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# Vehicle Selection for a Multi-Compartment Vehicle Routing Problem

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## Abstract

This paper addresses the selection of single and multi-compartment vehicles for the delivery of grocery products. The transport of grocery products requires to keep required temperatures for particular product segments (e.g., deep frozen, fresh, ambient). Retailers thereby used to rely almost exclusively on single-compartment vehicles (SCV) to transport products with one particular temperature zone. Due to recent technological advances retailers now have the option to use multi-compartment vehicles (MCV) for the distribution instead. MCV possess the ability to transport several temperature zones jointly on the same truck by splitting the loading area into different temperature-specific compartments. For retailers this imposes a selection between different vehicles. This choice is associated with different costs dependent on the corresponding vehicle types. More precisely, costs for loading, unloading and transportation have to be distinguished between the vehicle types and the corresponding routing. In literature either the use of SCV or MCV has been considered for the distribution without a distinction between the vehicle dependent costs and the possibility to use both vehicles in the same distribution fleet to achieve a cost optimal fleet mix. We therefore identify all decision relevant costs within a case study and present an extended MCVRP for the vehicle selection that takes into account vehicle dependent costs. We solve the problem with a Large Neighborhood Search and provide insides on the benefits of using SCV and MCV jointly in grocery distribution. Further, the approach is applied to a real life case to evaluate the economic impact of our extended model.

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