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TECHNICAL PAPER

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LET'S TALK TRUCKING: TRUCKS AND TRAILERS IN USE IN THE SOUTH[1]

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Fifteen different mills were visited to sample the truck population. Sites were chosen close to state lines where possible, to increase the number of states represented in the sample. Sites were also chosen based on the primary product delivered.

Truck and trailer data collected at each location included the truck model and make; engine make and horsepower; number and capacity of fuel tanks; trailer make, model, type (double bunk, folding pole, drop neck, or double bunk with drop center) and whether it was single- or double-frame; the species and length of product hauled; the empty and loaded weights; use of aluminum components; number of drive axles and whether the truck had a "sleeper." Measurements were also taken to determine the wheelbase for the truck and trailer, kingpin offset and overall length.

Information for the 527 trucks on which complete information was available are summarized in ***Table 1.*** Mack and Kenworth were the most popular makes of truck, and two Peterbilts, a 1966 and a 1971, were the oldest trucks operating.

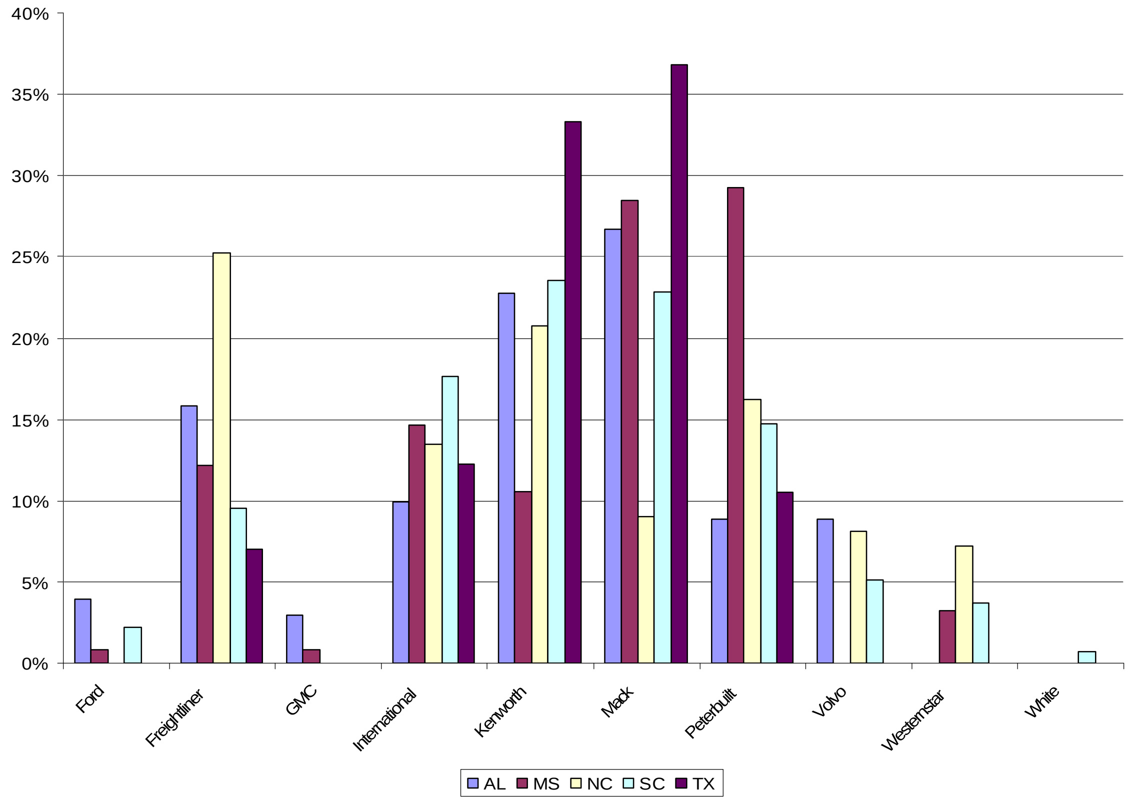
Table 1. *Truck make and number by make with the averages for age, horsepower and tare weight.*

