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The objective of this paper was to address the problem of accelerated highway and bridge deterioration from overloaded trucks by developing a profile of trucks which exceed overweight permit authorization. The profile of trucks in violation of overweight permits include location, seasonal variation, commodity group, origin/destination, scale type and permit type. The profile was developed from a statewide telephone survey of permit violations between November 1, 1991 and October 31, 1992 and provide policy makers, transportation planners and law enforcement officials greater understanding of the nature of load-related damage created by overload permit violations.

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A CASE STUDY OF MOTOR VEHICLES VIOLATING SPECIAL WEIGHT PERMITS IN THE STATE OF WASHINGTON

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SUMMARY

This project addresses the problem of accelerated highway and bridge deterioration due to overloaded trucks violating excess weight permits. The study focuses on permitted trucks by determining the degree and frequency in which permits are violated and then develops a profile of trucks currently responsible for weight permit violations in Washington. The truck profile includes location, seasonal variation, commodity group, origin/destination, scale type and permit type. These profiles were developed from a statewide telephone survey of permit violations between November 1, 1991 and October 31, 1992. The survey indicated that 479 permittees were responsible for 721 recorded permit violations at 104 identified locations across the state during this period. The profiles developed in this study provide policy makers, transportation planners and law enforcement officials greater understanding of the nature of load-related damage created by overload permit violations. Given the economic incentive for truckers to exceed legal overload weight limits, an apparent need exists for a reevaluation of Washington's current permit/fee system. Previous studies reveal that current revenues from permit fees and overloading fines fail to completely compensate for damage to highways and bridges because of overloaded trucks. Thus, a more effective cost-allocation system of permits and fines is needed.

One proposed change to the permit and fine system is to base all permits and fines on the weight-mileage concept thereby insuring that all trucks violating overload permits assume responsibility for their respective damage to highways and bridges. Currently, only single trip Additional Tonnage and Special Motor Vehicle Permits have fees based on the weight-mileage concept.

INTRODUCTION

The highway/road system of Washington plays a significant part in the state's economy. However, Washington's transportation system is currently experiencing deterioration in its infrastructure. One of the causes of accelerated deterioration is increased traffic. Another serious contributor is the overloaded truck, whether operating legally (with a permit) or illegally, with or without a permit.

Trucking firms, like any business, are pressured to operate efficiently and maximize profits. This requires maximizing payloads and minimizing per unit costs. This practice may ultimately provide the incentive for overloading, both legally and illegally. Economic incentives to overload arise from cost savings realized from eliminating truck mileage to haul a particular volume, or from the value of the extra load (number of overlegal units hauled times the rate received per unit). The combined effect of a low probability of being captured and low fines provides further incentives to illegally overload.

Although there is little information currently available regarding the benefits accrued to trucking companies from overloading, a recent study by Casavant (1991a) concluded a truck traveling 2,500 miles with a 10 Kip (one Kip equals 1,000 pounds) overload would realize a $605 cost savings over a truck hauling a legal load. The first-offense fine imposed in Washington for 10 Kip overweight is $404 or a net fine (assuming a 10 percent capture rate)

of $40.40. The fee for a permit would be $350. Hence, the economic incentive to illegally overload is considerable.[2]

The willingness to overload is a function of decreased per unit costs and the fee paid to legally overload or the estimated risk of the fine assessed for illegally overloading. The degree of risk is a function of the probability of being apprehended by weight enforcement officers. The capture rate in Washington has been estimated to be 10 percent (Casavant). An inverse relationship exists between capture rate and the economic incentive to overload. As the capture rate increases, the economic incentive to overload decreases. Therefore, if enforcement efforts in Washington are aided with a profile of permit violators, the capture rate could increase. Initially, an increase in revenues to compensate for road damage may be realized, followed by a decreased incentive to haul illegal tonnage.

There are federal and state regulations on truck weights to reduce the economic incentive to overload and to protect pavements and bridges from the effects of heavy loads. Since the 1950s, the American Association of State Highway and Transportation Officials (AASHTO) has conducted tests to determine equivalent single-axle load values (ESALs) for single, tandem, and tridem axles on various pavement types (Figure 1). Loads were evaluated using the common measures of Kips and ESALs, equivalent single axle loads rated at 18,000 pounds. It was concluded that "load-equivalence factors vary sharply with weight, following roughly a fourth-power relationship" (TRB, 1990, p. 72). Hence, 100 passes across flexible and rigid pavements by a 20,000 pound axle would exhibit an equal effect on pavement life as would 150 crossings

[2]For further information regarding economic incentives versus fees and fines, see Casavant's 1991 Washington Fee and Fine System study.

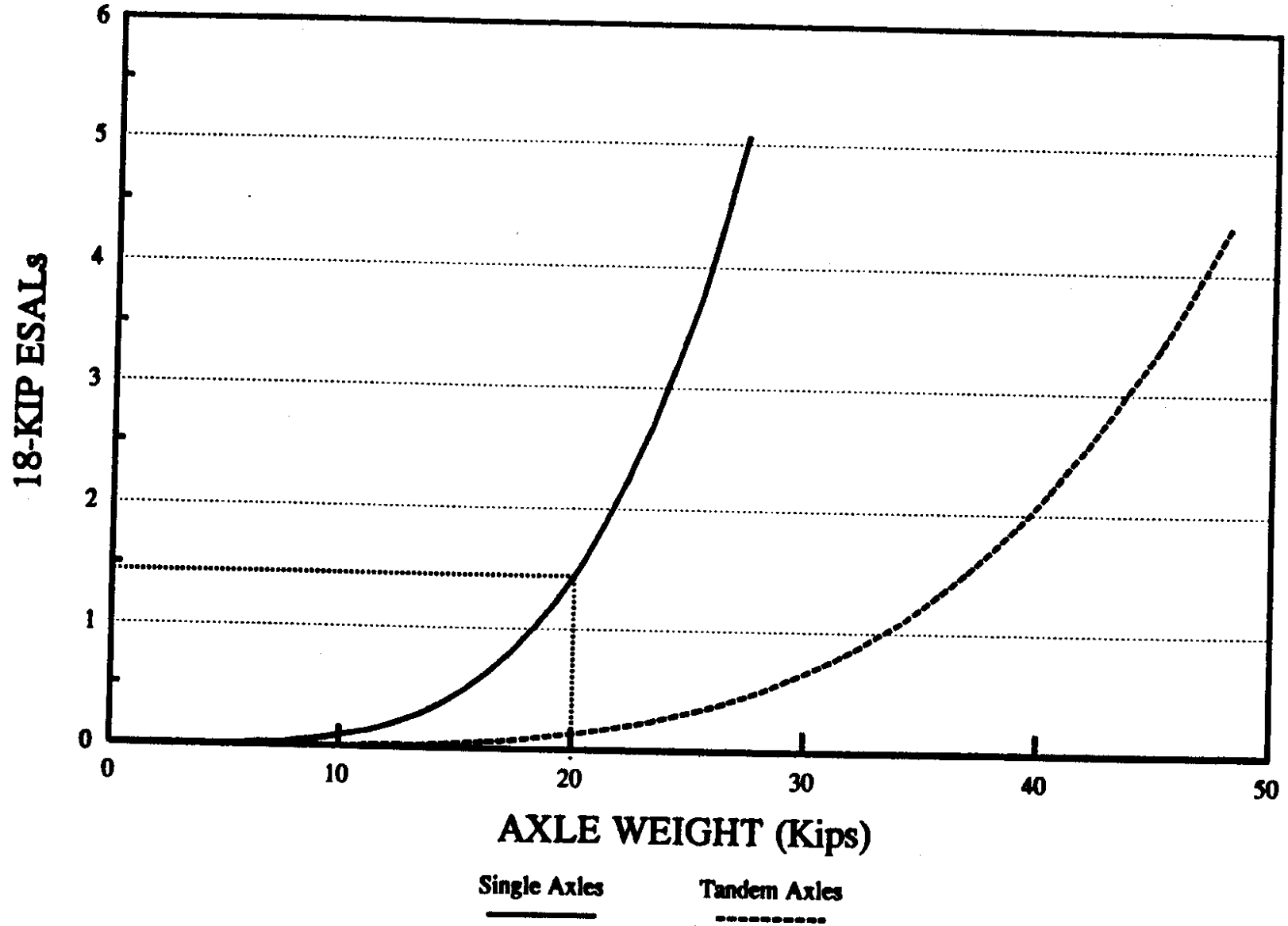

Figure 1. Axle Load Effects on Flexible Pavements (AASHTO, 1986).

of an 18,000 pound axle ($(20/18)^4 = 1.5$). AASHTO has performed separate tests for rigid and flexible pavements. The primary difference between ESAL values on the two pavement types is that tandem axles caused greater damage on rigid pavements.[3]

Objectives

There is considerable concern about the extent of damage caused by overloaded trucks to the nation's roads and bridges. Rough estimates suggest that overloaded trucks cause more than $1 billion dollars of damage to all federal-aid highways annually (TRB, 1987). There is also concern that truckers who overload are not paying for their share of potential and actual pavement damages.

> Because the actual damages related to overloading usually are not known immediately after use, the costs of an overload permit may not cover the full expenses of damages. Thus there is need for a proper cost-allocation method in the permit administration. Moreover, because load-related damage is accelerated by excessive overload permit issuance, there needs to be strategic policies in permit administration to account for the damages (TRB, 1987).

The truckers who are the focus of this study may be causing vast damage to pavements. They purchased permits allowing them to haul tonnage in excess of the weight limits permitted by Washington laws, then violated those rights by exceeding the granted limits on gross, axle, bridge, or tire weights. Hence, these truckers are not only exceeding the maximum weight limits stipulated in the Revised Codes of Washington (RCWs) but are also violating special permits which grant them extra rights to haul extra tonnage.

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[3]Information concerning damage estimates to Washington's roads from overweight vehicles can be found in Casavant and Lenzi's "An Economic Evaluation of the Fee and Fine Structure for Overloaded Trucks in Washington," *Transportation Quarterly*, April 1993.

