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**Federal Highway
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# Commercial Vehicle Fleet Management and Information Systems

**Technical Memorandum 2**

Summary of Case Study Interviews

DTFH61-93-C-00084

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# 1.0 INTRODUCTION

The FHWA has commissioned the Commercial Vehicle Fleet Management and Information Systems study to determine if there are fleet management needs that the public sector can address through the development of ITS for commercial vehicle operations. As part of this examination, this technical memorandum reports the results of in-depth case study interviews conducted with motor carriers to determine the applicability of technology-based fleet management systems to different types of fleet operations.

This technical memorandum comprises five sections. Section 2.0 describes the process used to select the case study carriers. Section 3.0 summarizes the case study findings. Section 4.0 examines how fleet operating characteristics and fleet management decision factors affect motor carriers' adoption of specific ITS technologies. Section 5.0 presents the conclusions of this research effort.

## 2.0 SELECTION OF CASE STUDY CARRIERS

In Tasks A, B, and C of this study, the research team developed a system to categorize and segment the commercial motor carrier industry based on critical operating characteristics of trucking companies. These operating characteristics are as follows:

- Principal product;
- Geographic range of operation;
- Fleet size;
- Routing variability; and
- Time sensitivity of deliveries.[1]

Using this new typology, and based on analyses of data from the national Truck Inventory and Use Survey (TIUS), the research team developed more than twenty profiles of fleet types to include in the study. Guided by those profiles, the project team selected 20 case study carriers representing major segments of the motor carrier industry.[2] Many of these carriers are "bellwethers," having been among the first in their industry segments to adopt some form of fleet management technology.

The 20 case study carriers included representation from each of the following three categories: private motor carriers, for-hire motor carriers, and motor coach operators. The project team developed separate interview guides for each of these categories of motor carriers because of each segment's unique operational characteristics and business practices. For example, for-hire carriers often serve customers with dissimilar logistics patterns, while private fleets typically operate within single supply and distribution chains. Also, private and for-hire carriers may use different criteria to evaluate fleet performance. The researchers designed the interview guides to collect similar data for each industry segment, to provide baseline data, and to permit comparisons across industry segments. Appendix A includes copies of the interview guides.

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1/ For a detailed description of these fleet characteristics, see Cambridge Systematics, Inc., Commercial Vehicle Fleet Management and Information Systems: Technical Memorandum 1: Classification of Fleet Operations, and Selection of Candidate Case-Study Fleets, November 4, 1994.

2/ Two of the carriers each operate two separate fleets. One is a motor coach company that operates both a fixed-route fleet and a variable-route charter fleet. The second is a carrier that operates a regional pick-up and delivery fleet, as well as a national line-haul fleet. Therefore, the twenty case study carriers comprise twenty-two fleets.

# 3.0 SUMMARY OF INTERVIEW FINDINGS

This section summarizes the findings from the case study interviews. Section 3.1 defines a variety of fleet operating characteristics. Section 3.2 describes four ITS fleet management technologies for which information was collected. Section 3.3 provides a brief description of each case study fleet. Section 3.4 discusses the operating characteristics of the case study fleets discussed, with particular attention given to similarities and differences among the carriers. Next, Section3.5 details the factors that are critical to carrier routing and dispatching decision-making processes, and Section 3.6 discusses the ITS technologies used by the carriers in their daily operations. Finally, Section 3.7 summarizes key trends that will affect future fleet management practices and the ITS needs of the case study motor carriers.

## 3.1 FLEET OPERATING CHARACTERISTICS

The case study interviews focused on four fleet operating characteristics: fleet size, operating range, routing variability, and the time sensitivity of deliveries. These operating characteristics largely determine motor carrier fleet management needs and, hence, the utility of ITS/fleet management technologies to different trucking companies. A fifth operating characteristic, principal product, was important in the selection of the case study fleets, but it is not included in this discussion because it does not directly affect carrier fleet management needs.[3]

### 3.1.1 Fleet Size

The case study fleets are grouped into four fleet size categories, according to the number of power units (or single-unit trucks) in each fleet. The fleet size categories are:

- Small (1-19 vehicles);
- Medium (20-99 vehicles);
- Large (100 -499 vechicles);and
- Very large (500 or more vehicles).

3/ The product(s) a motor carrier hauls influence the carrier's operating range, routing variability, and time sensitivity, and, therefore, its fleet management needs. Except in extreme cases (e.g., hazardous materials), however, principal product does not directly affect carriers' fleet management needs. Principal product was included as a factor in the selection of candidate fleets to insure that fleets from a variety of industry segments were chosen.

In all cases, fleet size counts include only trucks with gross vehicle weights greater than 10,000 pounds (power unit and trailer, or single unit).[4]

There are at least two ways in which fleet size may affect the adoption of ITS for fleet management. First, companies with large fleets may have proportionately more resources available for maintaining and upgrading their fleets than do companies that operate a small number of trucks. Even if fleet maintenance budgets are proportional across fleet sizes, the absolute cost per truck of installing certain ITS technologies may be beyond the reach of small carriers. Second, for some large carriers, the total initial cost of implementing certain ITS technologies may be a significant burden, due to the absolute number of vehicles involved.

### 3.1.2 Operating Range

This study uses three categories of operating range. Fleets that operate within a single city are considered to be local. Regional fleets are those whose operations take them beyond their local areas, but remain primarily within a single region of the country. A fleet that operates within the Pacific Northwest, for example, is regional. Fleets whose operating ranges extend across multiple regions are classified as national.[5]

Fleets with different operating ranges face different routing, scheduling, load planning, and communications challenges, and operate in different traffic conditions (e.g., urban versus rural). Because fleets with different operating ranges are likely to have different fleet management needs, their ITS requirements may differ.

### 3.1.3 Routing Variability

The case study fleets have either fixed or variable routing. Fixed-route fleets operate on the same routes every day and, typically, have regular pick-up and delivery schedules. By contrast, variable-route carriers are subject to frequent (sometimes daily) routing and scheduling changes.

Generally, fleets with variable routing will have a greater incentive to adopt ITS. ITS allow fleet managers to track truck movements, to re-route vehicles rapidly, and to select the shortest or fastest alternate routes. Consequently, ITS can help variable-route carriers reduce the uncertainty inherent in their operations.

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4/ While some fleets include small, light trucks (i.e., pickup trucks), large trucks are significantly different from light trucks and automobiles because of their size, weight, handling characteristics, road use restrictions, and the business and safety regulation governing their use. These characteristics of large trucks make them better candidates for ITS/fleet management technology.

5/ Technical Memorandum 1 used the operating range categories from the Truck Inventory and Use Survey (TIUS) as the basis for developing fleet operating range profiles. The TIUS grouped trucks into three operating range categories: less than 50 miles from base of operation, 50 to 200 miles from base of operation, and over 200 miles from base of operation. In this Technical Memorandum, we have adopted a more flexible classification structure. The case study fleets are classified as local, regional, or national on the basis of their prevailing patterns of operation, rather than strict mileage classifications.

### 3.1.4 Time Sensitivity of Deliveries

The case study fleets are grouped into three categories of time sensitivity: low, moderate, and high. Time sensitivity refers to the urgency of a shipment, the "window" of time in which deliveries can be made, and the consequences for carriers of missing specified delivery times. Carriers whose operations have "low" time sensitivity usually are not tied to specified delivery windows, and rarely, if ever, provide next-day delivery.

Carriers whose operations are "moderately" time sensitive frequently make express (e.g., next day) deliveries, and may, in addition, have narrow time slots within which shipments must be picked up or delivered. Certain ITS technologies may be cost-effective for carriers with moderate time sensitivity.

Carriers with "high" time sensitivity are those who always handle express shipments and/or must make their deliveries and pickups within tight time windows. Carriers in this category include those that make "just-in-time" deliveries directly to manufacturing facilities, where an early or late arrival can cause problems on the production line. Trucking companies that operate on highly time-sensitive schedules can benefit greatly from the capabilities that ITS provide to track individual vehicles and to forecast delivery times precisely.

