

EFFECT OF OREGON S AXLE-WEIGHT-DISTANCE TAX INCENTIVE

by

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ABSTRACT

Oregon s weight-mile tax was amended in 1990 to provide for a lower tax rate for trucks weighing more than 80,000 pounds if they added axles. The additional axles within a weight class reduce the amount of road damage. The tax break was largely based on equity considerations, since trucks within a weight class tend to do less road damage if they have more axles; however, the tax reductions also created an economic incentive to add axles and thus reduce road damage. This article is a report on attempts to determine if the tax break actually led to an increase in the number of axles within weight classes and a reduction in the amount of road damage. Statistical data indicates that there has been a small increase in the number of axles in most weight classes and a large increase in mileage by the heaviest trucks with the most axles. This has reduced the damage per ton shipped on trucks subject to the axle incentive, but it is not possible to determine if this was due to the weight-mile tax. A series of structured interviews supplemented the statistical analysis and indicates that the tax incentive is not a major determinant of truck configuration. One reason is that regulatory constraints, particularly weight limits, limit the effectiveness of the tax incentives.

OREGON S WEIGHT-DISTANCE TAX

Current Status

The weight-mile tax in Oregon is levied on all trucks weighing more than 26,000 pounds. Trucks subject to the weight-mile tax are exempted from Oregon's Diesel fuel tax. Fuel taxes are levied for vehicles weighing less than 26,000 pounds. Trucks subject to the weight-mile tax must declare a maximum operating weight. The declared weight alone determines the tax rate for trucks between 26,001 pounds and 80,000 pounds. For trucks declaring maximum operating weights between 80,001 pounds and 105,500 pounds, the weight and the number of axles determine the tax rate. Within each weight class, the tax rate declines with more axles. The rate of decline is based on the expected reduction in road damage. The highest single rate is for trucks declaring operating weights up to 98,000 pounds with only five axles. Such trucks are subject to a tax rate of 19.2 cents per mile traveled in the State of Oregon. However, adding a sixth axle with the same declared weight lowers the tax by 17.45% to 15.85 cents per mile. Adding a seventh axle for the same declared weight would lower the tax by an additional 12.93% to 13.8 cents per mile. Taxes are reduced for up to nine axles.

Table 1 shows Oregon weight-mile rates for vehicles over 80,000 lbs. along with the percentage difference in tax rate by number of axles for each weight class. As the number of axles increases from 5 to 9, the tax rate falls between 23% and 36%, depending on weight class. There is a cost associated with additional axles in direct capital cost and increased tare weight. Based on this cost a break-even Oregon mileage could be estimated. For example, using a 1995 estimate of \$3,000 as capital cost and ignoring tare weight, a truck in the 90,001 to 92,000 lb. class would recover all of the capital cost for a sixth axle in less than 13,000 Oregon vehicle-miles. Of course, other factors are important, as will be discussed shortly.

Table 1

Oregon Weight-Mile Tax Rates: Percent difference in rate by number of axles (Rate is specified in mills per mile)											
	5		6		Number of Axles 7		8		9		total %
Declared Weight											
80,001 to 82,000	141.0	8.51%	129.0	6.59%	120.5	4.98%	114.5	5.68%	108.0	23.40%	
82,001 to 84,000	145.5	9.97%	131.0	6.49%	122.5	5.31%	116.0	5.60%	109.5	24.74%	
4,001 to 86,000	150.0	10.67%	134.0	7.09%	124.5	5.62%	117.5	5.53%	111.0	26.00%	
86,001 to 88,000	155.0	11.61%	137.0	7.66%	126.5	5.53%	119.5	5.86%	112.5	27.42%	
88,001 to 90,000	161.0	12.73%	140.5	8.54%	128.5	5.45%	121.5	5.76%	114.5	28.88%	
90,001 to 92,000	168.0	13.99%	144.5	9.69%	130.5	5.36%	123.5	5.67%	116.5	30.65%	
92,001 to 94,000	175.5	15.38%	148.5	10.77%	132.5	5.28%	125.5	5.98%	118.0	32.76%	
94,001 to 96,000	183.5	16.62%	153.0	11.44%	135.5	5.90%	127.5	5.88%	120.0	34.60%	
96,001 to 98,000	192.0	17.45%	158.5	12.93%	138.0	6.16%	129.5	5.79%	122.0	36.46%	
98,001 to 100,000			164.5	14.29%	141.0	6.38%	132.0	6.06%	124.0	24.62%	
100,001 to 102,000					144.0	6.25%	135.0	6.67%	126.0	12.50%	
102,001 to 104,000					147	6.12%	138	6.88%	128.5	12.59%	
104,001 to 105,500					151	6.62%	141	7.09%	131	13.25%	

Weight Mile Tax Structure and Rates

Since implementation in 1990, Oregon's Axle-Weight tax has changed in both structure and rates. Changes effective in 1992 simplified the tax structure and changed rates. Rates were again changed in 1994 and 1996.

