Evaluating the Resilience of a Loading Facility with Estimated Time of Arrival Information

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Abstract

Slot management systems such as the Truck Appointment System (TAS) play a crucial role in the functioning of the logistic terminals such as loading and unloading facilities by managing the timing of truck arrivals. But truck arrivals are unpredictable due to the uncertain nature of road traffic. Both early and late truck arrivals increase truck waiting times and create congestion around the loading facilities, which is undesirable. Due to the emergence of Industry 4.0 technologies, real-time truck arrival information can be shared to manage slot adjustments better as late arrivals reduce slot utilization and affect slot availability for future bookings. This study is focused on a loading facility facing uncertain truck arrivals and proposes mathematical models for optimal rescheduling of slots in the presence of truck arrivals information. The integer mathematical model developed for optimal rescheduling minimizes the truck waiting times by explicitly capturing the complexity of loading operations at a petrochemical facility. We integrated the rescheduling model into a discrete-event simulation model to compare the performance of the proposed approach with the current scenario to estimate the expected benefits at higher congestion and demand levels. The results show that the truck waiting time reduces by more than 50% at higher congestion levels.

Keywords
Slot management, Online rescheduling, Estimated Time of Arrival, Truck appointment system, Road traffic

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Biographies
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