## 3.2 ITS TECHNOLOGIES

The case studies included information on the prevalence of four categories of ITS/fleet management technologies:

- Routing and Dispatching Systems: This category includes computer software and hardware used to plan, optimize, and monitor load consolidation, vehicle routing and dispatching, backhauling, and other functions. Routing and dispatching systems allow carriers to accomplish multiple objectives simultaneously, such as minimizing mileage while maximizing backhauling.

- Onboard Computers (OBCs): This category includes devices used to monitor engine performance, driving patterns (e.g., acceleration, shifting), vehicle and/or driver hours-of-service, vehicle maintenance, arrivals and departures, loading and unloading times, and other functions. Onboard computers often are used in conjunction with routing and dispatching systems. The routing and dispatching programs use data on route distances and travel times collected by the onboard computers to select optimum routes.

- Mobile Communications: This category includes radios, cellular telephones, and text transmission/reception devices that allow drivers to communicate with each other, with dispatchers, and with customers. One innovative application of mobile communications, which has been tested but is not currently in use, is the electronic transmission of registration, safety compliance, hazardous materials, driver credentials, waybill and other necessary information directly to the vehicles that need them. Such a system eliminates the need for each vehicle to carry paper copies of all relevant certificates and forms, and may be especially useful for fleets whose drivers change vehicles frequently, or whose loads vary.

- Vehicle Location / Global Positioning Systems: This category includes on-vehicle devices that use signals from satellites or from ground-based radio transmitters to obtain a vehicle's exact position, and then to transmit that information to the dispatcher. Vehicle location / GE systems allow dispatchers to monitor fleet activities, to predict vehicle arrival times, and to track shipments precisely.

### 3.3 CASE STUDY FLEETS

For reasons of business confidentiality, the names of the case study companies cannot be disclosed. Instead, in the text and tables of this report, each fleet is assigned an identification number. The following text provides a brief description of each fleet.

**Fleet 1:** A small, private fleet of locally-operated petroleum tankers. This fleet moves gasoline and diesel fuel from a single petroleum terminal to 130 retail service stations within a large metropolitan area in the southeastern United States. The fleet operates on fixed routes, and its deliveries are generally of low time sensitivity. This carrier employs 29 drivers, including eight contracted owner-operators and 21 company employees, all non-union.

**Fleet** 2: A medium-sized, for-hire carrier of bulk commodities for the baking and paper manufacturing industries. This regional fleet operates out of three terminals (two in California and one in Washington State), serving customers throughout the western United States. The fleet operates tankers for liquid goods, and pneumatic tankers for dry bulk goods. Deliveries are typically highly time sensitive, especially deliveries to commercial bakeries. This carrier employs 100 drivers, all non-union company employees.

**Fleet** 3: A small, regional, private fleet of an electrical utility in the southeastern United States. The fleet primarily operates on fixed routes and its deliveries of parts and equipment generally are of low time sensitivity (except during emergency situations such as power outages.) Operating out of a single dispatch facility, this fleet employs 12 drivers, all company employees and all union members.

**Fleet** 4: A very large, for-hire carrier of packages and general freight. The carrier comprises a pick-up / delivery fleet (regional) and a separate line-haul fleet (national). The pickup / delivery fleet is actually a series of fleets, each serving one of the company's multiple regional distribution hubs. The pick-up / delivery fleet operates on variable routes, while the line-haul fleet operates on fixed routes between distribution centers. On average, both fleets operate on moderately time-sensitive delivery schedules. This carrier employs over 10,000 drivers, all company employees and all union members.

**Fleet** 5: A very large, for-hire carrier of bulk chemicals. This national fleet of tankers operates on fixed routes and under conditions of low time sensitivity. Operating out of approximately 70 distribution facilities nationwide, this carrier employs 1,200 drivers, 700 of whom are company employees and 500 of whom are contracted owner-operators. Approximately half the drivers are union members.

**Fleet** 6: The large, private fleet of a processed food manufacturer. This fleet of refrigerated trucks operates nationally, on variable routes, under conditions of moderate time sensitivity.

This carrier employs 300 drivers. All drivers are company employees and union members. The fleet operates out of five distribution facilities located in Utah, Idaho, and Montana.

**Fleet** 7: A very large, national, for-hire carrier of general cargo. This fleet operates on variable routes, and its shipments are moderately time sensitive. About 5,000 drivers work for this carrier. All drivers are company employees, and all are non-union.

**Fleet** 8: A medium-sized, private fleet serving a cooperative of grocery stores in the Pacific Northwest. This regional fleet has two distribution facilities, both in Washington State, and operates on fixed routes. Its shipments are moderately time sensitive. The fleet employs about 200 drivers, all of whom are company employees and union members.

**Fleet** 9: A medium-sized motor coach (bus) company. This fleet operates regionally (in Texas, Louisiana, and Arkansas) out of five dispatch facilities / garages. Its operation comprises both daily, fixed-route service and variable-route charter service. Daily service is highly time-sensitive (buses run on a set schedule), while the time sensitivity of charter service is low. The company employees 200 full-time and 50 part-time drivers; all of the drivers are union members.

**Fleet 10**: A very large, for-hire fleet carrying refrigerated foods. The fleet operates on variable routes, and its deliveries are moderately time sensitive. **This** carrier operates out of two distribution facilities, one in the West and one on the east coast. All 2,000 drivers are non-union company employees.

**Fleet 11**: A medium-sized, for-hire fleet that handles intermodal (truck-rail) containers. This regional fleet operates from one facility in southern California. Shipments are moderately time sensitive and routing is fixed. Of the 70 drivers working for this carrier, 65 are independent owner-operators under contract, and five are full-time company employees. None of the drivers are union members.

**Fleet 12:** The large, private fleet of a pharmaceutical manufacturer. This fleet operates in the southeastern United States from six distribution centers. The fleet travels fixed routes under conditions of low time sensitivity. Approximately 200 drivers, all non-union company employees, work for this carrier.

**Fleet 13:** The medium-sized, private fleet of a manufacturer of carpet backing and industrial fibers. This regional fleet operates in the Southeast, on variable routes. It has eight distribution centers / factories. Deliveries are highly time sensitive. This carrier employs 70 drivers, all of whom are non-union company employees.

**Fleet 14:** A large, for-hire carrier of general freight. This carrier specializes in less-than-truckload shipments and freight consolidation. The fleet operates out of four distribution / freight handling centers in southern California. Deliveries are on fixed routes, under conditions of moderate time sensitivity. The 230 drivers working for this carrier are all under contract (no company employees), and none are union members.

**Fleet 15:** A large, for-hire carrier of general freight. Most of this carrier's work involves less-than-truckload shipments. This regional carrier serves the western states, with 15 distribution centers. The fleet operates on variable routes. Its deliveries are moderately time sensitive. The fleet employs 150 non-union drivers, all of whom are company employees.

**Fleet 16:** The very large, private fleet serving an electrical utility. This regional fleet operates in a southeastern state, on variable routes. The fleet has one central warehouse / dispatching center, and serves 56 delivery points throughout the State. In general, shipments are of low time sensitivity. Some 1,200 drivers work for this fleet. All drivers are company employees and union members.

**Fleet 17:** A medium-sized, for-hire carrier specializing in munitions movement. The fleet has one central dispatch facility, and operates nationally, on variable routes, under conditions of moderate time sensitivity and very high security. All 100 drivers employed by this carrier are non-union, company employees.

**Fleet 18:** A medium-sized, for-hire mover of household goods, specializing in moving corporate executives. This carrier operates nationally and has two storage / dispatch facilities, one in New England and one in the Midwest. Routing is variable, and deliveries are highly time sensitive. The carrier employs about 100 drivers, all of whom are non-union, company employees.

**Fleet 19:** The large, private fleet of a cooperative of grocery stores in the western states (primarily Utah.) This fleet of dry vans and refrigerated trucks operates from five distribution facilities, and travels predominantly on fixed routes. Deliveries typically are of low time sensitivity. All of this carrier's 235 drivers are company employees, and 200 are non-union.

