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Deployment Paths of ATIS: Impact on Commercial Vehicle Operations, Private Sector Providers and the Public Sector

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## **Deployment Paths of ATIS: Impact on Commercial Vehicle Operations, Private Sector Providers and the Public Sector**

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**California PATH Research Report  
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# **Deployment Paths of ATIS: Impact on Commercial Vehicle Operations, Private Sector Providers and the Public Sector**

## **FINAL REPORT**

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**September 2002**

## **ABSTRACT**

Most studies of the economic benefits of Advanced Traveler Information Systems (ATIS) have focused on the passenger transportation market. Few analyses have addressed the applications of ATIS to freight operations even though using ATIS to route or divert commercial vehicles can make a significant improvement in overall traffic flow and system performance. In this study, multivariate demand models were estimated based on large-scale surveys of commercial vehicle operators in California to determine the current use and perceptions of advanced information technologies, especially advanced traveler information systems (ATIS), among these firms. Data were used to identify organizational and operational characteristics that made these technologies more or less attractive, and to predict potential adoption of the technologies by carrier type. Many characteristics proved influential including company size, type and location of operation, length of load moves, provision of intermodal service and private versus for-hire status. A secondary goal was to explore the extent to which new logistics intermediaries, especially "infomediaries" are likely to develop advanced information technologies for the freight industry. Private sector providers of ATIS have not lived up to earlier expectations. While there still may be a significant future role for private sector involvement in providing this type of information, for now the burden appears to fall primarily on state and local transportation agencies.

### **Keywords:**

Commercial vehicle operators, Advanced traveler information systems, Advanced driver information systems

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## 1. INTRODUCTION

Most studies of the economic benefits of Advanced Traveler Information Systems (ATIS) have focused on the passenger transportation market (see, for example, Levinson, Gillen and Chang, 1999). Few analyses have addressed the applications of ATIS to freight operations even though using ATIS to route or divert commercial vehicles can lead to significant improvements in overall traffic flow and system performance.

This project examined the use and perceptions of the value of ATIS technologies among a large sample of commercial vehicle operators. We investigated the following specific issues:

- What is the state-of-the art of ATIS technologies for commercial vehicle operators (CVO)?
- What is the perceived usefulness of these services?
- Who is providing these services?
- Will third party logistics providers begin to develop and provide ATIS services to their partners or customers?
- How are, or will, these services be bundled with other information or services?
- What are the benefits of these services to commercial vehicle operators?

We began our research with a 1998 survey of a large sample of commercial vehicle operators. This survey dealt with operators' use and perceptions of the value of various sources of traffic information including ATIS and with the adoption of these technologies within the firms. We then examined the potential development of new ATIS sources for the freight industry. At the time, it seemed likely that new on-line third-party logistics providers (3PL) would be bundling ATIS within their commercial systems, and we made an extensive analysis of relevant changes in this sector.

In 1991, we developed and analyzed data from a second survey. The main focus of this survey was on the use and impacts of advanced information technologies, especially ATIS, among freight carriers in California as influenced by carriers' perceptions of traffic congestion and other factors. We describe both surveys in the next two sections.

## **2. THE 1998 SURVEY**

### **2.1. Protocol and Sample**

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 conducted by a private survey research firm for the Institute of Transportation Studies at the University of California, Irvine. The survey was implemented as a computer-aided telephone interview (CATI) directed to the appropriate manager of logistics or operations within each California firm. A total of 1,177 trucking firms were surveyed. Each telephone interview lasted slightly over 18 minutes.

The sample was randomly drawn from a set of 5,258 freight operators: 804 California based for-hire trucking companies with annual revenues of over \$1 million; 2,129 California based private fleets of at least 10 vehicles (power units); and 2,325 for-hire large national carriers (not based in California) with annual revenues of over \$6 million. The lists of companies and information on individual contacts were drawn from a database of over 21,000 for-hire carrier and 25,000 private fleets maintained by Transportation Technical Services Inc.

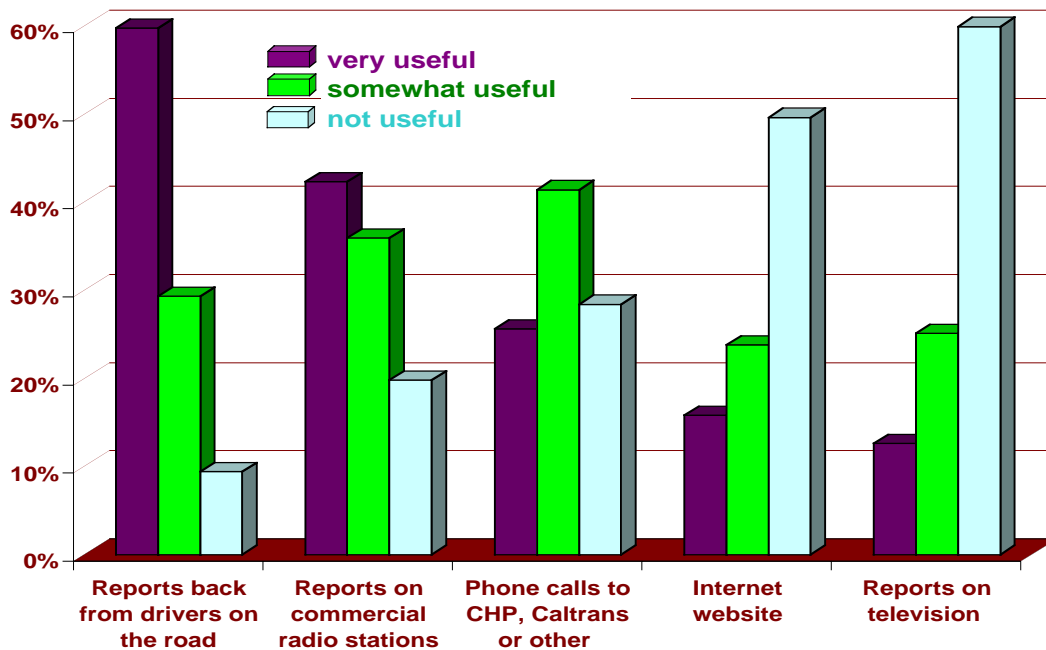
We had an overall response rate of 22.4%. Many of the national carriers were excluded because of insufficient operations within the State of California. Eliminating carriers with no operations in California and carriers with invalid telephone numbers, our effective response rate was approximately 35%. Detailed analysis of non-response showed no statistically significant differences between respondents and non-respondents (detailed in Golob and Regan, 1999).

### **2.2. Perceived Benefits of Traffic Information Sources**

In the first study, 15 sources of traffic information were rated. These included five types of existing sources available to dispatchers, five existing sources available to drivers, and five new sources. Each source was rated on a three-point scale: "very useful", "somewhat useful" or "not useful".



Figures 1 through 3 show how the trucking industry respondents rated the usefulness of these information sources. Companion Tables 1 through 3 summarize the relationships between the exogenous variables (firm type and operating characteristics) and attitudes toward the information sources. These figures and tables qualitatively summarize the results of the survey's non-linear canonical correlations and graphically present the study's primary findings. Full details are presented in Golob and Regan (2002a).



