Optimizing Railway Schedules for the Simplon corridor*

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Today the railway timetabling process and the slot allocation of trains is one of the most challenging problems to solve by a railway infrastructure company. Especially due to the deregulation of the transport market in the recent years several suppliers of traffic have entered the market. This leads to an increase of slot requests and then it is natural that conflicts occur among them. Our goal is to resolve them by producing a feasible and conflict free timetable where a maximum of utilization is attained.

From a mathematical point of view the optimization problem can be stated as a multi-commodity flow problem through a extremely large network in space and time with certain additional constraints. The problem is well known in the literature, but only recently practical problem sizes are tractable due to development of improved models and algorithms. Nevertheless a decomposition of the problem can be observed. On the one hand for networks, or at least for long railway corridors, only simplified macroscopic models with a simplified routing through the railway infrastructure are considered, as in [7, 4, 10, 2, 5, 3, 6, 12, 1]. On the other hand, routing through complex stations can be considered on a more detailed, but of course only on a local level, see [15, 8, 14, 11]. The only recent reference, to the best knowledge of the authors, describing the interaction of both approaches is [9] by using a top-down approach.

In this paper an bottom-up approach of automatic simplification to complex microscopic railway infrastructure data is presented and applied for the Simplon corridor. This aggregation technique condenses a microscopic representation of the railway system to its relevant parameters from a planning and optimization point of view. We prove error estimations for the transformation and evaluate the re-transformed solution schedules in the microscopic simulation tool `OpenTrack`, [13]. We present computational results to different optimization scenarios for the Simplon corridor using the integer programming based solver `TS-OPT`, [1]. Furthermore, the dimension of the Simplon corridor allows for extensive optimization experiments with several aggregation levels in space and time. Finally, we present a sensitivity analysis for the corridor capacity w.r.t. different discretizations.

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*This work was funded by the Federal Ministry of Economics and Technology (BMWi), project *Trassenbörse*, grant 19M7015B.

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