**Fleet 20: The** large, private fleet of a furniture and small appliance retail chain with 630 stores. The fleet operates out of seven distribution centers located in six southern states and California. Operations are regional, and take place on variable routes under highly time-sensitive conditions. This carrier employs 255 drivers, all of whom are non-union, company employees.

## 3.4 SUMMARY OF FLEET OPERATING CHARACTERISTICS

As was discussed in Section 3.1, this study pays particular attention to fleet size, operating range, routing variability, and time sensitivity of deliveries. Table 1 summarizes the operating characteristics of the case study fleets.

### 3.4.1 Fleet Size

The case study fleets are fairly evenly distributed across the medium, large, and very large size categories. Only two of the fleets have fewer than 20 vehicles, eight fleets have between 20 and 99 vehicles, six fleets are in the 100 to 499 vehicles category, and six fleets have over 500 vehicles.[6]

6/ The lack of small fleets is not representative of the trucking industry as a whole, which contains thousands of small companies that have only a few large trucks. However, it is arguable that the fleet management needs of small fleets are limited, and that they do not represent a likely market segment for ITS fleet management technologies.

Table 1. Operating Characteristics of Case Study Fleets

| Fleet | Fleet Size[1] | | | | Operating Range[2] | | | Routing[3] | | Time Sensitivity[4] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Small | Medium | Large | Very Large | Local | Regional | National | Fixed | Variable | High | Moderate | Low |
| Fleet 1 | ● | | | | ● | | | ● | | | | ● |
| Fleet 2 | | ● | | | | ● | | | ● | ● | | |
| Fleet 3 | ● | | | | ● | | | | ● | | | ● |
| Fleet 4 | | | | | | | | | | | | |
| Line-Haul Fleet | | | | ● | | | ● | ● | | | ● | |
| P & D Fleet | | | | ● | | ● | | | ● | | ● | |
| Fleet 5 | | | | ● | | | ● | ● | | | | ● |
| Fleet 6 | | | ● | | | | ● | | ● | | ● | |
| Fleet 7 | | | | ● | | | ● | | ● | | ● | |
| Fleet 8 | | ● | | | | ● | | ● | | | ● | |
| Fleet 9 | | | | | | | | | | | | |
| Regular Route | | ● | | | | ● | | | ● | ● | | |
| Charter | | ● | | | | ● | | ● | | | | ● |
| Fleet 10 | | | | ● | | | ● | | ● | | ● | |
| Fleet 11 | | ● | | | | ● | | ● | | | ● | |
| Fleet 12 | | | ● | | | ● | | ● | | | | ● |
| Fleet 13 | | ● | | | | ● | | | ● | ● | | |
| Fleet 14 | | | ● | | | ● | | ● | | | ● | |
| Fleet 15 | | | ● | | | ● | | | ● | | ● | |
| Fleet 16 | | | | ● | | ● | | | ● | | | ● |
| Fleet 17 | | ● | | | | | ● | | ● | | ● | |
| Fleet 18 | | ● | | | | | ● | | ● | ● | | |
| Fleet 19 | | | ● | | | ● | | | ● | ● | | |
| Fleet 20 | | | ● | | | | ● | | ● | ● | | |
| **Total** | **2** | **8** | **6** | **6** | **2** | **12** | **8** | **9** | **13** | **5** | **10** | **7** |
| Percent of All Fleets | 10 | 35 | 30 | 30 | 10 | 60 | 40 | 45 | 65 | 25 | 50 | 35 |

Notes:

[1] Small = 1-19 vehicles.
Medium = 20-99 vehicles.
Large = 100-499 vehicles.
Very Large = 500+ vehicles.

[2] Local = Operates within single city.
Regional = Operates in multiple cities or states, but not across the country.
National = Operates across the country.

[3] Fixed = Operates on the same routes every day.
Variable = Routing changes frequently.

[4] High = Always handles express shipments or faces tight delivery windows.
Moderate = Frequently handles express shipments or faces tight delivery windows.
Low = Rarely or never handles express shipments or faces tight delivery windows.

### 3.4.2 Operating Range

Twelve of the case study fleets operate regionally, while two operate locally and eight are national carriers. This distribution is different from that of the trucking industry as whole. Nationally, approximately seventy-five percent of large trucks operate locally. The apparent overrepresentation of regional and national fleets reflects that the case studies concentrate on motor carriers whose operations are complex enough to warrant the consideration of ITS fleet management tools. Fleets operating regionally and nationally face communication, scheduling, routing and dispatching challenges with which most local operations do not contend. For example, while local fleets can often meet their communication needs using two-way radios, regional and national fleets' operations extend beyond the range of such systems, and require more sophisticated communications technologies.

### 3.4.3 Routing Variability

Nine of the case study fleets operate primarily on fixed routes, while the other 13 are characterized by variable routes. Variable-route carriers may benefit more than fixed-route carriers from the sophisticated routing and vehicle tracking capabilities some ITS technologies provide.

### 3.4.4 Time Sensitivity of Deliveries

The case study sample included five carriers with "high" time sensitivity. Carriers whose deliveries are highly time sensitive may have the greatest need for the powerful route planning, load management, dispatching, vehicle tracking, and communications capabilities of ITS.

Among the case study fleets, there were ten carriers who operate under conditions of "moderate" time sensitivity. Many of these carriers may benefit from vehicle tracking systems, as well as from communications technologies, route planning systems, and dispatching systems.

Seven case study fleets operate under conditions of "low" time sensitivity. Carriers whose operations have "low" time sensitivity have only limited need for automatic vehicle location technology, but may still find value in other ITS, such as automated routing and dispatching software, and onboard communications technology.

## 3.5 FLEET MANAGEMENT DECISION FACTORS

The case study interviews identified a number of factors that influence motor carrier fleet management decisions. Commercial vehicle fleet managers must rank these factors in terms of their importance, and gear their fleets' operations toward meeting the top priorities. The factors that are critical to the operation of one fleet may be less important to other carriers.

The fleet management decision factors are not mutually exclusive. Indeed, certain objectives, such as maximizing revenue per mile, are realized by meeting others, such as obtaining backhauls and minimizing unladen mileage. This section discusses the prevalence of the above factors in the fleet management decisions of the case study fleets. Table 2 identifies the fleet

Table 2. Fleet Management Decision Factors of Case Study Fleets

| | Case Study Fleets | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Total | Percent of All Case Study Fleets |
| Maximize Revenue/Mile | | | | | | ● | ● | | ● | | | ● | | | | | | | | | 4 | 20 |
| Maximize Revenue/Trip | | | | | | | | | ● | | | ● | | | | | | | | ● | 3 | 15 |
| Minimize Unladen Mileage | | | | | | | ● | | | ● | | ● | | | | | ● | ● | | ● | 6 | 30 |
| Equipment Availability | ● | ● | ● | ● | ● | | | ● | ● | ● | ● | ● | | ● | | ● | ● | ● | | ● | 14 | 70 |
| Maximize Equipment Utilization | ● | | | | | ● | | | | | | ● | | | | ● | | ● | | ● | 6 | 30 |
| Minimize Operating Costs | | | ● | | | | | | | | | | | | | | | | | | 1 | 5 |
| Driver Availability | ● | | ● | ● | | ● | | ● | ● | | | ● | | ● | | ● | ● | ● | | ● | 12 | 60 |
| Backhaul Opportunities | | | | | | ● | | ● | | | | | | | | | | | | | 2 | 10 |
| Driver's Hours-of-Service Limits | ● | | | | | | | | | | | ● | | | | | | | | ● | 3 | 15 |
| Driver Home Time | | | | | | | ● | | | | | | | | | | | | | | 1 | 5 |
| Importance of Account | | ● | | | ● | ● | | | | | | ● | | | | | | ● | | ● | 6 | 30 |
| Shipment Origin/Destination | ● | | | ● | ● | | | | | ● | ● | ● | | ● | ● | ● | ● | ● | | ● | 12 | 60 |
| HAZMAT Routing Considerations | | | | | ● | | | | | | | ● | | | | ● | ● | | | | 4 | 20 |
| Inventory Management | ● | | | | | ● | | | | | | ● | ● | | | ● | | | | ● | 6 | 30 |
| Delivery Times/Dates | | | | ● | | | | | | | | | ● | | | | | | | ● | 3 | 15 |
| Size of Shipment | | | | | | | | | | | | | | | | | | | ● | | 1 | 5 |
| Fuel Conservation | | | | | | | ● | | | | | | | | | | | | ● | | 2 | 10 |

management decision factors used by each of the case study carriers, and Table 3 shows the fleet management decision factors to which specific ITS technologies are applicable.

