Application of Building Information Modelling (BIM) in the Hong Kong Housing Authority’s Public Housing Developments

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Outline of Presentation

- Introduction
- Applications of BIM
  1. Design
  2. Construction
  3. Facility Management
- Integration of BIM with other technologies & the Way Forward
Introduction
The Hong Kong Housing Authority

• Objective

The objective of the Government's housing policy is to maintain a stable environment for the sustainable and healthy development of the private property market, as well as to provide subsidized public housing for people who cannot afford private rental housing.

Vision

• To help all families in need to gain access to adequate and affordable housing

Mission

• To provide affordable quality housing, management, maintenance and other housing related services in a proactive and caring manner
• Cost-effective and rational use of public resources
• Competent, dedicated and performance-oriented team
• About 30% of Hong Kong’s 7 million people are residing in public rental housing.

• We have an existing stock of about 700,000 public rental flats, and we are building an average of about 15,000 new flats per year.

• Allocation standard is 7 sq.m. Average living space is about 12 sq. m.
Public Housing in Hong Kong - a Sustainable Community

To meet present social, economic and environmental needs but NOT at the expense of future generations.
A Sustainable Community
The Comprehensive Redevelopment Programme for the Ngau Tau Kok Resettlement Estates

Partnering with Residents – Community Engagement

Tenants’ Participation in Design of Greening and Open Space
A Sustainable Community

The Comprehensive Redevelopment Programme for the Ngau Tau Kok Resettlement Estates

Energy Efficiency

- Meet EMSD Energy Efficiency requirements
- 30% saving in annual electricity consumption at public areas
- Trial application of solar lighting and solar fan

Choice of materials based on Life-cycle analysis

Total of 21 Certificates under The Hong Kong Energy Efficiency Registration Scheme for Buildings -
- Electrical Installation
- Lighting Installation
- Lift & Escalator Installation

Life-cycle costing and assessment on typical public housing domestic buildings in 2002 to 2005
A Sustainable Community
Sau Mau Ping South Estate
- Apply Wind and Solar Energy

Generate Renewable Energy for LED Lighting over 850 m² Open Space with Educational Value and Estate Identity
Applications of BIM

1. Design
2. Construction
3. Facility Management
Building Information Modelling (BIM)

- is the process of generating 3-dimensional, digital representation of building data throughout its life cycle.
Examples of BIM applications throughout whole project life cycle
BIM - from modular flats to feasibility study
Visual Assessment

3D Terrain and Building Models
Environmental Studies – Sun Shading

The north landscape area is almost completely shaded throughout the year.

Recreational facilities are located on the Eastern and Southern part of the site to avoid over-heating.
Environmental Studies
Airflow & Ventilation Study

Summer condition (SW wind)

Wind goes through the windows and improves the wind condition

Toilet
Exhaust
High level operable Window

Wind Corridor

Winter corridor at Level 3 & 4 Summer Condition (SW wind)

South View

Wind Corridor

Scheme Design
BIM
Design and Coordination

Fire Services Pump Room  Pipes in Ceiling Void
Design and Coordination

Underground Services and Utilities
Examples of BIM applications in construction

Project Life Cycle

- Feasibility/Planning
- Scheme Design and Project Budget
- Detailed Design and Specification
- Tender Documentation
- Construction of Foundation / Building
- Completion, Management and Maintenance
Site Formation - Excavation, Lateral support

Kwai Chung Area 9H

1. Complicated excavation and lateral support system on site
2. 3D model is easier to understand than 2D drawings and written method statements
3. Discussed with site staff and contractor before construction to ensure smooth/safe operations
Safety and Logistics Arrangement

Safety and Logistic Arrangement for Typical Floor
PRH at Tai Pak Tin Street, Kwai Chung Area 9H
6 – Day Construction Cycle

6-Day Construction Cycle for Typical Floor
PRH at Tai Pak Tin Street, Kwai Chung Area 9H
## 6 – Day Construction Cycle

<table>
<thead>
<tr>
<th>Floor</th>
<th>No. of Working Day</th>
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<tbody>
<tr>
<td>1/F</td>
<td>Precast Façade and Steel Mold Installation</td>
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<tr>
<td>2/F</td>
<td>Material Storage Platform Installation and Cycle Learning</td>
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<td>3/F</td>
<td>Learning of Working (4 Days)</td>
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<td>4/F</td>
<td>Six Day Cycle with Tower Crane Climbing (2 Days)</td>
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<tr>
<td>5/F</td>
<td>Six Day Cycle (2 Days)</td>
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Use of BIM to assist Construction Management

- Identify and resolve site difficulties
- Simulate site programme and operation to enhance safety
- All relevant parties can comprehend the designed demolition sequence more effectively
- Assist to plan and walkthrough working areas
- Assist to simulate buildability
- Assist to conduct safety training with BIM models instead of physical mock-up
4D Simulation of Demolition of Precast Building in Lower Ngau Tau Kok Estate
Effective Site Safety Planning

Simulation of Demolition Sequences
Examples of BIM applications in Facility Management
Potential use of BIM for Facility Management

- **Financial Management**
  - Facility Investment & Operation Cost

- **Space Management**
  - Utilization & Maintenance

- **Operational Management**
  - Leasing & Property Management
  - Floor Plan retrieval
  - Shop selection

- **Behavioral Management**
  - Security, Safety, Health
  - Occupiers Satisfaction
YAU LAI SHOPPING CENTRE

