The Rural Technology Initiative
University of Washington
and
The Transportation Research Group
Washington State University

Report to the Washington State Legislature

The Washington Log Trucking Industry: Costs and Safety Analysis

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Acknowledgements

This report represents a synthesis of information and analysis provided from many sources. A comparable investigation of the log truck industry has never been undertaken in Washington. The work of the research team included a statewide survey of log trucking firms, review of scientific, government, and industry literature, interviews with government agency personnel, products venders, association representatives, and log truckers. Field visits were taken to log hauling operations. Members of the collaborative research team included Larry Mason, Research Scientist and Project Coordinator of the Rural Technology Initiative (RTI) at the College of Forest Resources (CFR), University of Washington (UW); Dr. Ken Casavant, Professor of Economics at the Transportation Research Group (TRG) School of Economic Sciences (SES), Washington State University (WSU); Bruce Lippke, Economics Professor at CFR UW and Director of RTI; Diem Nguyen, WSU Research Assistant and PhD. candidate; and Dr. Eric Jessup, Assistant Professor of Economics at the TRG SES WSU.

Critically important to the completion of this project were the countless conversations with log truck drivers, association representatives, government agency personnel, products venders and other timber industry professionals that provided information and professional insights regarding the business and safety of log hauling in Washington State.

A list of the most prominent information contributors presented in alphabetical order includes: Jerry Bonagofsky (Washington Contract Loggers Assn), Darin Burt (Log Trucker Magazine), Mike Crouse (Log Trucker Magazine), Jeff Dennis (Jeff Dennis Trucking), Rick Dunning (Washington Farm Forestry Assn), Jim Dynes (Kibble and Prentice), John Ehrenreich (Washington Forest Protection Assn), Art Farley (Washington Dept of Licensing), Dave Giles (Washington Dept of Transportation), Jon Green (Phelps Tire), Ted Hall (Kenworth NW), Rick Ham (Cummins NW), Wayne Hofer (NC Power Systems), Gary Irwin (Mattei Insurance Services), Craig Iskra (Washington Trucking Associations), Scot Kelsey (Michelin), Jim Murphy (Michelin), Roger Nafts (PacLease Kenworth), Jim Neilson (NW Log Truckers Cooperative), Bill Pickell (Washington Contract Loggers Assn), Dan Ramsey (Kenworth NW), Eddie Rauser (Washington Dept of Labor and Industries), Jonathan Reimer (Oregon Department of Transportation), Ken Rollins (NW Log Truckers Cooperative), Linda Shincke (Washington State Patrol), Doug Smith (Les Schwab), Thomas Smith (Washington Dept of Transportation), Ryan Spencer (Spencer Trucking), Peregrin Spielholz (Washington Dept of Labor and Industries), Bill Street (International Association of Machinists and Aerospace Workers), Pete Strom (Barry Swanson Trucking), Wayne Tuthill (NW Log Truckers Cooperative), Jim Wilhelm (Phelps Tire), Maurice Williamson (Williamson Consulting), Jeff Wimer (Oregon State University), Brett Whitaker (Whit-Log Inc.).

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Abstract

In 2007, the State Legislature requested scientists from the University of Washington and Washington State University undertake an investigation of the Washington log truck industry towards gaining better understanding of "the costs to safely provide log hauling services." No such study had previously been conducted in Washington. Deregulation of the trucking industry, rising fuel prices, declining wood markets, shortages of skilled drivers, increases in traffic congestion and other ensuing circumstances have added new operational pressures that could logically have safety implications for this historically dangerous industry. Safe and sustainable log hauling services are needed to support a significant Washington forest industry and to protect the traveling public. Review of the scientific, government, and industry literature was accompanied by interviews with government agency personnel, products venders, association representatives, log truckers, and other industry professionals. Field visits were taken to log hauling operations, a statewide survey of log truck companies in Washington was completed, and a cost of operations model was developed. Cost estimates were developed as baseline required expenses of log truck operation, regardless of company revenues.

From 2006 to 2008, operating expenses rose by 20 percent, largely as a result of increases in diesel fuel prices. For 2008, analysis indicates non-wage cost of operations should average $1.58 to $1.72 per mile. When average wage-related costs are included, total operation expenses can be expected to increase to between $2.46 and $2.98 per mile depending on wage assumptions, provision of overtime, and health insurance benefits. A review of gross revenues as reported by survey respondents reveals that some businesses may be struggling to meet cost of operations. It has been suggested that economic pressures could result in deferred maintenance and increased public safety hazard. No evidence was found to indicate an increase in collisions, injuries, or fatalities associated with log truck operations. By contrast, the accident record for log trucks compares very favorably with that of the broader population of state commercial carriers. However, a number of disturbing concerns were discovered that could challenge future safety performance. The issues of rising cost of operations, extended hours of service, an aging workforce, poor driver recruitment, increasingly congested roadways, and the influx of out-of-state trucks will need periodic review to monitor impacts.

Keywords: Log trucks, log haul, truck cost of operations, truck safety, timber industry, hours of service

Executive Summary

The Washington forest industry employs 45,000 people and annually generates $2 billion in wages, $16 billion in gross business revenues and over $100 million in tax receipts. Washington produces six billion board feet of lumber per year, one billion square feet of plywood panels, and seven million tons of pulp and paper products. Washington has the second largest lumber production in the nation and is fourth in production of both plywood and pulp and paper products. All of this activity is dependent upon the drivers and trucks that move raw logs from the woods to process facilities.

In 2007, the State Legislature requested that scientists from the University of Washington and Washington State University undertake an investigation of the Washington log truck industry towards gaining better understanding of "the costs to safely provide log hauling services." No such study had previously been conducted in Washington. Deregulation of the trucking industry, rising fuel prices, declining wood markets, shortages of skilled drivers, increases in traffic congestion and other ensuing circumstances have added new operational pressures that could logically have safety implications for this historically dangerous industry.

A review of scientific, government, and industry literature was accompanied by interviews with government agency personnel, products venders, association representatives, log truckers, and other industry professionals. Field visits were taken to log hauling operations, a statewide survey of log truck companies in Washington was completed, and a cost of operations model was developed.

Cost of operations

First, all estimated costs, other than wages, of operating a log truck for a single truck company operating a 1998 tractor and a multiple truck company operating a new tractor, based upon average 2006 fuel prices as reported by trucking survey respondents ($2.74 per gallon) are developed. Second, we present operations costs for both company type examples with a current approximated average fuel price for Washington for June 12, 2008 ($4.91 per gallon). In the period from 2006 to June 2008 the price of diesel fuel had increased by 79%. Two different operational scenarios were developed to show cost differences relative to company size, equipment age, and increases in fuel prices. Cost estimates are to be considered as baseline required expenses of log truck operation regardless of company revenues. Estimates are for average road conditions of 17 percent gravel and 83 percent pavement.

Non-wage cost of operations for single and multiple truck companies; 2006 and 2008

	Single Truck Company			Multiple Truck Company		
	2006	**2008**	**% change**	**2006**	**2008**	**% change**
Fixed cost/mile	$0.30	$0.30	0.0%	$0.53	$0.53	0.0%
Variable cost/mile	$0.85	$1.28	51.6%	$0.75	$1.19	57.9%
Total cost/mile	$1.14	$1.58	38.1%	$1.28	$1.72	34.0%
Fixed cost/ton	$1.14	$1.14	0.0%	$2.35	$2.35	0.0%
Variable cost/ton	$3.23	$4.89	51.6%	$3.35	$5.28	57.9%
Total cost/ton	$4.37	$6.03	38.1%	$5.70	$7.64	34.0%
Fixed cost/hour	$6.46	$6.46	0.0%	$11.96	$11.96	0.0%
Variable cost/hour	$18.28	$27.72	51.6%	$17.02	$26.87	57.9%
Total cost/hour	$24.75	$34.19	38.1%	$28.98	$38.84	34.0%

A full accounting of the cost of operations would not be complete without consideration of wages and wage-related costs. Surveyed companies and interviewed truckers were asked about compensation. Log hauling companies in Washington with employed drivers utilize two primary approaches for compensation; some drivers are paid an hourly wage and others are paid on a percentage of the truck daily gross revenue. Analysis of survey response data indicates that truck drivers receive either an average wage of $16.09 per hour or are paid based upon an average of 32.0% of the gross revenue for the truck.

In order to offer a representative range of the full cost of operations of a log truck for each company example as developed for non-wage cost estimates presented above, we provided one low-cost scenario (A) in which we use the suggested hourly wage of $16.09 but consider this as a flat rate in lieu of over-time and do not include health insurance benefits. In the high-cost scenario (B), we model as for more conventional businesses and use the suggested hourly wage for the first 40 hours per week but increase to $24.14 ("time-and-a-half") for over-time hours in excess of 40 hours per week. For the high-cost scenario, we also include estimated costs of health insurance for driver and spouse. Employee-related costs such as social security, industrial insurance, and drug test charges are also included. Employment benefits such as retirement plans and paid vacations were not included in this analysis but, if provided, would increase costs of benefits.

Cost of operations for single (1A) and multiple (2A) truck companies with wage-related costs *excluding* overtime and benefits; 2006 and 2008.

	Single Truck Company - 1A			Multiple Truck Company - 2A		
	2006	**2008**	**% change**	**2006**	**2008**	**% change**
Fixed cost/mile	$0.30	$0.30	0%	$0.53	$0.53	0%
Variable cost/mile	$1.72	$2.16	25%	$1.68	$2.12	26%
Total cost/mile	$2.02	$2.46	22%	$2.22	$2.65	20%
Fixed cost/ton	$1.15	$1.15	0%	$2.37	$2.37	0%
Variable cost/ton	$6.56	$8.23	25%	$7.47	$9.41	26%
Total cost/ton	$7.71	$9.38	22%	$9.84	$11.78	20%
Fixed cost/hour	$6.53	$6.53	0%	$12.03	$12.03	0%
Variable cost/hour	$37.19	$46.63	25%	$38.01	$47.86	26%
Total cost/hour	$43.72	$53.16	22%	$50.04	$59.89	20%

Cost of operations for single (1B) and multiple (2B) truck companies with wage-related costs *<u>including</u>* overtime and health insurance benefits; 2006 and 2008.

	Single Truck Company - 1B			Multiple Truck Company - 2B		
	2006	**2008**	**% change**	**2006**	**2008**	**% change**
Fixed cost/mile	$0.46	$0.48	6%	$0.67	$0.70	4%
Variable cost/mile	$1.90	$2.34	23%	$1.85	$2.28	24%
Total cost/mile	$2.36	$2.83	20%	$2.52	$2.98	18%
Fixed cost/ton	$1.75	$1.85	6%	$3.00	$3.10	4%
Variable cost/ton	$7.26	$8.93	23%	$8.20	$10.14	24%
Total cost/ton	$9.01	$10.78	20%	$11.20	$13.24	18%
Fixed cost/hour	$9.89	$10.47	6%	$15.24	$15.79	4%
Variable cost/hour	$41.17	$50.61	23%	$41.69	$51.55	24%
Total cost/hour	$51.07	$61.08	20%	$56.93	$67.33	18%

Cost of operations compared to average reported gross revenues

The average 2006 gross revenue per truck for a log trucking company in Washington, as reported by 103 survey respondents, was $137,775. A comparison of this gross return to simulations of cost of operations for 2006 suggests that average revenues for log truck companies were marginally equivalent to our lowest estimate of full cost of operations as modeled for the 2006 owner-operator scenario (1A; without overtime or benefits). Analysis of the distribution of survey-reported gross revenues suggests that about half of respondent companies were operating log trucks with revenues below estimated minimum cost of full-time operations. In contrast, less than six percent of survey respondents reported gross earnings that exceeded the simulated 2006 high cost of operations (2B) for a new truck with a driver that received $16.09 per hour with over time and health insurance benefits.

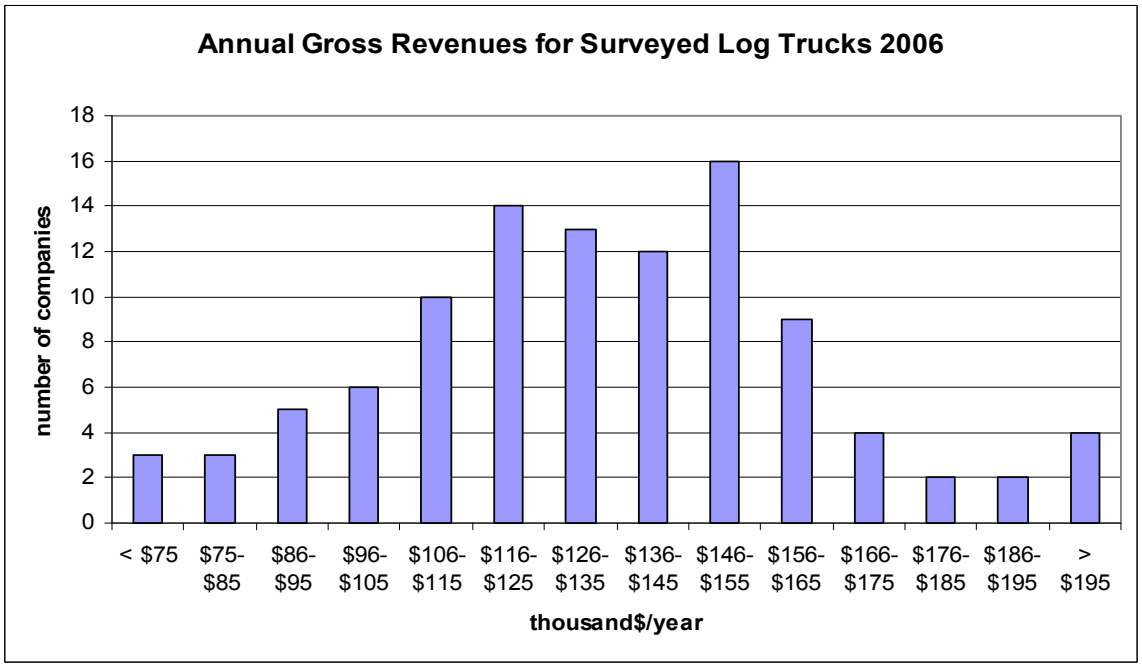
Log truck survey results for 2006 annual gross truck revenues.

	Average	*Median*	*Min*	*Max*
Annual Truck Gross 2006	$137,775	$134,198	$42,000	$232,910

Summary comparison of modeled total annual operation costs and fuel costs for 2006 to 2008. Ranges reflect low (self-employed driver: older truck with no overtime or benefits) to high (employed driver: new truck with overtime and benefits). Base wage = $16.09/hr.

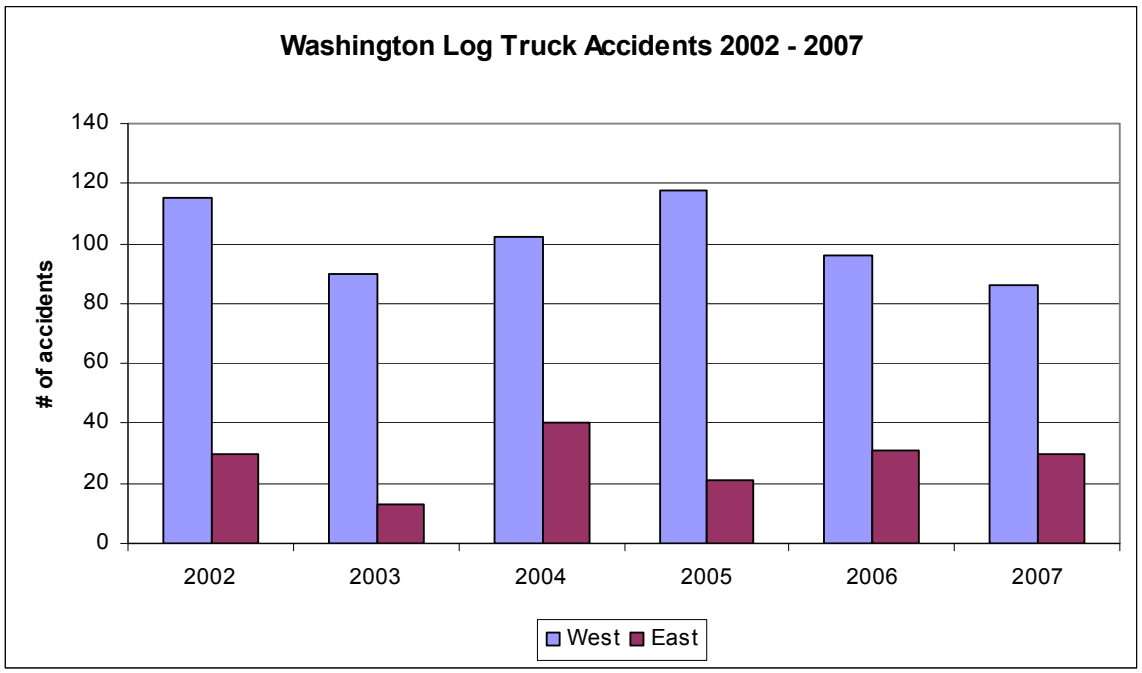
	Low Costs of Operation		**Percent**
	2006	**2008**	**Increase**
Total Cost	**$133,721.90**	**$162,592.71**	**21.6%**
Fuel Cost	**$35,524.37**	**$63,658.63**	**79.2%**

	High Costs of Operation		**Percent**
	2006	**2008**	**Increase**
Total Cost	**$179,524.23**	**$212,321.64**	**18.3%**
Fuel Cost	**$38,253.62**	**$68,549.38**	**79.2%**



Safety

Analysis of accident data provided by the Washington State Patrol and the Washington Department of Transportation for all collisions involving log trucks for years 2002 through 2007 showed no trend of increasing safety hazard to warrant public concern. WA accidents involving log trucks declined by 11% from 2004 to 2006 while collisions of all state commercial carriers increased by 15% during the same period. A review of WA Department of Labor and Industries data for on-the-job injuries and fatalities of log truck drivers also showed no trend indicating increase.



While the accident record of the Washington log trucking industry shows no apparent trends to indicate increased collision, injury, or fatality incidence, this investigation uncovered a number of concerns that could challenge future safety performance and economic viability of log truck operations. Trucking issues such as deregulation, rising cost of operations, extended hours of service, an aging workforce, poor driver recruitment, and increases in roadway congestion have been linked by prior research to declines in the safety performance of commercial carriers. The current influx of out-of-state trucks log trucks providing hauling services within Washington is a new issue with uncertain safety and economic implications. Public health impacts associated with diesel exhaust exposure represent an emerging safety concern with potential to increase cost of operations.

Survey results

The following information was developed from averaged results of a statewide survey of the log truck industry to which 129 companies operating 336 trucks responded. 64% of respondents reported operation west of the Cascades, 13% east of the Cascades, and 23% operated statewide.

Demographics – The average age of a log trucker is 55 years. The average experience in log truck operation spans 27 years. The majority of log hauling companies (64%) are owner-driver operations with a single truck and trailer. The average company has been in business for 21 years. The average truck is a 1990's model six-axle "long logger" that can travel about five miles on a gallon of diesel fuel. The average log truck has a gross legal weight limit of 88,000 lbs. with a net payload potential of 58,835 lbs. Logs are hauled an average of 12.2 hrs/day for 5.1 days/wk with 6.8 hrs/wk required for maintenance. The average work week was 69 hours. Three loads of logs are delivered daily. The average one-way distance from point of loading to point of delivery is 67.4 miles of which 17% are traveled on gravel and 83% are traveled on pavement. Logs are hauled 42 wks/yr with 5.7 wks/yr lost to fire season, road closures and other seasonal constraints and 1.7 wks/yr lost for equipment breakdowns. The average log truck driver hauled logs more than 66,000 miles in 2006 and earned $33,404 in personal income.

Safety – Survey respondents overwhelmingly (89%) indicated that traffic and road conditions are considered to be the most dangerous parts of their jobs. Only 11% of drivers felt that the loading and unloading of logs presented the greatest danger. Seventy-six % of respondents felt that Washington paved roadways are in worse condition today as compared to 10 years ago. 99% indicated that traffic is worse today. Respondents report an average of 21.3 stops per year for weight and equipment inspections with each stop lasting 25 minutes. Seventy-five % of respondents report getting voluntary annual equipment inspections for their log trucks with 50% reporting that voluntary inspections help to reduce time lost for road checks. While survey responses suggest that many log truck drivers regularly operate beyond legal hours of service, no evidence was found to indicate that such practice resulted in unsafe log truck operation.

Implications for the future – Eighty-seven % of respondents report that it is very difficult to find and keep skilled truck drivers and 99% report that skilled drivers are harder to find today than 10 years ago. An analysis of WA Department of Licensing data revealed that the number of log trucks registered in Washington has declined by 36% from 2059 trucks in 1998 to 1325 trucks in 2006. Survey responses (2006) show 28% of log hauling companies lost money, 50% broke even, and 21% reported making a profit. By 2008, the price of fuel had increased by 79% and the total cost of operations increased by 20%. Thirty-five % of respondents reported plans to make equipment purchases within the next five years, while 65% indicated that no investment was anticipated. Thirty-eight % of respondents reported plans to retire or otherwise leave the industry, 36% reported plans to stay the same, 13% expected to diversify to other trucking industry, 12% intend to downsize, and 1% plan to expand hauling operations. When asked to rate the business environment in Washington for the log hauling industry, 83% of respondents reported poor, 17% said average, and 0% selected good.

Summary comments and recommendations

Log trucking in Washington has always been a uniquely independent and small-operator-dominated industry. In the early years when contract "gyppo" truckers were first displacing the railroads as the main form of wood transport, there were no standardized haul rates or safety practices. By the late 1930's, however, state trucking regulations were being established. For decades the relationships between cost of operation and revenue per unit output were effectively stabilized by state regulations that controlled entry, set haul rates, and established safety standards. However, since 1995 and federal deregulation of the trucking industry, this has no longer been the case. This investigation found evidence of highly variable current haul rate arrangements that have resulted in many companies operating below cost of operations. Constrained revenues to log trucking companies come at a time of unprecedented fuel price increases with unstable economics contributing to declines in the number of Washington log truck companies and an inability of the industry to recruit young drivers. While our analysis of accident records reveals that, in spite of economic challenges, the log hauling industry is comparatively safe relative to the performance of the broader population of commercial carriers, safety does not translate to economic viability. There is ample evidence to suggest that the sustainability of log trucking businesses is in question and such uncertainty is a legitimate matter for private and public concern. Economic viability comes from the actual relationship between private cost of operation and revenue to the trucking firm. We hope that the results of this investigation will prove useful to both buyers and sellers of hauling services by helping to inform contract discussions. Survey results indicate that many log truckers would like to see re-imposition of state-regulated haul rates. A review of the relevant laws leads to a conclusion that federal deregulation of trucking precludes such possibility. However, our investigation has identified two potential state legislative opportunities to provide relief for log trucking companies that may be worthy of consideration.

Business and Occupation Taxes - The Washington Business and Occupation Tax (B&O Tax) is calculated at 1.926 percent of gross revenues. Depending upon costs simulation scenario, we estimate that B&O Taxes will add $3,072 to $4,012 to cost of operations for log hauling companies in 2008. B&O Taxes associated with fuel and wages account for 70% to 79% of the total B&O Tax responsibility. From 2006 to 2008, although loads of logs hauled remained constant, the B&O Tax payment, for log trucking companies, increased by about 20 percent. B&O Taxes add to cost burdens for log hauling businesses with fixed levels of productivity that struggle to accommodate increasing fuel and wage-related costs. B&O Taxes, as currently levied, affect employees by lowering company profitability and serving as a disincentive for employers to provide better wages and benefits. Relief from B&O Taxes could be helpful to many Washington businesses but would be especially beneficial to fuel-intensive transportation industries.

Equipment options to reduce costs and increase safety - Great strides in emissions reduction equipment development have been made by manufacturers but acceptance and investment lag potential. Heavy trucks of 2007 vintage or newer are equipped with exhaust systems that allow very low emissions of fine particulates and other pollutants. This is not the case for older trucks. Since diesel engines can provide a million miles or more of service it could take decades to significantly reduce the adverse effects of diesel exhaust in Washington. Retrofit of diesel particulate filters that are designed to cut soot emissions by 90 percent can be accomplished for trucks 1990 and newer. However, the cost of retrofit is estimated at $7,000 to $10,000 per truck. Both the Governor and the Legislature have identified pollution reduction as an important state objective to improve human health and to control emissions of green house gasses. The Washington Department of Ecology estimates a public benefit of three to sixteen dollars from every dollar invested in reducing diesel pollution. It appears that trucking companies, such as log haulers, may not be able to afford such investment without assistance.

Equipment upgrades to heavy trucks for reduced pollution are not limited to exhaust systems. We identified central tire inflation systems and "super-single" tires as low-cost opportunities where investments in equipment upgrades could reduce fuel consumption by upwards of five percent, on any age of truck. Achievement of reductions in fuel consumption automatically results in avoided emissions and can also provide economic relief to trucking companies. States such as California have recognized that public expenditures through grants and tax incentives for "green" equipment upgrades for heavy trucks are prudent public investment in climate change mitigation. State programs for investment to support equipment upgrades that reduce fuel consumption and pollution could help trucking companies reduce fuel costs and provide significant public environmental benefit.

Future research **-** A significant change for the log truck industry occurred when intrastate trucking was deregulated by the United States Congress. There is broad disagreement within the trucking literature as to the costs and benefits of deregulation. Other regulatory discussions, as yet unresolved, that could affect log trucking relate to increases to gross weight limits and whether current disparate state rules should be replaced with uniform federal standards. As state and federal regulatory authorities evolve through time, the implications for a safe and sustainable log truck industry will merit periodic evaluation.

Little data were found available with which to develop trend analysis for the log hauling industry. Lack of data challenges scientific research and hinders informed policy-making. Many factors uncovered by this investigation suggest that the log trucking industry could experience dramatic changes in the future. Issues such as revenue shortfalls, rising costs of operation, extended hours of service, an aging workforce, poor driver recruitment, increasingly congested roadways, shifting regulations, and growing public concern about pollution have been highlighted by this investigation. The interconnectivity of these issues should be a research focus as policy solutions are crafted for the future.

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Section I: Background

The Washington forest industry employs 45,000 people and annually generates $2 billion in wages, $16 billion in gross business revenues and over $100 million in tax receipts (Eastin et al. 2007). Washington produces six billion board feet of lumber per year, one billion square feet of plywood panels (3/8" basis), and seven million tons of pulp and paper products (Eastin et al. 2007, Ince et al. 2001). A comparison of production statistics by state indicates that Washington has the second largest lumber production in the nation and is fourth in production of both plywood and pulp and paper products (Eastin et al. 2007, Ince et al. 2001). All of this activity is dependent upon truck transport to move raw logs from the woods to process facilities.

History

In 1915, the Gerlinger Motor Car Company of Seattle produced its first truck; framed in heavy steel and powered by a six-cylinder engine. Eight years later this company would become known as Kenworth (Kenworth Truck Company). With the coming of World War I, movements of troops, supplies, and food overloaded the nation's rail system. Equipment manufacturers responded with production of gasoline-powered trucks to ease domestic transportation demands, as well as to provide machinery needed abroad by the military (Peterbilt Motor Company).

The first known use of a truck in a logging operation in Washington occurred in 1913 near Covington (Knapp 1921) but it was World War I (WWI) that established log trucking in Washington. In 1917, fine quality Sitka spruce, unique to the forests of the Pacific Northwest, was urgently needed to manufacture airplanes for the war. However, the best spruce trees were dispersed here and there requiring selective harvest that was impractical for railroad logging. The army organized the Spruce Production Division, which assigned thousands of soldiers to build roads into the forests of western Washington. Hard-tired trucks were put to use to travel on plank roads and retrieve the cants of spruce that were felled, bucked and split by woods crews (Prouty 1982).

Figure 1.1. Early truck hauling split spruce log on a "fore and aft" plank road on the Olympic Peninsula (Forks Timber Museum).

Following the Armistice in November 1918, the Spruce Production Division was disbanded but newly constructed roads, surplus trucks, and accessible timber stands remained and provided the beginning for what would become the rapid growth in the use of trucks for commercial log hauling. New interest in the use of aircraft combined with the ready availability of a spruce resource helped to establish the new Boeing Corporation as a mainstay of the economy of Washington and a purchaser of spruce logs for many years (Williams 1999). After WWI, an expanding economy brought a steady increase in road construction and motor vehicle use. Small log producers were quick to recognize opportunity. The purchase and operation of trucks was much less costly than locomotives. Isolated patches of timber near new public roads could be purchased and hauled by truck at low cost. Salvage of shingle cedar and Douglas-fir peeler blocks became possible. Track-type tractors had been developed for use in WWI. This equipment soon too found popular logging application. The logging industry, long dominated by big companies with logging camps and railroad lines, began to change. With the tractor and the truck came the independent or "gyppo" logger and the contract "gyppo" trucker. These were small businesses many of which would become primary log suppliers for small sawmills (Brown 1936).

Figure 1.2. Early loggers hauling peeler blocks with a Kelley-Springfield truck on a "cross-plank" road in Pacific County (Pacific County Historical Society and Museum).

Motor trucks were found to be uniquely versatile. When trucks weren't hauling logs they could be used for delivering equipment and supplies. Larger logging companies with big contiguous timber holdings that employed railroads to move huge volumes of timber also found trucks useful for operation on spur roads to bring scattered log volumes to train reloads (Knapp 1921).

There were several types of roads used in the early days of truck logging. In dry weather a cleared dirt path might suffice. But for year-round travel a more substantial road was needed. Three types of roads were most favored and all were made of wood (See Appendix C). A "cross-plank" road (Figure 1.2) was made of sawn timbers spiked to hewn log stringers. A "fore and aft" pole road was constructed of hemlock poles that were available in the woods. Trucks operating on pole roads were fitted with steel flange wheels (Figure 1.3). For greater permanence in applications where a large volume of logs was to be hauled, a "fore and aft" plank road could also

be constructed (Figure 1.1). All used considerable amounts of wood with the fore and aft plank requiring the most; about 160,000 board feet per mile (Knapp 1921). In the early 1920s on good roads with favorable grades, logging trucks traveled at rate of speed of 10 to 12 miles per hour. The maximum haul distance was generally limited to 15 miles (Bryant 1923). A new log truck could be purchased for about $4000 and was expected to last four years (Knapp 1921).

Figure 1.3. Mack truck with flange wheels on "fore and aft" pole road (Coos Historical and Maritime Museum).

In 1919, C.L. Cummins introduced the diesel engine for use in commercial trucks (Peterbilt). Diesel fuel was a third the cost of gasoline (Kenworth). By the 1920s and 1930s, progress came quickly for the gyppo loggers. Improvements in truck motors and design increased the popularity of trucks in logging operations. More engine horsepower allowed for transport of larger payloads at greater speed. Better brakes made trucks safer. The introduction of wider pneumatic tires with treads allowed for greater truck speed, rougher road conditions, and greater carrying capacities. !n, 1925, The Holt Manufacturing Company and the C.L. Best Tractor Company merged to form the Caterpillar Tractor Company. Track-type tractors became known as "Cats" (Caterpillar Inc.). Road graders were introduced. Logging companies were able to easily construct graded gravel roads, substituting for the labor- and material-intensive wood style of forest road. The log truck trailer was developed with an adjustable wooden reach that allowed trucks to haul more weight with greater flexibility for log length variation (Knapp 1921). Trucks could be equipped with winches with which to pull trees to the road ("yarding") and load the logs onto a trailer (Brown 1936). By this time it was clear that log trucking was established as a permanent fixture in the logging industry, one that would eventually replace railroads and become the sole source of transport. By 1931, there were about 900 trucks operating in Oregon and Washington (Van Tassel and Bluestone 1940). By the mid-1930s, trucks were hauling about as many trees out of Pacific Northwest forests as were railroads (Oregon History Project).

The operational flexibilities of log trucks made possible development of silviculture practices such as commercial thinning, salvage of distressed timber, and staggered harvest sites or "settings". In addition to low cost log hauling, trucks were shown to be valuable for fire fighting, machinery movement, crew transport, quick repairs to woods machinery, crew safety (rapid evacuation of injured personnel), fire safety (no sparks as were common with railroads), reduced yarding distances, year-round operation of logging sides and small mills, and operation on steeper terrain (Murray 1948). Brown (1936) wrote a text on logging transportation, concluded that trucks were here to stay, and provided early analysis of the cost of operations for logging trucks. He recognized the entrepreneurial benefits of trucks for low cost to entry into the logging business

but offered a precautionary note. Based upon his observations of the uniquely independent and small-operator-dominated contract hauling industry, he expressed concern that many truckers did not did not know how to accurately determine the cost of operations including depreciation, taxes, interest charges, fuel, oil, repairs, and etc. Brown suggested, as a consequence, that some contract log truckers were hauling logs at rates below cost of operations thereby creating instability within the timber industry.

Figure 1.4. By the 1950s, the remaining railroads were few and trucks dominated log transport in the Pacific Northwest (Oregon Historical Society, #CN 017408).

Truck and trailer equipment and operation

Today, in the Pacific Northwest, truck tractors are configured for log hauling with a single set of bunks and stakes attached to a turn table mounted on the frame. The standard log haul tractor is a tandem-axle truck. The "headache rack," located directly behind the cab, is a heavy bulkhead made of pipe and meant to stop any forward cargo shift. The tractor pulls a trailing set of log bunks and stakes also mounted on a turn table under which there are two non-powered axles. Bunks cradle loaded logs and, when used for hauling on public roads, are limited in Washington to eight foot six inches in width to the outside of the stakes. The maximum height of the loaded truck must not exceed 14 feet. To receive a load of logs, the trailer is attached to the tractor with a length-adjustable steel tube called a "reach" or "stinger". The reach is adjustable to accommodate loads of different lengths. Under this arrangement the tractor shares the weight of the log load with the trailer. Log truck bunks are designed to swivel up to 360 degrees. When the log truck is not loaded, pins are inserted in the turn tables to keep bunks stationary. When the log truck is ready to receive a load, the pins are removed so that the load will turn and the trailer will track properly. All loads must, by law, be secured with chains and cables known as "wrappers or binders." For binder location specifications see Appendix D. Both tractor and trailer are equipped with air brakes. The Jacobs "jake" brake is an engine retarder that increases braking efficiency by manipulating the engine valves to use engine compression to slow the vehicle.

