Chair of Cartography

ProZeit

A Novel Workflow of Optimizing the Geometric Design of Railway Alignment for Travel Time Saving

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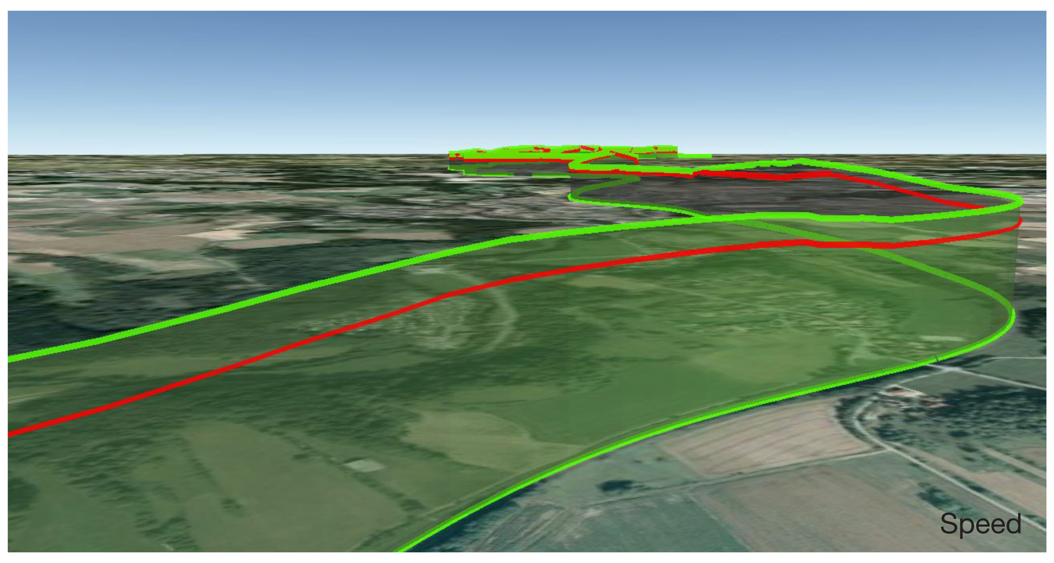
Introduction

A successful timesaving of approximately 5-10 minutes on a 100 km railway route, is of great interest in the railway industry.

We propose a novel workflow, ProZeit, to achieve a minute-level travel timesaving by optimizing the geometric design of the railway alignment. The travel time saving is achieved with low cost. Instead of planning and constructing a completely new track, ProZeit allows travel time saving based on increasement of cant within technical guidelines. The cant increasements can be implemeted during regular railway track maintanance.

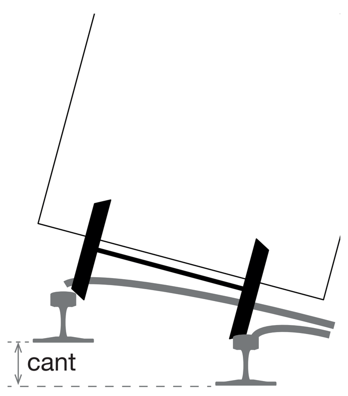


Cant

The cant is used on railway tracks to balance the centrifugal force on the train in curve sections. The value of cant is the difference, one rail is lifted compared to the other rail.

