Truck dispatching in a tank terminal

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Large-scale manufacturing of products, such as gases and chemicals, requires adequate storage facilities. While tank terminals may store these products, the necessary transportation to and from terminals is not included. Consequently, clients outsource transport requirements to external contractors. Employing these contractors may incur additional costs when delays within the tank terminal itself exceed a certain threshold.

While the type of vehicle employed to transport products varies, this paper's focus exclusively concerns trucks. Trucks load or unload their cargo at the loading yard. The layout of the loading yard implicitly introduces a blocking constraint: a stationary truck preventing another truck from reaching its destination further on in the loading yard. Although scheduling problems in container terminals have been extensively discussed [1], scheduling in tank terminals has not yet been academically addressed. Currently, it is the responsibility of truck schedulers to assign each truck to its loading position. Schedulers dispatch trucks on a first-come-first-served basis whereby the first truck whose loading position is available and reachable is sent through the yard. Presently, there is no evidence whether the applied dispatching rule is efficient or not. Thus, the primary objective of this research is to reduce the average blocking time via optimization and decision support, resulting in a more efficient schedule.

The focus of this work is on the algorithm employed to minimize the total blocking time and various other important objectives. The proposed algorithm finds a dispatch order for the trucks followed by the construction of a feasible schedule via a schedule generator. The schedule generator takes the dispatch order and the loading position to which each truck is assigned and constructs a schedule from this input while simultaneously respecting all necessary constraints (including the blocking constraint). When offering terminal customers a competitive service it is important to address not only the average blocking time, but also to minimize the additional costs experienced when contractual handling times are exceeded. Certain possible approaches capable of achieving this are to consider either the total number of trucks violating this soft constraint or the total amount of time each truck has violated their contractual handling time.

Instances, which include truck arrival times and the specific product processed, are made available by the tank terminal of Oiltanking Stolthaven Antwerp NV (OTSA) for the experiments conducted. These instances provide a means of comparing our algorithm's schedules against the manually-generated schedules created by truck schedulers.

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References

[1] Dirk Steenken, Stefan Voß, and Robert Stahlbock. Container terminal operation and operations research – a classification and literature review. *OR Spectrum*, Volume 26, 2004, Pages 3–49.