**Figure 1**  
**Perceived Usefulness of Sources of Traffic Information Used by Dispatchers**

Table 1

Summary of the Strongest Relationships between the Exogenous Variables and the Perceived Usefulness of Sources of Traffic Information Used by Dispatchers

Source of traffic information	Judged to be more useful	Judged to be less useful
Reports from drivers on the road	Carriers serving rail terminals Intermodal: multiple modes	Contract carriers Movers Carriers with load moves $\geq$ 500 mi.
Traffic reports on commercial radio stations	General LTL carriers Operations out of Los Angeles Area	Exclusively truckload carriers Operations out of other areas of CA <sup>a</sup> Carriers with load moves $\geq$ 500 mi.
Traffic reports on television	Movers Intermodal: rail only	Carriers with short load moves
Computer traffic maps on the world wide web	Operations from outside of CA Intermodal: rail only Carriers with load moves $\geq$ 500 mi.	Carriers with short load moves Private carriers
Phone calls to Caltrans or other information services	Operations out of other areas of CA <sup>a</sup>	Operations from outside of CA Carriers with no intermodal services

<sup>a</sup> Any areas of California outside of the Greater Los Angeles Area and the San Francisco Bay Area

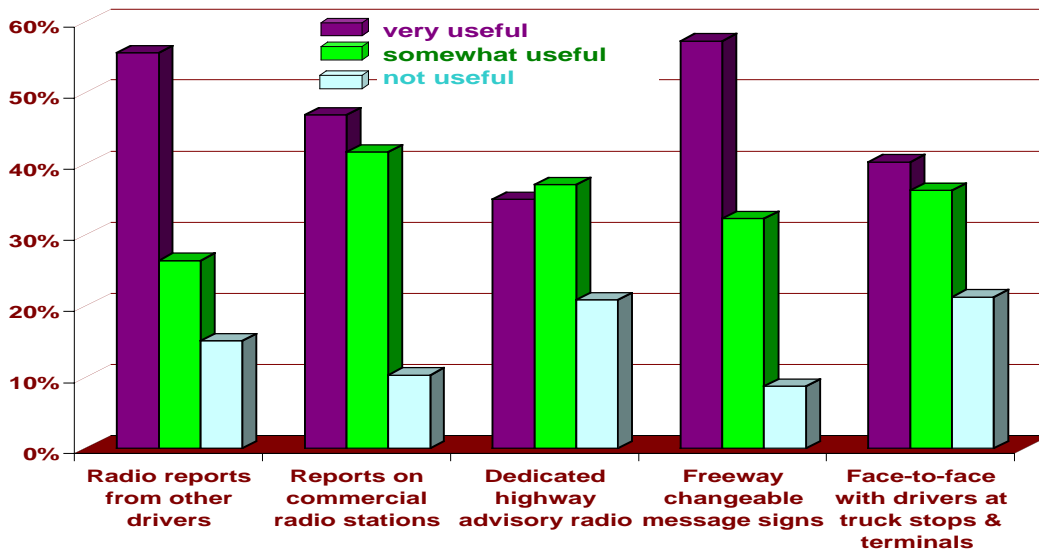
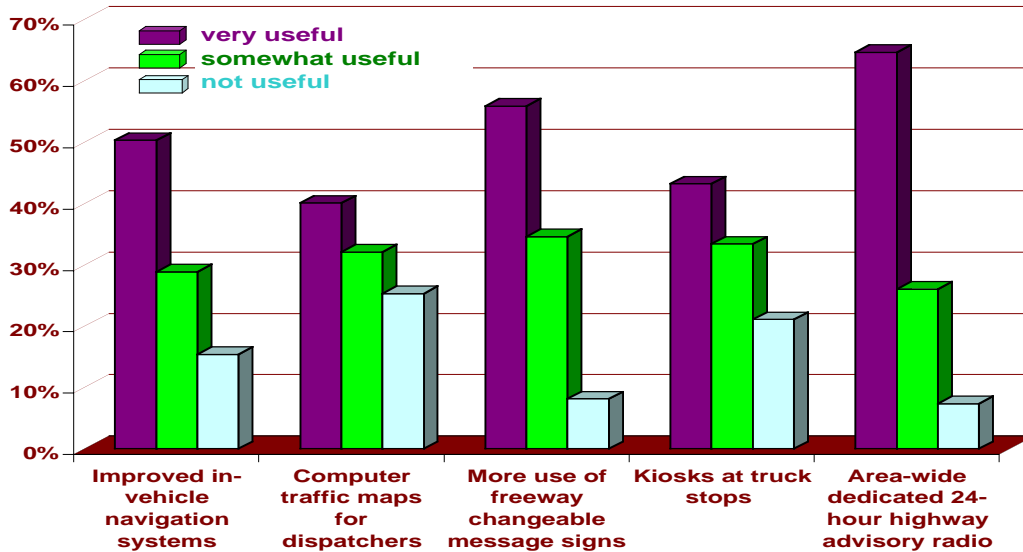


Figure 2  
Perceived Usefulness of Sources of Traffic Information Used by Drivers

**Table 2**  
**Summary of the Strongest Relationships between the Exogenous Variables and the Perceived Usefulness of Sources of Traffic Information Used by Drivers**

Source of traffic information	Judged to be more useful	Judged to be less useful
CB radio reports from other drivers	Exclusively truckload carriers Operations from outside of CA Carriers with long load moves	Private carriers Operations in the Los Angeles Area Operations in the S. F. Bay Area Carriers with short load moves
Traffic reports on commercial radio stations		Operations from outside California
Dedicated highway advisory radio (HAR)	Common carriers Carriers with long load moves	Private carriers Operations out of Los Angeles Area Carriers with short load moves
Freeway changeable message signs (CMS)	Common carriers Operations from outside of CA Carriers with long load moves	Private carriers Tank carriers Carriers with short load moves
Face-to-face reports among drivers at truck stops and terminals	Intermodal: rail only	



**Figure 3**  
**Perceived Usefulness of New Sources of Traffic Information**

**Table 3**  
**Summary of the Strongest Relationships between the Exogenous Variables and the Perceived Usefulness of New Sources of Traffic Information**

Source of traffic information	Judged to be more useful	Judged to be less useful
Cheaper and better in-vehicle navigation systems	Operations from outside California Intermodal: multiple modes Carriers with long load moves	Private carriers Intermodal: no services Carriers with short load moves Carrier with other specialized services
Computer traffic maps for dispatchers	Operations from outside California Carriers with long load moves	Private carriers Intermodal: no services Carriers with short load moves
More freeway changeable message signs (CMS)	Operations from outside California Carriers with long load moves	Carriers with specialized services Operations out of S.F. Bay Area Intermodal: no services Carriers with short load moves
Kiosks at truck stops where drivers can punch up traffic information	Carriers with long load moves Operations from outside California	Private carriers Carriers with specialized services Operations out of Los Angeles Area Operations out of S.F. Bay Area Intermodal: no services Carriers with short load moves
Dedicated area-wide 24-hour highway advisory radio stations	Carrier with both truckload & LTL	Exclusively LTL carrier Carrier with other specialized services Carriers with short load moves

### **2.3. Adoption of Advanced Information Technologies (IT)**

The next step in our study was to examine trucking industry demand for advanced information technologies. These technologies are poised to transform commercial vehicle operations across the supply chain. Our study examined the demand for seven key technologies. These were:

- Satellite or radio-based communication (S/RC)
- Automatic vehicle location (AVL)
- Automatic vehicle identification (AVI)
- Electronic data interchange (EDI)
- Vehicle maintenance systems (VMS)
- Routing and scheduling software (R/SS)
- Citizens band radio (CBR).

Data from a large-scale survey of the trucking industry in California were used to estimate a multivariate discrete choice model. This model was designed to identify the influences of each of twenty operational characteristics on the propensity of trucking firms to adopt each of seven different information technologies. Results showed that the distinction between for-hire and private fleets was paramount, as was the size of the fleet and the provision of intermodal maritime and air services.

