

OCTOBER 2017

Newsletter

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ICT / CONSTRUCTION

Digitalization of the Construction Industry with BIM

Digitalization will not spare the construction industry. With **BIM** (Building Information Modeling), digital work processes will find their way into planning and construction as well as real estate and facility management. BIM has many advantages - but brings new challenges which must be addressed in contractual provisions.

1 WHAT EXACTLY IS BIM?

1.1 VIRTUAL BEFORE REAL BUILDING

BIM (Building Information Modeling) stands for the idea of creating a building **first in a virtual model – and only then in reality**. With BIM, a digital (virtual) 3D-model is created, comprising information relevant for the construction and the building itself. This digital information is then available for the entire lifecycle of a building - from planning, construction and facility management to deconstruction.

1.2 FROM THE PAPER PLAN TO THE 3D-MODEL

The core of a BIM project is the **digital building model**. The planners' (architect, civil engineer, plumbing engineer, etc.) work is incorporated into this model. Instead of a large number of paper plans, a virtual 3D-model is created. In addition to the 3D-visualization, this model contains **all**

construction-relevant additional information (such as e.g. materialization and costs). The information can be centrally managed and used for various applications (such as cost calculation, construction planning, facility management, etc.).

There are **two possible approaches**. Firstly, it is possible for the project participants to work **on the same model**, if they are all using the same software (so-called *closed BIM*). This is usually the case when a total or general contractor uses BIM for internal coordination. Secondly – and this is the more frequent approach – the participants use their own software, which is tailored to their specialist area (so-called *open BIM*). In this case, all specialists create **their own specific models** (e. g. electrical, static, ventilation, etc.), which are then regularly combined into a **coordination model**.

1.3 NEW ROLES AND RESPONSIBILITIES

BIM requires a specific IT infrastructure and corresponding processes. The use of BIM in a construction project sets high requirements for the contractual, technical, organizational and planning processes.

In order to be able to cope with these requirements, new functions have emerged: The **BIM manager** takes care of the technical and organizational handling of the BIM project (securing the technical infrastructure, the data exchange, the related technical processes, etc.). The **BIM coordinator**, on the other hand, is responsible for construction-related issues (coordination of the individual models and assuring the overall planning quality). The task of BIM coordinator is usually assigned to the architect.

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2 WHAT IS THE BENEFIT OF BIM?

2.1 EFFICIENCY GAIN THROUGH DATA FLOW

BIM promises to **increase efficiency** by facilitating the **continuous flow of information**. Depending on the implementation model, all parties involved can access the data and use it in their respective areas. For example, the specialized engineer can build his design on a reference model provided by the architect and has thus only to supplement it with his specific contributions. Similarly, the executing contractor can feed the data into his construction machines in order to have them carry out automated work, or prefabricate certain building components based on the data at hand.

The data of the BIM model can be used **throughout the entire lifecycle of a building** (i.e. also for management, subsequent conversions, deconstruction, etc.). Since around 80% of the costs of a building are incurred during the operating phase, there is a great savings potential which can be realized with BIM.

2.2 EARLIER DETECTION OF MISTAKES

In the virtual model, **planning mistakes** can be detected earlier and thus avoided more easily and cost-effectively. **Mistakes during the execution** of the construction can also be better controlled. An *as-built model*, created by laser-assisted measurement of the actual physical structure (once built) can be used to check whether the built structure corresponds to the planned model.

In addition, planning and execution mistakes are **easier to prove and to allocate**. The virtual model and its digital history can be used to determine precisely when the mistake happened, where it occurred and who was responsible. However, this requires that the responsibilities, in particular any potential specific control obligations, have been accurately assigned in the contract (see section 3).

It is also worth noting that, with the virtual building model, the employer can gain a better understanding of its future building already in advance. This way, any misunderstandings or misaligned expectations can be cleared up already at an early stage.

2.3 MORE CERTAINTY IN COST AND PLANNING

The planner can use the BIM information to create the bill of quantities and perform software-based checks to determine whether all components for the planned building are included in the required quantity (e.g., correct number of rivets for the support beams). This means more reliable bills of quantities and more accurate **cost estimates** already at the time of planning. This can help to avoid (or at least to better manage) change orders and the resulting additional costs.

With BIM, the construction process and the logistics can be simulated and planned in detail in the virtual model already in the planning phase. This means that delivery dates can be determined earlier and queues, delay costs and friction losses can be reduced. This leads to a **reduction of disruptions in the construction process** and to more reliable planning.

2.4 LESS POTENTIAL FOR DISPUTES

If the contracts have been drafted carefully, in particular regarding the allocation and scope of the tasks and responsibilities of the project participants, as well as of the appropriate fee arrangement (see section 3.3), BIM has the **potential to reduce disputes**. The fact that mistakes and defects can be detected or avoided earlier, that costs can be estimated more accurately and that the processes can be planned more reliably can help to prevent disputes between the project participants. This benefits all players in the construction industry, since construction disputes are usually complex, costly and time-consuming.

