A pickup and delivery problem with automated guided vehicles - modelling approaches

Pickup and Delivery Problems (PDP) and their variants are commonly found in logistics and transportation systems. This work addresses a logistic transport problem where homogeneous vehicles must fulfill transportation requests between pickup and delivery nodes, subject to service level agreements (SLAs). We compare the performance of two Mixed-Integer Linear Programming (MILP) models: one formulated as a natural PDP and the other as a sequencing problem. Results show that the sequencing-based formulation is more efficient in terms of computational performance.

Furthermore, as the overall objective is to minimize both empty vehicle travel and delivery delays, we decompose the original multi-objective function into two separate single-objective models. This decomposition enables a clearer analysis of the individual impact of each objective component on the quality and structure of the solutions.

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