Dynamic pricing in the vehicle ferry industry

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Abstract

We will present an optimisation approach for vehicle ferry pricing and packing, where we allow for different ferry configurations (e.g. movable decks). When demand is high, the optimal prices we derive should regulate demand so as to encourage the most profitable vehicle mix and deck configuration. Optimal packing solutions are firstly derived for all vehicle mixes; these vehicle mixes define the ferry's capacity envelope, and the optimal packing solutions correspond to its Pareto front. Allowing for different ferry configurations enlarges the capacity envelope. The vehicle mixes are used as the states of a dynamic program, which is solved to determine the optimal price points for each vehicle type at each level of remaining capacity and time interval during the selling season. The proposed approach is based on ferries which use a lane based approach for loading on departure day. As an extension, we also evaluate the revenue impact of relaxing the strict lane-width constraint by making lane-width a decision variable of the model, leading to a 2-dimensional rectangular packing problem. We use simulation to compare the revenue obtained using the optimal static booking limit solution with the optimal dynamic pricing solution and pricing solutions obtained using heuristic packing algorithms. We will present computational results on generated instances based on data from commercial partners, which highlight the revenue impact and computational cost of the proposed approach.