An Analysis of the Operational Costs of Trucking: 2017 Update

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ATRI American Transportation Research Institute

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LIST OF ACRONYMS

ATA	American Trucking Associations
ATRI	American Transportation Research Institute
BLS	Bureau of Labor Statistics
CFO	Chief Financial Officer
CNG	Compressed Natural Gas
CPH	Cost per Hour
CPM	Cost per Mile
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
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
VMT	Vehicle Miles Traveled

INTRODUCTION

Since 2008, the American Transportation Research Institute (ATRI) has published *An Analysis of the Operational Costs of Trucking,* an annual report aimed at providing more accurate marginal cost data on motor carrier operations. In the 2008 inaugural study, ATRI identified historical research that reported cost calculation findings ranging from $22 per hour to over $370 per hour[1] – figures which were considered unreasonably high or low by many in the trucking industry. Additionally, some of these studies calculated costs using highly subjective "value-of-time" calculations that may extend far beyond direct costs – resulting in dramatic variability for industry costs depending on the metrics used.

Consequently, ATRI undertook research to document and quantify motor carriers' key operational costs, stratified by fleet size, sector, and region of the country. The goal of this research was to accurately identify and promulgate current operational costs based on real-world data provided directly by motor carriers. The resulting analyses could then be used by both motor carriers as a high-level benchmarking tool, and by public sector agencies for various transportation impact assessments.

This research was initially identified as a top research priority by ATRI's Research Advisory Committee (RAC).[2] The RAC sought more accurate cost data to better inform policymakers on the impact that new and potentially inefficient transportation funding strategies could have on freight movement. The trucking industry, which is heavily reliant on the 4 million miles of public roadway in the United States,[3] has a vested interest in efficient, effective, and equitable funding and maintenance of the nation's transportation system.

Since its original publication in 2008, ATRI has received over 13,500 requests for the *Analysis of the Operational Cost of Trucking* reports. Based on the continual high demand for this research, ATRI has updated the "ops cost" data on an annual basis, making minor adjustments and improvements to the data collection methodology as needed. Over the years, these improvements have led to a more streamlined process for obtaining sensitive and proprietary fleet cost data on an annual basis. This report includes the most recent 2016 cost data.

[1]Trego, Todd. *An Analysis of the Operational Costs of Trucking*. American Transportation Research Institute. Arlington, VA. 2008

[2] The American Transportation Research Institute (ATRI) Research Advisory Committee (RAC) 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.

[3] Table HM-20 *Public Road Length – Miles by Functional Class*. Highway Statistics Series 2015. Federal Highway Administration, United States Department of Transportation. Available online: https://www.fhwa.dot.gov/policyinformation/statistics/2015/pdf/hm20.pdf

RESEARCH OBJECTIVE

This research is predicated on the need for accurate and timely operational cost data in the trucking industry. Although previous studies conducted by consultants and academic entities have attempted to quantify these costs, the use of modeled data or highly subjective value-of-time metrics produced immensely inconsistent results that were considered inaccurate or political by industry stakeholders. These disparate results can be detrimental to both the trucking industry and public sector transportation planners seeking objective, standardized data. For instance, lower operational cost estimates have been used to downplay the value or significance of certain transportation investments, while unreasonably high figures have been used to minimize the financial impact that innovative financing initiatives have on trucking companies and drivers.

Continued improvements in ATRI's operational cost methodology from 2008 through 2016[4] have resulted in more precise cost metrics. The result of this research is a standardized survey methodology that captures and analyzes sensitive motor carrier operational costs. The data presented in this report reflects 2016 cost data collected from a wide range of motor carriers. With the addition of this 2016 data, ATRI has now collected nine years (2008 – 2016) of detailed operational cost data, providing an invaluable presentation of changing industry costs over time.

[4] Torrey, W. Ford and Dan Murray. *An Analysis of the Operational Costs of Trucking: A 2016 Update*. American Transportation Research Institute. Arlington, VA. 2016.

METHODOLOGY

This 2017 analysis utilized a similar data collection methodology to previous years. Several changes were made to the survey to allow for more detailed analyses of truck industry segments and other operational factors in subsequent years as ATRI's respondent base continues to grow.

The first expansion in the 2017 survey was to allow respondents to provide a more detailed classification of their business operations. The list was expanded to include operations that had previously been categorized as "Specialized;" namely Flatbed, Tanker, Express / Parcel Service, and Automotive Transportation operations (Figure 1). To account for this change, a second question was altered to collect information on the asset count and age from a more robust selection of trailer types to reflect the new business operation categories for which information was requested.

Another question was modified to allow for the collection of more granular incentive and bonus pay for both single and team truck-tractor drivers. Financial incentive and bonus pay per driver were requested for a set of standard industry incentives – safety bonus, on-time delivery bonus, new / starting driver bonus, and retention bonus – and aligned with the same driver classifications for which driver wage and benefit data were collected. These alterations will allow for a more comprehensive analysis of driver compensation than had been possible in previous years.

The most significant addition to the 2017 survey was an expansion of the information collected specifically on straight trucks, with a new section of the survey dedicated to the costs associated with operating these trucks (Appendix A). Respondents are now asked to provide a similar set of operational and cost data for straight trucks as had been solicited for truck-tractors in previous iterations of the survey. The goal of this major expansion is to build a cost history and analysis for straight trucks in parallel with ATRI's current analysis of truck-tractor data. This expanded research scope will allow researchers and practitioners to assess operational costs of straight trucks as their use proliferates with surging last-mile deliveries fueled by e-commerce.

Figure 1: New and Expanded Survey Questions

Expanded Question:
What is your primary for-hire business operation type? *(Select one)*

Truckload	☐
Less-Than-Truckload	☐
Flatbed	☐
Tanker	☐
Express / Parcel Service	☐
Intermodal Drayage	☐
Automotive Transportation	☐
Dedicated Services	☐
Household Goods Mover	☐
Other (please specify):	☐

Expanded Question:
What was your company's fleet size, average age and average number of miles traveled (including owner operators) in 2016 for each equipment type?

Trailer Type	Number of Assets	Average Age (in years)
28' Trailer		
45' Trailer		
48' Trailer		
53' Trailer		
Tank		
Flatbed		
Auto Transporter		
Refrigerated Trailer		
Other (please specify):		
Other (please specify):		
Other (please specify):		

Expanded Question:
Do you provide any additional financial incentives and/or bonus pay for SINGLE TRUCK-TRACTOR drivers that are not part of their regular wages?

☐ Yes	☐ No	☐ Don't Know

If yes, what was the average incentive and/or bonus pay paid per driver in 2016? (*Please report as an annual average paid per driver.)*

Type of Bonus	Company Driver / Company Truck	Leased Driver / Company Truck	Owner Operator
Safety Bonus			
On-Time Delivery Bonus			
New / Starting Driver			
Retention Bonus			

In addition to a host of demographic queries, the data collection form solicited common industry operational and financial metrics, and was beta-tested with motor carriers. Specifically, the research team solicited technical guidance and review from industry financial officers or those with working knowledge of motor carrier cost structures.

Due to the highly competitive nature of the trucking industry and the extreme sensitivity associated with corporate financials and expenditures, the operational cost information was collected confidentially from motor carriers at the per-mile or per-hour level, and the data is presented in aggregate form only. ATRI also provided survey respondents with non-disclosure agreements (NDA) as requested.

Data collection efforts commenced in June 2017, with data request forms being sent electronically to a representative group of for-hire carriers which included truckload (TL), less-than-truckload (LTL), and specialized fleets. ATRI also solicited carrier participation through targeted industry mailings and emails, news alerts, and coverage in major industry news outlets. The 50 State Trucking Associations also solicited carrier participation from their respective memberships. Participants were provided several options for submitting data to ATRI: utilizing the online response form, or transmitting the data to ATRI via email or fax. All responses were carefully reviewed by the research team for clarity, and the research team contacted respondents to clarify any ambiguous responses as needed. Responses were collected through the end of September 2017.

The survey's composition was primarily focused on components and sub-components of carrier marginal costs per mile (CPM), which allows for comparative analyses across the different industry business models. In order to convert line-item CPM figures into a total marginal cost per hour (CPH) figure, a GIS-generated, industry-vetted average operational speed of 39.98 miles per hour (MPH) was used in these calculations. It should be noted that this speed relates to moving trucks only, and includes all roadway speeds rather than solely highway speeds.[5]

To ensure representativeness, ATRI then weighted survey responses to reflect industry-standard shares of the major for-hire trucking sectors. Compared to national averages, Specialized carriers were over-represented in the survey sample while LTL and TL carriers were slightly under-represented (Table 1). As noted, responses were weighted to national industry averages to yield more representative results.

[5] ATRI derived this speed using several datasets from the ATRI/Federal Highway Administration (FHWA) Freight Performance Measures (FPM) program. ATRI analyzed one full week of national FPM data in each of the four seasons in 2010 (February, May, August, October). This dataset consisted of over 110 million truck speed data points. The average speed figure was also validated by multiple motor carriers from various sectors of the industry. The 39.98 mph figure more accurately represents an average operational speed since it includes speeds in all types of operational conditions.

Table 1: For-Hire Industry Sector Breakout

Industry Sector	ATRI Survey Respondents	U.S. Trucking Industry[6]
Truckload	47.6%	52%
Less-than-Truckload	13.1%	24%
Specialized	39.3%	24%

Where applicable, cost data were cross-tabulated by factors such as fleet size, operating sector, and operating region. Again, the data collected are presented in aggregate form in order to protect proprietary carrier information.

Representativeness

The "ops cost" surveys were generally completed by high-level managers and executives who have extensive knowledge of the financial workings of the organizations; namely presidents, chief financial officers (CFOs), general managers, business intelligence analysts, and fleet owners. The fleets represent long-haul to local pick-up and delivery, carrying a vast assortment of commodities and operating across the U.S. Additionally, the fleets cover the continuum of fleet size and revenue levels. As such, ATRI considers the data to be an adequately representative sample of the industry population from which to draw current operational cost data.

