

## COMPANY

**Architectural Services Department,  
HKSAR Government**

## PROJECT

**Heritage Information Modelling**

## LOCATION

**Victoria Peak Fire Station, No. 7 Gough Hill Path,  
Victoria Peak, Hong Kong**

## TYPE

**Heritage Project**

## SCHEDULED TIME OF COMPLETION

**2015**

“Heritage Information Modelling can help with heritage conservation, facilities upkeep, and enhance interaction among people.”

— **Ir Cheng Wai-hung**

Senior Building Services Engineer/  
Heritage  
Architectural Services Department

## BIM PARTNERS INVOLVED

**Advanced Construction Information  
Development**

# Creating Images from History



Image courtesy of Architectural Services Department, HKSAR Government

Heritage conservation encompasses the identification, protection and promotion of the elements of significances which are important to our culture and history. “To promote best practices in construction, sustainable development and heritage conservation are our core vision and mission,” says Ir Cheng. Building information modelling (BIM) can help visualize, understand, interpret, and interact with the historic fabrics and thus promote conservation of the built-heritage. Heritage information modelling (HIM) is an extension of BIM incorporating additionally the heritage information and significances. BIM is growing to be one of the useful tools and platform to facilitate successful collaboration and coordination for the upkeep and adaptive re-use of heritage buildings.

Architectural Services Department developed a Heritage Information Model, by employing a combination of advanced BIM, mobile communication, position identification and augmented reality (AR) technologies, to enhance heritage conservation, facilities upkeep and allow visitors better understand heritage. Architectural Services Department performs three core functions, namely, monitoring and advisory services, facilities upkeep, and facilities development, in relation to Government-owned and Government-funded facilities.

Victoria Peak Fire Station (VPFS) was selected for the pilot HIM. VPFS is a Grade 2 historic building, which was originally the Peak School,

built in 1915. The school was used until 1966. It has then been re-used as a fire station since 1967.

“By integrating the heritage information and building information into a HIM framework, we could form a heritage information model prototype as an interface and platform to collect, interlink, visualise, analyse, share, present and navigate the heritage archives, building assets and maintenance information by multiple users,” says Ir Cheng. “We could leverage communication technologies including mobile apps, geo-location, and AR to maximise the usages and benefits of HIM for on-site applications. We hope also to enhance the interactions and communications among people by providing visual, interactive and readily accessible information.”



Image courtesy of Architectural Services Department, HKSAR Government

## Technical challenges

BIM for new buildings are usually created from design to construction stages and thus the building information can be made available for applications at operation and maintenance stage. Heritage buildings are however assets built in the past where record drawings in many cases are lacking, and the main challenge of HIM is to create the 3D data from scratch using photogrammetry and scanning technologies. Intangible and tangible heritage values and conservation requirements for the character defining elements of the heritage buildings must also be considered. The project team faced several challenges. "Internal laser scanning for creation of the building information model in an occupied building could not be undertaken as easily as for a vacated area," says Ir Ip Sing-yue, Building Services Engineer/Heritage, Architectural Services Department. "We had less than two working days allowed for the scanning, yet the project team accomplished this task within the time constraints."

Rather than simply generating a mesh model, the photogrammetry /laser scanning information was converted to a true 3D model with textual information for subsequent processing in multiple applications. This required extensive research on the interface of HIM with other application software and technologies. Another challenge arose from the need to interface HIM with mobile devices, and thus require the use of various position identification technologies including NFC tag, QR code, RFID, proprietary indoor detector, GPS, and optical recognition for determining objects' locations.

