Dynamic Multimodal Freight Routing using a Co-Simulation Optimization Approach

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Abstract

One of the challenges for freight transport efficiency arises from the fact that both freight and passenger traffic share the same infrastructure for
moving people in addition to freight goods which leads to non-homogeneous traffic. This non-homogeneity has a detrimental impact on urban
transport performance because of the differences of vehicle sizes and dynamics between passenger and freight vehicles. Without efficient management
of the freight transport, the whole transportation network will face severe capacity shortages, inefficiencies, and load imbalances.
However route decision-making in a dynamical and complex urban multi-modal transportation environment aims to minimize a certain objective cost
relying on the accurate prediction of traffic network states and estimation of route costs that are not readily available. We introduce a hierarchical
routing system to solve the formulated freight routing problem when hard vehicle availability and capacity constraints exist. The simulation layer
provides the state and cost estimation and prediction for the upper optimization layer in which we use a COSMO (CO-Simulation Optimization)
approach to solve the formulated freight routing problem based on iteratively rebalancing the freight loads. A simulation testbed consisting of a road
traffic simulation model and a rail simulation model for the Los Angeles/Long Beach Port regional area has been developed and applied to
demonstrate the efficiency of the proposed approach.

Keywords: Logistics, Routing, Load Balancing

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