Figure 1.5. Contemporary 5-Axle log truck (Log Trucker Magazine).

An additional trailer with twin bunks and stakes, referred to as a "pup," can be trailed to haul a second load. Pup trailers are free rolling on two independent axles. Tractors and trailers can be equipped with "drop axles," air-powered lift-axles which, when lowered, provide greater load carrying capacity. When short logs are to be hauled, a "mule train" or "hay rack" is preferred. Mule train tractor frames are extended to accommodate a second set of bunks and stakes such that a log load is entirely supported by the truck. A trailer is pulled behind to haul a second load. A hay rack is a flatbed fixed with multiple sides or stakes to safely retain a load of many piece lengths. All log trucks other than hayracks approach the loading location or "landing" empty with the trailer loaded "piggyback." Piggyback refers to the way empty log trailers are carried on the

bed of a tractor such that no axles touch the ground, tire wear is reduced, and maneuverability is maximized (see Figure 2.1). When an empty trailer is carried on the tractor, the tractor stakes are positioned between the trailer wheels and the reach rests in a notched receptacle located on the top of the headache rack. Pup trailers are towed loaded or empty except in the case of the mule train. Use of hay racks on logging roads can be problematic due to the extended length of the trailer. For images of the variety of log truck configurations currently in use see Appendix A.

For all log trucks, knowing the loaded weight is important for operating safely, maximizing payloads, and avoiding overweight fines. On-board scales use either load cell technology or pressure readings from air suspension to calculate the weight on the vehicle axles. Correctly operating on-board weight scales are very cost-effective tools. Payloads can be confidently maximized at the landing eliminating concern for violation of legal load limits (Conway 1976). In the early 1970's, as truck-mounted scales first achieved broad use and truckers could confidently load up to legal weight limits, average increases in load size approached ten percent (Arola 1972).

Travel time and haul costs are affected by road surface, gradient, road alignment, haul distance, and other road-related factors such as width and turnout locations. The cost of hauling logs varies with the length of the haul. The longer the distance the higher the per-unit cost. Very short hauls require more time for being loaded, unloaded, scaled, and weighed. In addition, short hauls generally mean disproportionate time spent on woods roads, with steeper grades, more curves, and narrower widths than on public roads. Unlike other commercial freight carriers, about one half of a log truck's daily miles are driven empty during return to the woods.

Regulation of truck rates

The Motor Carrier Act of 1935 gave the Interstate Commerce Commission (ICC), a federal government agency, the authority to regulate *interstate* truck and bus companies, known collectively as "motor carriers." The ICC's new powers with respect to motor carriers were similar to those it had over railroads, which it had regulated since 1887. The ICC imposed regulatory limits to entry into the trucking business by determining which companies could become motor carriers, what services they could offer, and what rates they could charge. The constitutionality of the act rested on Congressional authority to regulate interstate commerce under Article I, section 8 of the U.S. Constitution. The Federal *interstate* regulatory system operated under the direction of the ICC with little public notice or debate from 1935 to the 1960s. President John F. Kennedy, in the early 1960's, urged greater reliance on the forces of competition and less reliance on the restraints of regulation. In 1971, President Richard Nixon's Council of Economic Advisers called for deregulation of the transportation industries. Presidents Gerald Ford and Jimmy Carter both supported a relaxation of regulation. In 1980, at Carter's behest, Congress passed the Motor Carrier Regulatory Reform and Modernization Act (MCA) of 1980 which significantly reduced the level of ICC regulation over the trucking industry, though it did not eliminate *interstate* regulation entirely. Congress finally ended sixty years of motor carrier regulation with the ICC Termination Act of 1995. This act eliminated virtually all economic control of motor carriers and abolished the ICC. Many investigations have been conducted over the years to investigate the costs and benefits of trucking deregulation. Some report positive while others report negative outcomes (Belman and Monaco 2001, Peoples and Peteraf 1999, Brown and Greenlee 1995, Allen et al. 1993, McMullen and Stanley 1988, Glaskowsky 1986, Corsi etal. 1981, Moore 1978).

As the ICC regulated *interstate* commercial motor carrier activities, the Washington Utilities and Transportation Commission (WSUTC) regulated the within state (*intrastate*) trucking industry. The WSUTC limited entry by requiring trucking companies desiring to haul commercial loads to prove fitness, need, and necessity. The WSUTC also determined the rates that trucking companies, including log haulers, were paid by shipping clients for *intrastate* deliveries. "State rates" explicitly defined the formulas for the calculation of transport charges. Five distinct road quality types were identified to which different cost/revenue factors were assigned. Billing for hauling services was determined upon measurement of road segment types, multiplied by the

road type rate, with all segment charges then summed to establish the total cost for any given log haul route. Explicit prescriptions were also provided for calculation of ancillary charges such as loading, unloading, and wait time. A completed classification of each haul contract was required to be filed with a WSUTC no later than five days after commencing transportation. Regulatory periodic adjustments to road rates were imposed through the years to keep pace with a changing economy. Passage of the federal Motor Carrier Act in 1980 did not conflict with state regulation of *intrastate* commercial trucking rates. In 1994, however, the United States Congress passed the Federal Aviation Administration Act of 1994 which found that the regulation of *intrastate* transportation of property by individual states had imposed an unreasonable burden on *interstate* commerce by impeding the free flow of trade, traffic, and transportation. The WSUTC responded with an emergency rule that repealed and amended portions of the Washington Administrative Code (WAC) and the Revised Code of Washington (RCW) that regulated haul rates. The *intrastate* commercial carrier industry in Washington, including log hauling, was "deregulated" by the passage of the Federal Aviation Administration Act. Since 1995, when the law went into effect, the state no longer has had jurisdictional authority to regulate entry or rates for commercial log hauling. Weight limits, hours of service, and other aspects of safe operation of commercial trucks are still subject to state authority. Currently there is debate over whether national uniform standards for all trucking activities should be established by the federal government.

The displacement of railroads by trucks as the main source of log transport was an historic event that resulted in a unique evolution of machinery, business, culture, and regulation. For the majority of the seven decades since Brown (1936) first warned of gyppo contractors hauling logs below actual costs, regulations served to impose rate stability on the log trucking industry. In recent years, however, deregulation of haul rates combined with rapid increases in operating costs have created new questions about the safety and sustainability of a log trucking industry struggling to adapt to changing circumstances.

Study Methods

In 2007, the State Legislature requested that scientists from the University of Washington and Washington State University undertake an investigation of the Washington log truck industry towards gaining better understanding of "the costs to safely provide log hauling services." Deregulation of the trucking industry, rising fuel prices, declining wood markets, shortages of skilled drivers, increases in traffic congestion and other ensuing circumstances have added new operational pressures for the log truck industry that could logically have safety implications. Investigation methods were designed to gather pertinent information from multiple sources:

1) **The Research Team** A research team of scientists from the University of Washington College of Forest Resources and Washington State University Transportation Research Group was formed.
2) **Literature Review** A broad review of the scientific literature, government publications, regulatory records, and industry/trade journals was undertaken for topics concerning timber industry operations, heavy truck operations, heavy truck regulations, and commercial motor vehicle safety.
3) **Government Data Analysis** Data on log truck registrations and accident histories were collected from many state agencies and analyzed to investigate demographics, operational costs, and safety issues.
4) **Interviews with Log Truckers** Meetings were attended throughout the state that were held by the Washington Trucking Associations Log Truckers Conference (WTA) and the Northwest Log Truckers Cooperative (NWLTC). Truckers were briefed on this investigation and were asked about trucker concerns. Staff personnel from the Washington Contract Loggers Association (WCLA) were also interviewed.
5) **Field Visits** Three field trips were made to accompany log truckers (Forks, Snohomish, and Enumclaw) as they performed log hauling services.

6) **Interviews with Government Agency Representatives** Representatives from state agencies engaged in traffic safety and log truck industry oversight from Washington, Oregon, and Idaho were contacted and interviewed and data results obtained.
7) **Association Briefings** Mid-project briefings with preliminary results were provided to industry stakeholders that included the Washington Truckers Association, the Northwest Log Truckers Cooperative, the Washington Contract Loggers Association, the Washington Farm Forestry Association (WFFA), and the Washington Forest Protection Association (WFPA).
8) **Interviews with Industry Venders** Parts, equipment, and insurance providers for the log hauling industry were contacted and interviewed.
9) **Log Truck Industry Survey** A comprehensive draft questionnaire for the log trucking survey was developed and sent for review by the five industry associations mentioned above. A mailing list of log haul contractors was created from a merge of membership data from WTA, NWLTC, and WCLA. Six hundred and forty-six unique companies were identified. The Log Trucker and the Springboard Magazines were contacted and followed up with publication of articles on the commission of the log truck study by the Legislation and the importance of the upcoming industry survey. An intensive survey with 73 questions in a 17-page brochure was sent to log truck company owners. The questionnaire was accompanied by support letters from WTA, NWLTC, and WCLA included in which was a request that truckers take time to respond. A postcard of thanks and reminder was then sent to all truckers. A second mailing with duplicate questionnaire followed and, at the request of truckers, the deadline for response was extended. One hundred and twenty-nine trucking firms provided usable survey responses. Data analysis was then conducted.
10) **Cost Model** A cost of operations model was developed for single-truck and multi-truck companies for 2006 and 2008 with and without consideration of wages. The model was informed with data provided by venders, public records, association inputs, and survey results.
11) **Safety Analysis** An analysis of recent log truck industry accident statistics was conducted with results compared to the historic record, all state commercial carrier safety performance, and national heavy truck operation trends as available. **All Information Reviewed** Relevant data and results obtained throughout the investigation were reviewed and organized for report presentation. Conclusions and recommendations were developed.

Figure 1.6. A double trailer short logger or "mule train" getting loaded (Mason).

Section II: Operating Costs

Non-Wage Cost of operations
Washington Log Truck Industry

An interactive cost accounting model was constructed to simulate a range of log truck operation costs for two example scenarios; 1) companies with self-employed single-truck operations with older equipment and 2) companies with new equipment that employ drivers to operate multiple trucks. Using these examples, a comparison of the fuel (diesel) price increases from 2006 to 2008 was developed with most other operational costs remaining constant for each scenario. Operation cost estimates were developed from information provided by state agencies, products venders, available literature, and the Washington Trucking Association in combination with the specific survey response data collected from the log truck industry. Cost estimates were initially developed as baseline required expenses regardless of company revenues.

First, we present all estimated costs, other than wages, of operating a log truck for both small and larger companies based upon average 2006 fuel prices as reported by trucking survey respondents ($2.74 per gallon). Second, we present operations costs with a current approximated average fuel price for Washington as calculated with June 12, 2008 data taken from the American Automobile Association Daily Fuel Gauge web site ($4.91 per gallon) (AAA 2008). In the period from 2006 to June 2008 the price of diesel fuel has increased by 79%. Two different operational scenarios are offered to show cost differences relative to company size, equipment age, and impact of increases in fuel prices.

Costs of operating a log truck are presented under two general accounting/economic categories; fixed and variable costs. Fixed costs are incurred whether the truck operates or not and do not vary with the level of output, e.g. miles or hours of operation. For most companies, the dominant fixed costs are truck and insurance payments. The more logs that are hauled the more that fixed costs are reduced as measured by dollars per unit output. Variable costs are expenses that are directly related to the operation of the log truck. Variable costs of truck operation are dominated by fuel, repairs, and wages. These are costs that increase with levels of hauling activity. Some operation expenses, such as utilities and administration, may actually function as mixed costs that are fixed but may change with thresholds of activity. For simplicity, the following analysis considers all costs as either fixed or variable.

Figure 2.1. Six-axle long-logger; mounted trailer (Whit-Log Inc).

While there are varied truck and trailer configurations employed by log hauling companies (For images of the variety of log truck configurations currently in use see Appendix A), the most common in Washington is a six-axle long-logger (Figure 2.1 above), therefore, all cost simulations presented in the following pages are based upon this model. A long-logger is designed to haul long logs generally forty feet in length. The popularity of the long-logger results from timber purchaser preferences for long-length logs. Many log purchase orders require length averages in excess of thirty feet with the price of shorter logs discounted. Other configurations are known to have somewhat different cost factors but are too many and varied to present in this report. It was our intent, therefore, to select the most representative truck type and to suggest that the relative differences demonstrated by cost simulation alternatives are consistent for other truck types.

1) Non-Wage Cost of operations for a Company with a Single Log Truck

Of the 129 companies that responded to our survey, 83 (64%) were single-truck companies. The average company owner was 55 years of age. The median year of manufacture for trucks operated in this industry subset was 1998. Consequently the sample truck, selected for cost simulations, was a 1998 six-axle long-logger with gross weight 88,000 lbs. and an average net payload weight of 58,835 lbs. (29.4 tons), based on survey results. Survey analysis further indicated that in 2006, single-truck companies operated an average of 43.4 weeks per year, delivering logs 5.1 days per week and 12.4 hours per day. An additional 7.1 hours for maintenance were required each week. Fuel consumption averaged 5.1 miles per gallon. Average miles driven were 66,122 per year with approximately 17% on gravel roads and 83% on paved roads. 17,336 tons of logs on average were hauled on each truck in 2006. Survey analysis showed an average of 589.3 loads per year per truck with 112.2 round-trip miles per load, or an average of 56.1 miles from the point of loading ("the landing") to the point of unloading ("the drop").

Table 2.1. Demographic and performance averages for single-truck companies.

Operator age in years	55
Truck type	6-axle long-logger
Truck gross weight (lbs)	88,000
Truck net payload (lbs)	58,835
Truck net payload (tons)	29.4
Truck year	1998
Operation weeks per year	43.4
Operation days per week	5.1
Operator hours per day	12.4
Maintenace hours per week	7.1
Fuel consumption (MPG)	5.1
Percent gravel roads	17%
Recent paved roads	83%
Operation miles per year	66,122
Tons hauled per year	17,336
Ave. loads per year	589.3
Ave. miles per load	112.2
Ave. miles landing to drop	56.1

Fixed costs for a company with a single log truck

For reference, we begin with an estimate of the average cost of a new truck, as suggested by survey respondents, which was found to be $122,991. The average cost of a new trailer was indicated by respondents to be $31,909. Since there are many customized variations on new truck orders that can greatly influence sticker price, we assume that estimated prices of new

equipment are a reliable consensus surrogate for average new equipment cost. This assumption was confirmed as reasonable by the Washington Trucking Association (Miller 2008). *It is apparent, however, from survey response data that single–truck companies may not generally operate new trucks*. The median year of manufacture for trucks operated by these companies was 1998. Consequently, a six-axle long-logger of this age was selected as representative of the equipment preference. Based upon review of used equipment sales advertisements, we estimated that a 1998 log truck can be purchased at a price of $30,000, which is approximately 25% of the cost of a new truck. A used trailer can be purchased for $15,000, or approximately 50% of the new cost of a trailer. Total purchase price for used equipment needed to haul logs was therefore estimated to be $45,000. This estimated representative cost of log hauling equipment was confirmed as reasonable by the Washington Trucking Association (Miller 2008).

For simulation purposes, we assumed that this equipment was purchased with financed funds, kept for seven years, and then replaced. Following seven years, the truck and trailer are seventeen years old but do retain some salvage value. We calculated the salvage value at $9,000, which is 20% of the initial truck and trailer purchase price. The present value of the salvage recovery, calculated to be $4,923, was deducted from the purchase price, which leaves a net cost of $40,077 for the truck and trailer. In addition to the purchase price, there is an 8% sales tax of $3,600 on this vehicle purchase. The total purchase cost to be financed was therefore $43,677, which was to be paid over seven years at an interest rate of 9% as suggested by the Kenworth Sales Department as an approximate current average rate for equipment finance (Hall 2008). Depreciation is considered to be equally distributed over the seven-year period. The first fixed cost is then a payment obligation of $8,432.61 per year for seven years ($702.72 per month for 84 months).

Truck insurance estimates (collision, liability, and property damage) were sought from insurance companies but were not made available due to proprietary concerns and risk rate variability for customers. The Mattei Insurance Services Company and the Washington Contract Loggers Association both provide insurance for many log truck companies. Representatives from both organizations agreed that, while insurance rates are highly variable by customer, log truck insurance rates have stayed flat or even declined in recent years due to competition amongst underwriters and lack of change in risk rating for the insured (Irwin 2008, Bonagofski 2008). Survey response analysis indicated that the average truck insurance cost for companies operating a 1998 long-logger in 2006 was $3,971 per year. The Washington Trucking Association confirmed that this is a reasonable average insurance estimate for this application (Miller 2008).

License fees for a six-axle long-logger are $2,225 per year if trucks are registered as instate log haulers under Schedule A (RCW 46.16.070). An additional annual fee of $90 is charged for trucks that are registered under Schedule B for combination use and travel outside Washington State. In 2006, 68% of log trucks in Washington were registered as Schedule A (WSDOT, WSDOL 2007). Survey findings provided close agreement to this statistic; indicating that 62% of respondent trucks are registered as schedule A. Consequently, the Schedule A license fee is the rate that was used for the cost analysis.

Parking and shop costs were estimated to be $1200 per year ($100 per month), based on survey results. Administration costs were approximated at $2,213 per year (average $10 per day and 221.3 days of operation per year in 2006 as indicated by survey results). Utilities needed for truck operations include phone, heat, and electricity. An estimated annual utility cost of $1,355 was the average reported by survey respondents. Note that while administration and utilities may correctly be regarded as mixed costs for some accounting applications, for simplicity of presentation these expenses are held constant as fixed costs with no significant compromise to analysis results.

Table 2.2. Summary of fixed costs for single-truck companies.

Net purchase price plus taxes	$43,677
Interest Rate	9%
Finance Period (years)	7
Monthly Payment	$703
Truck Insurance/year	$3,971
License Fees/year	$2,225
Truck shop/ year	$1,200
Administration costs/year	$2,213
Utilities/year	$1,355

Variable costs for a company with a single log truck

Variable cost factors were developed based upon interviews with truckers, venders, and association representatives, response data from the log truck survey, and information from the Washington Department of Revenue (WSDOR 2008). Many variable costs were found to be related to proper practices of equipment maintenance with schedule and expense more or less standard throughout the industry, regardless of the age of equipment. Variable maintenance expenses are held constant for cost simulations. Oil changes were estimated to occur every 6 weeks or 10,000 miles at a cost of $175 per change, including labor, filters, and oil (6 gallons @ $7.00/gallon). Lubrication and maintenance was scheduled for once a month and was assigned a cost of $240 to include 3 to 4 hours of shop time plus materials. Replacement of miscellaneous hoses, lights, and other minor parts associated with normal truck wear was expected to cost $25 per week. Average brake replacement for all wheels was considered to occur once a year, at a cost for parts, machine services, and labor of $600.

The use of new tires is required by law for steering axles but retreads may be used for the drive and trailer axles. Subject to driver preference, sound steering axle tire casings may be given new tread and re-used as tire replacements elsewhere on the truck. Tire dealers report that the cost of new drive and steer tires has increased marginally by 14% (1.3% per year) and 5% (0.5% per year) respectively over the eleven-year period from 1998 to 2008. This low new tire price increase is credited to the emergence of China as the world's largest tire manufacturer. Retreads, however, have increased by 31% (2.8% per year) during the same period (Smith 2008, Kelsey and Murphy 2008). New log truck tires cost between $300 and $500 each depending upon manufacturer and profile. A retread tire for a log truck can be purchased for $100 to $200. There are twenty tires on a six-axle long-logger. Based upon the estimated average annual tire replacement costs as reported by survey respondents, tire costs are calculated at $6,371 per year for 2006 and $6,562 per year for 2008 (2008 tire cost reflects average 1.5% per year tire price increase).

Table 2.3. Summary of variable costs for single-truck companies.

Oil change/~6 weeks or 10,000miles	$175
Lube & maintenance/month	$240
Misc hoses and lights/week	$25
Brakes/year	$600
Tires/year	$6,371
Misc repairs/year	$5,000
Misc expenses/year	$2,000
Business & Occupation Tax	1.926%

Older trucks, such as the 1998 model assumed for this cost simulation, require periodic replacement of major components. While expenses for such repairs may differ dramatically by year and company, we, based on survey responses, estimated that, during the seven-year period of ownership for the simulation, repairs average $5000 per year. Miscellaneous expenses to

cover lodging, meals, association dues, truck washes, citations, and other incidental costs of operations were estimated to average $2000 per year. Variable costs other than fuel and tires were held constant for 2006 and 2008 cost comparisons. Business and Occupation Tax for log truckers is charged by the State of Washington against gross revenue at a rate 1.926%.

Fuel costs in recent years have been an especially challenging and variable expense for log truck operators, as it has for all truckers. Impacts of changing fuel prices are two-fold: the average rise in cost has been dramatic and the variability in cost has been rapid, extreme, and unpredictable. The impacts of price variability are difficult to simulate as changes occur in short time-frames and revenue responses for adjustment must be customized by individual business relationships. A comparison, however, of the impact of the increase in fuel price from 2006 to 2008, and its impact on per mile costs is presented in the following cost simulations. The average diesel price for 2006 was reported by survey respondents to be $2.74 per gallon. The Washington State average diesel price on June 12, 2008 was estimated to be $4.91 per gallon (AAA 2008). These figures indicate a 79% increase in diesel fuel price from 2006 to 2008 and a corresponding percentage increase in the fuel/cost per mile.

Table 2.4. Summary of comparative fuel costs 2006-2008.

2006 diesel cost/gallon	$2.74
Average miles/gallon	5.1
Fuel cost/mile	$0.54
2008 diesel cost/gallon	$4.91
Average miles/gallon	5.1
Fuel cost/mile	$0.96

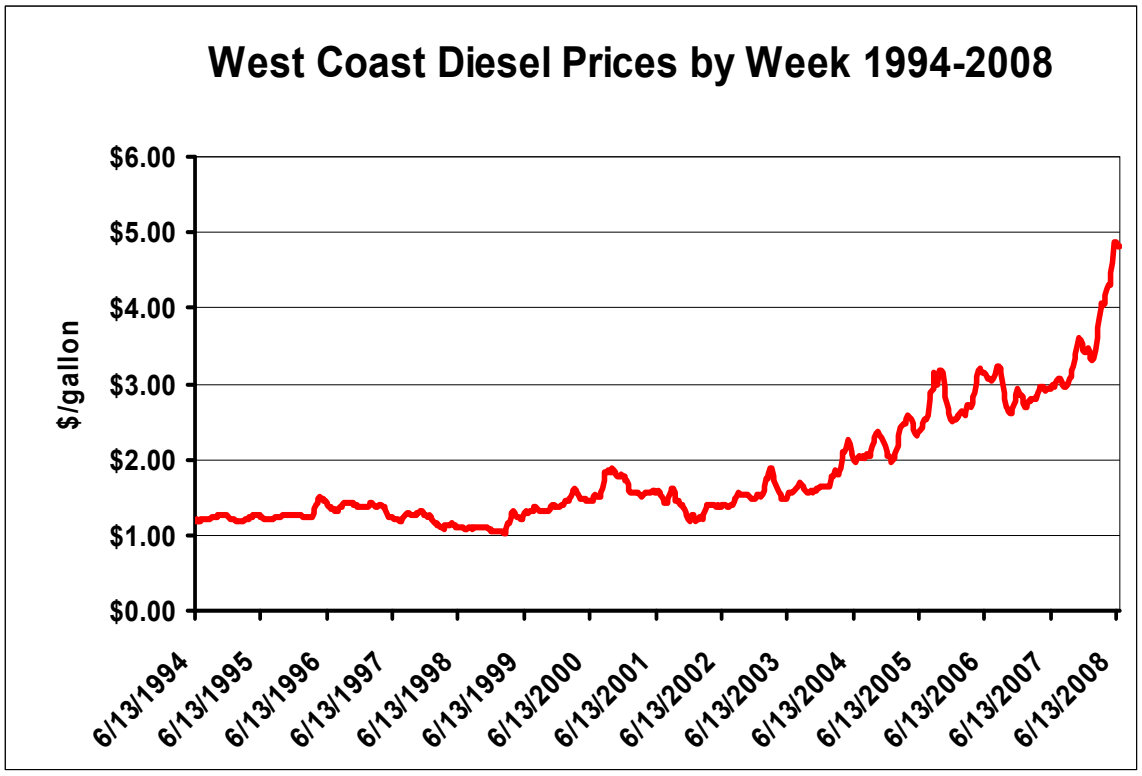

Figure 2.2. Diesel fuel prices 1994 to 2008 (EIA).

Table 2.5. 2006 Cost of Operations for a Company with a Single Log Truck.

(Without wage-related costs)

Annual	
Fixed Costs	
Truck payment	$8,432.61
Insurance	$3,971.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$2,213.00
Telephone, Electricity, Heat,	$1,355.00
B&O Tax	$373.58
Total Fixed Costs/Year	$19,770.19

Monthly	
Fixed Costs	
Truck payment	$702.72
Insurance	$330.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$184.42
Telephone, Electricity, Heat,	$112.92
B&O Tax	$31.13
Total Fixed Costs/Month	$1,647.52

Daily	
Fixed Costs	
Truck payment	$38.10
Insurance	$17.94
License & other fees	$10.05
Truck garage/shop	$5.42
Administration costs	$10.00
Telephone, Electricity, Heat,	$6.12
B&O Tax	$1.69
Total Fixed Costs/Day	$89.34

Annual	
Variable Costs	
Fuel	$35,524.37
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,085.00
Brakes	$600.00
Tires	$6,371.00
Misc Repairs	$5,000.00
Misc Expenses	$2,000.00
B&O Tax	$1,056.61
Total Variable Costs/Year	$55,916.98
Total Annual Costs	**$75,687.17**

Monthly	
Variable Costs	
Fuel	$2,960.36
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$90.42
Brakes	$50.00
Tires	$530.92
Misc Repairs	$416.67
Misc Expenses	$166.67
B&O Tax	$88.05
Total Variable Costs/Month	$4,659.75
Total Monthly Costs	**$6,307.26**

Daily	
Variable Costs	
Fuel	$160.53
Oil Change	$6.33
Lube and maintenace	$13.01
Misc hoses and lights	$4.90
Brakes	$2.71
Tires	$28.79
Misc Repairs	$22.59
Misc Expenses	$9.04
B&O Tax	$4.77
Total Variable Costs/Day	$252.68
Total Daily Costs	**$342.01**

Table 2.6. 2008 Cost of Operations for a Company with a Single Log Truck.

(Without wage-related costs)

Annual	
Fixed Costs	
Truck payment	$8,432.61
Insurance	$3,971.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$2,213.00
Telephone, Electricity, Heat,	$1,355.00
B&O Tax	$373.58
Total Fixed Costs/Year	$19,770.19

Monthly	
Fixed Costs	
Truck payment	$702.72
Insurance	$330.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$184.42
Telephone, Electricity, Heat,	$112.92
B&O Tax	$31.13
Total Fixed Costs/Month	$1,647.52

Daily	
Fixed Costs	
Truck payment	$38.10
Insurance	$17.94
License & other fees	$10.05
Truck garage/shop	$5.42
Administration costs	$10.00
Telephone, Electricity, Heat,	$6.12
B&O Tax	$1.69
Total Fixed Costs/Day	$89.34

Annual	
Variable Costs	
Fuel	$63,658.63
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,085.00
Brakes	$600.00
Tires	$6,562.00
Misc Repairs	$5,000.00
Misc Expenses	$2,000.00
B&O Tax	$1,602.16
Total Variable Costs/Year	$84,787.79
Total Annual Costs	**$104,557.98**

Monthly	
Variable Costs	
Fuel	$5,304.89
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$90.42
Brakes	$50.00
Tires	$546.83
Misc Repairs	$416.67
Misc Expenses	$166.67
B&O Tax	$133.51
Total Variable Costs/Month	$7,065.65
Total Monthly Costs	**$8,713.16**

Daily	
Variable Costs	
Fuel	$287.66
Oil Change	$6.33
Lube and maintenace	$13.01
Misc hoses and lights	$4.90
Brakes	$2.71
Tires	$29.65
Misc Repairs	$22.59
Misc Expenses	$9.04
B&O Tax	$7.24
Total Variable Costs/Day	$383.14
Total Daily Costs	**$472.47**

2) Non-Wage Cost of operations of a Log Truck by a Multi-Truck Company

Of the 129 companies that responded to our survey, 46 companies (36%) reported operation of more than one truck. These companies operated a total of 253 trucks of which 222 were log trucks, representing 73% of all log trucks surveyed. To demonstrate cost differences for multi-truck verses the single-truck operations, we simulated a company adequately capitalized to purchase new log trucks every seven years on a staggered rotation with a fleet of 10 trucks in continuous operation. The example truck for cost simulation purposes was held as a six-axle long-logger with gross weight 88,000 lbs. and net payload weight of 58,835 (29.4 tons). For this simulation, cost analysis was based upon the purchase price of a new 2008 model. A 2008 log truck was certainly not in use in 2006 but, for analysis to examine the impacts of increases in fuel prices, the estimated cost of the 2008 truck was used as a surrogate cost of a new truck in 2006. Seventy eight companies, operating newer log trucks (2001-2008), reported that their trucks hauled logs in 2006 for an average of 45.7 weeks per year, 5.1 days per week and 12.3 hours per day. An additional 6.4 hours for maintenance were required each week. The average miles driven were 71,202 per year. 16,036 tons of logs on average were hauled in 2006 for an average of 545.1 loads per year with 130.6 average round-trip miles per load indicating 65.3 average miles from landing to drop. Consistent for the industry, these truckers also reported that 17% of miles are traveled on gravel roads and 83% on paved roads, fuel consumption was 5.1 miles per gallon, and average owner age is 55 years.

Table 2.7. Demographic and performance averages for multi-truck companies.

Operator age in years	55
Truck type	6 axle long-logger
Truck gross weight (lbs)	88,000
Truck net payload (lbs)	58,835
Truck net payload (tons)	29.4
Truck year	2008
Operation weeks per year	45.7
Operation days per week	5.1
Operator hours per day	12.3
Maintenace hours per week	6.4
Fuel consumption (MPG)	5.1
Percent gravel roads	17%
Recent paved roads	83%
Operation miles per year	71,202
Tons hauled per year	16,036
Ave. loads per year	545.1
Ave. miles per load	130.6
Ave. miles landing to drop	65.3

Fixed costs for a multi-truck company

The average cost of a new truck, as suggested by survey respondents, was estimated to be approximately $122,991. The average cost of a new trailer was indicated by respondents to be $31,909. The average price of new equipment as suggested by respondents is a reliable consensus surrogate for average new equipment cost. This assumption was confirmed as reasonable by the Washington Trucking Association (Miller 2008). For this simulation, a 2008 log truck is purchased at a new price of $122,991. Interviews with truckers suggest that a new trailer is infrequently purchased as, with proper care and maintenance, log trailers have a longer useful life than the tractors that haul them. To simulate these circumstances in our cost analysis we determined, as in the previous example, that a used trailer could be purchased for $15,000, or approximately 50% of the new cost of a trailer. Total purchase price for a new truck and used trailer needed to haul logs was therefore determined to be $138,946. As above, this equipment is

purchased with financed funds, kept for seven years, and then replaced. Following seven years of use, the truck and trailer do retain some salvage value. The estimated salvage value was $55,397 which is 40% of the initial truck and trailer purchase price. The present value of the salvage recovery was calculated to be $30,304 and was deducted from the purchase price, leaving a net cost of $108,188 for the truck and trailer. In addition to the purchase price, there is an 8% sales tax of $11,079. The total purchase cost to be financed was therefore estimated to be $119,267 which was paid over seven years at an interest rate of 9%. Depreciation is considered to be equally distributed over the seven-year period. The first fixed cost established for this simulation is an annual payment obligation of $23,027 for seven years ($1919 per month for 84 months).

Survey response analysis indicated that the average insurance cost (collision, liability, and property damage) for companies operating a 2001-2008 long logger was $4,643 per truck per year ($672 per year greater than for the single-truck company with older equipment). The Washington Trucking Association confirmed that this is a reasonable average insurance estimate for this application (Miller 2008). License fees for a six-axle long logger registered for Schedule A use are $2,225 per year. Parking and shop costs were kept constant at $1200 per year ($100 per month) as were utilities at $1355 per year. Administration costs per day were doubled, as compared with single-truck companies, to reflect an increased cost of accounting, scheduling, dispatch, and other activities required to operate 10 trucks. We estimated administration costs to average $4,644 per year per truck (average $20 per day and 232.2 days of operation per year).

Table 2.8. Summary of fixed costs for multi-truck companies.

Net purchase price plus taxes	$118,836
Interest rate	9%
Finance period (years)	7
Monthly payment	$1,912
Truck insurance/year	$4,643
License fees/year	$2,225
Truck shop/year	$1,200
Administration costs/year	$4,644
Utilities/year	$1,355

Variable costs for a multi-truck company

Many variable costs relate to proper practices of equipment maintenance with schedule and expense more or less standard throughout the industry regardless of the age of equipment. For simplicity, variable maintenance expenses were held constant for cost simulations. Oil changes were estimated to occur every 6 weeks or 10,000 miles at cost of $175 per change, which includes labor, filters, oil (6 gallons @ $7.00/gallon). Lubrication and maintenance was scheduled for once a month and assigned a cost of $240 to include 3 to 4 hours of shop time plus materials. Replacement of miscellaneous hoses, lights, and other minor parts associated with normal truck wear was expected to cost $25 per week. Average brake replacement for all wheels was considered to occur once a year at a cost for parts, machine services, and labor of $600. Based upon the estimated average annual tire replacement costs as reported by survey respondents and tire venders, tire costs were calculated at $6,371 per year for 2006 and then increased to $6562 per year for 2008.