Make	Number	Age (yrs.)	Horsepower	Tare Weight (lbs.)
Ford	8	15	359	30,085
Freightliner	76	11	398	29,405
GMC	4	16	325	29,360
International	74	12	390	29,247
Kenworth	110	8	441	29,638
Mack	124	8	402	28,946
Peterbilt	89	10	440	29,950
Volvo	25	12	395	29,806
Westernstar	17	8	455	30,514
White	1	13	400	28,480

[1] This is the first in a series of five articles written from research conducted at Auburn University during 2004 on ways to improve the productivity, efficiency, safety and costs of the trucking operation associated with logging. For more information on this research study, please contact Tom Gallagher at tgallagher@auburn.edu . The research was funded by the Wood Supply Research Institute (WSRI). For more information on WSRI, contact Jim Fendig at fendig@bellsouth.net.

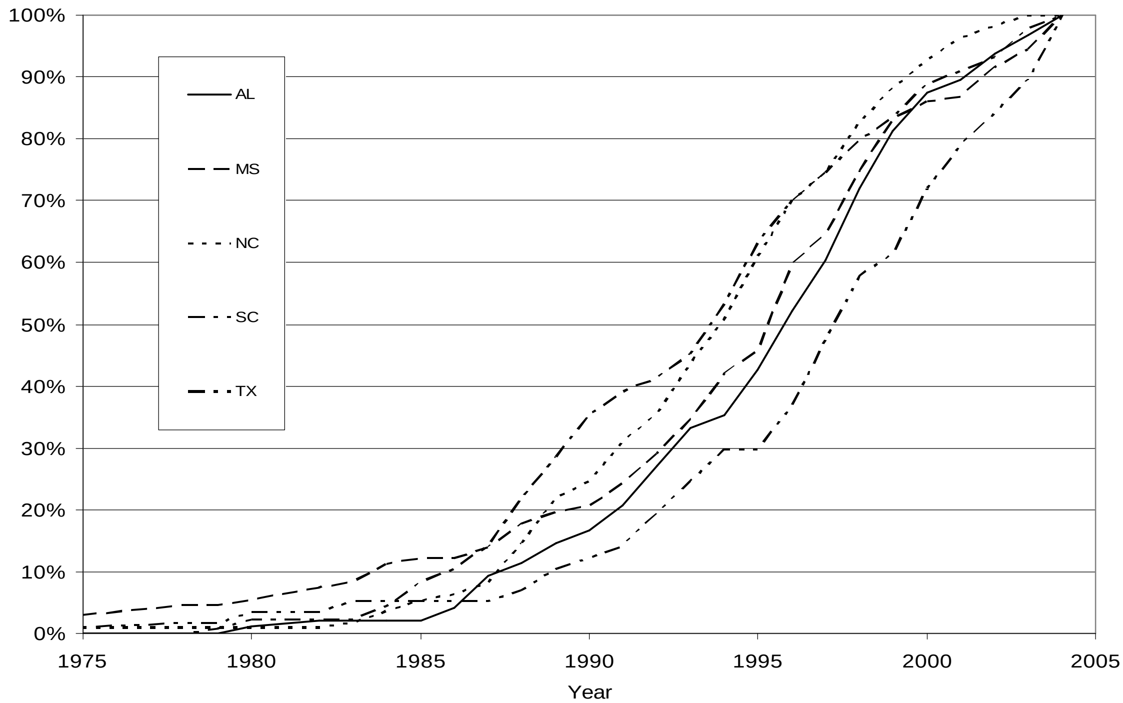
Truck makes by state are depicted in ***Figure 1.*** Half of the trucks in the Alabama region were Mack (27%) and Kenworth (23%). In the Mississippi region Peterbilt (29%) and Mack (28%) were the most common. The Texas region showed the strongest preference for a particular brand with Mack (37%) and Kenworth (33%) accounting for 70% of the trucks sampled. Truck choice was more evenly distributed in the Carolina regions; however Freightliner (25%) and Kenworth (21%) were the most popular in the North Carolina region while Kenworth (24%) and Mack (23%) were the most common in the South Carolina region.

