

Building Information Modeling for Infrastructure

Paul Shillcock – Transport for London, UK

CI3836

The United Kingdom (UK) is experiencing an exponential demand for rail travel, combined with demands from passengers for safer, faster, more reliable trains. The only way to meet this demand today, and for future generations, is to invest heavily in the UK's rail infrastructure. However, in today's economic climate, rail infrastructure owners have to spend available capital wisely and ensure better outcomes, based on quality design and construction. This class looks at how UK rail infrastructure owners are adopting Building Information Modeling (BIM) as a key enabler to making informed business decisions throughout the life of the asset, based on accurate, complete, and unambiguous information. To achieve this, they are developing standardized processes and providing client leadership for their supply chain to build integrated teams with the capability and capacity to deliver their requirements.

Learning Objectives

At the end of this class, you will be able to:

- Describe the key terms and four levels of maturity in the UK
- List the key drivers for the UK implementation of Information Modeling
- List what infrastructure owners can do to increase their capability
- List the benefits of Information Modelling for infrastructure owners

About the Speaker

Paul currently has a strategic and business change leadership role in Transport for London, who move over 1 billion passengers around London each year and invest over £2.5 billion each year upgrading and increasing the capacity of their network.

He is a prominent industry figure in support of the UK Government's Construction Strategy as an active member of the Government BIM Task Group and Chairman of 'BIM for infrastructure'. More recently, he is co-authoring PAS1192-2:2012 "Information management for the capital/delivery phase of construction projects using Building Information Modelling", the long awaited sequel to BS1192:2007, due to be published by the British Standards Institution (BSI) in 2013.

Email: paul@operam.co.uk

Key Terms

1. Information Modeling

How we produce, use and maintain data.

2. Information Management

How we manage the requirements for data

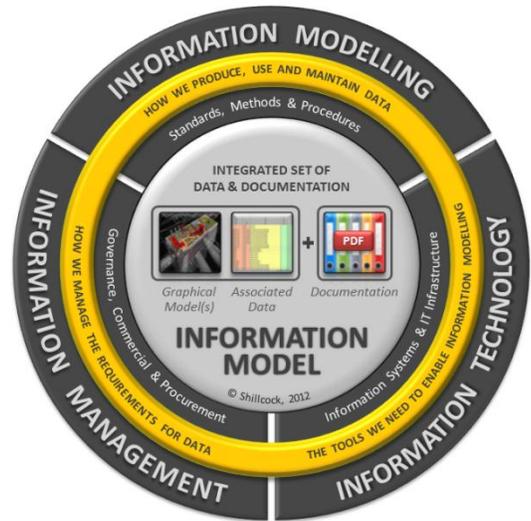
3. Information Technology

The tools we need to enable Information Modeling

4. Information Model

Integrated set of data & documentation comprising of:

- Graphical Model(s)
- Associated Data
- Documentation



Information Model Maturity Index

The following maturity index has been developed in the UK to articulate the level of sophistication used within the elements of the Information Model and the typical information exchange mechanism.

	0	1	2	3
Information Model				
Graphical Model(s)	2D Models (lines, arcs & text)	2D/3D Models (solid, surface & point)	3D Models (object-based)	3D Models (object-based)
Associated Data	Tables & Schedules (manual)	Structured Data (manual)	Structured Data (automated)	Structured Data (integrated)
Documentation	Paper/Electronic	Electronic (static)	Electronic (static/dynamic)	Electronic (dynamic)
Information Exchange	Post/Email	File Based Collaboration	File and Library Management	Extranet/Cloud

Key Drivers in the UK

Industry Reports

The following reports have been produced in the UK, each highlight the waste that exists within the construction industry and each make recommendations on how to improve industry performance.

1. Latham, M. (1994), Constructing the Team, London: HMSO.

The Latham Report, titled Constructing the Team, was an influential report written by Sir Michael Latham, published in July 1994. Latham was commissioned by the UK Government and industry organizations to review procurement and contractual arrangements in the UK construction industry, aiming to tackle controversial issues facing the industry during a period of lapse in growth as a whole. The Latham Report was not the first report to identify systemic failings in the UK construction industry; previous reports dating back to the 1960's had identified similar issues and made similar recommendations.

2. Egan, J. (1998) Rethinking Construction: Report of the Construction Task Force, London: HMSO.

The Egan Report, titled Rethinking Construction, was an influential report on the UK construction industry produced by an industry task force chaired by Sir John Egan, published in November 1998. Together with the Latham Report produced four years earlier, Constructing the Team, did much to drive efficiency improvements in UK construction industry practice during the early years of the 21st century.

3. Egan, J. (2002) Accelerating Change: Consultation Paper by Strategic Forum for Construction, London: HMSO.

In July 2001, the Strategic Forum for Construction was set up by ministers under the chairmanship of Sir John Egan. On 12 September 2002 it published Accelerating Change, a report on its first year of activity. This report also underlined the potential importance of information technology in achieving greater integration, and set the tone for future UK government initiatives, notably the drive from 2010 onwards under chief construction advisor Paul Morrell to implement building information modeling on all UK public sector construction projects.