There are many reasons why, if affordable, new equipment is more desirable than old. One reason is driver recruitment. When survey respondents were asked how difficult it is to find and keep skilled drivers; 87% indicated very difficult, 8% indicated occasionally difficult, and 5% indicated that drivers were readily available. When asked if skilled drivers are harder to find today than 10 years ago; 99% of respondents indicated harder to find, 1% indicated the same, and zero indicated easier to find. In an industry, such as log hauling where employee recruitment and retention can be difficult, a number of truck company owners have told us that operation of

newer, more reliable, and comfortable equipment can help to attract and retain the most skilled help. Also important to company owners is the reliability, low maintenance cost, and warranty benefits associated with new trucks. To model the comparative benefit of new truck purchase, we made the conservative assumption that new trucks should not require *significant* repair beyond normal maintenance. Miscellaneous expenses to cover lodging, meals, association dues, truck washes, citations, and other incidental cost of operations were estimated to average $2000 per year. Variable costs other than fuel and tires are held constant for 2006 and 2008 cost comparisons. Business and Occupation Tax for log truckers is charged by the State of Washington against gross revenue at a rate 1.926%.

Table 2.9. Log truck survey question 29: "If you are an employer, how difficult is it to find and keep skilled truck drivers?"
(n = 84)

Very difficult	*Occasionally a problem*	*Easier to find*
87%	8%	5%

Table 2.10. Log truck survey question 30: "How available are skilled truck drivers today as compared to 10 years ago?"
(n = 107)

Harder to find	*The same*	*Easier to find*
99%	1%	0%

Table 2.11. Summary of variable costs for multi-truck companies.

Oil Change/~6 weeks or 10,000miles	$175
Lube & maintenance/month	$240
Misc hoses and lights/week	$25
Brakes/year	$600
Tires/year	$6,371
Misc repairs/year	$0
Misc expenses/year	$2,000
Business & Occupation Tax	1.926%

The average diesel price for 2006 was reported by survey respondents to be $2.74 per gallon. As previously cited, the State average diesel price on June 12, 2008 was estimated to be $4.91 per gallon. These figures indicate a 79% increase in fuel price from 2006 to 2008.

Table 2.12. Summary of comparative fuel costs 2006-2008.

2006 diesel cost/gallon	$2.74
Average miles/gallon	5.1
Fuel cost/mile	$0.54
2008 diesel cost/gallon	$4.91
Average miles/gallon	5.1
Fuel cost/mile	$0.96

Table 2.13. 2006 Cost of Operations for a Multi-Truck Company.

(Without wage-related costs)

Annual	
Fixed Costs	
Truck payment	$23,026.73
Insurance	$4,643.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$4,644.00
ROI	$2,302.67
B&O Tax	$688.33
Total Fixed Costs/Year	$38,729.73

Monthly	
Fixed Costs	
Truck payment	$1,918.89
Insurance	$386.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$387.00
ROI	$191.89
B&O Tax	$61.06
Total Fixed Costs/Month	$3,231.17

Daily	
Fixed Costs	
Truck payment	$99.17
Insurance	$20.00
License & other fees	$9.58
Truck garage/shop	$5.17
Administration costs	$20.00
ROI	$9.92
B&O Tax	$3.16
Total Fixed Costs/Day	$166.99

Annual	
Variable Costs	
Physical/drug test/compliance	$200.00
Fuel	$38,253.62
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,142.50
Brakes	$600.00
Tires	$6,371.00
Telephone, Electricity, Heat,	$1,355.00
Misc Repairs	$0.00
B&O Tax	$1,005.41
Total Variable Costs/Year	$53,207.54
Total Annual Costs	**$91,937.27**

Monthly	
Variable Costs	
Physical/drug test/compliance	$16.67
Fuel	$3,187.80
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$95.21
Brakes	$50.00
Tires	$530.92
Telephone, Electricity, Heat,	$112.92
Misc Repairs	$0.00
B&O Tax	$83.78
Total Variable Costs/Month	$4,433.96
Total Monthly Costs	**$7,665.13**

Daily	
Variable Costs	
Physical/drug test/compliance	$0.86
Fuel	$164.74
Oil Change	$6.03
Lube and maintenace	$12.40
Misc hoses and lights	$4.92
Brakes	$2.58
Tires	$27.44
Telephone, Electricity, Heat,	$5.84
Misc Repairs	$0.00
B&O Tax	$4.33
Total Variable Costs/Day	$229.15
Total Daily Costs	**$396.13**

Table 2.14. 2008 Cost of Operations for a Multi-Truck Company.

(Without wage-related costs)

Annual	
Fixed Costs	
Truck payment	$23,026.73
Insurance	$4,643.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$4,644.00
ROI	$2,302.67
B&O Tax	$688.33
Total Fixed Costs/Year	$38,729.73

Monthly	
Fixed Costs	
Truck payment	$1,918.89
Insurance	$386.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$387.00
ROI	$191.89
B&O Tax	$57.36
Total Fixed Costs/Month	$3,227.48

Daily	
Fixed Costs	
Truck payment	$99.17
Insurance	$20.00
License & other fees	$9.58
Truck garage/shop	$5.17
Administration costs	$20.00
ROI	$9.92
B&O Tax	$2.96
Total Fixed Costs/Day	$166.79

Annual	
Variable Costs	
Physical/drug test/compliance	$200.00
Fuel	$68,549.38
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,142.50
Brakes	$600.00
Tires	$6,371.00
Telephone, Electricity, Heat,	$1,355.00
Misc Repairs	$0.00
B&O Tax	$1,588.91
Total Variable Costs/Year	$84,086.79
Total Annual Costs	**$122,816.52**

Monthly	
Variable Costs	
Physical/drug test/compliance	$16.67
Fuel	$5,712.45
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$95.21
Brakes	$50.00
Tires	$530.92
Telephone, Electricity, Heat,	$112.92
Misc Repairs	$0.00
B&O Tax	$132.41
Total Variable Costs/Month	$7,007.23
Total Monthly Costs	**$10,234.71**

Daily	
Variable Costs	
Physical/drug test/compliance	$0.86
Fuel	$295.22
Oil Change	$6.03
Lube and maintenace	$12.40
Misc hoses and lights	$4.92
Brakes	$2.58
Tires	$27.44
Telephone, Electricity, Heat,	$5.84
Misc Repairs	$0.00
B&O Tax	$6.84
Total Variable Costs/Day	$362.13
Total Daily Costs	**$528.93**

Results and Discussion - Simulations of non-wage operational costs

Non-wage operation costs analysis for a 1998 six-axle long-logger by an owner-operator company with a single log truck – 2006 & 2008 compared

Costs per mile, per ton, and per hour can be calculated from total cost of operations based upon performance averages presented in Table 2.1. Our estimated total non-wage cost of operations for a 1998 six-axle long-logger in 2006 was approximately $1.14 per mile. By June 2008, this cost had increased to $1.58 per mile, due primarily to the increase in fuel costs. The average cost per ton in 2006 was $4.37. The average cost per ton in June 2008 was $6.03. The average cost per hour in 2006 was $24.75 while in June 2008 the average cost per hour was $34.19. Findings indicate an increase in non-wage operations cost from 2006 to 2008 of 38.1%.

Table 2.15. Summary of non-wage single-truck operations cost.

Summary of cost/mile - 2006		**Summary of cost/mile - 2008**	
Fixed cost/mile	$0.30	Fixed cost/mile	$0.30
Variable cost/mile	$0.85	Variable cost/mile	$1.28
Total cost/mile	$1.14	Total cost/mile	$1.58
Summary of cost/ton - 2006		**Summary of cost/ton - 2008**	
Fixed cost/ton	$1.14	Fixed cost/ton	$1.14
Variable cost/ton	$3.23	Variable cost/ton	$4.89
Total cost/ton	$4.37	Total cost/ton	$6.03
Summary of cost/hour - 2006		**Summary of costs/hour - 2008**	
Fixed cost/hour	$6.46	Fixed Cost/hour	$6.46
Variable cost/hour	$18.28	Variable cost/hour	$27.72
Total cost/hour	$24.75	Total cost/hour	$34.19

Figure 2.3. Six-axle log truck; loading at the landing (Mason).

Non-wage operation costs analysis for a new six-axle long-logger by a company that operates a fleet of ten trucks – 2006 & 2008 compared

Costs per mile, per ton, and per hour can be calculated from total cost of operations based upon performance averages presented in Table 2.7. Our estimated average total non-wage cost of operations for a new six-axle long-logger by a fleet in 2006 was $1.28 per mile. By June 2008, this cost had increased to $1.72 per mile, due primarily to the increase in fuel costs. The average cost per ton in 2006 was $5.70. The average cost per ton in June 2008 was $7.64. The average cost per hour in 2006 was $28.98 while in June 2008 the average cost per hour was $38.84. Findings indicate an increase in non-wage operations cost from 2006 to 2008 of 34.0%.

Table 2.16. Summary of non-wage multiple truck operations cost.

Summary of cost/mile - 2006		**Summary of cost/mile - 2008**	
Fixed cost/mile	$0.53	Fixed cost/mile	$0.53
Variable cost/mile	$0.75	Variable cost/mile	$1.19
Total cost/mile	$1.28	Total cost/mile	$1.72
Summary of cost/ton - 2006		**Summary of cost/ton - 2008**	
Fixed cost/ton	$2.35	Fixed cost/ton	$2.35
Variable cost/ton	$3.35	Variable cost/ton	$5.28
Total cost/ton	$5.70	Total cost/ton	$7.64
Summary of cost/hour - 2006		**Summary of costs/hour - 2008**	
Fixed cost/hour	$11.96	Fixed Cost/hour	$11.96
Variable cost/hour	$17.02	Variable cost/hour	$26.87
Total cost/hour	$28.98	Total cost/hour	$38.84

Non-Wage Cost of operations; Simulation Comparisons

The results of non-wage operations costs simulations presented above indicated that both small and larger companies have experienced dramatic increases in operating costs due mainly to the rising price of diesel fuel in the two-year period from 2006 to 2008. Based upon the cost analysis results, we found that the change in the price of diesel fuel from 2006 to 2008 resulted in an operating expense increase of approximately $30,000 per year for each truck.

Table 2.17. Non-wage costs comparisons: single and multiple truck companies

	Single Truck Company			**Multiple Truck Company**		
	2006	**2008**	**% change**	**2006**	**2008**	**% change**
Fixed cost/mile	$0.30	$0.30	0.0%	$0.53	$0.53	0.0%
Variable cost/mile	$0.85	$1.28	51.6%	$0.75	$1.19	57.9%
Total cost/mile	$1.14	$1.58	38.1%	$1.28	$1.72	34.0%
Fixed cost/ton	$1.14	$1.14	0.0%	$2.35	$2.35	0.0%
Variable cost/ton	$3.23	$4.89	51.6%	$3.35	$5.28	57.9%
Total cost/ton	$4.37	$6.03	38.1%	$5.70	$7.64	34.0%
Fixed cost/hour	$6.46	$6.46	0.0%	$11.96	$11.96	0.0%
Variable cost/hour	$18.28	$27.72	51.6%	$17.02	$26.87	57.9%
Total cost/hour	$24.75	$34.19	38.1%	$28.98	$38.84	34.0%

Results suggested that owner-operators using older equipment may be able to deliver logs at a lower cost of operations as compared to newer truck fleet operations. Comparisons, however, are clouded by several factors. Tax benefits derived from new truck purchases are beyond the

scope of this investigation and have not been considered. Repair expenses for older trucks are averaged and may be understated. Operational differences in traffic congestion and haul distances may not be adequately considered. Simulations are based on performance metrics of hours per day, weeks per year, miles per year, and tons per year for theoretical company types that were derived from analysis of survey respondent information. In part, this approach was employed to see if down time associated with older truck operation and assumed repair costs ($5000 per year) would result in reduced performance that offset savings from lower purchase cost of an older truck. In fact, it is apparent from survey data that older trucks may work less days per year and require more hours of maintenance. However, for the sample simulation, operation costs per unit of output were higher for new truck companies.

For further comparison, we present the tables below. On the left are the percentage differences when multiple truck operations with newer equipment are compared to single truck operations with older equipment given the different assumed performance metrics for each company type as developed from survey averages (Tables 2.1 and 2.7). On the right are the percentage differences when multiple truck operations with newer equipment are compared to single truck operations with older equipment when miles traveled, tons hauled, and hours worked are held constant at the total survey average. Note that fixed costs are higher for the newer trucks (higher truck payments) but variable costs are lower (less repairs). For circumstances presented here with caveats offered above, savings on variable costs for multiple truck companies fail to offset higher fixed cost of operations resulting in a 12% higher average cost of operations for 2008 simulations.

Table 2.18. Percent difference cost/performance comparisons.

Performance (survey-based)		**Performance (constant)**	
Summary of cost/mile - 2008		**Summary of cost/mile - 2008**	
Fixed cost/mile	77%	Fixed cost/mile	90%
Variable cost/mile	-7%	Variable cost/mile	-6%
Total cost/mile	9%	Total cost/mile	12%
Summary of cost/ton - 2008		**Summary of cost/ton - 2008**	
Fixed cost/ton	106%	Fixed cost/ton	90%
Variable cost/ton	8%	Variable cost/ton	-6%
Total cost/ton	27%	Total cost/ton	12%
Summary of cost/hour - 2008		**Summary of costs/hour - 2008**	
Fixed cost/hour	85%	Fixed Cost/hour	90%
Variable cost/hour	-3%	Variable cost/hour	-6%
Total cost/hour	14%	Total cost/hour	12%

It should be pointed out, in regards the comparison above, that newer truck owners and older truck owners are both needed for a sustainable least-cost industry. Both benefit from a reciprocal equipment relationship. The newer truck owner requires the older truck owner to purchase a truck retired after seven years of operation. The older truck owner must rely upon the newer truck owner for provision of used trucks and lowered investment necessary for entry to the industry.

The preceding simulations presented an analysis of non-wage costs of log truck operation with emphasis on changing fuel prices, rather than a conclusive comparison of operation type cost efficiencies. Current (2008) non-wage operating costs fall within the ranges of $1.58 to $1.72 per mile, $6.03 to $7.64 per ton, and $34.19 to $38.84 per hour. The average non-wage total operational cost increase from 2006 to 2008, resulting primarily from fuel prices, has been within the range of 34% to 38%.

Operating Cost Simulations with Wages Considered Washington Log Truck Industry

An investigation of the complete costs of providing safe truck service in the logging industry needs to consider wages and wage-related costs. Surveyed companies and interviewed truckers were asked about compensation. Survey results showed that log hauling companies in Washington with employed drivers utilize two primary approaches for compensation; per hour and pay as a percentage of the truck daily gross return. Survey responses indicate truck drivers receive either an average wage of $16.09 per hour or are paid based upon 32.0% of the gross for the truck.

The U.S. Department of Labor Bureau of Labor Statistics (USBLS 2008) tracks wages in the state for most occupations. Unfortunately, log trucking is not tracked as a distinct occupational classification. We speculate that USBLS does not track log truck operator wages because independent operators are not subject to employment security scrutiny and hired drivers may be listed as employed in other occupations. For example, drivers employed by trucking firms may be listed as heavy truck operators while those employed by logging companies may be classified as loggers. However, current average wages for related occupational classifications as reported by USBLS for Washington State (Table 2.19) suggest that our survey averages for wage payments (Table 2.20), are not unreasonable, and may even be conservative.

Table 2.19. Average 2007 hourly wages for selected occupations as reported by USBLS.

Truck Driver, heavy and tractor-trailer	$18.96/hour
Logging Equipment Operator	$19.94/hour
Logging Workers, all others	$18.19/hour

Table 2.20. Average driver compensation alternatives indicated by survey respondents.
(n = 52; n = 25)

	Average	*Median*	*Minimum*	*Maximum*
Log Truck Driver $/hr	$16.09	$16.50	$8.00	$31.00
Log Truck Driver **%**	32.0%	33.0%	24.0%	37.0%

Responses to the log truck survey income questions suggested that some independent truckers may be less than certain about how much they actually earn per hour. Given an average driver age of 55 years, it is apparent that most log truckers spent a significant portion of their early careers delivering logs during the years when rates were set by the State. Under such circumstances, knowledge of practical accounting for individual firms may not have been essential. This has not been the case, however, since deregulation.

Another characteristic, possibly more apparent in the log hauling industry as compared to other businesses, is the degree to which truckers regard their work as a lifestyle as much as a source of income. Discussions with truckers conducted during this investigation, corroborated by analysis of survey response data, suggested that operators compensate for challenging income situations by working extended hours of service and by doing their own maintenance and repairs. Several respondent companies indicated that wives do the bookkeeping and receive no compensation. Many independent truckers appear to accept their income as being whatever is left at year-end rather than as part of a rate calculation prior to acceptance of a haul commitment. Survey responses in the following tables reflect the informal nature of log hauling contracts.

Table 2.21. Log truck survey question 22: "Do you know what you will be paid prior to beginning a new haul from a logging site?"
(n = 128)

Yes	*Sometimes*	*No*
26%	50%	24%

Table 2.22. Log truck survey question 23: "How long from the time of haul until you are paid?"
(n = 124)

Average	*Median*	*Minimum*	*Maximum*
3.4 weeks	3.0 weeks	1 week	11 weeks

As Brown commented back in 1936, when independent log hauling commitments are established by small "gyppo" contractors, some of whom may underestimate the total cost of operations, uneconomic competition can be the result leading to attrition in the industry.

In order to offer a representative range of the costs of operating a log truck for each company example, we developed one low-cost scenario (A) in which we use the suggested hourly wage of $16.09 but consider this as a flat rate in lieu of over-time and do not include insurance benefits. In the high-cost scenario (B), we model as for more conventional businesses and use the suggested hourly wage for the first 40 hours per week but increase to $24.14 ("time-and-a-half") for over-time hours in excess of 40 hours per week. For the high-cost scenario, we also include costs of insurance benefits for a 55-year-old driver and spouse. Survey analysis indicates that 50% of company owners provide themselves with health care benefits while 29% report extending similar benefits to employees. Other employment benefits such as retirement plans and paid vacations were not included for analysis but, if provided, would increase benefits costs.

The following section expands upon the analysis developed for non-wage costs of operations by adding low-cost and high-cost compensation scenarios for each sample company type for the years 2006 and 2008. Driver income for all simulations is anchored to a suggested average wage of $16.09 per hour. Hourly rates verses percent of truck gross are compared.

1) Total Costs of Operation for a Company with a Single Log Truck

Scenario 1A – Costs of Operation for a Company with a Single Log Truck
(With wage-related costs excluding overtime and health insurance benefits)

The self-employed driver does not pay State Labor and Industries taxes and does not pay Employment Security taxes. Social Security (Federal Insurance Contributions Act tax, FICA), as required by law for the self-employed, was calculated at 15.3% of earnings. All hours were considered straight time ($16.09 per hour) and no health insurance benefits were provided. All results are before federal income tax, do not include pension accommodations, and are presented as company costs estimates, not as revenue targets. All non-wage costs were held constant from previous simulations by company type. Cost results are provided for 2006 and for 2008.

Scenario 1B – Costs of Operation for a Company with a Single Log Truck
(With wage-related costs including overtime and health insurance benefits)

We modeled the same cost inputs as in Scenario 1A except compensation for hours worked was calculated with straight time ($16.09 per hour) for the first 40 hours each week and overtime ($24.14 per hour) for addition hours each week. Health insurance benefits were added for a 55 year-old company owner and spouse. Insurance rates of $841 per month (2006) and $984 per month (2008) were provided for the Regence Blue Shield Individual Plan© with $,$1,500 deductible. This company provides insurance to approximately 500 employees and members of the Washington Contract Loggers Association (Dynes 2008). All results are before federal income tax, do not include pension accommodations, and are presented as company costs estimates not as revenue targets. All non-wage costs were held constant from previous simulations by company type. Cost results are provided for 2006 and for 2008.

Table 2.23 1A - 2006 Cost of Operations for a Company with a Single Log Truck.

(With wage-related costs excluding overtime and health insurance benefits)

Annual	
Fixed Costs	
Truck payment	$8,432.61
Insurance	$3,971.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$2,213.00
Telephone, Electricity, Heat,	$1,355.00
Physical/drug test/compliance	$200.00
Benefits	$0.00
B&O Tax	$377.43
Total Fixed Costs/Year	$19,974.04

Monthly	
Fixed Costs	
Truck payment	$702.72
Insurance	$330.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$184.42
Telephone, Electricity, Heat,	$112.92
Physical/drug test/compliance	$16.67
Benefits	$0.00
B&O Tax	$31.45
Total Fixed Costs/Month	$1,664.50

Daily	
Fixed Costs	
Truck payment	$38.10
Insurance	$17.94
License & other fees	$10.05
Truck garage/shop	$5.42
Administration costs	$10.00
Telephone, Electricity, Heat,	$6.12
Physical/drug test/compliance	$0.90
Benefits	$0.00
B&O Tax	$1.71
Total Fixed Costs/Day	$90.26

Annual	
Variable Costs	
Operator Wages	$49,209.11
FICA	$7,528.99
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$35,524.37
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,085.00
Brakes	$600.00
Tires	$6,371.00
Misc Repairs	$5,000.00
Misc Expenses	$2,000.00
B&O Tax	$2,149.39
Total Variable Costs/Year	$113,747.86
Total Annual Costs	**$133,721.90**

Monthly	
Variable Costs	
Operator Wages	$4,100.76
FICA	$627.42
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$2,960.36
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$90.42
Brakes	$50.00
Tires	$530.92
Misc Repairs	$416.67
Misc Expenses	$166.67
B&O Tax	$179.12
Total Variable Costs/Month	$9,478.99
Total Monthly Costs	**$11,143.49**

Daily	
Variable Costs	
Operator Wages	$222.36
FICA	$34.02
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$160.53
Oil Change	$6.33
Lube and maintenace	$13.01
Misc hoses and lights	$4.90
Brakes	$2.71
Tires	$28.79
Misc Repairs	$22.59
Misc Expenses	$9.04
B&O Tax	$9.71
Total Variable Costs/Day	$514.00
Total Daily Costs	**$604.26**

Table 2.24. 1A - 2008 Cost of Operations for a Company with a Single Log Truck.

(With wage-related costs excluding overtime and health insurance benefits)

Annual	
Fixed Costs	
Truck payment	$8,432.61
Insurance	$3,971.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$2,213.00
Telephone, Electricity, Heat,	$1,355.00
Physical/drug test/compliance	$200.00
Benefits	$0.00
B&O Tax	$377.43
Total Fixed Costs/Year	$19,974.04

Monthly	
Fixed Costs	
Truck payment	$702.72
Insurance	$330.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$184.42
Telephone, Electricity, Heat,	$112.92
Physical/drug test/compliance	$16.67
Benefits	$0.00
B&O Tax	$31.45
Total Fixed Costs/Month	$1,664.50

Daily	
Fixed Costs	
Truck payment	$38.10
Insurance	$17.94
License & other fees	$10.05
Truck garage/shop	$5.42
Administration costs	$10.00
Telephone, Electricity, Heat,	$6.12
Physical/drug test/compliance	$0.90
Benefits	$0.00
B&O Tax	$1.71
Total Fixed Costs/Day	$90.26

Annual	
Variable Costs	
Operator Wages	$49,209.11
FICA	$7,528.99
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$63,658.63
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,085.00
Brakes	$600.00
Tires	$6,562.00
Misc Repairs	$5,000.00
Misc Expenses	$2,000.00
B&O Tax	$2,694.93
Total Variable Costs/Year	$142,618.67
Total Annual Costs	**$162,592.71**

Monthly	
Variable Costs	
Operator Wages	$4,100.76
FICA	$627.42
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$5,304.89
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$90.42
Brakes	$50.00
Tires	$546.83
Misc Repairs	$416.67
Misc Expenses	$166.67
B&O Tax	$224.58
Total Variable Costs/Month	$11,884.89
Total Monthly Costs	**$13,549.39**

Daily	
Variable Costs	
Operator Wages	$222.36
FICA	$34.02
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$287.66
Oil Change	$6.33
Lube and maintenace	$13.01
Misc hoses and lights	$4.90
Brakes	$2.71
Tires	$29.65
Misc Repairs	$22.59
Misc Expenses	$9.04
B&O Tax	$12.18
Total Variable Costs/Day	$644.46
Total Daily Costs	**$734.72**

Table 2.25. 1B - 2006 Cost of Operations for a Company with a Single Log Truck.

(With wage-related costs including overtime and health insurance benefits)

Annual	
Fixed Costs	
Truck payment	$8,432.61
Insurance	$3,971.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$2,213.00
Telephone, Electricity, Heat,	$1,355.00
Physical/drug test/compliance	$200.00
Benefits	$10,092.00
B&O Tax	$571.80
Total Fixed Costs/Year	$30,260.42

Monthly	
Fixed Costs	
Truck payment	$702.72
Insurance	$330.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$184.42
Telephone, Electricity, Heat,	$112.92
Physical/drug test/compliance	$16.67
Benefits	$841.00
B&O Tax	$47.65
Total Fixed Costs/Month	$2,521.70

Daily	
Fixed Costs	
Truck payment	$38.10
Insurance	$17.94
License & other fees	$10.05
Truck garage/shop	$5.42
Administration costs	$10.00
Telephone, Electricity, Heat,	$6.12
Physical/drug test/compliance	$0.90
Benefits	$45.60
B&O Tax	$2.58
Total Fixed Costs/Day	$136.74

Annual	
Variable Costs	
Operator Wages	$59,570.80
FICA	$9,114.33
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$35,524.37
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,085.00
Brakes	$600.00
Tires	$6,371.00
Misc Repairs	$5,000.00
Misc Expenses	$2,000.00
B&O Tax	$2,379.49
Total Variable Costs/Year	$125,924.98
Total Annual Costs	**$156,185.40**

Monthly	
Variable Costs	
Operator Wages	$4,964.23
FICA	$759.53
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$2,960.36
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$90.42
Brakes	$50.00
Tires	$530.92
Misc Repairs	$416.67
Misc Expenses	$166.67
B&O Tax	$198.29
Total Variable Costs/Month	$10,493.75
Total Monthly Costs	**$13,015.45**

Daily	
Variable Costs	
Operator Wages	$269.19
FICA	$41.19
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$160.53
Oil Change	$6.33
Lube and maintenace	$13.01
Misc hoses and lights	$4.90
Brakes	$2.71
Tires	$28.79
Misc Repairs	$22.59
Misc Expenses	$9.04
B&O Tax	$10.75
Total Variable Costs/Day	$569.02
Total Daily Costs	**$705.76**

Table 2.26. 1B - 2008 Cost of Operations for a Company with a Single Log Truck.

(With wage-related costs including overtime and health insurance benefits)

Annual	
Fixed Costs	
Truck payment	$8,432.61
Insurance	$3,971.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$2,213.00
Telephone, Electricity, Heat,	$1,355.00
Physical/drug test/compliance	$200.00
Benefits	$11,808.00
B&O Tax	$604.85
Total Fixed Costs/Year	$32,009.47

Monthly	
Fixed Costs	
Truck payment	$702.72
Insurance	$330.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$184.42
Telephone, Electricity, Heat,	$112.92
Physical/drug test/compliance	$16.67
Benefits	$984.00
B&O Tax	$50.40
Total Fixed Costs/Month	$2,667.46

Daily	
Fixed Costs	
Truck payment	$38.10
Insurance	$17.94
License & other fees	$10.05
Truck garage/shop	$5.42
Administration costs	$10.00
Telephone, Electricity, Heat,	$6.12
Physical/drug test/compliance	$0.90
Benefits	$53.36
B&O Tax	$2.73
Total Fixed Costs/Day	$144.64

Annual	
Variable Costs	
Operator Wages	$59,570.80
FICA	$9,114.33
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$63,658.63
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,085.00
Brakes	$600.00
Tires	$6,562.00
Misc Repairs	$5,000.00
Misc Expenses	$2,000.00
B&O Tax	$2,925.03
Total Variable Costs/Year	$154,795.79
Total Annual Costs	**$186,805.25**

Monthly	
Variable Costs	
Operator Wages	$4,964.23
FICA	$759.53
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$5,304.89
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$90.42
Brakes	$50.00
Tires	$546.83
Misc Repairs	$416.67
Misc Expenses	$166.67
B&O Tax	$243.75
Total Variable Costs/Month	$12,899.65
Total Monthly Costs	**$15,567.10**

Daily	
Variable Costs	
Operator Wages	$269.19
FICA	$41.19
Unemployment Compensation	$0.00
WA L&I Tax	$0.00
Fuel	$287.66
Oil Change	$6.33
Lube and maintenace	$13.01
Misc hoses and lights	$4.90
Brakes	$2.71
Tires	$29.65
Misc Repairs	$22.59
Misc Expenses	$9.04
B&O Tax	$13.22
Total Variable Costs/Day	$699.48
Total Daily Costs	**$844.13**

2) Total Cost of Operations for a Multi-Truck Company

Scenario 2A – Cost of Operations for a Multi-Truck Company
(With wage-related costs excluding overtime and health insurance benefits)

Washington State businesses with employees are required to pay State Labor and Industries Insurance and Employment Security taxes. For the theoretical company, modeled here as an employer of log truck drivers, we used a State Industrial employer obligation of $3.00 per hour and an Employment Security tax of 1.7% of wages. The employer contribution to FICA is 7.65% of wages. All hours were considered straight time ($16.09 per hour) and no health insurance benefits were provided. All results are before federal income tax, do not include pension accommodations, and are presented as company costs estimates not as revenue targets. All non-wage costs were held constant from previous simulations by company type. Cost results are provided for 2006 and for 2008.

Scenario 2B – Cost of Operations for a Multi-Truck Company
(With wage-related costs including overtime and health insurance benefits)

We modeled same cost inputs as in Scenario 2A except compensation for hours worked was calculated with straight time ($16.09 per hour) for the first 40 hours each week and overtime ($24.14 per hour) for addition hours each week. Health insurance benefits were provided for a 55 year-old driver and spouse. Insurance rates of $828 per month (2006) and $969 per month (2008) were provided by the Regence Blue Shield Group Plan© with $1000 deductible as the most comparable to the Regence Blue Shield Individual Plan© as shown for the owner-operator scenario above. This company provides insurance to approximately 500 employees and members of the Washington Contract Loggers Association (Dynes 2008). All results are before federal income tax, do not include pension accommodations, and are presented as company costs estimates not as revenue targets. All non-wage costs were held constant from previous simulations by company type. Cost results are provided for 2006 and for 2008.

Figure 2.4. Six-axle long-logger; unloading at the dump (Log Trucker Magazine).

Table 2.27. 2A - 2006 Cost of Operations for a Multi-Truck Company.

(With wage-related costs excluding overtime or insurance benefits)

Annual	
Fixed Costs	
Truck payment	$22,943.60
Insurance	$4,643.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$4,644.00
Telephone, Electricity, Heat,	$1,355.00
Physical/drug test/compliance	$200.00
Benefits	$0.00
B&O Tax	$716.68
Total Fixed Costs/Year	$37,927.27

Monthly	
Fixed Costs	
Truck payment	$1,911.97
Insurance	$386.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$387.00
Telephone, Electricity, Heat,	$112.92
Physical/drug test/compliance	$16.67
Benefits	$0.00
B&O Tax	$59.72
Total Fixed Costs/Month	$3,160.61

Daily	
Fixed Costs	
Truck payment	$98.81
Insurance	$20.00
License & other fees	$9.58
Truck garage/shop	$5.17
Administration costs	$20.00
Telephone, Electricity, Heat,	$5.84
Physical/drug test/compliance	$0.86
Benefits	$0.00
B&O Tax	$3.09
Total Fixed Costs/Day	$163.34

Annual	
Variable Costs	
Operator Wages	$50,736.21
FICA	$3,881.32
Unemployment Compensation	$862.52
WA L&I Tax	$9,459.83
Fuel	$38,253.62
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,142.50
Brakes	$600.00
Tires	$6,371.00
Misc Repairs	$0.00
Misc Expenses	$2,000.00
B&O Tax	$2,264.73
Total Variable Costs/Year	$119,851.72
Total Annual Costs	**$157,779.00**

Monthly	
Variable Costs	
Operator Wages	$4,228.02
FICA	$323.44
Unemployment Compensation	$71.88
WA L&I Tax	$788.32
Fuel	$3,187.80
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$95.21
Brakes	$50.00
Tires	$530.92
Misc Repairs	$0.00
Misc Expenses	$166.67
B&O Tax	$188.73
Total Variable Costs/Month	$9,987.64
Total Monthly Costs	**$13,148.25**

Daily	
Variable Costs	
Operator Wages	$218.50
FICA	$16.72
Unemployment Compensation	$3.71
WA L&I Tax	$40.74
Fuel	$164.74
Oil Change	$6.03
Lube and maintenace	$12.40
Misc hoses and lights	$4.92
Brakes	$2.58
Tires	$27.44
Misc Repairs	$0.00
Misc Expenses	$8.61
B&O Tax	$9.75
Total Variable Costs/Day	$516.16
Total Daily Costs	**$679.50**

Table 2.28. 2A - 2008 Cost of Operations for a Multi-Truck Company.

