Innovative Integrations Boost Designing with BIM

Hong Kong Housing Authority overcomes doubts to integrate site formation and lighting design with Revit models

Image courtesy of Hong Kong Housing Authority

It is well-known that whilst most individual practitioners in the Hong Kong construction industry have extensive experience in deploying Revit for designing Architectural, Structural and Building Services works respectively, the BIM models are usually separated from the other key software packages. This meant that the capacity and power of BIM technology are not always fully realised. Examples are the separation of site formation and building design, as well as lighting design as a standalone process.

An integrated approach was much needed. Yet the software vendors, BIM consultants and architects/engineers could not find examples of information being readily transferred between Revit and packages such as Civil 3D or DIALux. "For a long time, people told us it can't be done," says Ir Dr Wong King-cheong, Senior Geotechnical Engineer, Hong Kong Housing Department.

Yet with the support from the IT, Architectural, Land Surveying, Geotechnical Engineering, and Building Services Engineering teams and the perseverance of staff, the Housing Department eventually achieved great success in integrating Civil 3D, GIS and Revit for a potential housing development in the northern fringe of Tai Po and in the integration of BIM and DIALux.

Integrating Civil 3D, GIS and Revit models

"We found that there were Paste Surface and Grading functions, which allowed us to do the site formation design directly on existing topographic surface in Civil 3D, and export the site formation design model to Revit using one button." says Dr Wong.

This new approach provides a collaborative and holistic platform enabling the design, review and, evaluation of public housing development proposals at feasibility and schematic design stages. A 3D digital model of the proposed platform and housing blocks layout can be built in Civil 3D, through combining the site formation design, along with digital ortho-photographs, digital maps and 3D spatial data from the Lands Department and LiDAR data from the Civil Engineering and Development Department.

"Before, the process was very difficult – we didn't have topography in the models, and we needed to input it manually," says Dr Wong. "Now, after we have changed to a 3D service, it's easy to design retaining walls, cut sections and perform cut and fill calculations."

This enables Architects to see more realistic 3D models. Also, though Civil 3D is an engineering tool, its virtual models are not ideal for live presentations. For instance, it may take longer to rotate them to view from different angles. Dr Wong's team worked with

other GIS software such as Map 3D to create visualisations as well as carrying out spatial analyses. These helped shorten the design and approval process, enhanced design quality through optimization and carrying out studies on different design options. It also promotes teamwork and integration of professionals of different disciplines in the feasibility study process.

After finalising design of the building platform and housing blocks layout, the 3D model is exported to Revit, for the continuation of the architectural and structural design work. "Other government departments are interested in this workflow," says Dr Wong. "They too hadn't realised there was already such functionality in the software – which is powerful, and easy to use."

Prevent delay may last for months

Dr Wong believes this will eliminate major clashes and mis-matches that were sometimes only found unexpectedly during the construction stage, such as when a planned retaining wall could not match the profile. "These could prove very expensive costing to change the design at the construction stage. Delays could last for months with

serious disruption to project progress." he says. "Now, we are confident that a design will be buildable, though there may be minor troubles."

BIM for lighting simulation

"For lighting simulation and rendering, we are also trying to exploit the potential of BIM, which is a developing technology," says Ir Tse Sze-wing, Senior Building Services Engineer, Building Services Section 2, Housing Department. "We have been using very powerful DIALux software for lighting simulations. But we have to build our own models, place the luminaires and do the lighting simulation."

"The models we built in DIALux can only be a simple one, with little building information as we cannot afford to spend too much time and resources just on the lighting simulations. For instance, a room in the model might be simply a rectangular box with the ceiling, floor and walls only. Other building information often has to be forsaken."

"We tried to see if we could capitalize the information in Revit and do the lighting simulation in DIALux," says Ir Tse. "This could have more building information, such as
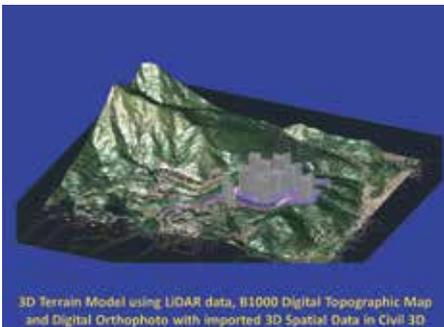

3D Terrain Model using LiDAR data, B1000 Digital Topographic Map and Digital Orthophoto with imported 3D Spatial Data in Civil 3D

Image courtesy of Hong Kong Housing Authority
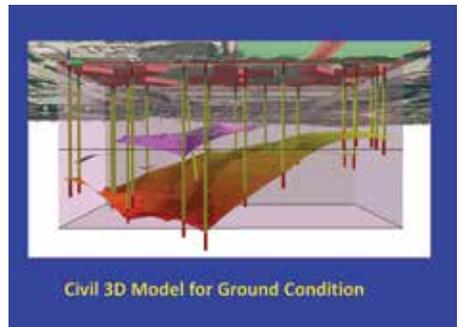

Civil 3D Model for Ground Condition

Image courtesy of Hong Kong Housing Authority

windows, metal gates, doors, lift landing doors and other reflective surfaces. Our staff ventured to integrate the two software. Inspired by the fact that '3ds' format can be used in DIALux , our intuitions led us to venture into testing if Revit 'rvt' format can be transformed into '3ds' format for onward manipulations in DIALux."

