Autodesk BIM Awards 2015 - HONG KONG, MACAU & TAIWAN





ACKNOWLEDGEMENT

Sincere thanks to the eight awarded organizations - Arup & MTR Corporation, Architectural Services Department of HKSAR Government, BTA & RLP Company Ltd., CECI Engineering Consultants, Inc., Taiwan, CLP Power Hong Kong Limited, Hong Kong Housing Authority, Moh & Associates, Inc., Water Supplies Department of HKSAR Government, and the six honorable mention – Arup & IDA, Century Property Investment Ltd., Henderson Development Agency Ltd., Kerry Properties Ltd., NTT Com Asia Ltd., Sun Hung Kai Real Estate Ltd., in providing such valuable information and pictures of their projects. Besides, we are extremely grateful for the contributions of the AIAB committee and members, Mr. Serdar Aydin, Dr. Jack Cheng, Mr. Ken Mao, Mr. Simon Ng, Prof Marc Aurel Schnabel and Ir Dr. Stewart Wan who are profiled in this booklet.

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The BIM Paradigm Shift Gathers Pace

Worldwide, there's a paradigm shift underway in the construction industry, with the development of BIM, and the transition from 2D to 3D design. BIM is a classic disruptive technology - set to replace an earlier technology, with early adopters becoming enthusiasts and others joining as they discover the benefits can far outweigh any costs in making the switch.

Like typical disruptive technologies, BIM is used both as expected, and in some surprising ways, which have often been devised not by BIM's originators, but by innovative, imaginative, pioneering users. It's a privilege to work in Autodesk at this time, witnessing and helping BIM grow from a young, novel technology towards being a tool in use on a day to day basis, with an expanding user base worldwide.

It's also a privilege and a thrill to learn of the ways BIM is being used in Hong Kong and Taiwan, where both private enterprise and government are playing important roles in pushing the envelope, demonstrating that BIM can be so much more than "just" a way to design buildings. As the winners of the Autodesk BIM Awards show, BIM is indeed changing how buildings, infrastructure, and utilities are planned, designed, built, and managed.

At Autodesk, we have spent over a decade enhancing our core BIM software, Revit, whilst expanding its capabilities and optimising its interactions with a range of other software solutions. We will continue with improvements, to maintain Revit as the industry's tool of choice, no matter whether to assist with initial designs, maximise efficiency of building construction, facilitate long-term management, or even reveal the best ways to demolish tower blocks, before a building cycle begins again.

On behalf of the Autodesk APAC and Emerging Markets team, I would like to congratulate all this year's award winners, and thank all project teams for sharing their wonderful insights, which will surely be of immense value to others in the construction industry. I look forward to seeing completed projects, and ways BIM uses expand, playing a key role in a more sustainable building industry.

Patrick Williams Senior Vice President, Asia Pacific Autodesk

BIM Deployment Fast Growing Across Greater China



As the winning projects of this year's Autodesk BIM awards demonstrate, BIM is being increasingly adopted in Hong Kong and Taiwan, and for a wide range of uses, ranging from a power line gantry in a challenging location to railway lines including stations. Indeed, BIM deployment is growing across Greater China - which now ranks among the world's five fastest regions for expansion of BIM.

Architects and especially contractors in China are discovering the benefits of BIM, and have become global leaders in using BIM to accelerate client approval cycles. Contractors find that BIM boosts the image of their organisation, along with minimising errors in construction documents, enhancing collaboration among project team members, and reducing need for rework.

Such benefits are evident among the winners of the Autodesk BIM awards. In this booklet, you can read summaries of these winning projects - notably how they used BIM to overcome challenges that might have been difficult or impossible to tackle using traditional 2D design. I hope these success stories will inform and inspire other companies that are deploying or planning to use BIM.

Autodesk is a leading advocate for the adoption of BIM in China, and we're delighted and encouraged by findings of a recent report showing the rapid deployment of this game-changing process, coupled with the software and cloud technologies to support BIM. Across Greater China, the construction industry is poised to leverage BIM to improve productivity and efficiency, along with the quality and safety of its projects - while spurring moves towards sustainable development.

On behalf of the Autodesk Greater China team, I would like to congratulate all awardees, and thank them for sharing their stories - which I believe will help foster the development of BIM across the region.

Richard Li Director of Sales, Greater China Region Autodesk



BIM Helps Create a Sustainable Future

BIM is an intelligent, model-based process-based simulation that can help create, explore and save the building design and construction data. It's an outstanding process for boosting decision-making and productivity, and has a versatility enabling uses way beyond 3D design.

Already, BIM is being extensively deployed for better project management, providing information for facilities management, calculations to analyse sunlight, ventilation and heat absorption, and for accurate assessments of material quantities to minimise procurement and logistics costs.

As shown during previous Autodesk BIM awards, several companies and organisations in Hong Kong are at the vanguard of adopting BIM, which was first introduced here in 2002. We have seen varied and often innovative uses of BIM, together with its increasing acceptance. To foster development of BIM technology in Hong Kong, the Construction Industry Council designated "BIM Year 2014".

This year's Autodesk BIM Awards include seven winners from Hong Kong, with projects ranking among the highlights of BIM Year 2014. Plus, for the first time, there are winners from Taiwan. Taiwan uptake of the latest technology has been rapid, as reflected in the sophistication of the winning projects.

One recent development is the growth of cloud computing technology, which has the potential to elevate use of BIM to new levels, enabling international collaborations, inspiring designers, and further optimising allocations of human resources and building materials for smart cities.

At Autodesk, we will continue supporting and encouraging such progress, as our suite of BIM related software helps designers and engineers in the creative process, so the construction industry can help create a sustainable future. We also applaud the BIM practitioners recognised in this year's Autodesk BIM Awards, including all six receiving honorable mention – Arup & IDA, Century Property Investment Ltd., Henderson Development Agency Ltd., Kerry Properties Ltd., NTT Com Asia Ltd., Sun Hung Kai Real Estate Ltd., - and especially the ten winning projects from Architectural Services Department, HKSAR Government, Arup & MTR Corporation, BTA & RLP Company Ltd., CECI Engineering Consultants, Inc., Taiwan, CLP Power Hong Kong Limited, Hong Kong Housing Authority, Moh and Associates, Inc., Water Supplies Department, HKSAR Government – from Hong Kong and Taiwan. Congratulations!

Dr Wendy Lee Regional Manager, Taiwan, Hong Kong and Macau Autodesk

Autodesk BIM Awards 2015 – HK, Macau & Taiwan

Congratulations to the award winners and the honorable mention!

Award Winners



Award Winners – Students

Kwok Hoi Ling

The Hong Kong University of Science and Technology

Feng Chung-Wei, Ho Ya-Ting, Lin Yu-Che, Wang Po-Ren, Chien Yi-Hsuan, Liu Hao-Wei, Lin Zih-Han National Cheng Kung University of Taiwan

Award Winners



ORGANIZATION Architectural Services Department, HKSAR Government

PROJECT Heritage Information Modelling



ORGANIZATION Architectural Services Department, HKSAR Government

PROJECT The Use of BIM for Landscape Design – Landscape Information Modelling



ORGANIZATION Arup & MTR Corporation

PROJECT MTR Corporation Limited – Shatin to Central Link



ORGANIZATION BTA & RLP Company Ltd. PROJECT Xiqu Centre



ORGANIZATION CECI Engineering Consultants, Inc., Taiwan PROJECT Sanying Line Metro Rapid Transit Project



ORGANIZATION CECI Engineering Consultants, Inc., Taiwan PROJECT

Construction of Jakarta Mass Rapid Transit Project Underground Section CP106



ORGANIZATION CLP Power Hong Kong Limited

PROJECT New Gantry Construction for CLP Lai Chi Kok Substation



Hong Kong Housing Authority PROJECT BIM Culture – A New Paradigm Towards Partnering for Change



ORGANIZATION Moh & Associates, Inc.

ORGANIZATION

PROJECT THSR Changhua Station Project



ORGANIZATION Water Supplies Department, HKSAR Government PROJECT Study on the Trial Use of BIM for Asset Management

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



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.

Image courtesy of Architectural Services Department, HKSAR Government

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. 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. Image courtesy of Architectural Services Department, HKSAR Government

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



BIM Process

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. Geolocation 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



Image courtesy of Architectural Services Department, HKSAR Government



mage courtesy of Architectural Services Department, HKSAR Government



Image courtesy of Architectural Services Department, HKSAR Government





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.

COMPANY

Architectural Services Department, HKSAR Government

PROJECT

The Use of BIM for Landscape Design – Landscape Information Modelling

LOCATION Victoria Park, Causeway Bay; Parks in To Kwa Wan & Kwun Tong TYPF

Landscape Design and Construction

SCHEDULED TIME OF COMPLETION 2015-2018

"We benefit from L.I.M. as the final products, such as, 2D drawings, illustrations and animation clips, provide a coherent means for the understanding of landscape design proposals."

— Kevin Li Senior architect

Architectural Services Department

BIM PARTNERS INVOLVED Vircon Ltd. Kalloc Studios Asia Ltd.

BIM Adds Value to Landscape Design Work



Active planting, proper maintenance, preservation of trees and vegetation would enhance the quality of our living environment. Landscape projects bring many benefits yet there are challenging issues to be tackled, sustainable design principles, aesthetic value and other functional requirements to name a few.

Given the interplay between these factors can be complex, building landscape models facilitates the evaluation of various "what-if" scenarios. Design team members can then hold discussions, to identify and resolve potential issues at an early stage.

The conventional approach to design communications relies on 2D drawings. Yet as it's challenging to interpret these drawings and picture the outcome in the three-dimensional real world, this is heavily reliant on design team members' experience. Issues might be under-valued, mis-interpreted or even entirely overlooked.

In a bid to improve the design process, a team in the Architectural Services Department opted

to use BIM techniques on a trial basis, adapting them to become L.I.M. - Landscape Information Modelling. They used BIM as a platform for holding data collected from topographical surveys, utility mapping, tree surveys, and found such process invaluable for checking data integrity and assessing design options.

Efficient and Effective Understanding of Designs

"Adopting BIM techniques permit examining of data in context," says Kevin Li, Senior Architect, Architectural Services Department. "Our challenge is to convince stakeholders that there is alternative and more effective way to produce equal or better results. We benefit from L.I.M., as the final products, such as, 2D drawings, illustrations and animation clips, provide a coherent means for the understanding of landscape design proposals."

The gradual adoption of L.I.M. reflects landscape architects and their collaborators being keen to explore ways of enhancing and adding value to landscape work during early design and construction stages. The team

Image courtesy of Architectural Services Department, HKSAR Government



worked on some preliminary explorations, by assembling Landscape Information Models (LIM) for three projects: a proposed extension of a park in To Kwa Wan; a proposed urban park in Kwun Tong and a display in the 2015 Flower Show held in Victoria Park, Causeway Bay.

A model for all seasons

For the proposed park extension in To Kwa Wan, existing site features and proposed design were incorporated in the landscape information model.

The wealth of information included data on trees, namely, species, location, height and proposed treatment, like whether a tree would be retained or removed. This data assisted indepth understanding and benefited the design process, but will also be used in subsequent tree management.

Using L.I.M., qualitative and quantitative comparisons of design options were conducted easily, such as, a comparison of lawn areas and affected trees. The park's future appearance could be shown, with trees almost instantly growing taller at the click of a mouse button. Plus, the model allowed generation of endless numbers of views and animation showing how the park will look in different seasons, this flexibility would be unthinkable by application of conventional design tools.

Before and after views

The site for the proposed urban park in Kwun Tong is small, and ringed by high-rise buildings. This made it especially important for the design team to model shading from the sun throughout the 12 months of a year, showing how different parts of the park will be affected by sunlight. Using the same base model, the team evaluated prevailing wind conditions, to optimize the plant selection.

The model was also useful for generating images to show how the park will look. These were shown along with photographs taken from the same vantage point, it makes Image courtesy of Architectural Services Department, HKSAR Government

the comparison easy for laymen as well as professionals. "The impact of proposed landscape design can be easily demonstrated," says Kevin Li.

Towards a complete Landscape Information Modelling

The exhibit for the 2015 Flower Show was to feature a collection of flowering plants plus short wooden pillars in a swirling pattern. The design team incorporated locations of particular plants, together with soil depth, plant colour etc, in the landscape information model.

This model not only allowed visualisation of the disposition of plant cluster, the layout plan and planting schedule were automatically generated from the model. Such improvement



Image courtesy of Architectural Services Department, HKSAR Government

on workflow is a time-saving feature yet ensuring the information is consistent.

"The trial runs were not smooth sailing," says Kevin Li. "But the outcomes did stimulate debates and discussions. The exercises focused on how to create a comprehensive set of landscape information across all work stages and the benefits of doing so." He adds that the L.I.M. approach is quite different from current practices, and anticipates further technical developments, such as on software, library objects and work flows for landscape design, which will be important in facilitating the journey to a richer Landscape Information Modelling.



Image courtesy of Architectural Services Department, HKSAR Government



Image courtesy of Architectural Services Department, HKSAR Government



Image courtesy of Architectural Services Department, HKSAR Government





Image courtesy of Architectural Services Department, HKSAR Government

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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.

COMPANY Arup & MTR Corporation PROJECT

MTR Corporation Limited – Shatin to Central Link

LOCATION **Wan Chai, Hong Kong** TYPE

Government-owned Public Infrastructure Project

SCHEDULED TIME OF COMPLETION 2021

"Without BIM, this particular project would have been very tough. It helps to minimise design inconsistencies at the start, and problems can be mitigated efficiently."

