Integration of BIM in Public Housing Development

9 November 2013
International QS BIM Conference

Speaker:
Ms Ada FUNG, JP
Deputy Director of Housing
(Development & Construction)
Contents

• Introduction to Housing Authority (HA)
• Information and Communication Technology (ICT) in HA
• Concept of Building Information Modeling (BIM)
• BIM in Current Projects
• Integration of BIM and GIS
• Change Management
• Way Forward
• Conclusion
Introduction to HA
Hong Kong Housing Authority

• The Hong Kong Housing Authority (HA) is a statutory body established in April 1973 under the Hong Kong Housing Ordinance. The Housing Department is HA’s executive arm.

• HA develops and implements a public housing programme to meet 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.

• The HA has an existing stock of about 730,000 rental flats.

• We build 79,000 new PRH flats for five years from 2012/13 to 2016/17 and build 100,000 new PRH flats for the five years starting from 2018.

• We build 17,000 new HOS flats for four years from 2016/17 to 2019/20 and thereafter 5,000 new HOS flats a year.
ICT in HA
Information & Communication Technology (ICT)

- CPMS
- COMIS
- HRMIS
- HA Intranets
- e-Housing Portal
- HAFIS
- HA/HD website
- MISIS
- Works
- Project Management System (HOMES)
- Executive Information System (EMMS)
- Integrated system of Housing Management
- Tenancies management, stock control, and CADD applications on mainframe
- Structural engineering, statistical analysis, and financial accounting applications on PC platforms
Concept of BIM
Building Information Modeling

“Building Information Modeling (BIM) is the process of developing and using three-dimensional, digital representation of building data throughout its life cycle.”
BIM’s Versatility

Construction

Simulation

Material Quantities

2D Drawings

BIM Models

Design

Rendering

Performance Analysis

Visual Impact

Collision Check
BIM Software

- Revit (BIM Modeling)
- ETABS / ORION (Structural Analysis)
- Solibri (Code Checking)
- Civil 3D (CE/GE Design)
- Navisworks (4D Simulation)
- 3D Max (Photo-realistic Rendering)
- Ecotect (Performance Analysis)
- Navisworks (Collision Check)
- Cost X (Material Quantities)
Adoption of BIM in Current Projects
Quick Assembly of Domestic Blocks

Assembly of Standard Modular Flats to form building for general project design.
Enhance Quality of Design

Sunlight & Shadow Studies

Daylight Analysis

Wind flow Studies
Enhance Cost Control and Environmental Protection

Balancing of Cut and Fill volume

Excavation volume

CUT / FILL volume of each Mass Fill
Better Building Services Co-ordination

Actual Construction

BIM Virtual Model
Optimize Lighting Design for Energy Saving

Integration of neighborhood, building and surrounding lighting contribution to achieve optimum site lighting design.

Development of more energy efficient lighting operation mode.

Accurate simulation of 3D lighting level.
Site Safety Planning
Construction Site Planning
6-Day Construction Cycle

6-Day Construction Cycle for Typical Floor
3D Printing Triggers Innovative Ideas
5D BIM Model

Cash flow simulation has been created by the integration of extracted quantities from BIM model, construction programme and cost information.

- Reveals actual and predicted cash flow of the project.
- Better understanding of project cash flow.
BIM as a Value Management Tool
Geological Profile & 4D Model for ELS

3D Print-out of geological model of the site.

Illustrate Geological Profile of the Site

Simulate the Construction Sequence of ELSW & Buoyancy Raft
Contractor’s Applications

**Site Layout Planning**

**Clashes Study**

**Virtual Rehearsal: Six-day Cycle for Typical Floor**

**Rebars Fixing & Services Installation Collaboration**
Integration of BIM and GIS
Development of Geographic Information System & Application in HA

Development & Construction Division

- 2005: Desktop GPIS for Planning Studies
- 2009: Web based 2D GPIS for Planning Studies
- 2012: 3D GIS for Feasibility Studies, & Design
- 2013: 3D GIS for Facilities Management

Estate Management Davison

- Site Feasibility Study
- Terrain Modelling
- Visual Impact Analysis (Sightline & Corridor)
GIS Applications – Contextual Study
GIS Applications – Spatial Planning

Study the connection between proposed buildings, external works, open space and landscape areas for the project
GIS Applications – Ridge Line Analysis

Selected Viewpoint at Shing Mun River, No. 2 Promenade Rest Garden

Proposed Buildings
GIS Applications – Ridge Line Analysis

Skyline Surface for checking the visual impact on the ridge lines
GIS Applications – Schemes Comparison
GIS Applications - Micro-climate Studies

- Determination of prevailing wind by Wind Tunnel Test
- Ventilation conditions of mid, high and low zones of domestic blocks are studied
- Enhancement to immediate neighbourhood

Wind Tunnel Test  | Wind Environment  | CFD simulations
--- | --- | ---
Before Redevelopment  |  |  
After Redevelopment  |  |  
Before  | After

