ALLPLAN
A NEMETSCHEK COMPANY

"NEXT LEVEL" BIM: ACHIEVING AN INTEGRATED WORKING METHOD IN SEVEN STEPS

WHITE PAPER

Digital design with BIM is continuing to advance everywhere. In addition to the benefits that architects, engineers and specialist designers can see – such as a high level of efficiency and maximum cost reliability in the design and building phase – it is the clients and real estate operators who are recognizing the added value of building information modeling with increasing awareness. But there are only a few regulations at the international level that shape the digital design method in projects. Every country seems to want to go its own. And rightly so: construction is anchored in the respective country's DNA. That means it is just as varied as the people themselves who shape the country's culture. Then there are the different professional profiles of architects, engineers and specialist designers. BIM must also take account of the resulting social characteristics – and still define design processes that have international validity.

For several years, many regional, national, international institutions and work groups have been working to define standards for digital design with BIM. It is all the more important since construction has become an international business. The overall construction costs which require a European-wide tender are relatively low. The directive 2004/18 EC regulates the point from which the so-called "EU thresholds" take effect across the entire EU. The current figure for public-sector buildings is EUR 5.186 million. Even for everyday construction tasks, such as building a primary school or a municipal multi-purpose hall, this threshold is quickly exceeded and has to be put out for tender across Europe. In general, members of the Government Procurement Agreement (GPA) can also apply for all projects above the EU thresholds. In addition to the EU member states, this currently constitutes 19 additional countries, including advanced industrial countries such as Switzerland, the USA, Canada, Norway, and Japan.

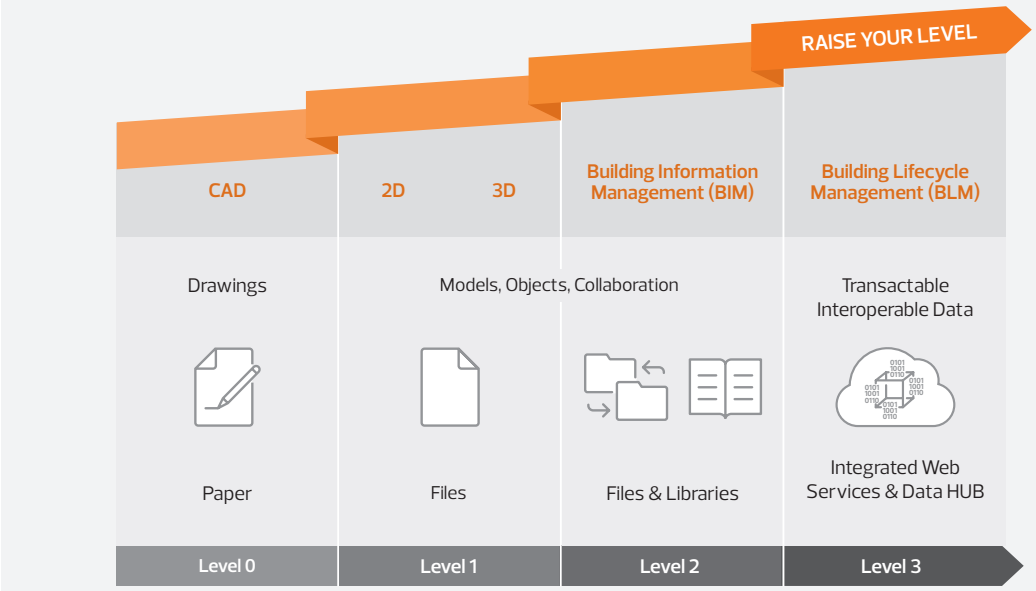
1. DEVELOPING UNIVERSAL DESIGN RULES

The fact that in theory a construction company with a design department from Tokyo could plan and build a new cafeteria for the University of Kassel on the other side of the world makes it clear: internationally valid and binding regulations are desperately needed for the BIM planning process. **One of the important basic parameters that buildingSMART, standards committees, and software manufacturers are increasingly adopting is the so-called BIM level.**
It defines the depth of BIM implementation within the respective project. Different levels are defined for this purpose – currently from 0 to iBIM in level 3. An update to level 4 and beyond is to be expected.

2. DEFINING THE BIM DESIGN DEPTH IN THE BIM DEVELOPMENT STAGES

In BIM levels 0 to 3, the development stages of construction design that are still relevant today can be placed in an evolutionary order. If level 0 assumes purely 2D-oriented CAD, which is solely based on graphic elements, then level 1 combines 2D and 3D information, which generates the initial advantages compared to 2D planning. In this way, modeling in 3D facilitates the understanding of the draft and specialized designs. In addition, simple collision checks of superimposed technical plans are also already possible due to the 3D view. The collision check ("clash detection") creates added value that is not present in level 0: automatically detecting mistakes in the design phase and rectifying these ahead of making expensive adjustments on the building site. BIM level 1 in different incarnations is still the standard today in many design offices.