— Ir Timothy Suen Director Arup

BIM PARTNERS INVOLVED TFP Farrells Langdon & Seah

BIM Benefits Displayed in Exhibition Station



Image courtesy of Arup

The 3D images of the existing underground facilities of the adjacent area of the Exhibition Station look a very little like an upside-down porcupine with its mass of spines pointing down. These "spines" are pilings, both existing and planned, and their abundance gives some indication of the complexity of the project to design and then construct this new station along the forthcoming Shatin to Central Link.

Exhibition Station will be under north Wanchai, in a harbourfront area that currently includes a public transport interchange, a sports centre and a swimming pool. "The biggest challenge is that there are so many things happening around the site, including Wanchai Development Phase II and a related bypass," says Ir Timothy Suen, Director, Arup. "BIM could help the design, as well as showing the sequence of work and how this relates to other projects in terms of land or work sites availability. For critical paths, with the main risks, we could use the BIM model to find alternatives more effectively if other work could not be done according to plan."

This flexibility is essential given that the station design team is preparing for multi-stages of

major traffic diversion schemes, each of which will be very dependent on land being available for work sites. The BIM model helped identify two especially critical junctions at Fleming Road and Tonnochy Road, which are congested with underground utilities, and with modelling the sequences for diversions and related construction, such as diverting drainage pipes, culverts and installing pipe piles and diaphragm wall.

Unforeseen underground problems demand flexibility

"MTRC work is very different to typical BIM projects, involving buildings - as it's mostly underground, and unforeseen conditions make changes unavoidable," says Ir Suen. "With BIM we can find remedies and alternatives, while minimising time impact on the project."

The Arup team built the BIM model from a variety of sources, including record drawings from different utility companies, scans for underground structures and site survey. Yet for underground utilities in Hong Kong, to achieve an accuracy needed for the project, a lot of



Image courtesy of Arup

sensitive check and "what if" can be done by using the model.

One challenge arose from the existing and planned foundations for the future station. "We will demolish the swimming pool and indoor games hall; and build a station as well as replicate the facilities," says Ir Suen. Because of zoning for the excavation, the diaphragm wall will need to be constructed in plentiful piling; yet removing all foundations before installing the diaphragm wall is not practical. The design team used the BIM model to accurately locate the existing piles and foundations, and plan a diaphragm wall alignment that will avoid them as much as possible. This minimises generation of waste, and will save considerable time and costs.

Value engineering and stakeholder participation

The BIM model has also enabled the team to carry out value engineering throughout the design process. It helps with selecting the most cost-effective schemes to minimise excavation, reduces wastage in abortive works – with thousands of clashes already identified, and enhances resource allocation for unforeseen problems and conflicts.

"Engineers and modellers sit together, and identify clashes and how to resolve them," says Derek Lau, Associate, Arup. "We have workshops, including engineers and architects who find their designs may not match. For instance, there may be problems with levels; perhaps the headroom for a staircase is incorrect. Using the BIM model, these can be resolved straight away. We've been learning a lot."

With complex designs like the station, even experts might find them hard to understand using 2D drawings, and could overlook potential errors. The 3D model, including information, proves a great help. Plus it benefits other stakeholders.

"The vivid 3D images and animations make it easy for people like district councillors to visualise our designs, such as for the reprovisioned swimming pool," says Mr Lau. "We can rotate the images on screen, and show construction sequences. With a better understanding, stakeholders feel ownership and participation in the project."



Training crucial for transition to BIM

Arup aims to be at the forefront of technological advances, notes Ir Suen, and now wants to utilise BIM as much as possible in their projects. In fact, Arup has been working with MTRC in fostering the transition to BIM, with the first detail design project developed in 2010 as MTRC's pilot scheme for using BIM. He likens the changes underway to when AutoCAD came into the market during the 1980s, as engineers made a switch from drawing on boards to computer aided design. "We believe that we need designers architects, along with MEP, civil and structural engineers - doing their own BIM," he says. "We need more training for designers, and we're training modellers to do some design and resolve clashes."

Once the design process is completed, the BIM model will be passed to the contractor, and then developed further so it can be used for construction and facilities management.

"Without BIM, this particular project would have been very tough," says Ir Suen. "It helps to minimise design inconsistencies at the start, and problems can be mitigated efficiently. Even if work reveals changes in the geology, we can include these too."



Image courtesy of Arup



Image courtesy of Arup

ARUP



Image courtesy of Arup

About Arup

Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. We offer a broad range of professional services that combine to make a real difference to our clients and the communities in which we work.

We are truly global. From 92 offices in 40 countries our 12,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion.

Founded in 1946 with an enduring set of values, our unique trust ownership fosters a distinctive culture and an intellectual independence that encourages collaborative working. This is reflected in everything we do, allowing us to develop meaningful ideas, help shape agendas and deliver results that frequently surpass the expectations of our clients.

The people at Arup are driven to find a better way and to deliver better solutions for our clients. We shape a better world.

COMPANY BTA & RLP Company Limited PROJECT Xiqu Centre LOCATION West Kowloon Cultural District, Hong Kong TYPE Theatre and Retail SCHEDULED TIME OF COMPLETION 2017

One BIM Model for Designers on Three Continents

"A theatre is one of the most complex building types, and for coordination of services, you need a tool like BIM."

"The design of the Xiqu Centre required a real -time collaborative process involving many international experts due to the complex nature of this sophisticated building typology. The Revit BIM platform was key to achieving a successful outcome."

— Earle Briggs Director BING THOM ARCHITECTS

BIM PARTNERS INVOLVED West Kowloon Cultural District Authority Buro Happold International Rider Levett Bucknall Atkins China Ltd. Front Inc. Hip Hing Construction Co. Ltd. Kingsfield Engineering Ltd.



The Xiqu Centre being built in Hong Kong's West Kowloon Cultural District (WKCD) will be one of the first arts and cultural venues to open in the district, and is dedicated to promoting the rich heritage of Xiqu performances. It features two auditoriums, one for full scale performances and another more intimate" traditional tea house", along with expansive public leisure space.

The project is designed by BTA & RLP Company Limited (BTA & RLP) which is a joint venture company of Canada-based Bing Thom Architects (BTA) and Hong Kong-based Ronald Lu & Partners (RLP). Together with BTA's extensive theatre and cultural facility design experience and RLP's local knowledge and expertise on the recently completed Koshan Theatre annex, BTA & RLP won the competition for the Xiqu Centre.

Inspired by the concept of 'flow' or 'qi'

Mr Ching notes that West Kowloon Cultural District Authority were forward thinking enough to require the use of BIM in the design Image courtesy of BTA & RLP Company Ltd.

process for all WKCDA projects as part of the Consultancy Agreement. In addition the BIM model will be employed by the Authority for faculty management of individual projects. "A theatre is one of the most complex building types, and for coordination of services, you need a tool like BIM," says Mr Ching.

"The design is inspired by the concept of 'flow' or 'gi', with interiors that are both curvilinear in plan and form," adds Earle Briggs, Co Managing Director, Bing Thom Architects - who has set up a Hong Kong office to work on the Xigu Centre. "For non- orthogonal geometry in the public areas of the building including the main theatre, it was not possible to design it in 2D - you need 3D." Like Ronald Lu & Partners, Bing Thom Architects has extensive experience of BIM, which they began using in 2004, and it's now their tool of choice for design and documentation on all major projects. For the complex geometry, dimensional control relies on Revit model rather than dimensions marked on drawings, resulting in reduced time for drawings production.



"The design of the Xigu Centre requires a real-time collaborative process involving many international experts due to the complex nature of this sophisticated building typology. The Revit BIM platform is key to achieving a successful outcome", says Mr Briggs. Though BTA & RLP's office in Hong Kong is the hub for the design, there's an international team of specialists at work, including acoustic, theatre, landscape, performance video, performance sound and communication lighting and additional support from BTA's Vancouver office Using BIM enables team members to work together and maintain the high standard of consistency and design quality, sharing the same information in real time. "With team members working simultaneously on three continents, and over 20 people collaborating on the model at the same time," says Mr Briggs. "We really felt like we were breaking new ground by maximizing our resources for production, while working across continents."

The model is kept on Revit Server, but with 1.5GB of information, it's significantly larger size of a normal model, which has resulted in some issues with delays in loading and saving. Network optimization has boosted speeds, significantly increasing efficiency.

Face-to-face communication helps too

Another apparently appealing option for boosting speeds was to reduce file sizes by splitting the design into several models. "In theory splitting would work perfectly for most building types, but for our case, everything is closely tied together," says Alvin Y.H. Kung, Architect, Ronald Lu & Partners. Difficulties included loss of information when models were linked together again, and the team eventually settled on models for the main building, the theatre, and the facade. Image courtesy of BTA & RLP Company Ltd.

Paradoxically, while able to cooperate around the world, the Hong Kong team members found it was best to move into one space, for face-to-face communications between architects working on the same aspects of the project. "This has made a good atmosphere to collaborate," says Mr Kung. "The way you draw in Revit is more interactive than in CAD this is especially important as a lot of changes may happen with a very few moves."

Working with BIM has helped to find and resolve design changes. Mr Ching explains this is especially important with the Xiqu Centre, as only the basement is in concrete, while the remainder of the building is steel, "and it's not so forgiving - it's delivered on site, and you cannot cut a steel truss." Plus, the contractors can better understand the design than they would with 2D drawings. These benefits have been proven in early construction stages, with the foundations and basement



Image courtesy of BTA & RLP Company Ltd.



Image courtesy of BTA & RLP Company Ltd.

work completed, and construction of the superstructure underway.

"A big advantage of the model, which we used from the very beginning of the design process, is the capability to create visualisations, spatial walkthroughs using both Navisworks and Showcase," says Mr Briggs. "You can create a path through the building, and visualize elements and spatial qualities you were not aware of. It's very helpful."

Further models and a full-scale mock-up

The virtual images including animations also helped the Client to understand the space and design concept, and allow them to check that the facilities will suit their need by using BIM, which the design team learned, include needing 3.7-metre clearances so some performers can walk through with full headgear. Design consultants are also making use of the model. Fisher Dachs Associates theatre consultant, in New York, has used the model to ensure good sight lines, manipulating seating levels to optimize views to the stage. The model has been taken as the basis for acoustics study by Sound Space Design, enabling the acoustics experts to create a more precise model than they could from 2D drawings. Based on the integrated BIM model, researchers at the University of Ontario have built physical models for wind tunnel testing, partly to check, for pedestrian comfort, the semi-enclosed plaza won't itself become like a wind tunnel.

The BTA Vancouver office has printed the main theatre model and major section of the building, finding that having a physical model helps visualize design. In addition, 1:1 scale models were printed to review custom designed supports for cladding system to maintain the high standard of consistency and design quality since the BIM is shared among consultants across the disciplines.



Image courtesy of BTA & RLP Company Ltd.





Image courtesy of BTA & RLP Company Ltd.

About Ronald Lu & Partners

Ronald Lu & Partners (RLP), established in Hong Kong in 1976, is an award-winning practice specializing in architectural and interior design and master planning. The firm has completed and is engaged in wide variety of projects, including large-scale integrated urban developments, transit-oriented developments, commercial buildings, residential developments, and cultural and public developments. RLP has received over 110 local and international accolades for its exceptional projects, in particular the Zero Carbon Building, Academic 3 of the City University of Hong Kong, the China Resources Building and Pak Tsz Lane Park. RLP has offices in Hong Kong, Beijing, Shanghai, Guangzhou and Shenzhen, housing its strong team of over 600 staffs.

About Bing Thom Architects

Bing Thom Architects (BTA) is an innovative Canadian architectural practice with an emphasis on civic and institutional projects. Founded in Vancouver in 1982 by Hong Kong born and Canadian raised architect, Bing Thom, the firm has a staff of over 45 who originate from a dozen different countries and bring equally diverse language skills and cultural understanding.

BTA is passionate about the positive social and economic value that architectural excellence brings to communities and been the recipient of numerous honours and awards, including the 2011 RAIC Gold Medal, Canada's highest honour in architecture. In 2012, BTA set up an office in Hong Kong and together with local Hong Kong architect, Ronald Lu & Partner, pursued and won the international design competition for Hong Kong's Xiqu Centre. BTA has followed this success with the award of further projects in Hong Kong.

COMPANY

CECI Engineering Consultants, Inc., Taiwan

PROJECT

SANYING LINE METRO RAPID TRANSIT PROJECT

LOCATION New Taipei City, Taiwan

TYPE Basic Design and Project Construction Management Consultant Service

SCHEDULED TIME OF COMPLETION Q3, 2022

"The combination of BIM, GIS and Infraworks 360 is a major breakthrough that has brought many unprecedented benefits"

— Shen Chia-Ray Deputy Manager, PE Department of Rapid Transit Engineering at CECI

BIM PARTNERS INVOLVED

Project Owner: New Taipei City Government

Maximizing Project Planning Efficiency with BIM and GIS



To provide more convenient public transport and boost local development, the New Taipei City Government has prioritized construction of the Taipei Mass Rapid Transit (MRT) system's Sanying Line, setting a target deadline of Q3, 2022, and contracted CECI for preliminary designs and project management.

The 12 stations and depot of the 15-kilometre Sanying Line cover regions such as Sanshia and Yingge, with plans for further extension to Fengming, Taoyuan. As the elevated MRT line will be built on roads that are merely 15 to 18 metres wide, one priority is minimizing the impact on residents. In addition, the line's length and the two rivers and the two highways that cross will increase the challenges faced by designers. The project team must consider the complex topography, busy traffic, and distribution of underground cables and wires.

