An Analysis of the Operational Costs of Trucking: 2019 Update

November 2019

Prepared by the American Transportation Research Institute

ATRI American Transportation Research Institute

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LIST OF ACRONYMS

AOBRD	Automatic On-Board Recording Device
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
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
LPG	Liquefied Petroleum Gas
LTL	Less-than-Truckload
MC	Marginal Cost
MPH	Miles per Hour
NPTC	National Private Truck Council
NDA	Non-Disclosure Agreement
NR	Natural Rubber
Ops Costs	Operational Costs
OS/OW	Oversize/Overweight
P&D	Pick-up and Delivery
RAC	Research Advisory Committee
R&M	Repair and Maintenance
SBR	Synthetic Butadiene Rubber
TL	Truckload
UMTRI	University of Michigan Transportation Research Institute
VMT	Vehicle Miles Traveled

INTRODUCTION

In 2008, the American Transportation Research Institute (ATRI) produced its first edition of *An Analysis of the Operational Costs of Trucking* to provide accurate average marginal cost data for the trucking industry. Initially, ATRI's Research Advisory Committee (RAC)[1] identified the research need for accurate trucking cost data based on the need to resolve current disparities in various published documents. Outside sources reported industry costs as low as $22 per hour and as high as $370 per hour.[2] The large discrepancies in estimated costs were the result of inaccurate data and subjective metrics, such as "value-of-time" calculations.

Through conversations with industry experts, ATRI identified key components of the trucking industry's cost structure, and then developed a standard approach that quantified carrier costs by fleet size, sector and region of operation. The objective of the research was to provide real-world documentation of direct carrier costs for use as both a high-level benchmarking tool for industry professionals and to provide reliable information for public sector freight planning activities.

Based on the large number of requests for the first *Analysis of the Operational Costs of Trucking* reports, ATRI now annually updates the "Ops Costs" data – making minor adjustments and adding new metrics to the methodology as needed. Over the years, ATRI has attempted to streamline the process for obtaining sensitive and proprietary fleet cost data by expanding the options for submitting data. This report includes the most recent 2018 cost data.

RESEARCH OBJECTIVE

ATRI's Ops Costs research, first initiated in 2008, derives from the need for more accurate trucking industry operational cost data by motor carriers and government transportation planners. The primary metrics focus on marginal line item costs associated with per-mile or per-hour operational costs. While previous outside studies have provided operational cost measurements, many relied on modeled data and subjective value-of-time metrics that were considered by industry experts to be inaccurate or subjective.

Minor modifications to the 2019 data collection process include ELD cost impacts. One of the most valuable components of the Ops Costs research is the ability of users to monitor changes in line item costs over time – based on the inclusion of historical cost data going back a decade. Furthermore, the published data can be analyzed by sector, fleet size and other industry stratifications. ATRI also uses these data in related ATRI analyses such as truck parking, congestion impacts and the annual Top Truck Bottleneck Report.

[1] ATRI's Research Advisory Committee RAC is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, federal government agencies, labor and driver groups, law enforcement, and academia. The RAC is charged with annually recommending a research agenda for the Institute.

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

METHODOLOGY

ATRI continues to use a standardized data collection methodology. One question was added to this year's data collection form to provide insight into the financial burden placed on motor carriers as a result of the Federal Motor Carrier Safety Administration (FMCSA) regulation requiring the use of Electronic Logging Devices (ELDs).[3] Additionally, two questions were modified to account for the growing utilization of truck driver bonuses and incentives.

The specific additions and changes to the 2019 data collection form were:

- New Question #1: Respondents were asked to submit their fleet's use of electronic logging technology. This question was added to provide information about the use and cost of electronic logging technology in order to maintain compliance with the ELD mandate.
- Expanded Question #1: Two response blocks for "Other Bonuses paid to single truck-tractor drivers" were added to collect additional information about bonuses paid to solo drivers.
- Expanded Question #2: Two response blocks for "Other Bonuses paid to team truck-tractor drivers" were added to collect additional information about bonuses paid to team drivers.

The 2019 data collection form can be found in the Appendix.

In addition to carrier and driver demographic information, the Ops Costs data collection form asks for line item operational and financial metrics that relate to standard costs across carriers. The data collection form is annually pretested with confidential stakeholders to determine its reliability and applicability across the industry.

Due to the highly competitive nature of the trucking industry and the extreme sensitivity associated with corporate finances and expenditures, the Ops Costs information was collected confidentially from motor carriers, and the data is presented in aggregate form only. ATRI also provided respondents with non-disclosure agreements (NDAs) when requested.

ATRI initiated the newest data collection process in April of 2019, with electronic forms being distributed to a diverse group of for-hire industry stakeholders in all sectors of trucking, including truckload (TL), less-than-truckload (LTL) and specialized fleets. To increase carrier response rates, ATRI utilized targeted industry mailings and emails, news alerts, and coverage in major industry news outlets. Many of the 50 State Trucking Associations also solicited carrier participation from their respective memberships. Participants were able to submit data via an online response form, email or fax. Each submission was carefully reviewed by the research team; if any response was unclear, ATRI followed up with the respondent. Responses were collected through the end of August 2019.

[3] Federal Motor Carrier Safety Administration. *General Information about the ELD Rule.* Retrieved from Federal Motor Carrier Safety Administration website: https://www.fmcsa.dot.gov/hours-service/elds/general-information-about-eld-rule

The Ops Costs research calculates an average marginal cost per mile (CPM) and average cost per hour (CPH). These two primary metrics allow for year-over-year analyses, as well as inter-industry comparisons. The CPH metric is converted from the CPM metric using an industry-vetted 39.42 miles per hour (MPH) derived from industry GPS-generated data.[4] This speed calculation is based exclusively on moving trucks, and is applicable to all roadways, not just highway speeds.

To ensure representative data from Ops Costs submissions, ATRI weights survey responses to reflect industry sector percentage shares of TL, LTL and specialized carriers. When comparing ATRI's response sample to the U.S. trucking industry, TL carriers were underrepresented, while both LTL and specialized carriers were overrepresented (Table 1).

Table 1: For-Hire Industry Sector Breakout

Industry Sector	ATRI Ops Costs Respondents	U.S. Trucking Industry[5]
Truckload	37%	55.7%
Less-than-Truckload	42%	28.7%
Specialized / Other	21%	15.6%

Cost metrics were also weighted, as necessary, using fleet sector type, fleet size and region of operation. This process provides more accurate insight into subsets of the Ops Costs data, such as the cost of operations by region or by industry sector. As with all data reported in this study, these subsets were only presented in aggregated form to protect the confidential information submitted by individual carriers.

Representativeness

The Ops Costs data collection form was completed by relevant and knowledgeable company officials, including presidents, chief financial officers (CFOs), managers and accountants – all with working knowledge of fleet costs, revenue and other pertinent information. Fleet trip types include local pick-ups and deliveries (less than 100 miles) through national deliveries (greater than 1,000 miles), and fleets carry a multitude of commodities in all regions of the United States (U.S.) and Canada. In addition to geographic and commodity diversity, carrier fleet size ranged from single-truck operations to fleets well over 1,000 trucks.

In summary, submissions to the annual Ops Costs research provide a representative industry sample, encompassing all fleet sizes, commodities and business models within the for-hire industry.

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[4] ATRI derived this speed using data from the ATRI Freight Performance Measures (FPM) program. ATRI analyzed one full week of national FPM data in each of the four quarters in 2017 (February, May, August, October). This dataset consisted of nearly 500 million truck speed data points. The 39.42 MPH figure is an update to the 39.98 MPH figure used in previous iterations of this report, which was based on truck speed data from 2010. The average speed figure was also validated by multiple motor carriers from various sectors of the industry. This speed figure more accurately represents an average operational speed since it includes speeds in all types of operational conditions.

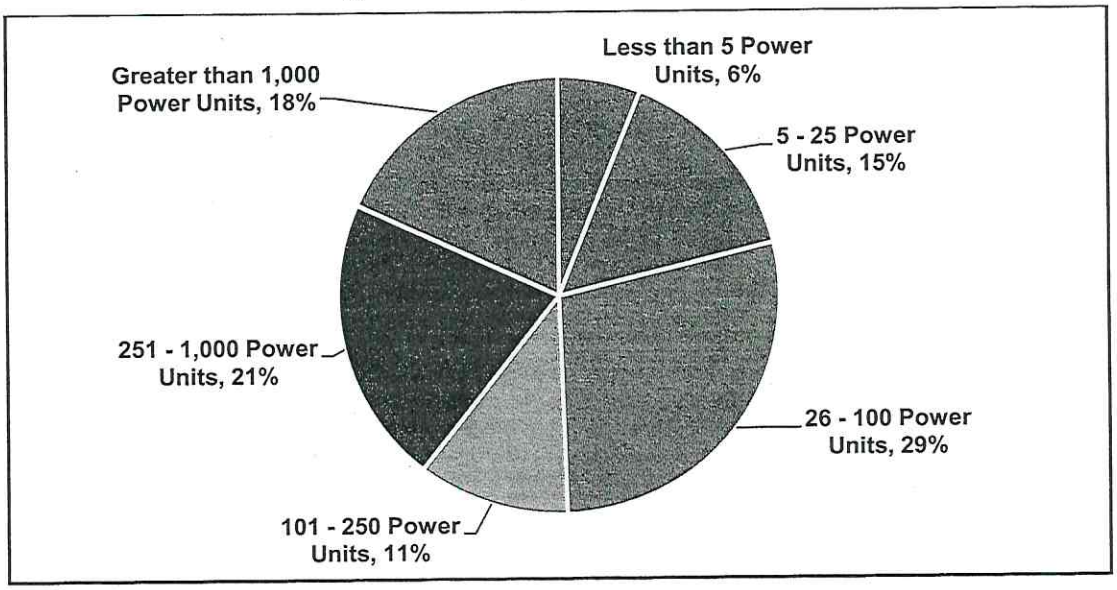
[5] 2018 Current Employment Statistics. United States Department of Labor, United States Bureau of Labor Statistics. Available online: https://data.bls.gov/PDQWeb/ce

RESPONDENT DEMOGRAPHICS

Size of Operation

The carriers that submitted information for *An Analysis of the Operational Costs of Trucking: 2019 Update* consisted of 119,633 truck tractors, 6,232 straight-trucks and 460,825 trailers, and accrued over 10 billion total operating miles. A decrease in non-revenue, or "deadhead," miles occurred with 16.6 percent of traveled miles being deadhead miles in 2018 compared to 20.7 percent in 2017. In terms of fleet size, approximately 39 percent of respondents operate more than 250 power units while approximately 50 percent of respondents operate 100 power units or less (Figure 1). Overall, the average fleet size is 1,271 power units.