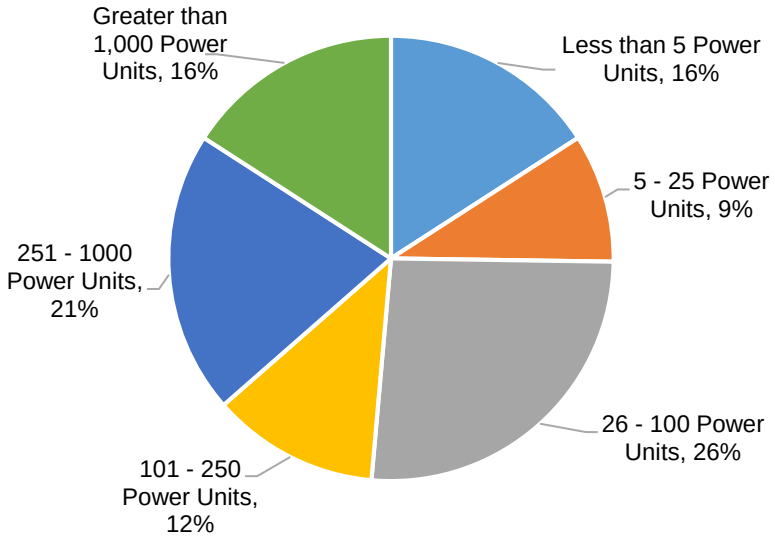
[6] 2002 Vehicle Inventory and Use Survey. United States Department of Commerce, Economics and Statistics Administration, United States Census Bureau. Available online: https://www.census.gov/svsd/www/vius/2002.html

RESPONDENT DEMOGRAPHICS

Size of Operation

With respondents accounting for a total of 85,305 truck-tractors, 4,359 straight-trucks trucks, and 411,956 total trailers, the 2017 Operational Costs of Trucking Survey has yielded another strong sample of motor carriers. The carriers surveyed this year accumulated almost 9 billion miles in 2016 across a variety of industry segments and fleet sizes, an increase of 36 percent from the roughly 6.6 billion miles reported in 2015. 19.5 percent of these miles were non-revenue or "dead-head" miles, down slightly from the 20.4 percent reported by respondents in 2015. The average fleet in the sample operated 838 power units, though responses were again skewed toward smaller firms as indicated by a median fleet size of 97 power units. Indeed, a majority of respondents represented smaller fleets, with 63.6 percent operating fleets with 250 or fewer power units (Figure 2). On the other end of the continuum, 20.6 percent of respondents operated fleets with 251 and 1,000 power units, while the remaining 15.9 percent reported fleets in excess of 1,000 power units (Figure 2).

Figure 2: Respondent Fleet Size



Further corroborating the representation of smaller fleets in the broad continuum of respondents' operations is the similar trend that emerges when analyzing reported revenues (Table 2). The large gap between the average annual trucking-related revenue reported for 2016 ($307,381,241) and the median ($17,797,000) reflect the relatively greater proportion of smaller fleets in the sample. Very large operations in the respondent pool can ultimately skew averages for metrics like fleet size and revenue upward, so statistical measures such as the median can more accurately reflect the broader survey sample.

Table 2: Respondent Revenue Statistics

Percentile	Revenue
75th Percentile	$74,272,447
50th Percentile (Median)	$17,797,000
25th Percentile	$5,348,017
Average (Mean)	$307,381,241

Type of Operation

The respondents in this year's sample were predominantly focused on local and regional pick-ups and deliveries where the average haul lengths were less than 500 miles per trip. An average of 61 percent of respondent trips were of the local and regional variety, while 23 percent of the respondents' trips were inter-regional. The remaining 16 percent of the respondents' trips were longer, national trips in excess of 1,000 miles traveled (Table 3).

Table 3: Survey Respondent Trip Types

Trip Type	Survey Respondent Share of Trips
Local pick-ups and deliveries (less than 100 miles)	21%
Regional pick-ups and deliveries (100-500 miles)	40%
Inter-regional pick-ups and deliveries (500-1,000 miles)	23%
National (over 1,000 miles)	16%

Comparing respondents' 2016 share of U.S. vehicle miles traveled (VMT) by region to commercial truck registrations by region provides another indication of the representativeness of the ATRI survey sample. As can be seen in Table 4, the share of respondents' operations in each U.S. region roughly aligns with the share of truck registrations by region. The Midwest and Southwest were again slightly under-represented in this year's sample, while the Northeast and Southeast were slightly over-represented. This finding may highlight the common occurrence of motor carriers having different headquarter locations from where they "base state" the fleet, for cost-saving purposes.

Table 4: Survey Respondent Truck VMT and National Truck Registrations by Region

Region	Survey Respondent Share of Miles Traveled[7]	Share of U.S. Truck Registrations[8]
Midwest	34%	39%
Northeast	13%	8%
Southeast	23%	20%
Southwest	11%	13%
West	18%	20%

When asked to identify the primary commodities hauled in respondents' operations, responses were concentrated in general freight, retail store/general merchandise, agricultural products, automotive parts and vehicles, and construction/building materials.

Equipment

The trucking industry hauls a majority of freight in the United States, accounting for 66 percent of the nation's freight tonnage and 73 percent of freight value.[9] Similar to the previous year's analysis, a sizable majority of responding fleets operated truck-tractors as their primary type of power unit in 2016. A typical truck-tractor in the ATRI sample was reported to have driven 103,945 miles per year, compared to just 25,511 miles for straight trucks. As expected, 28- and 53-foot trailers remained the most prevalent among respondents' fleets, though Refrigerated Trailers, a new addition to this year's survey, accounted for 17,250 trailers that would have been included in the "Other Trailers" category in previous years (Table 5).

[7] Column total will not sum to 100 percent since roughly 2 percent of VMT were reported in Canada.
[8] *Table MV-9: Truck and Truck-Tractor Registration*. 2015 Highway Statistics Series. Office of Highway Policy Information, Federal Highway Administration, United States Department of Transportation. February 2017. Available online: http://www.fhwa.dot.gov/policyinformation/statistics/2015/mv9.cfm
[9] "2016 Freight Quick Facts Report." Federal Highway Administration, United States Department of Transportation. Washington DC. 1 February, 2017. Available online: https://ops.fhwa.dot.gov/publications/fhwahop16083/ch1.htm#t1

Table 5: Survey Respondent Truck/Trailer Type, Average Truck Age, and Average Miles Driven per Year per Truck

Equipment Type[10]	Number of Trucks/ Trailers	Average Age (Years)	Average Miles Driven per Year per Truck
Straight Trucks	4,359	9.4	25,511
Truck-Tractors	85,305	5.5	103,945
Total Trucks	**89,664**		
28' Trailers	97,574	6.9	
45' Trailers	1,509	7.7	
48' Trailers	22,157	9.1	
53' Trailers	92,052	6.4	
Tank	4,582	11.0	
Flatbed	9,632	6.1	
Auto Trailers	2,234	6.1	
Refrigerated Trailers	17,250	2.9	
Other Trailers[11]	164,966	6.4	
Total Trailers	**411,956**		

Analyzing reported trade cycles can provide further insight into the equipment characteristics of survey respondents. Respondents reported holding equipment for more miles, but slightly fewer years compared to the previous year's analysis. This indicates that trucks are being used more intensively each year and are likely wearing out in less time than before. In particular, straight trucks were reported to be held for an average of 10.0 years, on par with last year's figure, but were expected to clock 350,000 miles before replacement compared to the 225,000 miles reported last year (Table 6). At the same time, truck-tractors were held 6.3 years, on average, before replacement, down from 7.0 years, while trailers were held for 12.7 years compared to 12.4 years. However, respondents reported an average of 754,000 miles before replacing truck-tractors, up from 724,374 during the previous year.

Table 6: Survey Respondent Equipment Trade Cycle

Equipment Type	Average Number of Years Until Replacement	Average Miles Driven Until Replacement
Straight Trucks	10.0	350,000
Truck-Tractors	6.3	754,000
Trailers	12.7	

[10] ATRI stopped collecting data on "Other" trucks in 2017 due to concerns over their potential influence on operational cost figures.
[11] Other trailer types include containers, chassis, double-drop, and heated trailers.

These trends almost certainly reflect the soft freight market of 2016, which created a need to "squeeze" more revenue time out of each truck. The alternative impact, however, is the per-truck increase in age and miles can dramatically increase repair and maintenance costs; and in fact, this line-item cost went up seven percent from 2015 to 2016.

Increased motor carrier reliance on existing truck fleets can also be seen in the slow pace of new sales observed in 2016.[12] Although the pace of new truck sales continued to slow during the first half of 2017, both the economy and truck sales have improved in the latter half of 2017.[13] That said, it is likely that motor carriers will continue to maximize revenue miles from their trucks regardless of age – simply because the trucking industry cannot find new drivers to operate the desired capacity expansion.

The proportion of respondents reporting the use of at least some alternative fuel vehicles held roughly the same level in 2016 as in 2015 – with 11.2 percent of respondents reporting vehicles using a fuel other than diesel or bio-diesel blends. However, these vehicles accounted for a paltry 0.4 percent of total trucks in the sample and relied almost entirely on compressed natural gas (CNG) and liquefied natural gas (LNG). However, adoption of CNG- and LNG-fueled vehicles still has a ways to go to meet the Energy Information Administration's (EIA's) projection that medium- and heavy-duty vehicles will become the largest consumers of LNG by 2040,[14] in part because "the fuel cost savings of LNG offset the significant incremental capital costs of LNG vehicles."[15]

Nonetheless, the alt-fuel transition will ultimately be influenced by diesel fuel prices and the fuel efficiency of new diesel truck models. Increasing diesel prices would make the adoption of alt-fuel trucks a more financially attractive proposition. Increases in the fuel efficiency of diesel trucks, however, can counter increases in diesel prices as more fuel-efficient trucks would allow carriers to stretch their costs over more mileage. Although diesel prices are climbing in latter 2017 from 2016 levels, diesel prices have yet to reach a level for alternative fuels to become a viable option for motor carriers. At the same time, newer model trucks continue to improve their fuel efficiency to comply with tightening consumption standards nationwide.[16] Taken together, the outlook for adoption of alternative fuel vehicles in the trucking industry remains subdued.

[12] Gilroy, Roger. "November Class 8 Sales Fall 27.5%." Transport Topics. 19 December, 2016. Available online: http://www.ttnews.com/articles/november-class-8-sales-fall-275
[13] Gilroy, Roger. "Class 8 Sales Top 17,000, Second-Highest Month in 2017." Transport Topics. 15 September, 2017. Available online: http://www.ttnews.com/articles/class-8-sales-top-17000-second-highest-month-2017
[14] *Annual Energy Outlook 2015 with Projections to 2040*. U.S. Energy Information Administration, Office of Integrated and International Energy Analysis, U.S. Department of Energy. Washington D.C. (April 2015) Available online: http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf
[15] *Annual Energy Outlook 2016 with Projections to 2040*. U.S. Energy Information Administration, Office of Integrated and International Energy Analysis, U.S. Department of Energy. Washington D.C. (August 2016) Available online: https://www.eia.gov/outlooks/aeo/pdf/0383(2016).pdf
[16] Ibid.

Despite the effect of technological improvements on fuel efficiency, one of the most significant factors that can influence a fleet's fuel efficiency are travel speeds and driving behavior. With this in mind, a large majority of respondents (84.1%) reported use of speed limiters, with 85.6 percent of these fleets utilizing limiters on their entire fleet. As has been the case for the last several years, 65 miles per hour remained the most common maximum speed setting, though this figure sometimes varies within fleets based on operations and driver performance.

Though new truck models are becoming more fuel efficient, indications of an increase in fuel economy have lagged. For example, the overall fuel economy of the respondent sample held steady at an average of 6.3 MPG, compared to the median heavy-duty fleet fuel economy of 6.5 MPG reported in research conducted jointly by the University of Michigan's Transportation Research Institute and ATRI in 2016.[17] As motor carriers replace their existing fleets with newer models in the years ahead, the fuel economy of fleets surveyed can be expected to increase.

