BIM A Multi-Disciplinary Approach
Are you ready for Level 2 BIM?

Engineers Ireland BIM: Transforming Irish Workplaces - 30th October 2015

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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 Multi-disciplinary Projects
- RPS BIM for Infrastructure
- RPS BIM in Structural Engineering
RPS employs over 5000 people in Ireland, the UK, the Netherlands, the United States, Canada, Brazil, Africa, the Middle East, Australia and Asia.

Since the beginning of 2010, we have undertaken projects in 125 countries across six continents.
- RPS employs over 580 staff in Ireland
- We have delivered over 50,000m² of buildings projects within a BIM environment since 2013
- BIM design process on a number of our large Infrastructural Projects
- Standards and Protocols in place as recommended in BS 1192:2007 and PAS 1192 – 2:2013
- BIM was always going to form an integral part of our approach to projects within RPS
Project Lifecycle

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

- **Hardware**
  - Multiple packages / platforms with capacity to link seamlessly - **Interoperable**

- **Software**
  - Developed **skillsets** with relevant **competence**

- **Designers & Modellers**
  - Employer Information Requirement (**EIR**)

- **Employer**
  - Operational Information (**O&M**)  

- **End User**

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**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”
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!
Why BIM?

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 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)

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

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

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

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

Benefits of RPS/GMIT Collaboration
Project Level - BIM Process

Project Information Model

1. Brief
2. Concept
3. Definition
4. Design
5. Build & Commissions
6. Handover & Closeout
7. Operation
n. In Use

Asset Information Model

- Documentation
- Non-Graphical Data
- Graphical Model

Common Data Environment

Design Process

Construct

Operate Maintenance & Use (PAS 1192-3)

Information Data Drop

1 2 3 4 5 6 7 n

Client Decision Points

1 2 3 6 7
BIM Maturity Levels

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**

Figure 1 - PAS 1192-2:2013
BIM at Contract Level

Figure 3 PAS 1192-2:2013
**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

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**Client Requirements - EIR**

**Pre-BIM Execution Plan**

- Project Plan for BIM
- Level of Model Definition
- BIM Capability Assessment Forms

**Contract Award**

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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

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**Contract Award**

**Post – BIM Execution Plan**

- Project Management
- Planning and Documentation
- Standards and Procedures
- IT Solutions
- Master Information Delivery Plan (MIDP)

**Test Interoperability**

**BIM Implementation on Project**
<table>
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<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>
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<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>
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BIM for Infrastructure
M8/M73/M74 Motorway Scotland

Dual three-lane motorway, 16km of motorway upgrades – undertake simultaneous BIM design process on Raith Junction – At grade to free flow junction
Federated BIM Model

3D Coordinated BIM Model – Alignment/Structures/Drainage/Utilities/Temporary Works/Signage/Road Markings/Lighting – Common Data Environment 4 Projects
Model existing surface / new surface - compare to minimise cut/fill requirements
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

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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>
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<td>15909.190</td>
<td>92781.237</td>
<td>76872.047</td>
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Totals

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<th>2d Area (sq.m)</th>
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* Value adjusted by cut or fill factor other than 1.0

Geometric Design Output
Geometric Design
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
Scotia GAS – Traffic Modelling in Central London
BIM in Structural Engineering
Industrial Facility
Advantages of Using BIM – Complex Design

- Production areas 13 m spans – roof trusses to hang 2 floor – plant areas on 1st and 2nd floors
- Existing facility to remain operational – no foundations near structure – cantilevered floors
- Large canopy to delivery area
- 5 stair cores/lift shaft large spans foundations to cantilever
- Cater for future expansion
Industrial Facility

Advantages of Using BIM – Existing Structure

- Connect into existing portal frame structure
- Add link corridor, access ramps, remove lift shafts
- Add additional brise soleil frame to hide building
- Protect existing block façade with protrusions
Industrial Facility

Advantages of Using BIM – Exchange of Info with Robot

- Information transferred to and from Robot SA to design and analyse structure.
Summary

- Utilise BIM Approach on wide range of multidisciplinary projects – has altered entire way in which a project is procured, delivered, constructed and operated.
- Allows detailed information to be developed and extracted at an early stage.
- Many advantages to allow designers to visualise and analyse design options – allow collaboration among large project teams.
- Issues still exist in the area of Interoperability, Ownership & Understanding.
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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.