When originally passed in 1989, the tax structure required carriers to report trips for trucks with registered weights over 80,000 pounds on the basis of actual weight for each trip, and to report empty miles separately. This created a rate category for weights 80,000 pounds and below. Effective in 1992, the tax structure was simplified so that all miles for trips at extended weights were reported at the truck's registered weight. This change was also reflected in the tax rates, which were adjusted downward to account for the higher rate now levied when operating below registered weight. The final rates for 1992 also reflect a concurrent increase in the weight-mile tax. The rates were again raised effective in 1994 and reduced in 1996.

The change in the tax structure in 1992 has particular implications for the weight and mileage data pre- and post-1992. Eliminating the weight category for 80,000 pounds and below and changing the basis for reporting mileage

from actual to registered weight compromised the comparability of data reported before and after the change. The current reporting structure reflects more mileage in each axle-weight group than were actually traveled at that weight.

The tax is levied based on the number of miles driven in the State and the declared weight. For trucks operating with extended weight permits (over 80,000 pounds), a maximum operating weight must be declared. Trucks may declare more than one maximum weight above 80,000 pounds if they add or remove trailers. There must be one declared weight for each configuration. Whenever the truck changes configuration, e.g., by adding a trailer, it must report all mileage at the weight declared for that configuration. Hence, a truck may report mileage at different weights above 80,000 pounds on a trip if the configuration is changed during the trip.

Most trucks must have mileage reported, and the reports may be monthly, quarterly, or annual, depending on the magnitude of travel in Oregon. Mileage must be reported for each truck subject to the weight-mile tax. Several classes of trucks have the option of being taxed on a flat-fee basis. Trucks operating under flat-fees pay a monthly tax based on the average mileage for trucks of that type operating under the flat fee. Hence, the revenue generation is expected to equal what the weight-mile tax would have generated, but under the flat fee the tax will not vary with usage for any particular truck.

Objectives of the Weight-Mile Tax

The Oregon weight-mile tax promotes two distinct objectives. One is to apportion the cost of road construction and repair in an equitable manner among those who affect the standards needed for construction and cause the need for repair. The second is to discourage the use of heavy axle-loads; and thus reduce the wear on the road system. Road wear from truck traffic rises much more than proportionately with the weight on an axle. Oregon's weight-mile tax reflects this increase in road damage by levying higher tax rates on heavier trucks, and Oregon is the only state to try to discourage heavy axle loads by offering a tax reduction for trucks with additional axles in weight classes above 80,000 pounds. This project was intended to investigate whether the weight-mile tax caused a noticeable change in behavior by truckers. This included examining evidence of the effect of the weight-mile tax on the types of trucks operated in Oregon and on the axle configurations for trucks within a weight class.

At the national level, it has been estimated that changing from the current highway financing system to one based more on weight-mile charges would substantially reduce the amount of damage done by trucks carrying the same volume of freight (*1*). At the extreme, these estimates imply that moving from a weight-mile tax to fuel taxes

in Oregon could increase the damage done by trucks carrying the same volume of freight by more than fifty percent relative to current levels. While there is theoretical evidence that the weight-mile tax would reduce road damage, there are several issues that have not been adequately addressed in considering the use of such a tax in one state when neighboring states do not use it. For example, a truck traveling from Los Angeles to Seattle might be configured differently if it had to pay weight-mile taxes on the entire route than it would be if it paid such taxes only on the Oregon segment. Hence, the reduction in road damage due to the weight-mile tax in Oregon would be lower in Oregon than implied by the national estimates; but there could also be some spillover benefits to other states in reduced road damage. This project is a first attempt to address some of these questions and assess the impact that the tax has had on trucker behavior and ultimately on road damage.

