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Research Project T9903-36
Freight Productivity

THE POTENTIAL FOR FREIGHT PRODUCTIVITY IMPROVEMENTS ALONG URBAN CORRIDORS

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16. ABSTRACT

The impacts that would result from providing "reserved capacity" for trucks rather than restricting trucks are considered in this study. In the extreme case, trucks would be allowed to travel in a dedicated or exclusive lane. A more moderate approach would be to provide a "cooperative" dedicated lane in which vehicles such as trucks and buses could share a common lane and yet be separated from general traffic.

The study determined the following. Reserved-capacity strategies for trucks would offer (1) nearly $10 million in annual travel time savings for the trucking industry, (2) a savings of about 2.5 minutes per average truck trip (less than 8 percent savings in trip travel time), and (3) almost $30 million in annual travel time savings for single-occupancy vehicles in the Seattle region. The difference in travel times between the reserved-capacity strategy that would add trucks to the existing HOV lanes and the one that would add an exclusive truck lane would be insignificant, providing little justification for the construction of an exclusive truck lane. In all likelihood, the impact of reserved-capacity strategies on safety would be small, depending on the particular reserved capacity strategy. Reserved capacity strategies for trucks would accelerate pavement deterioration in the reserved lanes, but the reduction in the pavement deterioration rates of the general purpose lanes might help to balance future reconstruction costs. Surveys of the general public and subsequent statistical analysis showed considerable resistance to reserved-capacity strategies for trucks. However, this resistance is not unlike that encountered when HOV lanes were first considered.

It is the recommendation of this study that the idea of reserved-capacity strategies for trucks continue to be presented to the trucking industry, to the public, and to other impacted agencies for discussion and consideration. The study showed that the adverse impacts of such strategies are easily manageable and there is at least potential for freight-productivity improvements.

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EXECUTIVE SUMMARY

Several studies have explored ways to improve urban congestion by focusing on truck travel. In particular, strategies for improving urban congestion have investigated limiting truck travel by restricting lanes, routes, or time of day. These strategies are based on the perceptions that large trucks (1) restrict motorists' vision because of their size, (2) threaten safety because of slow braking capabilities, and (3) delay motorists because of slow accelerations and an inability to maintain speed on upgrades.

Over time, the trucking industry has developed strategies of its own to lessen congestion-related delays. These strategies, based on congestion avoidance, include (1) changing operations hours to avoid peak travel periods and (2) changing travel routes to avoid highly congested segments of the interstate. Each of these strategies is not without its drawbacks. Peak congested periods are expanding throughout the day, limiting the hours of operation available to truckers who want to avoid congestion. Changing routes to avoid congestion contributes to the deterioration of city streets and arterials not designed for heavy truck traffic. Because of these drawbacks, other strategies need to be explored.

Given that large trucks typically make up less than 5 percent of the average daily traffic (ADT) in urban areas, perhaps a disproportionate amount of effort is being spent on *restricting* large truck travel. Instead, perhaps attention should be redirected toward improving freight productivity by minimizing the impacts of urban congestion on the trucking industry.

The impacts that would result from providing "reserved capacity" for trucks are of particular interest. Adequate capacity could be guaranteed for trucks, eliminating their need to compete with the general traffic. In the extreme case, trucks would be allowed to travel in a dedicated or exclusive lane. Vehicles other than trucks would be restricted from using this lane. A more moderate approach would be to provide a "cooperative" dedicated lane in which vehicles of different modes could share a common lane and yet be separated from general traffic. Trucks and buses share many characteristics for which consideration of a common travel lane is

warranted. For example, trucks and buses (1) have similar operating characteristics and size, (2) have similar freeway accessibility needs (the typical exit/entrance activity of both modes is low), and (3) share the desire to achieve shorter and more predictable travel times.

RESEARCH APPROACH

The study considered both exclusive and cooperative reserved capacity strategies on major freight movement routes in urban areas in the Puget Sound region. The operational analysis consisted of (1) collecting the necessary traffic and truck related data to support the traffic simulation, (2) performing the traffic simulation and estimating the economic impacts of reserved-capacity strategies, (3) examining impacts to safety as a result of redistributing truck traffic, and (4) predicting a change in pavement deterioration rates as a result of the truck traffic redistribution. Attitudinal surveys were developed and distributed to all parties that would be impacted by truck traffic redistribution. These parties included the trucking industry, truckers, motorists who did not use HOV lanes, motorists who did use the HOV lanes, transit companies, bus drivers, and the Washington State Patrol.

The surveys included questions regarding actual travel characteristics (e.g., frequency of travel on routes, time of day of travel) and background characteristics (e.g., age, sex, and the types of vehicles operated). The surveys also included speculative questions, such as

- Will redistributing truck traffic provide improvement to the traffic flow?
- Will redistributing truck traffic further hinder traffic flow or introduce other negative impacts?
- Will concentrating trucks in certain lanes present safety problems?
- Will special enforcement be required?
- Should restrictions be 24 hours a day?
- Would this change be likely to reduce accidents?
- Would the respondent be willing to pay a usage fee to use a reserved capacity lane?

A mail survey was used for the majority of the data collection because it allowed more detailed information to be collected, while cost was not prohibitive. A small proportion of

surveys was distributed in person at local truck stops. Surveys were distributed to 1,885 general public drivers, 338 large truck operators, 150 truck company representatives, 200 bus drivers, and 148 traffic enforcement personnel (Washington State Patrol).

FINDINGS

The study determined that reserved-capacity strategies for trucks would offer nearly $10 million in annual travel time savings for the trucking industry in the Seattle region. Although this is not a large amount in relation to the amount of truck activity in the area, it is still a sizable savings.

In terms of truck-industry productivity, the impact of reserved-capacity strategies on individual trips would be small, about 2.5 minutes saved per average trip (less than 8 percent savings in trip travel time). Although it is unlikely that trucking firms could effectively use such a small savings in travel time to improve productivity, it is possible that some trucking operations could benefit, particularly those whose trucks would spend large portions of their trip on facilities with reserved capacity. In addition, the potential reduction in the variance of travel-time could help the trucking industry. However, whether the trucking industry would be able to take advantage of the average 2- to 3-minute reduction in trip times and the reduction in travel-time variance remains unknown.

The biggest impact of truck reserved capacity strategies is the travel-time savings they would create for single-occupancy vehicles, almost $30 million in travel time saved per year. (Note that this is not an unusually large number in comparison to the $250 million annual travel-time loss in the Seattle area due to delays resulting from freeway incidents.) This travel-time savings would be an artifact of the current under-utilization of HOV lanes in the Seattle area and not necessarily a virtue of reserved-capacity strategies. Still, this result must be weighed in any policy implementation.

The study also determined that the difference in travel times between the reserved-capacity strategy that would add trucks to the existing HOV lanes and the one that would add an

exclusive truck lane would be insignificant, providing little justification for the construction of an exclusive truck lane.

The effect of reserved-capacity strategies on safety would be a function of whether the reserved lanes were on the left or right side. Left-side lanes might increase side-swipe accidents, whereas right-side lanes might create other types of incidents because of interactions with merging traffic. On the other hand, sight distances and the operation of general-purpose lanes would improve with the reduction in truck travel. In all likelihood, the impact of reserved-capacity strategies on safety would be small.

Without doubt, reserved capacity strategies for trucks would accelerate pavement deterioration in the reserved lanes. This would necessitate reconstruction of the lanes carrying trucks and would be a capital expense associated with reserved-capacity strategies. However, this expense would be offset by a reduction in the pavement deterioration rates of the general purpose lanes. Although the net effect would likely be an increase in capital expenditures, this increase would likely be small.

The most significant obstacle to reserved-lane capacities would be public opinion. Our surveys of the general public and subsequent statistical analysis showed considerable resistance to reserved-capacity strategies for trucks. However, this resistance is not unlike that encountered when HOV lanes were first considered. As a result, one would expect that careful marketing and resolve on the behalf of the implementing agency could persuade the public to accept reserved-capacity strategies for trucks.

CONCLUSIONS

In conclusion, although there are many factors to consider, one key concern is whether the trucking industry could take advantage of reductions in travel time and travel-time variance that would result from the implementation of a reserved-capacity strategy for trucks. This is a difficult question to answer—and one our surveys suggested that the trucking industry itself can not answer. It is the recommendation of this study that the idea of reserved-capacity strategies for trucks continue to be presented to the trucking industry, to the public, and to other impacted

agencies for discussion and consideration. Our study showed that the adverse impacts of such strategies are easily manageable and there is at least potential for freight-productivity improvements.

CHAPTER 1
INTRODUCTION

Along urban corridors, a key variable in determining the efficiency of freight movement is travel time. Travel time is highly dependent on the speed of the vehicle. Vehicle speed is limited by regulation, by technology, and by the level of congestion through the urban corridor. It is unclear how freight delays resulting from congestion rank in comparison to delays caused by other factors such as limits on drivers' hours, double handling of the product, wait time for connections or access, and rough pavement. Creating such a ranking is especially difficult because the trucking industry is constantly changing to improve efficiency and reduce the delays associated with these factors.

For the trucking industry, shorter travel times mean moving more freight more quickly. Improved travel time and reduced delay ultimately improve competitiveness in both domestic and international markets. One reason is that efficient freight transportation maintains the price of consumer goods, whereas inefficient freight movement ultimately results in higher prices. In addition, many U.S. businesses now assemble parts manufactured in other locations, making transportation a necessary part of production. And predictability in travel times improves the potential for just-in-time deliveries, which in turn improves efficiency at the point of delivery. Unfortunately, as urban congestion grows, freight travel times continue to increase and become less predictable.

Several studies have explored ways to improve urban congestion by focusing on truck travel. In particular, strategies for improving urban congestion have investigated limiting truck travel by restricting lanes, routes, or time of day. These strategies are based on the perceptions that large trucks (1) restrict motorists' vision because of their size, (2) threaten safety because of slow braking capabilities, and (3) delay motorists because of slow accelerations and an inability to maintain speed on upgrades. However, given that large trucks typically make up less than 5 percent of the average daily traffic (ADT) in urban areas (BST Associates 1991), perhaps a disproportionate amount of effort is being

spent on *restricting* large truck travel. Instead, perhaps attention should be redirected toward improving freight productivity by minimizing the impacts of urban congestion on the trucking industry.

BACKGROUND

A number of strategies are employed to improve freight mobility in urban corridors. Over time, the trucking industry has developed strategies of its own to lessen congestion-related delays. These strategies, based on congestion avoidance, include (1) changing operations hours to avoid peak travel periods and (2) changing travel routes to avoid highly congested segments of the interstate. Each of these strategies is not without its drawbacks. Peak congested periods are expanding throughout the day, limiting the hours of operation available to truckers who want to avoid congestion. Changing routes to avoid congestion contributes to the deterioration of city streets and arterials not designed for heavy truck traffic. Because of these drawbacks, other strategies need to be explored.

Many of the current improvement strategies, both restrictive (lane, route, time of day) and non-restrictive (changed hours of operation, changed routes), were developed under the same premise: truck operations are most efficient when trucks are separated (either physically or by time of day) from general traffic. Perceived benefits include (1) improved safety, (2) reduced incident impacts, (3) increased capacity, and (4) less fuel consumption and better air quality. Studies have considered the impacts to both the trucking industry and general traffic in implementing restrictive strategies. However, little work has been done to determine the impacts that would result from non-restrictive strategies that allowed the trucking industry special travel benefits.

The impacts that would result from providing "reserved capacity" for trucks are of particular interest. Adequate capacity could be guaranteed for trucks, eliminating their need to compete with the general traffic. Several variations of reserved capacity exist.

In the extreme case, trucks would be allowed to travel in a dedicated or exclusive lane. Vehicles other than trucks would be restricted from using this lane. The exclusive

truck lane could be operated continuously throughout the day or during peak congested periods (i.e., the lane would be reserved for truck travel during the peak periods but would be open to general traffic at other times of the day). The provision of exclusive truck lanes would require (1) costly construction of an additional lane or (2) conversion of an existing lane. Public/private investment strategies might be feasible for the implementation of exclusive truck lanes; private trucking firms could support the construction of an exclusive lane or facility by paying a usage fee.

A more moderate approach would be to provide a "cooperative" dedicated lane in which vehicles of different modes could share a common lane and yet be separated from general traffic. Private trucking firms could support the development of a cooperative dedicated lane by paying a per-use toll, as suggested in the Regional Congestion Pricing project. While not limited to trucks, the Regional Congestion Pricing project considers the "sale" of excess capacity in the high occupancy vehicle (HOV) lanes to motorists willing to pay a fee to avoid congestion.

Trucks and buses share many characteristics for which consideration of a common travel lane is warranted. For example, trucks and buses (1) have similar operating characteristics and size, (2) have similar freeway accessibility needs (the typical exit/entrance activity of both modes is low), and (3) share the desire to achieve shorter and more predictable travel times. These common characteristics were noted by researchers in Texas, who conducted a study to determine the impacts of combining trucks with buses in a common contraflow lane. The idea was abandoned—not because of operational concerns, but because the trucking industry perceived no benefit from using the limited access lane. (Holder, Christiansen, Fuhs and Dresser 1979).

In Washington, the implementation of a common truck and bus lane would require legislative changes. Currently, the law related to reserved HOV lanes reads:

> *RCW 46.61.165 Reservation of portion of highway for use by public transportation vehicles, etc. The state department of transportation and the local authorities are authorized to reserve all or any portion of any highway under their respective jurisdictions, including any designated lane or ramp, for the exclusive or*

preferential use of public transportation vehicles or private motor vehicles carrying no fewer than a specified number of passengers when such limitation will increase the efficient utilization of the highway or will aid in the conservation of energy resources...

Under this law, the vehicle occupancy requirement would limit the use of the reserved lane by trucks. Additionally, implementation of a leftmost truck/bus lane may be impacted by the following:

RCW 46.61.100 Keep right except when passing, etc. ...(2) Upon all roadways having two or more lanes for traffic moving in the same direction, all vehicles shall be driven in the right-hand lane then available for traffic, except (a) when overtaking and passing another vehicle proceeding in the same direction, (b) when traveling at a speed greater than the traffic flow, (c) when moving left to allow traffic to merge, or (d) when preparing for a left turn at an intersection, exit, or into a private road or driveway when such left turn is legally permitted. On any such roadway, a motor truck shall be driven only in the right-hand lane except under the conditions enumerated in (a) through (d) of this subsection. (3) It is a traffic infraction to drive continuously in the left lane of a multilane roadway when it impedes the flow of other traffic...

The caveat, "when traveling at a speed greater than the traffic flow," would allow trucks and buses the opportunity for continuous travel in a leftmost lane under this law. New legislation, similar to that which allows motorcycles to travel in reserved lanes (see below), may be required to allow large trucks to travel with buses in a single lane.

RCW 46.61.608 Operating motorcycles on roadways laned for traffic. (1) All motorcycles are entitled to full use of a lane and no motor vehicle shall be driven in such a manner as to deprive any motorcycle of the full use of a lane...

The potential benefits of implementing reserved capacity strategies would be wide ranging. Freight movement efficiency benefits would include the following:

- a reduction in truck travel times, improving freight movement efficiency
- more predictable travel times, allowing expansion of just-in-time delivery options
- an improvement in domestic and international competitiveness
- the maintenance of consumer goods pricing.

The benefits for other users of the facility would include the following:

- an improvement in capacity for the facility by removing trucks from the general purpose lanes and making better use of shared or cooperative lanes

- a reduction in truck idle time due to congestion, which would reduce fuel consumption and improve air quality
- an improvement in safety (a reduction in the number of accidents and accident severity) by grouping vehicles of similar characteristics in a single lane
- a reduction in incident impacts (fewer lanes blocked, easier to access and clear) by concentrating trucks to an outside lane
- a reduction in pavement rehabilitation costs by concentrating heavy loads in a single lane (i.e., only a single lane would have to be rehabilitated, and this lane could eventually be reconstructed for additional strength)
- a more comfortable driving environment for those intimidated by driving near trucks.

REPORT CONTENTS

This report provides a set of quantified estimates of how various changes in the distribution of truck traffic would impact facility operation throughout the Seattle urban area. If the results show that one type of truck redistribution would result in substantial increases in time savings or safety, the Washington State Department of Transportation may consider a demonstration test to determine the applicability. This would involve either a public/private partnership to investigate an exclusive lane, or changes to HOV lane use policies to allow for truck use. If the demonstration were successful, other areas in the U.S. might be interested in pursuing similar investigations.

The following is an outline of the report's contents:

- a summary of available literature describing truck mobility strategies
- a description of the research approach for both the operational analysis and the public opinion survey
- the results of traffic simulation models that describe the operational changes and economic impacts that would occur if reserved capacity strategies were implemented in the Puget Sound region
- a consideration of safety impacts and changes in pavement deterioration rates
- a description of the public opinion survey results from all types of people who would be impacted by a redistribution of truck traffic
- a discussion of potential ITS (formerly IVHS) and Automated Highway System applications.

CHAPTER 2
LITERATURE REVIEW

Literature on such topics as exclusive lanes, shared lanes, and truck mobility strategies was reviewed as part of this project. Learning about previous freight mobility efforts helped to direct the efforts of this project by (1) bringing to light alternative freight mobility strategies for possible inclusion, (2) identifying problems encountered during others' analyses, and (3) describing the outcomes of their efforts for comparative purposes.

SHARED HOV, BUS/TRUCK, OR DEDICATED TRUCK LANES

A shared HOV lane is a lane that is reserved for buses, carpools or vanpools, and large trucks. A bus/truck lane is a lane reserved for large trucks and buses only. Trucks and buses share many of the same characteristics, which make the idea of allowing trucks to utilize the HOV lane feasible.

Literature pertaining to trucks in high occupancy vehicle (HOV) lanes is limited. A study in Texas examined the impacts of joint truck and bus use of a limited access contraflow lane. The study concluded that a joint limited access contraflow lane should not be implemented because of low perceived trucking industry benefit. (Holder, et al 1979) The reason cited was that the trucks needed to enter and exit the facility more often than was allowed.

An international study, *Cargo Routes: Truck Roads and Networks* (Organisation for Economic Co-operation & Development 1992), examined whether evidence is sufficient to justify the creation of dedicated lanes or a completely new road network for trucks. It concluded that

> Truck-only lanes appear to be of limited value. Generally, it appears that they would reduce the operational flexibility of use of the road. Particular problems may arise where trucks try to overtake other trucks or where the road is heavily congested and the trucks are traveling faster than vehicles in the other lane(s). (Organisation for Economic Co-operation & Development 1992)

Public acceptance of a truck-only lane was also discussed by the *Cargo Routes: Truck Roads and Networks* report, which concluded that they may be unpopular with the public. (Organisation for Economic Co-operation & Development 1992) A truck-only lane may be viewed as not providing benefits because the general public would not be able to use them. More efficient transportation of food and goods is not clearly understood as a benefit by the general public. Cooperative truck-HOV lanes may receive the same public disapproval because trucks may be perceived as receiving special treatment.

A 1979 study by R.J. Hansen and Associated Ltd., researched two options: (1) the addition of unreserved lanes, and (2) adding separate busways. The study concluded that adding unreserved lanes was the better cost effective improvement because of the high cost of adding separate roadways. The study also noted that for either of these options, passenger cars received 60 to 70 percent of the derived benefits. This indicates that the majority of benefit from freight mobility strategies that added lanes would go to the general public, increasing the likelihood of their favor.

CONGESTION

Congestion is a concern on most urban freeways. Not only does congestion continue to increase annually, but truck volumes are also rising. The 1987 annual growth in truck traffic nationally was estimated to be approximately 7.5 percent, whereas the annual growth in all traffic was 4.9 percent. (Organisation for Economic Co-operation & Development 1992)

The relationship between freight mobility and congestion is an important one because congestion reduces the efficiency of trucks and results in higher costs for moving goods. Congestion may make regions less competitive because of higher transport costs, including the costs of fuel consumption, wear on transmission systems, driver stress, driver time, vehicle purchase, fleet inefficiency, and the likelihood of accidents. Congestion also requires trucks to move slowly, worsening noise and pollution levels. (Organisation for Economic Co-operation & Development 1992)

Freight mobility strategies can have important economic impacts in urban areas. Giving trucks timely and reliable access to the urban area during daytime hours cuts the costs of goods delivery, and this must be weighed against the impact of trucks on daytime congestion. Most congestion management techniques point to truck restrictions of some sort, mainly by limiting hours of usage or limiting lane usage, and do not take into consideration economic effects. However, the *Regional Freight Mobility Action Packages* report developed for the Puget Sound Regional Council (Harvey Consultants Inc. 1994), clearly states that freight movement must be protected from policies that will restrict general purpose lanes, especially if general purpose lanes are being converted to HOV use. In fact, it suggests that selective freight be allowed access to HOV lanes if general purpose lanes are being taken away.

Millendorf (1989) reported that the following measures would be appropriate for freight carriers to take to alleviate congestion on limited access facilities:

1) utilize communication systems that provide timely and reliable traffic advisories
2) implement automatic vehicle identification (AVI) systems to record passage and to bill trucks using toll facilities
3) support efforts to implement transportation systems management (TSM) programs to increase vehicular capacity.

All three of these measures are either being utilized or are available in the Seattle area to some extent. The Washington State Department of Transportation (WSDOT) has a nationally recognized freeway management program in Seattle, with ramp metering, variable message signs, a computer generated congestion map that shows levels of traffic congestion on limited access facilities, and peak-period traffic reports. The congestion map can be adapted for use in trucks equipped with a laptop computer and cellular modem, making timely and reliable traffic information available to truck drivers. In addition, WSDOT and two local transit agencies are conducting AVI research.

Truck restrictions may actually increase what is perceived by motorists to be congestion. (Congestion is a function of vehicle speed and traffic volumes and not directly related to the distance between vehicles or headway.) Garber and Gadiraju concluded that restricting trucks to the right lane resulted in a decrease in vehicular headways in that lane. This decrease was significant on three-lane (one-direction) highways carrying AADT of greater than 75,000 and a truck proportion of greater than 3.6 percent and on two-lane (one-direction) highways with AADT of greater than 23,000 and a truck proportion of greater than 32 percent. (Gaber and Gadiraju 1990) These conditions are met on Washington state urban freeways and require additional consideration when a right-side truck mobility facility is considered.

As mentioned, congestion has economic effects on freight mobility, but it also has social and environmental effects. For example, daytime congestion may cause a truck company to begin nighttime operation, which may lead to environmental problems such as higher nighttime noise levels. Trucks that operate during the daytime may increase air and noise pollution because of slower travel speeds. Social losses would be associated if, for example, a firm lost jobs because it could not provide timely transport. (Organisation for Economic Co-operation & Development 1992)

All proposed freight mobility strategies discussed within this report are related to improving mobility during congestion; however, it is obvious that some of these strategies will provide better mobility under congestion than others. For example, providing trucks with a reserved lane would certainly eliminate general traffic congestion, but this strategy is cost-prohibitive within most urban areas where widening is restricted. If the reserved truck lane were adjacent to rather than separate from the general purpose lanes, enforcement might be an issue if the lane were on the same side of the roadway as on- and off-ramps (i.e., the lane would be difficult to enforce with all entering and exiting traffic crossing through it).

SAFETY

Truck safety is not directly related to freight mobility. However the impacts of the various freight mobility strategies on safety must be understood. The following factors have been identified as having the greatest impact on highway truck safety:

1) directional and advisory roadway signing
2) roadway infrastructure components such as pavement conditions, ramp geometrics, and protective barriers
3) provisions for traffic safety at construction and maintenance sites. (Garber and Gadiraju 1990)

Combination vehicles are involved in a relatively small share of all motor vehicle accidents, about 1 in 7 to 1 in 5. But when accidents do involve trucks, they tend to be more serious, and they include a higher share of fatalities. (Organisation for Economic Co-operation & Development 1992; Transportation Research Board 1985)

Grenzeback et al (1990) concluded that "the volume of large trucks on the freeways does not have a significant effect on peak-period congestion but that truck-involved incidents and accidents do affect congestion significantly." Only when truck volumes exceed 10 percent is congestion affected by trucks. (Grenzeback et al 1990)

Roadway design is an important factor in many truck accidents. The WSDOT design standards for HOV lanes and the recommended design standards for trucks were compared. In general, the requirements for the HOV lanes meet truck design standards because the HOV lanes must accommodate buses. Possibly the element of greatest difference is shoulder widths because most WSDOT HOV lanes through Seattle were built in the existing roadway width, leaving very little room for shoulders.

PAVEMENT EFFECTS

Trucks increase pavement costs by reducing the service life of existing pavements. Not only is the interval between initial paving and resurfacing shortened, but a thicker pavement layer is required for resurfacing. (Transportation Research Board 1985) Because

the volume of buses using Seattle area HOV lanes is low, the current reduction in pavement life is not substantial; allowing large volumes of trucks in the HOV lanes would increase pavement deterioration.

SUMMARY

The literature on freight mobility strategies does not provide encouraging results. Reserved lanes for trucks may not be cost effective or may have limited mobility value. In addition, the real benefits may be for the general public and not for freight operations. Congestion is the root of the freight mobility problem, and it creates a multitude of complications for large truck operators. AVI or TSM devices may provide truck drivers with real-time information and tools to avoid congestion and to define alternative routes through or around urban areas.

CHAPTER 3
RESEARCH APPROACH

STUDY SCOPE

The first step in the research was to define the study scope. In defining the scope of the study, researchers considered (1) the geographic study area, (2) the variety of reserved capacity strategies for freight mobility, and (3) the public/private partnerships available to implement freight mobility improvements.

Geographic Study Area

The study focused on major freight movement routes in urban areas in the Puget Sound region. Two major trucking corridors exist. Interstate 5 runs north to south from the Canadian border, through the Seattle central business district, and through Oregon and California, where it joins Interstate 10 and heads east through Arizona, New Mexico, and Texas. Interstate 90, the major east to west route in this region, originates in the Seattle central business district and runs east, through the eastern half of Washington State, then Idaho, Montana, and beyond.

Both I-5 and I-90 provide convenient routes for transporting goods that arrive at the Port of Seattle for shipment to other parts of the nation. In addition, I-5 is a convenient route for transporting goods that arrive at the Port of Tacoma. I-5 and I-90 also provide convenient access between urban areas for short-haul deliveries.

Secondary truck routes that were included in the geographic scope of this study include State Route 520, a limited east-west route connecting the Seattle central business district and Bellevue, and I-405, a north-south route on the east side of Lake Washington. See Figure 3.1.

Reserved Capacity Strategies

A variety of reserved capacity strategies were examined, from the most extreme to the least extreme. Exclusive truck lanes were considered, as were shared lanes. The truck

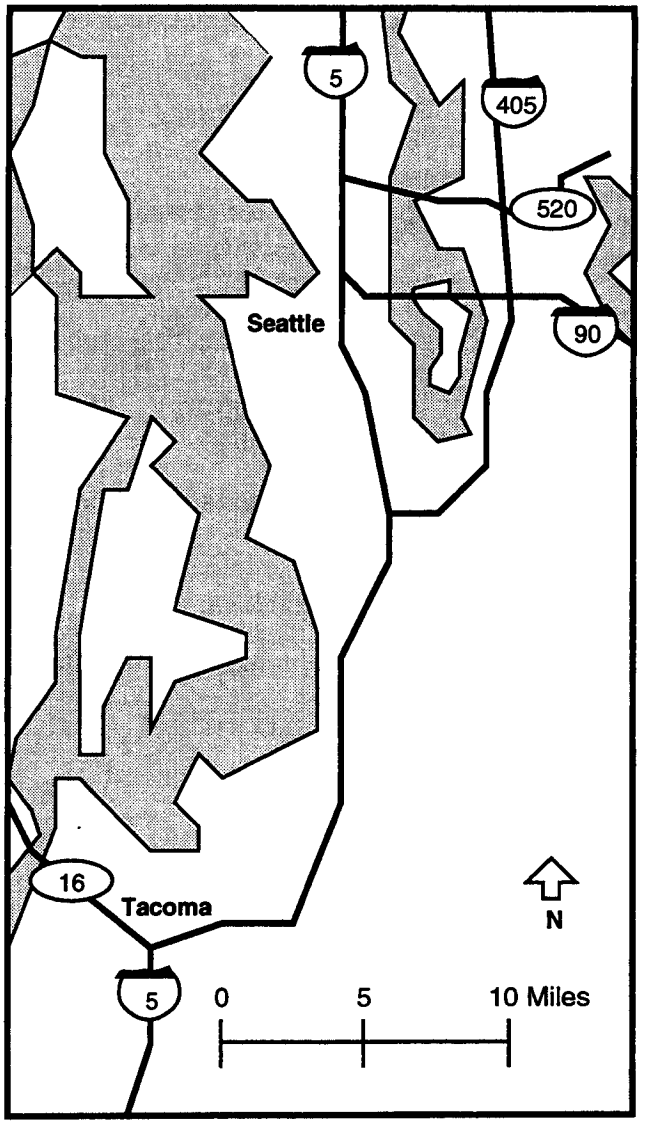


Figure 3.1 Major Puget Sound Truck Routes

classes that would be affected by the redistribution varied. For example, the truck redistribution applied only to large trucks of a certain class in one case, small delivery trucks in a second case, and all trucks in a third example.

Other variables included the number of lanes set aside for capacity sharing strategies, the particular lane set aside, the access and egress areas affected, the entrance

and exit activity of the trucks, traffic volumes, and continual operation or peak period operation.

Public/Private Partnerships

Within the trucking arena, the possibility for partnerships is tremendous. Such partnerships may include

- federal, state, and local governments partnering with trucking companies
- government policy makers and highway engineers partnering with manufacturers and the trucking companies
- partnering among states and countries to standardize regulations and requirements
- ITS engineers and trucking companies.

In addition, private/private partnerships including partnering between shipper and carrier, and carrier and carrier, may ultimately occur.

OPERATIONAL ANALYSIS

The operational analysis consisted of (1) collecting the necessary traffic and truck related data to support the traffic simulation, (2) performing the traffic simulation and estimating the economic impacts of reserved-capacity strategies, (3) examining impacts to safety as a result of redistributing truck traffic, and (4) predicting a change in pavement deterioration rates as a result of the truck traffic redistribution.

Traffic Simulation

To measure the impact of reserved-capacity strategies on freight productivity improvements, several traffic assignment software packages were considered. The traffic assignment package chosen is a standard user equilibrium assignment package that has been previously applied to the Seattle network with considerable success (Garrison and Mannering 1990). The assignment package, XXE, is a deterministic, macroscopic assignment program. It is based on the user-equilibrium theory that states that all travelers will choose routes that minimize their travel times and user equilibrium will exist when no travelers can unilaterally improve their travel times by changing routes. The package

predicts traffic flows on individual highway links for a highway network using an origin-destination matrix, the physical characteristics of the highway network, and highway link performance functions (functions that relate travel time to traffic volume). A more detailed explanation of the mathematical formulae, assumptions, and constraints used in the methodology of the XXE program can be found in Garrison, Sebranke, and Mannering (1989).

Use of the XXE program required three input files: (1) a network file, NW.DAT, (2) a vehicle origin-destination file, OD.DAT, and (3) a control file, CN.DAT. The data required for these files to assess the two freight productivity options discussed above are described in the following sections.

NW.DAT

The NW.DAT file contained all the data pertaining to the link performance characteristics. It was structured in two parts. Each line in the first part of NW.DAT contained the highway link origin, the highway link destination, the length of the link, the capacity of the link, the speed limit of the link, and a short description of the link. A more detailed explanation can be found in Garrison et al (1989). The general format of this input file is shown in Table 3.1. The data in this file had to be sorted by ascending order, first the "from" nodes and then the "to" nodes.

Table 3.1. The Format of NW.DAT Input File

Columns	Format	Description
1-4	I4	"From" node or A-node of link
5-8	I4	"To" node or B-node of link
9-13	F5.2	Link length, miles
14-18	F5.0	Capacity at LOS E
19-21	F3.0	Free flow speed on link, mph
22-41	5A4	Link description

OD.DAT

The OD.DAT file contained all the information needed from the origin-destination matrix. Each line of this file listed the origin, the destination, and the number of vehicles that travel from the origin to destination in the period of interest. The format of this file is shown in Table 3.2. Like the NW.DAT file, the OD.DAT file had to be sorted in ascending order, first by origin zone and then by destination zone.

Table 3.2. The Format of OD.DAT Input File

Columns	Format	Description
1 - 4	I4	Origin zone
5 - 7	I3	Destination zone
8 - 12	F5.0	Trips from origin to destination

CN.DAT

The CN.DAT file described the files NW.DAT and OD.DAT and also described the main program values for convergence (convergence criteria for the user equilibrium Frank-Wolfe algorithm), the maximum number of iterations if Frank-Wolfe algorithm convergence was not achieved, and the type of printout desired. The format of this data file is presented in Table 3.3.

Table 3.3. The Format of CN.DAT Input File

Columns	Format	Description
1 -5	I5	Total number of links
6 -10	I5	Number of zones
11 -15	I5	Total number of nodes
16 - 20	I5	Number of transportation links
21 - 25	I5	Number of records on OD.DAT
26 - 30	I5	Number of first network node
31 - 38	F8.5	Convergence criterion
39 - 41	I3	Maximum number of iterations
42 - 44	I3	Print centroid connectors (1 = yes, 2 = no)

Network Description

The application of the user equilibrium model to the Seattle-area highway network (as shown in Figure 3.2) required that highway links and nodes be specified and that the origin-destination characteristics of both truck and passenger-vehicle travel be determined. The manner in which this was done is described below.