To gain a deeper understanding of fuel economy in the ATRI sample, these MPG figures were broken down by operating weight. As detailed in Table 7, fleets that reported loaded operating weights between 40,001 and 60,000 pounds reported the highest fuel economy (6.8 MPG), closely followed by fleets operating between 20,001 and 40,000 pounds (6.7 MPG). Unsurprisingly, LCV fleets typically operating at weights in excess of 80,000 pounds reported the worst fuel economy, with an average of 5.4 MPG. Further, these differences in fuel economy may be due to a fleet's ability to maintain a more efficient speed for fuel economy purposes at certain operating weights. Based on the increase in urban freight deliveries, as well as increasing traffic congestion, motor carriers may lose the fuel efficiencies that would have come from newer vehicles.

Table 7: Survey Respondent Reported Fuel Economy Compared to Typical Operating Weight and Average Operating Speed

Typical Operating Weight	MPG	Average Operating Speed (MPH)
Less than 20,000 lbs	6.3	46
20,001 - 40,000 lbs	6.7	53
40,001 - 60,000 lbs	6.8	51
60,001 - 80,000 lbs	6.0	55
Greater than 80,000 lbs	5.4	51

[17] Schoettle, Brandon, Sivak, Michael, and Michael Tunnel. "A Survey of Fuel Economy and Fuel Usage by Heavy-Duty Truck Fleets." Sustainable Worldwide Transportation and American Transportation Research Institute. Ann Arbor, MI. October 2016

With the impending implementation of the Federal Motor Carrier Safety Administration (FMCSA) mandate on the use of Electronic Logging Devices (ELDs), it was not surprising to see the significant uptick in ELD adoption in 2016. The percentage of respondents in the ATRI sample responding in the affirmative to ELD use jumped over 11 percentage points to 74.8 percent between 2015 and 2016. Moreover, with legal challenges ostensibly resolved,[18] it is reasonable to expect full ELD adoption in the trucking industry as motor carriers come into compliance between December 2017 and December 2019.[19]

[18] Jaillet, James. "With Supreme Court blow to ELD legal challenge, mandate has no roadblocks remaining." Commercial Carriers Journal. 14 June, 2017. Available Online: http://www.ccjdigital.com/with-supreme-court-blow-to-eld-legal-challenge-mandate-has-no-roadblocks-remaining/

[19] *Implementation Timeline*. Federal Motor Carrier Safety Administration. Washington DC. 31 August, 2017. Available online: https://www.fmcsa.dot.gov/hours-service/elds/implementation-timeline

MOTOR CARRIER COSTS

Motor carrier operational costs can be impacted by a number of underlying influences and externalities. As a result, some line-item costs are more easily measured than others. These may include fuel and tire costs. Alternatively, costs such as labor can be impacted by driver experience, performance and differing compensation models. Finally, in several instances ATRI worked closely with carriers to refine certain costs that straddle both fixed and marginal metrics. For example, insurance is often considered a fixed-cost, but is typically based on truck VMT as a measure of risk or exposure.

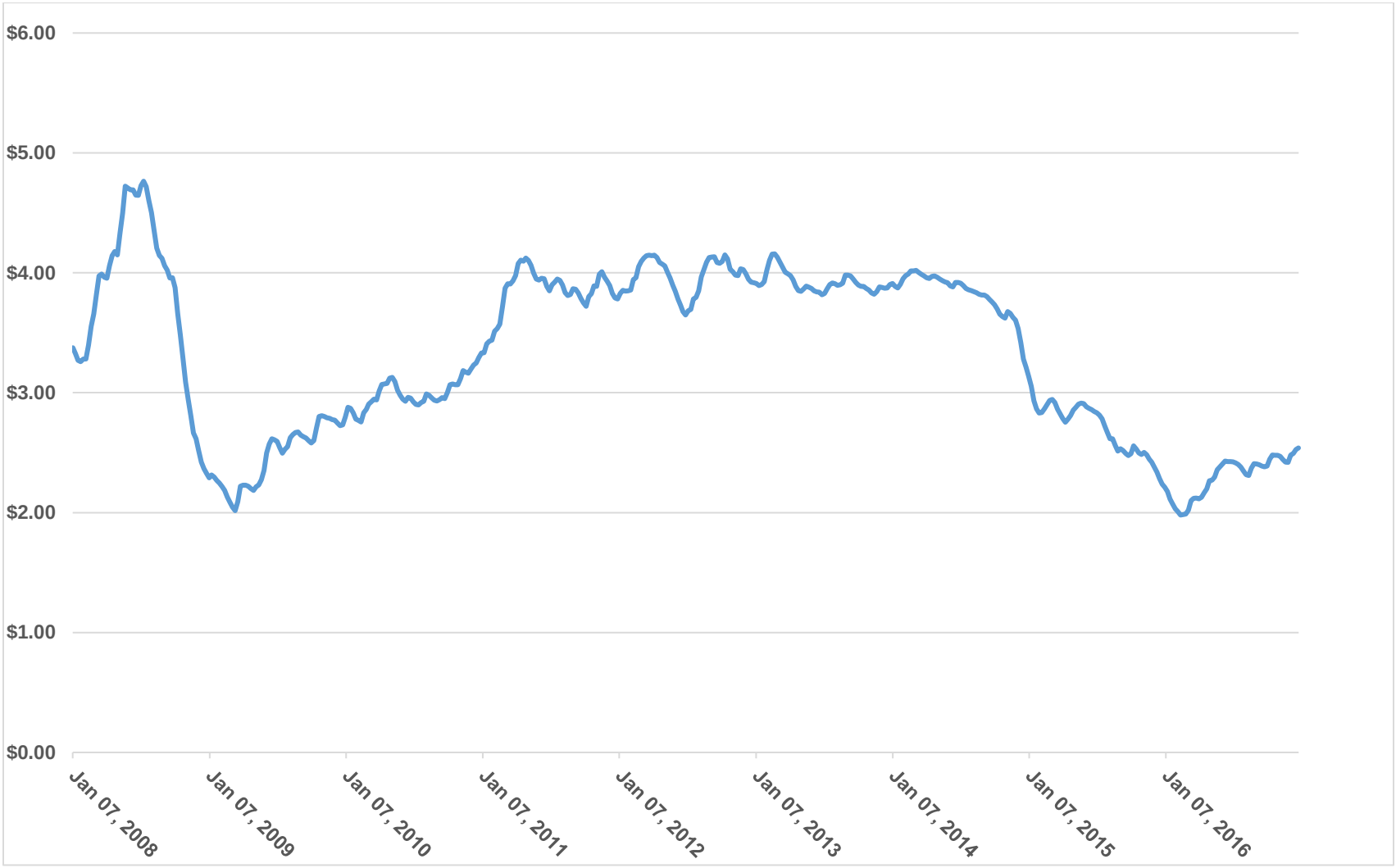
ATRI chose to document and analyze those cost centers most closely associated with driver and vehicle operations, effectively representing a motor carrier's marginal costs (MC).

Fuel

Fuel prices have fluctuated dramatically over the years since the inception of this study. U.S. diesel prices peaked at almost $4.80 per gallon in the summer of 2008 before a precipitous fall to roughly $2.00 per gallon by March of the following year.[20] As the economy recovered from the Great Recession, diesel prices started to pick up again, growing through 2010 before stabilizing in the $3.75-$4.15 range between 2011 and mid-2014. At that time, the emergence of U.S. shale oil induced a global supply glut that resulted in plummeting diesel prices for the next two years until reaching a bottom price of $1.98 in February 2016 (Figure 3).[21] At the time of this publishing diesel fuel was $2.79 per gallon – up slightly due to the impacts of Hurricane Harvey in Texas.

[20] Gasoline and Diesel Fuel Update. U.S. Energy Information Administration. Available Online: http://www.eia.gov/petroleum/gasdiesel
[21] Ibid.

Figure 3: Average U.S. On-Highway Diesel Prices, 2008 – 2016

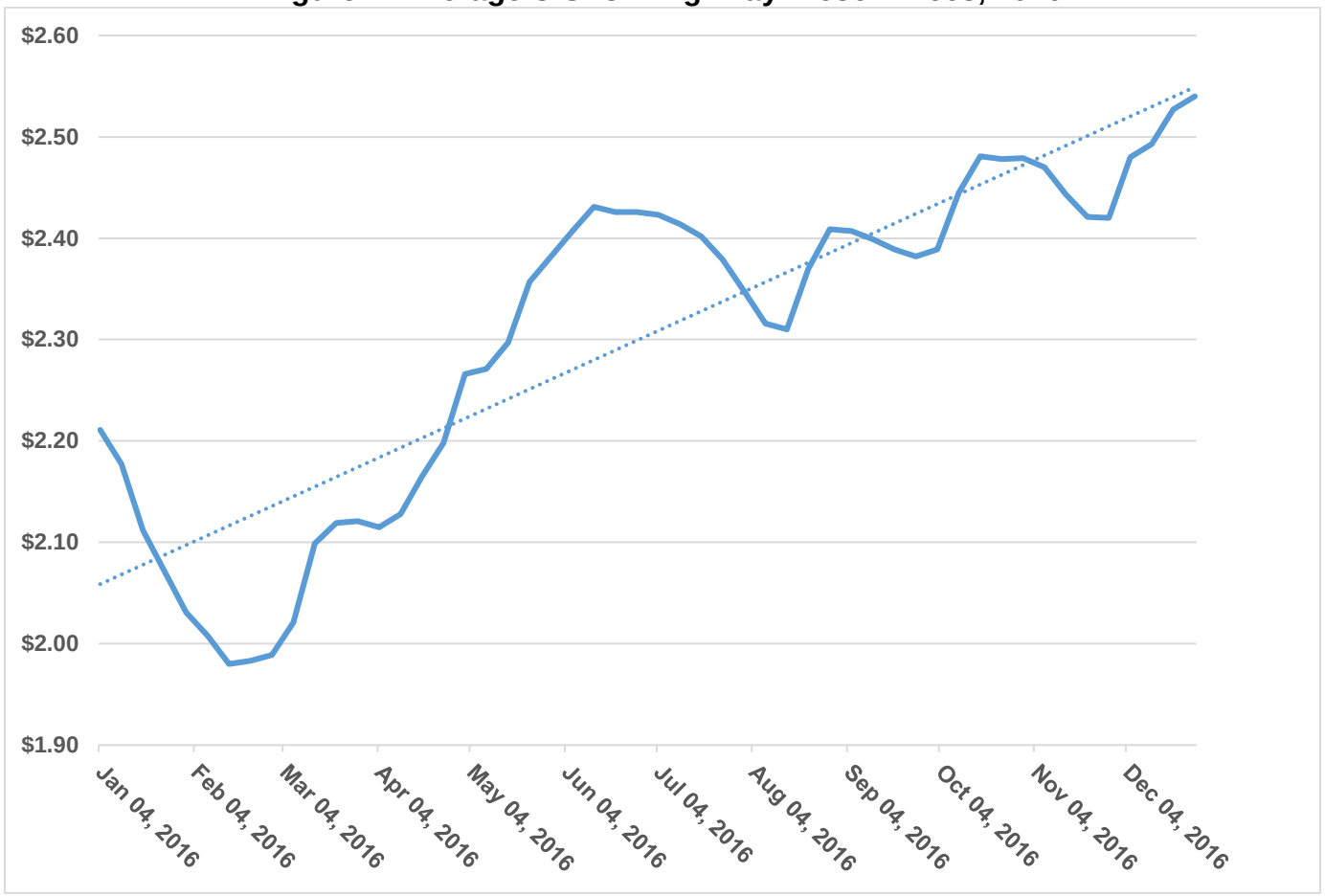


After hitting the trough at $1.98 per gallon in February 2016, fuel prices rose steadily throughout the year, reaching a peak of $2.54 per gallon in the last week of December 2016 (Figure 4).[22] Nonetheless, diesel prices remained well below their

[22] Ibid.