Maximized efficiency thanks to the synergy of GIS and BIM

To resolve the multiple conundrums arising with the Sanying Line, CECI designs using software

Image courtesy of CECI Engineering Consultants, Inc., Taiwan

such as Civil 3D and AutoCAD 3D, together with geographic information such as topographic maps, digital Ortho-photographs and UAVgenerated colour 3D models. Data is integrated into Autodesk Infraworks 360, allowing engineers and project stakeholders to discuss and coordinate on a single, common interface.

The project team can visualise the Sanying Line's entire route with the BIM 3D model, which shows the relative positions of stations, viaducts and various topographic features. This in turn enables the team to identify potential problems with the construction process, while enabling the owner to thoroughly understand the planning and design of the Sanying Line. With efficient communication and appropriate adjustments, the quality of design, construction and future operation of the Sanying line are ensured.

"By integrating building information models with the geographic information system during design and plan phase, CECI was able to overcome challenges such as the clashes involving complex underground cable routes, as well as transmission towers and wires," said Shen Chia-Ray, Deputy Manager, PE, Department of Rapid Transit Engineering at CECI. "We were thus able to present suggestions on how these positions or our design could be appropriately adjusted."

Optimized station design with 3D simulations

Featured stations are other key elements of the project. For instance, one Sanying Line terminus is an elevated station that will be jointly structured with the underground Dingpu station, terminus of the Bannan Line. To support this structure, CECI had to design a passageway for passengers to transfer between the two lines. With software like Revit, engineers could divide every level into exploded view drawings, and the project team used these to accurately formulate plans for the passageway.

In addition, with energy simulations and innovative building simulation techniques, CECI could precisely assess the changes of wind directions and sunlight in summer and winter, and then adjust the station design in accordance with green simulation models. For example, the team decided to install more sunshades and wall openings on the south side, so that direct sunlight can be blocked and heat better dispersed from inside. On the north side, glass screens and special paints



are added, to block northeasterly winds in winter. Finally, the roof design was adjusted to introduce more natural light into the station.

"Autodesk Revit enabled us to readily build a 3D model of stations, and with wind direction, sunlight and heat flow analyses we could decrease the buildings' energy consumption, increase natural lighting indoors and direct natural wind into the buildings, so that passengers can find the stations more comfortable," said Ms. Hsu Li-ting, engineer, Rapid Transit Engineering Department at CECI.

Image courtesy of CECI Engineering Consultants, Inc., Taiwan

Complete Building Lifecycle Management - From 3D to 6D

With Autodesk Navisworks, CECI built a 4D model for detailed construction planning, error analysis and management, as well as 4D animation demonstrations. Various scenarios were implemented showing the complexity of the underground Dingpu station, the elevated LB01 station and the joint structure, so the contractors could accurately formulate and follow construction procedures.

With BIM 5D scheduling, model data have been linked to the project schedule and cost data to control budgets and assist the project team with formulating the most cost-effective



Image courtesy of CECI Engineering Consultants, Inc., Taiwan



Image courtesy of CECI Engineering Consultants, Inc., Taiwan

design. When the structures are complete, the BIM model will be given to the operation unit for 6D management.

To extend the application of BIM, CECI further utilized Autodesk Infraworks 360 as a platform to integrate and share all information. Large amounts of geographic information models and building information models were combined – improving efficiency of teamwork, coordination and communication so the design could be more quickly approved.

"Thanks to Infraworks 360, we were able to formulate a plan with a holistic view, and to visualise and dynamically recognise the interaction between the Sanying Line and the local community for further detailed design," noted Ir Hsu. "All parameters will be collected in a database, realising comprehensive 3D to 6D building lifecycle management."

Ir Shen added: "The combination of BIM, GIS and Infraworks 360 is a major breakthrough that has brought many unprecedented benefits and allows us to more accurately predict the operational efficiency of stations, rails and bridges in their ambient environments. In future, CECI will deploy and explore various new techniques to fully capitalise on BIM technologies."



Image courtesy of CECI Engineering Consultants, Inc., Taiwan





Image courtesy of CECI Engineering Consultants, Inc., Taiwan

About CECI Engineering Consultants, Inc., Taiwan

CECI was established in 1969 primarily for the purpose of upgrading Taiwan's engineering technology and assisting in the economic development of Taiwan and developing countries, and has been awarded ISO certification for planning, design, construction supervision, construction management, information technology and system engineering as well as numerous other accreditations.

With its sense of entrepreneurship, CECI has seized the opportunity to participate in Taiwan's most important projects and be a part of the economic miracle which transformed Taiwan and resulted in advanced transportation infrastructure including the nation's first freeway, the world's biggest High Speed Railway BOT project, world class metro systems, and the famous hi-tech corridor of science and technology parks which are home to some of the world's top researchers, developers and manufacturers of cutting edge industries.

Furthermore, with the emergence of the information age, CECI has been actively expanding its scope of services into new technologies and areas of work, including Building Information Modeling (BIM), Geographical Information Systems (GIS), Global Positioning Systems (GPS), Intelligent Transportation Systems (ITS), e-Ticketing and other types of applications which answer to the tendencies and trends of technological advancement.

With a staff of over 1,700 professionals representing virtually all engineering design disciplines, their hard working dedication and support enable us to provide cost-effective solutions with superior quality of service and collaborate with other partners, organisations and societies. We demonstrated our goal of becoming an internationalised firm to assist in the economic development of other countries and share in our commitment to keep a harmonious relationship with nature while using our precious natural resources safely and wisely.

COMPANY

CECI Engineering Consultants, Inc., Taiwan

PROJECT

Construction of Jakarta Mass Rapid Transit Project Underground Section CP106

LOCATION Jakarta, Indonesia

TYPE Public Infrastructure Project and Design -Build Mode

SCHEDULED TIME OF COMPLETION 2018

"BIM ensures efficiency and quality. It gives us competitive advantages during submission of tender documents."

— Shen Chia-Ray

Deputy Manager, PE Department of Rapid Transit Engineering at CECI

BIM PARTNERS INVOLVED

Project Owner: PT MRT Jakarta - CMC: Oriental Consultants Global Co., Ltd. Other Consultant: THI Consultants Inc. Main Contractor: SMCC HK JO

BIM Boosts Precision and Safety in MRT Project Design



To solve chronic traffic problems, the government of Jakarta, Indonesia, since 2013 has invested in a project to construct an MRT system, scheduled for completion in 2018. This is Indonesia's first MRT project, and was ranked as among the world's best infrastructure projects by World Finance Magazine last year.

Jakarta's MRT system has a total length of 15.7km, including 13 stations. CECI is responsible for detailed design of section CP106, including Bunderan HI station, Dukuh Atas station and two tunnels.

The section is in a crowded downtown area with limited space. Making the design and construction even more challenging, tunnels must be created below rivers and existing train tracks and between many closely packed buildings. CECI chose BIM as a project platform to enhance collaboration and design quality.

Communication and coordination for best decisions

Many stakeholders are involved in the Jakarta MRT project, and there may be communication

Image courtesy of CECI Engineering Consultants, Inc., Taiwan

gaps between professionals. CECI utilises BIM technology to design station access, ventilation and cooling towers. Software such as Autodesk Revit and 3ds Max is used to build 3D models. 3D visualisations have significantly improved communication and coordination between the government and landowners, while using Autodesk Navisworks enables different disciplines to work together. Models from architects, civil engineers, structure engineers, tunnel engineers, mechanical engineers and environmental control engineers have been integrated in Revit, to identify potential design conflicts and resolve them as early as possible.

Alignment data determine the precise location of each station. If locations are along curved sections of track, it is critical to ensure correct clearance between trains and the platform edge for operation and safety. CECI used BIM to consider multiple spatial limitations as well as functional requirements.

"Limited space is one of the main challenges in the Jakarta MRT project, especially since the section is in a central business district," says Ricky Kurniawan, engineer, CECI. "BIM is a great tool. Alignment data in Civil 3D can be imported to Revit, to decide on track routes and platform location. This enables us to verify there will be appropriate spaces between trains and platforms, to ensure operations and safety of passengers, including those with physical disabilities."

Shen Chia-Ray, Deputy Manager, PE, Department of Rapid Transit Engineering at CECI, adds: "Although the turnkey contractor in this project uses a 2D design process, it requires high standards of detail and precision. Fortunately, the data could be imported to a BIM model, maximizing technical support and achieving the quality requirements."

Achieving value engineering

In value engineering studies, smaller stations save building materials, energy consumption and emissions. After deciding on the initial design, CECI introduced BIM technology to simulate station and tunnel works, in order to carry out value engineering as well as to reduce space, materials and construction time.

"With BIM technology, we finished value engineering studies on station deployments and alignment reviews," says, project engineer



Image courtesy of CECI Engineering Consultants, Inc., Taiwan

Passenger simulation enhances safety

To ensure operational safety, THI Consultants, commissioned by CECI, used data from the BIM model to conduct passenger simulations and analysis. These included potential emergency scenarios, to eliminate some potential failures in the first place, and can also evaluate station deployment and evacuation capabilities. These simulations are especially important given one station has three storeys underground, along with connections to the



Ricky Kurniawan. "Take underground stations

Bunderan HI and Dukuh Atas, for example.

Cooperation between project architects and

engineers reduced the length of Bunderan HI

from 439 metres to 429 metres, and Dukuh

Shen notes that, "In addition to assisting the

BIM also saves costs, time, and unnecessary

bills - achieving a win-win scenario for the

turnkey contractor and government."

space. In future, there will be lower electricity

turnkey contractor with reduce station lengths,

Atas from 220 metres to 200 metres "

existing train station and a future high speed rail station.

"We used station models developed in Revit to simulate various scenarios in the event of emergencies," says Ir Kurniawan, "Both station planning and passenger flow simulation in the same model can avoid communication gaps."

CECI fully utilises BIM models in civil engineering projects, finding efficient project management is possible, even in "fast-track" projects such as the Jakarta MRT. Coordination and resource sharing among various disciplines offer the turnkey contractor comprehensive support for construction planning and decision.

"In the CP106 project, BIM ensures efficiency and quality," says Ir Shen. "This is an important international case for CECI. With value-added services achieved by utilising BIM tools, the Japanese turnkey contractor in Indonesia has recognised CECI as the best design consultant in the Jakarta MRT project. Hence, BIM gives us competitive advantages, and they are willing to pay for our participation in other projects."



Image courtesy of CECI Engineering Consultants, Inc., Taiwan



Image courtesy of CECI Engineering Consultants, Inc., Taiwan





Image courtesy of CECI Engineering Consultants, Inc., Taiwan

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COMPANY CLP Power Hong Kong Limited

PROJECT New Gantry Construction for CLP Lai Chi Kok Substation

LOCATION Cheung Hang Road, Lai Chi Kok TYPE

Construction of New Gantry and Platform SCHEDULED TIME OF COMPLETION

2015

"The beauty of BIM is that it allows you to visualise the real situations of your site. By using it, we ensure the construction works to deliver good value for money and safety management."

—CL Mak

Senior Substation Implementation Manager CLP Power Hong Kong Limited

BIM PARTNERS INVOLVED

Furgo (Hong Kong) Ltd. isBIM Ltd.

Beauty of BIM Powers Safety First Approach



Though CLP Power Hong Kong Limited (CLP Power) has a wealth of experience in building electrical power networks across Kowloon and the New Territories, the planning and construction of a new gantry beside a substation at Lai Chi Kok, situated in the northern west part of Kowloon, looked set to be especially challenging. "There is an existing high voltage overhead line just above, and the access road to the construction site is steep and, very narrow," says Anthony Ip, Senior Project Engineer of CLP Power, "We would have a crane at the site close to the overhead lines, and therefore needed to ensure the safety of site operation ."

Given the very challenging site constraints, the project team decided to use BIM, which CLP Power had recently adopted for the design of transmission substations.

By transforming the design into a 3-dimenionsal model, BIM enabled the project team to visualise and review the design and site logistics at the early stage of project planning. At first, the team did not know the most suitable locations to site the temporary platform for erecting the gantry,

Image courtesy of CLP Power Hong Kong Limited

to place the mobile crane for lifting equipment and construction materials, and to erect the temporary scaffolding. Then they used BIM model to fine-tune the design by trial and error – virtual errors in the computer simulation rather than actual errors on site. "It was relatively easy to do this by BIM modelling.

We designed together with engineers from the contractor, determining the best fit." says Anthony. He mentioned that even locations of trees in the site area were included in the BIM model, facilitating CLP's planning to safeguard valuable trees from damage during construction.

BIM provides good platform for discussing issues

Traditionally, a project like this usually involves reorganising aspects of the site while construction works are underway. Since changes of the site condition could be simulated and reviewed through the virtual design, it benefited engineers and frontline workers as their tasks could be proceeded more smoothly. One example is `time needed – and hence rental



Image courtesy of CLP Power Hong Kong Limited

costs' – for the equipment (including the mobile crane with 35m operating radius and 70 tons lifting capacity) could also be kept to a minimum.

In addition, instead of totally relying on experience of operators to ensure the provision of adequate safety margins – such as maintaining a safe working distance of the crane from the live overhead lines – these could be determined through the 3D visualisations.

"The BIM model is a good platform for discussing issues related to the construction project such as interfacing and, most



Image courtesy of CLP Power Hong Kong Limited

importantly, safety," says CL Mak, Senior Substation Implementation Manager of CLP Power. "We could even determine every detail before the actual site work, issues like locations of hooking points for safety harnesses, as well as those of the safety barriers."

Frontline workers excited to see the 3D model

Once construction got underway, the BIM model helped workers readily understand the project. Usually, explanations and discussions between foremen and workers would rely on 2D site plans and sketches, which sometimes could not fully reflect the actual environment of a complex project. "But we discovered that the frontline workers were excited to see the 3D model of this construction project," says CL.

