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Freight Operators' Perceptions of Congestion Problems and the Application of Advanced Technologies: Results from a 1998 Survey of 1200 Companies Operating in California

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Freight transportation plays a vital role in the economy of the nation and of the state of California in particular. The value of total freight shipments originating in California in 1997 is estimated at $638.5 billion, 10.6 percent of all US shipments by value.[1] This represents 706.5 million tons of freight an amount equal to 7.2 percent of the freight moved nationally, measured by weight. Measured by value and weight, respectively, 67.4 and 73.7 percent of this freight moved by truck. An additional 15.4 and 2.4 percent (by value and weight) of the freight originating in California moved over more than one mode, most likely spending part of its journey over the road.[2] The California Trucking Association estimates that trucking employs one out of twelve workers in California.[3]

The (draft) 1998 California Transportation Plan for goods movement developed by the California Department of Transportation (Caltrans) identifies four constraints and deficiencies affecting freight transportation in the state.[4] These are: Capacity and Congestion, Safety, Geometrics and Surface Conditions, and, Intermodal Connections. This study addresses the first and last of these and touches on the second and third, from the point of view of trucking companies. It examines the impact of congestion on trucking operations, the use and usefulness of information technologies in their

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operations and the efficiency of intermodal transfer facilities across the state.

During the Spring of 1998, a survey of California-based for-hire trucking companies, California-based private trucking fleets and large national carriers with operations in California was carried out by a private survey research company for the Institute of Transportation Studies at the University of California, Irvine. The sample was drawn randomly from a set of 5258 freight operators, broken down into: (1) 804 California-based for-hire trucking companies, with annual revenues of over $1 million, (2) 2129 California-based private fleets of at least 10 vehicles (power units) and (3) 2325 for-hire large national carriers not based in California with annual revenues of over $6 million. The list of companies and individual contact information was drawn from a database of over 21,000 for-hire carrier and 25,000 private fleets maintained by Transportation Technical Services Inc. An overall response rate of 22.4% was obtained, with many of the national carriers excluded on the basis of insufficient operations in the state of California. Eliminating the contacts with no operations in California and invalid telephone numbers, the effective response rate was approximately 35%.

The computer aided telephone survey was conducted by Strategic Consulting and Research, an Irvine, California-based survey company with extensive experience in the transportation industry. The questions were posed to the logistics or operations manager in charge of operations in California. Respondents include a wide variety of private and for-hire companies providing both general and specialized services, interstate, statewide (California) and local operations.

Views were sought on the impact of traffic congestion on operating efficiency and safety, proposed infrastructure improvements and policies that have been proposed to relieve congestion, the use of information technologies in day to day operations, and the use and perceived efficiency of maritime, rail and air-freight intermodal facilities across the state. This paper provides an overview of the results of the survey. In the next two sections we briefly describe the survey instrument and the key characteristics of the sample.

THE SURVEY INSTRUMENT

The survey was conducted as a computer-aided telephone interview (CATI), with an average interview time of 18 minutes. The survey dealt with five main topics: (1) traffic congestion, (2) reactions to possible ways of relieving congestion, (3) use and usefulness of information technologies, (4) use and efficiency of intermodal terminals in California, and (5) operational characteristics. Each section is briefly described below.

Traffic Congestion

This section included questions about carriers' perceptions about the impact of traffic congestion on their operations. Company spokespersons were asked whether they considered each of a number of possible congestion-related effects to be a problem for their operations. Each potential effect was rated on a four-point scale, ranging from "not a problem" to "major problem."

Congestion-Relief Policies

The investigation of congestion-related problems was followed by questions asking the operators to rate the effectiveness of possible means of reducing congestion on five-point scales, ranging from "not at all effective" to "very effective."

Use of Technologies

Questions were used to elicit information about carriers' current use of technologies including mobile communication devices, Electronic Data Interchange (EDI), Automatic Vehicle Location (AVL), an electronic clearance system (PrePass^{TM})[5], as well as publicly available traffic information updates. Company spokespersons were asked to rate the usefulness of various technologies and information sources.

Use of and Satisfaction with Intermodal Facilities in California

Carriers' use of maritime, rail and air intermodal facilities were investigated. Questions were asked about typical delays and the predictability of the time required for picking up

and delivering loads to these facilities. Operators were also invited to describe the types of problems they faced in operating at intermodal facilities.

Operational Characteristics

The remaining questions focused on the operational characteristics of the companies. Of interest were the types of services offered, the average length of haul, time sensitivity of the operations, the locations of the main terminals and the fleet size.

CHARACTERISTICS OF THE SAMPLE

Two hundred and seventy-six of the respondents were from for-hire trucking companies headquartered in the state of California. That group had the highest raw response rate, with over 34% of the companies completing the rather lengthy survey. Four hundred and seven were from California-based private fleets. That group had the lowest raw response rate for the survey, 19%. It was in general more difficult to make contact with the appropriate manager in these companies. The remaining four hundred and ninety-three responses came from national for-hire carriers. Twenty-one percent of these were willing to answer the survey and had operations in California. The for-hire carriers were identified as common carriers which serve the general public or other businesses at established (or negotiated rates), contract carriers which move freight on a for-hire basis, but under contract to a specific set of shippers, or, as those which provide both common and contract services (Figure 1). Over 57% of the companies responding provide truckload service only, while another 33% provide truckload and LTL service. Only 9% of the companies surveyed listed LTL operations only as the primary service they provide (Figure 1).

