The Impact of a Newer Fleet

The Effect of New vs. Old Trucks on Maintenance Costs and Fuel Economy

A White Paper
By The Keystone Group

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Introduction

Over the past few years, trucking companies have been hit by what many have called the "perfect storm": sky-high fuel prices, an unprecedented housing bubble bursting, and the resulting economic downturn which for many carriers is still a reality today. Carriers have taken notice of the number of company failures that have rocked their industry, and although most industry participants agree that a reduction in the supply side of the trucking market will be a good thing for those who remain, the road to supply and demand equilibrium has been a painful one.

Through our experience with trucking companies, it has become apparent that many of them, regardless of fleet size, have stepped-up their efforts to cut and control costs. There has been a renewed focus on streamlining fleet operations, controlling maintenance costs, improving fuel consumption, reducing back-office costs, etc. As the economy picks up steam and recovers, demand for trucking services will rebound. And as it does, carriers need to be ready to seize the opportunity with lean and efficient operations, motivated drivers, and a fleet that is ready to hit the road.

For the carriers that make it through this industry shake-up, one of the questions that still looms is whether or not to upgrade aging fleets. Conventional wisdom suggests that operating a newer fleet of trucks is more profitable than operating an older fleet of trucks. Intuitively, one would expect to see costs per mile increase as a truck ages and piles on more miles with each passing year. Similarly, we would expect to see a newer fleet be more fuel efficient than an older fleet.

To prove (or disprove, as the case may be) these claims, we gathered, analyzed, and compared data from seven for-hire carriers (the "Sampled Carriers"). The resulting sample size represents over 15,000 trucks. *Table 1* shows the participant profiles for each of the Sampled Carriers that provided data for this analysis. We estimate that the revenue size of the Sampled Carriers ranges from approximately $200 to $600 million per company. The group includes both publicly traded and privately held carriers.

Table 1 - Participating Fleet Profiles

Company	% Flatbed	% Van	% Reefer	Weighted Avg Tractors 2009	2009 Total Miles (Millions)
A	45%	45%	10%	1,500-2,000	150-200
B	-	100%	-	2,500-3,000	200-250
C	-	96%	4%	2,000-2,500	250-300
D	100%	-	-	1,000-1,500	100-150
E	100%	-	-	2,500-3,000	200-250
F	-	100%	-	2,000-2,500	250-300
G	43%	57%	-	2,500-3,000	250-300
Total	**38%**	**60%**	**2%**	**15,575**	**1,493**

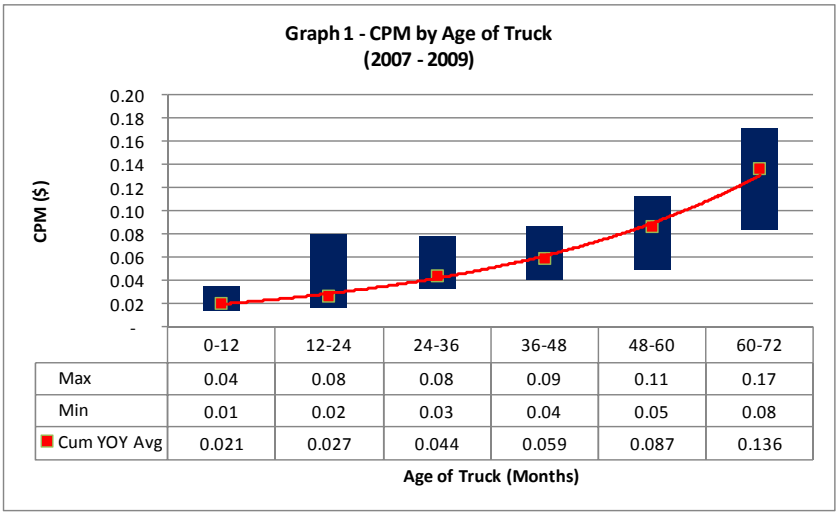
In addition to the Sampled Carriers, Keystone also interviewed personnel and reviewed information from many of the major truck and engine original equipment manufacturers (OEM's), including Cummins, Daimler, Detroit Diesel, Freightliner, Kenworth, Navistar, Paccar, and Volvo. In this white paper, we will discuss our findings and share some of the key trends experienced by the Sampled Carriers.