### **2.3.1 Influence of Trucking Firm Characteristics on IT Demand and Adoption**

In this section we present results of our analysis of the ways in which operating characteristics can be used to predict carriers' use of advanced information technologies. The analysis was guided by a multivariate demand model. We present our most salient findings below.

Of all the variables, the characteristic "private fleet" had the greatest overall explanatory power. Private fleets had substantially lower levels of demand for all of the technologies with the exception of satellite/cell-based radio communication (S/RC) and citizen's band radio (CBR). The more routine operations of many private fleets negate the need for advanced communications and routing and scheduling technologies. The greatest differences between private and for-hire fleets were in the demand for vehicle maintenance systems (VMS), followed by electronic data interchange (EDI), automatic vehicle location (AVL) and routing and scheduling software (R/SS).

Adoption of information technology was also strongly related to fleet size. Large fleets (those with 100 or more power units) had the greatest demand for each of the first six technology components. Small fleets (those with fewer than ten power units) had the lowest demand for all technology components with the exception of EDI. Demand for EDI was lowest among mid-sized fleets.

Consistently lower probabilities of technology adoption are also shown by companies with less-than-truckload (LTL) operations, unless the company is a large LTL operator with more than two terminals in California. These larger LTL carriers are more likely than smaller LTL operators to use all of the technology components except EDI and CBR.

Carriers engaged in just-in-time operations show higher probabilities of adopting S/RC, AVL and AVI. Short-haul carriers are less likely to adopt satellite or radio communication links, AVL and EDI, but are more likely to adopt R/SS. Long-haul carriers, on the other hand, are less likely to adopt S/RC, AVI and VMS.

The four specialized service variables (tanker, refrigerated, hazardous materials or high-value freight) were significantly related to adoption of most of the technology components, particularly AVL and AVI. Two of these variables had similar patterns of influence. Provision of refrigerated services and hazardous materials (HAZMAT) services had similar effects on adoption of AVL, AVI, and to a certain degree, EDI and R/SS. While there was some overlap of these characteristics (30% of those in our study providing refer service also moved hazardous materials while 35% of those moving hazardous materials also provided refer service), there were also over 300 carriers that provided one type of service but not the other. Information technology is clearly important in operations that involve either of these specialized services.

Regarding intermodal services, carriers serving rail terminals were much less likely to adopt many of the technologies, while those serving seaports and airports were more likely to use these same technologies. The information technology components with opposing demands by intermodal maritime and air versus intermodal rail were AVL, AVI, EDI and VMS. This is a somewhat surprising result, because conventional wisdom generally considers intermodal maritime and rail to be the most similar pair of intermodal services. Instead, we found that when controlling for all other operating characteristics all three modes have unique influences on demand for information technology, and the interaction between maritime and air services was also important. When significantly different than zero, this interaction term ensures that the effect of joint provision of sea and air services is not simply equal to the sum of the two separate effects. Taking the interaction term into consideration, the most similar intermodal effects were the negative effects on adoption of S/RC by joint sea and air operators and by rail operators.

We explore the influences of trucking firm attributes on demand for each of the first six components of information technologies in the remainder of this section. Full details are provided in Golob and Regan (2002b).

### **2.3.1.1. Satellite or Radio-Based Communication (S/RC)**

Fleet size was a strong predictor of adoption of satellite or radio communication links. Small fleets, in particular, were less likely to use such links. Truckload carriers, household movers, small LTL carriers, and companies with long average loaded movements were also less likely to use S/RC. To a lesser extent, adoption of S/RC was negatively related to provision of rail intermodal service and multiple air and sea intermodal services. Just-in-time carriers were likely to be equipped with S/RC.

### **2.3.1.2. Automatic Vehicle Location Systems (AVL)**

Sixteen of the twenty operating characteristics were strong predictors, both positive and negative, of carriers' use of AVL technologies. Large fleets, movers, and carriers that provided refrigerated, hazardous materials (HAZMAT), high-value, or just-in-time services were most likely to adopt AVL. Private fleets are much less likely to use AVL, *ceteris paribus*, as are carriers with small and medium-sized fleets and carriers engaged in short-haul or tanker operations. Intermodal maritime operations was a positive predictor of AVL adoption, while intermodal rail operations was a negative predictor; air or joint sea/air operations had little effect on demand.

### **2.3.1.3. Automatic Vehicle Identification (AVI)**

Propensity to use AVI devices in the form of PrePass transponders was predicted by size of operation (LTL service with two or more terminals in California, or having 100 or more power units in CA) and provision of any of the specialized services (tanker, refrigerated, HAZMAT, or high-value service). General truckload and just-in-time carriers were also more likely to adopt AVI, while long-haul carriers, private fleets, and small LTL carriers were less likely to adopt AVI. As in the case of AVL, intermodal maritime operations was a positive predictor of AVI adoption, and intermodal rail operations was a negative predictor. However, here provision of service to airports was a strong negative predictor of AVI. The sea/air interaction term canceled the two countervailing forces, so that there was a nearly neutral result for carriers that provided both air and maritime services.

#### **2.3.1.4. Electronic Data Interchange (EDI)**

Adoption of EDI was highest among truckload carriers, household goods movers, and providers of refrigerated, HAZMAT, and high-value services. Use of EDI was also predicted by service to maritime ports. The influence of size of fleet was non-monotonic; probability of adoption was high for large fleets and low for mid-sized fleets, with small fleets being neutral. Once again, private fleets were least likely to adopt EDI, as were carriers engaged in short-haul or intermodal rail operations.

#### **2.3.1.5. Vehicle Maintenance Software (VMS)**

The most effective indicator of adoption of vehicle maintenance systems (VMS) was fleet size; companies with less than 25 vehicles were less likely to use VMS. As expected, companies that provided HAZMAT services were much more likely to use VMS; refrigerated and intermodal maritime services were also positive predictors. Private fleets, LTL operators, long-haul operators and carriers providing intermodal air or rail operations were less likely to adopt VMS.

#### **2.3.1.6. Routing and Scheduling Software (R/SS)**

Ten of the twenty exogenous variables were significant predictors of adoption of routing and scheduling software (R/SS). R/SS adoption was greatest among companies that provided refrigerated and HAZMAT services. R/SS adoption was also more likely for large fleets, truckload carriers, and carriers engaged in short-haul operations, *ceteris paribus*. Demand for R/SS was lower for private fleets, LTL operators, and companies that provided tanker operations. Carriers that served maritime ports were more likely to use R/SS. But, taking into account the interaction term, rail, air or joint sea/air operations had no significant effect on adoption of R/SS.



### **3. THE 2001 SURVEY**

#### **3.1. Protocol and Sample**

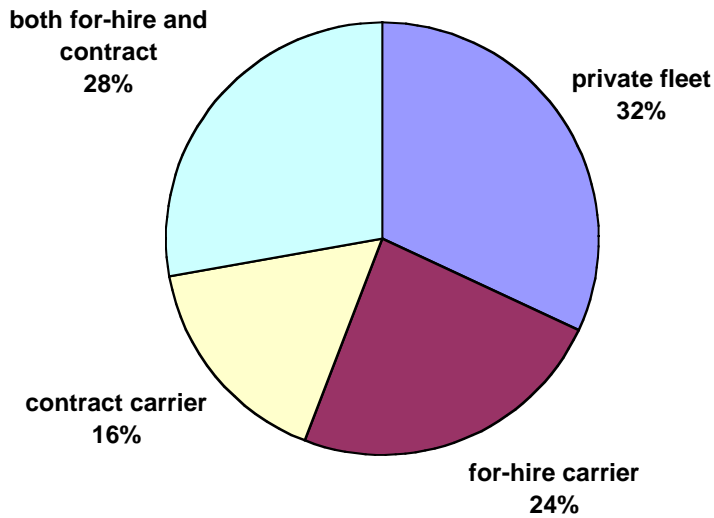
A survey of more than 700 trucking companies operating in California was conducted in the spring of 2001. The main focus of the survey was the use and impacts of information technologies in their operations. Of particular interest was the use of Advanced Traveler Information Systems (ATIS). Other parts of the survey dealt with the perceived effects of traffic congestion on trucking operations, communication between dispatchers and drivers, company use of the Internet, and relationships to third-party logistics providers (3PLs). Extensive questions about the operations of each company provided independent variables for our models.

