



Research at the Institute for Traffic Safety and Automation Engineering

Design and visualization of dynamic model of a railway-system of Switzerland in space and time



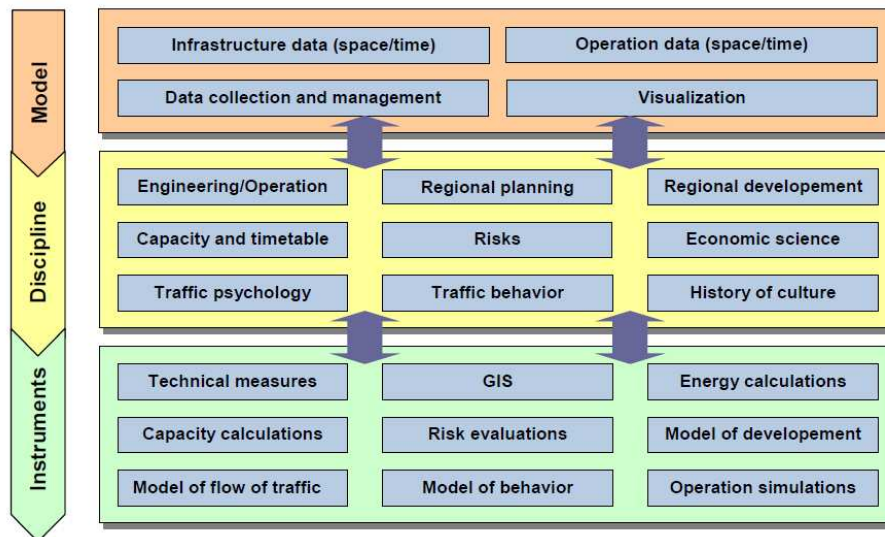
The research project concerns the methods for the construction of a railway system model in space and time. These include the collection of data on infrastructure and operations. With a special view of the system-theoretical approach, this project tries to contribute to understanding the dynamic interactions in the complex system of railways.

Models represent a section of reality in a certain scale, typically featured at a certain time. The modeling in a time interval is, due to their complexity, often too costly or at most possible for a spatial very limited cut-out. The railway system model which is described here, should serve as a basis for dynamic studies, which can also be done in a time interval. This is an important requirement, if it was necessary to consider not only a few system elements in isolation, but the whole system and the interactions in a broader context.

The methodological work to build a dynamic railway system model tries to indicate how an extensive data base for studies in the complex system of railways can be built. For this, the actual possible methods for collecting and managing data will be included. Furthermore, the work would present, how this model can be used as the basis for simulations with realistic pictures to investigate non-measurable factors. This concerns especially problems related to interfaces between humans and machines. In addition, such visualizations allow a view into the past and the future of rail transport in a way that until now has been hidden.

In terms of the current state of technology, the question is often not yet of the acquisition of data. Rather, the goal-oriented selection and processing of existing data has become a real challenge for us. The present work wants to take these barriers and try to develop an innovative approach for the data management in the field of infrastructure and operations of railways. Thereby, for qualitative and quantitative methods should especially be applied the hermeneutic circle. The workflow is divided into six phases and leads finally to a visualization in the terrain model.

For the development and application of this model several research projects must be performed and coordinated. This places high demands on the project organization. In essence, these studies focus on the quantitative and qualitative data collection (photogrammetry, image analysis, participatory approach), with the merging and processing the electronic data base, with the visualization in the 3D model, with simulations and with generation of value, which means with the use of the entire complex model.



The railway system model at the three levels of the model (red), the disciplines (yellow) and the instruments (green). Between all system elements (blue) are interactions that are to be especially considered for the construction of the model. The model serves as a groundwork for applied methods for investigations, which are based on infrastructure and operational data.

Once completed, the model provides in practice a number of uses: Today, a particular problem cannot often be studied deeply enough, because the preparation and modeling appear to be too costly. Examples can be found in the field of risk analysis, where due to the need for representative samples and the resulting significance levels, calculations must be done in a long term and as precise as possible. Such situations we know about in the context with safety systems (failed components with high availability) or natural hazards. Also for complex capacity calculations which affect the entire network or for expensive infrastructure expansion projects, the current models are pushed to their limits; often, only some individual system elements can be considered at most.

The railway system model described here intends by its detail, its interconnectedness, and especially due to the imaging of objects in space and time to create new opportunities for studies and thus contribute to the development activities of the railways.

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