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BLOCK II COMPUTER TOOLS

BIMVET3 Tutorial No3

Title: READINESS TO APPLY BIM METHODOLOGY: KEY CRITERIA GROUPS

1 - Aims

The objectives of this tutorial are as follows:

To get acquainted with and be able to assess the level of maturity of the organization's preparation for BIM.

The main groups of criteria for preparation for the application of the BIM methodology are introduced.

The student is able to identify the main groups of criteria for preparation for the application of BIM methodology.

2 - Learning methodology

- The teacher will provide an explanation of material with examples.
- Students will read this lesson and analyse examples of the video.
- To evaluate the achievements of practical teaching, each student will write short descriptions and answer questions provided.

3 - Tutorial duration

The practice described in this tutorial will be carried out in a computer classroom.

It will last 1 teaching hours.

4 - Necessary teaching recourses

Hardware require: computer room with computers with access to multimedia and internet.

Required software: None

5. Tutorial Contents

READINESS TO APPLY BIM METHODOLOGY: KEY CRITERIA GROUPS

5.1 Introduction

In order to set goals or evaluate(self-assess) what level of BIM we are or want to be, accurate descriptions of BIM levels are created, tables that are usually provided in BIM normative documents. The aim is, that the process constitute the planning, design, construction and use stages.

BIM maturity levels are described by evaluating:

- BIM working methods;
- IT infrastructure;
- data exchange;
- BIM process management;
- BIM implementation strategy;
- BIM legal system.

5.2 BIM maturity levels

According to the expert findings, the organisation's readiness to use BIM should be assessed using the 4 maturity levels. For example, the lowest level of readiness is 0, which means that the organization is not ready to apply the BIM methodology and a forced transition to the BIM application would be difficult.

Moving towards a fully digitized, cooperative construction sector,should havethe planned stages and steps of BIM level.

BIM is a very broad term used to describe the development of a digital model. Models can be very various, such as buildings, bridges, roads, engineering networks.

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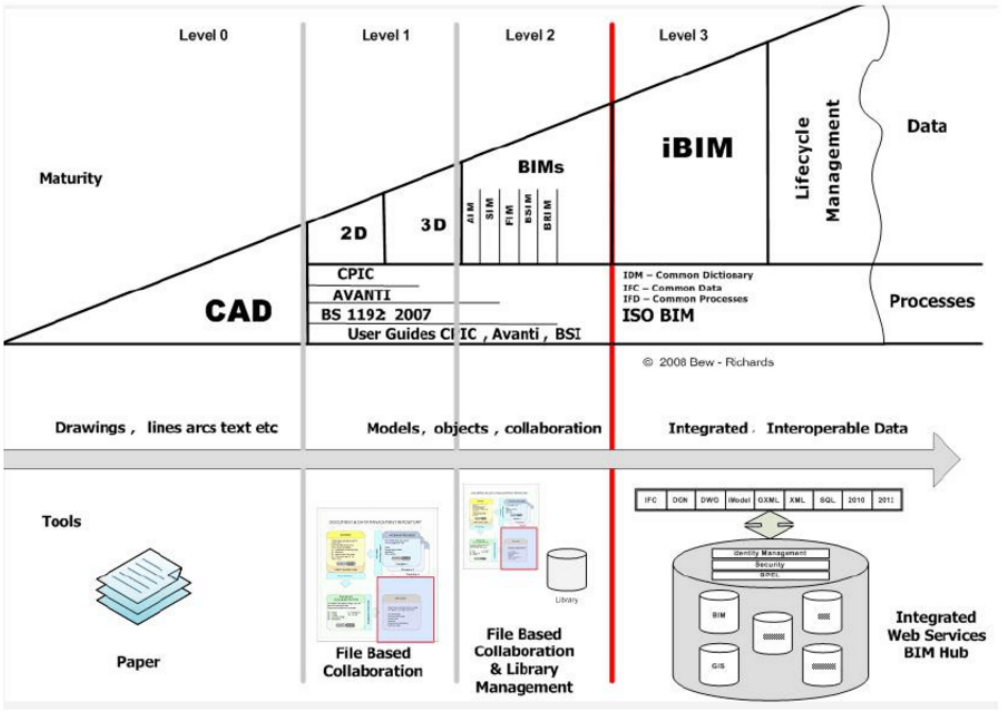

Fig 1. BIM maturity levels according to Mark Bew and Mervyn Richards

BIM maturity levels overview and the software used at each level.