(With wage-related costs excluding overtime or insurance benefits)

Annual	
Fixed Costs	
Truck payment	$22,943.60
Insurance	$4,643.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$4,644.00
Telephone, Electricity, Heat,	$1,355.00
Physical/drug test/compliance	$200.00
Benefits	$0.00
B&O Tax	$716.68
Total Fixed Costs/Year	$37,927.27

Monthly	
Fixed Costs	
Truck payment	$1,911.97
Insurance	$386.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$387.00
Telephone, Electricity, Heat,	$112.92
Physical/drug test/compliance	$16.67
Benefits	$0.00
B&O Tax	$59.72
Total Fixed Costs/Month	$3,160.61

Daily	
Fixed Costs	
Truck payment	$98.81
Insurance	$20.00
License & other fees	$9.58
Truck garage/shop	$5.17
Administration costs	$20.00
Telephone, Electricity, Heat,	$5.84
Physical/drug test/compliance	$0.86
Benefits	$0.00
B&O Tax	$3.09
Total Fixed Costs/Day	$163.34

Annual	
Variable Costs	
Operator Wages	$50,736.21
FICA	$3,881.32
Unemployment Compensation	$862.52
WA L&I Tax	$9,459.83
Fuel	$68,549.38
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,142.50
Brakes	$600.00
Tires	$6,562.00
Misc Repairs	$0.00
Misc Expenses	$2,000.00
B&O Tax	$2,851.90
Total Variable Costs/Year	$150,925.65
Total Annual Costs	**$188,852.92**

Monthly	
Variable Costs	
Operator Wages	$4,228.02
FICA	$323.44
Unemployment Compensation	$71.88
WA L&I Tax	$788.32
Fuel	$5,712.45
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$95.21
Brakes	$50.00
Tires	$546.83
Misc Repairs	$0.00
Misc Expenses	$166.67
B&O Tax	$237.66
Total Variable Costs/Month	$12,577.14
Total Monthly Costs	**$15,737.74**

Daily	
Variable Costs	
Operator Wages	$218.50
FICA	$16.72
Unemployment Compensation	$3.71
WA L&I Tax	$40.74
Fuel	$295.22
Oil Change	$6.03
Lube and maintenace	$12.40
Misc hoses and lights	$4.92
Brakes	$2.58
Tires	$28.26
Misc Repairs	$0.00
Misc Expenses	$8.61
B&O Tax	$12.28
Total Variable Costs/Day	$649.98
Total Daily Costs	**$813.32**

Table 2.29. 2B - 2006 Cost of Operations for a Multi-Truck Company.

(With wage-related costs including overtime or insurance benefits)

Annual	
Fixed Costs	
Truck payment	$22,943.60
Insurance	$4,643.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$4,644.00
Telephone, Electricity, Heat,	$1,355.00
Physical/drug test/compliance	$200.00
Benefits	$9,936.00
B&O Tax	$908.04
Total Fixed Costs/Year	$48,054.64

Monthly	
Fixed Costs	
Truck payment	$1,911.97
Insurance	$386.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$387.00
Telephone, Electricity, Heat,	$112.92
Physical/drug test/compliance	$16.67
Benefits	$828.00
B&O Tax	$75.67
Total Fixed Costs/Month	$4,004.55

Daily	
Fixed Costs	
Truck payment	$98.81
Insurance	$20.00
License & other fees	$9.58
Truck garage/shop	$5.17
Administration costs	$20.00
Telephone, Electricity, Heat,	$5.84
Physical/drug test/compliance	$0.86
Benefits	$42.79
B&O Tax	$3.91
Total Fixed Costs/Day	$206.95

Annual	
Variable Costs	
Operator Wages	$61,159.92
FICA	$4,678.73
Unemployment Compensation	$1,039.72
WA L&I Tax	$9,459.83
Fuel	$38,253.62
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,142.50
Brakes	$600.00
Tires	$6,371.00
Misc Repairs	$0.00
Misc Expenses	$2,000.00
B&O Tax	$2,484.26
Total Variable Costs/Year	$131,469.59
Total Annual Costs	**$179,524.23**

Monthly	
Variable Costs	
Operator Wages	$5,096.66
FICA	$389.89
Unemployment Compensation	$86.64
WA L&I Tax	$788.32
Fuel	$3,187.80
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$95.21
Brakes	$50.00
Tires	$530.92
Misc Repairs	$0.00
Misc Expenses	$166.67
B&O Tax	$207.02
Total Variable Costs/Month	$10,955.80
Total Monthly Costs	**$14,960.35**

Daily	
Variable Costs	
Operator Wages	$263.39
FICA	$20.15
Unemployment Compensation	$4.48
WA L&I Tax	$40.74
Fuel	$164.74
Oil Change	$6.03
Lube and maintenace	$12.40
Misc hoses and lights	$4.92
Brakes	$2.58
Tires	$27.44
Misc Repairs	$0.00
Misc Expenses	$8.61
B&O Tax	$10.70
Total Variable Costs/Day	$566.19
Total Daily Costs	**$773.14**

Table 2.30. 2B - 2008 Cost of Operations for a Multi-Truck Company.

(With wage-related costs including overtime or insurance benefits)

Annual	
Fixed Costs	
Truck payment	$22,943.60
Insurance	$4,643.00
License & other fees	$2,225.00
Truck garage/shop	$1,200.00
Administration costs	$4,644.00
Telephone, Electricity, Heat,	$1,355.00
Physical/drug test/compliance	$200.00
Benefits	$11,626.92
B&O Tax	$940.61
Total Fixed Costs/Year	$49,778.13

Monthly	
Fixed Costs	
Truck payment	$1,911.97
Insurance	$386.92
License & other fees	$185.42
Truck garage/shop	$100.00
Administration costs	$387.00
Telephone, Electricity, Heat,	$112.92
Physical/drug test/compliance	$16.67
Benefits	$968.91
B&O Tax	$78.38
Total Fixed Costs/Month	$4,148.18

Daily	
Fixed Costs	
Truck payment	$98.81
Insurance	$20.00
License & other fees	$9.58
Truck garage/shop	$5.17
Administration costs	$20.00
Telephone, Electricity, Heat,	$5.84
Physical/drug test/compliance	$0.86
Benefits	$50.07
B&O Tax	$4.05
Total Fixed Costs/Day	$214.38

Annual	
Variable Costs	
Operator Wages	$61,159.92
FICA	$4,678.73
Unemployment Compensation	$1,039.72
WA L&I Tax	$9,459.83
Fuel	$68,549.38
Oil Change	$1,400.00
Lube and maintenace	$2,880.00
Misc hoses and lights	$1,142.50
Brakes	$600.00
Tires	$6,562.00
Misc Repairs	$0.00
Misc Expenses	$2,000.00
B&O Tax	$3,071.43
Total Variable Costs/Year	$162,543.51

Monthly	
Variable Costs	
Operator Wages	$5,096.66
FICA	$389.89
Unemployment Compensation	$86.64
WA L&I Tax	$788.32
Fuel	$5,712.45
Oil Change	$116.67
Lube and maintenace	$240.00
Misc hoses and lights	$95.21
Brakes	$50.00
Tires	$546.83
Misc Repairs	$0.00
Misc Expenses	$166.67
B&O Tax	$255.95
Total Variable Costs/Month	$13,545.29

Daily	
Variable Costs	
Operator Wages	$263.39
FICA	$20.15
Unemployment Compensation	$4.48
WA L&I Tax	$40.74
Fuel	$295.22
Oil Change	$6.03
Lube and maintenace	$12.40
Misc hoses and lights	$4.92
Brakes	$2.58
Tires	$28.26
Misc Repairs	$0.00
Misc Expenses	$8.61
B&O Tax	$13.23
Total Variable Costs/Day	$700.02

Total Annual Costs	**$212,321.64**	**Total Monthly Costs**	**$17,693.47**	**Total Daily Costs**	**$914.39**

Results and Discussion - Simulations of full cost of operations

Full cost of operations analysis for a 1998 six-axle long-logger by an owner-operator company with a single log truck – 2006 & 2008 compared

Scenario 1A – Cost of operations for a Company with a Single Log Truck
(With wage-related costs excluding overtime and health insurance benefits)

Results, presented for 2006 and 2008, indicated that the average cost of small company operations with wage-related costs excluding overtime and health insurance for a 1998 six-axle long-logger in 2006 was $2.02 per mile. By June 2008, this cost had increased to $2.46 per mile. The average cost per ton in 2006 was $7.71 while the average cost per ton in June 2008 was $9.38. The average cost per hour in 2006 was $43.72 while in June 2008 the average cost per hour was $53.16. Simulation 1A findings indicated an increase in cost of operations from 2006 to 2008 of 22%. Table 2.31 shows total cost/unit measure (for simulation 1A) presented as the sum of fixed and variable cost or as no-wage and wage cost.

Table 2.31. Summary of single-truck operation costs without overtime and benefits (1A).

Summary of cost/mile - 2006		**Summary of cost/mile - 2008**	
Fixed cost/mile	$0.30	Fixed cost/mile	$0.30
Variable cost/mile	$1.72	Variable cost/mile	$2.16
No-wage cost/mile	$1.15	No-wage cost/mile	$1.58
Wage cost/mile	$0.87	Wage cost/mile	$0.87
Total cost/mile	**$2.02**	**Total cost/mile**	**$2.46**
Summary of cost/ton - 2006		**Summary of cost/ton - 2008**	
Fixed cost/ton	$1.15	Fixed cost/ton	$1.15
Variable cost/ton	$6.56	Variable cost/ton	$8.23
No-wage cost/ton	$4.38	No-wage cost/ton	$6.04
Wage cost/ton	$3.34	Wage cost/ton	$3.34
Total cost/ton	**$7.71**	**Total cost/ton**	**$9.38**
Summary of cost/hour - 2006		**Summary of costs/hour - 2008**	
Fixed cost/hour	$6.53	Fixed Cost/hour	$6.53
Variable cost/hour	$37.19	Variable cost/hour	$46.63
No-wage cost/hour	$24.80	No-wage cost/hour	$34.24
Wage cost/hour	$18.91	Wage cost/hour	$18.91
Total cost/hour	**$43.72**	**Total cost/hour**	**$53.16**

Scenario 1B – Cost of operations for a Company with a Single Log Truck
(With wage-related costs including overtime and health insurance benefits)

Results, presented for 2006 and 2008, indicated that the average cost of small company operations with wage-related costs including overtime and health insurance for a 1998 six-axle long-logger in 2006 was $2.36 per mile. By June 2008, this cost had increased to $2.83 per mile. The average cost per ton in 2006 was $9.01 while the average cost per ton in June 2008 was $10.78. The average cost per hour in 2006 was $51.07 while in June 2008 the average cost per hour was $61.08. Simulation 1B findings indicated an increase in cost of operations from 2006 to 2008 of 20%. Table 2.32 shows total cost/unit measure (for simulation 1B) presented as the sum of fixed and variable cost or as no-wage and wage cost.

Table 2.32. Summary of single-truck operation costs with overtime and benefits (1B).

Summary of cost/mile - 2006		**Summary of cost/mile - 2008**	
Fixed cost/mile	$0.46	Fixed cost/mile	$0.48
Variable cost/mile	$1.90	Variable cost/mile	$2.34
No-wage cost/mile	$1.30	No-wage cost/mile	$1.77
Wage cost/mile	$1.06	Wage cost/mile	$1.06
Total cost/mile	**$2.36**	**Total cost/mile**	**$2.83**
Summary of cost/ton - 2006		**Summary of cost/ton - 2008**	
Fixed cost/ton	$1.75	Fixed cost/ton	$1.85
Variable cost/ton	$7.26	Variable cost/ton	$8.93
No-wage cost/ton	$4.97	No-wage cost/ton	$6.74
Wage cost/ton	$4.04	Wage cost/ton	$4.04
Total cost/ton	**$9.01**	**Total cost/ton**	**$10.78**
Summary of cost/hour - 2006		**Summary of costs/hour - 2008**	
Fixed cost/hour	$9.89	Fixed Cost/hour	$10.47
Variable cost/hour	$41.17	Variable cost/hour	$50.61
No-wage cost/hour	$28.16	No-wage cost/hour	$38.18
Wage cost/hour	$22.89	Wage cost/hour	$22.89
Total cost/hour	**$51.07**	**Total cost/hour**	**$61.08**

Comparison of 1A and 1B

Addition of overtime and health insurance benefits for the small company owner-operator increased the total cost of operations in 2008 by 14.9% with a wage base rate of $16.09 per hour. As mentioned above, some companies determine driver wage based upon a percentage of the gross (32% was the survey average). A comparison of the hourly and percentage-based average wage rate produced interesting results. While percent share for a driver is based upon gross revenue not total costs, for relative comparisons we calculated a percent share of total costs as derived from the $16.09 hourly wage anchor. When the percentage share remained constant at 32.0% from 2006 to 2008, driver earnings increased as the price of fuel increased. In 2006, the hourly rate produced the highest annual income for both 1A and 1B scenarios, whereas, in 2008, this was not the case. 2008 simulations for 1A (no overtime or benefits) produced a 5.4 percent benefit for the percent wage but when overtime was included the hourly wage and the percentage wage were very close to equal (Table 2.33). Some trucking companies have reported establishing contracting relationships in recent years that make periodic adjustment to haul rates by adding a fuel surcharge to accommodate spikes in the diesel price that could otherwise result in operation losses. If fuel surcharges become a common market arrangement to equitably absorb periodic increases in fuel costs, the use of a simple percentage of the gross as means to determine wages would produce undesirable results more linked to fuel price than productivity and without some adjustment might serve to undermine the effectiveness of fuel surcharges at offsetting the impacts of rising diesel prices. Further examination of wage calculation implications occur in Table 2.36. Fuel is the single largest cost of log truck operations and wages is the second largest cost.

Table 2.33. Comparison of $16.09 per hour and 32.0% of total truck costs as a determiner of annual wage for a single-truck operation in years 2006 and 2008.

	2006 - $16.09/hr	**2006 - 32%**	**2008 - $16.09/hr**	**2008 - 32%**
1A - Without Overtime	$49,209	$42,791	$49,209	$52,030
1B - With Overtime	$59,571	$49,979	$59,571	$59,778

Full cost of operations analysis for a new six-axle long-logger by a multi-truck company – 2006 & 2008 compared

Scenario 2A – Cost of operations for a Multi-Truck Company
(With wage-related costs excluding overtime and health insurance benefits)

Results, presented for 2006 and 2008, indicated that the average cost of fleet operations, with wage-related costs excluding overtime and health insurance, for a new six-axle long logger in 2006 was $2.22 per mile. By June 2008 this cost had increased to $2.65 per mile. The average cost per ton in 2006 was $9.84. The average cost per ton in June 2008 is $11.78. The average cost per hour in 2006 was $50.04 while in June 2008 the average cost per hour is $59.89. Simulation 2A findings indicated an increase in cost of operations from 2006 to 2008 of 20%. Table 2.34 shows total cost/unit measure (for simulation 2A) presented as the sum of fixed and variable cost or as no-wage and wage cost.

Table 2.34. Summary of multi-truck company operation costs without overtime and benefits (2A).

Summary of cost/mile - 2006		**Summary of cost/mile - 2008**	
Fixed cost/mile	$0.53	Fixed cost/mile	$0.53
Variable cost/mile	$1.68	Variable cost/mile	$2.12
No-wage cost/mile	$1.29	No-wage cost/mile	$1.72
Wage cost/mile	$0.93	Wage cost/mile	$0.93
Total cost/mile	**$2.22**	**Total cost/mile**	**$2.65**

Summary of cost/ton - 2006		**Summary of cost/ton - 2008**	
Fixed cost/ton	$2.37	Fixed cost/ton	$2.37
Variable cost/ton	$7.47	Variable cost/ton	$9.41
No-wage cost/ton	$5.71	No-wage cost/ton	$7.65
Wage cost/ton	$4.13	Wage cost/ton	$4.13
Total cost/ton	**$9.84**	**Total cost/ton**	**$11.78**

Summary of cost/hour - 2006		**Summary of costs/hour - 2008**	
Fixed cost/hour	$12.03	Fixed Cost/hour	$12.03
Variable cost/hour	$38.01	Variable cost/hour	$47.86
No-wage cost/hour	$29.03	No-wage cost/hour	$38.89
Wage cost/hour	$20.99	Wage cost/hour	$20.99
Total cost/hour	**$50.04**	**Total cost/hour**	**$59.89**

Scenario 2B – Cost of operations for a Multi-Truck Company
(With wage-related costs including overtime and health insurance benefits)

Results, presented for 2006 and 2008, indicated that the average cost of fleet operations, with wage-related costs including overtime and health insurance, for a new six-axle long logger in 2006 was $2.52 per mile. By June 2008 this cost had increased to $2.98 per mile. The average cost per ton in 2006 was $11.20 and was $13.24 in June 2008. The average cost per hour in 2006 was $56.93, while in June 2008 the average cost per hour was $67.33. Simulation 2B findings indicated an increase in cost of operations from 2006 to 2008 of 15%. Table 2.35 shows total cost/unit measure (for simulation 2B) presented as the sum of fixed and variable cost or as no-wage and wage cost.

Table 2.35. Summary of multi-truck company operation costs with overtime and benefits (2B).

Summary of cost/mile - 2006		**Summary of cost/mile - 2008**	
Fixed cost/mile	$0.67	Fixed cost/mile	$0.70
Variable cost/mile	$1.85	Variable cost/mile	$2.28
No-wage cost/mile	$1.43	No-wage cost/mile	$1.89
Wage cost/mile	$1.09	Wage cost/mile	$1.09
Total cost/mile	**$2.52**	**Total cost/mile**	**$2.98**

Summary of cost/ton - 2006		**Summary of cost/ton - 2008**	
Fixed cost/ton	$3.00	Fixed cost/ton	$3.10
Variable cost/ton	$8.20	Variable cost/ton	$10.14
No-wage cost/ton	$6.34	No-wage cost/ton	$8.39
Wage cost/ton	$4.85	Wage cost/ton	$4.85
Total cost/ton	**$11.20**	**Total cost/ton**	**$13.24**

Summary of cost/hour - 2006		**Summary of costs/hour - 2008**	
Fixed cost/hour	$15.24	Fixed Cost/hour	$15.79
Variable cost/hour	$41.69	Variable cost/hour	$51.55
No-wage cost/hour	$32.24	No-wage cost/hour	$42.65
Wage cost/hour	$24.68	Wage cost/hour	$24.68
Total cost/hour	**$56.93**	**Total cost/hour**	**$67.33**

Comparison of 2A and 2B

Addition of overtime and health insurance benefits for employee drivers working for a multiple truck company increased the total cost of operations in 2008 by 12.4% with a wage base rate of $16.09 per hour. Simulated comparisons of hourly verses percent wage calculation were developed for cost analysis scenarios 2A and 2B. Table 2.36, below, contains results as were presented for scenarios 1A and 1B in Table 2.33. When the percentage share remains constant at 32.0% from 2006 to 2008, driver earnings increase with the price of fuel. In 2006 for scenario 2A, which excluded overtime, the percentage rate produced about 3% more annual income than the annual income from the hourly wage. When allowance for overtime was included (scenario 2B), the situation reversed; the hourly wage scenario for 2006 produced about 3% higher annual income than the percentage. For 2008, the percentage share of truck costs produced significantly higher annual income from both the A and B simulations. Worthy of note is that the 2008 percentage income for 2A (straight time) is greater than the 2008 income from the hourly wage with overtime included (2B). This was not the case for the owner-operator simulations (Table 2.33). Our demonstration of hourly wage verses percentage calculations to determine truck driver income (Tables 2.33 and 2.36) has been offered here to demonstrate the potential impracticality of percentage-based wage calculation when cost of operations fluctuates independent of productivity.

Table 2.36. Comparison of $16.09 per hour and 32.0% of total truck costs as a determiner of annual wage for a fleet driver of a new long-logger in years 2006 and 2008.

	2006 - $16.09/hr	**2006 - 32%**	**2008 - $16.09/hr**	**2008 - 32%**
2A - Without Overtime	$50,736	$50,489	$50,736	$60,433
2B - With Overtime	$61,160	$57,448	$61,160	$67,943

Implications of Business and Occupation Taxes

Our review of cost implications for the hourly wage verses the percentage wage highlights an important reality for trucking companies. Increases to variable costs such as fuel or compensation result in correspondent increases to total cost of operations and, consequently, to any element of operations costs that is determined as a percentage of the total. The Washington Business and Occupation Tax (B&O Tax) is calculated at 1.926 percent of gross revenues. An examination of the implications of B&O Taxes relative to increases in fuel costs and worker compensation was conducted using our simulations of log truck operation costs examples.

Table 2.37. B&O Tax implications for the single-truck company from Scenarios 1A and 1B; 2006-2008.

2006	Total	Fuel	Wages	Fuel & Wages
B&O Taxes - 1A$	$2,527	$684	$1,093	$1,777
B&O Taxes - 1A%	100%	27%	43%	70%
B&O Taxes - 1B$	$2,951	$684	$1,517	$2,201
B&O Taxes - 1B%	100%	23%	51%	75%
2008	**Total**	**Fuel**	**Wages**	**Fuel & Wages**
B&O Taxes - 1A$	$3,072	$1,226	$1,093	$2,319
B&O Taxes - 1A%	100%	40%	36%	75%
B&O Taxes - 1B$	$3,530	$1,226	$1,550	$2,776
B&O Taxes - 1B%	100%	35%	44%	79%

From the B&O Tax Table 2.37, presented above for the single-truck examples (Scenarios 1A and 1B; 2006-2008), we can see that, depending upon scenario, B&O Taxes associated with fuel and wages accounted for between 70% and 79% of the total B&O Tax responsibility. In 2008, simulated B&O Taxes for fuel cost alone were $1,226 per year. Based upon miles traveled per year (66,122) and rate of fuel consumption in miles per gallon (5.1), we estimated that, for this cost simulation, 12,965 gallons of fuel were used annually. With 2008 fuel price, B&O Taxes function as an additional $0.10 per gallon fuel tax except, unlike actual fuel taxes, B&O Taxes are calculated based upon the total price at the pump, which includes significant state and federal taxes. From 2006 to 2008, although loads of logs hauled remained constant, the increase in the price of fuel resulted in an increase in the total B&O Tax of 18.4% to 21.4% for the single-truck company example. Wage-related costs were also double-taxed; in addition to direct wages and benefits, B&O Taxes are charged against FICA expenditures.

Table 2.38. B&O Tax implications for the multi-truck company from Scenarios 2A and 2B; 2006-2008.

2006	Total	Fuel	Wages	Fuel & Wages
B&O Taxes - 2A$	$2,981	$737	$1,251	$1,988
B&O Taxes - 2A%	100%	25%	42%	67%
B&O Taxes - 2B$	$3,392	$737	$1,662	$2,398
B&O Taxes - 2B%	100%	22%	49%	71%
2008	**Total**	**Fuel**	**Wages**	**Fuel & Wages**
B&O Taxes - 2A$	$3,569	$1,320	$1,251	$2,571
B&O Taxes - 2A%	100%	37%	35%	72%
B&O Taxes - 2B$	$4,012	$1,320	$1,694	$3,014
B&O Taxes - 2B%	100%	33%	42%	75%

Tax exposures are more onerous for employers. From the B&O Tax Table 2.38, presented above for employer examples (Scenarios 2A and 2B; 2006-2008), we can see that, depending upon scenario, B&O Taxes associated with fuel and wages account for between 67% and 75% of the total B&O Tax responsibility. While the percentage increase to total costs goes down slightly for the employer, the actual cost goes up. The implications of B&O Taxes on fuel costs remain the same for both truck simulations; about $0.10 per gallon of fuel at 2008 price. Recall that the fleet company fuel costs are higher because the simulation showed the fleet truck traveling more miles per year. From 2006 to 2008 although loads of logs hauled remained constant, the increase in the price of fuel resulted in an increase in the total B&O Tax of 17.2% to 19.6% for the multi-truck company example. In addition to direct wages and benefits, for employers, B&O Taxes are charged against FICA, Labor and Industries, and Unemployment Security expenditures. B&O Taxes add to cost burdens for companies such as log haulers with fixed levels of productivity that struggle to accommodate increasing variable costs of operations such as fuel and wage-related costs. B&O Taxes, as currently levied, can affect employees by lowering company profitability and serving as a disincentive for employers to provide better wages and benefits.

Analysis Summary and Conclusion - Total Costs of Operating a Log Truck

Log hauling business scenarios were previously synthesized to provide benchmark ranges of fixed, variable, and total costs. Special attention to significant increases in variable costs for the log truck industry from 2006 to 2008 was presented. The tables below display summary cost ranges from the simulation results.

Table 2.39. Fixed, variable, wage and non-wage, and total cost of operations for miles, tons, and hours for scenarios 1A and 2A (without overtime and benefits).

	Single Truck Company - 1A			Multiple Truck Company - 2A		
	2006	**2008**	**% change**	**2006**	**2008**	**% change**
Fixed cost/mile	$0.30	$0.30	0%	$0.53	$0.53	0%
Variable cost/mile	$1.72	$2.16	25%	$1.68	$2.12	26%
No-wage cost/mile	$1.15	$1.58	38%	$1.29	$1.72	34%
Wage cost/mile	$0.87	$0.87	0%	$0.93	$0.93	0%
Total cost/mile	$2.02	$2.46	22%	$2.22	$2.65	20%
Fixed cost/ton	$1.15	$1.15	0%	$2.37	$2.37	0%
Variable cost/ton	$6.56	$8.23	25%	$7.47	$9.41	26%
No-wage cost/ton	$4.38	$6.04	38%	$5.71	$7.65	34%
Wage cost/ton	$3.34	$3.34	0%	$4.13	$4.13	0%
Total cost/ton	$7.71	$9.38	22%	$9.84	$11.78	20%
Fixed cost/hour	$6.53	$6.53	0%	$12.03	$12.03	0%
Variable cost/hour	$37.19	$46.63	25%	$38.01	$47.86	26%
No-wage cost/hour	$24.80	$34.24	38%	$29.03	$38.89	34%
Wage cost/hour	$18.91	$18.91	0%	$20.99	$20.99	0%
Total cost/hour	$43.72	$53.16	22%	$50.04	$59.89	20%

Table 2.40. Fixed, variable, wage and non-wage, and total cost of operations for miles, tons, and hours for scenarios 1B and 2B (with overtime and benefits).

	Single Truck Company - 1B			Multiple Truck Company - 2B		
	2006	**2008**	**% change**	**2006**	**2008**	**% change**
Fixed cost/mile	$0.46	$0.48	6%	$0.67	$0.70	4%
Variable cost/mile	$1.90	$2.34	23%	$1.85	$2.28	24%
No-wage cost/mile	$1.30	$1.77	36%	$1.43	$1.89	32%
Wage cost/mile	$1.06	$1.06	0%	$1.09	$1.09	0%
Total cost/mile	$2.36	$2.83	20%	$2.52	$2.98	18%
Fixed cost/ton	$1.75	$1.85	6%	$3.00	$3.10	4%
Variable cost/ton	$7.26	$8.93	23%	$8.20	$10.14	24%
No-wage cost/ton	$4.97	$6.74	36%	$6.34	$8.39	32%
Wage cost/ton	$4.04	$4.04	0%	$4.85	$4.85	0%
Total cost/ton	$9.01	$10.78	20%	$11.20	$13.24	18%
Fixed cost/hour	$9.89	$10.47	6%	$15.24	$15.79	4%
Variable cost/hour	$41.17	$50.61	23%	$41.69	$51.55	24%
No-wage cost/hour	$28.16	$38.18	36%	$32.24	$42.65	32%
Wage cost/hour	$22.89	$22.89	0%	$24.68	$24.68	0%
Total cost/hour	$51.07	$61.08	20%	$56.93	$67.33	18%

Cost of operations compared to average survey-reported gross revenues

The average annual gross revenue for 2006 for a log trucking company as reported by 103 survey respondent companies was $137,775 (Table 2.41). A comparison of this gross return to simulated cost of operations for 2006 suggests that average revenues for log truck companies were marginally equivalent to our lowest estimate of full cost of operations as modeled for the 2006 owner-operator scenario (1A; without overtime or benefits). Annual estimated costs of operations are shown below in Table 2.42 for 2006 and 2008 based upon low (1A) and high (2B) operations simulations.

Table 2.41. Log truck survey results for 2006 gross return.
(n = 103)

	Average	*Median*	*Min*	*Max*
Annual Truck Gross 2006	$137,775	$134,198	$42,000	$232,910

Table 2.42 Modeled annual cost of operations and fuel costs for 2006 to 2008. Ranges reflect low (1A self-employed driver: older truck with no overtime or benefits) to high (2B employed driver: new truck with overtime and benefits). Base wage = $16.09/hr.

	Low Cost of Operations		**Percent**
	2006 (1A)	**2008 (1A)**	**Increase**
Total Cost	**$133,721.90**	**$162,592.71**	**21.6%**
Fuel Cost	**$35,524.37**	**$63,658.63**	**79.2%**
	High Cost of Operations		**Percent**
	2006 (2B)	**2008 (2B)**	**Increase**
Total Cost	**$179,524.23**	**$212,321.64**	**18.3%**
Fuel Cost	**$38,253.62**	**$68,549.38**	**79.2%**

Analysis of the distribution of survey-reported gross revenues (Figure 2.5) suggests that about half of respondent companies were operating log trucks with revenues below estimated minimum cost of full-time operations (1A). In contrast, less than six percent of survey respondents reported gross earnings that exceeded the simulated 2006 high cost of operations (2B) for a new truck with a driver that received $16.09 per hour with over time and health insurance benefits.

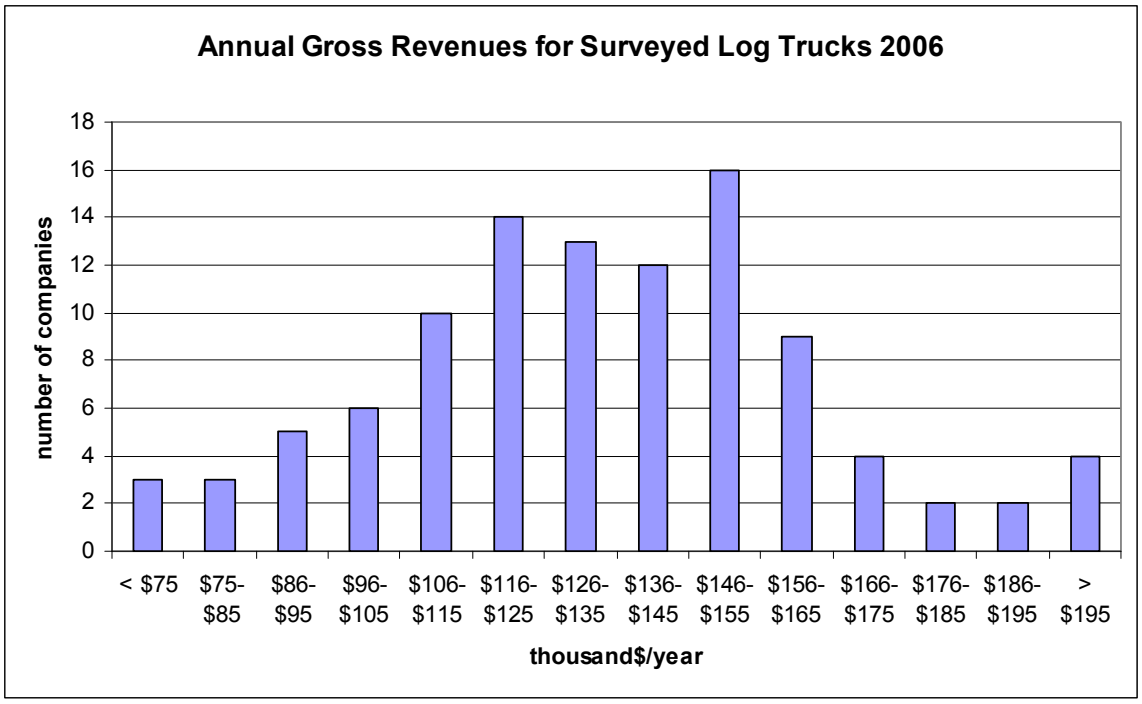

Figure 2.5. 2006 gross revenue per truck as reported by respondent log truck companies.

The authors have simulated above a representative range of the average cost of operations for a log truck in Washington. Input data were developed from a broad survey of log trucking firms and discussions with vendors and institutional associations, allowing a thorough investigation of the industry. Our investigation results are, therefore, to be considered as reasonable averages that approximate cost magnitudes and sensitivities. Costs will logically vary considerably for individual businesses. Additional costs may be present that have not been included in this review. Federal income taxes are calculated from revenues and consequently were not included in our cost analysis. Results are to be considered as conservative estimates of baseline required operating expenses based upon best available information.

Table 2.43, presented on the final page of this report section, provides a side-by-side comparison of the 2008 least-cost annual operational costs estimates (self-employed driver: older truck with no overtime or benefits) as compared to high-cost annual operational costs estimates (employed driver: new truck with full overtime and benefits). It should be noted that the least-cost example should be considered as applicable only for owner-operators as wage-related costs for an employer, with all other costs held constant, would increase total annual costs of operation for the least-cost example by approximately $6500 per year. Current regulations do not allow denying employees overtime. To hold total annual costs constant at the level of the least-cost example and apply to a company with hired drivers, the hourly wage would be significantly reduced to approximately a net of $11.75 per hour in order to accommodate the calculation requirement of time-and-a-half for weekly hours worked over 40.

Table 2.43. 2008 estimated total cost of operations (fuel = $4.91/gallon; wages = $16.09/hour). Ranges reflect low on left (1A owner-operator: 1998 truck with no overtime or benefits) to high on right (2B employed driver: new truck with full overtime and benefits).

