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Vehicle Dispatching with Time-Dependent Travel Times

Time-dependent vehicle routing problems have been relatively ignored in the literature, even if they more closely model real-world problems. Variations in travel times may come from predictable events, like congestion during peak hours, or unpredictable ones, like accidents and vehicle breakdowns. In this work, we propose a solution approach for vehicle routing and dispatching with predictable time-dependent travel times. This approach exhibits a desirable "first-in-first-out" property. That is, any vehicle moving from location i to location j at a given time, will reach j before any other identical vehicle moving from i to j at a later time.

The proposed approach is applied both in a static context where all customer requests are known in advance and in a dynamic context, where the requests occur continuously over time and must be dispatched in real-time.

A tabu search heuristic, previously developed for problems with fixed travel times, was modified to address the time-dependent issue and assess the benefits of our approach. The results show that the solutions produced with a fixed approximation of the true travel times (e.g., by using an average taken over the entire day) are clearly not competitive with those produced with the time-dependent heuristic. This conclusion applies both in the static and dynamic contexts.