5.3 BIM 0 level

It is the simplest form, level 0 effectively means no collaboration, includes 2D drawings. Engineering calculations and analysis are not related to the development of design information and development tools, they are performed manually or using specialized CAE (Computer Aided Engineering) software. Quantities and spreadsheets are also calculated and prepared non-automatically. Paper or electronic documents are used.

BIM 0 level – 2D CAD file information is stored on paper. The most likely mechanism for data exchange is the transmission of drawings in a electronic or paper format without clearly defined standards or procedures.

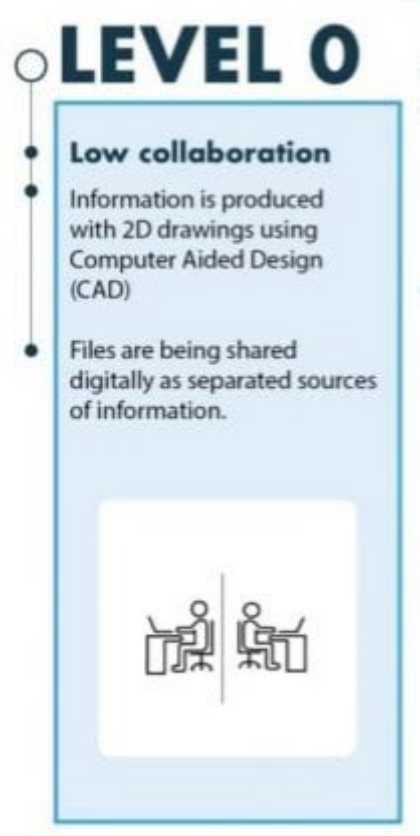

Fig 2. BIM 0 level

5.4 BIM 1 level

Level 1 BIM involves using 3D models and 2D documentation. Computer drawing standards and electronic sharing through a central database are used.

In the BIM Level 1 concept phase, 3D models are used and 2D documentation is used for debugging and production. Computer drawing standards and electronic sharing through a central database are already in use.

To achieve Level 1 BIM:

- Roles and responsibilities should be agreed upon;
- Naming conventions should be adopted;
- Arrangements should be put in place to create and maintain the project specific codes and project spatial co-ordination;
- A "Common Data Environment" should be adopted, for example a file server and then information to be shared between all members of the project team;
- A suitable information hierarchy should be agreed.

In this level, information from the 3D model can be transmitted to computing programs

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or disciplines.

BIM 1 level– 2D and/or 3D CAD models can be managed, common data environment is partially used.

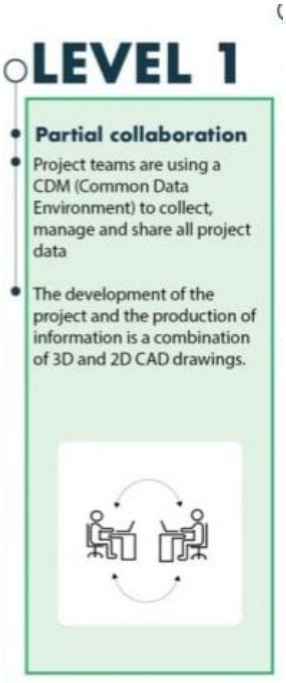

Fig 3. BIM 1 level

5.5 BIM 2 level

BIM Level 2 connect many interdisciplinary and collaborative Federated models. Models consist of both 3D geometric and non-graphical data, they are developed by individual project participants during the project life cycle, using Common Data Environment (CDE) to ensure a coordinated information management process.

In the example (fig 3) we see a Federated model that includes parts of architecture, structures, engineering systems. Specialized software is used to create such a model. In this case, the manufacturer's add – onWavinRevit was used, which means that the model has the exact geometry and all the manufacturer's attribute information.

