

New Logistics

This paper is based on work completed as part of The University of Minnesota's Transportation Futures Project. More information about The Transportation Futures Project can be found on the [project homepage](#).

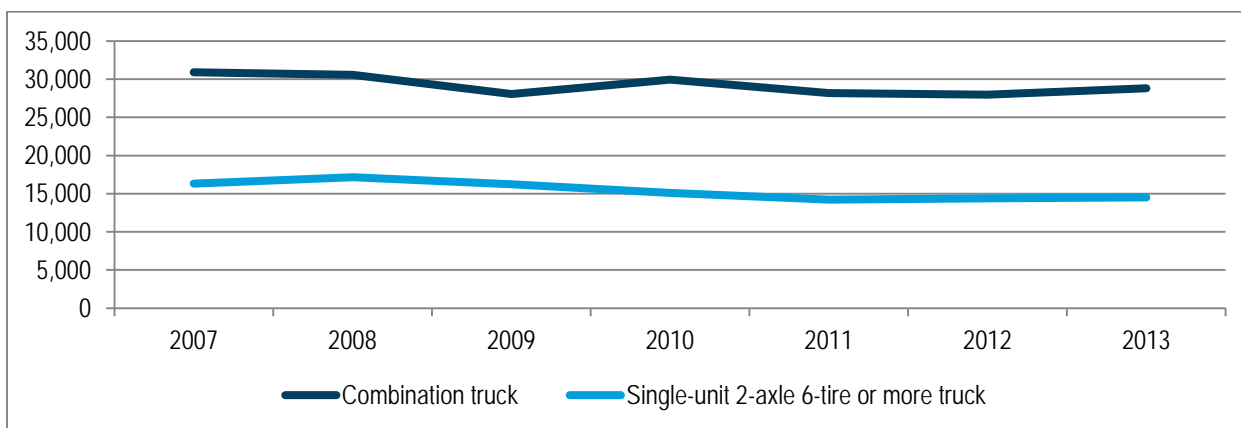
Nearly one-third of all energy used for transportation in the world is consumed by trucks, ships, and trains moving freight from one market to another.¹ In the Midwest and in Minnesota in particular, trucks are the dominant mode of transportation for freight. New business models are changing the ways in which customers expect goods to move around the country, driven by changes in e-shopping and companion product delivery methods (more information can be found in the Telecommunications & Transportation trend analysis paper). These changing expectations will have significant impacts on how logistics companies adapt and evolve into the future.

FREIGHT MOVEMENT IN MINNESOTA

Freight in Minnesota is moved by a variety of methods, including trucks, rail, ships, airplanes, pipelines, and in some cases, other modes. Trends in the freight rail industry are covered at length in the [Freight Rail in Minnesota](#) trend analysis paper. Minnesota has seen an increase in the use of heavy duty trucks over the last several years after a drop in tonnage carried from 2008 to 2009.² Data from the U.S. Department of Transportation's Freight Analysis Framework shows that on a ton-by-ton basis, trucks are by far the most utilized mode for moving freight in Minnesota, with a total of more than 795 million tons shipped on trucks in 2012.³ Trucks also move the highest total value of goods in Minnesota, but not on a per-ton basis. Air cargo traveling to, from, or within Minnesota has an average per-ton value of \$102,701, due in large part to the fact that high-priced small goods are often shipped by air, including electronics, medical devices, and precision instruments.⁴ Truck shipments' value averages just over \$700 per ton.⁵ More information about the portion of tonnage and value of freight shipped in Minnesota during the year 2012 can be found in Figure 2 on the next page. Multimodal shipments include any freight that is carried on multiple modes over the course of its journey, or by the U.S. Postal Service or other couriers. Freight classified in the "Other" category includes shipments for which a mode could not be determined.

