BUILDING INFORMATION MODELLING (BIM)

- GLOBAL MATURITY IN ADOPTING BIM

FIG ACCO Meeting, Athens 24 Jan 2015

By See Lian Ong, Chair – Commission 10
“At its simplest level, BIM provides a common environment for all information defining a building, facility or asset together with its common parts and activities. This including building shape, design and construction time, costs, physical performance, logistics and more.”

(RICS “What is BIM”)

- BIM model is the primary tool for the whole project team
- It is a shared information model
What is a Building Information Model (BIM)?

3D visualisation

- 1D Architecture
- 2D Mechanical Electrical Plumbing
- 3D Structure

Plus information

- 4D Time planning
- 5D Capital expenditure (CAPEX)
- 6D Operation expenditure (OPEX)
Why would we use BIM – Push and Pull?

- Better coordination of design and project outcomes
- Improved collaboration within project teams
- Integrated cost, time and risk planning
- Speed of delivery improved
- Reduction in errors

Project delivery into Asset operation
How?

BIM Service Map

1. Identify objectives and BIM strategy
2. Assess and test BIM execution planning
3. Move through design into construction phase
4. Monitor, validate and learn during construction phase
5. Deliver assets into operation or disposal

Measurement, reporting and feedback

- What do we get from this and next steps?
- Set up the environment for BIM and collaboration
- Procure the right project partners for collaboration
- Utilise the right approach to deliver the benefits
- Realise benefits and learn
Design

- Thermal performance analysis
- Energy analysis

Result:
- Reduced running cost
- Improved building performance
Cost

- Quantity generation
- Pricing
- Whole life
### BIM - Time Management

| Task Name                                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|-----------------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Send out Letters for sponsorship              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Vehicle frame measurement                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Center of gravity determination              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Modeling of possible mounting points          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Analysis in the Adams software                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Solidworks drawing of knuckles                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Solidworks drawing of control arms            |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Solidworks                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Solidworks                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Stress analysis                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Material selection                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Find Best Material                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Machining                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Cutting                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Fabricating tabs for suspension attachment     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Welding                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Suspension installation                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Physical testing                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Improvements and modifications                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Oral presentation preparation                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Final written report                           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Communication with flotation design group      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Website work                                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Other data

- Sustainability
- Methodology
- Locational
Connections

- Land
- Construction
- Property
- Digital economy
Benefits

- BIM - Return on Investment

  - Up to 40% elimination of unbudgeted change
  - Up to 80% reduction in time taken to generate a cost estimate
  - Cost estimation accuracy within 3%
  - A savings of up to 10% of the contract value through clash detections
  - Up to 7% reduction in project time
Benefits

Delivery team workflow

- Definition of asset
  - Enhanced understanding
  - Better decisions
  - Scenario testing
  - Increased certainty of proposed solution
  - Stakeholder engagement
  - Assist with planning applications
  - Assist with development appraisals

- Construction of asset
  - Greater collaboration
  - Enhanced coordination of asset delivery
  - Increased cost, time and performance certainty
  - Reduced risk in construction
  - Better quality outcomes

- Operation of asset
  - Digital asset data captured for use
  - Baseline for KPI
  - Understanding of the asset enabling efficient hard and soft FM
  - Complete definition of the asset for transfer or 3rd party operation
  - Re-use / remodelling can be planned easily
Benefits

- Genuine collaboration
- Better “joined up” design
- Greater control of information, change and cost
- Less risk of project failures, delays and cost overruns
- Better understanding and control of lifecycle costs
- Better accessibility to facilities management information and operation costs – replacing traditional O & M manuals
Benefits

- Powerful value engineering tool
- Should result in savings in construction and operation costs
- Gives bidders real competitive edge
- Less likelihood of disputes
Benefits of BIM

- Contractors Citing BIM Benefit Among Top Three for their Company

- Reduced Errors and Omissions: 41%
- Collaborating With Owners/Design Firms: 35%
- Enhancing Your Organization’s Image: 32%
- Reducing Rework: 31%
- Reduced Construction Cost: 23%
- Better Cost Control/Predictability: 21%
- Reducing Overall Project Duration: 19%
- Marketing New Business: 19%

Source: McGraw Hill Construction 2013

Global Maturity

- Status of BIM adoption globally
Increasingly private sector clients require suppliers to apply a BIM approach.

Public sector clients - BIM either has been, or will soon be, formally adopted by Governments in:

- Netherland
- Denmark
- Finland
- Norway
- UK
- European Union
- USA
- UAE – Dubai Municipality
- Singapore
- Hong Kong
- Australia
- South Korea
Growth of BIM in UK

Based on a diagram created by Mark Bew of BuildingSmart and Mervyn Richards of CPIC (2008)
BIM Connections

- BIM and other complementary paradigms
BIM Awareness

International BIM report

“It’s worth bearing in mind that the survey did not give a definition of BIM. This opens up the possibility that ‘BIM’ has come to mean different things, or to have different nuances of meaning in different countries.”

**Awareness of BIM**

- UK: 94%
- Canada: 96%
- Finland: 87%
- New Zealand: 98%

**Respondents aware of and currently using BIM**

- UK: 39%
- Canada: 64%
- Finland: 65%
- New Zealand: 57%

Source: NBS
BIM Future Adoptions

International BIM report

- We currently use BIM:
  - UK: 43%
  - Canada: 66%
  - Finland: 67%
  - New Zealand: 57%

- In one year's time we will use BIM:
  - 77%
  - 84%
  - 85%
  - 77%

- In three years' time we will use BIM:
  - 91%
  - 93%
  - 90%
  - 92%

- In five years' time we will use BIM:
  - 93%
  - 97%
  - 92%
  - 95%

Source: NBS
BIM and Change

International BIM report

“Across the countries we surveyed, we can see that there is strong agreement that BIM is much more than purchasing and using a piece of software. BIM requires changes... The data suggests these changes are worthwhile.”