This research was exploratory in nature. At the start of the project, identification of viable data sources was a key concern. One conclusion from the study is that the data currently available do not allow a definitive answer to the question of whether Oregon's weight mile tax leads to a reduction in road damage. However, the data does suggest that there is an effect, albeit not as large as was anticipated. The data analysis was supplemented by a series of structured interviews, and information from the interviews indicates that regulatory limits on weight mitigated the potential impact of the tax.

RESEARCH OBJECTIVES

The ultimate objective is to determine if the weight-mile tax leads to changes in truck equipment and usage that results in reduced road damage from the freight carried on Oregon's roads. However, direct attempts to examine this objective suffer from a variety of conceptual and data issues. First, there are many factors that influence both the type of truck traffic and the damage that it does. For example, long distance haulers tend to favor larger and heavier vehicles. Savings in driver salaries and operating costs relative to multiple vehicles offset the extra time needed to load and unload such vehicles. States that have substantial amounts of through traffic are then likely to have relatively more heavy-vehicle traffic. The types of commodities typically carried will also influence truck loads, with certain types of commodities carried more economically on larger, heavier trucks while others are better suited economically to smaller and faster vehicles. Hence, direct observation of the types of trucks used in Oregon and changes in the mix over time can provide some information on what the tax may have accomplished; but it can not be considered definitive without some base of comparison to determine what would have happened in the absence of the tax.

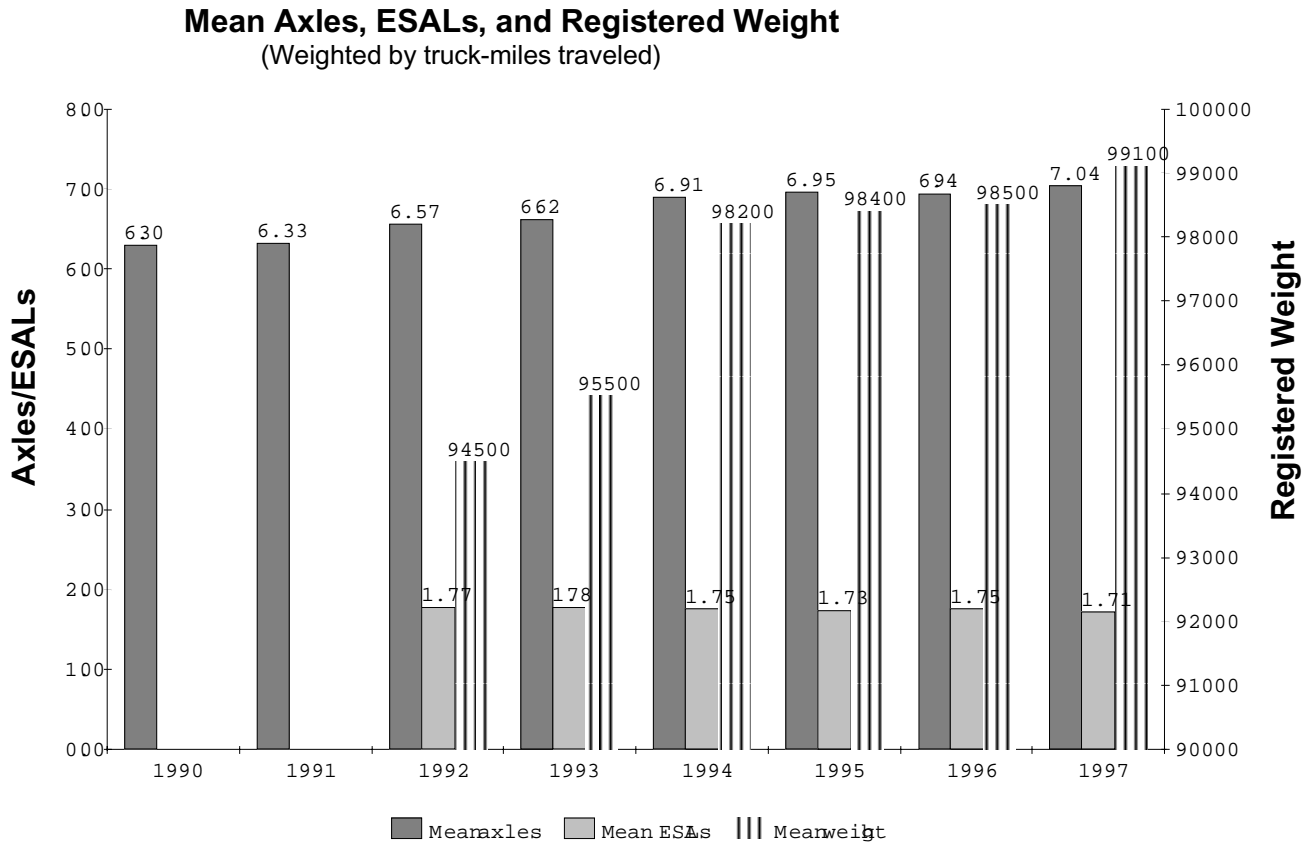
The information to be provided below is primarily descriptive in nature. For a variety of reasons, appropriate data for the comparisons was not yet available. For example, comparison of behavior for trucks operated exclusively in Oregon with behavior for trucks operating largely outside of Oregon was expected to provide important information. However, this comparison could not be made because data on mileage outside of Oregon was not available. This information is reported to the State but it is not entered into the electronic database, and it was not feasible to access the data from the original source. Other states do not collect mileage data by weight class and axle configuration, so direct comparisons were not possible; and differences in maximum weights, allowable configurations, and so on across states will make comparisons based on aggregate totals problematic, even when national data becomes available.