Maintenance Costs

It is difficult, if not impossible, to compare absolute maintenance costs between carriers. Carriers can have widely differing warranty terms, preventative maintenance schedules, levels of sophistication when it comes to their maintenance capabilities, and costs in their reported maintenance cents per mile. For example, some include mechanics wages, benefits and workers compensation in the maintenance costs while others do not. Other differences include the handling of warranty costs and repairs associated with accidents. However, based on the data we reviewed, two things became apparent:

1. Assuming similar miles driven annually, newer trucks cost less to maintain than older trucks;
2. As a truck ages and piles on more miles, its average cost to maintain increases with each passing year.

We looked at data from each of the Sampled Carriers and trended their reported maintenance costs by age of truck to see if in fact we could see any difference between newer and older trucks. *Graph 1* shows the average cost per mile (CPM) incurred from 2007 to 2009 by our seven carriers. The averages are weighted based on the number of total miles driven per fleet for each age range.

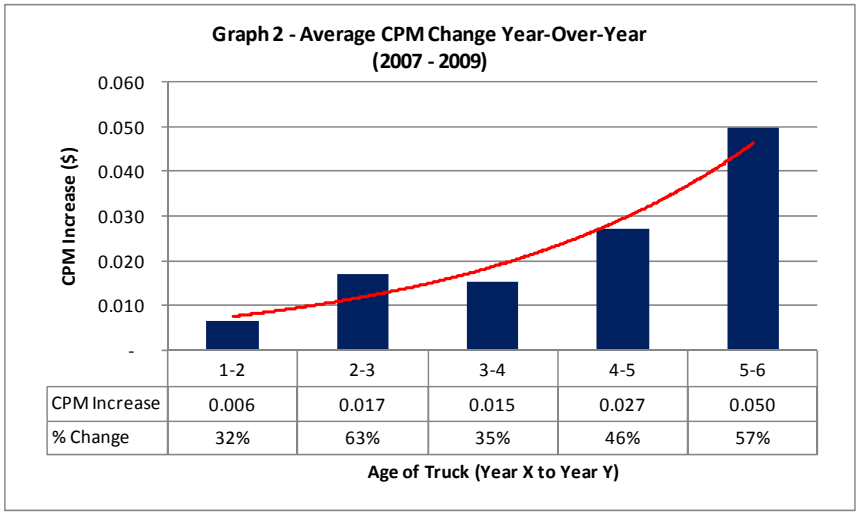


	0-12	12-24	24-36	36-48	48-60	60-72
Max	0.04	0.08	0.08	0.09	0.11	0.17
Min	0.01	0.02	0.03	0.04	0.05	0.08
Cum YOY Avg	0.021	0.027	0.044	0.059	0.087	0.136

Note: The red data points are the cumulative year-over-year average CPM changes
Source: Keystone analysis based on 2007 - 2009 data provided by seven trucking fleets

As mentioned earlier, we were not surprised to see a range of reported maintenance costs between the carriers, based on differing accounting and reporting methodologies, as well as vastly differing operating processes, cost bases, capabilities, and strategies. That being said, in 2009, all of the Sampled Carriers experienced higher maintenance costs for their older trucks than they did for their newer trucks. Based on the data we collected, a 60-72-month-old truck required on average $0.136 per mile to maintain while a 0-12-month-old truck required only $0.021 per mile to maintain, or an 85% decrease. To put this in perspective, each $0.01 per mile savings for a carrier with a fleet of 2,500 trucks running an average of 100,000 miles/truck/year would improve EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) by $2.5 million per year.

In order to control for the differences in maintenance reporting methodologies among the Sampled Carriers, we analyzed the average year-over-year changes in maintenance CPM, as seen in *Graph 2*. With a starting CPM of $.021 for a one-year-old truck (based on average data from 2007-2009), CPM increases $.006 from year one to year two and exponentially thereafter. Thus, the data from our sample suggests it becomes increasingly more expensive to maintain a truck as it ages. While we were not able to gather CPM data beyond year six, we would not expect this exponential trend to continue. Based on discussions with many in the industry, many major repairs typically occur during years five and six.