It takes a significant amount of fuel to move freight around the United States. Truck-based freight transportation in the United States uses over 40 billion gallons of fuel to carry goods to market.⁶ For comparison, passenger vehicles in the US used about 123 billion gallons of gasoline in 2014, just over three times as much fuel as the freight transportation system.⁷ The amount of fuel used by trucks in the U.S. can be found in Figure 1.

Figure 1: Millions of gallons of fuel used by trucks in the United States⁸



¹ Levinson et. al., 2015

² Levinson et. al., 2015

³ [Freight Analysis Framework, 2016](#)

⁴ Ibid.

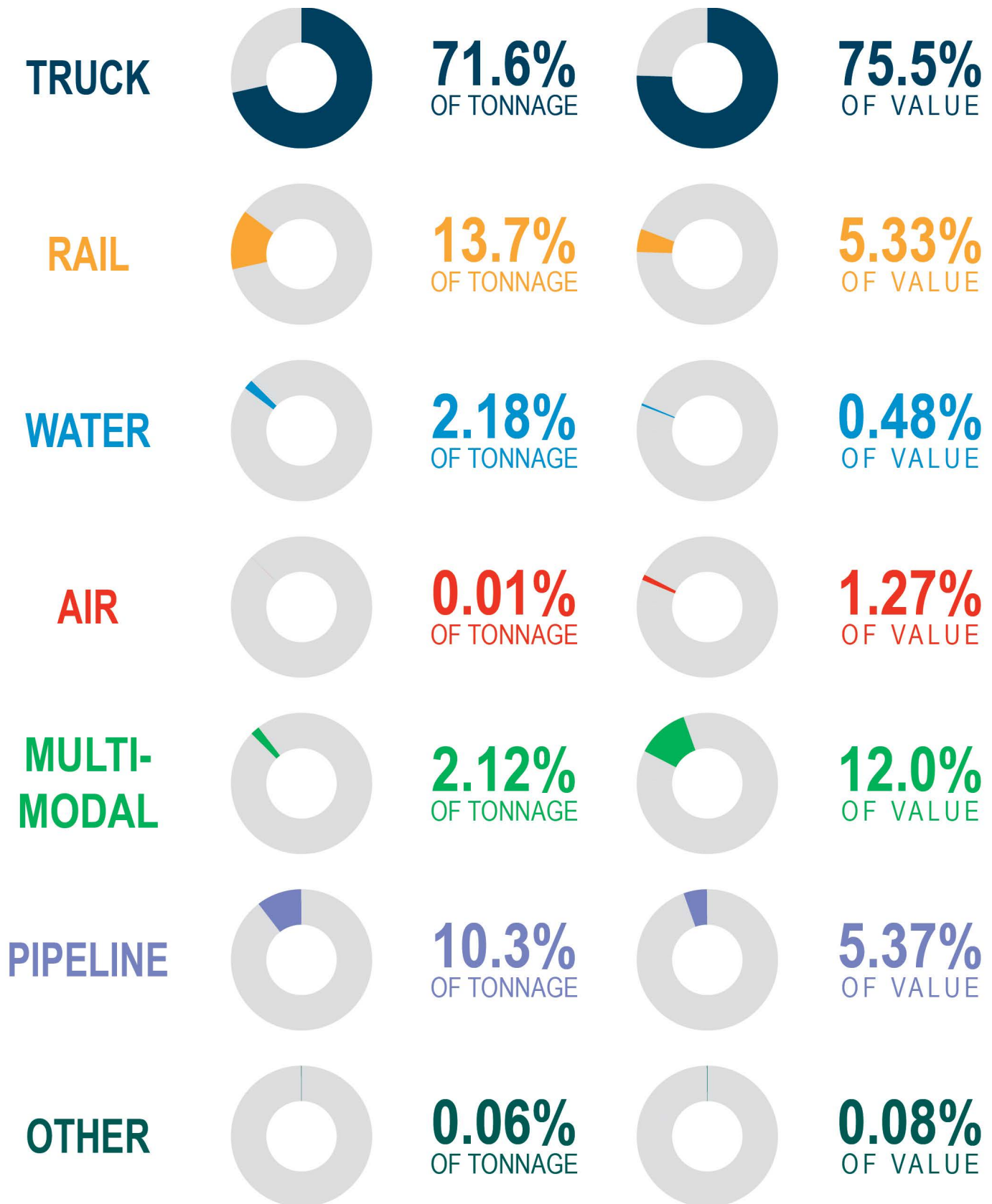
⁵ Ibid.