Figure 1: Respondent Fleet Size



The gap between median fleet revenue ($25,995,161) and mean revenue ($403,334,886) exemplifies the large variation in size distribution from carrier respondents – again reflecting the higher percentage of small fleets (Table 2). Median metrics are provided as a secondary measure to account for unintended bias associated with the impact that large carriers have on the mean of the sample.

Table 2: Respondent Revenue Statistics

Percentile	Revenue
75th Percentile	$120,367,567
50th Percentile (Median)	$25,995,161
25th Percentile	$6,954,085
Average (Mean)	$403,344,886

Type of Operation

Since 2011, the trucking industry has experienced a seven percentage point increase in short trips, with 63 percent of all trips being less than 500 miles in 2018 (Table 3). Inter-regional length hauls (500-1,000 miles) decreased five percentage points and national length hauls (over 1,000 miles) decreased three percentage points over the 7-year period. This almost certainly reflects e-commerce and driver shortage strategies (of shifting freight to shorter urban trips) first identified by ATRI in its "*E-Commerce Impacts on the Trucking Industry.*"[6]

Table 3: Respondent Trip Types, 2011 to 2018 Comparison

	2011	2018
Local pick-ups and deliveries (less than 100 miles)	19%	26%
Regional pick-ups and deliveries (100-500 miles)	36%	37%
Inter-regional pick-ups and deliveries (500-1,000 miles)	26%	21%
National (over 1,000 miles)	19%	16%

ATRI's 2018 vehicle miles traveled (VMT) by region continues to be comparable to U.S. truck registrations by region, with a slight overrepresentation of the Midwest and Southwest regions of the U.S. (Table 4). The ATRI dataset is underrepresented by VMT in the West, where longer trips may divert to rail, and in the Northeast, which may indicate a reluctance to operate in areas with higher fixed costs created by traffic congestion, tolling and higher taxes. It may also indicate the favorable tax and registration environment associated with base-stating trucks in certain states, independent of the states in which they operate.

The most commonly reported commodities hauled in 2018 were construction and building materials, general freight, agricultural products and automotive parts.

[6] Hooper, A., & Murray, D. *E-Commerce Impacts on the Trucking Industry.* American Transportation Research Institute. February 2019. Arlington, VA.

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

Region	Ops Costs Respondent Share of Miles Traveled[7]	Share of U.S. Truck Registrations[8]
Midwest	27%	24%
Northeast	13%	16%
Southeast	27%	26%
Southwest	15%	11%
West	14%	23%

Equipment

The trucking industry hauled 11.49 billion tons of domestic freight in 2018, which is 71.4 percent of freight tonnage shipped in the U.S.[9] To haul that freight, truck tractors were reported as the primary power unit used by the majority of Ops Costs participants, with 28-foot and 53-foot trailers listed as the predominant trailer types. A total of 287,530 trailers were 28-foot and 53-foot trailers, which is over half of the 460,825 total reported trailers. On average, these trailers were 9.6 years old and 6.4 years old, respectively. The average annual miles driven for truck tractors in 2018 was 91,506 miles and the average age of the tractors was 4.4 years (Table 5). While larger fleets typically turn tractors over more frequently than smaller fleets, the preponderance of small fleets in the data scales the average tractor age upward.

In comparing year-over-year changes in equipment trade cycles (which is different from average equipment age), motor carriers indicated that truck tractors were traded after seven years (6.96 years) in 2018, compared to 7.6 years in 2017. While the trade cycle of truck tractors decreased by 0.6 years, the average mileage of a tractor increased slightly from 89,804 miles in 2018 to 91,506 miles in 2019, a two percent increase from the previous year.

[7] Column total will not sum to 100 percent since roughly 4 percent of VMT were reported in Canada.
[8] "Table MV-9: Truck and Truck-Tractor Registration - 2017"; 2017 Highway Statistics Series. Office of Highway Policy Information, Federal Highway Administration, United States Department of Transportation. April 2018. Available online: https://www.fhwa.dot.gov/policyinformation/statistics/2017/pdf/mv9.pdf
[9] "American Trucking Trends 2019." American Trucking Associations. Arlington, VA. 2019.

Table 5: Respondent Equipment Characteristics

Equipment Type	Number of Trucks / Trailers	Average Age (Years)	Average Miles Driven per Year per Truck
Straight Trucks	6,232	8.5	25,720
Truck Tractors	119,633	4.4	91,506
Total Trucks	**125,865**		
28' Trailers	168,436	9.6	
33' Trailers	633	5.7	
45' Trailers	2,799	10.8	
48' Trailers	22,159	7.2	
53' Trailers	119,094	6.4	
Tank Trailer	17,652	15.8	
Flatbed Trailer	5,390	5.9	
Auto Trailer	2	0.4	
Refrigerated Trailer	18,869	3.9	
Other Trailers	105,791	9.4	
Total Trailers	**460,825**		

In 2018, the trucking industry experienced a large increase in contract rates.[10] Generally speaking, the gross revenue increases were used to increase driver compensation, reduce the average fleet age, and cover the increasing costs of fuel and insurance. Ultimately, 2018 contract price increases were slightly higher than the rising costs, providing a slight improvement in carrier operating margins from 2017 to 2018. Research published in ACT Research's "*For-Hire Public TL Carrier database*" corroborates that average carrier revenue per mile increased 12 percent from 2017 to 2018 – more than offsetting the increased per mile costs identified in this report. The delta between these figures directly enhanced carriers' operating margins.

Table 6: Respondent Equipment Trade Cycle

Equipment Type	Average Number of Years Until Replacement	Average Miles Driven Until Replacement
Truck Tractors	7.0	700,000
Trailers	13.3	

The continuing decline in truck tractor age is a direct result of record truck and trailer sales over the last few years. Class 8 tractor sales skyrocketed in 2018, experiencing a 32.1 percent

[10] Broughton, D. "*Can Rates rise in 2019?*" FreightWaves. December 12, 2018. Available online: https://www.freightwaves.com/news/economics/will-trucking-rates-continue-rising

increase in year-over-year sales.[11] This trend began reversing in the 2nd quarter of 2019, when the economy – and freight movement in general – softened. Class 4 through Class 6 trucks did not experience the same increase in year-over-year sales, rising only 2.5 percent from 2017-2018.[12] The relatively small increase for straight truck sales is surprising given the strong growth rate of e-commerce sales over that same time period. In terms of trailer sales, according to ACT Research, trailer sales hit 385,794 in 2018 – a healthy 15.3 percent increase over 2017 figures.

Alternative Fuels

In 2018, 13 percent of carriers reported using alternative fuel vehicles (fuels other than diesel or biodiesel), a three percentage point increase from 2017. Compressed natural gas (CNG) was the predominant alternative fuel – accounting for 76 percent of the respondents' alternative fuel truck tractors. Other fuels such as liquefied natural gas (LNG) and liquefied propane gas (LPG) were also reported, but represented a small percentage of the total sample. When the Ops Costs alt fuel data is compared to a 2016 fuel economy study jointly developed by ATRI and the University of Michigan Transportation Research Institute (UMTRI), the Ops Costs alt fuel vehicles are comparable, further confirming the representativeness of ATRI's sample of alt fuel vehicles (Table 7).

Table 7: Use of Alternative Fuel Vehicles

Alternative Fuel Type	Percent of ATRI Ops Costs Respondents Using Alternative Fuels	Percent Fuel Type Usage by Fleets in ATRI/UMTRI Research[13]
CNG	10.1	18.5
LNG	4.0	5.1
Electric	1.0	3.8
LPG	1.0	2.6

Despite the increased usage of alt fuel vehicles, alt fuel truck tractors only accounted for, on average, six percent of any given carrier's fleet that reported using them. The high initial investment costs combined with relatively low diesel prices since 2016 presented little incentive to switch to alternative fuels. The elevated interest in alternative fuels that existed prior to 2013 waned with major decreases in fuel prices.[14] For many fleets, diesel truck tractors provide consistent and reliable operations that were favorable to investing in alt fuel vehicles. While LPG maintenance is similar to diesel maintenance, CNG storage and maintenance requires specialized mechanics and CNG certifications for maintenance

[11] "Class 8 Trucks Sales Rise 21.8% in November." Transport Topics. December 13, 2018. Available Online: https://www.ttnews.com/articles/class-8-truck-sales-rise-218-november

[12] "American Trucking Trends 2019." American Trucking Associations. Arlington, VA. 2019.

[13] Schoettle, B., Sivak, M., & Tunnell, M. *"A Survey of Fuel Economy and Fuel Usage by Heavy-Duty Truck Fleets."* University of Michigan Transportation Research Institute. Ann Arbor, MI. October 2016

[14] Avila, Larry. "Trucking Companies Remain Committed to Alternative Fuels Despite Low Diesel Prices." Transport Topics. February 6, 2017. Available online: https://www.ttnews.com/articles/trucking-companies-remain-committed-alternative-fuels-despite-low-diesel-prices

facilities.[15,16] The alt fuel versus diesel considerations may change, as diesel prices continue to rise. In January 2019, diesel fuel averaged $2.98 per gallon, while the equivalent amount of CNG cost $2.48 and the equivalent amount of LNG cost $2.71.[17]

Government agencies continue to promote shifts to alternative fuels, primarily through incentives, disincentives and information sharing. In 2019, California introduced a voucher program, providing up to $60,000 per truck tractor for eligible carriers to ease the higher cost of alternative fuel trucks.[18] Construction of new CNG fueling stations also increased, totaling more than 1,000 in 2019.[19] These factors, alongside decreasing transport distances and recovering diesel prices, may spur the purchase of alternative fuel trucks.