ANALYSIS OF WEIGHT-MILE DATA

Overview

The primary objective of this project was to determine the effect of the weight-mile tax on the behavior of truck owners. In particular, the project focused on whether the weight-mile tax reduction for additional axles in the over 80,000 pound weight class led to an increase in the number of axles per truck in this weight class. The expected damage from a truck is often expressed in equivalent standard axle loads (ESALs), and this procedure was used here. (2) contains detailed information on mileage and ESALs by axle-group within each weight class. This data does indicate a small increase in the number of axles per truck within weight groups over the period 1992-1997. Most weight groups show some shift toward more axles, although the shift is relatively small; and a few weight groups show a shift toward fewer axles. The net effect of these shifts has been a decrease in the number of ESALs per mile. However, the increase in the number of miles in the heaviest weight group leads to an overall effect that shows a much greater net reduction in the number of ESALs per ton. The ESALs per mile are very similar between the weight classes due to the additional axles typically found on the heavier trucks, but the heavier weight classes carry more tons. Figure 1 shows the average number of axles, the average number of ESALs per truck, and the average weight per truck reporting on the axle-weight distance tax. As the graph shows, the reduction in ESALs per truck is accompanied by an increase in the mean weight of trucks. The increase in mean axles per truck is due to the combination of an increase in mileage by the heavier trucks (with more axles) and the increase in the number of axles on average within weight groups.

