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# E-Commerce Impacts on the Trucking Industry

February 2019



Prepared by the American Transportation Research Institute



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## LIST OF ACRONYMS

3PL	Third-Party Logistics
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
BLS	Bureau of Labor Statistics
CSA	Compliance, Safety, Accountability
EIA	Energy Information Administration
ELD	Electronic Logging Device
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FPM	Freight Performance Measures
HOS	Hours-of-Service
JIT	Just-in-Time
LCV	Longer Combination Vehicles
LNG	Liquefied Natural Gas
LTL	Less-than-Truckload
MC	Marginal Cost
MPH	Miles per Hour
NDA	Non-Disclosure Agreement
P&D	Pick-up and Delivery
RAC	Research Advisory Committee
R&M	Repair and Maintenance
TL	Truckload
U.S.	United States
VMT	Vehicle Miles Traveled



## **RESEARCH OBJECTIVE**

In 2017, the American Transportation Research Institute (ATRI) Research Advisory Committee<sup>1</sup> (RAC) ranked “The Impact of E-Commerce Growth on the Trucking Industry” as one of its top research priorities for the year. Citing the rapid pace of change in retail supply chains and distribution/fulfillment models caused by the emergence of e-commerce, the RAC asserted that trucking industry stakeholders would benefit from understanding how these changes would impact trucking issues and operations.

This report has two main objectives in response to the RAC’s mandate:

- 1) Provide background on emerging e-commerce and omni-channel retailing trends, as well as on the ongoing transformation in retail supply chains and distribution/fulfillment networks; and
- 2) Map the effects of e-commerce to trucking operations and ATRI’s 2018 Top Industry Issues.<sup>2</sup>

To accomplish these goals, this report merges analyses of distribution models and consumer behavior – in conjunction with data and insight provided by trucking industry experts – to provide salient business intelligence on shifting retail logistics and supply chains. Finally, this report will provide trucking industry stakeholders with a better understanding of how to adapt to the opportunities and challenges that e-commerce has presented to the industry.

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<sup>1</sup> ATRI’s Research Advisory Committee is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, labor and driver groups, law enforcement, federal government, and academics. The RAC is charged with annually recommending a research agenda for the Institute.

<sup>2</sup> “Critical Issues in the Trucking Industry – 2018.” American Transportation Research Institute (ATRI). October 2018. Arlington, VA.

## **INTRODUCTION**

Technological advancements and the ongoing migration of business operations to online, or e-commerce, platforms have dramatically improved consumer experiences and expectations. Consumers, particularly in densely populated urban areas, now expect a broad inventory of goods to be readily available to them both in-store and online. Consumers also expect that these products can be picked up or delivered to them at little-to-no additional cost in much shorter delivery windows.

The retail industry has had many difficulties adapting to these consumer-driven changes. Business models that revolved around centralized distribution networks and a substantial brick-and-mortar store presence are evolving into flexible omni-channels that are defined by varied consumer interfaces, points of sale, and modes of order fulfillment.

While motor carrier operations have been affected by e-commerce and omni-channel retailing, the extent to which these emerging consumer trends will affect industry operations and the industry's most critical issues is not fully understood. This research highlights a variety of ongoing changes and challenges, and analyzes how motor carriers can adapt to these trends.

## **E-COMMERCE AND OMNI-CHANNEL RETAILING**

E-commerce, which is defined as retail and business transactions involving the use of online platforms, and omni-channel retailing, which represents a synchronized retail experience across multiple sales platforms (e.g. online and in-store), have emerged as disruptive business models in the retail industry. Technological innovations have fueled significant improvements in the consumer experience and, consequently, changes in the supply chain and distribution models needed to support these improvements.

### *Changing Consumer Spending Patterns*

Traditionally, the retail business model involved a direct, physical relationship between consumers and retailers (Figure 1). The primary objective for retailers was to draw foot traffic to their brick-and-mortar stores to drive sales, competing with other retailers over price, quality, selection, and location. Consumers would then commute to malls and stores to purchase items, and transport the goods themselves. Behind the scenes, retailers managed inventory at their stores through a centralized network of distribution centers. These high-volume “big box” facilities would be spread throughout a retailer’s region of operation, and would service the inventory needs of all the retail locations within their respective zones. From a logistics perspective, retailers and suppliers would leverage a combination of air, rail, and over-the-road trucking to move products inter-regionally, with local truck services handling local and regional hauls.

**Figure 1: The Traditional Retail Model**

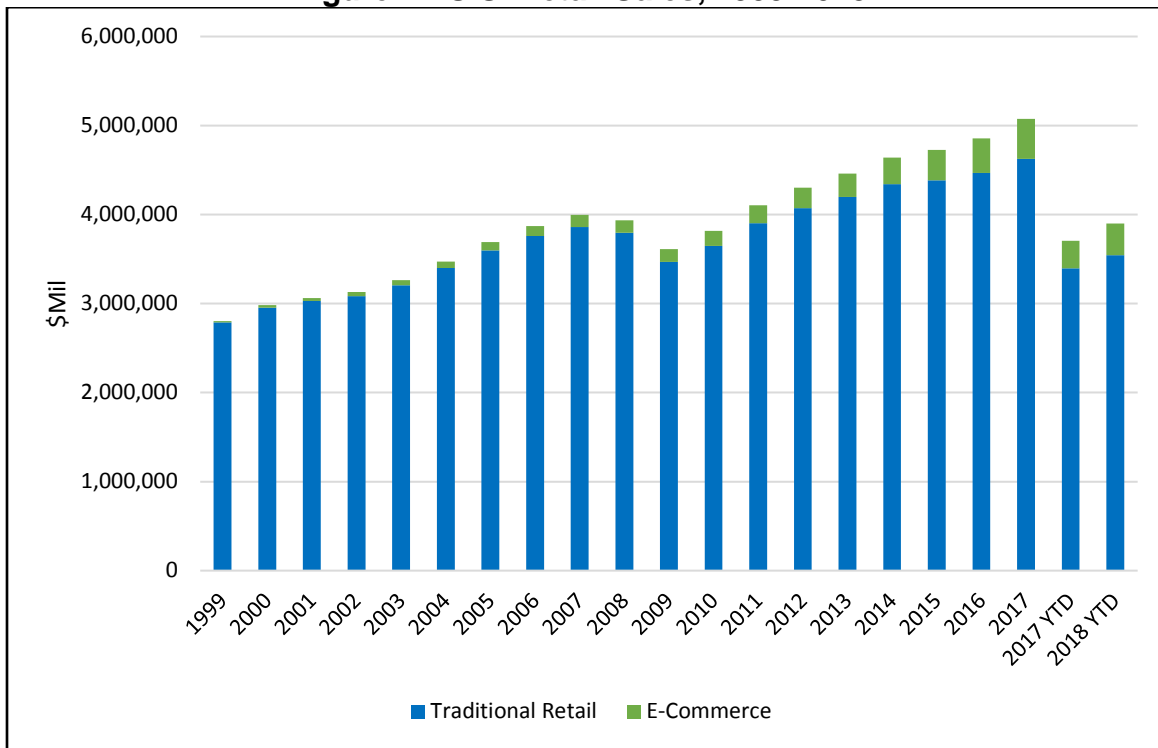


Emerging consumer spending patterns are changing retail models in new ways – total retail sales in the U.S. amounted to over \$5 trillion in 2017,<sup>3</sup> of which e-commerce represented \$449.9 billion, or nearly nine percent, of this total (Figure 2). This marks a period of tremendous growth, as e-commerce accounted for less than one percent of total retail sales in 1999. Indeed, the growth rate for e-commerce spending has ranged

<sup>3</sup> Monthly Retail Trade Report. “Estimates of Monthly Retail and Food Services Sales by Kind of Business.” *U.S. Census Bureau*. Retrieved June 11, 2018. Available online: <https://www.census.gov/retail/mrts/www/mrtssales92-present.xls>.

from 13 to 16 percent annually over the past five years, outpacing the one to five percent annual growth in traditional retail sales observed during the same time period.<sup>4</sup>

**Figure 2: U.S. Retail Sales, 1999-2018<sup>5</sup>**



An overwhelming majority (85.9%) of e-commerce sales are generated by non-store retailers, which are businesses that have a primary presence outside traditional brick-and-mortar stores.<sup>6</sup> For instance, retailers like Amazon and eBay are defined by an online presence, while others like QVC are involved in televised home shopping. E-commerce sales at these non-traditional retailers more than tripled between 2006 and 2016, while e-commerce sales at other types of businesses have also grown at a rapid pace during this time period (Table 1).<sup>7</sup>

<sup>4</sup> Quarterly E-Commerce Report. "Estimated Quarterly U.S. Retail Sales (Not Adjusted): Total and E-commerce." U.S. Census Bureau. Retrieved January 4, 2019. Available online:

<https://www.census.gov/retail/mrts/www/data/excel/tsnotadjustedsales.xls>.

<sup>5</sup> Year-to-Date (YTD) figures are year-to-date through September.

<sup>6</sup> "Non-store Retailers: NAICS 454." U.S. Department of Labor Bureau of Labor Statistics. Retrieved June 14, 2018. Available online: <https://www.bls.gov/iag/tgs/iag454.htm>.

<sup>7</sup> Annual Retail Trade Survey 2016. "Estimated Annual U.S. Retail Trade Sales – Total and E-commerce: 1998-2016." U.S. Census Bureau. Retrieved June 11, 2018. Available online: <https://www2.census.gov/programs-surveys/arts/tables/2016/ecommerce.xls>.

**Table 1: E-Commerce Sales by Business Type, 2016**

<b>Business Type</b>	<b>E-Commerce Sales (\$Mil)</b>	<b>10-Year Growth</b>	<b>5-Year Growth</b>
Non-store Retailers	334,197	279.0%	98.1%
Motor Vehicles and Parts Dealers	32,016	70.0%	53.7%
Clothing and Clothing Access Stores	7,843	566.4%	204.1%
Misc. Store Retailers	3,723	199.0%	N/A
Food and Beverage Stores	2,463	255.9%	195.3%
Building Materials and Garden Equipment and Supplies Dealers	2,251	339.6%	N/A
Sporting Goods, Hobby, Musical Instruments, and Book Stores	2,219	126.9%	33.7%
Electronics and Appliance Stores	2,186	116.2%	49.6%
Furniture and Home Furnishings Stores	1,076	193.2%	169.0%
<b>Total</b>	<b>389,111</b>	<b>243.3%</b>	<b>95.0%</b>

Digital spending has been concentrated in consumer products like apparel, furniture and furnishings, and electronics (Table 2); businesses have also begun to shift their purchases of industrial and construction supplies to online platforms.<sup>8</sup> Moreover, online spending across all categories has grown substantially over the past decade, reflecting the extent to which e-commerce spending is crowding out spending at traditional retail outlets (Table 2).<sup>9</sup>

<sup>8</sup> Soper, S. "Amazon Launches 'Business Prime' to Bring Quick Delivery to Work." *Bloomberg*. October 24, 2017. Available online: <https://www.bloomberg.com/news/articles/2017-10-24/amazon-launches-business-prime-to-bring-quick-delivery-to-work>.

<sup>9</sup> Annual Retail Trade Survey 2016. "U.S. Electronic Shopping and Mail-Order Houses (NAICS 4541) – Total and E-commerce Sales by Merchandise Line (1999-2016)." *U.S. Census Bureau*. Retrieved June 11, 2018. Available online: <https://www2.census.gov/programs-surveys/arts/tables/2016/ecommerce4541.xls>.