4. Wolstenholme, A. (2009) Wolstenholme Report (Never Waste a Good Crisis), London: Constructing Excellence.

Never Waste a Good Crisis is a report from Constructing Excellence authored by Andrew Wolstenholme of Balfour Beatty Management. The report looks to determine the level of industry progress since Rethinking Construction and define the improvement agenda for the next decade.

5. McNulty, R. (2011) Realising the Potential of GB Rail, London: Department for Transport

An independent report of a study chaired by Sir Roy McNulty and commissioned by the Secretary of State for Transport. The report was jointly sponsored by DfT and ORR (Office of Rail Regulation) to examine the opportunities and barriers to improve the value for money of GB rail for taxpayers, passengers and freight customers.

6. Greening, J. (2012) Reforming our railways - Putting the customer first, London: Department for Transport

The Command Paper sets out the Government's vision for the railways, alongside the policies that are needed to realize that vision. "Making life better for customers – both passengers and freight users – is at the heart of our approach. We must also make the railways financially sustainable in the longer term, so they can contribute to the country's economic growth and environmental goals."

UK Government Publications

The following publications from the UK Government set objectives that infrastructure owners are being challenged to achieve.

1. Low Carbon Construction, Final Report (2009) Department for Business Innovation and Skills

This review looked at the strengths of and opportunities for the UK construction industry in a low carbon economy and considered how the UK can be a world leader in this sector. The review was led by Paul Morrell, the Chief Construction Adviser and undertaken by a mix of industry experts and those with wider business experience.

2. Infrastructure Cost Review, Main Report (2010) HM Treasury

This is a report of an investigation into how to reduce the costs of delivery of civil engineering works for major infrastructure projects. The report identified a number of drivers for the higher cost of construction in the UK compared to other EU countries and supports the view that higher costs for UK infrastructure are mainly generated in the early project formulation and pre-construction phases. The Infrastructure Cost review aims to address client organization and supply chain issues that are barriers to innovation and sustainability of the supply chain and significant drivers for higher cost. Efficiency improvements could lower the costs of delivery and realize potential benefits of £2-3 billion per annum

3. Government Construction Strategy (2011) Department for Business Innovation and Skills

The Government Construction Strategy is the framework for a range of workstreams, all of which have the ultimate aim of reducing the cost of government construction projects by 15-20% by the end of the current Parliament. Notably, the strategy mandated that Government would require fully collaborative 3D BIM on all centrally procured construction contracts by 2016. The Strategy was published in May 2011 and publicly launched by the Minister for the Cabinet Office, Francis Maude, in July 2011. On 2 July 2012, the One Year On report and Action Plan update were published.

The role of the Infrastructure Owner

The infrastructure owner (client) has a pivotal role to play in enabling the Information Modelling process. This role has been proven to be essential in the adoption of Information Modelling in other industries, such as manufacturing.

The infrastructure owners' role begins way before the Information Modelling process even commences and referred to as Information Management.

Infrastructure owners are strongly recommended to complete the following six stages prior to any project commencing.

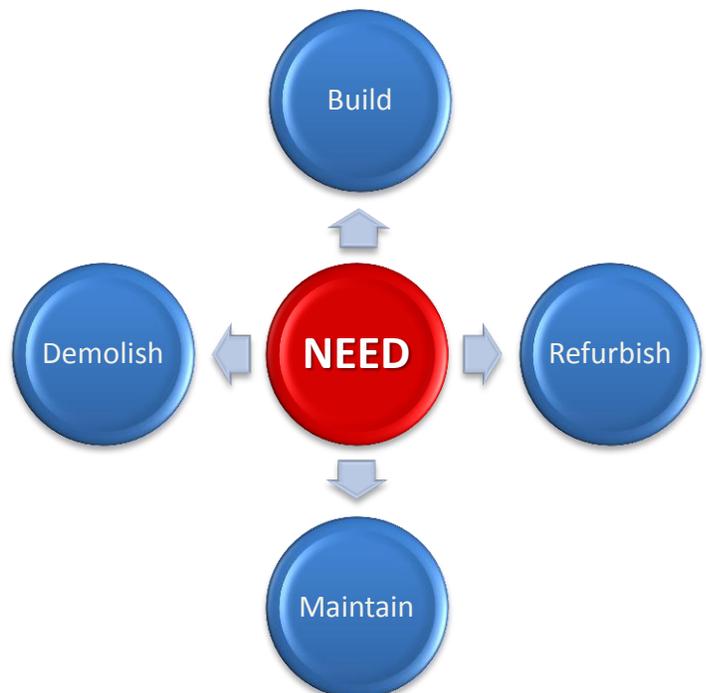
1. Need

At some point infrastructure owners will be faced with a business need which they need to balance with available funding. Typically, this need relates to an increase in demand for their core services and therefore an increase in capacity is required.

When a need is identified, the infrastructure owner needs accurate and complete information to make an informed decision as to what is the most viable option.