	1-2	2-3	3-4	4-5	5-6
CPM Increase	0.006	0.017	0.015	0.027	0.050
% Change	32%	63%	35%	46%	57%

Note: Year 1 represents a 0-12-month-old truck; Year 2 represents a 12-24-month-old truck, etc.
Source: Keystone analysis based on data from 2007 - 2009 provided by seven trucking fleets

When considering CPM across fleets, it is important to consider that companies can make a variety of operating improvements that will reduce their CPM. These include, but are not limited to 1) a better adherence to preventative maintenance programs and schedules to avoid breakdowns that require costly over-the-road or out-of-network repairs, 2) proper tire air pressure, 3) driver pre-trip inspections of their tractors and trailers, 4) tracking and analyzing maintenance costs by "reason code" to address recurring problems, 5) smarter driver incentives and training, and 6) reducing preventable accidents. The extent to which the Sampled Carriers have implemented such measures will also add variability to our data. In our analysis, we are assuming that if the Sampled Carriers have put in place such programs, they will have done so across their entire fleet, irrespective of the relative age of their trucks.

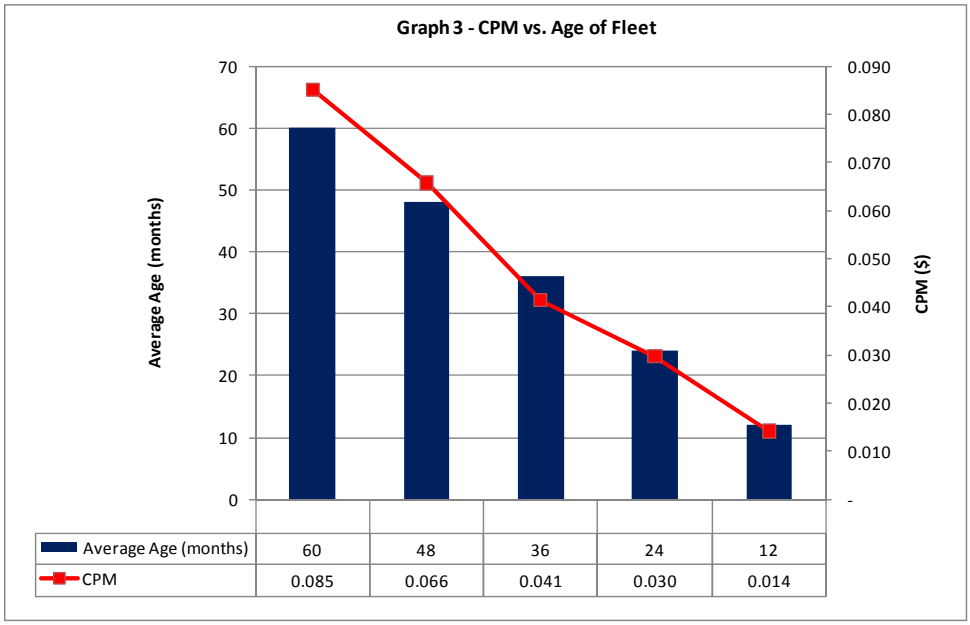
Case Study: Fleet Maintenance Costs

After we looked at expected CPM for our seven carriers, we wanted to run a simulation based on a broader set of data. To accomplish this task, we asked MacKay & Company (a specialized market research firm headquartered in suburban Chicago, focused since 1968 on commercial on-highway vehicles, construction equipment, farm field machinery and related components such as engines and transmissions), to utilize its comprehensive database and modeling capabilities to run a simulation on maintenance CPM. For this exercise, MacKay & Company leveraged data collected over a four-year period from a total of 12 surveys, representing 450,000 Class 8 trucks across 1,620 for-hire fleets with a total of 47 billion annual miles.

In order to conduct the simulation, a number of inputs were assumed, including:

- 90% active fleet running an average of 2,250 miles/truck/week for 50 weeks or 101,250 miles/truck/year
- Maintenance parts and lubricants are based on typical prices that a fleet pays
- The cost per drive tire is $180; the cost per steer tire is $300
- The average price paid for engine oil is $6.38 per gallon
- The average mechanic wage rate is $16.50 per hour (unloaded/unburdened)

Given the key assumptions noted above and the underlying statistics in the database, the resulting CPM based on this simulation can be seen in *Graph 3*.



Source: MacKay & Company, 2010.

Based on this simulation, the expected CPM of an average 48-month-old fleet is $0.066. If a carrier were to upgrade its fleet by purchasing new trucks and ultimately bring down the average age of the fleet to 24 months, the expected CPM of that fleet would be $0.030, or a total reduction of 55%. Although different fleets will have different cost bases, the improvements shown in this case study should be indicative of any fleet's CPM improvement based on similar fleet upgrades.

