

## COMPANY

Hip Hing Engineering Company Limited  
Architectural Services Department,  
HKSAR Government  
Vircon Limited

## PROJECT

Design and Construction of Transport  
Department's Vehicle Examination Centre at  
Sai Tso Wan Road, Tsing Yi

## LOCATION

Sai Tso Wan Road, Tsing Yi

## TYPE

Design and Build Contract

## SCHEDULED TIME OF COMPLETION

30 Nov 2020

“Being one of the largest scale of facility buildings in the world, the Vehicle Examination Centre (VEC) at Tsing Yi sets a new benchmark for its kind. Infused with creative ideas and innovative solutions, VEC fuels new energy to the local community by ensuring the safety and quality of every vehicle on the road, and elevating the quality of life.”

## – Athena Fung

Chief Project Manager 101,  
Architectural Services Department,  
HKSAR Government

## – Kent Chan

Project Director,  
Hip Hing Engineering Company  
Limited

## – Ian Ku

Project Manager,  
Hip Hing Engineering Company  
Limited

## – Billy Wong

Head of BIM,  
Hip Hing Engineering Company  
Limited

## BIM PARTNERS

Wong Tung & Partners Limited

WSP (Asia) Limited

WSP Hong Kong Limited

## AUTODESK PRODUCTS USED

Autodesk® 3ds Max®

Autodesk® AutoCAD®

Autodesk® BIM 360® Design

Autodesk® BIM 360® Docs

Autodesk® Civil 3D®

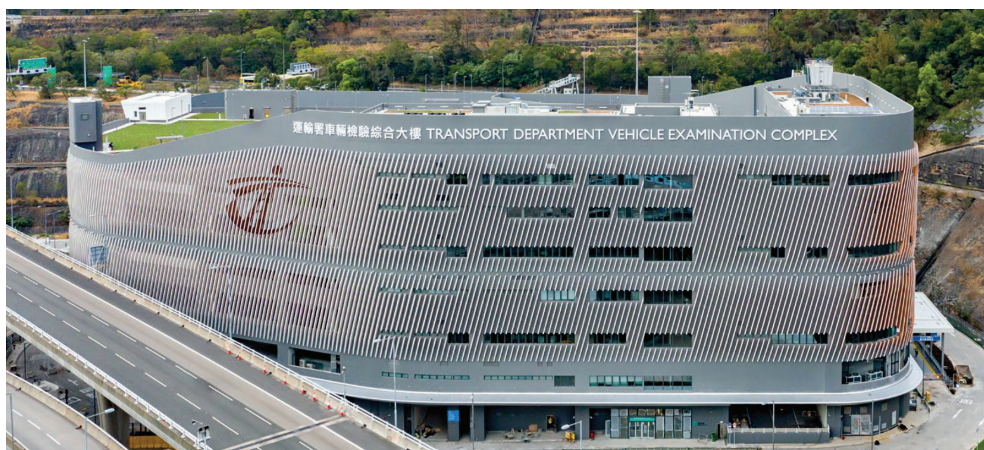
Autodesk® Dynamo

Autodesk® Navisworks®

Autodesk® ReCap® Pro

Autodesk® Revit®

# Virtual Environment Collaboration & Value Engineering Construction for Vehicle Examination Centre (VEC)



Vehicle Examination Centre Overview

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

## Vehicle Examination Centre

Vehicle Examination Centre is a multi-storey functional building which comprises 30 inspection lanes, 7 storeys of office blocks and 2 sets of scissor ramps. In contrast to conventional building projects, the project includes a big portion of civil engineering works such as slope improvement as well as road widening works. VEC provides a wide range of examination services including visual check, lamp test, brake test, exhaust emission test and under carriage inspection, etc. Therefore, careful planning and due care of interfacing of Vehicle Examination Equipment (VEE) is of utmost importance to ensure smooth operation of its intricate and complex functions.

## Major Challenges and Site Constraints

With its complex nature, the project

presented a number of challenges. Beyond the contract requirements, the top management proactively took the initiative to adopt BIM, with the objectives to mitigate risks and facilitate the operation of the project.

