Abstract for the UIC Sustainability Conference 2010

Main Category: Energy Efficiency and CO2

Authors: Michael Meyer zu Hörste, Tilo Schumann and Katrin Gerlach,
German Aerospace Centre (DLR), Institute of Transportation Systems,
Lilienthalplatz 7, Braunschweig, Germany

Title: Combination of train driver assistance and trackside systems for energy-efficient railway operation

The purpose of the project
A number of praxis-proven train driver assistance systems are available for trains. Some of them are specialised for a defined application or a specific operation. They differ in functionality and visualisation concept. The goal of the first part of the project, which will be the subject of this contribution, was to collect information on different existing driver assistance systems and to evaluate the success and the spread of these systems in the world.

The second part of the project will focus on trackside aspects like dispatching decisions. Typical dispatching situations will be analysed and evaluated in regard to minimise energy consumption. An important constraint is that there will be no negative impact on the punctuality or the line and node capacity.

To reach the best improvement in energy-efficiency it is necessary to adjust trackside and on-board systems to each other. The on-board systems need input information from the trackside to reach their best benefit.

Examples for important static inputs are:
- Track topology and geometry
- Gradients
- Speed profile
- Timetable

Some more dynamic inputs are:
- Position data
- Signal aspects
- Current position of the surrounding trains
- Current timetable and position of connecting trains according to the latest dispatching decision

How it was organised
In a first step the existing systems were identified and classified. The main aspects which were collected here are:
- Traffic type: Long-distance passenger traffic, urban rail, metro, freight traffic
- Traction kind of application: electrical traction, diesel traction, loco and/ or multiple units
- Optimisation algorithm (for only a few systems)
- Functionality

- DMI concept and steps of recommendation
- Localisation concept, precision and reliability
- Degree of functional integration: with or without centre, functionality of the centre
- Degree of technical integration: integrated or stand-alone

The second step was to collect information about savings of the energy consumption and the spread of the systems. This was done by a questionnaire, which was sent out to the developers and operators.

In a future third step fields for potential improvements will be identified. Some aspects to be analysed for this purpose are:

- Dispatching optimisation by suitable support tools
- Integration of the assistance systems with a centre for different purposes, e.g. for static or dynamic data distribution
- Improvement of the approach for specific types of traffic

The physical tasks of the project

The physical task of the project was the questionnaire sent out to the system specialists. The goal here is to identify possible measures which will lead to an improvement of the energy efficiency

Based on the experiences made in the first phase of the project, a future step could be the identification and description of different architectures for centres in a network for driver assistance systems. The purpose here is not the optimisation of the trip of a single train under off-line given data but to support the assistance system with real-time data and thus, to cut down the demand of energy for the specific train trip.

The results and impact on the sustainability performance of rail

The improvement of the energy-efficiency of driver assistance systems depends massively on two aspects: first the availability of data which were influencing the energy consumption of the train and second the synchronisation of the real-time data of trains on one line or in one area. The energy consumption can also be improved by dispatching support tools or at least dispatching standards.

How success of the project was or will be measured

The evaluation and classification of the results will be done by using a simulation tool which is able to compare the energy consumption of train trips.

Why you believe this paper should be awarded

Almost all driver assistance systems for energy-efficient driving in the world were analysed systematically in the first part of this project. The functionality and the ambitions of the systems have been compared. The current spread of the systems has been determined.