"They could look at simulated situations of site operation, such as the 'line of fire' for the crane and what would happen if it dropped materials during lifting operation. All the frontline staff found the 3D model impactful, and gave feedback that it was easier to understand the operational procedures, greatly improved efficiencies of meetings and discussions."

Every working day, there was a Pre-Work Risk Assessment to ensure safety. It also employed BIM visualisations. "The beauty of BIM is that



Image courtesy of CLP Power Hong Kong Limited



Image courtesy of CLP Power Hong Kong Limited


it allows you to visualise the real situations of your site, unlike generic occupational health videos," says Anthony. "Workers are more motivated when we use it to conduct safety briefings.

Slight changes of the plan can be incorporated in the BIM model, allowing us to ensure the construction works deliver good value for money and safety management."

Enhanced electrical interfacing

The 4D scheduling and sequencing, together with site logistics planning functions at BIM, helped to the project team identify traffic considerations and potential hazards in the surrounding areas of the site. The team also used the 4D model to evaluate the erection sequence and major construction activities, finding it an incredible asset that allowed the site work team to prepare a well-organised safety plan and logistic arrangement including site tidiness for workers. Hazards have been eliminated at an early stage, providing a safer work environment at the construction site.

"BIM has also helped with interfacing work,"" says CL. "We needed to install high voltage electrical trunking, which we usually conducted the installation works inside substations where the working environment is better. For this project, metallic high voltage electric trunking sections with unit length and diameter of approximate 6 metres and 600 millimetres respectively were being built inside a trough from the substation to the gantry along a steep slope. Each electrical trunking section was prepared in a very precise manner in order to fit the irregular site condition, including the steep slope. The electrical fitters needed to install and connect those trunking sections within a very tidy environment, similar to that of a clean room. Temporary site provision to achieve this requirement was planned effectively by means of BIM. Workers were surprised to see the BIM model with our plan for safe working procedures, and were more confident about installing this delicate 300-metre metal trunking."

Working on the gantry design and construction has provided valuable experience to the project team for handling future projects involving overhead lines. "We enjoyed the benefits of BIM, such as clashes and better design, and developing ways for safety promotion through BIM technology," says CL.

Image courtesy of CLP Power Hong Kong Limited





Image courtesy of CLP Power Hong Kong Limited

About CLP Power Hong Kong Limited

CLP Power Hong Kong Limited ("CLP Power") is a Hong Kong utility subsidiary wholly owned by CLP Holdings Limited, a company listed on the Hong Kong Stock Exchange and one of the largest investor-owned power businesses in Asia. CLP Power operates a vertically integrated electricity supply business in Hong Kong, and provides a highly reliable supply of electricity and excellent customer services to 5.8 million people in its supply area.

COMPANY Hong Kong Housing Authority

BIM Culture – A new Paradigm Towards Partnering for Change

LOCATION Hong Kong TYPE

Public Housing Development

"BIM has gradually grown from a new technology unfamiliar to most of Housing Authority staff, to an essential part of their work."

BIM PARTNERS INVOLVED

Tung Tau Cottage Area East Project Able Engineering Company Ltd. The Hong Kong Polytechnic University Forida Ltd.

Anderson Road Sites A & B Project

Chau Ku & Leung Architects & Engineers Ltd. AECOM Asia Co Ltd. C S Toh & Sons & Associates Ltd. Yau Lee Construction Ltd.

Sheung Shui Area 36 West Project

Yau Lee Construction Co Ltd. Meinhardt (M&E) Ltd. Summit Technology HK Ltd.

BIM Culture Boosts Working Harmony



BIM has gradually grown from a new technology plann unfamiliar to most of Housing Authority staff, to speci

While the Hong Kong Housing Authority has successfully deployed and even pioneered BIM in several projects, the BIM culture developed in the organisation may be even more important than the technical achievements.

an essential part of their work.

BIM was first introduced to the Housing Authority in 2006 and has since been put on trial in some public housing projects to predict the long term performance of the building, enhance design quality, site safety, improve construction coordination among concerned parties and reduce abortive works and waste.

Comprehensive infrastructure for BIM

The Housing Authority is unusual in Hong Kong for having a strong BIM strategy, with management ensuring all the necessary infrastructure is in place. This includes a BIM Project Steering Committee for strategic

planning, a BIM Working Group focusing on

specific implementation and technical details, and a BIM Service Team that supports project teams and nurtures in-house BIM experts. A BIM Centre features meeting and training rooms, where people working on projects can learn about applying BIM to their projects.

The Housing Authority has developed its own BIM standards, guidelines and manuals, together with in-house libraries. BIM training courses cover staff at all levels and disciplines, and around 80% of Housing Authority staff – approximately 1,300 persons – have received BIM training. There's a range of BIM related software, and staff participate in BIM conferences and seminars.

Given this strong foundation, all new development projects in the Housing Authority will adopt BIM. Indeed, BIM is already ingrained in various stages of projects, ranging from feasibility studies, through the scheme design stage, as a value management and design optimisation tool, and during construction.

All the way with BIM

The Housing Authority's Feasibility Study Team finds BIM indispensable for potential site assessment and feasibility studies, as well as for visual impact analysis. BIM is especially useful at the scheme design stage, especially for projects with complex site conditions and topography with significant level changes.

The Housing Authority has also used BIM as a Value Management, Design Visualization and Optimisation tool, helping project teams to choose the most efficient design option; and as an innovative and creative presentation tool.

BIM is utilised for detailed design and for drawing production. The Housing Authority became one of Hong Kong's first practitioners to use BIM at construction, and has explored creative applications such as Construction Site Safety Planning and Cash Flow Simulation.

Post construction, the Housing Authority is also employing BIM in several pilot projects on Facility Management.

BIMplementation rooms and harmonious environments

Recent Housing Authority projects involving successful use of BIM include the Tung Tau Cottage Area East in north Kowloon. This was a pilot project for BIM, which was employed from feasibility studies to the post-completion stage, delivering benefits such as improved efficiency and reduced abortive works, with perhaps eight days less reworking required than if traditional culture of work had been used.

Just northeast of Kowloon, Anderson Road Sites A & B is a public rental housing development with nine tower blocks. Here, the project team devised "BIMplementation" Room Concept, in which all stakeholders gathered to use BIM as a platform for collaboration, streamlining decision processes and workflows.

A BIMplementation Room was also adopted for a project at Sheung Shui 36 West, which was completed in January this year. Two notable benefits of using BIM were that there were less than 10 confirmed verbal instructions - far less than the average of 610 in other Housing Authority projects, and the project was completed five days ahead of the contract completion date. However, the benefits of BIM culture were reflected in people's behaviour, which led to higher productivity with a happier and more harmonious working environment and relations between disciplines, contractors and sub-contractors.

Though the Housing Authority has come a long way with BIM, it still has to keep pushing so it will gain a momentum of its own, and keep rolling by itself. This will require infiltration to all stakeholders, along with sharing experiences with BIM users within Hong Kong and internationally.

The Housing Authority's BIM team members are ambitious, wanting to explore every BIM application. There are hopes that the wider BIM community in Hong Kong can collaborate, including to establish standards that can ensure BIM develops swiftly here, delivering long-term benefits for the construction industry.





Image courtesy of Hong Kong Housing Authority



Image courtesy of Hong Kong Housing Authority



Image courtesy of Hong Kong Housing Authority



Image courtesy of 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 in April 1973 under the Housing Ordinance.

The HA develops and implements a public housing programme which seeks to achieve the Government's policy objective of meeting the housing needs of people who cannot afford private rental housing. Approximately 30% of the Hong Kong population is now living in public rental housing units.

COMPANY Moh & Associates, Inc. PROJECT THSR Changhua Station Project LOCATION Changhua County, Taiwan TYPE Off Ground Train Station SCHEDULED TIME OF COMPLETION December, 2015

> "With BIM visualisation technology, all members of the project team can efficiently coordinate with one another to carry out the project."

— Kang Szu-Min Manager BIM Management and Engineering Integration Center

BIM PARTNERS INVOLVED

Project Owner: Taiwan High Speed Rail Corporation Architect: Kris Yao Artech

Life-cycle Management for High Speed Rail Station



Construction of Taiwan High Speed Rail (THSR) Changhua Station in west Taiwan, began its on 9 January 2013. KrisYao-Artech, led by renowned architect Yao Ren-Shi, is responsible for the station design. Consultancy services are provided by MAA, which utilises BIM solutions as an effective tool for design, construction, and operational management.

As the station is in a county known for beautiful flowers, its design features petal-shaped pillars and flower-shaped sunroofs that allow natural light into the station. With plants arranged around the interior, the station presents a greener and more elegant space for travellers. A garden forms a symphony of colours to symbolise the character of Changhua County.

BIM: the key to improved quality

One challenge in planning THSR Changhua Station was the existing rail heights, restricting space. MAA implemented BIM technology and

Image courtesy of Moh & Associates, Inc

utilised Autodesk Revit, extracting the original 2D designs to create BIM models for detailed design, MEP and structural engineering. Cloudcomputing interfaces were also employed, integrating professional designs at an early stage.

In addition, engineers in each discipline could detect design discrepancies and clashes from the models, and then systematically integrate them into clash reports, which were submitted to the design unit and THSR Corporation for further review and adjustments. In the process, THSR Corporation could finalise approvals that would ensure accurate construction and quality design.

"Whether or not the design is proper decides the cost, time and accuracy of the construction," commented Kang Szu-Min, Manager of BIM Management and Construction Integration Center at MAA. "The BIM team took five months to assist the THSR Corporation with assessing



the design results of the design unit. In the first round of reflection and adjustments, we discovered 98 major issues, which the design unit rectified. After many revisions, design clashes were greatly reduced, and in the fourth round of reflection and adjustments there were only 13 secondary issues to rectify. We not only improved the design quality, but also ensured that we could build the intended structure on time with less information gaps in following construction procedures."

3D visualisation: assisting communication across disciplines

Another advantage of the BIM model is that it enabled effective coordination among disciplines to share annotations, report errors and discrepancies on drawings, and generate clash reports. With the 3D BIM model, detailed designs and construction reviews were beneficial for the client, the designers and the contractors, who then gained a better picture of the construction of THSR Changhua Station.

A "frozen" BIM model in the design phase provided a visualised platform to inspect construction drawings provided by the contractors. For example, the THSR Corporation asked for cross section drawings of the flower-shaped pillars, and the drawings were then compared, with the curvatures of the pillars and the positions of ring beams indicated by the contractors' design, to check if there were mismatches. These comparisons were directly carried out using BIM, significantly increasing project efficiency. "The visualised BIM technology served as a coordination platform," commented Kang. "Using this, the project team members received all data, and efficiently coordinated with one another to carry out the project."

With Autodesk Navisworks, the project team reassessed the construction time and procedures, enabling them to more accurately control the outcomes and progress. The team Image courtesy of Moh & Associates, Inc.

worked on the artistic design of the petalshaped pillars, with a 4D procedure simulation to clearly present the clear installation procedure for staff members. This technology not only enhanced communication, but also accuracy.

MAA could readily utilise the original 3D BIM model to construct a 3D animation required by the THSR Corporation, which learned more



Image courtesy of Moh & Associates, Inc



Image courtesy of Moh & Associates, Inc.

about how the station would look like as well as circulation planning.

Integration of drawings: enhancing operation management

THSR Changhua Station is close to completion. To meet a request from the THSR, MAA imported all designs and construction related models to build a BIM management database that classifies assets such as equipment brands, models and equipment components. The database will be implemented for operation management after the station opens.

"At MAA, we've already developed an equipment management system that prints out the list of equipment that must be managed." Kang commented, "In addition, once all drawings are linked to corresponding items of equipment, integration of drawings and management is achieved."

BIM: unlimited possibilities

BIM is now a necessity for major public infrastructure projects, as well as an effective tool for renowned construction firms in Taiwan and abroad. It has been seven years since MAA first deployed BIM. After countless projects and reflections on them, MAA witnessed the power of BIM. Hence, four years ago, MAA established the BIM Management and Engineering Integration Center, which extends the advantages of BIM to all projects.

"When we look at BIM, we see a bright future," said Kang. "Take THSR Changhua Station for example: senior managers at THSR have indicated that BIM technology not only reduced costs by 20% and design errors by 80%, but also increased the construction progress by 4%. In future, there will be more functions that can be applied on the BIM platform, such as smart cities and the Internet of Things. As BIM application grows, the future of construction will only get brighter."







Image courtesy of Moh & Associates, Inc.

About Moh & Associates, Inc.

Founded in 1975, MAA is a leading engineering and consulting service provider in East and Southeast Asia, focusing on infrastructure, environment, buildings, land resources, and information technology.

To meet the global needs of both public and private clients, MAA has a full range of engineering capabilities providing integrated solutions ranging from conceptual planning, general consultancy and engineering design to project management.

Today, MAA has over 1000 employees with offices in Beijing, Hong Kong, Macau, Shanghai, Taipei, Bangkok, Singapore and Yangon, creating a close professional network in East and Southeast Asia.

Water Supplies Department, HKSAR Government

PROJECT

Study on the Trial Use of Building Information Modelling (BIM) for Asset Management

LOCATION Tai Po and Telegraph Bay Salt Water Pumping Stations

TYPE

Waterworks

SCHEDULED TIME OF COMPLETION 2015

"We've developed a 3D viewer for operation and maintenance staff – like a computer game. I think there could be many potential applications – it's up to the client to imagine how BIM can be used."

- Ir Tam Siu Ming Engineer/Asset Management(1) Water Supplies Department

BIM PARTNERS INVOLVED

Summit Technology (HK) Ltd. Sino-iTech Holdings Co Ltd.