2008 - 1A - 1998 owner-operator without overtime or benefits		
Annual		**Percent**
Fixed Costs		
Truck payment	$8,432.61	5.2%
Insurance	$3,971.00	2.4%
License & other fees	$2,225.00	1.4%
Truck garage/shop	$1,200.00	0.7%
Administration costs	$2,213.00	1.4%
Telephone, Electricity, Heat,	$1,355.00	0.8%
Physical/drug test/compliance	$200.00	0.1%
Benefits	$0.00	0.0%
B&O Tax	$377.43	0.2%
Total Fixed Costs/Year	$19,974.04	12.3%
Annual		
Variable Costs		
Operator Wages	$49,209.11	30.3%
FICA	$7,528.99	4.6%
Unemployment Compensation	$0.00	0.0%
WA L&I Tax	$0.00	0.0%
Fuel	$63,658.63	39.2%
Oil Change	$1,400.00	0.9%
Lube and maintenace	$2,880.00	1.8%
Misc hoses and lights	$1,085.00	0.7%
Brakes	$600.00	0.4%
Tires	$6,562.00	4.0%
Misc Repairs	$5,000.00	3.1%
Misc Expenses	$2,000.00	1.2%
B&O Tax	$2,694.93	1.7%
Total Variable Costs/Year	$142,618.67	87.7%
Total Annual Costs	**$162,592.71**	100.0%

2008 - 2B - new fleet truck with overtime and benefits		
Annual		**Percent**
Fixed Costs		
Truck payment	$22,943.60	10.8%
Insurance	$4,643.00	2.2%
License & other fees	$2,225.00	1.0%
Truck garage/shop	$1,200.00	0.6%
Administration costs	$4,644.00	2.2%
Telephone, Electricity, Heat,	$1,355.00	0.6%
Physical/drug test/compliance	$200.00	0.1%
Benefits	$11,626.92	5.5%
B&O Tax	$940.61	0.4%
Total Fixed Costs/Year	$49,778.13	23.4%
Annual		
Variable Costs		
Operator Wages	$61,159.92	28.8%
FICA	$4,678.73	2.2%
Unemployment Compensation	$1,039.72	0.5%
WA L&I Tax	$9,459.83	4.5%
Fuel	$68,549.38	32.3%
Oil Change	$1,400.00	0.7%
Lube and maintenace	$2,880.00	1.4%
Misc hoses and lights	$1,142.50	0.5%
Brakes	$600.00	0.3%
Tires	$6,562.00	3.1%
Misc Repairs	$0.00	0.0%
Misc Expenses	$2,000.00	0.9%
B&O Tax	$3,071.43	1.4%
Total Variable Costs/Year	$162,543.51	76.6%
Total Annual Costs	**$212,321.64**	100.0%

Section III: Safety

Basis of Concern

Figure 3.1. Overturned log truck (Associated Oregon Loggers).

In 2007, the State Legislature requested that scientists from the University of Washington and Washington State University undertake an investigation of the Washington log truck industry towards gaining better understanding of "*the costs to safely provide log hauling services*." No such study has previously been conducted in Washington. Log hauling has a history of being a hazardous profession. During the 40-year period from 1950 to 1989, 1246 log truck drivers (average 31 per year) were killed on the job (Milham 1997). Since that time, deregulation of the trucking industry, rising fuel prices, declining wood markets, shortages of skilled drivers, increases in traffic congestion and other ensuing circumstances have added new operational pressures that could logically have safety implications for this historically dangerous industry. The Legislature has correctly identified the safe operation of log trucks as a timely matter for public concern. Safe and sustainable log hauling services are needed to support a significant Washington forest industry and to protect the traveling public.

Motor vehicle accidents create a huge financial impact on society, dramatically affect quality of life, and are the leading cause of unintentional deaths in the United States (NSC 2005). In 2000, the total cost of motor vehicle crashes was estimated by the National Highway Traffic Safety Administration (NHSTA) to be $230.6 billion (NHTSA 2006). NHTSA reported that tractor-trailer trucks are only 3% of registered vehicles in the United States but are involved in 10% of all fatal vehicle crashes (NHTSA 2004). Collisions in Washington involving all heavy trucks increased by 15% from 2004 to 2006. Truck-related injuries increased by 7% and collision fatalities by 40% during the same period (WSDOT 2007).

Every year approximately one million loads of logs are hauled by log trucks on Washington's roadways. The cumulative annual distance of travel is approximately 140 million miles often under adverse road and weather conditions. For reference, 140 million miles is 0.4 percent of the total annual vehicle miles traveled (Total 2007 VMT = approximately 32 billion miles) in Washington (WSDOT 2008). Log trucks travel over private, county, state and federal road systems on dirt, gravel, and pavement. In 2007, log trucks were involved in 116 accidents in Washington (WSDOT 2008, WSP 2008).

In the previous section of this report, the costs of operations for a log truck under different service arrangements were established for 2006 and 2008. Worthy of note is the 20 percent increase in operations costs from 2006 to 2008 largely caused by increases in fuel prices. This significant

change indicates that costs of operations are volatile and, when compared with survey information on trucker revenues, suggests that revenues for some companies are probably not keeping pace. A survey of motor carrier insurers, conducted by the Federal Motor Carrier Safety Administration, revealed a consensus amongst insurance providers that the most financially stable trucking companies are also the safest companies (FMCSA 2008). Rapidly increasing cost of operations have been noted as a cause of instability and heightened safety hazard in the trucking industry with the least profitable and smallest companies most vulnerable (GAO 1991). Analysis of log truck registration data from the WA Department of Licensing indicated that, in 2006, 68 percent of registrations were from small independent operators (WSDOL). Independent operators with a single log truck represented 64 percent of survey respondent companies.

Current Safety Status of the Log Truck Industry

In this section, we examine safety information and report analysis of data collected from state agencies, transportation safety literature, interviews with truckers, and industry survey results. Remarkably, a key finding of our analysis of accident and fatality data from the WA Department of Labor and Industries (L&I), WA Department of Transportation (WSDOT), and the WA State Patrol (WSP) was that even as accident rates have increased for all heavy trucks in Washington, 15% from 2006 to 2008, the log truck subset of this larger traffic sector showed no similar trend.

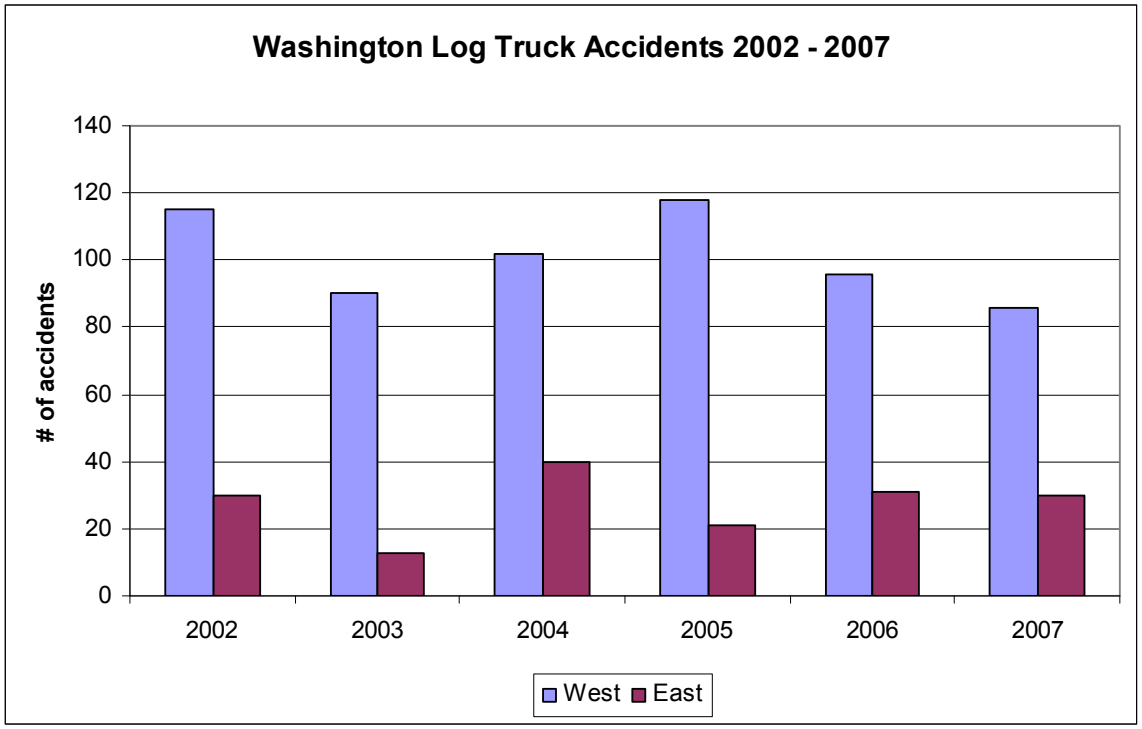

Figure 3.2. Washington log truck accidents 2002 – 2007.

Analysis of all log truck traffic accidents in Washington from 2002 through 2007, as displayed in Figure 3.2 above, shows no particular trend for either side of the Cascade Mountains. These data were complied by the WSP and the WSDOT based upon accident reports collected at the scene by responding officers. Included are all accidents, regardless of fault or vehicle state of origin that involved log trucks during the stated years. Over the six year period, a total of 772 accidents with an average of 129 accidents per year were found.

Further examination of log truck collision data was conducted to see if any trends could be found relative to issues of concern such as fatigue, defective equipment, and injury severity collisions.

Results are shown in Figures 3.3 and 3.4 below. Injuries reported included all occupants of collision-involved vehicles. There was no apparent increase in accidents resulting from defective equipment or fatigue; in fact, the last three years have been substantially under the previous three years. No trends indicating increases in injury severity collision were found to be present. Log truck accidents in Washington averaged approximately 0.1% of all vehicular accidents and 0.5% of all fatal accidents from 2002 to 2006. Large trucks typically are expected to have significantly higher rates of crash fatalities than automobiles due to size, weight, configuration and braking capability. Yet, this does not appear to be the case for log truck accidents in Washington. In 2006, log truck traffic accounted for 0.4% of total vehicle miles traveled (VMT) in Washington. From 2002 through 2007, there was only one confirmed case of log truck driver intoxication resulting in an accident.

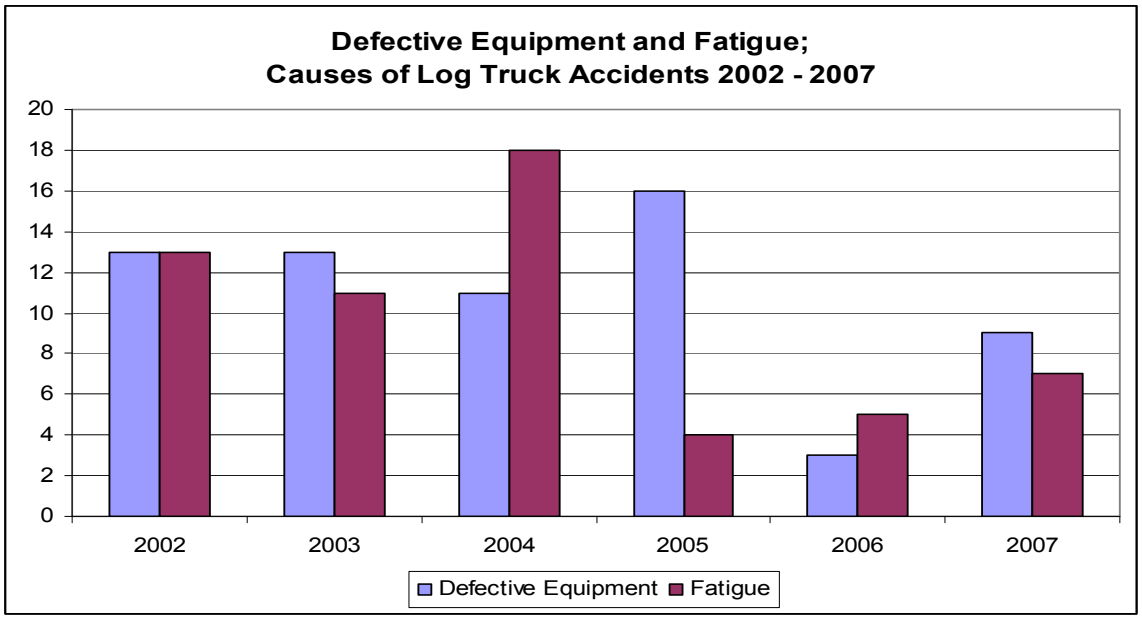

Figure 3.3. Defective equipment and fatigue; causes of log truck accidents 2002-2007.

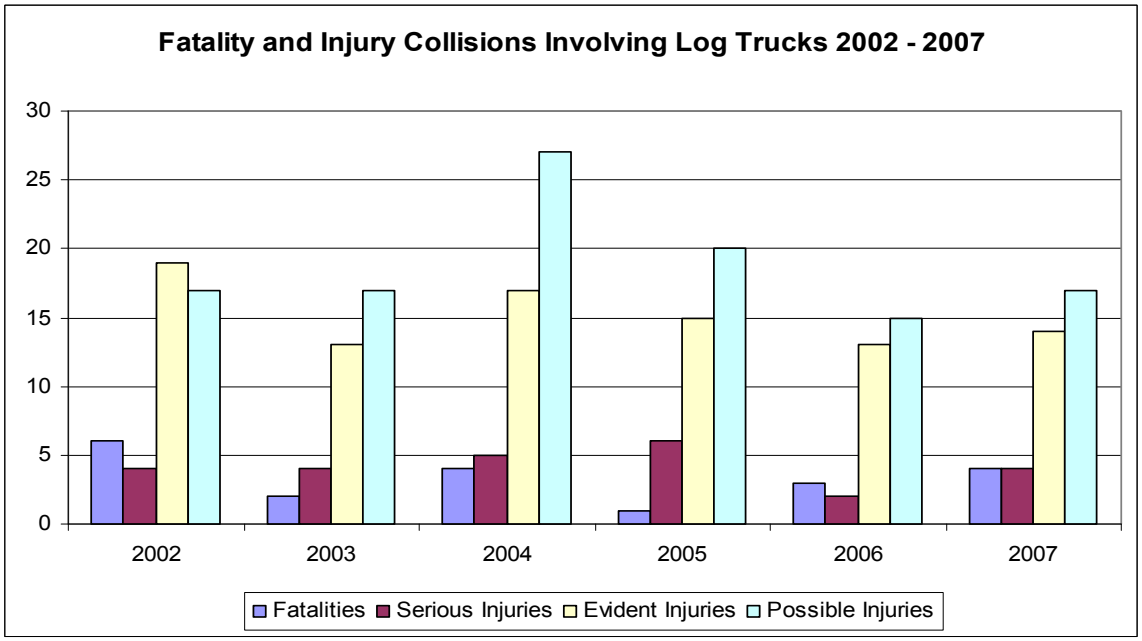

Figure 3.4. Fatality and injury collisions involving log trucks 2002 – 2007.

Further investigation of the safety performance of the log truck industry focused on analysis of work-related injuries and fatalities as reported to the Washington Department of Labor and Industries (L&I). This data is limited to only those drivers that are employed by Washington companies (L&I Risk Code 5003). The Fatalities Assessment and Control Evaluation Program (FACE) provides statistics on work-related fatalities that can be searched by occupation type. Figure 3.5 shows the analysis of log trucker fatalities differentiated as involving truck operation or not involving truck operation (example: driver hit by log) as reported to L&I for years 1998 through 2007. No trend of increased safety risk was found.

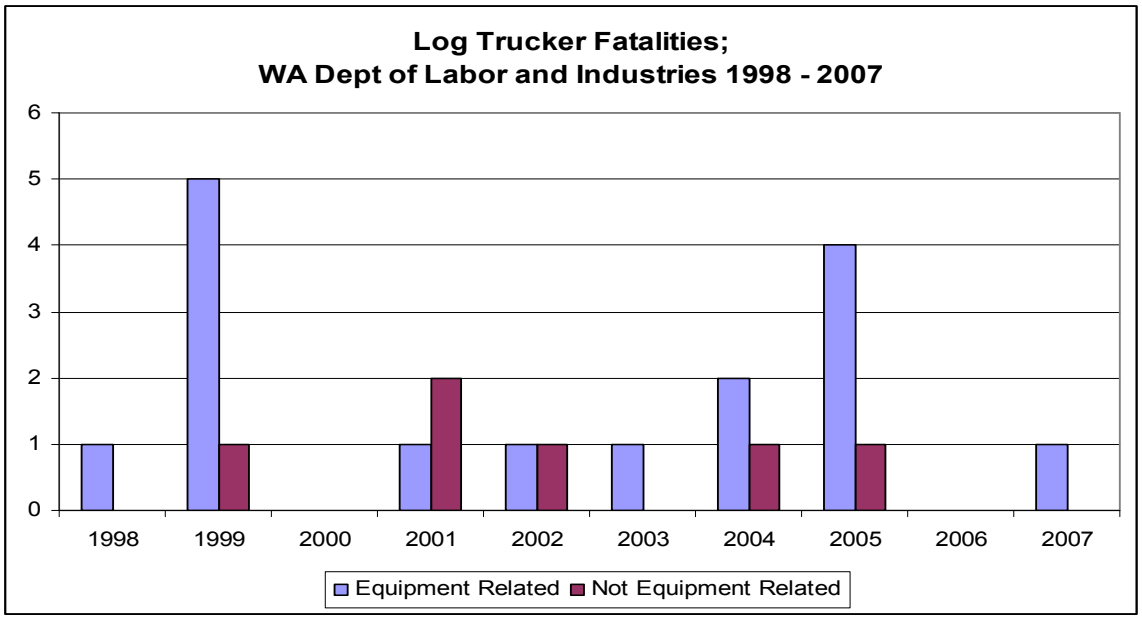

Figure 3.5. Log trucker fatalities as reported to L&I for years 1998 - 2007.

An analysis was conducted using data provided by L&I for all Risk Code 5003 injury claims for the years 1998 through 2005. During this period, a total of 1947 claims were filed by log truck drivers seeking worker compensation. Injuries resulted from a spectrum of industrial accident types of which a minority, 228 (12%), was identified as associated with vehicle operation (L&I 2007).

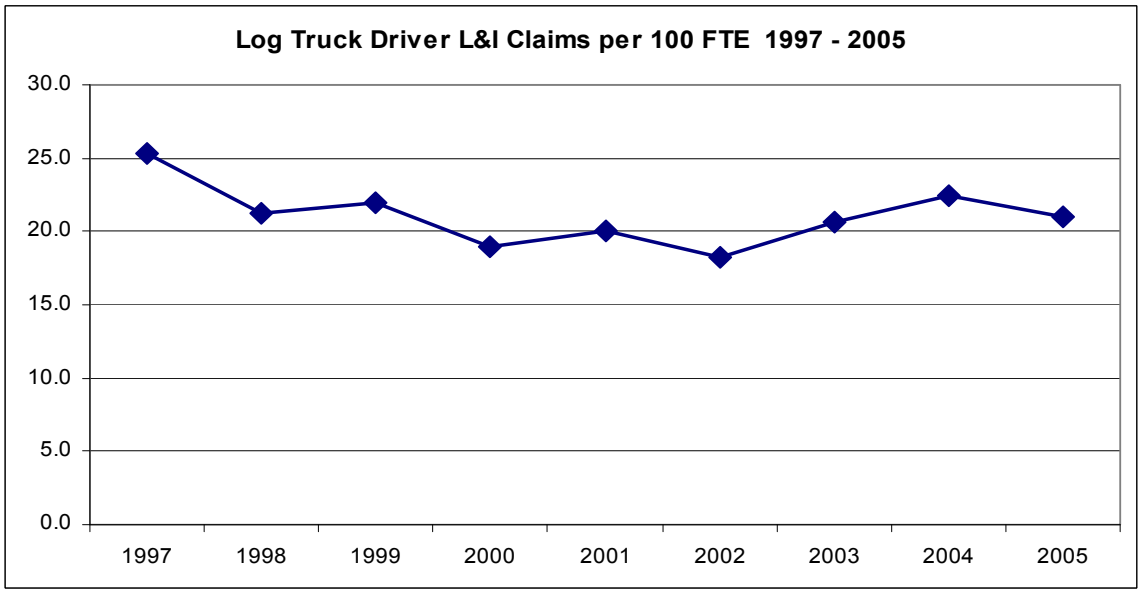

Figure 3.6. Log truck driver L&I claims per 100 FTE 1997 - 2005.

A graph of total claims per year per 100 full time employee equivalents (FTE) is shown in Figure 3.6. Again, no trend of increases in L&I accident claims was found.

This multi segmented analysis of available accident statistics revealed no evidence that economic pressures have resulted in increased log truck accident incidence. Historical annual accident data for years prior to 1997, needed to develop long-term trend analysis, were not found to be available. However, Milham (1997) reported total log hauling fatalities for the 40-year period of 1950 through 1989. The average for this period was 31 fatalities per year. While the number of truckers working during those years or the miles traveled isn't known, we can take comparative inference based upon annual timber harvest. The average state timber harvest volume for years 1950 through 1989 was 5.8 billion board feet per year. The average harvest volume for recent years (2002–2005) was 3.8 billion board feet per year or 66 percent of the 1950 to 1989 average annual harvest volume. All crash fatalities of log truckers, other collision-involved drivers and passengers plus L&I claimed fatalities not resulting from vehicle accidents for years 2002 to 2005 averaged 4 per year or 19 percent of the 1950 to 1989 average annual fatalities. This initial comparison, albeit crude due to data limitations, suggests that log hauling would appear to be a much safer occupation today than it was in years past. Interviews with log truck drivers and insurance providers, conducted during this investigation, also indicated that the log hauling industry has not experienced any recent increase in safety hazard.

Issues for Concern

Log truckers were asked if economic stresses resulting from increases to operational expenses outpacing gains in revenues would result in deferred truck maintenance that could compromise operational safety. Most truckers replied that operation of defective equipment would put their person and livelihood in unacceptable jeopardy. Evidence presented above leads to a conclusion that current economic challenges to state log hauling operations have not, as yet, resulted in increases in accident frequency. However, other issues could challenge future safe operation..

Fatigue and Hours of Service

Fatigue is difficult to assess as a contributing factor in truck crashes. Police reports often include a space to indicate a fatigued or asleep driver, but the reported data may be incomplete because the evidence is often circumstantial (Massie et al. 1997). Sleep deprivation impairs a person's ability to perform a variety of tasks, including those related to driving and operating equipment. Drowsiness slows reaction time, decreases awareness, and impairs judgment (Balkin et al. 2000, Van Dongen et al. 2003). Often a truck driver's fatigue is caused by inadequate daily sleep, rather than a complete absence of sleep. A truck driver's extended hours of operation can create a scenario of continuous sleep deprivation by limiting a driver's daily sleep time. Research has shown that less than seven hours of sleep each night has been found to consistently lower truck driver performance (NTSB 1995, Arnold et al. 1997, Balkin et al. 2000). Orris et al. (2005) published a research synthesis of the Transportation Research Board (TRB) publications that concluded that sleep deficits, night driving, reduced sleep, and fatigue are associated with dangerous driving, reduced performance, and falling asleep while driving. Driver impairment from fatigue is known to be a contributing factor in many commercial vehicle crashes (Advocates for Highway and Auto Safety, NIOSH 2003).

A large body of transportation research has shown that extended hours of service are linked to increased traffic hazards. Harris and Mackie (1972) found significant changes in truck driver performance after ten hours of driving. Drivers were physically less aware of external stimuli and more likely to create errors the longer that they kept driving. Jones and Stein (1987) found that relative risk for drivers who had been behind the wheel for more than eight hours was almost twice that of drivers with fewer hours. Lin et al. (1993) showed that the likelihood of a truck crash increased significantly after the fourth hour of driving and kept on increasing as driving hours were further extended. Campbell (2002) found that the relative risk of fatigue gradually increases

during the first eight hours of operation. During the ninth hour the fatigue risk was nearly double and by the twelfth hour the risk was higher by a factor of six.

Driver hours-of-service (HOS) regulations to limit the length of time that a commercial drivers can continuously operate a truck were first implemented in the United States in 1939 and remained largely unchanged until 1962. Through the years since there have been several adjustments to HOS rules and approaches to enforcement. In 2005, the U.S. Department of Transportation's Federal Motor Carrier Safety Administration (FMCSA) issued the latest update to federal HOS rules. The new rules prohibit truckers from driving more than eleven hours in a row, working longer than 14 hours in a shift and driving more than 60 hours over a seven-day period or 70 hours over an eight-day period. In addition, the new rules require truckers to rest for at least ten hours between shifts and provide a 34-hour period to recover from cumulative fatigue (FMCSA 2005). FMCSA (2003) has estimated that 100% adherence to HOS regulations would result in $1 billion in annual avoided costs due to reductions in crashes.

Fatigue and hours of service literature specific to operation of a log truck was not found. It is important to note, therefore, that the research summary, presented above, chronicles results taken primarily from studies of the long-haul heavy trucking industry and that log trucking is different in some critical respects as the hauls are shorter and driving breaks for loading and unloading occur at scattered intervals throughout the work day. However, survey results from log truck company owners, confirmed by log trucker interviews, clearly indicate that many log truck drivers work long hours and could be subject to fatigue (average 69 working hours per week).

Table 3.1. Log truck survey question 15: "How many hours per day per truck do you and/or your drivers normally work?"
(n= 128)

	Average	*Median*	*Min*	*Max*
Hours/truck/day	12.2	12	7	16

Table 3.2. Log truck survey question 16: "How many days per week per truck do you and/or your drivers normally work?
(n = 128)

	Average	*Median*	*Min*	*Max*
Days/week/truck	5.1	5	3.6	7

Table 3.3. Log truck survey question 17: "How many hours per week are normally required for maintenance of your log truck?"
(n = 126)

	Average	*Median*	*Min*	*Max*
Hours/week/truck	6.8	6	2	24

Table 3.4. Log truck survey question 14: "How many loads per day per truck do you and/or your drivers normally haul?"
(n = 126)

	Average	*Median*	*Min*	*Max*
Loads/day/truck	2.9	3	1	5

Table 3.5. Log truck survey question 13: "What is your average one-way haul distance?"
(n = 122)

	Average	*Median*	*Min*	*Max*
One-way miles	67.4	60.0	20	200

Unlike long-haul drivers, log truckers deliver multiple loads per day (Table 3.4). Analysis of national safety data for commercial truck operation indicates that short-haul drivers are less likely than long-haul drivers to be involved in fatigue-related truck crashes (FMCSA 2005). The

average one-way distance per log load was reported by survey respondents as 67.4 miles (see Table 3.5 above). It is apparent from survey analysis and interviews that the number of daily hours worked by log truckers is more a function of how many loads must be delivered than how many hours the driver may prefer to work. For the average haul distance, cost of operation estimates showed that three loads per day are required to be delivered to generate marginally sufficient gross revenues to cover operation costs (Section II; Tables 2.41 and 2.42). Since many log truckers begin and end their work days at home and the average round-trip delivery time appears to be approximately four hours, adjustments to daily hours worked could, therefore, only occur in four-hour increments, the time for the last load. With this limitation in mind and after review of survey and cost estimate analysis, we conclude that for most independent log truck operators, extended hours of operation appear to be required to generate sufficient revenues to remain in business. Extended hours of operation and chronic fatigue could become a cause for safety concern especially as drivers age.

Age

An aging workforce has become a common contemporary challenge for many industries. In Washington, 16% of commercial truck drivers are over 55 years of age (Lockhart and Wallace 2006). The log trucking industry appears have an even higher percentage of older drivers. Fifty-two percent of log truck survey respondents reported being 55 years of age or older.

Table 3.6. Log truck survey respondent age distribution.
(n = 128)

	Average	*Median*	*Min*	*Max*
Age in years	54.4	55.0	32	82

Age has been shown to be correlated with driver collision rates. A study of all national vehicle accident rates by age of driver showed that risk of collisions declines with age until 60 and then increases as drivers get older (NHTSA 1993). Another major U.S. study that was focused specifically on commercial carriers found that the youngest (21-39) and least experienced group of drivers were more likely by a factor of 1.6 to have accident involvement than the oldest (50+) and most experienced group of drivers (GAO 1991). Younger truck drivers are known to be more at risk because older drivers take less chances and have more experience (Venkataraman et al 1996, Chirachavala and Cleveland 1985). Numerous studies indicate that young drivers acquire driving skills quickly, but they require maturity and experience to develop the perceptual and cognitive skills needed to recognize hazards and respond appropriately (Deery 1999, Jonah 1986). Also related to immaturity is the tendency for younger drivers to overestimate their own driving skills (Gregersen 1996). Older drivers, by comparison, have developed skills to recognize and avoid hazards but they may not anticipate and react to hazards quickly enough (Holland and Rabbitt 1994). Reduced reaction times (both physical and cognitive), reduced ability to divide attention between tasks, and increased difficulty in handling complex and unfamiliar situations are associated with the normal aging process and are widely recognized and well-documented in the scientific literature (Brouwer et al. 1991, Holland and Rabbitt 1994, Stelmach and Nahom 1992). Normal aging results in declining visual acuity from reduced field of vision, less effective peripheral vision, and reduced ability to cope with glare from oncoming headlights (FHWA 2001). Night driving poses particular risks for older drivers. Night vision depends on seeing contrasts between objects, not on visual acuity alone, and this sensitivity to contrasts decreases with age (Burnham and Abrams 1998).

As we have shown with analysis of accident statistics, the log truck subsector has a better safety performance record than the broader population of Washington commercial carriers. The results of this comparison may be associated with differences in age distributions. Sixty-three percent of log truck survey respondents were between the ages of 40 and 60 years old. Age-to-collision-hazard analyses indicate that drivers of this age group are the most skilled and safest heavy truck operators. However, studies (Holland and Rabbitt 1994, NHTSA 1993) have shown that after age 60, safety performance of drivers may decline. An aging workforce, combined with the

demands of extended HOS, could compromise the long-term safety performance of the log truck industry.

Driver recruitment

It has been well documented that the trucking industry has experienced a shortage of qualified drivers with fewer young people choosing commercial driving as a career (Global Insight 2005). An FMCSA report estimates a current national shortfall of 20,000 commercial drivers and forecasts a national shortage of 110,000 drivers by 2014 (Corsi 2005). Log truck survey respondents also reported a scarcity of skilled drivers (Section II; Tables 2.9 and 2.10). Consequently, there is strong competition amongst trucking sectors and companies for drivers. In recent years, a significant factor aggravating the shortage of qualified drivers has been job-hopping or "churning." High rates of driver turnover may account for as much as 80 percent of the demand for commercial operators (FMCSA 2008). Competition for skilled operators is uniquely challenging for companies looking for log truck drivers; new drivers are hard to find and established drivers are hard to keep. Added costs of recruitment, training, wages, and benefits can be significant. Job-hopping has also been linked to higher safety hazard. A comparison of the Commercial Drivers License program database with the Motor Carrier Management Information System (MCMIS) database quantified the relationship between job change rate and crash experience. Commercial drivers that change jobs often were found to have a higher crash-involvement rate than drivers with stable employment history (FMCSA 2008).

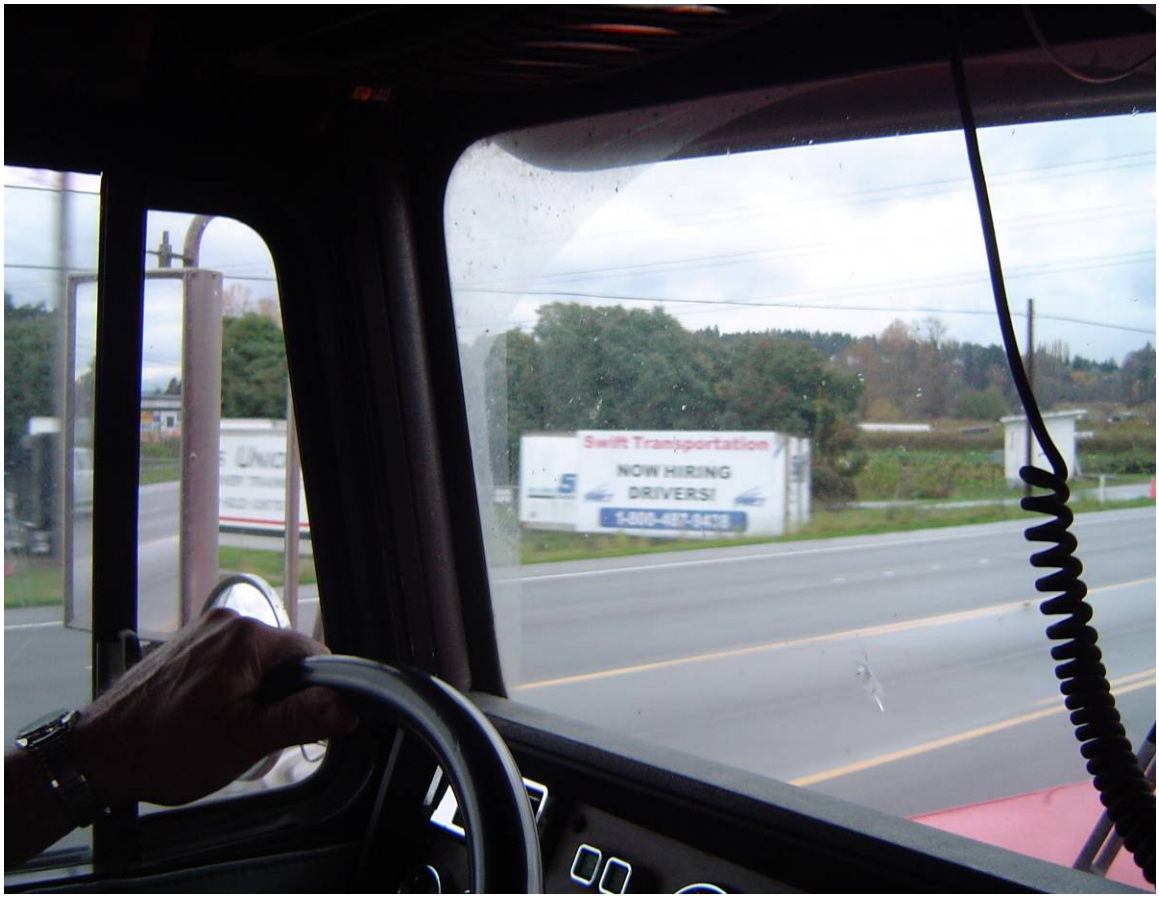

Figure 3.7. Trucking sectors compete for drivers (Mason).