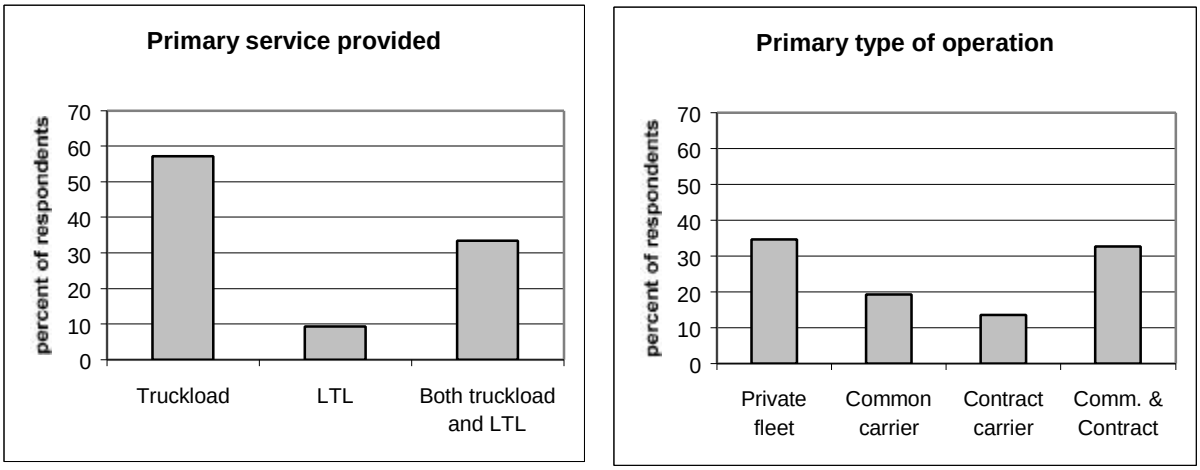

Figure 1. Sample breakdown by primary service and type of operation

The companies were asked to report on the size of the fleet (number of power units) typically operating in the state of California at one time. Fleet sizes ranged from 1 to 6000, with 58% of responding companies operating 25 vehicles (power units) or less in the state at one time. Excluding the 9 companies with more than 500 vehicles operating in California, the mean fleet size for companies completing the survey was 42 vehicles while the median was 20. Just under 69 thousand vehicles were represented in the survey, 51.6 thousand of these in for-hire fleets and about 17.4 thousand in private fleets. The U.S. Bureau of Transportation Statistics estimated that there were 295 thousand trucks and 758 thousand tractor trailer combinations owned by and operated by commercial carriers (excluding private fleets) nationally, in 1995.[6] Assuming an increase of about 5% per year over the past three years, we estimate that there are 1,219 thousand vehicles operated by commercial carriers nationally. Our survey represents 5.7% of these. Assuming that 7-10% of the vehicles operating nationally are in California at one time, this 5.7% represents between fifty-seven and eighty-one percent of the for-hire vehicles operating in California. Table 1 provides a summary of the number of vehicles operated, by type of company.

Table 1. Distribution of number of vehicles operating in California

Distribution of Fleet Sizes of Survey Respondents				
Power units typically operating at any one time in California	Private Fleets	For-Hire not Based in CA	For-Hire Based in CA	All Respondents
0-25	58.8%	43.2%	65.7%	58.1%
26-50	18.0%	27.7%	15.3%	19.1%
51-100	12.2%	17.0%	7.3%	11.2%
101-150	6.3%	8.1%	4.8%	6.1%
201-500	3.2%	3.0%	3.6%	3.3%
Greater than 500	0.2%	0.7%	1.2%	0.8%

The types of service provided by respondents varied widely. Categories used were: general truckload, general LTL, household goods, refrigerated, tank, bulk, and "other specialized" services. The smallest number of responses came from tank carriers with 62 companies completing the survey, while 442 carriers identified themselves as general truckload carriers (Figure 2).

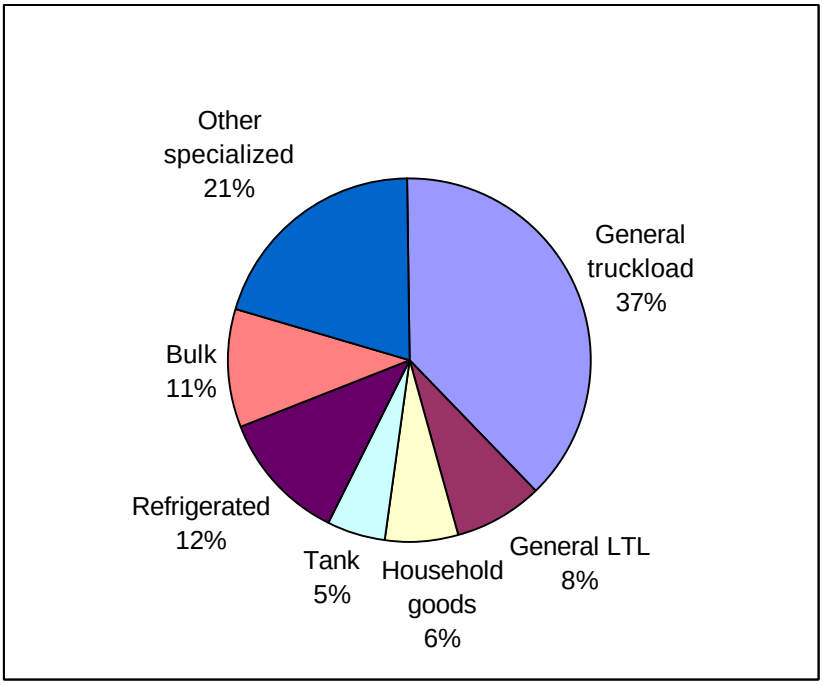

Figure 2. Primary service provided by respondents

RELATED STUDIES

Several other surveys of the industry have been conducted in the past few years. The costs and benefits of Intelligent Transportation Systems (ITS) technologies in commercial vehicle operations (CVO) was recently investigated by the American Trucking Associations (ATA) Foundation through a survey of 700 U.S. motor carriers and 180 technology vendors. The analysis of the data from that survey provided estimates of the market potential for motor carrier participation in six Federal Highway Administration ITS/CVO user services: (1) commercial vehicle administrative processes, (2) electronic clearance, (3) automated roadside safety inspections, (4) on-board safety monitoring, (5) hazardous materials incident response and (6) freight mobility.[7] Where applicable, the results of the ATA study are compared to the results of the technology use assessment section of our survey.

As part of an analysis of the future of communications technologies in commercial vehicle operations, Scapinakis and Garrison[8] conducted a survey in 1991 in which 253 responses regarding carriers' perceptions of a use of communications and positioning systems were analyzed. The primary findings of that study were: a) that the trucking industry is so diverse as to make it difficult to predict the information technology needs of the industry as a whole; and, b) that while short distance operators are heavy users of communication technologies, long distance carriers are likely to increasingly require both on-board communication and vehicle location (positioning).

Kavalaris and Sinha[9] also surveyed trucking companies with a focus on their awareness of and attitudes towards ITS (then called Intelligent Vehicle Highway Systems (IVHS)) technologies. The nearly 500 responses to their survey indicated that, in 1993, not only were most trucking companies not using ITS technologies in their operations, the majority were unaware of developments in automated toll collection, weigh station by-pass and related use of automatic vehicle identification devices.

A study by Ng *et al.*[10] reported on responses from two nationwide surveys of dispatchers and commercial vehicle operators. The 348 and 325 responses (dispatchers and drivers) were analyzed to determine characteristics that would determine likely acceptance of Advanced Traveler Information Systems (ATIS) technologies including: route guidance, navigation, road and traffic information, roadside services and personal communication. Key insights from their study are that drivers who plan their trips on the road were less likely to value ATIS features than those that began at home and that drivers and dispatchers who are already using advanced technologies in their operations were much more likely to value additional technologies than those who have not been similarly introduced.

A paper by Regan *et al.*[11] briefly describes a 1992 survey of about 300 companies which attempted to determine carriers' propensity to use new technologies, particularly two-way communication and automatic vehicle location/identification technologies. Primary findings were that interest in technology implementation was closely linked to

company size and that carriers believe that the use of communication and information technologies could improve the efficiency of their operations.

