Developing a GIS for railway operators

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Tanja is a transportation planner from Germany with experience in public transport. The content of this paper is based on her master thesis about the creation of a GIS for railway operators.

In the middle of the 20th century many railway lines in Germany were discontinued due to passengers shifting from public transport to private vehicles. While many have been reinstated in the last decades, some remain discontinued. But some lines are kept alive as historic railway lines. This is the case for the "Hessencourrier" railway in the state of Hessen, Germany. A 33 km long railway line that connects the city of Kassel and the town of Naumburg.

Figure 1: Historic railway "Hessencourrier" (Hessencourrier e. V., 2025)

A volunteer association is operating the railway and is responsible for maintaining the infrastructure. Accurate data on the existing infrastructure is essential for maintenance and improvement works. For this purpose, the railway and its infrastructure have been surveyed using a total station and a GNSS receiver, and the collected data was used to develop a geographic information system (GIS). The surveyed infrastructure includes the track alignment, control points, signals, signs, crossings, electrics, kilometre markers, track-related infrastructure, stations and stops, and buildings. Survey drawings were also provided. The goal was to use the provided data to create a GIS which includes all relevant information for the railway operator to maintain the infrastructure.

Using QGIS, the geographic information system was created containing all surveyed infrastructure and the survey drawings. The symbology of the signals and signs features was based on their actual design to allow for easy identification on the map (Figure 2). Each layer contains information about the type of feature, the geographic location (latitude and longitude coordinates, and elevation) and the survey year. The track alignment layers contain information about the radius of clothoids and curves, and the railway track superelevation. The track geometry (tangent, curve or clothoid) is visualised on the map.