**Table 2: E-Commerce by Merchandise Line, 2016**

Merchandise Line <sup>10</sup>	E-Commerce Sales (\$Mil)	10-Year Growth
Clothing and clothing accessories (includes footwear)	59,135	358.9%
Other merchandise	51,512	423.1%
Furniture and home furnishings	39,510	402.9%
Electronics and appliances	39,433	296.8%
Drugs, health aids, and beauty aids	29,692	448.2%
Computer, communications, and related equipment	18,686	80.1%
Toys, hobby goods, and games	14,332	465.1%
Sporting goods	13,389	457.4%
Books (includes audio books and e-books)	13,100	254.6%
Computer software (includes video game software)	10,550	421.5%
Non-merchandise receipts	9,597	36.4%
Food, beer, and wine	9,129	300.4%
Office equipment and supplies	9,069	84.4%
Audio and video recordings (includes purchased downloads)	8,665	232.6%
Jewelry	6,882	222.8%
<b>Total Electronic Shopping and Mail-Order Houses</b>	<b>332,681</b>	<b>287.1%</b>

As a result of these consumer spending shifts, many traditional brick-and-mortar retailers are struggling to manage their debt levels and have been forced to close thousands of stores and reduce payrolls.<sup>11</sup> Department stores, in particular, have been dramatically impacted by these trends, with employment at such stores falling by more than 385,000 jobs since 2011 (Figure 3). Many of these job losses occurred in 2016 and 2017 as retail chains went out of business or reduced their geographic footprint; there were 2,130 fewer department stores in operation in 2017 than there were just two years prior.<sup>12</sup> Most recently Sears, the nation’s largest retailer up until the early 1990s, filed Chapter 11 bankruptcy.<sup>13</sup>

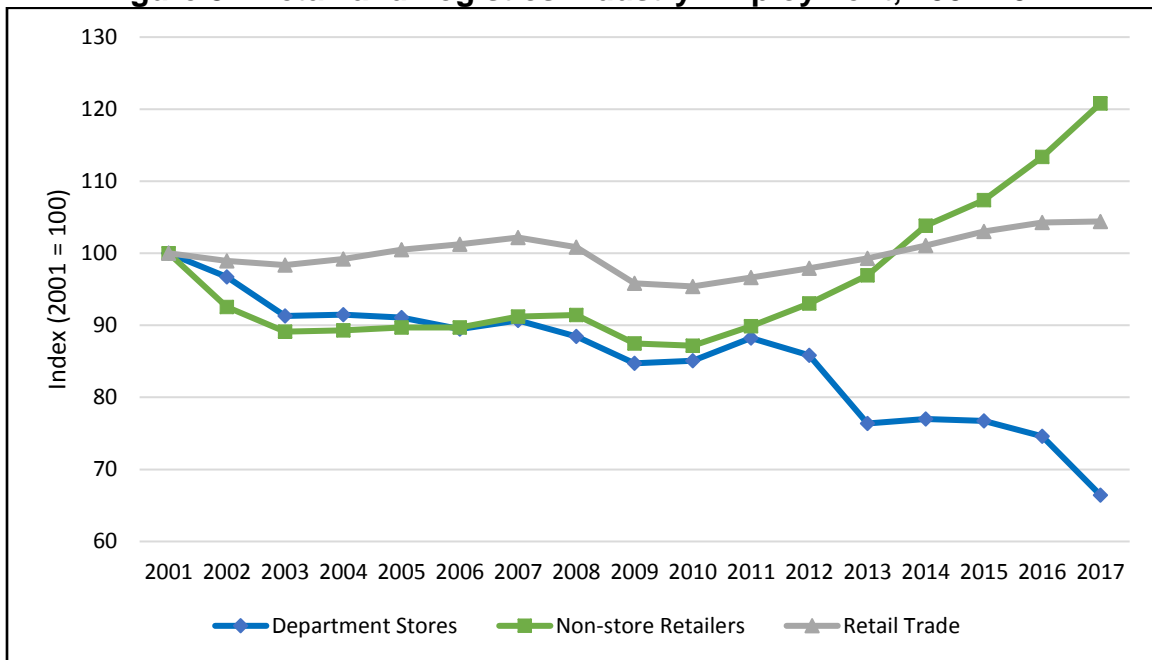
<sup>10</sup> Data represent sales at establishments engaged in the U.S. Electronic Shopping and Mail-Order Houses (NAICS 45411) industry, a subset of the Non-store Retailers (NAICS 454) industry.

<sup>11</sup> Townsend, M., Surane, J., Orr, E., and Christopher Cannon. “America’s ‘Retail Apocalypse’ Is Really Just Beginning.” *Bloomberg*. November 8, 2017. Available online: <https://www.bloomberg.com/graphics/2017-retail-debt/>.

<sup>12</sup> Quarterly Census of Employment and Wages (QCEW). *Bureau of Labor Statistics*. Retrieved June 11, 2018. Available online: <https://data.bls.gov/PDQWeb/en>.

<sup>13</sup> Green, R., McCarty, D., and Tiffany Kary. “Sears Goes Bankrupt, Mired in Debt and Deserted by Shoppers.” *Bloomberg*. October 14, 2018. Available online: <https://www.bloomberg.com/news/articles/2018-10-15/sears-said-to-be-filing-for-bankruptcy-protection-monday-morning>.

**Figure 3: Retail and Logistics Industry Employment, 2001-2017**

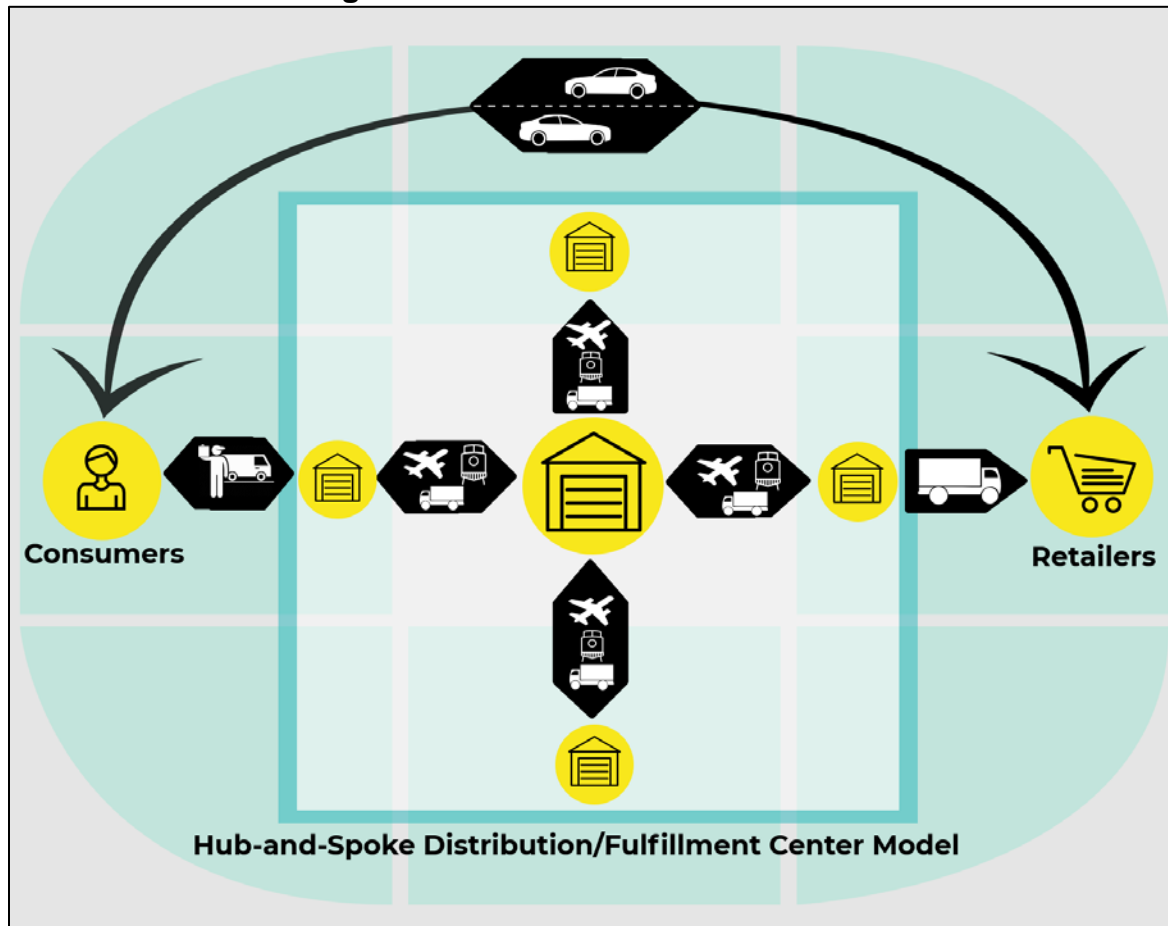


Some retail store job losses have been mitigated by increased employment at non-store retailers. There were over 16,000 new non-store retail establishments in 2017 compared to 2001, a majority (52.3%) of which have opened in the last five years. As a result, employment at non-store retailers has increased by 140,721 jobs since 2011 (Figure 3).

#### *Adapting Retail Business Models: Shrinking the Last Mile*

While brick-and-mortar stores still remain an essential component of current retail operations, retailers are becoming more flexible in how they reach and transact with consumers by decentralizing their distribution/fulfillment networks to bring inventory closer to consumers. The interaction between consumers and retailers can now take multiple forms – this flexible, or omni-channel, approach provides consumers with different options for order fulfillment (Figure 4).

**Figure 4: The Omni-Channel Retail Model**



After purchasing products online or in-person, consumers can opt to transport the goods themselves, or have the products shipped directly. For online orders, products can be delivered directly to their residence or place of work, or picked up at a fulfillment location or brick-and-mortar store. Additionally, consumers now expect orders to be fulfilled more quickly and reliably than ever before: common delivery windows include same-day, next-day, and two-day shipping.<sup>14</sup>

Given the variety of fulfillment options and delivery windows, the complexity of “behind the scenes” distribution/fulfillment operations have increased. These intricate, hub-and-spoke networks of robotic sortation, distribution, and fulfillment facilities bridge the “last mile” between retailers and consumers to facilitate reliable deliveries. According to research conducted by CBRE, a commercial real estate brokerage firm, “last mile” routes have indeed been shrinking in distance. In analyzing the 15 largest metropolitan areas, CBRE researchers found that the “last mile” of order fulfillment averages

<sup>14</sup> UPS Global Retail Strategy. “2017 UPS Pulse of the Online Shopper Study: Volume 5 Retail Fundamentals.” United Parcel Service. November 2017. Available online: <https://solutions.ups.com/UPS-Pulse-of-the-Online-Shopper-Volume-5-LP.html>.



between six and nine miles, and these distances are expected to shrink further as distribution/fulfillment networks continue to expand near large urban populations.<sup>15</sup>

Despite this buildout of urban distribution/fulfillment capacity, the relative demand for industrial warehouse space has picked up dramatically. Indeed, industrial vacancy rates for warehouses and distribution centers fell to an all-time low in 2017,<sup>16</sup> while steady price appreciation has driven the value of warehouses in the U.S. beyond that of office and retail space.<sup>17</sup> These market conditions reflect warehouse demand that far outstrips new supply – a trend that can be traced back to the end of the Great Recession.<sup>18</sup>

In addition to boosting demand for general warehouse space, the omni-channel needs of the retail industry have changed *how* warehouse space is being utilized.<sup>19</sup> For instance, smaller facilities in urban industrial zones are being repurposed to facilitate the growing volume of “last mile” deliveries.<sup>20</sup> These smaller fulfillment centers serve as the satellite “spokes” of re-engineered hub-and-spoke distribution models, and represented sizable proportions (73%) of the industrial warehouse market in 2017.<sup>21</sup> This is a considerable increase in market share in just two years, as these smaller locations accounted for 58 percent of the market in 2016.<sup>22</sup>

There are other changes occurring in the omni-channel distribution system: a new breed of “big box” warehouse space has also emerged as retailers and their supply chain partners build out their regional distribution hubs. Specifically, the largest class of distribution centers have doubled in size over the past ten years,<sup>23</sup> as buildings with 32 foot ceilings are now being supplanted by 40 foot tall facilities as developers work around land constraints.<sup>24</sup> These taller facilities allow retailers and their distribution partners to stock a wider array of goods than before, and require two to three times as

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<sup>15</sup> Ibid.

<sup>16</sup> Berman, Jeff. “JLL calls 2017 a ‘banner year’ for U.S. industrial real estate market activity.” *Modern Materials Handling*. February 6, 2018. Available online:

[https://www.mmh.com/article/jll\\_calls\\_2017\\_a\\_banner\\_year\\_for\\_u.s.\\_industrial\\_real\\_estate\\_market\\_activit](https://www.mmh.com/article/jll_calls_2017_a_banner_year_for_u.s._industrial_real_estate_market_activit).

<sup>17</sup> Levitt, David M. “Warehouses Are Now Worth More Than Offices, Thanks to Amazon.” *Bloomberg*. March 28, 2018. Available online: <https://www.bloomberg.com/news/articles/2018-03-28/warehouses-are-now-worth-more-than-offices-thanks-to-amazon-com>.

<sup>18</sup> Smith, Jennifer. “Warehouse Space Shortage Eases, New Construction Catches up With Demand.” *The Wall Street Journal*. January 24, 2017. Available online: <https://www.wsj.com/articles/warehouse-space-shortage-eases-new-construction-catches-up-with-demand-1485296643>.

<sup>19</sup> Phillips, Erica E. “U.S. Warehouse Supply at Its Tightest in Two Decades.” *The Wall Street Journal*. July 11, 2018. Available online: <https://www.wsj.com/articles/u-s-warehouse-supply-at-its-tightest-in-two-decades-1531319401>.

<sup>20</sup> Phillips, Erica E. “Online Sales Leading Towards Smaller, Urban Warehouses.” *The Wall Street Journal*. August 7, 2015. Available online: <https://www.wsj.com/articles/online-sales-leading-toward-smaller-urban-warehouses-1438979692>.

<sup>21</sup> Simpson, Burney. “Fulfillment Centers Moving Closer to Consumers.” *Transport Topics*. February 8, 2018. Available online: <http://www.ttnews.com/articles/fulfillment-centers-moving-closer-consumers>.

<sup>22</sup> Ibid.

<sup>23</sup> Chao, Loretta. “Room to Grow: Warehouses Super-Size to Meet E-Commerce Demand.” *The Wall Street Journal*. November 3, 2015. Available online: <https://www.wsj.com/articles/room-to-grow-warehouses-super-size-to-meet-e-commerce-demand-1445331601>.