### 3.5.1 Maximizing Revenue per Mile

Four case study fleets gear their operations toward maximizing revenue per mile. These types of carriers are especially careful to plan routes and dispatch schedules that minimize total mileage, minimize mileage between pick-ups and deliveries, and, where possible, consolidate shipments so that long-distance trips contain as many high-revenue shipments as possible. These carriers are potential candidates for the adoption of automated routing, dispatching, and load planning systems.

### 3.5.2 Maximizing Revenue per Trip

For three of the case study fleets, the maximization of revenue per tip is important to their fleet management decisions. Carriers who seek maximum revenue on a per-trip basis are concerned with many of the same issues as carriers seeking to maximize revenue per mile, and so may benefit from the same ITS technologies. One important exception is that carriers seeking maximum per-trip revenue will tend to focus on shipments with the highest total value, regardless of trip distance. As a result, these carriers may be less concerned with choosing routes that minimize mileage, and may have less of a need for ITS routing systems.

### 3.5.3 Minimizing Unladen Mileage

An important fleet management objective of six of the case study carriers is to minimize unladen ("deadhead") mileage. For these carriers, two factors are important. First, these carriers are concerned with selecting routes and dispatch schedules that sequence pick-ups and deliveries so that trucks do not travel empty. Second, carriers seeking to minimize "deadhead" mileage try to set up a backhaul shipment for every outbound shipment. These carriers may benefit from routing and dispatching systems. In addition, because carriers often arrange backhauls while vehicles are en-route, these carriers may benefit from mobile communications systems and vehicle location systems.

### 3.5.4 Equipment Availability

Fourteen carriers indicated equipment availability as an important factor in their fleet management decisions. There are three different conditions under which equipment availability becomes important in the fleet management decision process. First, fleets hauling specialized products (e.g., bulk chemicals) often need a particular type of equipment to handle specific shipments. As a result, these carriers must plan routing and dispatching to insure that specific pieces of equipment are available when and where they are needed. These carriers may benefit from automated vehicle tracking technologies, and from computerized routing and dispatching systems.

The second condition under which equipment availability is an important fleet management decision factor involves operating range. The fleets of carriers that handle large volumes of long-distance, line-haul shipments often are dispersed across wide geographic areas. These

Table 3. Applicability of ITS to Fleet Management Decision Factors

| Fleet Management Decision Factors | ITS Technologies | | | |
|---|---|---|---|---|
| | Routing/Dispatching Systems | On-Board Computers | Mobile Communications | Automatic Vehicle Location |
| Maximize Revenue/Mile | ● | | | |
| Maximize Revenue/Trip | ● | | | |
| Minimize Unladen Mileage | ● | | ● | ● |
| Equipment Availability | ● | | ● | ● |
| Maximize Equipment Utilization | ● | ● | | |
| Minimize Operating Costs | | ● | | |
| Driver Availability | ● | ● | ● | ● |
| Backhaul Opportunities | ● | | ● | ● |
| Driver's Hours-of-Service Limits | ● | ● | | |
| Driver Home Time | ● | | | |
| Importance of Account | ● | | | |
| Shipment Origin/Destination | ● | | | |
| HAZMAT Routing Considerations | ● | | | ● |
| Inventory Management | ● | | ● | |
| Delivery Times/Dates | ● | | ● | |
| Size of Shipment | ● | | | |
| Fuel Conservation | ● | ● | | |

carriers cannot recall each truck to a centralized dispatch facility after every trip. Consequently, these carriers must plan routing and dispatching to insure that trucks reach their destinations on time. Pick-ups and deliveries often are scheduled en-route for each truck on both the outbound and return segments of its trip. Carriers with wide geographic operating ranges may benefit from vehicle locating and tracking systems, mobile communications, and computerized routing and dispatching systems.

Finally, carriers that operate small fleets often do not have enough trucks to assign each to a single route or shipment. For these carriers, pick-ups and deliveries must be sequenced to allow each truck to handle several shipments on a single run. Mobile communications and computerized routing and dispatching systems may be valuable in helping small carriers to achieve this goal.

### 3.5.5 Maximizing Equipment Utilization

Six of the trucking companies interviewed cited the desire to maximize the use of their trucks as a fleet management decision factor. Carriers seeking maximum equipment utilization try to maintain the smallest fleet necessary to meet their needs. In some cases, shipments may be delayed or rerouted so that they can be combined with other shipments. This requires careful route planning, load building, and dispatching. Companies that try to maximize equipment utilization will benefit from routing and dispatching systems, and many also may find onboard computers to be valuable for monitoring vehicle use.

### 3.5.6 Minimizing Fleet Operating Costs

For one of the case study carriers, the minimization of overall fleet operating costs is an important consideration in its fleet management decisions. Fleet operating costs include such items as driver salaries, maintenance costs, and fuel. Companies attempting to minimize costs try to extend the intervals between routine maintenance, to minimize the driver downtime while on the job (e.g., waiting at loading and unloading points), and to conserve fuel. For these companies, onboard computers can provide valuable data on truck use, engine performance, driving patterns, and other factors that may help them control their fleet costs.

### 3.5.7 Driver Availability

Of the carriers in this study, 12 indicated that the availability of drivers was an important factor in their fleet management decisions. Driver availability is influenced by the geographic locations of drivers with respect to shipment origins and destinations, and also by drivers' hours-of-service limitations. Trucking companies for whom driver availability is a key fleet management consideration will benefit from the use of onboard computers, for tracking hours of service; vehicle location/identification systems, for monitoring the locations of available drivers; mobile communications, for re-directing available drivers; and routing and dispatching systems, for matching drivers with vehicles and shipments.

### 3.5.8 Backhaul Opportunities

Two of the carriers stated that their fleet management decisions are influenced by attempts to secure backhauls for every trip. Backhauls represent "free" revenue for trucking companies by providing an opportunity to make money from trips the trucks must make, regardless of whether they are empty or full. Often, backhauls are arranged while a truck is already on the outbound portion of its trip. Trucks also may be re-routed on short notice to pick up backhauls. Carriers that actively pursue backhauling can make use of routing and dispatching systems, mobile communications, and vehicle location systems.

### 3.5.9 Driver Hours-of-Service Limits

Three of the carriers interviewed cited driver hours-of-service limitations as a significant factor in fleet management decisions. For such companies, onboard computers are valuable for collecting and processing hours-of-service data. In addition, routing and dispatching systems can use the hours-of-service data when assigning drivers to vehicles and shipments to insure that drivers do not exceed legal hours-of-service limits.

### 3.5.10 Driver Home Time

One of the carriers indicated that it attempts to minimize extended road trips so that drivers are away from home as little as possible. Routing and dispatching systems can help accomplish this goal by coordinating the activities of different vehicles and drivers to minimize the number of extended trips.

### 3.5.11 Importance of Particular Accounts

Six of the case study carriers design their routes and dispatch schedules so that priority is given to meeting the needs of key customers. In many cases, a carrier's operations may be built around meeting the needs of a core group of customers, with other shipments fit in as necessary. Routing and dispatching systems can assist carriers with the design of delivery schedules that give priority to particular customers, while meeting the requirements of other accounts as well.

### 3.5.12 Shipment Origins and Destinations

The origin and destination of each shipment are essential factors in the fleet management decisions of 12 case study carriers. Shipment origins and destinations are perhaps the most basic element of routing and dispatching decisions. They dictate the required routes, and influence many other factors, from equipment availability to the ability of carriers to acquire backhauls. Routing and dispatching systems are the key ITS technology for carriers who deal with a variety of shipment origins and destinations.