Note: The above case study addresses only a portion of a fleet's total maintenance costs (i.e., parts, tires, lubricants, and unloaded/unburdened labor); therefore, the absolute CPM data should not be used to make direct comparisons to other fleets. The data is relevant only when looking at directional and relative change, and is consistent with the relative change experienced by the Sampled Carriers in our study. For example, the CPM decrease from a 48-month-old truck to a 24-month-old truck in the above case study is $0.036, or 55%. Likewise, if the data for the Sampled Carriers is analyzed to compare similar timeframes, the change represents a decrease of $0.032 (from $0.059 to $0.027), or a 54% decrease.

Fuel Economy

The second key factor we analyzed was the fuel economy of newer vs. older model year trucks. Fuel economy is typically measured as miles per gallon, or MPG. Much information and many claims exist around the various factors that impact fuel economy. Some of these factors include types of tires, driver behavior, vehicle specifications, environmental conditions, maintenance procedures, route management, idle time management, etc. For this effort, we were able to obtain information from several OEM's including Kenworth, Volvo, and Cummins on the issue of fuel economy. *Table 2* below highlights possible improvements associated with equipment specifications and operational changes:

Table 2

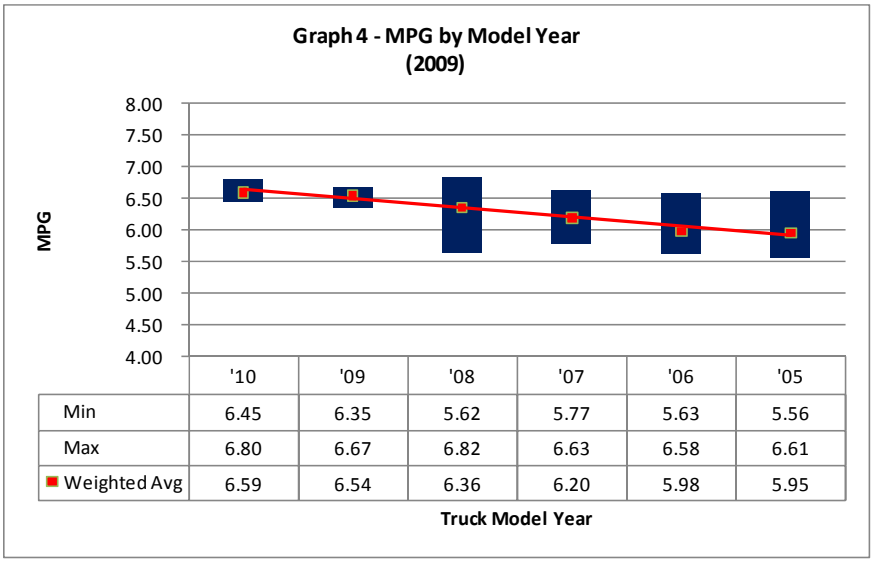
Item	MPG Improvement
Fuel Roof Fairing (for use with van trailer)	5-10%
Cab Extenders	1-4%
Chassis Fairings	1-2%
Air Cleaners (underhood)	1-2%
Aerodynamic Mirrors	1-2%
Source: Kenworth, 2008	

Item	MPG Improvement
Bunk Heater	3%
Tank Skirts	2%
Roof Fairings & Side Fairing Extenders	1%
Auxiliary Power Unit	3%
Wide Based Tires	2%
Source: Volvo, 2010	

Item	MPG Improvement
2% Reduction in Aerodynamic Drag	1%
1 mph decrease above 55 mph	0.1 MPG
Ribbed (vs. lugged) tires on Drive Axle	2-4%
Driver Efficiency (best vs. worst)	0-30%
Reduce idle time from 50% to 25%	2-4%
Source: Cummins , 2007	

While manufacturers' claims should be taken with a grain of salt since they are in business to sell trucks, many of the carriers we talked to would broadly support these claims based on their experience behind the wheel. However, we were cautioned not to view all of these improvements as cumulative. Depending upon specification changes between the new and old equipment, one could expect to see a 2-10% improvement in fuel economy.

