

Abstract

The introduction of Building Information Modelling (BIM) is providing the design, construction, and operation of buildings with an enormous amount of digital data. The availability of this data allows processes to be automated and decisions to be made based on data. The adoption of BIM by building authorities is currently a major topic. The introduction of BIM promises great potential in relation to the current time-consuming manual checking of building applications based on 2D plans against building regulations. In this context, this thesis deals with the digital transformation of the escape route checking based on digital building models and open formats (openBIM). Escape routes are elements that are typically not explicitly modelled in BIM models. Instead, the information implicitly available in BIM models provides the framework for escape routes to be automatically generated. In addition to the automatic generation and validation of escape routes, there are two essential steps that need to be considered: defining the necessary information to enable the automatic checking and processing the newly generated elements.

This thesis presents the development of a model-based checking process for escape routes, consisting of the three steps of defining information requirements, analysing escape routes, and archiving the results. For the definition of information requirements, the new open standard Information Delivery Specification (IDS) is extended to consider dependencies of related elements more specifically. Small changes to the schema result in a significant increase in functionality without compromising usability. For the analysis of escape routes, a new semi-automatic method is presented. Possible escape routes are first generated automatically, the desired escape routes are selected by the designer in a manual intermediate step and this selected escape route system is finally automatically validated by the building authority. This new process leaves the definition of escape routes to the designer with the support of automation and includes new concepts and algorithms for the generation of escape routes in compliance with building regulations. Results archiving addresses the previously unaddressed issue of permanently storing newly generated data in the model-based permit process. While the use of the Industry Foundation Classes (IFC) open data format has been established for designers' BIM models to eliminate software dependencies, newly generated elements have remained in the native software environment in which they were created. These new elements can also be mapped into IFC models, making them securely stored, permanently accessible, and usable in other BIM processes. In this thesis, all new concepts have been validated through the development of software prototypes. The results show that both the overall process and the new developments per process step meet the requirements for a digital, model-based permit process and also show potential for further applications.