<sup>24</sup> Whelan, Robbie. “Raising the Roof Making All the Difference in Warehouses.” *The Wall Street Journal*. May 12, 2015. <https://www.wsj.com/articles/raising-the-roof-making-all-the-difference-in-warehouses-1431451962>.

many workers as traditional warehouses.<sup>25</sup> The rapid development of large facilities over the past decade has boosted payrolls in the logistics industry, further offsetting some of the jobs shed by the retail industry: employment in the warehousing and storage subsector increased by over 360,000 jobs, or 54.7 percent, between 2007 and 2017.<sup>26</sup>

**Table 3: Emerging Distribution Hubs**

Location	Population within 250 Miles	Warehouse Net Absorption 2013-2017 (sq. ft.)
Cincinnati, OH	36,851,768	25,427,566
Indianapolis, IN	42,517,280	31,488,529
Kansas City, MO	14,610,044	24,081,777
Las Vegas, NV	26,036,082	23,497,992
Lehigh Valley (Allentown-Bethlehem-Easton, PA-NJ)	61,504,678	23,979,082
Memphis, TN	17,026,799	27,659,666
Phoenix, AZ	8,158,946	34,706,703
South Florida	16,804,444	28,479,041
St. Louis, MO	21,984,312	16,578,083
Stockton, CA	17,442,089	18,636,628

Several new regional distribution hubs are emerging as a consequence of the rapid development of new warehousing space nationwide (Table 3).<sup>27</sup> These emerging geographical hubs are located within a few hours of major population centers, have access to significant transportation infrastructure like ports,<sup>28</sup> airports, interstates, and rail, and have a sufficient supply of developable land to support large-scale distribution facilities. Locations such Indianapolis and Cincinnati are within 250 miles of a significant portion of the U.S. population and have seen millions of square feet of industrial warehouse space become occupied over the last five years. The facilities constructed at these locations serve as the primary feeder system to the smaller, “last mile” fulfillment centers in surrounding population centers, further shrinking regional supply chains and allowing for more flexible movements of goods.

The observable shifts in these macroeconomic data demonstrate that retailers and their third-party logistics (3PL) partners are indeed working to provide the supply chain and distribution/fulfillment capacity to support myriad order fulfillment options. To better

<sup>25</sup> Smith, Jennifer. “Online Retailers’ New Warehouses Heat Up Local Job Markets.” *The Wall Street Journal*. April 9, 2017. Available online: <https://www.wsj.com/articles/online-retailers-new-warehouses-heat-up-local-job-markets-1491739203>.

<sup>26</sup> Quarterly Census of Employment and Wages (QCEW). *Bureau of Labor Statistics*. Retrieved June 11, 2018. Available online: <https://data.bls.gov/PDQWeb/en>.

<sup>27</sup> “Top 10 Emerging U.S. Industrial Markets to watch in 2018.” *Colliers International*. Available online: <http://colliers-emergingindustrial2018.brandcast.com/>.

<sup>28</sup> Ashe, Ari. “Real Estate Prices Soaring for Warehouses Near Ports, Intermodal Ramps.” *Transport Topics*. January 8, 2018. Available online: <http://www.ttnews.com/articles/real-estate-prices-soaring-warehouses-near-ports-intermodal-ramps>.

understand how e-commerce is changing transportation, those business objectives and line-items that are most impacted must be dissected and analyzed.

### Shipping Costs

Despite the fact that companies are spending record amounts on shipping costs,<sup>29</sup> reducing delivery costs is a point of fierce competition among retailers. In many instances, the shipping costs presented to consumers can impact their order; results from one survey indicated that shipping costs influenced purchase decisions for a majority of the consumers surveyed.<sup>30</sup> Free shipping continues to grow in importance; results from a separate survey indicated that 64 percent of consumers would not pay extra for two-day shipping options, while roughly one-third of respondents would not pay extra for same-day shipping.<sup>31</sup>

This rapid change in consumer demand for faster and less expensive shipping can be attributed in part to the Amazon Prime membership program, which offers free two-day shipping on millions of eligible products. Amazon also offers free shipping to non-Prime members on orders exceeding \$25. Amazon has leveraged this approach to establish a dominant foothold in the e-commerce market, accounting for more than 43 percent of U.S. e-commerce sales and four percent of all retail sales in the country.<sup>32</sup> Other retailers have since responded with similar subscription services of free deliveries, and lower minimum orders required for free shipping.<sup>33</sup>

### Delivery Times

According to a study conducted by UPS, a majority (63%) of survey respondents indicated that delivery speed is important when searching for and selecting products.<sup>34</sup> As a result, consumer expectations regarding delivery speed have forced retailers and their supply chains to accommodate shifting and shrinking delivery windows. This push toward faster and more cost-effective shipping options has been the primary impetus for retailers and 3PLs to expand their distribution networks; these growing networks are used to further shrink “last mile” delivery windows and place a broad inventory selection closer to consumers.

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<sup>29</sup> Phillips, Erica E. “Companies Spent a Record \$1.5 Trillion on Shipping Costs in 2017.” *The Wall Street Journal*. June 19, 2018. Available online: <https://www.wsj.com/articles/companies-are-spending-more-on-shipping-and-thats-not-changing-soon-1529413500>.

<sup>30</sup> Chao, Loretta. “Online Shoppers Want Delivery Faster, Cheaper, Survey Shows.” *The Wall Street Journal*. June 13, 2016. Available online: <https://www.wsj.com/articles/online-shoppers-want-delivery-faster-cheaper-survey-shows-1465851072>.

<sup>31</sup> Baskin, Brian. “Amazon’s Free Shipping Pushes Small Retailers, Delivery Firms to Compete.” *The Wall Street Journal*. April 8, 2017. Available online: <https://www.wsj.com/articles/amazons-free-shipping-pushes-small-retailers-delivery-firms-to-compete-1491649203>.

<sup>32</sup> “Amazon’s Share of US Ecommerce to Surpass 40% in 2017.” *eMarketer*. October 2017. Available online: <http://www.emarketer.com/newsroom/index.php/amazons-share-us-ecommerce-surpass-40-2017/>.

<sup>33</sup> Ibid.

<sup>34</sup> UPS Global Retail Strategy. “2017 UPS Pulse of the Online Shopper Study: Volume 5 Retail Fundamentals.” *United Parcel Service*. November 2017. Available online: <https://solutions.ups.com/UPS-Pulse-of-the-Online-Shopper-Volume-5-LP.html>.

As a result of this shift, a majority (51%) of retailers now offer a same-day delivery option, up from just 16 percent of retailers in 2016.<sup>35</sup> The push toward same-day delivery has been a cornerstone of the omni-channel approach adopted by major retailers like Home Depot and Target. A number of startup delivery firms are servicing the needs of smaller retailers to provide similar delivery options. Firms such as Deliv<sup>36</sup> and Flexe<sup>37</sup> offer fulfillment services in an effort to rival the scope and scale of Amazon's own same-day Prime Now service.

### Expanded Delivery Locations

In order to increase flexibility and convenience for consumers, retailers and 3PL providers have expanded the types of locations where consumers can receive deliveries. Although deliveries to personal residences or businesses are the most common option, roughly 30 percent of online orders are delivered to alternate locations.<sup>38</sup>

To better compete, brick-and-mortar retailers are leveraging existing store space to provide one of the more popular alternate delivery locations available to consumers. For instance, some retailers have converted vacant mall space into locations where customers can pick up or return products bought online.<sup>39</sup> Similarly, a host of major retailers, such as Walmart, Target,<sup>40</sup> and Home Depot, have attempted to contain shipping costs by offering in-store consumer pickups for online orders. FedEx has also expanded its network of pickup and delivery stations through its partnership with Walgreens – rolling out these services to over 7,500 Walgreens locations across the U.S.<sup>41</sup>

Retailers and 3PLs are experimenting with other alternative delivery locations to further enhance the convenience of delivery offerings. Amazon Lockers, for example, provide an alternative to home delivery for theft-wary consumers. Some retailers, like 7-Eleven, and mall operators are installing these lockers to drive foot traffic to their locations as a

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<sup>35</sup> Howland, Daphne. "Same-day delivery services tripled in a year." *Supply Chain Dive*. September 19, 2017. Available online: <https://www.supplychaindive.com/news/retail-same-day-delivery-triples/505237/>.

<sup>36</sup> Lunden, Ingrid. "Same-day startup Deliv expands to 1,400 cities, rivalling Amazon's Prime Now." *TechCrunch*. August 31, 2017. Available online: <https://techcrunch.com/2017/08/31/same-day-delivery-startup-deliv-expands-to-1400-cities-rivalling-amazons-prime-now/>.

<sup>37</sup> Smith, Jennifer. "Flexe to Offer Next-Day Delivery for Online Retailers" *The Wall Street Journal*. May 11, 2017. Available online: <https://www.wsj.com/articles/flexe-to-offer-next-day-delivery-for-online-retailers-1494539661>.

<sup>38</sup> UPS Global Retail Strategy. "2017 UPS Pulse of the Online Shopper Study: Volume 5 Retail Fundamentals." *United Parcel Service*. November 2017. Available online: <https://solutions.ups.com/UPS-Pulse-of-the-Online-Shopper-Volume-5-LP.html>.

<sup>39</sup> Fung, Esther and Jennifer Smith. "Mall Owners Find Relief From Unlikely Source: Online Retailers." *The Wall Street Journal*. January 17, 2017. Available online: <https://www.wsj.com/articles/mall-owners-find-relief-from-unlikely-source-online-retailers-1484654403>.

<sup>40</sup> Nassauer, Sarah and Anne Steele. "Not All Big Box Stores Are Dead: Wal-Mart, Home Depot Buck Shopping Slump." *The Wall Street Journal*. February 21, 2017. Available online: <https://www.wsj.com/articles/not-all-big-box-stores-are-dead-wal-mart-home-depot-buck-shopping-slump-1487713372>.

<sup>41</sup> "FedEx Package Pickup and Drop-Off Now Available at More Than 7,500 Walgreens Locations in All 50 States." Walgreens. November 6, 2017. Available online: <https://news.walgreens.com/press-releases/general-news/fedex-package-pickup-and-drop-off-now-available-at-more-than-7500-walgreens-locations-in-all-50-states.htm>.

response to growing online spending by consumers.<sup>42</sup> More experimental delivery strategies include partnerships with car companies to offer app-based deliveries to smart lock-installed cars.<sup>43</sup>

### Reverse Logistics

Between 13 and 30 percent of all online orders result in the product being returned, as compared to a return rate of just eight percent for in-store purchases; the growing volume of product returns is now a critical challenge for retailers.<sup>44</sup> On top of this, consumers expect returns to be both convenient and free.<sup>45</sup> To respond to this trend, retailers are designing new approaches for efficiently handling the reverse logistics of returning items back through the distribution system.

For example, retailers have expanded product return options. The least expensive option, from the perspective of the retailer, is for the consumer to return the item to a physical drop-off point. Retailers are utilizing a number of different drop-off locations, such as Walmart's expedited Mobile Express Returns kiosks and Amazon's network of lockers.<sup>46</sup> Meanwhile, Kohl's is testing out an arrangement where it accepts returns of Amazon merchandise as a means of driving foot traffic to its stores.<sup>47</sup>

It is becoming commonplace for retailers to offer a range of return services; products can be returned to the store, or shipped back to the store using courier services – often without return shipping costs.<sup>48</sup> Return volumes logged during the holiday season demonstrate the popularity of this return route, as it is estimated that more than 1 million packages are returned daily in the month of December.<sup>49</sup>

### *Inventory Management*

Given the complexity of e-commerce, many firms are now altering their inventory management practices. In particular, retailers have adopted or begun testing just-in-time (JIT) inventory principles. JIT inventory systems control costs by ensuring the

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<sup>42</sup> Chao, Loretta. "7-Eleven Expands Locker Space, Hoping to Cash In on E-Commerce Wave." *The Wall Street Journal*. November 12, 2015. Available online: <https://www.wsj.com/articles/7-eleven-expands-locker-space-hoping-to-cash-in-on-e-commerce-wave-1447326538>.

<sup>43</sup> Stevens, Laura and Mike Colias. "Amazon to Start Offering In-Car Deliveries." *The Wall Street Journal*. April 24, 2018. Available online: <https://www.wsj.com/articles/amazon-can-now-deliver-packages-to-your-car-1524568172>.

<sup>44</sup> Ashe, Ari. "Retailers Balance Post-Holiday Returns Between In-Store and 3PL Options." *Transport Topics*. December 26, 2017. Available online: <http://www.ttnews.com/articles/retailers-balance-post-holiday-returns-between-store-and-3pl-options>.

<sup>45</sup> Ibid.

<sup>46</sup> Ibid.

<sup>47</sup> Rupp, Lindsey. "Amazon Returns Called 'No-Brainer' Buoying Kohl's Traffic." *Bloomberg*. May 7, 2018. Available online: <https://www.bloomberg.com/news/articles/2018-05-07/amazon-returns-boosting-shopper-traffic-at-kohl-s-analyst-says>.

<sup>48</sup> Phillips, Erica E. "Retailers Offer Myriad Returns Options to Retain Customers." *The Wall Street Journal*. December 26, 2017. Available online: <https://www.wsj.com/articles/retailers-offer-myriad-returns-options-to-retain-customers-1514308299>.