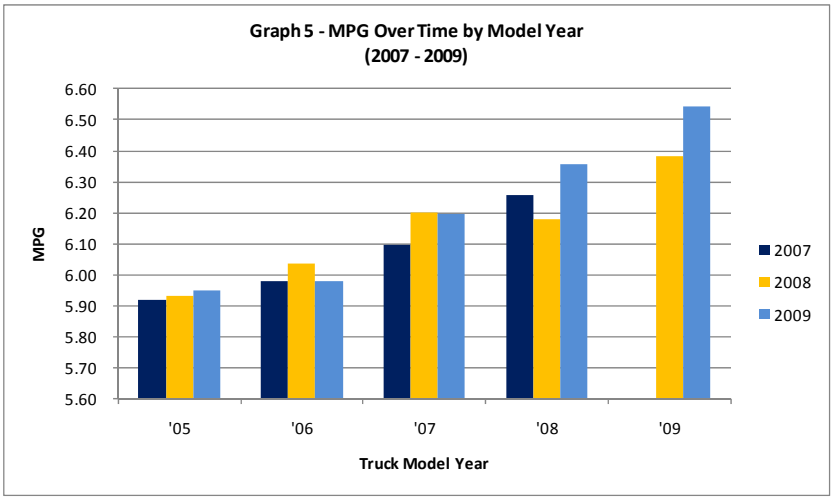
After our initial discussions with OEMs, we looked at the Sampled Carriers' fuel consumption data over time. With the caveat that it takes an average of 50,000 miles for a new truck to be fully broken-in, resulting in varying levels of fuel consumption during the first year of the truck's operation, our data suggests that the newer model year trucks average higher MPG than the older model year trucks, as shown in *Graph 4*. The data shows an 11% improvement in fuel economy between 2005 and



Source: Keystone analysis based on 2009 data provided by five trucking fleets

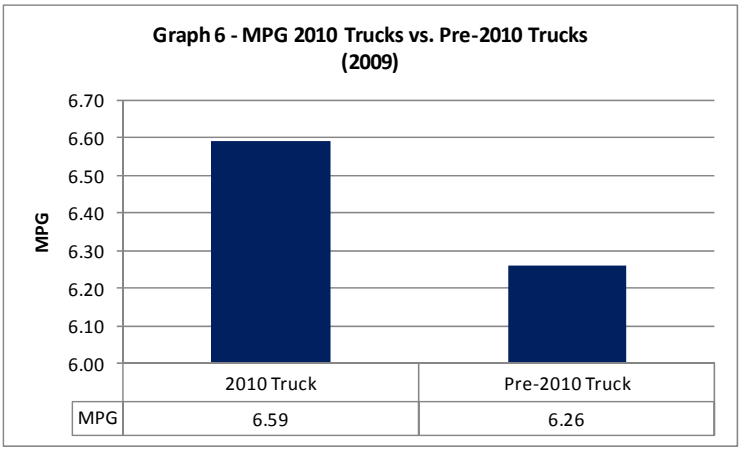
2010 model year trucks, and this year-over-year improvement is fairly linear. It is important to note that while there were over 900 model year 2010 trucks in our sample data, these trucks did not necessarily have EPA 2010 engines. (See "Impact of 2010 Engines" section later in this document for more information.)

One logical explanation for the trend in *Graph 4* is that OEM's continue to focus on fuel efficiency and are able to make technological improvements year-over-year that increase MPG, such as the ones identified earlier in *Table 2*. It is important to note that *Graph 4* is not suggesting that fuel efficiency decreases as trucks age over time, but that newer model year trucks are inherently more fuel efficient. In fact, our discussions with industry experts and the data we obtained from our carriers suggests that over time, a truck's fuel efficiency will improve, as shown in *Graph 5*. For all trucks in our sample, regardless of model year, fuel economy on average increased by .024 MPG from 2007 to 2008 and by .058 MPG from 2008-2009. This result is likely driven by the aforementioned operational improvements undertaken by carriers over the past few years. As an example, we have heard that many fleets have reduced their maximum allowable speeds from 67 miles per hour (mph) to 65mph or from 65mph to 62mph. Taken together, *Graphs 4 and 5* suggest that older model year trucks are less fuel efficient than newer model year trucks; however, over time, the Sampled Carriers have been able to improve fuel efficiency across all of their trucks, irrespective of model year/age of truck. Our view is that these improvements are the result of operational changes.



