Application of BIM and RFID in Public Housing Projects

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香港房屋委員會 Hong Kong Housing Authority

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1. 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.



A Sustainable Community

To meet present social, economic and environmental needs but NOT at the expense of future generations.



Use of Information Technology

in Development & Construction Division

• PMS – HOMES

(Housing Construction Management Enterprise System)

- Project Management, Contract and Site management
- Budget and Expenditure, Knowledge Management
- GIS ESRI for planning, feasibility study, trees management
- CAD AutoCAD for drafting

Commenced and Balling Pro-

- BIM Revit for design & building information
- PDA PASS (contractors' performance assessment) & Site inspection
- RFID Building components delivery & tracking

Economic

- TMS Time Management System for resource planning
- Discipline's applications Design & Analysis

2. BIM Technology in Public Housing Projects

What is BIM?

Building Information Modelling (BIM) is the technology providing a digital 3D environment for carrying out collaborative design and construction planning. The models contain fully parametric components with rich geometric information and properties.

Advantages

- Platform for communication, collaboration and coordination for various designers, builders and facility managers
- 2. Single source of information consistent and reliable



Use of BIM Technology in Housing Authority



- Planning & Feasibility Study
- Design Solution & Modeling
- Environmental Study
- Building Performance Validation

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- Documentation & Tender
- Buildability Study & Clash Resolution

- Construction Simulation
- Building materials tracking & monitoring
- Site inspection
- Site Safety Planning
- Logistics & Supply Chain Management
- Facility Management

| Feasibility studies | Scheme Design | Detailed Design | Tender | Construction | Facility Management |
|------------------------|--|--------------------|---|-----------------|------------------------|
| Design Options | Building Design a | nd Performances | Documentation | Quality Control | Facility Management |
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Creating models for modular flats for design optimization





1-2 Person Flat





- 2-3 Person Flat
- 2 Bedrooms Flat

Adding ground floor and roof



Assembling building wings and floors

Adding, co-ordinating utilities and services, detecting and resolving clashes

Unior pipe



Visual Assessment



Sun Shading Study



Daylight Analysis



Airflow & Ventilation Study



Optimization of Foundation Design



Excavation and Lateral Support Simulation



Site Safety Planning for Construction, Demolition



Demolition Simulation





5D Model to Study Cash Flow

6-Day Typical Floor Construction Cycle



BIM is not just a tool, it brings transformation to construction industry...



With BIM technology ...



Transformation - Organization & People



Transformation – Collaboration / Partnership



To transform, we developed ...

- HA BIM Standard (pioneered in 2009)
- HA BIM User Guide
- Localized Libraries
- HA Model Templates



Building Information Modelling (BIM) Library Components Design Guide for Development and Construction Division of Hong Kong Housing Authority

Available on HKHA Website



Construction Product Certification **Building Information** Modelling Tender Price Indices Performance Assessment Specification Library Use of Hydraulic Concrete Crusher in Demolition Works Prefabrication in Housing Blocks Standardised Components Use of Recycled Aggregates Procurement Principles and Counterparty List Tender Notices Working with Us Forms

representation of building data throughout its life cycle. BIM is an innovative technology for bridging communications between the architecture, engineering and construction industries Also, with the data packed BIM models, various sustainability design and environmental studies could be carried out, such as lighting, ventilation, energy, carbon emission and green design, etc.

The Housing Authority (HA) has started piloting BIM since 2006. We have used BIM for design visualization and progressively carried forward to subsequent stages to benefit the chain of stakeholders along the building fife cycle, from design to documentation, construction and facility management. Through pilot and actual implementation of BIM in our projects, we wish to improve our building quality by optimising our designs, improving coordination and reducing construction waste.

Standards, guidelines and component families are essential for successful BIM implementation. They are regured for effective model building, electronic file management. and communication between BIM users. To facilitate the process, we have prepared our in-house BIM standards, user guide, library component design guide and references. Please cick on the links below to view these documents.

- BIM Standards Manual (PDF Format, 242 KB)
- BIM User Guide (Part I) (PDF Format, 2.8 MB)
- BIM User Guide (Part II) (PDF Format, 5.1 MB)
- BIM Library Components Design Guide (PDF Format, 511 KB)
- BIM Library Components Reference (PDF Format, 4.2 MB)

http://www.housingauthority.gov.hk/en/business-partnerships/resources/buildinginformation-modelling/index.html

Benefits in Applying BIM

- 1. Higher quality of work
- 2. Saving in construction time
- 3. Cost saving
- 4. Environmental friendliness
- 5. Enhanced site safety

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6. Achieving sustainability development