Car to measure the track geometry including cant and curvature

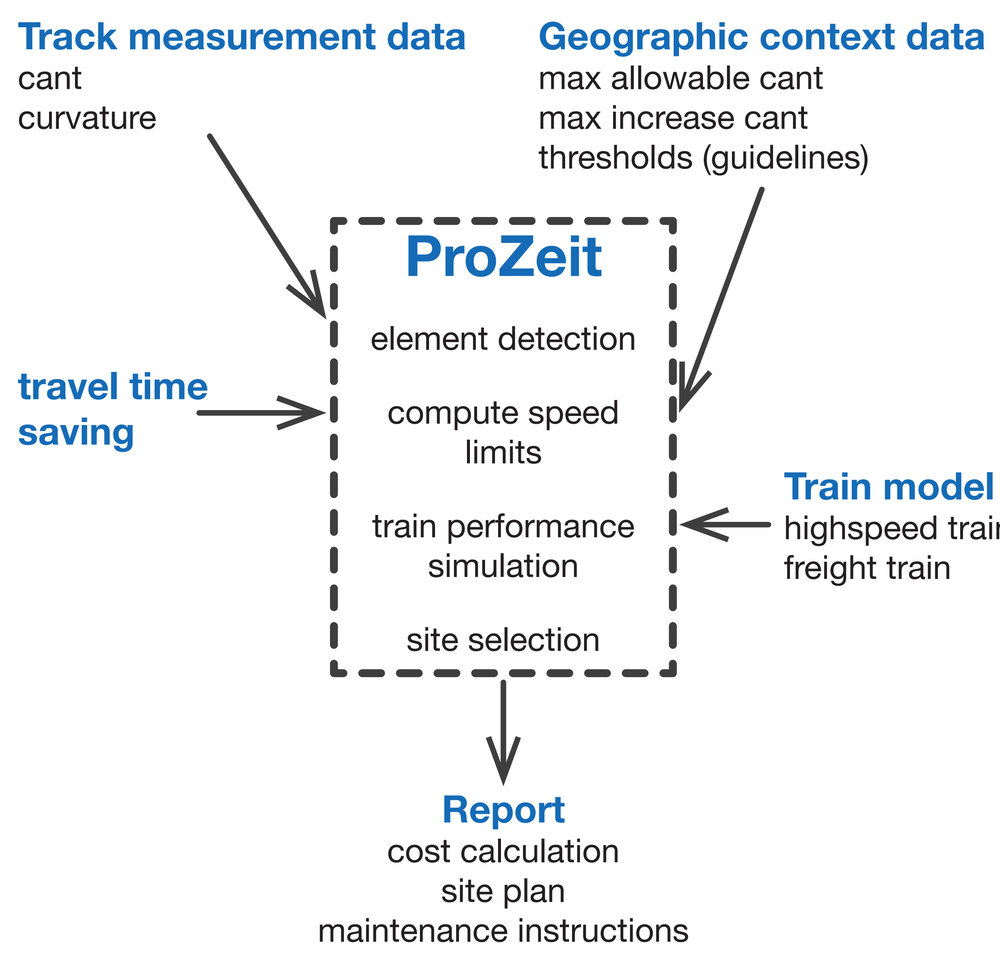
Tamping maschine to tamp the track ballast under railway tracks and to increase the cant (© Plasser & Theurer)



Workflow

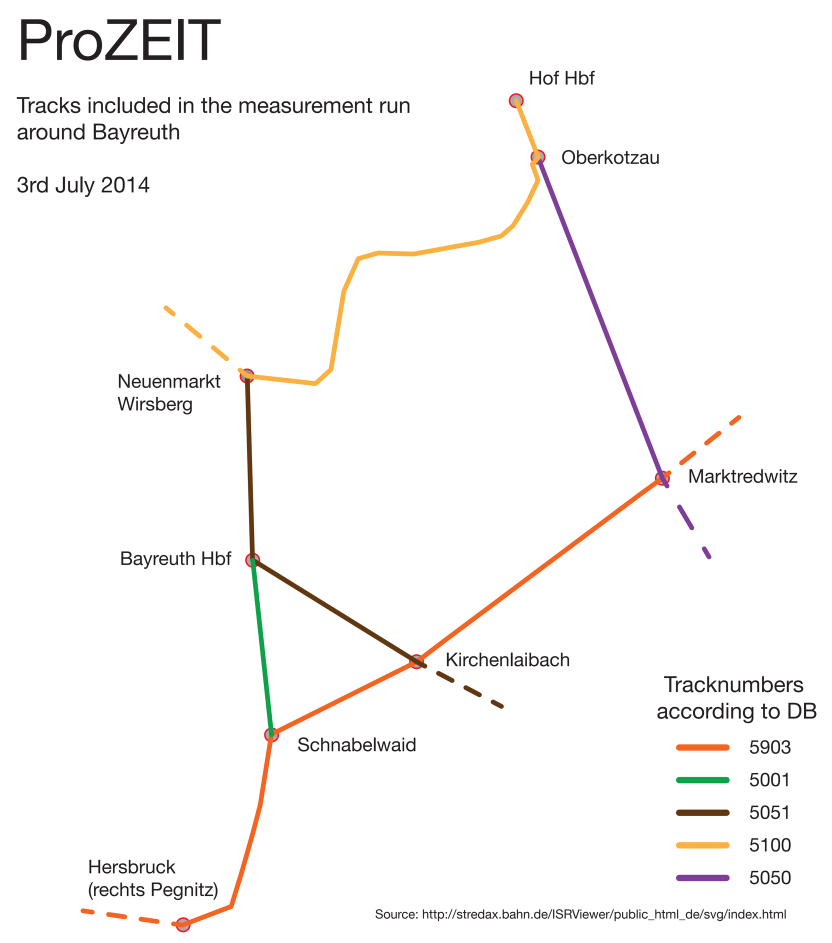
ProZeit is structured into **6** steps:

1. Railway track surveying to measure the geometric parameters of the railway track (e.g. cant, curvature).
2. Modelling of geometric elements as straight lines, circular curves and transition curves.
3. Enrichment of geo-context information, e.g. inhabitant area, railway stations, bridges, tunnels.
4. Train performance simulation: constraints and environmental impacts are considered to calculate the maximum allowable speed and its required change of geometric design.
5. Ranking of geometric elements based on the benefit of time reduction and cost of the maintenance work, i.e. tamping.
6. Report and visualisation of individual changes on the track elements and the impacts.