A recent report by Hall and Intihar[12] reports on a series of interviews with trucking terminal managers, focus group meetings with representatives of the trucking industry in California, and, telephone interviews with technology providers. Their study found that trucking companies were willing to invest and participate in ITS implementation as long as the investment required was modest, there were no new taxes or user fees imposed, the technologies promoted operating efficiency, customer service or safety, and, implementation were voluntary.

Several studies of EDI use in the Motor Carrier Industry have been conducted in the past few years. The most recent, by Crum *et al.*[13] *c*ompares two surveys of EDI capable carriers that were conducted in 1990 and 1996 and found significant increases in the use of EDI in carrier-shipper transactions during that six year period.

Finally, Hensher, *et al.*[14] and Hensher and Golob[15] present analyses of a survey of 150 organizations involved in manufacturing, retailing, warehousing and distribution as well as those involved in providing general (utility) services (electricity, telecommunications), contract distribution, freight hauling, and freight forwarding in the Sydney Metropolitan Area. The survey provided input to support policy decisions in the development of a State of New South Wales freight transport strategy. The New South Wales survey gathered attitudinal data concerning freight industry opinions about potential policy initiatives. As part of their study, Hensher and Golob developed a statistical model that links opinions about specific policies to freight industry sectors.

This study combines the primary topic of the ATA, Scapinakis and Garrison, Kavalaris and Sinha, Hall and Intihar, Regan *et al.* and Crum *et al.* survey-based analyses (technology use), with the topic of policy issues addressed in the Hensher and Golob study. In addition the study addresses carrier perceptions of the impact of congestion

on their operations and the current state of intermodal transfers involving trucks in this state.

The remainder of this paper presents the top-level results of the survey. In-depth analyses of the survey data, each focusing on a specific topic, are presented in Golob and Regan[16], Golob *et. al* [17] and Regan and Golob[18]. The first of these papers models carriers' perceptions of the effectiveness of twelve congestion mitigation policies aimed at improving commercial vehicle operations while the second presents a multivariate demand model for information technology use and the third examines maritime intermodal operations in California.

IMPACTS OF TRAFFIC CONGESTION

Freight operators in California are not optimistic about future traffic congestion on freeways and surface streets. When asked how they thought congestion would change over the next five years, over 85% of the company spokespersons believe that congestion will get worse, while only 10% believe that it will be about the same, and less than 3% said it would get better (Figure 3).

When asked how serious a problem congestion is for their business, only 18% of the operators said that congestion was not a serious problem while 64% and 18% respectively, feel that congestion is a somewhat serious or critically serious problem. Figure 4, on the other hand, shows that while a significant proportion of those asked believe that the congestion related issues identified are a significant or major problem for their organizations, an almost equal proportion of them rate these issues as either not a problem or a minor problem for their business. Essentially the same spread of responses may be found in Figure 5, which displays responses to questions about factors that may cause risks of loss of equipment or injury.

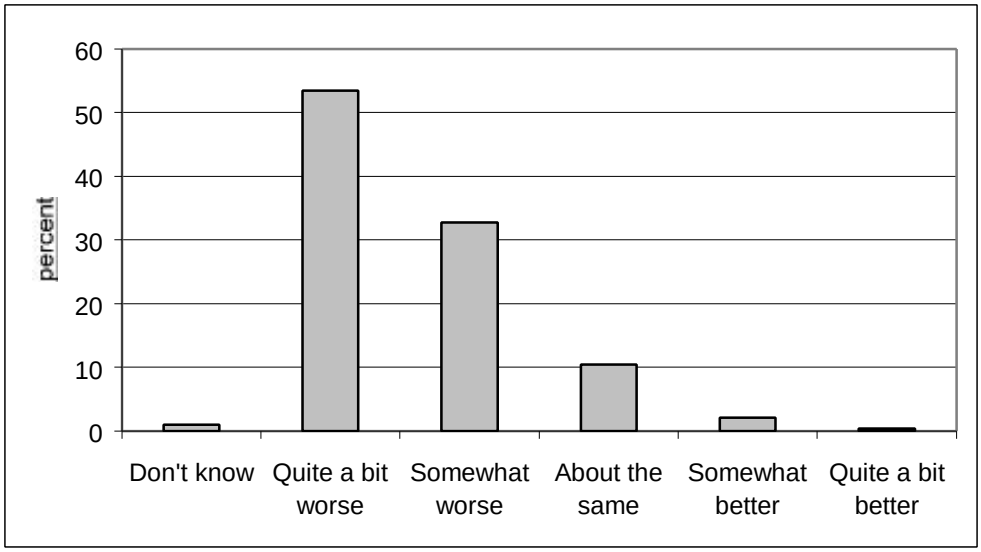

Figure 3. Freight operators' projections about traffic congestion over the next five years

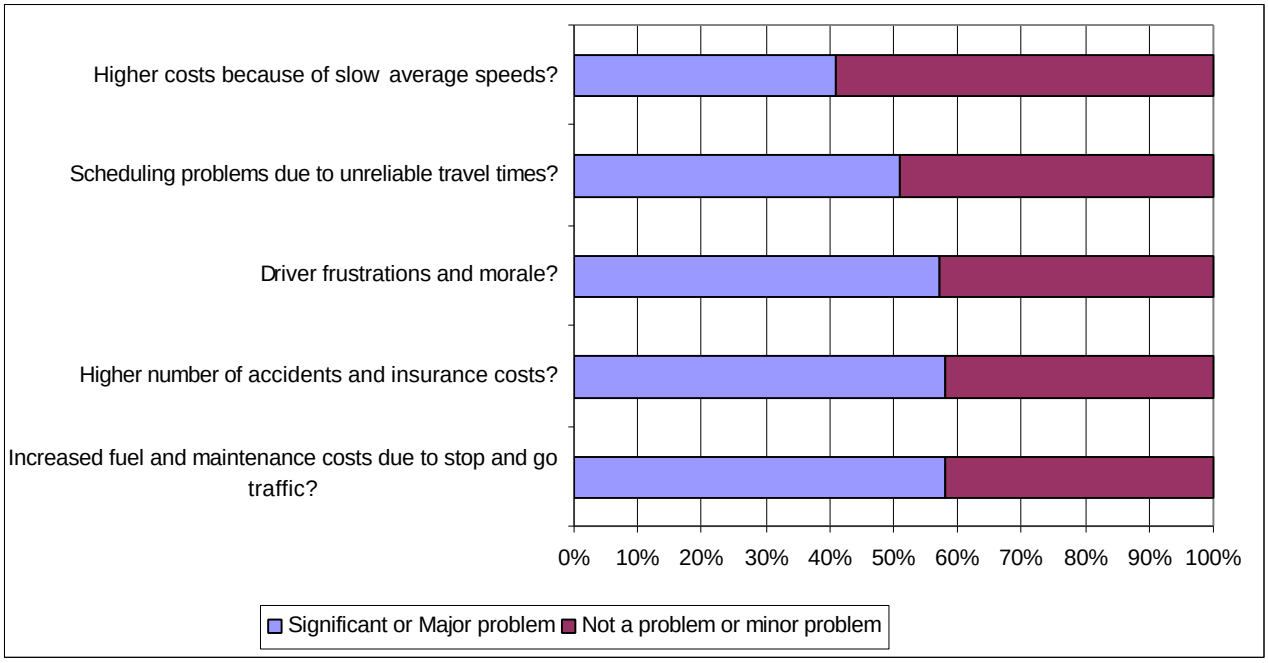

Figure 4. Carrier ratings of the significance a set of potential traffic congestion-related problems in their operations

