National Roads Conference 2015

Are you ready for Level 2 BIM?

Killarney 23rd September

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BIM Processes for the Organisation & Projects

- Project Lifecycle
- Collaborative Working
- What is BIM?
- Why BIM?
- BIM Requirements in Ireland
- Benefits to Transportation Projects
- RPS BIM Projects
Project Lifecycle

- Design Intent Model
- As Constructed Model
- Project Concept
- Initial Design
- Developed Design
- Construction
- Operation & Maintenance (O&M)
- Virtual Construction Model
Collaborative Working

Hardware
Software
Designers & Modellers
Employer
End User

Multiple packages / platforms with capacity to link seamlessly - Interoperable
Developed skillsets with relevant competence
Employer Information Requirement (EIR)
Operational Information (O&M)

Information Rich Model
Design Intent Model
Virtual Construction Model
As-Constructed Model (for use over Lifecycle of Project)

Project Information Model (PIM)
What is BIM?

Building Information Modelling
Three separate but linked processes

- Building Information **Modelling** – A business process that allows all stakeholders to have access to the same information

- Building Information **Model** – Is the output of the business process, a virtual computer model

- Building Information **Management** – using the model for a project lifecycle process

BIM alters the entire way in which a project is **procured, delivered, constructed and operated**. It is both a process and a deliverable.
Put Simply - This is BIM!

“It’s the economy stupid”
The BIM Process

Client Requirements
(Activity)

How?
(New Collaborative BIM Process)
Avanti findings incorporated into British Standard
BS 1192:2007

What?
(Data Rich Model – D/B/O/M)
“for the production of information to be truly lean we must begin with the end in mind”
PAS 1192 – 2:2013

Why?
(Avanti Research Project)
20% savings on wasteful activities

Now integral part of UK Government Project Requirements
Level 2 BIM

Value for Money - The Bottom Line!
UK Government Construction Strategy 2011

- Development of standards enabling all members of the supply chain to work collaboratively through BIM
- Requirement for fully collaborative 3D BIM by 2016

Other European and the US Government are stipulating similar requirements

Provides opportunities to work on major projects in the UK and Europe
BIM Requirements in Ireland

Current Tenders are looking for the following in advance of 2016:

1.23 Building Information Modelling (BIM)

**BIM Requirement.**
The use of a full level 2 collaborative BIM process is a requirement of this competition for Design Team Services. It is expected that the use of a BIM system will offer qualitative advantage to project development and delivery by facilitating more efficient design option studies and development and co-ordination of design information, maximising co-ordination between design team members identifying conflicts in design drawings and maximising accuracy in the scheduling and measuring of building elements. It is expected that the project will derive significant improvements in cost, value and carbon performance, through the use of open sharable asset information (BIM).

Please find attached the following documentation to assist you in formulating your prices:

A. A booklet of the current design drawings for each development,
B. Area schedules
C. A BIM capability questionnaire,
D. A scope of works document,

.... Level 2 BIM Certification is next !
Useful Documents

- UK Government Construction Strategy 2011
- BS 1192:2007 - Collaborative production of architectural, engineering and construction information
- PAS 1192-2:2013 - Specification for information management for the capital/delivery phase of construction projects using building information modelling
- PAS 1192-3:2014 - Specification for information management for the operational phase of assets using building information modelling
- CIC Protocol
- CPIX Online Templates (Pre-BEP, Post-BEP and BIM Capability Assessment Forms)
- BIM Task Group

RPS Breakfast Briefing Series 2015
Do you want the following?

- Improved Communications & Stakeholder Engagement
- Better Analysis (structure / energy / cost / programme)
- Improved Information Workflows
- Improved Design Coordination
- Improved Project Delivery
- Reduced Risk
- Value for Money & Cost Certainty
- Lower Capital & Operational Costs

….so you do want BIM!
Benefits to Transportation Projects

- **Collaborative Working**: Reduces risks, lowers costs, less variations
- **Clash Avoidance**: Reduces rework, conflicts, waste & delays
- **Information Planning**: Coordinated, timely & accessible information
- **Project Programming**: Efficient construction sequencing
- **Stakeholder Consultation**: Increases project appreciation & acceptance
- **3D Simulations**: Improved information workflows
- **Value**: Reduced capital & operational costs
Benefits of RPS/GMIT Collaboration

**Higher Diploma in Engineering In BIM (Level 8)**

**Year 1**
Semester 1 (12 Weeks)

**Year 1**
Semester 2 (Electives) (12 Weeks)

**Year 2**
Semester 3 (12 Weeks)

**Year 2**
Semester 4 (12 Weeks)

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**BIM Virtual Modelling**
Fundamentals of Structural/Architectural Models using Autodesk Revit Suite

**BIM Infrastructure**
Fundamentals of Engineering Networks and Road Design using Autodesk Civil 3D

**Electives**
- BIM Architecture
- BIM Structure
- BIM Infrastructure
- BIM Mep
- BIM Collaboration

**BIM Collaboration**
Fundamentals of Collaboration and Coordination within BIM using Autodesk Navisworks Manage

**BIM Research Project**
Analyse and evaluate in detail issues associated within actual RPS projects using primary and secondary research techniques

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**Benefits of RPS/GMIT Collaboration**

- **BIM Architecture**
- **BIM Structure**
- **BIM Infrastructure**
- **BIM Mep**
- **BIM Collaboration**
Project Level - BIM Process
Structured learning progression over a period of time