Links and Nodes. The network defined for this analysis consisted of 1002 directional links, 277 nodes, and 30 origin and destination zones (these are shown in Figures 3.2, 3.3, and 3.4). Of the 1002 directional links, 503 were transportation links; the remaining 499 links were access links between the transportation network and the zone centroid. It was impractical to include all the streets and intersections in the model; instead, the freeways, highways, and major arterials were used to represent the network. All other streets were assumed not to contribute significantly to the volumes of interzonal traffic and, more importantly, were assumed to have minimal impact on travel times and overall traffic congestion resulting from the implementation of the proposed options. Given that trucks

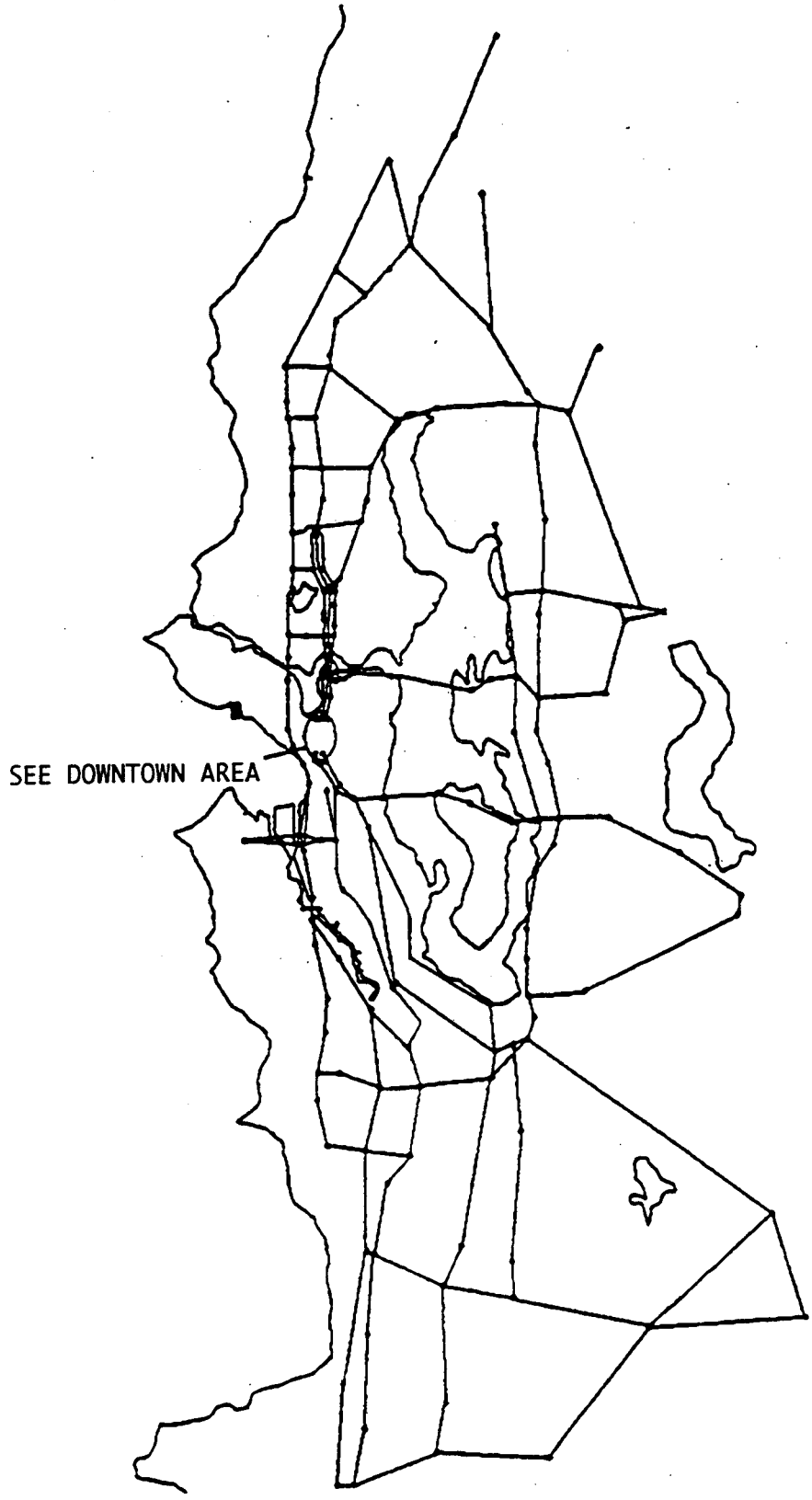


Figure 3.2. Network

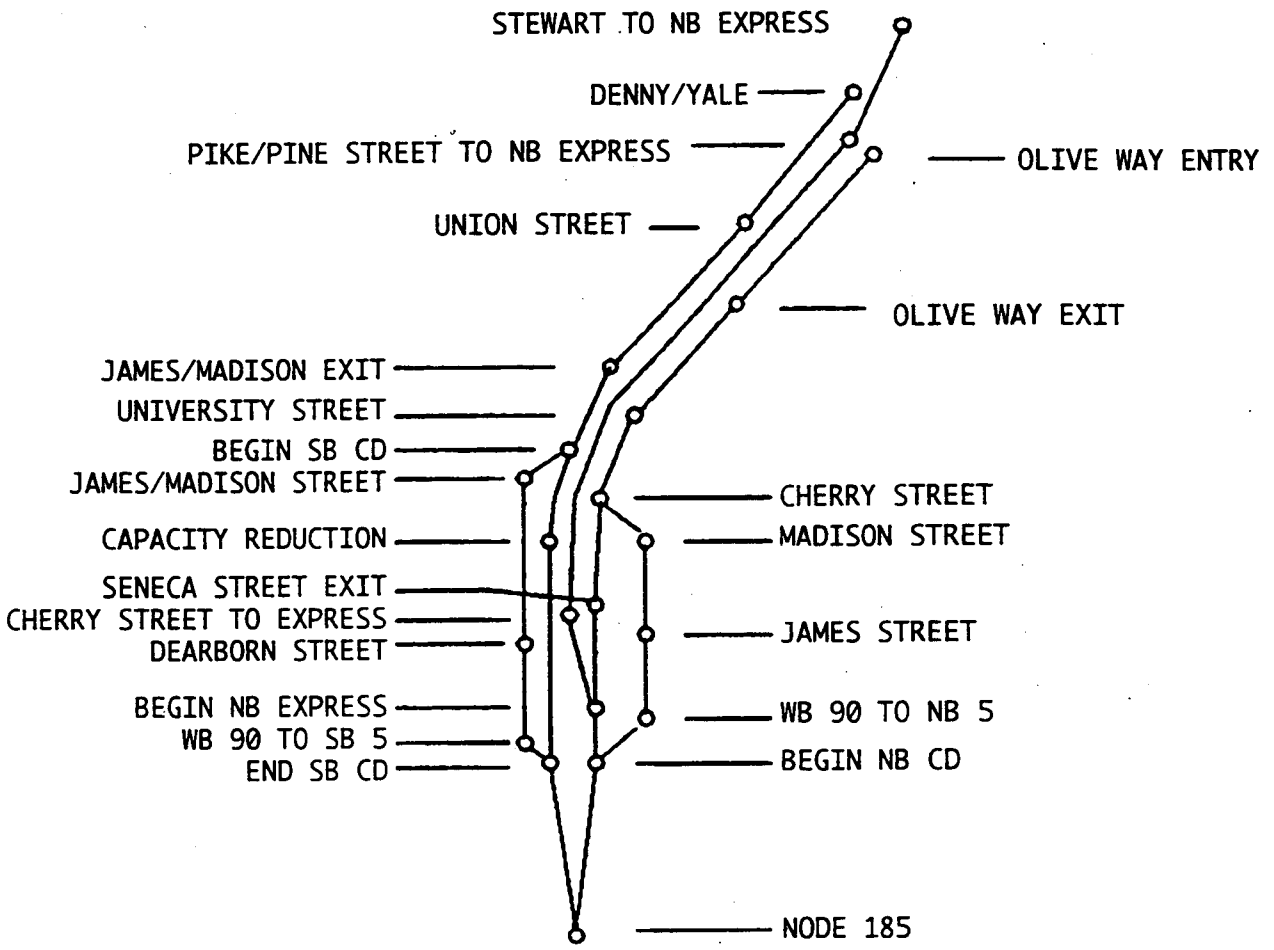


Figure 3.3. The Network in Downtown Seattle

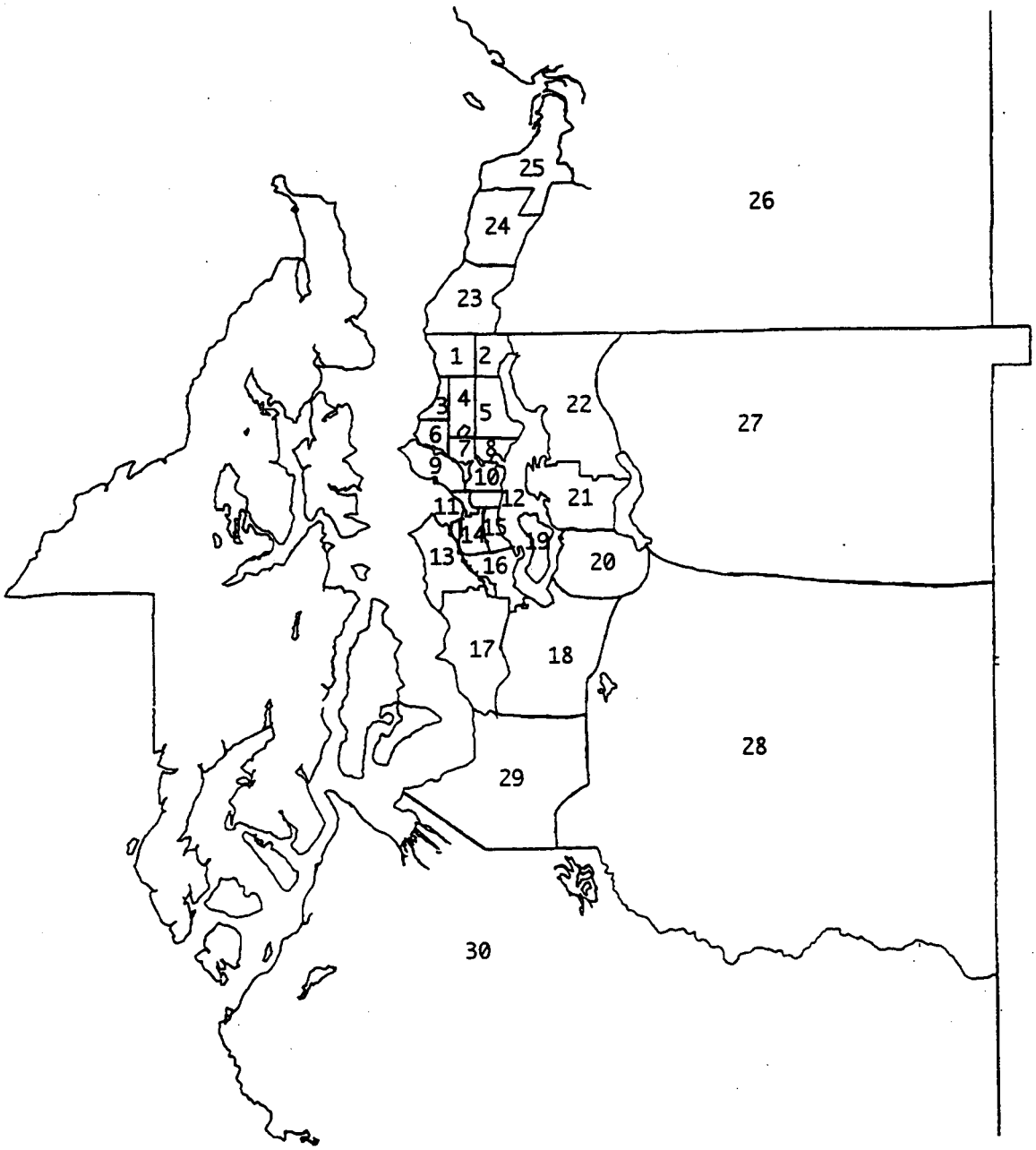


Figure 3.4. Aggregated Zones

would be unlikely to use the many residential streets that were not included, these were reasonable assumptions.

The highway links included in the analysis described the primary commuting routes and common diversion routes within the Seattle-area. Routes included were I-5, I-90, I-405, SR 99, SR 104, SR 167, SR 202, SR 509, SR 518, SR 520, SR 522, SR 599, SR 900, SR 908, and a number of arterials.

Origin and Destination Data. Origin and destination matrices for single occupancy and high occupancy vehicles were obtained from the Puget Sound Regional Council (PSRC). This information was available for the year 1990 at the traffic analysis zone (TAZ) level. However, because the PSRC origin-destination file was too detailed for the proposed analysis, the 512 traffic analysis zones used in the PSRC file were aggregated into the 30 zones used in the study (as shown in Figure 3.4). Also, because traffic assignment models usually deal with a 1-hour peak period, 1-hour morning peak-period data were derived for use in this analysis,by converting the 3-hour morning peak data provided by the PSRC. The 3-hour O-D data were initially converted to 1-hour data by dividing all trips contained in the origin-destination file by three, with the assumption that the 3-hour peak period trip table provided by PSRC could be made to simulate a 1-hour peak period through equal division. However, with this adjustment, XXE predicted most flows to be considerably lower than actual flows. This tendency for the XXE model to underestimate flows was mostly likely due to the aggregation of zones and trip patterns of morning commute hours and the fact that there had to be some variation among the three hours of the morning peak period (i.e., one hour had to have higher flows than the other two). Given this problem, the 1-hour peak data were derived from the 3-hour data by dividing by 2.6 (1.5 for the HOV O-D file). This division produced flows close to the actual morning peak-hour traffic counts. This procedure followed that previously used in Garrison and Mannering (1990).

Because truck origin-destination (O-D) data were not available, a systematic iterative approach was adopted in which a truck O-D matrix was assumed and the truck flows associated with this matrix (as estimated by the XXE traffic model) were compared to actual observed truck flows. If estimated truck flows deviated from observed truck flows, the O-D matrix was revised, and the process was repeated until model-estimated and observed truck flows were virtually identical. As an initial point, the truck O-D matrix was first approximated by using 5 percent of the single-occupancy vehicle's O-D trip matrix because trucks make up about 5 percent to 8 percent of Seattle-area traffic. The assumption of 5 percent provided a good starting point and matched actual truck-count data reasonably well. Socio-economic data from 1990 census were also used in approximating the truck O-D matrix by giving information on areas of high commercial and industrial activity. This information was used in updating the O-D matrix from one iteration to the next.

Note that this iterative procedure does not produce a unique solution. That is, in theory, many different O-D matrices can produce the same observed truck flows. However, this approach of using the single-occupancy O-D matrix along with census data on economic activity provided some confidence that the constructed truck O-D matrix was close to the actual truck O-D matrix.

Model Calibration

After the appropriate data for the network (highway-link information) were entered, a simulation of the existing traffic flows was run. The simulation required three O-D matrices—one for single-occupancy vehicles (SOVs), one for high-occupancy vehicles (HOVs), and one for trucks. The traffic indicated in these three matrices was assigned sequentially (a simultaneous assignment is not mathematically possible within the XXE model and might not be realistic because of the link choices that are made by HOVs while en route). It seemed natural that the simulation-running sequence should be SOVs, HOVs, and trucks. SOVs do not have choices with regard to HOV lanes, so they were naturally assigned first. HOVs can decide to take HOV lanes in response to observed congestion on

the general purpose lanes and thus can respond to observed SOV traffic flows. Therefore, they were assigned second. Finally, truck drivers are arguably the most knowledgeable people in the route-choice process because of their experience, the skill of their dispatchers, and their ability to communicate with other truck drivers to exchange traffic information. Their being assigned last suggests that they are able to respond to observed SOV and HOV flows, which was a reasonable assumption.

Given this assignment order, the calibration process was conducted. The objective of calibration was to replicate actual traffic flows on the network. The process of calibrating the model involved three steps. First, access-link lengths (i.e., those links that allow trips from the centriods of traffic zones to the physical highway network) were adjusted, zonal-centroid to highway-network access points were added, and the access-link capacity was adjusted (these access links are not physical highway links, and thus their length and capacity are intended to represent the difficulty that travelers in the traffic zone encounter, in terms of distance and congestion, when gaining access to or egress from the physical highway network).

Second, the network was refined. This process included adding and deleting links and nodes and adjusting capacities, lengths, and speed of various links to closely approximate the actual vehicle counts. Third, the origin-destination matrices were adjusted using a procedure similar to that described above for the creation of the truck O-D matrix (in fact, the truck O-D matrix was created simultaneously during this calibration process). Details on these last two steps of the calibration process are presented below.

The actual calibration process could not begin until the XXE model had been run error-free. This step involved a painstaking search through the NW.DAT and CN.DAT files to determine whether any links had been omitted or improperly coded. In terms of coding, data on no-turning restrictions were collected, and, to prohibit vehicles from traveling on turning-restricted links, separate links and nodes were defined for each

direction of travel. This problem proved to be significant near the Seattle central business district.

Once a successful run had been accomplished, the links of the modeled network were refined to provide a more accurate description of existing conditions. To account for merging, weaving, and geometric effects, the capacity determination procedures outlined in the HCM (Highway Capacity Manual 1994) were used to determine link capacity, a critical input element. The overall calibration procedure is summarized in Figure 3.5.

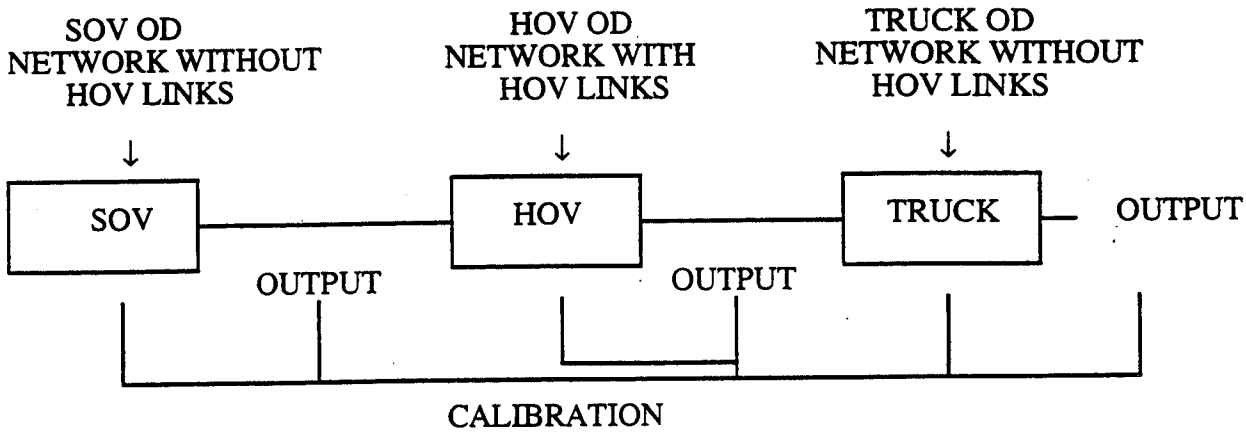


Figure 3.5. Calibration Process

Economic Impacts

In quantifying the economic impact that reserved capacity strategies for trucks might have on the Puget Sound region, the researchers considered the potential savings of time and money to individual drivers. These estimations can be extrapolated to the industry as a whole. Economic estimates were based on annual trucker salaries in the state of Washington and on improvement in mobility, as indicated by an increase in travel speed and a decrease in travel time.

Safety Impacts

Considering the types of accidents that would occur on the basis of increased lane change activity allowed the researchers to judge whether truck traffic redistribution would decrease the facility's level of safety. For example, if the number of accidents involving lane changing maneuvers was high, a strategy such as a reserved lane that encouraged a higher number of lane changes might not improve or even maintain facility safety. Traffic accident records were obtained from WSDOT.

Pavement Deterioration Rates

Little research has quantified the effects of increasing truck traffic in some lanes and decreasing it in other lanes. It is difficult to determine the effects because so much time must pass before a noticeable change in pavement deterioration rates can be observed empirically. However, ESAL and pavement deterioration relationships based on weight and repetitions are well known and were applied for analysis purposes.

Pavement deterioration rates were examined to determine the impacts that would result from a redistribution of trucks across a facility. This phenomenon is best described in terms of change in the present serviceability index (PSI). After years of repetitive loads, the pavement reaches a terminal serviceability index (TSI), which indicates that the road needs repair. For this study, a value of 2.5 was assumed for the terminal serviceability index. If no distribution of truck traffic occurred, the facility would reach the TSI at a specific time, assuming normal growth patterns. With redistribution of trucks across the

facility, the TSI will be reached earlier or later, depending on whether trucks are being moved into or out of a lane, respectively.

PUBLIC OPINION SURVEY

Attitudinal surveys were developed and distributed to all parties that would be impacted by truck traffic redistribution. These parties included the trucking industry, truckers, motorists who did not use HOV lanes, motorists who did use the HOV lanes, transit companies, bus drivers, and the Washington State Patrol.

The surveys included questions regarding actual travel characteristics (e.g., frequency of travel on routes, time of day of travel) and background characteristics (e.g., age, sex, and the types of vehicles operated). The surveys also included speculative questions, such as

- Will redistributing truck traffic provide improvement to the traffic flow?
- Will redistributing truck traffic further hinder traffic flow or introduce other negative impacts?
- Will concentrating trucks in certain lanes present safety problems?
- Will special enforcement be required?
- Should restrictions be 24 hours a day?
- Would this change be likely to reduce accidents?
- Would the respondent be willing to pay a usage fee to use a reserved capacity lane?

The surveys are contained in the appendix. Below is a summary of their main sections.

Section 1: Driving Characteristics

For each of the five surveys this section asked questions related to the frequency of travel on urban freeways and the freeway routes used most often.

Surveys distributed to the general public, bus drivers, and traffic enforcement personnel asked questions related to

- the usual mode of travel to work

- HOV lane usage
- the most frequently used route.

Surveys distributed to large truck operators and truck company representatives asked

- about their usual lane of travel on urban freeway segments
- whether they frequently encounter congestion
- whether they change their route in response to congestion.

Section 2: Preferences

The second section of the surveys allowed the respondents to state their preferences regarding large truck mobility strategies. This section was identical for the general public, truck driver, truck company, and bus driver groups. The traffic enforcement survey included additional questions related to enforcement concerns. Members of each group were asked to indicate their preferences regarding

- the type of freight mobility lane strategy, the choices being
  a) a truck-only lane
  b) a truck/bus-only lane
  c) allowing trucks into the HOV lane
- the location of a reserved lane
- whether drivers would change their current driving habits if one of the freight mobility strategies was implemented.

Section 3: Opinions

The third section of the surveys allowed the respondents to state their opinions on freight mobility strategies. This section was identical on all surveys. A subjective rating scale allowed the respondent to strongly disagree, disagree, be neutral, agree, or strongly agree with each of the questions. Questions related to

- whether the various freight mobility strategies would improve safety or congestion

- whether large trucks should get the same travel benefits as HOVs and public transit
- whether large trucks are vital to the U.S. economy.

Section 4: Background

The fourth section of the surveys was intended to collect socioeconomic information such as age, income, years as licensed driver, number of vehicles in household, and more. This section allowed further description of each group.

Target Group Population Sampling

A mail survey was used for the majority of the data collection because it allowed more detailed information to be collected, while cost was not prohibitive. A small proportion of surveys was distributed in person at local truck stops. Surveys were distributed to 1,885 general public drivers, 338 large truck operators, 150 truck company representatives, 200 bus drivers, and 148 traffic enforcement personnel (WSP). Survey participation was voluntary. Respondents were assured anonymity. Survey respondents were given approximately two weeks to respond to the surveys, although no surveys were excluded from the study for being late.

The sample population for the general public target group was obtained from random vehicle license plate numbers taken from several locations on urban Puget Sound region freeways (I-5, I-405, and SR 520) that have HOV lanes. Two groups of license plate numbers were sent to the Washington State Department of Licensing (DOL) to obtain the addresses of the licensed vehicle owners. (The second group of licensed owner addresses was requested because the first group did not contain enough addresses for the study.) The first group of requested license plates contained 1,059 numbers. From these, 1,022 addresses were returned, of which 928 were usable. The second group of license plates contained 1,314 numbers. From these, 1,114 addresses were returned, of which 957 were usable. The 1,885 postage-paid surveys were mailed to the households of the

licensed owners requesting that the most frequent driver within the household fill out the survey.

The truck driver sample was obtained by handing out 368 postage-return paid surveys on a weekday in September of 1995 at two interstate truck stops. The truck stops were both located in the Puget Sound area, one east of Seattle (North Bend) near I-90 and the other south of Seattle (Federal Way) near I-5. The respondents were recruited on a first-come first-served basis. Each driver who chose to respond was allowed to fill out the survey and hand it back at that time or take the survey and return it by mail.

Two companies that utilize large trucks were contacted to participate in this study, Safeway and the United Parcel Service (UPS). Both agreed to participate. Safeway was faxed a copy of the survey and made copies for its truck drivers. The main UPS office in south Seattle was sent 100 postage-paid surveys for its truck drivers.

The Washington State Trucking Association (WTA) was given 200 mail surveys for distribution to trucking companies. They were distributed within mailings to WTA members.

The operations management at Metro Transit received 200 bus driver surveys. The management at Metro distributed the surveys to bus drivers who had routes on freeways with HOV facilities. The operators were asked to complete the surveys and return them to management, who then mailed them together. Filling out the survey was not mandatory, and the bus drivers were not paid to do so.

The traffic section of the Washington State Patrol (WSP) at the Bellevue office was sent 148 traffic enforcement personnel surveys. The supervisors of each section were responsible for handing out the surveys, and each officer was allowed to return the survey by mail. Filling out the survey was not mandatory.

The survey data were entered into a 486 100-MHz personal computer for analysis using SST 1.1 (Statistical Software Tool, California Institute of Technology, CA) for modeling, and Excel 5.0 (Microsoft, Seattle, WA) was used for general data analysis. A

multivariate analysis helped determine the socioeconomic characteristics of the respondents who had positive or negative attitudes toward the mobility strategies.

CHAPTER 4
OPERATIONAL, SAFETY, AND PAVEMENT IMPACTS

TRAFFIC FLOW

This project evaluated the traffic-related impacts of two freight reserved-capacity improvement options in the Seattle area: (1) a policy that would permit heavy trucks (single-unit and tractor-trailer) to use high-occupancy vehicle (HOV) lanes and (2) a policy that would add a lane for the exclusive use of trucks on all facilities that have existing or planned HOV lanes. In evaluating these two options, the researchers sought to determine the impact of the options on the vehicle travel time and vehicle miles traveled by single occupancy vehicles (SOV), high occupancy vehicles (HOV), and heavy trucks. On the basis of these impacts, the potential freight productivity improvements and impacts on passenger travel can be assessed.

The first option, allowing heavy trucks to use the HOV lanes, has the potential to be easily implemented in terms of capital costs (as discussed elsewhere in this report, there are other obstacles to implementation, including political and safety concerns). The second option, adding a lane for the exclusive use of trucks to all facilities that have existing or planned HOV lanes, is an expensive capital proposition and would require a substantial shift in state transportation policy. Still, the project considered this alternative because it present an upper limit to the potential freight productivity improvements that could result from reserved-capacity strategies.

Calibration Results

The results of calibration are shown in Table 4.1. This table lists the many links that were considered crucial in the calibration process. Most of the links that were considered important for calibration efforts were those of I-5, Interstate 90, I-405 and SR 520.

The network was considered calibrated when most traffic volumes were within 20 percent of the measured counts obtained from the WSDOT's Ramp and Roadway Report, 1990. For truck counts, the State-Highway Log planning report was used. The State-Highway Log contains average daily traffic (ADT, all vehicles), peak-hour truck percentage, K-factor, D-factor, and total trucks. There were no direct data for calibrating morning peak truck volumes. To arrive at an approximation of the morning peak-hour volume, the following equation was used:

Morning peak-hour truck volume = ADT*K*D peak-hour truck percentage

The truck-count results shown in Table 4.1 must be viewed in light of the fact that the differences presented in this table tend to exaggerate the inaccuracy involved. This is because actual truck volumes were small, many below 100 per hour, and the percentage differences between model-estimated and actual truck volumes tended to be large. For example, an observed count of 20 and an estimated volume of 30 would give a 50 percent difference even though the actual inaccuracy (10 trucks) was comparatively small. Given this, the estimated truck volumes shown in Table 4.1 are quite reasonable.

Table 4.1. Calibration Results

ORIG	DEST		SOV +	HOV +	TRUCK			Actual (Total)		TRUCK	
NODE	NODE	CAP.	FLOW	FLOW	FLOW	TOTAL	NAME	Count	% Diff.	COUNT	% DIFF
61	62	4650	4162	188	387	4737	SB5:526 TO 128TH	4290	10.42		
62	61	4650	5010	169	217	5396	NB5:128T TO 526	5225	3.27	259	-16.22
62	63	4650	4330	161	275	4766	SB5:128T TO 164TH	5240	-9.05		
63	62	4650	4358	150	139	4647	NB5:164T TO 128TH	5055	-8.07		
63	64	6200	6471	161	275	6907	SB5:164T TO 405	5875	17.57		
64	63	6200	5674	224	285	6183	NB5:405 TO 164TH	4820	28.28	264	7.95
64	65	6000	6830	224	152	7206	SB5:405 TO 196TH	5725	25.87		
64	94	3100	3207	63	151	3421	SB405: 5 TO 527	3685	-7.16	156	-3.21
65	64	6000	5237	57	107	5401	NB5:196T TO 405	4775	13.11		
66	67	6000	5656	224	175	6055	SB5:44TH TO 220TH	5530	9.49		
66	117	1500	376	0	8	384	524 5 TO 99			24	-66.67
67	66	6000	3375	57	107	3539	NB5:220T TO 44TH	4255	-16.83		
67	68	6000	5808	224	175	6207	SB5:220T TO 236TH	5220	18.91		
68	67	6000	3409	57	107	3573	NB5:236T TO 220TH	3180	12.36		
68	69	6000	7069	0	263	7332	SB5:236T TO 205TH	6170	18.83		
69	68	6000	4539	75	212	4826	NB5:205T TO 236TH	3875	24.54	205	3.41

69	70	6000	6160	0	344	6504	SB5:205T TO 175TH	6140	5.93		
69	162	1550	1402	8	53	1463	E104 5 TO 522			63	-15.87
70	69	8000	2962	0	158	3120	NB5: 175th to 205th	3950	-21.01	230	-31.30
70	71	6000	7683	0	410	8093	SB5: 175TH TO 145TH	6560	23.37		
71	70	8000	3879	0	205	4084	NB5: 145T TO 175TH	4160	-1.83		
71	72	8000	9126	0	459	9585	SB5: 145T TO 125TH	8190	17.03		
71	229	1500	426	8	17	451	EB 145TH:ML5 TO SR5			20	-15.00
71	231	1000	780	4	26	810	WB 145TH:ML5 TO SR9			17	52.94
72	71	8000	4654	0	318	4972	NB5:125T TO 145TH	4270	16.44		
72	73	8000	8770	0	459	9229	SB5: 125T TO NORTHG	8650	6.69		
73	72	8000	4144	0	257	4401	NB5:NORTHGATE TO 13	4515	-2.52	283	-9.19
73	188	8000	4394	306	385	5085	NORTHGATE TO 85TH M	5475	-7.12		
73	236	5500	5050	0	124	5174	SBEX5 NORTHGATE TO	4240	22.03	125	-0.80
74	73	8000	2842	31	170	3043	85TH TO NORTHGATE M	4250	-28.40	281	-39.50
75	74	8000	4751	65	284	5100	LAKE CITY OFF TO 85			264	7.58
76	75	8000	6148	92	369	6609	RAVENNA OFF TO LAKE	5035	31.26		
79	223	1700	1888	19	37	1944	NB5: TO EB520	1885	3.13	45	-17.78
82	149	1800	2252	15	119	2386	RAMP:NB5: TO EB90			167	-28.74
83	82	8000	10097	222	412	10731	WEST SEATTLE FRWY T	8270	29.76	490	-15.92
85	86	8000	4323	180	193	4696	SB5:BOEING ACCESS T	4885	-3.87		
86	132	3100	2374	73	129	2576	NB5: 99 5 TO 99			85	51.76
87	86	10000	9868	386	242	10496	NB5: 405 TO 599	8585	22.26		
87	88	8000	2936	130	241	3307	SB5: 405 TO 188TH	4480	-26.18		
87	112	3000	3562	0	29	3591	N405 5 TO 167			199	-85.43
88	87	8000	8408	589	209	9206	NB5: 188T TO 405	8865	3.85		
88	89	8000	2647	193	320	3160	SB5: 188T TO MILITA			252	26.98
89	88	8000	8829	659	286	9774	NB5: MILI TO 188TH			396	-27.78
89	90	8000	2647	193	320	3160	SB5: MILI TO 516			243	31.69
90	89	8000	8829	659	286	9774	NB5: 516 TO MILITAR	7000	39.63	440	-35.00
91	90	8000	7076	612	261	7949	NB5: 272N TO 516	6210	28.00		
93	173	3100	1662	139	30	1831	N18 5 TO 167			59	-49.15
94	64	3100	4397	104	68	4569	N405 527 TO 5			72	-5.56
96	95	3100	1194	121	107	1422	N405 522 TO BEARDSL			127	-15.75
96	97	6000	4816	23	146	4985	S405 522 TO 160TH	5860	-14.93	123	18.70
98	99	6000	4816	23	146	4985	S405 124T TO 908	6510	-23.43	152	-3.95
99	98	6000	1899	178	131	2208	N405 908 TO 124TH			162	-19.14
99	182	3100	600	8	21	629	S908 405 TO WILLOWS			28	-25.00
100	101	6000	5523	15	125	5663	S405 70TH TO 520	6460	-12.34		
101	100	6000	4134	239	327	4700	N405 520 TO 70TH			293	11.60
101	102	8000	6036	46	336	6418	S405 520 TO 8TH	7225	-11.17		
101	145	4000	4377	0	34	4411	W520 405 TO LK WA B			58	-41.38
101	146	4000	1271	5	5	1281	E520 405 TO 148TH			80	-93.75
102	101	8000	5184	238	202	5624	N405 8TH TO 520	4825	16.56		
102	103	6000	5270	46	164	5480	S405 8TH TO 132ND	5205	5.28		
103	102	6000	5352	237	182	5771	N405 132N TO 8TH	6460	-10.67	231	-21.21
104	103	6000	7083	237	182	7502	N405 90 TO 132ND	6695	12.05	235	-22.55
104	105	6000	5030	254	206	5490	S405 90 TO COAL CRK	4715	16.44	231	-10.82
104	155	10000	3548	9	102	3659	E90 405 TO 148TH	3390	7.94		
105	104	6000	7329	362	128	7819	N405 COAL CRK TO 90	6295	24.21	235	-45.53
106	107	5000	4176	0	206	4382	S405 60TH- 44TH	4195	4.46		
107	106	5000	5244	0	128	5372	N405 44TH TO 60TH	4120	30.39		
107	108	5000	4662	0	206	4868	S405 44TH TO 30TH	4075	19.46		
108	109	5000	4235	0	150	4385	S405 30TH TO 900	3900	12.44		
109	108	5000	4947	0	96	5043	N405 900 TO 30TH	4530	11.32		
109	110	5000	4149	0	514	4663	S405 900 TO SUNSET	4205	10.89		
109	168	5000	1193	30	94	1317	E900 405 TO 138TH			43	118.60
110	109	5000	4056	0	145	4201	N405 SUNS BL TO 900	3720	12.93	266	-45.49
110	111	5000	4828	369	514	5711	S405 SUNS BL TO 169			347	48.13
111	110	5000	5122	250	145	5517	N405 169 TO SUNSET			266	-45.49
112	111	4000	3838	130	29	3997	N405 167 TO 169	3915	2.09		
113	87	4000	3742	37	29	3808	E518 99 TO 5	3812	-0.10	38	-23.68
115	139	4000	3115	89	151	3355	N509 518 TO 128TH			78	93.59
116	64	2000	1343	163	93	1599	S525 99 TO 405	1510	5.89	62	50.00
123	122	2500	1464	33	86	1583	N99 85TH TOHOLMAN R	2388	-33.71		
124	123	2500	3316	41	131	3488	N99 GREEN LK TO 85T			122	7.38
125	126	3600	4507	42	175	4724	S99 GREEN LAKE TO B			128	36.72
127	226	6000	3914	35	142	4091	SB SR99:BATTERY TO			161	-11.80
130	137	4000	1339	25	53	1417	S509 MWS TO CLOVERD			51	3.92
137	130	4000	2943	97	203	3243	N509 CLOV TO MWS			117	73.50
138	139	4000	2038	54	58	2150	S509 GLEN TO 128TH			51	13.73
139	115	4000	2664	28	7	2699	S509 128T TO 518			12	-41.67

139	138	4000	2569	125	247	2941	N509 128T TO GLENDA			127	94.49
140	115	4000	2084	81	103	2268	160TH TO 518	2200	3.09		
141	140	4000	2084	81	103	2268	DESMOINES WY TO 160			72	43.06
142	143	3600	3555	73	126	3754	E520 MONT TO 84TH	3850	-2.49	76	65.79
143	144	4000	1903	23	43	1969	E520 84TH TO 92ND			74	-41.89
144	145	4000	1740	23	43	1806	E520 92ND TO LAKE W			64	-32.81
145	101	4000	2611	63	136	2810	E520 LAKE WASH BLVD			74	83.78
146	147	4000	422	17	56	495	E520 148T TO 908			51	9.80
147	146	4000	1651	34	98	1783	W520 908 TO 148TH			58	68.97
149	150	4800	3175	35	169	3379	RAINIER TO LAKE WAS			179	-5.59
150	151	5400	3175	35	169	3379	E90 LAKE WASH BLVD	3850	-12.23	213	-20.66
151	150	5400	2953	0	87	3040	W90 W MERCER TO LAK	3985	-23.71	106	-17.92
153	154	6680	3290	284	174	3748	E90 E MERCER TO BEL	3045	23.09	203	-14.29
154	153	6000	4153	0	148	4301	W90 BELL WY TO E ME	5980	-28.08		
155	104	8000	4525	40	200	4765	W90 148T TO 405	5385	-11.51		
155	156	8000	3560	13	49	3622	E90 148T TO W LK SA			89	-44.94
156	155	8000	4518	19	276	4813	W90 901 TO 148TH			215	28.37
156	157	8000	3560	13	49	3622	E90 901 TO 900			122	-59.84
157	156	8000	4518	19	276	4813	W90 900 TO W LK SAM	5040	-4.50		
157	169	3100	1458	17	63	1538	W900 90 TO NEWPORT			31	103.23
159	96	3100	2678	19	82	2779	S522 202 TO 405	3055	-9.03	78	5.13
159	183	1550	13	0	94	107	S202 522 TO REDMOND			66	42.42
160	161	2500	2553	61	30	2644	S522 527 TO 68TH			26	15.38
161	160	2500	1311	4	38	1353	N522 68TH TO 527			58	-34.48
162	69	1550	1368	155	63	1586	W104 522 TO 5			71	-11.27
162	229	2000	2751	0	125	2876	SB522: SR104 TO 145			91	37.36
163	228	2000	2060	0	98	2158	SB522:SR513 TO NORT			57	71.93
170	112	3100	3391	132	90	3613	N167 84TH TO 405			181	-50.28
170	171	3100	2999	135	42	3176	S167 84TH TO 516			197	-78.68
171	170	3100	3391	132	90	3613	N167 516 TO 84TH			287	-68.64
171	176	3100	1363	120	120	1603	E516 167 TO 515			131	-8.40
172	173	3100	1625	117	234	1976	S167 277T TO 18			288	-18.75
173	172	3100	4491	103	100	4694	N167 18 TO 277TH			301	-66.78
173	179	3100	2750	36	165	2951	N18 167 TO AUB/BLK			119	38.66
182	99	3100	416	16	49	481	N908 WILL RD TO 405			35	40.00
188	189	8000	6504	275	369	7148	85TH TO 70TH AND LA	5445	31.28		
189	190	8000	7853	296	420	8569	70TH TO 50TH ML5 SB	6935	23.56		
191	192	8000	6061	191	337	6589	RAVENNA ON TO 45TH	6540	0.75		
192	193	8000	8746	330	502	9578	45TH ON TO ROANOKE	7860	21.86		
194	223	1700	1459	46	36	1541	SB5: TO EB520	1680	-8.27		
198	200	2000	2162	0	57	2219	SBEX5 DENNY/YALE TO	1845	20.27		
223	142	3600	3347	65	73	3485	EB520 TO I5 RAMPS	2915	19.55	74	-1.35
226	127	6000	3154	61	107	3322	NB SR99:DWNTWN TO B			164	-34.76
227	228	1500	240	6	13	259	NB 522:12 AVE TO NO			81	-83.95
228	163	2500	240	6	13	259	NB 522: NORTHGATE W			81	-83.95
229	71	1000	310	0	26	336	WB 145TH: SR 522 TO			15	73.33
229	162	2500	1006	19	41	1066	NB 522:146TH TO SR1			91	-54.95
231	71	1000	1332	0	43	1375	EB 145TH:SR99 TO ML			36	19.44
236	237	6000	5780	0	145	5925	SB522:LAKE CITY TO	5415	9.42		
237	198	6000	7127	170	190	7487	SBEX5:42ND TO DENNY	5600	33.70	182	4.40
238	239	2000	0	290	0	290	HOV:SB5 236TH TO 20	290	0.00		
239	240	2000	0	404	0	404	HOV:SB5 205TH TO 17	435	-7.13		
240	241	2000	0	447	0	447	HOV:SB5 175TH TO 14	480	-6.88		
241	242	2000	0	471	0	471	HOV:SB5 145TH TO 12	470	0.21		
242	243	2000	0	435	0	435	HOV:SB5 125TH TO NO	440	-1.14		
246	247	2000	0	223	0	223	HOV:SBEX5 DENNY/YAL	495	-54.95		
248	249	2000	0	46	0	46	HOV:NB5 NORTHGATE T	30	53.33		
249	250	2000	0	44	0	44	HOV:NB5 125TH TO 14	40	10.00		
250	251	2000	0	37	0	37	HOV:NB5Z 145TH TO 1	45	-17.78		
256	257	2000	0	165	0	165	HOV:W90 W MERCER TO	195	-15.38		

Simulation of Reserved Capacity Strategies and Estimates of Economic Impacts

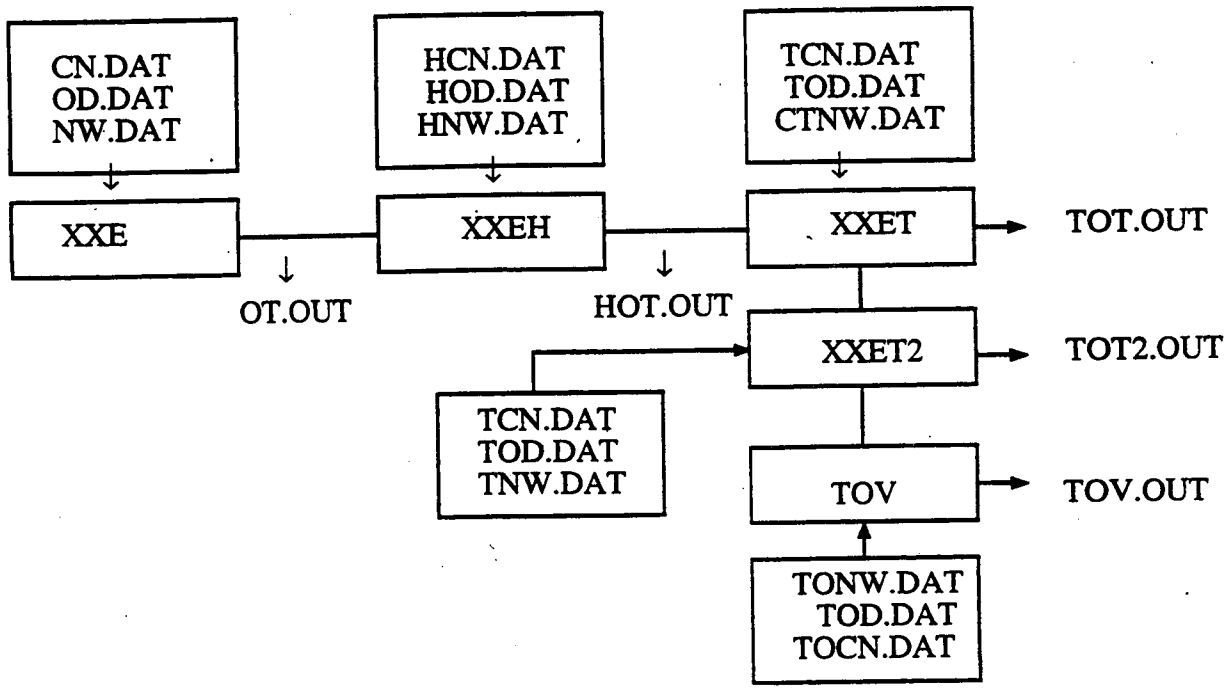
As stated earlier, two freight reserved-capacity options were evaluated: (1) a policy that would permit heavy trucks (single-unit and tractor-trailer) to use high-occupancy vehicle (HOV) lanes and (2) a policy that would add a lane for the exclusive use of trucks to all facilities that have existing or planned HOV lanes. These two reserved-capacity options were evaluated with the calibrated traffic assignment model XXE (as described above). An overview of the model application procedure is presented in Figure 4.1. It is assumed that SOVs will not travel in HOV lanes (i.e., no violators) but HOVs can travel in general purpose lanes if HOV lanes become congested or general purpose lanes otherwise provide lower travel times.

