Open GIS-to-BIM-Converter (LKMap 2025 Data to IFC 4.3 Data)

Graduate

Jamie Maier

Initial Situation: Underground networks and cadastres are managed in Geographic Information Systems (GIS), which mostly contain 2D data. For the exchange and publication of this information, the standard SIA 405 (LKMap) exists in Switzerland, which is a minimalistic approach that allows the coordination of the parties involved mainly through the geometries. LKMap is currently under revision to support some 3D geometries, as there is a high demand for this information to be available in 3D. Therefore, the focus of this thesis is on the latest version of the model, LKMap 2025. Further, 3D geometries would be of great benefit in Building Information Modeling (BIM). The cadastral data would allow BIM operators to visualize, plan, model and design the exact locations where utility infrastructures intersect with building elements of their model.

Objective: This thesis aims to provide a Command Line Interface (CLI) prototype that lets users convert INTERLIS LKMap 2025 data (.xtf) to valid 3D IFC 4.3 data (.ifc). The generated data should provide users with visualizations of uncertainty geometries. The prototype should be standalone and Open Source.

Result: The solution strategy and software architecture has been divided into three main logical containers. The first is the CLI, the entry point for users, which requires them to pass at least two arguments, the LKMap 2025 INTERLIS data file and a reference null point defining the origin position used to generate the 3D elements. The second container focuses on extracting and preparing the given INTERLIS data, ensuring that the elements passed to the IFC generation logic container contain valid 3D coordinates. The technologies used here are ili2gpkg (Java) to write a GeoPackage file from the INTERLIS data file, and pyogrio (Python library) to extract data

from the generated GeoPackage file. The processed data is then passed to the third container containing the IFC creation logic, which is achieved using the Python library IfcOpenShell. This container constructs IFC elements with their geometric representations, including uncertainty representations when geometries are marked as imprecise.

Uncertainty geometries of a generic duct and pipe. Pink = height uncertainty, Orange/Yellow = position uncertainty
Own presentment
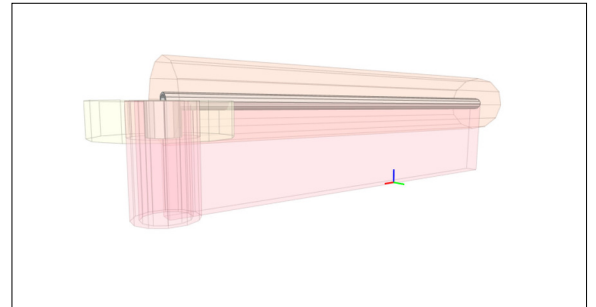
2D view of Dorfstrasse/Kirchgasse junction in Meilen ZH. Blue = pipes, Red = ducts, Black polygons = special structures
Own presentment
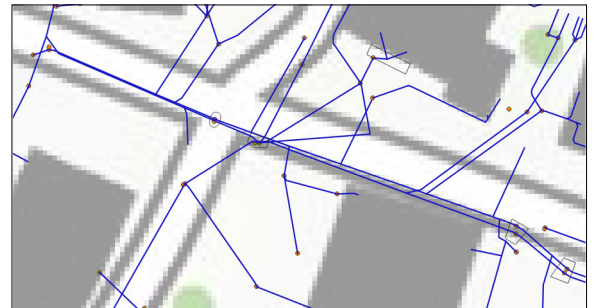
3D view of Dorfstrasse/Kirchgasse junction in Meilen ZH including uncertainty geometries
Own presentment
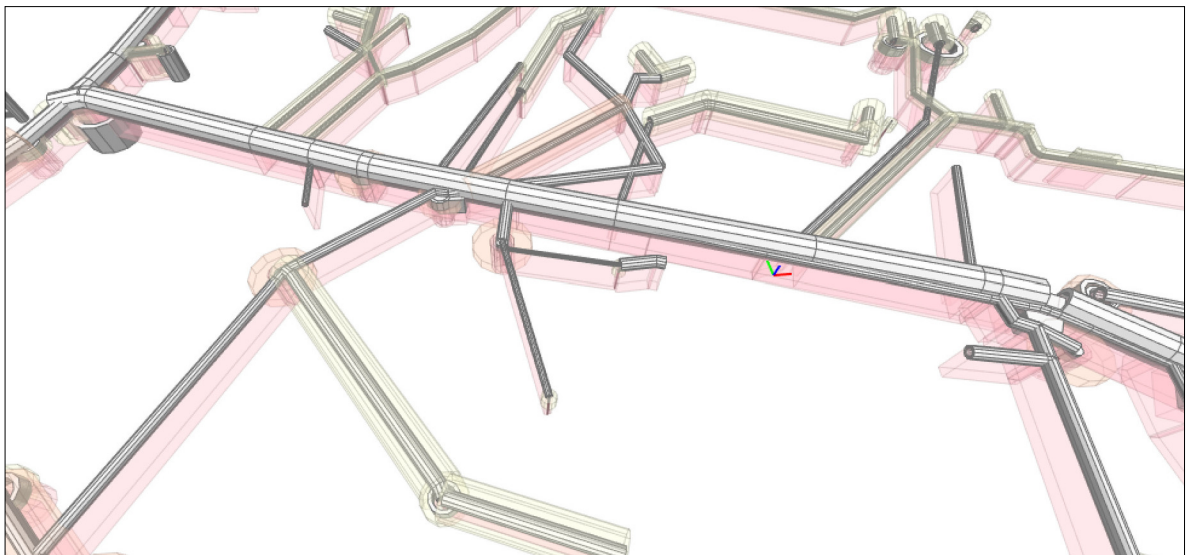
Advisor
Prof. Stefan F. Keller

Co-Examiner
Claude Eisenhut, Eisenhut Informatik AG, Burgdorf, BE

Subject Area
Software, Application Design, Miscellaneous

Project Partner
Reto Senn, Bitforge AG, Zürich, Zürich / Prof. Martin Beth, Bauingenieurwesen, Rapperswil, St. Gallen