The Use of BIM in Public-Private Partnership Projects

Presentation by

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Increasing complexity, high fragmentation, and inadequate inter-organizational collaboration result in poor project productivity performance.

Integration (flow of knowledge and information) is a key to resolve these problems.

Two levels of integration:

Technological Perspective (BIM)

Organizational Perspective (PPP)
BIM-PPP in Research
Part One
BIM [Definition [Framework]]

Part Two
[BIM Standards for PPP ]

Part Three
[Use of BIM in PPPs ]

BIM in Australia
Digital Engineering Framework

BIM in the UK
BIM Maturity Levels
The information delivery cycle

Role of BIM in PPPs

Implementing BIM in PPPs

Current Research Project
Centre for Smart Modern Construction (c4SMC)
BIM Definition

Building Information Model (BIM) (Product)
An object-based digital representation of the physical and functional characteristics of a facility.

Building Information Modelling (BIM) (Process)
A collection of defined model uses, workflows, and modelling methods used to achieve specific, repeatable, and reliable information results from the model.
**BIM Framework**

**BIM Fields**
- Technology
- Process
- Policy
- Interactions
- Field Overlaps

**BIM Stages**
- Pre-BIM
- Modelling
- Collaboration
- Integration
- IPD

**BIM Lenses**
- Depth of enquiry to identify, assess and qualify BIM Fields and Stages

*(Adapted from: Succer, 2009)*
<table>
<thead>
<tr>
<th>BIM Stage</th>
<th>Collaboration &amp; Integration Level</th>
<th>Main Attributes</th>
<th>Technology</th>
<th>Outcomes</th>
<th>Deliverables</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Modelling (object-based)</td>
<td>Low</td>
<td>No significant model-based interchanges between different disciplines</td>
<td>ArchiCAD, Revit, Digital Project, Tekla,...</td>
<td>2D documents, 3D visualization, basic data exports and light-weight 3D models (no modifiable parametric attributes)</td>
<td>Architectural design model, duct fabrication, door schedule, concrete quantities, FFE cost, 3D DWF, 3D PDF, NWD</td>
<td>Model-based interchanges between disciplines</td>
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<tr>
<td>2. Collaboration (model-based)</td>
<td>Medium</td>
<td>Interchangeable models through ‘proprietary’ and non-proprietary formats</td>
<td>Digital Project (3D object-based model) interchange with Primavera (scheduling) and Rawlinsons (cost estimating database)</td>
<td>.RVT file format (for interchange between Revit Architecture and Revit Structure IFC file format (e.g. ArchiCAD and Tekla)</td>
<td>Collaboration model within one or between two PLC phases 4D model (time analysis) 5D model (cost estimating)</td>
<td>Contractual relationships and higher details models (e.g. more steel fabrication details)</td>
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<tr>
<td>3. Integration (network-based)</td>
<td>High</td>
<td>Models are created, shared, and maintained across PLC Complex analyses of virtual design at early stage Project phases are overlapped (phase-less process) Collaboration is ‘spirals iteratively’ around the model</td>
<td>Servers (proprietary, open or non-proprietary formats) Single integrated/distributed federated databases Software as a service (SaaS)</td>
<td>Business intelligence, lean construction principles, green policies, and whole lifecycle costing</td>
<td>Interdisciplinary nD models</td>
<td>Contractual relationships, risk allocation and procedural flows</td>
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<td>4. IPD</td>
<td>Very High</td>
<td>Long-term vision of BIM (amalgamation of technology, processes, and policies)</td>
<td>All above</td>
<td>Horizontal, vertical, and temporal data integration and information management</td>
<td>Improved collaboration, coordination, communication, decision making</td>
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(Adapted from: Succer, 2009)
The Use of BIM in Public-Private Partnership Projects

[Part Two]

- **Part One**
  - BIM [Framework]

- **Part Two**
  - BIM [BIM Standards for PPP]
  - BIM in the UK
    - BIM Maturity Levels
    - The information delivery cycle

- **Part Three**
  - Use of BIM in PPPs
  - Role of BIM in PPPs
  - Implementing BIM in PPPs

- **Current Research Project**
  - Centre for Smart Modern Construction (c4SMC)
It was used to assist in the phased construction of Heathrow Airport’s Terminal three 1986

Robert Aish coins phrase “Building Modeling.”

2016
U.K. mandates BIM use for publicly funded projects.
BIM Maturity Levels

**Level 0** Unmanaged CAD
- Drawings, lines, arcs, text etc.,

**Level 1** Managed CAD in 2D or 3D.
- Models, objects, collaboration integrated, interoperable data

**Level 2** Managed 3D environment with data attached, but created in separate discipline models

**Level 3** Single, online, project model with construction sequencing, cost and life-cycle management information.
- Dictionary IFD (International Framework Dictionaries)
- Process IDM (Information Delivery Manual)
- Data IFC (Industry Foundation Classes)

**What level would you say is the highest level of BIM your organisation has reached on a project?**

NBS National BIM Report 2018

- 21% Level 1
- 70% Level 2
- 8% Level 3
The Information Delivery Cycle

Part Two
[BIM Standards for PPPs]

Relationship between elements of information management
Information Delivery Cycle – PAS 1192-2/PAS 1192-3

Project Information Model (PIM)
Levels Of Model Definition

- Modelling Standards
- BIM Method of Modelling Documents
- Data Exchange Protocols

A360 is to be used as CDE for all Shared and WIP work.