Source: Keystone analysis based on 2007 - 2009 data provided by five trucking fleets

Given our earlier discussion of the many factors that impact fuel economy, it is not possible to link any/all MPG improvement to the age of the truck, but it is fair to say that based on our data set, on average, the newer model year trucks get better fuel economy. We also looked at the average MPG for the 2010 trucks in our sample data compared to all pre-2010 trucks in our data set, as shown in *Graph 6*. Even with the decrease in MPG during a truck's break-in period, the Sampled Carriers experienced better fuel efficiency (a 5.8% improvement)



Source: Keystone analysis based on 2009 data provided by five trucking fleets

with their 2010 trucks compared to their pre-2010 trucks. This is consistent with the anticipated fuel economy improvement range discussed above.

Impact of New 2010 Engines

The Environmental Protection Agency's (EPA) 2010 diesel engine emissions standards require manufacturers to further reduce the amount of nitrogen oxide (NOx) that is emitted. To comply with these emissions standards, most engine manufacturers (i.e., Cummins, Detroit Diesel, Paccar, and Volvo/Mack) are employing selective catalytic reduction (SCR), an aftertreatment technology that works in conjunction with exhaust gas recirculation (EGR) to reduce NOx emissions to the prescribed level. As a result of the EPA's standards, harmful emissions (i.e., NOx and particulate matter) for new diesel engines in 2010 will be nearly zero. (Quixote Group, 2008)

Manufacturers utilizing SCR claim the system will deliver a 3-5% improvement in fuel economy compared to 2007-compliant engines. The simple reasoning for this improvement is that SCR allows the engine to operate at a more optimal combustion temperature, which translates into more power and increased fuel efficiency. The tradeoff is that SCR requires a separate urea-based liquid known as Diesel Exhaust Fluid (DEF), or AdBlue in Europe, which must be stored in a separate tank on the truck. (Leavitt, 2008) This presents fleets with additional costs associated with the price and availability of DEF, the weight of the DEF tank and SCR system, and additional maintenance costs associated with the SCR system. Due to limited data available from carriers, it is not yet clear whether or not these costs will be offset by fuel economy savings over the lifetime of the truck. If not, fleets upgrading to new EPA 2010 engines will actually face a net cost increase.

Financial Benefits of a New vs. Old Truck

The prior sections discuss some of the more obvious and larger costs associated with operating and maintaining an older fleet versus new equipment. However, in order to fully understand the financial impacts of that decision, it is important to note a few more items:

- New costs that are associated with many of the new 2010 EPA compliant engines
- Typical costs associated with starting up a new truck and disposing of an old one
- Intangible benefits of owning a newer fleet

New Costs Related to the Selective Catalytic Reduction (SCR) System

As previously discussed, a key material used in the SCR system is DEF. Discussions with industry experts as well as engine OEM's suggest that the ratio of DEF consumed to fuel consumed will range from 2-3% depending on driving conditions, or said another way, anywhere from one to one-and-a-half gallons of DEF fluid for every 50 gallons of fuel. For the purposes of this paper, we have assumed a 2.5% mixture rate.

When purchased at any of the more than 5,000 retail locations throughout the country today, American Petroleum Institute-certified DEF can cost anywhere from $5-10/pre-packaged gallon and around $2.80/gallon when purchased in bulk. Our discussions with carriers, OEM's, and other 3rd parties suggest that DEF is expected to become more widely distributed as carriers upgrade their fleets to EPA

2010 compliant trucks and thus increase demand for DEF. For instance, travel centers have announced that they will add DEF bulk island filling stations as they remodel or build out new locations, and carriers plan to install DEF pumps at their terminals. As the distribution network for DEF expands in the coming years, its price is expected to stabilize and remain close to or under the price of diesel fuel. (Doran, 2010) Therefore, for the purposes of our analysis, we have used the DEF bulk price of $2.80/gallon.

Finally, generally speaking, the SCR system comes only with a standard one-year warranty. As a result, it is logical to expect new maintenance costs related to the replacement of the various pumps and sensors that make up the SCR system. While it is unknown how much maintenance will actually be required, the cost of a pump can be a few hundred dollars while the sensors can be significantly more than that. One industry expert felt he could easily justify a cost of $500 to $1,000 over the life of a truck. We assumed $250/year of maintenance-related expenses after the first year of operation.