Study on Integration of BIM, HOMES & RFID



BIM Technology in HA – R & D



Our Goal: To apply BIM to all new projects from design stage by 2014/15

| | 10/11 | 11/12 | 12/13 | 13/14 | 14/15 |
|--|-------------|---------------|-------------------|-------------------|----------------------------------|
| Current | 12 projects | 17 projects | 25 projects | 21 projects | |
| Annual | | ~ 5 projects* | ~ 6 - 8 projects* | ~ 2 - 3 projects* | ~ 2 - 3 projects* |
| By 14/15 | | | | | 20+ projects |
| Demand on BIM Skill & Experience | | | | | |

* The numbers of projects will be subject to adjustment

~ 1000 nos. (54%) professional + technical + site staff trained

BIM Awards

In recognition of our efforts and commitment, HA received -

 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

 Meritorious award for Civil Service Outstanding Service Award Scheme 2011

- HK ICT Award – Silver 2011









Make Amazing Happen Autodesk Hong Kone (IIM Awards 2011





3. RFID in Public Housing Projects



Monitoring Cycle

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RFID System

- A RFID System comprises
 - RFID tag (with a unique identification no.) is an integrated circuit chip with antenna
 - Reader is for input or retrieve such data information into or from the tag through radio frequency waves, and to upload it onto a host computer system
 - Software in computer system is for such data information processing



(A) **RFID** in Selected Building Components



(1) Precast Concrete Facade



(2) Aluminium Window



(3) Timber Doorset

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(4) Metal Gateset

Benefits of RFID in Building Components

- Excellent traceability ability
 - Assuring components produced in a particular factory have been delivered to a designated site
- Streamlining data management along supply chain
 - Minimizing human errors and efforts
 - Instant data transfer /sharing amongst relevant parties via internet
 - Real time records
- Prevent fraudulent products
- Saving paper and storage space for documents
- Facilitate future maintenance

Building Components at Factory and on Site



(B) Concrete Cubes on Site



Tag Currently in Use



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Concrete Cubes Delivered to Laboratory



Benefits of RFID in Concrete Cube Testing

- Excellent traceability
 - track the movement of cubes from site to laboratory
- Prevent fraudulent products
 - confirm the same cube is being tested at each step of testing (i.e. weight measurement, dimension measurement, compression test)
- Streamlining data management
 - capture electronically test results and transfer to database for issuance of test reports
- Minimizing human errors and effort
- Paper savings
- Real time records and access to all data via internet
- Improve testing efficiency through automation

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(C) Use of RFID in Monitoring C&D Materials Disposal on Site and at Public Fill



Benefits of RFID in Monitoring C&D Materials Disposal in Foundation Projects

- Track movement of dump trucks from site to public full
- Check and record truck load and view content of C&D materials before leaving site
- Capture details and upload to web-database
- Cross-check with truck load details when truck arrives at the public fill; if information of both stations match, prevention of illegal dumping can be achieved
- The Civil Engineering and Development Department has permitted Housing Authority to install RFID set up at public fill entrance /exit

Type of RFID Tag

- Active type tag
 - Stuck to the windshield of dump truck
 - Readable at a distance of 3m to 3.5m



P.C.D.C.M. M. M. Balling C. J. C.



RFID Reader (active type) installed at the Weighbridge

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RFID Recording System at the Guard House



Display of the empty truck weight upon entering site



Display of the loaded truck weight upon leaving site

(Plate No. is recorded in the system by linking with the Tag ID)

Street the Charles





Scanning of the barcode on CHIT Form and entering into database



Display of the Loading Condition of the empty truck



Display of the Loading Condition of loaded truck (photo captured in the system)

CEDD's Dumping Facilities at Tuen Mun Area 38



3 Entrances and 2 Exits (5 Lanes)



Weighbridge at Entrance

Integration of **RFID** to **HOMES**

Information hub on site operations and contract management



Way Forward for RFID Application

- Exploring the viability of applications in other aspects of HA construction
 - Testing : steel bars testing
 - Building components : building components other than the four types of components
- Mass application of RFID in
 - Testing : concrete cube testing

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- C&D materials disposal monitoring for all demolition /piling /building contracts
- Integration with BIM
 - Track data of building components on site and completion of works to facilitate cost planning, payment, cash flow analysis, etc
- Integration with HOMES
 - Capture information in RFID database to migrate to a new module in the HA's corporate information system (HOMES)

Integrate BIM with Radio Frequency Identification Detection (RFID)

to track installation of building components / construction progress



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Integration of HOMES and RFID



Housing Construction Management Enterprise Management System

(HOMES) provides a common information backbone for the building construction industry. Planning, programme, project, contract and site management, budgeting and payment are fully integrated for ease of information sharing and data exchange amongst all parties. Other data that can be incorporated into



Conclusion

Technology Brings Changes...



Thank You



We build a Collaborative Future with People, Process and Technology