⁶ Levinson et. al., 2015

⁷ [U.S. Energy Information Administration, 2015](#); passenger vehicle fuel use accounts for [about 90%](#) of gasoline consumption.

⁸ [US RITA, 2015](#)

Figure 1: Percentage of tonnage and total value shipped by mode in Minnesota⁹



⁹ Freight Analysis Framework, 2016; Data reflects estimated 2012 shipments

LOGISTICS ORGANIZATION

Widely available data is changing the logistics sector in many of the same ways that it has pushed people to rethink business models in many other aspects of 21st century life. Using data to share information about shipments, to select optimum routes, and to time deliveries precisely offers the opportunity to increase efficiency, reduce the number of vehicles needed to move freight, and to reduce the environmental footprint of the logistics industry. Improvements in IT practices may help to limit the total mileage of freight shippers on the freight system, and will also likely result in the use of vehicles that are filled closer to their capacities.¹⁰

In addition to implementing new IT capabilities, many distributors are building more distribution centers than they have utilized at any time in the past. Walmart, for example, has more than 100 distribution centers in the United States, compared to only 12 one decade ago.¹¹ The increase in distribution center prevalence has been driven by multiple factors, one of which is a pervasive lack of truck drivers in the United States willing to take on long-haul shipping routes.¹² Additional distribution centers may also better facilitate the implementation of same-day shipping. By building more distribution centers, shipping companies are able to perform “drop-and-hook” movements of freight around the country which allow for more short-haul freight movements and additional home-time for truck drivers.¹³

The Physical Internet

One potential idea for reorganization in the freight industry revolves around a concept known as the “Physical Internet.” The Physical Internet imagines a reorganized system for how companies and freight carriers interact and move goods from point A to point B. In the concept of the physical internet, companies that ship goods utilize one of a series of pods or Pi containers that homogenize the exterior packaging of goods, much like shipping containers do on ocean-faring cargo ships.¹⁴ The name is linked to how data moves through the internet on connections via standardized packages of data. By doing so, shipping companies can anticipate one specific type of container that fits with other containers.¹⁵ This eliminates the need for multiple loading devices, standardizes shipment size across different industries and countries (the U.S. uses a different pallet size than European or Asian countries, for example), and minimizes the amount of unused space on a good-carrying vehicle.¹⁶

A study conducted by researchers at the University of Arkansas and Virginia Tech University found that transitioning 25% of the U.S. supply chain from current methods to a conceptual Physical Internet would yield a 33% reduction in carbon dioxide emissions, \$100 billion in increased profits for participating firms, and cheaper goods for consumers.¹⁷ The current freight shipment industry often relies on older, inefficient practices to move goods across the country. The average utilization rate of a semi-trailer on the road in the United States today is carried at 50% capacity.¹⁸

BUSINESS DELIVERY

Business delivery services and same-day-delivery service for commercial operators have existed in some capacity for years. Traditional same-day-delivery companies like Grainger have offered deliveries of low to medium quantities of industrial parts to businesses for two decades.¹⁹ Emerging technologies have significantly changed the way that businesses conduct same-day deliveries between one-another and future technical advances have the potential to disrupt the market even further. Startup companies using the same basic principles as Uber and Lyft have begun to offer business-to-business delivery by relying on delivery personnel using their own vehicle or bicycle to deliver packages within a city.²⁰ At some point,

¹⁰ Levinson et. al., 2015

¹¹ Ibid.

¹² Ibid.

¹³ Ibid.

