

BIM is a Big Boon

Building Information Modelling not only can make life easier for surveyors, it can also mean simpler, more cost-effective construction

Kit M Yip



Photo : Getty Images



Sr Lam Lit-yin

Council Member of HKIS' Land Surveying Division and General Manager of D-Reality Consultancy Limited



Sr Sunny Choi Shing-lam

Honorary Secretary of HKIS' Quantity Surveying Division, Chairman of HKIS' BIM Subcommittee and Senior Quantity Surveyor of Project Services at the Housing Department

BIM enables visualisation of the 3D design of a project. This is very useful when assessing potential sites and doing feasibility studies.

“BIM makes 3D diagrams easier to read. It shows information intuitively so that different industry players can store and retrieve information at different stages of construction, as well as present results and make direct comparisons.”

The 2017 Policy Address proposes using Building Information Modelling (BIM) technology to help improve productivity. In this issue, we will explore how BIM helps surveyors, its strengths, limitations and applications in Hong Kong, and whether it offers a solution to labour shortages and high construction costs.

Sr Lam Lit-yin, Council Member of HKIS' LSD Land Surveying Division Council and General Manager of D-Reality Consultancy Limited, uses the imagery of a “3D file manager” to describe BIM, which facilitates the storage and recall of information among users.

In the past, surveyors made traditional 2D diagrams on paper for sizes and locations, after which engineers did calculations about reinforced concrete and cement. Professionals then cross-checked onsite structures with the diagrams to ensure consistency.

Since the introduction of computers, the industry has moved from 2D filing to 3D or above. Building on the basic information about colour, rendering and material, other dimensions such as time, placing, budgeting, as-built model, accident/safety reports, environmental reports, and complaints are now added, to enable 4D, 5D, 6D, 7D, and a potentially unlimited number of dimensions.

“BIM makes 3D diagrams easier to read,” says Lam. “It shows information intuitively so that different industry players can store and retrieve information at different stages of construction, as well as present results and make direct comparisons. With some training, non-professionals can read and understand the diagrams. This helps professionals communicate with clients, district councils or other stakeholders to eliminate misunderstanding and enhance transparency and communications.”

As BIM information can be stored via cloud computing, different professionals get the same information in real-time. This saves time and reduces inaccuracies, disputes, claims, delays or over-budgeting. Frontline workers on site can easily view augmented reality (AR) and virtual reality (VR) on computer tablets to ensure a perfect

match. The enhanced efficiency may help alleviate problems caused by labour shortages, and increase productivity.

There are two kinds of BIM models: Design and As-Built. For new mega projects, Design BIM Models are generated from the very beginning, in order to facilitate facility management later. For existing structures, land surveyors can capture their existing status via laser scanning and photogrammetry to generate As-Built BIM Models, which again facilitates facility management.

As such, BIM is useful for environmental and heritage preservation. For instance, for eco-friendly heat-reducing vegetation at external walls of buildings, BIM helps file information about watering, fertilisation, cost, and suppliers for easy maintenance. For heritage structures such as Queen's Pier or Lui Seng Chun, laser scanning generates As-Built BIM Models before demolition or revitalisation, which can later contribute to new Design BIM Models for redevelopment.

Lam thinks BIM provides opportunities in the long term but faces challenges in the short run. “BIM involves a total transformation of the work culture and heavy initial input. It encourages detailed planning from day one and the adoption of BIM from the beginning to the end of the building cycle, i.e. from design tender all the way to building maintenance. Foreign studies show that initial costing at the beginning has risen from only 5% of the total project cost without BIM, to up to 20% with BIM.”

With BIM's good file management however, project costs towards the end are expected to decrease and offset the initial costing, resulting in an overall reduction. Having said that, the question remains as to how the initial bottleneck can be solved, i.e. who is going to bear the initial cost and allocate resources.

“Traditionally, during the initial stage of the design tender it has not been common for developers or contractors to make decisions about post-construction work,” Lam says. “It is only when a major corporation is responsible for the entire building cycle from end to end that a comprehensive BIM adaption

“Whereas the Hong Kong 2030+, East Kowloon and Kai Tak plans realise the vision of building a smart city with big data, BIM will be part of the bigger vision, combined with smart transport and communication in order to proceed to full digitalisation.”

is facilitated. Smaller firms can hardly ensure that other vendors abide by the same standards, not to mention the fact that smaller developers usually consider the handover to facility management as the end of their involvement.”

Lam therefore thinks that government incentives or mandatory requirements will be useful. “This had been the case in mainland China and Singapore, and even in Western countries. While some projects by individual government departments in Hong Kong have such requirements, there is not yet a consensus for entire project adoption.”

Besides, Lam believes another way is to involve and benefit minority owners, i.e. give them BIM models of units they have purchased, so that they can carry out management and maintenance more easily. Neighbouring owners can then join together to hire firms to do facility management of the entire building with BIM models combined. The resulting transparency would help reduce bail-rigging or over-budgeting.