The survey was conducted as a computer-aided telephone interview (CATI). The interviews lasted an average of 17 minutes. The survey was aimed at large national carriers with operations in the state of California, California-based carriers of all sizes and private fleets corporately located in the state. The contact list for the survey was obtained from a company that maintains nearly exhaustive contact information for trucking companies in the US. Managers of 3,438 companies were contacted, and 86% of these qualified by having operations in California. Of the 2,972 companies with California operations, 75% (2,218) initially agreed to participate in the survey. For these companies, 712 interviews were completed with the person in charge of California operations. The large number of unresolved contacts reflects the difficulty of tracking the appropriate individual and the need to schedule call-backs at a more convenient time. The 712 completed interviews represent a 49% response rate of all resolved contacts, and a 24% response rate of all qualified companies.

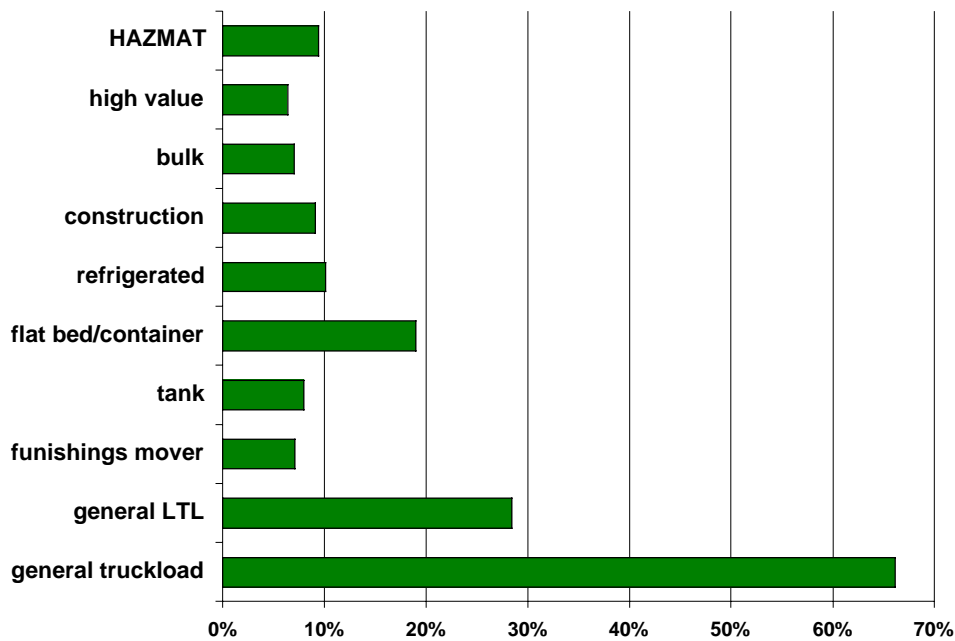
#### **3.2. Company Operating Characteristics**

Our sample was comprised of all types of trucking companies. As shown in Figure 4, 32% of the companies in our study were private fleets while the remaining 68% were for-hire, contract or both for-hire and contract carriers. The frequency distribution of the types of services provided by these companies is shown in Figure 5. Fleet sizes typically operated in California ranged from 1 to 1000 vehicles with a mean of 49. The skewness of the distribution of fleet size is shown by its 90th percentile value of 100 and

by its median of 20, which was also the mode (6.6% of the companies typically operated 20 vehicles in California).

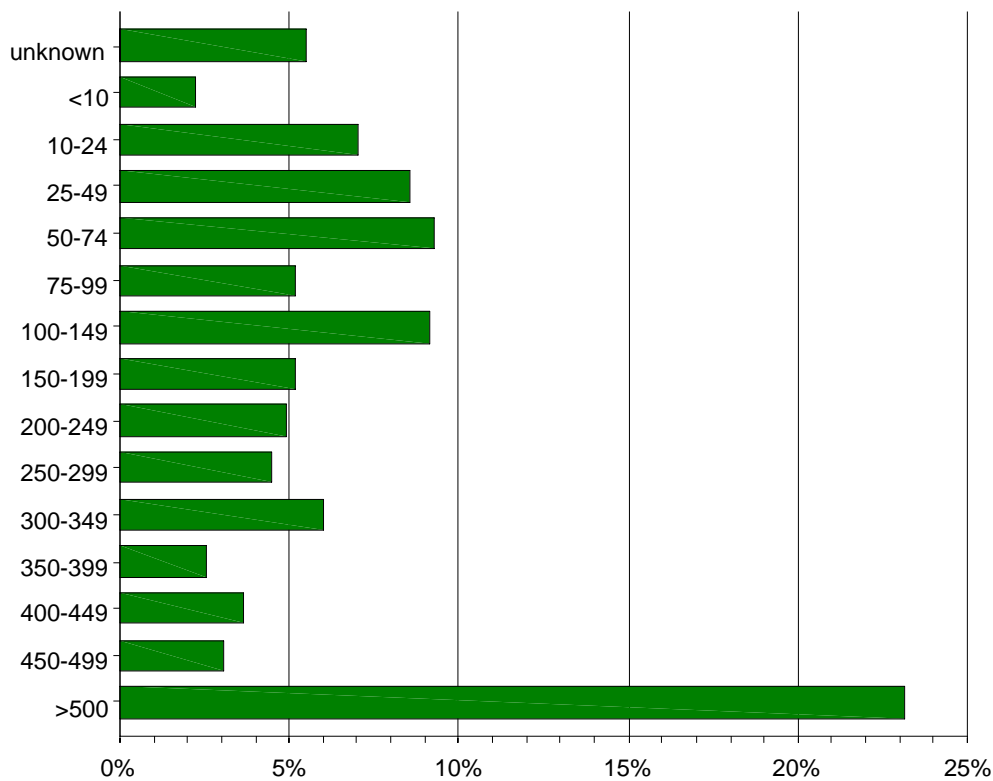


**Figure 4**  
**Breakdown of Survey Sample by Type of Operation**



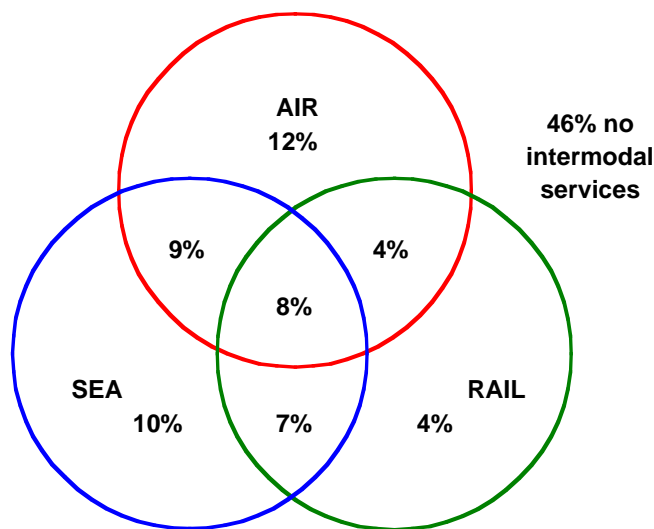
**Figure 5**  
**Breakdown of Survey Sample by Type of Services Provided**

In addition to type of operations and services, length of loaded movements and provision of intermodal services are likely to explain differences in valuation of type of driver information. Our sample included both short and long-haul carriers (Figure 6), with long-haul carriers, defined to have average loaded movements of 500 miles or more, accounting for almost a quarter of the sample. Regarding provision of intermodal services, the sample was quite heterogeneous (Figure 7). Fifty-four percent of the companies provided at least one type of service, with 34% of the companies providing maritime services, 33% providing air cargo services, and 23% serving rail terminals. The most common combinations were those involving sea and air.