¹⁴ [Trebilcock, 2012](#)

¹⁵ Levinson et. al., 2015

¹⁶ [Trebilcock, 2012](#)

¹⁷ [Meller & McGowan, 2012](#)

¹⁸ [Meller, Ellis & Loftis, 2012](#)

¹⁹ Levinson et. al., 2015

²⁰ [Dropoff, 2016](#)

companies may move beyond requiring these deliveries all together. It is possible that 3D printing and additive manufacturing could create some of the parts that must currently be delivered from one business to another.²¹

HOME DELIVERY

Numerous online retailers have begun assembling plans for same-day-delivery services to more closely mimic the immediacy of shopping in brick-and-mortar stores. Walmart, Amazon, and Google in addition to others are all developing same-day-delivery projects in cities and regions around the United States.²² In addition to retailers, other third-party companies like Postmates are beginning to develop rapid delivery services to bring goods from local and big-box stores to consumers.²³ The total value of the same-day-shipping market likely means that new players and additional innovations will continue to emerge into the future. Projections for the total amount collected in same-day-shipping fees are projected to grow beyond \$1 billion in the year 2018, a 100-times increase from the amount collected in 2013.²⁴

The re-organization of distribution patterns will have a significant effect on the cost of same-day delivery to consumers, and the total impact on the transportation system and environment. Consolidated delivery locations, where parcels are dropped off for more than one customer, may reduce the amount of time spent going from door to door by delivery companies, though it remains to be seen whether or not customers would accept losing the convenience of online-to-door shipping. Alternatives, like Amazon Prime Air, are exploring the possibility of delivering goods using drone technology within a short amount of time from purchase.²⁵ Amazon's prototype delivery drone uses sense-and-avoid technology to identify and avoid obstacles and has the ability to see in a 10 mile radius.²⁶ It is also conceivable that autonomous vehicle technology could be used to deliver parcels from stores to consumers without requiring human direction. Peer-to-peer delivery services being developed by Uber, Lyft, and other players in the so-called "shared" economy also offer options for increasing the availability of same-day delivery. These developments compliment further gains in home grocery delivery and prepared food delivery over the last decades.

DIGITAL GOODS

The translation of previously tangible goods like books, music, and movies, into data products has dramatically changed entire industries in the United States. Small neighborhood bookstores were put out of business by larger big-box bookstores, which were eventually forced to adapt or close by online giants like Amazon.²⁷ The process of renting movies from retail outlets like Blockbuster underwent rapid changes as Redbox and streaming services like Netflix changed the way that people watched movies and TV shows at home. At this point, consumable entertainment seems to have transitioned almost completely to electronic delivery with only nostalgia tying people to purchasing books, movies, and music in physical forms.

Further transformation of goods delivery into the digital realm could be realized with the advent of cost-effective, small-scale three-dimensional printing. Whether or not the eventual home of 3D printers is within the home, they promise to offer more decentralized manufacturing for goods that will likely reduce the total amount of travel required for the production of materials. Researchers at the University of Minnesota envision three different scenarios for the eventual adoption of 3D printing.²⁸ In the first, 3D printers are used by consumers to prototype goods and send designs to professional "makers" for production. In the second scenario advanced desktop printers are available in homes and consumers purchase intellectual property files from designers which are then used to print goods. In the third an entire industrial revolution occurs with small printing factories rising up across communities to make products that are designed through computer coding by people from all walks of life. While raw materials will still need to be shipped, a reduction in intermediary steps would likely result in a drop in total miles traveled by vehicles in the freight system.

²¹ Ibid.

²² Levinson et. al., 2015

²³ [Postmates, 2016](#)

²⁴ Levinson et. al., 2015

²⁵ More information about the impact of drones on Minnesota's transportation system can be found in the Unmanned Aerial Systems trend analysis paper.

²⁶ [Amazon, 2016](#)

²⁷ Levinson et. al., 2015

²⁸ Ibid.