

Title

IFC Application Solution
for Building Safety and Security in Times of Disaster

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Summary

The Industry Foundation Classes (IFC) data model developed by buildingSMART is a standardized specification for Building Information Modelling (BIM) data.

BIM manages to deal with the various building data exchange throughout its lifecycle based on the 3D building information defined as a collection (an aggregation) of properties of object data, such as the shape, dimension, area and volume of walls, columns, windows, and other building elements, together with their specification, costs, schedules, and facility management information. It is also named as 4D or 5D building information model, which can be widely used in building design, construction and facility management.

Europe and United States led the BIM research emphasized on design qualities before 2010. This research focus on offering the solution based on IFC data application, the main objective of this research is to deal with the problems of building safety and security in times of disaster. The Great East Japan Earthquake occurred in the preparation period of this research caused serious damage because of furniture overriding, so the importance of the simulation of furniture overriding and agent movement for evacuation is emphasized again. Based on the specification of buildingSMART, the new model view definitions (MVD-Furniture Stumble) is proposed to integrate evacuation simulation information and BIM data. This research explains the application of BIM data in building safety and security, which helps improve the building safety.

There are 4 groups to do the studies in this research.

1. IFC Platform Construction Group

The MVD for furniture overriding is defined according to the IFC building data, furniture shape and relevant building information, such as the total building storey number, the coefficient of friction between furniture and floor. Based on the 3D viewer software of IFC Viewer, the IFC platform is developed, which can not only display the 3D geometry, but also append the information for building safety simulation. Moreover, based on the evacuation simulation software FDS+Evac and IFC data analysis, Visual FDS is developed to evaluate the fire safety and the impact of furniture layout on evacuation.

2. Visualization of Building Hazards Group

The research group studies the building models' fire safety and building flooding. According to the visualization of flooding, smoke falling and agent movement in buildings, it is easy to predict the risk of life and properties in times of disaster. The research group also concludes

the building information of evacuation safety which formulates the building database for the IFC platform. Considering the future promotion of the application of building IFC data, this group also studies the necessary information about the life safety in times of flooding and fire.

3. Case Study Group

This research group established two building models, A is an office building and B is a high-rise mansion.

Model A is a steel structure office building with 9 floors above ground and 1 floor underground, and the total floor space of 11,000 m². Model B is a high-rise mansion under construction in Shinjuku, Tokyo, with 55 floors above ground, the building height of 180m and the total floor space of 100,000 m². This group extracted obtain the BIM building data in 3 residents by simulating the daily family life.

4. Solution Proposal Group

According to the investigation conclusion of examples of hazard prediction and simulation results calculated by the Visualization of Building Hazards Group, the evacuation scenario analysis and the solutions for fire evacuation and earthquake in Model A and Model B are discussed. With the application of IFC data, it is possible to deal with the complicated situation. The building safety and security is improved with these scenario analysis.

The study of BIM and IFC was not emphasized sufficiently in Japan when this research started in 2010. After IFC model of BIM data regulated as official international standard (ISO 16739:2013) in March 2013, the advancement of IFC application will accelerate with a good prospect. The Visual FDS and the solution for building safety and security developed in this research are hoped to contribute to the reconstruction from the Great East Japan Earthquake.