Models and documents are to be named as per the naming convention.

Individual team WIP areas are to be used and BIM coordinator is to facilitate the collation of issued models prior to data drops.

COBie (Construction Operation Building information exchange)

PA1:1192-2:2013
Recommendation 6

The Committee recommends that the Australian Government leads the formation of a suitably qualified and resourced Smart Infrastructure Task Force, led by Infrastructure Australia, on the model of the UK BIM.

Recommendation 7

The Committee recommends that the Australian Government, as part of its project procurement processes, require BIM on all major projects, exceeding $50 million in cost, receiving Australian Government funding, including projects partially funded by Federal Government in partnership with state.
Creating A Digital Asset

When data and information is managed effectively as a ‘digital asset’, this creates the ability for consistent and assured information to be re-used in all stages of project delivery and allows for seamless handover into operations and maintenance.
### BIM in Australia

#### Part Two

**BIM Standards for PPPs**

**Digital Engineering Framework Program**

**Interim Approach**

26th September 2018

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<th>Standards</th>
<th>Guidance</th>
<th>Engineering/Design</th>
<th>Information Management/CDE</th>
<th>Asset Information</th>
<th>Costing</th>
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#### Standards

**Guidance**

- **M** = Mandatory
- **R** = Recommended
- **C** = Mandatory with concessions

**Industries**

- **BS 1192:2007+AS2016**
  - Collaborative production of architectural, engineering and construction information - code of practice
- **AS 51193-2:2013**
  - Specification for information management for the capital andearly phases of construction projects using building information modelling (BIM)
- **AS 51192-5:2014**
  - Specification for information management for the operational phase of assets using building information modelling (BIM)
- **AS 51192-5:2016**
  - Specification for security-enabled building information modelling, digital built environments and smart asset management
The Use of BIM in Public-Private Partnership Projects

[Part Three]

Part One
- BIM Definition [Framework]

Part Two
- BIM Standards for PPP

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Role of BIM in PPP

Part Three
[Use of BIM in PPP]

How BIM can help?

• Monitor and evaluate asset’s life-cycle performance
• Measure and monitor sustainability
• Real-time information for accurate assessment of Value For Money (VfM)
• Management platform for a life-cycle information exchange

Challenges

• Changes in requirements
• Fixed-price contracts
• Lack of flexible collaboration models
• Lack of definition of BIM
• Tight schedule
Part Three
Use of BIM in PPPs

Framework to Implementing BIM in PPP

1. Establish Detailed Requirements (SPV)
2. Establish Data Capture and Common Data Environment (Quality Assurance and Control Consultants)
3. Create BIM Execution Plan (Design, Engineering, and Construction Team)
4. Develop Asset Information Model and Check Data Entered
5. Acceptance of Data Handover / COBie Spreadsheet

- Organizational Information Requirements (OIR)
- Asset Information Requirements (AIR)
- Employer’s Information Requirements (EIR)
- Project Information Model (PIM)

Relationship between elements of information management
Information Delivery Cycle – PAS 1192-2/PAS 1192-3
# Examples of BIM Functions for PPPs

## PPP Stages

### Initial Stages & The Project Selection

- **BIM Functions**
  - Information Formatting & Requirements of Stakeholders
  - Clear Project Brief
  - Site Brief/Information

- **BIM Tools/Carrier**
  - OIR
  - EIR

### Management /Partnership

- **BIM Functions**
  - Management platform for a life-cycle information exchange
  - Monitoring

- **BIM Tools/Carrier**
  - OIR, AIR, BIM 360, Infraworks 360
  - BIM 360, Navisworks

### Procurement

- **BIM Functions**
  - Tender Process
  - Compliance Checking
  - Scanning to ensure quality

- **BIM Tools/Carrier**
  - EIR, BIM Execution Plan
  - Autodesk Revit
  - Recap, Navisworks

### Implementation

- **BIM Functions**
  - Information Exchange
  - Construction Scheduling
  - Project Management
  - Energy Management

- **BIM Tools/Carrier**
  - BIM Execution Plan, COBie
  - Navisworks; ProjectWise; Tekla
  - BIM 360
  - AIR, Energy Plus
BIM processes are enabling successful PPPs by facilitating informed decision making among shareholders across the project lifecycle

Andrew Pryke, Managing Director, Royal BAM Group
Part Three
Use of BIM in PPPs

Centre for Smart Modern Construction (c4SMC)
Current Project

Project No. 5
Developing a Methodology for Integrating Blockchain Data with BIM for Construction Supply Chains

Prof. Srinath Perera

Dr. Ali Al-Ashwal

Dr. Rodrigo Calheiros

The research aims to develop a methodology to integrate the CSC operating in a blockchain platform with BIM for building and/or infrastructure projects.
Thank You

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