Although the trucker rational behind violating special permits is somewhat difficult to ascertain, the following reasons may be valid: 1) Trucks are inadvertently overloaded; 2) Actual weight may exceed that allowed under a special permit so the maximum additional weight allowed is purchased to save on fines (fees per pound are generally less than fines); 3) An annual permit may be held but only violated a few times during the year; 4) Permits are inadvertently used for the wrong vehicle; 5) Permits/licenses are not purchased according to regulations, usually due to lack of knowledge of regulations. For example, an AT is purchased for 105,000 pounds on an 8-axle vehicle with a wheelbase of 62 feet but the maximum allowable in this case is 100,000 pounds so the permittee is operating at 5 Kips overweight; or 6) Time constraints (eg. SMVP applications are required to be submitted to WSDOT at least 36 hours in advance of the proposed movement).

This study was undertaken to determine the degree and frequency in which permits are violated and develop a profile of those who violate truck weight permits in Washington. These motor vehicles are the very heavy trucks which are causing extensive damage to roads, according to the damage function mentioned earlier. If particular inferences can be made as to the locations where trucks tend to be overloaded, the main routes of heavy trucks, times when trucks are more likely to be overloaded, and the commodities which are apt to be carried on overloaded trucks, enforcement efforts may be aided. Truckers may also become more conscious of enforcement practices, and truck weights and weight regulations.

Road Enforcement Regulations

In 1913, in response to the need for highway/road and bridge protection, Washington and three other states (Maine, Massachusetts, and Pennsylvania) became the first states to enact laws on truck weights (TRB, 1990). Twenty years later all states had limits on truck weights but it was not until 1956 that the federal government became involved in regulating vehicle weights on interstate highways.

Washington's system was primarily designed to either eliminate the economic incentive to overload or recover the road damage associated with the extra weight. It is comprised of a set of fees (permits) and fines (penalties) and is implemented via a two-step process: 1) Road enforcement of weight regulations by designated agencies and 2) Court enforcement. . .

In Washington, enforcement of weight laws is a function of the Washington State Patrol (WSP). Additional enforcement is carried out through sheriff's offices and commercial vehicle enforcement officers (CVEOs) in other agencies such as city Public Works departments. As of January 1, 1993, there were 144 CVEOs authorized by the state legislature. Some WSP CVEOs are assigned to Ports of Entry (POEs) where, in general, trucks are weighed 24 hours a day. Officers not assigned to POEs weigh trucks at other scalehouses on an as-needed basis determined by peak traffic volume, time, seasonal traffic, etc. Officers are also assigned patrol vehicles equipped with portable and semi-portable (wheel load weighers/axle scales) scales.[4]

There are four categories in which truck weights are measured: Gross, Axle, Internal Axle Spacing (often referred to as Bridge Formula B), and Tire. Gross weight is the total

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[4]For simplicity, in the remainder of this report "portable scales" includes both portable and semi-portable scales.

weight of the vehicle (tractor and trailer) including the commodity hauled. Gross weight limits vary according to the number of axles a truck has and the distance between the extremes of any group of axles. The current maximum licensed capacity on gross weight permitted in Washington (also the federal limit) is 40,000 pounds for a single-unit vehicle with 3 or more axles and 80,000 pounds for a combination of vehicles. Maximum allowable gross weights are presented in RCW 46.44.041.

Truck configurations are usually composed of single axles and tandem axles (two consecutive axles spaced between 40 and 96 inches apart and articulated from a common attachment). The weight carried on axles is extremely important because it is heavy axle loads rather than heavy vehicles that cause pavement damage. Two trucks with equal gross weights but different lengths and/or axle numbers will cause varying degrees of damage to roads. According to the fourth-power relationship, longer, heavier trucks will not necessarily cause more damage to roads than shorter, less heavy vehicles. The amount of damage incurred is a function of weights carried on axles. There are limits on the amount of weight each axle or set of axles may carry legally on roads in Washington. These limits are the same as federal limits (Washington has the same limits for interstate and non-interstate roadways); single axles are limited to 20,000 pounds and tandem axles may carry up to 34,000 pounds (without special permits).

There are also restrictions on the amount of weight that may be carried on any group of two or more consecutive axles based on the number of axles and the distance between the two extreme axles. The Bridge formula was primarily intended to limit truck weights to amounts that can be safely carried across existing bridges (TRB, 1990). In 1973, Washington adopted

Nature and Extent of Permits and Fees

Since 1939, Washington has allowed the purchase of special permits which authorize the operation of a vehicle with a weight exceeding the maximum granted by law. ATs for additional gross weight may be purchased if a single vehicle has been licensed to 40,000 pounds gross weight or if a combination of vehicles has been lawfully licensed to a gross weight of 80,000 pounds, provided the applicant complies with the provisions of RCW 46.44.041 and all laws pertaining to tire and axle limits. Limits to the amount of additional tonnage allowed are determined by the WSDOT and depend on the capability of highways to withstand certain weight loads without incurring any undue injury. Gross weights on ATs are limited to a maximum of 105,500 pounds (axle, bridge and tire limits must not be exceeded); non-reducible loads with SMVPs may be as high as 300,000 or 400,000 pounds provided the stipulations in RCW 46.44.091 are adhered to.

Fees for additional tonnage must be paid in addition to the regular license and tonnage fees. The Transportation Research Board (TRB) recommended in its "Effects of Permit and Illegal Overloads on Pavements" (1987) that an effective fee system could be based on the weight-mile concept already used in some states. Washington's fee structure has been based on the weight-mile concept for many years. Before 1959, fees were based on seven weight groups and three mileage categories. Since 1959, fees have been based on weight and the actual number of miles traveled. In 1967, the number of weight categories increased from 7 to 14. Between 1967 and 1990, the only modification to the laws was an increase from 77,999 pounds to 79,999 pounds in one of the weight classifications. In 1990, a 40 percent increase in permit fees was given legislative approval (Casavant, 1991a). Current fees are displayed in Table 1.

Table 1. Special Permit Fees for Overweight Movements on Washington's Roads and Highways

Weight Exceeding That Allowed by Statute	Fee per Mile on State Highways
1 - 5,999 pounds	$0.07
6,000 - 11,999 pounds	$0.14
12,000 - 17,999 pounds	$0.21
18,000 - 23,999 pounds	$0.35
24,000 - 29,999 pounds	$0.40
30,000 - 35,999 pounds	$0.63
36,000 - 41,999 pounds	$0.84
42,000 - 47,999 pounds	$1.05
48,000 - 53,999 pounds	$1.26
54,000 - 59,999 pounds	$1.47
60,000 - 65,999 pounds	$1.68
66,000 - 71,999 pounds	$2.03
72,000 - 79,999 pounds	$2.38
80,000 pounds or more	$2.80

SOURCE: "R.C.W. 46.44.0941." West's Revised Code of Washington, Annotated, 1992 Cumulative Annual Pocket Part. St. Paul, MN: West Publishing Company, 1991.

NOTE: There is a $14.00 minimum fee for overweight loads.

Annual ATs may also be purchased for travel on Washington's highways and roads. The fee for annual additional tonnage is $52.50 for each 1,000 pounds (or fraction thereof) of excess tonnage, regardless of miles traveled. ATs can be purchased at any time during the year and if purchased for less than one year, fees are one-twelfth the annual amount multiplied by the number of months for which the permit is purchased.

Logging trucks in Washington may buy special permits to haul overlegal loads providing certain criteria are met. A three axle truck tractor and a two axle pole trailer combination hauling logs is permitted to carry additional tonnage through the purchase of an LT. This permit will allow an excess of 6,800 pounds weight on a vehicle legally licensed for 68,000 pounds. Special conditions on LTs stipulate that the distance between the first and last axles must be at least 37 feet and the weight carried on two axles spaced less than 7 feet apart shall not exceed 33,600 pounds.

LTs are issued for a 12 month period commencing and terminating on April 1 of each year. LTs may be purchased at any time but must expire on April 1. Fees are calculated on a quarterly basis; $50.00 for an annual permit, $37.50 for permits purchased on or after July 1, $25.00 for permits issued on or after October 1, and $12.50 for those issued on or after January 1. Like annual AT fees, LT fees ignore trip mileage.

Other special permits, referred to as Special Motor Vehicle Permits (SMVPs), may be purchased for oversize or overweight movements on Washington's highways and roads. They pertain to overlegal loads having overlength, overwidth, overheight, or overweight features and to farm implements. SMVPs allow for excess weight on axles, up to 22,000 pounds (total) on single axles and 43,000 pounds on dual axles with a wheelbase between three feet, six inches

and seven feet. Groups of axles may also carry excess weight. Actual limits are based on wheelbase and specific formulas for these limits are displayed in RCW 46.44.091. Fees for SMVPs are either fixed or variable, depending on the permit type. Fixed fees range from $10.00 to $150.00 and are either for single trips or continuous operations for periods of 30 days to one year. Variable fees are charged on SMVPs which grant additional tonnage (except permits for 3-axle fixed load vehicles up to 65,000 pounds) and are the same as those for single-trip ATs (See Table 1). Specific information can be found in RCWs 46.44.091 through 46.44.0941.

Permit fees are paid to the political jurisdiction (eg. city, county, etc.) issuing the permit if the entire movement is confined to routes for which that jurisdiction is responsible. For movements involving a combination of state, county, or city roads, see RCW 46.44.096 to determine to whom the fee is paid. Permit fees paid to the WSDOT are forwarded to the state treasury and deposited in the motor vehicle fund.

Study Approach

Officers issuing citations for permit violations are required to send a permit violation notice to WSDOT Motor Carrier Services. All notices received by Motor Carrier Services regarding permit violations on weight that occurred between November 1, 1991 and October 31, 1992 were utilized in this analysis. Only those who possessed weight permits and violated them were included in the analyses. Those who had expired permits (3) or were cited for not possessing an extra tonnage permit (11) were deleted from this study. Only those who possessed weight permits and violated them were included in the analyses. Data collected from the

citations included date when violation occurred, location where violation occurred, arresting officer, permittee name and address, permit type, commodity hauled, origin/destination, and overload magnitude.