Figure 1. *Truck make by region.*



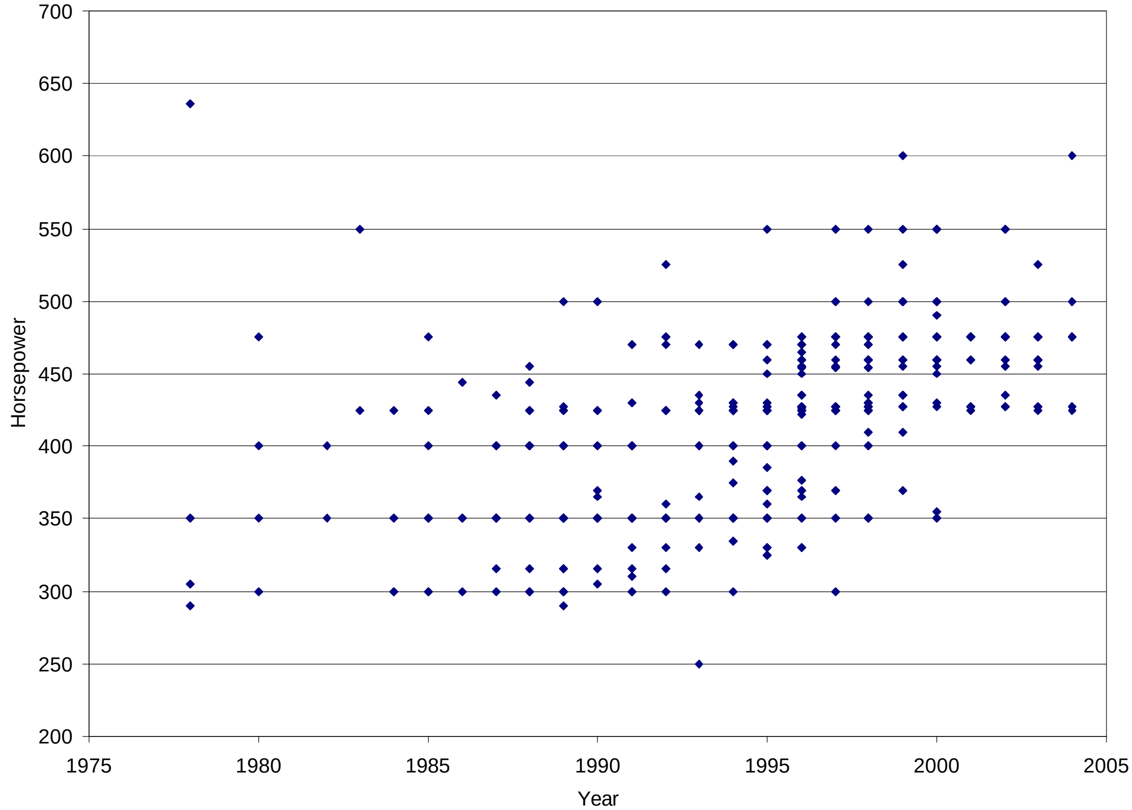
Truck age by state is shown in ***Figure 2.*** The lines indicate the cumulative percent by year for each region. As an example, the South Carolina region line crosses the 60% horizontal grid line at 1995 indicating that 60% of the sampled trucks are 1995 model or older and 40% are newer than 1995, compared to the Texas region where 40% of the trucks are 2000 model or newer (60% are 1999 or older). The further the line is to the right, the newer the truck fleet; so, the Texas region has the highest percentage of newer trucks. The bottom of the line shows that the Mississippi region has the most old trucks, but looking at trucks that are 15 or more years old (1989 model and previous) the South Carolina region had the most with 29%; followed by North Carolina, 22%; Mississippi, 20%; Alabama, 15%; and Texas, 11%.

Figure 2. *Percentage of the truck fleet older than a given year model by region.*



Horsepower is plotted against model year in ***Figure 3.*** Other than a 1993 Mack with 250 horsepower, the minimum acceptable horsepower seems to be about 300. There was a significant trend toward larger engines for later model trucks, with the minimum engine size after 2000 being 427 horsepower, and two of the newer trucks had 600 horsepower engines. One driver reported having a 638 horsepower Cummins engine in his 1978 Peterbilt truck which was significantly larger than any of the other older models.

