Examining the Differential Responses of Shippers and Motor Carriers to Travel Time Variability

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ABSTRACT
Shippers and motor carriers are impacted by and react differently to travel time variability due to their positions within the supply chain and end goals. Through interviews and focus groups these differences have been further examined. Shippers, defined here as entities that send or receive goods, but do not provide the transportation themselves, are most often concerned with longer-term disruptions, which are typically considered within the context of transportation system resilience. Motor carriers, defined here as entities engaged in transporting goods for shippers, are most often concerned with daily travel time variability from events such as congestion. This paper describes the disparity in concerns and the strategies shippers and motor carriers are likely to engage in to address time travel variability. This knowledge allows for a better understanding of how investments to mitigate travel time variability will impact shippers and motor carriers.

Keywords: Freight Transportation, Resilience, Shipper and Motor Carrier, Supply Chain Disruptions, Transportation System, Travel Time Variability

INTRODUCTION
Over the last ten years, the United States’ transportation infrastructure has suffered from significant disruptions. The terrorist attacks of September 11th, the 2002 West Coast lockout of dock labor union members, infrastructure failures following Hurricane Katrina, and various extreme weather disruptions have all caused delay to users of the transportation system. At the same time, supply chain management techniques have favored lean supply chains, and minimal infrastructure development has created more reliance on individual pieces or segments of the transportation network, such as specific ports of entry, and rail or road corridors. Disruptions, when they occur to essential pieces of the network, ultimately increase travel times. This has lead to the consideration of resilience
in supply chains and transportation network planning. While these major disruptions are of concern, smaller disruptions, or those with shorter timeframes of disruption, occur on a daily basis. Disruptions caused by congestion are the most frequent of these disruptions and have significant implications for the cost of moving goods, particularly in urban areas. According to the Texas Transportation Institute’s Urban Mobility Report, in 2007 roadway congestion (based on wasted time and fuel) in urban areas within the U.S. is estimated to have cost approximately $87.2 billion (Schrank & Lomax, 2009). Disruption can be measured either as an increase in travel time or increase of transportation cost to reduce or eliminate travel time increases. These disruptions have significant impacts on the movement of people and goods, and on the economic system.

Travel-time variability is the opposite of travel-time reliability, a desired performance characteristic. It is defined as the degree to which the travel time for the same trip varies from day-to-day (the same trip implies from the same origin to the same destination, at the same time of the day, using the same mode, and by the same route). If there is large variability, then the travel time is said to be unreliable because transportation system users have difficulty predicting travel times. If there is little or no variability, then the travel time is said to be reliable because you can expect travel times to be the same day to day. Variability in travel times increase transportation and inventory cost as more flexibility must be built into the operations through strategies such as increasing equipment, drivers, and inventories.

Shippers and carriers are two specific transportation system users who are concerned with travel time variability. A shipper is an entity that wants their goods moved. Sometimes shippers fulfill their own transportation needs using in-house transportation, but often, and within the context of this paper, shippers are those sending or receiving goods, but not responsible for their transportation. Examples of shippers include retailers such as Wal-Mart, or manufacturers such as Boeing. While 75% of North American shippers outsource domestic transportation and 70% outsource international transportation (Langley et al., 2009), this definition of shipper does not limit the significance of this analysis, as shippers who carry out their own transportation are considered carriers within the context of this paper. A carrier is a company or individual that is engaged in transporting goods for a shipper or receiver. While there are also water, air, and rail carriers, within this research, we consider only motor carriers. Examples of such motor carriers include logistical services providers like FedEx, or trucking companies such as J.B. Hunt. Motor carriers employ their drivers, hire independent contractors, or use some combination of the two. Motor carriers pay employee drivers by the mile, hour, or some combination of the two, and typically pay independent contractors by the trip.

Shippers and motor carriers are impacted by and react differently to travel time variability due to their positions within the supply chain and end goals of their operations. This paper describes the many factors which impact the relative cost and exposure of shippers and motor carriers to travel time variability. Also, the range of responses to travel time variability are examined, as current and future responses to disruptions impact the relative cost of these disruptions. In examining these differential responses, a relationship develops between the concepts of transportation disruptions and travel time variability. Transportation disruptions are of concern for improving transportation system resilience, and travel time variability is a concern for achieving travel time reliability. This paper argues that major disruptions, which are the outliers of these travel time observations are the primary concern of shippers, and that travel time variations which occur more frequently are the primary concern of motor carriers. Figure 1 depicts these two regions of concern and serves as a framework of analysis. The box on the left considers the more frequent, but smaller magnitude disruptions of concern to motor carriers. In the existing transportation literature, these types of disruptions are generally addressed when discussing reliability of travel time. The
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