The WSDOT forms used by CVEOs to report permit violations have been updated several times over the past decade. Notices issued after 1983 include a space for permittee's address and those issued after 1990 request that commodity hauled and origin/destination be revealed (based on forms designed by the co-authors). Although forms were updated in 1990, old forms (some from as early as 1972) were still being used by some officers in 1992. Occasionally there were updated forms where origin/destination or commodity were left unreported. Thus, in some cases, data were unavailable causing differences in sample sizes among variables.

There were 721 permit violations recorded during the sample period. Hence, 721 is considered the total population of those who violated weight permits. Data were analyzed according to number of violations and average excess weight per infraction category (gross, axle, bridge, and tire).

Due in part to diversity throughout Washington in traffic density, numbers and routes of roads, etc., weight enforcement practices across the state vary. To determine where enforcement is practiced, where and when most permit violations occur, and what type of commodities are being hauled in large weight magnitudes, permit violations were analyzed according to issuing officer, month occurred, location occurred, and commodities hauled. Further analysis on commodities was performed to determine if movement of specific goods are responsible for violations in certain locations and during certain times of the year. Permit

violations were analyzed by permit type to see if specific types are being violated more than others and more in specific locations as well as to see if certain commodities/items, such as logs, are repeatedly hauled in over legal limit loads. To detect repeat violators, evaluations of citations by permittee were performed.

STUDY RESULTS

Officer Location and Activity

To remain eligible for federal highway construction funds, Washington must submit to the Federal Highway Administration (FHWA) an annual report verifying that federal and state size and weight laws are being enforced on all federal aid highways. An analysis of incidence and location of citations issued by officers was performed to learn about enforcement efforts and the use of permanent and portable scales.

There were 82 officers who issued citations for permit violations during the study period. Citations per officer ranged from 1 to 67. WSP District 5 had the most (8) officers issuing more than 10 citations while WSP District 2 had 5 officers issuing over 10 citations each (See Appendix A for a map of WSP Districts). WSP District 2 was also the area where 67 citations were issued by one officer and 43 by another. WSP District 5 had one officer who issued 50 tickets for permit violations over the year.

WSP District 5 had a large number of officers issuing more than 10 tickets during the study period. It includes the POE at Vancouver and six other permanent scale sites and there is a large volume of traffic traveling on I-5 between Oregon and Washington. In WSP District 2 the officer issuing the most tickets was based at a station at North Bend. Although there are

only three scalehouses in WSP District 2, they are located on I-5 and I-90 which are busy thoroughfares. Many of the officers' citations were also issued on county and city roads throughout King County. Additional cases of multiple citations issued through the use of portable scales occurred in Whatcom County and on I-5 and SR14. Hence, officers patrolling the roads with portable scales were found to apprehend as many or more vehicles for permit violations as officers assigned to POEs.

Location of Road Enforcement Activities

There are 8 WSP Districts and 56 scalehouses (55 are operational), including 5 POEs, located throughout Washington (Appendix A). Scalehouses are permanent scale sites. POEs are located near state borders and normally operate 24 hours a day, 7 days a week. Commercial vehicle enforcement is not only administered at these permanent scale sites but also across the state through the use of portable scales. There were 104 identified locations and 8 unreported locations at which violations occurred. Thirty-eight of the known locations were scalehouses; the remaining 66 locations were randomly situated throughout the state. For analytical purposes, the remaining locations were categorized as State Highways, Interstate Highways, and All Others (county and city roads).

Most of the infractions were dispensed at permanent scale sites in western Washington (Table 2). Of the 713 permit violations that occurred at reported locations, 575 (81 percent) were issued at scalehouses. Scale 77 at Kelso was the location at which the largest number (76) of permit violations occurred. Officers at Scale 72 (Vancouver POE) issued 74 permit violations while Scale 33 (Bow Hill POE) had 55 infractions and Scale 25 at North Bend had 47. The

Table 2. Number of Violations and Average Excess Weights Occurring at Specific Locations

Location	Total Number of Violations[1]	GROSS		AXLE		BRIDGE		TIRE	
		Average Excess Weight	Number of Violations	Average Excess Weight	Number of Violations	Average Excess Weight	Number of Violations	Average Excess Weight	Number of Violations
Scalehouses	575	3,956	335	3,372	206	5,248	30	1,675	4
State Highways	116	5,265	65	5,184	49	9,922	2	3,000	2
Interstate Highways	13	6,960	5	4,967	6	1,900	2	-	0
All Others[2]	49	9,020	28	4,226	18	14,933	3	-	0

[1]Total number of violations exceeds 713 because some trucks were violating more than one weight category.

[2]County roads, city roads, etc.

locality with the most violations (17) issued through the use of portable scales was SR169 in King County.

A majority (84 percent) of the locations had less than 10 permit violations. There were 43 permanent and portable scale sites (41 percent) at which only one permit violation was issued. This does not suggest that weight enforcement is being neglected in those areas but reflects use of scales in varying traffic flows.

It is apparent that a majority of the violations are detected at permanent scale sites, especially at POEs. However, the relatively high numbers of permit violation citations issued by CVEOs at SR169 and SR522 in King County, in Whatcom County, and along I-5 and SR14 again suggest that officers are successfully utilizing portable scales to apprehend overweight trucks in problem areas not covered by permanent scales.

To determine whether the heavier illegal loads may be bypassing scalehouses in hopes of avoiding citations, an evaluation of excess weights by location was performed. Average excess weights varied between locations, with "All Others" having the heaviest average excess gross weight and the heaviest average excess weight on bridge (Table 2). The location with the heaviest excess weights on axles and on tire size was State Highways. There were no permit violations for tire size on Interstate Highways or on "All Other" roadways.

Although the greatest number of permit violations occurred at scalehouses, the excess weights were generally lighter at the permanent scales than at other locations. Average excess weights at scalehouses were the lightest in the gross weight category and the second lightest in the other three categories. This indicates that heavier trucks are bypassing scalehouses

somewhat and hence, supports WSP's strategy of deploying officers with portable scales to areas around those scalehouses that are easily bypassed.

Of the 55 operational scalehouses in Washington, 32 are on the western side of the state and 23 are located in eastern Washington. Most (78 percent) of the noted permit violations occurred in western Washington. There were 426 citations (74 percent) issued at scalehouses in western Washington and 149 (26 percent) at scalehouses located on the eastern side of the state (Table 3). Western Washington was also where the majority (90 percent) of permit violations detected by officers using portable scales occurred.

It is difficult to make any conclusive comparisons on why more violations occurred in western versus eastern Washington without additional information (enforcement practices, traffic volume, etc.). It can be said, however, that the ratio of violation notices issued per number of scalehouses was higher in western Washington than in eastern Washington. In western Washington, there were 13 violations issued per scalehouse while the number issued per scalehouse in eastern Washington was 6. Based on only the number of scalehouses where permit violation citations actually were issued during the year (18 in western Washington and 20 in eastern Washington), there were 23 citations per scalehouse on the western side of the state and 7 on the eastern side. In western Washington, there were 14 scalehouses that did not dispense any citations for permit violations while there were only 3 in eastern Washington. This does not necessarily mean that officers at those scalehouses are not fulfilling their responsibilities. There may not be many overweight trucks in those areas or trucks that are overweight may not possess special permits, and hence are not considered in this analysis.

Table 3. Number of Violations and Average Excess Weights in Each Weight Category for Western and Eastern Washington

Weight Category	WESTERN WASHINGTON		EASTERN WASHINGTON	
	Number of Violations	Average Excess Weight (Pounds)	Number of Violations	Average Excess Weight (Pounds)
Gross	296	4,597	115	4,515
Axle	220	3,877	44	3,411
Bridge	33	6,254	0	-
Tire	4	1,600	1	3,300

Seasonal Variation

Permit violations were sorted into the months in which they were issued to determine if there were any seasonal variation in permit violation occurrences. The average number of permit violations per month for the one year period was 60. However, permit violation numbers varied by month. April had the most infractions (79) while October had the least (31) (Table 4).

There were more total violations during the winter months than the summer months (Figure 2). The average number of infractions during the winter season (November through February) was 67 per month whereas the summer season (May through August) had an average of 53 per month. The cooler weather in the winter (possibly causing slower trip times and physical detriment) may mean that truckers do not take as much time to check their weights as they do in the summer. Enforcement practices generally do not vary with the seasons, especially in Western Washington where the weather is relatively mild year-round.

Monthly violations tended to be contrasting between excess gross weight and excess axle weight. Those months with the higher average excess gross weights were inclined to have the lower average excess axle weights and vice-versa (Table 5). For example, August and October were two of the three months with the highest average excess gross weights but they were also two of the months with the lowest average excess axle weights. June and November had the second and third heaviest average excess weights on axles but they were the months with the two lightest gross weight violations. Although there is a definite trend present, rationalizations are somewhat inconclusive. Perhaps the weights reflect differing truck configurations or commodities hauled. Special Motor Vehicle Permits (SMVPs), for instance, were violated

Table 4. Number of Violations and Average Excess Weights (in pounds) by Month

MONTH	VIOLATIONS	GROSS	AXLE	BRIDGE	TIRE
January	68	4,085	2,681	4,933	-
February	63	7,614	3,593	6,667	-
March	72	4,604	3,488	-	950
April	79	4,063	3,927	4,000	-
May	47	3,677	3,800	-	2,250
June	46	3,473	5,307	2,900	3,300
July	61	3,521	3,939	9,260	-
August	58	6,450	3,247	7,650	1,000
September	59	4,690	5,479	9,214	-
October	31	5,407	2,894	-	-
November	70	2,972	3,980	4,133	-
December	67	4,646	3,448	3,700	-