Out-of-state log trucks

An aging workforce combined with limited opportunities for new driver recruitment may be contributing factors to industry decline. We found from analysis of WSDOL data that the number of log trucks registered in WA declined by 14 percent from 2002 to 2006 while, for those trucks continuing operation, there was a 12 percent shift to combination registration under schedule B so that goods other than logs can be sometimes hauled. Out-of-state trucks are making up for a growing in-state log truck infrastructure shortfall. Data for Idaho log trucks operating in Washington are not collected by the Idaho Department of Transportation, however, a significant number of Idaho trucks are known to be operating in northeastern Washington (Williamson pers com.). An examination of records from the Oregon Department of Transportation indicated that, in 2006, 1,593 Oregon log trucks were registered to operate in Washington as compared to 1,325 log trucks registered in Washington (both schedule A and B) revealing that 20 percent more Oregon than Washington log trucks were registered for Washington operation (ODOT 2007). Perez-Garcia (2007) prepared a report for the Washington Transportation Center (TRAC) and WSDOT that presented results of an investigation into current and future forest products use of Washington roadways. This study forecasted an increase in log truck traffic of approximately 150,000 loads per year (15 percent) by 2020. The safety and economic implications of a growing shortfall in Washington log truck infrastructure accompanied by increases in out-of-state log trucks operating in Washington are not known but should be worthy of further study.

Roadways

Washington has the ninth largest population growth of U.S. states increasing at a rate of 1.8 percent per year (WSOFM 2007). Annual vehicle miles traveled (VMT) on Washington roads have increased at a significantly greater rate than population (Figure 3.8). From 1981 to 2007, population increased by 53 percent from 4.23 million to 6.49 million people (WSOFM 2007). During the same period, VMT per year increased by 98 percent from 16.16 billion to 31.97 billion miles (WSDOT 2008). Average VMT per person per year have increased by 29 percent. From 1981 to 2007, total road-miles in Washington (principal, minor, collector, and interstate) increased 2 percent from 6,885 to 7,044 miles (WSDOT 2008). Quantified by VMT per road-mile, there is conceivably a 93 percent increase in traffic and associated congestion on Washington's roadways. Increases in traffic congestion have both safety and economic implications for Washington log truck operators. Survey respondents reported that 83 percent of their travel occurred on paved roadways.

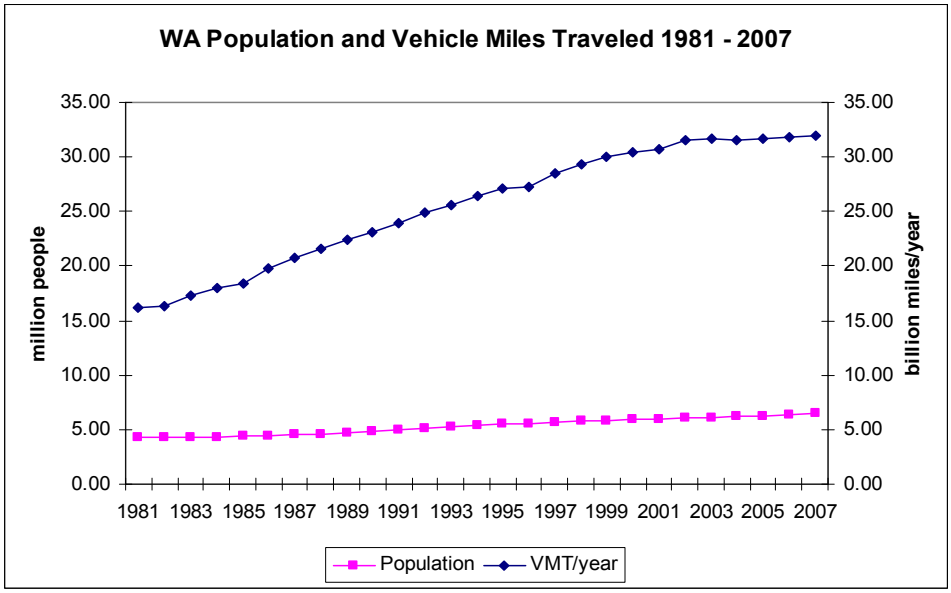

Figure 3.8. Increases to WA population and annual VMT (WSDOT 2008, WSOFM 2007).

Two questions, included the Washington log truck survey, were asked about the dangers of activities associated with log hauling. Survey respondents were asked to identify, in their own words, the most dangerous part of driving a log truck. Responses were classified by type and are presented below in Table 3.7. Respondents overwhelmingly indicated that traffic and road conditions (89 percent) are considered to be the most dangerous parts of their jobs. Only 11 percent of drivers felt that the loading and unloading of logs presented the greatest danger.

Table 3.7. Log truck survey question 65a: "What do you feel is the most dangerous part of your job as a log truck driver?"
(n = 122)

	Traffic	*Roads*	*Load/Unload*	*Age/Fatigue*	*Weather*	*Equipment*	*Other*
Number	84	25	13	11	4	4	6
% of n	69%	20%	11%	9%	3%	3%	5%

This topic was developed further by asking respondents to consider comparatively the relative hazard of various elements of log hauling. Results presented below in Figure 3.9 show agreement with Table 3.6. Roadways are considered to be riskier places than landings with travel on state and interstate highways considered as the greatest safety challenge faced by log haulers. This finding corresponds with the VMT trend presented above.

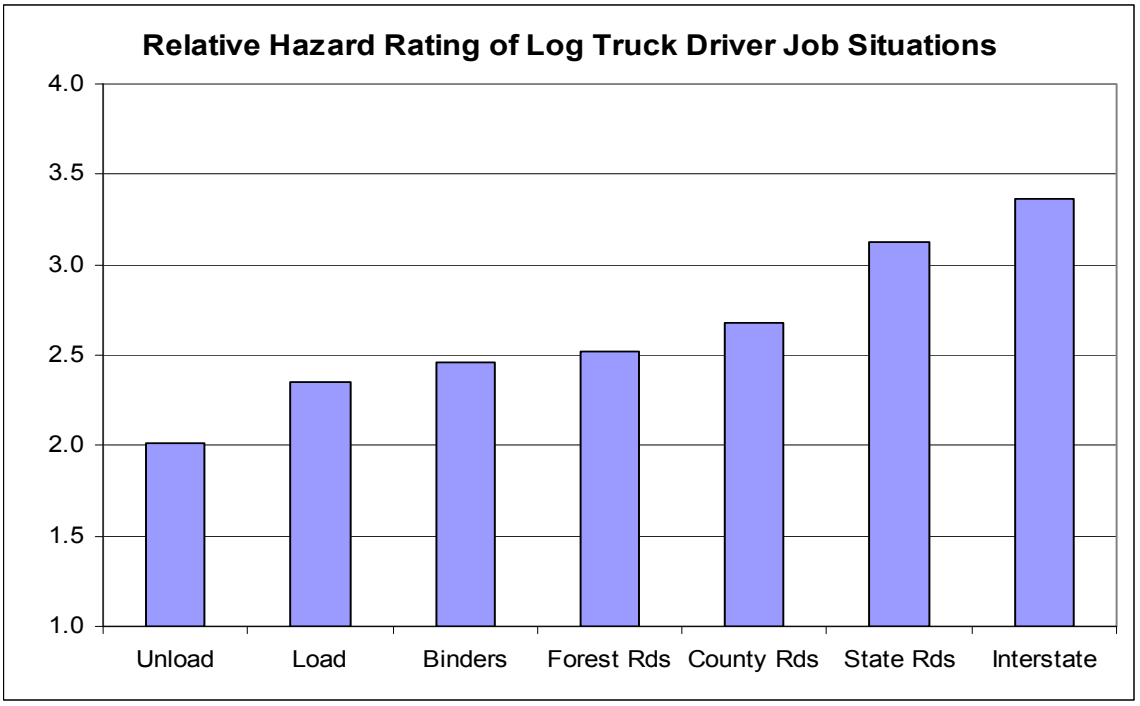

Figure 3.9. Log Truck Survey Question 65b: "On a scale of 1 to 5 with 1 as safe and 5 as very dangerous please rate the following job situations relative to possible accident hazard." *(n = 126)*

An examination of statistics of all Washington accidents from 1993 to 2005 revealed that 61 percent of traffic fatalities occurred on rural roads, while 39 percent occurred on urban roads. By road type, 38 percent of deaths occurred on state or federal highways, 31 percent on county roads, 18 percent on city streets, and 11 percent on interstates (WSP 2007). These data might appear as contradiction to survey findings about state and interstate highways. However, our analysis of the subset of state accidents from 2002 to 2007, limited to only those accidents that involved log trucks, shows agreement with the respondent perspective (WSDOT, WSP 2008).

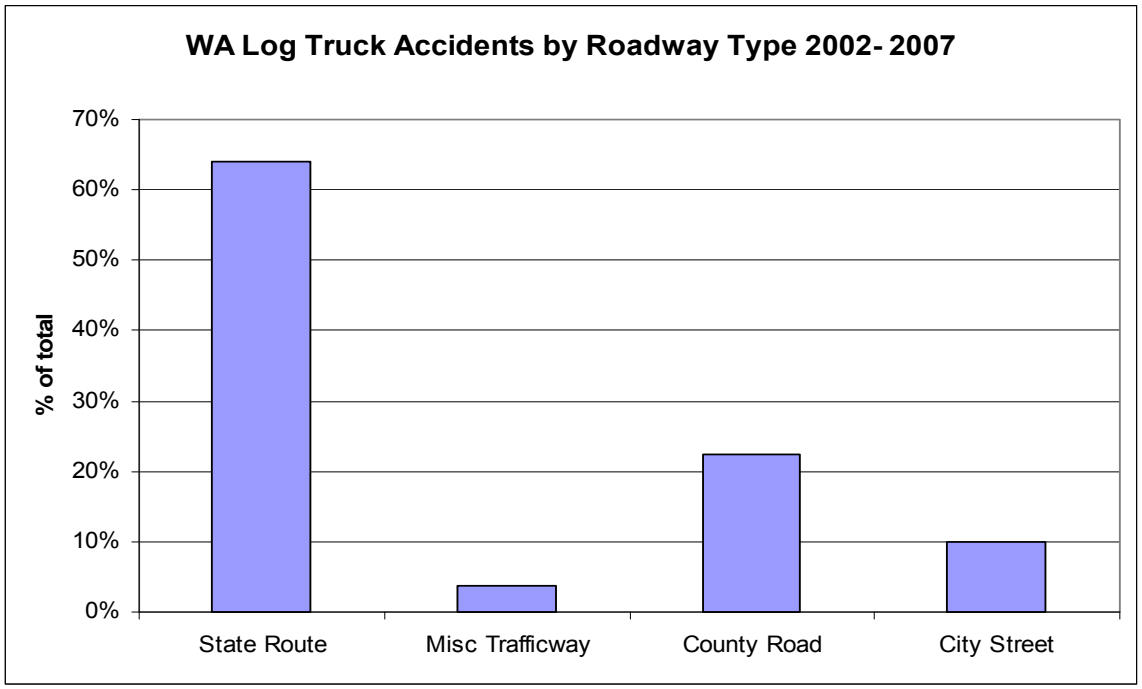

Figure 3.10. WA log truck accidents by roadway type 2002-2007.

Further justification of log trucker concern about highway danger can be found in WSP statistics that show, in 2004, 75 percent of all fatal collisions involving commercial motor vehicles were caused by the passenger vehicle not the truck (WSP 2007). There is abundant agreement in transportation literature that most accidents involving commercial carriers are caused by passenger vehicles (Hanowski et al. 2007, Wang et al. 1999, Blower 1998). In 2005, to help address this situation, the WSP started the Ticket Aggressive Cars and Trucks (TACT) project that involved trooper placement in commercial carriers to spot and ticket passenger vehicles violating safe driving rules in truck traffic. As another part of this program, in 2005, the WSP Commercial Vehicle Division conducted 126,644 Commercial Vehicle Safety Alliance (CVSA) inspections. Inspections are conducted to help reduce collisions involving equipment failure (WSP 2007). In addition, the WSP and the Washington Trucking Associations (WTA) jointly sponsor a voluntary truck inspection program each year. Seventy-five percent of survey respondents reported participation in the voluntary inspection program with 50 percent reporting that voluntary inspections reduced time lost for roadside equipment checks. A letter from the WSP recognizing the safety contribution of the voluntary inspection program is included in Appendix F. Respondents report an average of 21.3 stops per year for weight and equipment inspections with each stop lasting an average of 25 minutes.

Table 3.8. Stopping distances for cars versus trucks; estimates are for 80,000 lb. loaded tractor-trailers traveling on a dry, level road. (Oregon Trucking Association).

Speed	Reaction/Braking Distance Cars	Reaction/Braking Distance Trucks	Stopping Distance Cars	Stopping Distance Trucks
40 mph	44' / 80'	44' / 125'	124'	169'
55 mph	60' / 165'	60' / 275'	225'	335'
65 mph	71' / 245'	71' / 454'	316'	525'

Another element of the TACT project is education. Stuster (1999) concluded that the most common factor in truck versus passenger vehicle crashes was the passenger vehicle driver's lack of knowledge and awareness about the performance capabilities of large trucks. Specifically, drivers may be unaware of truck limitations in acceleration, braking, and visibility. At highway speeds heavy trucks require significantly greater stopping distances than passenger vehicles (Table 3.8). Stopping distances become greater on wet pavement.

Increases in traffic on major roadways elevate safety risk and add to costs of log truck operations. Added costs include greater accident risk, higher insurance rates, delayed deliveries, and increases in fuel consumption. The log truck survey respondents are well aware of changing traffic conditions as evidenced by responses shown in Table 3.9 where 99 percent of respondents report that traffic conditions are getting worse.

Table 3.9. Log truck survey question 40: "How would compare the traffic on Washington paved roads today as compared to 10 years ago?"
(n = 129)

	Much worse	*Somewhat worse*	*The same*	*A little better*	*A lot better*
Number	96	32	1	0	0
% of n	74%	25%	1%	0%	0%

A summary of traffic accidents involving logging trucks in 1971 was published by the WSP (1972) and, when compared with current conditions reported by WSP, provides an example of how things have changed. In 1971, drivers of logging trucks were cited for 63 percent of collision-related violations. In 2004, drivers of trucks accounted for 25 percent of collision-related violations (WSP 2007).

Survey respondents were also asked about their perceptions of road quality change over the last ten years. Road quality has a direct relationship not only to safety but also to fuel consumption and equipment maintenance costs. Results are presented in Tables 3.10 and 3.11 below. Survey respondents report deterioration of both paved and gravel roads.

Table 3.10. Log truck survey question 39: "How would you compare the quality of Washington paved roads today as compared to 10 years ago?"
(n = 118)

	Much worse	*Somewhat worse*	*The same*	*A little better*	*A lot better*
Number	35	54	29	11	0
% of n	30%	46%	25%	9%	0%

Table 3.11. Log truck survey question 41: "How would you compare the quality of Washington gravel roads today as compared to 10 years ago?"
(n = 116)

	Much worse	*Somewhat worse*	*The same*	*A little better*	*A lot better*
Number	42	34	40	10	1
% of n	36%	29%	34%	9%	1%

Equipment options to reduce costs and increase safety

The age and condition of equipment operated by log hauling companies have influence on company productivity and operating costs. As evidenced by WSP investment in roadside equipment inspections of commercial carriers, the condition of heavy trucks is an important matter of safety concern. Commission of this log trucking study confirms that the State Legislature also has interest in this topic. Due to the size, weight, configuration and braking capability of large commercial trucks, proper equipment condition is fundamental to minimized vehicle collision hazard. If we accept safety performance as a surrogate indicator for sufficiency of equipment maintenance then, based upon comparison of accident rate trends, it appears that Washington log trucks may be better maintained than other commercial carriers. Further support

for this hypothesis is found in comparison of driver demographics. Log haulers are by percentage older and more experienced than the broader commercial carrier population. Fifty-two percent are 55 years of age or older. This does not mean, however, that there is not room for pursuit of further safety improvements.

Log truck survey respondents were asked about their preferences for equipment investment Results are presented in Tables 3.12 showing a pretty even split between those that purchase new and used equipment. We further asked, "What factors most influence the decision to purchase new verses used equipment?" Purchasers of used equipment were motivated almost exclusively by costs and availability of quality used trucks. Purchasers of new trucks overwhelmingly cited the benefits of warranty and dependability (62 percent) as being the prime motivation for a new truck purchase. Other benefits that respondents associated with new truck purchases included tax benefits, comfort, safety, reduced TARE weight (TARE refers to truck-empty weight), greater fuel efficiency, and more horsepower.

Table 3.12. Log truck survey question 50: "When replacing a truck tractor do you generally purchase…?
(n = 124)

	A new truck	*A used truck*	*Sometimes new or used*	*A kit (rebuild)*
Number	44	53	22	5
% of n	35%	43%	18%	4%

An analysis of truck ages, maintenance, and revenues was performed using survey response data. A total of 305 log trucks were reported to be operated by 129 respondent companies in the survey. Of this number, the ages of 256 trucks were identified and linked for analysis to company performance reports. The distribution of truck ages and comparative benefits of new trucks were revealed (Figures 3.11 through 3.14). Figure 3.11 displays a generally even distribution on either side of the 1991 to 2000 ten-year age class. However, 85 percent of trucks were found to be greater than ten years old (≤ 1998) indicating a generally aging fleet.

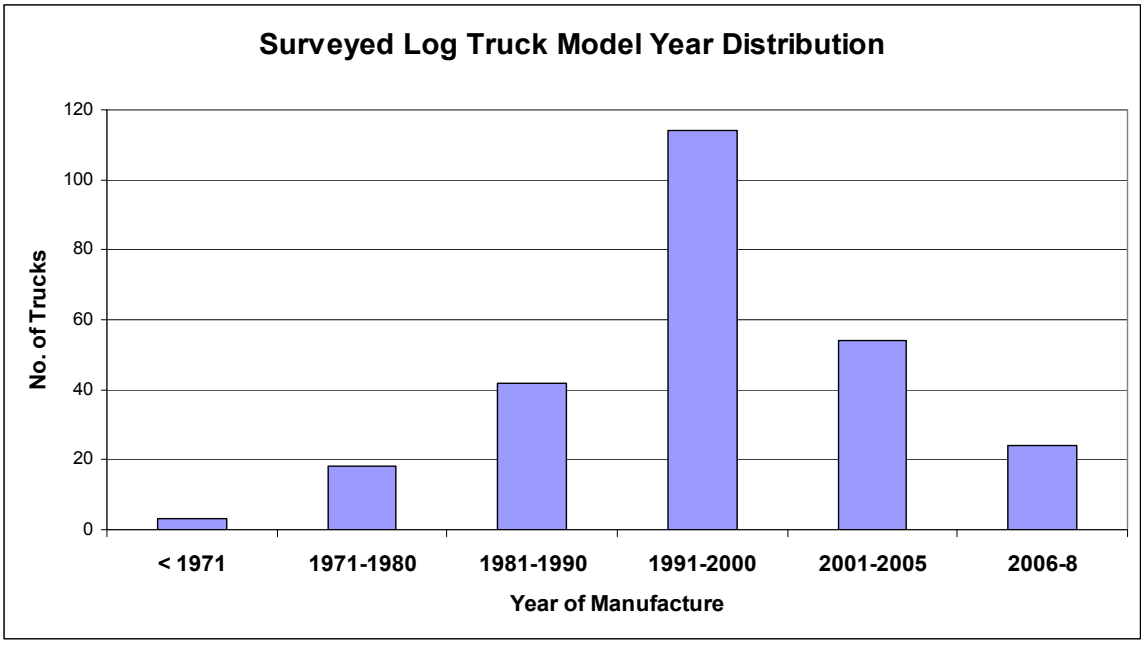

Figure 3.11. Surveyed log truck model year distribution.

Newer trucks were reported to require less maintenance, earn greater revenues, and provide greater net income (Tables 3.12 – 3.14). While there are many human factors associated with truck productivity, it does appear that newer equipment operated by survey respondents is

correlated with greater profitability. But, are newer trucks safer? We do not have data to assess the relative roadway safety performance of log trucks by age. While the age, condition and value of equipment are determinants in truck insurance premiums (a surrogate for safety performance) the age of the truck is often irrelevant as condition is dependent upon upkeep as well as recently installed equipment (Cover Me Insurance Agency Inc). We can, however, say with some certainty that newer trucks are safer in one regard, namely that newer trucks are equipped with equipment required by the EPA to reduce pollution (EPA 2004).

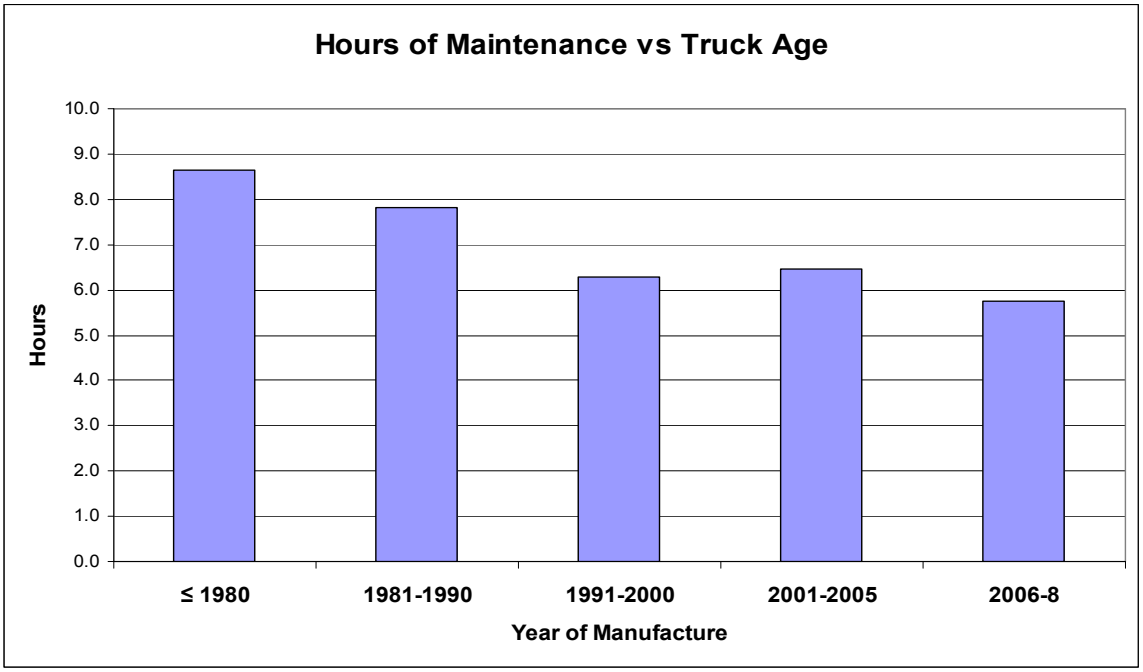

Figure 3.12. Hours of maintenance verses truck age.

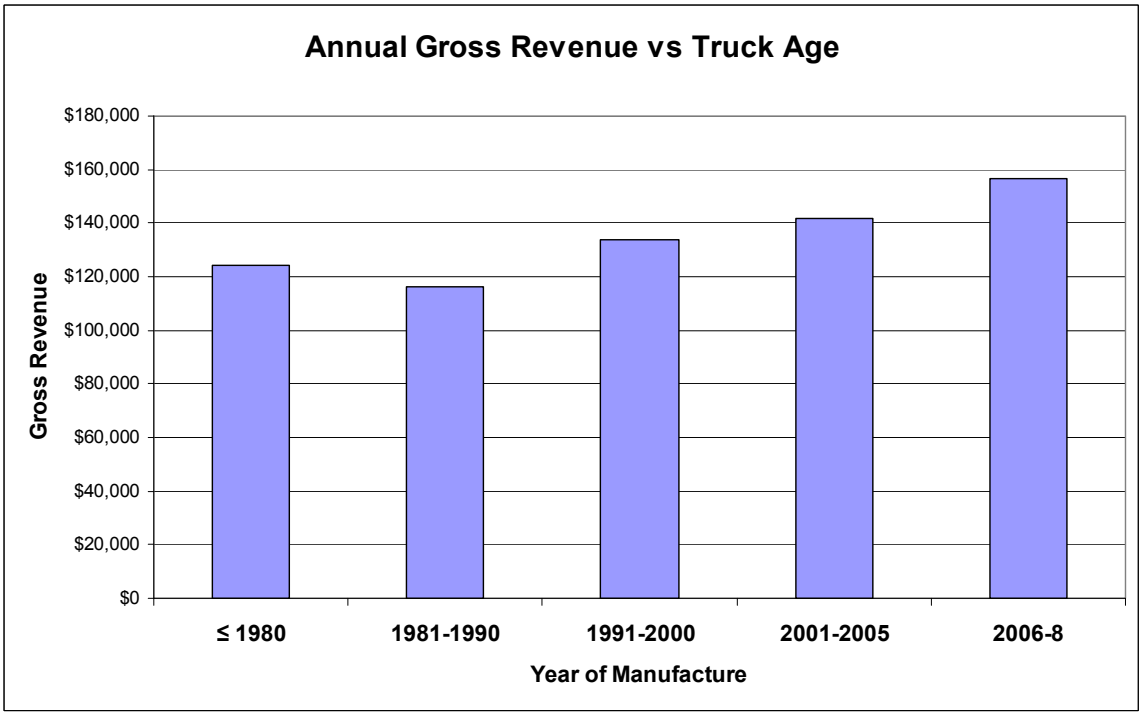

Figure 3.13. Annual gross revenue verses truck age

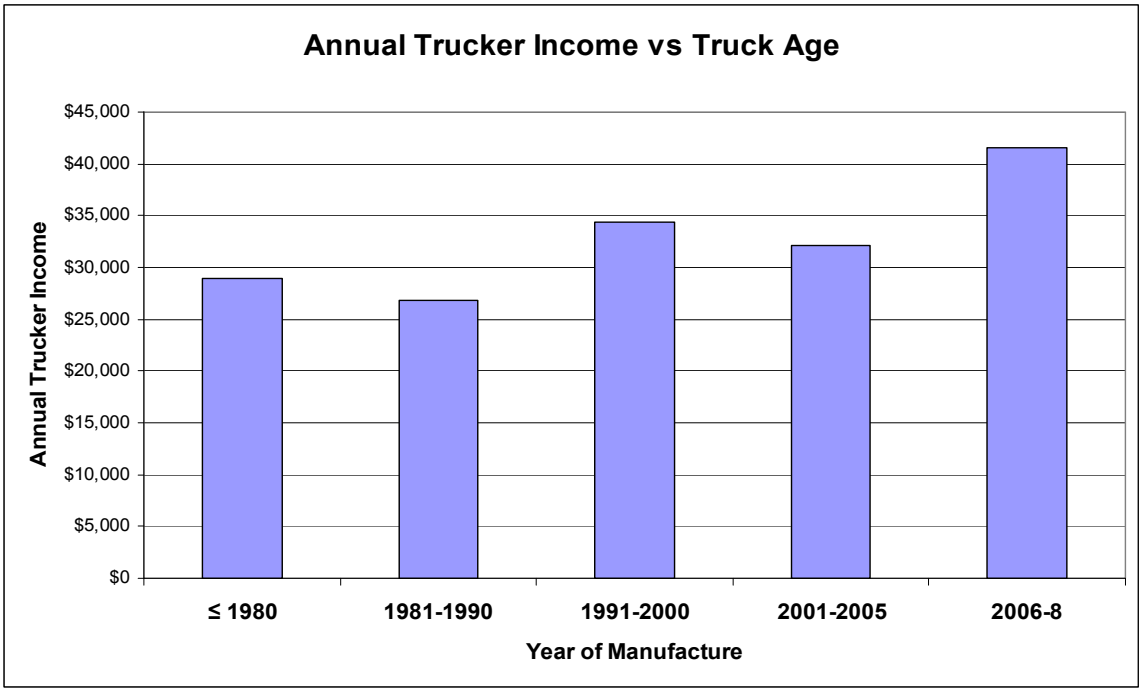

Figure 3.14. Annual trucker income verses truck age.

Federal emission standards have been evolving for highway diesel engines since the passage of the Clean Air Act in the early 1970s. The first regulations focused on control of exhaust of smoke. Subsequent regulations broadened emission control requirements to include gaseous and particulate pollutants. The 1990 amendments to the Clean Air Act directed EPA to set stringent standards for emissions for all heavy-duty highway engines. In 2000, 2002, and 2007, diesel engine manufacturers responded with incremental changes to pollution control systems that targeted reductions in nitrogen oxides (NO_x), non-methane hydrocarbons (NMHC), particulate matter (PM), and carbon monoxide (CO). Figure 3.15 shows dramatic improvements in pollution reduction equipment for diesel engines with 2002 and 2004 as key upgrade years. Reductions in other exhaust pollutants such as sulfur oxides (SO_x), benzene, butadiene, formaldehyde, acetaldehyde, acrolein, and dioxins have also been achieved (EPA 2004, 2002, 2000).

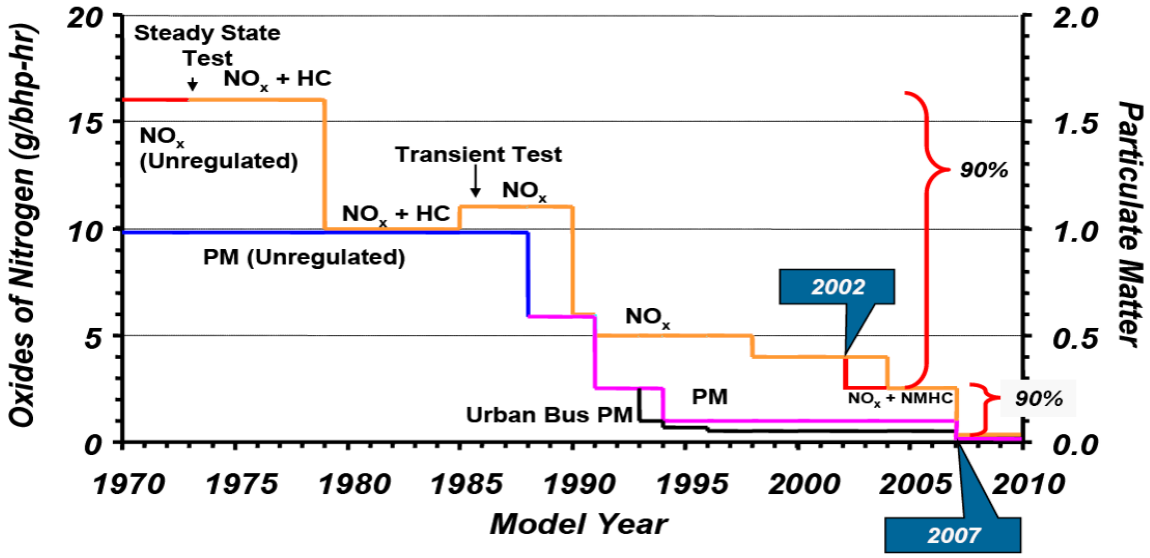

Figure 3.15. Historical Trend in Emissions from New Diesel Engines (USDOE 2006).

Combustion of diesel fuels releases green house gases associated with global warming; accounting for 20 percent of all transportation sector emissions (Waterman-Hoey and Nothstein 2007). Asthma attacks, respiratory diseases, heart attacks, and other health declines are serious public problems that have been linked to emissions from diesel engines (WSDOE 2006, Clean Air Task Force 2005, EPA 2002). Fine particulate matter (PM2.5; 2.5 micrometers in diameter and smaller) is known to be harmful to human health (EPA 2008). A study of health impacts linked to diesel exhaust fine particle exposure estimated that, in 1999, 248 people died in Washington from associated heart and lung ailments (Clean Air Task Force 2005). For comparison, there were 63 large truck collision fatalities in Washington 1999 (FARS 2008). Particularly at risk from exposure to diesel pollution are truck drivers. (Laden et al. 2007, Steenland et al. 1998, Zaebst et al. 1991).

Diesel emissions represent a serious public safety hazard for which there is significant room for improvement, yet investment trails opportunity. Heavy trucks that are 2007 and newer are equipped with exhaust systems that allow very low emissions of fine particulates and other pollutants. As shown in Figure 3.15, this is not the case for older trucks. Since diesel engines can provide a million miles or more of service it could take decades to significantly reduce the adverse effects of diesel exhaust in Washington (WSDOE 2006). The Washington Department of Ecology (WSDOE) has identified heavy trucks as the most significant state source of on-road diesel PM (78 percent) and is seeking funding to underwrite private sector costs of retrofits to reduce fuel consumption and pollution. WSDOE cites a public benefit of three to sixteen dollars from every dollar invested in reducing diesel pollution (WSDOE). Retrofit of diesel particulate filters (DPFs) that are designed to cut soot emissions by 90 percent can be accomplished for trucks 1990 and newer. However, cost of retrofit is estimated at $7,000 to $10,000 per truck (Fox et al. 2006). Struggling trucking companies, such as log haulers, will not be able to afford such investment. Accommodation of pollution reduction expenditures was not included in our cost of operations estimates. The federal government has a program that may assist truck owners with retrofit costs (EPA). A regional public/private partnership called Cascade Sierra Solutions is pursuing similar goals. California, in May of 2008, appropriated $200 million for grants to trucking companies purchasing pollution reducing equipment (CEPA 2008). Public investments to support equipment upgrades that reduce pollution could help trucking companies and provide significant public benefit.