### 3.5.13 HAZMAT Routing Considerations

Four fleets indicated that hazardous materials routing considerations enter into their fleet management decisions. Trucks carrying hazardous materials are restricted to certain routes

and travel times. Routing and dispatching systems can allow carriers to maintain as much flexibility as possible in terms of acquiring backhauls, picking up shipments en-route, minimizing mileage, and other objectives, while still complying with hazardous materials routing restrictions. Automated vehicle location systems also can assist carriers that have hazardous materials concerns by allowing dispatchers to monitor the location of hazardous shipments en-route.

### 3.5.14 Inventory Management

Six of the carriers indicated that inventory management was a key factor in their fleet management decisions. All of these are private carriers involved in the total logistics of the companies they serve. These carriers play an essential role in maintaining inventory of products or raw materials, and in transferring inventory between facilities. These carriers must be able to respond rapidly to factory, warehouse, or retail store orders. In addition to benefiting from routing and dispatching systems, carriers involved in inventory management can profit from mobile communications technologies, which allow dispatchers to send routing, scheduling, and inventory information directly to trucks while they are in transit.

### 3.5.15 Pick-up and Delivery Times/Dates

Three of the interviewed carriers said that shipment pick-up and delivery dates and times influenced their fleet management decisions. These include time-sensitive carriers who must make deliveries according to strict time schedules, and carriers that must juggle many different pick-up and delivery times and dates. Carriers for whom delivery times and dates are important fleet management decision factors may benefit from routing and dispatching systems and from mobile communication systems, which allow dispatchers to monitor how closely their trucks are meeting delivery schedules.

### 3.5.16 Size of Shipments

One carrier indicated that shipment size is a critical factor in its fleet management decisions. Large shipments can affect the ability of less-than-truckload carriers to consolidate loads, and can create load planning and scheduling problems for carriers with small or medium-sized fleets. Conversely, small shipments can be problematic for carriers who are trying to maximize equipment utilization if they are forced to dispatch trucks before they are full (with respect to either weight or cubic cargo space). This situation could occur if carriers have small shipments that are time sensitive or must be delivered overnight, because the carriers would not be able to delay the dispatch of trucks to allow for the consolidation of several small shipments. Carriers for whom shipment size is an important fleet management factor may benefit from the load planning and dispatching capabilities of ITS routing and dispatching software.

### 3.5.17 Fuel Conservation

Two carriers indicated that fuel conservation is an important factor in fleet management decisions. Selecting routes to minimize mileage is one way for carriers to conserve fuel. For this purpose, computerized routing systems are the most useful ITS technology. The greatest fuel-efficiency gains come, however, from optimizing the performance of the vehicles themselves.

Carriers can use onboard computer systems to monitor both engine performance and the manner in which drivers use the vehicles. Onboard computers can track drivers' acceleration and gear shifting patterns, as well as maximum speeds, to insure that the trucks are being driven as efficiently as possible.

## 3.6 ITS TECHNOLOGY INTEGRATION

This section discusses the prevalence of ITS technologies among the case study fleets, and describes the ways in which the case study fleets are using each ITS technology. Table 4 summarizes the use of ITS technology among the case study fleets.

### 3.6.1 Routing and Dispatching Systems

Automated routing and dispatching systems are used by 11 of the case study fleets. Some fleets use commercially available software systems or packages (e.g., Qualcomm, Rand McNally); others have developed their own proprietary systems. The routing and dispatching systems assist the carriers with a variety of tasks, from selecting routes, to consolidating LTL shipments into loads, to sequencing the dispatch of trucks to insure on-time deliveries.

### 3.6.2 Onboard Computers

Onboard computers are used by 11 of the case study fleets. While some of the carriers use their onboard computers for a relatively limited range of functions, such as recording engine performance, other fleets exploit the capabilities of onboard computers to the fullest extent. These fleets use their systems to track driver hours-of-service, engine idling and running intervals, arrival and departure times, loading and unloading intervals, driver shifting and acceleration patterns, maintenance schedules, trip distances and durations, and other items.

### 3.6.3 Mobile Communications

Among the carriers interviewed, mobile communication technologies are the most widely used ITS. Currently, 14 of the case study carriers use some form of mobile communications technology. Several of these carriers continue to rely on two-way radios, but many carriers have replaced radios with cellular telephones, and others have installed two-way text or voice-plus-data transmission devices (e.g., Qualcomm). In general, carriers appear to use radios for routine communications such as reporting pick-ups and deliveries, and to inform dispatchers of emergencies or delays. Carriers use cellular telephones in much the same manner as radios, except that the increased range and added flexibility of cellular technology makes it possible for carriers to use cellular telephones to contact both local and line-haul drivers en-route so that they may relay changes in routing or scheduling.

Carriers that have adopted onboard text, data, and voice transmission equipment use these systems to transmit each vehicle's route and shipment information to individual drivers. In addition, onboard systems may be used in emergencies or to report delays.

Table 4. ITS Technologies In Use by Case Study Fleets

| Fleet | ITS Technologies | | | |
|---|---|---|---|---|
| | Routing/Dispatching Systems | On-Board Computers | Mobile Communications | Automatic Vehicle Location |
| Fleet 1 | ● | ● | | |
| Fleet 2 | | | ● | |
| Fleet 3 | ● | | ● | |
| Fleet 4 | | | | |
| Line-Haul Fleet | ● | ● | ● | ● |
| P & D Fleet | ● | | ● | |
| Fleet 5 | | ● | | |
| Fleet 6 | ● | ● | ● | |
| Fleet 7 | ● | ● | ● | ● |
| Fleet 8 | ● | ● | ● | *Planned* |
| Fleet 9 | | | | |
| Regular Route | | | | |
| Charter | | | | |
| Fleet 10 | | | ● | |
| Fleet 11 | | ● | ● | ● |
| Fleet 12 | ● | ● | | |
| Fleet 13 | ● | ● | ● | |
| Fleet 14 | | | | |
| Fleet 15 | | | | |
| Fleet 16 | | | | |
| Fleet 17 | ● | | ● | |
| Fleet 18 | | ● | ● | ● |
| Fleet 19 | | | | |
| Fleet 20 | ● | ● | ● | ● |
| Total | 11 | 11 | 14 | 5 |
| Percent of All Fleets | 55 | 55 | 70 | 25 |

### 3.6.4 Automatic Vehicle Location Systems

Automatic vehicle location (AVL) systems are currently being used by five of the case study fleets. One additional fleet plans to adopt AVL in the near future. One carrier uses a radio-based AVL system, while the others use satellite-based systems. All of the fleets that are using (or plan to use) AVL systems have significant line-haul components to their operations. For these carriers, the ability to locate individual vehicles is essential for setting up backhauls, making delivery or routing changes, tracking the progress of time-sensitive shipments, and, in the case of one carrier, ensuring the security of shipments.

## 3.7 FUTURE FLEET MANAGEMENT NEEDS

The case study interviews gathered information on the changes commercial vehicle fleet managers anticipated in their operations, the types of ITS in which they were considering investments, and the kinds of information and services to which they would like to have access.

### 3.7.1 Anticipated Changes in Fleet Operations

Several fleet managers expect that they will need to make operational changes to respond more effectively to customer needs. Specifically, fleet managers believe that they will need to provide customers with better shipment tracking information, more accurate estimated pick-up and delivery times, and more extensive and seamless electronic data exchange capabilities. Significantly, the changes fleet managers anticipate have much more to do with improving the quantity, quality, variety, and timeliness of information provided to customers, than with improving the actual movement of goods.

The case study findings suggest that many trucking companies are becoming integral parts of their customers' operations by playing key roles in production and in inventory management, in addition to product delivery. To perform these new functions successfully, motor carriers must make themselves integral to their customers' operations; many fleets are looking to ITS to help them meet this goal.