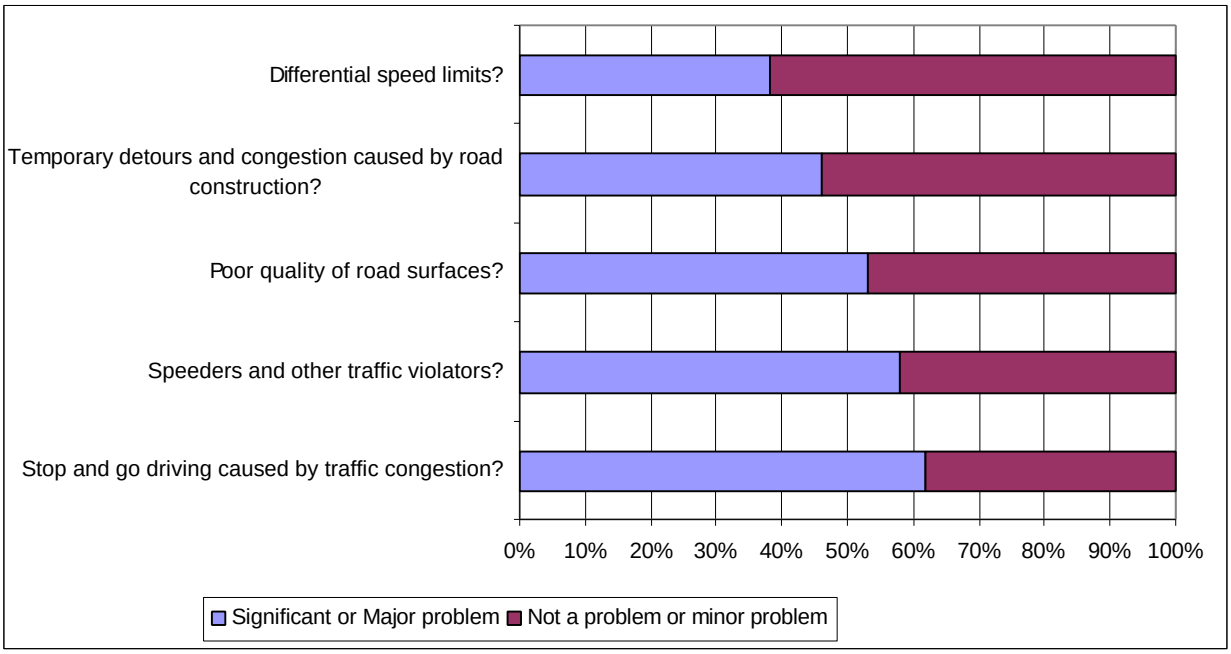

Figure 5. Carriers' ratings of problems that may create risks of loss of equipment, damaged goods, or even injury to drivers.

Despite the lack of consensus about which congestion related problems are the most troublesome, a significant fraction of operators report that schedules are missed often (27%) or sometimes (62%) due to congestion, while only 11% report that schedules are not missed due to congestion (Table 2).

Table 2. Regularity with which congestion-related problems occur

Congestion-Related Problem	**Regularity with which the problem occurs**		
	Never	Sometimes	Often or very often
How often are schedules missed because of congestion?	11%	62%	27%
How often are drivers re-routed because of road congestion?	11%	69%	19%
How often do customer time-windows force your drivers to work in congestion?	12%	38%	50%

CONGESTION-RELIEF POLICIES

Twelve traffic congestion-relief policies, couched as "ideas for relieving congestion" were presented to company spokespersons, who were asked to rate each idea on a five-point scale, with anchors "1. Not at all effective" and "5. Very Effective." The ideas, listed in Figure 6, were rotated from questionnaire to questionnaire in a random fashion to eliminate order bias. It is important to recognize that the scales on which the responses were recorded are ordinal in nature. That is, in comparing a respondent's ratings of two policies on the five-point scale from "1. Not at all effective" to "5. Very Effective," if one policy is given a higher value than the other, we can conclude that the respondent judges the policy with the higher value to be more effective. However, there is no reason to believe that the difference between a rating of 5 and a rating of 4 is the same as the difference between any other two adjacent scale values. Moreover, the interpretation of the anchor words and the general use of the scales will vary across respondents. The analysis in Golob and Regan[19] presents a detailed confirmatory factor analysis of operators' ratings of these alternatives and takes the ordinal nature of the responses into account. For the purposes of this more cursory presentation of results however, the median value over all responses is used to compare the relative attractiveness of each potential solution.

The solution receiving the highest median ranking (5 out of 5) is that of adding more freeway lanes where possible to relieve congestion. Dedicated truck lanes and improved traffic signal coordination are also popular congestion mitigation strategies. Only one strategy had a negative median rating (any rating under 3.0 is considered more negative than positive) -- rush hour congestion pricing was nearly uniformly unpopular. Two other strategies, the installation of electronic clearing stations at international border crossings and having devices available to allow trucks to pre-empt some traffic signals received a neutral median ranking of 3.0. It is likely that this rating reflects the fact that these solutions while not perceived to be negative, are perceived to be likely to affect only a small fraction of the freight moving in the network (as with

automation of international border crossings) or to be highly unlikely to be implemented (as with signal pre-emption).