Source: NBS
BIM Standards

- Building Smart and ISO
- UK Standards
- RICS Guidance
Case Studies
The 3D model was used to convey the visual element of the design and provide the client confidence that the final building would suit their requirements.

Analyzing the Design - Designing the building in the virtual environment meant that the team could be confident that the design was structurally sound.

Manufacturing - Use of the model saved on time and materials wastage – model tested before work began on site.

Complicated design would have been extremely difficult and time consuming (hence expensive) without the use of the BIM.

Awarded a Bentley BE Award for the Best Use of BIM.

Ref: Construction Excellence 2010
Blackfriars Road

BIM approach not adopted until Stage C

Faster design and construction. The use of BIM accelerated the development of the design.

De-risking construction. Achieving fully coordinated design at Stage E – reduction in design risk.

Improved building performance. The overall net-to-gross area of the building has been improved.

Operation and maintenance. Identified information that will support the operation and maintenance phase.

Ref: BCO May 3013
Crossrail – Asset Management

As part of Programme Partner, effective use of project information is vital to successful delivery.

Established common cost and work breakdown structures for **consistent reporting**.

BIM model is being developed within Engineering for **Asset Management**.

Discussions with Bentley Academy and other stakeholders to **integrate** Programme Partner role into model.

Vital that integration is achieved early to realise full dimensional functionality of BIM.

Ref: Turner & Townsend 2013
The Place, London Bridge Quarter – Schedule Management

Programme Managers for LBQ, Project Managers for The Place

Bar coding to track component delivery & installation, updating status within model

Use of iPad technology to allow track progress in real time, with corresponding reporting

As built information fed into the model, improves quality process and rectification of snags

Generating built asset data bank for use by landlord, tenant and FM company

Ref: Turner & Townsend 2013
The Crick – Cross Management

- CADMeasure BIM enabled measurement from Model
- Quick analysis of quantities for BoQ checks, scheme options and changes
- Size of model v. hardware required elemental slices – increased dialogue
- Potential to accelerate cost plan process on future projects
- Integrating whole life and FM data into model

Below: CAD Measure BIM Screenshots

Above: All K10/135 partitions coloured and quantity measured with two clicks

Ref: Turner & Townsend 2013
**HMYOI Cookham Wood**

- Planning submission as a 3D model allowed the planner to more easily understand the impact of the proposed scheme.
- Use of 3D model in design meetings allows us to focus and visualise the issues quickly and accurately leading to efficient resolution.
- Early project scoping and stakeholder engagement, aided by the use of the BIM model as a visual tool, has assisted the operations phase.
- The contractor linked the model to their construction programme to effectively simulate the construction sequence.
- The model was used in BIM workshops to identify and remove these mis-coordinated elements ahead of construction.

*The developed models for the buildings allowed me to present to my Senior Management Team and Staff Managers a walk-through of the buildings highlighting views into and out of areas that normally I couldn’t do until completion. All before anything started!“*

**Emily Thomas**  
Governor HMYOI Cookham Wood

Ref: MoJ July 2013
Partners Across The Globe Are Bringing The 787 Together

THE COMPANIES

U.S.
- Boeing
- Spirit
- Vought
- GE
- Goodrich

CANADA
- Boeing
- Messier-Dowty

AUSTRALIA
- Boeing

JAPAN
- Kawasaki
- Mitsubishi
- Fuji

KOREA
- KAL-ASD

EUROPE
- Messier-Dowty
- Rolls-Royce
- Latecoere
- Alenia
- Saab

WING TIPS
- Korea

MOVABLE TRAILING EDGE
- Australia

TAIL FIN
- Fredrickson, Washington

PASSION ENTRY DOORS
- France

CENTER WING BOX
- Nagoya, Japan

Landing Gear
- Gloucester, UK

MAIN LANDING GEAR WHEEL WELL
- Nagoya, Japan

HORIZONTAL STABILIZER
- Foggia, Italy

AFT FUSELAGE
- Charleston, S.C.

CARGO/ACCESS DOORS
- Sweden

FORWARD FUSELAGE
- Nagoya, Japan

FORWARD FUSELAGE
- Wichita, Kansas

ENGINE NACELLES
- Chula Vista, CA

CENTER FUSELAGE
- Grottaglie, Italy

WING/BODY FAIRING LANDING GEAR DOORS
- Winnipeg, Canada

ENGINES
- GE-Evendale, Ohio
- Rolls-Royce-Derby, UK

FIXED AND MOVABLE LEADING EDGE
- Tulsa, Oklahoma

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Conclusions

- BIM is developing rapidly in tandem with growing internet access and capability
- BIM standards are key
- Exemplar projects show the way
- Change is NOW

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<td>Status Quo</td>
<td>Disruption</td>
<td>Exploration</td>
<td>Rebuilding</td>
</tr>
<tr>
<td>Reaction</td>
<td>Shock, Denial</td>
<td>Anger, Fear</td>
<td>Acceptance</td>
<td>Commitment</td>
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THANK YOU