Figure 1



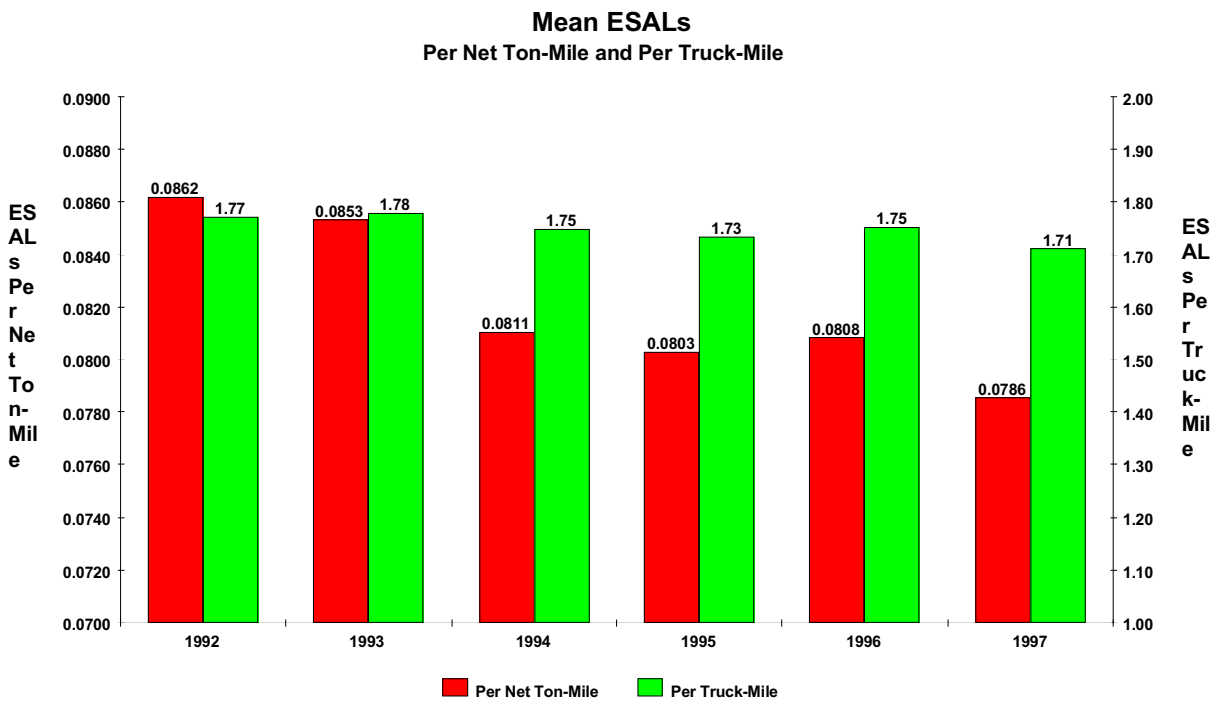
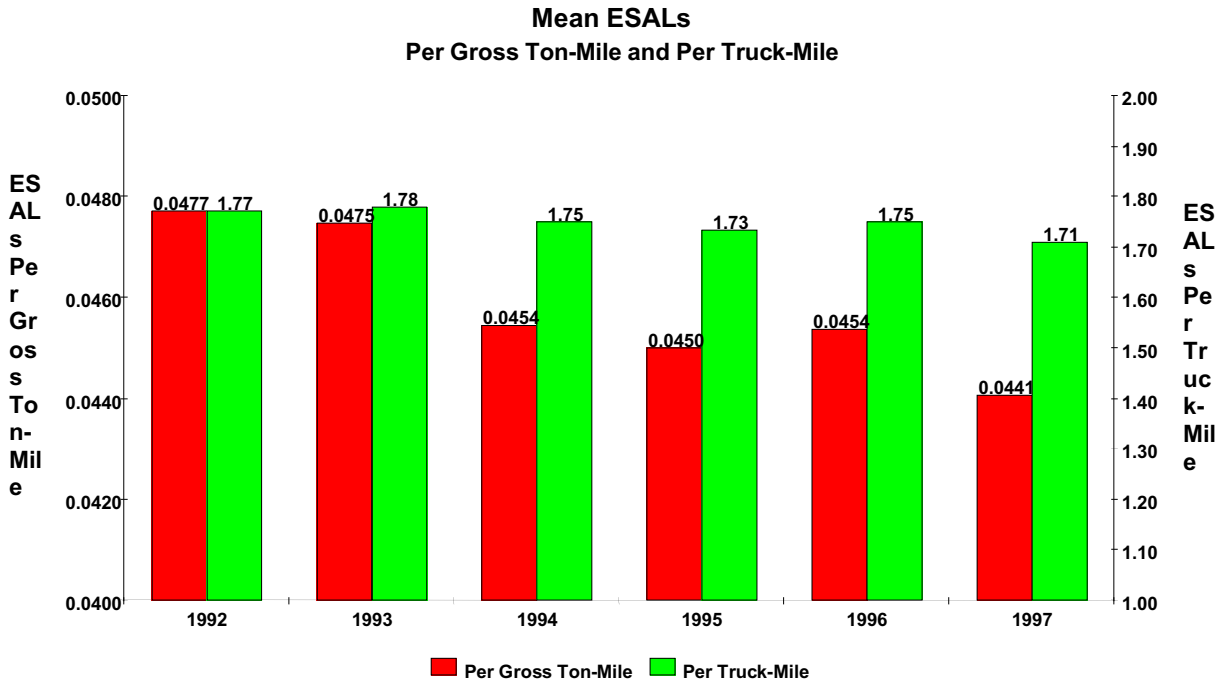
In the 104,000 — 105,500 pound category, there is some slight shift to 8-axle trucks, but no noticeable shift to 9-axle configurations. If the shift were due largely to the tax differential, then the 9-axle configuration should be more popular, since the tax differential between seven and eight axles is the same as the differential between eight and nine axles. In general, where the difference in tax rates is on the order of ten mills per mile, there seems to be little effect on the choice to add an axle. In situations where the tax differential is much larger than this, the impact of the tax differential is confounded by regulatory restrictions.