Case studies

The workflow has been successfully applied in the planning of in total 5 railway routes in Bayern, Germany and has received quite many positive feedbacks from the industry partners



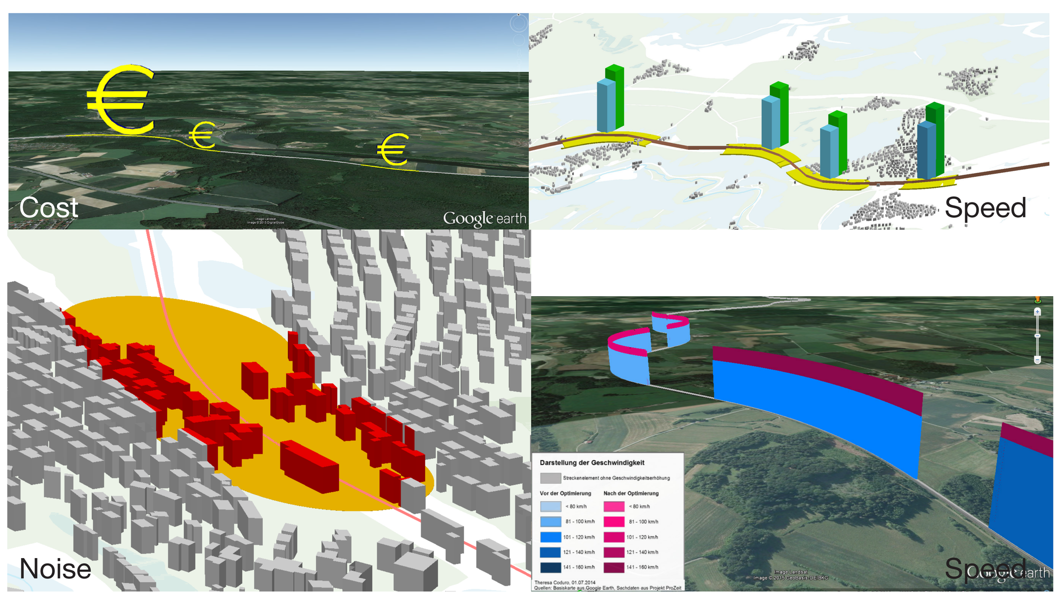
The 5 case study tracks in Bavaria, Germany

Visualisation for two user groups

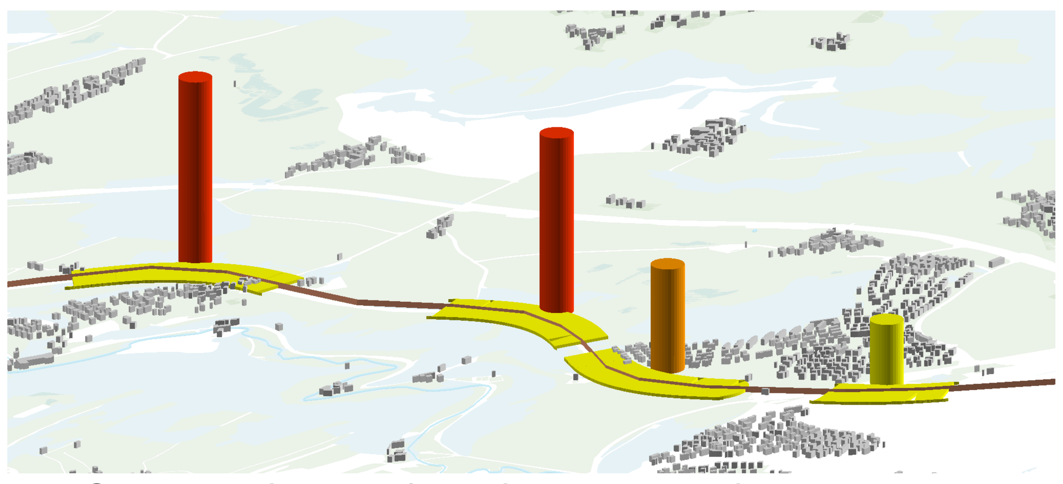
The visualisation of results has to be designed in order to meet the user demand. Two user groups with contrasting needs have been identified.

Vivid illustrations with a low level of interaction are created to address the target group consisting of the general public, affected residents and political decision-makers.

The other target group, professional users that would use the visualisation as a base for further detailed railway alignment planning, is provided with a comprehensive visualisation tool set that offers much more detail information.



Different visualizations for the two user groups



Cost visualization for selected sites along the track

Outlook

In the future development, we will focus on:

1. Developing a more sophisticated model to manage multiple linear attributes along the railway alignment using linear referencing
2. Using a robust filtering technique in track element detection which takes into account multiple measurements simultaneously, i.e. Kalman filter
3. Including vertical alignment (DEM) for energy consumption estimation

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