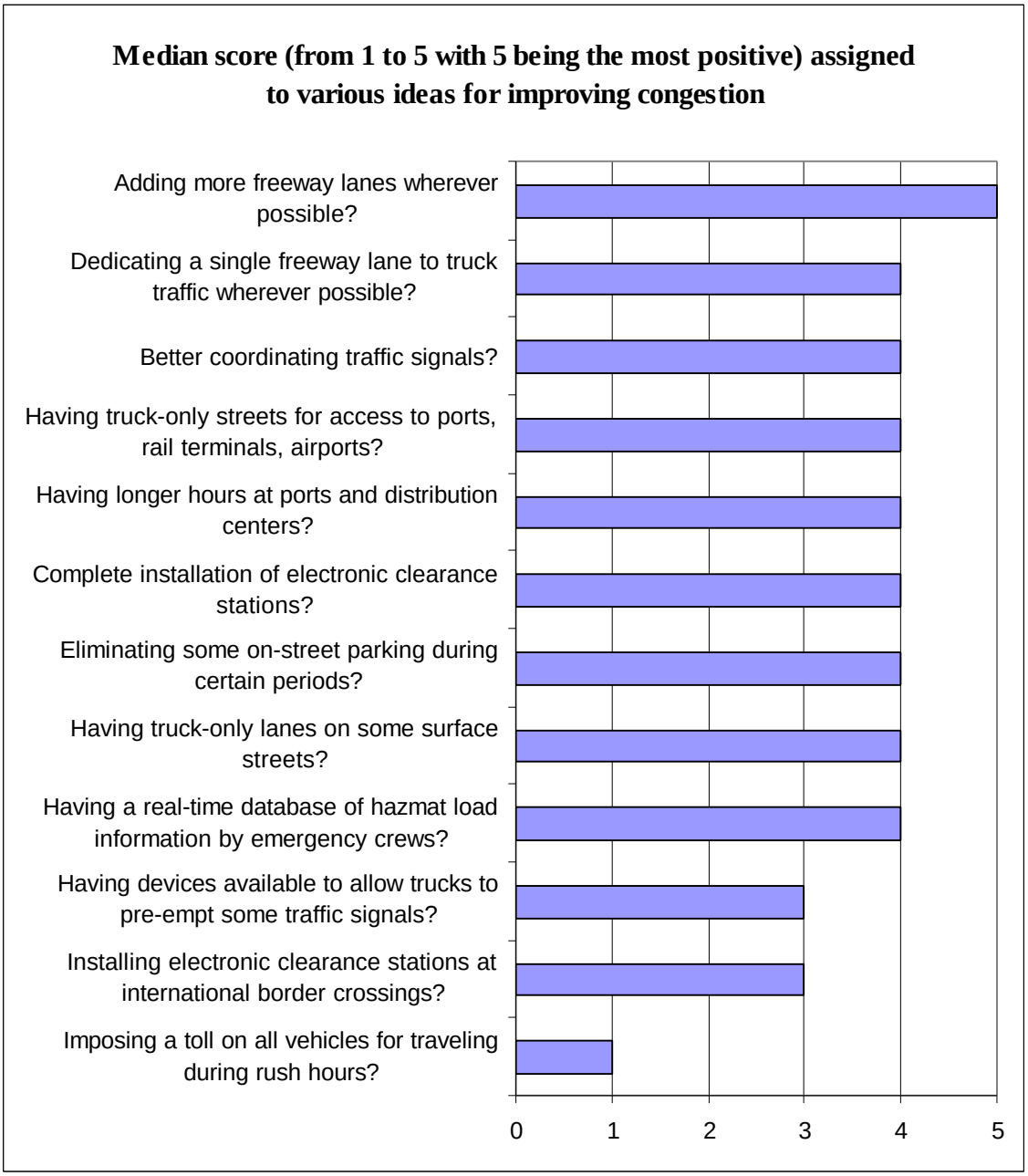

Figure 6. Median effectiveness ratings of possible policies (on a scale of 1= "not at all effective" to 5 = "very effective")

The subset of the CVO population who favor congestion pricing was identified as companies who specialize in exclusively just-in-time services, those who specialize in short distance moves, and, household movers. That these carriers should be more sympathetic to tolls for traveling at rush hour seems logical. In the case of just-in-time carriers, services provided are driven by strict time constraints; in the case of household movers and companies with short loaded moves, areas served tend to be in congested urban centers.

In addition to evaluating this set of 12 congestion mitigation strategies, operators were asked if they could think of any other ways to reduce congestion. The most common suggestions were to increase public/mass transit (49 responses) and carpooling (20 responses) and to change warehouse/intermodal facility restrictions to allow pickups and deliveries at night (20 responses).

USE OF TECHNOLOGIES

The second set of questions was intended to elicit information about truckers' use of various technologies. While technology use is increasing, to date it has not kept pace with the rapid decrease in the cost of such technologies. Most vehicles are equipped with two-way communication devices but not with automatic vehicle location devices or automatic vehicle identification devices. Table 3 shows the frequency of responses to questions regarding the percent of the fleet equipped with these devices.

Table 3. Percent of fleet equipped with TWC, AVL and AVI devices

Technology	Percentage of vehicles operating in CA equipped with technology		
	0 -25%	26 –75%	76 -100%
Mobile communication devices	27%	11%	61%
PrePass^{TM} (AVI) transponders	87%	3%	7%
Automatic vehicle location devices	76%	4%	18%

We hypothesized that larger companies would be much more likely to have technology equipped operations and that these raw responses may under-represent the true likelihood that vehicles are equipped. For that reason, an estimate of the fraction of the vehicles represented in the survey that are equipped was also estimated. We further supposed that carriers might be equipped with AVI devices other than PrePass^{TM}. However, a negligible number of operators reported to be using other AVI devices. As expected, for-hire fleets use these technologies more than private fleets and large fleets use technologies more than small ones. Table 4 shows the estimated percent of for-hire and private vehicles represented by this survey that are technology equipped. It should be noted that follow-up communication suggests that while companies had not, at the time if the survey, equipped their fleets with PrePass^{TM} transponders, they are likely do so in the near future.

Table 4. Comparison of technology use: private and for-hire fleets

Type of freight operation	Estimated percentage of vehicles with technology		
	Mobile communication devices	PrePass^{TM} transponders	Automatic vehicle location devices
Private fleets	64%	6%	11%
For-hire fleets	72%	10%	25%
Overall	70%	9%	21%

Questions about technology use were not limited to the three basic technologies discussed in Tables 3 and 4. Carriers were also asked about EDI, CB radio, phone and cellular phone use. They were asked about the frequency of communication between dispatchers and drivers and the regularity with which dispatchers transmit not only assignments but traffic information.

While the current penetration of information technologies was less than we expected, it is significantly higher than the penetration found by the ATA study which was conducted in late 1994. The ATA study estimated that market penetration for mobile communications, EDI and AVL was 46%, 11% and 2%, respectively while the market

penetration for companies in our study was 80%, 32% and 21%. It is likely however that our study undercounted small companies and hence over estimated the market penetration, compared to the ATA study. For this reason the comparison is presented for the overall sample and for large fleets only. The ATA study defined large fleets as those with more than 100 vehicles, the University of California, Irvine (UCI) study defined large fleets as those operating 50 or more vehicles (power units) in California at one time (Table 5). The UCI study shows an increase in most technology use with the exception that the large carriers represented in this survey appear to use EDI less than those in the ATA survey.

A related study by Crum *et al.*[20] also examined carrier use of EDI. That study showed significant increases in EDI use by carriers during the period 1990-1996. The numbers reported in that paper deal with the extent of EDI use (measured in the percent of EDI shippers, percent of EDI transactions, and percent of revenue attributable to EDI shippers) and do not lend themselves to direct comparison to either the ATA or UCI study. However, results reported suggest that both the ATA and UCI study may in fact underestimate the overall use of EDI since carriers using EDI may account for a disproportionate fraction of the overall shipper-carrier transactions.