Costs to Prep a New and Old Truck

When a new truck is purchased, a number of items need to be completed to prepare it for the road. Depending on the specification of the truck when it arrives, some of these may be: attaching decals, installing certain carrier-specific systems, installing auxiliary power units, etc. The costs associated with these preparations are estimated to be anywhere from a few hundred dollars to a few thousand. For the purposes of this effort, we have assumed that most accessories will already come installed with the new equipment. As a result, we have assumed a modest $500 per new truck.

In addition to prepping a new truck for the road, there are also a number of one-time costs associated with cleaning up an old truck to get it ready for a trade or sale. Most of these items are focused on body repair, such as finally fixing a "ding" on the bumper. While these costs can vary, one carrier said it typically plans for an average expense of $1,500 per truck for this type of work.

Intangible Benefits

The trucking industry is known for having very high turnover levels with many companies experiencing 80-100% turnover of their drivers on an annual basis. This obviously has a cost, which can be minimized if carriers can improve driver retention. Although we were unable to obtain any quantitative data to support their claims, many in the industry believe a newer fleet does a great deal to improve driver retention. Recruiting drivers requires advertising, orientation and its associated hotel, travel and per diem costs, drug testing, sign-on bonuses in some instances, and other general recruiting expenses. For one particular carrier we worked with, the recruiting cost per driver brought on board was approximately $5,000 (not including overhead costs, allocations for use of facilities, phones, office supplies, etc.). For that carrier, a 10% reduction in driver turnover alone was worth an estimated $325,000 per year EBITDA improvement. So if having a newer fleet of trucks increases the success rate of bringing candidates into the fold, and then helps retain those drivers who make it through orientation, the financial impact of a newer fleet of trucks on recruiting costs can be very meaningful. However, based on our discussions with carriers, it is difficult to accurately quantify the specific improvement in driver retention based on a newer fleet of trucks alone.

Similarly, many in the industry also believe a newer fleet is helpful in attracting and retaining *highly skilled* drivers. The rationale is that better drivers look for newer trucks, and those drivers tend to have fewer accidents and better on-the-road behavior and habits. As previously mentioned, better behavior typically translates into better efficiency on the road. Again, while a logical argument appears to exist, it is difficult to accurately quantify this benefit.

A final intangible benefit relates to fleet utilization, a metric that is measured in various ways throughout the industry (i.e., seated percentage, active percentage, etc.). Many of the carriers we interviewed believe newer trucks increase the overall utilization rate of the fleet. This is based on two assumptions. First, newer trucks require less maintenance and therefore spend less time in the shop and more time on the road. Second, as previously discussed, newer trucks attract more highly skilled drivers, which means trucks are less likely to stay parked because of a driver shortage or mistakes as a result of poor driving habits. This being said, while it seems reasonable to assume utilization will be higher for a newer fleet, we did not obtain consistent data to support a conclusion.

Taken together, these intangible benefits could lead to material financial benefits; however, financial analysis of these items is beyond the scope of this paper.

Financial Summary

The table on the next page summarizes certain financial benefits of operating a new truck vs. an average six-year-old truck based on our sample data. We have limited the financial analysis to changes in only the following:

1. Maintenance expense savings
2. Fuel expense savings (net of DEF costs)
3. Trade-in and new truck prep

We have not quantified the expected benefits of lower driver turnover, attracting a more highly skilled driver base, and higher equipment utilization. In addition, we have not assumed anything related to the estimated $6,000-10,000 increase in purchase price of a new truck (versus the purchase price of a new truck in prior years), including additional interest or depreciation, or any changes to the residual value of old or new trucks. We have limited our analysis to direct EBITDA impacts.

This table shows the resulting “margin” that is generated after taking into account the expected cost savings outlined above. This resulting margin can then be used to cover all remaining expenses associated with an operation (see footnotes in table). Many of the assumptions in the data below are based on our sample data and have been described in this white paper.