Four Major Site Constraints:

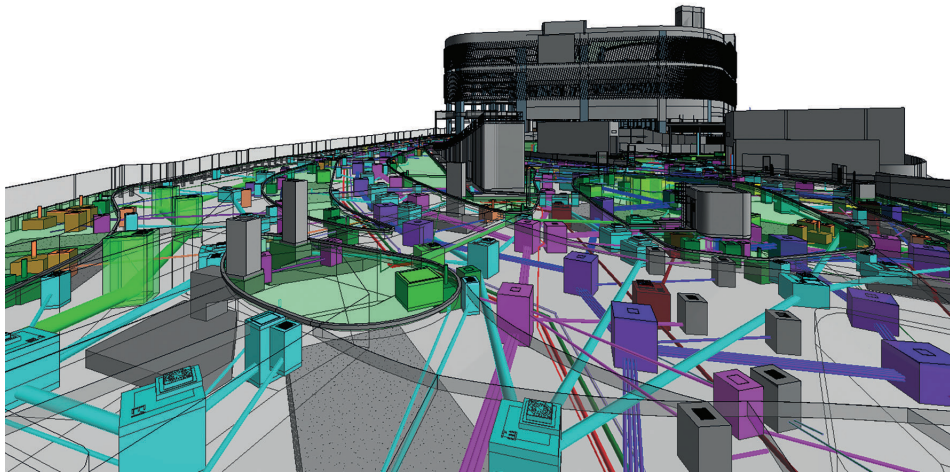
1. Design and build of a vast amount of underground utilities (750 manholes and draw pits and network of 3,000+ pipes, with a total length of 17km), which requires careful coordination with other building elements. (existing underground utilities, the footings of adjacent elevated highways and new gantry footings to be constructed)
2. An extensive area of drainage reserve within the construction site
3. Compacted site bounded by slope and elevated highway structures



Inspection Hall

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





Underground Utilities BIM Model  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited

4. Proposed new building in close proximity to existing traffic sign of highway (600 mm distance)

Through BIM Technology, rock excavation volume of new design was successfully reduced by 40% compared to the original design and the number of manholes was reduced by 20% in final design.

### Design Review and Optimization of Underground Utilities and Wayfinding

In this project, the complex arrangement of underground utilities (750 manholes and draw pits) was initially built & integrated virtually in the BIM environment. Drawing on our engineering and BIM technology expertise, our project team was able to visualize the installations, detect clashes and resolve potential conflicts between new and existing utility services and structures prior to construction. The early virtual design and construction enhanced design certainty and accuracy and provided valuable insights for planning the efficient construction to the works, and therefore mitigating the risk of abortive works. In addition, the BIM platform allowed project team to take into account the maintenance requirements of the utilities providers, which prevented disruption to the existing live utility systems and ensured smooth construction in the future,.

Compared to traditional 2D drawing context, BIM environment enables an extraordinary immersive approach to review the design of wayfinding element. For example, virtual camera can be configured to simulate the perspective of drivers, thus the design of wayfinding elements can be more optimized and customized to the client's requirements and user's needs.

### Drone Scanning and 3D Scanning

Applying the technology, the accurate spatial information was provided for project team to review spatial relationships between the planned and existing building elements. With reliable information such as the critical clearance between the elevated structure and traffic sign, the construction planners and construction safety officers were able to implement risk management strategy, such as tolerance control for the construction safety.

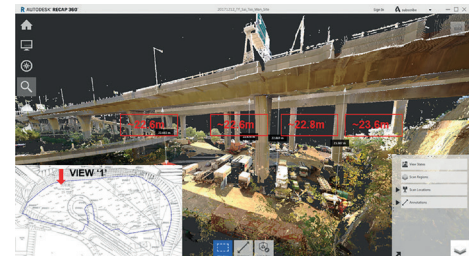
### Rock Excavation study

Adopting 5D-BIM for quantity-take off (QTO), the rock excavation volume can be measured by Civil 3D and Revit for project design team to optimize the foundation design and reduce the excavated rock and transportation time. Comparing to the original design, the rock excavation volume adopted in the new design was reduced by 40%.

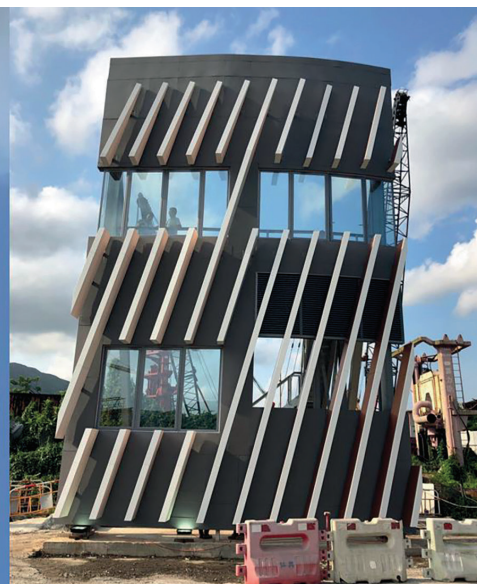
### Value Engineering – Façade

The façade design for VEC is unconventional. We built the model using parametric design. The aim of the design was to block the sunlight using fins. Taking the advantage of parametric modification enabled by BIM, the optimal design can be identified by striking a balance between the degree of sunlight and size of the fins.

