



Creative Construction Conference 2014, CC2014

## Integration of document- and model-based building information for project management support

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### Abstract

In spite of the upcoming BIM based work paradigm and related technologies in the AEC sector traditional semi- and unstructured documents, like formwork or reinforcement drawings, will remain an essential part of the overall project information resources. Such kind of documents are still the basis of the daily work in construction projects and are, in contrast to a BIM, valid as mandatory objects of agreement and integral parts of contracts. Therefore document management will remain a crucial part of the overall project management. Based on the fact that in the frames of practical projects traditional documents will coexist together with model-based building information the existing technological separation between those different worlds of information is counterproductive and out-of-time since it may cause information losses, inconsistent information resources and hinders an adequate and project wide adoption of BIM technologies. The aim of this work is to develop a practical method that allows for the use of IFC building information models within a database-driven project management environment to make model-based building information available for project and document management purposes. The proposed method will establish an integrated overall project information resource constituted by a persistent linkage between elements of the building model and the associated documents.

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Peer-review under responsibility of the Diamond Congress Kft.

*Keywords:* Building information modeling; document management; project management; IFC; data integration; document-object-links

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### 1. Introduction

Building information is been represented traditionally by semi- or not formalized documents like construction drawings, specifications for building systems and material lists. Due to the upcoming method of Building

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Information Modeling (BIM) the traditional way of building information representation is shifted to a model-oriented approach where the overall building information is stored in a commonly shared comprehensive building information model that allows for on demand retrieval of information subsets needed by downstream tasks and business processes [14]. Whereas the model based approach is widely adopted in the early project phases, e.g. for design, clash detection and coordination of disciplines, traditional documents are still the dominant information resource in the later project phases. In terms of practical projects this mostly results in a complementary but technological separated use of document and model based project information. Accordingly, existing BIM software applications and tools already used in practical projects are mostly focused on design phase offering functionality e.g. for building design, modeling and (3D) visualization. Downstream building life cycle phases like construction, operation and maintenance as well as general project management are still weakly supported by appropriate BIM tools. This might be one of the reasons for the slow implementation of the BIM work paradigm in the AEC industry [5] [8], in spite of the well documented benefits especially with regard to the later building life cycle phases [1]. This leads to a technological gap within the overall process chain and a setback from new model based working to traditional document based processes. Based on the fact that in the frames of practical projects traditional documents will coexist together with model-based building information the technological separation between those different information resources is counterproductive and out-of-time since it may cause information losses, inconsistent information resources and hinders an adequate and project wide adoption of BIM technologies. From this point of view a complementary linkage between model and document based building information on data level is supposed to re-connect the interrupted overall information process chain by establishing an integrated project information resource [7].

In practical project environments the use of document management systems (DMS) is common practice in order to cope with the large sets of documents generated during the project lifecycle. Modern DMS provide at least for archival storage of various types of documents, document lifecycle management and document retrieval ensuring reliable access to the set of stored documents. In most practical applications a DMS is integrated into a project management information system (PMS). A PMS allows for assignment between a set of documents and related (pre-defined) business processes in order to specify and control the workflow and information delivery with respect to the project requirements. However, in almost all cases the inclusion of a document into the DMS database is based on an alphanumeric document key stored in the document file name. The document key is created manually by the document owner (according to a given project specific document key schema, i.e. a given list of attributes and predefined sets of attribute values) and decrypted by the DMS based on predefined rules. This approach has several drawbacks since it is error-prone and restricted to a very small set of building and document information, consequently limiting the document retrieval and management capabilities offered by the DMS.

An alternative approach to this would be the application of embedded, descriptive document metadata which may serve as a bridge between unstructured/semi-structured and structured project information resources [10]. Document metadata represents structured information which can be used to describe the document content, its structure or administrative information to support resource management [11]. In combination with BIM-CAD authoring tools a significant part of the descriptive document metadata required for document management and information integration could be derived directly from the internal building model without the need for manually rework. Such kind of metadata enables a computer interpretable connection between a document and the related content of the corresponding building information model based on automated workflows for document validation, inclusion and integration. Furthermore, the capabilities and functions of new BIM data management tools and methods (e.g. model querying, 4D/5D model analysis and simulation, change management and model comparison) will become available for practical document and project management business processes if a reliable connection between the document and the model based information resources exists.

## **2. Link methodology**

The suggested methodology aims to integrate document and model based information resources based on the application of explicit document-object-links which can be generated automatically and stored in a DMS data base.

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