<sup>49</sup> Van Grove, Jennifer. "UPS Touts Record Number of Package Returns This Holiday Season." *Transport Topics*. January 2, 2018. Available online: <http://www.ttnews.com/articles/ups-touts-record-number-package-returns-holiday-season>.

optimal quantity of inventory needed to meet the requirements of end customers, while also maintaining the ability to respond to sudden changes in consumer demand.<sup>50</sup>

These practices have been implemented by some of the largest retailers in the U.S. Walmart, for instance, now keeps a smaller quantity of a wider variety of products at distribution centers so that a product is more likely to be available to customers even if a store is out of stock.<sup>51</sup> At the same time, lower inventory levels have placed a greater emphasis on accurate delivery times, forcing the retailer's logistics partners to tighten delivery windows to ensure that shelves remain stocked.<sup>52</sup>

Target has also started to hold less inventory at stores, while using the same warehouse inventory to restock both stores and fulfill online orders.<sup>53</sup> The purpose of these changes at Target is to create a more nimble inventory management system that can handle its omni-channel retail needs.

### *Vertical Integration vs. Outsourcing*

No choice has been more critical to changing retailer business models than the decision of whether to integrate distribution within the existing business, or to outsource these functions to firms that specialize in order fulfillment. In both models the objective is to provide a reliable platform for delivering their products to a variety of locations (e.g. residences, places of work, stores) quickly and inexpensively.

### Vertical Integration

Retailers such as Amazon, Home Depot, Target, and Walmart have made significant capital expenditures to build out an internal network of fulfillment options and delivery capabilities. Amazon, for instance, has built or plans to build over 150 million square feet of various warehousing space in a ten-year period to support the huge volume of online orders flowing through its network (Figure 5).<sup>54</sup> Walmart has also made the construction of large e-commerce fulfillment centers a priority – building at least twelve of these facilities since 2013.<sup>55</sup> Similarly, Home Depot plans to spend \$1.2 billion over

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<sup>50</sup> Larson, Chris. "A Just-In-Time Supply Chain? Achieving Just-In-Time operational objectives requiring the coordination of Production, Planning, Sourcing and Logistics." *United Parcel Service Supply Chain Solutions*. 2005. Available online: [https://www.ups-scs.com/solutions/white\\_papers/wp\\_JIT.pdf](https://www.ups-scs.com/solutions/white_papers/wp_JIT.pdf).

<sup>51</sup> Chao, Loretta. "Wal-Mart Reins Back Inventory in a Revamped Supply Chain." *The Wall Street Journal*. August 18, 2015. Available online: <https://www.wsj.com/articles/wal-mart-reins-back-inventory-in-a-revamped-supply-chain-1439933834>.

<sup>52</sup> Nassauer, S. and Jennifer Smith. "Wal-Mart Tightens Delivery Windows for Suppliers." *The Wall Street Journal*. January 29, 2018. Available online: <https://www.wsj.com/articles/wal-mart-tightens-delivery-windows-for-suppliers-1517266620>.

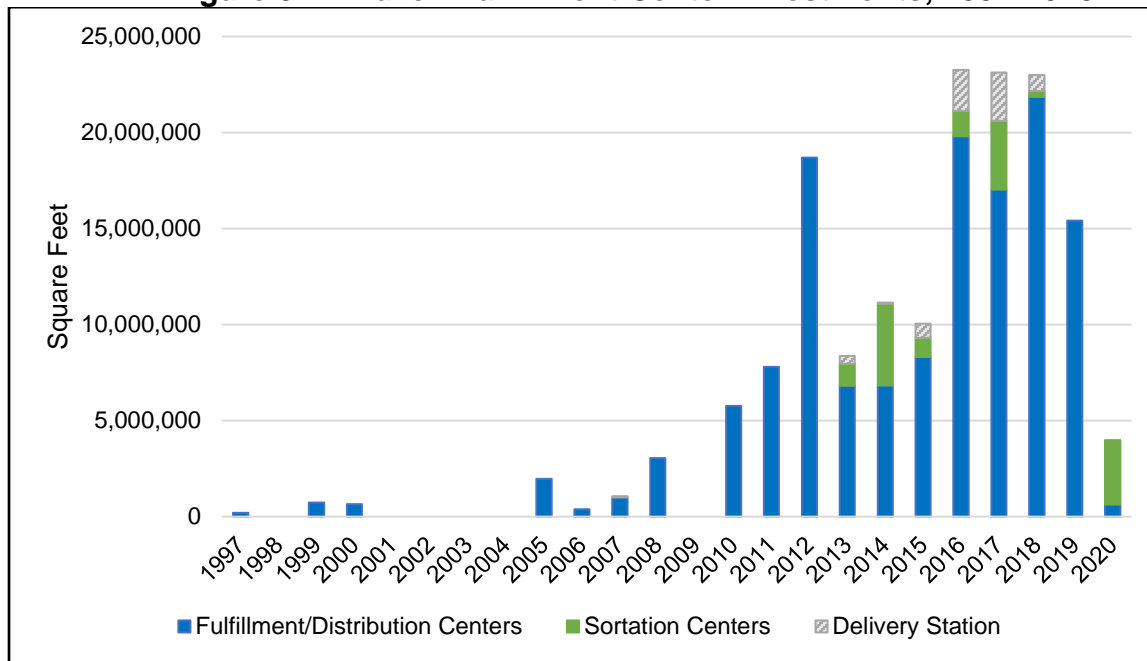
<sup>53</sup> Smith, Jennifer. "Target Tests Retail 'Flow Center' for Faster, Nimbler Distribution." *The Wall Street Journal*. May 14, 2018. Available online: <https://www.wsj.com/articles/target-tests-retail-flow-center-for-faster-nimbler-distribution-1526299200>.

<sup>54</sup> "Amazon Global Fulfillment Center Network. MWPVL International. Retrieved July 2, 2018. Available online: [http://www.mwpvl.com/html/amazon\\_com.html](http://www.mwpvl.com/html/amazon_com.html).

<sup>55</sup> "The Walmart Distribution Center Network in the United States." MWPVL International. Retrieved July 2, 2018. Available online: <http://www.mwpvl.com/html/walmart.html>.

the next five years to add 170 distribution facilities to its network so that it can reach 90 percent of the U.S. population within one day.<sup>56</sup>

**Figure 5: Amazon Fulfillment Center Investments, 1997-2020**



In terms of delivery vehicles, Amazon is building out its own cargo hauling and delivery capacity to supplement the existing capacity provided by the U.S. Postal Service (USPS), UPS, and FedEx. The e-tailer announced it was spending \$1.5 billion to build its first air cargo hub to support its growing fleet of cargo planes.<sup>57</sup> Amazon’s fleet of leased Boeing 767 cargo jets, operating as Amazon Air, now contains 32 freighters and is slated for further growth as its new air hub will have capacity for 100 of these jets.<sup>58</sup> The company has also purchased more than 7,500 truck trailers to handle its own intermediate hauling operations.<sup>59</sup> Amazon already employs drivers to deliver some of its own orders, and recently announced “Shipping with Amazon,” which would use its own fleet to pick up packages from businesses and shipper warehouses for consumer delivery.<sup>60</sup> Amazon also announced plans to further expand its package delivery

<sup>56</sup> Smith, Jennifer. “Home Depot Sets \$1.2 Billion Supply-Chain Overhaul.” *The Wall Street Journal*. June 11, 2018. Available online: <https://www.wsj.com/articles/home-depot-sets-1-2-billion-supply-chain-overhaul-1528739061>.

<sup>57</sup> Stevens, Laura. “Amazon.com Plans First Air Cargo Hub.” *The Wall Street Journal*. February 1, 2017. Available online: <https://www.wsj.com/articles/amazon-com-plans-first-air-cargo-hub-1485901557>.

<sup>58</sup> Hammerand, Jim. “Amazon’s Prime Air cargo fleet is bigger than ever and has a new name.” *Houston Business Journal*. December 28, 2017. Available online: <https://www.bizjournals.com/houston/news/2017/12/28/amazon-prime-air-cargo-jet-fleet-boeing-767.html>.

<sup>59</sup> Stevens, Laura. “Amazon Drivers Deeper Into Package Delivery”. *The Wall Street Journal*. June 28, 2018. Available online” <https://www.wsj.com/articles/amazon-drives-deeper-into-package-delivery-1530158460>.

<sup>60</sup> Stevens, Laura. “”. *The Wall Street Journal*. February 9, 2018. Available online: <https://www.wsj.com/articles/amazon-to-launch-delivery-service-that-would-vie-with-fedex-ups-1518175920>.

network by providing operational and financial support to individuals looking to start their own delivery business.<sup>61</sup>

Target is another retailer looking to expand its internal home delivery capabilities, and has relied on acquisitions to accomplish this goal. To expand same-day deliveries, the retailer purchased Grand Junction, a delivery technology company that manages local deliveries through a network of more than 700 carriers,<sup>62</sup> and invested \$550 million in its acquisition of grocery delivery startup Shipt Inc.<sup>63</sup>

## Outsourcing

Outsourcing is the other strategy retailers are using to expand their e-commerce delivery networks. In this model, retailers contract with 3PL providers capable of handling combinations of a retailer's warehousing, distribution, and transportation needs. As a result of growing e-commerce demand, 3PL providers have experienced strong growth, with growth expected to continue at least through 2022.<sup>64</sup>

Drop-shipping, which refers to an order that is fulfilled by a 3PL provider on behalf of a retailer, is a related strategy that has emerged as a popular choice for retailers.<sup>65</sup> In this model, retailers can offer a wider product selection without holding the necessary inventory themselves. When an order is placed through the retailer, the products are shipped directly from a warehouse operated by the supplier or 3PL, with the remaining logistical functions serviced by the 3PL. This approach is especially useful for smaller retailers and manufacturers that do not have the resources to build their own order fulfillment network.<sup>66</sup>

Similar to retailers that are internally integrating, 3PLs are expanding their own operations and networks to meet growing e-commerce requirements. The 3PL industry underwent a period of major consolidation in 2014 and 2015 as many of the industry's biggest players ramped up the scale of their operations in areas like technology,

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<sup>61</sup> Stevenson, R. and Thomas Black. "Amazon Spurs Delivery Startups With Shot at \$300,000 Profit." *Bloomberg*. June 28, 2018. Available online: <https://www.bloomberg.com/news/articles/2018-06-28/amazon-enlists-delivery-startups-to-help-expand-shipment-volume>.

<sup>62</sup> Kumar, Kavita. "Target acquires delivery technology firms, beefs up grocery team." *Star Tribune*. August 15, 2017. Available online: <http://www.startribune.com/target-acquires-delivery-firm-grand-junction-as-same-day-service-race-heats-up/440316523/>.

<sup>63</sup> Boyle, Matthew. "Target to Buy Shipt for \$550 Million in Challenge to Amazon." *Bloomberg*. December 13, 2017. Available online: <https://www.bloomberg.com/news/articles/2017-12-13/target-to-buy-shipt-for-550-million-in-bet-on-same-day-delivery>.

<sup>64</sup> Berman, Jeff. "Ongoing global revenue growth is in the cards for 3PLs, says Armstrong report." *Logistics Management*. October 11, 2017. Available online: [https://www.logisticsmgmt.com/article/ongoing\\_global\\_revenue\\_growth\\_is\\_in\\_the\\_cards\\_for\\_3pls\\_says\\_armstrong\\_report](https://www.logisticsmgmt.com/article/ongoing_global_revenue_growth_is_in_the_cards_for_3pls_says_armstrong_report).

<sup>65</sup> Ashe, Ari. "E-Commerce Boom a Boon for 3PLs." *Transport Topics*. July 13, 2017. Available online: <http://www.ttnews.com/articles/e-commerce-boom-boon-3pls>.

<sup>66</sup> Smith, Jennifer. "'Drop Shipping' Looks Set to Go Mainstream as More Retailers Get on Board." *The Wall Street Journal*. January 26, 2017. Available online: <https://www.wsj.com/articles/drop-shipping-looks-set-to-go-mainstream-as-more-retailers-get-on-board-1485453446>.



warehousing, and transportation equipment.<sup>67</sup> For example, XPO Logistics grew from a non-asset truck brokerage company grossing \$175 million in revenues into the largest logistics provider in North America with annual revenues exceeding \$15 billion in just five years.<sup>68</sup>

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<sup>67</sup> Phillips, Erica E. "Logistics Consolidation Likely to Accelerate, Survey Finds." *The Wall Street Journal*. September 28, 2015. Available online: <https://www.wsj.com/articles/logistics-consolidation-likely-to-accelerate-survey-finds-1443450726>.

<sup>68</sup> Black, Thomas. "With His Stock Up 330%, a Serial Dealmaker Seeks Biggest Hit Yet." *Bloomberg*. October 2, 2017. Available online: <https://www.bloomberg.com/news/articles/2017-10-02/with-his-stock-up-330-a-serial-dealmaker-seeks-biggest-hit-yet>.

## **TRUCKING INDUSTRY IMPACTS**

The trucking industry provides the critical linkages for the omni-channel needs of retailers, from the first mile to the last mile and back again. In fact, the regional fragmentation of supply chains and distribution/fulfillment networks has forced retailers and their supply chain partners to rely more on motor carriers; truck transportation is best equipped to provide the flexible and reliable services needed by JIT inventory management systems, decentralized distribution/fulfillment networks, and tighter delivery windows.

### *Changing Industry Operations*

There are two characteristics of omni-channel business models that have had the greatest impact on trucking operations:

- 1) the re-emergence of decentralized hub-and-spoke distribution/fulfillment networks; and
- 2) a greater emphasis on reliable deliveries throughout these networks as delivery windows continue to shrink.

