ETL processes for the conversion of parcels (2D) and terrain models (2.5D) to openBIM projects using IFC

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SUMMARY

Building Information Modeling (BIM) greatly facilitates collaborative work involving the creation and exchange of digital models. These models encompass comprehensive information for a building's entire lifecycle. This methodology enhances interoperability, significantly improving planning efficiency and reducing the need for redundant data entry that often burdens conventional workflows.

Since buildings exist within an environment, geospatial data plays a crucial role in various phases of BIM projects and must seamlessly integrate into these processes. Achieving this integration, openBIM projects rely on open standards, such as the Industry Foundation Classes (IFC), developed by BuildingSMART International (bSI).

However, transforming geospatial data into IFC is complex due to the differing model intentions of BIM and GIS. They employ various paradigms for semantics, geometric representation, and georeferencing. Acknowledging this complexity, numerous software providers have developed specialized solutions for efficiently and accurately transforming geospatial data into the IFC format. Among these solutions, the Feature Manipulation Engine (FME) by Safe Software Inc. is a Extract-Transform-Load (ETL) software application widely used by industries, governmental agencies, and academia.

The primary focus of this paper is to investigate the effectiveness of FME in converting 2D land parcel data (vector) and 2.5D terrain models (raster, TIN) into the IFC format while retaining geometry, georeferencing, topology, and semantics. To address this, four key research questions are explored: How can 2D land parcel data and 2.5D terrain models (DTM) be converted to IFC while preserving their classification and attributes? What criteria can be used to assess the success of

these conversions, and how can independent validation be achieved? How can various georeferencing methods within IFC be programmatically implemented using FME? How can geospatial data be aggregated according to BIM conventions to make it useful for collaboration in BIM software?

This research paper aims to practically answer these questions. The research outcomes are implemented workflows tailored for the transformation of geospatial data into valid IFC models, using FME. These workflows are published as a foundational framework that can be extended and adapted in the future.

In preparation for workflow creation, decision trees were designed to outline the transformation steps for each data source, providing a clear roadmap for implementation. The ETL process is not a simple format conversion or a 1:1 schema mapping. It's crucial that the IFC concepts are conveyed in a manner that allows non-geospatial BIM modeling and coordination software to interpret the generated geospatial content in the IFC models effectively, recognizing that BIM and GIS serve different purposes.