Interview results (reported fully in a later section) found that one complication is the weight of the extra axle itself. Where a truck is at a legal weight limit, such as 105,500 pounds, adding an axle actually reduces the net load

that can be carried. In many cases, this effect would more than offset the tax savings due to the additional axle. Most truckers report that they add axles to allow going into a higher weight class; but for some weight groups this would not be possible. This may also be a factor for the trucks in the 80,000-pound weight class. While adding a sixth axle would reduce taxes for trucks in this class, they would have to reduce net weight to stay under 80,000 pounds. This could be important for trucks going into California, where 80,000 pounds is the general limit.

Figure 2 shows the reduction in the number of ESALs per gross ton in the first part and per net ton in the second part. The reduction per gross ton is about 7.5% while the reduction per net ton is about 8.8% over the 1992-1997 time period. Hence, the combined effect of more axles per truck and more use of heavier trucks (with more axles) lead to a reasonably large reduction in expected damage per ton shipped. We, of course, can not conclude that these changes are due to the axle-weight distance tax since there are other factors that may have been changing over time. However, it is suggestive that the tax has had some impact, although the growth of the highest weight classes is an important factor and it is not at all clear how this is related to the weight-mile tax.

Figure 2



Methodology

The distribution of mileage by axle and weight groups presented in this report is based on mileage reported as it appears in the Oregon Department of Transportation Highway Use Database. The database had a number of problems and inconsistencies, but none appeared to create any bias in the results. A variety of tests on the database as well as the detailed methodology for the ESAL estimates can be found in (2).

EFFECT OF WEIGHT-MILE TAX ON ROAD DAMAGE: STRUCTURED INTERVIEWS

Due to the limited information provided by the statistical data, further qualitative information was developed through a set of structured interviews. The qualitative data was obtained from twenty-five structured interviews from a cross-section of trucking firms. This section presents the results of the structured interviews.

Qualitative data of the sort described below provides additional insights into the decision-making of firms and is used to help interpret the results of the quantitative analyses. Although the data is presented in a form that indicates the number of interviewees who responded in a certain way, they are only suggestive of the attitudes and behaviors of all of the firms who pay taxes, fees or are registered in Oregon. The procedure for this section of the project was to develop an interview protocol, and to use this as a guide for a series of structured interviews. The structured interview format allows the person being interviewed substantial discretion in raising issues while maintaining a consistent set of questions to provide information on all areas of interest.

Interview Protocol

An interview protocol was developed and designed to gather information that:

- describes the characteristics and activities of the firms;
- defines the relative importance of different factors in determining truck configuration to carry various loads;
- identifies the impact of the weight-mile tax on decisions of the firm; and
- describes attitudes on proposed changes in taxing, registration, or fee policies.

A copy of the protocol is included in (2).

Selection of firms

Thousands of trucking firms pay taxes and fees in Oregon. In selecting the twenty-five firms to interview, the research team, with the assistance of the Oregon Department of Transportation, selected a variety of different types of firms that represent different segments of the trucking industry. No effort was made to select a sample that could be used for statistical analysis. The sample of firms chosen included small, medium and large sized firms, firms that travel only in Oregon, firms that travel interstate, private firms, and for hire firms, firms that only haul loads less than 80,000 lbs., firms that haul both, and firms that haul only over 80,000 lbs. In addition, staff attempted to select firms from different sectors of the industry based on the material hauled.

The final group of interviews represented:

- nine interstate,
- eleven regional,
- five intrastate firms.

Of these, ten firms were private and fifteen were for hire. The commodities hauled are quite diverse and include heavy equipment, general freight, building materials, wood products, over-dimensional loads, sand and gravel, steel, asphalt, aggregate, logs, cement, wood chips, groceries, baked goods, petroleum products, drilling equipment, theatrical sets, and frozen foods.

Based on weight carried, the group of interviewees represented firms that fell into three categories.