With BIM level 2, we are referring to a consistent BIM working method. Level 2 is characterized by an object-based working method with specialist structured models, which are enriched with a wealth of information as part of the design process. Quan-



The BIM levels describe the BIM development stages from pure CAD to fully integrated database-driven design. Source: ALLPLAN

tities and volumes can also be derived just as plans and sections, or a logistics and building schedule of the future building site can be derived based on the structured model. This makes cooperation among specialist designers much easier and much more efficient. Above all, the coordination model consolidated from the specialist models, which centrally merges all relevant information, creates transparency and cost reliability. The object-based working method increases the importance of quality control in the structured model as well. All object properties (in addition to geometric information, this may be fire protection parameters, application areas, load limits, etc.) can be checked and utilized for model-based quality and error management. **BIM level 2 is the current working standard among the pioneers in the industry.**

3. SUPPORTING THE DATABASE-ORIENTED DESIGN PROCESS

BIM level 3 should be characterized by the integral working method that, unlike in level 2, is based on a database. **To allow BIM level 3, the BIM design process must be based on a uniform environment that is called a "Level 3 common data environment" (CDE)** (also see 6). The database-oriented modeling results in, among other things, advantages for better collaboration as well as comprehensive evaluation possibilities (such as calculating quantities). Tasks are localized, described, managed, and transparently communicated in a model-based fashion via the manufacturer-neutral BIM Collaboration Format (BCF). This makes it easier to rectify design errors as well as document and rectify building defects. This therefore dramatically increases the project quality. BIM level 3 thus takes the building operation into consideration in addition to planning and the building phase. The building life cycle thus has a complete continuity of data flow for the first time in BIM level 3. In addition, level 2 already requires openBIM: an open cross-manufacturer data exchange of information. And this is independent of the software solution used by the respective project participant.

4. CONSIDERING DIVERSITY WITH NATIONAL ADJUSTMENTS

In recent years, various industrial nations have been working intensively with the BIM method and thus with the definition of the BIM levels. In addition to the United Kingdom, these include the Scandinavian countries as well as the USA and Japan, which practice BIM at various levels. The United Kingdom is commonly considered as the world's pioneer when it comes to introducing this design method. Since April 2016, a "full collaborative 3D BIM" is required for public buildings, for which all relevant project information and building data as well as the necessary documentation must be available digitally. BIM has already been anchored in Scandinavia

A survey by the UK Institute of Civil Engineers (ICE) and ALLPLAN of 2019 shows that many civil engineers use BIM for their work. Half of the 241 respondents see a lack of awareness and understanding for BIM as an obstacle for the application in their company.

for more than ten years. In Denmark, it has been mandatory to use the method in all public building projects with a building cost of over EUR 2.7 million since 2007. In Finland, the largest state property owner also demanded in 2013 that submitted building models should always be delivered in the open IFC standard. Norway, on the other hand, sees BIM as generally required and only permits public sector projects to forego the BIM methodology in exceptional cases.

The implementation of BIM is not quite as advanced in the three major European economic countries of Germany, France, and Italy. **However, there are national efforts in all three countries to set standards. Work groups, interdisciplinary committees or national "BIM Task Groups" are developing country standards that are usually based on the introduced "British Standard."** In the coming years, they intend to establish BIM as a digital planning method for public buildings. In addition, the German-speaking countries of Germany, Austria and Switzerland have assumed a special role that is based on their historic diversity in the construction sector. Unlike in the United Kingdom, France, or Holland, the working range of architects in these countries is much broader. In German-speaking countries, it is normal that, after the building permit has been issued, an architect accompanies and coordinates their project until the keys are handed over to the client or is also responsible for the various specialist design phases as a project manager in major projects. This circumstance means they use an adjusted BIM working process that is individually derived from different countries or regions and is not identical.

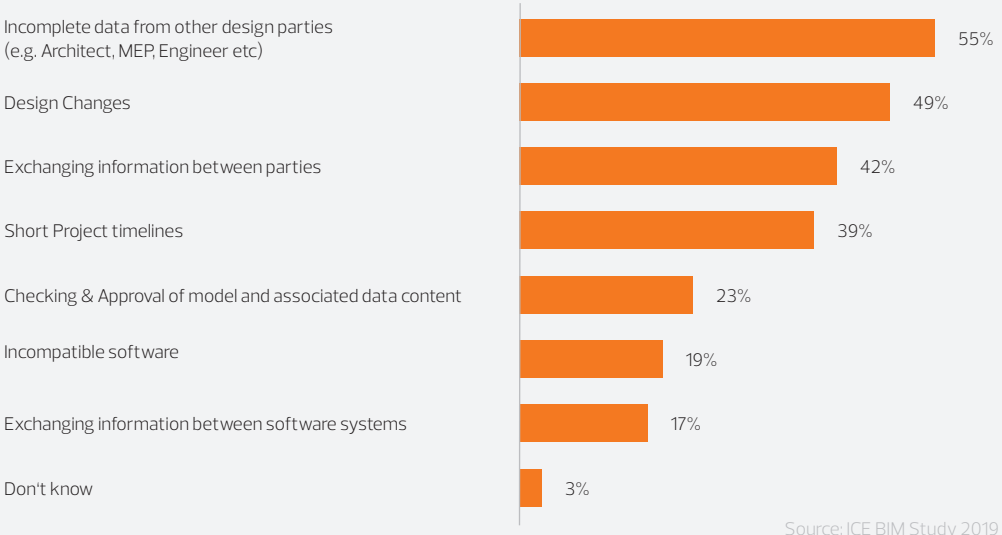
5. MEANINGFULLY SUPPLEMENTING STANDARDS AND REGULATIONS