Table 5. Comparison of results of 1994 ATA survey and 1998 UCI survey

	All fleets		Large fleets	
Technology	ATA Study	UCI Study	ATA Study	UCI Study
Mobile Communication devices	46%	80%	63%	88%
Electronic data interchange (EDI)	11%	32%	65%	41%
Automatic vehicle location (AVL)	2%	21%	23%	32%

Another set of questions was intended to identify the extent to which companies find various sources of information on traffic congestion helpful. Company spokespersons were asked to rate sources of information used by drivers on the road and used by dispatchers as very, somewhat, or not useful ("don't know" was also an option).

Because the assessments of the usefulness of sources of information about traffic were gathered on ordinal scales, median scores are used to compare the relative evaluations of the information sources. Regarding the usefulness of sources of traffic information that the drivers use directly (Figure 7), CB radio reports from other drivers and freeway changeable message signs were rated as being the most useful, while dedicated highway advisory radio, traffic reports on commercial radio stations, and face-to-face reports among drivers at truck stops and terminals were all judged less useful.

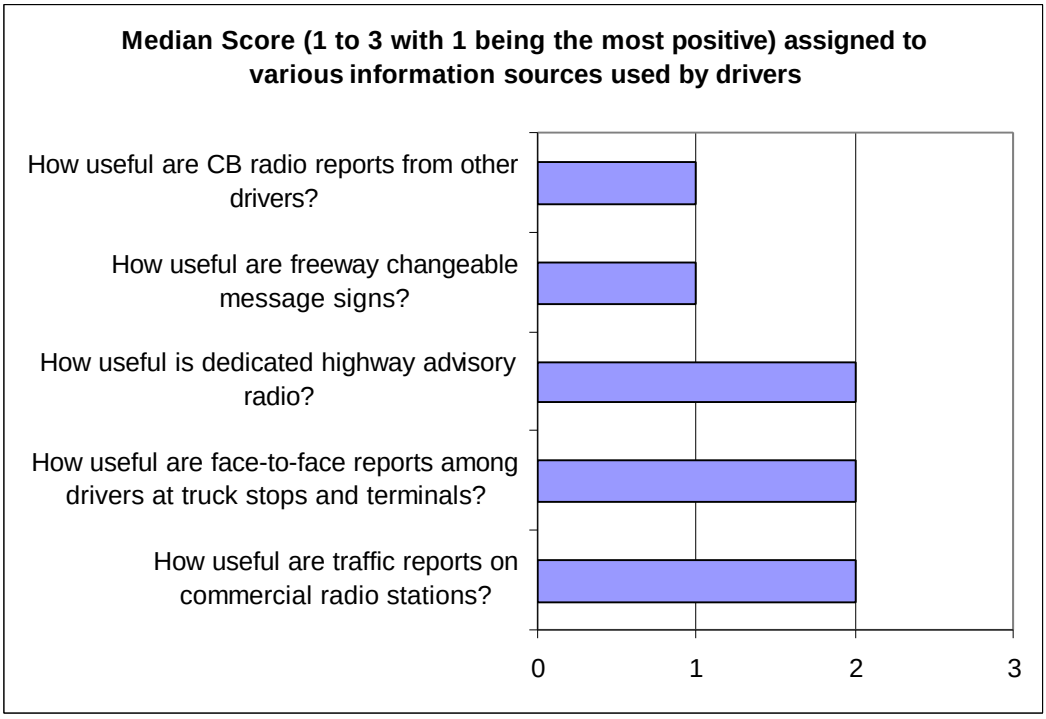

Figure 7. Relative merits of information sources used by drivers on the road (on a scale of 1 = "very useful," 2 = "somewhat useful" and 3 = "not useful")

Regarding the usefulness of sources of traffic information to dispatchers (Figure 8), reports from drivers on the road was rated as being the most useful, followed by phone calls to Caltrans and other information sources and traffic reports on commercial radio stations. Computer traffic maps on the world wide web and traffic reports on television were rated as being less useful to dispatchers, presumably because of the lack of availability of televisions and computer terminals.

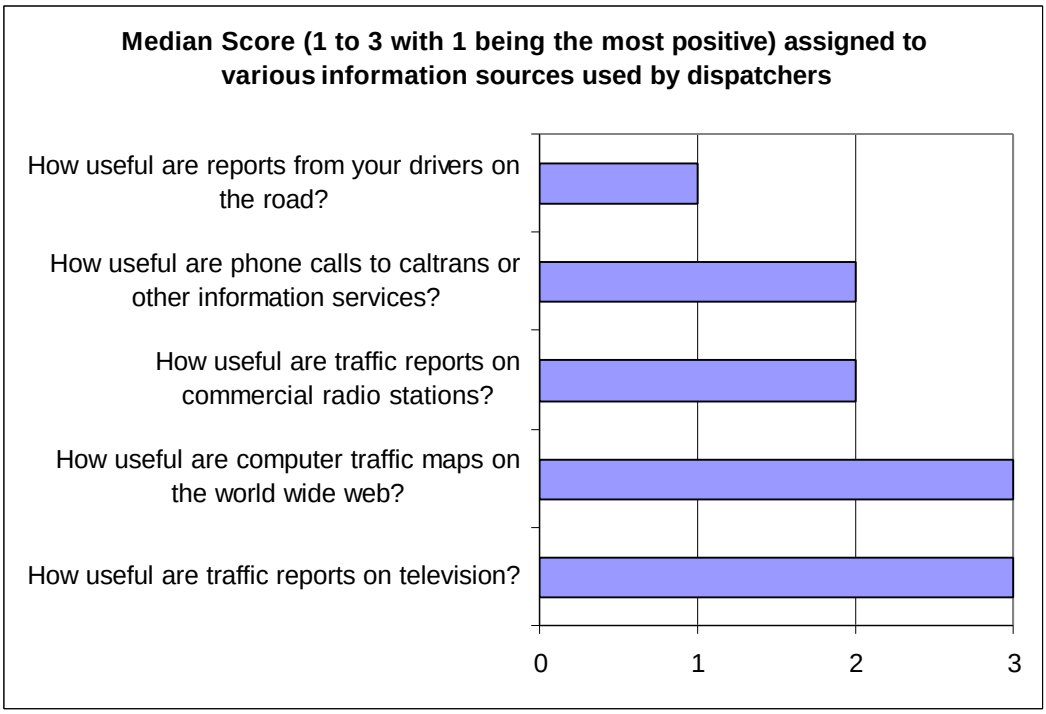

Figure 8. Relative merits of information sources used by dispatchers (on a scale of 1 = "very useful," 2 = "somewhat useful" and 3 = "not useful")

INTERMODAL OPERATIONS

The remaining section of the survey has as its focus intermodal transfer facilities in the state of California. About 38 percent of the operators served maritime ports, while only 19 percent served rail terminals, and 14 percent served airports. A significant fraction of carriers providing intermodal services said that congestion or other problems at these facilities impacts their operations.