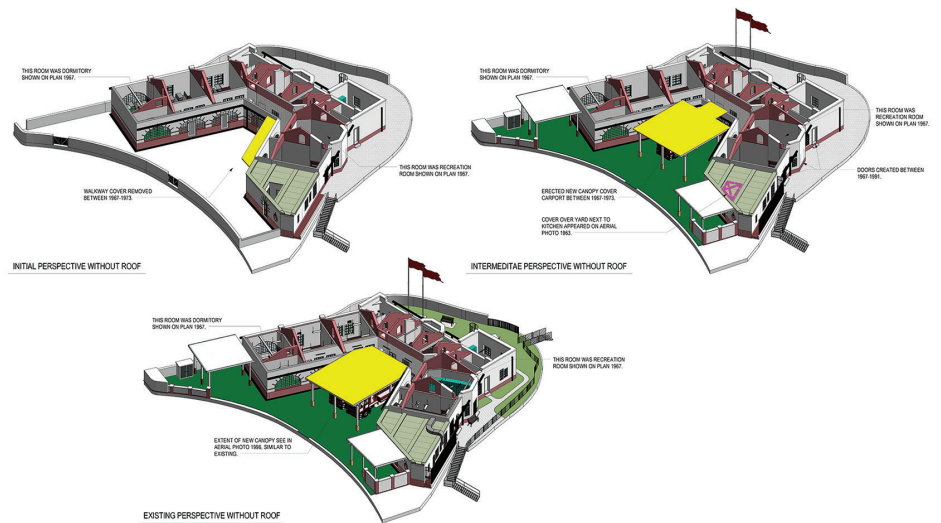


Image courtesy of Architectural Services Department, HKSAR Government

While GPS could be used outside buildings, determining internal object locations would be reliant on non-standard techniques in areas of weak mobile signal strength, yet there are limit of precision using technologies as Wi-Fi location and optical recognition mapping. The project team has tried the iBeacon indoor detector/NFC tag/QR code and they need to be pre-installed.

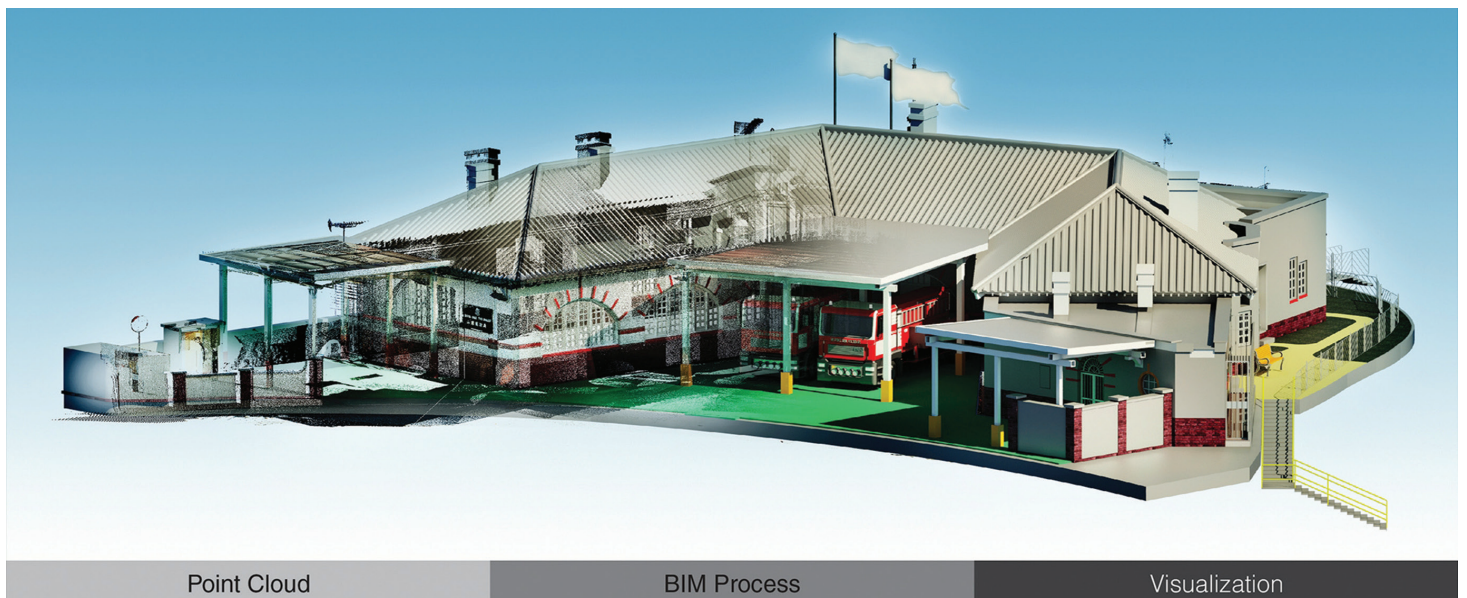
### Linking the 3D Model to Archives and Maintenance Information

