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Industry Needs and Opportunities for Truck Platooning

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Industry Needs and Opportunities for Truck Platooning

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California Department of Transportation
University of California PATH Program
Volvo Technology Americas
Cambridge Systematics, Inc.
Peloton Technology
with support from
American Transportation Research Institute (ATRI)

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Partial Automation for Truck Platooning
Federal Highway Administration
Exploratory Advanced Research Program

February 2015

Table of Contents

Abstract.....	3
1. Introduction.....	3
2. National Survey of the Trucking Industry.....	4
3. Needs and Opportunities Along the I-710 Corridor.....	10
4. Volvo and Mack Fleet Customer Interactions.....	12
5. Peloton Technology Findings.....	12
6. Conclusions.....	14
Appendix A – ATRI Survey Instrument.....	15
Appendix B – Results of ATRI Survey.....	32
Appendix C – Results of Southern California Survey.....	55

ABSTRACT

Representatives of the trucking industry have been surveyed to try to identify their needs and concerns related to truck platooning systems. One survey was done at the national level by ATRI, in cooperation with a parallel EAR project on truck platooning, using an online survey instrument, while a second survey was done among the members of the Harbor Trucking Association near the Los Angeles/Long Beach port, using a combination of online and in-person surveys. These surveys revealed the need to provide clearer and more comprehensive descriptions of the truck platooning concepts to ensure that the respondents understand what it is and how it works. The fleet managers tended to be more receptive to truck platooning than the drivers, and even those respondents who had some prior experience driving trucks with ACC and forward collision warning systems were no more receptive to truck platooning than those who lacked such experience. The Harbor Trucking Association respondents received a more complete description of the truck platoon concept than the national respondents, and their responses were significantly more positive regarding driver acceptance of the system.

1. Introduction

This initial task in the project is focused on interacting with the trucking industry to understand their perspectives on truck platooning. Since they will be the people who decide whether to purchase vehicles equipped for truck platooning and how much to use the system after they acquire their trucks, it is important to understand their thinking. This includes their attitudes and preconceptions about truck platooning as well as the requirements that the system must meet to be acceptable to them and the opportunities that the system could provide to them.

The trucking industry is highly diverse, so it's important to obtain multiple samples to gain a wide enough view of that diversity. The differences are particularly large between the independent owner-operators and the large fleets (both common carriers and private fleets), but there are also significant differences between long-haul interstate operators and short-haul drayage operators.

We are seeking to learn a variety of things about the potential users of truck platooning systems:

- what is their prior familiarity with adaptive cruise control (CACC) and truck platooning?
- have they developed an accurate perception of these systems, or do they labor under significant misconceptions about it?
- what benefits do they expect to gain from use of CACC or platooning?
- what concerns do they have and what risks do they perceive from CACC or platooning?
- what economic factors will influence their decision about adopting CACC or platooning for their trucks? (payback period, initial cost, operating and maintenance costs)

-

We have taken several approaches to collecting information from this diverse population early in the project. We have collaborated with the team working on a parallel FHWA EAR project on truck platooning to conduct a national online survey of trucking industry people. In parallel with that effort, Cambridge Systematics has administered the same survey to members of the Harbor Trucking Association, representing the drayage carriers in the Los Angeles/Long Beach port complex, to get a local perspective on their attitudes. Volvo Technology and Peloton Technology have talked with their fleet customers (and potential future customers) to gain better understanding of their attitudes with regard to use of the platooning technology.

The remaining sections of this report describe the findings from each of these interactions with the industry participants, and the Appendices contain the full text of the survey instrument and a tabulation of its results.

2. National Survey of the Trucking Industry

Early in the project, the project team became aware that another project team led by Auburn University, working on a parallel truck platooning project under the same FHWA Exploratory Advanced Research Program, was also planning to survey the trucking industry about their opinions on the truck platooning technology. After some discussion between the two project teams, we came to the conclusion that it would be mutually beneficial and efficient to combine our efforts on a single integrated survey rather than doing separate surveys. In this way, we could combine the best ideas about questions from both teams and could make a single integrated approach to the industry people to seek their responses, rather than fragmenting the industry and asking some to submit one survey while the rest submit the other survey. After the sponsors of both projects indicated their approval of the merger, we produced the integrated survey.