**Figure 6**  
**Breakdown of Survey Sample by Average Length of Loaded Movement (in Miles)**

Trucking company managers were also asked about the areas within the State of California in which they operated. About half of the 712 companies (49%) operated statewide, while the remaining half operated regionally. In total, 79% of the companies operated in the Los Angeles Metropolitan Area, 65% operated in the San Diego Area and in the Inland Empire (San Bernardino and Riverside Counties East of Los Angeles), and 64% in the San Francisco Bay Area. These were the only areas of operation related to differences in valuations of ATIS information.



**Figure 7**  
**Breakdown of Survey Sample by Provision of Intermodal Services**

### 3.3. Preferences for Wireless ATIS Information

Our examination of these data began with the following question: If truck drivers could use Internet-enabled wireless devices to access traveler information, what type of information would they most want to have? We were interested in variations in response according to the type of trucking operation, region of operations and other factors. We analyzed preferences for traveler information from managers of 700 trucking companies to determine how they valued information about such things as locations of freeway incidents and lane closures, port and rail terminal schedules and clearances, delays at terminals, train arrivals at grade crossings, weather, and travel times on alternative

routes. Using a factor-analytic model with regressor variables, we found clear differences in preferences across types of trucking operations. We summarize some key findings here. Full details are found in Golob and Regan (2002c).

### **3.4. Valuations of Different Types of Information**

Company managers were asked to evaluate the importance of nine types of information that drivers might receive or send using in-vehicle or handheld wireless devices. The exact question was: "Now or in the future, drivers may receive or send information using in-vehicle or handheld Internet-enabled wireless devices. Which of the following types of information would be most important to your operation?" The interviewer elicited ratings of each of nine types of information on a four-point ordered categorical scale: "very important," "fairly important," "somewhat important," and "not important." The nine items were randomly rotated among surveys, and respondents were also given the opportunity to choose "don't know" as an answer for each item. The nine types of information are listed in Figure 8, together with the aggregate distributions of responses in terms of the four scale categories. Less than 1% of respondents indicated "don't know" on each of the nine items, with the exception of "Delays at U.S.-Mexican Border Crossings" (1.8%). "Don't know" responses are treated as missing data and are not shown in Figure 8.

"Locations of freeway incidents and lane closures," "weather information," and "travel times on alternative routes" were evaluated as important by the greatest number of carriers. Judged not important by the greatest number of carriers was "delays at U.S.-Mexico border crossings." However, the aggregate results of Figure 8 fail to reveal that each of these types of information is likely to be more or less important to a certain segment of the trucking industry. Aggregate results also fail to show the extent to which valuation of different types of information are correlated. Therefore, we developed a structural equation model to quantify relationships between company characteristics and valuations of information types, while simultaneously summarizing the correlations among the valuations in a factor-analytic structure.

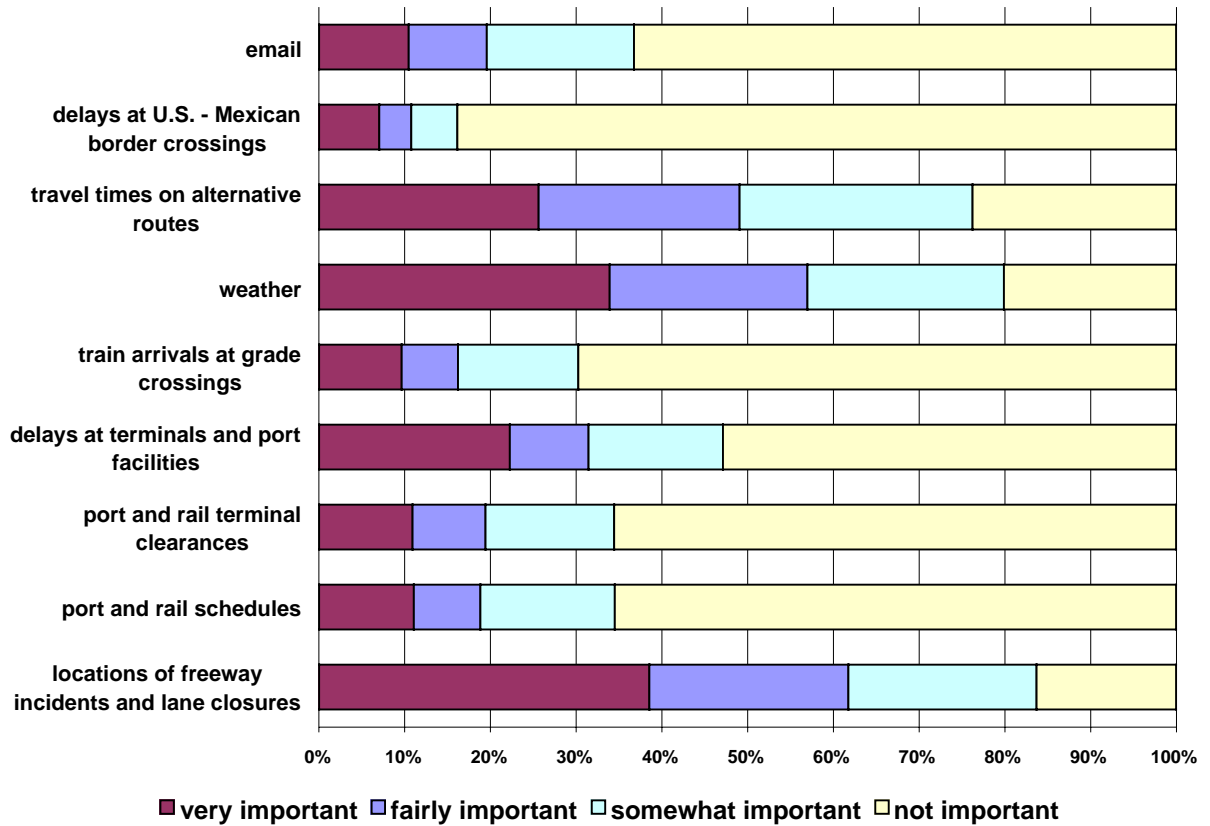


Figure 8

Aggregate Distributions of Evaluations of the Usefulness of Nine Types of Information Drivers Might be Able to Receive or Send Using In-Vehicle or Handheld Internet-Enabled Wireless Devices

### 3.5. Model Structure

The model contains three latent variables (factors). The factor structure is shown in Figure 9. We refer to these factors, or bundles of information services, as “traffic information”, “intermodal information” and “general information”. The estimated coefficients of the measurement submodel, equivalent to factor loadings, are listed in Table 4. The three primary information types that make up the traffic information bundle are travel times on alternative routes, locations of freeway incidents and lane closures, and weather information. In addition, the traffic information bundle also includes a secondary group of three types of information: email, train arrivals at grade crossings, and delays at international border crossings.