Option 1—Heavy Trucks Using High-Occupancy Vehicle Lanes

The impacts of allowing heavy trucks to use Seattle area HOV lanes (with passenger cars and buses) were estimated with the calibrated XXE traffic assignment model. The impact of this policy on traffic congestion in the Seattle area was measured in terms of the impact on vehicle travel time and total vehicle-miles-traveled. Table 4.2 gives a summarizes the results, and Figure 4.2 presents the percentage of change in travel times.

Table 4.2. Simulation Results—Impacts of Allowing Trucks to Use HOV Lanes

	Trucks using general-purpose lanes only	Trucks permitted in HOV lanes	Change in vehicle hours and miles
Single-occupancy vehicle travel times (veh-hrs)	170,680	168,260	-2420
High-occupancy vehicle travel times (veh-hrs)	4389.5	4406.6	+17.1
Truck travel times (veh-hrs)	5154.5	4758.7	-395.8
Total travel time (veh-hrs)	180,230	177,430	-2800
Total vehicle miles of travel	1,808,496	1,810,906	+2410



XXE : user equilibrium program for single-occupancy vehicle
XXEH : user equilibrium program for high-occupancy vehicle
XXET(2) : user equilibrium program for truck using HOV lane
TOV : user equilibrium program for truck using truck lane
CN : control file for XXE
OD : SOV origin-destination matrix
NW : network file without HOV links
HCN : control file for XXEH
HOD : HOV origin-destination
HNW, TNW : network file with HOV links
TCN : control file for XXET, XXET2
TOD : Truck OD
CTNW : Network file with HOV links (set HOV link capacity 0)
TONW.DAT : network file with truck lane
TOCN.DAT : control file for TOV

Figure 4.1 Simulation Process

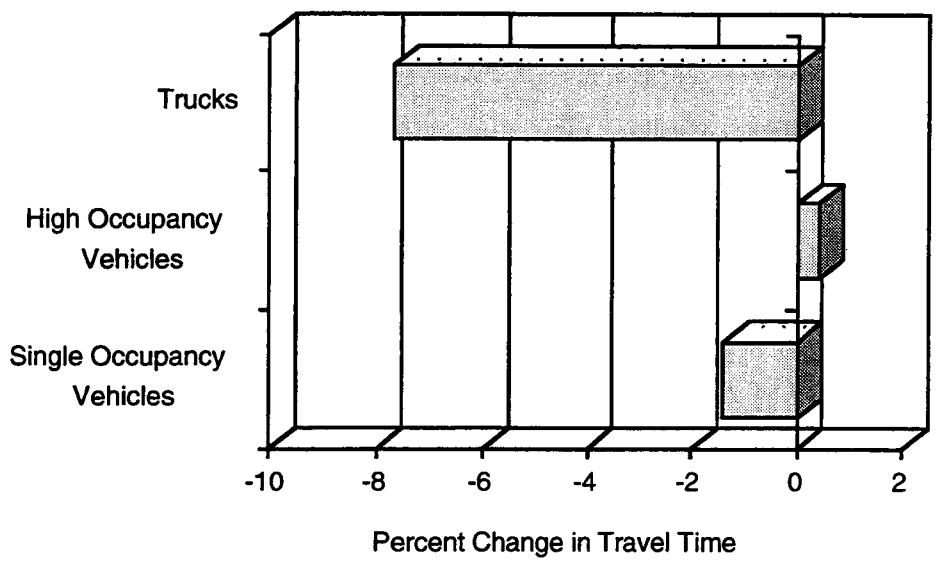


Figure 4.2. The Percentage of Change in Travel Times Resulting from Allowing Trucks to Use High-Occupancy Vehicle Lanes.

Table 4.2 shows that allowing trucks to use the HOV lanes would save single-occupancy vehicles 2420 vehicle-hours during the morning peak hour while costing high-occupancy vehicles only 17.1 vehicle hours. If the vehicle occupancy of high-occupancy vehicles is estimated at 2.2 per vehicle, this policy would produce a savings of 2382.4 person-hours during the morning peak hour. If it is further assumed that morning and afternoon peaks last about three hours with approximately the same impact, the savings would be 14,294.3 person-hours per day (2382.4 x 6, conservatively ignoring possible benefits during off-peak periods). With about 260 work days per year, the total would be 3,716,513 person-hours saved. At a time value of $8 per hour, the saving would be $29,732,102 per year.

Savings in truck travel time would be 395.8 vehicle-hours during the morning peak hour, or approximately 617,448 (395.8 x 6 x 260) vehicle hours per year. With the American Trucking Association's estimate of $15.85 per hour for the value of truckers'

time, savings would amount to $9,786,551 per year. Thus, the net annual savings (SOV plus truck travel time savings minus increase in HOV travel times) is $39,518,653.

Although these potential savings seem significant, some caution should be exercised in interpreting these results. First, the actual per-trip savings would be comparatively small, as shown in Figure 4.3. The average truck trip would save about 2.5 minutes, but whether these savings could be translated into improved productivity is questionable. This is because 2.5 minutes may be too small of a time increment to be used productively by manufacturing inventory control and truck dispatching. Second, HOV lanes in the Seattle area are currently underutilized, and thus any policy that increased their use would have a comparatively large impact on total vehicle travel time (e.g., the almost 3.7 million person-hours saved per year). Thus the impact on non-truck travel is not necessarily an artifact of the truck reserve-capacity policy but an underlying characteristic of the highway system.

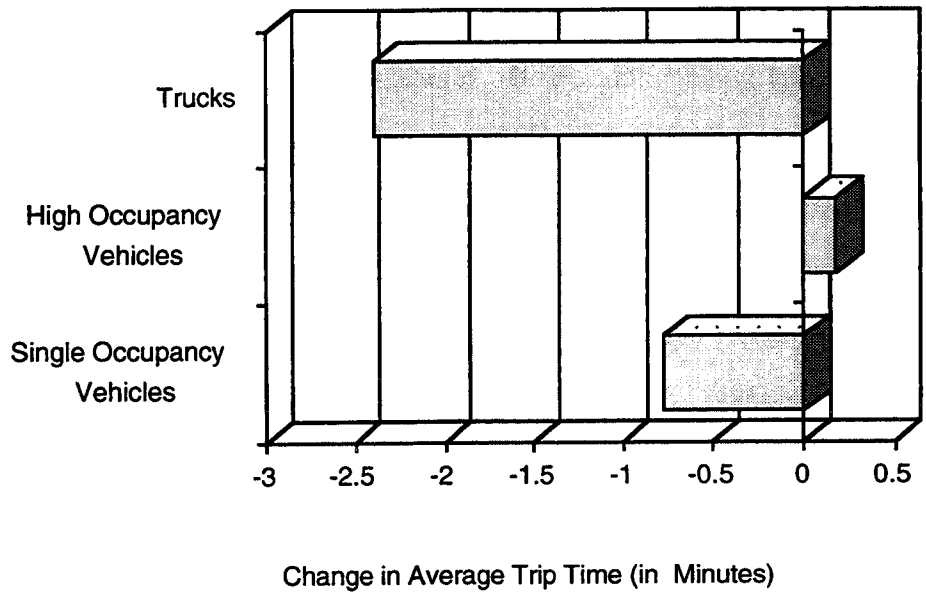


Figure 4.3. The Change in Average Trip Time Resulting from Allowing Trucks to Use High-Occupancy Vehicle Lanes.

To be sure, an unmeasured possible benefit of allowing trucks to use the high-occupancy vehicle lanes would be the potential reduction in the variance of trip travel times. For example, if an average trip travel time of 30 minutes, with a standard deviation of 20 minutes, could be reduced to an average trip travel time of 28 minutes, with a standard deviation of 5 minutes, there could be potential for significant productivity improvements. Experiences with HOV travel times suggest that a reduction in variance does indeed occur when reserved capacity is provided. However, because a significant portion of the trip would be on streets without exclusive HOV facilities, the reduction in travel-time variance would likely be small. Although measuring the variance in trip travel times is beyond current traffic-assignment modeling, this factor must be considered when results are interpreted.

One might ask why truck-trip travel times would decline by less than 8 percent if trucks were allowed to use the HOV lanes. The reason is that, on average, a comparatively small portion of the total truck-trip distance is on facilities that have HOV lanes. Many trips do not use facilities with HOV lanes at all and are only indirectly affected by the policy in that some trips may be diverted from the routes that they do use. Interstate trucks traveling through the Seattle region may travel entirely on facilities with HOV lanes and thus could show larger reductions in travel time when allowed to use HOV lanes. However, the amount of such through-truck traffic is comparatively small during the peak hours, as truckers seem to arrange their schedules to avoid peak-hour trips when possible. A possible adverse consequence of allowing trucks to use the HOV lanes is that more trucks might be tempted to travel during peak periods, adding to traffic congestion.

Finally, as expected, the total vehicle-miles traveled would increase by 2,410 vehicle-miles (a mere 0.133 percent), as travelers are attracted to high-capacity facilities that offer lower travel times but slightly longer distances.

Option 2—Adding an Exclusive Lane for Heavy Trucks

Although politically and economically unlikely, the policy of constructing exclusive truck lanes (to be constructed everywhere HOV lanes exist or are planned) was assessed to provide an upper limit on the potential impacts of truck reserved-capacity alternatives. Once again, the XXE model was applied, and the impact of this policy on traffic congestion in the Seattle area was measured in terms of the change in vehicle travel time and total vehicle-miles-traveled. Table 4.3 summarizes the results.

Table 4.3. Simulation Results of the Impacts of Exclusive Truck Lanes

	Trucks permitted in HOV lanes	Trucks using exclusive truck lanes
Single-occupancy vehicle travel times (veh-hrs)	168,260	168,170
High-occupancy vehicle travel times (veh-hrs)	4406.6	4396.5
Truck travel times (veh-hrs)	4758.7	4750.9
Total travel time (veh-hrs)	177,430	177,320
Total vehicle miles of travel	1,810,906	1,810,700

Table 4.3 shows that constructing a truck-lane system to parallel the HOV-lane system would produce results almost identical to the scenario that allowed trucks to use the HOV lane. In comparison to the policy allowing trucks to use the HOV lanes, the exclusive truck lane would save only 90 single-occupancy vehicle-hours, 10.1 high-occupancy vehicle hours, and 7.8 truck-hours during the morning peak period. These small improvements reflect (1) the comparatively small number of heavy trucks (i.e., small benefits from having their own lane), (2) the fact that many truck trips do not use facilities that have HOV-lanes (and thus would use truck-only lanes), and (3) the current underutilization of the HOV-lane system. The underutilization of the HOV-lane system

makes the difference in travel time between the two policy options insignificant because allowing trucks in the HOV lane would have minimal effects on HOV-lane congestion and travel times. Thus the policy option of adding an additional exclusive truck lane could not be justified on the basis of travel-time savings.

SAFETY IMPACTS

Large trucks are often perceived as a threat to safety because they (1) restrict motorists' vision because of their size, (2) have slow braking capabilities, and (3) delay motorists because of slow accelerations and an inability to maintain speed on upgrades. The following accident analysis considers each of these factors.

The accident analysis data were obtained from WSDOT for urban interstate highways within the Northwest Region of WSDOT. The Northwest Region covers King, Snohomish, Skagit and Whatcom Counties; I-90 and I-405 are located only within King County and I-5 is located within all four counties. The data were collected for a three-year period between 1992 and 1994.

Table 4.4 shows the accident statistics for the selected interstate roadways and three year period. When considering the percentage of general purpose, truck and bus accidents overall total, there are only a few areas of note. The most disconcerting is that the fatal accident rate for trucks is a greater percentage of the overall truck accidents -- 6.0 percent greater -- clearly indicating that truck accidents yield a higher fatal accident rate.

Sideswipe accidents also saw an increase over the overall truck accident rate with an increase of 19.4 percent. Since sideswipe accidents are typically due to the movement of vehicles from one lane to another, it is not surprising that there is such a large increase in this accident type for trucks which clearly have a sight-distance problem. Allowing trucks into an left-side HOV lane may increase the lane changes for trucks and possibly increasing the number of sideswipe accidents. (Left-side HOV lanes in urban areas are not effective because all on- and off-ramp traffic must move through the HOV lane to get to the general purpose lane—creating a rather ineffective HOV lane and a decreased incentive to use it.)

Table 4.4. Accident Statistics

	General Purpose		Truck		Bus	
	#	%	#	%	#	%
Total Accidents	20,101	89.7	2,174	9.7	138	0.6
Property Damage Only	10,991	88.7	1,402	11.3	86	0.7
Injury Accidents	9,151	91.8	763	7.7	52	0.5
Fatal Accidents	45	83.3	9	16.7	0.0	0.0
Number of Injuries	13,644	92.4	1,034	7.0	90	0.6
Number of Deaths	52	85.3	9	14.8	0.0	0.0
Number of Vehicles	41,504	89.4	4,626	10.0	317	0.7
Amount of Property Damage	$64.2 million	87.7	$8.5 million	11.6	0.5 million	0.7
Alcohol Related Accidents	1,587	95.5	68	4.1	6	0.4
Fixed Object Accidents	3,104	96.0	123	3.8	7	0.2
Rear End Accidents	11,421	94.6	605	5.0	46	0.4
Sideswipe Accidents	2,582	69.3	1,085	29.1	60	1.6
Opposite Direction Accid.	482	94.5	25	4.9	3	0.6
Entering At Angle Accidents	579	91.3	47	7.4	8	1.3
Overturn Accidents	484	94.5	28	5.5	0.0	0.0
Pedalcyclist Accidents	15	100.0	0.0	0.0	0.0	0.0
Pedestrian Accidents	31	100.0	0.0	0.0	0.0	0.0

However, right-side HOV lanes may lessen the number of lane changes for trucks, if they used them. It is uncertain whether the current lane change activity for large trucks is attributable to their attempts to maintain consistent speeds (i.e., trucks may be changing lanes to pass slower moving vehicles); if so, lane change activity for large trucks may actually decrease with the implementation of a reserved lane.

The number of truck-involved, rear end accidents accounts for 5 percent of the total rear end accidents. Given that the weight of a truck is several times that of a typical general purpose passenger vehicle requiring longer stopping distances and that trucks may be traveling at speeds slower than the traffic stream, this relatively small percentage may indicate that safety is not compromised to the degree expected.

The bus accident statistics for the specified interstate roadways were comparable for all areas except a slight increase of 0.1 percent in the total amount of property damage and an increase of 0.7 percent in the entering at angle accidents. Buses typically enter and exit limited access facilities, such as interstate roadways, at a greater rate then trucks. The trucks are usually making only one or no stops within urban areas, while buses enter and exit to allow passengers on and off the buses.

The resulting safety impacts to HOVs if large trucks were allowed to travel in the same lane are difficult to discern from this accident data. Potential safety-related problems could include: (1) reduced site distance for HOVs traveling behind large trucks, (2) increase lane change and merge activity, and (3) potentially unsafe HOV maneuvers to maintain speeds on upgrades. Given the relatively small percentage of large trucks in the traffic stream (5 percent), these potential problems would likely not become a reality unless tremendous growth in either large truck or HOV traffic occurred.

PAVEMENT EFFECTS

Pavement failure typically falls into two categories, rutting and fatigue cracking. Rutting failure is defined as 0.5 inches of depression in the wheel path area, and fatigue cracking failure is defined as cracks over 10 percent of the wheel path area. The WSDOT Pavement Guide (1994) extensively compares the response of a typical I-90 asphalt concrete pavement (ACP) section to a passenger vehicle and a truck load. After approximately 3.3 million truck axle loads, the standard pavement section is expected to fail by both rutting and fatigue cracking. In comparison, if only passenger cars used the

pavement section, fatigue cracking would occur after 3.9 billion passenger car axle loads, and rutting would occur after 88.7 billion passenger car axle loads. (14)

As an example, if large trucks make up 4.3 percent of the daily vehicles on Interstate 5 through downtown Seattle, and the daily volume of vehicles is 200,000, it is estimated that 8,600 trucks would use that portion of roadway daily over eight lanes of travel (both directions). Because truck traffic is not distributed equally over the lanes, a typical middle lane would receive the highest volume, and for this example it could be 1,420 trucks per day (approximately 1/3 of the volume for single direction of travel). When computed to equivalent truck axle loads, defined in the WSDOT Pavement Guide for interstate trucks as 1.2 axle loads per truck, the number of truck axle loads per year would be 621,960. At this rate, the ACP pavement would show noticeable failure in 5.3 years. However, if all of the trucks were placed in one lane per direction, in this case 4,300 trucks (1,883,400 axle loads per year), failure would be noticed in only 1.75 years.

For the typical freeway pavement infrastructure, pavement damage resulting from large trucks is a real concern. Concentrating large volumes of trucks into one lane would result in rapid pavement deterioration. A special pavement section would have to be designed for any lane that was going to carry a large concentration of trucks. The medium of choice for such a special pavement section is Portland Cement Concrete (PCC) because it is much stronger than ACP and, if correctly designed, can withstand a large volume of trucks.

CHAPTER 5
SURVEY RESULTS

Freight mobility efforts involve or affect a variety of groups. These groups may include trucking associations and their members, private trucking firms, enforcement agencies, transportation agencies, and other users of the roadway.

Trucking associations have traditionally shown guarded enthusiasm toward the prospect of improving mobility for large trucks in urban areas. Negative public opinion is cited as the most important reason for not taking advantage of travel benefits.

Enforcement agencies have expressed concerns regarding enforcement of truck mobility strategies. Because they, like many public agencies, have faced reductions in funding as local and federal governments have made cut-backs, adding enforcement personnel has typically not been possible. Another of their concerns is the possibility of more accidents involving large trucks if the facility would require them to make lane changes. As an example, a truck facility on the inside of a freeway would require trucks to cross several lanes every time they entered or exited the freeway.

Transportation departments typically emphasize mobility. Traditional mobility projects have been aimed at person movement. Despite knowing that large trucks make up a relatively small proportion of traffic on urban freeways, transportation departments have emphasized restricting truck traffic.

Traditionally, the general public has been opposed to changing the existing freeway lane configuration by reducing general purpose lane capacity. A mail survey revealed that a majority of the public disliked a 1994 project on I-90 that converted an existing general purpose lane into an HOV lane (Kim et al 1995). The study identified several socioeconomic classes that could be targeted for informational campaigns. Current public policy within WSDOT requires that the public be allowed to participate in every stage of the design process for projects. The public's input is given weight and has prevented projects from being constructed.

For this project, five surveys were developed for five target groups: the general public, large truck operators, truck companies, bus drivers, and traffic enforcement personnel. The results of these surveys are described below.

RESPONDENT INFORMATION

General Public

The participation of general public drivers was acceptable, with 310 surveys returned out of the 1,885 mailed (16 percent). The average respondent was male (60 percent), between the ages of 41 to 45, had been driving for an average of 27 years, and drove between 11 to 15 miles to work. The general public respondents were well educated, 71 percent having attended a university.

Bus Drivers

The participation of bus drivers was acceptable, with 69 surveys returned out of the 200 surveys given to Metro Transit (34.5 percent). Of these, 11 were missing the first page, omitting information on driver characteristics and partial data on driver preferences. The average bus driver was male, between the ages of 41 to 45, and had been driving a bus for an average of 8.7 years. The average bus driver worked 6.4 hours per day.

Truck Drivers

The participation of truck drivers was acceptable, with 80 surveys returned out of the 368 handed out at the truck stops (22 percent); 40 of these were returned at the truck stops and 40 were returned by mail. Of the two companies that employ large trucks, only Safeway responded as promised, returning 67. The average truck driver who responded from the truck stop segment was male (90 percent), between the ages of 41 to 45, had been driving large trucks for an average of 16 to 20 years, drove 10 hours a day (55 percent), and carried either general commodities or food products (69 percent). The average Safeway truck driver who responded was male (90 percent), between the ages of 51 to 55, had been driving large trucks for an average of 26 to 30 years, and drove 10 hours a day (36 percent). The background of both segments was similar.

Truck Companies

The participation of the truck companies was acceptable, with 71 out of the 200 surveys given to the Washington Trucking Association returned (36 percent). The average truck company used 25 to 30 large trucks in Washington and had been in business an average of 31 years. A little over half of the truck companies, 56 percent, owned their own trucks.

Washington State Patrol

The participation of Washington State Patrol troopers was quite high, with 95 of the 148 surveys returned (64 percent). The average responding State Patrol trooper was male, between the ages of 35 to 40, and had been on the force an average of 8.3 years. The average trooper made 2.2 traffic stops involving large trucks per week, indicating a familiarity with large trucks movement on the roadways.

SURVEY GROUP COMPARISON

Return Rates

Return rates for all of the surveys, except the bus driver segment that was distributed by Metro to selected bus drivers, are shown in Figure 5.1. The rate for the general public is consistent with rates shown in similar mail-back surveys.

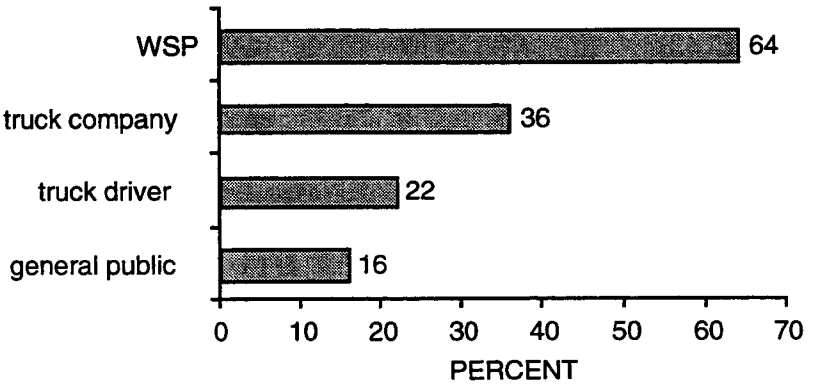


Figure 5.1: Survey Response Rate

Travel Routes

I-5 was the most frequent route used for the majority of the survey groups; only the truck drivers (both the truck stop segment and the Safeway segment) reported using other freeways more frequently. Interestingly, the truck companies indicated that their drivers used I-5 72 percent of the time, a great contrast to the 4 percent indicated by the truck stop segment of truck drivers.

Driving Conditions

To understand typical freeway driving conditions for the respondents, they were asked whether they encountered congestion on a regular basis. A graph illustrating the percentage of each respondent segment that regularly encountered congestion is shown in Figure 5.2. The truck drivers and bus drivers indicated encountering congestion at similar rates, which were slightly higher than those of the general public and WSP. However, all groups encountered congestion at a very high rate, 75 percent or greater. This indicates that we succeeded in surveying respondents who were familiar with congestion and its problems.

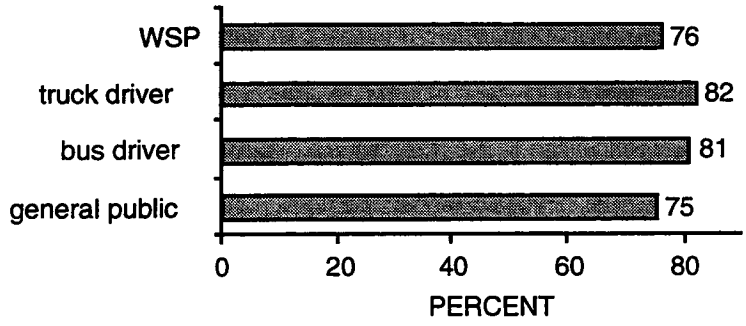


Figure 5.2: Congestion Experience

Freight Mobility Strategies

The respondents were queried about their preferences for the freight mobility strategies: exclusive truck-only lanes, cooperative truck and bus lanes, and allowing trucks into existing HOV lanes. As Figure 5.3 shows, the general public and WSP troopers clearly favored the truck and bus lane strategy, which is perhaps an indication

that they perceive trucks and buses as similar in size and weight. Interestingly, the bus drivers preferred the truck-only strategy, indicating that they do not want to be in the same lane as trucks. The truck companies and truck drivers appeared to slightly favor the truck-only and HOV/truck-only choices, indicating that sharing a lane with buses was their least favorite option.

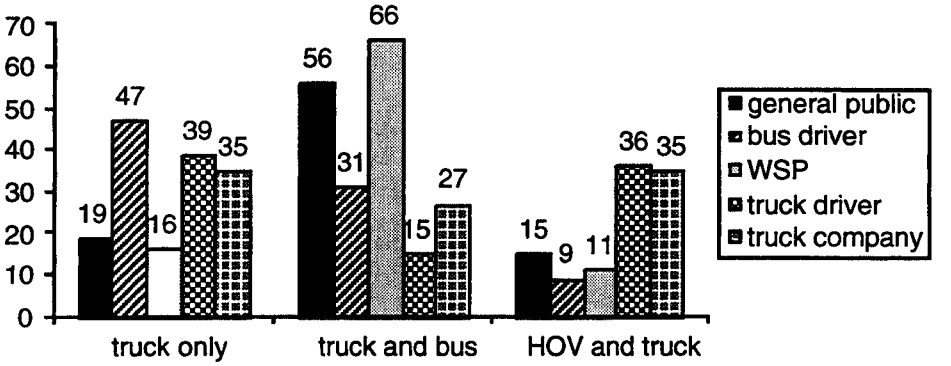


Figure 5.3: Preference Rate for Various Freight Mobility Strategies (Lane-usage Alternatives)

Large Trucks in HOV Lanes

Table 5.1 shows how respondents thought they would behave if large trucks were allowed into the HOV lanes. This question was not asked of the WSP troopers. The general public and bus drivers gave similar responses, and the responses of the truck companies and truck drivers were also similar. In response to a previous question, 36 percent of the general public stated that they frequently use HOV lanes; however, this percentage would drop significantly to only 11 percent if trucks were allowed into HOV lanes. As for those who never use the HOV lanes, 12 percent of the general public currently do not use them, and this percentage would rise dramatically to 49 percent if trucks were allowed into the HOV lanes. This is a clear indication that the general public does not want to be in the HOV lane with large trucks. It also appears that the truck companies were optimistic about how often their drivers would use the HOV lane;

because the drivers would be the ones driving, their rate of use may be considered slightly more accurate.

Respondents were asked to comment on their reasons for these responses. Among the general public and bus drivers who said they would use the HOV lanes less, the most common reason was related to speed; large trucks cannot maintain a constant speed. Paradoxically, the truck companies' and truck drivers' most common answer was that they would use the HOV lane because it would provide better flow. The lack of constant speed among large trucks on freeways was not the only concern raised by the general public; they also said they would use the HOV lane less because they believe large trucks reduce visibility and are unsafe. These comments are in the appendix.

Table 5.1. Predicted HOV Lane Usage If Large Trucks Were Permitted

	General Public	Bus Driver	Truck Company	Truck Stop Driver	Safeway Driver
not use HOV	49%	38%	13%	14%	13%
occasionally use HOV	35%	43%	28%	36%	36%
frequently use HOV	11%	17%	55%	48%	45%

HOV Lane Location

The respondents' preferences for which side of road the reserved lane or HOV/truck lane should be located are noted in Figure 5.4. Four of the five segments indicated a clear preference for a right-side reserved or HOV/truck lane. Only the truck drivers preferred to have the HOV lane on the left-side of the road, and this was only slightly more popular than their preference to locate them on either side of the roadway. The truck drivers' comments hinted that they may prefer the left-side reserved or HOV/truck lane because they usually make long-hauls through the city and would encounter fewer disruptions caused by on- and off-ramp traffic on the left side. The general public and bus drivers are more likely to make shorter trips, making a left-side reserved or HOV/truck lane inconvenient to access. The truck companies may prefer the

right-side reserved or HOV/truck lane because they want their drivers to not access the left-lane for public relation reasons, that is, they prefer their drivers to stay out of the left lane at all times. Similarly, WSP troopers might prefer the right-lane because they feel large trucks should limit their lane changes for safety reasons.

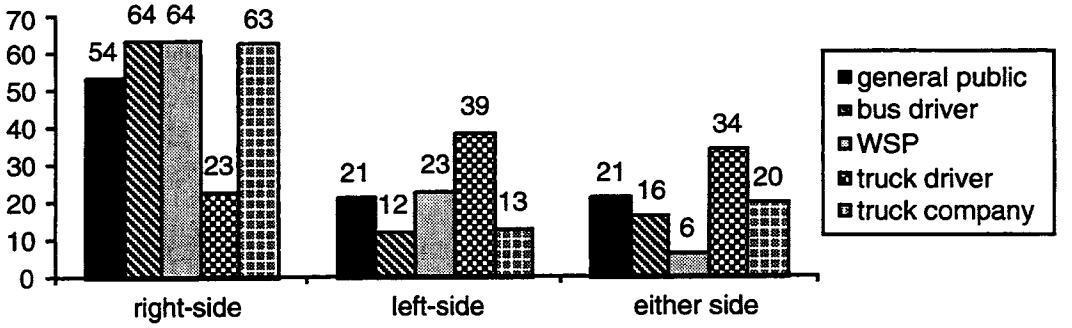


Figure 5.4: Preference Rate for Various Lane Location Alternatives

Time of Day Restrictions

Responses to whether large trucks should be restricted by time of day from using the HOV lane or reserved lane are shown in Figure 5.5. Only WSP troopers preferred to not allow trucks into the lane at any time. The rest of the respondents preferred to allow them into the lane at all times. These answers indicate that all of the groups would prefer consistency, whether all or nothing, if a freight mobility option is implemented.

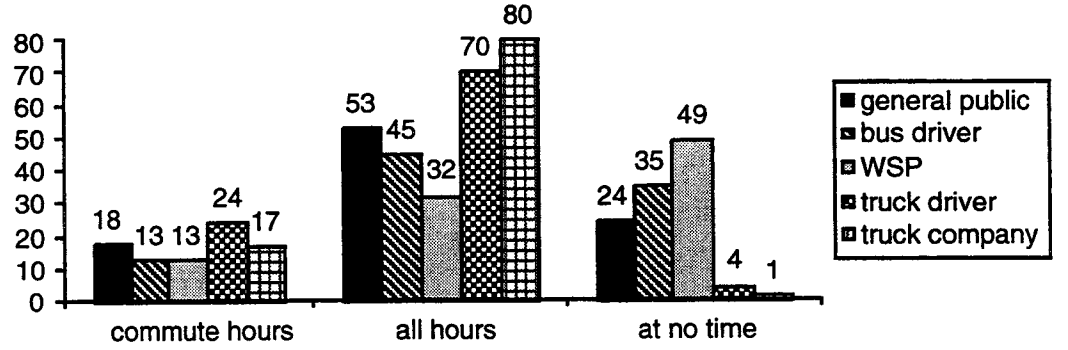


Figure 5.5: Percentages Preferring Restrictions on Lane-Usage Times

Safety and Congestion

The respondents rated all opinion section freight mobility questions similarly for safety and congestion. If a strategy was viewed an improvement to safety, it was also viewed as a way to improve congestion. For these questions, the agreement and disagreement ratings were added together; i.e., *agree* and *agree strongly* were added to produce an agreement rating, and *disagree* and *disagree strongly* were added to produce a disagreement rating.

Figure 5.6 illustrates how each responding group agreed with the statement that a freight mobility strategy would improve safety and congestion. In the figure, safety and congestion improvement responses were combined and averaged for each freight mobility strategy. As can be seen in the figure, there is general agreement among all but WSP troopers that the truck-only lane would produce the most improvement in safety and congestion. The bus and truck-only lane strategy would be next, followed by the HOV and truck lane strategy. The WSP troopers rated the bus and truck-only lane slightly higher than the truck-only lane for safety and congestion improvements. This response could be due to the fact that troopers view buses and trucks to be similar in the ways they cause accidents and create congestion. They see removing both from the general use lanes as the best way to decrease overall congestion and increase overall safety.

