# Foreword

Vehicle routing has been the subject of intensive research for 50 years, both in Operations Research (OR), where the development of many kinds of algorithms has been advanced, and in Logistics, where various fields of application have been investigated. A quite new direction of transport planning has occurred due to recent developments in information and communication technology, "Telematics", which enable a central planning department to control a large vehicle fleet in real time. The necessary technical equipment is standard in any truck nowadays. Thus, OR-oriented research has increasingly turned towards dynamic vehicle routing since about 2000. Most studies in this field attempt to "dynamize" known algorithmic concepts and to investigate their appropriateness for dynamic routing. The most frequently used test data for this purpose are dynamic versions of the classical Solomon data (1987) for the vehicle routing problem, which unfortunately has little importance as a dynamic problem, except maybe for collecting goods. Much more important in this context is the Pickup and Delivery Problem (PDP) with depot free routing. Most of the real applications so far concern a PDP in a local urban area.

The present thesis starts from earlier work in this field. The author extends the approach of Fleischmann and Sandvoß (2004) for the Single Load PDP with time windows, based on the optimal assignment of orders to vehicles, for the Multi Load case with capacity constraints. Moreover, he develops a new Local Search algorithm, based on Multiple Neighborhood Search (MNS), and compares various algorithms in a comprehensive computational test.

However, the cooperation with a large German carrier led to an entirely new field of application: the dynamic control of a huge fleet of more than 1000 trucks which perform occasional transportation orders, mostly full truck loads, across the whole of Europe. This network free transportation concept, also known as "Tramp Transportation", is of increasing importance. Particular requisites of this case are the consideration of the EC regulations on driving and working hours, and different types of vehicles and orders with restricted compatibility.

The author modifies the MNS algorithm for this problem and uses it in a large case study with real data from a five-week period with 950 vehicles and 14,000 orders. He simulates the use of the MNS algorithm and compares the results with the actual routes as a benchmark. Objectives are the empty driven kilometers and the delays against the time windows, which can be influenced by different settings of the penalty costs, resulting in a trade-off curve. He shows that computation time for the local search is critical: the best results are obtained if the simulation clock advances in real time. The author succeeds in creating solutions with a trade-off curve significantly below the benchmark. The results are validated in detail by the experts of the carrier.

This work impresses with innovative algorithms, carefully designed computational tests and a thorough analysis of the results. Its main achievement is the solution of a practical case of dynamic routing with an extremely complex planning situation, which had not been investigated prior to now. I hope that this outstanding contribution to the field of transport planning attracts widespread attention.

Augsburg, January 2011 Bernhard Fleischmann