10-year average of $3.31 per gallon for the duration of 2016.[23]

Figure 4: Average U.S. On-Highway Diesel Prices, 2016



[23] Ibid.

Fuel costs have consistently been the biggest MC line-item expense across most of the years ATRI has conducted this research, and generally account for approximately 30 to 40 percent of a motor carrier's CPM.[24] However, due to the continual steady decline of fuel prices in 2015 and early 2016, fuel's share of a carrier's MC was lower than historically experienced and was in fact surpassed by driver wages for the second consecutive year. Additionally, diesel prices are projected by the EIA to increase throughout 2017,[25] driven in part by major weather-related disasters such as Hurricane Harvey.[26] Accordingly, the fuel costs reported by motor carriers can be expected to increase slightly in 2017.

Equipment

The age, type, and turnover of a motor carrier's equipment can affect a number of other operating costs, including lease and purchase payments, repair and maintenance, insurance premiums, permits and special licensure, and tire costs. This year's survey respondents accounted for roughly 89,700 trucks, 412,000 trailers, and almost 9 billion vehicle miles traveled in 2016. As previously detailed, respondents reported using both truck-tractors and straight trucks more intensively before replacement than was documented in 2015; coupled with increased costs for maintenance of newer truck models (both labor and components), it is expected that repair and maintenance costs will continue to increase.

Driver Pay

A number of industry shifts have continued to exert upward pressure on driver pay. In fact, in 2016 both driver wages and benefits grew for the fourth consecutive year, and are now ranked as the biggest cost center for motor carriers in ATRI's sample for the second consecutive year.

Chief among these shifts has been the much-discussed shortage of qualified drivers, a shortage that continued to plague the industry in 2016. For reference, the American Trucking Associations (ATA) estimates a shortage of nearly 50,000 drivers, with projections that the shortage could increase to 175,000 by 2025.[27] While driver supply has been tight, demand for drivers has skyrocketed as a function of strong economic growth.[28] This has served to place additional pressure on an already constrained market. Corroborating these findings are the growing number of carriers that have reported difficulty in recruiting drivers, particularly in the truckload sector.[29] Coupled with ongoing baby boomer retirements and slowly growing oilfield service employment

[24] Torrey, W. Ford and Dan Murray. *An Analysis of the Operational Costs of Trucking: A 2015 Update*. American Transportation Research Institute. Arlington, VA. (2015)
[25] Short-Term Energy Outlook. U.S Energy Information Administration. Available Online: http://www.eia.gov/forecasts/steo/
[26] "Average US gas price jumps after Harvey shuts refineries." Associated Press. 11 September, 2017. Available online: https://www.cnbc.com/2017/09/11/average-us-gas-price-jumps-after-harvey-shuts-refineries.html
[27] Costello, Bob. "ATA's Trucking Economic Review". Volume 17, Issue 4. 23 December, 2015.
[28] Costello, Bob. "ATA's Trucking Economic Review." Volume 19, Issue 1. 13 January, 2017.
[29] Gilroy, Roger. "The Driver Shortage Is More Acute, Some Truckers Say." Transport Topics. 18 July, 2017. Available online: http://www.ttnews.com/articles/driver-shortage-more-acute-some-truckers-say

that pull from the same pool of labor as the trucking industry, it is clear that a number of key factors underpinning the driver shortage remained firmly in place during 2016.

Beyond a shortage of qualified drivers, another challenge facing the industry is the changing demographics of the industry's workforce. An ATRI study in 2014 identified alarming demographic trends in trucking – with 55.5 percent of its workforce 45 and older, and less than five percent of its workforce in the 20 to 24 year old age bracket.[30] Additionally, the driver population is likely being impacted by growing domestic oil production,[31] which provide alternative higher paying, albeit cyclical, job opportunities.

The confluence of these forces in the industry will continue to drive up wages and benefits in the trucking industry. This trend has persisted into 2017, as a number of carriers have been forced to boost driver pay to keep their experienced workforce and recruit additional drivers.[32] It is highly likely that driver pay will remain on its upward trajectory barring a sudden downshift in the pace of economic activity.

FINDINGS

Average Marginal Costs

In order to remain consistent with the previous operational cost analyses, marginal costs were once again divided into two general categories, vehicle- and driver-based, which included the following line items:

- Vehicle-based
  - Fuel
  - Truck/Trailer Lease or Purchase Payments
  - Repair and Maintenance
  - Truck Insurance Premiums
  - Permits and Special Licenses
  - Tolls

- Driver-based
  - Wages
  - Benefits

Table 8 displays the average cost per mile for all sectors, based on the survey data. The analysis found that the average CPM was $1.592 for 2016, up one percent from the costs of $1.575 found in 2015. The continued decline in fuel prices was countered by moderate increases in driver wages and benefits, as well as growing equipment lease and purchase payments, resulting in total costs roughly holding steady over the year. Utilizing a mean vehicle speed of 39.98 MPH, the average cost per hour for motor

[30] Short, Jeffery. *Analysis of Truck Driver Age Demographics Across Two Decades*. American Transportation Research Institute. Arlington, VA. (2014)
[31] Gilroy, Roger. "The Driver Shortage Is More Acute, Some Truckers Say." Transport Topics. 18 July, 2017. Available online: http://www.ttnews.com/articles/driver-shortage-more-acute-some-truckers-say
[32] Bearth, Daniel P. "More Fleets Boost Driver Pay as Freight-Hauling Capacity Tightens." Transport Topics. 3 October, 2017. Available online: http://www.ttnews.com/articles/more-fleets-boost-driver-pay-freight-hauling-capacity-tightens

carriers amounted to $63.66 in 2016 (Table 9). These figures remained below the nine-year average of the time period that the survey has been conducted.

Table 8: Average Marginal Costs per Mile, 2008-2016

Motor Carrier Costs	2008	2009	2010	2011	2012	2013	2014	2015	2016
Vehicle-based									
Fuel Costs	$0.633	$0.405	$0.486	$0.590	$0.641	$0.645	$0.583	$0.403	$0.336
Truck/Trailer Lease or Purchase Payments	$0.213	$0.257	$0.184	$0.189	$0.174	$0.163	$0.215	$0.230	$0.255
Repair & Maintenance	$0.103	$0.123	$0.124	$0.152	$0.138	$0.148	$0.158	$0.156	$0.166
Truck Insurance Premiums	$0.055	$0.054	$0.059	$0.067	$0.063	$0.064	$0.071	$0.074	$0.075
Permits and Licenses	$0.016	$0.029	$0.040	$0.038	$0.022	$0.026	$0.019	$0.019	$0.022
Tires	$0.030	$0.029	$0.035	$0.042	$0.044	$0.041	$0.044	$0.043	$0.035
Tolls	$0.024	$0.024	$0.012	$0.017	$0.019	$0.019	$0.023	$0.020	$0.024
Driver-based									
Driver Wages	$0.435	$0.403	$0.446	$0.460	$0.417	$0.440	$0.462	$0.499	$0.523
Driver Benefits	$0.144	$0.128	$0.162	$0.151	$0.116	$0.129	$0.129	$0.131	$0.155
TOTAL	**$1.653**	**$1.451**	**$1.548**	**$1.706**	**$1.633**	**$1.676**	**$1.703**	**$1.575**	**$1.592**

Table 9: Average Marginal Costs per Hour, 2008-2016

Motor Carrier Costs	2008	2009	2010	2011	2012	2013	2014	2015	2016
Vehicle-based									
Fuel Costs	$25.30	$16.17	$19.41	$23.58	$25.63	$25.78	$23.29	$16.13	$13.45
Truck/Trailer Lease or Purchase Payments	$8.52	$10.28	$7.37	$7.55	$6.94	$6.52	$8.59	$9.20	$10.20
Repair & Maintenance	$4.11	$4.90	$4.97	$6.07	$5.52	$5.92	$6.31	$6.23	$6.65
Truck Insurance Premiums	$2.22	$2.15	$2.35	$2.67	$2.51	$2.57	$2.89	$2.98	$3.00
Permits and Licenses	$0.62	$1.15	$1.60	$1.53	$0.88	$1.04	$0.76	$0.78	$0.88
Tires	$1.20	$1.14	$1.42	$1.67	$1.76	$1.65	$1.76	$1.72	$1.41
Tolls	$0.95	$0.98	$0.49	$0.69	$0.74	$0.77	$0.90	$0.79	$0.97
Driver-based									
Driver Wages	$17.38	$16.12	$17.83	$18.39	$16.67	$17.60	$18.46	$19.95	$20.91
Driver Benefits	$5.77	$5.11	$6.47	$6.05	$4.64	$5.16	$5.15	$5.22	$6.18
TOTAL	**$66.07**	**$58.00**	**$61.90**	**$68.21**	**$65.29**	**$67.00**	**$68.09**	**$62.98**	**$63.66**

Total average marginal costs in the trucking industry grew slightly (1%) in 2016 as the continued decline in diesel fuel prices was countered by large increases in driver wages and benefits. Equipment lease and purchase payments, repair and maintenance, permits and license costs, and tolls also increased from 2015 (Table 10).

Table 10: Annual Change of Average Marginal Costs

Motor Carrier Costs	2015-2016 Change
Vehicle-based	
Fuel Costs	-17%
Truck/Trailer Lease or Purchase Payments	11%
Repair & Maintenance	7%
Truck Insurance Premiums	1%
Permits and Licenses	13%
Tires	-18%
Tolls	23%
Driver-based	
Driver Wages	5%
Driver Benefits	18%
TOTAL	**1%**

The interesting shifts observed in some of the line-item cost ratios in 2015 continued in 2016. Fuel costs continued to drop in 2016 as a share of total average marginal cost, falling to just 21 percent – the lowest ratio in the survey's history. As noted, driver wages remained the largest share of total costs for the second consecutive year, followed by equipment lease or purchase payments at 16 percent of total costs (Table 11). In a similar rank to 2015, repair and maintenance, insurance premiums, permits and license, tires, toll costs, and driver benefits each represented 10 percent or less of average total marginal costs.

