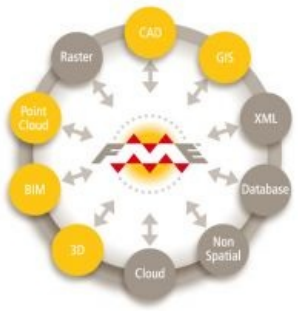
Interoperable Data Exchange â€“ A Key Factor for BIM

Interoperability is key in the building information modelling (BIM) context. Data diversity and interfaces, as well as possibilities for combining different data in BIM projects, are outlined in this article.



Hardly any other topic dominates the digitalization of the construction industry with such intensity as building information modelling (BIM). The pressure to reduce costs and to plan and build more complex buildings faster and more safely is increasing due to international competition. Interoperable data exchange between systems and players is a key factor for BIM. Previously used data formats have to be brought together with newer formats that are constantly undergoing a standardization process. This also poses an enormous challenge for the software systems used. This article contains a discussion of data diversity and interfaces in the BIM context and shows possibilities for combining different data in BIM projects.

BIM offers the possibility to map the entire life cycle of a building object. This includes the planning, construction, operation and deconstruction of a building. The BIM method favours the close cooperation of all experts involved in the construction process. However, those who work with BIM will undoubtedly be confronted with different data contents and formats. Whether for an existing object that is maintained and operated according to BIM or for a new project: the number of different data formats used, and their characteristics is large.

Interfaces in the BIM process

The requirements for information in the BIM method are that the data is up to date and generally available for all parties involved in construction. The BIM concept includes the partial components of data type, data creation and data exchange. Within the BIM method there is an open, standardized and manufacturer-neutral exchange data format, the Industry Foundation Classes (IFC). So why do we need to take a closer look at interfaces?

Merging of Tendering, Awarding, and Invoicing

Merging data from tendering, awarding, and invoicing with information on the building itself, such as statics and building services engineering, is an important part of a BIM project. For instance, in the tendering, awarding, and invoicing process, data from architects' or engineers' execution planning must be handed over to construction companies for the construction work.

The complexity of a project results in the need for interfaces for different types of information, both in the digital and in the real world. Due to the diversity of the software used, data exchange is a weak point in communication in the BIM process.

Figure 1: BIM data embedded in their environment (ArcGIS 3D web scene, displayed with map.apps)

The ongoing development of IFC

IFC was developed by the International Alliance for Interoperability (IAI) in 1995. In 2004, the IAI changed into buildingSMART. buildingSMART is continuing to develop the IFC exchange format and has defined the ISO standard ISO/PAS 16739. The current version of the IFC is IFC4.2.

In addition to the further development of the original IFC format, which was defined primarily for building construction, there are extensions such as IFC Bridge and IFC Rail. The development of these variants is at different stages, which makes it even more difficult for software manufacturers to implement them in the ongoing development.

Transformation of data from different sources

Different actors within a project usually use different specialist software, which is optimally adapted to their tasks. Different processing

focuses also result in different requirements for the data product. Accordingly, depending on the problem and the needs of the respective user, information must be extracted from data, processed or enriched. With a complex data model such as IFC, the data volume alone can be enormous, depending on the structure and export method, and cannot be processed further with every other application.

Where data from several sources are merged, it is usually necessary to carry out harmonisation and quality assurance. Depending on the volume and structure of the data, this can lead to extensive processes that require automated data processing.

Integration of geodata

For the planning and implementation of a construction project it is essential to consider the environmental influences that affect and emanate from it. Already during the planning phase, an exchange with environmental planners is of great importance. Issues such as noise protection, possible consequences of environmental changes or the basic assessment of environmental interventions and resulting compensation measures require a smooth exchange of data and information for the assessment of further measures and costs. In addition, there are legal contents, such as development plans or official property data, which also have spatial relevance.

Much of this spatial information is maintained as geodata in GIS systems and must now be combined with the building information from BIM. The formats and contents of the geodata are diverse: for example, raster data, point clouds or vector data, in various coordinate systems, with different topicality or complex contents. The intersection, analysis and processing of geographic information with construction data can be a considerable challenge for those involved.

Figure 2: FME as a data integration platform for BIM.

Tools for interoperable data exchange

The software used in the BIM context usually has import and export functions to handle different data formats such as IFC. One advantage of these interfaces is that they are usually optimally adapted to the internal data models and generate a valid export. In practice, however, it often turns out that the data structures created in this way cannot be used across systems.

However, special tools for data conversion and transformation of BIM, CAD and GIS data are able to close this gap and create a cross-system, semantic interoperability. Particularly user-friendly solutions have graphic-interactive user interfaces for defining the necessary process steps. As format-independent tools, they combine different work steps, such as integration and data harmonisation, quality assurance, data preparation and 3D data generation, in a single process, thus enabling smooth and highly efficient data exchange.

The most comprehensive support available on the market for spatial data integration is provided by the FME platform. It supports players in the BIM process by enabling them to read and write not only GIS and non-spatial data formats, but also BIM-relevant data formats such as Revit, BIM Collaboration Format (BCF) and IFC, as well as to automate workflows. Once a workflow is created, project data is processed much more efficiently.