As an intermediate step before simulation in DIALux, the team found that in 3ds Max, a photo rendering software, it can import and simplify the Revit model and then save as a '3ds' file. "The Revit models are very large, so we need to simplify the information to such extent just enough for the lighting simulations," says Ir Tse.

Richer lighting calculations

Rather than having to remove unnecessary items for lighting simulation item by item, it's possible to carry out the simplification by discarding unnecessary items for lighting
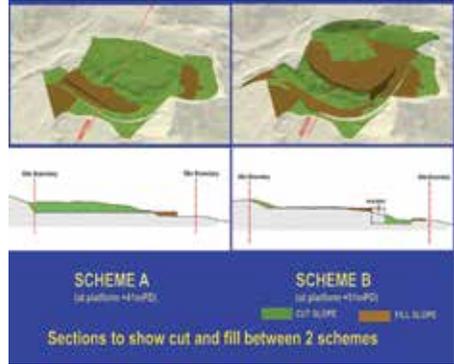

SCHEME A
(at platform +1/mPD)

SCHEME B
(at platform +1/mPD)

CUT SLOPE   FILL SLOPE

Sections to show cut and fill between 2 schemes

simulation by categories. Despite the simplification, the DIALux model contains far more than simple geometric shapes, enabling much richer lighting calculations.

"For exteriors, we can take account of topographic surfaces in our lighting simulation – we can have photo realistic rendering, as well as animations with much richer building information," notes Ir Tse. Architects and housing management colleagues can visualise the effects of lighting placement in very early
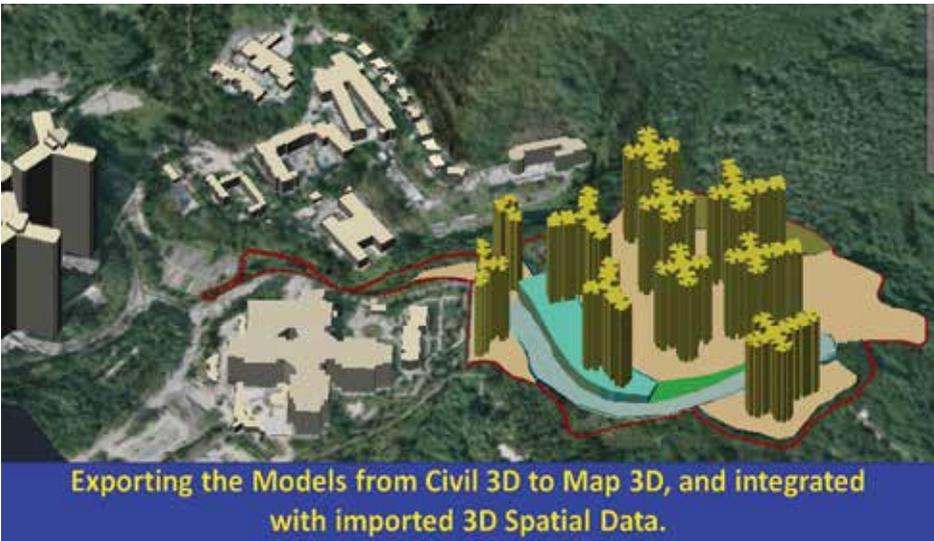

Exporting the Models from Civil 3D to Map 3D, and integrated with imported 3D Spatial Data.

Bringing people together

"There's direction from our management to use BIM," says Alex K K Ho, Information Technology Manager, Information Technology Sub-division, Housing Department. "End users are in a much better position to exploit the use of BIM since they know what they want to achieve from BIM models based on the professional knowledge of their own fields. As a whole, we can shorten design lead time and increase the generation of design options. It's now possible to start using BIM even as early as the Feasibility Stage."

stages, for assessing aesthetic effect as well as operation and management considerations.

The method for integrating the Revit and DIALux models is now included in the Housing Authority's BIM MEP User Guide. So it can be used by every project team. "I think many industry professionals are trying to capitalise on the potential of BIM," says Ir Tse. "We are part of this process."

In the past, the Housing Authority's use of BIM was mainly IT driven. "Now it's more a collaborative effort," says Ir Tse. "The two ventures are good examples that BIM is a good platform for bringing people together." "Together, we can venture into new frontiers," says Dr Wong.

![Hong Kong Housing Authority logo] **Hong Kong Housing Authority**

Image courtesy of Hong Kong Housing Authority

About Hong Kong Housing Authority

The Hong Kong Housing Authority (HA) is a statutory body established to develop and implement Hong Kong's public housing programme. Its mandate is to help low-income families in need gain access to affordable housing. Approximately 30% of the Hong Kong population is now living in public rental housing units.

The HA plans, builds, manages and maintains different types of public housing, including rental housing estates, interim housing estates, and transit centres. In addition, the HA owns and operates some flatted factories and ancillary commercial and other non-domestic facilities. Also, with the resumption of Home Ownership Scheme, HA builds 17,000 new HOS flats for four years from 2016/17 to 2019/20 and thereafter 5,000 new HOS flats a year.

The Housing Department acts as the executive arm of the HA to help the Government achieve its policy objective on public housing.