Table 11: Share of Total Average Marginal Cost, 2008-2016

Motor Carrier Costs	2008	2009	2010	2011	2012	2013	2014	2015	2016
Vehicle-based									
Fuel Costs	38%	28%	31%	35%	39%	38%	34%	26%	21%
Truck/Trailer Lease or Purchase Payments	13%	18%	12%	11%	11%	10%	13%	15%	16%
Repair & Maintenance	6%	8%	8%	9%	8%	9%	9%	10%	10%
Truck Insurance Premiums	3%	4%	4%	4%	4%	4%	4%	5%	5%
Permits and Licenses	1%	2%	3%	2%	1%	2%	1%	1%	1%
Tires	2%	2%	2%	2%	3%	2%	3%	3%	2%
Tolls	1%	2%	1%	1%	1%	1%	1%	1%	2%
Driver-based									
Driver Wages	26%	28%	29%	27%	26%	26%	27%	32%	33%
Driver Benefits	9%	9%	10%	9%	7%	8%	8%	8%	10%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

As previously noted, the analysis stratified motor carrier responses by operating sector where applicable. Given the different operating conditions and business models for each sector, total average marginal costs again varied considerably across these sectors in 2016. Specialized carriers reported the highest CPM for the third year in a row – driven again by relatively higher rates of driver pay than other industry sectors (Table 12). TL carriers continued to face considerably lower costs than other industry sectors in 2016, due in large part to the continued decline of fuel costs. LTL carriers reported the largest increase in CPM over the year after reporting a decrease of a similar magnitude in 2015. Strong increases in driver pay and equipment lease and purchase payments contributed the most to this year-over-year increase for LTL.

Table 12: Average Total Marginal Costs by Sector, 2008-2016

Sector	2008	2009	2010	2011	2012	2013	2014	2015	2016
LTL	$1.81	$1.43	$1.76	$1.93	$1.79	$1.84	$1.83	$1.60	$1.74
Specialized	$1.87	$1.67	$1.61	$1.79	$1.73	$1.67	$1.85	$1.72	$1.83
TL	$1.48	$1.36	$1.43	$1.57	$1.51	$1.60	$1.58	$1.50	$1.42

Line-Item Costs

Fuel Costs

In order to standardize the collection of fuel costs, respondents were asked to provide fuel cost data that excluded any revenue from fuel surcharges. Since fuel surcharges are negotiated as a fuel "subsidy" between two parties, excluding fuel surcharge reveals the actual dollar amount spent directly on fuel.

Fuel prices have fluctuated dramatically over the years since the inception of this study. U.S. diesel prices peaked at almost $4.80 per gallon in the summer of 2008 before a precipitous fall to roughly $2.00 per gallon by March of the following year.[33] As the economy recovered from the Great Recession, diesel prices started to pick up again, growing in 2010 before stabilizing in the $3.75-$4.15 range between 2011 and mid-2014. At that time, the emergence of U.S. shale oil induced a global supply glut that resulted in plummeting diesel prices for the next two years until reaching a bottom of $1.98 in February 2016. After February 2016, fuel prices rose steadily throughout the year, reaching a peak of $2.54 per gallon in the last week of December 2016 (Figure 4).[34] Nonetheless, diesel prices remain well below their 10-year average of $3.31 per gallon.

The data reported by respondents in ATRI's survey sample over the years is consistent with trends observed in the EIA data. Survey data indicated that fuel costs fell significantly from 63.3 cents per mile in 2008 to 40.5 cents per mile in 2009, before rising from 2010 to 2013. Calculated on an annualized basis, the average fuel CPM

[33] Gasoline and Diesel Fuel Update. U.S. Energy Information Administration. Available Online: http://www.eia.gov/petroleum/gasdiesel
[34] Ibid.

was 48.6 cents in 2010, 59.0 cents in 2011, 64.1 cents in 2012, 64.5 cents in 2013, 58.4 cents in 2014, and 40.3 cents in 2015.

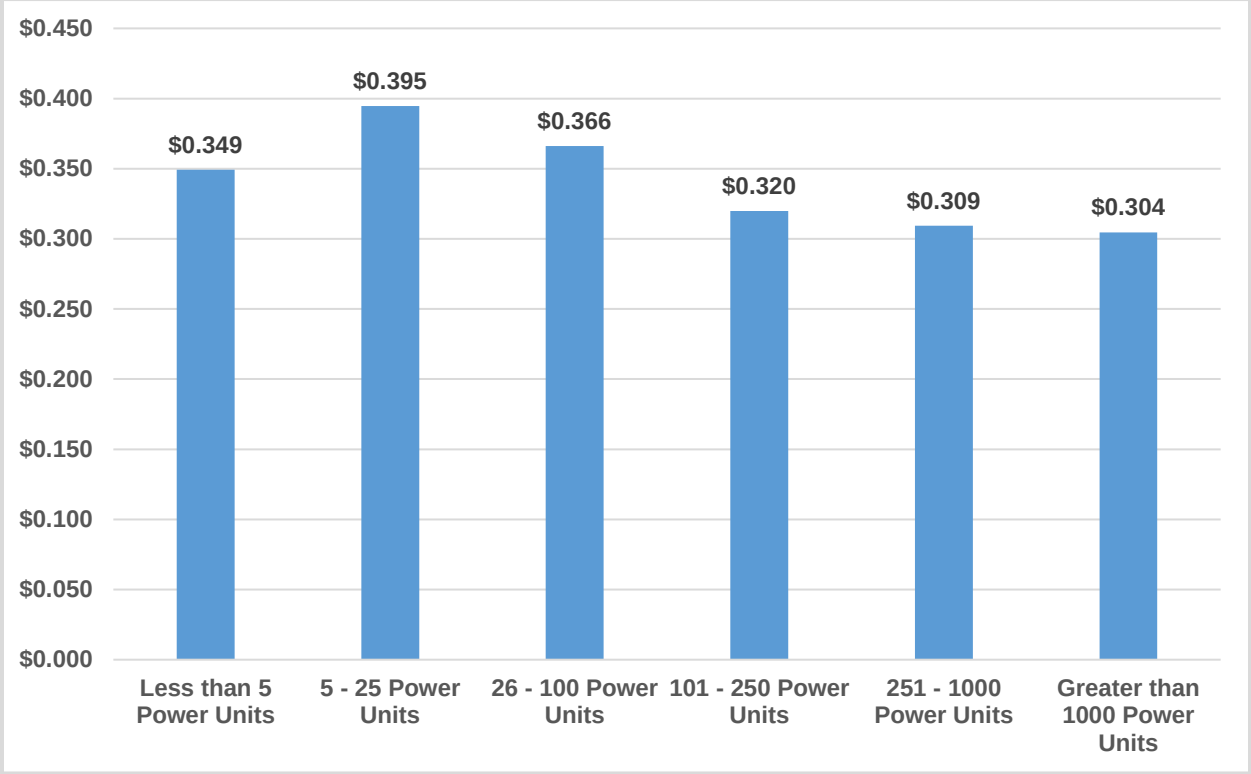
The fuel CPM reported in 2016 of 33.6 cents is the lowest reported figure since the inception of this study. Furthermore, fuel costs now account for just 21 percent of total annual carrier costs – the lowest of the years studied, and the second consecutive year that it was surpassed by driver wages in terms of cost-share. Analyzed by sector, Specialized carriers had the highest fuel CPM of 36.5 cents, followed by LTL carriers at 34.8 cents, and TL carriers at 31.8 cents.

These for-hire fuel costs trend very closely with the National Private Truck Council's (NPTC's) 2017 Benchmarking Report of private fleet data. In the 2017 report, private fleets reported that per-mile fuel costs decreased 14 percent from 43 cents to 37 cents over the year.[35]

While fuel costs are known to vary based on equipment age, operating sector, and vehicle weights, fleet size is another important factor that can affect fuel costs. Larger fleets can leverage their size in terms of diesel buying power, engage in more sophisticated price hedging strategies, and use technology to distribute their fleet's trips in a more fuel-efficient manner. Accordingly, fuel costs per mile are expected to decrease with fleet size, a fact that has been corroborated by ATRI's survey sample for a number of years. This holds true again in 2016, as fleets operating between 5 and 25 units faced the highest fuel CPM, while these costs decreased for each subsequent fleet size category (Figure 5).

[35] *Benchmarking Survey Report 2017*, p.42. National Private Truck Council. Arlington, VA. August 2017. Available only to NPTC members.

Figure 5: Respondent Fuel Cost per Mile by Fleet Size



While fuel prices are known to be highly volatile due to geopolitical concerns and unpredictable supply disruptions, diesel prices are projected by the EIA to slightly increase throughout 2017.[36] These trends are further supported by near-term increases in diesel prices caused by the effect of Hurricane Harvey on oil refinery and distribution in Texas.[37] Accordingly, the fuel costs reported by motor carriers are expected to increase in next year's report.

Equipment Lease or Purchase Payments

Truck and trailer payments were classified as a quasi-operational cost since many motor carriers purchase trucks and trailers in response to capacity constraints in strong economic periods; those payments continue whether the truck is operated or not, but are paid for with operating revenue. Survey respondents indicated that truck/trailer lease or purchase payments rose again in 2016, increasing to 25.5 cents per mile. Truckload carriers reported the highest lease or purchase CPM at 27.2 cents, while Specialized carriers reported the second highest lease or purchase CPM at 24.4 cents. LTL carriers followed closely behind, reporting lease or purchase costs of 22.9 cents per mile in 2016.

[36] Short-Term Energy Outlook. U.S Energy Information Administration. Available Online: http://www.eia.gov/forecasts/steo/

[37] "Average US gas price jumps after Harvey shuts refineries." Associated Press. 11 September, 2017. Available online: https://www.cnbc.com/2017/09/11/average-us-gas-price-jumps-after-harvey-shuts-refineries.html

Repair and Maintenance

Several factors impact a carrier's repair and maintenance (R&M) costs, such as the age of the trucks and trailers, the vehicle configurations used, and the technologies that are installed on the trucks. In addition, it is also well understood that the diesel technician shortage continues to drive up R&M costs. Average R&M costs for survey respondents grew by 1 cent between 2015 and 2016, reaching $0.166 cents per mile, the highest level recorded in the survey's history.

The increase in R&M costs can be partially attributed to the more intensive usage of truck-tractors reported by respondents this year. Truck-tractors in the sample were estimated to drive an average of 103,945 miles per year in 2016 – up substantially from 2015 mileage levels of 80,868 in 2015 (Table 13). At the same time, the average fleet age decreased from 8.7 years in 2015 to 7.0 years in 2016, reflecting significant turnover of the fleets owned by reporting motor carriers. The larger proportion of newer trucks in fleets may further drive increases in R&M costs due to the complexity of maintaining a fleet of technologically advanced vehicles. Specifically, the adoption of new technology in more recent truck models is creating costs that didn't exist before. Technologies like collision mitigation systems add a new layer of equipment and technology that can break down and require sophisticated repair and maintenance. Moreover, the growing list of fault codes associated with advanced systems now require more frequent inspections. Even when no defects are discovered during these inspections, carriers still expend costly labor hours addressing the issues.