With BIM, the project team was able to study the interfacing between design of facades and superstructure to prevent clashes. Modelling the 4D construction sequence and method for planned installation arrangements helped visualise the interfacing between existing highway and existing direction post. As a result, risks of different construction approaches could be identified in advance, and consequently



3D Scanning for Site Surveying  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited



Visual Mock-up for Design Review & Kinetic Effect Simulation  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited





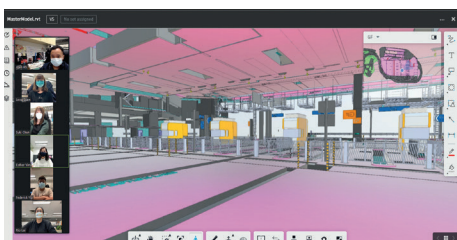
Off-site\_MiC Prefabrication  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited



On-site\_MiC Supervisor Booth  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited



VR Simulation and Demo  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited



BIM Coordination-digital video conferencing software  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited

delivering the ideal and safest construction solution.

### Design for Manufacture and Assembly (DfMA)

In order to shorten the construction period, we proposed an alternative innovative solution – Design for Manufacture and Assembly (DfMA) for the construction of the inspection booth. The Modular Integrated Construction (MiC) method was adopted in Lane Supervision Booths to take advantage of off-site fabrication. It helped achieve better quality and accelerate the construction. Furthermore, we also deployed MultiTrade integrated MEP (MiMEP) for E&M construction to unveil the potential risks for design, to minimize material consumption, production time and fabrication cost. To facilitate MiC and MiMEP, the BIM technology is an essential tool for the complete design and construction process. The BIM model maturity should meet the manufacture requirement without clash and discrepancy between each drawing sheet and each model component.

### Vehicle Inspection Process Simulation

In this contract, we have proposed recommendations to assist client to freeze design of route of vehicle inspection and the supportive signage system. We applied VR simulation (drive-through) to demonstrate the route of the inspection lane from the entrance, Vehicle Examination Equipment (VEE), lane supervisor booths, car ramp and to the departure location. Using the BIM platform, the client can visualize the vehicle inspection process of the bus through the first or third-person perspective. The demonstration speeded up the time of decision making.

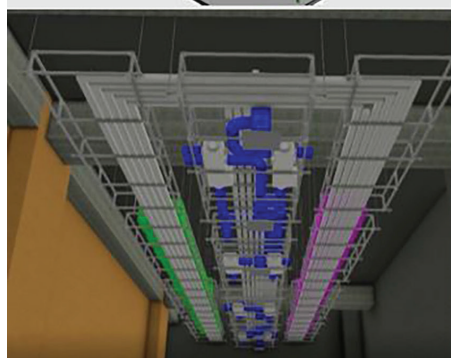
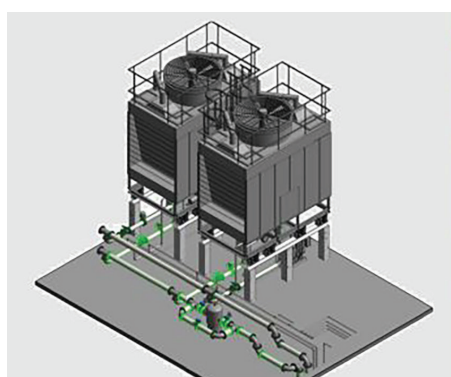
### Asset Information Model (AIM)

During as-built stage, the Asset Information Model (AIM) was developed from construction BIM Model. The model with 2D as-built record drawings comprise customized building attributes and file structure for data submission. The AIM will be used for future

development on retrieval of asset and works records mapping in GIS platform. Our team processed data conversion from the native file (revit file) in BIM 360 Docs platform to IFC standard (IFC4) in Asset Information System (AIS) web platform using Dynamo to facilitate smooth data conversion process.

### Web Collaboration (Work from Home)

Due to the COVID-19 pandemic and restrictions on face-to-face communications, the project team was confronted with the constraints of communication. However, the adoption of BIM virtual platform such as BIM 360 Docs helped resolve the issue and enhanced our communication and coordination significantly. Besides, applying BIM 360 design enabled the BIM operator to create and update BIM Models anytime and anywhere. Furthermore, collaborations, such as clash analysis and review can be performed to review the design of Architectural/Structural/Building Services Design with other parties effectively.



DfMA – Multi Trade integrated MEP (MiMEP)  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited





Design and Construction of Transport Department's Vehicle Examination Centre  
Image Courtesy of Hip Hing Engineering Company Limited and Architectural Services Department, HKSAR Government and Vircon Limited

## 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.

## About Architectural Services Department, HKSAR Government

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 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 300+ 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.