### 3.7.2 Anticipated ITS Investments

Many of the case study carriers that currently do not employ ITS are considering investing in one or more systems in the future. Furthermore, some carriers that currently use ITS are considering investing in additional systems. Three ITS technologies stand out as the most likely candidates for investment in the near-term: automated routing and dispatching systems, vehicle location/GPS systems, and cellular telephones. It is notable that carriers generally are not considering these technologies to automate existing fleet management functions (although fleet managers certainly recognize the automation benefits ITS can provide), but to improve their efficiency and shipment management capabilities. For example, two common reasons why carriers are considering investments in computerized routing and dispatching systems are to maximize equipment utilization, and to improve their overall fleet cost-effectiveness. Similarly, carriers that want to improve the accuracy of their delivery time estimates and shipment tracking are considering investments in vehicle location/GPS systems.

Many of the carriers who already have invested in various ITS are considering improvements to their ITS. The focus of these efforts involves systems integration to make the various technologies function more effectively as single systems. For example, two carriers are working on using route data collected from onboard computers to improve the accuracy of travel times predicted by their routing and dispatching software. Other carriers are interested in feeding vehicle operation data, such as hours of engine operation and total mileage, directly into maintenance-scheduling software, and with linking customer order-processing systems directly to routing and dispatching systems.

### 3.7.3 Desired Information and Services

There is a clear consensus among the case study fleets about the kinds of information to which they would like to have access. Carriers want accurate, real-time congestion and incident information. Such information could be transmitted to dispatchers or, with appropriate onboard technologies in place, directly to trucks on the road. One fleet manager stated that if such information were available, he would transmit it to his vehicles' existing onboard text transmission/reception devices. Many carriers view congestion and incident information as a key component in the ITS "infrastructure" for commercial vehicles. As more motor carriers adopt ITS, their capacities to use congestion and incident information effectively will improve, and, as a result the demand for such information (whether provided privately or by the public sector) will increase.

# 4.0 FACTORS AFFECTING CARRIERS' ADOPTION OF ITS

This section uses a series of cross-tabulations to examine relationships between the case study fleets' operating characteristics and fleet management decision factors, and their adoption of ITS. Although the small number of case studies does not allow for rigorous statistical analysis, some informative patterns are present among the case study fleets. The results of the analysis are summarized in Table 5.

## 4.1 FLEET OPERATING CHARACTERISTICS

### 4.1.1 Fleet Size

Fleet size appears to influence carrier adoption of onboard computers and mobile communication technologies. In particular, both ITS are most prevalent among the very large case study fleets. Of the six very large case study fleets, four have adopted on-board computers, and five use some type of mobile communications.

### 4.1.2 Operating Range

Operating range appears to be associated with the adoption of automated vehicle location systems by the case study fleets. Neither of the two local fleets use AVL, but three of the twelve regional fleets and three of the eight national fleets employ AVL technology.

### 4.1.3 Routing Variability

Adoption of routing and dispatching systems and mobile communication systems is greatest among the variable-route carriers in the case study fleets. Of the 13 variable-route case study carriers, 10 use some form of mobile communications, compared with four of the nine fixed-route fleets. Seven of the 13 variable-route carriers use routing and dispatching systems, compared with four of the nine fixed-route carriers.

## 4.2 FLEET MANAGEMENT DECISION FACTORS

### 4.2.1 Maximize Revenue per Mile

Routing and dispatching systems help carriers to select the shortest routes and optimum load consolidations, thereby maximizing per-mile revenues. Of the four case study carriers for whom maximizing revenue per mile is an important fleet management decision factor, three currently use routing and dispatching systems.

Table 5. Relationship between Fleet Operating Characteristics, Fleet Management Decision Factors, and Adoption of ITS

| Fleet | Total Number of Case Study Fleets | Number of Case Study Fleets Using ITS Technologies | | | |
|---|---|---|---|---|---|
| | | Routing/Dispatching Systems | On-Board Computers | Mobile Communications | Automatic Vehicle Location |
| **Operating Characteristics** | | | | | |
| Size | | | | | |
| • Very Large | 6 | | 4 | 5 | |
| • Large | 6 | | 2 | 3 | |
| • Medium | 8 | | 4 | 5 | |
| • Small | 2 | | 1 | 1 | |
| Operating Range | | | | | |
| • National | 8 | | | | 3 |
| • Regional | 12 | | | | 3 |
| • Local | 2 | | | | 0 |
| Routing Variability | | | | | |
| • Variable | 13 | 7 | | 10 | |
| • Fixed | 9 | 4 | | 4 | |
| **Management Decision Factors** | | | | | |
| Maximize Revenue Per Mile | | | | | |
| • Yes | 4 | 3 | | | |
| • No | 18 | 8 | | | |
| Equipment Utilization | | | | | |
| • Yes | 6 | 4 | 5 | | |
| • No | 16 | 7 | 6 | | |
| Inventory Management | | | | | |
| • Yes | 6 | 4 | | | |
| • No | 16 | 7 | | | |
| Delivery Times/Dates | | | | | |
| • Yes | 4 | 3 | | | |
| • No | 18 | 8 | | | |

### 4.2.2 Equipment Utilization

Onboard computers allow carriers to track vehicle use (including total mileage) and maintain accurate, up-to-date records of each truck's use. Of the six case study carriers for whom equipment utilization is an important fleet management decision factor, five currently use onboard computers. In contrast, only six of the 16 carriers for whom equipment utilization is not an important fleet management decision factor currently use onboard computers.

Routing and dispatching systems help carriers optimize the use of their vehicles so they can operate smaller fleets and use each vehicle as much as possible. Of the six case study fleets for whom maximizing equipment utilization is an important fleet management decision factor, four use routing and dispatching systems. By comparison, only seven of the 16 carriers for whom equipment utilization is not an important fleet management decision factor use routing and dispatching systems.

### 4.2.3 Inventory Management

Routing and dispatching systems allow carriers to optimize the scheduling of deliveries to help insure that inventory stocks are maintained and special orders are filled quickly. Case study carriers that are concerned with inventory management show a higher rate of adoption of routing and dispatching systems (four out of six) than do fleets for whom inventory management is not a critical fleet management decision factor (seven out of 16).

### 4.2.4 Delivery Times/Dates

Routing and dispatching systems help carriers schedule shipments and plan routes to insure that deliveries are made on time. Of the four carriers for whom delivery times and dates play critical roles in fleet management decisions, three use routing and dispatching systems, compared with eight of the 18 carriers for whom delivery times and dates are not critical fleet management decision factors.

## 5.0 CONCLUSIONS

This study has two fundamental goals: to understand the structure of the commercial vehicle ITS market; and, based on that understanding, to evaluate potential federal roles in commercial vehicle ITS.

The application of ITS can greatly enhance the effectiveness of commercial vehicle fleet management. Some motor carriers have been quick to adopt these technologies, but many other commercial motor carriers have been slow to take advantage of them. Based on the case study interview findings, the following conclusions can be drawn regarding the adoption of ITS:

- **No single ITS is applicable to all motor carriers.** The case studies indicate clearly that different motor carriers have different fleet characteristics and fleet management objectives. Every motor carrier is unique. An ITS technology that is appropriate for one carrier may not meet the needs (either functional and financial) of another. Furthermore, the demands on the motor carriers are evolving as the industry grows increasingly competitive, customer-service driven, and logistics-oriented. This suggests that public sector efforts to develop standardized ITS hardware or software would be ineffective, since the motor carrier industry appears to need diversification and flexibility in ITS.

- **Motor Carriers are aware of the range of available ITS.** Motor carriers appear to have a clear understanding of current ITS, including the limitations of particular systems, as well as of the improvements and innovations that appear likely in the near future. Lack of ITS adoption by motor carriers is not due to lack of information or understanding; rather, motor carriers are selective and cautious in their ITS investments. These findings suggest that federal involvement in technology transfer may be unnecessary, since lack of access to information about ITS is not an issue for most motor carriers.

- **Carriers adopt ITS when they believe that it will generate benefits with respect to efficiency or competitiveness.** Carriers have invested in ITS only when such systems can fill a clearly defined and significant need. Many carriers' operations are not complex enough to warrant ITS. Other carriers have not invested in ITS because they have not yet found a system that can meet their needs, and thus sufficient benefits to justify the investment. Again, in an extremely competitive market, motor carriers are cautious and selective in their adoption of ITS.