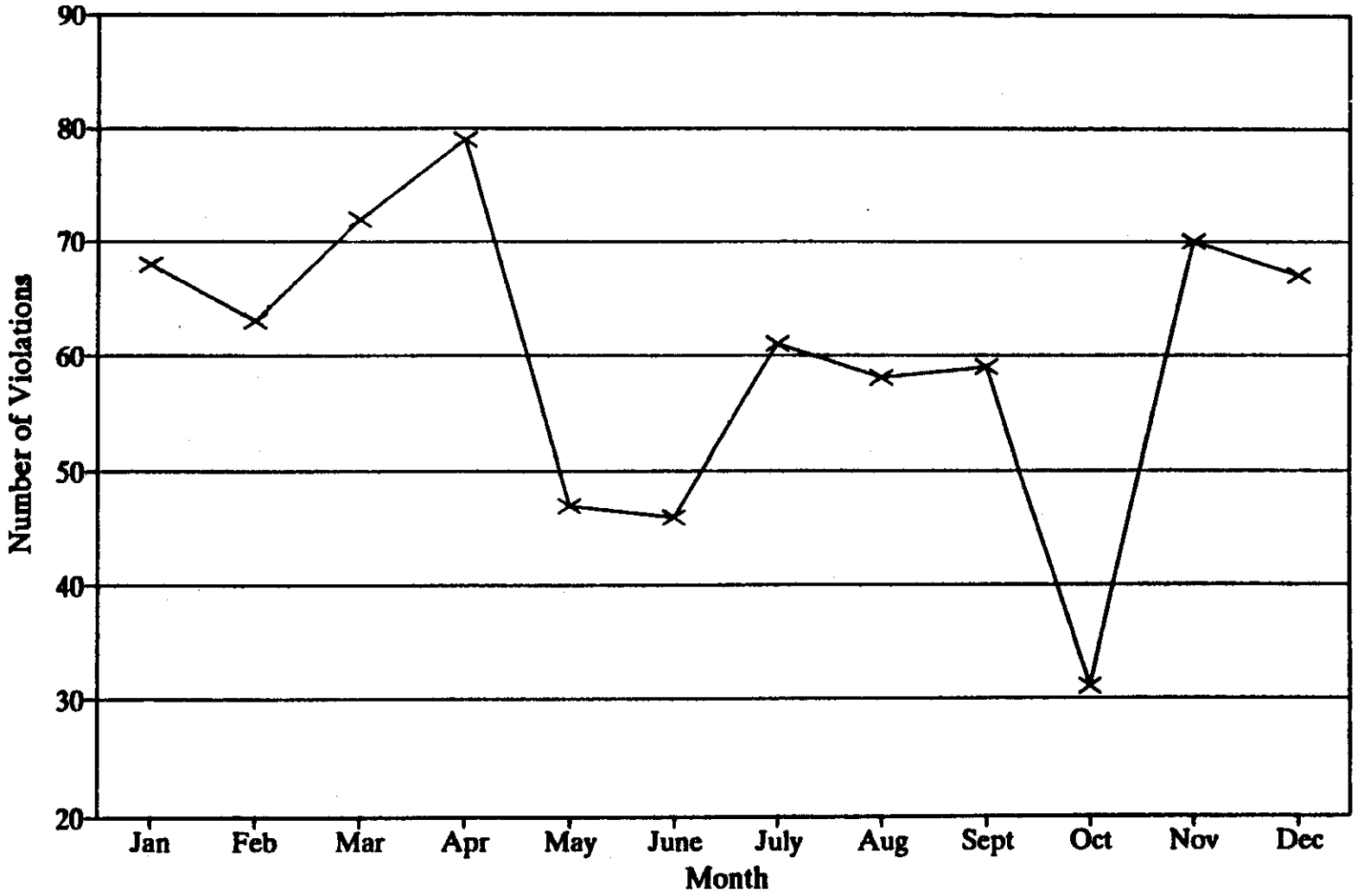

Figure 2. Number of Total Permit Violations Issued Per Month

Table 5. Rank of Average Excess Axle Weights and Average Excess Gross Weights (in pounds) by Month

MONTH	AVERAGE EXCESS GROSS WEIGHT	AVERAGE EXCESS AXLE WEIGHT
February	1	7
August	2	10
October	3	11
September	4	1
December	5	9
March	6	8
January	7	12
April	8	5
May	9	6
July	10	4
June	11	2
November	12	3

mostly during November which had one of the heaviest excess axle weights and the lightest excess gross weight. Recall that SMVPs are for non-divisible loads therefore axle weights are more likely to exceed limits as the loads cannot be offloaded or shifted easily.

Commodity Groups

Commodities were sorted into 15 major groups using categories developed by the Bureau of the Census for use in the Commodity Transportation Survey Portion of the 1977 Census of Transportation. The category with the most permit violations (93) was "Machinery, Except Electrical" (Table 6). The classifications with the next highest infraction numbers were "Lumber or Wood Products" with 57 and "Nonmetallic Minerals, Except Fuels" with 39. Four sections, "Chemicals or Allied Products," "Electrical Machinery," "Forest Products," and "Transportation Equipment" were accountable for only one violation apiece.

Weight

There is a high probability that certain commodities will be responsible for weight violations in specific categories (for example, machinery for axle violations because loads usually cannot be shifted). To determine the degree to which specific commodities are overloaded, it was useful to examine the excess weights on commodities in each weight category.

Average excess gross weights for commodity categories ranged from 15,800 pounds (Forest Products) to 800 pounds (Pulp, Paper, and Allied Products) (Table 7). "Machinery, Except Electrical" and "Waste and Scrap Materials" had the second and third highest average excess gross weights with 13,534 and 10,500 pounds, respectively. The commodities with the

Table 6. Number of Permit Violations Per Commodity Category

COMMODITY	NUMBER OF VIOLATIONS
Machinery, Except Electrical	93
Lumber or Wood Products	57
Nonmetallic Minerals, Except Fuels	39
Stone, Clay, Glass, or Concrete Products	20
Farm Products	18
Food and Kindred Products	15
Petroleum or Coal Products	11
Waste and Scrap Materials	8
Miscellaneous Mixed Shipments	3
Primary Metal Products	3
Pulp, Paper and Allied Products	2
Chemicals or Allied Products	1
Electrical Machinery	1
Forest Products	1
Transportation Equipment	1

Table 7. Number of Violations and Average Excess Gross Weights (in pounds) Per Commodity Category

COMMODITY	NO. VIOLS	EXCESS GROSS
Forest Products	46	15,800
Machinery, Except Electrical	34	13,534
Waste and Scrap Materials	1	10,500
Electrical Machinery	1	9,901
Nonmetallic Minerals, Except Fuels	28	4,432
Stone, Clay, Glass, or Concrete Products	11	4,432
Lumber or Wood Products	46	3,378
Petroleum or Coal Products	7	2,900
Farm Products	16	2,700
Transportation Equipment	1	2,500
Food and Kindred Products	14	2,236
Primary Metal Products	2	1,700
Miscellaneous Mixed Shipments	1	1,600
Pulp, Paper and Allied Products	1	800

lowest excess gross weights were "Pulp, Paper, and Allied Products" which was an average 800 pounds overweight, "Miscellaneous Mixed Shipments" with an excess gross weight average of 1,600 pounds and "Primary Metal Products" with an average of 1,700 excess pounds. There were no permit violations on gross weights recorded in the "Chemicals or Allied Products" group.

"Electrical Machinery" was the category with the highest average excess axle weight at 9,200 pounds (Table 8). This was probably due to the fact that it was a transformer, which is a non-reducible load. "Waste and Scrap materials" was the next highest weight at 6,213 pounds, a substantial decrease (almost 3,000 pounds) from the "Electrical Machinery" average excess weight. The groups with the lowest average excess axle weights were "Chemical or Allied Products" and "Miscellaneous Mixed Shipments" with 1,500 and 1,950 pounds, respectively. Four commodity categories did not have any excess axle weight infractions: "Food and Kindred Products," "Forest Products," "Primary Metal Products," and "Transportation Equipment." With the exception of "Transportation Equipment," these commodities are generally reducible and relatively easy to shift-load.

Six commodity groups had permit violations on internal axle spacing (Table 9). "Machinery, Except Electrical" had the extreme average excess weight with 10,962 pounds. The remaining five commodities had average excess weights ranging from 2,150 to 3,400 pounds.

Overweight violations on tire sizes were reported in only four commodity groups (Table 10). "Machinery, Except Electrical," "Nonmetallic Minerals, Except Fuels" and "Stone, Clay, Glass, or Concrete Products" had one violation each with excess weights of 3,300, 2,700 and

Table 8. Number of Violations and Average Excess Axle Weights (in pounds) Per Commodity Category

COMMODITY	NO. VIOLS	EXCESS AXLE
Electrical Machinery	1	9,200
Waste and Scrap Materials	9	6,213
Machinery, Except Electrical	67	5,358
Nonmetallic Minerals, Except Fuels	28	3,300
Stone, Clay, Glass, or Concrete Products	6	4,767
Farm Products	1	3,800
Pulp, Paper and Allied Products	2	3,550
Petroluem or Coal Products	6	3,340
Lumber or Wood Products	11	3,300
Miscellaneous Mixed Shipments	2	1,950
Chemicals or Allied Products	1	1,500

Table 9. Number of Violations and Average Excess Weights (in pounds) on Bridge Formula Per Commodity Category

COMMODITY	NO. VIOLS	OVER BRIDGE
Machinery, Except Electrical	3	10,962
Food and Kindred Products	1	3,400
Primary Metal Products	1	3,300
Lumber or Wood Products	2	2,950
Farm Products	1	2,700
Nonmetallic Minerals, Except Fuels	2	2,150

Table 10. Number of Violations and Average Excess Weights (in pounds) on Tire Size Per Commodity Category

COMMODITY	NO. VIOLS	OVER TIRE
Machinery, Except Electrical	1	3,300
Petroleum or Coal Products	2	2,700
Nonmetallic Minerals, Except Fuels	1	2,700
Stone, Clay, Glass, or Concrete Products	1	800

800 pounds, respectively, while "Petroleum or Coal Products" had two violations averaging 2,700 pounds over. Because of the low numbers of violations in this weight category, it is difficult to make any conclusions regarding the relationship between commodity hauled and tire size violations.

It should be noted that "Machinery, Except Electrical" had the highest excess weights in the bridge and tire size classifications, the second heaviest excess gross weight, and the third heaviest average excess axle weight. "Electrical Machinery" was responsible for the heaviest excess axle weight and fourth heaviest excess gross weight. Machinery, in general, is heavy in terms of weight relative to size. This may be a partial explanation of the heavy average excess weights in the "Machinery, Except Electrical" and "Electrical Machinery" categories. Moreover, it is difficult or impossible to separate many pieces of machinery into smaller sections. Consequently the load is non-reducible and essentially impossible to shift-load.