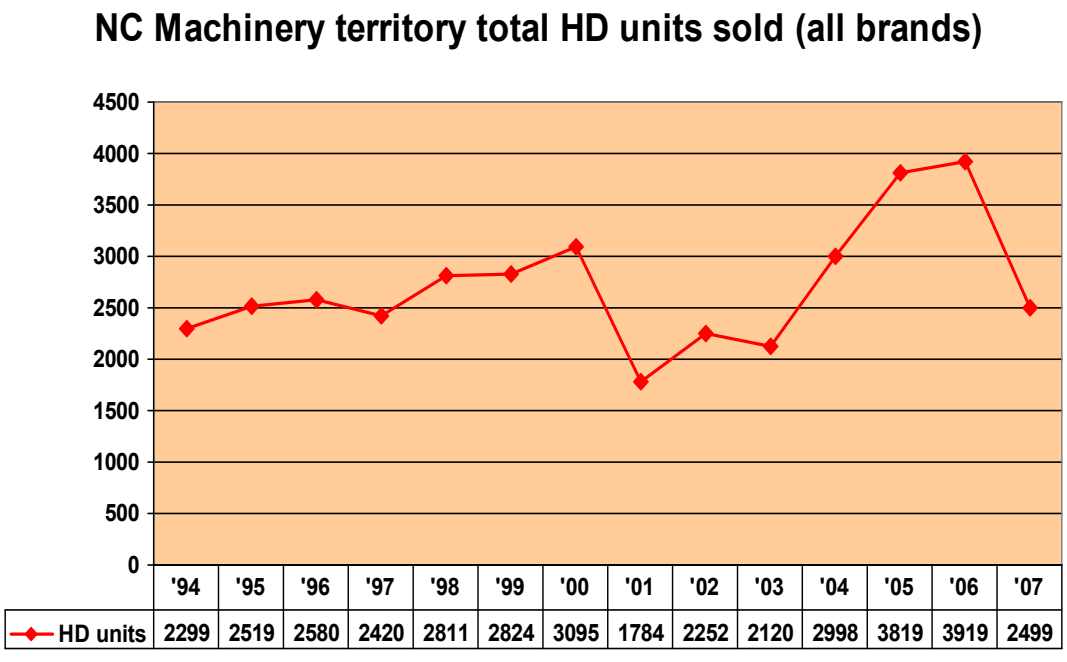

Figure 3.16. Heavy duty truck engines (all brands) sold in western Washington and Alaska from 1994 through 2007 (NC Power Systems Co.; NC Machinery Inc.).

The purchasing behavior of new heavy duty diesel engine buyers was discussed in interviews with NC Power Systems Truck Engine Business Manager, Wayne Hofer and Rick Ham, Cummins Northwest, LLC. An unintended consequence of pollution reduction policies was suggested. Equipment sellers report that sales of diesel engines tend to peak in years prior to new release of pollution compliant equipment. Figure 3.16 above shows truck engine purchase trends in western Washington and Alaska. A report prepared for FMCSA found similar buyer patterns as truck purchasers rushed to replace equipment in years prior to addition of expensive pollution reduction equipment (Fox et al. 2006). Diesel engine particulate filters, diesel oxygenation catalysts, and other emissions control equipment add $7,000 to $10,000 to the price of a new truck (Fox et al. 2006). In addition to cost, purchasers are concerned also about prototype malfunctions, maintenance costs, and reduced fuel economy as well as added weight of equipment (Fox et al. 2006, Gilroy 2006, Hall pers. com.). An opportunity exists for policy makers to hasten investment in pollution reduction by underwriting equipment costs through low cost loans, tax incentives, clean air grants, and other assistance programs (CEPA 2008).

Equipment upgrades to heavy trucks for reduced pollution are not limited to exhaust systems. Achievement of reductions in fuel consumption automatically results in avoided emissions and can provide economic relief to trucking companies. Decades ago the military developed central tire inflation (CTI) systems to allow a driver to automatically and uniformly vary the inflation pressure of a tires while the vehicle is moving. Truck tires perform better on different surfaces when inflation is adjusted. With a CTI system, truck tire pressure can be lowered on gravel roads and raised for pavement. Tire pressure can be adjusted for appropriate deflection as operation needs change from empty to loaded, high to low speed, and good to poor traction. The economic and environmental benefits of CTI systems have been documented. Lower inflation pressure results in larger tire footprints that can result in lower costs for road construction and maintenance of logging roads (Sturos et al. 1995). Reduced pressure on drive tires has been shown to allow logging trucks to ascend steep grades that would otherwise only be negotiable with an assist vehicle (Bulley and Blair 2001). Operation of log truck tires at lowered pressure on gravel roads under wet conditions can reduce sediment run-off that adversely affects salmon streams (Schiess pers. com., Foltz and Elliot). Larger tire imprints on gravel roads dampen drive-train shocks, decrease maintenance costs, and increase tire life and driver comfort (Sturos et al. 1995).

On pavement, under-inflated tires negatively impact a driver's ability to control against skidding, blowouts, and other tire failures. When tires are under-inflated, the tread wears more quickly and fuel consumption increases with rolling resistance. Goodyear estimates a 15 percent reduction in tire-miles for every 20 percent of under-inflation. Under-inflated tires cause sidewall stress and overheat more quickly than properly inflated tires resulting in tire damage and blow outs (Obringer). On wet surfaces, under-inflation increases stopping distance and likelihood of collision (NHTSA 2000). Ten pounds per square inch (psi) of drop in tire pressure will increase rolling resistance by two percent and fuel consumption by up to one percent (Ang-Olson and Schroeer). Over-inflation of tires is equally undesirable as it results in reduced tread life. Central tire inflation systems offer increased safety, longer tire service, and reduced fuel consumption. Federal recognition of the importance of proper tire inflation to safe operation of a motor vehicle is evidenced by the Transportation Recall Enhancement Accountability Documentation (TREAD) Act of 2000 that requires all passenger cars and light trucks produced in 2008 to be equipped with tire pressure monitoring systems. Unlike pollution control retrofits which are limited to 1990 and newer trucks CTI systems can be installed on any age of equipment. A number of different CTI systems are commercially available. Retrofit of CTI systems costs approximately $900 per truck (EPA 2005).

To move a truck at 65 miles per hour (mph) along a level highway, an average diesel engine produces 220 horsepower (hp). Approximately 70 hp (30 percent) is required to overcome the drag caused by rolling resistance in the tires (Ogburn and Ramroth). Reduction of rolling resistance through proper tire inflation results in fuel savings. Further benefit may be available through use of wide-base tires. Wide-base tires ("super-singles) have been developed by many

tire companies to replace duals on driver and trailer axles. Super-singles are up to 17.5 inches wide and are compliant with pavement weight laws in all 50 states (EPA 2002). When fitted with aluminum rims and wide-based tires, trucks can reduce TARE weight by 200 pounds per axle. Fuel saving have been estimated at four to six percent over typical dual tires (Ogburn and Ramroth). Because these tires are not mounted in pairs, drivers may be concerned that a tire failure could leave them immobilized. Manufacturers dispute this claim when super-singles are used on trucks with tandem axles (EPA 2002). Retro fit to replace duals with single-wides is estimated to cost $3000 per truck (EPA 2005).

CTI systems and single-wide tires could reduce fuel consumption and pollution; increasing public safety while providing financial relief for trucks if costs could be underwritten by public funding support. Both systems are recognized as effective green house reduction strategies by the EPA Smart Way program, the California Air Resource Board, and Cascade Sierra Solutions. CTI systems and single-wide tires offer low-cost opportunity for retrofit to reduce fuel consumption and pollution on older commercial carriers.

Safety Summary

A thorough examination of the safety record of the log hauling industry in Washington has been conducted leading to conclusion that log truck operation is safer today than in years past. The accident record for log trucks compares favorably with the broader population of all commercial carriers.

Pollution health impacts and associated need for emissions equipment upgrades were introduced as emerging public/private costs of safe log truck operation. Annual fatalities linked to diesel pollution (Clean Air Task Force 2005) illustrate the seriousness of this safety issue. While great strides in emissions reduction equipment development have been made by manufacturers, equipment upgrades are way behind potential suggesting further research is needed to inform effective response (Fox et al. 2006).

While the current safety record of the Washington log trucking industry has been shown to be encouraging, a number of disturbing concerns that could challenge future safety performance were identified. The issues of rising cost of operations, extended hours of service, an aging workforce, poor driver recruitment, increasingly congested roadways, and the influx of out-of-state trucks will need periodic review to monitor impacts.

Figure 3.17. Voluntary Safety Inspection; Log Truckers Conference of the Washington Trucking Associations (Mason).

Section IV: Results & Conclusions

Summary of Survey Results

An underlying assignment from the Legislature was to develop an understanding of the operating practices and economic characteristics of the Washington log trucking industry, while focusing on costs and safety. The following tables present summarized results from a survey of log truck company owners conducted during the spring of 2008. Survey methodology is presented in Section I. Demographic information taken from response data represents current information. Company performance metrics were reported for 2006. One hundred twenty nine useable company responses were received, representing individual owners with 3398 cumulative years of truck driving experience and companies with 2667 cumulative years in the business of log hauling. Respondent companies report operation a total of 336 trucks of which 305 are log trucks. No such survey had ever been conducted in Washington. A copy of the Log Truck Survey Questionnaire is in Appendix B.

General characteristics

Table 4.1. Firm size and ownership types.

		Eastern Washington		Western Washington		State	
	Total respondent	**24**		**105**		**129**	
	Type	***Total***	***%***	***Total***	***%***	***Total***	***%***
Firm size	Single truck	11	13	72	87	83	67
	Multiple trucks	13	28	33	72	46	33
Ownership	Sole	17	24	54	76	71	55
	Partnership	0	0	1	100	1	1
	Corporation	7	12	50	88	57	44

Table 4.2. Driver characteristics.

Driver's information	Average	Max	Min
Age	55	82	32
Years of experience	27	54	0
Average hourly wage	$16	$31	$8

Table 4.3. Truck makes, quantities, percentages, and average ages.

Make	Quantity	Percentage	Average age (yrs)
Kenworth	161	63	11
Peterbilt	66	26	14
International	16	6	20
Other	13	5	14
Total	**256**	**100**	**12**

Table 4.4. Truck age and associated variables.

Truck age Years	Total Trucks	Maintenance Hours/wk	Operation cost $/mile	Gross Return $/mile	Breakdown Weeks/yr	Mileage MPG
0-2	25	5.8	1.5	2.4	1.0	5.0
3-7	54	6.5	1.4	2.3	1.2	5.2
8-17	114	6.5	1.5	2.1	2.0	5.1
> 18	63	8.1	1.4	1.9	2.0	4.8

Table 4.5. Truck age and associated variables (continued).

Truck age Years	Total Trucks	Insurance $/trk/yr	Gross expenditure $/yr	Gross return $/yr	Annual income $/yr
0-2	25	4,838	113,589	154,582	38,564
3-7	54	4,794	99,710	144,021	33,742
8-17	114	3,939	90,900	141,173	35,732
> 18	63	4,144	90,182	120,695	27,466

Table 4.6 Truck configurations.

Configuration	Total	Number of axles	Gross weight	Net payload
Long logger	51	5	80,360	54,039
	116	6	87,470	58,684
	11	7	96,273	64,545
	5	8	97,200	64,932
Long logger & Pup	7	5 & 2	103,500	70,729
	33	6 & 2	105,440	69,549
Others (Mule train, self loader, etc.)	4	5	81,250	51,875
	16	6	91,500	57,066
	4	7	97,500	61,750

Table 4.7 Profitability reporting from respondents.

Losing Money	Breaking Even	Making a Profit
36	64	27
28%	51%	21%

Table 4.8 Future Plans of respondents.

Retire/Leave Industry	Diversify to other trucking	Downsize	Remain the same	Expand log hauling operations
53	18	17	51	1
38%	13%	12%	36%	1%

Characteristics by counties

Table 4.9 Log truck company demographics by county.

County	Number of respondents	Years in business	Years of driving	Age
Clallam	8	33	33	61
Cowlitz	9	20	27	55
Grays	16	23	25	55
King	7	26	36	61
Kittitas	6	19	30	54
Lewis	13	16	22	54
Pacific	5	17	15	53
Pierce	11	21	31	56
Snohomish	6	16	28	51
Stevens	6	25	19	46
Thurston	6	14	25	57
Other East	12	21	30	55
Other West	23	20	27	54

Table 4.10. Haul distances (landing to dump) and road quality by county.

County	Maximum one-way haul distance	Average one-way haul distance	Percentage of haul miles on gravel roads	Percentage of haul miles on paved roads
Clallam	159	91	12	88
Cowlitz	143	64	14	86
Grays	114	58	19	81
King	166	59	22	74
Kittitas	210	111	19	81
Lewis	107	64	18	82
Pacific	108	56	17	83
Pierce	128	61	22	79
Snohomish	193	86	16	84
Stevens	137	61	12	80
Thurston	141	52	16	85
Other East	179	78	20	79
Other West	114	59	14	86

Table 4.11. Loads per day, workdays per week, maintenance hours per week by county.

County	Loads/day/truck	Workdays/w/truck	Maintenance hrs/w/truck
Clallam	2.9	5.6	9.9
Cowlitz	2.9	5.0	5.4
Grays	3.2	5.1	8.5
King	3.3	5.0	9.6
Kittitas	2.5	5.2	8.3
Lewis	2.9	5.0	6.1
Pacific	3.0	5.2	8.8
Pierce	2.9	5.3	6.4
Snohomish	3.0	5.2	7.0
Stevens	4.0	5.3	3.7
Thurston	3.0	4.8	7.2
Other East	2.7	5.2	6.5
Other West	3.1	5.0	5.2

Table 4.12. Pay wait in weeks and gross return metrics by county.

County	Pay wait	$Return/ton	$Return/mile	$Return/load	$Return/day	$Return/year
Clallam	3.9	8.5	NA	240	633	150,000
Cowlitz	2.8	9.6	2.2	200	586	136,658
Grays	3.2	7.5	1.9	226	633	122,843
King	3.4	9.8	2.3	268	680	145,735
Kittitas	4.4	14.3	1.9	487	708	161,555
Lewis	2.5	9.4	2.0	259	600	120,671
Pacific	4.0	6.6	2.2	232	592	139,601
Pierce	3.5	8.7	2.5	214	654	129,142
Snohomish	3.9	8.9	2.2	255	796	162,609
Stevens	4.1	8.6	2.0	215	667	157,000
Thurston	3.1	8.1	2.2	279	760	163,057
Other East	3.1	9.9	2.2	272	676	138,219
Other West	3.4	9.3	2.1	242	632	137,125

Table 4.13. Insurance, tires, and utility costs per year and total value of current equipment investment by county.

County	$ Insurance cost per truck	$ Yearly tire cost per truck	$ Utility cost per year	$ Current investment
Clallam	3,924	4,767	1,825	200,500
Cowlitz	3,856	5,933	2,626	153,457
Grays	4,187	5,969	2,203	197,181
King	5,207	6,250	2,035	231,614
Kittitas	3,900	6,000	3,965	145,833
Lewis	3,765	6,359	2,305	260,100
Pacific	4,621	6,474	1,978	121,500
Pierce	5,024	5,857	2,356	170,625
Snohomish	4,634	10,000	4,425	72,500
Stevens	2,792	5,000	1,290	228,333
Thurston	4,533	6,551	2,598	154,167
Other East	4,211	7,383	1,358	130,000
Other West	4,281	6,857	3,484	144,722

Table 4.14. Diesel statistics for 2006 by county.

County	Miles/gallon	$ Diesel price	$ Highest price	$ Lowest price
Clallam	5.0	2.7	3.2	2.3
Cowlitz	5.1	2.8	3.1	2.3
Grays	5.1	2.7	3.3	2.6
King	5.2	2.8	3.2	2.4
Kittitas	4.9	2.8	3.4	2.5
Lewis	5.3	3.0	3.4	2.5
Pacific	5.2	2.6	3.0	2.2
Pierce	5.1	3.3	3.7	2.9
Snohomish	5.4	3.2	3.4	2.7
Stevens	4.5	3.1	3.6	2.7
Thurston	4.8	2.7	3.1	2.1
Other East	4.7	2.9	3.4	2.6
Other West	5.1	2.9	3.5	2.6

Characteristics from responses to text questions

Table 4.15. How are you responding to rising fuel prices?

Responses to rising fuel costs	Total reports from 88 respondents	Percentage
Park truck	7	8%
Sell truck/down size	7	8%
Plan to shut down/retire	14	16%
Defer maintenance	25	28%
In-house repairs	8	9%
Selective in taking jobs	17	19%
Request fuel surcharge	18	21%
Other (drive slower, haul heavier, etc.)	25	28%

Table 4.16. How would you rate the business environment in Washington for the log hauling industry?

Poor	Average	Good
104	22	0
83%	17%	0%

Table 4.17. What do you feel could be done at the state level to improve your business competitiveness?

Issues that need improvement	Total reports from 111 respondents	Percentage
Weight limits	8	7%
Taxes/fees	29	26%
Re-instate state rates	62	56%
Fuel prices/surcharge	19	17%
Others (less inspection, less state rules, etc.)	29	26%

Characteristics of responses related to roads

Table 4.18. What do you feel is the most dangerous part of your job as a log truck driver?

Traffic	Roads	Load/Unload	Age/Fatigue	Weather	Equipment	Other
84	25	13	11	4	4	6
69%	20%	11%	9%	3%	3%	5%

Table 4.19. How would compare the traffic on Washington paved roads today as compared to 10 years ago?

Much worse	Somewhat worse	The same	A little better	A lot better
96	32	1	0	0
74%	25%	1%	0%	0%

Table 4.19. How would you compare the quality of Washington paved roads today as compared to 10 years ago?

Much worse	Somewhat worse	The same	A little better	A lot better
35	54	29	11	0
30%	46%	25%	9%	0%

Table 4.20. How would you compare the quality of Washington gravel roads today as compared to 10 years ago?

Much worse	Somewhat worse	The same	A little better	A lot better
42	34	40	10	1
36%	29%	34%	9%	1%

Characteristics of revenue

Table 4.21. Log truck survey results for 2006 gross return.

	Average	Median	Min	Max
Annual Truck Gross 2006	$137,775	$134,198	$42,000	$232,910

Table 4.22. Log truck survey results for 2006 net income.
(n = 117)

	Average	Median	Min	Max
Annual Trucker Income 2006	$33,404	$33,000	-$15,000	$70,000

Application of Economic Findings

First, we present all estimated costs, other than wages, of operating a log truck for a single truck company operating a 1998 tractor and a multiple truck company operating a new tractor, based upon average 2006 fuel prices as reported by trucking survey respondents ($2.74 per gallon). Second, we present operations costs for both company type examples with a current approximated average fuel price for Washington for June 12, 2008 ($4.91 per gallon). In the period from 2006 to June 2008 the price of diesel fuel had increased by 79%. Two different operational scenarios were developed to show cost differences relative to company size, equipment age, and increases in fuel prices. Cost estimates are to be considered as baseline required expenses of log truck operation regardless of company revenues. Estimates are for average road conditions of 17 percent gravel and 83 percent pavement.

Table 4.23. Non-wage cost of operations for single and multiple truck companies.

	Single Truck Company			Multiple Truck Company		
	2006	2008	% change	2006	2008	% change
Fixed cost/mile	$0.30	$0.30	0.0%	$0.53	$0.53	0.0%
Variable cost/mile	$0.85	$1.28	51.6%	$0.75	$1.19	57.9%
Total cost/mile	$1.14	$1.58	38.1%	$1.28	$1.72	34.0%
Fixed cost/ton	$1.14	$1.14	0.0%	$2.35	$2.35	0.0%
Variable cost/ton	$3.23	$4.89	51.6%	$3.35	$5.28	57.9%
Total cost/ton	$4.37	$6.03	38.1%	$5.70	$7.64	34.0%
Fixed cost/hour	$6.46	$6.46	0.0%	$11.96	$11.96	0.0%
Variable cost/hour	$18.28	$27.72	51.6%	$17.02	$26.87	57.9%
Total cost/hour	$24.75	$34.19	38.1%	$28.98	$38.84	34.0%

A full accounting of the cost of operations would not be complete without consideration of wages and wage-related costs. Surveyed companies and interviewed truckers were asked about compensation. Log hauling companies in Washington with employed drivers utilize two primary approaches for compensation; some drivers are paid an hourly wage and others are paid on a percentage of the truck daily gross revenue. Analysis of survey response data indicates that the experience is that truck drivers receive either an average wage of $16.09 per hour or are paid based upon an average of 32.0% of the gross revenue for the truck.

In order to offer a representative range of the full cost of operations of a log truck for each company example as developed for non-wage cost estimates presented above, we provided one low-cost scenario (A) in which we use the suggested hourly wage of $16.09 but consider this as a flat rate in lieu of over-time and do not include health insurance benefits. In the high-cost scenario (B), we model as for more conventional businesses and use the suggested hourly wage for the first 40 hours per week but increase to $24.14 ("time-and-a-half") for over-time hours in excess of 40 hours per week. For the high-cost scenario, we also include estimated costs of health insurance for driver and spouse. Employee-related costs such as social security, industrial insurance, and drug test charges are also included. Employment benefits such as retirement plans and paid vacations were not included in this analysis but, if provided, would increase costs of benefits.

Table 4.24. Cost of operations for single (1A) and multiple (2A) truck companies with wage-related costs *excluding* overtime and benefits.

	Single Truck Company - 1A			Multiple Truck Company - 2A		
	2006	**2008**	**% change**	**2006**	**2008**	**% change**
Fixed cost/mile	$0.30	$0.30	0%	$0.53	$0.53	0%
Variable cost/mile	$1.72	$2.16	25%	$1.68	$2.12	26%
Total cost/mile	$2.02	$2.46	22%	$2.22	$2.65	20%
Fixed cost/ton	$1.15	$1.15	0%	$2.37	$2.37	0%
Variable cost/ton	$6.56	$8.23	25%	$7.47	$9.41	26%
Total cost/ton	$7.71	$9.38	22%	$9.84	$11.78	20%
Fixed cost/hour	$6.53	$6.53	0%	$12.03	$12.03	0%
Variable cost/hour	$37.19	$46.63	25%	$38.01	$47.86	26%
Total cost/hour	$43.72	$53.16	22%	$50.04	$59.89	20%

Table 4.25. Cost of operations for single (1B) and multiple (2B) truck companies with wage-related costs *including* overtime and health insurance benefits.

	Single Truck Company - 1B			Multiple Truck Company - 2B		
	2006	**2008**	**% change**	**2006**	**2008**	**% change**
Fixed cost/mile	$0.46	$0.48	6%	$0.67	$0.70	4%
Variable cost/mile	$1.90	$2.34	23%	$1.85	$2.28	24%
Total cost/mile	$2.36	$2.83	20%	$2.52	$2.98	18%
Fixed cost/ton	$1.75	$1.85	6%	$3.00	$3.10	4%
Variable cost/ton	$7.26	$8.93	23%	$8.20	$10.14	24%
Total cost/ton	$9.01	$10.78	20%	$11.20	$13.24	18%
Fixed cost/hour	$9.89	$10.47	6%	$15.24	$15.79	4%
Variable cost/hour	$41.17	$50.61	23%	$41.69	$51.55	24%
Total cost/hour	$51.07	$61.08	20%	$56.93	$67.33	18%

The average 2006 gross revenue per truck for a log trucking company in Washington, as reported by 103 survey respondents, was $137,775. A comparison of this gross return to simulations of cost of operations for 2006 suggests that average revenues for log truck companies were marginally equivalent to our lowest estimate of full cost of operations as modeled for the 2006 owner-operator scenario 1A - without overtime or benefits ($133,722). Analysis of the distribution of survey-reported gross revenues suggests that about half of respondent companies were operating log trucks with revenues below estimated minimum cost of full-time operations. In contrast, less than six percent of survey respondents reported gross earnings that exceeded the simulated 2006 high cost of operations (2B) for a new truck with a driver that received $16.09 per hour with over time and health insurance benefits.

Table 4.26. Log truck survey results for 2006 annual gross truck revenues.

	Average	*Median*	*Min*	*Max*
Annual Truck Gross 2006	$137,775	$134,198	$42,000	$232,910

Table 4.27. Summary comparison of modeled total annual operation costs and fuel costs for 2006 to 2008. Ranges reflect low (self-employed driver: older truck with no overtime or benefits) to high (employed driver: new truck with overtime and benefits). Base wage = $16.09/hr.

	Low Costs of Operation		Percent
	2006	2008	Increase
Total Cost	**$133,721.90**	**$162,592.71**	**21.6%**
Fuel Cost	**$35,524.37**	**$63,658.63**	**79.2%**

	High Costs of Operation		Percent
	2006	2008	Increase
Total Cost	**$179,524.23**	**$212,321.64**	**18.3%**
Fuel Cost	**$38,253.62**	**$68,549.38**	**79.2%**

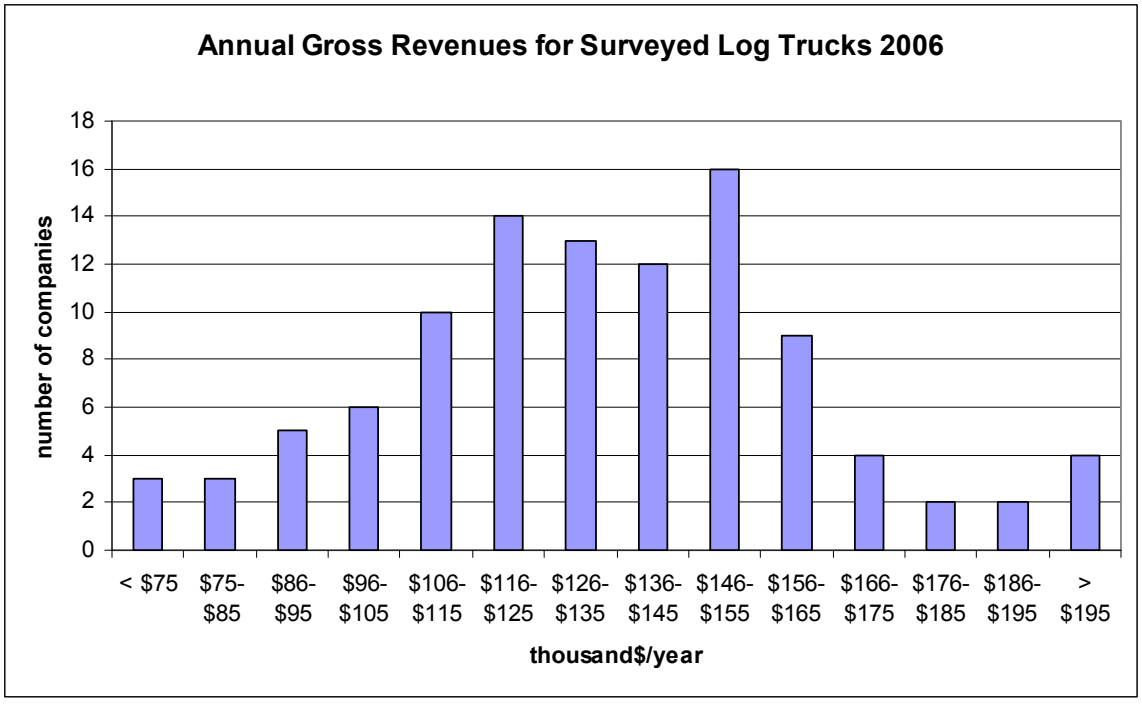

Figure 4.1. Annual 2006 gross revenue per truck for respondent log hauling companies.

Safety Summary

Analysis of accident data provided by the Washington State Patrol and the Washington Department of Transportation for all collisions involving log trucks for years 2002 through 2007 showed no trend of increasing safety hazards to warrant public concern (Figure 4.2). This examination of the safety record of the log hauling industry in Washington leads to conclusion that log truck operation is safer today than in years past. WA accidents involving log trucks declined by 11% from 2004 to 2006 while collisions of all state commercial carriers increased by 15% during the same period. A review of WA Department of Labor and Industries data for on-the-job injuries and fatalities of log truck drivers also showed no trend indicating increases of incidence.

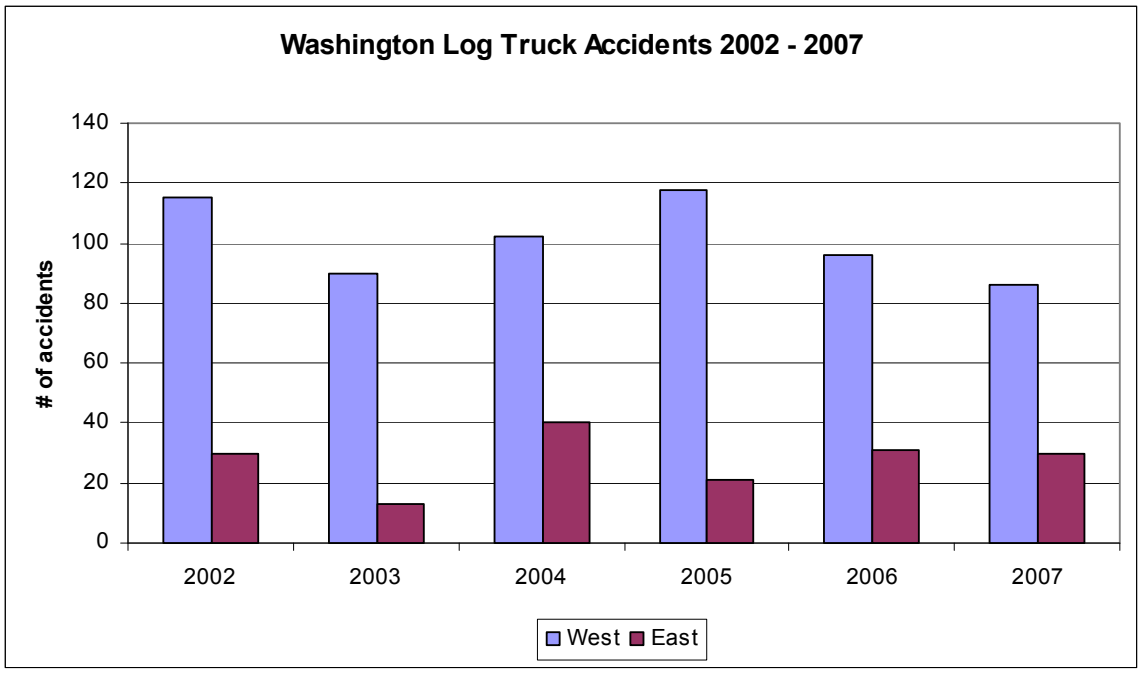

Figure 4.2. Washington Log Truck Accidents 2002-2007.

While the accident record of the Washington log trucking industry shows no apparent trends to indicate increased collision, injury, or fatality incidence, this investigation identified a number of concerns that could challenge future safety performance and economic viability of log truck operations. Trucking issues such as deregulation, rising cost of operations, extended hours of service, an aging workforce, poor driver recruitment, and increases in roadway congestion have been linked by prior research to declines in the safety performance of commercial carriers. The current influx of out-of-state trucks log trucks providing hauling services within Washington is a new issue with uncertain safety and economic implications. Public health impacts associated with diesel exhaust exposure represent an emerging safety concern with potential to increase cost of operations.

Conclusions and Recommendations

Conclusions

As reported earlier in Section I (Background) of this report, the Washington forest industry employs 45,000 people and annually generates $2 billion in wages, $16 billion in gross business revenues and over $100 million in tax receipts. Washington produces six billion board feet of lumber per year, one billion square feet of plywood panels, and seven million tons of pulp and

paper products. Washington has the second largest lumber production in the nation and is fourth in production of both plywood and pulp and paper products. All of this activity is dependent upon the drivers and trucks that move raw logs from the woods to process facilities.

Every year approximately one million loads of logs are hauled by log trucks on Washington's roadways. The cumulative annual distance of travel is approximately 140 million miles often under adverse road and weather conditions.

As noted in Section I of this report concerns about cost of operations are not new. Brown (1936) provided early analysis of the cost of operations for logging trucks. He recognized the entrepreneurial benefits of truck logging for low cost to entry into the logging business but offered a precautionary note. Based upon his observations of the uniquely independent and small-operator-dominated contract hauling industry, he expressed concern that many truckers did not did not know how to accurately determine the cost of operations including depreciation, taxes, interest charges, fuel, oil, repairs, and etc. Brown suggested more than 70 years ago that some contract log truckers were hauling logs at rates below cost of operations thereby creating instability within the timber industry.

In the years following Brown's warning, state regulations limiting company entry into the log hauling industry and setting rates for haul services were put in place. These regulations provided stability to the log hauling industry for decades. However, a critical review of the costs and benefits to the timber industry of such state-imposed rates was beyond the scope of this study and, given the federal deregulation of *intrastate* trucking imposed by the Federal Aviation Administration Act of 1994, could be of little current value. Since 1995, the state no longer has the authority to regulate *intrastate* trucking. Interestingly, survey data suggests that more half of respondent log truck companies are not aware of this jurisdictional reality and hope to see "state rates" re-imposed.