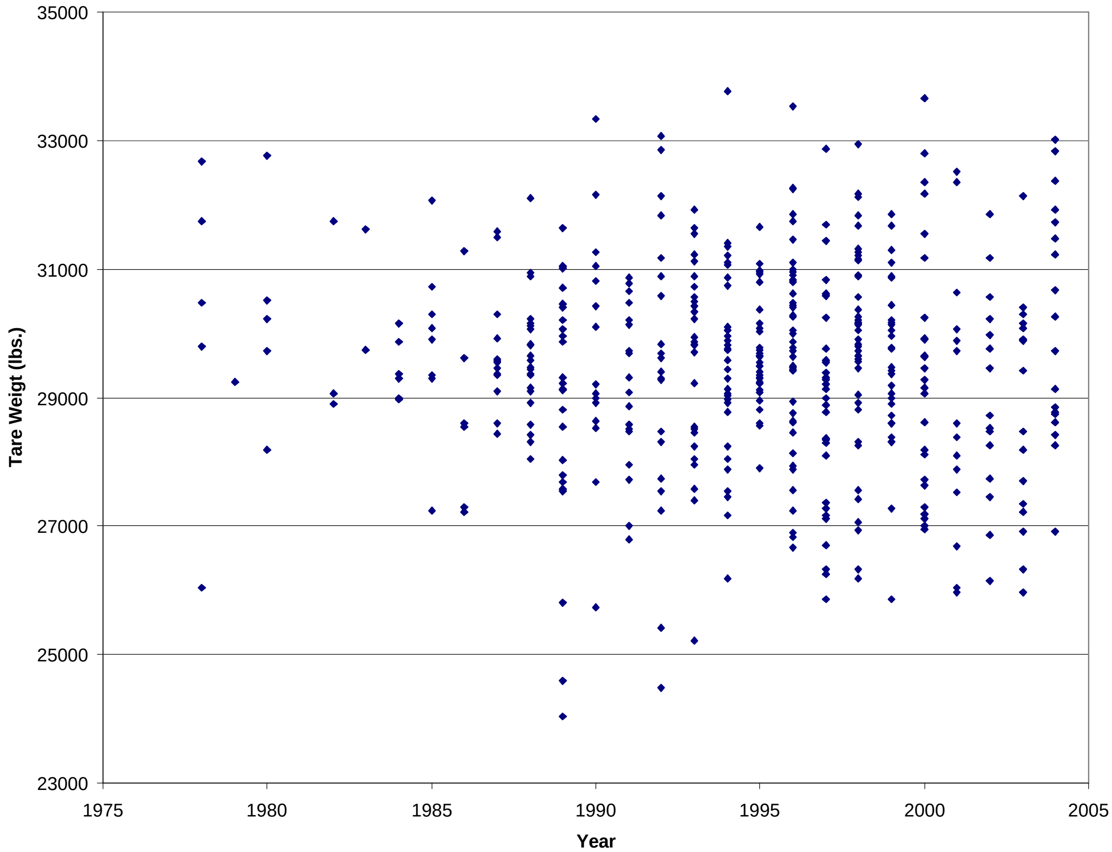
Figure 3. *Truck engine horsepower by truck age.*



Tare weight for the combination truck and trailer by year are shown in ***Figure 4.*** There is a slight trend toward lighter weight rigs for newer trucks, but that trend is not significant. The lightest combination weight was 24,040 pounds for a 1989 International truck with a 290 horsepower Cummins engine and a 1980 double bunk JCL trailer. The truck had an aluminum bumper and cab, but it was also equipped with a "sleeper." Two other combinations also weighed less than 25,000 pounds. One was a 1992 Mack with a 350 Hp engine and a 1979 Kent double bunk trailer. The other was a 1989 Kenworth with a Cummins 350 Hp engine pulling a 1998 Big John pole trailer. There were eight other rigs weighing less than 26,000 pounds, and each of them was pulling a pole trailer.