BIM Proves a Boon for Asset Management



The Water Supplies Department (WSD) places strong emphasis on asset management to maintain a secure and reliable water supply for Hong Kong, such as simple as ensuring pumps up and running. This in turn requires a wealth of data on these assets. With the current Asset Management System (AMS) almost a decade old - and far from ideal since it's a combination of several legacy systems that only support textual data and simple sketch drawings, with time and effort required to find conventional 2D drawings - the WSD decided to explore how the emerging technology can help improve or upgrade the current AMS to a new Asset Management Information System (AMIS), and to link this to BIM so that the latter's benefits in asset management could also be realised.

"We want to stay abreast of the latest technology, and are always looking at ways to improve," says Ir Chau Sai Wai, Chief Engineer/ Development(1), Water Supplies Department. "We know BIM is becoming popular, especially for design and construction. To use it in asset management, you need an integrated system downstream of BIM."

Image courtesy of Water Supplies Department, HKSAR Government

Modelling existing buildings

Assisted by consultants, the WSD team decided to adopt Construction Operations Building Information Exchange (COBie) as an interface solution to transfer asset information from BIM model to the AMIS. "We believe COBie is a simple and reliable information exchange tool", says Ir Chau. "It is in a format like a spreadsheet, containing all aspects of asset information essential to the operator and maintenance agents, and can be read by most facility and asset management softwares. We could also customise an asset hierarchy in COBie specific to our assets to effect the same asset hierarchy in the AMIS through the data transfer."

The team opted to implement the BIM plus COBie combination for two salt water pumping stations, at Tai Po and Cyberport. Information from as-built drawings was combined with results of laser-scanning to create the BIM models. Then, the team members extracted information from the existing asset management systems. "This was a painstaking process, as we had to rebuild relationships between assets and map objects in assets," notes Ir Chau. "We



held many working meetings to resolve the problems."

Ir Tam, Engineer/Asset Management(1), Water Supplies Department, adds that while the models were built relatively quickly from 2D drawings, the team soon found that there were issues in trying to map asset identities from the existing systems to the BIM model. This is because a design may only need relatively basic information on an asset, such as the shape and dimensions of a pump, while maintenance managers require extra details from maintenance point of view and would like treating the pump casing and pump motor separately, with full information on each – such as manufacturer, installation date, risk level, and time of last service. "There are around 130 key asset elements for each pumping station, and each asset may have 30-35 attributes," says Ir Tam.

Custom BIM standards

To tackle this issue, the team has tailored made specific BIM standards for WSD assets, producing a handbook that can be used for future projects, and can be expanded to

Image courtesy of Water Supplies Department, HKSAR Government

cover other types of assets. This has been challenging work, yet there are encouraging results from the pilot project.

"We've developed a 3D viewer for the operation and maintenance staff – like a computer game," says Ir Tam. "It's as if you were walking around a pumping station. You might check a fire extinguisher, and can call up all the details, like fire certificates so you know when they'll expire." Also, engineers can use the model to check pumping stations remotely, saving them the need to go to sites frequently. "They're happy as there's another



way of doing things, though it may take some time to adapt to change," adds Ir Tam. **An electronic owner's manual**

The BIM model has effectively become an electronic owner's manual, passing relevant data into the asset management process. Using it can lead to considerable time savings, compared to the existing systems. While input of all asset data of a water treatment works could take up to two years with the existing AMS during asset hand over, data conversion using the BIM plus COBie might take only a few months. Information retrieval is also much faster too, without the need to perhaps search through reams of printed material.

Furthermore, the project team is keen to explore whether the post processed BIM model may bring about more added values to our maintenance and operational staff, such as connection to CCTV footage or SCADA system. "I think there could be many potential applications – it's up to the client to imagine how BIM can be used," says Ir Tam.

Though the WSD team is confident that deploying BIM can provide a uniform and common platform for information exchange, along with less chance of data loss and more data consistency, they may apply it to only selected existing facilities, due to constraints on resources. However, for new projects they envisage adopting BIM from design stages, through to as-built models that will benefit long-term maintenance of assets.



Image courtesy of Water Supplies Department, HKSAR Government



Image courtesy of Water Supplies Department, HKSAR Government





Image courtesy of Water Supplies Department, HKSAR Government

About Water Supplies Department

The Hong Kong SAR Government's Water Supplies Department oversees and manages all aspects of sourcing and maintaining supplies of fresh and salt water throughout the Territory. Every day we pump 2.56 million cubic metres of fresh water to meet the needs of 7.19 million people. We get our fresh water supplies primarily from Hong Kong's expansive hillside catchments along with considerable reserves piped in from Dongjiang in southern China, which undergoes strict water testing and treatment to meet global safety standards. Afterwards fresh water is stored in a broad array of service reservoirs for distribution to homes and commercial developments. The Department also utilises seawater which is treated and then piped to toilet flushing systems. Seawater flushing is generally found in a majority of residential, commercial and industrial buildings throughout Hong Kong; the utilisation of this type of water resource helps lower our overall need for fresh water. The Department is also responsible for initiating and monitoring the development of new water sources based on methods like desalination, water recycling and rainwater harvesting.

WSD is an asset intensive organisation. To maintain a reliable water supply to the Hong Kong people, WSD depends very much on the proper operation and maintenance of the assets, including for example water treatment works, service reservoirs, pumping stations as well as underground watermains. In this regard, WSD has been deploying extensive resources in upkeeping the condition and raising the efficiency of the assets during the past decades.

We dedicate ourselves every day to meeting the expectations of our customers. Water is an essential element that underpins the vitality and prosperity of Hong Kong. For this reason, we will continue to closely work in collaboration with all stakeholders to optimise supplies so that Hong Kong's water remains secure and of high quality now and in the future.

Honorable Mention



ORGANIZATION **Arup & IDA** PROJECT **New Terminal 2 for Mactan Cebu International Airport**



ORGANIZATION Century Property Investment Ltd. PROJECT Tseuk Luk Street proposed Commercial Redevelopment



ORGANIZATION Henderson Development Agency Ltd. PROJECT BIM... from Virtuality to Augmented Reality



ORGANIZATION Kerry Properties Ltd. PROJECT Proposed Residential Development in So Kwun Wat (The Bloomsway)



ORGANIZATION NTT Com Asia Ltd.

PROJECT NTT Communications Hong Kong Financial Data Center Tower 2 (FDC2)



ORGANIZATION Sun Hung Kai Real Estate Ltd. PROJECT Proposed Comprehensive Development

Arup & IDA

PROJECT New Terminal 2 for Mactan Cebu International Airport

LOCATION Cebu, Philippines

TYPE Airport SCHEDULED TIME OF COMPLETION 2017

BIM Helps Create an Airport for Tomorrow



BIM PARTNERS INVOLVED

GMR Megawide Cebu Airport Corporation (GMCAC) Megawide GMR Construction JV (MGCJV)

About Arup

Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. We offer a broad range of professional services that combine to make a real difference to our clients and the communities in which we work.

We are truly global. From 92 offices in 40 countries our 12,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion.

Founded in 1946 with an enduring set of values, our unique trust ownership fosters a distinctive culture and an intellectual independence that encourages collaborative working. This is reflected in everything we do, allowing us to develop meaningful ideas, help shape agendas and deliver results that frequently surpass the expectations of our clients.

The people at Arup are driven to find a better way and to deliver better solutions for our clients. We shape a better world.

About IDA

Integrated Design Associates Ltd (IDA) is an award winning architectural practice established in 1999. We have completed several international projects like Hyderabad International Airport, Jinan International Airport, Parkview Green Beijing, Discovery College for ESF etc.

We aim to provide a high calibre design and planning consultancy services for our clients internationally.

Our philosophy is always that our projects irrespective of complexity, derives its architectural excellence from full multidisciplinary integration. We aim to add value for all our clients' projects.

The Project

Arup and Integrated Design Associates (IDA) work together on the design for major enhancements to Mactan Cebu International Airport in the Philippines - including a new passenger terminal and expansion of the existing terminal.

The Challenges

The project entailed significant challenges. Building height limitations must be identified, including by determining line of sight from the control tower to taxiways. Design options must be presented to the client, in a readily understood format. There were tight spatial constraints, with potential for clashes among entities from different disciplines. Analysis of solar access was required. The team also aimed to achieve optimised structural design through parametric modelling, design automation and model conversion, and to support facilities management.

The Solution

Line of sight from the Control Tower was assessed through creating BIM/3D massing models including the roof arches and shading structure, creating a plane on the taxiway, and viewing it in the virtual airport. Visualisations were used to convey the advantages and disadvantages of different options to the client. BIM allowed the team to identify a variety of spatial constraints and clashes among entities from different disciplines. Information in the BIM model was used in performing solar studies, at early design stages and during design development. BIM models created by the design team can be used for asset management.

The Benefits

BIM delivered an array of benefits for the project. There were several instances where it provided the designers insight regarding ways the different geometries and disciplines affect each other, helping swift resolution of issues such as with required clearances, complicated interfaces including the facade mullions to the main roof geometry, and avoiding hard clash between escalators and structural beams. The solar studies supported a value engineering exercise to optimise locations of skylights.

Better with BIM

3D models are especially useful for airport projects where the circulation of people is among key drivers in space planning. In this project, they allowed discussions of options, notably regarding the passenger movements from the departures and arrivals level to the fixed link bridges. BIM allowed for quick, efficient testing of the inter-relationships between competing airport requirements, such as for apron airfield topography, terminal floor heights, and road networks. The project has one source of information employing a true BIM ethos, with drawings produced directly from Revit.



Image courtesy of IDA



Image courtesy of Arup



Image courtesy of Arup



TYPF

Century Property Investment Ltd.

Tseuk Luk Street proposed Commercial Redevelopment

LOCATION LOT No, 5103, 33, Tseuk Luk Street, San Po Kong, Kowloon, Hong Kong

Proposed Commercial Redevelopment

SCHEDULED TIME OF COMPLETION Q3 2017

BIM PARTNERS INVOLVED

Project Architect: Sun Hung Kai Architects and Engineers Ltd.

Design Architect: Nikken Sekkei LTD Mechanical & Electrical Engineering Consultant:

J Roger Preston Limited Structural Engineering Consultant: Ove Arup & Partners HK Ltd.

Main Contractor: Yee Fai Construction Co. Ltd. Environmental Consultant: Allied Environmental Consultants Limited

Unique, Optimised Design for Compact Space

Century Property Investment Ltd.

The Project

Century Property Investment is developing a 24-storey office tower featuring 18 levels of office space and a retail podium in Kowloon, Hong Kong. The form of the building is quadrilateral, with huge V columns from G/F to 4/F creating a unique and iconic look.

The Challenges

This project is located in San Po Kong, one of the largest industrial hubs in Hong Kong; the site is located in a compact area with neighbouring buildings enclosing all three sides of our development. With the site constraints, many challenges were encountered during project coordination.

Since the building is enclosed on all three sides, our development has a limited entrance space, some challenges were encountered including the difficulty to position a manhole for underground utilities connection, the position of smoke vents for smoke emissions from the basement as well as the louvre location for cooking fume emissions from the lower three floors.

The BIM modelling was essential for project coordination meetings since some challenges were difficult to resolve using 2D methods. For example, coordination between different trades of building services contractors. Due to our aesthetic design of having the V columns, the architectural feature made it more difficult for building services coordination. Also, the BIM modelling was used to design the enlargement of the basement and verifying whether the car ramps' headroom were adequate. The BIM modelling helped to ensure effective communication among project team members of which some were overseas consultants.

The Solution

Through using BIM to model the comprehensive building elements, the project team found the best way to combine the building services routes and facilities them into the compact space. 3D modelling accelerated the design and drawing production process for the complicated structure components, such as the V columns.

Furthermore, structure alignment solutions were generated from the BIM model for different basement enlargement proposals, and layouts were optimised during collaboration meetings with consultants and sub-contractors. The BIM model was used intensively for clash analyses, and the car ramps were checked in the virtual model, with virtual vehicles that featured in the simulation. The images and animations that were generated from the BIM model was reviewed and shared through cloud services.

The Benefits

BIM has provided a collaborative and holistic platform enabling design reviews between project team members. For example, real-time walkthroughs during coordination meetings enabled the operations and maintenance team to check building services in advance. A clash free solution was generated, and all available spaces were fully utilized. After the building service elements under car ramps were optimised and clashes were eliminated in the simulation, the headroom above the car ramps was also resolved.

Better with BIM

BIM was intensively used in the project, serving as a test buds for design to ensure limited space was being maximized, also to combine data sets, and generate 2D drawings. The BIM model boosted confidence in the design as it ensured everyone was fully informed with the multiple aspects of the design during coordination meetings.



Image courtesy of Century Property Investment Ltd.



Image courtesy of Century Property Investment Ltd.



Image courtesy of Century Property Investment Ltd.



Image courtesy of Century Property Investment Ltd.

Henderson Development Agency Limited

PROJECT BIM... from Virtuality to Augmented Reality LOCATION

80 Queen's Road Central, Hong Kong

Commercial Development SCHEDULED TIME OF COMPLETION 2017

BIM PARTNERS INVOLVED

Laprairie Ltd. CL3 Architects Ltd. Ie, Siu & Chung Architects Ltd. P&T (M&E) Ltd. Stephen Cheng Consulting Engineers Ltd. WT Partnership (HK) Ltd. isBIM Ltd. Project Manager: Henderson Real Estate Agency Limited Sustainability Consultant: Arup

Creating a Jewel-like Art Showcase



HENDERSON DEVELOPMENT AGENCY LIMITED

The Project

Henderson Development Agency Limited developed an urban redevelopment project at 80 Queen's Road Central in Hong Kong's Central Business District - which will involve commercial uses comprising retail, restaurants, and art galleries. The key aim is to create a new and convenient gathering point for art galleries and fine-dining facilities.

