A Districting-Based Heuristic for the Coordinated Capacitated Arc Routing Problem

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The purpose of this project is to solve a multi-period garbage collection problem involving several garbage types called *fractions*, such as general and organic waste, paper and carboard, glass and metal, and plastic. The study is motivated by a real-life problem arising in Denmark. Because of the nature of the fractions, not all of them have the same collection frequency. Currently the collection days for the various fractions are uncoordinated. An interesting question is to determine the added cost in terms of traveled distance and vehicle fleet size of coordinating these collections in order to reduce the inconvenience borne by the citizens. The problem can be modeled as a number of Capacitated Arc Routing Problems with a certain coordination between them. To answer the research question, we develop a multi-phase heuristic: 1) small collection districts, each corresponding to a day of the week, are first created; 2) the districts are assigned to specific weekdays based on a closeness criterion; 3) they are balanced in order to make a more efficient use of the vehicles; 4) collection routes are then created for each district and each waste fraction by means of the FastCARP heuristic [1]. Extensive tests over a variety of scenarios indicate that coordinating the collections yields a routing cost increase of 12.4%, while the number of vehicles increases in less than half of the instances. The project is published in [2].

References

[1] S. Wøhlk and G. Laporte, "A fast heuristic for large-scale capacitated arc routing problems", *Journal of the Operational Research Society* 69(12), 1877-1887, 2018.

[2] S. Wøhlk and G. Laporte, "A districting-based heuristic for the coordinated capacitated arc routing problem", *Computers & Operations Research* 111, 271-284, 2019.