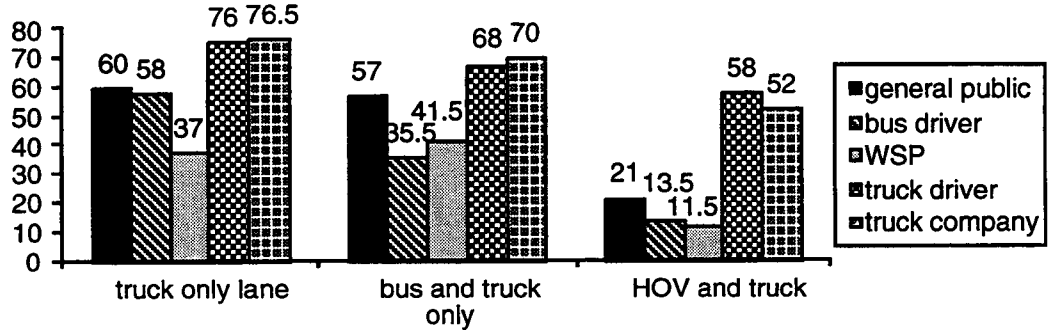


Figure 5.6: Percentages Believing Various Lane Strategies Will Improve Safety and Congestion

Occupancy Requirements for Trucks

The next question asked the respondents to agree or disagree with the statement that trucks should be allowed into the HOV lane only if they meet the occupancy requirement. Figure 5.7 shows that there was considerable agreement among all the respondents; they did not agree that trucks should be required to meet occupancy requirements to use an HOV lane. This would be agreeable from the WSP viewpoint because it is difficult to count the number of occupants in a large truck, and enforcement of the requirements would be difficult. From the viewpoint of buses it also make sense because buses are allowed to travel in the HOV lane without passengers.

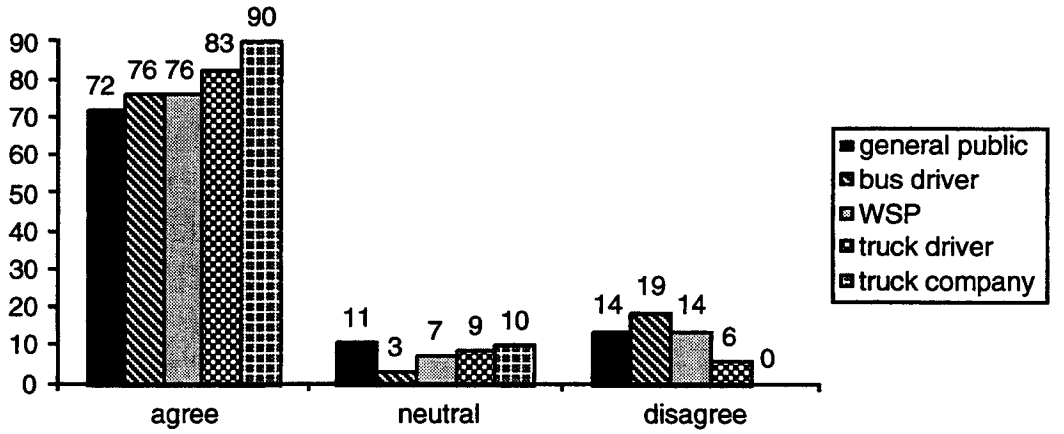


Figure 5.7: Responses to the Statement That Trucks Should Be Allowed to Travel in HOV Lanes Only if They Meet Occupancy Requirements

The Importance of Trucks

When the respondents were asked whether they agreed or disagreed that trucks are vital to the nation's economy, the results were similar for all groups. There was close agreement among all groups that trucks are important to the economy. This answer clearly shows that there is an understanding of the services provided by the trucking industry and the importance of trucks to our everyday life. Figure 5.8 shows the results.

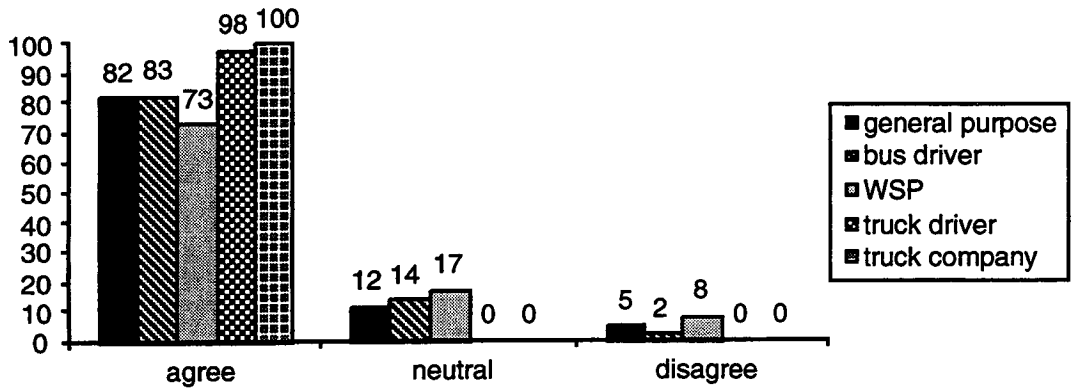


Figure 5.8: Responses to the Statement That Large Trucks Are Important to Our Nation's Economy

Travel Benefits for Trucks

Respondents were asked whether trucks should have the same travel benefits as public transit and HOVs. As can be seen in Figure 5.9, truck drivers agreed most strongly with this statement. Surprisingly, only 56 percent of the truck companies agreed. Unknown is whether the 18 percent of truck companies that disagreed preferred more benefits or fewer benefits for the truck drivers; however, one would assume that they would prefer more, which would lower their costs. WSP troopers disagreed most strongly that trucks should be allowed the same travel benefits, although the bus driver and general public responses were also fairly significant.

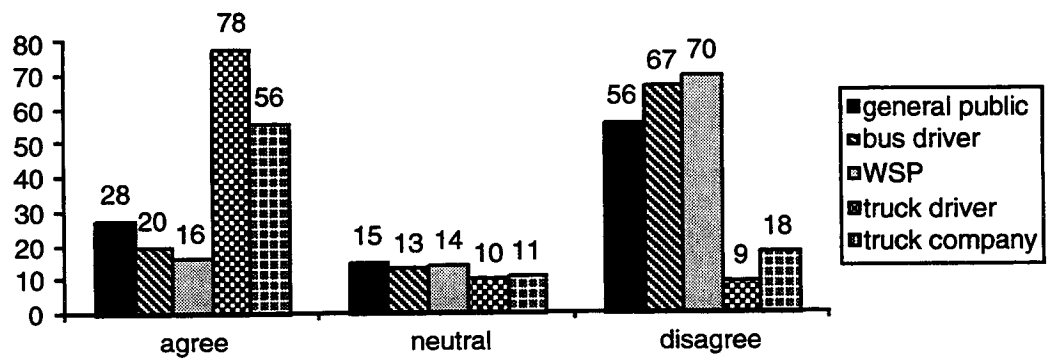


Figure 5.9: Responses to the Statement That Trucks Should Have the Same Travel Benefits as Public Transit and HOVs

Usage Fees for Trucks

The last question asked respondents whether they agreed or disagreed with the statement that trucks should pay a special fee to use a reserved or existing HOV lane. The responses can be seen in Figure 5.10. While truck drivers and truck companies clearly disagreed strongly with the statement, all of the other responding segments also disagreed more than they agreed. There was general agreement among all respondents that trucks should not pay additional fees to use a reserved or existing HOV lane. Currently, HOVs do not have to pay a fee to use the HOV lane. The majority of respondents from each group concurred that this same benefit should be given to large trucks if they are granted use of the lane.

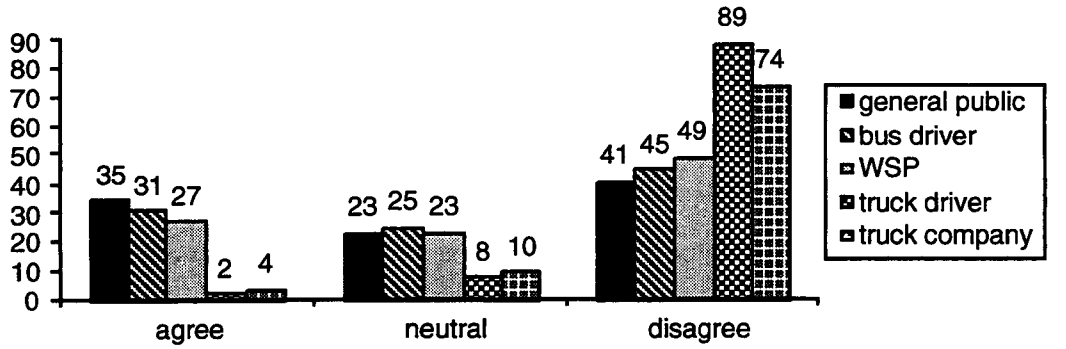


Figure 5.10: Responses to the Statement That Trucks Should Pay a Special Usage Fee to Use a Reserved or Existing HOV Lane

MODELING PUBLIC SUPPORT OF TRUCK TRAVEL BENEFITS

A statistical model, specifically an ordered probit, was developed to describe public response to the statement: *large trucks should have the same travel benefits as public transit and high occupancy vehicles*. The respondents indicated a level of agreement to the statement by checking one of five boxes: *disagree strongly, disagree, neutral, agree,* and *agree strongly*. The model determined how a typical person from the general public would answer this question, and more importantly, identified the

population characteristics that could be targeted for public education should freight mobility strategies prove promising.

An ordered probability model was appropriate in this situation because agreement ratings are discrete ordered responses, not continuous non-integers such as those handled by ordinary least squares regression. Ordered probability models account for the order of the responses, i.e., they account for the fact that "agree strongly" is of greater importance than the "agree" choice. Standard multinomial probability models do not take into account the order relationship between choices, thereby making ordered probability models potentially more accurate with discrete data that are ordered.

For our ordered probability model, the unobserved variable z was used to define the predicted importance rating choice by a respondent. The unobserved variable is specified as

$$z = \beta \mathbf{X} + \varepsilon, \qquad (1)$$

where $\mathbf{X}$ is a vector of characteristics determining the respondents' chosen agreement rating, β is a vector of estimable parameters, and e is a random disturbance term. Using this equation, observed agreement rating choices, y, are defined as

$$\begin{aligned} y \quad &= 0 \quad \text{if } z < \mu_0, \\ &= 1 \quad \text{if } \mu_0 < z < \mu_1, \\ &= 2 \quad \text{if } \mu_1 < z < \mu_2, \\ &= \ldots \\ &= 5 \quad \text{if } z > \mu_4 \end{aligned}$$

where μs are free estimable parameters that define y, and values of y (e.g., 0,1,2) correspond to agreement rating categories (i.e., disagree strongly, disagree, neutral, agree, and agree strongly). Note that without loss of generality, μ_0 can be scaled to zero.

Because the disturbance term (ε) in equation (1) follows a standard normal distribution (with mean = 0 and variance = 1), an ordered probit model results.

A total of 308 survey responses were entered into a spreadsheet and transferred to a text file for analysis using Statistical Software Tools (SST) version 1.1. An ordered probit model was estimated to determine the likelihood that a person from the general public would strongly agree, agree, be neutral, disagree, or disagree strongly that large trucks should receive the same travel benefits as public transit and high occupancy vehicles.

Table 5.2: Ordered Probit Model Describing Public Support of Truck Travel Benefits

Variable	Estimated Coefficient	t-statistic
Number of licensed vehicles in household (increased by 1 for each vehicle, 0 otherwise)	-0.19	-1.86
Over 2 licensed vehicles (1 if household has 3 or more licensed vehicles, 0 otherwise)	0.26	1.11
Age category (increased as respondent age increased, varied between 1 and 12 (oldest))	0.03	2.30
Number of years owned drivers license (increased by 1 for each year, 0 otherwise)	-0.04	-2.50
One	0.66	1.51
HOV policy awareness (1 if knew that trucks weren't allowed in HOV lane, 0 otherwise)	-0.27	-1.86
Sex (1 if male, 0 female)	-0.19	-1.32
Household income (1 if annual income is $40,000 - $59,999, 0 otherwise)	0.21	1.24
Household income (1 if annual income is greater than $75,000, 0 otherwise)	-0.30	-1.84
SOV (1 if drive alone, 0 otherwise)	0.19	1.29
No HOV use with trucks (1 if they would not use HOV lane with trucks, 0 otherwise)	-0.40	-2.90
Trucks are vital to economy (1 if they agreed with statement, 0 otherwise)	0.66	3.47
Household size (1 if there are more than 2 persons in household, 0 otherwise)	0.23	1.62
Comment (1 if pro-truck comment, 0 otherwise)	0.49	1.45
Comment (1 if anti-truck comment, 0 otherwise)	-0.77	-4.67
Education (1 if they have had some college or university education, 0 otherwise)	-0.24	-1.58
HOV use (1 if never uses HOV lane, 0 otherwise)	0.44	2.11
HOV policy (1 if HOV policy should be changed to allow trucks, 0 otherwise)	0.66	3.45

Table 5.2 provides the estimated coefficients and t-statistics for the probit model variables. The model has good overall convergence, with the log-likelihood for the model converging from -536.66 to -387.86 (a convergence from -536.66 to zero would be the perfect model) and a corrected rho-squared of 0.26. Variables with t-statistics over 1.0 were included in the probit model because of the small sample size (i.e., although a t-statistic of 1.0 is significant only at the 85 percent confidence level, a larger sample size would result in a higher confidence level because the estimators are consistent).

The distribution of agreement with the statement that large trucks should receive the same travel benefits as public transit and HOVs is shown in Figure 5.11. The majority of the general public disagreed that large trucks should have the same travel benefits as HOVs and transit.

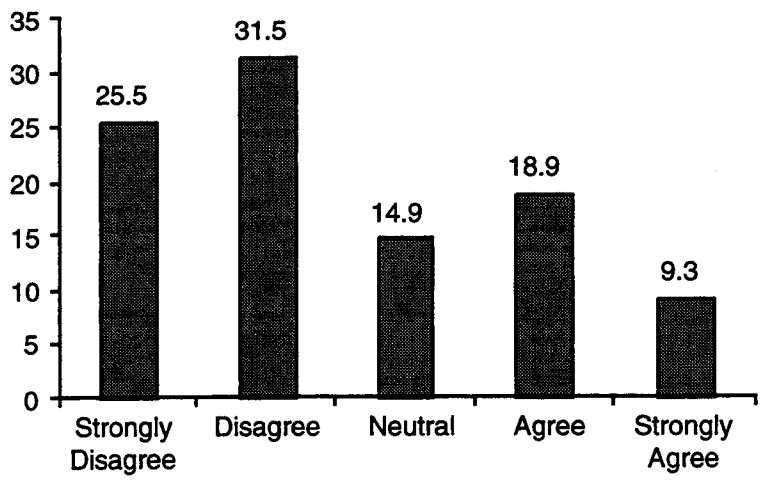


Figure 5.11: Responses to the Statement That Large Trucks Should Have the Same Travel Benefits as Public Transit and HOVs

Interpretations of the model variables are provided below under two separate sections. The first section contains variables that are intrinsically linked together; hence they must be discussed together within the model. There are two of these sets, four variables altogether. The second section contains the remaining variables from the model.

Variable Sets

1. Number of licensed vehicles

Variable: Number of licensed motor vehicles owned

Finding: As number of motor vehicles owned increases, the the likelihood that respondents would suport trucks having the same travel benefits as HOVs decreases.

Number of respondents qualifying for variable: 306

The negative coefficient indicates that as the number of licensed vehicles residing in the household increased, the likelihood that the respondent disagreed with the statement that trucks should have the same travel benefits as HOVs also increased. Multiple vehicles within a household indicates that more than one licensed driver may live there. If a vehicle is readily accessible, there is no incentive to carpool or use transit. Allowing trucks into the HOV lane may be perceived as encouraging higher volumes of trucks during congestion periods, a situation that would not be advantageous for someone who frequently used the freeways. In addition, allowing trucks into the HOV lane could displace HOV users to the general purpose lanes, a situation that would further lower capacity in the general purpose lanes.

Variable: More than two licensed vehicles in household

Finding: If more than two vehicles exist in a household, the likelihood that respondents would support trucks having the same travel benefits as HOV increases.

Number of respondents qualifying for variable: 98

The positive coefficient indicates that if there were more than two licensed vehicles at a household, the respondent was more likely to agree with the statement that trucks should have the same travel benefits as HOVs.

2. Age

Variable: Age of respondent

Finding: As age increases, the likelihood that respondents would support trucks having the same travel benefits as HOVs increases.

Number of respondents qualifying for variable: 305

The positive coefficient means that older respondents were more likely to agree with the statement that trucks should have the same travel benefits as HOVs than younger respondents.

Variable: Number of years owning a driver's license

Finding: As number of years owning a driver's license increases, the likelihood that respondents would support trucks having the same travel benefits decreases

Number of respondents qualifying for variable: 303

The negative coefficient means that the longer a respondent had owned a driver's license, the more likely he or she would be to disagree with the statement that trucks should have the same travel benefits as HOVs. A driver's license allows the owner to drive on public roads and therefore gives them a sense of ownership of these roads. The longer the license has been owned, the stronger the sense of ownership. This variable corresponded closely with the *Age of respondent* variable.

Single Variables

Variable: One

Number of respondents qualifying for variable: 308

The positive coefficient reflects a propensity for each respondent to agree with the statement that trucks should have the same travel benefits as HOVs. This variable (the constant term) was applied to everyone in the model.

Variable: Aware that trucks are not allowed in Washington HOV lanes

Finding: Awareness that trucks are currently not allowed in the HOV lane decreases the likelihood that respondents would support trucks having the same travel benefits

Number of respondents qualifying for variable: 217

The negative coefficient means that if a respondent knew that trucks are not allowed in HOV lanes within Washington, he or she was more likely to disagree with the statement that trucks should have the same travel benefits as HOVs. Conversely, if the general public respondent was not aware of the law, he or she was more likely to respond that trucks should have the same travel benefit as HOVs. Nearly a third of the respondents knew that trucks are not currently allowed in the HOV lane. These people were familiar with the regulations on the freeways; perhaps they did more driving and lived in areas where they could access HOV lanes. It makes sense that respondents who utilized the HOV lanes would not be receptive to regulations that would take away from the advantages that they receive by using them. For example, allowing trucks into the HOV lane might be perceived as a reduction of their current HOV benefits.

Variable: Respondent was male

Finding: Being male decreases the likelihood that respondents would support trucks having the same travel benefits

Number of respondents qualifying for variable: 185

If the respondent was male, he was more likely to disagree that trucks should have the same travel benefits as HOVs. This finding highlights gender differences in attitudes toward truck benefits.

Variable: Prefer HOV policy changed to allow trucks

Finding: If a change in HOV policy is preferred, the likelihood that respondents would support trucks having the same travel benefits increases

Number of respondents qualifying for variable: 45

If a lane were to be reserved for trucks, these respondents preferred to see HOV policy changed to allow them to use the HOV lane. These respondents already showed sympathy toward allowing trucks into the HOV lane, so their agreement with the statement that trucks should have the same travel benefits as HOVs and transit was not surprising.

Variable: Household income between $40,000 to $59,999

Finding: If household income is between $40,000 and $59,000, the likelihood that respondents would support trucks having the same travel benefits increases

Number of respondents qualifying for variable: 68

If the household income of a respondent was between $40,000 to $59,999, he or she was more likely to agree that trucks should have the same travel benefits as HOVs. It is likely that this relatively low household income bracket is more sensitive to economic changes. If they view trucks as vital to the economy, members of income bracket may support measures to maintain the current price of goods.

Variable: Household income equal to or greater than $75,000

Finding: If household income is greater than $75,000, the likelihood that respondents would support trucks having the same travel benefits decreases

Number of respondents qualifying for variable: 88

If the household income of the respondent was equal to or greater than $75,000, he or she was more likely to disagree that trucks should have the same travel benefits as HOVs. Although these respondents may realize the importance of the trucking industry, they may be less sensitive to increased costs resulting from inefficient goods movement.

Variable: Usually drives alone

Finding: If the respondent usually drives alone, the likelihood that respondents would support trucks having the same travel benefits increases

Number of respondents qualifying for variable: 224

If a respondent usually drove alone on freeways with HOV lanes, he or she was more likely to agree that trucks should have the same travel benefits as HOVs. Because allowing trucks into the HOV lane would create additional capacity in the general purpose lanes for SOVs, perhaps moving trucks into the HOV lane makes sense for single occupancy drivers.

Variable: Would not use HOV lane with trucks

Finding: If the respondent would choose not to use the HOV lanes with trucks, the likelihood that respondents would support trucks having the same travel benefits decreases

Number of respondents qualifying for variable: 152

If respondents answered that they would not use the HOV lane if trucks were allowed, they were less likely to agree that trucks should have the same travel benefits as HOVs. This variable acts as expected, in that respondents have already indicated opposition to trucks. They do not perceive that the HOV lanes would still provide travel benefits if trucks began using them.

Variable: Trucks are vital to the economy

Finding: If trucks are viewed as vital to the economy, the likelihood that respondents would support trucks having the same travel benefits increases

Number of respondents qualifying for variable: 253

If a respondent agreed that trucks are vital to the economy, he or she was more likely to agree that trucks should be allowed the same travel benefits as HOVs. These respondents realize that trucks are important to the delivery of many of the

basic goods we use every day. Allowing trucks the same travel benefits as HOVs and transit may be perceived as a way of keeping the economy running smoothly.

Variable: More than two people in household

Finding: If more than two people make up a household, the likelihood that respondents would support trucks having the same travel benefits increases

Number of respondents qualifying for variable: 135

If three or more people lived in the respondent's household, he or she was more likely to agree that trucks should have the same travel benefits as HOVs. If several people are in a household, they form *natural* carpools, i.e., they may commute to work, go shopping, and go on trips together. It appears that this group should disagree that trucks should be allowed the same travel benefits. The answer may be that this group perceives trucks as non-threatening to their current HOV travel benefits. In addition, larger households use greater amounts of truck-delivered goods, so they may better appreciate the importance of trucks to the economy.

Variable: Negative comment

Finding: If a negative comment was provided, the likelihood that respondents would support trucks having the same travel benefits decreases

Number of respondents qualifying for variable: 74

If a respondent made a negative comment about trucks, he or she was more likely to disagree that trucks should have the same travel benefits as HOVs. We would expect someone who speaks negatively about trucks to also disagree that trucks should enjoy any increase in travel benefits.

Variable: Positive comment

Finding: If a positive comment was provided, the likelihood that respondents would support trucks having the same travel benefits increases

Number of respondents qualifying for variable: 12

If a respondent made a positive comment about trucks, he or she was more likely to agree that trucks should have the same travel benefits as HOVs. The responses from this group did not contain any surprises.

Variable: College or university educated

Finding: A college or university education decreases the likelihood that respondents would support trucks having the same travel benefits

Number of respondents qualifying for variable: 217

If a respondent had received a college or university education, he or she was more likely to disagree that trucks should have the same travel benefits as HOVs. Those with higher education may be further removed from the trucking industry (white collar versus blue collar) and hence less sympathetic toward and less ikely to support benefits to trucking industry employees.

Variable: Never uses HOV lanes

Finding: If respondents never use the HOV lanes, the likelihood that respondents would support trucks having the same travel benefits increases

Number of respondents qualifying for variable: 37

If the respondent never used the HOV lane, he or she was more likely to agree that trucks should have the same travel benefits as HOVs. This may seem contradictory, but perhaps because these respondents do not use the HOV lane, they do not care about its fate. An added bonus for them would be that the majority of trucks might then move to the HOV lane, providing greater capacity in the general purpose lanes.

CHAPTER 6
CONSIDERING FREIGHT PRODUCTIVITY IMPROVEMENTS IN AN INTELLIGENT TRANSPORTATION SYSTEMS ENVIRONMENT

Much of this study considered the impacts of various freight productivity improvement strategies in the context of present or near-term roadway conditions. Recognizing that the advent of advanced technology applications in transportation, namely, Intelligent Transportation Systems (ITS) may change these conditions, this chapter considers the applicability of the various freight productivity improvement strategies in this new, high-technology operating environment.

Although a thorough examination of ITS technologies is beyond the scope of this project, the answers to several related questions should be explored:

- Would the implementation of the freight mobility strategies under consideration cause the goals of one mode to inhibit the other modes from achieving their own goals?
- Do the freight mobility strategies under consideration lend themselves to combined or multimodal ITS applications (e.g., sharing of equipment)?
- Would the freight mobility strategies under consideration interfere with ITS applications?
- Would the freight mobility strategies under consideration increase the benefits resulting from ITS applications?
- Would the freight mobility strategies under consideration increase the costs associated with ITS applications?

In answer to these questions, this chapter provides (1) a description of ITS, including various functional groups, overall ITS and functional group goals, and an overview of applicable technologies; (2) local and national ITS efforts; and (3) a discussion of the goals and technologies in the context of various freight productivity improvement strategies (i.e., exclusive truck lanes, cooperative bus/large truck lane).

ITS COMPONENTS AND RELATED GOALS

Transportation engineers have been struggling with the problem of improving safety and mobility without relying on traditional methods of capacity expansion (i.e.,

building new or widening existing roads); Intelligent Transportation Systems (ITS) are being touted as the solution. Instead of physically adding capacity to the roadway, ITS help people use existing capacity more efficiently through the application of advanced technology.

The overall goals of ITS are broad:

- improve safety
- increase operational efficiency and capacity
- reduce energy and environmental costs
- enhance present and future productivity
- enhance personal mobility, convenience, and comfort
- support development of the ITS industry.

ITS is not a single system but a composition of six interactive subsystems (or functional groups) working together. These functional groups have been defined as

(1) Advanced Traffic Management System (ATMS)

(2) Advanced Traveler Information Systems (ATIS)

(3) Advanced Vehicle Control System (AVCS)

(4) Commercial Vehicle Operations (CVO)

(5) Advanced Public Transportation Systems (APTS)

(6) Advanced Rural Transportation Systems (ARTS).

Advanced Rural Transportation Systems (ARTS) address the needs of rural and intercity travelers. Because the current effort focuses on improving freight productivity along *urban* corridors, ARTS will not be addressed further in this discussion. Each of the other functional groups is described below.

A summary of the various functional groups, their related goals, the affected mode of transportation, and potential mechanisms or technologies to help in reaching these goals is provided in Table 6.1.

Advanced Traffic Management Systems (ATMS)

Advanced Traffic Management Systems (ATMS) rely upon the collection and processing of real-time data to guide the management of various roadway functions, including freeway ramp metering and arterial signal control. Real-time data collected from vehicles on the roadway are sent to a traffic management center. Computers with advanced traffic control software process the real-time data and any other data (e.g., from vehicle probes) that may be available. After processing, adjustments are made to the roadway traffic control devices (e.g., ramp metering is adjusted). Dynamic traffic control systems respond to changing traffic conditions regardless of jurisdiction or type of road.

The goal of ATMS is to provide real-time traffic control capabilities that adapt to traffic movement, anticipating when and where traffic will be moving, so that signal and freeway control systems can provide optimum service. This maximizes the efficiency of the highway network and helps to maintain priority treatment for high occupancy vehicles (HOVs).

Advanced Traveler Information Systems (ATIS)

Advanced Traveler Information Systems (ATIS) use the real-time information collected through the ATMS to provide travelers with trip and traffic information. Information is relayed as safety and warning messages in a variety of forms, including in-vehicle navigation systems, informational kiosks, variable message signs, and highway advisory radio.

The goal of ATIS is to provide useful routing information that will assist the traveler in moving from origin to destination.

Advanced Vehicle Control Systems (AVCS)

Advanced Vehicle Control Systems (AVCS) assist drivers with various levels of vehicle control. Rudimentary functions include warning systems to alert drivers of obstacles or other vehicles. More advanced systems allow for limited vehicle control.

Ultimately, AVCS are intended to provide fully automatic steering and distance control between vehicles.

AVCS have two goals: (1) to improve traffic safety by reducing human/vehicle interaction and consequently reducing the potential for human error, and (2) to improve capacity by reducing the traveling distance between vehicles.

Commercial Vehicle Operations (CVO)

Commercial Vehicle Operations (CVO) include not only heavy trucks but also buses, vans, taxis, and emergency vehicles. More so than any of the other functional groups, CVO afford ITS system users a tangible economic benefit.

Technologies to improve the safety and productivity of commercial vehicles include the following:

- Commercial Vehicle Electronic Screening—facilitates domestic and border clearance; minimizes stops and delays at weigh stations and ports of entry; allows check of credentials, safety status, and weight at mainline speeds.
- Automated Roadside Safety Inspection—facilitates roadside safety inspections of vehicles and drivers, automated inspection, on-line access to records (safety performance, vehicles, carriers)
- Commercial Vehicle Administrative Processes—allows for the electronic application, purchase, and issuance of credentials, and automatic tax reporting and auditing.
- On-Board Safety Monitoring—monitors safety of vehicle, driver, and cargo, and provides automatic warnings for corrective action.
- Freight and Fleet Management—facilitates communication between drivers, dispatchers, transportation providers, highway traffic systems managers.
- Hazardous Materials Incident Notification—provides description of the hazardous materials involved in incidents and defines countermeasures.

The goal of CVO is to improve the safety of commercial vehicles by better tracking of safety conditions and to improve the operational efficiency of commercial vehicles by sharing information electronically.

Advanced Public Transportation Systems (APTS)

Advanced Public Transportation Systems (APTS) consist of three elements: (1) fleet management, (2) mobility management, and (3) traveler information. APTS rely

heavily on other ITS functional groups such as ATMS, ATIS, and AVCS to improve operation in each of these areas.

The overall goal of APTS is to increase the use and productivity of high occupancy vehicles. More specific objectives include encouraging ridesharing to reduce congestion, providing better information on bus arrival times, allowing for electronic fare payment, and ensuring better schedule adherence.

NATIONAL AND LOCAL ITS EFFORTS

The list of current ITS-related projects is boundless. Few of these efforts however, specifically consider or affect improvements to freight mobility through urban corridors.

- Advanced Traffic Management Systems (ATMS) efforts focus on (1) technology development, (2) advanced signal systems, (3) improved detection and surveillance, and (4) the integration of existing technologies and data needs.
- Advanced Traveler Information Systems (ATIS) efforts focus on technology development, including both in-vehicle and out-of-vehicle (e.g., kiosks) information sources and human factors issues related to the receipt and use of traveler information.
- Advanced Vehicle Control Systems (AVCS) efforts focus on technology development for both driver and vehicle monitoring.
- Commercial Vehicle Operations (CVO) efforts focus heavily on improving the efficiency of current regulatory functions (i.e., permit purchasing, electronically transmitting status information, streamlining the inspection process).
- Advanced Public Transportation Systems (APTS) efforts focus on improving operational efficiency and fleet management through the use of technology. Such efforts include automatic fare payment, scheduling, routing, and dispatching. In addition, work is being conducted in the area of traveler information (i.e., passenger information displays). In response to congestion, transit signal priority systems and real-time routing information for congestion avoidance are under development.

Table 6.1. Summary of ITS Goals and Technologies

FUNC-TIONAL AREA	GOAL	MODE	MECHANISM
ATMS	• *maximize efficiency of highway network* • *maintain priority for HOVs*	• all	• advanced surveillance and detection devices (loop detectors, radar detectors, CCTV) • advanced control hardware and software • dynamic freeway ramp metering and arterial signal control
ATIS	• *assist travelers*	• private vehicle • public transit	• on-board navigation systems • variable message signs • highway advisory radio • television • personal computers • kiosks
AVCS	• *improve safety* • *improve efficiency*	• all	• collision warning systems • automatic vehicle control • limited access automated lanes
CVO	• *improve efficiency* • *improve productivity*	• trucks • buses • vans • taxis • emergency vehicles	• automated vehicle location • automated vehicle identification systems • real-time driver and vehicle safety monitoring • hazardous materials tracking • site-specific highway warning systems • automatic mayday capability • electronic permitting • electronic log book and fuel tax reporting • automatic credential and weight checking (i.e., WIM) • computerized fleet tracking and dispatching
APTS	• *increase utilization of HOVs* • *improve productivity*	• public transit • carpools • vanpools	• real-time ridematching • smart cards • preferential traffic signal control

National Efforts

As described earlier, Commercial Vehicle Operations (CVO) efforts focus heavily on improving the efficiency of current regulatory functions. Few national efforts directly address the need to improve freight mobility along urban freeway corridors.

An effort currently conducted in Charlotte, North Carolina, seeks to address the problems of congestion specifically for large trucks. The Congestion Avoidance and Reduction for Automobiles and Trucks (CARAT) project is a long-range project that is implementing congestion management for freeways and connected arterials in the Charlotte urban area.

A number of national efforts focus on improving corridor movement but do not separate trucks from the general traffic. Hence, trucks will likely not receive preferential treatment of any kind.

Local Efforts

As with many of the national efforts, local efforts focus on improving corridor movement but do not separate trucks from the general traffic. Three corridors are currently being studied: (1) Seattle to Portland, (2) Portland to Boise, and (3) Seattle to Vancouver (British Columbia). These corridors serve as important national and international trade routes and include important intermodal linkages with railroad and barge transportation.

Truck-specific efforts include the multistate Commercial Vehicle Information Systems and Networks (CVISN) project, which is streamlining the regulatory process for large trucks, and two separate mainstreaming projects that are integrating ITS systems with CVO regulatory agencies. Although these ITS efforts will undoubtedly reduce the delay experienced at weigh stations, ports of entries, and border crossings, they provide little assistance to avoid recurring traffic congestion through urban freeway corridors.

ITS IMPLICATIONS FOR FREIGHT PRODUCTIVITY IMPROVEMENTS

Many of the ITS technologies under development will benefit large trucks as part of the general traffic stream; few will provide preferential treatment to large trucks. Those that will provide preference to large trucks will address the need to reduce delay at weigh stations, ports of entry, and border crossings and will do little to account for recurring congestion along urban freeway corridors. Indirectly, large trucks will benefit as the overall traffic flow is improved through ITS technologies.

If large trucks were provided preferential treatment through dedicated or cooperative restricted use lane (i.e., a truck/bus lane), mainline detection and surveillance or weigh-in-motion technologies could be concentrated in a single lane or lanes. This would allow for better capture of bus and truck volumes and weights; information lost to vehicle lane changes or vehicles that skirt the recognition limit of the technology (i.e., the outside lanes for centrally mounted, overhead detection or surveillance devices) could be minimized. Hazardous materials tracking could also be improved through better recognition of large trucks.

Preferential lane use information could be incorporated into ATIS technologies. For non-local truckers, ATIS could provide valuable information about the preferential treatment available to them through the Puget Sound region urban freeway corridors. Usage eligibility information could be provided (reducing the enforcement requirements), as well as time savings predicted to result from use of the preferential lane.

If traveler information were provided out of the vehicle, informational signing (i.e., variable message signing) could be located for better visibility for large trucks. If large trucks were provided preferential treatment on outside lanes, pole-mounted signs easily visible to taller vehicles could be constructed and deployed. Highway warnings particular to large trucks, such as speed or height restrictions, could be provided on the signs. Truckers are more likely to notice signing when they travel in the lane adjacent to the sign, rather than when dispersed in all lanes of the facility.

Preferential treatments, including an exclusive truck lane or a cooperative bus/truck lane, would allow similarly sized vehicles to platoon. Platooning relies heavily on the development of Automatic Vehicle Control Systems (AVCS). Platooned vehicles could maintain a shorter headway and consistent speed increasing the vehicle throughput of the lane and maintaining traveler benefits (e.g., travel time savings). In addition, safety could be improved through crash avoidance technologies. Technology development could focus more on the dynamics of heavy vehicles to account for increased stopping distance, higher center of gravity, and blind spots.

The opportunities described above to link freight mobility strategies with ITS technologies are within the scope of ITS and are consistent with ITS goals. However, a potential conflict might arise with a cooperative HOV/truck lane. Because a primary ATMS goal is to maintain priority for high occupancy vehicles, allowing trucks to share in the preferential treatment might decrease the benefits enjoyed by HOVs, especially carpools, which might not feel comfortable traveling with large trucks. However, truck volumes in urban areas are typically low. In addition, traditional arguments about a reduction of travel time savings resulting from trucks in the HOV traffic stream might not be valid in the ITS environment because ITS increases capacity through the application of technology.

Preferential treatment for large trucks on freeway corridors would likely lead to preferential treatment of trucks on arterials and local streets. Ramp metering bypasses or signal priority for large trucks might be a viable consideration in the future. First, a shift in viewpoint is needed; efficient freight and goods movement must be viewed as an important factor in our nation's economy.

CHAPTER 7
CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of this study can best be presented by reviewing the study's findings regarding operational and economic impacts, safety impacts, changes in pavement deterioration rates, and opinion surveys.

OPERATIONAL AND ECONOMIC IMPACTS

The study determined that reserved-capacity strategies for trucks would offer nearly $10 million in annual travel time savings for the trucking industry in the Seattle region. Although this is not a large amount in relation to the amount of truck activity in the area, it is still a sizable savings. In terms of truck-industry productivity, the impact of reserved-capacity strategies on individual trips would be small, about 2.5 minutes saved per average trip (less than 8 percent savings in trip travel time). Although it is unlikely that trucking firms could effectively use such a small savings in travel time to improve productivity, it is possible that some trucking operations could benefit, particularly those whose trucks would spend large portion of their trip on facilities with reserved capacity. In addition, the potential reduction in the variance of travel-time could help the trucking industry. However, whether the trucking industry would be able to take advantage of the average 2- to 3-minute reduction in trip times and the reduction in travel-time variance remains unknown. The biggest impact of truck reserved capacity strategies is the travel-time savings they would create for single-occupancy vehicles, almost $30 million in travel time saved per year. (Note that this is not an unusually large number in comparison to the $250 million annual travel-time loss in the Seattle area due to delays resulting from freeway incidents (Jones, Janssen, and Mannering, 1991)). This travel-time savings would be an artifact of the current under-utilization of HOV lanes in the Seattle area and not necessarily a virtue of reserved-capacity strategies. Still, this result must be weighed in any policy implementation. The study also determined that the difference in travel times between the

reserved-capacity strategy that would add trucks to the existing HOV lanes and the one that would add an exclusive truck lane would be insignificant, revealing little justification for the construction of an exclusive truck lane. Future growth in HOV and truck traffic may result in congested reserved lanes and reduced truck travel time savings.

