

Car packing on an electric ferry

We discuss a new electric car ferry operating along the west coast of Norway. The ferry visits a total of 17 different ports, of which only three are mandatory stops. It can carry up to 27 standard cars across three lanes. Depending on the loading arrangement, cars may need to reverse onto or off the ferry. In some cases, vehicles may also need to disembark at an intermediate port and reboard later to allow for the reorganization of the onboard layout.

We present an optimization model for creating an efficient loading, unloading, and parking schedule, ideally such that each vehicle remains stationary between its departure and destination ports. When that is not feasible, the objective is to minimize the number of vehicle relocations. The purpose of this model is to automate the planning process and reduce the workload and stress on the ferry's small crew.

A key challenge in our model is the uncertainty in customer demand, as bookings can be made online during the voyage. Therefore, we aim to develop a flexible solution capable of adapting to real-time changes.

Solving a full-scale instance of this problem using an exact method is computationally intractable. However, finding the optimal solution is not critical; what is needed is a feasible plan that supports automated loading and unloading to assist the crew. To this end, we propose a heuristic approach that can handle real-world problem sizes. The heuristic introduces the concept of “dummy cars”—rewarding solutions that leave room for additional vehicles—to encourage more flexible and adaptable loading configurations.

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