scanning the zone code, all major E&M equipment under this zone code are identified. Also, all major E&M



Integration of BIM-AM System and IoT Technology for remote monitoring
Image courtesy of Electrical and Mechanical Services Department, HKSAR Government



The Digital Twin feature
Image courtesy of Electrical and Mechanical Services Department, HKSAR Government



Asset fast located by QR code / RFID tag scanning
Image courtesy of Electrical and Mechanical Services Department, HKSAR Government

equipment are provided with RFID tags for asset locating. By scanning the space with RFID gun, nearby E&M equipment are highlighted in BIM model.

- The integration with the ZCP's Building Management System (BMS) can facilitate not only remote monitoring, but also the remote control of E&M systems.
- Through the System Topology, the relationship and grouping of the major E&M assets can be identified easily that facilitates the maintenance staff to carry out fault diagnosis.
- The integration with CCTV system can facilitate the remote monitoring of real-time E&M plant operation.
- The IoT technology can supplement the information which is not covered by BMS for facility management. It can also integrate with the BIM-AM System to form a Digital Twin.

Significant Improvement via BIM-AM Adoption

This project demonstrates the below benefits of using BIM technologies for asset management during the O&M stage:-

- Estimated 15% time saving for O&M workflow
- Fast locating asset
- Remote fault diagnosis
- Asset data and documentation can be well-organized on a unified platform

Way Forward

With the completion of ZCP's BIM-AM project, CIC and EMSD plan to make use of this platform to promote the BIM-AM principle to the industry, so that more stakeholders could understand how we could enhance productivity in the O&M stage by using the BIM technologies.



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The BIM project in Zero Carbon Zone implemented by EMSD and CIC
Image courtesy of Construction Industry Council & Electrical and Mechanical Services Department, HKSAR Government

About Construction Industry Council

The Construction Industry Council (CIC) was formed on 1 February 2007. CIC consists of a chairman and 24 members representing various sectors of the industry including employers, professionals, academics, contractors, workers, independent persons and Government officials.

The main functions of CIC are to forge consensus on long-term strategic issues, convey the industry's needs and aspirations to Government, as well as provide a communication channel for Government to solicit advice on all construction-related matters. In order to propagate improvements across the entire industry, CIC is empowered to formulate codes of conduct, administer registration and rating schemes, steer forward research and manpower development, facilitate adoption of construction standards, promote good practices and compile performance indicators.

CIC has set up Committees, including Committee on Building Information Modelling, to pursue initiatives that will be conducive to the long-term development of the construction industry. Please visit www.cic.hk for further details.

About Electrical and Mechanical Services Department, HKSAR Government

The Electrical and Mechanical Services Department (EMSD) of the HKSAR Government discharges its services to the public in Hong Kong via two separate teams: Regulatory Services and Trading Services. Our Regulatory Services team regulates electrical, mechanical and gas safety, and railway safety, as well as energy efficiency, via law enforcement and public education. It also monitors the technical performance and development plans of the electricity supply companies, and gives professional and technical support to the Government's wide range of safety and environmental initiatives from time to time. Our Trading Services team provides electrical and mechanical, electronic engineering and building services to government departments and public bodies. The team serves diverse client venues including the airport, hospitals, schools, security forces, transport and highways, port and harbour, government offices and law court buildings as well as public recreational and leisure facilities, with the ultimate goal of improving the quality of life for the public.