Location

A cross-evaluation of violations by location issued and commodity hauled was performed to determine if specific commodities were being hauled in overloaded trucks through certain areas. There were 124 groups with unique commodity/location attributes. Unique commodity/location means that a specific commodity is cited at a specific location. Thirteen (11 percent) of these categories had 5 or more violations (Table 11). For instance, at Scale 72 there were 15 permit violations issued to trucks carrying "Machinery, Except Electrical." Officers at Scale 72 also detected 12 violations on vehicles transporting "Lumber or Wood Products," 9 violations on trucks hauling "Farm Products" and 6 violations on overweight "Food and

Table 11. Number of Permit Violations Per Commodity Category at Specific Locations

LOCATION	COMMODITY	NO. OF VIOLATIONS
Scale 72	Machinery, Except Electrical	15
Scale 72	Lumber or Wood Products	12
Scale 27	Machinery, Except Electrical	10
Scale 72	Farm Products	9
Scale 25	Machinery, Except Electrical	8
SR 169 (King Co.)	Nonmetallic Minerals, Except Fuels	7
Scale 33	Machinery, Except Electrical	7
Sclae 53	Farm Products	6
Scale 72	Food and Kindred Products	6
Scale 53	Food and Kindred Products	6
Scale 16	Lumber or Wood Products	6
SR14 MP1-9	Machinery, Except Electrical	6
Scale 26	Machinery, Except Electrical	6
Scale 77	Machinery, Except Electrical	5

Kindred Products" loads. At Scale 27, there were 10 overweight trucks hauling "Machinery, Except Electrical" and at Scale 25, 9 violations were issued to trucks also carrying "Machinery, Except Electrical."

Data suggest there are specific areas in which trucks hauling similar commodities are violating weight permits. All the above-mentioned scales are located on I-5, the main thoroughfare for trucks hauling tonnage between the Vancouver, B.C., Seattle and Portland areas, and hence, traffic volume on this route is heavy. In this case, violation numbers on common commodities may be comparable to any area in the state (relative to traffic volume) but appear larger because of the busy route. At Scale 72 there were numerous permit violators hauling machinery, farm and food products, and lumber/wood products. Possible explanations include the high level of machinery use in urban areas. Food and farm products are also hauled to ports at Tacoma and Portland as are farm products hauled to processing plants or markets in the metropolitan areas. Permit violators also include haulers of Lumber/wood products from forests in Clallam/Jefferson counties and other logging areas to mills or construction/lumber companies in the urban areas. There were also numerous violations on trucks hauling machinery in the Seattle area. Construction and renovation in the metropolitan area probably account for this type of traffic.

Scale Type

Most of the locations where a number of trucks hauling similar commodities were cited for violations on weight permits were permanent scale sites. There were 48 instances where 2 or more citations were issued at the same location to trucks hauling similar commodities.

Thirty-six (75 percent) of those occurred at scalehouses while the remaining 12 took place along interstates and state roads. There were only two occurrences where portable scales were used to detect more than five weight violations in one area by trucks hauling like commodities. These were along SR169 in King County (seven violations) and from milepost one to milepost nine along SR14 (six violations). In comparison, there were 12 instances where more than five infractions occurred at the same scalehouse by trucks hauling like commodities. Four of these occurrences were at Scale 72 and two were at Scale 53. It is difficult to claim any correlation between overweight trucks hauling specific commodities and permanent versus portable scales. The differences in numbers were probably due to traffic flow and weighing times. Permanent scales are apt to have heavier traffic flows (due to their locations) and quicker weighing times than portable scales.

Monthly Variation

Commodities were analyzed according to the month in which violations occurred. Most of the violations on farm products occurred during January, February, March, and August. These commodities were mostly hay and hay cubes, often transported during the winter months to ports for export or to ranches for livestock feed. Those carried in late summer were vegetables and grain and were probably recently harvested and destined for market or processing facilities. SMVP violations on cranes, road graders, forklifts, dozers, concrete pumpers, excavators, and other machinery (not including logging) were distributed evenly throughout the year. Trucks hauling petroleum or coal products violated special permits primarily during the spring and summer seasons. Most of these trucks were hauling asphalt which is often applied

during the warmer months. Trucks carrying nonmetallic minerals most frequently violated permits from March through July. These products were mostly rock/stone, sand, gravel, and dirt which may be utilized more during the spring and summer seasons when it is warmer and drier and construction levels are higher.

Lumber and wood products (not including logs) had the most violations in January, February, April, and December. Because these commodities were veneer, wood chips, wood poles, and lumber, it is difficult to determine why violations occurred during those months. Trucks usually haul logs when the roads are dry or frozen. Trucks carrying logs violated permits mostly during July and August. This did not coincide with trucks hauling logging machinery that violated SMVPs. These violations occurred during February through April and November. As logging activities transpire year-round, it is difficult to make any definite conclusions as to why trucks hauling logging machinery violated permits during those times.

Origin/Destination

Enforcement efforts may be aided if CVEOs can determine those highways and roads most frequently traveled over by overloaded trucks. To learn if certain routes are repeatedly being used by overweight trucks carrying specific commodities, an origin/destination analysis was performed. Origins and destinations were recorded on 225 of the permit violations issued during the sample period. Although most of the origin/destination and commodity units were unique, there were some origin/destination locations with common commodities. Permit violators included three vehicles carrying "Machinery, Except Electrical" from Vancouver, WA to Bingen and two truckloads of "Nonmetallic Minerals, Except Fuels" traveling from Kirkland

to Seattle. Two loads of grain being moved from Kalama to Portland, OR were also cited for permit violations.

The most frequent origin/destination recorded on permit violation notices was "local." Nineteen truckloads originated and terminated in the same town/city. Six of the vehicles listed "local" under the origin/destination category while the remaining 13 specified the actual city or town. Four shipments originated and terminated in Black Diamond, all of which were "Nonmetallic Minerals, Except Fuels."

There were permit violators carrying like commodities which originated in the same cities. Six "Machinery, Except Electrical" loads commenced in Vancouver, WA while five loads of the same category originated in Seattle. Four shipments of "Nonmetallic Minerals, Except Fuels" originated in Tacoma; Tacoma and Bellingham were also origination points for four trucks hauling "Machinery, Except Electrical."

There was some correlation between origin/destination and commodity being hauled. Machinery loads tended to move in or between the larger urban areas in western Washington and "Nonmetallic Minerals, Except Fuels" (mainly dirt and sand/gravel) were often hauled locally in cities on the western side of the state. This was probably due to commodity mass and hauling costs relative to commodity value and the fact that dirt/sand/gravel are generally found throughout the state.

Permit Types

There were five unique categories in permit types: Additional Tonnage (AT), Special Motor Vehicle Permits (SMVP), Log Tolerance (LT), both AT and LT, and Unknown.

A total of 189,360 overweight permits were issued by WSDOT and its agents during the study period.[6] A majority (77 percent) of those permits were SMVPs while ATs and LTs accounted for 21 percent and 2 percent, respectively. From a total of 721 violations, there were 502 AT violations (70 percent), 108 LT violations (15 percent), 106 SMVP violations (15 percent), one violation of both an AT and an LT, and four violations where the permit type was not specified. For data interpretation in this section, the AT/LT permit violation was averaged into the AT and LT permit groups and the unknown or unspecified permits were not used. The percentage of SMVPs violated was 0.07 percent while 1.2 percent of the total ATs issued and 3.6 percent of the LTs issued were violated. To determine when, to what degree and where these permits were most frequently violated, analyses were performed on date of violation, weight and number of violations and location of violation on each permit type.

Seasonal Variance

Violations were analyzed according to the type of permit and the month in which the infraction occurred to determine if there were seasonal variances in violations on different permit types. There is evidence that different permit types are violated during different times of the year. April and March were the months with the two highest numbers of AT violations with 64 and 54, respectively (Figure 3). November was the month with the most SMVP and LT violations with 18 and 17, respectively. The month with the least AT permit violations was

[6]Total number of permits issued is a weighted average of permits issued during 1991 and 1992.

October which only had 20. October and August were the months with the least number (four) of LT violations while the least number (four) of SMVP violations occurred during June.

Further knowledge may be gained when the number of permits issued throughout the year are compared with permit violations during those times. Quarterly reports of permit sales were obtained from WSDOT. Analysis of ATs and SMVPs is difficult because these permits are issued for single-trips and annually throughout the year and the data are not broken down into such categories. Moreover, SMVPs for farm implements and excess weight, length, and width are all united into one SMVP category.

LTs, however, can be analyzed because they are issued on an annual basis and all expire on April 1. LT violations as a percentage of total LTs issued were analyzed by calendar year quarter. The second quarter (April-June) had the highest percentage of violations, 2.9 percent. During the fourth quarter (October-December), 2.4 percent of the total LTs owned were violated. In the third and first quarters, violations as a percentage of total permits owned were 1.3 percent and 0.9 percent, respectively. The first quarter percentage may be low and perhaps even misleading because during that period, data of permits issued includes all LTs purchased since April of the preceding year. For example, the percentage of first quarter violations was lower than that of the third quarter (0.9 percent versus 1.3 percent) but the real count of third quarter violations was significantly lower than that of the first (17 versus 27). However, it can be said that the greater percentages of violations per number of LTs issued tend to occur in the second (April-June) and fourth quarters (October-December).