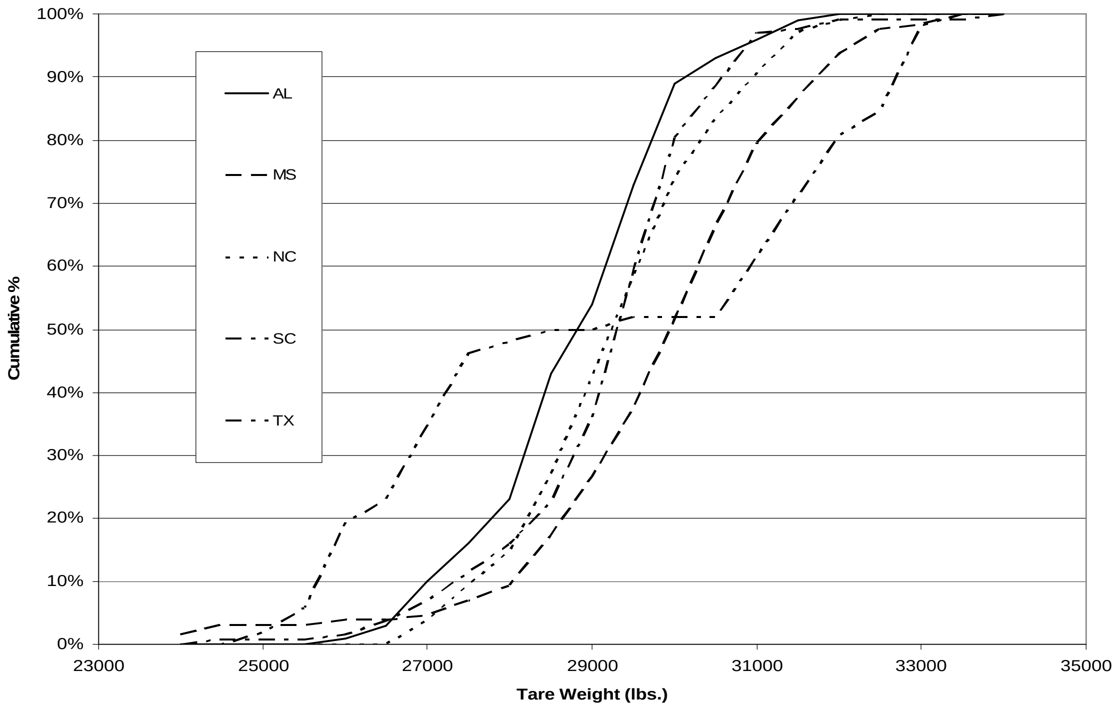
The heaviest empty combined weight was 33,760 pounds for 1994 Kenworth with a 430 Hp Detroit engine and a 1969 Evans double bunk trailer. There were six rigs that weighed more than 33,000 pounds. All of them had engines with 400 Hp or larger and pulled double bunk trailers.

Figure 4. *Tare weight in pounds by truck model.*



Tare weights by state are shown in ***Figure 5****.* This plot, as for ***Figure 2***, is a cumulative percent by tare weight; however, unlike ***Figure 2***, a lower tare weight is better so curves shifted to the left are better than those to the right. Interestingly, Texas, which averaged in the middle, had the most light trucks, half weighing less than 28,500 pounds, and also the heaviest trucks, with 48% weighing more than 30,500. Of the 52 trucks for which data were available, 24 of the half weighing less than 28,500 pounds had pole trailers, and 24 out of the heaviest 26 had double bunk trailers. The Mississippi region overall had the heaviest trucks, but also had more light trucks, with 4 rigs weighing less than 24,500 pounds, and these trucks were pulling double bunk trailers, not pole trailers. Overall, the Alabama region had the lightest tare weights.