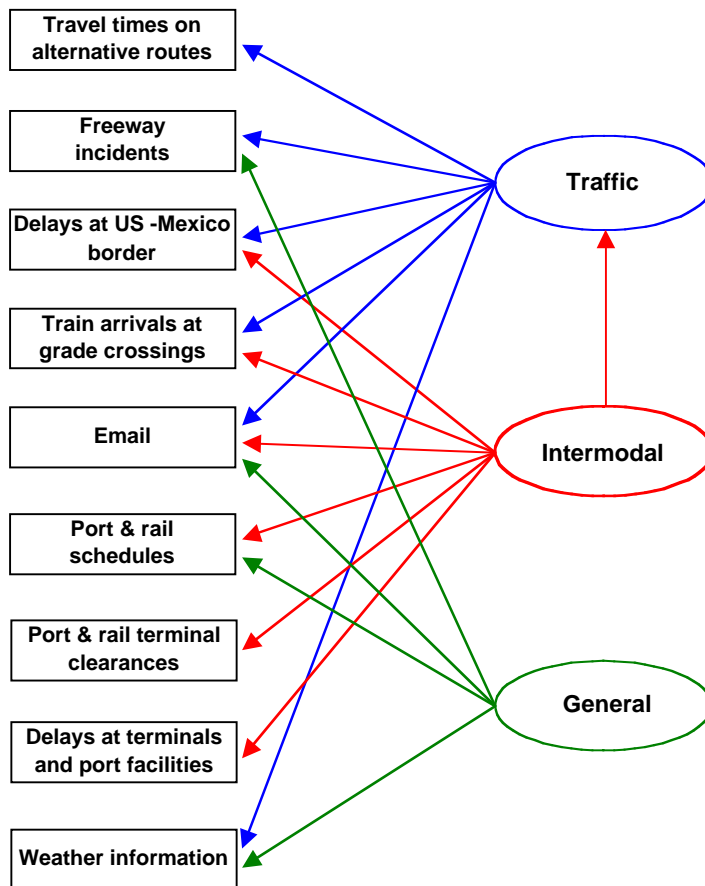


Figure 9  
Flow (Path) Diagram of the Measurement and Endogenous Structural  
Components of the Structural Equation Model

**Table 4**  
**Coefficients of Measurement Submodel Defining the Latent**  
**Variables in Terms of the Observed Variables (z-statistics in Parentheses)**

<b>Observed Variable</b> <i>Importance of Information on...</i>	<b>Latent Variable</b>		
	<b>Traffic</b>	<b>Intermodal</b>	<b>General</b>
Locations of freeway incidents and lane closures	0.878 (12.21)		-0.718 (-2.59)
Port and rail schedules		0.971 (31.04)	-0.383 (-2.97)
Port and rail terminal clearances		1.000 <sup>a</sup> (fixed)	
Delays at terminals and port facilities		0.954 (22.65)	
Train arrivals at grade crossings	0.227 (4.57)	0.472 (11.34)	
Weather information	0.838 (12.47)		1.000 <sup>a</sup> (fixed)
Travel times on alternative routes	1.000 <sup>a</sup> (fixed)		
Delays at U.S. - Mexican border crossings	0.151 (3.27)	0.293 (7.57)	
Email	0.355 (5.82)	0.208 (4.45)	0.877 (3.76)

<sup>a</sup> One observed variable must have a fixed value for each factor in order to fix the scale of the latent variable



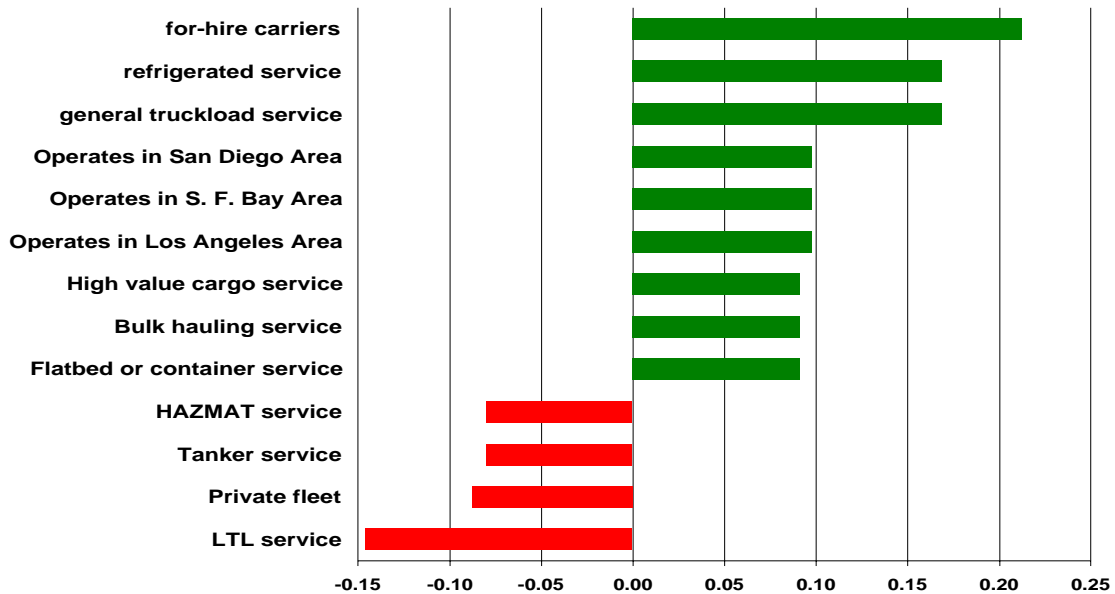
### 3.6. Industry Segment Differences in Valuations

The estimated coefficients of the regression effects of the operational characteristics on the factors are plotted in Figures 10 through 13, which we discuss in the remainder of this section. In determining the optimal model, we tested whether similar effects from separate variables within each block of variables (company type, services offered, fleet size, areas served, average load length and intermodal services offered) could be equated, thus simplifying the model. Five sets of equalities were found that could not be rejected according to standard rules of hypothesis testing in linear models. First, the effects on the traffic factor from (a) truckload and (b) refrigerated services were equal (and positive). Second, the effects on the traffic factor from (a) tank truck and (b) hazardous materials services were equal (and negative). Third, the effects on the intermodal factor from (a) flatbed or container, (b) bulk and (c) high value services were equal (and positive). Fourth, the effects on the traffic factor from operations in (a) Los Angeles, (b) San Francisco, and (c) San Diego were equal (and positive). Finally, the effects on the general factor from operations in (a) San Francisco and (b) San Diego are equal (and negative). This implies that a simplified model in which these effects are constrained to be equal should be developed. This is a standard step in the development of structural equation models.

As shown in Figure 10, for-hire carriers placed the highest value on the traffic bundle of information services that drivers might be able to receive or send using in-vehicle or handheld Internet-enabled wireless devices. If a company provided either refrigerated or general truckload services, this also increased the value of general traffic information. Providers of high-value, bulk, or flatbed services also placed a higher value on general traffic information, but to a lesser extent. As expected, companies operating in or near the three major California metropolitan areas (San Francisco, San Diego and Los Angeles) valued traffic-related information more than those operating exclusively outside these areas.