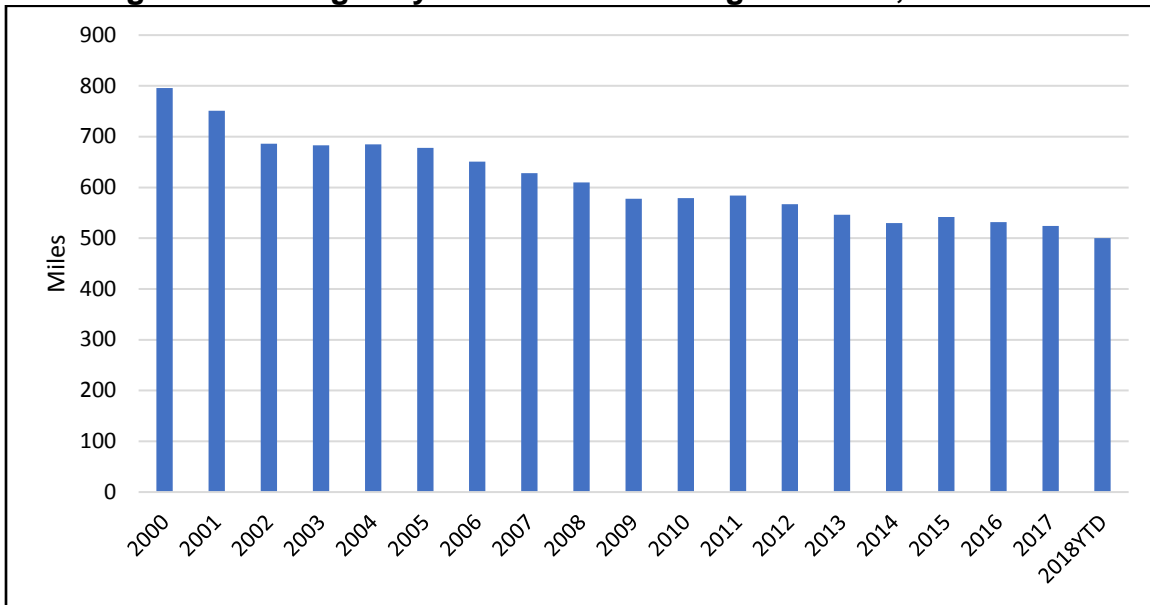
### Truck Trip Characteristics

The growing decentralization needed for e-commerce has created a considerable decrease in the average length-of-haul. Longer inter-regional or national hauls are now being replaced by shorter intra-regional and local hauls. These dramatic decreases in trip lengths and odometer readings are being experienced by truckload, LTL, and courier services alike. In fact, the average length-of-haul for dry van truckloads has declined almost continuously since 2000, falling by 296 miles, or 37 percent (Figure 6).<sup>69</sup>

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<sup>69</sup> "Trucking Activity Report (TRAC)." American Trucking Associations. Arlington, VA. September 2018.

**Figure 6: Average Dry Van Truckload Length-of-Haul, 2000-2018**

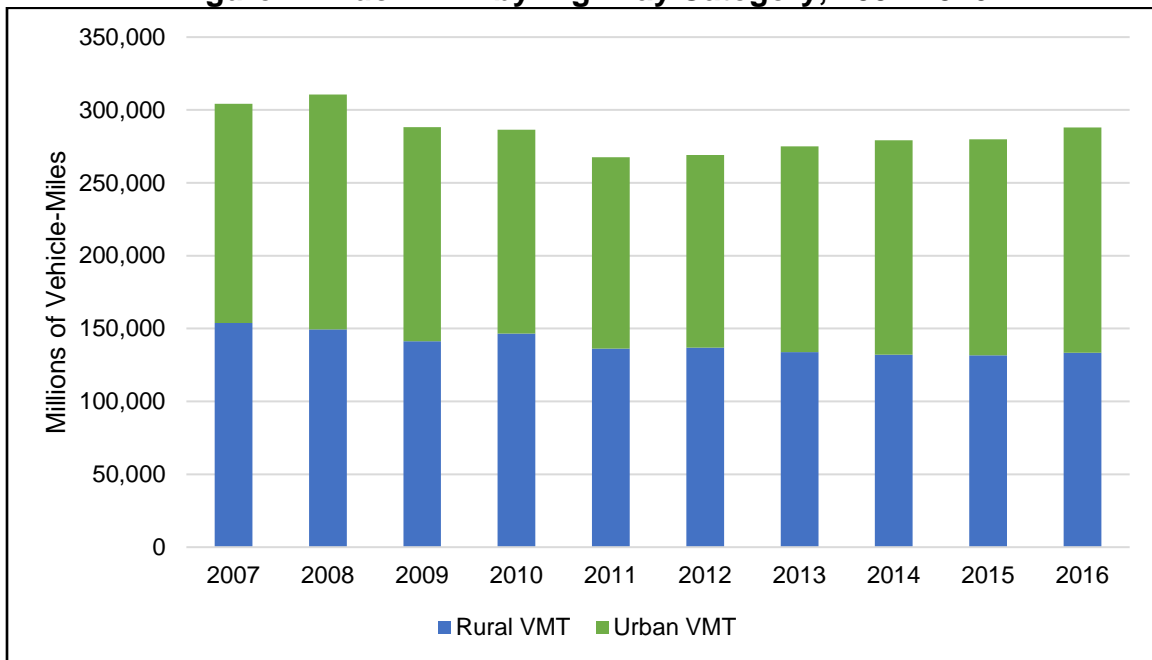


Although overall truck vehicle miles traveled (VMT) have yet to surpass the pre-recession peak, truck VMT increased by 7.6 percent between 2011 and 2016 (Figure 7).<sup>70</sup> The growth in truck VMT observed between 2011 and 2016 has been particularly strong in urban areas, with urban VMT logged by trucks growing by 17.7 percent while rural truck VMT actually fell 2.2 percent during this time period. A key conclusion that can be drawn from shorter truck trips and overall VMT increases is that e-commerce has significantly increased the number of new short-haul and last-mile trips. This is in-line with the growing volume of shipments in densely populated urban cores that motor carriers attribute to e-commerce and omni-channel retailing.<sup>71</sup>

<sup>70</sup> Highway Statistics Series Publications – Table VM-1. U.S. Department of Transportation Federal Highway Administration. Retrieved July 10, 2017. Available online: <https://www.fhwa.dot.gov/policyinformation/statistics.cfm>.

<sup>71</sup> Wiegler, Laurie. "Online Sales Surge Benefits Truck Freight, Experts Say." *Transport Topics*. June 19, 2017. Available online: <http://www.ttnews.com/articles/online-sales-surge-benefits-truck-freight-experts-say-0>.

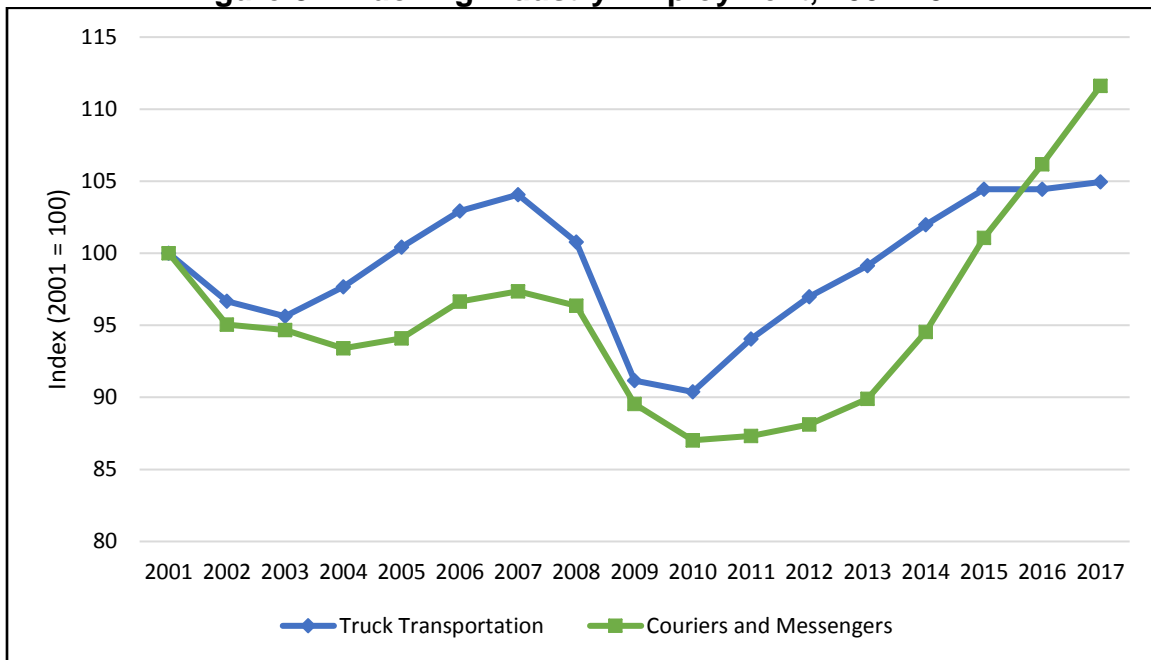
**Figure 7: Truck VMT by Highway Category, 2007-2016**



Many of these operational trends are also reflected in freight industry payroll trends. Overall truck transportation employment has only recently surpassed its pre-recession peak (Figure 8), though there has been a noticeable shift within the industry toward employment at local pickup and delivery (P&D) operations. In fact, there were nearly 2,000 more establishments, and 85,000 new employees, engaged as courier and messenger services in 2017 than there were in 2007.<sup>72</sup> Moreover, a significant portion (74%) of these new jobs were added in 2016 and 2017 alone as e-commerce and omni-channel retailing trends gained momentum (Figure 8).

<sup>72</sup> Quarterly Census of Employment and Wages (QCEW). *Bureau of Labor Statistics*. Retrieved June 11, 2018. Available online: <https://data.bls.gov/PDQWeb/en>.

**Figure 8: Trucking Industry Employment, 2001-2017**



The pressures associated with shorter delivery windows, and the requisite growth in JIT inventory management systems, have placed even greater emphasis on the reliability and timeliness of truck transportation. While this is not a new challenge for motor carriers, delivery windows continue to compress as retailers build out their omni-channel retailing capabilities. Walmart, for instance, raised the minimum threshold of on-time deliveries imposed on its suppliers, and will fine suppliers who fail to consistently deliver orders within a specified one- or two-day window.<sup>73</sup>

This trend is consistent with ATRI research findings from informal polling of motor carriers, in which many of the responding motor carriers indicated that their volume of shipments requiring a two-day or three-to-four-day delivery window had increased over the past five years. Carriers reported that these faster deliveries have cannibalized deliveries with a five-to-seven-day window. Motor carriers must now operate with faster turnaround times, and contend with a variety of external factors that work against them. The most frequently cited reasons for missing a delivery window were inclement weather, traffic congestion, and warehouse delays.

The trucking industry is also changing and responding to the litany of added services that are being offered by retailers. As more motor carriers enter the “last mile,” many are expanding their operations into “white glove” deliveries of large and bulky items like furniture and home appliances. A number of large motor carriers, such as Schneider National and J.B. Hunt, as well as 3PL providers like XPO Logistics, are engaging with retailers to not only deliver these items to residences, but to also provide value-added

<sup>73</sup> Nassauer, Sarah and Jennifer Smith. “Wal-Mart Tightens Delivery Windows for Suppliers.” *The Wall Street Journal*. January 29, 2018. Available online: <https://www.wsj.com/articles/wal-mart-tightens-delivery-windows-for-suppliers-1517266620>.

services like installation, product assembly, and repairs.<sup>74</sup> These services require greater training of drivers, who must navigate large trucks through residential neighborhoods, and provide high-quality service as they interface directly with customers.

## Equipment

As the trucking industry evolves to accommodate omni-channel retailing, both in terms of shorter trip lengths and the types of products being shipped, asset investments have changed to support the new delivery requirements. This is particularly true in the “last mile,” as more motor carriers that traditionally specialize in TL and/or LTL operations are building their last mile solutions to compete with the parcel carriers that currently dominate these deliveries.

The emphasis on purchasing equipment that supports “last mile” deliveries is evident in truck registration data. Registrations for single-unit trucks, a proxy for straight trucks<sup>75</sup> used for local deliveries, are growing at a faster rate than registrations of more traditional combination trucks. Single-unit truck registrations increased by 7.8 percent between 2007 and 2016 compared to 4.4 percent growth in combination truck registrations (Figure 9).<sup>76</sup> Much of this growth has occurred in recent years, as a sizable majority (66.3%) of the new straight truck registrations occurred between 2014 and 2016.

