Methodology for identification, design and evaluation of tangential bus connections to relieve the inner-city rail-based public transport system

Master‘s Thesis of Lukas Venneklaas

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Due to increasing populations in cities and the current climate protection goals of governments, the usage of the public transport system increased in many cities over the last decades. Especially monocentric cities with a radial rail-based public transport network with a small number of transfer stations in the city center worry about an overload of these stations. An adjustment of these rail stations to the increased requirements is time-consuming and expensive. At some stations, adjustments are even impossible. One possibility to relieve the inner-city public transport network is shifting passengers without an origin or destination in this area to a tangential line.

The thesis develops a methodology to identify, design, and evaluate tangential bus lines in monocentric cities. The methodology is based on the recommendations for transport planning processes by the German road and transportation research association. The thesis uses a macroscopic transport model to create a demand data set of the current network. It filters the demand data set according to the criteria, detour factor, number of transfers, and journey time ratio. It applies a transport system-based assignment and flow bundle analyses on this filtered demand and identifies corridors that might be useful for tangential lines. Furthermore, the thesis analyzes the current public transport supply in the corridors. Based on the results of these analyses, the method develops concepts for the corridors. This can be a new line or a change of an existing line. Finally, the method uses a qualitative evaluation, a multi-criteria analysis of key performance indicators, and a best-case scenario to evaluate and rank the different concepts. The flow chart on the right site visualize the steps of the developed methodology.

After the development of the methodology, the thesis applies it to one study case, the city of Munich. The analyses propose in seven corridors a new line and in one corridor the change of an existing line. The evaluation of the corridors shows that the new lines are in the range of existing lines and that they contribute to the relief of the inner-city rail-based public transport network, and the achievement of the climate protection goals. The change of the existing line is only partly successful due to a well-used extension but decreasing passenger volumes on sections of the existing line route.

The study case shows that the thesis developed a method for transport planners that identifies, designs, and evaluates new tangential lines. Since the method is tested only on one study case, the method needs to be verified by more study cases.