

# Toward a Common Data Environment: Enhancing GIS-BIM/CAD Interoperability in Infrastructure Projects

Universität Bamberg



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## INTRODUCTION

Infrastructure planning projects increasingly rely on complex data workflows involving both GIS and BIM/CAD systems. However, interoperability between these systems remains a significant challenge, particularly when it comes to maintaining data consistency across different formats and platforms.



### MOTIVATION

My motivations stems from my professional experience as a GIS-Analyst/Coordinator at an engineering firm, where I coordinate data and support for large-scale infrastructure projects, such as the planning of power transmission lines.



### RESEARCH HYPOTHESIS

A common data environment (CDE) based on SQL databases can serve as an effective bridge between GIS and BIM/CAD systems, improving data consistency, accessibility and collaboration throughout the infrastructure planning lifecycle – using GIS a data hub.

## GEO - AREA



The research is situated within the field of Geoinformatics, with a particular focus on the role of Geographic Information Systems (GIS) in infrastructure planning. It explores how GIS can serve as a central tool for data management and spatial analysis – especially in combination with Building Information Modeling (BIM) and CAD.

## TOPIC



The objective is to use GIS not only in the (early/outline) planning phases, but also to establish it as a consistent data platform for all planning phases by integrating it more closely into BIM/CAD workflows.

The research should address central issues of geospatial information technology, such as interoperability, data-modeling, spatial reference and multi-user access in complex planning processes and workflows.

## CHALLENGES & OBSTACLES



- How to store and access CAD/BIM data (or parts of it) directly within an SQL-based common data environment
- Overcoming the current ‘one-user-only’ limitation when working with CAD files on project servers
- Maintaining data integrity and semantic information during format translation (e.g.: DWG to GDB/GeoPackage)
- Establishing a ‘single source of truth’ across GIS and BIM/CAD disciplines
- Aligning GIS-based planning processes with BIM/CAD-based execution and design standards

## DATA & METHODS



The research utilizes real-world project data stored and managed in PostgreSQL databases, serving as a central data hub for all the 2D planning data which can be accessed/edited/viewed via GIS-Software.

### Methods:

- Analysis of current data workflows from GIS to CAD (and back)
- Evaluation of SQL database capabilities
- Identification of data loss or transformation issues during CAD-GIS translation processes

## FINDINGS SO FAR



- The use of SQL databases allows for multi-user access and simultaneous editing of GIS data during (early/outline) planning phases
- Current CAD-to-GIS workflows are manual, time-consuming and prone to data inconsistencies
- Data translation from CAD to GIS often results in loss of semantic and structural information
- CAD files are handled outside the database environment, limiting collaboration and increasing overhead
- Views and materialized views in SQL are valuable for managing and filtering complex geospatial datasets but depend on up-to-date source data

## DISCUSSION TOPICS



- Best practice for SQL-driven GIS-BIM/CAD integration
- Potentials and limitations of spatial databases in supporting BIM/CAD workflows
- Open standards (e.g.: IFC, CityGML) and their role in cross-platform data environment