The survey was posted online using the “Survey Monkey” service between November 17 and December 8 by the American Transportation Research Institute (ATRI). They advertised the survey through their extensive distribution list of people interested in trucking issues and posted announcements about the survey in online newsletters circulated to the broader transportation industry. The e-mail notice soliciting participants for the survey is shown in Figure 1. Following the practice of the parallel project, they referred to the concept as “Driver Assistive Truck Platooning” (DATP) to try to reinforce the notion that only one portion of the driving function (vehicle following) is being automated, while the driver retains the balance of the normal driving responsibilities. For the balance of this report, it will be referred to as truck CACC, since that is the concept that is being developed and tested in this project.

The full text of the survey is reproduced in Appendix A. The survey begins with a very brief description of the truck platooning concept to introduce the subject:

This concept is based on a system that controls inter-vehicle spacing based on information from forward-looking radars and direct vehicle-to-vehicle communications. Braking and other operational data is constantly exchanged between the trucks, enabling the control system to automatically adjust engine and brakes in real-time. This allows equipped trucks to travel closer together than manual operations would safely allow. Similar to currently deployed cruise control technology, the system still requires drivers to steer the truck and maintain situational awareness should any evasive maneuvers become necessary. An additional safety buffer is typically provided by integrating this with on-board active safety systems on the trucks. These systems are intended for use on multi-lane divided highways at cruising speed.

Subject: ATRI SEEKS INPUT ON DRIVER ASSISTIVE TRUCK PLATOONING
From: ATRI <ATRI@trucking.org>
Date: 11/17/2014 8:31 AM
To: ATRI <ATRI@trucking.org>



FOR IMMEDIATE RELEASE
Contact: Dan Murray
(651) 641-6162
November 17, 2014

ATRI SEEKS INPUT ON DRIVER ASSISTIVE TRUCK PLATOONING

Arlington, VA – In coordination with two different US DOT-sponsored research teams, the American Transportation Research Institute (ATRI) is launching a new data collection effort that seeks more detailed information on the likely costs and benefits associated with Truck Platooning. The survey seeks both truck driver and motor carrier input on the specific use scenarios and price points that might accrue from truck platooning, also known as Driver Assistive Truck Platooning (DATP).

The DATP concept is based on a system that controls inter-vehicle spacing based on information from forward-looking radars and direct vehicle-to-vehicle communications. Braking and other operational data is constantly exchanged between the trucks, enabling the control system to automatically adjust engine and brakes in real-time. This allows equipped trucks to travel closer together than manual operations would safely allow. Based on industry input, ATRI will conduct an empirical cost/benefit analysis to determine the degree to which Truck Platooning may be adopted in the trucking industry.

The online survey is available on ATRI's website at www.atri-online.org and will be open through December 8, 2014.

ATRI is the trucking industry's 501(c)(3) not-for-profit research organization. It is engaged in critical research relating to freight transportation's essential role in maintaining a safe, secure and efficient transportation system.

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Figure 1 – E-mail Notice Soliciting Responses to Survey

The survey introduction continued with a simple statement about the energy-saving potential of the truck platooning concept, with a range of levels of energy saving sufficient to accommodate diverse kinds of truck platooning:

When trucks are platooning at highway speed, several academic and industry studies have demonstrated fuel economy improvements in the range of 4-8% for the lead truck and 10-12% for the following trucks (compared to driving the same route without platooning).

Tightly-coupled platoons with constant-clearance gaps of a few meters would be at the upper end of the saving range, while more loosely coupled CACC trucks would be in the lower end of the saving range, avoiding the need to get into complicated explanations about the different versions of truck platooning. This simplification may have colored some of the answers about the willingness to pay, but it should not have had any effect on the most important question about willingness to pay, which involves the estimate of the pay-back period that the truck operator would expect before deciding to invest in the system.

The survey was sub-divided into separate sections for different categories of respondents, with slightly different questions for those different groups of respondents:

- owner-operators/independent contractors
- company (fleet) drivers
- fleet managers.

2.1 Results of National Survey

The national survey, despite its wide distribution, yielded only 109 responses. Of these, 78% were truck drivers, evenly divided between owner/operators and fleet drivers, while the other 22% were fleet managers. The fleet managers were significantly more favorably inclined towards truck CACC than the drivers, which should not be surprising considering that they are more likely to see the economic benefits of the energy savings that the system provides.

