5D BIM Implementations in Hong Kong and Mainland China

Dr. Julia GAO
Dept. of Real Estate and Construction
University of Hong Kong
Background

- Awareness of 5D BIM rapidly increasing in HK and mainland China
- Focus on how to use and tap potential out of BIM
Objectives

- Conduct case studies and interviews with professionals
- Illustrate why, when, for whom, at what level of detail, with which tools, and how 5D BIM was implemented on a project
- Explore important drivers and obstacles that shape 5D BIM implementations
- Compare the current use of 5D BIM in Hong Kong with that in the Mainland China
Why (Modeling Purpose)

- HA experimented 5D BIM on a new public rental housing development
- Use BIM for cash flow forecast and payment simulation
- Identify problems with current modeling approach
HK Case 1: 5D BIM (Client Perspective)

- When (Timing of Modeling)
  - BIM consultant created building information model during construction stage
HK Case 1: 5D BIM (Client Perspective)

- **Whom (Stakeholder Involvement)**
  - **Client:** Housing Authority
    - **QS team:** 1 senior QS, 1 QS, 3 technical staff
  - **GC:** China State Constr. Engr.
  - **Hired BIM consultant**
  - **BIM Consultant team**
    - 2 responsible for creating models
    - 1 for quantity takeoff and cost estimation
  - **HA issued a variation order (VO) to GC to carry out cash flow forecast & payment simulation by using BIM**
HK Case 1: 5D BIM (Client Perspective)

- What (Modeled Scope and Level of Detail)
  - BIM covered four work trades: piling, excavation, concrete works, & underground drainage
  - Four trades are the first few steps of construction even though concrete works are difficult to model and measure through BIM
HK Case 1: 5D BIM (Client Perspective)

- Which Tools (Modeling Software)
  - BIM consultant developed a plug-in.
  - BIM consultant created material takeoffs in Revit and then handed it off to the cost estimator.
HK Case 1: 5D BIM (Client Perspective)

- How (Workflow) – BIM Consultant
  - Received the 2D drawings
  - Built BIM in Revit
  - Put down methodology of creating the model for four work trades, coupled with standardized guidelines based on the HKSMM
  - Assisted quantity surveyors to extract quantities from BIM model
HK Case 1: 5D BIM (Client Perspective)

- How (Workflow) – HA QS team
  - Found the discrepancies between BIM measurement and manual measurement (most painful task)
  - Identified ways to minimize discrepancies as far as possible.
  - Checked the quantities from BIM measurement but not able to check the model
  - Adjustments made to fit HKSM still being pursued and no perfectness is achieved
HK Case 2: 5D BIM (Contractor Perspective)

- Why (Modeling Purpose)
  - Client requirement
  - Complicated design structure could not be built without BIM
HK Case 2: 5D BIM (Contractor Perspective)

- When (Timing of Modeling)
  - Contractor first thought BIM could be built before stage of construction drawings
  - Contractor later found what they expected was hard to be realized
  - Reason: design was changing all the time.
HK Case 2: 5D BIM (Contractor Perspective)

- Whom (Stakeholder Involvement)
  - Contract – BIM requirement: 1 BIM manager & 4 Modelers
  - Modeling work outsourced to BIM consultant
  - Contractor’s 5D BIM team: QS, Engineers, BIM adviser, & modelers
HK Case 2: 5D BIM (Contractor Perspective)

- What (Modeled Scope and Level of Detail)
  - LOD evolved as project progressed
  - Tender stage: LOD 100 (mass and form concept model for pricing)
  - Pre-construction stage: LOD 200 with major systems modeled
HK Case 2: 5D BIM (Contractor Perspective)

- Which Tools (Modeling Software)
  - Software selection criteria: quantity takeoff and scheduling function
  - Approach: through “Application Programming Interface” (API) to estimating program (direct link between costing system and Revit)
HK Case 2: 5D BIM (Contractor Perspective)

How (Workflow)

- Contractor developed modeling guidelines based on an international modeling standard (specifies how to build model to suite for cost breakdown structure)
- BIM consultant built BIM in Revit following contractor’s guidelines
- BIM consultant published Revit models to a 5D BIM management tool to generate construction-caliber quantities
- Contractor calculated costs by combining model-derived quantities with the contractor productivity rates by trade and standard formulas for deriving labor and material resource requirements
Motivators of 5D-BIM in Hong Kong

- Client’s requirements (mandate requiring BIM)
- Self-motivated
Obstacles of 5D-BIM in Hong Kong

- Inconsistency with current HKSMM
- Lack of Standard Approach for Modeling (SAM)
- Interest conflicts between QS and its upstream partners
- Human resource problem
5D BIM in Mainland China

- When (Timing of Modeling)
  - Traditional design-bid-build contract
  - BIM often built after the tender awarded
5D BIM in Mainland China

- Whom (Stakeholder Involvement) - Initiator

- Not like Hong Kong, government not the \textit{initiator} in implementing BIM

- Major contractors initiate 5D BIM R&D on their own projects, e.g., residential & institutional buildings.
5D BIM in Mainland China

- What (Modeled Scope and Level of Detail)
  - 90% of quantity takeoff for architecture and structure can be realized by the approach of 5D-BIM.
  - 20%-30% of MEP components needed for quantity takeoff can be reflected in current models.
  - Reason: many small MEP components not modeled
5D BIM in Mainland China

- Which Tools (Modeling Software)
  - Glodon and Luban: two primary domestic 5D-BIM software companies in Mainland China
  - Foreign software companies have little market share
  - Difficulty lies in localization: different provinces with different standards
  - Software companies have to localize QTO software to suit QS standards at provincial level
5D BIM in Mainland China

How (Workflow)

- Approach 1: add required information for cost estimation into model
- Approach 2: exact cost-related data from BIM to existing cost management system
- BIM consultant often reply on Approach 2

Constraint:

- Models built before construction not take QS requirements into consideration
- BIM-based QS not started until construction
Obstacles of 5D-BIM in China

- BIM created without reflecting appropriate information related to construction method, construction procedure, site constrains, etc.

- Many professionals in Mainland China not gained sufficient insights into how to implement 5D-BIM beyond fancy presentation

- A standard on material coding not been in place yet.
Compare 5D-BIM in Hong Kong and Mainland China

- Early R&D experiment stage: few projects used
- Early adopters
  - HK: HA & contractors working for public clients
  - China: major general contractors
- Technology-driven: 5D BIM tools customized to needs on local projects without little disruption of existing work practices
Recommendations

- Standard Approach for Modeling (SAM)
- BIM design (create BIM and directly produce 2D drawings from BIM)
- BIM at early stage
- QS professionals participate in creating BIM models