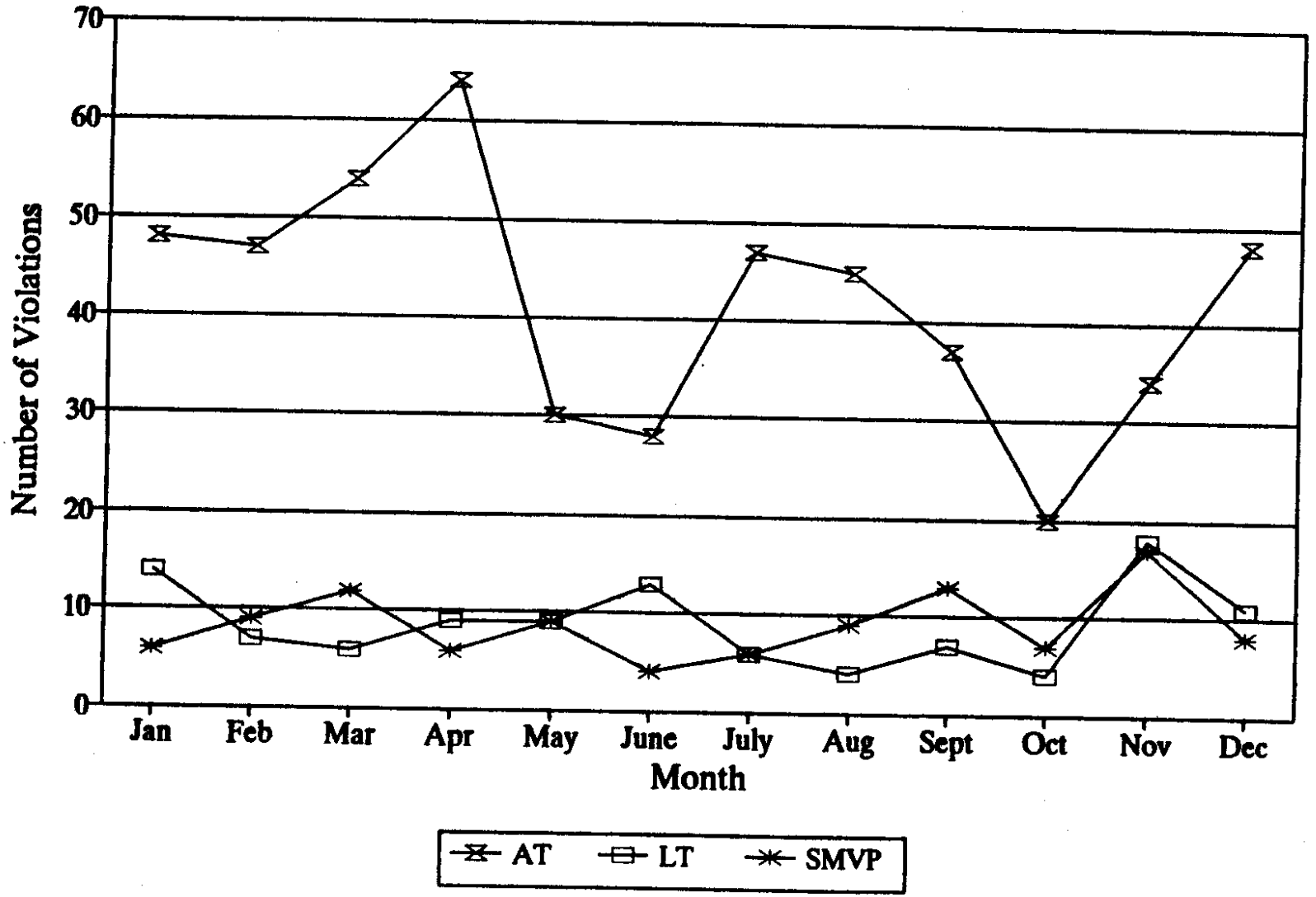

Figure 3. Violations Occurring Each Month on Specific Permit Types

Weight and Frequency

To learn whether some permit types are violated to a greater degree than others, violation numbers and average excess weights in each weight category were computed for each permit type. ATs had the largest number of violations in all four weight categories (Table 12). LTs were violated most frequently in the gross weight group while SMVPs were usually violated in the axle weight category. These data are what might be expected as SMVPs are for nonreducible loads and it is generally very difficult to load the weight evenly across all axles. ATs are likely to be violated on gross weights because it is usually easy to add additional units of product to the existing load while maintaining a uniform weight distribution across axles. LTs were mostly violated in the gross weight category. Very few violations were on axles and none were on bridge, probably because of the required truck configuration and because the weight of a log is usually fairly evenly distributed.

SMVP violations had the highest average excess weight (3,828 pounds) for all weight categories combined (gross, axle, bridge, and tire size) (Table 13). The category with the highest average excess gross weight was AT with 4,300 pounds. SMVP violations were responsible for the heaviest average excess axle (4,950 pounds) and bridge (7,567 pounds) weights. SMVP violations also had the higher average excess weight on tire size, 1,650 pounds. There were no LT permit violations on internal axle spacing or tire size during the year. The previous explanations may also explain these excess weights on each permit type.

It appears that SMVPs had the least number of total violations but the heaviest average excess weights in the overall, axle, bridge, and tire size categories. Although gross weight violations in this category were the lightest of all categories, SMVP violations may be the cause

Table 12. Number of Weight Violations on Permit Type

PERMIT	VIOLATIONS ON EXCESS GROSS	VIOLATIONS ON EXCESS AXLE	VIOLATIONS ON BRIDGE	VIOLATIONS ON TIRE SIZE
AT	309	182	33	5
LT	96	15	0	0
SMVP	31	82	2	1

NOTE: Total number of violations exceeds 718 because some trucks were violating more than one weight category.

Table 13. Numbers of Violations and Average Excess Weights (in pounds) on Special Permits

PERMIT	VIOLATIONS	GROSS	AXLE	BRIDGE	TIRE	OVERALL
AT	503	4,300	3,358	5,682	1,233	3,644
LT	109	3,317	3,100	-	-	1,604
SMVP	106	1,145	4,950	7,567	1,650	3,828

NOTE: Categories with no violations are not used to compute the overall average.

of a greater percentage of road damage than AT or LT violations simply because of the heavy excess tonnage being carried on each axle or axle group. The explanation for the heavier excess axle and bridge weights on SMVPs is that they are issued for non-divisible loads. Because these loads cannot be separated, it is difficult to load the weight so it is evenly proportioned over all axles.

Because Washington is a state with considerable logging activity, the general public and media are often inclined to blame logging trucks for much of the road damage. However, in this study trucks with LTs (trucks carrying logs) were responsible for the least number of violations in all four weight categories and less damage (lowest excess weights on axles and no violations on bridge or tire) than trucks with SMVPs or ATs. It should be noted, however, that those trucks with SMVPs or ATs could be carrying equipment or commodities associated with the logging industry, such as log skidders and loaders or even logs.

Location

Violations on certain permit types may be more apt to occur in certain areas throughout Washington. For instance, one might assume that metropolitan areas will have a high number of permit violations on SMVPs simply because there is apt to be more machinery in those areas compared to rural areas. Timberlands could also have a number of violations on SMVPs because of the machinery used in logging. It can be assumed there will also be more LT violations in those areas where logging activities occur due to the transportation of logs to mills.

Violations by permit type were examined according to the WSP districts in which they occurred to learn of the areas responsible for specific permit violations (Table 14). Districts 2 and 5 had the most AT and SMVP violations while District 8 had the most LT violations.

Table 14. Numbers of Permit Violations (by permit type) Occurring in each Washington State Patrol District

LOCATION	AT	LT	SMVP
WSP District 1	18	3	5
WSP District 2	118	7	36
WSP District 3	63	17	3
WSP District 4	38	0	1
WSP District 5	136	7	32
WSP District 6	33	4	4
WSP District 7	64	0	11
WSP District 8	19	69	13

District 8 also had the third highest number of SMVP violations. These numbers verify the above postulations that urban areas are more apt to have SMVP violations and logging areas are inclined to have more violations on LTs. It is also evident that urban areas have numerous AT violations which may be due to a large demand for products/services. I-5, a major route for traffic traveling between Canada and Oregon and within western Washington may also account for numerous AT violations.

Permittee Evaluation

To determine if certain firms are responsible for repeated violations, an evaluation of permittees was performed. There were 479 permittees who were responsible for violations on special weight permits. The number of repeat violations ranged from 1 to 26. One-hundred and twelve (23 percent) of the permittees were responsible for more than one violation, indicating that there are individual firms who are responsible for repeat permit violations and hence, extensive road damage.

The party with the most repeat violations was Weyerhaueser Company, with 26 weight violations in the gross, axle and bridge categories. Weyerhaueser's trucks were based in Cosmopolis, Pe Ell, Longview, and Snoqualmie. Puget Sound Truck Lines, Inc. in Lacey/Tumwater had 13 repeat violations in the gross weight, axle weight, and bridge categories. LTI, Inc. out of Lynden breached permits 12 times, all of which were gross weight violations, and Western Refuse in Cheney was responsible for 10 permit violations on gross and axle weights. There were eight firms who each accumulated five to nine violations, and five firms were responsible for four permit violations apiece.

Commodities carried by Weyerhaueser and Western Refuse trucks were not identified. However, it may be reasonably assumed that they were hauling lumber/wood products and waste/garbage, respectively. Puget Sound Truck Lines, Inc. was listed as hauling wood poles/wood chips and LTI, Inc. trucks reported carrying milk and cream. Hence, permittee and commodity are related.

To determine where most of the violators were based, permittee addresses were sorted into 11 categories: WSP Districts 1-8, Other US States, Canada, and Unknown (Table 15). The location where the most permittees were based was WSP District 2 with 69. It was followed closely by District 1 where 61 violators were based. Although these districts are the smallest by area, the population is large and many companies are based in the Seattle/Tacoma/Olympia area. Fifty-six permittees were from states other than Washington, mainly the neighboring states of Oregon and Idaho. One could conclude that truckers based out of Washington fail to identify the weight laws in this state before crossing borders. However, since most are from neighboring states, this assumption is probably not valid. It seems reasonable to suggest that out-of-state truckers may not realize the emphasis placed on weight limits in the state of Washington and therefore do not pay enough attention to the weight of their trucks. However, as most of the permittees (75 percent) were based in Washington, the reasons listed in the study approach section of this report probably apply to most truckers regardless of where they are based.