Figure 5. *Percentage of trucks in a region with a tare weight less than that shown on the x-axis.*



One of the objectives of the study was to identify the use of light-weight components. Thirty-five percent of the trucks in the study had an aluminum bumper, which was more common in the Alabama (43%) and North Carolina (43%) regions and less so in the Mississippi region (24%). Aluminum or fiberglass cabs were prevalent (73% of the trucks), with the widest use in the North Carolina region (97%). Fifty-nine percent of the trucks in the study had aluminum wheels, with the most in the Texas region (93%) and the least in the Alabama region (36%). Aluminum headache racks were also popular (71%) with the most in the North Carolina region (90%) and the least in the Texas region (53%). Sleepers were identified on 26% of the trucks in the study, being most common in the North Carolina (41%) and Alabama (37%) regions, with fewer than 20% in the other regions. In the North Carolina region 14 of the 17 heaviest trucks were equipped with sleepers, and only 4 of the lightest 36 had sleepers. In the Alabama region, 8 of the 12 heaviest trucks had sleepers, and only 4 of the lightest 30 had sleepers. Only 3% of the trucks had one fuel tank, and the other 97% had two fuel tanks.

Loaded gross vehicle weights for more than half the loads in each region were heavier than 80,000 pounds and in the Texas (58%) and Mississippi (54%) regions more than half the loads were heavier than 82,000 pounds. The South Carolina region had the lightest loads, and the Mississippi region had the heaviest loads, with 2% over 100,000 pounds and a maximum weight of 112,780 pounds. The majority of the load weights ranged from 77,000 to 85,000 pounds: Mississippi, 69%; North Carolina, 68%; South Carolina, 60%; Texas, 58%; and Alabama, 51% (which has a legal weight of 80,000 pounds but a 10% tolerance; so, overweight tickets are not issued until the weight exceeds 88,000 pounds).

Truck wheelbase averaged 17.3 feet and ranged from 11.3 to 24.1 feet. Most (77%) of the trucks with a wheelbase longer than 20 feet also had a sleeper. Trailer wheelbase averaged 33.3 feet and ranged from 22.9 to 38.9 feet, but only 10% were shorter than 30 feet and 4.4% longer than 36 feet.

Information was also collected on the make, age and type of trailers being used to haul forest products. Thirty-eight different makes of trailers were identified. The most common listed in order were: Pitts, 30%; Evans, 18%, Big John, 8%; Magnolia, 7%; Shop built, 7%; Ottrailer, 5%; Sun, 4%; Kent, 4%; White, 4%; Viking, 3%; and Nabors, 2%. The other 27 brands accounted for the remaining 10%. Trailer model ranged from a vintage 1966 Pitts to a 2004 Pitts. Fifty-five percent of the trailers were 10 years old or less (1995 model or newer), and 5% were more than 25 years old (1978 model or older). Only 6% of the trailers were pole trailers (5% folding pole trailers and 1% pole trailers that did not fold). The majority of the trailers were double bunk trailers, and of the total, 10% were double bunk with a dropped center and 8% were double bunk with a dropped neck. Almost all of the modified double bunk trailers were 1991 model or newer; however, there were two older dropped center trailers, a 1980 model and a 1985 model. Seventy-eight percent of all loads were treelength, and only 18% were log length.

Cost Analysis

Using the Foothills Model Forest Log Transportation Cost Model, Blair (1999) conducted a sensitivity analysis to identify the factors that had the greatest potential for reducing overall hauling cost in Alberta, Canada. The parameters he identified, in order of importance, were payload, truck utilization, cycle time efficiency, labor cost, capital cost, and fuel consumption.

Mooney (2004) refers to a Finnish transportation expert as saying that reducing weight by a pound is cost effective if the expense is only \$3 to \$5 per pound more than the heavier component. At three trips per day for 230 days per year, one pound of additional payload would generate 0.345 tons. Assuming a three year payback period, the additional pound would generate an extra ton, and if trucking rates were \$3 to \$5 per ton; then, you could afford to pay the additional amount to reduce weight. Using this rationale you can substitute your numbers to determine the cost effectiveness.