Additionally, the dramatic increase in e-commerce has increased local truck trips, making overnight recharging of electric trucks much more feasible and making electric trucks more viable. As such, electric trucks (as well as alt fuel trucks) are being increasingly utilized in the local delivery market.[20]

Even though alternative fuel vehicles only represent a small portion of vehicles in carrier fleets, their increasing use indicates that the competitive margins with diesel trucks are narrowing.

Fuel Efficiency

Although more sophisticated engineering and technology components play a key role in improved fuel efficiency, the overall fuel economy of trucks continues to lag in ATRI's sample. There was no improvement in average miles per gallon (MPG) from 2017 to 2018 – remaining at 6.4 MPG. Rising fuel prices should continue to encourage investment in more efficient vehicles; however, high upfront purchase costs make the incremental fuel savings a speculative investment. Based on the mean age of tractors in the sample and the dramatic increase in trucks sales in 2018, fuel economy is certain to improve over the next few years.

Close management of truck speeds can help with fuel economy. Speed governors (along with adaptive cruise control) can increase MPG when utilized effectively. The large majority of Ops Costs participants that utilize speed governors (90%, up from 86% in 2017) saw a nearly one MPG improvement (from 5.6 MPG to 6.4 MPG) in fuel economy. Of those respondents using speed governors, 88 percent utilized speed limiters on their entire fleet. The continuing

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[15] Ibid.

[16] LeSage, Jon. "Alternative Fuel Vehicles Study." Metropolitan Government of Nashville and Davidson County, Department of General Services, Office of Fleet Management. Retrieved from https://www.nashville.gov/Portals/0/SiteContent/GeneralServices/docs/fleet/Alternative%20Fuel%20Vehicles%20Study%205-15-15.pdf

[17] U.S. Department of Energy, Energy Efficiency & Renewable Energy. "Clean Cities Alternative Fuel Price Report." Washington, D.C. January 2019.

[18] "2019 Voucher Incentive Program, On-Road Heavy Duty Vehicles." South Coast Air Quality Management District. May 2019. Diamond Bar, CA. Available Online: http://www.aqmd.gov/docs/default-source/VIP/vip_brochure_english.pdf?sfvrsn=23

[19] *Natural Gas Fueling Stations.* Alternative Fuels Data Center, Office of Energy Efficiency & Renewable Energy, U.S. Department of Energy. September 2019. Available online: https://afdc.energy.gov/fuels/natural_gas_stations.html

[20] Roberts, Jack. "Why Electric Trucks? Why Now?" Truckinginfo. August 2018. Available Online: https://www.truckinginfo.com/312230/why-electric-trucks-why-now

increase in use of speed limiting devices will have a positive effect on fuel economy as more fleets move toward installing devices in 100 percent of power units.

While fuel economy remained stagnant from 2017 to 2018, a breakout by operating weight (Table 8) shows MPG rose for trucks operating over 80,000 pounds, seeing an increase to 5.5 MPG (from 4.9 MPG in 2017). Interestingly, trucks operating between 20,001 and 60,000 pounds saw a decrease in fuel economy of 0.4 MPG on average (from 7.0 MPG in 2017 to 6.6 MPG in 2018).

Table 8: Respondent Reported Fuel Economy by Typical Operating Weight

Typical Operating Weight	MPG
Less than 20,000 lbs	6.4
20,001 - 40,000 lbs	6.6
40,001 - 60,000 lbs	6.6
60,001 - 80,000 lbs	6.3
Greater than 80,000 lbs	5.5

MOTOR CARRIER COSTS

There are numerous factors that can influence motor carrier operational costs – and numerous direct and indirect relationships between line item costs – making cost analyses challenging and complex. In the case of driver compensation, labor costs shift up or down based on driver experience, safety performance, and different compensation models. Similarly, insurance is another highly variable cost center within the industry due to rate structures that vary between industry segments and different risk models across motor carriers. However, ATRI has worked closely with motor carriers and panels of industry experts to identify those driver and vehicle costs that effectively represent a motor carrier's marginal costs (MC).

In order to remain consistent with the previous operational cost analyses, marginal costs were divided into two general categories, vehicle- and driver-based, comprised of the following major line item cost centers:

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

FINDINGS

Average Marginal Costs

With the exception of tires, all line item cost centers measured in ATRI's Ops Costs report experienced increases from 2017 to 2018. The overall CPM increased 7.7 percent to $1.821 (Table 9). The two highest cost centers, fuel and driver compensation, continue to exert upward pressure on the overall CPM as both experienced large increases in 2018. The cost per hour increased to $71.78 in 2018 (Table 10). These costs represent the highest to date in ATRI's Ops Costs data collection history.

Table 9: Average Marginal Costs per Mile, 2010-2018

Motor Carrier Costs	2010	2011	2012	2013	2014	2015	2016	2017	2018
Vehicle-based									
Fuel Costs	$0.486	$0.590	$0.641	$0.645	$0.583	$0.403	$0.336	$0.368	$0.433
Truck/Trailer Lease or Purchase Payments	$0.184	$0.189	$0.174	$0.163	$0.215	$0.230	$0.255	$0.264	$0.265
Repair & Maintenance	$0.124	$0.152	$0.138	$0.148	$0.158	$0.156	$0.166	$0.167	$0.171
Truck Insurance Premiums	$0.059	$0.067	$0.063	$0.064	$0.071	$0.074	$0.075	$0.075	$0.084
Permits and Licenses	$0.040	$0.038	$0.022	$0.026	$0.019	$0.019	$0.022	$0.023	$0.024
Tires	$0.035	$0.042	$0.044	$0.041	$0.044	$0.043	$0.035	$0.038	$0.038
Tolls	$0.012	$0.017	$0.019	$0.019	$0.023	$0.020	$0.024	$0.027	$0.030
Driver-based									
Driver Wages	$0.446	$0.460	$0.417	$0.440	$0.462	$0.499	$0.523	$0.557	$0.596
Driver Benefits	$0.162	$0.151	$0.116	$0.129	$0.129	$0.131	$0.155	$0.172	$0.180
TOTAL	**$1.548**	**$1.706**	**$1.633**	**$1.676**	**$1.703**	**$1.575**	**$1.592**	**$1.691**	**$1.821**

Table 10: Average Marginal Costs per Hour, 2010-2018

Motor Carrier Costs	2010	2011	2012	2013	2014	2015	2016	2017	2018
Vehicle-based									
Fuel Costs	$19.41	$23.58	$25.63	$25.78	$23.29	$16.13	$13.45	$14.50	$17.07
Truck/Trailer Lease or Purchase Payments	$7.37	$7.55	$6.94	$6.52	$8.59	$9.20	$10.20	$10.39	$10.45
Repair & Maintenance	$4.97	$6.07	$5.52	$5.92	$6.31	$6.23	$6.65	$6.58	$6.72
Truck Insurance Premiums	$2.35	$2.67	$2.51	$2.57	$2.89	$2.98	$3.00	$2.95	$3.32
Permits and Licenses	$1.60	$1.53	$0.88	$1.04	$0.76	$0.78	$0.88	$0.92	$0.95
Tires	$1.42	$1.67	$1.76	$1.65	$1.76	$1.72	$1.41	$1.50	$1.50
Tolls	$0.49	$0.69	$0.74	$0.77	$0.90	$0.79	$0.97	$1.05	$1.17
Driver-based									
Driver Wages	$17.83	$18.39	$16.67	$17.60	$18.46	$19.95	$20.91	$21.97	$23.50
Driver Benefits	$6.47	$6.05	$4.64	$5.16	$5.15	$5.22	$6.18	$6.78	$7.10
TOTAL	**$61.90**	**$68.21**	**$65.29**	**$67.00**	**$68.09**	**$62.98**	**$63.66**	**$66.65**	**$71.78**

Between 2017 and 2018, total average marginal costs in the trucking industry continued to far outpace inflation – growing at 7.7 percent overall (Table 11).[21] These costs were pushed upward by rising diesel fuel prices, insurance premiums, toll rates, and higher driver wages.

Table 11: Annual Change of Average Marginal Costs

Motor Carrier Costs	2017-2018 Change
Vehicle-based	
Fuel Costs	17.7%
Truck/Trailer Lease or Purchase Payments	0.4%
Repair & Maintenance	2.4%
Truck Insurance Premiums	12.0%
Permits and Licenses	4.3%
Tires	0.0%
Tolls	11.1%
Driver-based	
Driver Wages	7.0%
Driver Benefits	4.7%
TOTAL	**7.7%**

Driver wages and benefits continue to be the number one cost for motor carriers, accounting for 43 percent of the costs per mile (Table 12). The driver wages increase in 2018 represents the sixth yearly increase in driver wage CPM. Fuel costs increased to 24 percent of total costs, a two-percentage point increase from 2017. While fuel and total driver compensation account for 67 percent of costs, it is important to monitor cost growth rates; year-over-year insurance cost increases of 12 percent are second only to fuel at 17.7 percent (Table 11).

Recognizing the different operating conditions for each industry sector (e.g. truckload, less-than-truckload and specialized), this analysis breaks out motor carrier costs by sector (Table 13).

Carriers in the specialized sector (e.g. tank trucks, flatbeds) have the highest cost per mile. Factors such as HazMat and OS/OW permit costs, complex maintenance requirements and higher driver compensation all contribute to the increased costs when compared to TL and LTL carriers. In contrast, truckload carriers have the lowest operating cost of $1.71 CPM, despite a 14.8 percent increase from the previous year. This large increase was driven primarily by driver compensation, as carriers continue to vie for drivers.

[21] "CPI-All Urban Consumers (Current Series)." U.S. Bureau of Labor Statistics, U.S. Department of Labor. 2018.

