

FACTFILE:

GCSE CONSTRUCTION AND THE BUILT ENVIRONMENT

UNIT 1: INTRODUCTION TO THE BUILT ENVIRONMENT
UNIT 2: SUSTAINABLE CONSTRUCTION



Building Information Modelling (BIM) Concept

Unit

Unit 1: Introduction to the Built Environment
Unit 2: Sustainable Construction

Purpose of FactFile?

To give a basic understanding of the Building Information Modelling (BIM) Concept.

Specific Learning Outcomes supported by the FactFile?

Demonstrate knowledge and understanding of the main technical, managerial and professional occupations in the construction industry, and identify the main roles carried out by each: BIM Co-ordinator. The concept of BIM effects both the design, construction and in-use stages of projects, therefore a basic knowledge will be necessary to apply to other learning outcomes.

Target audience? Student? Teacher? Both?

Teacher and Student.

How the FactFile supports development of Key Stage 4 Statutory skills?

Supports the development of Communication Skills: Talking & Listening, Writing and Reading, Working with Others and Self-Management.

What is BIM?

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 includes building shape, design and construction time, costs, physical performance and logistics.

BIM is an acronym for Building Information Modelling. BIM describes the means by which everyone can understand a building through the use of a digital model which draws on a range of data assembled collaboratively, before, during and after construction.

Most importantly, BIM is not a technology. It is a process. This is possibly the most important aspect to understand. BIM applies to all aspects of the construction of a building, from the design, the estimating, the supply chain, the delivery of goods during the build, the build process, the resource allocation, the productivity requirements to meet targets, the post-handover phase through Facilities and Asset Management.

Why use BIM?

BIM brings together all of the information about every component of a building, in one place. BIM makes it possible for anyone to access that information for any purpose, e.g. to integrate different aspects of the design more effectively. In this way, the risk of mistakes or discrepancies is reduced, and abortive costs minimised.

BIM data can be used to illustrate the entire building life-cycle, from inception and design to demolition and materials reuse. Spaces, systems, products and sequences can be shown in relative scale to each other and, in turn, relative to the entire project. By signalling conflict detection BIM prevents errors creeping in at the various stages of development/ construction. In other words, problems with the building can be seen and rectified before they happen on site.

Disadvantages of BIM

- BIM requires more effort at the front end of a project to establish the initial framework. The payoff is that you are able to extract a much higher quality and greater quantity of information from that model. BIM allows changes to happen easily, so clients may continue to make changes late in the process, which can impact construction and design costs.
- BIM results in much larger file sizes than traditional CAD systems, and requires higher performing computer hardware to operate it effectively.
- Cost of not only the hardware and software used within BIM, but also the cost of training personnel to use BIM, with some estimations of 6-8 months training for individuals.

Different Levels of BIM

BIM is being used at a number of different levels:

Level 0

Unmanaged CAD, in 2D, with paper (or electronic paper) data exchange.

Level 1

Managed CAD in 2D or 3D format with a collaborative tool providing a common data environment with a standardised approach to data structure and format. Commercial data will be managed by stand-alone finance and cost management packages with no integration.

Level 2

A managed 3D environment held in separate discipline 'BIM' tools with data attached. Commercial data will be managed by enterprise resource planning software and integrated by proprietary interfaces or bespoke middleware. This level of BIM may utilise 4D construction sequencing and/or 5D cost information.

Is there any Government Target for BIM?

The Government target was to have fully collaborative Level 2 BIM on all public projects (above £4.35m threshold) by 2016. This requires all designers sharing their building models to ensure they are properly coordinated.

How does BIM differ from CAD?

CAD is a generally graphical representation of the geometry of a building – 2D or 3D, whereas BIM covers more than just geometry. It also covers spatial relationships, light analysis, geographic information, and quantities and properties of building components as well as embracing aspects of Finite Element Analysis.

CAD is used to create a graphical record of the building dimensions and layout whereas BIM facilitates the input and recording of critical design and maintenance information right from the start of the design stage, information which stays embedded within the Building Model throughout the life cycle of the building.

What is Autodesk Revit?

Autodesk Revit is building information modelling software for architects, structural engineers, designers and contractors developed by Autodesk. It allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements, and access building information from the building model's database.

How Revit works and who uses it?

The architect will begin building the design model in Revit Architecture. Revit architecture is built for the architect meaning that the architect can work the conventional way by creating a building plan. However, in Revit you are actually building a 3D model. You will have plans and sections instantly. There are some 3D works to do to complete the building, but it is minimal. There is also the option of drawing the plan in 2D AutoCAD, then when complete the plan can be imported into Revit.

At an agreed time, the architect will send his model to the structural engineer. He will also send a copy to mechanical, electrical and plumbing engineers. Each discipline will link the architecture model into their own work space within the discipline version of Revit of their choice (i.e. Revit MEP or Revit Structure). This means that they are telling their own discipline versions of Revit to connect to the model that the architect sent and show it graphically within the same space.

Once linked in each discipline, they will begin their own work. For the structural engineers, beams, trusses and columns and, for MEP engineers, ducts, pipes and electrical connections. When they have finished the engineers send their models back to the architect.

The architect will link each model into his architecture model, and they will show up in their correct locations. Additionally, all objects that the engineers created will contain all original information inserted within them.

The importance of BIM in the modern built environment

BIM can assist in the following areas of sustainable design: Building orientation (selecting a good orientation can reduce energy costs), Building massing (to analyse building form and optimise the building envelope), Day-lighting analysis, Water harvesting (reducing water needs in a building), Energy modelling (reducing energy needs and analysing renewable energy options can contribute to low energy costs), Sustainable materials (reducing material needs and using recycled materials), Site and logistics management (to reduce waste and carbon footprints).

The role of the BIM Co-ordinator

A BIM Coordinator will be an integral part of the design team, establishing and managing the BIM project workflow and being responsible for quality, clash detection and data conversion. Typical roles include:

- Developing and maintaining the BIM Model for the project;
- Ensuring teamwork and goals are delivered on time;
- Quality control procedures, ensuring all work is fit for purpose;
- Identifying clashes using clash detection software;
- Coordinating the project teams and liaising with the design team and client to ensure success.

Therefore the BIM Coordinator is a key figure in a project team, as they are responsible for the BIM workflow and ensuring that any potential issues are dealt with effectively. They also reduce costs and construction time and lay the foundations for the ongoing management of the completed building.

Student Activity 1

Research job descriptions for the BIM Coordinator, stating salary and qualifications required.

Conclusion

The initial cost of BIM software, hardware and personnel training will be far outweighed by the increase in work design firms will be able to do and the amount of on-site savings. The construction industry is changing in favour of BIM worldwide, meaning if we do not embrace the change we will not be able to compete for work on a worldwide stage.

Additional information sources

Student Activity 2

Students could use the following links to make further notes on BIM and prepare a PowerPoint presentation to present to peers on assigned topics.

<http://www.rics.org/uk/knowledge/glossary/bim-intro/>

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/34710/12-1327-building-information-modelling.pdf

<https://www.aconex.com/what-is-BIM>