Sr Sunny Choi Shing-lam is Senior Quantity Surveyor/Project Services of the Housing Department, Honorary Secretary of HKIS Quantity Surveying Division, and BIM Subcommittee Chairman. He agrees that BIM can improve productivity. “Generally speaking, Hong Kong’s building industry has a ‘rush’ culture. Some design details are not yet complete before a project is tendered out. As a result, in the post-contract stage, project variations and abortive work are not uncommon.”

“With the adoption of BIM, the whole design phase has to be advanced. Architects and engineers have to contribute their models in good time to form the combined design model. Any clashes or discrepancies between models can thus be easily identified and rectified at an early stage. This reduces time and human resources for handling project variations during construction stage.”

BIM enables visualisation of the 3D design of a project. This is very useful when assessing potential sites and doing feasibility studies. Teams can examine computer-generated results and work

through different parameters and design options. “All surveyors will benefit from BIM,” Choi says. “For a quantity surveyor, BIM models contain information on quantity and technical specifications of objects like doors, windows, walls and floors to facilitate measurement and cost estimation. Moreover, BIM’s parametric modelling allows immediate visualisation of change in design and gives the corresponding change in quantity. On-screen digitised measurement reduces repetitive manual work. A digitised database can be created, which facilitates efficient value engineering and 5D BIM for clients.”

“BIM is particularly useful for construction that involves a lot of coordination of routing, installation, and management of voluminous data for asset or facility management. It enables sophisticated landmarks with complex geometry.”

Since BIM requires earlier design coordination, it allows for more prefabrication, which in itself can be a solution to combat Hong Kong’s labour shortage and high construction costs.

The Housing Department has made use of BIM in its New Works Capital Works projects since 2014/15. The Development Bureau, after testing BIM in several pilot projects, recently issued a circular about adopting it for capital works over HK\$30 million from 2018. The Construction Industry Council (CIC) has upgraded its Task Force on Roadmap for BIM Implementation to establish a new Committee to lead implementation in the sector.

“BIM’s inclusion in government projects gives a direct push to the industry, I hope the framework can be further strengthened by standards prepared by CIC and BIM contract conditions drafted by the HKIS.”

As for the future, Choi considers BIM to be a must. “Whereas the Hong Kong 2030+, East Kowloon and Kai Tak plans realise the vision of building a smart city with big data, BIM will be part of the bigger vision, combined with smart transport and communication in order to proceed to full digitalisation.”

The article is published courtesy of Classified Post.

「BIM 有助理解三維圖像，直接顯示資料，不同業者可以在建築過程中儲存及讀取資料、匯報結果和直接比較資料。」

善用建築信息模擬技術

建築信息模擬技術不但可以減輕測量師的工作，同時也可簡化建築程序和增加成本效益。

葉潔明

2017 年施政報告建議利用建築信息模擬 (BIM) 技術提升生產力。本期封面故事將探討 BIM 如何協助測量師工作，有關技術的優點、限制、在香港的應用情況，以及能否解決建築業人手短缺和建築成本高昂這些問題。

香港測量師學會土地測量組理事及現實點顧問有限公司總經理林烈賢測量師形容 BIM 為「三維檔案管理員」，有助用戶之間儲存和讀取資料。

測量師過往在紙上繪製平面圖去表達建築物的尺寸和所在位置，然後交由工程師計算所需的鋼筋水泥。其他專家則按照平面圖實地檢測建築物，確保建築物符合平面圖所述內容。

隨著電腦出現，業界由平面圖轉而使用三維或其他多維檔案。在考慮到顏色、繪圖和物料這些基本資料後，業界還可以加入其他資料，例如時間、位置、成本預算、竣工模型、意外 / 安全報告、環境報告和投訴等，製作四維、五維、六維、七維，甚至其他多維檔案。

林烈賢指：「BIM 有助理解三維圖像，直接顯示資料，不同業者可以在建築過程中儲存及讀取資料、匯報結果和直接比較資料。即使並非行業專家，只要經過練習，也可閱讀及瞭解圖表，變相有助專家與客戶、區議會或其他持份者溝通，消除各方誤解和提高透明度，加強溝通。」

由於 BIM 資料可作雲端儲存，各界別的專業人士都可以取得實時資料，不但節省時間，更可減少出現誤差、爭議、索償、延誤或超支等情況。前線人員可實地透過平板電腦的擴增實境和虛擬實境應用程式查看資料，確保圖樣與實物百分百吻合。提升工作效率，可紓緩因人手短缺所引致的問題，更可提高生產力。

BIM 可分為「設計」及「竣工」兩大類。在開展新大型工程項目時，工作人員會創建設計類 BIM 模型，以便日後管理設施。至於現有建築，土地測量師可以透過激光掃描和攝影測量術捕捉其現狀，創建竣工類 BIM 模型，用以日後管理設施。

