A multilevel variable neighborhood search heuristic for a practical vehicle routing and driver scheduling problem

The world's second largest producer of pork, Danish Crown, also provides a fresh meat supply logistics system within Denmark. This is used by the majority of supermarkets in Denmark. This article addresses an integrated vehicle routing and driver scheduling problem arising at Danish Crown in their fresh meat supply logistics system. The problem consists of a 1-week planning horizon, heterogeneous vehicles, and drivers with predefined work regulations. These regulations include, among other things, predefined workdays, fixed starting time, maximum weekly working duration, and a break rule. The objective is to minimize the total delivery cost that is a weighted sum of two kinds of delivery costs. A multilevel variable neighborhood search heuristic is proposed for the problem. In a preprocessing step, the problem size is reduced through an aggregation procedure. Thereafter, the aggregated weekly planning problem is decomposed into daily planning problems, each of which is solved by a variable neighborhood search. Finally, the solution of the aggregated problem is expanded to that of the original problem. The method is implemented and tested on real-life data consisting of up to 2,000 orders per week. Computational results show that the aggregation procedure and the decomposition strategy are very effective in solving this large scale problem, and our solutions are superior to the industrial solutions given the constraints considered in this work.