Table 15. Permittee Addresses Categorized by Washington State Patrol Districts, Other United States, Canada, and Unknown

PERMITTEE ADDRESS	NUMBER OF PERMITTEES
WSP District 1	61
WSP District 2	69
WSP District 3	32
WSP District 4	22
WSP District 5	47
WSP District 6	40
WSP District 7	45
WSP District 8	45
Other U.S. States	56
Canada	25
Unknown	37

CONCLUSIONS

Truckers in Washington have the option to purchase special permits which allow them to operate legally above state weight limits. Unfortunately, for reasons uncertain, there are many vehicles that abuse the privilege. Because they are the very heavy trucks, road damage caused by these vehicles can be extensive. Permit fees do not fully compensate for the additional damage to roads caused by the illegal weight. Trucks operating in violation of the weight permits issued them are doing so at the expense of other truckers and taxpayers.

Overweight vehicles cause immense amounts of damage to Washington's roads and highways each year and further research is recommended to decrease the economic incentive to illegally overload. Between November 1, 1991 and October 31, 1992 there were 721 recorded permit violations in the state of Washington. The actual capture rate of overloaded trucks is unknown but, in most cases, estimates as to the percentage of overloaded vehicles that are "apprehended" and cited range from 1 to 20 percent. At the mean of 10 percent there would be 7,210 trucks traveling within the state that are violating weight permits during a 12-month period. Casavant and Lenzi estimated a truck with a 30 Kip overload traveling 300 miles would cause $744.10 worth of damage to the average Washington road or highway (Casavant). A permit for a 30 Kip overload on a 300 mile trip is $189 which means approximately $555 of road "consumption" is unaccounted for. Moreover, in this case, the trucker would load 29,999 pounds overweight and only have to pay $120 because of the increments in which the fee schedule increases. This means even less of the damage is being compensated for by permit fees. At the heavier overloads and longer mileages, economic incentives to overload are higher than the fee or net fine (fine amount times the probability of being cited) (Casavant). This not

only encourages illegal overloading but could result in massive pavement damage and little funding for repairs. Hence, a need exists for a re-evaluation of Washington's current permit/fee system. One area to which further attention should be paid is the annual permit (ATs and LTs) fee system. Currently, fees for such permits are based only on additional tonnage, regardless of miles traveled. Although this system is perhaps the least complicated and does not require records on annual mileage, it does not reflect the total damage inflicted by overloaded vehicles. The permit system should be designed so that all permits, rather than only single-trip ATs and SMVPs, have fees that are based on a weight-mileage concept. In this way, all trucks assume equal responsibility for the damage they cause to the state's roads and highways.

Considerable economic incentives exists for truckers to overload, even to the extent that they are in violation of limits granted through the purchase of special weight permits which only partially compensates for roadway damage.

Additional research on weight permit violations and overloaded trucks is encouraged. To foster such efforts, records should be accurate and current. The authors strongly recommend that the old forms currently being used by some WSP CVEOs to report permit violations to WSDOT be thrown away and current forms dated 1992 be utilized. It is also advised that officers complete all the information requested on the new forms, including origin/destination and commodity hauled. This would greatly aid research efforts and increase the significance or credibility of project results and conclusions.

There is a need for strategic policies and programs in permit administration to account for the damages caused by legally overloaded trucks and trucks who violate permits. An evaluation of the fine system is also recommended; permit violation incidence may decrease if fines are increased as the estimated risk of the fine assessed for illegally overloading would

increase. Road enforcement and court enforcement must be combined with the proper fee and fine system to solve this dilemma.

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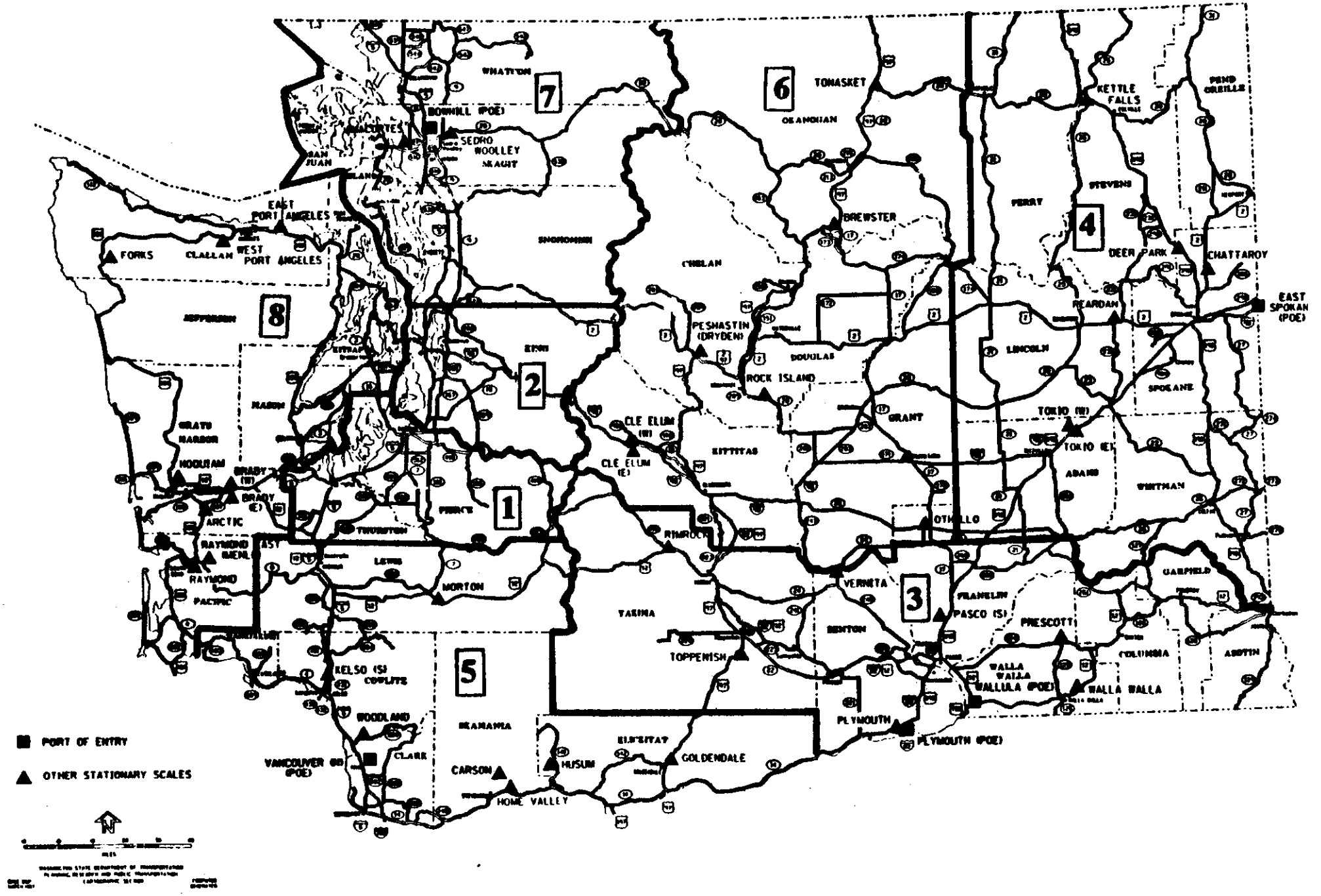
APPENDIX A