In interpreting the operational and economic impacts presented in this report, it is important to recognize the limitations of the traffic simulation approach used. First, the truck origin-destination matrix had to be estimated. Although we are confident that the matrix was reasonably close to the true matrix, some caution must be used in interpreting the results. Second, the model assigned travel on the basis of expected travel time and assumed that travelers and truckers would not change their trip-departure times or modes in response to congestion. The reserved-capacity strategies considered herein would almost certainly have long-term effects on departure times (i.e., more truckers and travelers might travel in peak periods when additional capacity was provided) and mode choices, which would have to be considered before any alternative was implemented. Despite these limitations, the results presented in this report provide a good idea of the range of impacts that could be expected.

SAFETY IMPACTS

The effect of reserved-capacity strategies on safety would be a function of whether the reserved lanes were on the left or right side. Left-side lanes might increase side-swipe accidents, whereas right-side lanes might create other types of incidents because of interactions with merging traffic. On the other hand, sight distances and the operation of general-purpose lanes would improve with the reduction in truck travel. In all likelihood, the impact of reserved-capacity strategies on safety would be small.

PAVEMENT DETERIORATION

Without doubt, reserved capacity strategies for trucks would accelerate pavement deterioration in the reserved lanes. This would necessitate reconstruction of the lanes

carrying trucks and would be a capital expense associated with reserved-capacity strategies. However, this expense would be offset by a reduction in the pavement deterioration rates of the general purpose lanes. Although the net effect would likely be an increase in capital expenditures, this increase would likely be small.

PUBLIC OPINION

The most significant obstacle to reserved-lane capacities would be public opinion. Our surveys of the general public and subsequent statistical analysis showed considerable resistance to reserved-capacity strategies for trucks. However, this resistance is not unlike that encountered when HOV lanes were first considered. As a result, one would expect that careful marketing and resolve on the behalf of the implementing agency could persuade the public to accept reserved-capacity strategies for trucks.

SUMMARY

In conclusion, although there are many factors to consider, one key concern is whether the trucking industry could take advantage of reductions in travel time and travel-time variance that would result from the implementation of a reserved-capacity strategy for trucks. This is a difficult question to answer—and one our surveys suggested that the trucking industry itself can not answer. It is the recommendation of this study that the idea of reserved-capacity strategies for trucks continue to be presented to the trucking industry, to the public, and to other impacted agencies for discussion and consideration. Our study showed that the adverse impacts of such strategies are easily manageable and there is at least potential for freight-productivity improvements.

REFERENCES

BST Associates, *1991 Washington Ports and Transportation Systems Study*, Washington Public Ports Association and Washington State Department of Transporation (1991)

Garber, Nicholas J. and Ravi Gadiraju, *Effects of Truck Strategies on Traffic Flow and Safety on Multilane Highways*, Transportation Research Record No. 1256 Freight Transportation -- Trucking Issues 1990, Transportation Research Board, National Research Council, Washington, D.C. (1990).

Garrison, D. and F. Mannering, Assessing the traffic impacts of freeway incidents and driver information, *ITE Journal*, Vol. 60, No. 8, 19-23, 1990.

Garrison, D., B. Sebranke, and F. Mannering, Seattle-area incident impact analysis: microcomputer traffic simulation results, Volume III, WA-RD 204.4, 131pp., 1989.

Grenzeback, Lance R., William R. Reilly, Paul O. Roberts, and Joseph R. Stowers, *Urban Freeway Gridlock Study: Decreasing the Effects of Large Trucks on Peak-Period Urban Freeway Congestion*, Transportation Research Record No. 1256 Freight Transportation -- Trucking Issues 1990, Transportation Research Board, National Research Council, Washington, D.C. (1990).

Harvey Consultants, Inc., Transmode Consultants, Inc. and Ellen Kret Porter, *Regional Freight Mobility Action Packages*, developed with the Regional Freight Mobility Roundtable, Puget Sound Regional Council, Seattle, WA (1994).

Highway Capacity Manual 1994

Holder, R.W., D.L. Christiansen, C.A. Fuhs and G.B. Dresser, *Truck Utilization of the I-45N Contraflow Lane in Houston,* Research Report 205-6, Texas Transportation Institute, College Station, Texas (1979).

Jones, B., L. Janssen, and F. Mannering, Analysis of the frequency and severity of freeway accidents in Seattle, Accident Analysis and Prevention, Vol. 23, No. 4, 239-255.

Kim, Soon G., Jodi Koehne, and Fred Mannering, *I-90 Lane Conversion Evaluation*, Washington State Department of Transportation, Seattle, WA, (1995).

Millendorf, Stuart F., *Facilitation of Goods Movement in the New York City Area*, A. Chatterjee (editor), Gordon P. Fisher and Richard A. Staley (co-editors), Goods Transportation In Urban Areas, Proceedings of the Fifth conference sponsored by the Engineering Foundation, American Society of Civil Engineers, New York, N.Y. (1989).

Organisation For Economic Co-Operation and Development,*Cargo Routes: Truck Roads and Networks*, Road Transport Research, Paris, France (1992).

R.J. Hansen Associates LTD, *Investigation of High Volume, Heavy Truck, Intercity Freight Corridors*, prepared for the US Department of Transportation, Washington, D.C. (1979).

Transportation Research Board,*Special Report 223: Providing Access For Large Trucks*, National Research Council, Washington, D.C. (1989).

Washington State Department of Transportation, Ramp and Roadway Report, 1990.

Washington State Department of Transportation,*WSDOT Pavement Guide*, Washington State Transportation Center, Seattle, WA, 1994.

BIBLIOGRAPHY

Accomplishments and Effectiveness Annual Report. Office of Motor Carriers, FHWA, U.S. Department of Transportation, May 1992.

Assessing the Relationship Between Transportation Infrastructure and Productivity. FHWA, U.S. Department of Transportation. August 1992.

Corsi, T.M. and C.M. Grimm. Strategies and Performance in the Truckload General Freight Segment Before and After Deregulation. Journal of the Transportation Research Forum. Vol. 30, No. 1, 1989, pp. 92-97.

Corsi, T.M. and C.M.Grimm. Changes in Owner-Operator Use 1977-1985: Implications for Management Strategy. Transportation Journal, Vol. 26, No.3, Spring 1987, pp 4-16.

Evaluating Shipper Related Productivity Gains. Final Report. Center for :Logistics Research, Pennsylvania State University, University Park, December 1991.

Evaluation of Highway Geometrics Related to Larger Trucks, Kentucky Transportation Center, College of Engineering, University of Kentucky,

Grimm, C.M. T.M. Corsi and R.D. Smith. Determinants of Strategic Change in the LTL Motor Freight Industry: A Discrete Choice Analysis. Transportation Journal, Vol. 32, No. 4, 1993, pp. 56-62.

IVHS America. Strategic Plan for Intelligent Vehicle-Highway Systems in the United States. May 20, 1992.

Keaton, M. A. Are There Economies of Traffic Density in the Less-Than-Truckload Motor Carrier Industry? An Operations Planning Analysis. Transportation Research, Vol. 27A, No. 5, September 1993, pp 343-358.

Larkin, J.G. Truckload Industry Review. Alex Brown and Sons, Inc., Baltimore , MD, Dec. 1992

Motor Carrier Activities of the Federal Highway Administration. FHWA, U.S. Department of Tranpsortation, May 1992

MVMA Motor Vehicle Facts and Figures '92. Motor Vehicle Manufacturers Association of the United States, Detroit, Mich., 1992.

National ITS Program Plan. Intelligent Transportation Systems. Volumes I and II. March 1995.

Schulz, J.D. Truckload Carriers Eye Short Hauls with Quality Service a Lure. Traffic World, March 30, 1992, pp 24-26.

Smith, R.D., T.M. Corsi, and C.M. Grimm. Motor Carrier Strategies and Performance. Transportation Research, Series A, Volume 24A, No. 3, 1990, pp201-210.

Traffic and Geometric Characteristics Affecting the Involvement of Large Trucks in Accidents, Volume 1, Accident Characteristics and Fault Tree Analysis

Traffic and Geometric Characteristics Affecting the Involvement of Large Trucks in Accidents, Volume 2, Linear, Poisson, and Logistic regression Models

The Truckload Carrier and Intermodal. Business and Market Planning. Fleet Managmenet Department, TTX, Oct 15, 1992.

U.S. Department of Transportation. Department of Transportation's Intelligent Transportation Systems (ITS) Projects. January 1996.

Washington State Department of Transportation. Advanced Technology Branch Status Report of Current Activities. March 1996.

Appendix A

List of Abbreviations

AVI -- automatic vehicle identification

HOV -- high occupancy vehicle

TSM -- transportation system management

UGM -- urban goods movement

WSDOT -- Washington State Department of Transportation

Appendix B`

Questionaires

Washington State Department of Transportation | University of Washington | TRAC Washington State Transportation Center

Freight Mobility Survey

The Washington State Department of Transportation and the University of Washington are working together to evaluate the effects of increasing the mobility of large trucks on urban freeways. As part of this evaluation, we need to understand your opinion on this subject. We ask that the most frequent commuter in your household complete this survey.

DRIVING CHARACTERISTICS

1. Which route do you most frequently use: (*pick one*)

   ☐ I-5 ☐ I-90 ☐ I-405 ☐ SR-520 ☐ SR-167 ☐ none

   ↳ How many times per week do you typically use this route?_____

   ↳ What is your usual mode of travel on this route?

   ☐ drive alone ☐ 2 person carpool ☐ 3 or more person carpool ☐ vanpool ☐ bus

   ↳ Do you frequently encounter congestion when traveling on this route? ☐ yes ☐ no

   ↳ Estimate your average speed when traveling on this route during **congested** periods:

   ☐ less than 25 mph ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65 mph or over

2. Do you use the high occupancy vehicle (HOV) lanes when eligible:

   ☐ always ☐ most of the time ☐ some of the time ☐ never

PREFERENCES

3. Are you aware that trucks are not allowed in HOV lanes in Washington State? ☐ yes ☐ no

4. If a lane was reserved lane for large truck travel, I would prefer that:

   ☐ the lane was reserved for large trucks only.
   ☐ the lane was reserved for large trucks and buses.
   ☐ existing HOV policy was changed to allow large trucks.

5. If large trucks were allowed to travel in the HOV lanes:

   ☐ I would not use the HOV lanes.
   ☐ I would occasionally use the HOV lanes.
   ☐ I would use the HOV lanes frequently.

   ↳ Why?_____

6. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ on the right-side of the roadway only.
   ☐ on the left-side of the roadway only.
   ☐ on either side of the roadway (no preference).

7. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ only during peak commuting hours.
   ☐ at all times.
   ☐ at no time.

OPINIONS	Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
8. A single reserved lane for large trucks only would improve:					
• safety.	_____	_____	_____	_____	_____
• congestion.	_____	_____	_____	_____	_____
9. A single reserved lane for large trucks and buses would improve:					
• safety.	_____	_____	_____	_____	_____
• congestion.	_____	_____	_____	_____	_____
10. Allowing large trucks to travel in the existing HOV lanes would improve:					
• safety.	_____	_____	_____	_____	_____
• congestion.	_____	_____	_____	_____	_____
11. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	_____	_____	_____	_____	_____
12. Large trucks are vital to our nation's economy	_____	_____	_____	_____	_____
13. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	_____	_____	_____	_____	_____
14. Large trucks should pay a special usage fee for using a reserved lane or the existing HOV lanes.	_____	_____	_____	_____	_____

BACKGROUND ***(for organizational purposes only, will not be disclosed)***

15. Do you wear a seatbelt? ☐ never ☐ sometimes ☐ always

16. How fast do you typically drive on the freeway if there is no congestion?

☐ less than 45 mph ☐ 45 - 49 ☐ 50 - 54 ☐ 55 - 59 ☐ 60 - 64 ☐65 mph or over

17. What is your age?

☐ under 21 ☐ 22 - 25 ☐ 26 - 30 ☐ 31 - 34 ☐ 35 - 40 ☐ 41 - 45 ☐ 46 - 50
☐ 51 - 55 ☐ 56 - 60 ☐ 61 - 65 ☐ 66 - 70 ☐ 71 or older

18. What is your gender? ☐ male ☐ female

19. What is your marital status? ☐ married ☐ single

20. Including yourself, how many people live in your household?_____

21. How many children under the age of 6 live in your household?_____

22. How many children between the ages of 6 and 16 live in your household?_____

23. How many persons in the household work outside the home?_____

24. How many licensed motor vehicles are at your home?_____

25. What type of vehicle do you usually drive?

☐ passenger car ☐ pickup ☐ van ☐ motorcycle ☐ other

26. What is your approximate household income per year?

☐ $10,000 or under ☐ $11,000-19,999 ☐ $20,000-29,999 ☐ $30,000-39, 999
☐ $40,000-49, 999 ☐ $50,000-59, 999 ☐ $60,000-74, 999 ☐ $75,000-100,000
☐ over $100,000

27. What is your highest level of education?

☐ some high school ☐ high school or GED ☐ community college or trade school
☐ college or university ☐ post graduate or doctoral

28. How many years have you been a licensed driver?_____

29. If employed, how many miles between home and your workplace -- approximately_____

30. What is the zipcode at your residence?_____

Additional
Comments:_____

_____

_____

Thank you for taking the time to complete this survey. When you are finished, please remove your address label for complete anonymity, refold the form so that the 'University of Washington' address is displayed, secure with tape, and drop it in a mailbox before July 15, 1995. Remember no postage is necessary.

Washington State Department of Transportation | University of Washington | TRAC Washington State Transportation Center

Freight Mobility Survey

The Washington State Department of Transportation and the University of Washington are working together to evaluate the effects of increasing the mobility of large trucks on urban freeways. As part of this evaluation, we need to understand your opinion on this subject.

DRIVING CHARACTERISTICS

1. When driving a bus, which route do you most frequently use: (*pick one*)

   ☐ I-5 ☐ I-90 ☐ I-405 ☐ SR-520 ☐ SR-167 ☐ none

   ↳ How many times per week do you typically use this route?_____

   ↳ Do you use the HOV lane on this route? ☐ yes ☐ no

   ↳ If not, why?_____

   ↳ Do you frequently encounter congestion when traveling on this route? ☐ yes ☐ no

   ↳ Estimate your average speed when traveling on this route during **congested** periods:

   ☐ less than 25 mph ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65 mph or over

PREFERENCES

2. Are you aware that trucks are not allowed in HOV lanes in Washington State? ☐ yes ☐ no
3. If a lane was reserved lane for large truck travel, I would prefer that:

   ☐ the lane was reserved for large trucks only.
   ☐ the lane was reserved for large trucks and buses.
   ☐ existing HOV policy was changed to allow large trucks.

4. If large trucks were allowed to travel in the HOV lanes:

   ☐ I would not use the HOV lanes.
   ☐ I would occasionally use the HOV lanes.
   ☐ I would use the HOV lanes frequently.

   ↳ Why?_____

5. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ on the right-side of the roadway only.
   ☐ on the left-side of the roadway only.
   ☐ on either side of the roadway (no preference).

6. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ only during peak commuting hours.
   ☐ at all times.
   ☐ at no time.

OPINIONS	Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
7. A single reserved lane for large trucks only would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
8. A single reserved lane for large trucks and buses would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
9. Allowing large trucks to travel in the existing HOV lanes would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
10. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	____	____	____	____	____
11. Large trucks are vital to our nation's economy	____	____	____	____	____
12. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	____	____	____	____	____
13. Large trucks should pay a special usage fee for using a reserved lane or the existing HOV lanes.	____	____	____	____	____

BACKGROUND *(for organizational purposes only, will not be disclosed)*

14. Do you wear a seatbelt in your personal vehicle? ☐ yes ☐ no

15. Do you use the HOV lane with your personal vehicle? ☐ yes ☐ no

16. How fast do you typically drive your personal vehicle on the freeway if there is no congestion?

☐ less than 25 mph ☐ 25 - 34 ☐ 35 - 44 ☐ 45 - 54 ☐ 55 - 64 ☐ 65 mph or over

17. How many years have you been a licensed driver?_____

18. What is your age?

☐ under 21 ☐ 22 - 25 ☐ 26 - 30 ☐ 31 - 34 ☐ 35 - 40 ☐ 41 - 45 ☐ 46 - 50
☐ 51 - 55 ☐ 56 - 60 ☐ 61 - 65 ☐ 66 - 70 ☐ 71 or older

19. What is your gender? ☐ male ☐ female

20. What is your marital status? ☐ married ☐ single

21. What is your approximate household income per year?

☐ $10,000 or under ☐ $11,000-19,999 ☐ $20,000-29,999 ☐ $30,000-39, 999
☐ $40,000-49, 999 ☐ $50,000-59, 999 ☐ $60,000-74, 999 ☐ $75,000-100,000
☐ over $100,000

22. What is your highest level of education?

☐ some high school ☐ high school or GED ☐ community college or trade school
☐ college or university ☐ post graduate or doctoral

23. What type of bus do you typically operate? ☐ single coach ☐ articulated ☐ other

24. How many hours per day do you operate a bus? _____

25. How many years have you been a bus driver? _____

Additional
Comments:_____

_____

_____

_____

_____

Thank you for taking the time to complete this survey. When you are finished, please remove your address label for complete anonymity, refold the form so that the 'University of Washington' address is displayed, secure with tape, and drop it in a mailbox before July 15, 1995. Remember no postage is necessary.

Truck Company

Washington State Department of Transportation | University of Washington | TRAC Washington State Transportation Center

Freight Mobility Survey

The Washington State Department of Transportation and the University of Washington are working together to evaluate the effects of increasing the mobility of large trucks on urban freeways. As part of this evaluation, we need to understand your company's opinion on this subject. We ask that the person most familiar with the company's truck routing complete this survey.

DRIVING CHARACTERISTICS

1. Which route do your trucks <u>most</u> frequently use: (*pick one*)

   ☐ I-5 ☐ I-90 ☐ I-405 ☐ SR-520 ☐ SR-167 ☐ none

   ↳ How many times per week do you typically use this route?_____

2. Does your company regulate the routes of their trucks on highways? ☐ yes ☐ no

   ↳ If yes, which routes are restricted?_____

3. Does your company regulate the time which trucks travel on urban highways? ☐ yes ☐ no

   ↳ If yes, what are the restricted times?_____

4. Does your company regulate the speed of your trucks on highways? ☐ yes ☐ no

   ↳ If yes, what is their maximum allowed highway speed? _____

PREFERENCES

5. If a lane was reserved lane for large truck travel, I would prefer that:

   ☐ the lane was reserved for large trucks only.
   ☐ the lane was reserved for large trucks and buses.
   ☐ existing HOV policy was changed to allow large trucks.

6. If large trucks were allowed to travel in the HOV lanes your trucks would:

   ☐ not use the HOV lanes.
   ☐ occasionally use the HOV lanes.
   ☐ use the HOV lanes frequently.

   ↳ Why?_____

7. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ on the right-side of the roadway only.
   ☐ on the left-side of the roadway only.
   ☐ on either side of the roadway (no preference).

8. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ only during peak commuting hours.
   ☐ at all times.
   ☐ at no time.

OPINIONS	Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
9. A single reserved lane for large trucks only would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
10. A single reserved lane for large trucks and buses would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
11. Allowing large trucks to travel in the existing HOV lanes would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
12. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	____	____	____	____	____
13. Large trucks are vital to our nation's economy	____	____	____	____	____
14. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	____	____	____	____	____
15. Large trucks should pay a special usage fee for using a reserved lane or the existing HOV lanes.	____	____	____	____	____

BACKGROUND ***(for organizational purposes only, will not be disclosed)***

16. How many trucks over 40,000 GVW does your company use in Washington state?_____

17. Does your company:

☐ own trucks ☐ use owner-operated trucks ☐ use both types ☐ other

18. Does our company haul:

☐ locally only ☐ statewide ☐ interstate ☐ internationally ☐ other

19. What type of hauling vehicles does your company use?

☐ straight truck . . . . . How many?_____

☐ straight truck with trailer . . . . . How many?_____

☐ tractor with semitrailer . . . . . How many?_____

☐ tractor with semitrailer and full trailer . . . How many?_____

☐ other _____. . . . . How many?_____

20. What are your typical gross vehicle weights (GVW)?

☐ straight truck _____

☐ straight truck with trailer _____

☐ tractor with semitrailer _____

☐ tractor with semitrailer and full trailer _____

☐ other _____

21. Does your company haul time sensitive cargo? ☐ yes ☐ no

22. How many years has your company been using trucks over 40,000 GVW?_____

23. What city and state is your company based in?_____

24. What is the zipcode where your company is located in Washington?_____

Additional
Comments:_____

_____

_____

_____

Thank you for taking the time to complete this survey. When you are finished, please remove your address label for complete anonymity, refold the form so that the 'University of Washington' address is displayed, secure with tape, and drop it in a mailbox before September 29, 1995. Remember no postage is necessary.

Washington State Department of Transportation | University of Washington | TRAC Washington State Transportation Center

Freight Mobility Survey

The Washington State Department of Transportation and the University of Washington are working together to evaluate the effects of increasing the mobility of large trucks on urban freeways. As part of this evaluation, we need to understand your opinion on this subject. Please take a few moments to tell us about your driving characteristics and opinions.

DRIVING CHARACTERISTICS

1. When driving your truck, which route do you most frequently use: (*pick one*)

   ☐ I-5 ☐ I-90 ☐ I-405 ☐ SR-520 ☐ SR-167 ☐ none

   ↳ How many times per week do you typically use this route?_____

   ↳ Which lane do you usually travel in on this route?

   ☐ right lane ☐ one of the middle lanes ☐ left lane

   ↳ Do you frequently encounter congestion when traveling on this route? ☐ yes ☐ no

   ↳ Estimate your average speed when traveling on the freeway during **congested** periods:

   ☐ less than 25 mph ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65 mph or over

2. Have you ever been subject to:

   ☐ restricted facilities (i.e., no trucks over a certain GVW)
   ☐ restricted lanes on a facility (i.e., no trucks in left lane)
   ☐ restrictions by time of day (i.e., no trucks 6-9am and 3-6pm)

3. Have you ever changed your hours of operation to account for: restrictions? ☐ yes ☐ no
   congestion? ☐ yes ☐ no

4. Have you ever changed your travel route to account for: restrictions? ☐ yes ☐ no
   congestion? ☐ yes ☐ no

PREFERENCES

5. Are you aware that trucks are not allowed in HOV lanes in Washington State? ☐ yes ☐ no

6. If a lane was reserved lane for large truck travel, I would prefer that:

   ☐ the lane was reserved for large trucks only.
   ☐ the lane was reserved for large trucks and buses.
   ☐ existing HOV policy was changed to allow large trucks.

7. If large trucks were allowed to travel in the HOV lanes:

   ☐ I would not use the HOV lanes.
   ☐ I would occasionally use the HOV lanes.
   ☐ I would use the HOV lanes frequently.

   ↳ Why?_____

8. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ on the right-side of the roadway only.
   ☐ on the left-side of the roadway only.
   ☐ on either side of the roadway (no preference).

9. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ only during peak commuting hours.
   ☐ at all times.
   ☐ at no time.

OPINIONS	Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
10. A single reserved lane for large trucks only would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
11. A single reserved lane for large trucks and buses would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
12. Allowing large trucks to travel in the existing HOV lanes would improve:					
• safety.	____	____	____	____	____
• congestion.	____	____	____	____	____
13. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	____	____	____	____	____
14. Large trucks are vital to our nation's economy	____	____	____	____	____
15. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	____	____	____	____	____
16. Truck drivers or companies should pay a special usage fee for using a reserved lane or the existing HOV lanes.	____	____	____	____	____

BACKGROUND ***(for organizational purposes only, will not be disclosed)***

17. Do you wear a seatbelt in your personal vehicle? ☐ yes ☐ no

18. How fast do you typically drive your personal vehicle on the freeway if there is no congestion?
☐ less than 45 mph ☐ 45 - 49 ☐ 50 - 54 ☐ 55 - 59 ☐ 60 - 64 ☐65 mph or over

19. Do you use the HOV lane with your personal vehicle? ☐ yes ☐ no

20. What is your age?
☐ under 21 ☐ 22 - 25 ☐ 26 - 30 ☐ 31 - 34 ☐ 35 - 40 ☐ 41 - 45 ☐ 46 - 50
☐ 51 - 55 ☐ 56 - 60 ☐ 61 - 65 ☐ 66 - 70 ☐ 71 or older

21. What is your gender? ☐ male ☐ female

22. What is your marital status? ☐ married ☐ single

23. What is your typical operating weight (GVW)?_____

24. What is your maximum operating weight (GVW)? _____

25. How many hours per day do you personally operate your vehicle? _____

26. How many miles per year does your vehicle average? _____

27. How would you describe your typical cargo? (e.g. household goods, perishable foods, fuel, etc.)

_____

28. What type of truck do you usually drive?
☐ single unit ☐ tractor-trailer ☐ tractor-semi and full trailer ☐ other_____

29. How many years have you been a licensed truck driver? _____

30. Are you currently: ☐ an independent truck driver?
☐ employed by a trucking firm?
☐ employed as a truck driver by a company?

Additional
Comments:_____

_____

_____

Thank you for taking the time to complete this survey. When you are finished, please remove your address label for complete anonymity, refold the form so that the 'University of Washington' address is displayed, secure with tape, and drop it in a mailbox before July 15, 1995. Remember no postage is necessary.

Washington State Department of Transportation | University of Washington | TRAC Washington State Transportation Center

Freight Mobility Survey

The Washington State Department of Transportation and the University of Washington are working together to evaluate the effects of increasing the mobility of large trucks on urban freeways. As part of this evaluation, we need to understand your opinion on this subject.

DRIVING CHARACTERISTICS

1. When on patrol, which route do you most frequently use: (*pick one*)

   ☐ I-5 ☐ I-90 ☐ I-405 ☐ SR-520 ☐ SR-167 ☐ none

   ↳ How many times per week do you typically use this route?_____

   ↳ Do you use the HOV lane on this route? ☐ yes ☐ no

   ↳ Do you frequently encounter congestion when traveling on this route? ☐ yes ☐ no

   ↳ Estimate your average speed when traveling on this route during **congested** periods:

   ☐ less than 25 mph ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65 mph or over

2. How many times per week do you stop large trucks for traffic infractions?_____

ENFORCEMENT PREFERENCES

3. Are you aware that trucks are not allowed in HOV lanes in Washington State? ☐ yes ☐ no

4. If a lane was reserved lane for large truck travel, I would prefer that:

   ☐ the lane was reserved for large trucks only.
   ☐ the lane was reserved for large trucks and buses.
   ☐ existing HOV policy was changed to allow large trucks.

5. If large trucks were allowed to travel in the HOV lanes, I would prefer that:

   ☐ lane use was limited by truck size (i.e., 5+ axle trucks).
   ☐ lane use was limited by truck weight (i.e., 40,000+ GVW trucks).
   ☐ lane use was open to all trucks.
   ☐ lane use was open to no trucks.

6. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ on the right side of the road only.
   ☐ on the left-side of the roadway only.
   ☐ on either side of the roadway (no preference).

7. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

   ☐ only during peak commuting hours.
   ☐ at all times.
   ☐ at no time.

OPINIONS	Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
8. A single reserved lane for large trucks only would improve:					
• safety.	_____	_____	_____	_____	_____
• congestion.	_____	_____	_____	_____	_____
9. A single reserved lane for large trucks and buses would improve:					
• safety.	_____	_____	_____	_____	_____
• congestion.	_____	_____	_____	_____	_____
10. Allowing large trucks to travel in the existing HOV lanes would improve:					
• safety.	_____	_____	_____	_____	_____
• congestion.	_____	_____	_____	_____	_____
11. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	_____	_____	_____	_____	_____
12. Large trucks are vital to our nation's economy	_____	_____	_____	_____	_____
13. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	_____	_____	_____	_____	_____
14. Large trucks should pay a special usage fee for using a reserved lane or the existing HOV lanes.	_____	_____	_____	_____	_____

BACKGROUND ***(for organizational purposes only, will not be disclosed)***

15. Do you wear a seatbelt in your personal vehicle? ☐ yes ☐ no

16. Do you use the HOV lane with your personal vehicle? ☐ yes ☐ no

17. How fast do you typically drive your personal vehicle on the freeway if there is no congestion?

☐ less than 25 mph ☐ 25 - 34 ☐ 35 - 44 ☐ 45 - 54 ☐ 55 - 64 ☐ 65 mph or over

18. What is your age?

☐ under 21 ☐ 22 - 25 ☐ 26 - 30 ☐ 31 - 34 ☐ 35 - 40 ☐ 41 - 45 ☐ 46 - 50
☐ 51 - 55 ☐ 56 - 60 ☐ 61 - 65 ☐ 66 - 70 ☐ 71 or older

19. What is your gender? ☐ male ☐ female

20. What is your marital status? ☐ married ☐ single

21. What is your approximate household income per year?

☐ $10,000 or under ☐ $11,000-19,999 ☐ $20,000-29,999 ☐ $30,000-39, 999
☐ $40,000-49, 999 ☐ $50,000-59, 999 ☐ $60,000-74, 999 ☐ $75,000-100,000
☐ over $100,000

22. What is your highest level of education?

☐ some high school ☐ high school or GED ☐ community college or trade school
☐ college or university ☐ post graduate or doctoral

23. How many years have you been a licensed driver?_____

24. How many years have you been with the Traffic Division at the Washington State Patrol? _____

Additional
Comments:_____

_____

_____

Thank you for taking the time to complete this survey. When you are finished, please remove your address label for complete anonymity, refold the form so that the 'University of Washington' address is displayed, secure with tape, and drop it in a mailbox before July 15, 1995. Remember no postage is necessary.

Appendix C

Survey Results

General Purpose Survey Results

DRIVING CHARACTERISTICS

1. Which route do you most frequently use:

I-5	51%
I-90	12%
I-405	20%
SR-520	9%
SR-167	2%
none	2%
multiple roads	4%
no answer	1%

↳ How many times per week do you typically use this route?

0 to 5 times	43%
6 to 10 times	32%
11to 15 times	17%
16 to 30 times	5%
no answer	3%

↳ What is your usual mode of travel on this route?

drive alone	73%
2 person	15%
3+ person	4%
vanpool	1%
bus	3%
no answer	5%

↳ Do you frequently encounter congestion when traveling on this route?

yes	75%
no	23%
no answer	2%

↳ Estimate your average speed when traveling on this route during **congested** periods:

> 25 mph	20%
25-34 mph	29%
35-44 mph	19%
45-54 mph	16%
55-64 mph	11%
< 64 mph	0%
no answer	4%

2. Do you use the high occupancy vehicle (HOV) lanes when eligible:

always	36%
most times	33%
sometimes	19%
never	12%
no answer	1%

PREFERENCES

3. Are you aware that trucks are not allowed in HOV lanes in Washington State?

yes	70%
no	29%
no answer	1%

4. If a lane was reserved lane for large truck travel, I would prefer that:

19%	the lane was reserved for large trucks only.
56%	the lane was reserved for large trucks and buses.
15%	existing HOV policy was changed to allow large trucks.
1%	multiple answers
9%	no answer

5. If large trucks were allowed to travel in the HOV lanes:

49%	I would not use the HOV lanes.
35%	I would occasionally use the HOV lanes.
11%	I would use the HOV lanes frequently.
0%	multiple answers
5%	no answer

↳ Why?

7%	neutral or unrelated comment
1%	feels trucks should be separated or not use during peak hours
19%	speed differential related comment -- "large trucks drive at different speeds"
8%	poor visibility related comment -- "can't see when driving behind large trucks"
7%	speed differential and poor visibility related comment
13%	dangerous/unsafe/accident prone related comment
2%	large trucks are imposing related comment
6%	don't like to follow or be near or diesel smell/they chip windshields
10%	doesn't matter/too much traffic/HOV lane not used enough/use fastest lane
1%	large trucks ruin pavement
1%	HOV lanes are too narrow for large trucks
1%	large trucks intimidate and block vision
2%	depend on amount of trucks using HOV lane/large trucks create congestion
1%	only if eligible/usually alone
0%	poor visibility related comment and large trucks ruin pavement
0%	speed differential related comment and depend on amount of trucks
2%	speed differential related and dangerous/unsafe/accident prone related comment
1%	poor visibility related and dangerous/unsafe/accident prone related comment
0%	don't like to follow and large trucks ruin pavement
1%	poor visibility related comment and don't like to follow
1%	speed differential related comment and don't like to follow
0%	speed differential related comment and only if eligible/usually alone
0%	poor visibility related comment and depend on amount of trucks using HOV lane
16%	no answer

6. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

54%	on the right side of the road only.
21%	on the left-side of the roadway only.
21%	on either side of the roadway (no preference).
4%	no answer

7. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

18%	only during peak commuting hours.
53%	at all times.
24%	at no time.
5%	no answer

OPINIONS		Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
8. A single reserved lane for large trucks only would improve:						
• safety.		10%	11%	13%	40%	26%
• congestion.	(none 1%)	13%	16%	16%	37%	17%
9. A single reserved lane for large trucks and buses would improve:						
• safety.	(none 3%)	10%	12%	14%	34%	27%
• congestion.	(none 4%)	12%	14%	17%	33%	20%
10. Allowing large trucks to travel in the existing HOV lanes would improve:						
• safety.	(none 1%)	42%	26%	15%	9%	7%
• congestion.	(none 2%)	35%	24%	15%	17%	9%
11. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	(none 3%)	47%	25%	11%	10%	4%
12. Large trucks are vital to our nation's economy.	(none 1%)	2%	3%	12%	45%	37%
13. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	(none 2%)	25%	31%	15%	19%	9%
14. Large trucks should pay a special usage fee for using a reserved lane or the existing HOV lanes.	(none 2%)	19%	22%	23%	16%	19%

BACKGROUND *(for organizational purposes only, will not be disclosed)*

15. Do you wear a seatbelt?

never	0%
sometimes	5%
always	95%
no answer	0%

16. How fast do you typically drive on the freeway if there is no congestion?

> 25 mph	0%
25 - 34 mph	0%
35 - 44 mph	4%
45 - 54 mph	44%
55 - 64 mph	41%
< 64 mph	10%
no answer	1%

17. What is your age?

> 22 years	2%
22 - 25 years	4%
26 - 30 years	9%
31 - 34 years	10%
35 - 40 years	15%
41 - 45 years	13%
46 - 50 years	15%
51 - 55 years	15%
56 - 60 years	8%
61 - 65 years	5%
66 - 70 years	3%
< 70 years	3%
no answer	1%

18. What is your gender?

male	60%
female	39%
no answer	1%

19. What is your marital status?

married	73%
single	27%
no answer	1%

20. Including yourself, how many people live in your household?

none	1%
one person	13%
two persons	42%
three persons	19%
four persons	15%
five persons	7%
six persons	1%
<six persons	2%
no answer	1%

21. How many children under the age of 6 live in your household?

none	82%
one child	11%
two children	4%
three children	1%
no answer	2%

22. How many children between the ages of 6 and 16 live in your household?

none	75%
one child	12%
two children	8%
three children	3%
<three children	1%
no answer	2%

23. How many persons in the household work outside the home?

none	7%
one person	30%
two persons	51%
three persons	8%
four persons	2%
five persons	1%
no answer	1%

24. How many licensed motor vehicles are at your home?

none	0%
one vehicle	18%
two vehicles	50%
three vehicles	20%
four vehicles	8%
five vehicles	2%
six vehicles	1%
<six vehicles	1%
no answer	1%

25. What type of vehicle do you usually drive?

passenger car	73%
pickup	10%
van	6%
motorcycle	0%
other	5%
no answer	5%

26. What is your approximate household income per year?

$10,000 or under	1%
$11,000-19,999	4%
$20,000-29,999	6%
$30,000-39, 999	8%
$40,000-49, 999	10%
$50,000-59, 999	12%
$60,000-74, 999	19%
$75,000-100,000	17%
over $100,000	12%
no answer	11%

27. What is your highest level of education?

some high school	1%
high school or GED	7%
community college or trade school	19%
college or university	46%
post graduate or doctoral	25%
no answer	2%

28. How many years have you been a licensed driver?

0 yrs.	0%
1 to 5 yrs.	1%
6 to 10 yrs.	6%
11 to 15 yrs.	11%
16 to 20 yrs.	13%
21 to 25 yrs.	14%
26 to 30 yrs.	16%
31 to 35 yrs.	11%
36 to 40 yrs.	14%
41 to 45 yrs.	5%
46 to 50 yrs.	4%
<50 yrs.	4%
no answer	2%

29. If employed, how many miles between home and your workplace?

0 miles	5%
1 to 5 miles	9%
6 to 10 miles	16%
11 to 15 miles	23%
16 to 20 miles	12%
21 to 25 miles	9%
26 to 30 miles	7%
31 to 35 miles	3%
36 to 40 miles	1%
41 to 45 miles	2%
46 to 50 miles	3%
<50 miles	2%
no answer	8%

30. What is the zipcode at your residence?

King County	70%
Pierce County	16%
Snohomish County	6%
Thurston County	2%
Mason County	1%
Spokane County	1%
Whatcom Coun ty	1%
Pacific County	>1%
Jefferson County	>1%
Asotin County	>1%
Yakima County	>1%
Clark County	>1%
Cowlitz County	>1%
Douglas County	>1%
no answer	>1%

Additional Comments:

positive comment (for trucks in HOV lane)	4%
neutral comment (unrelated comment)	14%
negative comment (against trucks in HOV lane)	24%
no comment	58%

Bus Driver Survey Results

DRIVING CHARACTERISTICS

1. When driving a bus, which route do you most frequently use:

I-5	60%
I-90	12%
I-405	16%
SR-520	10%
SR-167	0%
none	0%
multiple roads	2%
no answer	0%

↳ How many times per week do you typically use this route?

