Investigating the Impacts of Freight Consolidation and Truck Sharing on Freight Mobility

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Develops and validates two freight demand models for shared freight hauling and applies the models to holistically quantify truck sharing benefits

The trucking industry has become an indispensable part of the U.S. economy. However, the trucking industry is also fragmented - and this fragmentation presents a barrier to improving efficiency of the industry. It is difficult for small carriers to obtain enough shipping demand to fill their truckloads for each trip, especially their returning trips. Empty trucks increase freight cost, contribute to traffic congestion, and increase air pollution. The newly developed online freight-matching marketplaces can help small carriers find shippers to reasonably fill their truckloads. However, currently there are no online freight consolidation algorithms available, due to the complex nature of the problem itself. To address this problem, the study develops freight demand models for shared freight hauling and quantifies the impacts of truck sharing on network capacity, congestion, and the environment. The results of this study can be utilized by transportation authorities and logistics companies for online freight matching problems, and thus further improve freight efficiency and reduce traffic congestion and emissions.

Problem Statement

The trucking industry contributes over 84% of revenue in the U.S. commercial transportation sector. This industry is the source of many direct and indirect employment opportunities in the country. However, the U.S. trucking industry is fragmented. Currently there are over 110,000 carriers and 350,000 independent owner-operators. Among them, around 97% of the carriers own less than 20 trucks and around 90% own six or less trucks. This fragmentation hinders the efficiency of cargo transportation. It is difficult for small carriers to obtain enough shipping demand to fill their truckload for each trip, especially returning trips. An estimated 20% of the trucks on the road are traveling empty. This reduced efficiency causes a hike in shipping prices, greenhouse gas emissions, and traffic congestion. Further considering the unused spaces of non-empty trucks, there is significant need for improved efficiency. Truck sharing is one such way to attain better efficiency.

Figure 1. Empty trucks increase freight cost, contribute to traffic congestion, and increase air pollution.

The newly developed online freight-matching marketplaces can help small carriers find shippers to reasonably fill their truckloads. Online freight matching marketplaces work like Uber, using a mobile app as a communication platform between carriers and shippers. The online marketplaces eliminate the “middleman” between concerned parties, and using the mobile app costs less than paying a broker. The online freight-matching market places are rising to prominence with a network of small carriers. As the size of the network grows, large carriers are also beginning to use this option to handle unmet demand or unused capacities. However, online freight consolidation is much more complicated than Uber? s online driver-passenger matching, due to the many different types and sizes of freight and trucks. It is difficult and time-consuming for carriers to search shippers’ demand information online to identify freight consolidation options. Due to the complex nature of the problem, there are currently no online freight consolidation algorithms available.

Summary

The study aims to address this gap, by demonstrating the various benefits of online freight consolidation (most notably on freight mobility) - and providing information that transportation authorities and logistics companies can further utilize and develop models from. Specifically, this study involves:

- Conducting a literature review of truck sharing initiatives in the U.S.; identifying new start-up companies, types of commodities, tonnage of commodities, etc.
- Identifying available truck-sharing data and obtaining letters of commitment from data owners agreeing to share their data.
- Developing and validating freight demand models for shared freight hauling.
- Developing and validating models for quantifying impacts of truck sharing on network capacity, congestion, and environment.
- Applying these models to forecast freight moved by truck sharing (by commodity type) and estimating its potential benefit.

Status Update

Currently, the research team has completed the literature review, identification of available truck-sharing data, and developed preliminary freight sharing demand models. Data (a one-month sample) has been provided by Transplace. Transplace is a non-asset based logistic service provider, offering manufacture and retailer logistics and transportation management services. This data will be used to validate the developed models - as well as in estimating the potential benefit of truck sharing.

Currently, the two demand models have been mathematical established/formulated. Both models identify effective routes for trucks to pick up and deliver shipments. Different shipments are consolidated along a route, but will never be relayed over multiple trucks; hence reducing time and costs associated with loading/unloading.

Impacts

The results of this study can be further utilized by transportation authorities and logistics companies for online matching problems, including in the development of more efficient freight consolidation models/algorithms. The expected benefits of online freight consolidation includes higher utilization rate of truck capacity, overall higher efficiency, shorter shipping time, and lower cost to shippers. Online freight consolidation will also leverage the driver shortage problem, reduce the number of traveling empty trucks, and decrease traffic congestion and greenhouse gas emission.

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

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