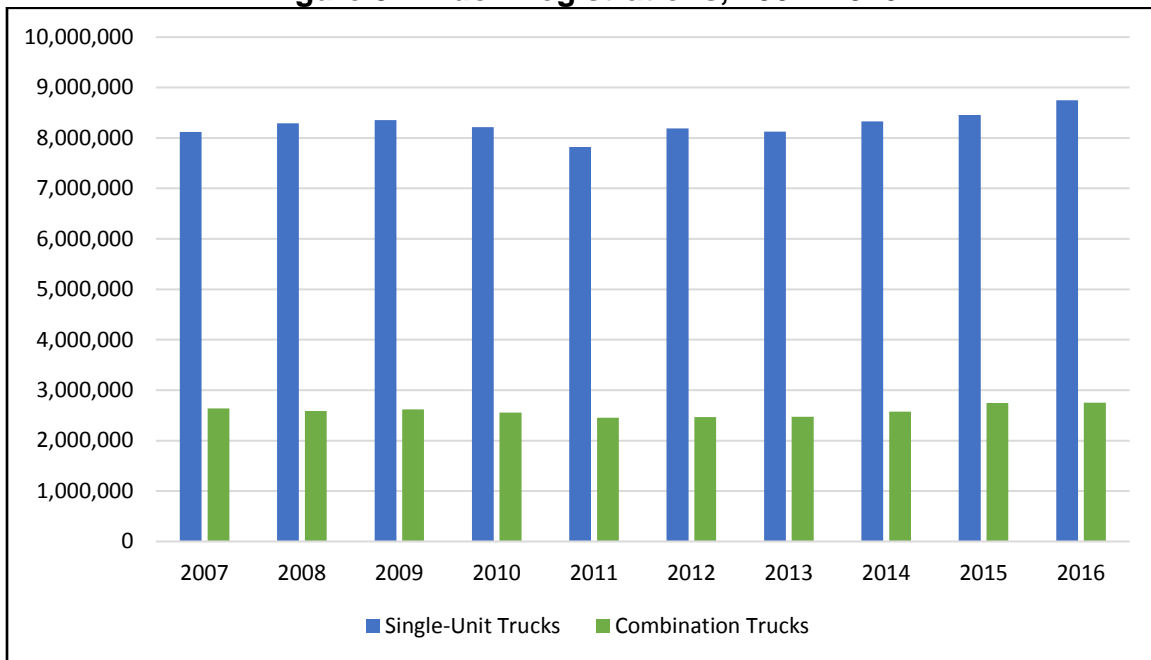
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<sup>74</sup> Johnson, Eric M. “UPS weights strategy to deliver bulky goods to boost growth.” *Reuters*. May 2, 2018. Available online: <https://www.reuters.com/article/us-ups-delivery-expansion-exclsuive/exclusive-ups-weighs-strategy-to-deliver-bulky-goods-to-boost-growth-idUSKBN1I31UH>.

<sup>75</sup> Data for single-unit trucks represent two-axle, six-tire, single-unit trucks. These are vehicles on a single frame, and include vehicles other than straight trucks like campers and recreational vehicles with two axles and dual rear wheels.

<sup>76</sup> Highway Statistics Series Publications – Table VM-1. U.S. Department of Transportation Federal Highway Administration. Retrieved July 10, 2017. Available online: <https://www.fhwa.dot.gov/policyinformation/statistics.cfm>.

**Figure 9: Truck Registrations, 2007- 2016**



According to publicly available data, companies like UPS and FedEx are also expanding the scale of their operations. Since 2007, FedEx Ground has more than doubled the number of owner-operated vehicles it employs to 57,000, and has also doubled the number of trailers in its fleet during this time period. Similarly, UPS reported a 19 percent increase in the size of its fleet, which includes package cars, vans, tractors, and motorcycles, during this time period.

Both motor carriers and equipment manufacturers are now experimenting with a variety of new technologies to address the challenges created by urban package deliveries. For example, UPS is testing how to incorporate a variety of vehicle types into its daily operations, including drones; UPS has designed and tested a drone that emerges and launches from the top of a delivery truck to deliver packages while the driver fulfills separate deliveries.<sup>77</sup> Amazon and others are also experimenting with drone technology to expand its residential delivery capacity.<sup>78</sup>

Expanded use of electric vehicles seems to be a natural extension of alternative energy-based e-commerce deliveries.<sup>79</sup> Efforts to address issues like air quality and noise pollution have expanded interest in and use of this technology, especially as more delivery vehicles begin to traverse local road networks.<sup>80</sup> The use of electric vehicles in e-commerce seems promising relative to other alternative fuel vehicles, as the start-

<sup>77</sup> Lockridge, Deborah. "The Big and Small of Last Mile Delivery." *Heavy Duty Trucking TruckingInfo*. April 18, 2017. Available online: <https://www.truckinginfo.com/157355/the-big-and-small-of-last-mile-delivery>.

<sup>78</sup> Ibid.

<sup>79</sup> Long, Mindy. "Electric Trucks to Power Fleets' Urban, Regional Needs First." *Transport Topics*. May 23, 2018. Available online: <http://www.ttnews.com/articles/electric-trucks-power-fleets-urban-regional-needs-first>.

<sup>80</sup> Lockridge, Deborah. "What Do Final Mile Trends Mean for Equipment and Maintenance Managers?" *Heavy Duty Trucking TruckingInfo*. March 8, 2018. Available online: <https://www.truckinginfo.com/279704/what-do-final-mile-trends-mean-for-equipment-and-maintenance-managers>.

and-stop nature of these routes allow for electrification and battery charging within a tight delivery radius. Continued technological advancements are also making the adoption of these vehicles economically feasible, as expected decreases in maintenance and battery costs can counter higher up-front costs on the vehicle and supporting infrastructure like charging stations.<sup>81</sup>

To this end, motor carriers and startups are experimenting with different types of vehicles to combat the growing scale and costs of urban P&D operations. Startups like Udelv, which is testing an autonomous (electric) cargo vehicle to handle local P&D operations, aim to reduce the costs of product deliveries and returns by removing the driver from the equation.<sup>82</sup> Other companies like Rad Power and Truck Trike are testing the viability of electric cargo trikes as a relatively inexpensive alternative to traditional delivery vehicles. UPS, which is working with Truck Trike to conduct tests in several markets, has found that the trike can be a less expensive option in certain neighborhoods.<sup>83</sup> While the economic viability of these alternative vehicle options is still being explored, motor carriers will continue to work on cost containment and managing the challenges of surging demand for local P&D operations.

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<sup>81</sup>Long, Mindy. "Electric Trucks to Power Fleets' Urban, Regional Needs First." *Transport Topics*. May 23, 2018. Available online: <http://www.ttnews.com/articles/electric-trucks-power-fleets-urban-regional-needs-first>.

<sup>82</sup> Simpson, Burney. "New Vehicles Tackle Challenges of Urban E-Commerce." *Transport Topics*. January 23, 2018. Available online: <http://www.ttnews.com/articles/new-vehicles-tackle-challenges-urban-e-commerce>.

<sup>83</sup> Ibid.



### *Impact of E-Commerce on the Trucking Industry's Top Issues*

Since 2005, ATRI has conducted an annual survey of motor carrier executives, commercial truck drivers, and other trucking industry stakeholders to identify the critical issues affecting the trucking industry. In the 2018 survey, the industry ranked the following as their top industry issues:<sup>84</sup>

1. Driver Shortage
2. Hours-of-Service (HOS)
3. Driver Retention
4. Electronic Logging Device (ELD) Mandate
5. Truck Parking
6. Compliance, Safety, Accountability (CSA)
7. Driver Distraction
8. Transportation Infrastructure/Congestion/Funding
9. Driver Health/Wellness
10. Economy

To fully assess how e-commerce and omni-channel retailing are affecting the trucking industry, the remainder of this study focuses on the implications of e-commerce on the industry's critical issues.

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<sup>84</sup> "Critical Issues in the Trucking Industry – 2018." American Transportation Research Institute (ATRI). October 2018. Arlington, VA.

## Issue 1: Driver Shortage

Perennially ranked as a top industry issue, the Driver Shortage topped the list in 2017 as an improving economy fueled concerns that the demand for truck drivers would further outpace the supply of qualified drivers. According to estimates by the American Trucking Associations (ATA), the shortage of for-hire drivers stands at 51,000 drivers.<sup>85</sup> Extrapolating current trends out several years, the industry could be short 170,000 drivers by 2026.<sup>86</sup>

Aside from a growing economy, other factors also contributing to the driver shortage include driver retirements and competition from other industries. The growing demand for truck transportation from e-commerce is further exacerbating the industry's issues with vehicle capacity and truck driver demand.<sup>87</sup> However, the changing supply chain and distribution/fulfillment models of e-commerce and omni-channels may present a solution for attracting more qualified truck drivers. Local P&D operations provide the type of jobs that will keep drivers closer to home, thus eliminating a frequently cited quality of life concern for current truck drivers and potential new entrants. The benefits of shorter truck trips also extend to drivers in the TL and over-the-road LTL segments of the industry, as the shorter intra- and inter-regional hauls needed to support omni-channel fulfillment networks may offer a more stable and predictable work schedule and provide drivers more home time.

Another factor that underlies the long-term driver shortage is the aging driver population – a majority (56.9%) of truck drivers are 45 years or older, a significantly higher proportion of workers than the average occupation in the U.S (Figure 10).<sup>88</sup> As the 28 percent of truck drivers over the age of 55 begin to retire, there are an insufficient number of younger entrants to take their place. This is primarily the consequence of public policy, which stipulates that an interstate driver must be at least 21 years old to get a Commercial Driver's License (CDL).<sup>89</sup> As a result, the trucking industry is losing out to other skilled trades like construction where there are no age restrictions on employment.

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<sup>85</sup> Lamb, Eleanor. "ATA's Bob Costello Says Driver Shortage Will Press Fleets." *Transport Topics*. February 22, 2018. Available online: <http://www.ttnews.com/articles/atas-bob-costello-says-driver-shortage-will-press-fleets>.

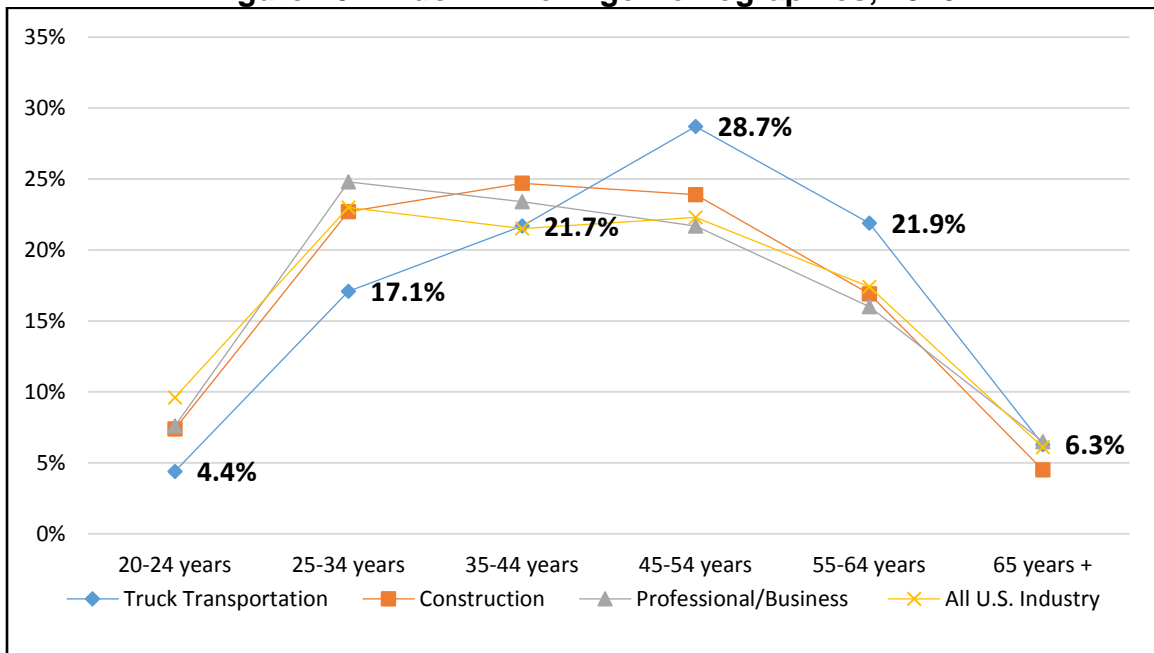
<sup>86</sup> Ibid.

<sup>87</sup> Shields, Nicholas. "Amazon is making the truck driver shortage worse." *Business Insider*. May 23, 2018. Available online: <http://www.businessinsider.com/amazon-making-truck-driver-shortage-worse-2018-5>.

<sup>88</sup> Current Population Survey (CPS) 2016. U.S. Census Bureau and Bureau of Labor Statistics.

<sup>89</sup> Long, Heather. "Amid trucker shortage, Trump team pilots program to drop driving age requirement to 18." *The Washington Post*. June 28, 2018. Available online: [https://www.washingtonpost.com/news/wonk/wp/2018/06/28/amid-trucker-shortage-trump-team-pilots-program-to-drop-driving-age-requirement-to-18/?utm\\_term=.a7351d476605](https://www.washingtonpost.com/news/wonk/wp/2018/06/28/amid-trucker-shortage-trump-team-pilots-program-to-drop-driving-age-requirement-to-18/?utm_term=.a7351d476605).

**Figure 10: Truck Driver Age Demographics, 2016**



The intra-regional and local hauls associated with e-commerce could be leveraged as a training opportunity to train younger drivers. Driver candidates between the ages of 18 and 21 could acquire training, and build experience for safe and efficient driving by completing intra-state hauls and local pickups and deliveries. In this “graduated CDL” concept, these now experienced drivers could transition to interstate operations when they turn 21. As one strategy in a suite of driver recruitment strategies, this could alleviate some pressure on motor carriers by expanding the supply of qualified truck drivers over time.