- **Carriers understand the benefits of multiple ITS.** Of the 20 case study carriers, 17 have adopted some form of ITS; 15 of these carriers have invested in multiple systems. This indicates that carriers have a clear understanding of the benefits that can be gained from integrating multiple ITS, over and above the benefits of each individual system. Indeed, as the case studies indicate, systems integration is a major focus for carriers that already have ITS.

- **Carriers need better information to obtain the full benefits** from **ITS.** ITS can help carriers understand and control many of the factors that influence fleet operations, provided the carriers have adequate data. Traffic congestion and incidents are significant factors for many carriers, especially those operating in urban areas. Even carriers that operate on rural roads may face problems from road closures. Many of the case study fleets noted that

accurate, real-time data on traffic and road conditions would be valuable to them. If carriers had access to such data, which generally now are unavailable, they could integrate the data into their current ITS. The collection and dissemination to carriers of real-time congestion, incident, and road closure information is an area in which public sector involvement may be appropriate and desirable.

# APPENDIX A

# FOR-HIRE MOTOR CARRIER INTERVIEW QUESTIONS

## I. INTRODUCTION

**Describe** purpose of study and interview.

## II. DEFINE FLEET OPERATION

### A. Fleet Characteristics

1. How many power units does your company operate?
2. How many of the power units does your company own vs. lease?
3. How many trailers does your company own vs. lease?
4. What types of trailers do you operate (e.g., refrigerated vs. dry)?
5. How many drivers does your company employ?
6. How many are company employees vs. contract or leased?
7. What is the union status of the drivers that operate your trucks?
8. How many / what types of facilities does your company operate?
9. Where are these facilities located?
10. Provide an overview of your company's maintenance program (is this done in-house or out-sourced)? If maintenance is out-sourced, what are the advantages / disadvantages of this approach?
11. What is the criteria for replacing vehicles? What is the average age of the power units / trailers in your fleet?
12. If company leases power units or trailers, why have they chosen to do this? Have they conducted any cost-benefit analyses that justifies this approach?

### B. Nature of Operations

1. What motor carrier category does your company fall in (i.e., LTL, TL, Common / Contract or some combination)?
2. Describe your company's operation approach.

3. Who are your customers, how many do you have in total?

4. Where are your customers located?

5. Describe the logistics patterns of your customers. Where do the services that you provide fit into their supply and distribution chain?

6. What are the performance standards that your company is subject to?

7. What are the penalties associated with non-performance?

8. How does your company target perspective customers?

9. How does your company market itself? What are your selling points?

10. What is your customer retention level?

11. Who from your company comes into contact with the customers (i.e., drivers, dispatchers, other company representatives)?

12. What operating or other productivity ratios does your company track?

13. Please provide an overview of your company's financial performance.

**C. Driver Management**

1. How are drivers compensated (e.g., per hour, load, etc.)?

2. What type of incentives does your company offer to drivers?

3. How would you describe your company's approach to quality of life issues with respect to drivers? How has this impacted driver retention?

4. What type of interaction is their between drivers and management? Is this considered to be important at your company?

5. What training does your company offer drivers (e.g., safety, etc.)? What is your company's philosophy about driver training?

**D. Regulatory Compliance**

1. Who is responsible for tracking drivers hours-of-service and other driver-related requirements?

2. Who is responsible for tracking information on individual vehicles (e.g., maintenance information, mileage, etc.)?

3. Who is responsible for obtaining vehicle/driver credentials?

4. What type of system(s) is being used to track this information (e.g., paper vs. database)?

## III. INDUSTRY SEGMENT DISCUSSION

1. How many carriers would you estimate are in your industry segment?
2. Break this down into local, regional, and national.
3. How do you think they vary with respect to range of operation?
4. How do you think they vary with respect to time sensitivity of shipments?
5. How do you think they vary with respect to route variability?
6. How do you think they vary with respect to fleet size (power units and trailers)?
7. In general, do you think most companies lease or own the equipment that they are operating?
8. How many drivers do most companies in your industry segment employ? Are most of the drivers company employees or contract drivers?
9. How profitable are most motor carriers in your industry segment?

## IV. ROUTING/DISPATCHING DISCUSSION

### A. "Walk Through" of Routing and Dispatching Process

1. What are the critical elements involved in the routing/dispatching process?
2. What type of information is being used for routing/dispatching?
3. How are unforeseen problems handled? For instance if a truck breaks down while moving a load.
4. Does the dispatcher maintain contact with drivers while they are in transit? If yes, what is the purpose of this communication?
5. If trucks are based at more than one location, is there more than one person responsible for routing and dispatching? If yes, are routing/dispatching activities coordinated?
6. How much slack time does the dispatcher usually have to work with?
7. What are the greatest day-to-day frustrations **with** respect to routing and dispatching?

## V. CORPORATE MANAGEMENT SYSTEMS

### A. Fleet Management

1. What hardware and software is currently being used to support fleet routing and dispatching? If more than one location is used for routing/dispatching, are the same systems being used?

2. When was the technology that you are currently using installed?

3. What are the strengths and weaknesses of the hardware/software?

4. What on-board systems are used for communication or record keeping?

5. When was this equipment installed?

6. What are the strengths and weaknesses of this equipment?

7. What systems were previously used? What prompted the decision to change/upgrade?

8. Has your company conducted cost-benefit analysis to determine the impact that this technology has had on fleet efficiency or operating cost savings?

9. If yes, please describe the analysis that was conducted. What were the units of measurement that were used (e.g., per truck, etc.)?

10. How does this technology relate to your ability to better serve customers?

11. Does the technology give your company a strategic advantage over your competitors?

### B. Other Management Systems

1. Provide a brief overview of the other MIS that your company uses

2. What hardware/software is being used to support these systems?

3. Is the fleet Management hardware/software compatible with these other systems?

### C. Relationship between Fleet Management Technology and other MIS

1. How does the fleet management system relate to other MIS?

2. What type of information is exchanged among systems or other company functional areas?

3. Describe your company's fleet budgeting practices. How does this process relate to other budgeting and accounting functions?

4. What are the limitations of the existing system?

## VI. FUTURE ROUTING/DISPATCHING AND TECHNOLOGY

### A. Anticipated Changes to Industry Environment Impacting Fleet Management

1. How will your customers needs change over the next decade?
2. Do you anticipate that your company will be providing the same services in the foreseeable future? If no, how do you see this changing?
3. If changes are expected how will this impact fleet management practices?
4. How will information needs change over the next few years?
5. What impact will technology advances have on your company and your competitors?
6. Do you see your company as an industry leader or follower with respect to the use of technology?

### B. Anticipated Technology Advances

1. Do you anticipate any changes to the routing/dispatching system that is currently being utilized?
2. Anticipated changes to other corporate MIS which may impact fleet management?

### C. Opportunities for Technology Applications

1. What equipment is available that you would like to be using now?
2. How would this benefit your operation?
3. What additional information would you like to have access to (e.g., congestion, road closures, etc.)?

## PRIVATE MOTOR CARRIER INTERVIEW QUESTIONS

### I. INTRODUCTION

Describe purpose of study and interview.

### II. DEFINE FLEET OPERATION

#### A. Fleet Characteristics

1. How many power units does your company operate?
2. How many of the power units does your company own vs. lease?
3. How many trailers does your company own vs. lease?
4. What types of trailers do you operate (e.g., refrigerated vs. dry)?
5. How many drivers does your company employ?
6. How many are company employees vs. contract or leased?
7. What is the union status of the drivers that operate your trucks?
8. How many / what types of facilities does your company operate?
9. Where are these facilities located?
10. Provide an overview of your company's maintenance program **(is** this done in-house or out-sourced)? If maintenance is out-sourced, what are the advantages / disadvantages of this approach?
11. What is the criteria for replacing vehicles? What is the average age of the power units / trailers in your fleet?
12. If company leases power units or trailers, why have they chosen to do this? Have they conducted any cost-benefit analyses that justifies this approach?