Of the 38 percent (or 445) of the freight operators serving maritime ports, less than 15 percent of the operators reported never encountering problems, while approximately 19 percent said that congestion or other problems at the ports impacted their operations always or very often, and an additional 24 percent said that congestion at the ports often impacted their operations (Figure 9). Thus, almost 44 percent of operators serving ports reported that their operations were often impacted by congestion at the

ports. The survey data are being subjected to further analyses aimed at investigating the nature of the problems reported by operators serving maritime ports.

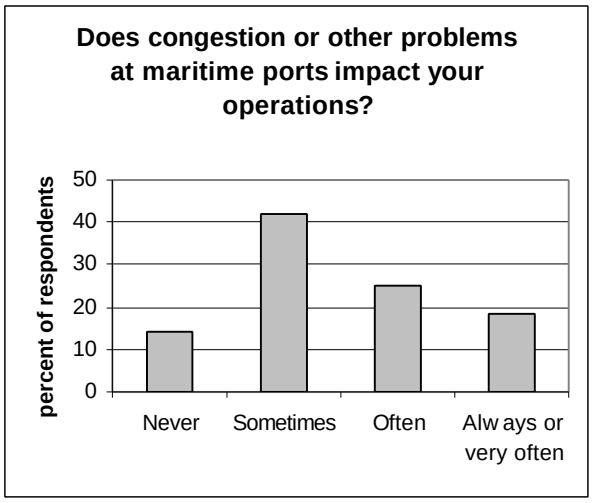

Figure 9. Impact of congestion or other problems at maritime port facilities on the operations of carriers providing intermodal services

With regard to congestion and other problems at airports (Figure 10), approximately 30 percent of the 160 operators in the survey who served airports reported that their operations were never impacted by congestion or other problems. However, 10 percent said that their operations were always or very often impacted, and almost a quarter (23 percent) of the intermodal-air operators reported that they encountered problems often or even more frequently.

Finally, experiences at intermodal rail operations were reported to be similar to, but somewhat worse than at intermodal air operations. As shown in Figure 11, in the case of rail terminals, 28 percent of the 224 intermodal operators in the survey reported never having their operations impacted by congestion and other problems, while approximately 28 percent reported that they encountered problems often or even more frequently.

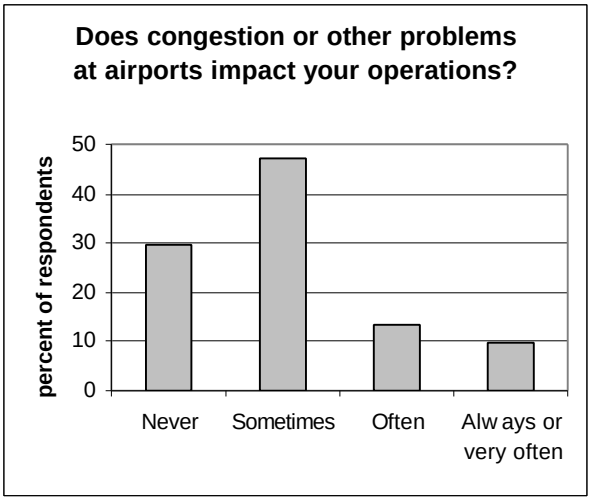

Figure 10. Impact of congestion or other problems at airports on the operations of carriers providing intermodal services

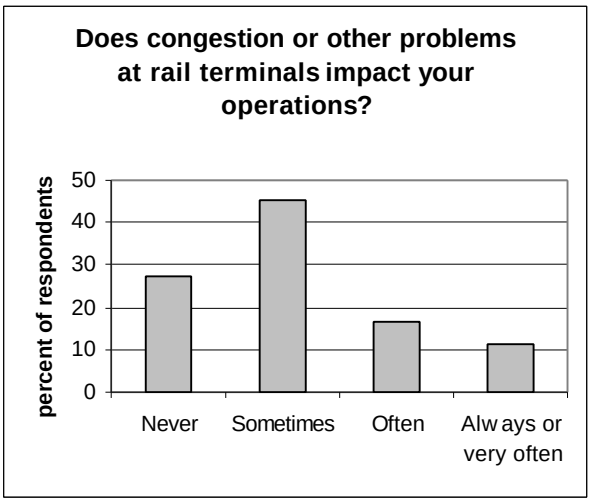

Figure 11. Impact of congestion or other problems at rail terminals on the operations of carriers providing intermodal service

In addition to problems with congestion in and around the intermodal facilities, carriers involved in intermodal services are more likely to be troubled by traffic congestion as well. Presumably this is because of traffic congestion near intermodal facilities. In addition, carriers providing intermodal services are more likely to be forced by port, airport and rail terminal schedules to work during peak traffic periods. Figures 12, 13

and 14 display the responses to the question of whether carriers face scheduling problems due to unreliable travel times. Only 14% of carriers serving ports report that scheduling is not a problem, verses 21% of those not serving ports. Similar comparisons for airports and rail terminals (figures 13 and 14) are 12% verses 19% and 15% verses 18%, respectively. Conversely, 55% of those serving ports rated scheduling problems due to unreliable travel times a significant or major problem, verses 48% of those who do not; the corresponding comparison for intermodal air freight was 57% verses 49%. Carriers serving rail terminals rated scheduling problems due to unreliable travel times a major problem 29 percent of the time, verses 21% for other carriers.

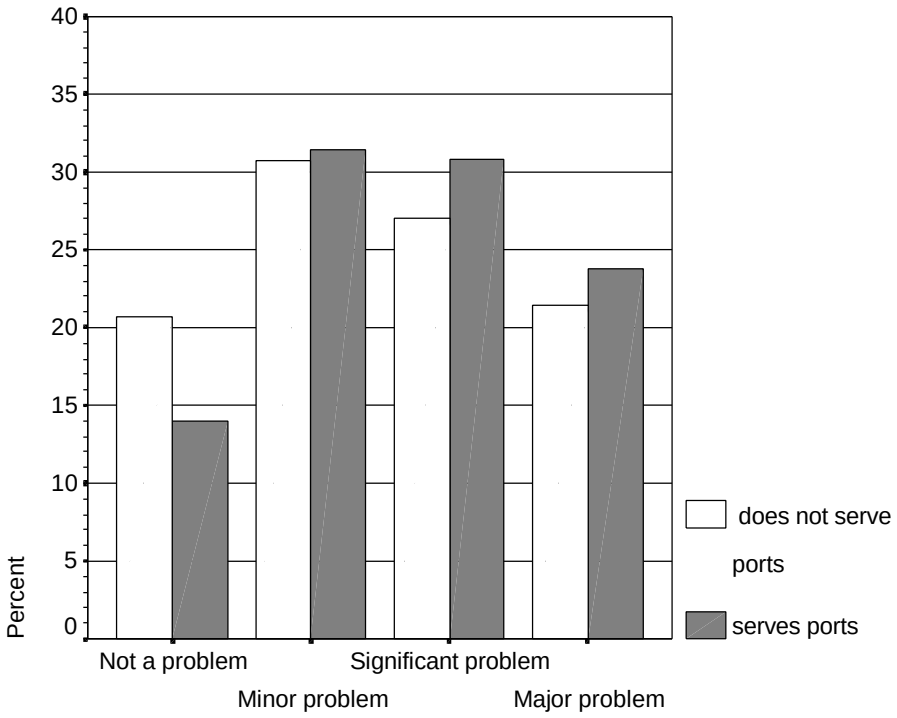

Figure 12. Comparison of scheduling problems due to unreliable travel times experienced by carriers providing and not providing service to maritime ports