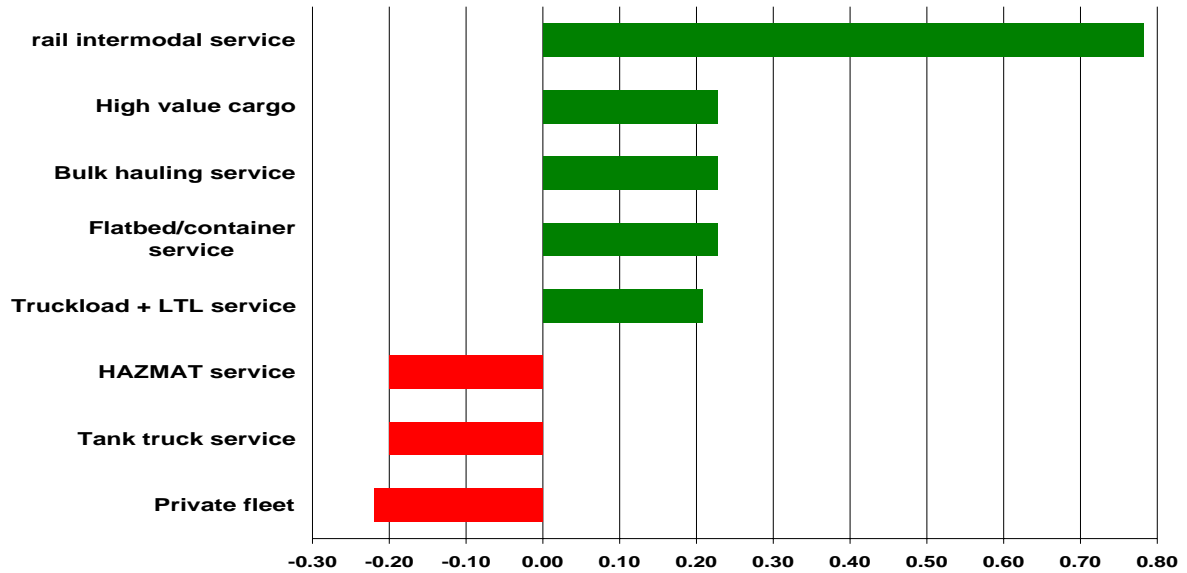
Private fleets and LTL carriers valued ATIS and other forms of real-time information less than their for-hire counterparts. This is likely because these carriers follow regular routes about which they have much better information. Hazardous materials carriers and tank

carriers valued traffic information less, as well, likely because they are already obtaining specialized traffic information from specific sources.



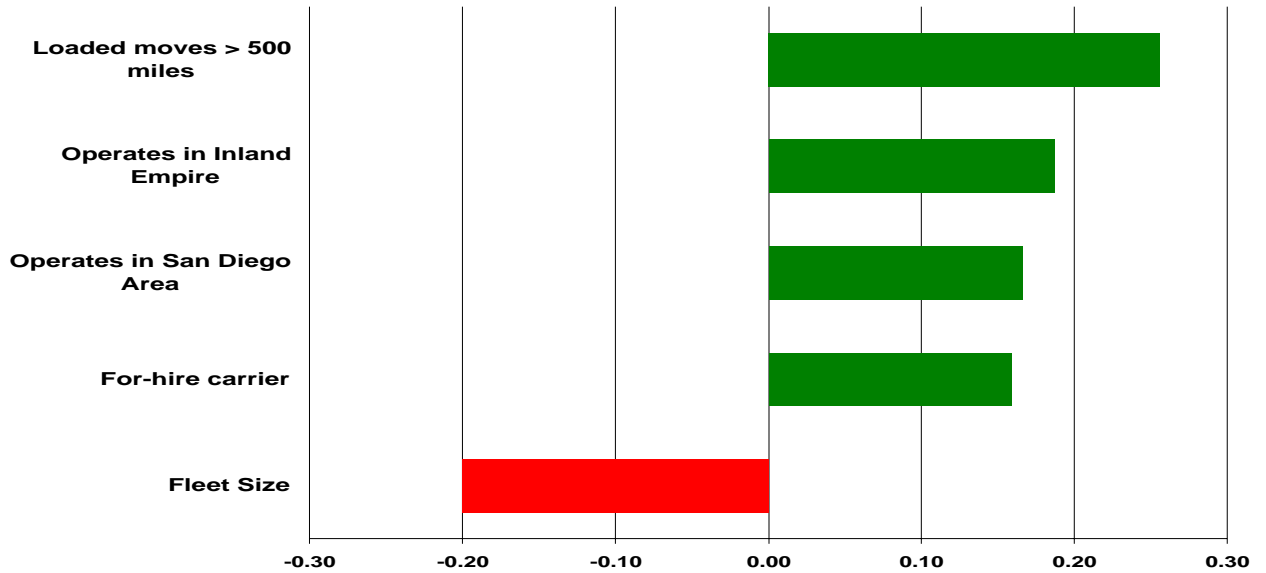
**Figure 10**  
**Regression Effects on the Value of Traffic Information (Showing only Effects Significant at the  $p = .05$  Level for Two-tailed Tests)**

Industry segment effects on the second bundle of services, intermodal information, are plotted in Figure 11. The interesting result is that the provision of rail intermodal services dominates other intermodal services. It appears that carriers serving rail terminals are most in need of traffic information using in-vehicle or handheld wireless devices. Carriers with flatbed and container services, which are often involved in maritime operations, also place a higher value on intermodal information, as do providers of high value services which often include air cargo operations and providers of bulk cargo services – often involved in rail intermodal moves. Carriers that generally do not provide intermodal services - HAZMAT carriers, tank carriers and private fleets – naturally place lesser value on intermodal information.



**Figure 11**  
**Regression Effects on the Value of Intermodal Information**  
**(Showing only Effects Significant at the  $p = .05$  Level for Two-tailed Tests)**

As shown in Figure 12, fleet size was negatively associated with carriers' perception of the value of the general information bundle; smaller fleets placed a higher value on this bundle which includes weather information and email. Many large carriers have already invested in vehicle location and communication systems for their fleets so they have less need for the provision of such services. Long-haul carriers and carriers that operated in the Inland Empire (defined as San Bernardino and Riverside Counties) and in San Diego County also valued weather and email information more highly. Spatially, the Inland Empire and San Diego County together span most of the mountainous and desert areas between the large coastal conurbations of Southern California and the eastern border of California. Weather and email information appear to be important to drivers crossing this area on long-distance runs.



**Figure 12**  
**Regression Effects on the Value of General Information**  
**(Showing only Effects Significant at the p=.05 Level for Two-tailed Tests)**

#### **4. THE POTENTIAL OF ATIS FOR COMMERCIAL VEHICLE OPERATIONS**

In the early phase of our study, we hypothesized that commercial vehicle operators would be early adopters of ATIS due to the high value of commercial travel-time savings and the potential gains in operating efficiency that would result from ATIS-based routing and scheduling information. The increase in just-in-time distribution systems, "visible" inventories, real-time communication systems and the emergence of consumer-to-business and business-to-business e-commerce have resulted in unprecedented numbers of time-sensitive deliveries. Accurate and detailed real-time information on roadway traffic and delays at intermodal facilities and distribution centers has obvious benefits for time-sensitive operations.

To gauge the current and potential market for ATIS in commercial vehicle operations, we analyzed data from a 1998 survey of over 1,700 California (see Section 2.0. above). We investigated two issues: What is the perceived usefulness to commercial vehicle operators of current sources of ATIS information? How do the operators judge the

potential of new ATIS services, based on their current experience and expectations?

We included six ATIS technologies in our survey:

- Cheaper and better in-vehicle navigation systems
- Computerized traffic information on the Internet
- Traffic information for dispatchers on cable or satellite TV
- Freeway changeable message signs
- Kiosks at truck stops where drivers can obtain traffic information
- Area-wide dedicated 24-hour highway advisory radio.