- Seven-storey Commercial Centre adjacent to MTR Yau Tong Station
- Approximate Gross Floor Area of 8,810 sq.m.
- Building completion in 6/2010

Scope of BIM
- Modelling
- Clash Detection
- Spatial Checking
- Design Refinement
- 2D and 3D Combined Services Drawings (CSD)
- Leasing
- Facility Management (First trial)
- Animation
BIM assists in Services and Utilities Management

- Careful planning & reduce risk of clashes at both planning and design stage
- Effective daily facilities management & provide platform of retrieval of useful data & accurate visualization
- Build up appropriate combined record for regular repair, preventive maintenance and life cycle reference.
BIM Application in Space Management

- Better Visualization
Facilities Management

Let’s take a look at each floor...
Facilities Management

Take a look at the Shop fronts
Facilities Management

Zoom in special design features, e.g. Hybrid Ventilation System

- Anemometer & Rain Sensor – at Roof
- Operable Window for air exhaust
- Indoor Temperature & Rain Sensor
- Operable Cladding for air exhaust – at high level
- Temperature & Humidity Sensor - inside intake air duct in AHU room
- Operable Door for air intake
- Indoor Temperature & Humidity Sensor - at ~2m AFFL (Typical)
- Operable Door for air intake – at low level
Facilities Management

Prospective tenants can visualize the space before placing bids
Facilities Management
For Building Services Installations
Facilities Management

Retrieve Escalator documents from BIM models easily

Certification of Completion (CLOP-FL1)

Certification of Periodic Examination (CLOP-FL31)
Facilities Management

Easy to retrieve the Glass Wall information from BIM
Facilities Management

Easy to retrieve Building Services Installations
Benefits in applying BIM on Facility Management

- Effective control in facility investment & operation
- Effective control on space management, interior design, fitting-out & relocation
- Enhance asset control in property & maintenance management
- Achieve user’s satisfaction, perception & participation
Integration of BIM with other technologies & the Way Forward
We can integrate BIM with other technologies for more potential applications:

- Radio Frequency Identification Detection (RFID)
- Mobile / Handheld technologies
- Geographic Information System (GIS)
- HOMES (Project / Contract Management)
Integrate with GIS for estate wide Facility Management

- Educational

For example, checking nearby community facilities

- Parking Facilities
Integrate BIM with Radio Frequency Identification Detection (RFID) to track facilities maintenance record

(a) Heavy duty tags – use in precast façade by embedment into concrete (Can withstand more severe working conditions, such as at high temperature; in chemical and presence of metallic interference)

(b) Light duty tags – use in concrete cubes, timber doors, trucks
Application of RFID in Monitoring the Disposal of Construction and Demolition Materials

- RFID Readers for Trucks entering & leaving the Site
- RFID Reader adjacent to Weight-bridge
- Camera for recording loading condition
- RFID Readers at Site Entrance
- Weight-bridge
- Recorded Information
- RFID Tag

Trial at So Uk Estate Phase 1
Potential viewing of BIM models on handheld devices

Easy to check facilities and retrieve information anytime anywhere.
Our Goal

Apply BIM to all new projects from design stage by 2014/15
## Transformations to Year 2014 /15

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<th>10/11</th>
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<td>BIM Skill &amp; Experience</td>
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* The numbers of projects will be subject to adjustment
BIM Shifts the Resource Profile:

Patrick MacLeamy, CEO of HOK
What’s our big picture?
Proposed BIM R&D Items

1. BIM to Assist Feasibility Studies
2. BIM for Environmental Studies
3. BIM for Structural Framing Integration Approach
4. BIM and Structural Analysis Software Integration for SE
5. BIM MEP for BSE
6. BIM Integration with Specification
7. BIM for ICU Submission
8. BIM for Building Code Checking
9. BIM for Construction Planning and Site Safety
10. BIM Integration with RFID
11. BIM for Facility Management

BIM R&D Items

Design Optimisation
Construction Simulation
Life Cycle Management
Integration of BIM, GIS & HOMES

Geo-Spatial
Convergence
Building Information

Project Life Cycle
Feasibility studies and Conceptual layout
Scheme Design and Project Budget
Detailed Design and Specification
Tender Evaluation
Construction of Foundation / Building
Completion, Management and Maintenance

Design Options
Building Design and Performance
Documentation
Quality Control
Facility Management

Housing CONstruction Management Enterprise System (HOMES)

Planning, Programme, Project, Contract, Site, Payment, Budget, Cabin, Sr. Executive, Knowledge Management
We have met the CEO of BIM (Dec 2009) and CEO of GIS (July 2010), and discussed with them about our dream...
Way Forward

HA will continue to use BIM to enhance our portfolio towards smart living, safety and sustainability -

- BIM facilitates simulation of design feasibility, buildability & site operation.
- BIM facilitates professional team members such as planners, architects & engineers to visualize & resolve design to make decision effectively.
- BIM provides useful data for facilities management, repairs & preventive maintenance.
- BIM provides effective record system for life cycle costing & maintenance monitoring.
Fulfilling the Housing Authority’s Mission: We apply BIM to help deliver our housing programme ...

According to our Core Values: 4Cs

- Caring
- Customer-focused
- Creative
- Committed

Email: ada.fung@housingauthority.gov.hk

Thank You!
BIM Presentation of Individual Shop Front
BIM Presentation of Individual Shop Layout