Table 13: Change in Annual VMT per Truck

	Average Miles Driven Per Year Per Truck		Percentage Change in Miles Driven Per Year Per Truck
Equipment Type	2015	2016	
Straight Trucks	21,821	25,511	16.9%
Truck-Tractors	80,868	103,945	28.5%

Respondents indicated that their fleets accumulated considerably more mileage in 2016 than 2015, as the average miles driven per truck increased almost 17 percent for straight trucks and 28.5 percent for tractors year-over-year. This is in line with motor carriers also reporting that trucks were traded in after a fewer number of years, but with more miles per truck than previous years. NPTC's private fleet data also indicated that the average Class 8 tractor was replaced more frequently than in the past. However, the trend of trucks being traded in with more miles per truck was reversed in the private fleet data, which showed that the mileage before replacement decreased during the same period.[38]

[38] *Benchmarking Survey Report 2017*, p.31. National Private Truck Council. Arlington, VA. August 2017. Available only to NPTC members.

LTL carriers reported the highest R&M costs again in 2016, reflecting the pressures of more frequent pick-up and delivery (P&D) and the growing influence of e-commerce. This marks a return to the historical norm, with LTL carriers reporting R&M CPM of 22.8 cents, followed by Specialized carriers at 18.2 cents, and TL carriers reporting costs of 13.1 cents per mile (Table 14).

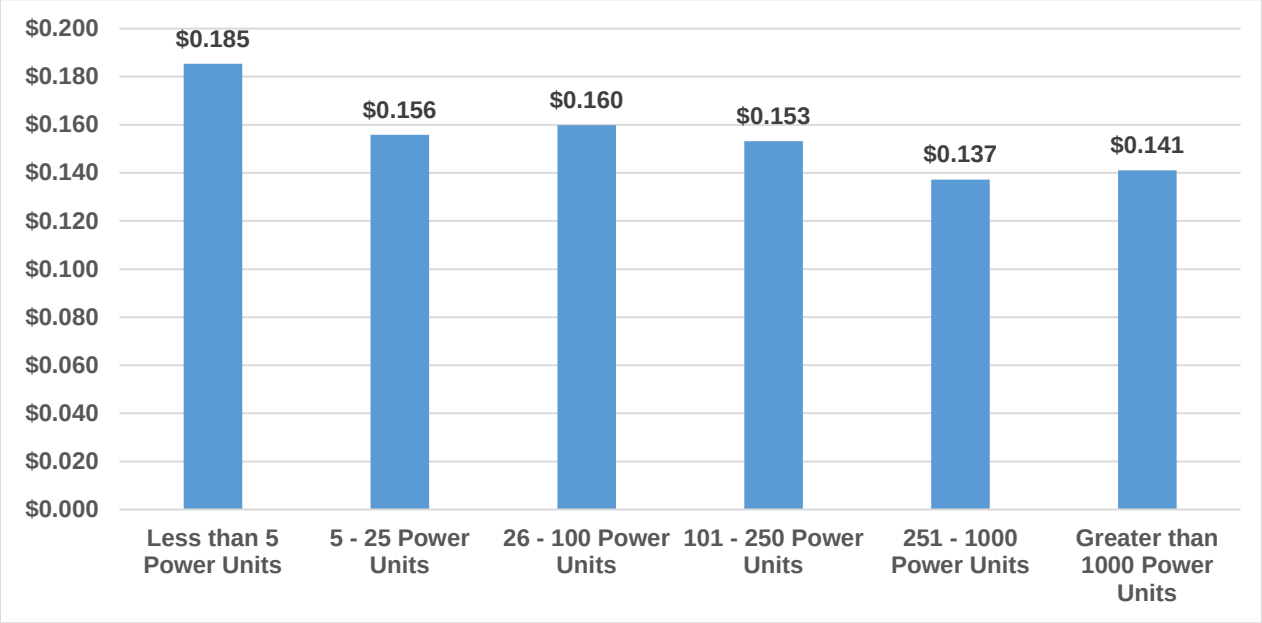
Table 14: Repair and Maintenance Costs by Sector

Sector	2008	2009	2010	2011	2012	2013	2014	2015	2016
LTL	$0.09	$0.16	$0.15	$0.18	$0.18	$0.18	$0.19	$0.17	$0.23
Specialized	$0.12	$0.14	$0.14	$0.16	$0.14	$0.13	$0.18	$0.17	$0.18
TL	$0.10	$0.10	$0.11	$0.14	$0.11	$0.14	$0.13	$0.14	$0.13

Fleet size is another of the many factors that can contribute to R&M costs due to economies of scale in purchasing, as well as differences in equipment and trade cycles. Smaller fleets, for instance, are more likely to have older equipment that requires more frequent and intensive repairs and maintenance, and also face higher costs to employ outside R&M services. As a result, fleets with fewer than five power units paid, on average, 18.5 cent per mile on R&M, the highest rate among fleet categories (Figure 6). On the other end of the spectrum, larger fleets were faced with more capacity when freight demand softened in 2016.[39] This resulted in motor carriers with 250 or more power units paying the least R&M.

[39] Costello, Bob. "ATA's Trucking Economic Review." Volume 19, Issue 1. 13 January, 2017.

Figure 6: Respondent Repair and Maintenance Cost per Mile by Fleet Size



Truck Insurance Premiums

Based on the data provided by the motor carrier respondents, commercial truck insurance premiums increased one percent to 7.5 cents per mile. These costs were substantially higher for Specialized carriers, who reported an average of 9.0 cents per mile in 2016. Truckload and LTL carriers reported average insurance premium CPM of 7.5 cents and 5.9 cents, respectively.

Moreover, the distribution of insurance costs across fleet sizes followed a similar pattern to that reported in 2015. Carriers operating fewer than 100 power units reported the highest insurance CPM, while the largest fleet operators reported substantially lower costs of 4.4 cents per mile (Figure 7).

As background, commercial insurance is a very complex and volatile cost center for motor carriers of all sizes. Many internal and external factors can impact a carrier's rates and costs – often exclusive of the carrier's crash history and safety ratings. In almost all instances, carriers rationally and regularly assess the relationship between insurance costs and crash/liability risks, and engage in a tenuous balancing act between managing risk and costs.

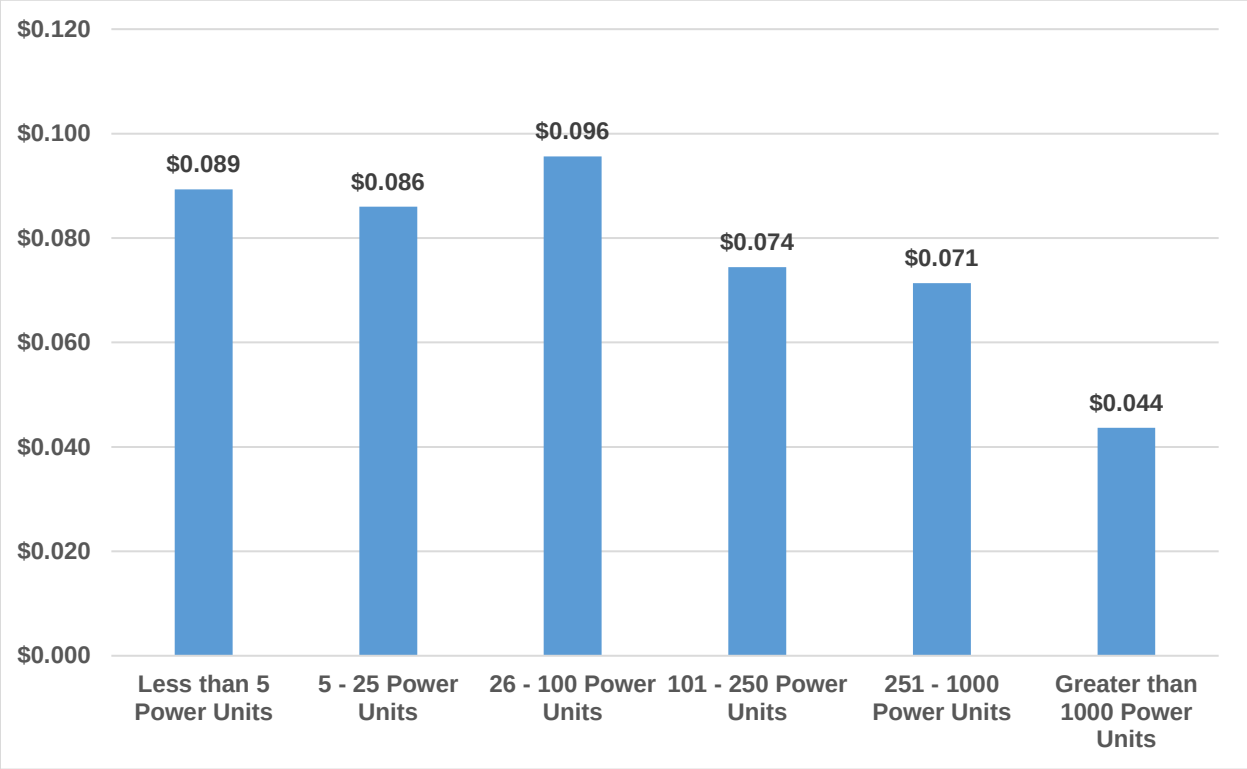
The 2016 insurance data reflects this strategy: larger fleets often self-insure with large deductibles, creating the appearance of lower overall and per-mile insurance costs. In many instances, larger fleets' insurance costs are being transferred to other line-items such as onboard safety technologies, or driving simulator training.

Smaller fleets will also attempt to hedge insurance rate increases in similar ways, such as increasing per-truck deductibles by 20 to 50 percent or joining a "captive" insurance

group – which distributes risk and cost across a wider safety net than any one fleet could financially accrue.

While an economic softening in 2016 played some role in lower exposure and lower equipment values, the primary reason the insurance line-item did not show higher increases comes down to cost management. After four straight years of insurance cost increases – representing an overall 19 percent increase – motor carriers are now better managing costs – and risk. The effect on the 2017 insurance cost line-item is a business masking of the ongoing insurance rate increases by accruing higher risk and lowering bottom line insurance costs.

Figure 7: Respondent Truck Insurance Premium Costs per Mile by Fleet Size



Permits and Special Licenses

The average permitting and licensing CPM for all carrier respondents was 2.2 cents per mile in 2016, reflecting a 13.3 percent increase over permitting and licensing observed in the last year. However, permit and special license costs remain below the levels observed in 2010 and 2011. Clearly, permit and licensing expenses remain one of the most volatile cost centers for carriers over the past nine years of this research. These costs are highly dependent on state budget conditions, type of carrier operations and geographic coverage.

Permit and special license costs were highest among Specialized carriers in 2016, as these carriers reported costs of 2.4 cents per mile, reflecting OS/OW and hazmat fees. TL carriers reported the second-highest costs at 2.2 cents per mile, closely followed by the costs incurred by LTL carriers at 1.9 cents per mile.