The Challenges

The site is at a premier location, with a high land value. Hence, major challenges stemmed from a need to ensure effective design process management, budget and time planning and control. The project team also aimed for environmental friendliness, by optimising indoor environmental quality, and minimising material use, operational energy and water consumptions. Another challenge was to ensure the building would suit art galleries, with connectivity to nearby cultural heritage and art venues.

The Solution

BIM was deployed in multiple ways. Visualisations were created for design options, and facilitated decision making together with spatial planning. BIM use was extended to 4D by adding the time dimension by simulating construction sequences and monitoring progress.

A 4D-BIM model was issued to the main contract tenderers at the tender stage, and this virtual construction tool was found to be helpful in achieving a highly cost-effective construction budget.

Building services routing was optimised. A simplified version of the BIM model and its embedded information would be embedded in the facility management system for future tenant and building users.

The Benefits

In addition to boosting efficiency and reducing costs, such as through minimising clashes and easing construction, the BIM deployment delivered benefits specific to this project. One aim of the design team was to make the building appear like a gleaming white jewel box. Glass fritted patterns were built into the BIM model, so the visual effects could be assessed using 3D visualisations. These included views from within the building looking out, to check the windows would seem transparent; and from outside at street level, with the designers verifying the building would indeed look dynamic and vibrant. BIM is also playing major roles in optimising the art show rooms, such as through spatial planning. The project team has created a BIM-enabled art exhibition virtual tour, facilitating the Augmented Reality opportunity.

Better with BIM

The BIM model is being used in ways that should attract potential customers to art exhibitions, such as through developing virtual tours featuring artworks with Augmented Reality and QR codes, and visualisations for leaflets and brochures. This is a novel integration of the engineering-oriented BIM platform with the art and culture business. To foster use of BIM, Henderson offered BIM training to its own project staff, consultant team members, main contractor and sub-contractors, and ultimately the facility management staff.



Image courtesy of Henderson Development Agency Limited



Image courtesy of Henderson Development Agency Limited



Image courtesy of Henderson Development Agency Limited



Image courtesy of Henderson Development Agency Limited

Kerry Properties Limited

Proposed Residential Development in So Kwun Wat (The Bloomsway)

LOCATION TMTL No. 423 – Area 48, So Kwun Wat, Tuen Mun, New Territories

TYPE Residential Development SCHEDULED TIME OF COMPLETION

End of 2017

BIM PARTNERS INVOLVED

Ronald Lu & Partners (HK) Ltd. P&T (M&E) Ltd. Meinhardt (C&S) Ltd. WSP (HK) Ltd. China Overseas Building Construction Ltd.

About Kerry Properties Limited

Kerry Properties Limited ("KPL") is a worldclass property company with significant investments in Asia. The Company is known for its property development activities in the People's Republic of China and Hong Kong. In both markets, KPL focuses on investing in premium quality property developments in prime locations. The Company has developed a successful business model for doing this over many years and has considerable experience as a developer and manager of quality properties. We act on principles of fairness and integrity, and we value the many relationships we have developed over our long history with staff, suppliers, partners, government agencies, and other key stakeholders.

Back to the Future with BIM



The Project

Kerry Properties Limited designed a Residential Development in So Kwun Wat, Hong Kong, (The Bloomsway) with a site area of 67,147 square metres.

The Challenges

The project's overarching challenge lay in finding how to create a workflow in which the many parties involved in the property's design and construction could collaborate as quickly and effectively as possible. The project team needed to find a way to quickly visualise the updated design ideas for all stakeholders, and reflect any updates in the BIM model. During the construction stage, the team wanted to ensure the coordinated layout would be accurately reflected in the contractor's working drawings. Optimum design also called for a strong understanding of the environmental factors. Other challenges arose when the Project Team includes all stakeholders in the beginning, aiming to let the business units and marketing teams understand the design at an early stage.

The Solution

The project team's main solution to the challenges was to use a workflow "in the reverse", transferring data from Revit to instant rendering software, enabling prompt design reviews. During the construction stage, collaboration with sub-contractors was strengthened by establishing an on-site BIM team. A new workflow was developed, for reviewing the model with sub-contractors on-site, and generating data-rich combined services drawings. The BIM model enabled simulations, with environmental factors such as the natural landscape, sun positioning and shading by nearby hills taken into account. Using BIM 360, the latest BIM models were uploaded to the cloud; and during the construction stage, the latest BIM models were enabled for access on mobile devices.

The Benefits

The BIM workflow enabled the team to move the project forward much more quickly than with traditional 2D design. There was an "immersive design environment" during coordination meetings, and after designs were reviewed and commented on, changes were synced back into the BIM model. The process was also faster than for the traditional BIM workflows, thanks to the on-line communication platform. Enabling access to BIM models on mobile devices removed the need to take extensive, time-consuming drawings to the site. 3D visualisations allowed non-technical personnel to fully understand the design and systems. A virtual tour was hugely beneficial to the marketing team, allowing them to prepare their sales and marketing material from very early on.

Better with BIM

The unique workflow "in the reverse" proved highly effective from the design to construction stages. The project team made strong use of on-line communications, leveraging developments with both BIM and cloud technologies.



Image courtesy of Kerry Properties Limited



Image courtesy of Kerry Properties Limited



Image courtesy of Kerry Properties Limited



Image courtesy of Kerry Properties Limited

NTT Com Asia Ltd.

PROJECT NTT Communications Hong Kong Financial Data Center Tower 2 (FDC2)

LOCATION Tseung Kwun O Industrial Estate, Hong Kong TYPE

Data Center Development SCHEDULED TIME OF COMPLETION September 2015

BIM PARTNERS INVOLVED

Leigh & Orange Ltd. Ove Arup & Partners (HK) Ltd.

About NTT Com Asia Ltd.

NTT Communications' wholly owned subsidiary – NTT Com Asia serves as the regional headquarter of East Asia, covering Hong Kong, Macao, Taiwan and Korea. Backed by the company's worldwide infrastructure, including leading global tier-1 IP network, Arcstar Universal One™ VPN network reaching 196 countries/ regions, and 140 secure data centers worldwide, and in collaboration with its affiliate HKNet, the company provides enterprise-class network, data center, cloud , hosting, e-Commerce solutions, and managed services in the region.

Ensuring Project Success for Data Center Development



The Project

NTT Communications Hong Kong Financial Data Center was launched in 2013 with one data center tower (FDC1) and one Command and Control Tower, featuring sophisticated infrastructure design and the highest level of redundancy, reliability and security.

Built on the robust foundation of FDC1, the campus second data center tower (FDC2), to be launched in December 2015, is designed with the latest technologies to create new values and enhance clients' business performance. To ensure project success, BIM was deployed at all stages from design to construction and development, which has effectively enhanced the overall communications, streamlined workflow and improved facility management of FDC2.

The Challenges

The project required communications between multiple consultants, owners and operators, who are involved in making different decisions about the concept and design. When construction began for FDC1 back in 2013, it was found that substantial amount of time and costs were taken to accommodate the design changes required, with an initial lack of tools to track the quality of work. Other challenges included the need to transfer design and performance data to the customised Data Center Facility Management System.

The Solution

In response to the challenges, an effective BIM model was developed for FDC2 project. In the BIM workflow, architects, structural engineers and MEP engineers built the 3D model, with a BIM Manager compiling the various files into a signal aggregate model, generating clash detection reports and distributing them to the project team. The designers reviewed clash reports, and addressed the issues that happened.

BIM 360 Glue was leveraged to enable closer collaboration and coordination among the team members. BIM 360 Field thus became the central hub to house all the important information for site activities, including document library, issue tracking, QA/QC inspection, commissioning checklists, and equipment management.

The Benefits

Once the BIM model was properly deployed, it helped facilitate communications among various stakeholders, enabling access to critical information needed for important decisions. Designs were effectively improved, with reduced time needed for meetings, and streamlined process for generating a coordinated model with minimal clashes, and ultimately increased the overall quality of the project. The model also helped communicate the design intent to contractors, and derive quantities. Data was seamlessly exported to the facility management system.

Better with BIM

BIM solved many problems and issues that NTT Com Asia faced in FDC1 data center development project. The key to project success was the commitment of NTT Com Asia as the project owner, including through collaborating with Autodesk in BIM Management Office, leading communication and collaboration between team members.



Image courtesy of NTT Com Asia Ltd.



Image courtesy of NTT Com Asia Ltd.







Image courtesy of NTT Com Asia Ltd.



Image courtesy of NTT Com Asia Ltd.

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Sun Hung Kai Real Estate Ltd. PROJECT Proposed Comprehensive Development

LOCATION

Inland Lot No.9027, Java Road and Tin Chiu Street, North Point, HK

TYPE Residential

SCHEDULED TIME OF COMPLETION

Phase 1A – PTI (Target Jan, 2016)
Phase 1B Residential (Target Aug, 2017)

BIM PARTNERS INVOLVED

Ronald Lu & Partners (HK) Ltd. J. Roger Preston Ltd. Siu Yin Wai & Associates Ltd. Forida Ltd. Chun Fai Construction Co Ltd. Lik Kai Engineering Co Ltd.

About Sun Hung Kai Real Estate Ltd.

Sun Hung Kai Properties Limited ("SHKP") was publicly listed in 1972 and is now one of the largest property companies in Hong Kong. It specializes in developing premiumquality residential projects, offices and shopping centres. The Group employs more than 37,000 people.

Sun Hung Kai Properties puts its longstanding belief in 'Building Homes with Heart' into practice, on the one hand by developing residences of the finest quality and offering first-class service to its customers, and also by contributing to the good of the community to make Hong Kong a better home for everyone.

The Group understands that buying a home is one of the biggest decisions people make in their lives, and so it spares no effort to deliver the very best. Vertical integration from planning, material sourcing and construction through to project monitoring and property management ensures high standards in every aspect of a development.

The Group's seasoned management team follows prudent strategies for long-term business development and the company's philosophy includes a strong sense of corporate social responsibility, both to its customers and to the public. The Group works for the benefit of the community with wide-ranging initiatives to protect the environment, care for the less fortunate and foster educational development.

Sun Hung Kai Properties – We're 'Building Homes with Heart'.

Strong Team Spirit with One BIM Model



The Project

Sun Hung Kai Properties is building a Comprehensive Development in North Point, Hong Kong, which includes residential towers, retail, clubhouses plus coach parking.

The Challenges

The project has a large area, with facilities including basement car park, public transport interchange and swimming pool - making it difficult to coordinate a verified design. Adding to the challenges are services below the interchange, smoke vents and transformer rooms, making it hard to express and clarify the design intent.

Plus, if following normal practices, separate BIM consultants would handle the design and tender stage, and the construction stage - which would reduce efficiency, partly as the BIM model might be entirely rebuilt.

The Solution

One BIM consultant was employed for both the design and construction stages.

A BIM model was created, and continually updated to represent the latest design. In addition to aiding multidiscipline coordination, the model was used by the contractor to facilitate the construction process.

Early in the site processes, a simulation was made to visualise the master construction programme – elevating BIM to serving as a tool for project planning by the builder.

The Benefits

2D CAD drawings were exported directly from 3D model, so each department to review the design, and for further coordination. Formal CSD was also generated from the model, with views to clearly describe the routing of all services. These drawings and views were created more swiftly than possible with traditional methods.

The BIM model was especially useful for coordination of services in tight spaces, such as the ground floor drainage system and the electrical & mechanical systems for the basement car park. The designers confirmed they could meet strict car park headroom requirements, which varied between areas.

The BIM model was used to work out several design options for over 30 smoke vents across the B1 level, which had to be coordinated with other services, and vented to several locations. Likewise, BIM was used to verify the design of the transformer room, ensuring it will be functional whilst having minimal impact on retail space - and suitable for delivery and installation of equipment.

Better with BIM

A strong team spirit was created during the design stage, and continued to the construction stage. This benefits and enhances the communication between design consultants and sub-contractors, while ensuring the BIM model is more sustainable. Indeed, the BIM model is almost "alive", always containing the latest information, and enabling a smooth project workflow.



Image courtesy of Sun Hung Kai Real Estate Ltd.



Image courtesy of Sun Hung Kai Real Estate Ltd.



Image courtesy of Sun Hung Kai Real Estate Ltd.



Image courtesy of Sun Hung Kai Real Estate Ltd.



Image courtesy of Sun Hung Kai Real Estate Ltd.

Advisors' Comments - Introduction

This year, we are extremely honoured to receive the invaluable support from the local supporting organisations and overseas BIM advisors. Locally, an advisory panel was formed by the representatives of local supporting organisations to discuss and review the selected projects, and their comments were consolidated and recorded. In addition to the comments of the selected projects, the overseas advisors also shared with us about the BIM development in other parts of the world.

Advisory Panel

- Autodesk Industry Advisory Board
- buildingSMART Hong Kong
- Chartered Institute of Architectural Technologists, Hong Kong Centre
- Hong Kong Institute of Project Management
- The Chartered Institute of Building, Hong Kong
- The Chartered Institution of Civil Engineering Surveyors, Hong Kong Region
- The Hong Kong Institute of Architects
- The Hong Kong Institute of Building Information Modelling
- The Hong Kong Institute of Facility Management













Advisory Panel - Award Winners

Architectural Services Department, HKSAR Government

The project for a Grade 2 historical building, built in 1915, is a good demonstration of applying BIM to integrate heritage information and current building information for multiple building uses, and leveraging ICT technologies and innovations to showcase the usages and benefits of heritage information modelling that can enhance interactions and communications among the people involved with the building. The capabilities of BIM can be applied to the areas of heritage conservation, building maintenance and asset management, and were expanded to on-site applications by incorporating BIM into mobile and various location based devices.