Table 12: Share of Total Average Marginal Cost, 2010-2018

Motor Carrier Costs	2010	2011	2012	2013	2014	2015	2016	2017	2018
Vehicle-based									
Fuel Costs	31%	35%	39%	38%	34%	26%	21%	22%	24%
Truck/Trailer Lease or Purchase Payments	12%	11%	11%	10%	13%	15%	16%	16%	15%
Repair & Maintenance	8%	9%	8%	9%	9%	10%	10%	10%	9%
Truck Insurance Premiums	4%	4%	4%	4%	4%	5%	5%	4%	5%
Permits and Licenses	3%	2%	1%	2%	1%	1%	1%	1%	1%
Tires	2%	2%	3%	2%	3%	3%	2%	2%	2%
Tolls	1%	1%	1%	1%	1%	1%	2%	2%	2%
Driver-based									
Driver Wages	29%	27%	26%	26%	27%	32%	33%	33%	33%
Driver Benefits	10%	9%	7%	8%	8%	8%	10%	10%	10%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 13: Average Total Marginal Costs by Sector, 2010-2018

Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018
LTL	$1.76	$1.93	$1.79	$1.84	$1.83	$1.60	$1.74	$1.84	$1.90
Specialized / Other	$1.61	$1.79	$1.73	$1.67	$1.85	$1.72	$1.83	$1.95	$2.02
TL	$1.43	$1.57	$1.51	$1.60	$1.58	$1.50	$1.42	$1.49	$1.71

Line Item Costs

Driver Compensation

Driver compensation, including wages, benefits and bonuses, has been the biggest line item cost for carriers since 2014, even during periods of decreasing overall marginal cost.

The truck driver shortage, which is the primary force behind the compensation growth, ranked as the top issue in ATRI's 2019 Top Industry Issues Report.[22] For reference, the American Trucking Associations (ATA) estimated that the driver shortage was 60,800 at the end of 2018, and if current trends were to continue, the shortage could grow over 160,000 drivers by 2028.[23] The ongoing shortage continues to plague the trucking industry by limiting carriers' ability to accept freight due to lack of available drivers.

Exacerbating the current shortage, the trucking industry has experienced a relatively low success rate for attracting new drivers into the industry. ATRI's 2014 study on driver demographic trends identified that the trucking industry was failing to attract young drivers to replace retiring baby boomers.[24] A more recent ATRI analysis of census data on employment sectors documents that the trucking industry has the lowest percentage of young entrants and the highest percentage of aging workforce entrants.[25]

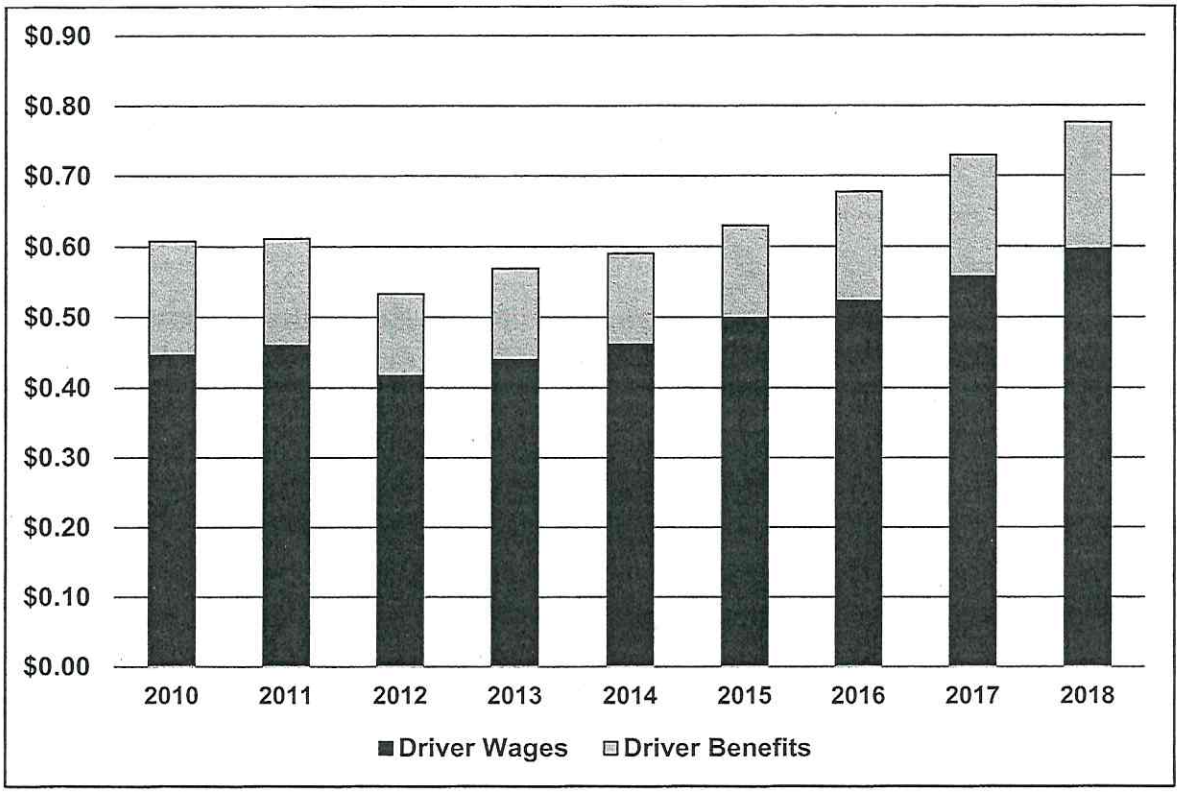
With 55.3 percent of trucking's workforce being 45 and older, and less than five percent of drivers in the 20 to 24 year old age range, the driver shortage will continue to worsen as older drivers approach retirement.[26] Together, these two factors create a severe strain on nearly all motor carriers as they struggle to fill their ranks with qualified drivers.

Driver Wages and Benefits

Since 2012, driver wages and benefits have steadily increased in an effort to attract and retain qualified drivers, as well as to compensate for detention times, traffic congestion, and regulations that negatively impact a driver's income (Figure 2). Wages are currently at 59.6 cents per mile – a 43 percent increase since 2012. In the same time period, drivers saw a 55 percent increase in benefits, for a total driver compensation of 77.6 cents per mile on average. This compensation includes medical, dental, vision coverage, and in some cases, 401(k) matching. This suggests that carriers see the necessity of including benefits similar to other industries to attract new drivers.

[22] "Critical Issues in the Trucking Industry – 2019." American Transportation Research Institute. Arlington, VA. October 2019.
[23] Costello, Bob and Alan Karickhoff. "Truck Driver Shortage Analysis 2019." American Trucking Associations. July 2019.
[24] Short, Jeffrey. "Analysis of Truck Driver Age Demographics Across Two Decades." American Transportation Research Institute. Arlington, VA. December 2014.
[25] "Employed persons by detailed industry, sex, and age, Annual Average 2018" U.S. Census Bureau – Current Population Survey.
[26] Ibid.

Figure 2: Driver Wages and Benefits per Mile, 2010-2018



When broken out by sector, LTL drivers received the highest total compensation at 94.7 cents per mile. Specialized drivers received 77.8 cents per mile in total compensation, reflecting the additional skill and credentials required to move non-standard equipment, such as tank-trailers or oversized flatbed trailers. Truckload carriers reported the lowest compensation, totaling 68.2 cents per mile.

Driver Bonuses

Seventy percent of carriers offered some type of bonus in 2018. The most common incentives were safety, starting, and retention bonuses.

In 2018, safety bonuses averaged $1,238, a surprising six percent decrease from the $1,317 reported in 2017 (Table 14). Starting bonuses saw an 11.5 percent increase to $1,562 in 2018, which is understandable as sign-on bonuses are a leading tool used to recruit new drivers.

Table 14. Single Driver Bonus Pay by Type

Bonus Type	2017	2018	Annual Change (%)
Safety	$1,317	$1,238	-6.0%
Starting	$1,401	$1,562	11.5%
Retention	$836[27]	$672	-19.6%

The average increase in starting bonuses provides further evidence that carriers are struggling to attract new drivers, and are using incentives beyond base compensation to appear more attractive to prospective applicants.

Recognizing that driver retention was the number two issue for motor carriers on ATRI's 2019 Top Industry Issues report,[28] retention bonuses are a primary tool for keeping good drivers. In 2018, truck driver retention bonuses averaged $672, down 19.6 percent from the $836 reported in the 2018 report. It appears that larger fleets maintained or increased retention bonuses from 2017 to 2018, but small-to-medium fleets decreased retention bonuses in that same time period. Among the smaller fleets, it appears that the retention bonus revenue was wrapped into higher driver base pay. This is likely a positioning strategy for addressing the driver shortage among smaller fleets, albeit a potentially risky strategy when economic conditions soften.

Looking Forward

With continued demand for freight, contract prices should maintain stability in 2019; however, spot market prices will remain volatile. External economic and geopolitical issues will create enough uncertainty that longer-term economic predictions will be challenging.

Presuming that issues such as trade agreements are positively resolved, there is an expectation that a recession can be avoided and growth will recover in the latter half of 2019 through 2020. In that "freight rebound" scenario, driver compensation is expected to rise in response to the high demand for truck drivers, and will be a large part of overall costs that a carrier incurs. As noted above, starting bonuses are one tool used to attract drivers, but until the driver shortage is quelled by an increase in new entrants, wages and benefits increases may only serve to increase driver "churn" across carriers.