## Issue 2: Hours-of-Service (HOS)

The federal HOS regulations govern the maximum amount of time a truck driver can be classified as on-duty and operate behind the wheel. For the typical over-the-road driver, these regulations dictate that he or she may be on-duty for up to 14 consecutive hours, drive up to 11 of those hours, and must rest at least 10 hours before the 14-hour on-duty window is refreshed. Other rules require rest breaks and limit the cumulative amount of weekly time spent on-duty.

One industry concern with federal HOS regulations is the lack of flexibility these regulations afford motor carriers to shift hours of operation in response to challenges like construction and traffic delays. These concerns have been compounded by the implementation of FMCSA's ELD Mandate, which requires drivers to log their hours-of-service electronically. Under the old system, drivers recorded their hours using paper logs, which among other things, allowed drivers to record their time in 15-minute increments. However, the shift to ELDs eliminates this marginal flexibility and forces drivers to make a hard-stop once they hit the on-duty time limits, regardless of any extenuating circumstances.

For over-the-road drivers, building in some flexibility into the HOS rules, such as allowing for a 3-hour break while pausing the 14-hour clock, would allow drivers to shift driving time to avoid traffic congestion when it is most severe.<sup>90</sup> This could increase operational efficiencies by cutting down on wasted time and fuel associated with stop-and-go traffic. In fact, ATRI estimates that drivers operating with more flexible split sleeper berth arrangements to avoid peak traffic congestion could result in direct savings in truck operating costs of more than \$150 million.<sup>91</sup> An additional benefit of this added flexibility is that it empowers drivers to plan ahead and avoid situations that could cause one of their shipments to be delayed.

One important exception to the federal HOS regulations that is particularly important for e-commerce operations is the HOS exemption afforded to drivers engaged in short haul operations. Specifically, drivers are not required to log their hours if they fall under the 100 air-mile radius exemption, which applies for any day in which a driver:

- Drives within a 100 air-mile radius of the normal work reporting location;
- Returns to the work reporting location and is released within 12 consecutive hours; and
- Follows all other basic hours-of-service rules including the 10-hour off-duty and 11-hour driving requirements.

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<sup>90</sup> Miller, Eric. "REST Bill Would Modify HOS to Allow Drivers One Three-Hour Break Per Shift." *Transport Topics*. March 30, 2018. Available online: <http://www.ttnews.com/articles/rest-bill-would-allow-drivers-one-break-shift>.

<sup>91</sup> Short, Jeffrey. "Technical Memorandum: Hours-of-Service Flexibility." *American Transportation Research Institute (ATRI)*. August 2018. Arlington, VA.

This is applicable to a growing subset of truck drivers due to the proliferation of local P&D operations and intra-regional hauls that can be attributed to e-commerce. More drivers are shifting to these locally-oriented positions, allowing them to operate under the more flexible HOS regulations stipulated by the federal exemption. This could ultimately mitigate one of the biggest concerns held by both drivers and motor carriers regarding federal HOS regulations.

### Issue 3: Driver Retention

The growing coverage of the long-term driver shortage has also emphasized the closely related issue of Driver Retention. Competition among motor carriers has driven up driver pay considerably over the past year, while drivers are also being offered sizable sign-on/retention bonuses.<sup>92</sup> The competition between carriers regarding sign-on bonuses, in particular, often encourages drivers to jump from carrier to carrier. This driver churn makes retaining qualified and safe drivers a challenge for many motor carriers.

However, it is important to understand that driver turnover is predominantly an issue in the TL sector. While driver turnover in this sector remains elevated around 90 percent, turnover rates are not nearly as severe for LTL carriers.<sup>93</sup> The turnover rate for over-the-road LTL carriers is approximately 10 percent, while the rate for local LTL is not much higher.<sup>94</sup>

As such, the e-commerce and omni-channel transportation preference for the shorter-haul LTL sector is beneficial in that it grows demand for the type of jobs that many truck drivers prefer – providing drivers with more opportunities to spend time with family and friends. These lifestyle differences give LTL carriers an advantage in both attracting new drivers to the industry and retaining their existing pool of drivers.

One potential downside for the industry of the growing demand for LTL and P&D operations is that it may lure drivers away from the TL sector, further exacerbating the long-standing retention issues affecting this industry segment. This potential intra-industry tradeoff emphasizes the need for the industry to properly address the driver shortage as it is one of the biggest factors underpinning retention issues.

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<sup>92</sup> Bearth, Daniel P. "Turnover Surges in Second Quarter." *Transport Topics*. September 18, 2017. Available online: <http://www.ttnews.com/articles/turnover-surges-second-quarter>.

<sup>93</sup> "Truckload Turnover Rate Sinks in Final Quarter of 2017." American Trucking Associations. March 19, 2018. Available online: <http://www.trucking.org/article/Truckload-Turnover-Rate-Sinks-in-Final-Quarter-of-2017>.

<sup>94</sup> "Truckload Turnover Surges in Second Quarter." American Trucking Associations. September 18, 2017. Available online: <http://www.trucking.org/article/Truckload-Turnover-Surges-in-Second-Quarter>.

#### Issue 4: Electronic Logging Device (ELD) Mandate

The ELD Mandate, which went into effect December 2017, requires all drivers for whom HOS regulations are applicable to record both their hours on-duty and time spent driving using electronic logging devices.<sup>95</sup> The ELD Mandate has less of an impact on local pickup and delivery operations as these drivers typically operate under the short-haul HOS exemption.<sup>96</sup>

For over-the-road drivers, more frequent truck trips and tighter delivery windows may force drivers to run up against the HOS limits more frequently. While the ELD mandate does not alter the underlying HOS regulations, it does eliminate some of the flexibility that paper logs, with 15-minute time bins, provided. In the context of responsive inventory management systems and tighter delivery windows, the lack of flexibility associated with ELDs could create issues with supply chain reliability and have implications throughout the distribution/fulfillment network. Pared down inventory levels at stores and fulfillment centers mean that a missed delivery can make the difference between maintaining adequate inventory levels and running out of stock.

Perhaps most importantly, a consumer does not know, and likely does not care, that their package was delivered late due to a missed delivery further up the supply chain due to policy and regulatory restrictions. As a result, the consumer may cancel their order or buy from other retailers in the future, reflecting how a missed delivery can damage a retailer's brand in the highly competitive world of e-commerce and omni-channel retailing.

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<sup>95</sup> "Electronic Logging Devices." U.S. Department of Transportation Federal Motor Carrier Safety Administration. June 21, 2018. Available online: <https://www.fmcsa.dot.gov/hours-service/elds/electronic-logging-devices>.

<sup>96</sup> "Interstate Truck Driver's Guide to Hours of Service." U.S. Department of Transportation Federal Motor Carrier Safety Administration. March 2015. Available online: [https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Drivers%20Guide%20to%20HOS%202015\\_508.pdf](https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Drivers%20Guide%20to%20HOS%202015_508.pdf).

## Issue 5: Truck Parking

The growing scarcity of private and public truck parking options is well documented.<sup>97,98</sup> For local pick-up and delivery drivers, the truck parking issue is focused more on insufficient load/unload zones for drivers attempting to complete deliveries in urban areas. This issue was one of several difficulties associated with bridging the “final 50 feet” of urban package deliveries identified by research conducted jointly by the University of Washington’s Supply Chain Transportation and Logistics Center and the Seattle Department of Transportation.<sup>99</sup>

This urban parking issue arises because cities were not designed with the growing volume of package deliveries in mind; the increased flow of packages is straining the existing capacity of urban infrastructure. The University of Washington research found that a majority of the buildings within the study area in Seattle lacked private loading bays or docks.<sup>100</sup> Delivery operations to these buildings must then compete with other delivery drivers and passenger vehicles for the limited supply of curb space.

Washington D.C. offers an interesting test case for how to handle the scarcity of load/unload zones. D.C. created a marketplace for curb space specifically for commercial vehicles delivering and picking up freight in designated load/unload zones.<sup>101</sup> To establish this system, the city built a database of street space and blended in freight and loading data in its transportation system. The final step was to install loading zone signs that accept payments via smartphone.<sup>102</sup>

While much remains to be done to address the challenges posed by urban pickups and deliveries, research in this area and other similar topics continues. ATRI’s RAC, for instance, selected “Urban Planning and Smart City Design for Trucks” as one of the Institute’s top research priorities for 2018. This ongoing research seeks to provide a roadmap for city planners and decision makers on how to provide sufficient capacity for freight to service the emerging needs of modern cities and shifting consumer tastes.

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<sup>97</sup> “Jason’s Law Truck Parking Survey Results and Comparative Analysis.” U.S. Department of Transportation Federal Highway Administration. 2017. Available online:

[https://ops.fhwa.dot.gov/freight/infrastructure/truck\\_parking/jasons\\_law/truckparkingsurvey/ch1.htm](https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch1.htm).

<sup>98</sup> Boris, Caroline, and Rebecca M. Brewster. “Managing Critical Truck Parking Case Study – Real World Insights from Truck Parking Diaries.” American Transportation Research Institute. December 2016.

<sup>99</sup> “The Final 50 Feet Urban Goods Delivery System.” University of Washington Supply Chain Transportation and Logistics Center and Seattle Department of Transportation. January 19, 2018. Available online:

[https://depts.washington.edu/sctlctr/sites/default/files/SCTL\\_Final\\_50\\_full\\_report.pdf](https://depts.washington.edu/sctlctr/sites/default/files/SCTL_Final_50_full_report.pdf).

<sup>100</sup> Abt, Neil. “Last mile? Crowded cities zero in on final 50 feet.” *FleetOwner*. May 17, 2018. Available online:

<https://www.fleetowner.com/technology/last-mile-crowded-cities-zero-final-50-feet>.

<sup>101</sup> Simpson, Burney. “Solving the ‘Final 50 Feet’ Delivery Challenge.” *Transport Topics*. January 10, 2018.

Available online: <http://www.ttnews.com/articles/solving-final-50-feet-delivery-challenge>.

<sup>102</sup> Ibid.



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## Issue 6: Compliance, Safety, Accountability (CSA)

Compliance, Safety, Accountability (CSA) is the Federal Motor Carrier Safety Administration (FMCSA) framework for evaluating motor carrier safety. Under this program, a Safety Management System (SMS) is used to monitor and manage crash and violation data related to seven safety categories to identify those carriers deemed at risk for crashes.<sup>103</sup>

More recently, the National Academies of Science (NAS) issued a report that recommended an overhaul of the CSA program to make its assessment of carriers' safety risk more fair and accurate.<sup>104</sup> Since these recommendations were published, FMCSA withdrew changes to the CSA system it had previously proposed in 2015, and is instead focusing on implementing a ratings model based on item response theory (IRT) and improving the system's transparency.<sup>105</sup> While there is no timeline for these reforms, FMCSA is working with NAS to develop a reformed CSA program.

Several of the existing CSA BASICs have a nexus to emerging e-commerce and omni-channels trends as described below.

**BASIC 1 – Unsafe Driving:** Given the concentration of trucking activity related to e-commerce in urban areas, violations of the Unsafe Driving BASIC such as speeding, reckless driving, improper lane change, and inattention may be magnified. Carriers now have more trucks operating in heavily congested urban areas, which may increase the total number of unsafe driving violations and negatively impact their raw scores.

**BASIC 2 – Hours-of-Service Compliance:** The HOS BASIC covers compliance with federal HOS regulations, as well as driver fatigue regardless of accumulated time on-duty.<sup>106</sup> While this does not affect drivers operating under the 100-mile air radius exemption, the more frequent truck trips and tighter delivery windows may cause over-the-road operations to run up against the HOS rules more frequently.

**BASIC 7 – Crash Indicator:** The Crash Indicator BASIC is defined as “histories or patterns of high crash involvement, such as frequency and severity.”<sup>107</sup> Overall, the relative frequency and severity of crashes for large trucks have been on a long-term

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<sup>103</sup> The Behavior Analysis and Safety Improvement Categories (BASICS) include: 1) Unsafe Driving, 2) Hours-of-Service Compliance, 3) Driver Fitness, 4) Controlled Substances, 5) Vehicle Maintenance, 6) Hazardous Materials Compliance, and 7) Crash Indicator.

<sup>104</sup> Jaillet, James. “CSA under fire: Researchers recommend major reforms to DOT carrier safety program.” *Commercial Carrier Journal*. June 27, 2017. Available online: <https://www.ccjdigital.com/csa-under-fire-researchers-recommend-major-reforms-to-dot-carrier-safety-program/>.

<sup>105</sup> Jaillet, James. “FMCSA scraps 2015 proposal to alter CSA to pursue larger reforms to the program.” *Commercial Carrier Journal*. July 13, 2018. Available online: <https://www.ccjdigital.com/fmcsa-scraps-2015-proposal-to-alter-csa-to-pursue-larger-reforms-to-program/>.

<sup>106</sup> “HOS Compliance BASIC Factsheet.” U.S. Department of Transportation Federal Motor Carrier Safety Administration. December 2012. Available online: [https://csa.fmcsa.dot.gov/Documents/FMC\\_CSA\\_13\\_004\\_BASICS\\_HOS\\_Compliance.pdf](https://csa.fmcsa.dot.gov/Documents/FMC_CSA_13_004_BASICS_HOS_Compliance.pdf).