Trucking managers were asked to rate these current and potential sources of information as: "very useful", "somewhat useful", "not useful" and "don't know". Results of this evaluation are presented in Table 5. Dedicated highway advisory radio was viewed as most useful to drivers and dispatchers, followed by more freeway changeable message signs and cheaper and better in-vehicle navigation systems. Web-based information found in dispatch centers and at kiosks at truck stops received mixed reviews, as did computer traffic maps on TV. The TV-based maps were judged more useful than maps available on the Internet. The relatively low rating for Internet information is probably both a function of the carriers' lack of Internet access and paucity of Internet-based ATIS services in 1998.<sup>1</sup>

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<sup>1</sup> Presumably this will change as carriers increase their use of computers with Internet connection in response to the demand for and availability of e-commerce. Networked computers will become more prevalent in CVOs due to demand for a wide variety of IT applications, such as routing and scheduling, vehicle monitoring, maintenance and record keeping software, tracking and tracing technologies for containers and packages, and Internet-based load matching services. As a consequence, Internet access is likely to be available to a greater number of carriers and there will be increased incentives for developing ATIS services due to their wider audience.

**Table 5**  
**Perceptions of the Usefulness of ATIS-based Sources of Traffic Information**

Information source	Sample breakdown (%)			
	Very useful	Some-what useful	Not useful	Don't know
Cheaper and better in-vehicle navigation systems	50.3	28.9	15.4	5.4
Computer traffic maps for dispatchers	40.1	32.1	25.3	4.3
More use of freeway changeable message signs	55.9	34.6	8.2	1.2
Kiosks at truck stops where drivers can access traffic information	43.2	33.4	21.1	2.8
Area-wide dedicated 24-hour highway advisory radio	64.7	26.1	7.4	1.8

Relative perceptions of the usefulness of ATIS technologies varied by carrier type and service characteristics (see Table 3). For "cheaper and better in-vehicle navigation systems", the primary explanatory variables were carrier type, spatial location, intermodal services and length of load moves. Large national and regional carriers based outside California, long-haul carriers and carriers with multiple intermodal services saw such sources of information as being particularly valuable. Private carriers, short-haul carriers, those without intermodal services and those with various unspecified specialized services were less inclined to rate in-vehicle ATIS as useful to their operations.

Perceptions of the usefulness of "Internet information in the form of computer traffic maps for dispatchers were primarily explained by carrier type, location, intermodal services and length of loaded moves. The primary market for such systems will likely be large national and regional long-haul carriers. Demand for such systems is less likely to come from private fleets, operators with short loaded moves and carriers with no intermodal service.

"More use of changeable freeway message signs" (CMS) was judged as valuable by the types of firms that favored Internet information. CMS was judged to be less advantageous by operators based in the San Francisco Bay Area, by short-haul carriers, by carriers with no intermodal services and by those with various unspecified specialized services.

The preference for ATIS kiosks at truck stops was primarily related to operators' length of loaded movements and secondarily related to spatial location, carrier type and extent of intermodal operations. Kiosks were judged to be useful by the same types of operators that favored driver-targeted ATIS, i.e. carriers based outside of California and long-haul carriers. However ATIS kiosks were deemed more useful by a variety of operation types: carriers operating either out of the Greater Los Angeles or San Francisco Bay areas, private fleets, short-haul carriers, carriers with no intermodal services and by carriers with various unspecified specialized services.

Finally, dedicated 24-hour highway advisory radio (HAR) found favor among carriers that provided both truckload and less-than-truckload (LTL) services. HAR was judged less useful by exclusive LTL carriers, short-haul carriers and carriers with various unspecified services.

These results provide valuable market research information. New video sources should be most welcomed by firms that score highest on the "basic operations" dimension. For providers of traffic information on the Internet, this indicates that demand is likely to come from large regional and national carriers, private carriers and carriers with no intermodal services. Operators that score high on the second cluster of exogenous variables, defined by load type, service area and intermodal operations, will prefer new sources that combine the attributes of the two personal-contact sources: "reports from drivers on the road" and "phone calls to agencies". Automated phone-in information sources, or sources accessible by handheld Internet devices ("smart phones") are likely to be favorably received by contract carriers and carriers serving rail and combinations of intermodal services.

Future developments in information technologies should greatly enhance the potential for effective and user-friendly traveler information. New ATIS services will be able to take advantage of Internet-based technology developed for the much larger market. In the near future, drivers and dispatchers engaged in commercial vehicle operations will likely be supplied with real-time information on traffic conditions, queues at intermodal distribution facilities, parking information and roadway hazards. Internet systems could eventually replace technology currently in use for ATIS.

## **5. CHANGES IN THE THIRD PARTY LOGISTICS INDUSTRY AND EVOLUTION OF THE "INFOMEDIARIES"**

Since 1999, many new types of freight transportation intermediaries and new business models have emerged. Online logistics providers are attempting to use the power of the Internet and new software tools to interact simply and efficiently with shippers, carriers, and traditional 3PLs. Some firms provide online marketplaces, enabling the purchase and sale of transportation capacity. These range from simple load-posting bulletin boards to sophisticated online exchanges. Some firms develop software tools to optimize freight operations or to simplify complex shipping problems. Others supply information on container ports or other intermodal facilities, or organize and aggregate buying power for various companies. These new intermediaries offer opportunities for third-party logistics providers to operate more effectively and provide better services, but they also threaten to supplant them by providing many of the services previously handled by traditional 3PLs.

During the last few years, "infomediary" firms experimented with many different business models. The first models used passive spot-market exchanges that allowed shippers and carriers to post available loads or capacity on a web-based bulletin board. While a few of these firms are still in operation, most went out of business quickly or were replaced by those offering more services such as tracking, automated payment, and freight matching.

Internet-based exchanges can leverage economies of scale and scope by managing freight for many smaller trucking firms and shippers. Their websites typically also offer discount rates for equipment and supplies, made possible by consolidating smaller purchases. Other exchanges allow load "pooling" among collaborative freight transportation communities, thus creating more efficient freight networks. The current leaders in that market claim to be reducing logistics costs for their clients by five to fifteen percent.

Another promising Internet-based service is pure information. Online infomediaries facilitate operations, such as at ports, provide real-time traffic information, or simply act



as clearinghouses for information and news. The Internet can potentially place up-to-the-minute information at the fingertips of anyone who needs it.

These new online freight transportation intermediaries and infomediaries are transforming the freight industry by enabling companies to move beyond traditional business paradigms and profit from the synergies of information. Intuitively, an industry made up of many small firms, with many existing levels of intermediation, is an ideal potential beneficiary of the Internet. For example, better information about congestion, queues at intermodal facilities, and border crossings, and attractive purchasing agreements should increase equipment utilization and network efficiencies and thus reduce operating costs. However, the optimal application of the Internet is not yet clear. This uncertainty, combined with insufficient resources, has slowed adoption of new technologies, but there is no question that the radical transformations seen in the post-deregulation era will continue. For more details, see Regan and Song (2001), Song and Regan (2001) and Regan (2002).

With respect to provision of ATIS information, these providers have not lived up to earlier expectations. The private sector has yet to find a cost-effective role for ATIS information. While there may be significant role for private sector involvement in the provision of such information in the future, for now the burden falls on state and local transportation agencies.

## **6. CONCLUSIONS**

In this report, we have described results from the application of nonlinear multivariate statistical models to attitudinal data from two large-scale surveys of commercial vehicle operators in California. These models explain how perceptions of the value of specific sources of traffic information are related to the operating characteristics of the trucking companies and provide valuable market research information. We specifically examined the development and deployment of ATIS aimed at commercial vehicle operators. Though progress has not been as rapid as anticipated, trucking companies are adopting technology and making use of many sources of information in their operations. The benefits of providing ATIS as a value-added service seem clear, yet third party logistics/information providers have yet to find a cost-effective role for ATIS information.

While there may be a significant role for private sector involvement in ATIS in the future, for now the burden falls on government agencies. The key issue for policy-makers is the appropriate role of the public sector in the development and deployment of information services for the private sector.

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