WASHINGTON STATE PATROL

DISTRICT AND SCALEHOUSE LOCATIONS

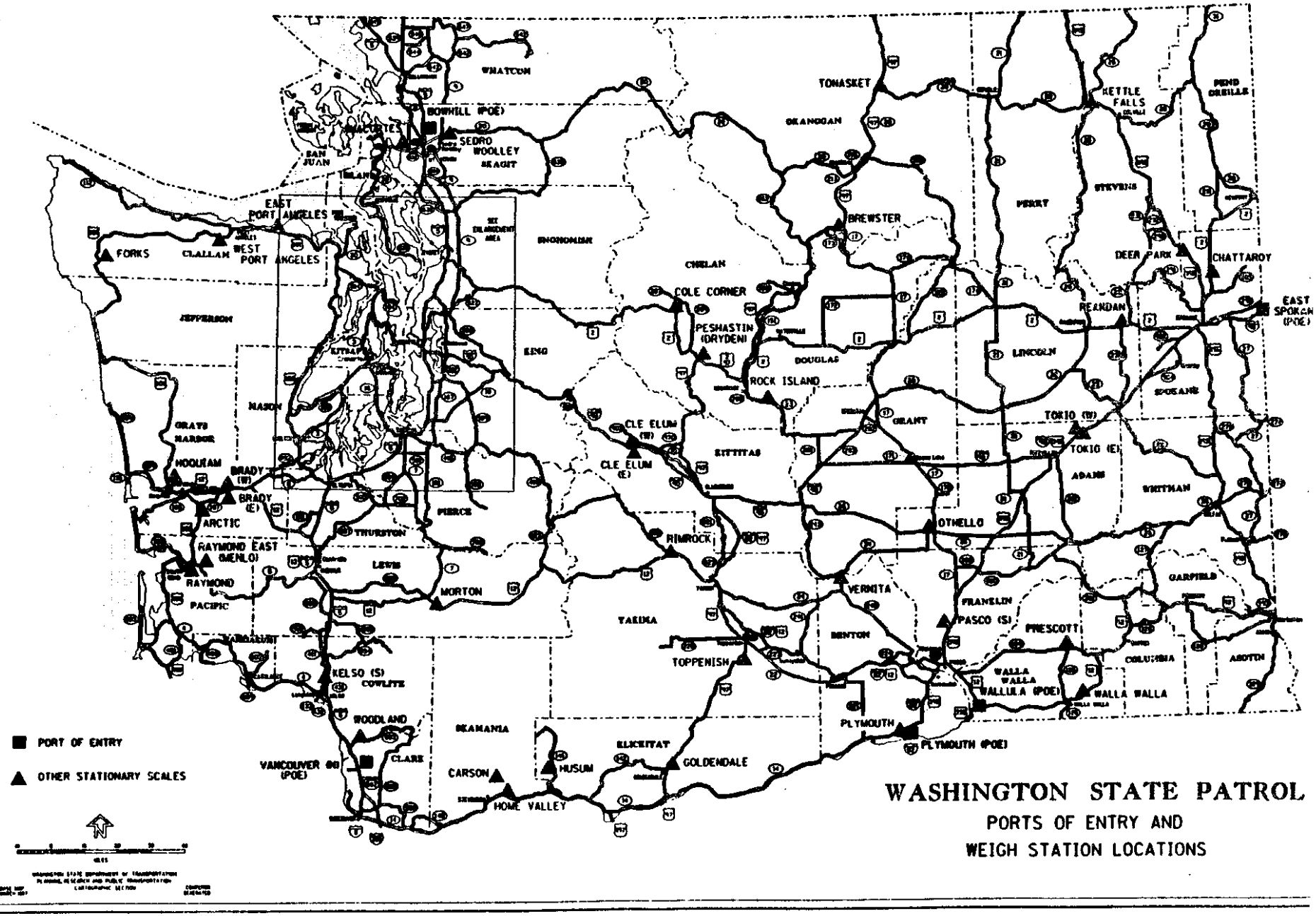


PORT OF ENTRY
OTHER STATIONARY SCALES
1
2
3
4
5
6
7
8
WHATCOM
BOWHILL (POE)
SEDRO WOOLLEY
SKAGIT
SAN JUAN
EAST PORT ANGELES
WEST PORT ANGELES
FORKS
CLALLAM
JEFFERSON
SNOHOMISH
KING
KITSAP
MASON
GRAYS HARBOR
HOQUIAM
BRADY (W)
BRADY (E)
ARCTIC
RAYMOND (MENL)
RAYMOND
PACIFIC
THURSTON
PIERCE
LEWIS
MORTON
KELSO (S)
COWLITZ
WOODLAND
CLARK
VANCOUVER (W) (POE)
SKAMANIA
CARSON
HOME VALLEY
HUSUM
KLICKITAT
GOLDENDALE
YAKIMA
TOPPENISH
RIMROCK
CLE ELUM (W)
CLE ELUM (E)
KITTITAS
CHELAN
PESHASTIN (DRYDEN)
ROCK ISLAND
DOUGLAS
GRANT
OTHELLO
VERNITA
BENTON
PLYMOUTH
PLYMOUTH (POE)
FRANKLIN
PASCO (S)
PRESCOTT
WALLA WALLA
WALLULA (POE)
WALLA WALLA
COLUMBIA
ASOTIN
GARFIELD
WHITMAN
ADAMS
TOKIO (W)
TOKIO (E)
SPOKANE
LINCOLN
REARDAN
DEER PARK
CHATTAROY
EAST SPOKANE (POE)
STEVENS
PERRY
KETTLE FALLS
PEND OREILLE
BREWSTER
OKANOGAN
TONASKET

WASHINGTON STATE PATROL SCALEHOUSES

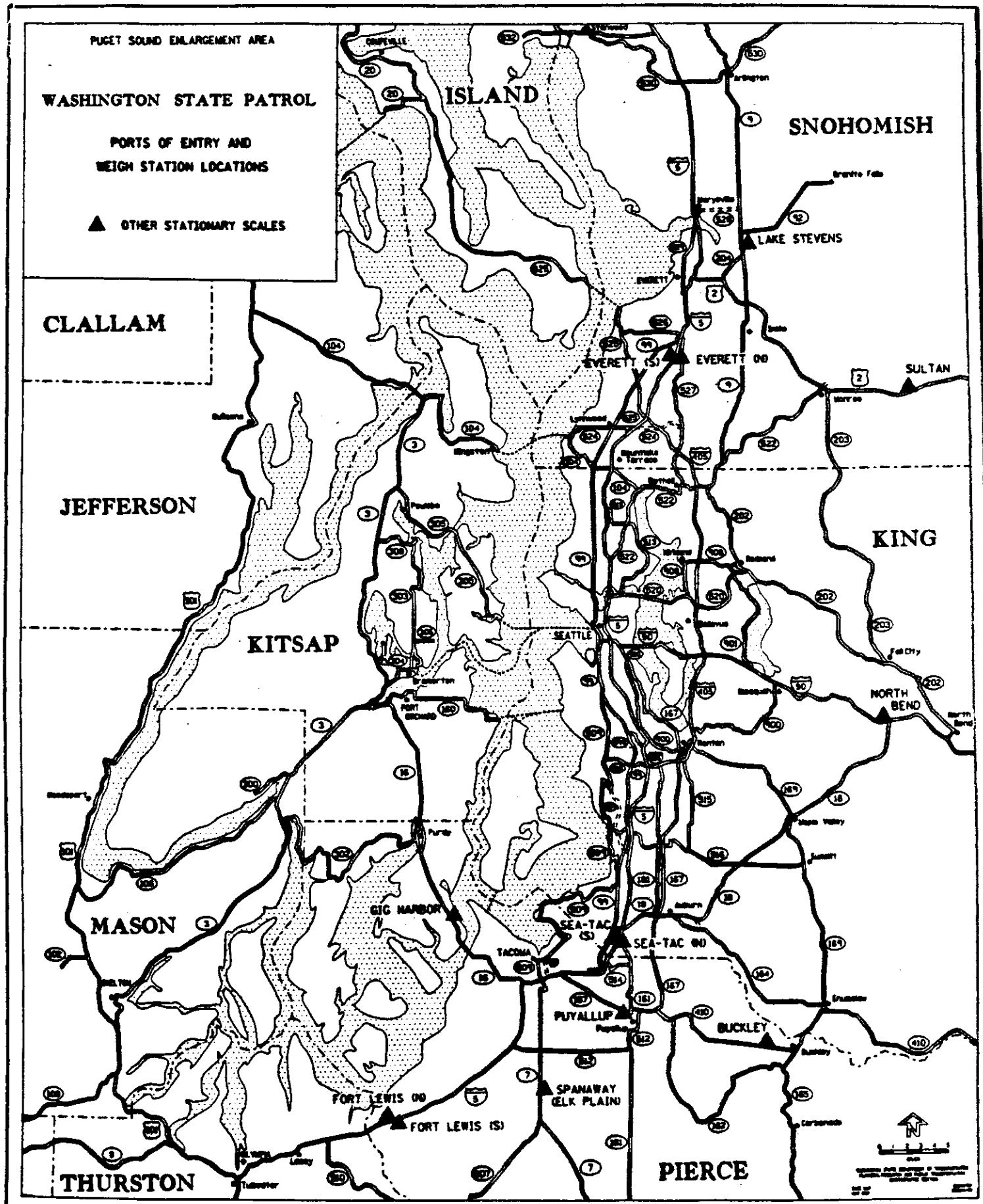
Scalehouse	City	County	Highway State Route	Mile Post
District 1				
7	Ft. Lewis, Northbound	Pierce	I-5	117
9	Puyallup	Pierce	167	5
10	Gig Harbor	Pierce	16	10
16	Spanaway (Elk Point)	Pierce	7	49
18	Buckley	Pierce	410	19
District 2				
25	Northbend	King	I-90	25
26	SeaTac, Northbound	King	I-5	141
27	SeaTac, Southbound	King	I-5	141
District 3				
40	Prescott	Walla Walla	124	35
42	Toppenish	Yakima	9	56
43	Wallula (POE)	Walla Walla	12	308
47	Rimrock	Yakima	12	185
48	Vernita	Benton	24	43
50	Plymouth	Benton	14	180
51	Walla Walla	Walla Walla	12	342
54	Plymouth (POE)	Benton	I-82	1
55	Pasco	Franklin	395	10
District 4				
60	Reardan	Lincoln	2	282
64	East Spokane (POE)	Spokane	I-90	300
65	Deer Park	Spokane	395	182
66	Chattaroy	Spokane	2	302
67	Kettle Falls	Stevens	395	239
68	Tokio, Eastbound	Adams	I-90	231
69	Tokio, Westbound	Adams	I-90	231

Scalehouse	City	County	Highway State Route	Mile Post
District 5				
72	Vancouver (POE)	Clark	I-5	15
74	Home Valley	Skamania	14	50
75	Goldendale	Klickitat	97	13
76	Morton	Lewis	12	100
77	Kelso	Cowlitz	I-5	44
79	Husum	Klickitat	141	8
83	Woodland	Cowlitz	503	49
85	Carson (county owned)	Skamania	Wind River	4
District 6				
52	Cle Elum, Eastbound	Kittitas	I-90	80
53	Cle Elum, Westbound	Kittitas	I-90	80
91	Brewster	Okanogan	97	265
92	Peshastin (Dryden)	Chelan	2	105
94	Rock Island	Douglas	28	9
96	Othello	Adams	26	41
97	Tonasket	Okanogan	979	315
District 7				
30	Sedro Woolley	Skagit	20	68
31	Sultan	Snohomish	2	21
33	Bow Hill (POE)	Skagit	I-5	235
35	Anacortes	Skagit	536	57
37	Lake Stevens	Snohomish	9	17
38	Everett, Northbound	Snohomish	I-5	188
39	Everett, Southbound	Snohomish	I-5	188
District 8				
11	Hoquiam	Grays Harbor	101	91
12	Arctic	Grays Harbor	101	77
13	Forks	Clallum	101	191
14	West Port Angeles	Clallum	101	237
15	East Port Angeles	Clallum	101	254
19	Brady, Westbound	Grays Harbor	12	13
20	Brady, Eastbound	Grays Harbor	12	13
71	Raymond	Pacific	101	57
82	Raymond, East (Menlo)	Pacific	6	



WASHINGTON STATE PATROL

PORTS OF ENTRY AND WEIGH STATION LOCATIONS


PUGET SOUND ENLARGEMENT AREA
WASHINGTON STATE PATROL
PORTS OF ENTRY AND
WEIGH STATION LOCATIONS
OTHER STATIONARY SCALES
ISLAND
SNOHOMISH
CLALLAM
JEFFERSON
KITSAP
KING
MASON
PIERCE
THURSTON
LAKE STEVENS
EVERETT (S)
EVERETT (N)
SULTAN
SEATTLE
NORTH BEND
GIG HARBOR
SEA-TAC (S)
SEA-TAC (N)
TACOMA
PUYALLUP
BUCKLEY
SPANAWAY (ELK PLAIN)
FORT LEWIS (N)
FORT LEWIS (S)