Identifying Money Collection Routes with a Dissimilar Arc Routing Problem*

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The design of routes for collecting money from the parking meters in Lisbon is a task of EMEL (Empresa Municipal de Mobilidade e Estacionamento de Lisboa, E.M. S.A.). Additionally to the usual problems behind routes definition in an arc routing approach, the money factor leads us to dissimilarity concerns. In fact, dissimilar routes being harder to predict may help in robberies prevention, and thus a Dissimilar Arc Routing Problem (DARP) should be tackled, as proposed in [1]. In this case, the arc routing base problem ([2], [3]) arises from the fact that safes to collect are spread all over streets in the application under study. DARP is then defined on a mixed graph, and each day routes should minimize the total time travelled, while routes in two successive days should be as dissimilar as possible to prevent robberies. Edges represent narrow two way streets that may be served by only one traversal. Arcs are large two way streets that need to be served in both directions, or one way streets. The nodes are street crossings, dead-end streets and a depot, where every tour must start and end. The links that represent streets with safes to be collected are named as tasks. Services should be performed on a daily basis and a planning time horizon of five working days is on focus. The company needs to define the routes to collect the safes, that respect vehicles capacities and a time limit per crew, while preventing robberies and minimizing the total collecting time per day. To impose dissimilarity, tours are divided into periods, and it is avoided that a same task is scheduled for the same period in different tours. We propose a branch and price methodology to tackle this problem. Preliminary computational experiments are reported and analysed.

References

[1] M. Constantino, M.C. Mourão, and L.S. Pinto, "Dissimilar arc routing problems", *Networks* 70(3), 233-245, 2017.

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[3] M.C. Mourão and L.S. Pinto, "An Updated Annotated Bibliography on Arc Routing", *Networks* 70(3), 144-194, 2017.

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