Tires

A number of factors, such as petroleum prices, and supply and demand for new trucks and trailers are known to influence the price of tires. The petroleum price link is most interesting and shows a relatively strong linear relationship: in 2016 when oil prices reached a nine-year low, tire costs fell to 3.5 cents per mile, down from 4.5 cents per mile in 2015. Specialized carriers topped the list again in terms of CPM, with the average carrier spending 4.9 cents per mile on tires in 2016. LTL carriers reported the second highest tire costs at 3.6 cents per mile, followed by TL carriers reporting tire CPM of 2.9 cents.

Tolls

Tolls can be a significant cost to motor carriers, depending on a carrier's region of operation. Many carriers and drivers attempt to avoid tolls whenever possible since shippers rarely reimburse carriers or drivers for toll-related expenses. Respondents to this year's survey reported a relatively sharp increase in toll expenditures, with tolls increasing from 2 cents per mile to 2.7 cents per mile between 2015 and 2016. Similar to last year's results, costs were highest in the Northeast (3.7 cents per mile) and lowest in the West (1.7 cents per mile). With states looking at tolls as a potential means to fund infrastructure, these costs can ultimately be expected to continue to grow in the coming year.

Driver Wages and Benefits

Most truckload drivers are paid on a per-mile basis while LTL P&D drivers are generally paid by the hour. Survey respondents indicated that average truck driver pay per mile was 52.3 cents in 2016, marking four years of continuous increases. In terms of hourly wages, the 2016 CPM figure translated to $20.91.

In response to the growing driver shortage and lost productivity associated with increasing regulations and traffic congestion, driver wages have steadily increased since 2012. When juxtaposed with the low fuel prices of 2016, driver pay retained its spot as the biggest cost center for motor carriers. Driver benefits per mile also increased from 13.1 cents per mile in 2015 to 15.5 cents per mile in 2016 – a sizable 18 percent increase year-over-year. This indicates that in addition to offering higher pay, carriers recognize that benefits and other indirect rewards and incentives can play a critical role in driver recruitment and retention. Respondents to this year's survey listed benefits ranging from full medical, dental, and vision coverage, to 401(k) matching. Although most of these benefits don't show up as direct compensation in a driver's wallet, they can lead to significant improvements in quality of life.

Another cost center in which motor carrier competition for drivers is heating up is in the amount and types of bonuses they offer to drivers. A majority (60.4%) of respondents indicated paying their drivers some type of financial incentive or bonus beyond wages. The incentives and bonuses reported by respondents reward drivers for safe driving, on-time delivery performance, as well as additional financial incentives to attract and retain qualified drivers (Table 15). Respondents reported paying drivers an average bonus of almost $1,500 for safe driving in 2016, while drivers who met the criteria for on-time delivery bonuses received an average annual bonus of approximately $1,950. Respondents also offered an average bonus of $979 to attract qualified drivers to their fleet, and offered an even larger bonus ($1,143) to retain them in 2016. As these bonus levels convey, the competition between motor carriers to attract good drivers from a shrinking driver pool is likely to continue into the future.

Table 15: Single Driver Bonus Pay by Type

Bonus Type	Average Bonus per Driver
Safety	$1,499
On-Time Delivery	$1,946
Starting	$979
Retention	$1,143

The number of carriers utilizing team drivers, who alternate driving the same truck during a trip, has held steady in the 25 to 29 percent range over the past several years. This held true again in 2016, with 27.4 percent of respondents indicating that they use team drivers. Of those respondents, the average wage per mile for a company team driver was 39 cents in 2016, on par with the 39.9 cents reported during the previous year.

Driver wages mimicked the historical trend of Specialized carriers reporting the highest driver wages, followed by LTL carriers and TL carriers. To that end, Specialized carriers reported a CPM of 67.4 cents in 2016, while LTL carriers reported wages of 58.3 cents and TL carriers reported 42.6 cents per mile. While the wages reported by Specialized and LTL carriers represent a sizable increase over the previous year, driver wages at TL carriers, the sector hit hardest by the soft 2016 economy, fell modestly.

Costs by Region

Average marginal costs were also calculated by region of operation in the U.S. (Table 16).[40] Carriers operating predominantly in the Southwest and Midwest reported the lowest operating costs in 2016, while the highest costs were concentrated in the West – where trip lengths are longer and traffic congestion can be challenging, and the Northeast which has extremely dense population centers, major toll facilities and untenable levels of traffic congestion.

Table 16: Average Marginal Cost per Mile by Region, 2016

Motor Carrier Costs	Midwest	Northeast	Southeast	Southwest	West
Vehicle-based					
Fuel Costs	$0.332	$0.348	$0.324	$0.286	$0.362
Truck/Trailer Lease or Purchase Payments	$0.274	$0.268	$0.227	$0.275	$0.278
Repair & Maintenance	$0.160	$0.202	$0.172	$0.133	$0.157
Truck Insurance Premiums	$0.061	$0.081	$0.077	$0.069	$0.091
Permits and Licenses	$0.023	$0.022	$0.020	$0.024	$0.028
Tires	$0.033	$0.031	$0.040	$0.036	$0.033
Tolls	$0.026	$0.034	$0.023	$0.022	$0.017
Driver-based					
Driver Wages	$0.501	$0.526	$0.538	$0.511	$0.572
Driver Benefits	$0.130	$0.145	$0.178	$0.185	$0.163
TOTAL	**$1.540**	**$1.655**	**$1.597**	**$1.541**	**$1.701**

Straight Trucks

The 2017 Operational Costs of Trucking Survey marked the first year in which respondents were asked to provide cost information specifically for straight trucks. This major addition to the ATRI survey comes as a response to the growing use of straight trucks in support of e-commerce expansion. Future iterations of this report will contain more detailed analysis of these figures as ATRI builds a more extensive history of this cost data similar to the truck-tractor data analyzed earlier.

[40] See survey in Appendix A for regions; Canada was excluded from this analysis.

For 2016, motor carrier responses represented nearly 4,400 straight trucks. These respondents reported an average marginal cost of $1.63 per mile in 2016, 63 percent of which were concentrated in three cost categories – driver wages, diesel fuel, and repair and maintenance (Table 17). These cost centers roughly follow distribution of costs for truck-tractors, though straight truck operators reported a significantly greater proportion of their costs in repair and maintenance.

Table 17: Straight Truck Average Marginal Costs per Mile, 2016

Motor Carrier Costs	Average Marginal Cost per Mile	Share of Total Average Marginal Costs per Mile
Vehicle-based		
Fuel Costs	$0.35	21%
Truck/Trailer Lease or Purchase Payments	$0.19	12%
Repair & Maintenance	$0.31	19%
Truck Insurance Premiums	$0.14	9%
Permits and Licenses	$0.04	2%
Tires	$0.05	3%
Tolls	$0.04	2%
Driver-based		
Driver Wages	$0.37	23%
Driver Benefits	$0.15	9%
TOTAL	**$1.63**	**100%**

CONCLUSION

ATRI has once again documented and updated the marginal operational costs that carriers experienced in 2016, using financial data provided directly from motor carriers operating in the U.S. This research continues to provide important benchmarking inputs, allowing carriers to discern and compare their performance against fleets. Additionally, carriers can compare select line-item costs to fleets of similar sizes, operating regions and sectors. Beyond strictly serving as a motor carrier benchmarking tool, an additional objective of this research is to ensure that accurate, real-world data inputs are available for public sector transportation planning and investment models in order to generate realistic costs and benefits that accrue to commercial vehicle operators on the nation's transportation system.

Based on data collected from motor carrier survey respondents, the average marginal cost per mile in 2016 was $1.592 for the for-hire sector of the trucking industry, up slightly from what was reported by motor carriers in 2015. The stagnation of costs can largely be attributed to the soft economy of 2016, along with a continued divergence of fuel costs and driver wages. Driver costs retained their position as the largest cost center for motor carriers in 2016, as a persistent driver shortage has exerted upward pressure on wages at the same time as fuel prices continued to drop due to growing domestic energy production.

With the same driver shortage factors holding firmly in place in 2017, and a number of indications that average diesel prices in 2017 will slowly rise, it is highly likely that the average marginal costs faced by motor carriers will rise again in 2017.

APPENDIX A

OPERATIONAL COSTS OF TRUCKING SURVEY

OPERATIONAL COSTS OF TRUCKING SURVEY

The American Transportation Research Institute (ATRI) is again conducting its annual survey of **for-hire** motor carriers to collect information on trucking industry operational costs in order to update ATRI's ongoing *Operational Costs of Trucking* report. ATRI is seeking cost data **from 2016** associated with operating a truck. The final report, which will be made available in early Fall, will support studies related to industry productivity, driver issues, and fuel efficiency. Please note that the questions below are focused on TRUCK-TRACTORS. IF your fleet also operates STRAIGHT trucks, you will have an opportunity at the end of the survey to submit separate cost information for the Straight trucks in your fleet.

Survey responses will be kept completely **confidential**. Personal, organizational, or financial information will never be released for public use under any circumstances, and will only be used internally for research analyses. The final report will only be presented in an aggregated, non-identifying format. As needed, ATRI will sign a Confidentiality Agreement.

The survey can be completed online at https://atri.checkboxonline.com/OpCosts2017.aspx, or by completing this form and returning it via email to dmurray@trucking.org or via fax to 770-432-0638.

All respondents submitting a completed, usable survey will receive an *advance* copy of the 2017 *Operational Costs of Trucking* report.

If you have any questions please contact Dan Murray at dmurray@trucking.org or 651-641-6162.

CONTACT INFORMATION

Please enter your contact information below. Occasionally ATRI will follow up with survey respondents to clarify answers. Your information will be kept strictly confidential**. All respondents will receive an advance copy of the report.**

Company	Contact Name
Street Address	Position/Title
City, State	Zip
Phone	Email

DEMOGRAPHICS

1) What was your company's annual trucking-related revenue in 2016? *(Exclude brokerage/logistics revenue)*
$_____

2) What is your primary for-hire business operation type? *(Select one)*

Truckload	☐
Less-Than-Truckload	☐
Flatbed	☐
Tanker	☐
Express / Parcel Service	☐
Intermodal Drayage	☐
Automotive Transportation	☐
Dedicated Services	☐
Household Goods Mover	☐
Other (please specify):	☐

3) What are the three primary types of commodities that your company hauls? *(While your company may haul multiple commodities, select only the top 3 most frequently hauled commodities.)*

☐ Agricultural Products	☐ Livestock
☐ Automotive Parts	☐ Manufactured Goods
☐ Construction/Building Materials	☐ Mine Ores
☐ Finished Vehicles	☐ Modular/Mobile Homes
☐ Forest Products	☐ Paper Products
☐ Garbage or Sanitation	☐ Petroleum Products
☐ General Freight	☐ Refrigerated Food
☐ Hazardous Materials	☐ Retail Store/General Merchandise
☐ Heavy Machinery/Equipment	☐ U.S. Mail/Parcel Service
☐ Household Goods	☐ Other (please specify):
☐ Industrial Gases	_____
☐ Intermodal Containers	☐ Don't Know

4) What was your company's fleet size, average age and average number of miles traveled (including owner operators) in 2016 for each equipment type?