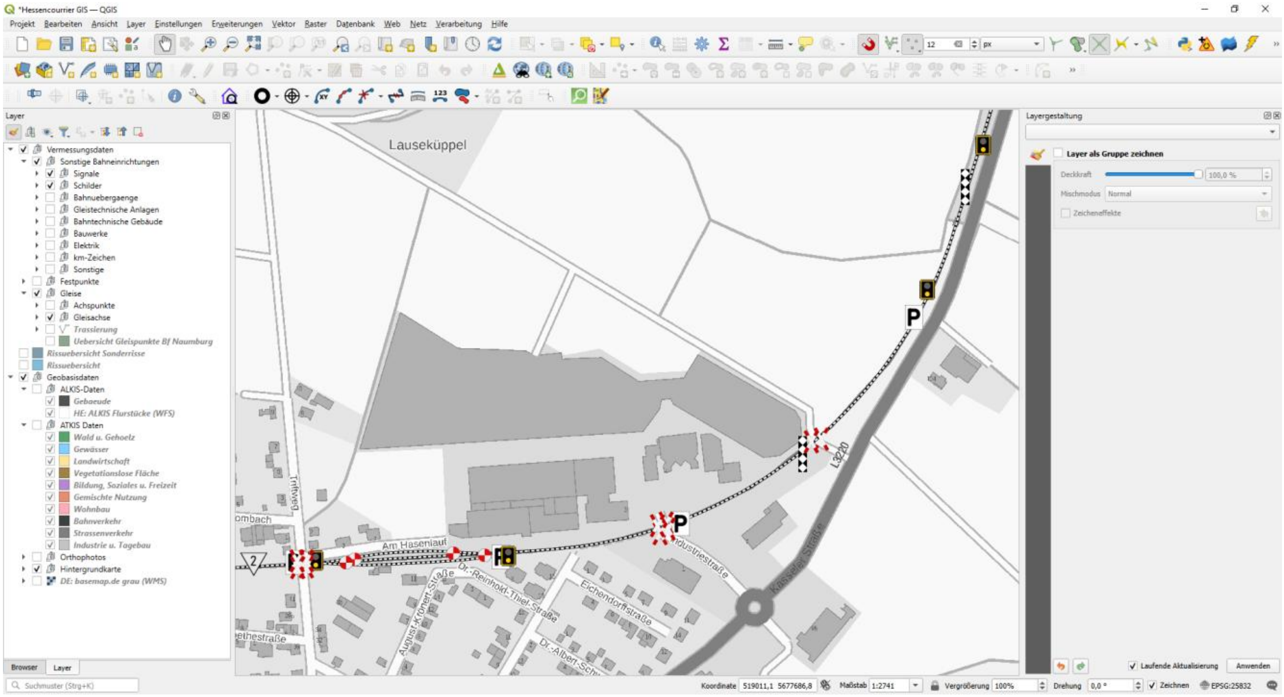

Figure 2: Visualisation of the signals and signs layers

Additionally, geospatial base data (land use, property boundaries and buildings) was added to the map (Figure 3). Photos taken during the survey and the survey drawings were added as attachments to the corresponding features.

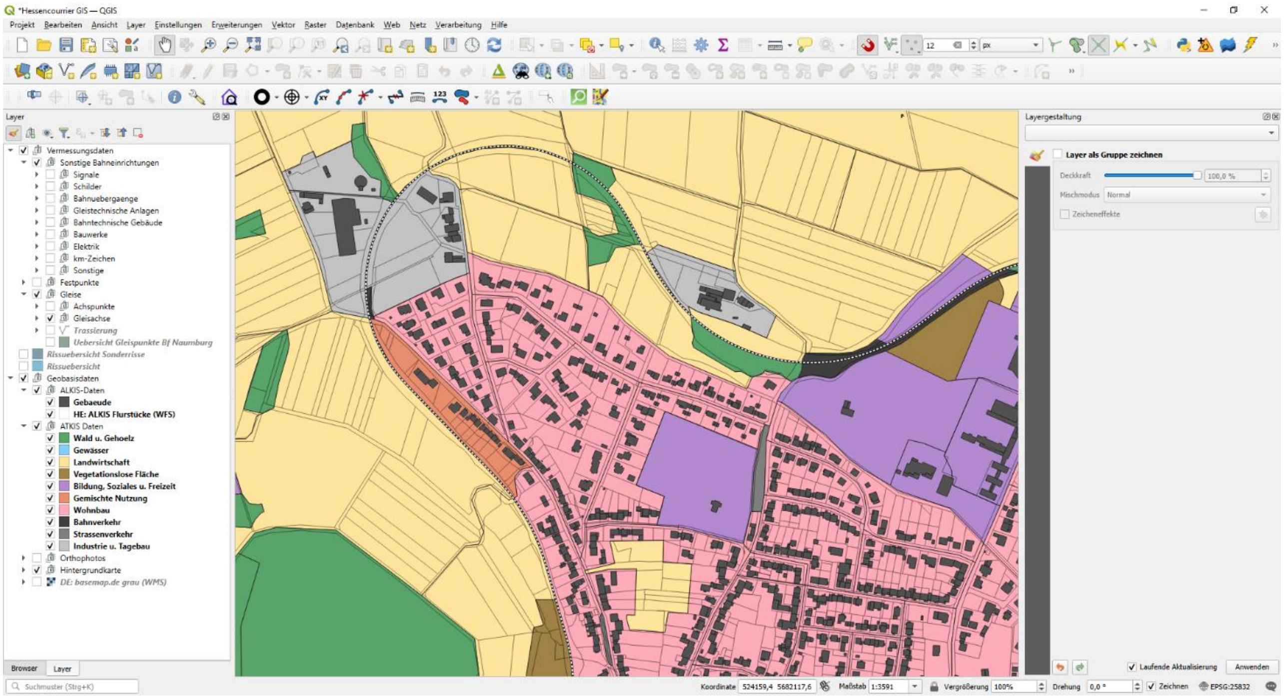

Figure 3: Visualisation of included geospatial base data

The result is an interactive map which contains all relevant data, survey drawings and photos. Everything, including the basemaps, is available offline to ensure access without an internet connection which is essential due to the rural location of the railway. The developed GIS serves as a foundation for future continuation and addition of new data. It provides the railway operators with important information for maintenance works.