- **Level 0** – Unmanaged 2D CAD
- **Level 1** – Managed 2D & 3D CAD
- **Level 2** – Managed 3D environment where collaboration and information exchange (using individual models) takes place through a common data environment (to create a Federated BIM Model) – **UK Target 2016**
- **Level 3** - Full collaboration between all disciplines by means of using a single, shared project model which is held in a centralised repository – **Open - BIM UK Target 2019**
BIM at Contract Level

Figure 3 PAS 1192-2:2013

CIC Protocol puts in place specific obligations, liabilities and associated limitations on the use of the models.
Employers Information Requirements (EIR)

- **Information Management** - Level of Detail, Training Requirements, Planning of Work and Data Segregation, Co-ordination & Clash Detection, Collaboration Process, Health & Safety Requirements, Security & Integrity, Information included or not, IT Constraints, Compliance Plan, Coordinate System, Software Requirements

- **Commercial Management** - Information Exchange, Client BIM Model Requirements, Software, Responsibility Matrix, BIM Standards and Protocols, BIM Roles

- **Competency Assessment** - BIM Capability Assessment Forms

Irish Employers are now requesting the following in line with PAS 1192-2:2013 – “Collaborative Working”
Level of Model Definition (LOMD) for Building and Infrastructure Projects

See Figure 20 in PAS 1192-2:2013
Post BIM Execution Plan

- **Project Management** - Roles and Responsibilities, Project Milestones, Project Information Model Delivery Strategy, Survey Strategy, Existing Data, Approval of Information and Project Information Model Process

- **Planning and Documentation** – Capability of Supply Chain, Project Process for Collaboration, Responsibility Matrix, Task Information Delivery Plan and Master Information Delivery Plan

- **Standards and Procedures** – Volume Strategy, Project Information Model Origin and Orientation, File Naming, Layer Naming, Construction Tolerances, Drawing Template and Attribute Data

- **IT Solutions** – Software Versions, Exchange formats and data management systems
Design Outputs from BIM

Geometric Design Output
Design Outputs from BIM

Mass Haul Output

- Contractors site requirements
- Cut and Fill volumes & site movements
- Graphic representation of accumulated volumes
- Cut and fill volumes updated in real time

### Volume Summary

<table>
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<tr>
<th>Name</th>
<th>Type</th>
<th>Cut Factor</th>
<th>Fill Factor</th>
<th>2d Area (sq.m)</th>
<th>Cut (Cu. M.)</th>
<th>Fill (Cu. M.)</th>
<th>Net (Cu. M.)</th>
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<td>1.000</td>
<td>57417.079</td>
<td>15909.190</td>
<td>92781.237</td>
<td>76872.047&lt;Fill&gt;</td>
</tr>
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</table>

### Totals

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<th>2d Area (sq.m)</th>
<th>Cut (Cu. M.)</th>
<th>Fill (Cu. M.)</th>
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</table>

*Value adjusted by cut or fill factor other than 1.0

Geometric Design Output
### Typical BIM Capability Assessment

<table>
<thead>
<tr>
<th>G1.1</th>
<th>Are you prepared to issue your native CAD / BIM format files?</th>
<th>Yes, if required we issue native CAD/ BIM formats to clients in line with specific project requirements?</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2.7</td>
<td>Do you understand the ‘Level of Information” required at each of the project delivery stages?</td>
<td>Yes, before the project starts we produce a Levels of Model Definition for Building and Infrastructure Projects (LOMD). This document outlines the graphical (geometry) and non-graphical (COBie data drop information and client requirements) information required</td>
</tr>
<tr>
<td>G5.1</td>
<td>Are all your CAD / BIM Tools covered by a yearly maintenance agreement?</td>
<td>Yes, RPS pays annual fees for all our software maintenance and support requirements</td>
</tr>
</tbody>
</table>
M8/M73/M74 Motorway Scotland

3D Coordinated BIM Model – Alignment/Structures/Drainage/Utilities/Temporary Works/Signage/Road Markings/Lighting – Common Data Environment 4 Projects
Federated BIM Model

3D Coordinated BIM Model – Alignment/Structures/Drainage/Utilities/Temporary Works/Signage/Road Markings/Lighting – Common Data Environment 4 Projects
RPS use GIS data within BIM to effectively design and communicate during conceptual and preliminary design stages.

Flood Mapping & Constraints data can be draped across our Topographical model in 3D Max Design.

InfraWorks 360 can also be used in this process.

Flood Level – 10m
BIM for Public Consultation

Traffic Calming Options – BIM and available mapping
Scotia GAS – Traffic Modelling in Central London
RPS has survey teams with the ability to capture and post process Point Cloud Data into a BIM Environment – “appropriate surveys such as Point Cloud or LiDAR shall be provided to verify the completeness of the as-constructed model”
Thank You

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RPS is the largest integrated multi-disciplinary consultancy in Ireland. We have integrated a BIM philosophy into our design ethos across core disciplines including civil, structural and mechanical engineering and architecture. In this series of breakfast briefings RPS will outline the benefits and challenges of working in a **collaborative environment**, the **protocols** and **processes** required and **competencies** necessary to meet the upcoming UK Government 2016 deadline along with current requirements set out in recent Irish Government tenders.

Mark Costello is Director for BIM in RPS. He has over twenty years’ experience of large infrastructural projects. Mark is currently managing BIM delivery of major roads, water, pharmaceutical, healthcare and education projects. Mark has been awarded the BIM Accredited Professional badge of approval from the BRE Academy and is also a member of building SMART, CITA and Engineers Ireland. He is currently working with a multi-party BIM Committee in the UK which has been instrumental in **driving improved integration** and **collaboration** between clients, designers and contractors.