The department's other award-winning project demonstrated the use of BIM for landscape design to resolves issues that conventional approaches to design communications employing 2D drawings could not tackle. This is an innovative approach for landscape architects in Hong Kong, making use of BIM as a platform to hold topographical data, utility mapping, tree survey and then create invaluable new design options.

Arup & MTR Corporation

This project clearly illustrates the benefits of using BIM in complex MTR station project. By using BIM, complexity of the Hong Kong Island Section of the Shatin-to-Central Link (SCL) and work sites in Wanchai can be managed by improving accuracy and efficiency. The usage of BIM could help to handle the challenges of a tight programme for design and construction in a heavily built-up area, multidisciplinary integration, minimised construction waste, complex interfaces with the Central-Wanchai Bypass and stakeholder engagement.

BTA & RLP Company Limited

This case demonstrated good use of BIM for value engineering and study of design options for the design and construction of a theatre building with a complex geometry. BIM supported a collaborative process among a large team of specialist consultants around the world, contributing to better performance of the overall project. By applying BIM, a common platform supports real-time collaboration, maximising resources for production that cannot be divided nor shared by conventional 2D manner due to specific spatial information and relationship of the architecture.

CECI Engineering Consultants, Inc., Taiwan

Both of CECI's award-winning projects demonstrate good use of BIM for integrating applications in building and civil infrastructure of rapid transit station projects. Whether a project is in Jakarta or Taipei, there are various challenges from external factors such as nearby rivers, existing railways, heavy traffic on surfaces and congested underground utilities. With support from BIM technology, value engineering studies and other sustainable design simulation could be carried out. Besides using BIM in design phase, the contractor of the design-build phase of the Sanying Line Metro Rapid Transit Project is requested to take on and further develop the BIM model. After construction, the as-built BIM model will be transferred to the operation company for 6D facility management.

CLP Power Hong Kong Limited

This project demonstrates an innovative use of BIM technology to overcome challenges in planning for effective construction work and safety in construction. The project was well planned with BIM before the commencement of work, due to site-specific challenges such as impact on existing trees and vegetation on a natural steep slope. The design of a new gantry and platform had to support the new overhead line cable to Lai Chi Kok Substation, and clear communications and decisions had to be conducted with both building and non-building professionals. By adopting BIM, building designs and outcomes became more accurate, buildable, predictable, and sustainable. Effective 4D BIM virtual construction simulation enabled all relevant parties to comprehend work details and safety measures. Training for construction workers in the limited site working areas could also be performed, to optimise work efficiency, minimise noise and dust nuisance as well as enhance cost estimates.

Hong Kong Housing Authority

After implementing various projects with BIM for over 8 years, this organisation has developed BIM culture and applied innovations in different stages of work, to influence their business counterparts and promote wider adoption of BIM in Hong Kong's current construction industry and future generations. Transformation of the organisation and people has spread from the Housing Authority to their working partners. Successful collaborative working models brought improved productivity, effective interactions and communications, improved efficiency, reduced abortive works and prompter customer services.



Moh & Associates, Inc.

This is a good demonstration of BIM usage in design, construction, operation and maintenance of a high speed rail station. The project outcomes have improved greatly due to the capability of on-site checking and generation of accurate construction drawings from the BIM model. During construction, drawings of special designs such as petal-like columns and the ring girders from the steel manufacturer were integrated with the sections generated from BIM models, to examine the curvature of each for clash detection - a task that would have been barely possible with 2D drawings. The as-built BIM models have also been modified and corrected for facility management.

Water Supplies Department, HKSAR Government

This is a good demonstration of a new application of BIM usage in Asset Management. BIM allowed users to review all inherited data captured from the design and construction phases. The project clearly illustrates how to access information via a single platform without wasting valuable time searching for information scattered across different systems and locations. Manpower resources can be saved by avoiding duplication of data entry efforts for all the assets handed over during the construction phase.











Advisory Panel - Honorable Mention

Arup & IDA

The New Terminal 2 for Mactan Cebu International Airport project is a good demonstration of applying BIM for competing airport requirements. The benefits of applying BIM include better space planning, more design options for clients' decisions, and project drawings from one source of 3D BIM models for better project coordination.

Century Property Investment Ltd.

The Tseuk Luk Street proposed commercial redevelopment project has demonstrated a good use of BIM to integrate multi-discipline designs into a single BIM platform, and made full use of the confined space. Coordination among multi-discipline consultants around the world is improved by using a collaboration cloud service.

Henderson Development Agency Ltd.

This urban redevelopment project at 80 Queen's Road in Central has demonstrated a good use of BIM to reduce costs and achieve efficiency and new user experiences, such as visualising artworks with Augmented Reality and QR codes in virtual tours.

Kerry Properties Ltd.

The Proposed Residential Development in So Kwun Wat made a good use of BIM for improved communications and approval processes. The project team made good use of on-line communications, leveraging developments with both BIM and cloud technologies for better collaboration and efficiency among project team members.

NTT Com Asia Ltd.

This is a new case of applying BIM in a data centre project in Hong Kong. BIM was used from design to construction stages, and to help the data centre owner with facility management. Collaboration and communications during quality assurance, quality control and commissioning process could be improved.

Sun Hung Kai Real Estate Ltd.

The Proposed Comprehensive Development in North Point is a good showcase of applying BIM for better co-ordination and communications from design to construction phases. The BIM model also enabled a smooth project workflow, with the latest project information for all project partners including design consultants and sub-contractors.

Dr. Calvin Kam

Overview

The 2015 Autodesk BIM Awards honor a remarkable collection of projects with innovative BIM applications supported by well-informed planning and unconventional team collaboration. Applying the SBI • bimSCORE evaluation framework in a preliminary assessment based on limited evidence available from the submissions, we have benchmarked the ten 2015 winners against past award winners and other projects from 16 countries. Within the global context, this year's winners fall between "Typical" and "Advanced" Practice. The winners, seven from Hong Kong and three from Taiwan, are further analyzed with respect to the four SBI • bimSCORE areas of Planning, Adoption, Technology, and Performance.

The following figures illustrate the overall performance of the winning projects, and their maturities in the four areas.



Planning

Planning for BIM implementation requires targeting objectives for success, supporting achievement with the needed tools and technical processes, and developing standards to guide an integrated project team. Public housing projects continue to be leaders in BIM planning, with well-defined roadmaps, BIM standards, modeling guidelines, in-house BIM support and decision-making groups. The Tai Po Pump Station also exhibited their project objectives and standards for BIM execution, and this allowed them to effectively utilize BIM for facility management (FM) work flows. Though these projects may be leading Hong Kong in BIM planning, they remain typical practices on the global scale for BIM management; authoring is still outsourced to third party consultants rather than being performed as part of an integrated project team effort. Relative to the global BIM practice, BIM planning and standardization of these winning projects spread across from 'Typical' to 'Best' practice. While the regional market is rapidly catching up with global leaders, the average score falls under the upper 'Typical' practice range.



Technology

The award winners have made informed selections of BIM analysis and tools that are supported by interoperable information exchanges and information-rich models. The two park projects by Architectural Services Department (ASD) applied BIM for landscaping planning and quantity scheduling, and the Victoria Peak Fire Station project applied advanced drone photogrammetry to develop point cloud models of historic buildings for improved facility management. Projects including the Lai Chi Kok Substation, Anderson Road, and Shatin to Central Link are pioneering BIM visualization and analysis to improve on-site safety and traffic logistics. Several award winners, such as the Tai Po Pump Station, are effectively leveraging BIM from design to construction, integrating it with FM systems to enhance maintenance processes. These award-winning projects demonstrate sophisticated technological maturity in the range of 'Advanced' practice when compared with projects across the globe.



Adoption

To fully utilize advanced BIM uses, the award winners have incorporated BIM and collaborative practices across project phases to support the entire facility lifecycle. The Sanying MRT project in Taiwan and Xiqu Centre project both leveraged BIM in early project phases to explore design options and perform sustainability analysis.

BIM's application during construction for coordination, sequencing, and quantity takeoff has seen a growing adoption among contractors, examples being the Lai Chi Kok Substation, Anderson Road, and Shatin to Central Link projects. With 80% staff trained in BIM, the Hong Kong Housing Authority (HKHA) strives to foster a healthy BIM culture across different stakeholders and project stages, driving BIM adoption in the local market. In order to promote the average adoption area score to the 'Advanced' practice range, BIM requirements from owners should emphasize on the culture of collaboration and integration as demonstrated by HKHA.



Performance

BIM has proven to be instrumental to process transformation, and increased automation has opened the door to advanced quantitative tracking of project performance to inform design and project management decisions. Public housing projects such as the Anderson Road development lead the way in targeting BIM objectives through internal guidelines and BIM Project Execution Plans, with regular assessments on internal BIM adoption and project performance. The Tai Po Pump Station established clear objectives for BIM use, and is developing analytics to evaluate and optimize asset and facility management processes. In Taiwan, the HSR Changhua Station project successfully tracked BIM's effectiveness in resolving coordination issues. It is encouraging to see increased interest in BIM performance tracking in Hong Kong and the larger Asia market as shown in the figure above, where the highest Performance score is in the range of 'Best' practice. Yet there is still a great potential to tap into the values of advanced metrics that support superior project performances for the regional market.





Dr. Calvin Kam

PhD, AIA, PE, LEED AP Founder, Strategic Building Innovation • bimSCORE

Dr. Calvin Kam is the Founder of Strategic Building Innovation • bimSCORE (USA, Hong Kong, and Singapore) — the "GPS Navigator" for any enterprise or project team charting a course for design and construction innovation. Dr. Kam is also the Director of Industry Programs and a Consulting Associate Professor at Stanford University's Center for Integrated Facility Engineering (CIFE), where he specializes in strategic innovation such as Building Information Modeling (BIM) and Virtual Design and Construction (VDC). He is a Co-founder and the Senior Program Expert of the National BIM Program with GSA Public Buildings Service and is an appointed international BIM expert for the Singapore government's Building & Construction Authority; China National BIM Union has appointed Calvin as the only international Honorary Director. Calvin is a Principal Investigator with Disney Research Laboratory; he is on the Board Knowledge Committee and International Chairman of AIA Center for Integrated Practice and AIA-TAP Knowledge Community.



Kwok Hoi Ling, Helen

INSTITUTION

School of Engineering, The Hong Kong University of Science and Technology

PROJECT NAME

Analysis and Evaluation of Green Building Features Using Building Information Modeling

PROJECT LOCATION Clearwater Bay, Kowloon, Hong Kong



Applying BIM to Evaluate the Energy Performance and Daylighting Efficiency of an Actual Building

Project Background

- The HKUST Jockey Club Institute of Advanced Studies (IAS) Building in the HKUST campus is selected for evaluation.
- The glass wall curtains all over the IAS Building and the glass roof are effective and commonly used green building features to maximize the influx of daylight, thus minimizing the electricity consumption of the building.
- The computer simulation analysis of the IAS Building focuses on its energy saving and daylighting efficiency.
- Green building certification systems have been established and recognized by professional organizations throughout the world. The mostly adopted one is LEED from the US. In Hong Kong, BEAM Plus is recognized by HKGBC.

Challenges and Solutions

- To convert an existing building into a BIM model.
- To estimate the annual energy and fuel consumption of the building.
- To maximize the energy saving potential of the building by modifying its orientation, lighting control and types of glass curtain wall.
- To evaluate the BIM model by green building certification systems such as LEED and BEAM Plus.

How BIM Helps

- The BIM model consists of different information of the IAS Building, which is essential for analysis, such as its geometry, the physical properties of the materials, the location of the building and the weather information.
- BIM allows the information of the building to be transferred smoothly into Autodesk Green Building Studio, an energy analysis program, which estimates energy consumption and produces alternative building designs for energy efficiency improvement.
- The BIM model can be exported into different formats such as gbXML, which can then be used in other programs such as EnergyPlus and Radiance for energy and daylighting analysis. The results can be reviewed and checked for certification.





Feng Chung-Wei Ho Ya-Ting Lin Yu-Che Wang Po-Ren Chien Yi-Hsuan Liu Hao-Wei Lin Zih-Han

INSTITUTION

Department of Civil Engineering, National Cheng Kung University of Taiwan

PROJECT NAME Exhibition Hall in Taipei City

PROJECT LOCATION **Taipei, Taiwan**

TYPE An Exhibition Hall



Implementing BIM with Construction Project Management For General Contractors

Project Background

- An exhibition hall has been selected as our project building, and it is built up with complex steels and concrete structure.
- We would like to focus on two specific and ordinary stakeholders: general contractor and manufacturer in our project scope.
- For general contractor, what they concern most should be various materials and different work items along with corresponding subcontractors.
- For manufacturer, on the other hand, they may think of whether the CAD drawing providing sufficient information for their production.

Challenges and Solutions

- It is struggling for implementing BIM in construction project while most stakeholders do not realize their requirements indeed for the complicated features of construction industry. And if the BIM model is built without necessary information, it is still away from practicable.
- We've tried to determine those information needs in a systematic way, exercise various software products to manage BIM model and information, and increase and expand the application of BIM in information sharing and utilizing for general contractors.
- We have developed a standard BIM-based procedure for general contractor and their professional subcontractor, which allows General Contractor to deliver their BIM model and relative data to their subcontractors, also records the feedbacks to update and maintain their BIM model.
- The procedure specifies the processes, stakeholders, and requirements of the information flow in this project.
- We have applied Microsoft Access® to build a relational database connecting Owner's bid, BIM model, and Professional subcontractor information with General Contractor.
- General contractor can use the developed database system to know the relationship between work items and model elements, after that, general contractor can go to their model to output specific drawings and information.

