Technical University of Munich
Georg Nemetschek Institute
Artificial Intelligence for the Built World

Master Thesis

GLOD: **L**evel **o**f **D**evelopment of Building Information **G**raphs

Background

In the architecture, engineering, and construction (AEC) industry, the Level of Development (LOD) framework serves as a standardized metric to define the completeness and reliability of BIM elements at various stages of a project [1]. This framework ensures that all stakeholders have a consistent understanding of the model's detail and accuracy, facilitating effective collaboration and decision-making throughout the project lifecycle. Therefore, LOD has been adopted and used worldwide. Concurrently, graph representation of building information models has demonstrated potential in enabling intelligent functionalities that are hard to achieve by using existing file-based technologies, such as change propagation [2] and graph-based version control [3].

Despite the advancements, there is a noticeable gap in integrating these two domains. Current LOD standards are primarily tailored for traditional, file-based BIM models and do not directly address the features of graph-based data structures. This poses the research gap in evaluating the information richness and accuracy of building information when represented as graphs. A framework that adapts similar principles but on the data format of graphs could provide practitioners with tools to assess and enhance the quality of their models, ensuring consistency and reliability across different representation paradigms.

Tasks

- **Literature Review**: Conduct a comprehensive review of existing studies on the Level of Development (LOD) and Level of Detail (LoD), as well as graph representation of BIM models.

- **Framework Design:** Validate the feasibility of conducting GLOD. Develop a novel framework that integrates LOD concepts into graph-based BIM representations. This will include defining criteria and metrics to assess the development levels of building information graphs

- **Validation**: Apply the proposed framework to selected case studies to evaluate its effectiveness and practicality. This will involve testing the framework on real-world projects, analyzing the outcomes, and refining the approach based on empirical findings.

Pre-requirements

- Motivation and interests are the most important. Desires to explore how to conduct research
- Basic programming skills in Python
- Nice to have: working experience in a design firm

Supervisor

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References

[1] BIMForum, 2025. Level of Development (LOD) Specification. https://bimforum.org/resource/lod-level-of-development-lod-specification/

[2] Wang, Z., Ouyang, B. and Sacks, R., 2023. Graph-based inter-domain consistency maintenance for BIM models. Automation in construction, 154, p.104979.

[3] Esser, S., Vilgertshofer, S. and Borrmann, A., 2022. Graph-based version control for asynchronous BIM collaboration. *Advanced Engineering Informatics*, *53*, p.101664.