0 to 5 times	55%
6 to 10 times	15%
11to 15 times	2%
16 to 30 times	17%
no answer	2%

↳ Do you use the HOV lane on this route?

yes	100%
no	0%
no answer	0%

↳ If not, why?

no answer	100%

↳ Do you frequently encounter congestion when traveling on this route?

yes	81%
no	16%
no answer	3%

↳ Estimate your average speed when traveling on this route during **congested** periods:

> 25 mph	22%
25-34 mph	28%
35-44 mph	21%
45-54 mph	16%
55-64 mph	9%
< 64 mph	0%
no answer	5%

PREFERENCES

2. Are you aware that trucks are not allowed in HOV lanes in Washington State?

yes	93%
no	7%
no answer	0%

3. If a lane was reserved lane for large truck travel, I would prefer that:

47%	the lane was reserved for large trucks only.
31%	the lane was reserved for large trucks and buses.
9%	existing HOV policy was changed to allow large trucks.
2%	multiple answers
12%	no answer

4. If large trucks were allowed to travel in the HOV lanes:

38%	I would not use the HOV lanes.
43%	I would occasionally use the HOV lanes.
17%	I would use the HOV lanes frequently.
0%	multiple answers
2%	no answer

↳ Why?

2%	neutral or unrelated comment
31%	speed differential related comment -- "large trucks drive at different speeds"
2%	poor visibility related comment -- "can't see when driving behind large trucks"
2%	dangerous/unsafe related comment
5%	large trucks would impede HOV traffic
7%	METRO policy states buses must use HOV lane whenever possible
5%	too many vehicles in HOV lane already/it would be too congested
2%	speed differential related comment and desiel fumes
3%	speed differential related and dangerous
12%	use lane with best flow
2%	poor visibility related comment and don't like to follow
2%	speed differential related comment and truck drivers are discourteous
12%	doesn't matter
14%	no answer

5. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

64%	on the right side of the road only.
12%	on the left-side of the roadway only.
16%	on either side of the roadway (no preference).
9%	no answer

6. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

13%	only during peak commuting hours.
45%	at all times.
35%	at no time.
7%	no answer

OPINIONS		Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
7. A single reserved lane for large trucks only would improve:						
• safety.	(none 1%)	14%	9%	14%	25%	36%
• congestion.	(none 4%)	17%	10%	13%	29%	26%
8. A single reserved lane for large trucks and buses would improve:						
• safety.	(none 1%)	29%	19%	12%	22%	17%
• congestion.	(none 4%)	32%	16%	16%	19%	13%
9. Allowing large trucks to travel in the existing HOV lanes would improve:						
• safety.	(none 1%)	55%	22%	9%	7%	6%
• congestion.	(none 3%)	52%	20%	10%	7%	7%
10. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	(none 3%)	57%	19%	3%	10%	9%
11. Large trucks are vital to our nation's economy.		1%	1%	14%	48%	35%
12. Large trucks should have the same travel benefits as public transit and high occupant vehicles.		39%	28%	13%	13%	7%
13. Large trucks should pay a special usage fee for using a reserved lane or the existing HOV lanes.		20%	25%	25%	12%	19%

BACKGROUND (*for organizational purposes only, will not be disclosed*)

14. Do you wear a seatbelt in your personal vehicle?

yes	97%
no	1%
no answer	1%

15. Do you use the HOV lane with your personal vehicle?

yes	72%
no	25%
no answer	3%

16. How fast do you typically drive your personal vehicle on the freeway if there is no congestion?

> 25 mph	0%
25 - 34 mph	1%
35 - 44 mph	0%
45 - 54 mph	9%
55 - 64 mph	84%
< 64 mph	6%
no answer	0%

17. How many years have you been a licensed driver?

1 to 5 yrs.	0%
6 to 10 yrs.	1%
11 to 15 yrs.	12%
16 to 20 yrs.	9%
21 to 25 yrs.	29%
26 to 30 yrs.	9%
31 to 35 yrs.	20%
36 to 40 yrs.	9%
41 to 45 yrs.	7%
46 to 50 yrs.	1%
<50 yrs.	0%
no answer	3%

18. What is your age?

> 22 years	0%
22 - 25 years	1%
26 - 30 years	3%
31 - 34 years	7%
35 - 40 years	17%
41 - 45 years	23%
46 - 50 years	16%
51 - 55 years	19%
56 - 60 years	10%
61 - 65 years	0%
66 - 70 years	1%
< 70 years	0%
no answer	1%

19. What is your gender?

male	78%
female	22%
no answer	0%

20. What is your marital status?

married	65%
single	30%
no answer	4%

21. What is your approximate household income per year?

$10,000 or under	3%
$11,000-19,999	10%
$20,000-29,999	9%
$30,000-39, 999	22%
$40,000-49, 999	16%
$50,000-59, 999	12%
$60,000-74, 999	7%
$75,000-100,000	9%
over $100,000	1%
no answer	12%

22. What is your highest level of education?

some high school	0%
high school or GED	16%
community college or trade school	28%
college or university	43%
post graduate or doctoral	7%
no answer	6%

23. What type of bus do you typically operate?

single coach	9%
articulated	65%
other	0%
no answer	26%

24. How many hours per day do you operate a bus?

1 to 4 hours	37%
5 to 8 hours	45%
9 to 12 hours	10%
<12 hours	4%
no answer	4%

25. How many years have you been a bus driver?

1 to 5 yrs.	51%
6 to 10 yrs.	12%
11 to 15 yrs.	20%
<15 yrs.	16%
no answer	1%

Additional Comments:

positive comment (for trucks in HOV lane)	4%
neutral comment (unrelated comment)	17%
negative comment (against trucks in HOV lane)	30%
no comment	48%

Truck Company Survey Results

DRIVING CHARACTERISTICS

1. Which route do your trucks most frequently use:

I-5	72%
I-90	8%
I-405	3%
SR-520	0%
SR-167	6%
none	0%
multiple roads	11%
no answer	0%

- How many times per week do you typically use this route?

1 to 25 times	18%
26 to 50 times	10%
51to 75 times	4%
76 to 100 times	13%
101 to 125 times	4%
126 to 150 times	3%
151to 175 times	3%
176 to 200 times	4%
<200 times	21%
no answer	20%

2. Does your company regulate the routes of their trucks on highways?

yes	35%
no	65%
no answer	0%

- If yes, which routes are restricted?

0%	I-5
0%	I-90
0%	I-405
0%	SR-520
0%	SR-167
1%	I-5 & I-405
1%	routes between points
7%	per size and weight restrictions
3%	SR-18
1%	downtown Seattle
1%	only use I-5
1%	residential
1%	S. 272nd
1%	SR-9 & SR-202
3%	SR-58 in Oregon
1%	SR-16 East
15	all restricted by over-length
1%	I-5, I-405, SR-520 & SR-167
73%	no answer

3. Does your company regulate the time which trucks travel on urban highways?

yes	8%

no	90%
no answer	1%

↳ If yes, what are the restricted times?

4%	stay out of comute times
1%	curfew 9am - 3pm/4pm in large cities
1%	try to avoid 7am - 4pm
93%	no answer

4. Does your company regulate the speed of your trucks on highways?

yes	87%
no	13%
no answer	0%

↳ If yes, what is their maximum allowed highway speed?

31%	50 mph
21%	55 mph
3%	58 mph
18%	60 mph
8%	62mph
1%	63 mph
3%	65 mph
14%	no answer

PREFERENCES

5. If a lane was reserved lane for large truck travel, I would prefer that:

35%	the lane was reserved for large trucks only.
27%	the lane was reserved for large trucks and buses.
35%	existing HOV policy was changed to allow large trucks.
1%	multiple answers
1%	no answer

6. If large trucks were allowed to travel in the HOV lanes your trucks would:

13%	not use the HOV lanes.
28%	occasionally use the HOV lanes.
55%	use the HOV lanes frequently.
0%	multiple answers
4%	no answer

↳ Why?

3%	not enough lanes/not used enough
4%	reduce lane changes/only use right lane
4%	less traveled and no merging problems
7%	to avoid congestion during peaks
8%	would not use/be in way/poor HOV design/inconvenient/dangerous
13%	less traffic/congestion
4%	as load and weather conditions indicate
13%	faster
1%	safer and saves time
1%	hazardous material
7%	drive slower in heavy traffic/can't maintain speed/don't speed

1% don't know HOV lanes
1% would not impede car traffic
1% unrelated comment
1% use for passing
1% wouldn't use in cities
1% to get away from 4-wheelers
1% safer
24% no answer

7. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:
   - 63% on the right side of the road only.
   - 13% on the left-side of the roadway only.
   - 20% on either side of the roadway (no preference).
   - 1% multiple answers
   - 3% no answer

8. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:
   - 17% only during peak commuting hours.
   - 80% at all times.
   - 1% at no time.
   - 1% no answer

OPINIONS		Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
9. A single reserved lane for large trucks only would improve:						
• safety.	(none 0%)	1%	7%	10%	41%	41%
• congestion.	(none 3%)	6%	10%	11%	34%	37%
10. A single reserved lane for large trucks and buses would improve:						
• safety.	(none 0%)	3%	8%	15%	41%	32%
• congestion.	(none 3%)	4%	11%	15%	37%	30%
11. Allowing large trucks to travel in the existing HOV lanes would improve:						
• safety.	(none 4%)	11%	20%	17%	31%	17%
• congestion.	(none 0%)	11%	20%	13%	35%	21%
12. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	(none 0%)	69%	21%	10%	0%	0%
13. Large trucks are vital to our nation's economy.	(none 0%)	0%	0%	0%	6%	94%
14. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	(none 0%)	3%	15%	11%	28%	28%
15. Large trucks should pay a special usage fee for using a reserved lane or the existing HOV lanes.	(none 1%)	69%	15%	10%	4%	0%

BACKGROUND *(for organizational purposes only, will not be disclosed)*

16. How many trucks over 40,000 GVW does your company use in Washington state?

1 to 5 trucks	7%
6 to 10 trucks	7%
11 to 15 trucks	8%
16 to 20 trucks	14%
21 to 25 trucks	13%
26 to 30 trucks	8%
31 to 35 trucks	10%
36 to 40 trucks	4%
41 to 45 trucks	4%
46 to 50 trucks	7%
51 to 100 trucks	6%
<100 trucks	8%
no answer	3%

17. Does your company:

56%	own trucks
7%	use owner-operated trucks
37%	use both types
0%	other
0%	no answer

18. Does your company haul:

6%	locally only
11%	statewide
68%	interstate
13%	internationally
0%	other
3%	no answer

19. What type of hauling vehicles does your company use?

straight truck	How many?
no straight trucks	69%
1 to 5 straight trucks	17%
6 to 10 straight trucks	11%
11 to 15 straight trucks	0%
16 to 20 straight trucks	1%
21 to 25 straight trucks	1%

straight truck with trailer	How many?
no straight trucks with trailers	82%
1 to 5 straight trucks with trailers	11%
6 to 10 straight trucks with trailers	1%
11 to 15 straight trucks with trailers	1%
16 to 20 straight trucks with trailers	1%
21 to 25 straight trucks with trailers	0%
26 to 50 straight trucks with trailers	1%
51 to 100 straight trucks with trailers	1%

tractor with semitrailer . . . . . How many?

no tractors with semitrailers	24%
1 to 10 tractors with semitrailer	20%
11 to 20 tractors with semitrailer	20%
21 to 30 tractors with semitrailer	18%
31 to 40 tractors with semitrailer	6%
41 to 50 tractors with semitrailer	3%
51 to 100 tractors with semitrailer	4%
100 to 150 tractors with semitrailer	4%
<151 tractors with semitrailer	1%

tractor with semitrailer and full trailer	How many?
no tractors with semitrailer and full trailer	54%
1 to 10 tractors with semitrailer and full trailer	17%
11 to 20 tractors with semitrailer and full trailer	8%
21 to 30 tractors with semitrailer and full trailer	7%
31 to 40 tractors with semitrailer and full trailer	1%
41 to 50 tractors with semitrailer and full trailer	4%
51 to 100 tractors with semitrailer and full trailer	3%
100 to 150 tractors with semitrailer and full trailer	1%
<151 tractors with semitrailer and full trailer	4%

other	How many?
no other type trucks	96%
12 other type trucks	1%
15 other type trucks	1%
20 other type trucks	1%
40 other type trucks	1%

20. What are your typical gross vehicle weights (GVW)?

straight truck	
none	68%
17000 lbs.	1%
20000 lbs.	1%
24000 lbs.	3%
25000 lbs.	1%
26000 lbs.	11%
28000 lbs.	1%
30000 lbs.	1%
32000 lbs.	4%
40000 lbs.	3%
46000 lbs.	1%
54000 lbs.	1%
96000 lbs.	1%

straight truck with trailer	
none	82%
40000 lbs.	1%
52000 lbs.	1%
80000 lbs.	1%
86000 lbs.	1%
90000 lbs.	1%
95750 lbs.	1%
101000 lbs.	1%
101500 lbs.	1%

105500 lbs.	7%

tractor with semitrailer

none	21%
44000 lbs.	3%
48000 lbs.	1%
52000 lbs.	1%
65000 lbs.	1%
66000 lbs.	1%
75000 lbs.	1%
78000 lbs.	1%
78500 lbs.	1%
80000 lbs.	52%
83000 lbs.	1%
84000 lbs.	1%
96000 lbs.	6%
105500 lbs.	6%

tractor with semitrailer and full trailer

none	56%
30000 lbs.	1%
72000 lbs.	1%
80000 lbs.	8%
90000 lbs.	1%
98000 lbs.	1%
101000 lbs.	4%
101500 lbs.	1%
102000 lbs.	3%
105000 lbs.	6%
105500 lbs.	15%

other

none	93%
80000 lbs.	1%
103000 lbs.	1%
105000 lbs.	1%
105500 lbs.	1%
145250 lbs.	1%

21. Does your company haul time sensitive cargo?

yes	76%
no	23%
no answer	1%

22. How many years has your company been using trucks over 40,000 GVW?

0 to 10 yrs.	15%
11 to 20 yrs.	21%
21 to 30 yrs.	23%
31 to 40 yrs.	10%
41 to 50 yrs.	17%
51 to 60 yrs.	4%
61 to 70 yrs.	6%
<70 yrs.	3%
no answer	1%

23. What city and state is your company based in?

Washington State	
Aberdeen	1%
Auburn/Sumner	6%
Buckley	1%
Chehalis	3%
Ellensburg	1%
Enumclaw	1%
Everett	4%
Federal Way	1%
Kelso	3%
Kent	6%
LaCenter	1%
Lyndon	1%
Marysville	3%
Methow	1%
Olympia	1%
Seattle	13%
Spokane	6%
Stanwood	1%
Tacoma	17%
Tukwila	1%
Vancouver	3%
Wenatchee	1%
Woodinville	1%
Yakima	4%
other	4%
Oregon State	4%
Utah State	1%
Canada	3%
no answer	3%

24. What is the zipcode where your company is located in Washington?

Aberdeen	1%
Auburn/Sumner	7%
Buckley	1%
Chehalis	3%
Ellensburg	1%
Enumclaw	1%
Everett	4%
Federal Way	3%
Kelso	1%
Kent	7%
LaCenter	1%
Lyndon	1%
Lynnwood	1%
Marysville	1%
Methow	1%
Olympia	1%
Pasco	1%
Port Angeles	1%
Seattle	18%
Snoqualmie	1%
Spokane	4%

Stanwood	1%
Tacoma	17%
Tukwila	3%
Vancouver	3%
Wenatchee	1%
Woodinville	1%
Yakima	4%
no answer	3%

Additional Comments:

positive comment (for trucks in HOV lane)	10%
neutral comment (unrelated comment)	13%
negative comment (against trucks in HOV lane)	14%
no comment	63%

Truck Driver Survey Results -- Truck Stop Segment

DRIVING CHARACTERISTICS

1. When driving your truck, which route do you most frequently use:

I-5	33%
I-90	45%
I-405	4%
SR-520	0%
SR-167	0%
none	0%
multiple roads	19%
no answer	0%

   - How many times per week do you typically use this route?

1 to 5 times	88%
6 to 10 times	4%
11to 15 times	0%
16 to 30 times	0%
no answer	9%

   - Which lane do you usually travel in on this route?

35%	right lane
51%	one of the middle lanes
3%	left lane

   - Do you frequently encounter congestion when traveling on this route?

yes	63%
no	18%
no answer	4%

   - Estimate your average speed when traveling on the freeway during **congested** periods:

> 25 mph	13%
25-34 mph	26%
35-44 mph	24%
45-54 mph	24%
55-64 mph	6%
< 64 mph	1%
no answer	6%

2. Have you ever been subject to:

4%	restricted facilities (i.e., no trucks over a certain GVW)
33%	restricted lanes on a facility (i.e., no trucks in left lane)
3%	restrictions by time of day (i.e., no trucks 6-9am and 3-6pm)
28%	restricted facilities and restricted lanes on a facility
1%	restricted facilities and restrictions by time of day
1%	restricted lanes on a facility and restrictions by time of day
20%	restricted facilities and lanes, and restrictions by time of day
11%	no answer

3. Have you ever changed your hours of operation to account for:

restrictions?	46%	yes	38%	no	16% no answer
congestion?	76%	yes	20%	no	4% no answer

4. Have you ever changed your travel route to account for:

restrictions?	56%	yes	25%	no	19% no answer
congestion?	81%	yes	15%	no	4% no answer

PREFERENCES

5. Are you aware that trucks are not allowed in HOV lanes in Washington State?

yes	95%
no	4%
no answer	1%

6. If a lane was reserved lane for large truck travel, I would prefer that:
   - 39% the lane was reserved for large trucks only.
   - 15% the lane was reserved for large trucks and buses.
   - 36% existing HOV policy was changed to allow large trucks.
   - 10% no answer

7. If large trucks were allowed to travel in the HOV lanes:
   - 14% I would not use the HOV lanes.
   - 36% I would occasionally use the HOV lanes.
   - 48% I would use the HOV lanes frequently.
   - 3% no answer

   ↳ Why?

   - 19% speed related (i.e. faster)
   - 21% better flow, less on/off ramp problems
   - 9% less traffic, safer
   - 3% only use HOV lane on left-side
   - 6% use it only to pass slower traffic
   - 3% won't help
   - 4% no difference
   - 6% only if traveling thru city, only if safe, only if not stopping, only if convenient
   - 8% won't use, dangerous, bad image, hard to get in and out of, slower
   - 5% only if its moving better, no accidents in it
   - 4% only use right 2 or 3 lanes, open up right lane
   - 0% can't always get into lane, inconsiderate HOV drivers
   - 0% open up left 2 lanes
   - 0% only traffic on one side
   - 13% no answer

8. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:
   - 23% on the right side of the road only.
   - 39% on the left-side of the roadway only.
   - 34% on either side of the roadway (no preference).
   - 5% no answer

9. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:
   - 24% only during peak commuting hours.
   - 70% at all times.
   - 4% at no time.
   - 3% no answer

OPINIONS		Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
10. A single reserved lane for large trucks only would improve:						
• safety.	(none 6%)	9%	3%	6%	39%	38%
• congestion.	(none 6%)	9%	5%	5%	39%	36%
11. A single reserved lane for large trucks and buses would improve:						
• safety.	(none 3%)	10%	4%	13%	36%	35%
• congestion.	(none 9%)	10%	4%	13%	36%	29%
12. Allowing large trucks to travel in the existing HOV lanes would improve:						
• safety.	(none 5%)	9%	10%	20%	24%	33%
• congestion.	(none 4%)	9%	10%	14%	31%	28%
13. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	(none 3%)	53%	30%	9%	1%	5%
14. Large trucks are vital to our nation's economy.	(none 3%)	0%	0%	0%	10%	88%
15. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	(none 4%)	8%	1%	10%	20%	58%
16. Truck drivers or companies should pay a special usage fee for using a reserved lane or the existing HOV lanes.	(none 3%)	65%	24%	8%	1%	0%

BACKGROUND *(for organizational purposes only, will not be disclosed)*

17. Do you wear a seatbelt in your personal vehicle?

yes	85%
no	14%
no answer	1%

18. How fast do you typically drive your personal vehicle on the freeway if there is no congestion?

> 25 mph	1%
25 - 34 mph	0%
35 - 44 mph	1%
45 - 54 mph	24%
55 - 64 mph	44%
< 64 mph	29%
no answer	1%

19. Do you use the HOV lane with your personal vehicle?

yes	28%
no	69%
no answer	4%

20. What is your age?

> 22 years	1%
22 - 25 years	4%
26 - 30 years	10%
31 - 34 years	4%
35 - 40 years	20%
41 - 45 years	16%
46 - 50 years	11%
51 - 55 years	19%
56 - 60 years	8%
61 - 65 years	6%
66 - 70 years	0%
< 70 years	0%
no answer	1%

21. What is your gender?

male	90%
female	10%
no answer	0%

22. What is your marital status?

married	60%
single	39%
no answer	1%

23. What is your typical operating weight (GVW)?

> 20000 lbs.	3%
20000 - 29000 lbs.	0%
30000 - 39000 lbs.	5%
40000 - 49000 lbs.	1%
50000 - 59000 lbs.	3%
60000 - 69000 lbs.	10%
70000 - 79000 lbs.	39%
80000 - 89000 lbs.	30%
90000 - 99000 lbs.	4%
100000 - 105000 lbs.	3%
< 105000 lbs.	3%
no answer	1%

24. What is your maximum operating weight (GVW)?

32000 lbs.	1%
43000 lbs.	3%
54000 lbs.	6%
65000 lbs.	0%
76000 lbs.	1%
87000 lbs.	79%
98000 lbs.	0%
109000 lbs.	9%
<109000 lbs.	1%
no answer	1%

25. How many hours per day do you personally operate your vehicle?

0 hrs.	1%
6 hrs.	1%
7 hrs.	1%
8 hrs.	6%
9 hrs.	9%
10 hrs.	55%
11 hrs.	5%
12 hrs.	6%
13 hrs.	1%
14 hrs.	1%
<14 hrs.	8%
no answer	5%

26. How many miles per year does your vehicle average?

> 10000 miles	11%
11000 -50000 miles	1%
51000 -75000 miles	5%
76000 -100000 miles	19%
101000 -125000 miles	16%
126000 - 150000 miles	19%
151000 - 175000 miles	0%
176000 - 200000 miles	6%
201000 - 225000 miles	1%
226000 - 250000 miles	6%
< 250000 miles	1%
no answer	14%

27. How would you describe your typical cargo? (e.g. household goods, perishable foods, fuel, etc.)

34%	food
23%	lumber, steel, machinery
1%	hazardous
35%	general commodities
1%	vehicles
1%	all types of loads
3%	air cargo
3%	no answer

28. What type of truck do you usually drive?

1%	single unit
58%	tractor-trailer
35%	tractor-semi and full trailer
3%	other
4%	no answer

29. How many years have you been a licensed truck driver?

1 - 5 yrs.	19%
6 - 10 yrs.	16%

11 - 15 yrs.	11%
16 - 20 yrs.	16%
21 - 25 yrs.	10%
26 - 30 yrs.	10%
31 - 40 yrs.	10%
41 - 50 yrs.	5%
no answer	3%

30. Are you currently:	25%	an independent truck driver?
	28%	employed by a trucking firm?
	43%	employed as a truck driver by a company?
	5%	no answer

Additional Comments:

positive comment (for trucks in HOV lane)	21%
neutral comment (unrelated comment)	35%
negative comment (against trucks in HOV lane)	5%
no comment	39%

Truck Driver Survey Results -- Safeway Segment

DRIVING CHARACTERISTICS

1. When driving your truck, which route do you most frequently use: (*pick one*)

I-5	4%
I-90	16%
I-405	57%
SR-520	3%
SR-167	3%
none	0%
multiple roads	16%
no answer	0%

   - How many times per week do you typically use this route?

1 to 5 times	51%
6 to 10 times	16%
11to 15 times	13%
16 to 30 times	19%
no answer	0%

   - Which lane do you usually travel in on this route?

88%	right lane
10%	one of the middle lanes
0%	left lane
1%	no answer

   - Do you frequently encounter congestion when traveling on this route?

yes	82%
no	18%
no answer	0%

      - Estimate your average speed when traveling on the freeway during **congested** periods:

> 25 mph	27%
25-34 mph	30%
35-44 mph	21%
45-54 mph	19%
55-64 mph	3%
< 64 mph	0%
no answer	0%

2. Have you ever been subject to:

25%	restricted facilities (i.e., no trucks over a certain GVW)
22%	restricted lanes on a facility (i.e., no trucks in left lane)
1%	restrictions by time of day (i.e., no trucks 6-9am and 3-6pm)
15%	restricted facilities and restricted lanes on a facility
1%	restricted facilities and restrictions by time of day
0%	restricted lanes on a facility and restrictions by time of day
10%	restricted facilities and lanes, and restrictions by time of day
24%	no answer

3. Have you ever changed your hours of operation to account for:

restrictions?	16%	yes	70%	no	13% no answer
congestion?	22%	yes	64%	no	13% no answer

4. Have you ever changed your travel route to account for:

restrictions?	55%	yes	24%	no	21% no answer
congestion?	69%	yes	19%	no	12% no answer

PREFERENCES

5. Are you aware that trucks are not allowed in HOV lanes in Washington State?

yes	100%
no	0%
no answer	0%

6. If a lane was reserved lane for large truck travel, I would prefer that:
   - 30% the lane was reserved for large trucks only.
   - 15% the lane was reserved for large trucks and buses.
   - 46% existing HOV policy was changed to allow large trucks.
   - 9% no answer

7. If large trucks were allowed to travel in the HOV lanes:
   - 13% I would not use the HOV lanes.
   - 36% I would occasionally use the HOV lanes.
   - 45% I would use the HOV lanes frequently.
   - 6% no answer

   ↳ Why?
   - 12% speed related (i.e. faster)
   - 13% better flow, less on/off ramp problems
   - 12% less traffic, safer
   - 0% only use HOV lane on left-side
   - 1% use it only to pass slower traffic
   - 6% won't help
   - 0% no difference
   - 1% only if traveling thru city, only if safe, only if not stopping, only if convenient
   - 6% won't use, dangerous, bad image, hard to get in and out of, slower
   - 3% only if its moving better, no accidents in it
   - 4% only use right 2 or 3 lanes, open up right lane
   - 6% can't always get into lane, inconsiderate HOV drivers
   - 1% open up left 2 lanes
   - 1% only traffic on one side
   - 1% eliminate HOV lanes
   - 30% no answer

8. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:
   - 58% on the right side of the road only.
   - 24% on the left-side of the roadway only.
   - 15% on either side of the roadway (no preference).
   - 3% no answer

9. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:
   - 16% only during peak commuting hours.
   - 76% at all times.
   - 6% at no time.
   - 1% no answer

OPINIONS		Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
10. A single reserved lane for large trucks only would improve:						
• safety.	(none 4%)	10%	4%	16%	34%	30%
• congestion.	(none 7%)	10%	10%	12%	27%	33%
11. A single reserved lane for large trucks and buses would improve:						
• safety.	(none 4%)	7%	6%	19%	34%	28%
• congestion.	(none 7%)	9%	9%	15%	27%	33%
12. Allowing large trucks to travel in the existing HOV lanes would improve:						
• safety.	(none 4%)	7%	10%	10%	33%	34%
• congestion.	(none 7%)	6%	10%	7%	28%	40%
13. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle).	(none 3%)	75%	15%	4%	1%	1%
14. Large trucks are vital to our nation's economy.	(none 1%)	1%	0%	0%	4%	93%
15. Large trucks should have the same travel benefits as public transit and high occupant vehicles.	(none 1%)	13%	7%	12%	18%	48%
16. Truck drivers or companies should pay a special usage fee for using a reserved lane or the existing HOV lanes.	(none 1%)	73%	7%	13%	0%	4%

BACKGROUND *(for organizational purposes only, will not be disclosed)*

17. Do you wear a seatbelt in your personal vehicle?

yes	90%
no	6%
no answer	4%

18. How fast do you typically drive your personal vehicle on the freeway if there is no congestion?

> 25 mph	0%
25 - 34 mph	0%
35 - 44 mph	6%
45 - 54 mph	76%
55 - 64 mph	16%
< 64 mph	1%
no answer	0%

19. Do you use the HOV lane with your personal vehicle?

yes	64%
no	33%
no answer	3%

20. What is your age?

> 22 years	0%
22 - 25 years	0%
26 - 30 years	0%
31 - 34 years	1%
35 - 40 years	6%
41 - 45 years	19%
46 - 50 years	16%
51 - 55 years	28%
56 - 60 years	25%
61 - 65 years	1%
66 - 70 years	0%
< 70 years	0%
no answer	1%

21. What is your gender?

male	90%
female	9%
no answer	1%

22. What is your marital status?

married	76%
single	22%
no answer	1%

23. What is your typical operating weight (GVW)?

> 20000 lbs.	3%
20000 - 29000 lbs.	0%
30000 - 39000 lbs.	0%
40000 - 49000 lbs.	3%
50000 - 59000 lbs.	0%
60000 - 69000 lbs.	1%
70000 - 79000 lbs.	33%
80000 - 89000 lbs.	57%
90000 - 99000 lbs.	0%
100000 - 105000 lbs.	0%
< 105000 lbs.	0%
no answer	3%

24. What is your maximum operating weight (GVW)?

70000 lbs.	1%
75000 lbs.	4%
80000 lbs.	28%
84000 lbs.	1%
88000 lbs.	60%
< 88000 lbs.	0%
no answer	4%

25. How many hours per day do you personally operate your vehicle?

0 hrs.	0%
1 hrs.	3%
2 hrs.	3%
3 hrs.	1%
4 hrs.	0%
5 hrs.	3%
6 hrs.	4%
7 hrs.	4%
8 hrs.	10%
9 hrs.	12%
10 hrs.	36%
11 hrs.	9%
12 hrs.	10%
13 hrs.	0%
14 hrs.	3%
<14 hrs.	0%
no answer	0%

26. How many miles per year does your vehicle average?

> 11000 miles	15%
11000 -50000 miles	25%
51000 -75000 miles	10%
76000 -100000 miles	27%
101000 -125000 miles	9%
126000 - 150000 miles	1%
151000 - 175000 miles	0%
176000 - 200000 miles	1%
< 200000 miles	0%
no answer	10%

27. How would you describe your typical cargo? (e.g. household goods, perishable foods, fuel, etc.)

99%	food
0%	lumber, steel, machinery
0%	hazardous
0%	general commodities
0%	vehicles
0%	all types of loads
0%	air cargo
1%	no answer

28. What type of truck do you usually drive?

0%	single unit
66%	tractor-trailer
31%	tractor-semi and full trailer
0%	other
3%	no answer

29. How many years have you been a licensed truck driver?

1 - 5 yrs.	0%
6 - 10 yrs.	1%

11 - 15 yrs.	3%
16 - 20 yrs.	19%
21 - 25 yrs.	15%
26 - 30 yrs.	30%
31 - 40 yrs.	24%
41 - 50 yrs.	3%
no answer	4%

30. Are you currently:

0%	an independent truck driver?
9%	employed by a trucking firm?
90%	employed as a truck driver by a company?
1%	no answer

Additional Comments:

positive comment (for trucks in HOV lane)	4%
neutral comment (unrelated comment)	25%
negative comment (against trucks in HOV lane)	0%
no comment	70%

Washington State Patrol Survey Results

DRIVING CHARACTERISTICS

1. When on patrol, which route do you most frequently use:

I-5	43%
I-90	24%
I-405	20%
SR-520	0%
SR-167	3%
none	2%
no answer	5%

- How many times per week do you typically use this route?