How BIM Helps

- Standardize steel structure engineering procedure.
- Integrate BIM and database to achieve information sharing.
- Integrate work items and model elements to help general contractor manage Professional subcontractor issues.
- Integrate drawings and models to help general contractor manage drawing records effectively.







About AIAB

AIAB (Autodesk Industry Advisory Board) is formed by a group of experts who are willing to share their valuable experience from Building, Civil, Media and Entertainment industry.

Mission

Autodesk Industry Advisory Board (AIAB) is an informal and non-profit making interest group that acts as a bridge between the industry and Autodesk for solid and bi-directional communications. AIAB, as its title suggests, has an advisory role. Its main objectives include, but not limited to:

- · Act as a platform for technology exchange and experience sharing
- · Advance the professional standards on Autodesk products
- Express and share opinions and views on technology development
- Promote the development, usage and awareness of design technology in HK, mainland China and Macau
- Provide cross-border technology exchange/visit:
- Provide latest technology update

Want to know more about AIAB? Please visit: http://www.aiab.org



Simon Ng Chairman of AIAB



The spirit of BIM

Simon Ng, chairman of AIAB is the Associate Director and the leader of WSP | PB Greater China BIM team consisting of over 45 staffs. The team has an unique nature of doing independent BIM consultancy and internal support for BIM enabled engineering design. Being awarded as the 'Young BIMer of the Year 2014' award by the Construction Industry Council (CIC) of Hong Kong, Simon has extensive experience in BIM management such as modelling standard, execution plan, template, family database, skills development, training, etc.

Simon is a Mechanical Engineer and had a wide range of experience in engineering design, project management and application of Information Technology in construction industry. It is amazing to see outstanding BIM projects that make full use of potential of BIM. BIM is about collaboration, information, visualization and analysis, but I am even more inspired by the sprit behind.

Innovation and Breakthrough

BIM is about new mindset. It changes to way we used to work, how we can work more efficiently? How we can do something that is not possible in the past? For example:

- Can we have early engagement of construction team or even facility management team during the design stage so that the constructability and operability can be considered in the design?
- We have an accurate BIM model, can we use this to produce "Virtual sample flat tour" for flat selling, can we use BIM to 3D print a to-scale sample flat model in flat show room?
- Can we use online game technologies to produce a real time virtual walkthrough, comments and collaboration

Information sharing

In traditional construction industry, information are scattered or just in someone's mind. The objective of BIM is to setup a database that information can be organized, generated and extracted for stakeholders, and this database should be live and grows during the building lifecycle. For example:

- Architect and Structural Engineer input the building geometry so the MEP designer can access and extract sections for combined services planning
- Designer input building element so Quantity Surveyors can access and extract material take off
- Construction contractors input installation information, manufacturing information and maintenance information so facility manager can extract such information for building operation.

Things clear

In traditional construction industry, most people may have a mindset that things can be finally resolved on site (i.e. by the site worker). The idea of BIM is to let everyone to preview what will happen at the earlier stage. Things can be simulated, predicted and solved before it is too late. What happens when all things are made clear?



- Designer can no longer have "ambiguous" design
- Contractors can no longer have "claims" due to unclear or conflicts of information.
- Corruption can be reduced if all specifications, procedures are clear and open to everyone.


Prof Marc Aurel Schnabel

Marc Aurel Schnabel is the founder of DARA. He is an Architect and Professor of Architectural Technology at the School of Architecture, Victoria University of Wellington, New Zealand and Visiting Professor at School of Architecture, Sheffield University. As Programme Director Architecture he is leading research and education a. o. in Architectural Design, Building Information Modelling (BIM), Virtual Reality, Digital Heritage, and Digital Manga within the field of digital media in architectural and urban design.



Serdar Aydin

Serdar Aydin is a researcher at DARA and a PhD Candidate at the School of Architecture, Victoria University of Wellington. His research thesis focuses on Kashgar heritage, westernmost city in China. His research is supported by Postgraduate Studentship at the Chinese University of Hong Kong, Victoria Doctoral Scholarship, Design Research Society's Student Bursary, Young CAADRIA Award and ROA Award by Hong Kong Government Education Bureau.



BIM and Digital Heritage

Digital Heritage is a field that is growing fast by providing opportunities for new collaboration types. A variety of sectors are brought together to integrate cutting edge technologies with heritage information. Just to name a few, these sectors range from archaeology, history and museumology to game design, computational architecture and computer graphics. BIM is not an exception.

As Digital Heritage aims at enduring value for future generations, it is crucial to create geometric/nongeometric datasets that are legible to not only these who are involved in the process but also those who are likely to.

Digital Architecture Research Alliance (DARA) deploys BIM methods, platforms and workflows to record heritage information in digital formats (www.daralab.net). In the context of Kashgar, the westernmost city, we use among others Autodesk 123D, Autodesk Memento and Autodesk Recap reality capture and 3D scanning software in order to model narrow roads of this ancient town. The model can be created in two ways; photogrammetric modelling and 3D scanning. The former gives good results for limited budgets with any digital camera, whereas the latter produces very accurate 3D point clouds with 3D laser scanners such as FARO. 3D models from Recap can be easily imported into BIM environments. In Autodesk Revit, we are then able to attach non-geometric information to the model.

Digital Heritage projects at DARA involves collaboration with other research teams and institutions. Based in Montreal, Canada, HYVE3D is an experienced incorporation in Virtual Reality applications (www.hyve3d.com). Their new VR system allows individuals to interact with 3D environments via embodied 3D sketching. We collaborate with HYVE3D to create immersive environments where heritage information and 3D content is generated and communicated by laypersons. This kind of collaborative workflows that include a range of information types and users is a gateway for BIM to test out its capacities that we focus on to develop and improve via innovative technologies.





Dr. Jack C.P. Cheng PhD MPhil BEng MHKIBIM MbSHK MASCE CAP MAEE

Dr. Jack Cheng is currently an Assistant Professor in the Department of Civil and Environmental Engineering at the Hong Kong University of Science and Technology (HKUST). He teaches BIM, Construction IT and Construction Management at HKUST. While studying at Stanford University for his PhD degree, he was involved in multiple research projects in Virtual Design and Construction including BIM. His research areas include BIM, data mining and retrieval, supply chain management, carbon auditing, green buildings, and sustainable construction. His research has been published in various international journals and conferences in different countries. He has also delivered seminars overseas. He is currently the Vice Chairman of Autodesk Industry Advisory Board (AIAB) and committee member of the ASCE Technical Council on Computing and Information Technology (TCCIT). He has received the Construction Industry Council (CIC) Young BIMer of the Year in 2015.



BIM – Beyond Modeling and Buildings

BIM is often known as "Building Information Modeling". However, BIM is more than simply the modeling of our built environment into digital representations for visualization purposes. BIM allows building information to be captured and managed systematically to facilitate the design, construction, delivery and operations of our built environment. We can leverage the information provided in BIM for various architectural and engineering analyses, for temporal clash detections and constructability evaluation, for cost planning and control, and for resources allocation. As BIM models become bigger in size in general, how to efficiently store and dissimilate BIM information and models becomes important. How to integrate BIM with information from various sources and utilize the integrated information for decision making are another important yet challenging tasks in the future.

At the same time, BIM is not only limited to buildings. The BIM concept can also be applied to civil infrastructure facilities like bridges and roads. However, the structure, components and terminologies for buildings are different from those for civil infrastructure facilities. For example, buildings contain windows and doors which do not exist in bridges and roads. Modification and further development





of the BIM technology and approaches are needed when applied to civil infrastructure facilities.

BIM adoption is a journey. While many people in the industry are trying to push the limit of BIM and explore various new applications, BIM has also gradually been incorporated in the curriculums in schools. HKUST, like other institutions in Hong Kong, offers courses in BIM and helps equip our next generation with the BIM knowledge. At HKUST, students not only learn how to create and use BIM, but also are encouraged to explore various possible uses of BIM through class projects and research projects. BIM education is fundamental to BIM adoption. With the preparation and support of the industry and academia, BIM will move to the next level soon.



Ken Mao BSc, BEng, MBA, MCIOB, MHKIE, MHKIBIM, MbSHK

Ken is currently a Technical Manager working for Paul Y. Engineering Group. In his career, he has engaged in planning and coordination work for a range of construction projects such as commercial & residential buildings, roadwork, slope maintenance and foundation works, etc. over 15 years. In recent years, apart from planning and coordination work, he assists the company to establish an in-house BIM team which provides BIM deliverables to construction projects.



BIM for Pre-construction Services



BIM is not merely used for visualization, clash analysis and 4D simulation for construction projects, but also creates information linkages to GIS, facility management, budget & cost management, laser scanning, aerial photography, 3D printing, etc. The question is how these usages effectively benefit a project? Well, it may depend on the project nature and the Client's budget.

We learn that early engagement of BIM in a project is essential to the effectiveness of BIM usage. In design phase, BIM is a good collaboration platform facilitating the Architect and design consultants to coordinate and tune their design elements in detail. In construction phase, it is no doubt that the direct benefit BIM brings to contractors is the early detection of potential problems among building components.

Although not all these problems can be solved at once, contractors may prioritize and review

the critical problems with the Architects and design consultants as early as possible. BIM also benefits construction planning particularly for pre-construction services where the potential contractor may early engage in a project in design phase and have more time to study and give advices on the detailed design in terms of buildability, constructability and preliminary cost. With the aid of BIM, the potential contractor may easily optimize construction method & sequence, site logistic planning and master programme. Besides, BIM also facilitates model-based measurement by which the potential contractor may easily measure quantities for building elements especially with complex geometry such rockwork and decorative glass reinforced plastic (GRP) panels. Measurement process for these complex building elements is no longer time consuming which saves quantity surveyors more time. They may focus on building up competitive price to meet the Client's target cost accordingly.

Although construction is one of the traditional industries in Hong Kong, certain new construction technology and innovation ideas have been implemented into practice for decades. For BIM, we observe successful cases of how technology benefits construction projects from design phase to construction phase. In contractors' perspective, the next challenges may be how the industry turns BIM as part of contract documents and brings BIM to the front line of construction.



Ir Dr. Stewart Wan FBCS, FHKIE, RPE, FCIBSE, CEng, SrMIEEE, MHKIBIM, BEAM Pro



BIM Interfacing Framework – Think out of the box

Stewart is the Head, ICT Planning and Construction Management of West Kowloon Cultural District Authority. He joined the Authority in 2011 and is managing the ICT strategy formulation, ICT infrastructure project execution and building systems technology. Since 2007, he has managed the adoption of BIM process in building and ICT project development for Hong Kong Science Park and West Kowloon Cultural District. He also drives the initiatives for utilizing BIM object database for ICT projects and the implementation of middleware for BIM-FM, BIM-GIS and BIM-RDS integration for new development. Stewart is a chartered engineer and an IT professional with fellow memberships in various local and international professional institutions. He has active participation in various conferences and judge panels for BIM awards. He is also a member in Construction Industry Council (CIC) BIM Working Group and Task Group for drafting the Hong Kong BIM Standard.





From 3D to 7D. BIM allows us to reach-out further dimensions for construction related processes and deliverables. Through the innovative thinking, we could achieve "X"D in the near future. "X" is meaningless and the key matter is about respective value creation behind the scene and how successful for its adoption by the industry players. In recent years, more and more people aware the beauty of BIM and gradually adopt the relevant BIM process in their project development. I feel excited on their good works in adoption and management, in the meantime wishing they could appreciate and apprehend more about the BIM process. It is a paradigm shift in various dimensions of construction project which require agile learning and connected knowledge in the community. AIAB is one of the good platforms for exchanging BIM practical experience and thoughts for a betterment in process and application in various dimensions.

BIM evolvement drives the framework development on its interfacing with other business processes/ systems. We have FM systems using COBie spreadsheet for interfacing with BIM object database for migrating construction into building operations stage. Geographic Information System (GIS) using IFC data exchange for integrating useable information from BIM for urban/district planning. To enable easy management of room data, we have native plug-in in BIM software application for information exchange to enable seamless Room Data Management. To enhance customer experience, we can leverage BIM information for smart phone application development to provide various experience in cyberspace.

BIM streamlines design verification process by fabricating prototype/mold directly out from model object. It also engages target audiences and articulates a better contract subdivision and parcel packaging. These are the real application projects in BIM world nowadays.

I congratulate all the 2015 BIM award winners. Good Job! Well Done! Wishing all of you to continue display your appreciation in BIM.

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Certified Expert Level II Examination (3 hours)

Choose from one of the categories:

- CEII Architecture (ArchiCAD)
- CEII Architecture (Revit)
- CEII Structure (Revit)
- CEII MEP (Revit)
- CEII Revit Families





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- Level II Revit Structure 2016
- Level II Revit MEP 2016
- Level II Revit Families Creation
- Level II BIM for Underground Utilities Gravity Pipe, Pressure Main and Cable using Civil 3D 2016*
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Building Information Model (BIM) Centric Facilities Management (FM) Solution

Manage facilities in a visual way

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- Intelligent navigation
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- Associate with IFC files

Extend BIM value in building lifecycle

- Keep building information up to date
- Automatic reuse all facilities information
- Retrieve technical document
- Building performance analysis

Enhance FM operation

- Space management
- Maintenance work efficiency
- Building commissioning process
- Support mobile devices
- Integration with Building Management System (BMS) and CCTV System









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