因此，BIM 有助環境及歷史保育。例如，在樓宇外牆種植節能降溫的植物，使用 BIM 可將澆水、施肥、成本和供應商等資料存檔，方便管理。以皇后碼頭或雷生春等歷史建築為例，在進行清拆或活化工程前，只需利用激光掃描創建竣工類 BIM 模型，日後進行重建工程時，方便創建設計類 BIM 模型。

林烈賢認為 BIM 長遠可提供各種機會，但短期內要克服不少挑戰。「BIM 需要從根本上改變工作文化和進行大量前期工作。換言之，工程一開始便需要進行詳細規劃，BIM 將貫穿整個建築周期，包括設計招標直至樓宇保養階段。外國研究顯示，在不使用 BIM 的情況下，涉及的前期工程成本佔整體項目開支 5%，但在使用 BIM 的情況下，有關成本將大幅攀升至最高 20%。」

但是，BIM 具備優良的檔案管理功能，有助減少後期工程開支，抵銷前期工程成本，達致減省整體開支的效果。但最初的樽頸問題：誰人承擔前期成本及分配資源，如何解決？

林烈賢解釋：「傳統上，在設計招標的前期階段，發展商或承辦商很少決定工程後期的施工。只有需要監督整個建築周期的大型公司才會採用全面的 BIM。規模較小的公司難以確保其他供應商跟從同樣的標準；規模較小的發展商往往認為，只要把樓宇交到負責管理設施的第三方，自己便可功成身退。」

因此，林烈賢期望政府推出其他鼓勵或強制措施。「中國內地、新加坡，以至西方國家的情況正是如此。雖然香港個別政府部門的工程有此類要求，但現時仍未就應否在整個項目周期採用 BIM 達成共識。」

另外，林烈賢相信另一個讓小業主參與和受惠的方法，是為他們提供所購置單位的 BIM 模型，讓他們更有效地管理及維修單位。相鄰單位的業主可合資聘用公司，結合 BIM 模型來管理整座樓宇。這樣增加透明度，將有助減少圍標或超支等情況。

房屋署的高級工料測量師 (工程事務)、香港測量師學會工料測量組的義務秘書及建築信息模擬小組委員會主席蔡盛霖測量師同意 BIM 有助提升生產力。「香港的建築界一般有『趕工』的情況出現。一些設計細節在工程投標前也無法落實。因此，即使到了後期的施工階段，修訂或甚至白幹重做工程的情況也時常會發生。」

「採用 BIM 後，整個設計階段便需要提前進行。建築師和工程師需要及時交出自己設計的模型，才可結合成總體的設計模型。方便找出互相不協調的地方並盡早作出修正，減少在施工階段需要修訂工程的時間和人力資源。」

BIM 可呈現工程項目的三維設計，有助評估項目所在位置的四週環境和研究項目的可行性。工作團隊可以根據電腦的運算，審視不同參數和設計選項。蔡盛霖表示：「所有測量師都可以選用 BIM。對於工料測量師來說，BIM 模型包括數量和技術規格的資料，好像門、窗、牆和地板等物件，方便量度和估算開支。此外，BIM 的參數建模功能可以即時呈現設計上的改變，並調整相應物料的數量。數碼化量度物料的方法可減省重複的人手工序。建立數碼化數據庫後，工料測量師可為客戶提供更快捷的工程估算及五維 BIM 服務。」

「BIM 特別適用於需要協調複雜的線路與設備安裝，以及管理大量涉及資產或設施管理數據的建造工程，再者，BIM 可應用創新的幾何設計，落實地標性的建築。」

由於 BIM 需要在早期協調及完善設計，變相可支援使用大量預製組件，這有望解決香港建築業人手短缺和建造成本高昂等問題。

房屋署自 2014/15 年度起已開始在多個新建築工程項目採用 BIM。發展局在數個先導項目中測試 BIM 後，最近亦發出一份技術通告 (工務)，表明由 2018 年起，所有推行超過 3,000 萬港元的基本工程均須採用 BIM。建造業議會改組原有的實施建築信息模擬路線圖工作小組，升格為一個新委員會，推動 BIM 技術。

「在政府工程項目中採用 BIM，有助推動業界採用有關技術。我期望建造業議會擬訂的標準以及香港測量師學會草擬的建築信息模擬合約條款能夠加強有關工作。」

蔡盛霖認為 BIM 是未來工程的必要元素。「香港 2030+、東九龍和啟德規劃實現以大數據建構智慧城市願景。BIM 將會是這願景的一部分，有望與智能交通及通訊結合，成就全面數碼化。」

本文由《Classified Post》撰文。



相片提供：Getty Images

「香港 2030+、東九龍和啟德規劃實現以大數據建構智慧城市願景。BIM 將會是這願景的一部分，有望與智能交通及通訊結合，成就全面數碼化。」