Standards and regulations are necessary – although they are not intended to restrict design freedom. This applies to the standardization of digital planning with BIM too. **National guidelines such as VDI 2552 in Germany or DIN SPEC 91391, published at the end of March 2019, are available to support working with BIM.**
Internationally, the working method with BIM is described in ISO 19650, among others. ISO 19650 is derived from the British BIM Standard BS/PAS 1192, in which, among other things, the BIM levels were formulated). In parts 1 and 2, however, ISO 19650 only applies to information and information management. It does not, for example, apply to the collection methods and the quality of the conveyed information and the technology behind it.

ISO 19650 part 1 primarily defines the technical terms associated with BIM and for the first time provides clarity for many previously vague terms.

The participants of the ICE and ALLPLAN survey stated that they consider incomplete data from other project partners, design changes and data exchanges to be the most frequent sources of error in building projects.

WHICH OF THE FOLLOWING BEST DESCRIBES THE SOURCE OF ERRORS (IN THE DESIGN PROCESS) THAT LEAD TO INCREASED RISK IN PROJECTS?



Source: ICE BIM Study 2019

This was always necessary if people want to find a uniform and generally binding language at the international level in the coming years. Part 2 of ISO 19650 is the practical part of the standard and describes the processes in the planning and building phases. This is very abstract and is intended to be used as a standard process description for the general planning structure of every BIM project.

6. UNIFYING CDE: DIN STANDARD WITH INTERNATIONAL APPEAL

The DIN SPEC 91391 first introduced in March 2019, on the other hand, deals with the important topic of "Common Data Environment" (CDE) – a uniform and common data environment for BIM projects. It focuses on the file-based data exchange that currently prevails in practice, i.e. BIM level 2. In addition, it describes an interface concept for data and information exchange between CDEs from various providers. It exists in two parts.

Part 1 details the advantages of a common data environment for a model-based and collaborative working method in the BIM project. It introduces the components of conventional BIM Level 1 project rooms and describes the range of functions that are necessary to be able to use them in BIM Level 2 projects.

Part 2 presents the concept of an open interface for data and information exchange between different CDEs. The aim is a loss-free exchange of data and information between the different platforms used throughout the building lifecycle. The basic principles of an openCDE interface described therein will be further developed by an international working group led by buildingSMART International. Since part 1 of DIN SPEC 91391 describes the current standard file-based approach (see 7) of information and data management, i.e. firmly located in level 2, openCDE also considers level 2 and is not yet database-oriented3. A continuation of the requirements of open CDE interfaces in BIM level 3 is therefore to be expected.

7. USE BIM LEVEL 3 TODAY

ALLPLAN provides a database-driven cloud solution Allplan Bimplus, a tool that already meets all the requirements for BIM Level 3 communication in the area of model management, the technological basis for which is to support an open and transparent BIM process. **This technology currently allows all native model data of building components with their information to be centrally administered on a fine-granular basis and consolidated to form a coordination model.**

This enables high-performance and dynamic data management for a smooth BIM process – even for very large and highly-attributed BIM models. **Allplan Bimplus goes beyond the boundaries of file-based project spaces and already offers the future technology for linking and professionally managing building information over the entire life cycle.** Its open API also ensures that Allplan Bimplus can be integrated into any system landscape, showing it truly as a digital data hub. No special software is required to use Allplan Bimplus other than an Internet browser. This saves administration effort and provides barrier-free access to model information for all project participants, regardless of the operating system or terminal device used.

ABOUT THE COMPANY

ALLPLAN is a global provider of Building Information Modeling (BIM) solutions for the AEC industry. For more than 50 years ALLPLAN has pioneered the digitalization of the construction industry. Always focused on our clients we provide innovative tools to design and construct projects – inspiring users to realize their visions. Headquartered in Munich, Germany, ALLPLAN is part of the Nemetschek Group. Around the world over 400 dedicated employees continue to write the ALLPLAN success story.

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