Usually used general data environments, which run on cloud based application this ensures the availability of information from any location and using a variety of devices - computers, smart devices.

For successful data sharing, procedures are established, defining the methods how the data is shared or used by all project participants. The principles of data exchange are

based on various standards, normative documents, such as the ISO 19650 group, IFC (Industry Foundation Classes), COBie (Construction Operations Building Information Exchange) and others.

BIM models are stored as files. Later using software, central storage additional applications, appropriate models are used to solve different tasks, for example, to calculate estimates, to plan production, to manage logistics and etc. BIM process includes all stages of a building's lifecycle, and allows gradually to develop an information model, to move from a project information model to an asset information model.

BIM 2 level – managed BIM environment. 3D models with data and other related information are integrated into a single information model that can be completed by engineers individually.

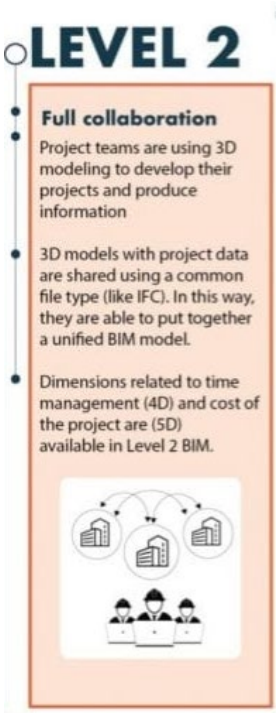

Fig 4. BIM 2 level

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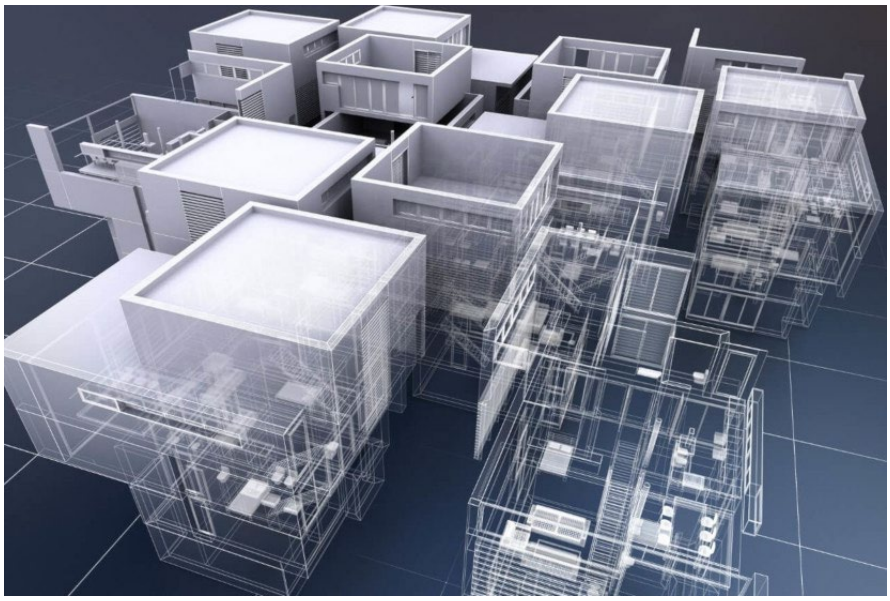

Fig 5. Project model

5.6 BIM 3level

BIM Level 3 changes how information is created and managed between different parties in the project - customers, designers, contractors, managers, etc.Working according level 3 of BIM are uses a common data environment in which all project participants work according to the granted access rights.

Modeling tools have direct interface with a project in central storage. When sharing information, export and import operations are not performed, that is, file formats become not relevant. When changes or updates occur, they are synchronized with the central model.

Such a principle, developed model example is given in Fig 5.

Central model is created on the shared environment server for the designer of each part,

Such as heating, ventilation and air conditioning, water supply and sewage, electrical engineering, creates local copies of the BIM model on computers. They have a relationship with the base model. When a designer changes or updates a model, it is possible to synchronize the changes with the central BIM model.