Fuel Costs

Fuel costs are the second highest line item for carriers behind driver compensation. In providing data for fuel CPM, carriers were asked to exclude any fuel surcharges because the introduction of recoverable expenses would result in an inaccurate representation of the

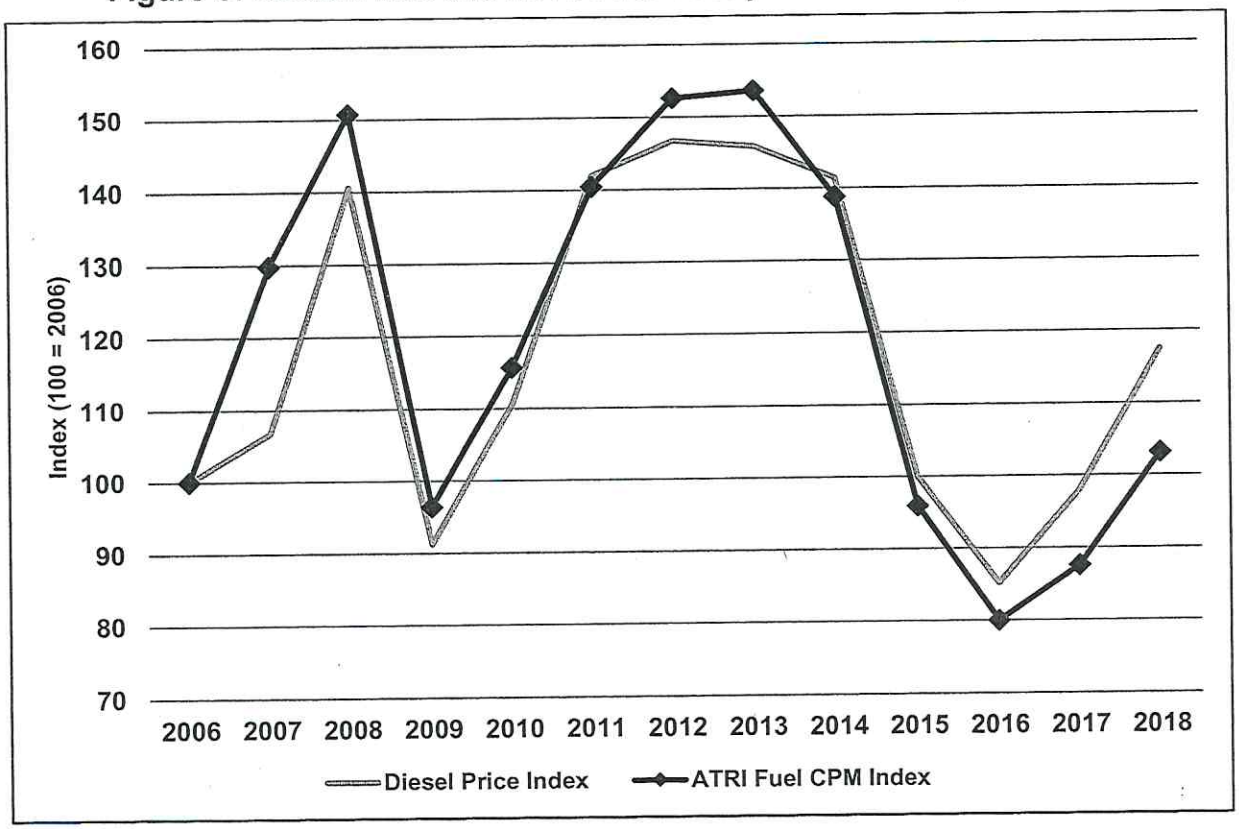
[27] Revised from figure published in 2018 report to address mid-year changes.

[28] "Critical Issues in the Trucking Industry – 2019." American Transportation Research Institute. Arlington, VA. October 2019.

carriers' per mile costs. After excluding surcharges, the revenues spent on fuel per mile can be compared across the trucking industry.

ATRI's carrier fuel cost index links closely with diesel prices, which has been consistent since the first ATRI study in 2008 (Figure 3). After relatively low diesel pricing in 2016 and early 2017, the diesel market regained pricing in the fourth quarter of 2017 and through 2018, with only a slight dip in market prices during November and December of 2018. As trucking is heavily dependent on diesel fuel, carriers are negatively impacted by market volatility. Small- to medium-sized carriers are particularly vulnerable as they usually do not hedge prices nor justify large-volume pricing discounts from fuel stops. In 2008, carriers paid more than 63 cents per mile as diesel prices skyrocketed.[29] In contrast, carriers only paid 33.6 cents per gallon in 2016 as prices fell considerably.[30]

Figure 3: Diesel Price and ATRI Fuel Cost per Mile Index, 2006-2018



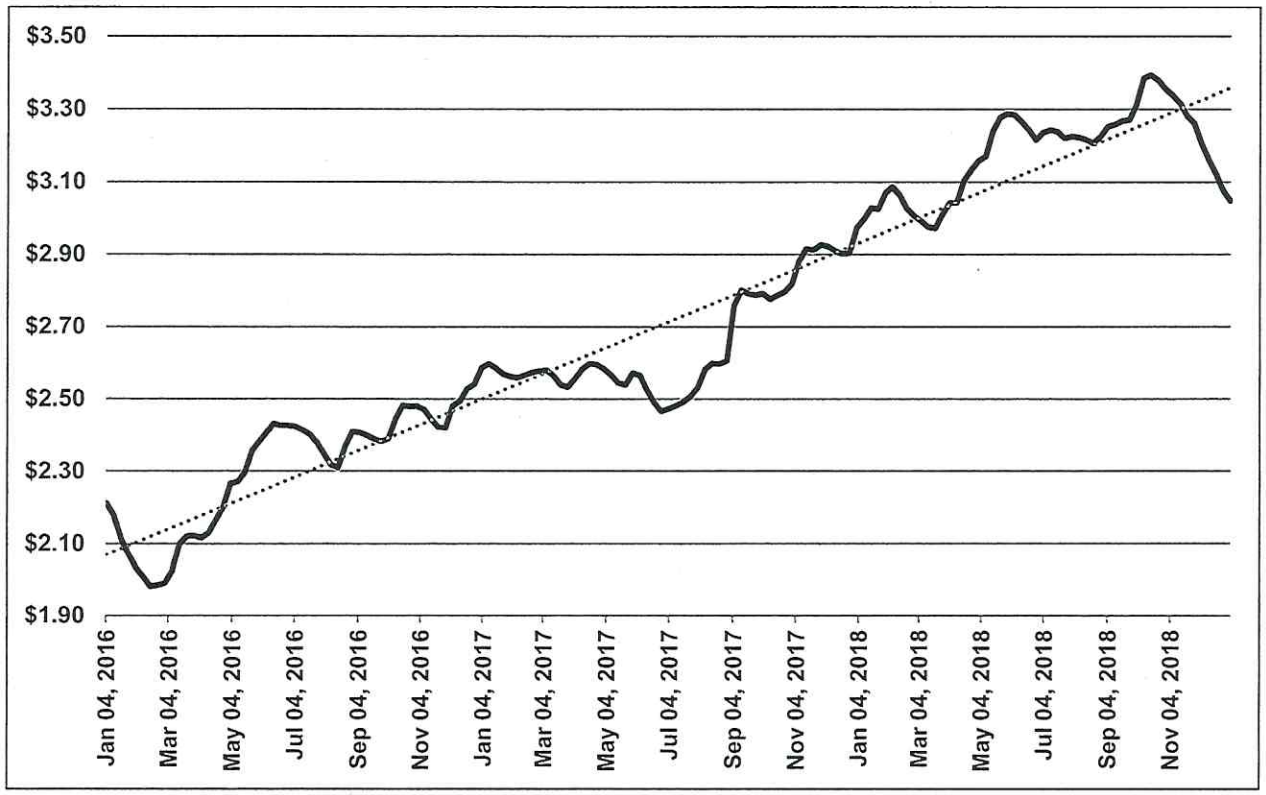
There has generally been an upward trend in fuel prices since February of 2016, which peaked in October of 2018 at $3.394 (Figure 4). From 2017 to 2018, the average weekly price of diesel increased from $2.650 to $3.179 – a 20 percent increase. Consequently, in this latest report, fuel CPM increased by 17.7 percent for carriers, from 36.8 cents per mile in 2017 to 43.3 cents per mile in 2018 (Table 9).

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

[30] Ibid.

Starting in February of 2016, fuel prices rose steadily throughout the year, reaching a peak of $2.54 per gallon in the last week of December 2016.[31] Nonetheless, diesel prices remained well below the average from the previous 10 years ($3.31 per gallon).[32]

Figure 4: Monthly U.S. On-Highway Diesel Prices, 2016-2018



Since that time, a number of factors have contributed to the continued increase in diesel fuel prices. The U.S. economy in 2017 and 2018 would be described as robust, with GDP growth rates exceeding 2.5 percent in both years (with the first quarter of 2019 exceeding 3.2 percent). As a result, diesel prices climbed based on growing demand and consumption.

In 2018, renewed sanctions on Iranian oil restricted the supply of oil to the U.S. and domestic production did not ramp up quickly enough to offset rising prices.[33] In addition, political uncertainty in Venezuela and the related U.S. embargo also had a likely role in oil price volatility.[34] However, prices are still well below the $4.50 per gallon experienced in July 2008.

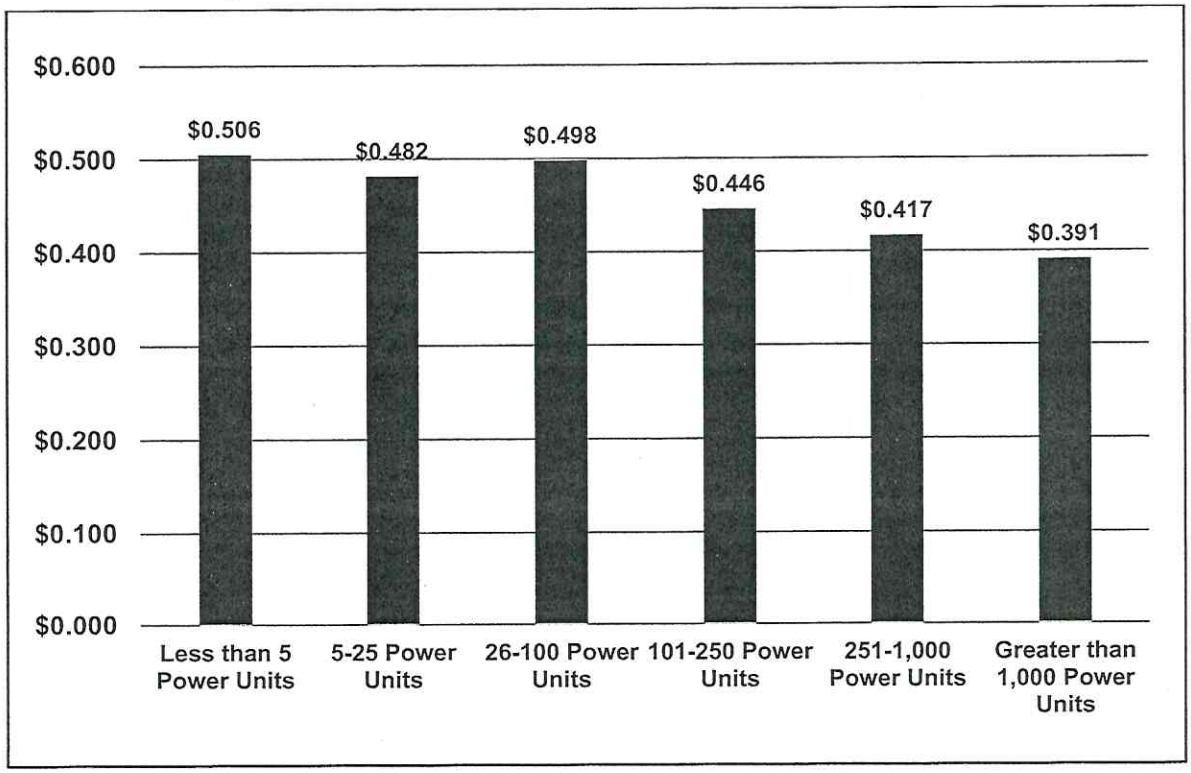
Diesel costs peaked in 2013 as the largest expenditure for motor carriers in ATRI's Ops Costs research data. Since then, driver wages have continuously surpassed fuel as the highest cost center.

