

The Multi-Trip Vehicle Routing Problem with Time Windows and Release Dates

Diego Cattaruzza, Nabil Absi, Dominique Feillet

► **To cite this version:**

Diego Cattaruzza, Nabil Absi, Dominique Feillet. The Multi-Trip Vehicle Routing Problem with Time Windows and Release Dates. VeRoLog 2013, Jul 2013, Southampton, United Kingdom. emse-01009595

HAL Id: emse-01009595

<https://hal-emse.ccsd.cnrs.fr/emse-01009595>

Submitted on 27 Jun 2014

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

The Multi Trip Vehicle Routing Problem with Time Windows and Release Dates

Diego Cattaruzza*

Department Sciences de la fabrication et logistique, Ecole des Mines de Saint-Etienne, CMP Georges Charpak, F. 13541 Gardanne, France, cattaruzza@emse.fr

Nabil Absi *Department Sciences de la fabrication et logistique, Ecole des Mines de Saint-Etienne, CMP Georges Charpak, F. 13541 Gardanne, France, absi@emse.fr*

Dominique Feillet *Department Sciences de la fabrication et logistique, Ecole des Mines de Saint-Etienne, CMP Georges Charpak, F. 13541 Gardanne, France, feillet@emse.fr*

In this paper, we introduce the Multi Trip Vehicle Routing Problem with Time Windows and Release Dates (MTVRPTWR) and propose a memetic algorithm for its heuristic solution.

This problem arises in the context of MODUM¹ project (founded by The French National Research Agency - ANR). In MODUM the development of an efficient system of mutualized distribution is studied. Carriers allowed to enter city centers (*vans* in the following) are parked at platforms located around the beltway where trucks *continuously* arrive during the day and are unloaded. Then, not all goods are available at the platforms at the beginning of the working day. This justifies the introduction of the concept of *release date* associated with the merchandise. Precisely, the release date represents the time merchandise is available at the platform for final delivery.

Final distribution to customers is made by vans with limited capacity, due to laws restriction imposed and the narrowness of streets that characterize historical parts of downtowns. Then, they are allowed to accomplish several trips during the working day. This introduces the multi trip aspect.

More formally, in the MTVRPTWR, a fleet of identical vehicles with limited capacity is based at the depot. A set of customer demands have to be fulfilled during the working day. The MTVRPTWR calls for the determination of a set of routes and an assignment of each route to a vehicle, such that the total routing cost is minimized and each customer is visited by exactly one route respecting capacity constraints on vehicles and time windows on customers. Moreover, each vehicle cannot leave the depot before the maximal release date associated with merchandise to be delivered in the trip vehicle is going to accomplish.

The MTVRPTWR is an extension of the Multi Trip VRP with Time Windows (MTVRPTW, Hernandez et al., 2011) that is in turn an extension of the Multi Trip VRP (Taillard et al., 1996).

An adaptation of the Split procedure introduced by Prins, 2004, in the VRP context, is used to evaluate chromosomes and obtain MTVRPTWR solutions from them.

A set of instances for the MTVRPTWR is introduced and the efficiency of the procedure is proved by result comparison on MTVRPTW instances with Hernandez et al., 2011.

References

- [1] F. Hernandez, D. Feillet, R. Giroudeau, and O. Naud. A new exact algorithm to solve the Multi-trip vehicle routing problem with time windows and limited duration. *Tech. Rep.*, 2011.
- [2] C. Prins. A simple and effective evolutionary algorithm for the vehicle routing problem. In *Computers & Operations Research*, 31(12) :1985–2002, 2004.
- [3] É.D. Taillard, G. Laporte, M. Gendreau. Vehicle Routing with multiple use of vehicles. In *Journal of Operational Research Society*, 47 :1065–1070, 1996.

¹<http://www-lipn.univ-paris13.fr/modum>