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Global Assumptions:

Total Miles/Tractor/Year	101,250	Diesel Exhaust Fluid (DEF) per Fuel	2.5%
Rate/Mile	$ 1.42	DEF Price/Gallon	$ 2.80
Net Fuel Price/Gallon[a]	$ 2.563		

	Avg. 66-mo. Old Truck[b]	New Truck Age (Months) 0-12	12-24	24-36	36-48	48-60	60-72	Comments
Annual Assumptions								
MPG improvement due to new equipment specifications	-	0.36	0.36	0.36	0.36	0.36	0.36	6% improvement over starting point
MPG % improvement due to new engine specs (SCR system)	-	97.5%	103.0%	103.0%	103.0%	103.0%	103.0%	MPG decline during first 50k miles, then an improvement of 3%
Resulting MPG	6.00	6.20	6.55	6.55	6.55	6.55	6.55	6.0 is average MPG of 2005 model year from sample data
Maintenance cost per mile (CPM)	$ 0.136	$ 0.021	$ 0.027	$ 0.044	$ 0.059	$ 0.087	$ 0.136	0.136 is average CPM of 2005 model year from sample data (avg '07-'09)
New maintenance cost of SCR system	$ -	$ -	$ 250	$ 250	$ 250	$ 250	$ 250	Assumption
Profitability of Truck								
Freight Revenue	$ 144,180	$ 144,180	$ 144,180	$ 144,180	$ 144,180	$ 144,180	$ 144,180	Calculation
Fuel Expense	43,250	41,848	39,613	39,613	39,613	39,613	39,613	Calculation
Diesel Exhaust Fluid Expense		1,143	1,082	1,082	1,082	1,082	1,082	Calculation
Maintenance[c]	13,792	2,087	2,995	4,720	6,267	9,010	14,042	Calculation
Cost of New Truck Prep[d]	-	500	-	-	-	-	-	Assumption
Cost to Prep Old Truck for Trade/Sale[d]	-	1,500	-	-	-	-	-	Assumption
Total Expenses	57,042	47,078	43,690	45,415	46,962	49,706	54,737	
Margin to Cover All Other Expenses[e]	$ 87,138	$ 97,102	$ 100,490	$ 98,765	$ 97,218	$ 94,474	$ 89,443	
Margin Improvement Over 2005 Truck	***$ -***	***$ 9,964***	***$ 13,352***	***$ 11,627***	***$ 10,080***	***$ 7,336***	***$ 2,305***	

1 $10k - $13k

3

4

(a) DOE less rebates, plus tax.

(b) Based on 2005 model year truck, which we estimate was on average 66 months old during 2009.

(c) The components of the maintenance expense line item can vary from company to company.

(d) Some companies capitalize the new truck prep costs and net the old truck prep costs against the gain/loss on the sale. If this was the case, it would be excluded from the above analysis.

(e) All Other Expenses includes any line items not identified above and can vary among companies depending on what they include in their maintenance expenses. It typically includes costs such as: non-mechanic wages, salaries, benefits, non-maintenance operations, insurance & claims, communication & utilities, operating taxes & licenses, general & administrative.

Based on the financial model above, there are a few key findings (see red numbered circles):

1. In each of the first two years, the margin improvement for a 0-24-month-old truck vs. a 66-month-old truck (2005 model year) is approximately between $10,000 and $13,000.
2. The margin improvement realized from a new truck in year one is negatively impacted by lower MPG associated with the truck's break-in period as well as the costs associated with the prep work for new and old trucks (see footnote "d" above).
3. The margin improvement realized from a new truck vs. a constant 60-72-month-old truck peaks in year two and falls in subsequent years due to the increasing maintenance CPM.
4. A new truck in months 60-72 delivers a higher margin than a 60-72-month-old truck today. This is largely a function of improved MPG offset by the additional costs associated with the new truck's SCR system.

Conclusion

The recent economic crisis forced many carriers to make significant changes to their overall operating cost structure. However, many of those cost reductions have been offset by increased expenses associated with maintaining an aging fleet of trucks. As the economy begins to rebound, many carriers who have been forced to let their fleets age are looking forward to upgrading their equipment. While there are both tangible and intangible benefits to consider, the seven Sampled Carriers in our study experienced maintenance CPM and fuel economy benefits that suggest operating a newer fleet of trucks is more profitable than operating an older fleet of trucks.

About the Authors

The Keystone Group is a management consulting firm headquartered in Chicago with offices in Dallas and Atlanta. Keystone works with middle-market manufacturers, distributors, and trucking companies across three main service lines: turnaround/profit-improvement, mergers & acquisitions, and strategy & operations. Christophe Jeannin is a Director at Keystone with over 20 years of consulting and industry experience. Joseph Zito is a Senior Principal with over 13 years of consulting experience. Brian Marks recently joined the firm as an Analyst.

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