BIM 3 level – fully integrated and collaborative processes, clearly defined procedures, and responsibilities. One consistent digital information model that stores all the information generated during all stages of the SGC is created.

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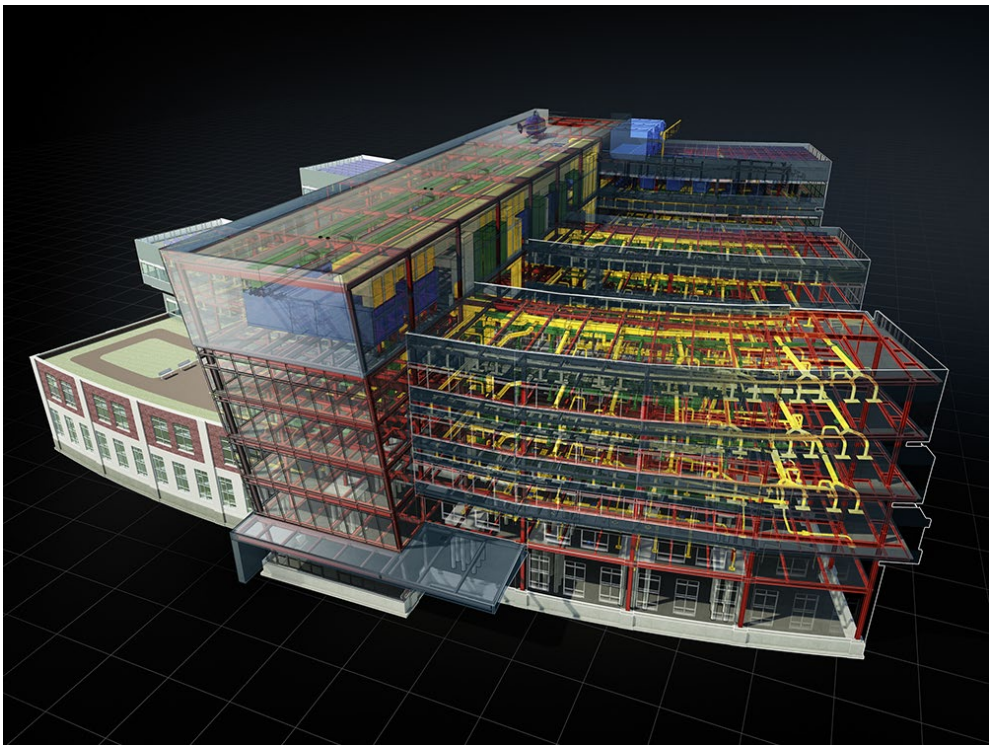

Fig 6.Project model

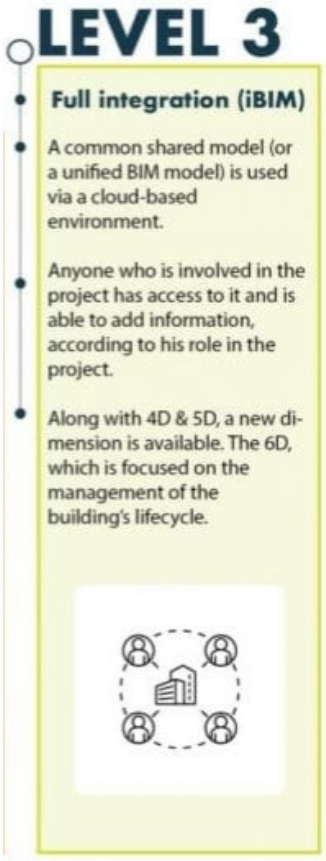

Fig 7. BIM Level 3

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Specialists create a structure of central and local models that the specialists in each part of the project see the models of the other parts, but they cannot make adjustments. If the designer sees a problem, such as where the duct crosses part of the pipe, and if we want to adjust the duct adjustment, the designer can go directly through the system and send request for responsible person.

Fig 8. Scheme of the central model

This allows to avoid losing information during data exchange.BIM software has the ability to connect to a central storage environment, review and save information, this ensures real-time collaboration and clear responsibilities of all project participants.