<sup>107</sup> “Crash Indicator BASIC Factsheet.” U.S. Department of Transportation Federal Motor Carrier Safety Administration. December 2012. Available online: [https://csa.fmcsa.dot.gov/Documents/FMC\\_CSA\\_12\\_005\\_BASICS\\_Crash\\_Indicator.pdf](https://csa.fmcsa.dot.gov/Documents/FMC_CSA_12_005_BASICS_Crash_Indicator.pdf).

decline – the rate of fatal crashes involving large trucks has declined 71 percent since 1975.<sup>108</sup> However, increases in the number of trucks on the road and overall truck VMT, due in part to e-commerce, can still result in increases in the total number of crashes involving large trucks despite the declining rate. In particular, the growing volume of truck traffic in increasingly congested urban areas is leading to more exposure to property damage only (PDO) crashes for motor carriers.<sup>109</sup> Since this BASIC does not consider the majority responsibility of cars in car-truck crashes, this BASIC could be very problematic for urban truck drivers.

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<sup>108</sup> “Large Truck and Bus Crash Facts 2016.” U.S. Department of Transportation Federal Motor Carrier Safety Administration. May 2018. Available online: <https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/safety/data-and-statistics/398686/tbcf-2016-final-508c-may-2018.pdf>.

<sup>109</sup> Murray, Daniel C. and Jeffrey Short. “Technical Memorandum: Quantifying Impacts from the 34-Hour Restart Provisions.” *American Transportation Research Institute (ATRI)*. April 2015. Arlington, VA.

## Issue 7: Driver Distraction

Although a number of different activities can draw any driver's attention away from the road (e.g. eating and drinking, operating in-cab devices), growing smartphone use has raised the profile of distracted driving as a major public safety issue. In fact, distracted driving was a factor in 14 percent of all police-reported traffic crashes in 2015, including 10 percent of all fatal crashes and 15 percent of injury crashes.<sup>110</sup>

While distracted driving is an issue that affects drivers of all vehicle types, driver distraction is of critical importance to the trucking industry for two reasons:

- 1) Trucks must safely operate around distracted car drivers; and
- 2) Motor carriers assume risk and may be liable if one of their drivers was involved in a crash caused by distracted driving.

These issues are of particular concern in urban areas, as urban drivers visibly manipulate handheld devices more frequently than drivers in rural areas.<sup>111</sup> Since more truck VMTs are being logged in urban locations due to e-commerce, truck drivers are at greater risk of being affected by these distracted drivers. Even with more states banning phone usage while operating a vehicle, it is clear that the trucking industry will continue to be affected by distracted driving as e-commerce shipments increase the number of truck trips on urban roadways.

In-cab technologies like lane-keeping and automatic braking systems can also be a source of distraction for truck drivers with their frequent and sudden alarms. Technologies associated with e-commerce can potentially add to this list of driver-distracting devices. For instance, retailers looking to add more convenient delivery options for consumers may offer control over deliveries even when a package is in transit. This means that a driver has to use or pay attention to technology that dynamically alters their route. Similarly, providing greater consumer visibility into an order's status while a good is in route requires additional input from the driver. Taken together, these added layers of technology in the cab may create new sources of distraction for drivers.

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<sup>110</sup> "Distracted Driving 2015." U.S. Department of Transportation National Highway Traffic Safety Administration. March 2017. Available online: <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812381>.

<sup>111</sup> "Driver Electronic Device Use in 2015." U.S. Department of Transportation National Highway Traffic Safety Administration. September 2016. Available online: [https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/driver\\_electronic\\_device\\_use\\_in\\_2015\\_0.pdf](https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/driver_electronic_device_use_in_2015_0.pdf).

## Issue 8: Transportation Infrastructure/Congestion/Funding

Since truck transportation hauls a majority (63.8%) of the nation's freight tonnage,<sup>112</sup> poorly maintained roads and traffic congestion negatively affect industry productivity and the U.S. economy overall. These interrelated issues address the condition, quality, and capacity of freight-significant roadways, and the negative effects of deteriorating transportation infrastructure has on each of these components.

In the context of e-commerce and the concentration of freight movements in urban areas, the growing volume of truck trips in these densely trafficked zones is further straining roads and curbside parking capacity. Accordingly, these emerging e-commerce and omni-channel trends hold major implications for infrastructure, traffic congestion, and funding.

**Infrastructure:** The transportation demands of e-commerce and omni-channel retailing strain urban transportation infrastructure in a number of ways. Major urban areas lack the infrastructure capacity needed to accommodate the increased truck activity in these densely populated regions. There is also a clear shortage of the load/unload zones needed to support urban package deliveries, which is an additional freight concern that city planners and decision makers must account for when updating transportation infrastructure.

**Congestion:** Traffic congestion is one of the most noticeable symptoms of strained transportation infrastructure. To this end, the impact of traffic congestion on trucking industry operations was \$74.5 billion in 2016, with 91 percent of these congestion costs accruing in urban areas.<sup>113</sup> Moreover, e-commerce deliveries are largely concentrated during the most congested times of the day as consumers are less willing to accept deliveries during off-peak hours. With e-commerce drawing more trucking operations into the stop-and-go traffic of urban congestion, the negative effects of traffic congestion on the trucking industry are likely increase.

**Funding:** There are several potentially offsetting trends attributable to e-commerce that may affect infrastructure funding. Growing package delivery volumes and more frequent truck trips along the supply chain serve to boost truck VMT. However, straight trucks and P&D vans operate with better fuel efficiency than truck-tractors according to data collected by ATRI as part of its *Operational Costs of Trucking* research.<sup>114</sup> Since these trucks are frequently used for urban deliveries, the improved fuel efficiency of the

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<sup>112</sup> "Freight Facts and Figures." U.S. Department of Transportation Bureau of Transportation Statistics. 2017. Available online: [https://www.bts.gov/sites/bts.dot.gov/files/docs/FFF\\_2017\\_Full\\_June2018revision.pdf](https://www.bts.gov/sites/bts.dot.gov/files/docs/FFF_2017_Full_June2018revision.pdf).

<sup>113</sup> Hooper, Alan. "Cost of Congestion to the Trucking Industry: 2018 Update." *American Transportation Research Institute (ATRI)*. October 2018. Arlington, VA.

<sup>114</sup> Hooper, Alan. "An Analysis of the Operational Costs of Trucking: 2018 Update." *American Transportation Research Institute (ATRI)*. October 2018. Arlington, VA.

mix of trucks on the road for these P&D operations may counter the increase in fuel usage and tax revenue associated with higher urban truck VMT.

The potential shift toward the use of electric or other alternative fuel vehicles to fulfil urban P&D needs may also reduce fuel usage and related tax receipts. If these types of vehicles displace diesel-powered trucks, revenues collected from federal and state gas taxes derived from commercial trucks will decline. Taken together, the potential impact of e-commerce operations on infrastructure funding are mixed and will depend on the decisions motor carriers make regarding their “last mile” operations.

## Issue 9: Driver Health and Wellness

Drivers, particularly in the long-haul sector, spend extended periods of time sitting behind the wheel during which they are unable to stand up or move around. Long-haul trucking also does not provide for many healthy eating and exercise options while on the road. Many in the industry recognize the critical connection between these health and wellness issues and the industry's ability to retain qualified drivers, with roughly 20 percent of drivers citing health problems as a factor influencing their decision to leave the industry.<sup>115</sup>

A benefit of the growing demand for intra-state and local truck driver jobs, due in part to e-commerce and omni-channels, is more time spent at home. This makes it easier for truck drivers to seek out healthier food options, and provides more time for exercise. From a health and wellness perspective, these are improvements over the food and exercise options available at rest stops and parking locations.

Furthermore, the decline in truck trip lengths attributable to e-commerce also means that drivers are able to get up from behind the wheel more frequently, a trend that can mitigate the negative health effects of sedentary work.<sup>116</sup> Similarly, "last mile" deliveries involve a significant amount of walking, as well as lifting of packages weighing up to 150 pounds; in the case of "white glove" deliveries of heavy and bulky items, the job may be considered a workout in and of itself.

Although Driver Health and Wellness concerns for over-the-road drivers remain, there are clear benefits to the types of jobs being created to fulfil the needs of e-commerce and omni-channels.

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<sup>115</sup> "One in Five Truck Drivers Leaves Job Because of Health Issues, Survey Finds." *Transport Topics*. May 11, 2016. Available online: <http://www.ttnews.com/articles/one-five-truck-drivers-leaves-job-because-health-issues-survey-finds>.

<sup>116</sup> Owen, N., Sparling P.B., Healy, G.N., Dunstan, D.W., and Matthews, C.E. "Sedentary Behavior: Emerging Evidence for a New Health Risk." *Mayo Clinic Proceedings*. 85(12): 1138-1141. December 2010. Available online: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996155/>.

## Issue 10: Economy

Although U.S. economic activity has increased at a robust pace in 2018, uncertainty surrounding emerging trade disputes and a prolonged federal government shutdown has clouded an otherwise positive economic outlook. The ongoing dispute between the United States and China, in particular, has already yielded tariffs on goods representing hundreds of billions of dollars in trade between the two nations;<sup>117</sup> tariffs on all remaining Chinese imports has also been proposed should ongoing trade negotiations falter.

The link between the economy and e-commerce is direct: consumer spending represents more than two-thirds of U.S. economic activity,<sup>118</sup> and e-commerce accounts for a rapidly growing share of this spending activity. Moreover, the investments made by retailers and logistics firms to support emerging e-commerce and omni-channels business models have also been a major source of jobs, and in turn, disposable income that has supported the ongoing economic expansion. The effects of the tariffs currently in place on this broad-based growth remain to be seen, as e-commerce spending data covering this time period has yet to be released. However, tariffs are increasing the prices paid by U.S. consumers on imported goods, while also hurting those employed in export-oriented industries. Taken together, actions that could impede further economic growth, like tariffs, could also potentially derail the significant momentum underpinning the rapid growth of e-commerce spending.

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<sup>117</sup> Leonard, J. and Jennifer Jacobs. "U.S. Plans More China Tariffs If Trump-Xi Meeting Fails, Sources Say." *Bloomberg*. October 29, 2018. Available online: <https://www.bloomberg.com/news/articles/2018-10-29/u-s-said-to-plan-more-china-tariffs-if-trump-xi-meeting-fails>.

<sup>118</sup> Emmons, William R. "Don't Expect Consumer Spending To Be the Engine of Economic Growth It Once Was." Federal Reserve Bank of St. Louis. January 2012. Available online: <https://www.stlouisfed.org/publications/regional-economist/january-2012/dont-expect-consumer-spending-to-be-the-engine-of-economic-growth-it-once-was>.

## **CONCLUSION**

E-commerce and the ensuing push toward omni-channel retailing are altering retail business models and distribution/fulfillment networks. The trucking industry is in a unique position to adapt to and prosper from these consumer-driven trends, as the more fragmented retail ecosystem has forced retailers to become more reliant on their logistics partners.

Trucking industry stakeholders are still adjusting to the implications of decentralized retail distribution/fulfillment networks and the growing demand for shipment and package deliveries in densely populated regions. As the composition of truck trips become more regionalized, motor carriers are experimenting with different types of equipment and technologies. Even more, carriers are tightening up their operations to accommodate the shorter delivery windows and faster turnaround times required by emerging retail business models.

This research has also shed light on the opportunities and challenges that these changes present for the most critical issues facing the trucking industry. For instance, the growing volume of intra-regional and local operations may help alleviate some of the quality of life concerns underlying issues with Driver Retention as well as Driver Health and Wellness. At the same time, this added demand for truck trips has further emphasized the need for long-term solutions to the Driver Shortage.

Ultimately, trucking operations will need to remain flexible and continue to adapt as the implications of e-commerce and omni-channel retailing shake out. The industry has largely benefited from this source of growing demand for truck transportation, and is presented with an opportunity to expand into a growing industry segment – the “last mile.”



**Table 4: List of Top Trucking Industry Issues and E-Commerce Benefits and Challenges**

Top Issue	Key E-Commerce Benefit	Key E-Commerce Challenge
Driver Shortage	Driving becomes more attractive with regimented work schedules and operations closer to home.	Exacerbates driver-constrained capacity issues.
Hours-of-Service	More drivers able to operate under the 100 air-mile ELD exemption.	Lack of flexibility in current regulations is more pronounced with more dynamic supply chains.
Driver Retention	Adding jobs in segments of the industry with lower driver turnover.	Growing demand for LTL and P&D may lure drivers away from TL sector.
Electronic Logging Device Mandate		More likely to miss tight delivery windows for trips running against the HOS rules.
Truck Parking		Insufficient load/unload zones in urban areas.
Compliance, Safety, Accountability		More urban-centered operations could increase number of unsafe driving violations and PDO crashes.
Driver Distraction		Trucks on the road with more distracted drivers in urban environments; potentially more distracting in-cab technologies.
Infrastructure / Congestion / Funding		Further strains congested transportation infrastructure already in need of repair and maintenance.
Driver Health / Wellness	Driver could be less sedentary; more healthful food and exercise options closer to home.	
Economy	Growing demand for truck transportation across all industry segments.	International trade disputes and government shutdowns a potential headwind for e-commerce.



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