

# Grocery delivery with modular multi-compartment vehicles

Delivery of fresh goods like groceries requires the usage of specially designed delivery vehicles that are capable of providing multiple temperature zones in separate compartments. Previously, (online) grocers like Amazon Fresh or REWE Lieferservice relied on multi-compartment delivery vehicles with fixed compartment partitions for the joint delivery of goods with heterogeneous temperature requirements.

Now, technological advances allow for modular vehicles that can change their compartment allocation between consecutive delivery tours. This provides the opportunity to lower operational costs by mitigating superfluous cooling of unused space, increase vehicle utilization by redistributing storage area and to re-purpose the fleet for e.g. parcel delivery during off-peak hours.

## Aims and scope of the thesis

The aim of this thesis is to investigate the benefit of using modular multi-compartment delivery vehicles in a city logistics context. This comprises the following research tasks:

- Modeling of the problem
- Development and implementation of a scalable solution approach
- Generation of a suitable dataset
- Comparison and evaluation of the performance of modular multi-compartment delivery vehicles against fleets of non-modular multi compartment delivery vehicles

## Requirements

This thesis targets students of the TUM-BWL (with a major in Supply Chain Management), Management & Technology, Informatics, Engineering or similar study programs. Knowledge of mathematical programming, optimization, and a general-purpose programming language (e.g. C++, Java, Python) is required. Prior participation in one of the seminars offered by the chair (i.e. Modeling Future Mobility Systems, Advanced Seminar) is recommended. The thesis should be written in English.

## Related Research

- Ostermeier, M. and Hübner, A. (2018): Vehicle selection for a multi-compartment vehicle routing problem. In: European Journal of Operational Research, Volume 269, Issue (2), 2018, pages 682-694.
- Henke, T., Speranza, M. G., and Wäscher, G. (2015): The multi-compartment vehicle routing problem with flexible compartment sizes. In: European Journal of Operational Research, Volume 246, Issue 3, 2015, pages 730–743.

**Begin:** as soon as possible

**Advisor:** Patrick Klein

**Application:** See <https://www.osm.wi.tum.de/education/masters-thesis/>