

# Arc Routing for Parking Enforcement

Reinaldo Ferreira

BNP Paribas Securities Services

Email: reinaldodsf@hotmail.com

Maria Cândida Mourão<sup>b,c</sup>, Margarida Moz<sup>b,c</sup>, Leonor Santiago Pinto<sup>a,c</sup>

<sup>a</sup>CEMAPRE; <sup>b</sup>CMAFciO; <sup>c</sup>Instituto Superior de Economia e Gestão, Universidade de Lisboa, Portugal

Vasco Móra<sup>d</sup>, João Ribeiro<sup>e</sup>

<sup>d</sup>CML - Câmara Municipal de Lisboa; <sup>e</sup>EMEL - Empresa Municipal de Mobilidade e Estacionamento de Lisboa

This paper aims to define and solve a new problem that consists in the generation of daily pedestrian routes for parking enforcement officers, named as the *Parking Enforcement Routing Problem* (PERP), a serious and current issue in nowadays cities' parking management. Parking Enforcement Officers (PEO) must ensure that the users of the street parking lots pay the correspondent fee, and also that they comply with all the parking rules established by legislation and municipal regulation. The duration of the routes is limited by the PEO daily working schedules. Moreover, it was stipulated that a street could not be supervised more than once on consecutive hours, and also that two PEOs could not simultaneously supervise the same street. Nowadays, there is a growing concern in making contemporary cities increasingly smart, organized and sustainable. Such concern includes dealing with problems arising from the intensive use of public space, usually scarce. In cities where automobiles predominate, there is an urgent need to ensure good mobility and accessibility conditions to improve the residents/visitors' quality of life, as well as to mitigate the consequences of the intense car traffic. The enforcement of on-street parking is a fundamental instrument for the application of public parking policies, where mobility conditions have a wide relevance. In Lisbon, the enforcement of on-street parking is delegated to the municipal company EMEL-Empresa Municipal de Mobilidade e Estacionamento de Lisboa. In this context, the on-street parking requires a frequent supervision by PEOs walking through a wide area of Lisbon, during the daily operating work schedule. The problem is tackled as a capacitated arc routing problem with profits ([1],[2]) over a specific network. Having one or two-way streets with up to four different parking sides, the underlined network has some specificities usually not found. Arcs are scored according to recent events, namely issued fines, as well as the number of days without supervision. This work aims to obtain the maximum score per route while fulfilling time/staff/geographical constraints. To increase the efficiency of its operation, as well as to make the solution repeatable and usable in a daily routine, a software tool was developed to generate daily routes for each PEO working in a specific part of Lisbon's parking area. In this talk we present heuristics and a mixed integer linear programming formulation for the problem. Solutions to real instances obtained by all methods are compared and analysed.

## References

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