ACCA SOFTWARE

The 7 dimensions of BIM – 3D, 4D, 5D, 6D, 7D BIM explained

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An intuitive overview to discover the different dimensions of BIM and the information flows involved in a BIM-based design

The **building construction environment** is exposed to new input and more information regarding the digitization and computerization of this sector.

Every time a specific type of information is specified into the model, a different dimension is set and, for this reason, various dimensions have been generated. As a matter of fact, according to BIM fundamentals there are seven recognized **"dimensions**".

3 dimensions are generally sufficient for geometric purposes. On the other hand, we can use new descriptive modalities and refer to other dimensions, such as time, costs, etc., so to introduce a different type of information.

The technical aspects of a **BIM based** design can be illustrated as follows:

BIM dimensions

What are the dimensions of BIM?

BIM doesn't simply mean the creation of the **3D model of a building.** It also implies adding information relating to its design, construction and maintenance phases.

BIM dimensions – 3D, 4D, 5D and 6D and even 7D, enhance the data associated with the model to share a greater level of understanding of the construction project. Adding extra information to data, in fact, enables you to find out how the project will be delivered, what it will cost and how it should be maintained.

The BIM dimensions, which refer to the levels of information in a given BIM data, are:

- **3D modelling |** geometrical**,** graphical information
- **4D time-related info** | construction sequencing by means of Gantt charts and timelines
- **5D cost analysis**| cost management, construction cost estimating, etc.
- **6D sustainability**| environmental, economic and social sustainability impact studies
- **7D life cycle and maintenance** | Facility Management: planning and management of maintenance operations throughout the building's lifecycle.

Find out more about the BIM software solutions that allow you to work more efficiently.

3D BIM is just a geometry modelling matter?

Using cutting-edge tools for reproducing construction digital models allows us to take care of the graphic detail of our design, while guaranteeing a realistic rendering of the aesthetic appearance and excellent geometric adherence of the modelled elements.

Problem that can be solved during the planning stage don't just concern the model rendering as such, being separated from the technical disciplines involved, but it also contemplates the **interaction of several roles involved/disciplines** as a key component of this methodology.

Activity management need, known as *"model checking"*, can be expressed with two separate operations:

- **code checking**, the verification of the model adherence to the project and to standards requirements.
- **clash detection**, the preventive analysis of the possible geometric conflicts present in the model.

It follows the need for a formal verification of what has been modelled in each discipline.

4D BIM: The time dimension to manage work schedules

4D BIM adds an extra dimension to a project describing task duration and timing in order to drive a 3D representation of how the building evolves in relation to the various construction phases.

Time management represents a fundamental aspect in construction planning.

Some of the traditional methods employed in this sector (such as **Gantt** and **Pert charts**) for the construction site or project time management have certain limits and critical issues:

- data loss from designer to the construction company.
- lack of communication between works management and suppliers.
- the effective presence and precise placement of materials on the construction site.
- the progress of works.

The continuous need to reduce, manage and re-organize project timing according to more dynamic and analytical evaluations can be satisfied when adopting certain new tools and methodologies.

The *"**WBS – Work Breakdown Structure**"*, for instance, as a data organization methodology, allows the site manager to subdivide the entire construction process into elementary time periods which are connected to the elementary parts of the model which are viewed as a logical progression of simulated construction phases for improved control and management.

5D BIM: quantity and cost estimate. A new strategy or a traditional approach?

The focal point of **5D BIM** is the "**Quantity Take Off**", which consists in the measurements extraction from a project to define the material/s quantity necessary for one or more elements modelling. Once this operation has been completed, it is necessary to choose the price items to be assigned to the construction works, with the relative unit price, and then determining the amount. Consequently, you can monitor the choices made by the quantity surveyor and verify if they match with the designer's ones.

Typically, the cost estimate updates in parallel with how the project design evolves, with the risk of data loss during the updating process (the probability is quite high!).

By making a comparison between the cost estimate and **4D BIM**, we can assess whether the result should be a static or dynamic product. The outcome can be linked to some aspects, such as maintenance, which are interconnected but treated separately.

Therefore, it is clear how the processes reconsideration, interaction and tools can streamline the information management, linking this last dimension to other aspects of the " building life cycle".

6D BIM: sustainability and energy efficiency

The sixth dimension concept is associated with aspects related to energy efficiency and the sustainable development of a new or already existing building. 6D BIM simulation practically allows an exhaustive analysis in terms of (economic, environmental, energy, etc.) sustainability of the intervention.
Analysing the energy performance right from the design stage provides the designer the most suitable technical solutions to be adopted to ensure lower energy consumption, greater quality and comfort thus guaranteeing the sustainability of the project.

7D BIM: the maintenance phase

One of the objectives of the **BIM methodology** is to create a virtual (three-dimensional and informative) model more faithful to what has actually been achieved. A model defined "*As-built*" includes, indeed, not only what has been designed, but also what is being built during the construction phase.

What is conceived during project phase, is traditionally reviewed and modified on the construction site to cope with possible variations during the construction building or for resolving geometric or operational conflicts not taken into account in the initial building stage.

This model is not to be intended as a model produced by a single "BIM authoring" software but as a product from a set of models made with a software and able to describe the construction work in an appropriate manner compared to the appropriate level of digital development required (LOD here intended as *" Level of Development "*).

The generated “model” must include the transmission of the information database built around the virtual representation of the “building object”, in order to preserve and transmit what has been designed.

At this stage, is the process to be considered completed? Moreover, can the delivery of what has been achieved be considered as a finished product?

When talking about “building life cycle” we certainly cannot disregard maintenance and dismantling aspects or the renovation of the building work.