#### B. Nature of Operations

1. What type(s) of products does your company transport?
2. Explain the role that your fleet of trucks plays in serving internal and external customers

3. What is your company's operational approach (e.g., backhaul driven vs. outbound driven)?

4. If your company provides backhaul service describe how this is marketed to potential customers.

5. If your company provides backhaul service, who are your primary customers, where are they located, how many in total?

6. What are the delivery parameters for backhaul services that your fleet provides?

7. What are the penalties associated with non-performance?

8. What are the delivery parameters for your primary customers?

9. What are the penalties associated with non-performance?

10. How does your company target perspective customers?

11. How does your company market itself? What are your selling points?

12. What is your customer retention level?

13. Who from your company comes into contact with the customers (i.e., drivers, dispatchers, other company representatives)?

14. What operating or other productivity ratios does your company track?

15. Please provide an overview of your company's financial performance.

C. Driver Management

1. How are drivers compensated (e.g., per hour, load, etc.)?

2. What type of incentives does your company offer to drivers?

3. How would you describe your company's approach to quality of life issues with respect to drivers? How has this impacted driver retention?

4. What type of interaction is their between drivers and management? Is this considered to be important at your company?

5. What training does your company offer drivers (e.g., safety, etc.)? What is your company's philosophy about driver training?

### D. Regulatory Compliance

1. Who is responsible for tracking drivers hours-of-service and other driver-related requirements?

2. Who is responsible for tracking information on individual vehicles (e.g., maintenance information, mileage, etc.)?

3. Who is responsible for obtaining vehicle / driver credentials?

4. What type of system(s) is being used to track this information (e.g., paper vs. database)?

## III. INDUSTRY SEGMENT DISCUSSION

1. How many carriers would you estimate are in your industry segment?

2. Break this down into local, regional, and national.

3. How do you think they vary with respect to range of operation?

4. How do you think they vary with respect to time sensitivity of shipments?

5. How do you think they vary with respect to route variability?

6. How do you think they vary with respect to fleet size (power units and trailers)?

7. In general, do you think most companies lease or own the equipment that they are operating?

8. How many drivers do most companies in your industry segment employ? Are most of the drivers company employees or contract drivers?

9. How profitable are most motor carriers in your industry segment?

## IV. ROUTING/DISPATCHING DISCUSSION

### A. "Walk Through" of Routing and Dispatching Process

1. What are the critical elements involved in the routing / dispatching process?

2. What type of information is being used for routing / dispatching?

3. How are unforeseen problems handled? For instance if a truck breaks down while moving a load.

4. Does the dispatcher maintain contact with drivers while they are in transit? If yes, what is the purpose of this communication?

5. If trucks are based at more than one location, is there more than one person responsible for routing and dispatching? If yes, are routing/dispatching activities coordinated?

6. How much slack time does the dispatcher usually have to work with?

7. What are the greatest day-to-day frustrations with respect to routing and dispatching?

## V. CORPORATE MANAGEMENT SYSTEMS

### A. Fleet Management

1. What hardware and software is currently being used to support fleet routing and dispatching? If more than one location is used for routing/dispatching, are the same systems being used?

2. When was the technology that you are currently using installed?

3. What are the strengths and weaknesses of the hardware/software?

4. What on-board systems are used for communication or record keeping?

5. When was this equipment installed?

6. What are the strengths and weaknesses of this equipment?

7. What systems were previously used? What prompted the decision to change/upgrade?

8. Has your company conducted cost-benefit analysis to determine the impact that this technology has had on fleet efficiency or operating cost savings?

9. If yes, please describe the analysis that was conducted. What were the units of measurement that were used (e.g., per truck, etc.)?

10. How does this technology relate to your ability to better serve customers?

11. Does the technology give your company a strategic advantage over your competitors?

### B. Other Management Systems

1. Provide a brief overview of the other MIS that your company uses

2. What hardware/software is being used to support these systems?

3. Is the fleet management hardware/software compatible with these other systems?

### C. Relationship between Fleet Management Technology and other MIS

1. How does the fleet management system relate to other MIS?
2. What type of information is exchanged among systems or other company functional areas?
3. Describe your company's fleet budgeting practices. How does this process relate to other budgeting and accounting functions?
4. What are the limitations of the existing system?

## VI. FUTURE ROUTING/DISPATCHING AND TECHNOLOGY

### A. Anticipated Changes to Industry Environment Impacting Fleet Management

1. How will your customers needs change over the next decade?
2. Do you anticipate that your company will be providing the same services in the foreseeable future? If no, how do you see this changing?
3. If changes are expected how will this impact fleet management practices?
4. How will information needs change over the next few years?
5. What impact will technology advances have on your company and your competitors?
6. Do you see your company as an industry leader or follower with respect to the use of technology?

### B. Anticipated Technology Advances

1. Do you anticipate any changes to the routing/dispatching system that is currently being utilized?
2. Anticipated changes to other corporate MIS which may impact fleet management?

### C. Opportunities for Technology Applications

1. What equipment is available that you would like to be using now?
2. How would this benefit your operation?
3. What additional information would you like to have access to (e.g., congestion, road closures, etc.)?

# BUS COMPANY INTERVIEW QUESTIONS

## I. INTRODUCTION

Describe purpose of study and interview.

## II. DEFINE FLEET OPERATION

### A. Fleet Characteristics

1. How many buses does your company operate?
2. What type(s) of buses does your company operate?
3. How many of the buses does your company own vs. lease?
4. How many drivers does your company employ?
5. How many are company employees vs. contract or leased?
6. What is the union status of the drivers that operate your buses?
7. How many / what types of facilities does your company operate?
8. Where are these facilities located?
9. Provide an overview of your company's maintenance program (is this done in-house or out-sourced)? If maintenance is out-sourced, what are the advantages / disadvantages of this approach?
10. What is the criteria for replacing vehicles? What is the average age of the buses in your fleet?
11. If company leases buses, why have they chosen to do this? Have they conducted any cost-benefit analyses that justifies this approach?

### B. Nature of Operations

1. Describe your company's operation approach.
2. Who are your customers?
3. Where are your customers located?

4. What are the performance standards that your company is subject to?

5. What are the penalties associated with non-performance?

6. How does your company target perspective customers?

7. How does your company market itself? What are your selling points?

8. What is your customer retention level?

9. What operating or other productivity ratios does your company track?

10. Please provide an overview of your company's financial performance.

**C. Driver Management**

1. How are drivers compensated (e.g., per hour, by trip, etc.)?

2. What type of incentives does your company offer to drivers?

3. How would you describe your company's approach to quality of life issues with respect to drivers? How has this impacted driver retention?

4. What type of interaction is their between drivers and management? Is this considered to be important at your company?

5. What training does your company offer drivers (e.g., safety, etc.)? What is your company's philosophy about driver training?

**D. Regulatory Compliance**

1. Who is responsible for tracking drivers hours-of-service and other driver-related requirements?

2. Who is responsible for tracking information on individual vehicles (e.g., maintenance information, mileage, etc.)?

3. Who is responsible for obtaining vehicle/driver credentials?

4. What type of system(s) is being used to track this information (e.g., paper vs. database)?

**III. INDUSTRY SEGMENT DISCUSSION**

1. How many bus companies would you estimate are in your industry segment?

2. Break this down into local, regional, and national.

3. How do you think they vary with respect to range of operation?

4. How do you think they vary with respect to time sensitivity?

5. How do you think they vary with respect to route variability?

6. How do you think they vary with respect to fleet size?

7. In general, do you think most companies lease or own the equipment that they are operating?

8. How many drivers do most companies in your industry segment employ? Are most of the drivers company employees or contract drivers?

9. How profitable are most companies in your industry segment?

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4. Does the dispatcher maintain contact with drivers while they are in transit? If yes, what is the purpose of this communication?

5. If buses are based at more than one location, is there more than one person responsible for routing and dispatching?

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8. Has your company conducted cost-benefit analysis to determine the impact that this technology has had on fleet efficiency or operating cost savings?

9. If yes, please describe the analysis that was conducted. What were the units of measurement that were used (e.g., per bus, etc.)?

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