3 LEGAL ASPECTS

BIM does not fundamentally change the rights and obligations of those involved in the project. However, **new challenges arise**. Since corresponding standards and norms are still in the development stage, a BIM project will currently have to be regulated by **appropriate specific contractual provisions**.

3.1 NEW CHALLENGES

The new challenges raised by BIM are:

- > In Switzerland, BIM is still in the development phase and the **implementation effort** is therefore high. Not all players already have full BIM competence and capacity. The employer will have to define much earlier and more precisely which data it wants to receive from the planners, and for what purpose. The **precise definition of the services** expected from the involved parties and the **allocation of risks and responsibilities** can be demanding.
- > BIM requires closer cooperation between all project participants. This places additional requirements on the **organization and implementation** of a BIM project. Planners will have to provide **new services** (e.g. data-related work steps). Finally, on the project timeline, the planners' **tasks and services** are shifted to earlier project phases, which must be reflected in the remuneration mechanism.
- > BIM leads to more **transparency** in the construction project. The planning and work stages of each project participant are easier to trace in the digital model. If defects or mistakes are detected later, they can be

attributed more easily to a party. This makes it easier to prove defects and provide evidence regarding mistakes made.

3.2 STANDARDS ARE BEING DEVELOPED

The existing norms and standards (such as SIA 102 / 118) do not yet reflect BIM. However, standardization efforts in connection with BIM are underway, especially from **SIA** (Swiss Society of Engineers and Architects), **KBOB** (Coordination Group of the Public Employers), **CRB** (Swiss Center for Construction Rationalization) and **Building Digital Switzerland** (abroad, some corresponding standards already exist, at least in part). However, there is currently no firmly established practice on how to apply these standards.

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3.3 CONTRACTUAL PROVISIONS REQUIRED

In order to address BIM-specific aspects, **appropriate specific contract provisions** are required in the following areas:

- > **BIM as a working method** is not yet standard. The parties involved in the project must therefore be required to use BIM. It is also necessary to define what exactly is to be understood by "BIM" in the project at hand – and what exactly the employer wants to see implemented. This includes specifications regarding the **BIM work products to be delivered**, in particular which models are to be supplied for which purposes (e.g. energy analysis, construction, facility management, etc.), in which data format and in what level of detail.
- > In principle, in a BIM project (like in a traditional project), **each party involved is only liable for "its own domain"**. However, with BIM there is much less certainty as to which services fall within whose domain. Therefore, the BIM services to be performed and the BIM-specific roles must be defined and accurately assigned to the individual project participants. Only then can the **responsibilities and liabilities** of the involved parties be allocated properly.
- > When defining the remuneration mechanism, it should be taken into account that in a BIM project, additional BIM-specific services must be provided. In addition, the **workload of the planners is shifted** to earlier project phases compared to traditional projects.
- > **Information technology aspects** (e.g. regarding software, licenses, data storage and data control, data exchange and data formats) as well as questions regarding **intellectual property rights and licensing** must be addressed: Potential copyrights must be addressed in such a way that the use cases of the BIM project (e.g., facility management) can be achieved.

3.4 COMPATIBILITY OF ALL CONTRACTS

The individual contracts of the project participants have to be coordinated with respect to BIM in order to ensure a

smooth project execution. BIM-specific **general contract terms** ("BIM-GCT") can be used to address the legal aspects of BIM, by making them an integral part of every contract with all parties involved (architect, planner, construction company, etc.). A **BIM project execution plan** ("BEP") addresses the project management, organization and execution, terminology and milestones of the BIM project. BIM-GCT and BEP together define the basic BIM principles for all parties involved.

4 CONCLUSION AND RECOMMENDATION

BIM is an important step in the construction industry's **(digital) future**. The potential **efficiency gain** is considerable, especially for an employer managing its own buildings, because the data created with BIM can be used throughout the entire lifecycle of the building. A successful implementation of a BIM project requires an appropriate **organization** and a **project coordination** focused on BIM. The increasing importance and potential of BIM is also reflected in the fact that, increasingly, public tenders prescribe BIM.

BIM requires a lot from planners, entrepreneurs and employers alike. Accordingly, all project participants must be required to comply with the project-specific BIM specifications. This presupposes that the **contractual provisions are tailored to BIM** and that the specific features of a BIM project are adequately addressed. The BIM-specific provisions must be aligned with the objectives of the employer and the competences and capacities of the project participants.

When implementing a BIM project, it is advisable to involve **technical and construction specialists** at the earliest stage possible and to ensure that the **contractual provisions are properly drafted**.

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