Integrating the use of public transport in dial-a-ride services

Yves Molenbruch[*1,2], Kris Braekers[†1], Patrick Hirsch[3], and Marco Oberscheider[3]

[1]Hasselt University – Belgium
[2]Research Foundation - Flanders (FWO) – Belgium
[3]University of Natural Resources and Life Sciences, Vienna – Austria

Abstract

In many Western countries, governments are currently implementing an innovative demand-driven mobility policy. Providers of collective door-to-door transport, called dial-a-ride services, are increasingly invoked to replace unprofitable public transport in rural areas. This requires an integrated mobility system in which a user's trip may consist of a combination of dial-a-ride services and regular public transport.
In order to optimally integrate both systems from an operational point of view, dial-a-ride providers need to solve a challenging routing problem which integrates the opportunity to use public transport in the classical dial-a-ride problem. Dial-a-ride routes should be synchronized to the timetables of the public transport services, while the optimal selection of the users' transfer terminals depends on the actual structure of the dial-a-ride routes.

This paper introduces a metaheuristic routing algorithm, based on Large Neighbourhood Search, to solve this integrated routing problem. An exact scheduling procedure is embedded to enforce the synchronization between dial-a-ride routes and public transport.
Experiments, performed on a new artificial benchmark data set with realistic characteristics, clearly indicate that considerable operational benefits are obtained by integrating dial-a-ride services and public transport. The resulting distance savings for the dial-a-ride vehicles are shown to depend on the operational characteristics of the system, the geographical distribution of the demand, and the ability to flexibly assign transfer terminals to user requests.

Keywords: Dial, a, ride, routing with synchronization, passenger transportation, meta, heuristics, integrated routing problem

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[*]Corresponding author: yves.molenbruch@uhasselt.be
[†]Speaker