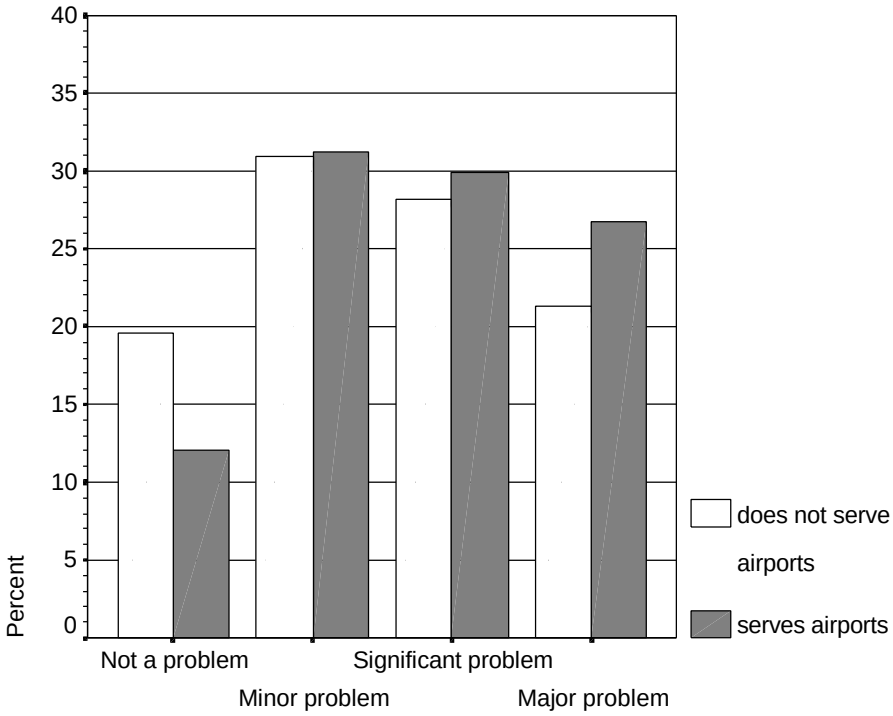

Figure 13. Comparison of scheduling problems due to unreliable travel times experienced by carriers providing and not providing service to airports

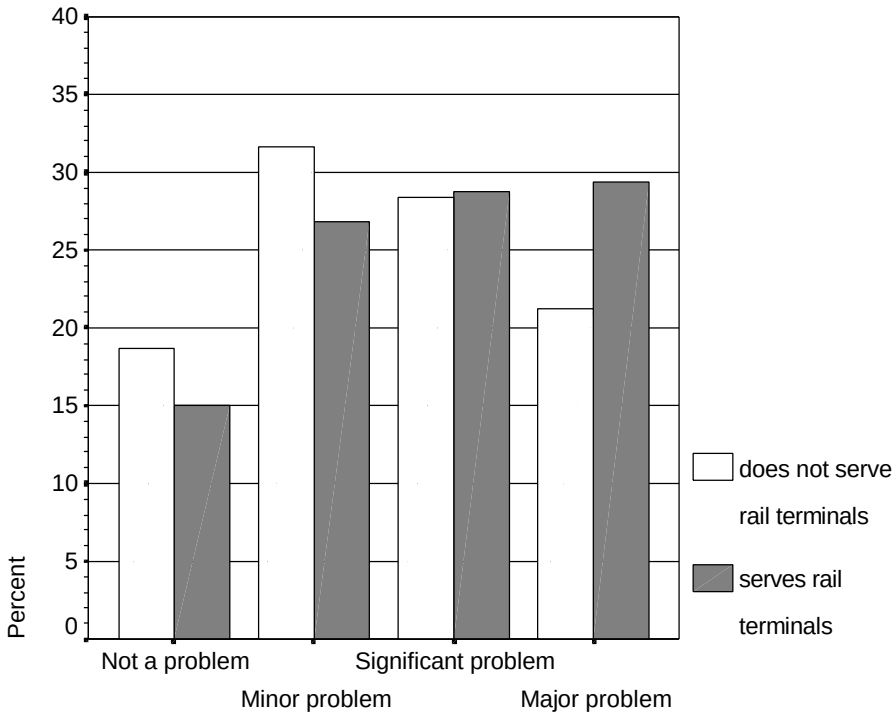

Figure 14. Comparison of scheduling problems due to unreliable travel times experienced by carriers providing and not providing service to rail terminals

CONCLUSION

This paper provides an overview of the results of a large-scale survey of nearly 1200 trucking companies operating in California. One of the largest surveys of the industry to date, the results are also fairly robust. Results lend insight into the primary causes and impacts of congestion on trucking operations, carriers' perceptions of the potential benefits of congestion mitigation policies, the extent of technology use in the industry and, the state of intermodal freight terminals across California. This paper is intended to introduce the results of the survey in a general way.

The vast majority of carriers perceive traffic congestion worsening in the next few years. More than half say that higher fuel and maintenance costs, increased accidents and rising insurance costs, and, driver frustration and lower morale caused by congestion presents serious or very serious problems for their operations. Similarly, over half of the operators say that the poor quality of road surfaces, speeders and other traffic violators and stop and go traffic due to traffic congestion are serious or very serious problems that may lead to carrier loss, damage and even injury.

The most popular congestion relief policy of the twelve presented to operators is the addition of freeway lanes wherever possible, while congestion pricing was the least popular. All policies had some supporters however.

With respect to technologies, a vast majority of fleets are completely equipped with one of the many different two-way communication devices on the market. While fewer than might be expected are using AVI transponders and AVL technologies, there has been a significant increase in the use of these technologies, compared to just a few years ago.

With respect to real-time information updates about traffic conditions, carriers rated CB radio reports from other drivers and variable message signs the most effective ways for drivers to get traffic information while they rated reports from drivers on the road as the most effective way for dispatchers to receive information, indicating that as more

sophisticated information systems for commercial vehicle operations become available, simple technologies may in fact continue to provide reliable and regular information updates.

Finally, congestion at intermodal facilities, like traffic congestion, costs carriers significant amounts of time and money. From the point of view of trucking companies, maritime terminals appear to be the most problematic but inefficiencies at rail terminals and airports are not far behind.

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