Using Autodesk ReCap 360 software, the team integrated data from terrestrial laser scanning, aerial photogrammetry, close range photogrammetry and panoramas to create a true 3D model of the building, which can facilitate building maintenance, alteration and upkeep. This model also helped formulate a HIM framework connecting various technologies, workflows and data.

The team's HIM prototype comprised not only building information but also historic archives and maintenance information. "It can be used as a platform embracing a comprehensive data bank of building information such as materials, dimensions, state of conservation and history of the building," says Ir Ip. "Plus it allows the flexibility to add future information, such as updating of maintenance and adaptive re-use modifications to the building."

### Mobile office and information centre

To maximise the benefits of HIM, extension of the information model originally used in office environment for more applications in the field to facilitate daily works will be a future trend. The HIM information will be shared not only by the building practitioners but also by public visitors. The project team has deployed an array of information and



Point Cloud

BIM Process

Visualization

Image courtesy of Architectural Services Department, HKSAR Government



communication technologies (ICT) in the prototype including mobile apps, interactive control, position detection, animation, web access, and augmented reality to showcase how HIM can benefit on-site applications and act as a useful mobile tool in built-heritage management, facilities upkeep, heritage conservation, heritage education and training, and user engagement.

“It would be very challenging to leverage HIM using ICT in mobile devices for practical field applications,” says Ir Cheng. “There are still gaps in the software designed for BIM and HIM for desktop computers in office and apps used for mobile devices. The workflow in migrating the information and 3D data in BIM and HIM for access by mobile apps or devising an integrated platform to facilitate data exchange between two systems catering for real-time interactive applications is yet to be bridged. Also, use of indoor position detection technologies as well as the security control for interactive access of HIM through mobile devices by different users, namely, building practitioners, management staff, occupants and general public is yet

to be established and standardized. Closer collaboration among the BIM specialists, ICT developers and heritage conservationists to spearhead further research and development in BIM and HIM would be needed.”

### An exciting experience for users

Use of NFC tag, etc. for mobile apps enables the heritage information model to act as a visitor’s personal tour guide – retrieving animations and history, and providing historic details at key points. They also help with retrieving past images, hidden details, alteration records and historic character defining elements of the building. Geo-location based augmented reality can even allow a mobile device to provide a “heads-up” display of points-of-interest or overlay a past image on existing building fabric or element, thus providing an exciting yet informative experience for the visitors.

“A special feature of HIM is the incorporation of a timeline into the model, with historic information,” says Ir Ip. “BIM then becomes a powerful tool to store all the historic changes

in the information model, so people can visualise the changes to a heritage building over the course of time. In Victoria Peak Fire Station, we used a phasing technique to define the original school configuration, together with that in 1967 when the school was converted to a fire station, and then current condition. This enhances heritage education and promotion.”

The images from history are among a host of outputs the team has generated from the model. “The 3D drawings, 3D animated videos, visualisations, 3D interactive controls, information display for building elements and its integration with different application software have showcased the usages of HIM,” says Ir Cheng. “They will be useful for analysis and understanding of the original configuration and layout of the building and the changes, for formulation of more comprehensive conservation strategies to achieve sustainability in heritage conservation and adaptive re-use.”