[31] Ibid.
[32] Ibid.
[33] Jaffe, Amy M. "What Effects Will Tighter U.S. Sanctions on Iran's Oil Have?" Council on Foreign Relations. April 25, 2019.
[34] Salama, Vivian. "U.S. Expands Sanctions Against Venezuela Into an Embargo." Wall Street Journal. August 5, 2019.

Within the ATRI data, multiple factors influence fuel CPM, including industry sector, vehicle configurations, commodities hauled and average truck age. Specialized carriers experienced the highest fuel costs at 48.6 cents per mile, followed by TL carriers at 42.5 cents per mile and LTL carriers at 42.1 cents per mile.

Larger fleets have more bargaining power, and are able to better leverage their position and capital to maximize routes through efficient planning. They also often have newer equipment. These impacts are shown in Figure 5, where fleets with over 100 power units have lower fuel costs per mile.

Figure 5: Respondent Fuel Cost per Mile by Fleet Size



Looking Forward

International embargos and trade restrictions could possibly restrict the supply of imported oil, which could drive up the price of diesel fuel and petroleum futures in the U.S. The forecast is highly speculative as the ability to turn up domestic production is contingent on minimum prices per barrel; $50 per barrel is often considered a necessary target price.[35]

Equipment

Carriers' equipment-related purchase or lease decisions have direct effects on several other cost centers. Equipment purchasing decisions and trade cycles directly affect lease and purchase payments, repair and maintenance costs, and fuel efficiency. These same decisions will likely impact insurance rates, as replacement costs on newer vehicles are typically higher. As equipment prices increase, carriers may have to forego other expenditures such as optional onboard safety systems. All of these actions will directly impact the average marginal CPM for equipment costs.

Truck/Trailer Lease and Purchase Payments

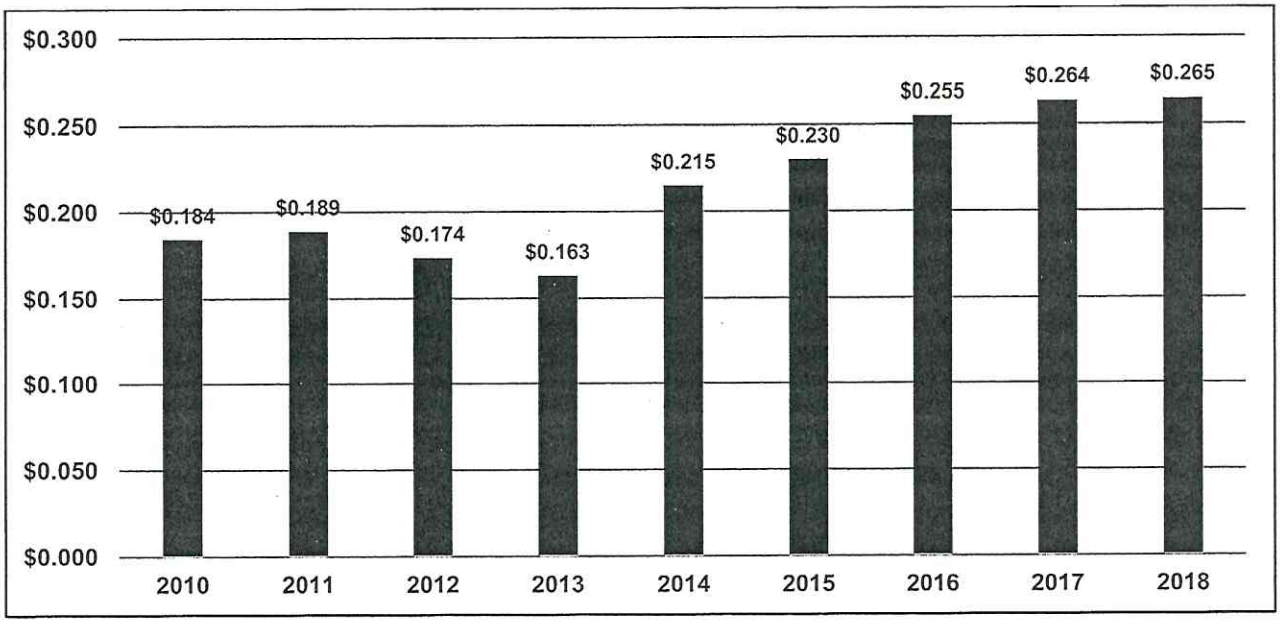
Truck and trailer payments are classified as a quasi-operational cost, since equipment purchases made during 2018's strong economy must still be paid for using operating revenue, even if the truck is not operated due to a decrease in demand. Consequently, purchase costs are included since per-mile IFTA-related revenue is necessary to cover this line item. Carriers have reported increasing lease or purchase payments since 2013, which continues into 2018. Lease or purchase payments increased from 26.4 cents in 2017 to 26.5 cents per mile in 2018 (Figure 6).

More specifically, growth of lease or purchase payments is almost certainly related to the higher costs for heavy duty trucks. Since 2010, heavy duty truck prices have steadily increased; however, in 2018 prices remained stagnant from the previous year.[36] The relatively small increase from 2017 to 2018 is masked by the larger cost increases experienced in the previous three years. By 2018, it appears that a price balance between high equipment demand and willingness-to-pay has been reached. Based on preliminary 2019 data and the economic softening of the 3rd quarter, this price stability will likely continue.

[35] Jaffe, Amy M. "What Effects Will Tighter U.S. Sanctions on Iran's Oil Have?" Council on Foreign Relations. Washington, D.C. April 25, 2019.

[36] "Producer Price Index by Industry: Heavy Duty Truck Manufacturing." Federal Reserve Bank of St. Louis. St. Louis, MO. Retrieved September 25, 2019. Available Online: https://fred.stlouisfed.org/series/PCU3361203361202

Figure 6: Respondent Lease/Purchase Payments per Mile, 2010-2018



The strong demand for trucking capacity in 2018, and requisite carrier confidence in higher spot and contract pricing had a considerable impact on Class 8 truck purchases. Manufacturers received a record number of orders in 2018, as fleets primarily sought to replace current truck tractors, with only marginal increases in new capacity. Purchases were stable for the first half of 2019 but dramatically declined, starting in the 3rd quarter, due to a softening economy.[37]

Specialized carriers reported the highest lease or purchase CPM in 2018 with costs over 30 cents per mile, surpassing truckload carriers, who reported 28.8 cents a mile. LTL carriers reported the lowest CPM, at 20.4 cents per mile for 2018.

Repair and Maintenance

Repair and maintenance (R&M) costs are considered a bellwether of everything from aging equipment to operating in regions with poor infrastructure. In addition, two major components of rising R&M costs include:

- Higher expenses associated with diagnosing and repairing / maintaining highly sophisticated components found in new trucks; and
- Labor costs buried in the R&M line item for the severe shortage of diesel technicians.[38] As equipment becomes more complex, the ability to train and recruit this labor force will become extremely challenging.

[37] "Most Recent Class 8 Orders." FTR Transport Intelligence. Retrieved September 25, 2019. Available Online: https://ftrintel.com/news/latest-orders/index.php

[38] "Diesel technician shortage a perfect storm gathering for decades." Equipment World. March 18, 2019. Available online: https://www.equipmentworld.com/diesel-tech-shortage-part-1-call-it-the-perfect-storm-one-thats-been-gathering-for-decades/

Overall, the R&M CPM has increased by 66 percent from 2008 to 2018.

While long term R&M cost increases can be attributed to the more complex R&M and technician shortages noted above, a likely explanation for the 2.4 percent growth from 2017 is increased equipment usage. From 2017 to 2018, the average increase in miles driven per truck was nearly two percent (Table 15). This increased mileage directly impacts preventative maintenance and repairs on equipment

Table 15: Change in Annual VMT per Truck

	Average Miles Driven Per Year Per Truck		Percentage Change in Miles Driven Per Year Per Truck
Equipment Type	2017	2018	
Truck Tractors	89,804	91,506	1.9%

