Chair of Computing in Civil and Building Engineering
TUM School of Engineering and Design
Technical University of Munich

Modeling:
Mathematics:
Programming:
Science:

Software Lab:

IFC-based Regulation Impact Visualisation

Description

Building regulations are typically consulted as textual documents, separate from the digital building models they govern [1]. This separation makes it difficult for designers, regulators, and researchers to understand how specific regulatory clauses affect a building as a whole, or how individual building elements are constrained by multiple, overlapping regulations. While IFC provides a rich, structured representation of building geometry and semantics, links between regulatory requirements and IFC elements are usually implicit, fragmented, or entirely absent.

This project focuses on developing an IFC-based visualisation framework that explicitly connects building models with the applicable regulations and makes these relationships explorable in an interactive and intuitive manner [2]. The core idea is a bi-directional querying mechanism. Starting from the regulatory side, users should be able to select a regulation or regulatory clause and visualise its impact on the building [3], distinguishing between global impacts, local impacts, and the specific building elements involved. Conversely, starting from the model side, users should be able to select one or more IFC elements and retrieve all regulations that apply to those elements.

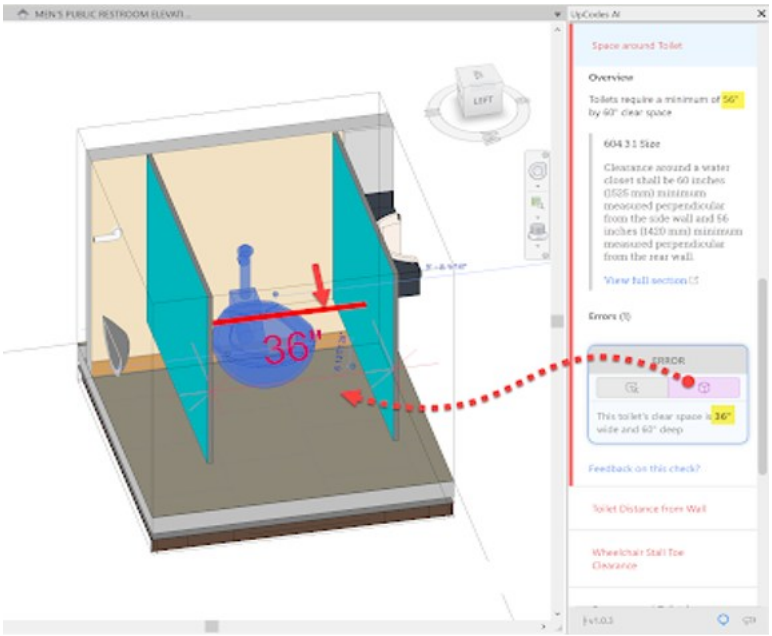

Figure 1 Real-time IFC/BIM-based code compliance visualisation [4]

To support meaningful exploration and filtering, regulatory information should be structured hierarchically or across multiple levels, for example, by code, chapter, clause, or semantic similarity. This structure can be extended with embedding-based techniques to enable more advanced filtering, clustering, or similarity-based queries. Optionally, the system can be augmented with IFC-specific regulation question answering, allowing users to ask natural-language questions about regulatory impacts and receive model-grounded, visual responses [5].

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Task

Design and implement an IFC-based regulation impact visualisation system:

- Conduct a literature review on regulation modelling, IFC-based visualisation, and bidirectional links between regulations and building models.
- Define a data model that links regulatory requirements to IFC elements, supporting both global and element-level impacts.
- Implement a visualiser that allows users to
  - select regulations and inspect their impact on the building, including affected elements and scope, and
  - select IFC elements and retrieve all applicable regulations.
- Design hierarchical or multi-level representations of regulations to enable structured filtering and exploration, optionally enhanced with embedding-based techniques.
- Optionally, integrate an IFC-specific regulation question answering component to support natural-language interaction with the model–regulation links.

Supervisor

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