Wind Corridor Design

GIS Applications - Micro-climate Studies
BIM (Graphics & Attributes)  GIS

Autodesk Revit

INTEGRATION

FME

BIMserver & BIMsurfer (Viewer) with JRE Update 7

Method 1

Floor Plans in BIM

Geo-reference Floor Plans in BIM

Export to IFC Format

3D GIS (CityGML)

GeoDatabase (Multiview)

ESRI ArcGIS

Method 2

Batch Conversion of Floor Plans and Attributes using ArcPy and Data Interoperability Extension in ArcGIS

Geo-database in ArcGIS
GIS +BIM Applications – Colour Scheme Study
GIS + BIM Applications – Geotechnical Study

Geotechnical Study (Design Cut Slopes, Fill Slopes, Retaining Wall and Screen Wall in Civil 3D environment)

Perform 3D Visualization and animation in GIS environment
Change Management
BIM is not just a tool, it brings transformation to construction industry…
Transformation Process

- **Technologies**: BIM 3D modeling, Analysis, 3D printer, RFID, GIS, R&D
- **Organization**: Tighter team formation, multi-disciplinary team, supporting team structure
- **People**: BIM skill, think ahead, teamwork, change management, industry practitioners, academia, workforce
- **Processes**: Upfront design process, re-engineering, office procedures, disciplines practices, industry practices
- **Partnership**: Collaboration among project team, consultants, contractors and subcontractors.
Challenges - BIM Process Shifts the Design Curve

Patrick MacLeamy, CEO of HOK
Transformation – Organization & People

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIM Project Steering Committee</td>
<td>BIM Working Group</td>
<td>BIM Centre &amp; BIM Service Team</td>
<td></td>
</tr>
<tr>
<td>Change Management</td>
<td></td>
<td>Site Team BIM Working Group</td>
<td></td>
</tr>
<tr>
<td>Training &amp; Seminars</td>
<td>Experience Sharing; Seminars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training; Workshops</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Change Management: BIM Project Steering Committee
BIM Working Group
BIM Centre & BIM Service Team
Site Team BIM Working Group
Experience Sharing; Seminars
Training; Workshops
BIM Central Support - BIM Services Team and BIM Centre

Act as in-house consultant and support, collect feedbacks, training and skill exchange (~2000 users)

Centralized BIM Team

Training

Discussion

Hardware and software support
HA BIM Standards & User Guides

HA Standard Library

Revit Structural Families

Revit Architectural Families

Revit MEP Families
Our Goal
Apply BIM to all new projects from design stage by 2014/15

Training to HA Staff (includes professionals & technical staffs)

- Architects
- Structural Engineers
- Building Services Engineers
- Civil Engineers
- Geotechnical Engineers
- Quantity Surveyors
- Planners
- Landscape Architects
- Land Surveyors
- Site Staff

Tentatively, it will become 70% at the end of Mar 2014 and more than 85% in 2015

* As at the end of September 2013
We Walked the Extra Mile

Promote to our Professional Service Providers (e.g. architects, engineers & surveyors...) and contractors

Promote to academia e.g. HKU, PolyU, CityU etc.
Impact

- Local Universities & Academia
  - Prevalent research topics.
  - BIM courses.

- Professional Service Providers
  - BIM models support submissions.

- Construction Industry
  - Enhance collaboration among design team, contractors, sub-contractors & suppliers.
  - Contractors have set up their own BIM working teams.
  - BIM Task Force in the *Construction Industry Council* of Hong Kong
  - *Chaired by Ms. Ada Fung* with members from academia, professional institutes, developers associations, government departments, etc.
  - Develop a BIM roadmap for HK Construction Industry
Way Forward
Proposed BIM R&D Items

Project Life Cycle

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

BIM R&D Items

1. Assist Feasibility Studies
2. Environmental Studies
3. BIM Model - Drawings Integration
4. Design/Analysis Software Integration
5. Integration with Specification
6. ICU Submission
7. Building Code Checking
8. Construction Planning and Site Safety
9. Facility Management

- Design Options
- Building Design and Performance
- Documentation
- Quality Control
- Facility Management

Design Optimization
Construction Simulation
Life Cycle Management
Study on Integration of GIS, BIM, HOMES & RFID

Geo-Spatial

GIS (Geo-spatial Database Infrastructure)

BIM (Building Information Modelling)

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

RFID
- Choice of materials
- Site material tracking & monitoring

Enhancement of HOMES:
Integration of RFID into HOMES construction module
Import of Point Cloud to BIM

Indoor As-built Survey (From Point Cloud to BIM)

3D Realistic Point Cloud Model from Laser Scanning

Point Cloud→BIM System

Floor / Area Plan
Conclusion
Who get the benefit?

Housing Authority
- Environmental

Business Partner
- Economic
- Sustainability

General Public
- Social
BIM Awards

- HK BIM Awards for four consecutive years 2009 -2012
  2009: Towards Customization with Standard Modular flats in Mass Housing Design
  2010: Transforming the whole Delivery Practice
  2011: Versatile BIM / What You See is What You Can Do
  2012: Pioneering 5D BIM for Quantity Surveying
  2013: Fast-track HOS and Site Coordination in a PRH project.
- Meritorious award for Civil Service Outstanding Service Award Scheme 2011
- HK ICT Awards 2012 – Silver