- firms that *never or seldom* carried over 80,000 lbs. (five firms)
- firms that *almost always carried loads in excess* of 80,000 (six firms).
- firms that *hauled both below and above* the 80,000 lbs. level (14 firms)

The interview protocol asked similar questions to those who hauled under 80,000 lbs. and to those who hauled over. When a firm did both activities, the interviewee was asked to respond to both parts of the questionnaire. The number of axles used by individual firms ranged from three to thirteen. However, most firms routinely used between five and eight axles.

Interviewees

Staff contacted each firm and asked to speak with the individual in the firm who was most familiar with taxes, regulations and other determinants of truck configuration. In most instances, the initial contact (e.g., secretary) was

able to identify one person who met these criteria. In several instances, staff needed to speak with two people to obtain some of the detailed information, such as number of miles traveled. All but one of the interviews was conducted by phone. The person selected usually was a direct employee of the firm. In one instance, however, the interviewee was a contract employee.

Factors Affecting Configuration of Trucks

Interviewees in each of the broad categories (under 80,000 lbs. and over 80,000 lbs.) were asked to indicate the importance of the following factors in determining the configuration of trucks used for hauling:

- regulations,
- fuel costs,
- fuel taxes,
- safety,
- weight mile taxes,
- registration fees,
- commodity hauled, and
- customer request.

For each factor, the interviewee was asked to indicate whether the variable was very important, important or not important. After eliciting responses to the entire list of variables, the interviewee was then asked to indicate which of the factors was most important and which was least important. The interviewer took care to remind the interviewee that the question related explicitly to the configuration of a truck and the number of axles which were used.

For firms that carry under 80,000 lbs. all or some of the time.

The majority of nineteen firms that hauled under 80,000 lbs. indicated the following factors as very important for determining truck configuration:

- regulations (13 firms),
- safety (12 firms),
- commodity (12 firms)
- customer requests (11 firms).

- Weight-mile tax (two firms)
- Fuel costs (one firm)
- Fuel taxes (three firms)

We asked the interviewees to then indicate which of the above factors was **most important** in determining the configuration of their trucks when they were hauling under 80,000 lbs. The factors listed as most important were

- Regulations (five firms)
- Safety (three firms)
- Safety and regulations (four firms)
- Commodity (four firms)
- Customer (two firms)
- Weight-mile tax (one firm)

The responses of this group suggest that a variety of factors can determine truck configuration; however, taxes, fees and fuel costs are generally not perceived as the most important factors.

When asked to indicate which factor was least important, nearly two-thirds (13) indicated that taxes or fees were least important; five (5) indicated fuel costs; one (1) indicated customer request; one (1) the weight mile tax, and one (1) the commodity hauled. As would be expected with this group of interviewees, the weight-mile tax is of minimal importance in determining truck configuration.

To insure that we were not losing the perspective of the firms that exclusively haul under 80,000 lbs., we reviewed their responses separately. We wanted to be certain that the weight-mile tax was not affecting their decision not to haul in excess of 80,000 lbs. Nothing in their responses suggested this would be the case. Their responses were similar to the group as a whole.

For Firms hauling over 80,000 lbs.

The interviewees who indicated that their firms hauled over 80,000 lbs. were also asked to indicate the importance of the above factors in determining truck configuration. Their responses were very similar to the under 80,000 lbs. group.

The majority of the 22 firms that hauled over 80,000 lbs. indicated the following factors as very important :

- regulations (20 firms);
- safety (14 firms)

- commodity (13 firms)
- customer (13 firms)

When asked to specify which factor was **most important**, the factors indicated were

- regulations (eleven firms)
- safety (3 firms),
- commodity (5 firms)
- customer (3 firms).

Similar to the firms hauling under 80,000 lbs., the interviewees indicated that taxes and fees were the least important factors. Thirteen of the twenty-two firms took this position. Other factors mentioned as being least important included fuel costs (5 firms), the customer (1 firm), and weight mile tax (1).

Responses to additional questions on the importance of the weight mile tax in determining configuration of trucks.

The structured interview contained additional questions that explored the impact of the weight mile tax on decisions related to truck configuration. First, the trucking firms were asked to indicate if they had significantly increased the number of axles used on their trucks since 1990. Additionally, the firms were asked directly if they added axles because of the weight mile tax.