In absence of state regulation, the competitive market must resolve questions of compensation for log haul contractors. It is clear from analysis of survey responses that compensation for services may be highly variable with some businesses appearing to be receiving annual gross revenues that are below cost of operations while others appear to be profitable. Comparison of survey results to modeled cost of operations leads to a conclusion that the industry, as a whole, marginally has costs equal to revenue but only when compared to the lowest cost (lowest wage and benefit) scenario. One explanation for the profitability of some companies and not others could be associated with the long-term business relationships that some log hauling companies have established with loggers and timber owners local to their areas of operations. More generally, however, symptoms of economic pressure are apparent and manifest themselves as extended hours of service, an aging workforce, poor driver recruitment, and marginal profitability. Declines in the registrations of log trucks in Washington appear to be accompanied by a gain market share by out-of-state trucks (see prior discussion in Section II and Figure 4.3 below). The economic and safety implications of this shift are unknown but suggest that trucks from other states must be lowering cost of operations in some manner in order to gain competitive edge.

Figure 4.3, below, shows a comparison of the number of all log trucks registered in Washington to the total trucks registered in Oregon to operate in Washington. Between the years 1998 and 2006 the of log trucks registered in Washington declined by 36 percent while, by 2006, there were 20 percent more Oregon trucks operating in Washington than Washington trucks. Data are not available for Idaho trucks operating in Washington but anecdotal evidence suggests that many Idaho trucks are hauling logs in northeastern Washington. A recent report prepared for the Washington Department of Transportation (WSDOT) forecasted an increase in log truck traffic of approximately 150,000 loads per year (15 percent) by 2020 (Perez-Garcia 2007). An investigation of state biomass inventory, prepared for the Washington Department of Ecology, estimates that two million tons per year of logging residues could be utilized as feedstock material for renewable energy (Frear et al 2005). Retrieval of logging residues could mean an additional 80,000 truck loads per year of wood hauled in Washington (8 percent). Declines in WA log truck registrations

have averaged four percent per year but studies project a needed 23 percent increase in trucking capacity. It appears that critical issues of wood transport capacity will need to be addressed in the future.

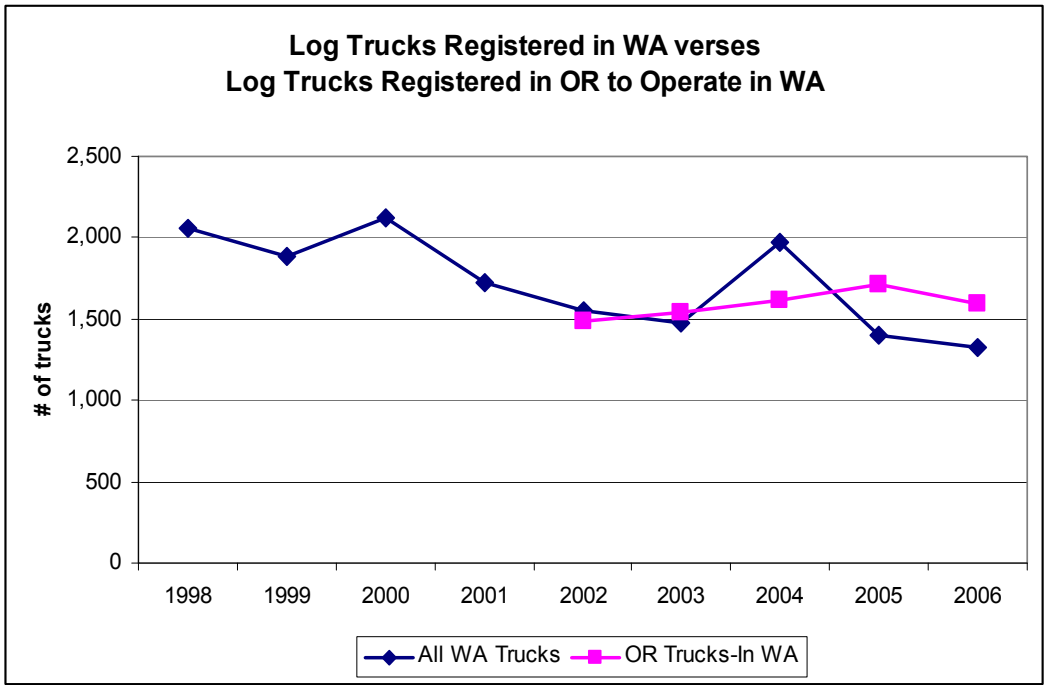

Figure 4.3. Log trucks registered for operation in Washington verses log trucks registered in Oregon to operate in Washington (WSDOT, WSDOL, & ODOT).

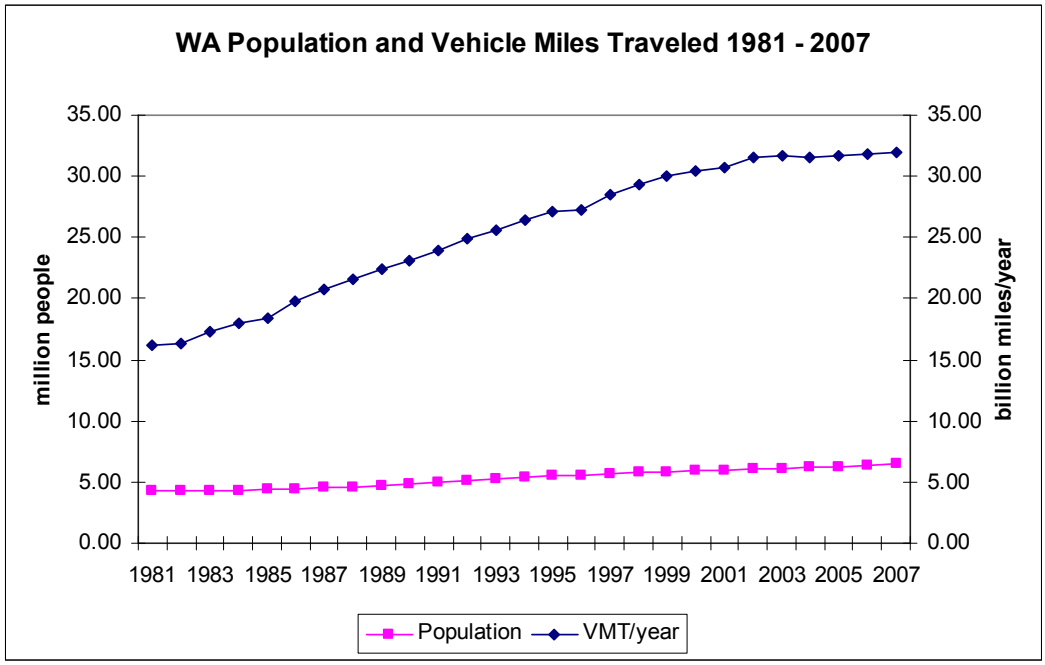

Figure 4.4. Increases to WA population and annual vehicle miles traveled (VMT).

Another important safety consideration, beyond the control of log haulers, is traffic congestion. From 1981 to 2007, state population increased by 53 percent from 4.23 million to 6.49 million people. During the same period, vehicle miles traveled (VMT) per year increased by 98 percent

from 16.16 billion to 31.97 billion miles. Average VMT per person per year have increased by 29 percent. From 1981 to 2007, total road-miles in Washington (principal, minor, collector, and interstate) increased 2 percent from 6,885 to 7,044 miles. Quantified by VMT per road-mile, there is conceivably a 93 percent increase in traffic and associated congestion on Washington's roadways. Increases in traffic congestion have both safety and economic implications for Washington log truck operators. Sixty-nine percent of survey respondents felt that diving in traffic is the most dangerous challenge of their job.

Recommendations

While our analysis of accident records reveals that the log hauling industry is comparatively safe relative to the performance of the broader population of commercial carriers, safety does not translate to economic viability. There is ample evidence to suggest that the future viability of log trucking business is in question and such uncertainty is a legitimate matter for private and public concern. With an expected 23 percent increase in wood transport, it appears that critical issues of capacity will need to be addressed in the future. Economic viability comes from the actual relationship between private cost of operation and revenue to the trucking firm. We hope this report will be useful to both buyers and sellers of hauling services by helping to inform contract discussions. Survey results indicate that many log truckers report difficulty accommodating increasing costs with current levels of compensation and would like to see adjustment through re-imposition of state-regulated haul rates. A review of the relevant laws leads to a conclusion that federal deregulation of trucking precludes such possibility. However, our investigation has identified two potential state legislative opportunities to provide relief for log trucking companies that may be worthy of consideration.

Business and Occupation Taxes

The Washington Business and Occupation Tax (B&O Tax) is calculated at 1.926 percent of gross revenues. An examination of the implications of B&O Taxes relative to increases in fuel costs and worker compensation was conducted using our simulations of log truck operation costs. Depending upon cost simulation scenario, we estimate that B&O Taxes will add $3,072 to $4,012 to cost of operations for log hauling companies in 2008. B&O Taxes associated with fuel and wages account for 70% to 79% of the total B&O Tax responsibility. With 2008 fuel price that approaches $5 per gallon, B&O Taxes function as an additional $0.10 per gallon fuel tax except, unlike actual fuel taxes, B&O Taxes are calculated based upon the total price at the pump, which already includes significant state and federal taxes.

From 2006 to 2008, although loads of logs hauled remained constant, the increase in the price of fuel resulted in an increase in the total B&O Tax of about 20 percent. Wage-related costs also incurred multiple taxation. In addition to direct wages and benefits, B&O Taxes are effectively charged against FICA, Labor and Industries, and Unemployment Security expenditures. B&O Taxes add to cost burdens for companies that struggle to accommodate increasing variable cost of operations such as fuel and wage-related costs. B&O Taxes, as currently levied, affect employees by lowering company profitability and can serve as a disincentive for employers to provide better wages and benefits. Relief from B&O Taxes could lower log hauling businesses costs of operation.

Equipment options to reduce costs and increase safety

This study included an evaluation of the pollution health impacts and associated need for emissions equipment upgrades as emerging public/private costs of safe log truck operation. Comparison of fatalities linked to diesel pollution with collision fatalities illustrates the seriousness of this safety issue. Great strides in emissions reduction equipment development have been made by manufacturers but distribution and investment by the industry lags potential. Heavy trucks that are 2007 and newer are equipped with exhaust systems that allow very low emissions

of fine particulates and other pollutants. This is not the case for older trucks. Since diesel engines can provide a million miles or more of service it could take decades to significantly reduce the adverse effects of diesel exhaust in Washington. Retrofit of diesel particulate filters that are designed to cut soot emissions by 90 percent can be accomplished for trucks 1990 and newer. However, cost of retrofit is estimated at $7,000 to $10,000 per truck. Both the Governor and the Legislature have identified pollution reduction as an important state objective to improve human health and to control emissions of green house gas. The Washington Department of Ecology estimates a public benefit of three to sixteen dollars from every dollar invested in reducing diesel pollution. It appears that trucking companies, such as log haulers, will not be able to privately afford such investment without assistance.

Equipment upgrades to heavy trucks for reduced pollution are not limited to exhaust systems. Central tire inflation systems and "super-single" tires were identified as low-cost opportunities where investments in equipment upgrades could reduce fuel consumption by upwards of five percent on any age of truck. Achievement of reductions in fuel consumption automatically results in avoided emissions and can also provide economic relief to trucking companies. States such as California have recognized that public investments through grants and tax incentives in "green" equipment upgrades for heavy trucks can be prudent public investment for climate change mitigation. State programs for public investments to support equipment upgrades that reduce pollution could help trucking companies to reduce fuel costs and provide significant public environmental benefit, thus a win-win situation.

Future research

Remarkably, after almost 100 years of truck logging in Washington, we found no record of a prior state study to examine the costs of operation and the safety performance of this important industry. We also found that while the industry appears to contracting, the demand for services is expected to expand.

Figure 4.5. 1940 Mack log truck (Spoestra).

A significant change for the log truck industry occurred when intrastate trucking was deregulated by the United States Congress. There is broad disagreement within the trucking literature as to the costs and benefits of deregulation. Other regulatory discussions, as yet unresolved, that could affect log trucking relate to increases to gross weight limits and whether current disparate state rules should be replaced with uniform federal standards. As state and federal regulatory authorities evolve through time, the implications for a safe and sustainable log truck industry will merit periodic evaluation.

Little data were found available with which to develop trend analysis for the log hauling industry. Lack of data challenges scientific research and hinders informed policy-making. Many factors uncovered by this investigation suggest that the log trucking industry could experience dramatic changes in the future. Issues such as revenue shortfalls, rising costs of operation, extended hours of service, an aging workforce, poor driver recruitment, increasingly congested roadways, shifting regulations, and growing public concern about pollution have been highlighted by this investigation. The interconnectivity of these issues should be a research focus as policy solutions are crafted for the future.

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Images have been used with permission for non-commercial scholarly publication only.

Early log truck with single steer tire, chain drive and wooden trailer around 1918 (University of Washington Libraries, Special Collections, UW8462).

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Pacific County Historical Society, South, Bend, WA.

ProFab Manufacturing Inc., Chemainus, B.C.

Spoelstra, T., Forks, WA.

University of Washington, Special Collections, #UW8462, Seattle, WA.

Whit-Log Inc., Wilbur, OR.

Appendix A

Log Truck Configurations

1) 5-Axle Long Logger (Whit-Log Inc.).

2) 6-Axle Long Logger (Whit-Log Inc.).

Log Truck Configurations

3) 7-Axle Long Logger (Whit-Log Inc.)

4) 8-Axle Long Logger (Log Trucker Magazine).

Log Truck Configurations

6) 6-Axle Long Logger with "Pup" Trailer (Log Trucker Magazine).

7) Hay Rack Trailer (ProFab).

Log Truck Configurations

7) 5-Axle Self-Loading Log Truck (Log Trucker Magazine).

8) 6-Axle Self-Logging Log Truck (Log Trucker Magazine).

Log Truck Configurations

9) 5-Axle Mule Train (Whit-Log Inc.).

10) 7-Axle Mule Train (Whit-Log Inc.).

Log Truck Configurations

11) 6-Axle Self-Loading Mule Train (Whit-Log Inc.).

12) Tractor and Pole Trailer (Log Trucker Magazine).

Appendix B

University of Washington and Washington State University

Log Trucking Study

Name of company representative completing this survey*:

_____

Job Title:

_____

** Please be aware that all information from this questionnaire will be kept CONFIDENTIAL. If you would like to receive a copy of the Final Report developed from this survey please check here:*

☐ Yes ☐ No

WSU & UW thank the following sponsors:

Please check the correct box or enter other information as requested. Please, since you are most familiar with your firm and the industry, provide your best estimates.

1) Are you?

Owner operator (single truck)	Owner operator (multiple trucks)	Owner non-driver	Other company employee

2) a) Approximately how many years has your company been in business?

_____

b) Approximately how many years have you driven log trucks?

_____

c) How old are you? _____

3) What is your company form of ownership?

Sole Proprietorship	Partnership	Corporation

4) Approximately how many people did your company employ in 2006?

_____

5) How many, including yourself, were drivers? _____

6) How many trucks does your company operate? _____

7) What year, make, model is/are your truck(s)? What is the normal trailer configuration that is used with each truck?

Please attach extra information sheet if needed.

Year	Make	Model	Configuration
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8) How many axles on each truck-trailer configuration mentioned above do you operate on your equipment? What is/are your gross weight and net payload(s) by truck/trailer configuration?

Please attach extra information sheet if needed.

Configuration	Axles	Gross weight	Net payload
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

9) Do you use a second pup trailer with your truck/trailer? □ Yes □ No

If yes: How many trucks do you operate with pup trailers? _____

10) How many of your trucks are self-loaders? _____

11) Where do you primarily operate? *(Please enter percentages. Total should equal 100%)*

West of the Cascades	East of the Cascades	Both

12) How far away from home do you normally work? (*Please enter percentage, total should equal 100%).*

0 - 50 miles	0 - 100 miles	0 - 150 miles	0 - 200 miles	> 200 miles

13) Haul distance and roads:

What is your maximum one-way haul distance from the logging site to the delivery point? _____ Miles

What is your maximum one-way haul distance? _____

What is your average one-way haul distance? _____

What percentage of your haul miles are on gravel roads? _____

What percentage of your haul miles are on paved roads? _____

14) How many loads per day per truck do you and/or your drivers normally haul? _____ Loads

15) How many hours per day per truck do you and/or your drivers normally work? _____ Hours

16) How many days per week per truck do you and/or your drivers normally work? _____ Days

17) How many hours per week are normally required for maintenance on your log truck? _____ Hours

18) Where do you start clocking your daily time for pay? *(Check only one).*

From Home ☐ From the Shop ☐ From the Landing ☐

19) Where do you stop clocking your daily time for pay? *(Check only one).*

At Home At the Shop At the Drop

☐ ☐ ☐

20) What is your annual ***personal*** income from trucking each year?

_____

21) If you are the company owner, what is the average hourly wage for employees by job type?

_____ Truck Driver

_____ Mechanic

_____ Other (*Please identify*) _____

22) Do you know what you will be paid prior to beginning a new haul from a logging site? ☐ Yes ☐ Sometimes ☐ No

*If you responded sometimes or never, please explain*_____

_____

23) How long from the time of haul until you are usually paid?_____

24) How are you usually paid? *(Check one).*

☐ By the hour ☐ By the load

☐ By the mile ☐ By the day

☐ By the ton ☐ Other

Please identify if other: _____

25) What was your average 2006 truck gross return in

$ per day? _____ $ per load? _____

$ per year?_____ $ per ton? _____

$ per mile?_____

26) If you are the company owner, what benefits do you provide to yourself from your company? *(Check those applicable).*

Health Insurance	Disability Insurance	Retirement Plan/IRA	Vehicle Use	Other

27) What benefits do the employees receive from your company? *(Check those applicable).*

Health Insurance	Disability Insurance	Retirement Plan/IRA	Vehicle Use	Other

28) If health insurance is provided by the company, is it also provided for family members?

□ Yes □ No

29) If you are an employer, how difficult is it to find and keep skilled truck drivers? *(Check one).*

Very difficult	Occasionally a problem	Drivers are readily available

30) How available are skilled truck drivers today as compared to 10 years ago? *(Check one).*

Harder to find	The same	Easier to find

31) What was your total truck cost operating in 2006 (equipment, fuel, repairs, insurance, and other costs *except wages*) in:

$ Per mile for the year _____

$ Per ton for the year _____

32) What were your total truck cost expenditures for your total business in 2006 (all costs *except wages*).

_____

_____

33) What was your company's gross revenue in 2006?

_____

34) What was the average rate you received for log hauling in Washington in 2006, by *any or all* of the following pay units that are most appropriate?

$ per mile? _____ $ per load? _____

$ per hour? _____ $ per ton? _____

$ per day? _____

35) What was the average number of miles driven by a log truck in your company during 2006? _____ Miles

36) What is the average life of:

Trailers in miles _____ Tractors in miles _____

Trailers in years _____ Tractors in years_____

Truck motor in miles _____

37) If possible please estimate the average total year volume of timber hauled by a log truck in your company during 2006? _____Tons

38) How difficult is it to find hauling contracts to keep your company operating? *(Check one).*

Very Difficult	Occasionally Difficult	Readily Available

39) How would you compare the QUALITY of Washington PAVED roads today as compared to 10 years ago? *(Check one).*

Much worse	Somewhat worse	The same	A little better	A lot better

40) How would you compare the TRAFFIC on Washington PAVED roads today as compared to 10 years ago? *(Check one).*

Much worse	Somewhat worse	The same	A little better	A lot better

41) How would you compare the QUALITY of Washington GRAVEL roads today as compared to 10 years ago*? (Check one).*

Much worse	Somewhat worse	The same	A little better	A lot better

42) What number of weeks of down time per year do you usually experience for fire season, break up, road closures, or other seasonal constraints?_____

_____

43) What number of weeks of down time per year do you usually experience for equipment breakdowns?

_____

44) How many weeks in total did you operate in 2006?

_____

45) Please estimate how many times your truck got stopped (both weight scales and equipment check) in 2006. If you have more than one truck please estimate the average.

_____

46) What was the average length of time for each weight or equipment check stop? _____

47) Do you get voluntary annual equipment inspections for your trucks?

□ Yes □ No

If you filled in Yes, does this help reduce time lost for road checks?

□ Yes □ No

48) Do you plan on investing in equipment in the next five years?

□ Yes □ No

If yes, what type of equipment will you purchase and how much do you plan to spend?

Equipment: _____ Expenditure: _____

49) What is the average new replacement cost of basic equipment needed to haul logs?

Trailer_____ Tractor_____

50) When replacing a truck tractor do you generally purchase? *(Check one).*

A New Truck	A Used Truck	Sometimes New or Used	A Kit

51) What factors most influence your decision to purchase new versus used equipment?

_____

_____

_____

_____

52) Do you ever lease equipment for your use? □ Yes □ No

If yes: cost _____ per _____

53) What is your annual insurance cost for a truck and trailer? _____

54) How many of your truck(s) are registered as:

Log truck	Combination

55) What is your annual licensing cost for a truck and trailer? _____

56) What is the average cost of truck tires? _____

57) What is the average life of tires?

Trailer tires in miles_____ Tractor tires in miles _____

Trailer tires in months _____ Tractor tires in months _____

58) What is your estimated average miles per gallon for your truck(s)?

_____ Miles/gallon.

What was the average diesel price per gallon that you paid in 2006? _____ $/gallon.

What was the highest diesel price per gallon that you paid in 2006? _____ $/gallon.

What was the lowest diesel price per gallon that you paid in 2006?

_____ $/gallon.

59) Please estimate the value of your current investment in buildings, office facilities, garages, garage equipment, and other facilities?

_____

60) What is your estimated annual total cost of support personnel (clerks, accountants, mechanics, laborers, etc)?

_____

61) What is your estimated annual cost for utilities (telephone, electricity, heat, etc.)? _____

62) What other costs did you pay in 2006? Please specify and estimate cost. _____

_____

_____

_____

_____

63) What are the impacts to your company of rising fuel costs and how are you responding to these changes? _____

_____

_____

_____

_____

64) Have you ever had an accident in your log truck in last five years?

□ Yes □ No

If yes, please describe the circumstances:

	Causes	Locations	Cost of damage	Degree of injury
2006	_____	_____	_____	_____
2005	_____	_____	_____	_____
2004	_____	_____	_____	_____
2003	_____	_____	_____	_____
2002	_____	_____	_____	_____

65) What do you feel is the most dangerous part of your job as a log truck driver?

_____

_____

_____

65) On a scale of 1-5 with 1 as safe and 5 as very dangerous please rate the following job situations relative to possible accident hazard.

Loading logs on the landing _____

Driving forest roads _____

Driving county roads _____

Driving state roads _____

Driving Interstate roads _____

Unloading logs at the dump _____

Putting on and taking off log binders _____

Other (please specify) _____

66) How much has your productivity changed, for better or worse, between 2000 and 2006? *(Indicate the approximate percentage)* _____

67) What factors have most contributed to your productivity change?

_____

_____

_____

68) Is your company currently? *(Check one).*

Losing Money	Breaking Even	Making a Profit

69) Given your response to the last question, what are your future plans?

Retire/ Leave industry	Diversify to Other Trucking Industry	Downsize	Remain the Same	Expand Your Log Hauling Operations

70) How would you rate the business environment in WA State for the log hauling industry?

Poor	Average	Good

Why? _____

_____

_____

_____

_____

_____

_____

71) What state regulatory factors do you feel have reduced or improved your competitiveness, efficiency, and profitability?

_____

_____

_____

_____

_____

_____

72) What do you feel could be done at the state level to improve your business competitiveness?

_____

_____

_____

_____

_____

_____

73) What do you feel is the single most critical issue facing the log hauling industry over the next three years?

_____

_____

_____

_____

_____

ADDITIONAL COMMENTS: *Please attach extra information sheets as may be needed.*

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY!

Please place completed survey forms in the enclosed envelop and return to:

Ken Casavant

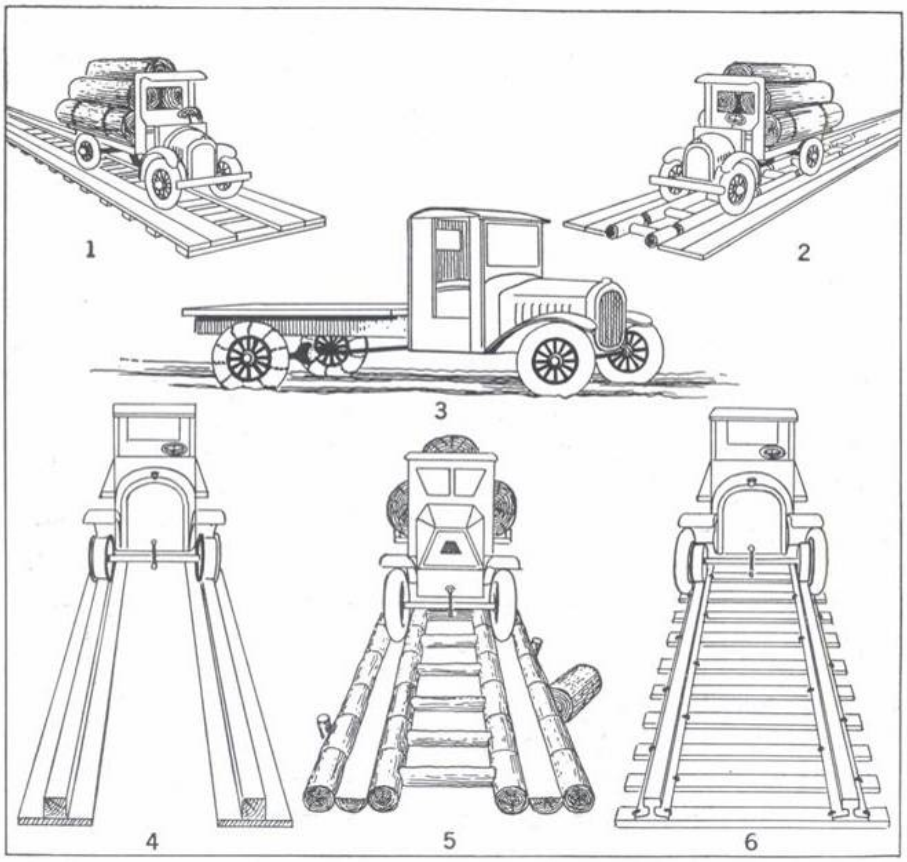
Washington State University

School of Economics Sciences

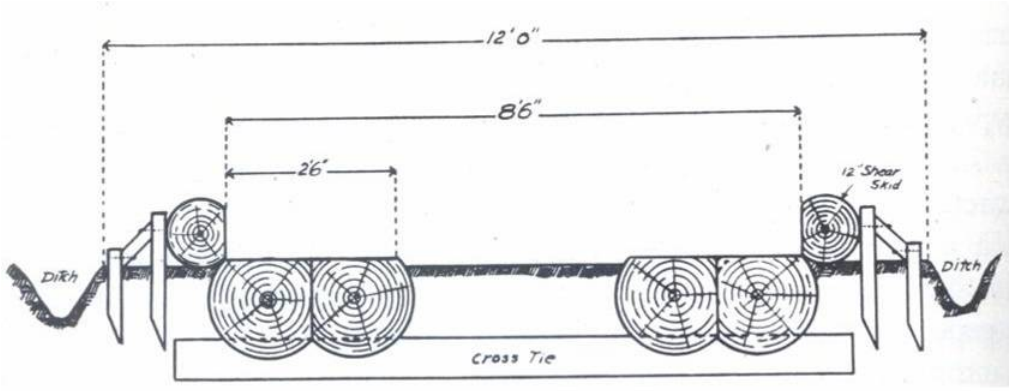
PO Box 646210

Pullman, WA 99164-6210

Appendix C



Wooden road types employed by loggers in the early twentieth century (Brown 1936).

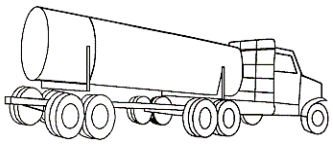


Cross section of pole road construction (Knapp 1921).

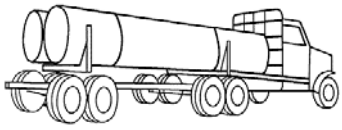
Appendix D

PLACEMENT AND NUMBER OF WRAPPERS

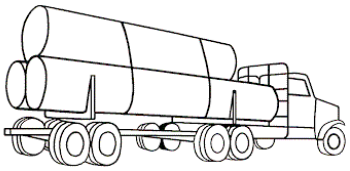
WAC 296-54-58950 Log trucks--Wrappers and Binders



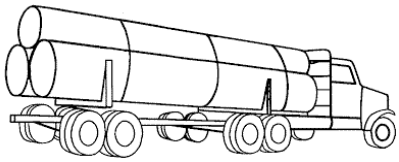
One Log Load



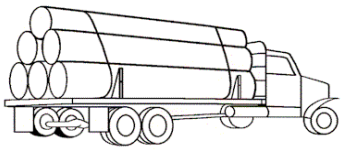
Two Log Load



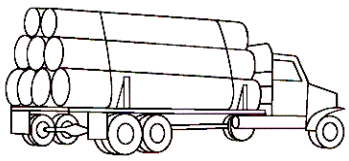
Three or Four Log Load 44 Feet or Less



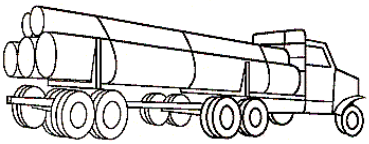
Three or Four Log Loads More Than 44 Feet



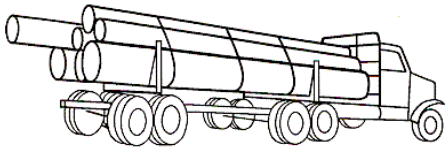
Five or Six Log Load-All Logs 17 Feet or Less



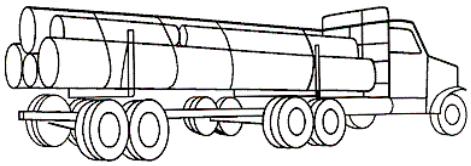
Seven or More Log Load-All Logs 17 Feet or Less



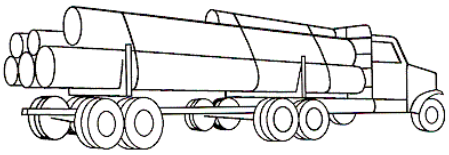
Five or More Log Load if any Logs are More Than 17 Feet



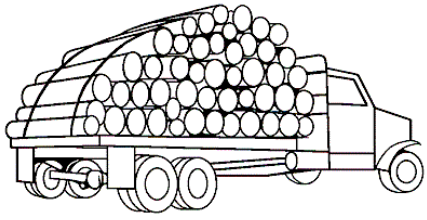
Proper Support for Logs



Outside Logs or Top Logs



A Wrapper Must be Near Each Bunk



Short Logs Loaded Crosswise

Appendix E

Washington Utilities and Transportation Commission
Tariff No. 4-A; Log Road Classification System
April 26, 1994

Class A: Paved or macadamized, reasonably free from chuck holes, ruts, washboard conditions and other hazards, not exceeding grades of 6 percent.

Class B: Paved or macadamized, or graveled, other than the specifications in Class A as applicable, not exceeding grades of 12 percent.

Permanently and continuously maintained with fine gravel, smooth surface, free from chuck holes, ruts, washboard conditions and other hazards, with grades exceeding 6 percent but not exceeding 12 percent.

Good plank not exceeding grades of 12 percent. "Good plank road" shall be defined as at least 10 feet wide with side guards at least 6 inches high on cross planking or center guard at least 6 inches high on longitudinal planking. It must be constructed of planks at least 3 inches by 10 inches, firmly spiked down and with sufficient turn out space for truck passing at least every 200 yards. Supporting timbers must be at least 10 inches by 10 inches.

Class C: All roads with grades exceeding 12 percent but not exceeding 18 percent.

All dirt, rock, or plank other than good plank specified under Class B, not exceeding grades of 18 percent.

Class D: All roads with grades exceeding 18 percent but not exceeding 22 percent.

Class E: All roads with grades exceeding 22 percent.

Roads consisting of mud or water to a depth of 8 or more inches, or any road that cannot be negotiated by the truck under its own motive power.

Appendix F

CHRISTINE O. GREGOIRE
Governor

JOHN R. BATISTE
Chief

STATE OF WASHINGTON
WASHINGTON STATE PATROL
PO Box 42614 • Olympia, Washington 98504-2614 • www.wsp.wa.gov

January 28, 2008

Mr. Norm Miller
Washington Trucking Associations
930 South 336th ST STE B
Federal Way WA 98003

Dear Mr. Miller:

The Washington State Patrol (WSP) and the Washington Trucking Associations (WTA) jointly sponsor a voluntary truck inspection program each year for the log and dump truck operations. The voluntary truck check is a great program. It allows the opportunity to meet and discuss issues with drivers and industry, which is an important factor used to accomplish our goal of truck safety around the motoring public.

I would like to recognize the following WTA Chapters for their hard work by achieving an "Under 10% Out of Service rating." Thank you for the work put forth by these Chapters to ensure trucking safety out on our state highways.

AREA	CHAPTER	PERCENT OUT OF SERVICE
Aberdeen	Hoquiam/Grays Harbor Chapter	5.3%
Centralia	Lewis Chapter	9.8%
Cle Elum	Kittitas Chapter	5.5%
Forks	Forks Chapter	7.1%
Kelso	Lower Columbia Chapter	6.0%
Mount Vernon	Skagit Chapter	6.6%
Port Angeles	Olympic Peninsula East Chapter	5.5%
Tacoma	Valley Chapter	7.4%
Vancouver	Southwest Chapter	9.4%

In April 2008 the WSP will be conducting voluntary truck inspections and we look forward to another great year of partnerships.

Sincerely,

Captain Darrin T. Grondel
Commercial Vehicle Division

DTG:dav
cc: Mr. Larry Pursley, Washington Trucking Associations ✓
Lieutenant Fred Fakkema, Commercial Vehicle Division
CVEO 4 Steve Gee, Commercial Vehicle Division

Washington State Patrol recognition of Voluntary Truck Inspection Program success