If this information does not exist, then the infrastructure owner needs to commission some sort of data capture, adding additional cost.

Only when a complete set of information is available, is the infrastructure owner able to provide an accurate estimate and a viable business case.

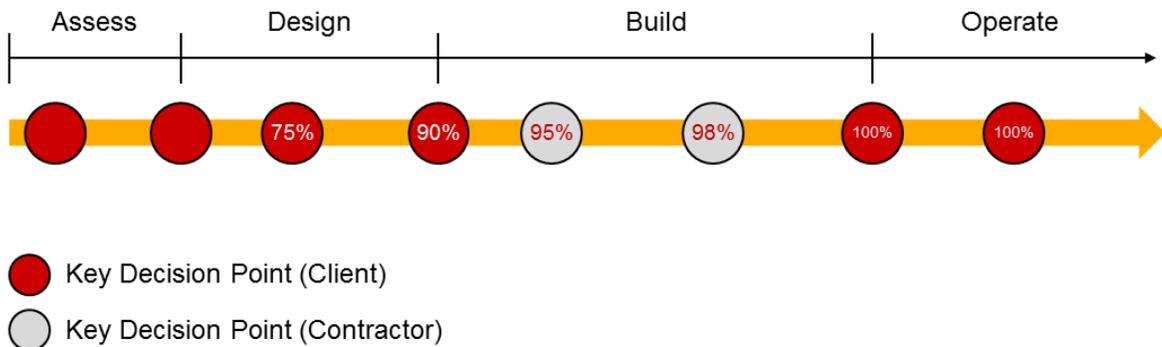


2. Requirements

Articulating requirements for information is often overlooked at the start of a project. Not only does the infrastructure owner have to capture project requirements, but also internal stakeholder requirements; such as operators and maintainers, and external stakeholders; such as local authorities and emergency services. Poorly defined requirements will inevitably lead to over processing of information, increasing the cost of the project.

Requirements for Information

- Why you need information?
- When you need information?
- What level of detail?



Standards

An infrastructure should mandate the use of any standards which enable the re-use of the data during and beyond the life of the project.

- File formats
- Naming conventions
- Location coding
- Data model/structure
- Object libraries
- Drawing sheets
- Grid reference system
- Status/revision codes
- Annotation

Methods

An infrastructure should mandate the use of any methods which enable the re-use of the data during and beyond the life of the project.

- Massing Strategy
- Volume Strategy
- Modelling Strategy
- Origin and orientation
- Level of detail (each stage)
- Method of measure
- Method of construction

Procedures

Procedures should be agreed prior to commencing any work, but they should be flexible and scalable, depending on the project requirements.

- Data Capture
- Production & Coordination
- Design review/approval
- Use (3D, 4D & 5D etc)
- Information exchange
- Maintenance
- Common Data Environment

References:

BS 1192:2007 Collaborative production of architectural, engineering and construction information. Code of practice

BS 1192 is the British Standard that establishes the methodology for managing the production, distribution and quality of construction information, including that generated by CAD systems, using a disciplined process for collaboration and a specified naming policy. BS 1192 is applicable to all parties involved in the preparation and use of information throughout the design, construction, operation and deconstruction throughout the project lifecycle and the supply chain.

BIP 2207 Building information management. A standard framework and guide to BS 1192

BIP 2207 provides a standard framework and comprehensive guide to BS 1192. It looks at best practice methods for the development, organization and management of production information – such as architectural drawings, engineering drawings and computer-aided designs – for the construction industry. Through a detailed explanation of the processes and procedures needed to improve the quality of production information, this book helps designers to better prepare their designs and graphics before the construction team takes over.

3. Procurement

Once the requirements for information are established, they need to be articulated in a clear manner, so that any potential supplier is able to accurately price for the work.

- Pre-Qualification
- Invitation to Tender
- Evaluation Criteria
- Contracts
- Risk/Insurance Profile
- Project Base Data

4. Execution

In response to the tender, each potential supplier should complete the following documents to enable the client to understand their true capability and capacity to deliver their requirements.

NOTE: This should also extend to their proposed supply chain.

- BIM Execution Plan
- Project Implementation Plan
 - Supplier Information Modelling Assessment Form
 - Supplier Information Technology Assessment Form
 - Supplier Resource Assessment Form
 - Supply Chain Capability Summary Form
- Roles and Responsibilities

5. Planning

The production of coordinated design and construction information is a task- and time-based process. Each task needs to be carried out in a particular order for the mutual benefit of all those involved. Information Modelling requires a different approach to the production of information, which often extends the traditional design stage, but shortens the build stage (due to less rework and improved planning)

- Non-traditional methods
- Information Delivery Plan
- Information Delivery Index
- Information Exchanges
- Responsibility Matrix
- Resource availability

6. Mobilization

The final stage is to ensure that everyone in each of one of the task teams has everything they need prior to commencing work, avoiding any costly delays.

- Training and Education
- Software
- Hardware
- IT Infrastructure
- Office moves
- Data collection

More Information

If you would like more information please feel free to contact the presenter:

paul@operam.co.uk or @paulshillcock