The purpose of BIM level 3 is to eliminate the exchange of information using a file structure. All data should be stored in databases. The developers of the BIM model will connect to the database using specialized tools and modify the content directly. Necessary protocols and procedures must be developed for this. BIM level 3 systems will have libraries with all the necessary product, installation information, which will be available by integrating manufacturers, BIM systems using services. These systems will include all Building Life Cycle processes, will integrate various technologies already mentioned BIM, GIS, AI, loT. Also will be developed Digital Twin, where we will have physical and integrated virtual reality.

5.7 Determination OF BIM levels

In assessing the working methods of the BIM we need to know, what information modeling is performed, for example, at the second BIM level (BIM 2), coordinated information modeling is performed, when PIM and AIM models are being developed.

These models are linked into one coordinate system, one common model is developed from the model of different disciplines. Visualizations, drawings, calculations, and other information are derived from the BIM model. In the first level (BIM 1), models are developed only for certain parts of the project, CAD technologies are used. If models are developed, they are not coordinated with each other. Standard 2D documents are usually provided as project results. 3D information models are used only to perform certain fragmented activities, such as calculations or visualization of a specific location.

In terms of IT infrastructure, the main differences are what technologies are used. At BIM 2 and BIM 3 levels cloud technologies are used, the information model or data base is accessible to interested parties if they are grantedrights. At lower levels, local area networks are used to transfer the required files to interested parties or upload them to the intended repositories. Working in this way no connections are maintained between files, links to each other.

The form of data management is taken into account when assessing data exchange. For example, at BIM level 2, is used Common Data Environment (CDE) with integrated task management. At the BIM 1 level, the structure of file directories is managed by the principles of a central repository, but it may not exist. At BIM level 2 data is transmitted automatically. Model creator works in its local location and the central storage system synchronizes the created information, files with the server in the cloud. BIM 1 information is exchanged in a semi-automated way. BIM 2 uses software formats such as DWG, RVT, DGN, DB1, as well as open formats IFC4, BCF, CObie, GML. At BIM level 1, DWG, DGN, PDF files are used to transmit drawings and other graphical information.

In Level 2 BIM tasks are managed jointly and coordinated. Project roles and BIM competencies are clearly defined and agreed. At lower levels there is no link between task management and traditional project roles.

When comparing BIM 1 and BIM 2 from the legal point of view, the main difference is that at level 2 compliance with accepted international national standards and classifications. At level 1 standards are only developed, adapted and used by project

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participants developed BIM / CAD standards. In this case, there are no BIM standards at level 0. At BIM level 3, the legal preconditions should be created to integrate the digitization of the construction sector into the overall strategy for the digitization of the European construction sector.

5.8 BIM maturity levels

Software solutions	BIM maturity levels			
	0 level	1 level	2 level	3 level
1. CAD software	+	+	+	+
1.1. 2D CAD software	+	+	+	+
1.2. 3D CAD software		+	+	+
1.3. Architectural CAD software		+	+	+
1.4. Constuction CAD software		+	+	+
1.5. MEP CAD software		+	+	+
1.6. Automated CAD module generation software		+	+	+
2. BIM software		+	+	+
2.1. Analysis software				+
2.2. Construction simulation software				+
2.3. BEP and Construction Schedule software				+
2.4.Project cost forecast and analysis software				+
2.5. Building performance management software				+
2.6. Common Data Environment (CDE) software		+	+	+
2.6.1. Collaboration software		+	+	+
2.6.2. BIM content management software			+	+
2.6.3. Building information modeling coordination software			+	+

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6. Deliverables

To assess the achievement of the practice, students will write a report of 2 pages maximum and will have to answer the submitted test questionnaires.

In this report, the student will explain the main groups of criteria for the application of the BIM methodology are introduced.

7. What we have learned

To get acquainted with and be able to assess the level of maturity of the organization's preparation for BIM.

The main groups of criteria for preparation for the application of the BIM methodology are introduced.

The student is able to identify the main groups of criteria for preparation for the application of BIM methodology.