In reply to the first question, sixteen firms out of the twenty-five interviewed stated that they had not added axles since 1990. Of the remaining firms who did add axles there were several explanations, all unrelated to the weight mile tax. One stated that the firm was trying to get productivity gains. Another indicated that they did it because of a change in regulations. A third indicated that the firm began upgrading the stock prior to 1990 to protect their equipment given the need to carry heavier loads. Another suggested that customers demand created a need to carry heavier loads which in turn required upgrading equipment. Finally, none of the firms stated that axles were added explicitly because of the weight mile tax.

Given the importance of these answers, follow-up interviews were conducted with five of the firms to explore the perceived unimportance of the weight mile tax in the decisions of the trucking firms with regard to axle configuration. Staff selected two firms that had indicated that the weight mile tax was important and three that did not consider it important. The responses of all of the firms supported the findings reported above. Only one firm indicated that on occasion consideration of the tax might lead the firm to add an axle on a specific run. However,

the interviewee made a point of indicating that the situations were rare. All of the other firms indicated that the tax had no impact. Two firms noted that the tax could be a disincentive for some firms to add axles. Their reasoning was that there would be a loss in net payload, for example at 105,500 lbs, along with an increase in the cost of equipment and maintenance. The tax break did not compensate for the higher cost and lower payload.

SUMMARY AND CONCLUSIONS

Oregon's weight-mile tax is based on a cost-responsibility approach to road financing. Because trucks require higher standards of road construction and generate substantial road damage, the tax is intended to accurately reflect the costs of the higher road standards and the damage done by trucks traveling on the State's roads. While cost-responsibility is the primary reason for the tax, it is also expected to influence behavior. Higher taxes for trucks that damage the roads more should lead to less usage of such trucks relative to trucks that damage roads less. However, there have been no studies to determine if, in fact, there has been a change in behavior that would lead to reduced road damage. This report presents some evidence that the weight-mile tax does seem to influence behavior in a manner consistent with reduced road damage; however, the data are not complete enough to allow for a definitive conclusion.

Data limitations severely restricted the type of analysis that could be accomplished. The primary data analysis focused on trucks carrying more than 80,000 pounds; and the impact of Oregon's tax incentives on the decision to add axles. The data indicate that there has been a slight increase in the number of axles within each weight class, leading to a reduction in the number of ESALs per truck mile. In addition, there has been substantial growth in the mileage reported in the highest weight class, up to 105,500 pounds. Trucks in this weight class typically use seven or eight axles, so that they generate only slightly more ESALs per mile than many lighter trucks with fewer axles. Hence, the ESALs per ton shipped tend to decline with more mileage in this weight class. This contributes substantially to the observed decline in ESALs per ton shipped for trucks subject to the axle-weight tax, but it is not possible to determine exactly why this is occurring.

The data analysis was supplemented by a series of structured interviews. The interviews indicate that taxes are a relatively unimportant determinant of the type of equipment used. In particular, regulatory and safety considerations are considered much more important than taxes in determining the number of axles used. This is particularly

important when a truck is at the legal weight limit and the addition of an axle would reduce the net load that could be carried.

The analysis suggests that the weight-mile tax may have an influence on shipping that leads to a reduction in the amount of road damage. However, the data are not sufficient for a definitive conclusion; and the interviews suggest that the impact of economic incentives is circumscribed by the importance of regulatory limits. For example, trucks used in interstate commerce are limited to 80,000 lbs. in most states. Hence, they are typically not able to take advantage of Oregon's higher weight limits and axle-incentives. Even trucks operating solely in Oregon run into the limit of 105,500 lbs., and this weight limit offsets the tax incentive to add axles. One possible interpretation of the results are that tax incentives offered by one state are unlikely to affect the behavior of interstate shippers; but it also raises questions about the impact of such taxes at the federal level. While weight-distance taxes at the federal level would allow for more accurate recovery of cost, regulations, such as the 80,000 lb. maximum weight, may limit the impact on behavior at this level as well.

Future Research

The single most important source for follow-up analysis is likely to be the 1997 Truck Inventory and Use (3) data when it is released. This will allow a comparison of trends between Oregon, other states, and the nation, in the number of axles used, ESALs per net ton shipped, and related analysis. In particular, it should allow for a better analysis of how regulatory differences among the states affect truck type and configuration as compared to tax differences.

The findings also raise questions about the economic efficiency of the current weight regulations on trucks. The binding effect of some of the regulatory weight limits suggests that if trucks were paying the full marginal cost of road usage, they would still choose to carry heavier loads than are currently allowed.

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