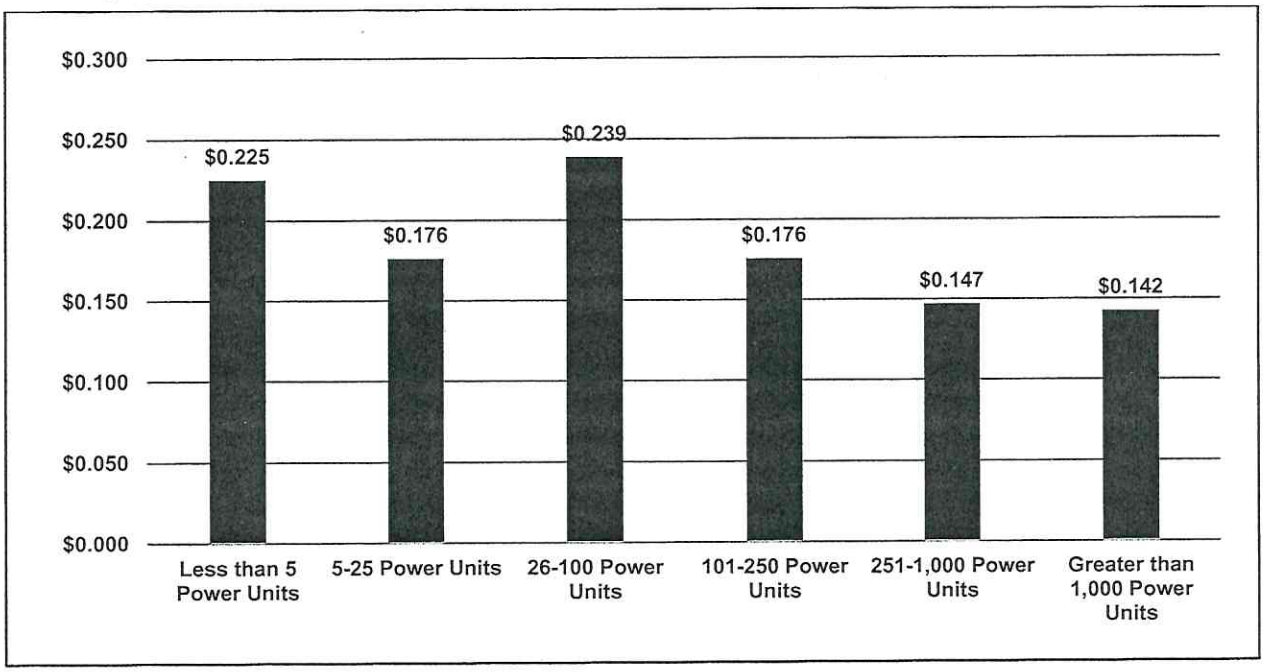
The different industry sectors experience repair and maintenance costs differently. Specialized carriers consistently pay more for R&M than both LTL and TL, paying 23 cents for R&M per mile (Table 16).

Table 16: Repair and Maintenance Costs by Sector, 2010-2018

Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018
LTL	$0.15	$0.18	$0.18	$0.18	$0.19	$0.17	$0.23	$0.19	$0.18
Specialized / Other	$0.14	$0.16	$0.14	$0.13	$0.18	$0.17	$0.18	$0.22	$0.23
TL	$0.11	$0.14	$0.11	$0.14	$0.13	$0.14	$0.13	$0.13	$0.15

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. Smaller fleets also face higher costs to employ outside R&M services. As a result, fleets with fewer than 100 power units paid the highest rates among fleet size categories (Figure 7).

Figure 7: Respondent Repair and Maintenance Cost per Mile by Fleet Size



Looking Forward

R&M costs are expected to increase in 2019, despite the erroneous assumption that new truck tractor acquisitions will lower maintenance costs. As integrated technology has become more prominent in truck tractors, the cost of maintaining a new truck in 2018 was more expensive than maintaining a new truck in 2008. Increasing diesel technician wages also contribute to rising R&M costs, particularly with advanced technology requiring specialized technicians for maintenance.

Truck Insurance Premiums

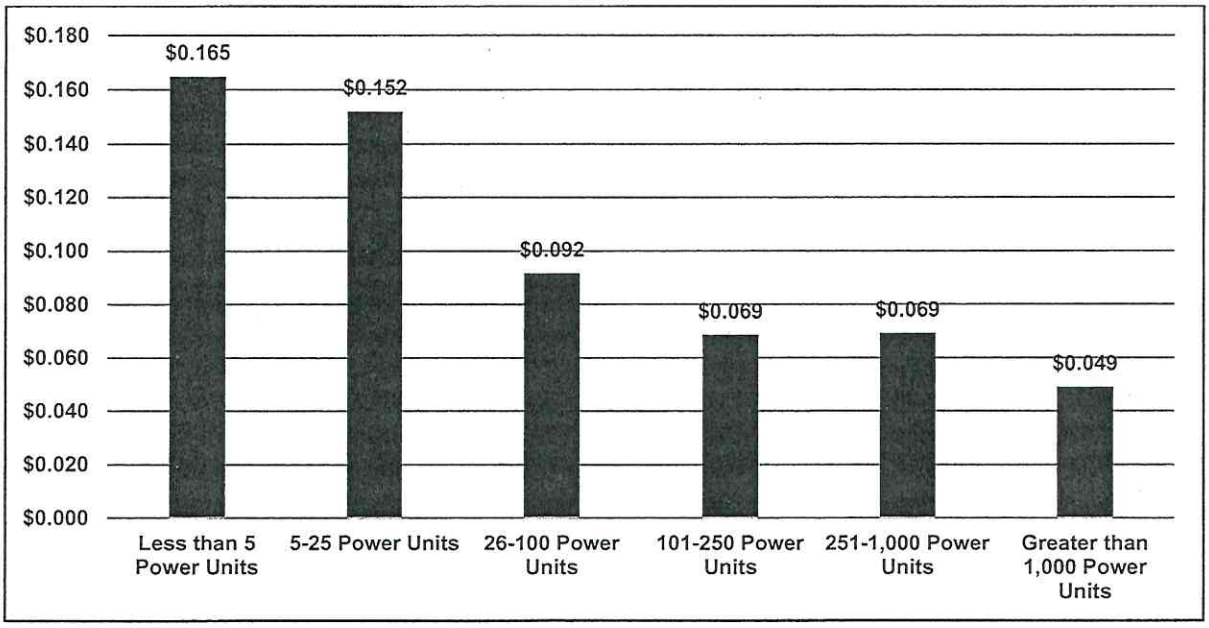
Commercial trucking insurance is a volatile cost center for motor carriers, independent of fleet size. There are many external factors that affect carrier rates, and several are not related to a fleet's safety rating or crash history. Carriers are continuously evaluating their insurance costs and risk liability, trying to effectively manage the balance of risk and cost.

Based on data provided by motor carrier respondents, insurance CPM increased by 12 percent, to 8.4 cents per mile in 2018. Specialized carriers paid the highest cost, reporting 10.4 cents per mile. These costs reflect the higher risk associated with specialized carriers, such as tank trucks and oversized/overweight trucks that haul non-standard cargo.

The principle reasons for increased premiums include growing litigation, increased traffic associated with the expanding economy, as well as increasing vehicle prices. With more people on the road as a result of a growing economy, the likelihood of a crash increases. Seemingly independent of increasing traffic-related crash risk, truck-involved crashes are generating dramatic increases in both the number of civil litigation case filings as well as

increases in jury awards and out-of-court settlements. Figure 8 shows a trend line that has now become commonplace: insurance costs increasing across the board; increasing fastest among small to medium fleets that do not have the ability to increase financial risk; and larger carriers maintaining insurance cost stability, through high deductibles and/or self-insurance. In most cases, carriers have increased coverage beyond the FMCSA-required minimum coverage of $750,000. In any case, these and many other factors force insurance companies to dramatically increase premiums across the entire base of insured carriers, regardless of sector or fleet size.

Figure 8: Respondent Truck Insurance Premium Costs per Mile by Fleet Size



The growing cost and sophistication of repairing damaged truck tractors also requires the insurance companies to distribute high repair costs across all carriers.

Ultimately, insurance costs become one of the most complex line items to assess since carriers continuously modify deductible levels, coverage amounts, and self-insurance and re-insurance coverage levels.

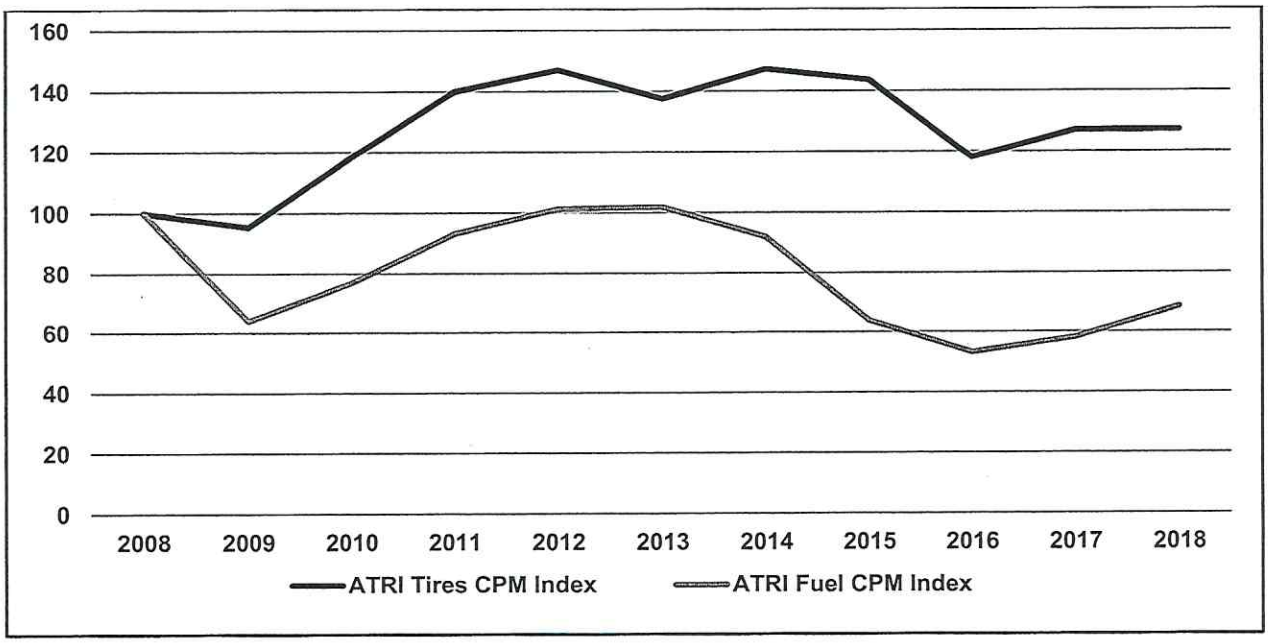
Tires

As both tires and fuel derive from petroleum, they typically share a strong cost correlation (Figure 9). However, after the Great Recession, tire prices climbed to some of the highest levels in ATRI's tenure of collecting operational cost data – in spite of low petroleum prices. The primary cause was high tire demand (needed for the record truck/trailer sales) outstripping supply amid low tire inventories coming out of the recession. The slight decline in tire prices over the last four years – and stable tire pricing across 2017 and 2018 – is likely due to the

large U.S. surplus of styrene butadiene rubber (SBR), a synthetic rubber used to replace natural rubber (NR) in tires.[39,40]

Not surprisingly, carriers in the specialized category continue to experience higher tire costs than both TL and LTL carriers. In 2018, specialized carriers expended 0.046 cents per mile on tires, while LTL TL carriers experienced similar per mile tire costs at $0.037 and $0.036 cents per miles respectively.