Power Unit	Number of Assets	Average Age (in years)	Average Miles per Year per Unit
Truck-Tractor			

Trailer Type	Number of Assets	Average Age (in years)
28’ Trailer		
45’ Trailer		
48’ Trailer		
53’ Trailer		
Tank		
Flatbed		
Auto Transporter		
Refrigerated Trailer		
Other (please specify):		
Other (please specify):		
Other (please specify):		

5) How long do you typically keep your equipment? *(Specify years or miles)*

Equipment Type	Avg. Trade Cycle	Years	Miles
Truck-Tractors		☐	☐
Trailers		☐	☐

6) Are any of the trucks in your fleet powered by an alternative fuel (i.e. do not run exclusively on diesel or gasoline)?

☐ Yes	☐ No	☐ Don’t Know

If yes, please indicate the number of trucks in your fleet that use each of the alternative fuels listed below.

Alternative Fuel Type	Number of Trucks
Compressed Natural Gas (CNG)	
Liquefied Natural Gas (LNG)	
Battery - Electric	
Hybrid Engine	
Other (please specify):	

7) Based on your fleet’s IFTA data for TRUCK-TRACTORS, what was your fuel economy in miles per gallon (MPG) for 2016 (i.e. real miles driven divided by gallons of fuel purchased)?

_____MPG

8) For your fleet, what is your typical operating weight in pounds?

_____ LBS

9) While your vehicles were in motion, what was your fleet-wide average travel speed in miles per hour (MPH)?

_____ MPH

10) Does your company currently use Electronic Logging Devices (ELDs) for Hours-of-Service recordkeeping (also known as Electronic On-board Recorders, or EOBRs)?

☐ Yes	☐ No	☐ Don't Know

If yes, what percentage of your company's trucks used ELDs in 2016?

_____ % of trucks

11) Are any of the trucks in your fleet speed limited or governed?

☐ Yes	☐ No	☐ Don't Know

If yes, please provide the maximum speed setting and the percent of your fleet governed at that speed.

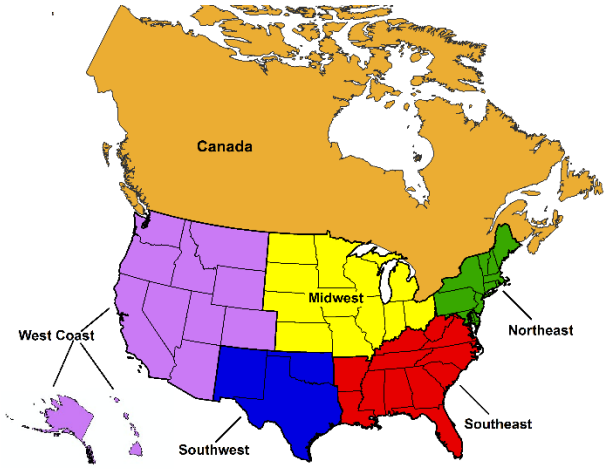
Maximum Speed (MPH)	Percent of Trucks

12) Based on your fleet's IFTA miles, what percentage of your drivers' trips were in the following categories in 2016? *(Total must sum to 100%)*

Local pickups and deliveries (less than 100 miles)	
Regional pickups and deliveries (100 – 500 miles)	
Inter-regional pickups and deliveries (500 – 1,000 miles)	
National (greater than 1,000 miles)	
Total	**100 %**

13) Please estimate the percentage of miles traveled by your fleet (include owner operator miles) in the following regions during 2016. (*Total must sum to 100%*)

Region	% of Total Miles
Midwest	
Northeast	
Southeast	
Southwest	
West	
Canada	
Total	**100%**



14) What percent of your total annual truck-tractor miles were <u>non-revenue/dead-head miles</u> in 2016?

_____ % of total 2016 miles

15) What was your average loading/dwell time per trip involving truck-tractors at shipper / receiver facilities in 2016? *(Average time in hours)*

_____ Hours per trip

OPERATIONAL COSTS

16) Please list the pay per mile ($/mile) or pay per hour ($/hour) for SINGLE TRUCK-TRACTOR drivers in 2016. *(If there are multiple pay rates for the same type of driver please use the average pay rate.)*

Type of Pay	Company Driver / Company Truck	Leased Driver / Company Truck	Owner Operator
Pay per Mile[1]			
Benefits per Mile[2]			
Pay per Hour[1]			
Benefits per Hour[2]			

[1] Pay – Include only base pay. Do not include benefits, incentives and bonuses.
[2] Benefits – Include employer contributions to medical insurance, per diem and other financial benefits to the driver that are a standard part of employment. Do not include incentives and bonuses.

Please list the benefits you provide to drivers that were included in the calculation above:

_____

17) Do you provide any additional financial incentives and/or bonus pay for SINGLE TRUCK-TRACTOR drivers that are not part of their regular wages?

☐ Yes	☐ No	☐ Don't Know

If yes, what was the average incentive and/or bonus pay paid per driver in 2016? (*Please report as an annual average paid per driver.)*

Type of Bonus	Company Driver / Company Truck	Leased Driver / Company Truck	Owner Operator
Safety Bonus			
On-Time Delivery Bonus			
New / Starting Driver			
Retention Bonus			

18) Do you employ team drivers?

☐ Yes	☐ No	☐ Don't Know

If yes, please list the pay per mile ($/mile) or pay per hour ($/hour) rates for the following types of TRUCK-TRACTOR drivers who drove as part of a TEAM in 2016. *(Please use the pay rate for each individual driver, not the team rate. If there are multiple pay rates for the same type of driver, please use the average pay rate.)*

Type of Pay	Company Driver / Company Truck	Leased Driver / Company Truck	Owner Operator
Pay per Mile[1]			
Benefits per Mile[2]			
Pay per Hour[1]			
Benefits per Hour[2]			

[1] Pay – Include only base pay. Do not include benefits, incentives and bonuses.
[2] Benefits – Include employer contributions to medical insurance, per diem and other financial benefits to the driver that are a standard part of employment. Do not include incentives and bonuses.

Please list the benefits you provide to drivers that were included in the calculation above:

_____

19) Do you provide any additional financial incentives and/or bonus pay for TEAM TRUCK-TRACTOR drivers that are not part of their regular wages?

☐ Yes	☐ No	☐ Don't Know

If yes, what was the average incentive and/or bonus pay paid per individual driver in 2016? *(Please report as an annual average paid per driver.)*

Type of Bonus	Company Driver / Company Truck	Leased Driver / Company Truck	Owner Operator
Safety Bonus			
On-Time Delivery Bonus			
New / Starting Driver			
Retention Bonus			

20) Please list your 2016 average TRUCK-TRACTOR cost per mile for the following key cost centers, calculated using IFTA miles: *(If the amount equals zero, please enter 0. If the line-item does not apply to your operation, please enter N/A.)*

Expense Type	2016 Cost per Mile
Repair & Maintenance • Include R&M costs for all trucks and trailer; do not include tire-related expenses.	$
Tires • Include all purchase, maintenance, re-treading, and replacement costs.	$
Fuel Costs • Include all transportation fuel. Do not include fuel surcharge revenue.	$
Truck Insurance Premiums • Include all liability, cargo, and excess liability policy premiums related to insuring the truck. Do not include workers compensation costs/insurance.	$
Truck and Trailer Lease or Purchase Payments • Include all payment costs, and interest and fees associated with the payments. Do not include depreciation tax benefits.	$
Tolls	$
Permits & Special Licenses • Include permits for oversize/overweight, HazMat, etc.	$
Other • Please specify: _____	$
Total	**$**

STRAIGHT TRUCKS

21) Does your fleet operate straight trucks?

☐ Yes	☐ No

22) What was the number, average age and average number of miles traveled in 2016 for straight trucks in your fleet?

Power Unit	Number of Assets	Average Age (in years)	Average Miles per Year per Unit
Straight Truck			

23) How long do you typically keep straight trucks? *(Specify years or miles)*

Equipment Type	Avg. Trade Cycle	Years	Miles
Straight Truck		☐	☐

24) Based on your fleet's IFTA data for STRAIGHT TRUCKS, what was your fleet-wide fuel economy in miles per gallon (MPG) for 2016 (i.e. real miles driven divided by gallons of fuel purchased)?

_____MPG

25) What percent of your total annual straight truck miles were non-revenue/dead-head miles in 2016?

____ % of total 2016 miles

26) What was your average loading/dwell time per trip involving straight trucks at shipper / receiver facilities in 2016? *(Average time in hours)*

____ Hours per trip

27) Please list the pay per mile ($/mile) or pay per hour ($/hour) for STRAIGHT TRUCK drivers in 2016. *(If there are multiple pay rates for the same type of driver please use the average pay rate.)*

Type of Pay	Company Driver / Company Truck	Leased Driver / Company Truck	Owner Operator
Pay per Mile[1]			
Benefits per Mile[2]			
Pay per Hour[1]			
Benefits per Hour[2]			

[1] Pay – Include only base pay. Do not include benefits, incentives and bonuses.
[2] Benefits – Include employer contributions to medical insurance, per diem and other financial benefits to the driver that are a standard part of employment. Do not include incentives and bonuses.

Please list the benefits you provide to drivers that were included in the calculation above:

_____

28) Do you provide any additional financial incentives and/or bonus pay for STRIGHT TRUCK drivers that are not part of their regular wages?

☐ Yes	☐ No	☐ Don't Know

If yes, what was the average incentive and/or bonus pay paid per driver in 2016? (*Please report as an annual average paid per driver.)*

Type of Bonus	Company Driver / Company Truck	Leased Driver / Company Truck	Owner Operator
Safety Bonus			
On-Time Delivery Bonus			
New / Starting Driver			
Retention Bonus			

29) Please list your 2016 <u>average STRAIGHT TRUCK cost per mile</u> for the following key cost centers, calculated using IFTA miles: *(If the amount equals zero, please enter 0. If the line-item does not apply to your operation, please enter N/A.)*

Expense Type	2016 Cost per Mile
Repair & Maintenance • Include R&M costs for all trucks and trailer; do not include tire-related expenses.	$
Tires • Include all purchase, maintenance, re-treading, and replacement costs.	$
Fuel Costs • Include all transportation fuel. <u>Do not</u> include fuel surcharge revenue.	$
Truck Insurance Premiums • Include all liability, cargo, and excess liability policy premiums related to insuring the truck. Do not include workers compensation costs/insurance.	$
Truck and Trailer Lease or Purchase Payments • Include all payment costs, and interest and fees associated with the payments. <u>Do not</u> include depreciation tax benefits.	$
Tolls	$
Permits & Special Licenses • Include permits for oversize/overweight, HazMat, etc.	$
Other • Please specify: _____	$
Total	**$**

Thank you! We greatly appreciate your participation.

Please return completed survey to ATRI via
Email (**dmurray@trucking.org**) or fax (**770-432-0638)**

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