> 6 times	40%
6 to 10 times	18%
11to 20 times	10%
21to 50 times	14%
< 50 times	4%
no answer	14%

- Do you use the HOV lane on this route?

yes	66%
no	30%
no answer	4%

- Do you frequently encounter congestion when traveling on this route?

yes	76%
no	13%
no answer	6%

  - Estimate your average speed when traveling on this route during **congested** periods:

> 25 mph	33%
25-34 mph	19%
35-44 mph	21%
45-54 mph	9%
55-64 mph	5%
< 64 mph	6%
no answer	6%

2. How many times per week do you stop large trucks for traffic infractions?

none	19%
>1 time	7%
1 time	20%
1.5 times	3%
2 times	17%
2.5 times	5%
3 times	5%
4 times	2%
5 times	7%
<5 times	4%
no answer	9%

ENFORCEMENT PREFERENCES

3. Are you aware that trucks are not allowed in HOV lanes in Washington State?

yes	88%
no	10%
no answer	2%

4. If a lane was reserved lane for large truck travel, I would prefer that:

16%	the lane was reserved for large trucks only.
66%	the lane was reserved for large trucks and buses.
11%	existing HOV policy was changed to allow large trucks.
7%	no answer

5. If large trucks were allowed to travel in the HOV lanes, I would prefer that:

5%	lane use was limited by truck size (i.e., 5+ axle trucks).
5%	lane use was limited by truck weight (i.e., 40,000+ GVW trucks).
9%	lane use was open to all trucks.
78%	lane use was open to no trucks.
3%	no answer

6. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

64%	on the right side of the road only.
23%	on the left-side of the roadway only.
6%	on either side of the roadway (no preference).
6%	no answer

7. If large trucks were allowed to travel in a reserved lane or in existing HOV lanes, I would prefer the lanes to be:

13%	only during peak commuting hours.
32%	at all times.
49%	at no time.
6%	no answer

OPINIONS	Disagree Strongly	Disagree	Neutral	Agree	Agree Strongly
8. A single reserved lane for large trucks only would improve:					
• safety.	19%	26%	17%	28%	11%
• congestion.	19%	24%	21%	24%	11%
9. A single reserved lane for large trucks and buses would improve:					
• safety.	16%	19%	22%	33%	10%
• congestion.	14%	18%	29%	31%	9%
10. Allowing large trucks to travel in the existing HOV lanes would improve:					
• safety. (none 2%)	39%	38%	13%	6%	1%
• congestion. (none 1%)	39%	34%	10%	12%	4%
11. Large trucks should be allowed to travel in the HOV lanes, only if they meet the occupancy requirements (i.e., having two or three persons in the vehicle). (none 2%)	41%	35%	7%	5%	9%
12. Large trucks are vital to our nation's economy. (none 2%)	3%	5%	17%	45%	28%
13. Large trucks should have the same travel benefits as public transit and high occupant vehicles. (none 1%)	27%	43%	14%	13%	3%
14. Large trucks should pay a special usage fee for using a reserved lane or the existing HOV lanes. (none 1%)	20%	29%	23%	17%	10%

BACKGROUND (for organizational purposes only, will not be disclosed)

15. Do you wear a seatbelt in your personal vehicle?

yes	100%
no	0%
no answer	0%

16. Do you use the HOV lane with your personal vehicle?

yes	93%
no	7%
no answer	0%

17. How fast do you typically drive your personal vehicle on the freeway if there is no congestion?

> 25 mph	0%
25 - 34 mph	0%
35 - 44 mph	0%
45 - 54 mph	3%
55 - 64 mph	86%
< 64 mph	11%
no answer	0%

18. What is your age?

> 22 years	0%
22 - 25 years	14%
26 - 30 years	41%
31 - 34 years	16%
35 - 40 years	12%
41 - 45 years	7%
46 - 50 years	10%
51 - 55 years	0%
56 - 60 years	0%
61 - 65 years	0%
66 - 70 years	0%
< 70 years	0%
no answer	0%

19. What is your gender?

male	95%
female	5%
no answer	0%

20. What is your marital status?

married	69%
single	31%
no answer	0%

21. What is your approximate household income per year?

$10,000 or under	0%
$11,000-19,999	1%
$20,000-29,999	4%
$30,000-39, 999	26%
$40,000-49, 999	21%
$50,000-59, 999	15%
$60,000-74, 999	11%
$75,000-100,000	19%
over $100,000	1%
no answer	2%

22. What is your highest level of education?

some high school	0%
high school or GED	16%
community college or trade school	27%
college or university	51%
post graduate or doctoral	6%
no answer	0%

23. How many years have you been a licensed driver?

0 to 5 yrs.	1%
6 to 10 yrs.	20%
11 to 15 yrs.	39%
16 to 20 yrs.	13%
21 to 25 yrs.	12%
26 to 30 yrs.	9%
31 to 50 yrs.	6%
no answer	0%

24. How many years have you been with the Traffic Division at the Washington State Patrol?

0 to 5 yrs.	51%
6 to 10 yrs.	22%
11 to 15 yrs.	10%
16 to 20 yrs.	7%
21 to 25 yrs.	10%
no answer	0%

Additional Comments:

positive comment (for trucks in HOV lane)	0%
neutral comment (unrelated comment)	6%
negative comment (against trucks in HOV lane)	16%
no comment	78%

Appendix D

Comments

General Purpose

#	Question #5 Response	Comments
1	I really would like to see trucks restricted to one lane. Truck Drivers, especially on I-5 from Seattle to Portland, drive aggressively and fast and are intimidating to car drivers. I think trucks need to be totally separated from cars. If cars were interspersed between trucks on an HOV lane, it would increase the danger for the car passengers in the HOV lane.	I don't think trucks should be mixed with buses, necessarily. I don't think trucks and cars should be in the same lane; they should be separated. Trucks should have their own lane. Trucks should have a separate lane; a separate lane for trucks may or may not be an advantage to the truckers from a congestion or speed standpoint. Large trucks should pay a special usage fee to finance the construction of separate truck lanes. I believe large trucks should be separated from cars and even have separate highways -- at the least separate lanes. The construction of the lanes could be financed from higher gasoline taxes and truck usage fees. If financing separate lanes would be prohibitive, give the trucks and buses the HOV lanes.
2	*blank*	As a sales rep, I drive constantly. I feel that truck traffic should be able to have reduced rate licenses to be used for night travel only. I would like to see trucks driven onto rail cars to get from Vancouver to Bellingham.
3	I know trucks are necessary for nations economy (transport of goods) but I don't care to drive behind or next to them -- their speeds are inconsistent (slow up hill and fast down, due to their weight) and they tend to spray rocks up on windshields.	HOV lanes should always be on the left. Its very confusing (this is very irritating) when it alternates from one side of the freeway to the other!! Also HOV requirements should be consistent: i.e. 2 people minimum everywhere (SR 520 requires 3). Trucks in HOV (on left side of road is OK as long as they don't impede traffic.
4	Mixing uses is what we already have.	We travel mostly off hours so traffic isn't much of a problem. Please schedule construction at intelligent times.
5	Trucks would slow the HOV lane, especially uphill stretches, probably to speeds below other lanes.	*blank*
6	Large trucks reduce visibility and often cut-off traffic when moving to/from exits and entrances to freeway.	*blank*
7	Poor visibility, especially in rain.	*blank*

General Purpose

#	Question #5 Response	Comments
8	Trucks often go slower and they obstruct my vision	*blank*
9	HOV's are intended to encourage more efficient use of carpooling, to cut down on use of gas, and better manage pollution issues. Big trucks in HOV lanes don't qualify.	Trucks should drive below the speed limits and should stay on the right. We drive a small passenger wagon and big trucks make us feel unsafe when they pass us or are traveling above the speed limits.
10	Trucks are too slow -- especially on inclines.	Feel strongly that trucks are vital to our economy but they need their own lane!!
11	Makes no difference to me.	A lot of on-ramps should be improved for safety reasons. Congestion higher than expected when designed, one can assume.
12	*blank*	I feel that large trucks should be able to travel in the HOV lanes but it isn't worth the expense to have a separate lane just for large trucks.
13	Trucks are dangerous.	I think trucks should be banned from freeway except for 11 p.m. to 5:30 a.m.
14	*blank*	*blank*
15	*blank*	A number of truckers drive too fast and tailgate. Have had my new car for 3 years -- and driven 82,000 miles -- my car is very important to me.
16	Too hard to see around.	*blank*
17	Can't see around them.	The HOV lanes are already overloaded at peak times. Adding trucks won't help anyone go faster.
18	Don't think I would impact travel time.	I find having HOV lanes on right side of freeway, which majority of on-ramps are located, are very dangerous and difficult for single occupancy vehicles, e.g. HOV cars traveling @ 45 MPH and single occupancy lane cars traveling @ 10 MPH, it's almost impossible to change lane from HOV to single occupant.
19	Visibility poor when behind a large truck especially on rainy days.	*blank*
20	I don't think it would make a difference to me.	Try allowing trucks in HOV lanes, see what happens!
21	Only if it was faster.	*blank*
22	Trucks would feel that they OWNED	*blank*

#	Question #5 Response	Comments
	the lane and intimidate car drivers to get out of the way.	
23	This survey sucks.	This is ridiculous. There are too many trucks for only one lane. You got too big a mess to find a cure.
24	I use when convenient and eligible.	*blank*
25	Slows traffic.	*blank*
26	Do not like following trucks.	My main concern in following trucks is getting windshield nicked by falling or pitching objects.
27	Truck drivers are maniacs on the highway.	I would like to see all trucks only allowed to use the roads after 10:00PM and before 5:00AM.
28	*blank*	*blank*
29	Less traffic.	*blank*
30	Trucks usually cruise well over the 55 mph speed limit. I don't feel safe in the same lane. Also, visibility is impaired (a passenger car driver cannot see around a truck).	*blank*
31	I travel alone, don't qualify.	Please hurry and change the highway 405 continues to be a nightmare. Change HOV to left side of lanes.
32	Too big, they drive too fast, can't see anything in front of you.	*blank*
33	Large trucks and buses are dangerous to the other vehicles on the freeway. They speed, follow too close, cut off other drivers, and travel in the fast lanes (where is the State Patrol!).	I-5 North has 5 lanes (4 regular + HOV). Trucks (large) and buses should be restricted to the right two lanes. After three tickets, drivers of large trucks and buses should have their drivers license revoked. I have seen too many dangerous situations on I-5 by these drivers (every day!).
34	Too dangerous.	*blank*
35	I don't like driving blind behind a big truck.	I strongly disagree with giving large trucks any special lane privileges. The next thing RV's or out-of-state license, etc. will want their special lanes.
36	Why not.	*blank*
37	Large trucks slow down traffic, defeating the purpose of HOV lanes.	There should be a lane exclusively for large trucks and buses. Anyone else using the lane should be fined. Trucks and buses should be able to use the next lane over to pass only. This for high

General Purpose

#	Question #5 Response	Comments
		congestion and rush hour traffic times only.
38	Depending on traffic flow and if I was carpooling.	*blank*
39	Don't like being behind large trucks/no visibility.	*blank*
40	Drive alone.	*blank*
41	Start and stop in close quarters is not only hard on the truck but dangerous to others who frequently slip in ahead of my truck, cutting my stopping distance by 70%.	I.speak for all truckers when I say that I hope this survey will help to gain the necessary improvements to make our career more safe and enjoyable.
42	*blank*	*blank*
43	Safety factor -- visibility.	*blank*
44	*blank*	*blank*
45	I don't believe that they are the answer to the problem.	The money could be better spent on reasons for congestion. Dated hwy. structures, bad engineering, where the bottleneck happens.
46	Speed/time.	*blank*
47	Large trucks cannot maintain a steady speed.	*blank*
48	Don't like to be near trucks: they are frequently too slow!	Instead of making commuter lanes -- I would prefer trucking lanes to ease congestion.
49	They destroy the lanes.	*blank*
50	Large trucks have usually slower speed.	More freeways and highways could be, maybe, better solution for safety and congestion improving.
51	My use would depend on degree of intimidation, number and speed of trucks etc.	However, I'm not in favor of reserving a lane for trucks.
52	I don't prefer being behind a large truck or bus so would use it less frequently.	I dislike the way large and med. trucks seem to dominate the road. Getting them into a HOV or other special lane is a great idea.
53	Increased uphill congestion.	*blank*
54	*blank*	*blank*
55	When eligible I would use HOV lanes except if large trucks slowed down traffic i.e. if trucks going uphill heavily loaded.	*blank*
56	*blank*	*blank*

General Purpose

#	Question #5 Response	Comments
57	They'd be going too slow up hills.	This survey sounds like you would like large trucks to use HOV lanes. They're not the problem. We need commuter trains etc. I travel highway 16 over the Narrows bridge and think something should be done about commuter time congestion AM/PM. Maybe reversible lanes, new bridge, (tunnel to Seattle!!).
58	I would use HOV lanes as ever I do.	*blank*
59	Large truck belong in the outside "slow" lane. They are difficult to see past.	Speed limit should be raised. Truck and buses be long in slow lane -- not HOV lanes.
60	Because they should have their own lane.	*blank*
61	*blank*	*blank*
62	Because they move too slow up large inclines.	*blank*
63	*blank*	Fees for truck lanes (question #14) should only be considered if special lane reduces their travel time considerably. This could be a fair exchange. Four questions are not clear regarding benefit, if any, to truckers on this point.
64	Afraid of accident.	*blank*
65	Depends which lane is moving faster.	Large trucks and buses each travel at different speeds. Restricting them to one lane would cause undue delay to the faster large trucks and buses.
66	Can't see around them, speed at which they travel, rain!	I have felt for years that trucks and buses should have their own lane. They are dangerous esp. in rain. They hog the center lane. I have turned several in for causing problems and safety hazards!
67	I routinely travel alone and do not use the lanes. I prefer the courtesy of large truck drivers over the single passenger vehicle driver. I respect the size and velocity (stopping distance) of large trucks.	*blank*
68	I don't do much highway traveling.	*blank*
69	I would not need to, because truck having their own lanes would free up the other lanes so that they would move more freely.	I think if truck's had their own lane to travel in there would be a lot less accidents with truck's, and also would speed the other lanes up because car's

General Purpose

#	Question #5 Response	Comments
		would not hesitate as much when merging on to freeway.
70	I do not now use HOV lanes.	1. In Oregon trucks remain in far right lane unless passing = safer. 2. I drove long haul trucks. Today drivers are not safety conscious, equip. not maintained = dangerous.
71	Trucks should be limited to the slow lane except to pass. They should not be in an HOV lane.	Keep the trucks out of the HOV lanes! Other states restrict large trucks and cars towing trailers to the slow lane or permit them to travel in other lanes only to pass. With the weather conditions in the northwest this should be another reason to restrict them to the slow lane for safety's sake. Instead of considering permitting trucks in the HOV lanes why don't you focus on making the HOV lanes consistently as close to the fast lane as possible, not like I-405 where it changes frequently!
72	I have a fear of large trucks.	*blank*
73	They are slow and/or inconsiderate. They should be regulated to the two outside lanes only.	Isolating trucks will be the only plan that would improve safety and reduced congestion.
74	Because the speed limit for the trucks are 50/55 and it would provide unsafe conditions if the trucks travel 55/60 with a load.	*blank*
75	Large trucks speed varies too much -- 75+ down hill, 45 up hill.	Truck drivers try to make up time lost when their speed decreases going up hills. They exceed the capability to stop or avoid accidents. Double and triple trailers should be restricted from interstate highways during peak commute times.
76	*blank*	Trucks have no business in the far left lane as so many times they are in all three lanes and then there is congestion; the same when a cop car is going in the same way.
77	Obstruct vision/throw rocks from tires or load.	*blank*
78	They scare me, I don't feel safe around them.	I am neutral on congestion because I don't know if having a number of trucks

#	Question #5 Response	Comments
		and buses in one lane would be safe for oncoming cars to get through. However, if the lane were on the far left, we would have problems with having them in all the lanes.
79	I currently do not use them.	Excellent idea!!
80	Exhaust, impedes vision, stressful.	I don't want large trucks going in and out of HOV lane.
81	They block visibility particularly in rain, they are slow on hills, they can not easily leave the lane if they get slowed by hills, etc.	No! Restrict large trucks to a lane don't reserve a lane for them! Please don't reserve a lane for trucks, restrict them to a multiple use lane on right side of highway at peak traffic. They benefit from freeways far more than they pay for maintenance and construction of freeways -- so I oppose special privileges. At rush hour they are a hazard if in any lane other than right hand most.
82	*blank*	*blank*
83	Don't like driving around large trucks.	*blank*
84	*blank*	*blank*
85	I do not find large trucks a problem.	*blank*
86	They back up traffic!	*blank*
87	Large trucks quickly deteriorate the road making for a bumpy commute. I also prefer not to drive next to/near large trucks. Visibility is poor and large vehicles have large blind spots making me difficult to see.	*blank*
88	*blank*	Much of the congestion is caused by merging traffic. Having left side HOV/truck lanes would be very beneficial.
89	*blank*	*blank*
90	The HOV lanes would become rutted like a washboard. No advantage for multiple occupancy vehicles.	I strongly recommend large trucks be restricted to a reserved lane during commute hours (6:30AM to 9:00AM and 3:30PM to 7:00PM) and keep HOV lanes open to buses and multiple occupied

#	Question #5 Response	Comments
		passenger vehicles.
91	I avoid large trucks. Can't see around them, throw up rocks @ windshield, bus diesel fumes make me nauseous and headachy.	There should be a concerted effort, including tax relief, etc., to encourage increased use of rail lines, with less use of long haul trucking. Cheaper gas and diesel costs inspire highway use. Also, more public transport and get single commuters off the highway.
92	Can't see -- visual impairment.	*blank*
93	Congestion.	*blank*
94	They are very dangerous -- putting them in HOV lane at higher speeds.	I strongly disagree with the idea of putting trucks and HOV cars in the same lane!! These lanes are typically moving at higher speeds and large trucks + speed = DANGER!!
95	The HOV lanes I see around Seattle are much too narrow for large trucks. It would take away any advantage for cars and discourage drivers to use HOV lanes.	No truck in HOV. Buses during rush hours in HOV lanes -- Yes. Trucks during rush hours in HOV lanes -- No. It would be OK in off hours for trucks if they fit -- but they don't too large.
96	No change in HOV usage.	*blank*
97	I am very conscious about large trucks. I don't even drive near them if all possible.	People should be educated to be more aware of larger trucks. Often the time I see people fighting lane with larger trucks or jumping their cars right in front of them which cause the trucks suddenly to brake or swing widely. It's very dangerous for other cars behind. Some people, sometimes larger trucks too, won't slow down or measure the distance as the freeway entrance approaches.
98	*blank*	*blank*
99	Why not.	*blank*
100	Smell of diesel when behind older trucks.	*blank*
101	Slowing on hills and curves.	*blank*
102	*blank*	*blank*
103	They are slower and can't see around them.	SR-167 should be widened ASAP!
104	Too big and slow up hills, etc.	*blank*
105	I'm scared of large trucks and their loads and rude drivers that tailgate or cut-off regular traffic.	*blank*

General Purpose

#	Question #5 Response	Comments
106	I don't like to drive behind trucks because they block the line of sight.	*blank*
107	Trucks already congest the left lanes, this would really slow the HOV.	I think trucks should be limited to the right lanes; never to be in the left or HOV.
108	They are a hazard.	*blank*
109	Large trucks would slow the HOV lanes to a speed lower than the other lanes.	The greatest improvement to safety and congestion would come from ticketing all slow vehicles in the left lanes.
110	Speed and visibility would suffer. Safety would be seriously impacted.	HOV lanes under-utilized. Allowing trucks in one HOV lane on I-90 would improve traffic flow on mainline without causing major HOV problems. Same not true on other roads where only one HOV lane. Buses on I-90 should continue to be able to use both HOV lanes to maintain schedules and encourage ridership.
111	Large trucks block my visibility -- especially in wet weather.	*blank*
112	*blank*	Poor design is a primary cause of freeway congestion. Traffic merges into fast lane only to exit from slow lanes, no continuity of travel can occur (Seattle area).
113	Don't wish to be run over! They are aggressive!	Would prefer large trucks were not even on the Interstate during peak commute times.
114	*blank*	*blank*
115	They are rude driver's who think nothing of tailgating if you're not driving "their" over the limit speed.	*blank*
116	*blank*	*blank*
117	Most truckers are pushy on the freeway. Trucks insist the right of way. Most truckers are in a time schedule and some have caused major accidents as a result of being tired when driving and in a rush.	I am concerned about how truck drivers sometimes drive for 16-18 hours or so with no sleep in order to get somewhere for delivery on time. How can this be changed? Fatal auto accidents have resulted due to this fact.
118	They are in the way and once slowed or stopped are long at getting up to speed again.	I strongly feel that large trucks should not even be on the freeway or highway during high-peak commuting hours 6-8:30 am and 3-6 PM. The HOV lane is not used that much during commuting hours. I see a lot of single passenger vehicles using

#	Question #5 Response	Comments
		HOV. Open up the lane to all traffic. Make SR-167 three lanes (at least) to Tacoma. I-405 should be four lanes all the way anyway. The HOV lane crossover on I-405 is the insane traffic change I have ever seen. The person that invented it should drive it during commuting.
119	Congestion on hills.	*blank*
120	*blank*	WSU rules.
121	Cars cut in front of big trucks and slow them down in regular lanes.	*blank*
122	Because uphill grades they slow down and most truckers tailgate.	If large trucks are allowed to use HOV lanes with only 1 passenger, let all use HOV lane. In other words, no HOV. The idea of a freeway system is to move traffic.
123	Trucks travel too slow going up hills this would make HOV lane slower than normal lanes.	*blank*
124	I saw an accident involving a semi -- there could not have been any survivors. I've been practically run off the road by trucks. On incline trucks have to slow down.	It would be a mistake to categorize trucks and mass-transit buses together. Trucks should never use the HOV lanes and should never, ever use the fast lane or Express. Should always have an 1-800 number or large ID# on back of truck.
125	*blank*	*blank*
126	Assume truck traffic cumbersome.	Traffic is a major concern in greater Seattle area and HOV concept compounds problem. Concept and application of HOV is flawed and not working. All lanes should be available at all times to alleviate congestion.
127	*blank*	*blank*
128	They are scary, which affects my driving concentration.	*blank*
129	Trucks are dangerous to smaller cars. I avoid them when possible.	Trucks are a necessary means of transportation in our society, but they are also responsible for many accidents, due to their large loads and weight. They should have their own lane when possible to increase safety and decrease congestion. The passenger highways would last longer, too.

General Purpose

#	Question #5 Response	Comments
130	Increased danger.	*blank*
131	The benefit to HOV lanes is less congestion and large trucks frequently carry heavy loads and thus slow traffic.	How about large trucks allowed in existing HOVs only during non-peak hours. Cars already "pull into" HOV lanes at spur of the moment. Slow moving large trucks may negatively "encourage" more unsafe conditions. Interesting concept but could be costly to build additional "reserved" large truck lanes (not to mention space prohibited), i.e., allowing large trucks to use existing HOV lanes, only in non-peak hours, seems a viable option.
132	It would depend on the grade, uphill grades trucks lose speed and slow down traffic flow.	As a commuter it is miserable, as a local truck driver it is worse. The HOV lane only handles a small fraction of the volume of traffic. An additional lane for all to use would definitely be a benefit, rather than having a restricted lane and barely anyone in it. SR-167 has to be the best example of this.
133	*blank*	*blank*
134	Too much traffic.	*blank*
135	I hate driving behind them - visibility is decreased and speed is not consistent on the incline.	*blank*
136	If truck was not near -- trucks intimidate, block vision.	*blank*
137	Trucks are harder to see around. Don't like driving behind trucks. HOV lanes in some areas are already too crowded on hills and where HOV lanes end.	Favor additional lane for large trucks. Strongly feel that if an additional lane is added it should be for buses and/or other HOV vehicles also. I normally don't travel I-5 during peak hours.
138	Large trucks travel much too fast now if allowed in HOV lanes the danger would increase a great deal.	If large trucks are to have their own lanes they should be restricted to travel only in those lanes.
139	Trucks and commuter cars don't belong on the same highway.	Large trucks are dangerous when allowed to operate with cars -- which are getting smaller. Would like to see trucks restricted to 72,000 lbs. as the highways were designed to handle vehicles of this size.
140	Can't see ahead of truck.	*blank*
141	Why not -- if eligible vehicles did not	*blank*

#	Question #5 Response	Comments
	use HOV lanes -- regular lanes would be more congested.	
142	Some are not safe to be around. They brake different and they could squish my car easy. Would this help HOV?	*blank*
143	They slow down the traffic especially on hills.	*blank*
144	I don't like replacing my windshield more than once a year.	*blank*
145	Poor speed, poor visibility, fumes, spillage of materials.	*blank*
146	Can't answer as I am not driving but I imagine buses would continue to use HOV lanes no matter how slow they become. (*bus rider*)	I believe that large trucks should be limited to non-peak, no rush hour, traffic -- they travel much too fast and follow too close.
147	I don't like the way heavy truckers drive. They drive large rigs as if they were sport car drivers. (Follow too close, change lanes too often, too quickly.)	*blank*
148	I dislike traveling behind trucks as I have had many windshields damaged from thrown rocks.	*blank*
149	*blank*	*blank*
150	Loss of visibility when behind truck. Large trucks are not able to maintain speed.	*blank*
151	Inconsequential question. Any uncongested lane will be utilized if the freeway is congested.	HOV lanes should/must be isolated from merging traffic. Learn from I-5 and I-405 corridors in southern California.
152	Why should I use HOV if doing so means being behind the slowest vehicles on the road.	The trucking lines that do not schedule routes around "rush hour" allow for the extra travel time. Special privileges for these vehicles will only add to congestion.
153	Narrow lanes and slow traffic cause too many lane changes by large vehicles.	*blank*
154	It depends how fast they will go?	*blank*
155	HOV lanes are not available in my area.	*blank*
156	*blank*	*blank*
157	Large trucks are a "safety" obstruction when in or next to the HOV lanes.	Large trucks should <u>not</u> be permitted in the HOV or "left-fast lane", except within a set distance from a left off-ramp, or

General Purpose

#	Question #5 Response	Comments
		leave as is!
158	Large vehicles changing lanes clear across road is hazard. Bus and trucks have caused me to use brakes changing into or across my lane. I usually take the 2nd or 3rd lane and stay there.	Trucks should drive in 2nd lane if they can maintain speed. The 1st lane for all on/off and all slower traffic. There should (never) be any on or off ramps on the left side of the road. Railroads should be more fully used to reduce long haul trucks on roads. Trucks block visibility of all traffic. All the roads should be constructed don a cost per year basis not the cheapest that deteriorates in a few years and Federal matching funds too -- its all tax money. All on and off ramps to the right, this lane should be on/off and slower traffic of any sort. Trucks in 1st or 2nd lane. HOVs lanes left side always.
159	They drive too slow and bunch up.	Highway SR-16 is a big problem.
160	I've had to replace two windshields in two years from rocks from large trucks.	Large trucks on our freeways are a very serious problem -- very hazardous -- and it's worse every day!!
161	Trucks make me nervous so I would avoid them by changing lanes.	I think a reserved lane for trucks is the best answer to present problems. I don't want my taxes to pay for it, however.
162	Trucks are obstructive to vision.	*blank*
163	The truck lose too much speed going up hills.	*blank*
164	Time on the freeway is spent commuting alone.	*blank*
165	Usually alone so not eligible.	*blank*
166	*blank*	Trucks should never be allowed to be in the fast lane. A ticket should be issued.
167	HOV lanes aren't used frequently enough.	*blank*
168	Ease of breaking.	*blank*
169	Large trucks make visibility difficult. If a large truck or bus doesn't follow the maximum speed limit, passing them would be difficult and traffic would become more congested. Further, I don't believe trucks and buses would use the truck lane for the same reasons I listed above, so one lane would be under used.	*blank*
170	Too dangerous and large trucks are too	*blank*

#	Question #5 Response	Comments
	hard on the road. Also most of large truck drivers are very pushy.	
171	*blank*	I don't think changing the large truck traffic will help the congestion problems in Seattle. There's just not enough alternative routes around and through our city. Perhaps every little bit will help.
172	Usually drive alone.	*blank*
173	I wouldn't follow large trucks because it is impossible to see around them.	I don't want trucks in the HOV lanes because they would probably cause more risk of accidents in that lane.
174	Large trucks on hills slow traffic considerably.	HOV lanes were created to improve traffic by 'ride sharing' -- letting trucks use them would be unbelievable. I am for a ban on large trucks on freeway during rush hours as I have seen in New York.
175	Because I don't want to follow a large truck all the time or be squeezed in between two large trucks. Driving near a large truck makes me nervous. So I would use the HOV lanes only if I had to, if large trucks were allowed to use them.	Double and triple trailer large trucks are unsafe and shouldn't be allowed.
176	If trucks don't often travel at the higher speeds in HOV lane -- it may be more expedient to use regular lanes.	*blank*
177	It would depend on amount of truck traffic.	I think a reserved lane for trucks should be tried on a set aside area to determine if it offers benefits before universal use.
178	For everyone's use.	Good luck.
179	It would depend on truck density in HOV lane and on truck speed in the HOV lane.	*blank*
180	Trucks are on other parts of highway -- what's the difference?	I feel the trucks with double loads are a hazard. Also, if trucks are in right lane and coming down a hill and around a curve, they would not be able to stop if cars are backed up to get off on exit!!
181	Too many truckers work too many hours and display impaired judgment while driving.	Passenger in a passenger car, have NO chance at the hands of an overly worked/tired trucker. Extended trailer trucks are even more dangerous. Not to mention truckers using drugs to meet a deadline.

General Purpose

#	Question #5 Response	Comments
182	Slows me down.	*blank*
183	Too slow and dangerous.	*blank*
184	Why not? How would it change the existing pattern of use all that much (I have no idea how many trucks travel on the freeway system, so I can't really make a good choice here).	Questions 4 and 5 are limiting. For instance, for #4, how would a lane just for trucks affect the total # of lanes? If a lane would be lost so it could be used solely for truck travel, I might feel differently. If a lane were to be added, what would be the cost? How many trucks travel on the freeways?
185	Safety.	*blank*
186	Too slow behind truck, limited visibility.	*blank*
187	To avoid congestion.	*blank*
188	Trucks go above speed limit and do not allow space for stopping when behind you.	*blank*
189	There can be quite a few large trucks in traffic at the same time when traffic is congested. If there were a large number of trucks in the HOV lane at one time, I would not use the HOV lanes even if I had 2 or more persons in my vehicle, because it could very likely be that the trucks could clog the HOV lanes. Also, in stop and go traffic, even the HOV lanes are some times clogged now. It's very dangerous to be in a convoy of large trucks because I feel they are not as ready to stop fast, when needed, as other vehicles are.	I strongly agree that large trucks should have their own lane. I am not sure whether or not designating the HOV lane as the truck lane is a good idea or not. I think HOV lane should be open to <u>all</u> traffic during non-"commuting" times. I also think <u>all</u> HOV lanes should be for 2 or more persons <u>not</u> 3 or more persons.
190	The frequent uphill inclines force them to slow drastically causing back-ups.	Large trucks only seem to be a problem in particular areas -- in and out of downtown Seattle, Southcenter hill. But due to <u>extremely poor road design</u> and access -- not the trucks.
191	*blank*	*blank*
192	Slow speed, congestion.	Large trucks should be restricted to non-rush hour times on major highways (I-5, I-90, SR-520, I-405).
193	Tandem trucks and oversize trucks are too scary, too fast and too heavy to stop and might run over me.	Trucks, i.e. large trucks, are positively frightening on highways.
194	I think it's dangerous to be behind large	*blank*

#	Question #5 Response	Comments
	trucks -- no visibility.	
195	I don't like being behind a large truck.	*blank*
196	Who wants to be behind a truck!!	*blank*
197	*blank*	Increasing speed limits on Interstates from 55 to 65 is an excellent idea. HOV should be 2.
198	Large trucks often travel slowly, take more time to accelerate and more distance for braking.	I am most concerned with trucks traveling in the outside lane where the majority of merging occurs.
199	*blank*	*blank*
200	Large amount of truck travel would slow HOV lane speeds for all.	*blank*
201	*blank*	*blank*
202	Dangerous.	Large trucks are consistently exceeding the speed limits -- a hazard for smaller vehicles.
203	They are dangerous and drivers are not skilled or courteous! And they move too slow!	Speed up construction projects and let trucks drive more at night!
204	Can't see around them; they are slow going up hills.	Properly design exit and on ramps, i.e. 167/405 interchange is a mess for trucks. It is a MAJOR cause of congestion.
205	Hard to see around. Splash up a lot of water and they DO NOT belong in an HOV lane!	I am from the midwest. There, trucks are only allowed in right two lanes; never in far left lane. I absolutely shudder at the idea of trucks using the HOV lanes. That is <u>not</u> their purpose.
206	Don't always have 2+ people.	*blank*
207	Large trucks are often driven recklessly; sometimes they're driven too slowly; they often "spit" rocks and pebbles on cars behind them.	*blank*
208	Large trucks are dangerous to drive behind because you can't see what is going on in front of them, and I hate to have a large trucks on my tail.	*blank*
209	*blank*	I would support non-peak non-commuter rush hours for trucks. Trucks (3+ axles) should only use the freeways during "off-hours" this would optimize the freeway utilization and not require building more freeway lanes.
210	I don't like to follow trucks and they	*blank*

#	Question #5 Response	Comments
	destroy the road.	
211	Can't see cars in front of you.	*blank*
212	Trucks in the HOV lane defeat the purpose of an HOV lane. Trucks slow traffic down and decrease driver's visual distance.	*blank*
213	They're already using the 3rd lane, and they make traffic even slower.	I would like to see the large trucks use the right two lanes.
214	Trucks limit visibility and some exceed speed limits now.	I think allowing trucks in HOV lanes is not to the best interest or safety of the public.
215	Too dangerous plus many are uncovered.	*blank*
216	I would feel driving wouldn't be safe for cars and trucks.	I also use SR-522 everyday which is monopolized with large trucks causing all kinds of problems.
217	I find trucks to be very dangerous -- also -- I work for the insurance industry and see numerous claims involving fatalities.	I am very much in favor of having a dedicated truck lane to improve highway safety, but to allow them to use HOV defeats the purpose.
218	Immediate congestion -- large trucks and cars do not blend well. Leave the HOV for cars and let the trucks tailgate each other.	*blank*
219	Depends on route/exits/etc.	*blank*
220	When I use the HOV lanes, I do so to get away from large trucks.	Large trucks deserve no special preferences, nor should my tax $ be spent creating these lanes. Large trucks do not deserve special treatment and therefore should not use HOV lanes, nor should the state spend the $ to construct a special HOV truck lane. If this lane is created, it should be funded SOLELY by truck license and toll fees.
221	Afraid of getting hit.	*blank*
222	Too slow, don't maintain a constant speed, plus -- there are too many trucks period!	*blank*
223	Trucks usually are slow and staying behind a big truck is very dangerous.	*blank*
224	There are no other passengers in my car.	*blank*
225	Large trucks traveling at high speed tend to make it difficult to steer small autos.	I have often observed the wind generated by fast large trucks passing cause small autos to veer sideways almost a full width

#	Question #5 Response	Comments
		of one lane. Very dangerous.
226	If traffic warrants and I have a passenger.	*blank*
227	Dangerous.	*blank*
228	Although trucks would be using lane, they'd still move more efficiently.	As a commuter between Tacoma and Seattle everyday and a listener to traffic updates, I am amazed at the frequency in which trucks are the cause or are involved in accidents. Thanks for addressing this issue.
229	Rocks upon windshield/sight problem.	I have always been told that trucks were restricted to right lane except when passing -- so I always consider that a truck lane.
230	I drive alone.	*blank*
231	HOV lanes are intended for the efficient movement of vehicles traveling with 2 or more people. Trucks do not and cannot slow down and accelerate or maneuver like cars. Trucks and cars in an HOV lane would be a disastrous mistake.	If you reserve a lane for truck/bus traffic only, then those buses/trucks should be restricted to that lane at all times. Another alternative would be to restrict large trucks over a certain gross weight from traveling in particular corridors during peak commute hours (i.e. 7 AM - 9 AM; 4 PM - 6 PM).
232	Because they are like huge vacuum machines - picking up debris from the road and the dirt and rock trucks don't cover their loads.	*blank*
233	Because the trucks going more slowly.	*blank*
234	Large trucks travel slowly and would defeat the advantage of having HOV lanes.	I don't feel trucks deserve any special privileges in the commute. If you really want to improve congestion, restrict the movement of trucks altogether during peak hours as was done successfully for the 1984 Summer Olympics in Los Angeles.
235	*blank*	*blank*
236	When eligible and if they were at speed limit!	I believe that since we all pay taxes that paid for the third (HOV) lanes we should all get to use them! And the WSP should enforce minimum speed/left lane for passing laws.!
237	1. Trucks usually slow way down on uphill grades. 2. Rock and debris flying from large trucks.	*blank*

General Purpose

#	Question #5 Response	Comments
238	Blocks vision, smelly, noisy.	Large trucks are first a safety concern them congestion. Everyone here drives extremely rapidly, switching lanes all the time, jostling for position and the myriad of exits. Trucks block the view, can't maneuver or speed like cars and scare us with their size and weight. Why not copy L.A. (if I understand correctly) and limit truck traffic to certain lanes and times and parking/loading zones opposite of commuter times -- win win, etc.
239	I could not see the traffic exits, etc.	All of us have to make a living - truck drivers, in my lifetime, have been very courteous on the road and have been helpful to me and my family. They pay high tariffs and they do not make the living money many think that they do. I have depended on their driving skills in storms and fog and feel safe to see one at any time!!
240	Because of the extreme damage large trucks do to the roadbed.	Why not build a trucks only lane. They pay for construction and maintenance of such a lane. Truck speed limits (60 mph) should be strictly enforced. They travel much too fast and too close to intimidate and scare other drivers out of their way. Large trucks should be restricted to one lane only. Preferably the far right, to keep the severe damage they cause to one lane only. The roadway from Centralia to Portland is becoming very poor in lanes other than the right as trucks shun the damage they have caused and move to lanes to the left.
241	I'm not HOV.	Too many trucks tailgate.
242	I would use them to get to my destination.	*blank*
243	Too hard to see ahead.	*blank*
244	Because trucks have irregular speeds.	*blank*
245	Depends on traffic in the other lanes -- it's difficult to see behind large trucks.	*blank*
246	Probably would be too congested.	*blank*
247	I prefer the normal lanes.	HOV lanes are a bad idea. They are clearly not carrying as many people as

#	Question #5 Response	Comments
		normal lanes and where they exist there would be less congestion if the HOV lane was open to all vehicles.
248	HOV lanes are never congested. If I traveled with someone I would always use them even if large trucks were also using them.	*blank*
249	*blank*	Raise the speed to 65 M.P.H.
250	Poor driving from drivers of large trucks, especially tail-gating.	I feel sorry for trucks in commuter traffic - but they are dangerous, they tailgate and hot rod. Even the good drivers are dangerous because of the size and weight of their trucks. Don't have them crossing traffic lanes to get to a left hand lane.
251	*blank*	*blank*
252	Convenience.	*blank*
253	Time of travel.	*blank*
254	Too slow.	*blank*
255	I favor the European method of vehicles staying to the right lane except to pass.	I would favor a truck lane but not combined with the HOV lane!
256	*blank*	*blank*
257	Not enough large trucks to over congest HOV lanes.	*blank*
258	They would be slow, especially uphill.	*blank*
259	Accident with a semi.	*blank*
260	*blank*	*blank*
261	Safety concerns.	Trucks are a danger to all motorists, especially during congested traffic periods. I would prefer to restrict truck travel on urban commuter routes to non-congested periods.
262	Feel uncomfortable with large trucks.	I don't like the idea of trucks using HOV lanes. Doesn't seem safe.
263	Large trucks are very intimidating and they have a nasty habit of tailgating automobiles.	*blank*
264	Because they are jerks with attitudes. they would believe they owned the HOV lane also. Accidents involving semi's are more often fatal.	I do not want to see large trucks in HOV lanes. Thank you!
265	Who wants to compete with trucks -- you cannot see around them.	The HOV lane on I-405 should be consistent. Changing from inside to outside is dangerous. HOV lane

#	Question #5 Response	Comments
		requirements should be suspended on weekends.
266	Throws rocks.	*blank*
267	Don't like to driving behind or among large trucks.	I believe that large trucks are a hazard on our highways. I like the idea of a separate lane for large trucks and buses but only if such vehicles would be required to use those lanes during peak commuting hours.
268	*blank*	*blank*
269	Block traffic view; travel slower. Buses are also very bad in HOV lane -- they are so slow.	*blank*
270	Because the HOV lanes were created for van/carpooling and to get by the traffic not to have to slow down for large trucks.	Large trucks are vital to economy but not in HOV or a private lane. Like everyone else who works -- driving is part of their job! HOV lanes were crated to ease the flow of traffic and encourage people to ride together and have less congestion. If the HOV lanes were utilized by trucks it would cut down the efficiency of the HOV lanes. I am totally against large trucks in HOV lanes.
271	Trucks slow traffic.	*blank*
272	*blank*	*blank*
273	Cause they are reserved for bus.	*blank*
274	It would slow down the lane and end the incentive for carpooling.	If you make the HOV lane as congested as all the others, you will end all incentives to carpool. Is the goal to have fewer high occupancy vehicles? Why should large trucks have special status simply because they are large?
275	I'm going north away from Seattle.	*blank*
276	*blank*	*blank*
277	I'm against a large truck lane.	How can you ask questions about congestion without knowing in what direction I travel. I go north at rush hour! Why are there no questions on the need to change what currently exists?
278	One cannot see far enough ahead to drive responsibly when there are a lot of large trucks ahead. Being surrounded by large trucks can become intimidating especially in bad weather.	I-405 is bad enough as it is -- allowing trucks in the HOV lanes would deter legitimate carpool drivers from using them and lead to more congestion.