Trucking costs were determined on a one-year, cash-flow basis using a spreadsheet to determine the factors with the most influence on trucking cost. Assumptions in the model were as follows. The purchase price for the truck was \$90,000 and the purchase price of the trailer was \$19,000. To account for the entire cost, it was assumed that the total price was financed for 48 months at 7.5% interest for a monthly payment of \$2,635.50. Insurance costs per year for the truck and trailer were assumed to be \$4,850 and taxes and tags at \$1,200 per year for a total annual fixed cost of \$37,676.00. The price of fuel was \$1.60 per gallon, and the initial mileage was assumed to be 4.5 mpg. Maintenance, repair and tire costs were estimated from numbers provided by a contractor. The annual amounts for the truck and trailer combined were \$2,300 for maintenance, \$4,720 for repairs, and \$5,250 for tires. The driver wage was \$12 per hour plus 30% for fringe benefits on all hours worked and overtime at \$18 per hour. The driver was scheduled to work 10 hours per day plus any extra to get another load if he could complete at least half of the trip during the scheduled hours. The total annual cash flow was \$115,023.74, and the largest categories were labor at 35%; payments, 27%; and fuel, 21%. Each of the other categories was 5% or less.

Truck production was based on the following assumptions. The truck was assumed to average 40 mph loaded and 45 mph empty and the one-way haul distance was 50 miles. The loading time was 21 minutes and the unloading time was 45 minutes. Based on these assumptions, the truck could make three loads per day during 10.4 hours. The average payload, based on the data collected, was 51,800 pounds.

The cost per ton, based on the previous assumptions was $6.44. If the number of months financed was increased to 60 months instead of 48, the annual cost decreases to $109,607 and the price per ton drops to $6.13. If fuel consumption could be improved by 10% to 4.95 mpg through driver training or truck improvements, the cost per ton would decrease to $6.31. If fuel costs increased by $0.15 per gallon (approximately 10%) the cost per ton would increase to $6.57, or a 2% increase.

If the haul distance were reduced to 35 miles, the driver could make an extra load per day by working 11 hours, and the cost per ton would drop to $4.89; a 24% cost reduction. If the haul distance remained 50 miles and the driver worked 13.84 hours he could get the fourth load, but because of the increased fuel and wages, the cost per ton would only decrease to $5.89, or an 8.5% reduction, and increased tire and repair cost would reduce these savings.

The best way to reduce hauling cost is to increase payload by reducing tare weight. Discussions with a truck manufacturer's representative produced specifications for two trucks, one typical to the logging industry and a second of the same model with lighter components (such as aluminum components, lighter axles, fixed fifth wheel, single fuel tank, etc.) but the same 400 Hp engine and 10-speed transmission. The total weight saved was 3,206 pounds and the lighter truck was a few dollars less expensive. Increasing payload weight by 3,200 pounds increased annual production to 18,975 tons from 17,871 tons and reduced the cost per ton to $6.06, a 5.9% savings.

Conclusions

The average truck age was 9.7 years. The cost analysis above assumed purchasing a new truck every 4 or 6 years. One of the best ways to reduce overall cost is to keep a piece of equipment longer than the payment period to spread the fixed cost over more years. Another way to reduce the fixed cost is to purchase used equipment.

Reducing tare weight will reduce the variable hauling cost per ton and, probably, the fixed cost as well (assuming the weight reduction is not overly expensive). Ninety-three trucks were purchased this decade (2000 to 2004), and were, probably, specified for hauling timber products (as opposed to "used" over-the-road trucks). However, there was no trend toward reduced tare weights, in fact, the average tare weight was 29,200 pounds with the average for each year approximately 29,000 pounds except for 2004 when the average was 30,165 pounds. Evidently there is a concern that lighter components will not stand up to use in the woods.

Reducing engine horsepower and travel speeds has the potential to reduce fuel consumption. For the 93 newer trucks, however, only three had less than 427 horsepower. It may be more economical to add gears as opposed to horsepower.

Tare weight could be reduced by switching from a double bunk to a folding pole trailer, which will increase payload, reduce fuel consumption and reduce maintenance and repair costs. Most (78%) of the loads were treelength material, but only 5% of the trailers were folding pole trailers. Other ways to reduce tare weight include replacing steel with aluminum components where cost effective, and carrying only the fuel needed for the day.