Figure 9: ATRI Tires and Fuel Cost CPM Indices, 2008-2018



Tolls

Toll costs have continued to rise since the first publication of this report in 2008. Among the factors contributing to this increase is the pricing power that many U.S. toll authorities have, allowing for inflation or above-inflation toll increases.[41] Additionally, in some U.S. markets there are limited alternatives to tolled routes, especially in major urban areas with tolled bridge systems. These factors likely contributed to the 11 percent increase in toll CPM in 2018.

Permits and Special Licenses

The average permit and licensing CPM for all carrier respondents was 2.4 cents per mile in 2018. While there was a small increase from 2017, 2018 permit costs remain low compared to 2010 and 2011. Permit and license fees can differ greatly by sector. As would be expected,

[39] Raleigh, Patrick. "Tire Materials costs trending higher". European Rubber Journal. October 1, 2018. Available Online: https://www.european-rubber-journal.com/2018/10/01/tire-materials-costs-trending-higher/

[40] "Four key factors shaping the tire materials market to 2021" Smithers. Retrieved September 23, 2019. Available online: https://www.smithers.com/resources/2016/mar/four-key-factors-shaping-the-tire-materials-market

[41] Global Infrastructure & Project Finance. Fitch Ratings. Spring 2019. Available online: https://tollroadsnews.com/wp-content/uploads/2019/04/Fitch_US-Transportation-Trends_Spring-2019.pdf

specialized carriers experience fees greater than the average TL or LTL carrier for this line item. In 2018, both TL and LTL carriers paid 2 cents per mile for permits and licenses, while specialized carriers paid 4.8 cents per mile – more than double the permit costs of TL and LTL.

Other factors that affect permit and licensing fees are geography and state economic conditions. While ATRI is presently researching the degree to which toll revenue is returned to infrastructure maintenance and reconstruction, there is little understanding of the use or designation of permit and licensing fees to infrastructure.

Costs by Region

Carriers operating predominantly in the Southwest and Southeast reported the lowest operating costs in 2018, a recurrence of previous years. The highest Ops Costs were incurred by carriers operating predominantly in the West and Northeast (Table 17). Operations in the West are known for longer trip lengths and above-average traffic congestion on the coast. The Northeast experiences heavy population concentrations and requisite traffic congestion and truck bottlenecks; these traffic conditions often come with increases in truck-involved crashes – which generate higher repair and maintenance and insurance costs. There is also a preponderance of toll roads in the Northeast – which raises that particular line item cost.

Table 17: Average Marginal Cost per Mile by Region, 2018

Motor Carrier Costs	Midwest	Northeast	Southeast	Southwest	West
Vehicle-based					
Fuel Costs	$0.404	$0.457	$0.390	$0.405	$0.466
Truck/Trailer Lease or Purchase Payments	$0.274	$0.288	$0.244	$0.260	$0.272
Repair & Maintenance	$0.148	$0.193	$0.155	$0.139	$0.199
Truck Insurance Premiums	$0.073	$0.080	$0.074	$0.077	$0.091
Permits and Licenses	$0.028	$0.030	$0.022	$0.029	$0.033
Tires	$0.033	$0.040	$0.035	$0.040	$0.043
Tolls	$0.033	$0.049	$0.029	$0.027	$0.025
Driver-based					
Driver Wages	$0.566	$0.598	$0.553	$0.467	$0.495
Driver Benefits	$0.168	$0.229	$0.229	$0.132	$0.187
TOTAL	**$1.727**	**$1.962**	**$1.679**	**$1.577**	**$1.810**

Industry Sector in Focus: Tank Trucks

ATRI continues to expand the annual Operational Cost of Trucking analysis with its "Industry Sector in Focus" section. When ATRI determines that an industry sector submits sufficient data to produce a targeted assessment of line item average marginal costs, it attempts to isolate and emphasize unique industry sectors. In this report, Tank Truck fleets provided sufficient data to analyze their operational costs.

Table 18: Tank Truck Average Marginal Costs per Mile, 2018

Motor Carrier Costs	Average Marginal Cost per Mile	Share of Total Average Marginal Costs per Mile
Vehicle-based		
Fuel Costs	$0.515	24%
Truck/Trailer Lease or Purchase Payments	$0.310	14%
Repair & Maintenance	$0.279	13%
Truck Insurance Premiums	$0.105	5%
Permits and Licenses	$0.035	2%
Tires	$0.055	2%
Tolls	$0.015	1%
Driver-based		
Driver Wages	$0.699	32%
Driver Benefits	$0.142	7%
TOTAL	**$2.155**	**100%**

ATRI's tank truck dataset included 10,082 trucks and 17,652 trailers in 2018. Respondents reported an average marginal cost of $2.16 in 2018 – 18.4 percent higher than the average marginal cost of truck tractors overall (Table 18). This increase is likely due to higher costs in key cost centers as noted below.

- R&M costs for tank trucks were significantly higher (63.2%) per mile than the average for all truck tractors. This is attributable in part to the specialized equipment utilized in hauling corrosive and hazardous materials, which yields increased maintenance and repair costs. Secondly, tank trailers in the ATRI dataset were, on average, over 15 years old, which would result in higher costs across multiple line items.
- The truck insurance premium cost per mile for tank trucks was $0.105, 25 percent higher than the average for all truck tractors, reflective of the higher cost to insure hazardous cargo.
- At $0.699 per mile, the tank driver wage cost per mile was 17.3 percent higher than the overall driver wage cost per mile. This was likely driven by the higher premium paid for drivers with a hazmat endorsement on their CDL.

Electronic Logging Device Costs

As described in the Methodology, the 2019 Ops Costs data collection included questions on technology deployment and associated costs from FMCSA's ELD Mandate. Effective December 2017, the mandate allowed fleets already utilizing Automatic On-Board Recording Devices (AOBRDs) to wait until December 2019 to transition to Electronic Logging Devices (ELDs). Therefore, motor carrier respondents were asked to submit fleet usage of both equipment types as well as associated costs.

The vast majority of 2019 respondents used some type of electronic logging device, with 31 percent of respondents using ELDs and 67 percent using AOBRDs.[42] Based on several different assessments of carrier transitions from AOBRDs to ELDs, most industry surveys and anecdotal evidence indicate that the majority of fleets had converted to ELDs by the third quarter of 2019.[43]

On average, the ELDs were approximately $200 cheaper compared to AOBRDs, with only marginal differences in subscription fees (Table 19). The lower price of ELDs is likely associated with greater competition among ELD providers versus the much smaller number of legacy AOBRD providers.

Table 19: ELD and AOBRD Costs

	ELD	AOBRD
Per Unit Fee	$757.81	$960.97
Monthly Subscription Fee	$37.32	$39.32

CONCLUSION

In this 2019 report, ATRI documented and updated the marginal operational costs that carriers experienced in 2018 using financial data provided directly from motor carriers. This research continues to provide important benchmarking inputs – allowing carriers to discern and compare their performance against other peer fleets. Additionally, carriers can compare select line item costs to fleets of similar sizes, operating regions and industry sectors. 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.

Based on the industry data, the average marginal cost per mile in 2018 was $1.821 for the for-hire sector of the trucking industry. This was a 7.7 percent increase from 2017. The robust

[42] These numbers will not add to 100 percent as two percent of respondents reported being exempt from the federal mandate.
[43] Clevenger, Seth. "Training Key for Smooth Transition From AOBRDs to ELDs." Transport Topics. October 6, 2019. Available online: https://www.ttnews.com/articles/training-key-smooth-transition-aobrds-elds

economy, a longstanding labor shortage, increasing diesel fuel and insurance prices all contributed to the increasing year-over-year cost per mile of trucking.

Driver compensation continued to be the single largest cost that carriers faced in 2018. If the driver shortage continues, wages are expected to increase, exacerbating the already large cost of employee compensation. In addition, if the geopolitical, trade and legislative environments favorably resolve their issues, 2019 data will likely reflect a solid growth in both trucking services and related costs.

While ATRI's Ops Cost research focuses exclusively on the for-hire sector of trucking, the for-hire data can be juxtaposed with private fleet data to identify interesting comparisons. The National Private Truck Council (NPTC) produces an annual "Private Fleet Benchmarking Report" which is based on private fleet operating statistics. In NPTC's 2019 report, the overall average operating cost for private fleet trucks ranged between $2.69 and $3.14 – depending on mileage. This equates to a 48 percent to 72 percent premium over the for-hire average costs published in this report. Much of the cost differential between for-hire and private fleets derives from the higher administrative costs associated with managing trucks within a much larger business enterprise.

Based on NPTC's $3.14 CPM in the 2019, private fleet costs rose 7.9 percent over the previous year; ATRI's year-of-year increase of 7.7 percent indicates an extremely similar landscape for line item cost pressures.

Starting wages for truck drivers were listed as an average 48.5 cents per mile, with an average maximum per-mile wage of 51.7 cents. That said, only 34 percent of private fleet truck drivers were paid on a per-mile basis.

For private fleet bonuses, more than 80 percent of fleets provide some type of safety bonus; followed by 63 percent of fleets providing new-hire referral bonuses; rounding out the top three with 52 percent of fleets providing compliance bonuses. Two more relatively common private fleet bonuses were for fuel economy and reduced idling time.

As expected in a private fleet business model, empty or "dead-head" miles are more common as only 6 in 10 private fleets have "for-hire operating authority" (to move others' products). Consequently, approximately 28 percent of private fleets operated dead-head miles vs.16.6 percent in ATRI's for-hire sample.

Finally, in comparing for-hire and private fleet trade cycles, NPTC's private fleet sample had a trade cycle of 6.5 years as compared to ATRI's for-hire average trade cycle of 6.96 years.