#	Question #5 Response	Comments
279	Trucks throw gravel (bad for paint job) and typically move slower than traffic flow.	I commute to work in another state 2-3 times a month making carpool not an option although a good transit that is cost effective from eastside to airport I would use every time!
280	Because too many trucks on road and they are discourteous and drive fast all the time.	*blank*
281	Cannot see past trucks and they slow traffic.	*blank*
282	*blank*	*blank*
283	Too dangerous.	*blank*
284	Too busy.	*blank*
285	Too dangerous.	*blank*
286	Danger.	Poorly designed poll. Loaded questions.
287	They would probably still be less congested.	
288	Depending on the flow.	*blank*
289	On the hills they go very slow, and take a lot of time to gain speed. Also, visibility will be poor.	Large trucks should be allowed on the highway, during rush-hour only if they are empty. Otherwise they should commute in the off-hours.
290	*blank*	*blank*
291	I don't want to be behind big trucks. I can't see other traffic. It may encourage truckers to speed.	*blank*
292	I don't think large trucks should be allowed during high congestion times, 6 AM - 6 PM, Monday - Friday, anywhere on I-5 and I-405.	*blank*
293	Travel lane that moves most quickly.	*blank*
294	Too dangerous -- I oppose a truck lane to enable them to travel faster.	Who put this questionnaire together, the trucking industry? 1) You should look at Europe, particularly Germany for a better model. Truck speeds are strictly controlled for safety. 2) Worse problem on I-5. Canadian truckers who tailgate and use inside lanes -- ignored by State Patrol.
295	They slow things down.	*blank*
296	They would be just as congested -- or more as other lanes.	Truck drivers are generally far better drivers than your average freeway driver. They cause lower % of accidents. Don't

General Purpose

#	Question #5 Response	Comments
		make things worse.
297	Blocking views. Garbage trucks usually speed. They have less control of wheels.	I also believe ALL HOV lanes should be on the right to allow for exit/entrance of buses, etc. without crossing lanes.
298	Because buses and trucks are not able to maintain speed going up hill, i.e. Southcenter hill.	*blank*
299	Can't see around them or in front of them.	*blank*
300	Unsafe -- no visibility.	*blank*
301	Because they don't make me feel safe sandwiched in between for rear-end collisions.	*blank*
302	I usually am alone.	*blank*
303	*blank*	I hope tax dollars weren't involved in making this survey!
304	I don't like driving behind big trucks.	This whole survey seems slanted to putting trucks in the HOV lane one way or another. Please keep them out of the HOV lane.
305	*blank*	*blank*
306	Trucks are too slow on hills -- block view.	*blank*
307	*blank*	I think large semi's should be excluded from freeways on weekends and holidays. No such thing as a Sunday drive to get away from it all. We are tired of being intimidated by the large trucks.
308	Trucks, especially on inclines defeat the purpose of having an HOV. Also safety would decrease.	Trucks should not be allowed in HOV lanes. If new lanes constructed for trucks only, costs should be passed on to users. If too costly explore railroad transportation. For areas where truck lanes needed, there is no room to add additional lanes without paying a high prices. The only other option would be to take away a passenger lane -- which would not be acceptable to most users. Recommendation: Leave as is. Explore RTA as way to reduce passenger traffic.

Bus Driver

#	Question #4 Response	Comments
		having trucks in HOV lanes would make it more different to enforce (if they even decide to).
8	I don't like to be behind large trucks, I need to be able to see traffic and road conditions ahead.	*blank*
9	Because large trucks cause 50% of accidents on the highway.	*blank*
10	I use what ever lanes are moving in my car, but when I am driving a bus I am suppose to use the HOV whenever possible.	*blank*
11	*blank*	*blank*
12	*blank*	*blank*
13	They go too slow up hills.	HOV should be at least 3 or 4 people. HOV should stay on one side of the freeway (right), or have left-side on and off ramps. Trucks go too slow up hills. If you put them in the HOV lane, have a passing HOV lane up hills.
14	I would use HOV lanes only when they would expedite travel.	HOV lanes should only be on right-side of road and NEVER be designed to merge with a standard lane to continue moving. Transition should only be as southbound I-5 at Kent/DeMoines exit; lane continues but vehicle restriction is removed.
15	Because they are too crowed already.	*blank*
16	*blank*	I am strongly against large trucks being allowed in the HOV lanes. I strongly support large trucks being restricted to the right two lanes during all hours of the day. They are a hazard to safety and contribute greatly to congestion.
17	They tie the lane up.	Trucks should be kept in the right two lanes only. HOV should be three passenger only.
18	*blank*	Less "cheaters" use the left-side HOV lanes. Confine use of HOV to: TRUCKS, BUSES, HOV VANS (no carpools). Moot point?: Change "accident prone" southbound HOV lane at I-5 and Spokane to extend one mile south to Michigan off ramp. Do not have lane merge. Use same design as southbound I-5 at Kent. Right

Bus Driver

#	Question #4 Response	Comments
		lane would be exit only to Michigan Street.
19	They are slower than the buses.	*blank*
20	*blank*	*blank*
21	Truckers are just like us, they have schedules to keep.	*blank*
22	*blank*	*blank*
23	If they slowed me down I would change.	*blank*
24	*blank*	If trucks are allowed in same HOV lane might as well forget having them. Only a separate lane for trucks would accomplish anything.
25	Most of the time, trucks can roll as fast as cars. It's only when trucks have to slow down or stop, and try to get going again uphill; that is the problem!!!	Being a trucker now, for over 35 years, I'm well aware of the problems encountered. Allowing trucks and buses, and three occupant vehicles a separate lane would help congestion greatly.
26	I would use HOV lanes whenever they are moving better.	Buses during peak hours should be the only vehicles in HOV lane to improve service and encourage people to want to take the bus. Right now at times it is just as fast or slower than driving your personal vehicle.
27	Trucks in HOV lanes would slow travel due to their slower speed on hills. Also, the number of serious and fatality accidents would increase with large number of trucks in HOV lanes due to their habit of following close behind vehicles.	A truck only lane should be on the right-side of the freeway. Trucks in HOV lane would increase the frequency of serious accidents. Trucks are not policed on their following distances.
28	Some trucks are very slow.	*blank*
29	Because of driver courtesy.	*blank*
30	Trucks are very slow uphill if loaded.	Ridiculous idea for trucks to use HOV. Trucks using right two lanes would help. Also, HOV lanes should change two passenger to three passenger during peak hours. Off peak hours could be used for trucks for trial period.
31	Because the mainline is much faster then the HOV lanes are.	Trucks should have their own lanes. Buses also should have their own lanes. And autos should have their own lanes with four or more in the HOV lanes.
32	Because trucks move too slow going up or down hill.	HOV should be three or more persons.

Bus Driver

#	Question #4 Response	Comments
33	The large trucks, usually, cannot maintain a speed of 45 mph at tops going up grades!	Large trucks should stay in the right two lanes as professional drivers. Why not have two carpool lanes, so when there is an accident in one or the other the HOV traffic can still keep moving. Then when the regular lanes get gridlocked maybe the one person car's will start seriously considering carpool!
34	Some trucks keep up with traffic, other trucks aren't able to.	*blank*
35	Trucks tailgate too close.	Slow moving vehicles, trucks, buses with no passengers, motorhome, pleasure-car boat trailers ought to be restricted to the right lane. These vehicles can only use second lane from right to pass slower vehicles only. HOV lane reserved for carpool and buses with passengers only. No work trucks or pick-ups with trailers.
36	Too dangerous, too congested.	*blank*
37	Depending on conditions.	*blank*
38	I would use the HOV lanes only when necessary... the back-up of large trucks in the HOV lanes would not make them (HOV lanes) any faster.	Allowing large trucks to use the current HOV lanes would only congest them, making them useless. A separate lane, or only allowing high occupancy vehicles and charging trucking companies a special tax would work better.
39	Depends on the congestion of HOV.	*blank*
40	Slow truck.	*blank*
41	*blank*	*blank*
42	Many trucks travel too close, and fast.	*blank*
43	Large trucks should be banned during peak hours.	*blank*
44	I will always travel where I can move the quickest. If large trucks did not impede my driving -- fine -- but if they did impede, then I would utilize another lane.	Sharing HOV with trucks would be acceptable, if only trucks and buses were allowed to use HOV. No cars.
45	Similar size vehicles, similar concerns and needs.	*blank*
46	Trucks would slow down buses.	We need "bus lanes" not HOV lanes! Think of it (E-3 Busway's everywhere) no cars, no trucks. Guaranteed 20 minute service to downtown, etc. There are too many vehicles for road now, let alone in

#	Question #4 Response	Comments
		the next 10 years.
47	Too slow.	*blank*
48	Congestion of numerous slower vehicles.	*blank*
49	Often move slower than regular traffic -- can't keep schedule.	*blank*
50	Some trucks are slower then the coaches. Could slow me down when trying to make time points.	The problem are not with the truckers, it's with the regular drivers that are the problem. They insist on driving in HOVs when they shouldn't.
51	I don't think they will impede the flow and it will certainly make the mainline safer. Truckers are dangerous drivers -- we can handle them better than car drivers.	The people who design our road system should look to the future like they want the voters to do. The automobile industry spends BILLIONS $ yearly to sell more cars -- does somebody think we're not going to drive them?
52	Truck drivers speed and tailgate other vehicles -- they endanger the public and are very unprofessional.	Big trucks are a hazard to the freeway. Big trucks should not be given a special lane to speed and drive recklessly more then they do now!!! The laws regarding truck drivers, who ignore the laws of the road, need to be strictly enforced and law breakers need to be heavily punished. Truck drivers need to be forced to drive safely at all times or get them off the road!!! Before they kill more innocent people with their illegal and reckless lawlessness. Driving needs to be a earned privilege and not a free right given to anyone who has a pulse!!!
53	Lanes are too poorly designed. Buses accelerate faster, large trucks would ruin freeway flow. All good HOV's are on right-side where traffic must enter and exit freely or, nothing works.	Why would you ever put an HOV on the left-side?
54	Being as large trucks and buses are very similar, thus the speeds are more constant.	*blank*
55	All else considered, (safety is a big concern) it would probably still be the fastest or most efficient way to move my passengers.	I don't think that moving groceries, letters, boxes of stuff, etc., faster is a big problem! UPS promises next morning by 8:30 AM already! We must look to getting more people out of single (or even double) occupancy vehicles and onto

#	Question #4 Response	Comments
		public transportation. Then fund (or vice-a-versa) a much larger scale mass transit regional system. Solve that problem and all others go away! Move people more efficiently not stuff!
56	I trust the trucks more than the cars.	*blank*
57	They would impede traffic flow on HOV.	Make SR-520 an HOV only road during peak hours! Both directions.
58	Slow, fumes.	*blank*
59	N/A	*blank*
60	N/A	I would like to see HOV lanes for buses only. Also, I would like to keep trailers out of HOV.
61	N/A	Do I get detail time for this?
62	N/A	The HOV lanes for trucks will only cause more accidents. When merging over, cars cutting trucks off, etc. Also, if we build HOV lanes (like on I-5), lets make them go all the way through to downtown Seattle. With a special merge over ramp for buses only.
63	N/A	Question #1 to choose one is not right. Many operators use both SR-520 and I-90 for deadhead route and in route. Check California trucking law, I believe they use second or third lane from right.
64	N/A	It is very difficult to see around large trucks. When operating a bus it is necessary to "see ahead" to predict traffic. This would be difficult with large trucks in HOV.
65	N/A	*blank*
66	N/A	Let's move people! Divided transit only lanes separate from other HOV lanes are the only real way to people to take transit as this is the only way to improve travel-time.
67	N/A	During off-peak hours HOV lanes should be open to all traffic. Taxpayers paid to have the HOV lanes built and should be allowed to use them (including SOVs) during off-peak hours. They allow SOV in the HOV lanes during off-peak in Honolulu, Hawaii (and other states) and it

#	Question #4 Response	Comments
		works extremely well, an additional plus is a more favorable perception of HOV lanes by the public (people tend to respect the HOV lanes more when a fair system is used thus less offenders during peak hours.
68	N/A	*blank*
69	N/A	More HOV lanes for buses!

Truck Company

#	Question #6 Response	Comments
1	Because there are not adequate lanes on any freeways at present.	Shipping costs/freight rates are rising because of a tremendous lack of adequate freeway lanes and new freeways.
2	To reduce lane changes.	*blank*
3	*blank*	Loaded trucks will cause problems for empty trucks on uphill grades. They are going to pass if possible. Then it would be safer with less congestion.
4	HOV lanes are not as heavily traveled and do not have the merging/exiting traffic as much.	*blank*
5	To avoid congestion during peak hours.	*blank*
6	Would be in the way! Traffic in HOV lanes are usually speeding.	*blank*
7	Less traffic.	*blank*
8	Less congestion.	*blank*
9	Lane design is not safe regarding the locations of HOV lanes.	Heavy truck traffic needs to stay out of HOV lanes and the two left lanes of travel on major freeway systems.
10	*blank*	*blank*
11	*blank*	*blank*
12	Only in congested traffic times to meet schedules.	*blank*
13	*blank*	*blank*
14	HOV lanes generally have less traffic.	*blank*
15	*blank*	*blank*
16	*blank*	*blank*
17	As load and weather conditions would dictate!	A dedicated truck lane of some type would greatly improve safety and congestion on I-5 between Tacoma and Everett.
18	Faster travel time.	*blank*
19	Save time during peak commuting hours.	*blank*
20	*blank*	HOV on left-side of freeway is not as useful as HOV on right-side for our tractors and trailers.
21	1. HOV lanes are typically placed on inside lane -- it's safer there. 2. To date HOV lane speeds are higher -- saves time.	We feel the key to reducing congestion in the Puget Sound region is adding more lanes of travel, period. Utilizing existing lanes for HOV or light rail will not solve the problems. Build more lanes or travel -- that we <u>are</u> willing to pay extra for!

Truck Company

#	Question #6 Response	Comments
22	Less traffic congestion.	We have additional terminal operations in Spokane, Tukwila, and Seattle (2).
23	During peak hours, it would help.	*blank*
24	Hazardous material -- i.e. flammable and combustible.	*blank*
25	*blank*	*blank*
26	To make better time. Traffic back-ups coast us money -- we can't charge back to customers.	*blank*
27	We prefer our truck's drivers slower in heavy traffic.	*blank*
28	I'm not certain how HOV lanes are used.	Our operations in Seattle are limited. If trucks are allowed in left lanes without adequate power to keep up with flow of traffic, antagonism and loss of goodwill by auto motorists would ensue.
29	*blank*	*blank*
30	Controlled access, safer.	It is my belief that commercial vehicles with GVW of "X" lbs. be restricted to certain lanes -- similar to highways in Toronto, Ontario area.
31	*blank*	Our trucks don't spend a lot of time in the Sea-Tac area. However, when they do it is slow going.
32	If oversized load is on -- we could not use.	Question #1 is just not correct -- it qualifies this whole survey toward one highway.
33	Saves time on road.	HOV lanes on I-5, SR-167, and I-405 are a waste of tax payers money. Need to have them opened to all vehicles.
34	*blank*	*blank*
35	We travel at high peak times.	*blank*
36	To get to destination faster.	*blank*
37	They would not be impeding car traffic.	I think truck traffic should stay to the right lanes to keep uniformity.
38	Time savings.	Thank you for this opportunity to complete this.
39	Less Traffic.	*blank*
40	Easiest and fastest way to travel.	I believe having a special lane for trucks is a great idea from a safety and congestion standpoint. Our trucks are not allowed in far left-hand lane if 3 or more lanes.

Truck Company

#	Question #6 Response	Comments
41	Congestion.	*blank*
42	When two riders per car are allowed, they do a good job!	I-5 is critical to movement of freight in the west. Seattle, Tacoma, and the ferries are a giant bottleneck. We haul bulk cement, deliveries on time are critical! Time lost in congestion cost hundreds to us daily. The HOV lanes have helped! Keep the darn Canadians out of the left lane. The damage to truck public relations is hurting us all!
43	*blank*	The problem with all trucks in one lane is the under-powered trucks will hold up all of the other vehicles with the more efficient engines -- on hills and getting started from a stop. Keep trucks and buses out of all left lanes. Move all HOV to right-side of roadways.
44	To get through high congested areas.	*blank*
45	*blank*	*blank*
46	We are over dimensional/oversize loads.	Truck only lanes should be wider than normal; it should be a through lane not one that cars should exit or enter.
47	Passing.	*blank*
48	Less traffic weaving.	*blank*
49	*blank*	*blank*
50	Because of volume from Kent area to Eastside and north.	*blank*
51	*blank*	As owner of a large trucking company I would like to see trucks restricted to the right lanes. Too often I see trucks traveling in the center lane, the right lane is empty and traffic is backed up trying to get around the truck. They should be in the right lane and it should be enforced.
52	Should only be a through lane in large city areas.	*blank*
53	Not able to travel same speed as cars.	*blank*
54	From my driving experiences in Seattle it doesn't meet needs of common traffic patterns.	We will look forward to this survey doing some good.
55	Do not want trucks speeding.	*blank*
56	This would depend on traffic flow and congestion.	Open the HOV lanes to all traffic.

Truck Company

#	Question #6 Response	Comments
57	Inconsistent lane changes; most HOV left lane.	*blank*
58	Eliminate the hassle of 4-wheelers.	*blank*
59	Too dangerous.	There are too many large trucks under powered for the loads they are hauling on the highway system. This needs to be corrected, before thinking of allowing large trucks to use special lanes and HOV's.
60	Congestion and get the freight to the customer quickly.	*blank*
61	They don't need to use it.	I believe that trucks should be limited to one lane, right-side and second lane only to pass.
62	Lanes on wrong side of road.	*blank*
63	We don't want to travel over 58 MPH. Too much time in HOV lanes would make general public mad.	*blank*
64	Out of mainstream of traffic.	Putting cars and trucks in the same HOV lane defeats the purpose, at least as far as safety is concerned. Cars and trucks travel at different speeds, i.e. rate of acceleration and deceleration -- hills, etc.
65	*blank*	*blank*
66	It would slow traffic even more.	*blank*
67	To help prevent accident.	*blank*
68	To avoid slow traffic.	Moving trucks from mixed traffic lanes to truck only lanes would be safer and would also help to control congestion!
69	We are "through" traffic with big engines.	We don't mind paying more per mile if it saves us time. But we go primarily into Portland so, unlike Seattle, most of our bottleneck is not in Washington.
70	Save time and money.	*blank*
71	*blank*	*blank*

Truck Driver -- Truck Stop

#	Question #7 Response	Comments
1	Could get there faster.	I drive for Quasar Express. We are sent out of Sioux Falls, S.D. I leave Sioux Falls, go to California as a rule, come to Washington then go back east somewhere.
2	*blank*	*blank*
3	If this is a faster way -- and also would stop the problem with merging and exiting traffic.	Mixing large trucks and passenger buses could be a bad mix in fog -- slippery conditions. Too many lives at stake in a bus.
4	In HOV lanes you keep the trucks away from cars that enter or exit and the flow of traffic is not disrupted, and it keeps cars away from trucks and less accidents.	There has to be something done about the congestion in large cities. I don't think HOV or far left lanes is the answer, because cars will also use it, it goes faster. As businesses expand more trucks will be on the road, about double the amount today. Maybe create business parks outside cities, so there won't be all this congestion, and maybe less cars also.
5	Save on/off ramp antics.	Reserved truck lane great idea. Will require major enforcement to keep 4-wheelers OUT OF IT!
6	*blank*	*blank*
7	I drive in a lane that lets me flow with traffic.	Letting big trucks use additional lanes is a good idea, but maybe helping to advise automobile drivers about our blindspots, lack of mobility, and need for space in front of us so that we have a cushion to stop in traffic would be useful also.
8	Because there is less traffic in HOV lanes and there is LESS danger of merging traffic accidents from on-ramps.	If you come to the Washington area you better have a load coming back out because there is absolutely no freight for a hot shot truck. So you can keep this god forsaken state.
9	Speed of travel.	If the government was serious about truck safety they would require all drivers/operators to be paid by the hour. Time and 1/2 over 40, triple over 70 -- where it wouldn't be economically feasible to work a driver too hard. Would you speed or work over 70 hours if you weren't getting paid for it?
10	When the HOV lane was the left lane I would use it to stay out of traffic, but	Education of drivers at the beginning level and urging acts of kindness on the road

Truck Driver -- Truck Stop

#	Question #7 Response	Comments
	would not use it in the right lane because of entering and exiting traffic.	would help a lot as would allowing yourself plenty of time to reach your destination safely!
11	To pass slower traffic in other lanes.	Having access to the HOV lanes could improve (lessen) congestion and possibly safety. Of course, as with everything, common sense and courtesy (how do you teach these things?) do the most good. I try to practice these and encourage others to do so.
12	*blank*	Safe operating speed is only determined by congestion.
13	It would be much safer when going through cities. You would not have to be congested with cars coming on and off freeway.	*blank*
14	Usually we don't get off or on, going through except deliveries.	Opinion #s 10, 11 and 12 -- the HOV lanes are already there in some states and of course the people using them are not having 2 or more passengers, just speeding. But large trucks going through not exiting would be the purpose and not being cut off by someone going fast out there, then coming right to get off at exit.
15	I don't believe that a lane for trucks will help because you have too many trucks with various motor and power or cut back in power.	I thank you for the time you spent trying to make the highways more safe for all of us. But I feel that giving a lane for truck only will cause more problem, but yet having use's of the HOV lanes might be a good idea. Thank you.
16	To get on down the road.	*blank*
17	Pass Schuleder trucks.	*blank*
18	Less stop and start.	Cars/pick-ups, motorcycles should be subject to all rules and regulations as is a CDL holder -- speeds, drug tests, fines, penalties. Don't single out any select group. More driver education; more qualifications required for all to obtain any license!!! Cars, pick-ups, vans, motorcycles, small trucks.
19	*blank*	*blank*
20	Because of others who are slower.	Lets just have weigh stations at each end of states, and get rid of the rest of them.

#	Question #7 Response	Comments
		Just going in and out of each state is enough of them, no others are needed.
21	It wouldn't be any different from normal lanes HOV large trucks only YES / with cars NO!	Truck drivers pay too much already! There should be truck only lanes in every major city. If cars would realize how hard it is to stop and go. If they would see themselves a lot of them would sell their cars and ride Metro.
22	To avoid congestion if possible.	The enforcement of current laws of cars would contribute a lot to safety. Getting cut off by exiting cars at ramps and passes on the shoulder is a big problem for most of the big trucks and the interstate roads.
23	Only traveling through cities -- knowing exits or looking for exits.	If lanes or "routes" for "large trucks only" are established it should be enforced. Small vehicles (cars and pick-ups) should not be allowed. I've traveled in states that have "truck only" lanes and the amount of small vehicles out number large trucks in those cases. What is being accomplished?
24	When going through -- out of the way of cars getting off and on.	*blank*
25	*blank*	*blank*
26	*blank*	*blank*
27	To have more accessibility	#10: The sad thing about this question is that everybody would abuse the privilege of using this lane, including 4-wheelers. Other drivers would also not use it even when it is designed for them.
28	The merge to the left is a problem if an exit has to be made. Local trucks need right lane.	HOVs work better if all the way through -- not good fro local routes. Too many on and off points, make it a mess to drive in.
29	*blank*	I want a through travel lane to go through major cities to avoid congestion and merging on-ramp traffic.
30	So we can get through town faster and with less problems.	I want a through travel lane to go through major cities so we can avoid congestion and merging on-ramp traffic.
31	For greater speed.	Too damn many weigh stations.
32	Response to changing traffic situations.	Make the maximum speed limit the same for everyone (slower traffic keep right) and forget lane reservations -- keep it simple and enforce the rules. The HOV

#	Question #7 Response	Comments
		lane offers such little incentive to so few drivers that it's presently just a wasted lane. Allow traffic to establish it's own flow between the maximum posted speed and slower traffic to the right -- size of vehicle shouldn't matter. How much are you paying these broads to stand around handing these "surveys" out? Three quarters of the government and the rest of the welfare state should get jobs doing something -- fix it, replace it, make it, transport it, do something. Jesus Christ, you're like tits on tractions -- useless.
33	To pass slower or stopped traffic.	*blank*
34	Because getting over to exits.	*blank*
35	To get through cities quicker.	*blank*
36	To hard to get back over to get off freeway.	Discrimination against truck drivers who move this country should stop not only by local governments but Federal as well. If we don't move this country would STOP -- it's about time someone realizes this before they lose the professionals.
37	Because during congestion to hard to get to exits.	*blank*
38	Pass J.B. Hunt.	*blank*
39	To help rid some of the congestion and allow other vehicles on and off freeway easily.	I also believe the speed limit should be the same for all vehicles on the road. That people who drive auto's only should have to take part of a truck drivers test for stopping a large truck, so when they pull in front of a truck and hit their brakes, the truck cannot stop on a dime. Which most auto drivers believe.
40	I would only use to avoid slower traffic.	*blank*
41	Trucks should have Truck Only lane.	Split speed limits for cars and trucks are very unsafe causing cars to weave in and out of slower traffic.
42	So that I would be able to meet delivery times easily.	*blank*
43	To avoid stop and go.	I believe trucks should be sent to left lane, this would improve safety of merging and exiting traffic. The biggest hazard we

#	Question #7 Response	Comments
		face is traffic getting on and of roadways. Being in the left lane we would not have to put up with the guy cutting two to three lanes of traffic trying to make his exit or the guy in too big a hurry to take time to merge. Cars are better equipped to maneuver around these people. Most trucks are just going through these towns and are not getting off. In the left lane they could go and not contend with on and off traffic.
44	Don't travel fast enough to make proper use of left lane.	*blank*
45	If vehicle breaks down in HOV lane it makes lane impossible to others.	Split speed limits for cars and truck can cause real problems for everyone. All vehicles should be allowed to travel at the same rate of speed everywhere and be uniform throughout the country.
46	Less traffic -- cars exit off and on more often.	I hope something comes of this survey but keeping trucks in left lanes would be much better since were usually just passing through.
47	Large trucks and cars are a bad combination at any speed, but very bad at rush hours.	*blank*
48	To keep moving better with the flow of traffic.	I don't think trucks should pay more charges for better highways if we would use the National Highway Trust fund for it's intentional purpose.
49	To avoid traffic getting on and off.	*blank*
50	It would keep me away from traffic entering and leaving the highway when I am passing them. That way traffic is not cutting me off and I am not in their way.	*blank*
51	Save time and fuel. To make my deliveries in town on time for once.	More law enforcement, need more uniform law not aimed at large, out-of-state trucks. Cars are not a match for large trucks, people need to be aware of our size and to be educated for own safety. I see people going to work reading papers, doing paperwork, drinking, and driving like a bat out of hell to make it to work on

#	Question #7 Response	Comments
		time. Why? The police will stop us first, not the cars, we leave a little room for safety, the next thing you know a car has cut in front of you, no room to work, and you are stopped for tailgating the car. What do you do? Out-of-state you have to pay now, and you are not the one at fault.
52	More steady travel speed. To get away from entering and exiting traffic.	Driver's license for RVs, require disabled cars to put reflective triangles out, outlaw smoked covers on tail and headlights, random roadside checkpoints for insurance, driver's license, lights working, walk around safety look for cars, RVs, small trucks, more truck stops or parking in major cities.
53	*blank*	*blank*
54	Trucks and buses right 2 lanes only.	Trucks and buses should be allowed in right 2 lanes only. Re: all through traffic should use left 2 lanes in city and congested areas.
55	Seems like the thing to do!	People need to get a grip and quit thinking we are a bunch of criminals. We are out here making a living like everyone else. Just leave us alone, and get the dirty money thieving cops off our backs.
56	Faster transit.	Glad to see someone showing an interest in the trucking industry.
57	Very much safer!! Less Cars.	*blank*
58	Extra traffic would be avoidable.	*blank*
59	Because I pay taxes on the whole road not just part.	I'm sick and tired of being singled out as a driver of a truck as a low life. Every policy the States have in the name of safety are nothing but a money scheme for the State. I pay a huge amount of fuel taxes but the State still discriminates against me.
60	They are generally the inside lane and you usually don't have to worry about entering and exiting traffic.	Speed limits for trucks should be the same -- 65 mph for cars and trucks.
61	Because it's hard enough to stay away from four wheelers already.	Thank God somebody is concerned about the truckers. It seems that all State and police forces focus right at truckers. Industry that's so vital to our country,

#	Question #7 Response	Comments
		shouldn't be such a large negative target.
62	Only when it is safe -- not all drivers are safe.	Heavy trucks should only run in the middle or right lane ONLY. If in the far left lane with a heavy load and coming up to a hill or steep grade -- what will the driver do? Automatically he or she will try to move to far right -- with speed dropping tremendously and other traffic not knowing what to do will only hurt and kill people. Plus all u-haul and RVs should pass some kind of an exam to determine if the driver can handle what is expected of us them, as us professional so called drivers, so they can share the blame of an accident.
63	As a rule I don't drive in left lane when there are three lanes or more.	*blank*
64	Less congestion.	*blank*
65	Just when needed as per traffic conditions.	Washington has one of the most expensive road and fuel taxes implemented on commercial vehicles already. Use it for what it is supposedly intended for.
66	Traffic moves better -- less congestion -- generally smoother flow.	I believe that limiting trucks to one lane use is unsafe -- and causes congestion -- confusion. Also I believe that dual speed limits one for autos, one for large trucks is also unsafe.
67	*blank*	*blank*
68	Be faster.	*blank*
69	Try for faster movement.	Thank you for this. The food warehouses are hard to get along with (unloading) -- makes it hard to stay on time.
70	Less traffic to deal with.	Speed for getting on and off the freeway with a large truck is a problem. We have to deal with that!! Some help from other motorists would be a big help!! In deed large truck lanes would help.
71	Avoid traffic, speed delivery.	Letting commercial trucks use HOV would ease congestion. The greatest affect would be greater safety and efficiency of large trucks.
72	Depending on amount of HOV to keep traffic flowing.	States product and economy is helped by truckers, if product is not moved people's

#	Question #7 Response	Comments
		incomes and companies suffer by delayed billing, etc. We love the state of Washington -- even to purchasing land here. The congestion of campers and 4-wheelers is a detriment to your highways, both in safety and time lost to OTR professional drivers. Thanks for the survey, it shows you care and are trying.
73	To avoid the on and off changing of lanes.	*blank*
74	Far left lane safer then far right.	*blank*
75	So I was not hung up in traffic. Also so I wasn't late for appointment because of traffic.	I think there is too many cars and trucks using freeways and not enough freeway -- too much congestion. Cars I think cause most of these accidents involving trucks -- because they have to be in front of trucks thinking they will get where they are going faster -- and slam on brakes not realizing trucks can not stop like a car. People do not realize the danger of driving these big trucks.
76	Washington drivers as a whole are very inconsiderate of large trucks. They ignore turn signals, making it hard to change lanes under congested conditions.	Washington's 60 MPH truck speed is a safety hazard. It creates constant lane change for most of the vehicles using Washington interstate systems. Lane changes are always a potential for accidents. as for reserved lanes for trucks, there is a vast difference in truck power, load, etc. Hence there is a vast difference in speed trucks travel and even move -- so in Washington where terrain is at times far from level, one reserved lane would be a real problem.
77	To pass through town without exiting.	*blank*
78	Cars wouldn't be in the way.	*blank*
79	*blank*	Fix roads, get the D.O.T. off our backs. The D.O.T. is not in the business of making money off of trucking companies. The D.O.T. and police are our enemy!!! Not our friend!!!
80	I go too slow.	*blank*

Truck Driver -- Safeway

#	Question #7 Response	Comments
1	They frequently have a higher speed of travel.	*blank*
2	*blank*	*blank*
3	*blank*	Do away with HOV lanes. Everyone abuses them anyway. Just make it another lane.
4	Too dangerous.	Do away with all HOV lanes. The design is terrible and abuse is bad.
5	*blank*	I drive for Safeway stores and the figures above for GVW is related to commercial vic., specifically Safeway trucking.
6	Because trucks belong in the right lane, it makes it better to get on and off, and I don't like cars speeding by on both sides.	There are not enough lanes on the freeways to allow a trucks only lane. They would not be full making congestion worse. But if we could use HOV lanes it would be safer and make getting on and off safer for trucks and cars. Because we would all really be in the right lane and not have to try to get over in a very short distance.
7	*blank*	If we are going to have HOV lanes, don't change sides of the highway as I-405 in Renton does.
8	To get around traffic.	*blank*
9	To move traffic faster.	*blank*
10	Keep the truck moving.	*blank*
11	*blank*	*blank*
12	*blank*	People are very rude to truck drivers.
13	Cars won't let you in.	*blank*
14	Truck travel at a consistent speed.	No HOV lane on the right! Also, we pay more for our driver license than an auto driver, don't start adding more fees to commercial driver license.
15	Going up hill - right lane.	HOV lanes should be left lane only -- <u>not right lane</u>!
16	*blank*	*blank*
17	Cars hold up traffic not trucks.	*blank*
18	To reduce the amount of time loss in congested areas.	*blank*
19	*blank*	90% of all cars especially on I-405 (Bellevue, WA area) will not let you in when trying to move to exit lanes. Cars do not pay any attention to speed limits

#	Question #7 Response	Comments
		on all of Washington roads.
20	Because the cars will not give you an opening to merge to the normal traffic lanes.	99% lack of cooperation from passenger vehicles towards trucks, especially in Bellevue, WA.
21	*blank*	*blank*
22	Relieve traffic flow on hills.	*blank*
23	Faster travel.	*blank*
24	It would open up the two left lanes.	*blank*
25	*blank*	*blank*
26	Safe -- less traffic. More professional of drivers.	Need a better way of testing for drivers license for personal vehicles -- not difficult enough in driving ability.
27	Exiting and entering traffic (people do not know how to merge).	Trucks are not the main problem, but will be, if deregulation of the industry is approved. The added truck traffic will increase the number of accidents. The added weight will further breakdown an already degenerating highway system. We need more regulation -- not less!
28	Faster travel.	HOV lanes on two sides of the freeway is a danger to all traffic (I-405 Renton).
29	*blank*	*blank*
30	*blank*	*blank*
31	Because the cars that can seldomly do.	*blank*
32	A large truck moving, doesn't slow traffic down.	*blank*
33	Our slow speeds on hills.	*blank*
34	Less congestion.	Have a strict law to force auto and trucks, each and every vehicle, to use turn signal whenever the vehicle moves it's lane of travel.
35	To keep moving.	*blank*
36	Congestion.	I feel a truck only lane would increase traffic flow especially high congestion and on long hills, i.e. I-405 during rush hour (Kennydale hill).
37	So cars would only be traveling past you in one lane.	*blank*
38	I fell it would improve the flow of traffic for everyone.	*blank*
39	Due to the fact HOV lanes now are right lanes it would be easier to exit if you were able to get into HOV or right lane	HOV lanes should be the left lane as the general public has a hard time entering and exiting freeways having to cross an

#	Question #7 Response	Comments
	when you had the opportunity.	HOV lane in the right lane. Also this would allow emergency vehicles a better chance of moving during non-peak traffic hours.
40	*blank*	*blank*
41	Less stop and go. 80,000 lbs. does not stop as quick as a car that cut in front of it and slams on brakes.	Truck traffic should be moved as far away from on/off ramps as possible -- for safety and less agitation of car drivers.
42	Because of inconsiderate HOV lane drivers speeding.	D.O.T. engineers rebuilt the "S" curves at Renton because of accidents and congestion. Then they run the HOV lane from Tukwila to "S" curves in left-hand lane where it should be. Then cross over in the middle of the "S" curves to the outside lane causing massive traffic congestion and accidents. Washington State Patrol should patrol I-405 HOV lanes for speeders. 90% of drivers in HOV lanes are speeding 60 mph or faster most of the time (90% between Tukwila and Renton).
43	Bad public image.	HOV lanes should be for morning and afternoon rush hours only. They should also delete the HOV lanes in places where there is a short distance between on/off ramps (Richards Rd. past SR-520 interchange and 70th St. past 124th on I-405).
44	To maximize consistent traffic flow.	*blank*
45	I would do whatever traffic required.	*blank*
46	HOV lanes ought to be eliminated and that lane used by everyone.	Open HOV lanes to everybody for everyday use.
47	It would be less congested.	*blank*
48	Because you can't get in and out of them very easily.	
49	It would be too hard crossing lanes of traffic to get back to slower lanes of travel when HOV lanes end during higher traffic periods.	*blank*
50	*blank*	*blank*
51	Could travel at freeway speeds.	*blank*
52	Quicker.	*blank*

Truck Driver -- Safeway

#	Question #7 Response	Comments
53	It would impede traffic.	*blank*
54	*blank*	*blank*
55	To avoid congestion.	*blank*
56	Don't worry about changing lanes.	*blank*
57	*blank*	*blank*
58	Pull hills.	*blank*
59	To get out of the way of fast traffic.	*blank*
60	*blank*	*blank*
61	Safety.	*blank*
62	*blank*	*blank*
63	Slow moving day dreaming drivers spread out blocking all lanes. Auto drivers tend not to take driving serious.	*blank*
64	*blank*	*blank*
65	HOV lanes are on right-side frequently.	*blank*
66	*blank*	*blank*
67	Help to lessen congestion in other lanes.	*blank*