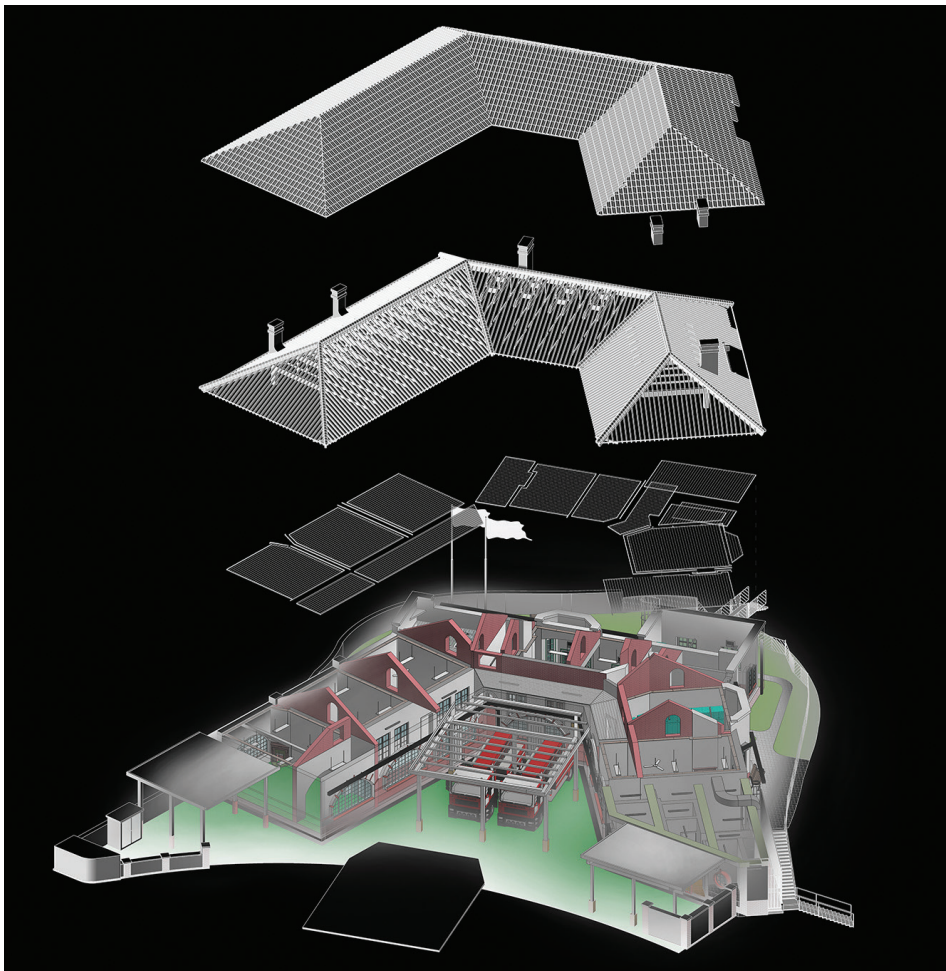


Image courtesy of Architectural Services Department, HKSAR Government



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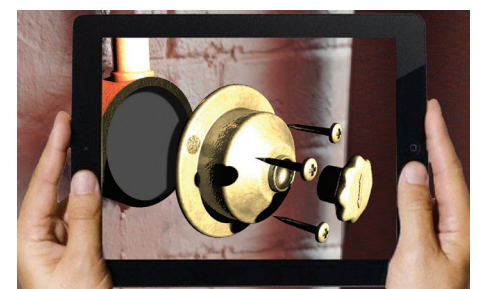


Image courtesy of Architectural Services Department, HKSAR Government

**Architectural Services Department**

The Government of the Hong Kong Special Administrative Region



Image courtesy of Architectural Services Department, HKSAR Government

**About Architectural Services Department, HKSAR Government**

Architectural Services Department (ArchSD) performs the following three core functions in relation to Government-owned and Government-funded facilities:

- 1) Monitoring and advisory services;
- 2) Facilities upkeep; and
- 3) Facilities development.

ArchSD commits to provide quality services to the public and explore every opportunity to integrate innovative and sustainable elements into its projects for the betterment of the society with due consideration on cost effectiveness. In recent years, ArchSD projects received some recognition including but not limited to the Hong Kong Institute of Architects Annual Awards, the Hong Kong Institute of Landscape Architects Design Awards, Quality Building Award and Green Building Award.