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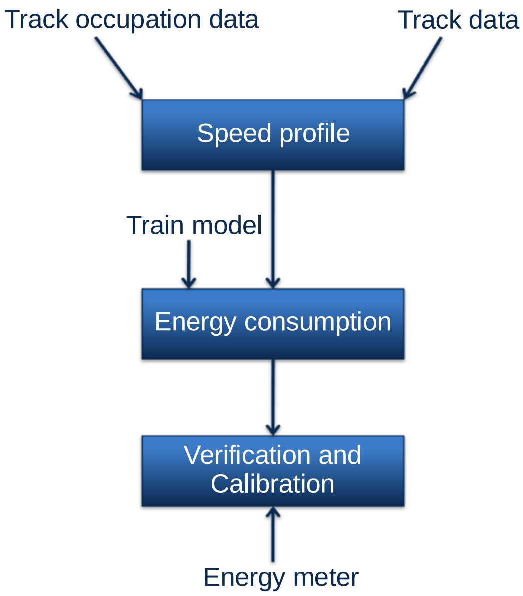
Thomas Albrecht[1], Christian Gassel[1], Joke Knijff[2], Jelle van Luipen[2]
[1] Institute for Intelligent Transport Systems, Dresden University of Technology, Germany
[2] ProRail, Railway Development, Utrecht, The Netherlands

Analysing railway traffic flow and energy consumption by means of track occupation data – Experiences from the project "RouteLint"

Energy consumption and timetable adherence can be improved by applying information and communication technology like driver information or advice systems [1, 2]. For railway practitioners it is often difficult to estimate the efficiency of these tools in practical operation due to lack of information how they are really used by the drivers in everyday operation and which amount of energy saving and improvement of operational quality can really be achieved. The decision on fleet wide rollout of those systems is usually based on a pilot application. It is necessary to measure and analyse the obtainable effects in this pilot phase. Equipping rolling stock with measurement units like energy or fuel meters often is very expensive. Additionally, high logistic effort is necessary to let the equipped rolling stock run on dedicated services for the tests.
The Dutch railway infrastructure manager ProRail faced this problem when it decided to test a new driver information system called RouteLint [3]. This system informs the driver on the state of the signal sections in front of his train (route set/ not yet set due to train *k* which has a delay *d*) so that the driver can adapt his driving style to the current operational situation and thereby avoid unnecessary braking and save energy. After a simulation trial, ProRail and NS (the Dutch national railway) wanted to know what the effect of the system could be in real-world operation with a particular focus on energy consumption.
A tool called EMMA (Energy Measurement Monitoring and Analysis) has therefore been developed at TU Dresden, which is able to reconstruct train speed profiles from track occupation data using non-linear least-squares curve fitting [4]. The speed profiles itself are used to examine bottlenecks in the network (by analysis of the speed distribution along the line). They have been verified with GPS data. In a second processing step, traction energy consumption is computed from the speed profiles. This process step has been verified with real energy meter data gained from energy meters which have been installed on board of five locos for the TRAINER EU project. It turned out, that the reconstructed value is not reliable enough for an individual train, but it can be used to compare groups of trains with statistically significant size, e.g. to see the effect of RouteLint on fleet energy consumption.



The tool EMMA is therefore very powerful in that it not only allows estimating the effects on energy consumption, but it also shows the reasons of deviations as long as they lie within railway operation. Additionally, EMMA only has to be calibrated once and can then be applied for every train running on the network.
RouteLint and EMMA are two examples, how existing data within railway companies can be used to improve processes. The success of the project is based on having made this data available for innovative purposes – and on a close cooperation between railway infrastructure manager and train operating companies which own this data.

Selected References

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