Taking the survey results as a whole, it was apparent that the respondents did not have a clear perception about the CACC system and how it operates. These misconceptions led them to make assumptions about safety issues that are not valid, indicating the importance of effective outreach from this project to educate them about the system in the future. Because the verbal description in the survey did not appear to be effective, it will probably be necessary to create a narrated video demonstrating the use and operation of the system, including showing how the driver activates and deactivates it, as well as giving demonstrations to opinion leaders within the trucking industry. As with most driver assistance and automation systems the most effective outreach tool is a demonstration that allows the participants to drive the vehicle themselves, but

this is only likely to be feasible for a very limited number of invited guests in the course of the project.

One other clear trend across all the survey respondents was a reluctance to delay a trip to be able to couple with another equipped truck heading in the same direction. This indicates limited potential for global coordination among trucks except in the case that a fleet manager determines that it is required for drivers under his or her leadership.

Owner-Operator Results

Responses to the full set of survey questions were only available from 22 owner-operators, but they were a relatively experienced bunch, with half of them having more than 15 years of driving experience. Half of them are regularly driving long-haul routes (over 1000 miles), while most of the rest were split between regional and inter-regional driving.

Only seven of these drivers had any experience with ACC, and three of those were frequent users. Only four had ever used a collision warning system, and only one was a frequent user, so driver assistance technologies are a new concept for most of these drivers. Unfortunately, there was no positive correlation between experience with these systems and propensity to use a CACC system, which was one of the most disappointing findings. The drivers who had the most experience with ACC were more negative about CACC than the average across all the drivers, which indicates some lack of trust in the ACC technology. That appears to be a consequence of some unfavorable experiences with the ACC systems that they have used, and is a topic worthy of future investigation.

When the survey reached the questions about potential use of and payment for use of CACC systems, only seven drivers were even interested in considering use of the system. None of them thought the system would have a positive impact on driver retention and only one thought that drivers would be likely to want to use the system. The drivers who would consider using the system were receptive to the concept of transfer payments between leaders and followers to compensate for differences in energy saving, although this receptivity varied considerably. Only one would consider the possibility of delaying a departure to facilitate coupling with another CACC truck. They were also quite flexible about coupling with other owner-operators and with trucks from other fleets.

Among the seven owner-operators who were receptive to using the CACC system, the mean value of acceptable pay-back period to recover the initial cost from fuel savings was ten months, with a median value of six months. They were willing to pay an average of \$1511 (median of \$850) to install the system or an average and median value of \$500 per year to operate the system if it were to be provided as a service rather than as a product to be purchased.

Fleet Driver Results

In many ways the reactions of the fleet drivers were similar to those of the owner-operators, but in some regards they were more negative because they would not see the direct financial benefits from use of the CACC system.

Responses to the full set of survey questions were only available from 20 fleet drivers, and they were a similarly experienced bunch, with more than half of them having more than 15 years of driving experience. Only a quarter of them were regularly driving long-haul routes (over 1000 miles), while most were split between regional and inter-regional driving.

Only six of these drivers had any experience with ACC, and five of those were frequent users. Only six had ever used a collision warning system, four of which were frequent users, so driver assistance technologies are still a relatively new concept for most of these drivers.

When the survey reached the questions about potential use of CACC systems, 60% of these drivers were willing to consider using the system. Two of them thought the system could have a somewhat positive impact on driver retention but none thought that drivers would be likely to want to use the system. The drivers who would consider using the system were receptive to the concept of transfer payments between leaders and followers to compensate for differences in energy saving, although this receptivity varied considerably. Only two would consider the possibility of delaying a departure to facilitate coupling with another CACC truck. They were quite flexible about coupling with owner-operators and with trucks from other fleets, but were primarily interested in coupling with other trucks from their own fleet.

It's not clear how meaningful the willingness to pay questions are for fleet drivers, since they are company employees rather than having a direct economic stake in the equipment costs or fuel savings. The mean value of acceptable pay-back period to recover the initial cost from fuel savings among these drivers was 20 months, with a median value of 12 months. They were willing to pay an average of \$1040 (median of \$850) to install the system or an average of \$350 per year (median of \$525) per year to operate the system if it were to be provided as a service rather than as a product to be purchased.

Fleet Manager Results

Not surprisingly, the fleet managers were more interested in the CACC systems than either category of drivers since they would be the economic beneficiaries of the energy cost savings. It

is also good that they are likely to be the primary decision makers about investing in the technology when purchasing their new trucks. Unfortunately only 13 fleet managers completed the survey, but quite a few of them represented sizable fleets (six in the range of 51-500 power units, one in the 1001-5000 range and two in the over-500 units range). Considering these fleet sizes, they represent a substantially larger portion of the industry than all the driver respondents.

More than half of the represented fleets were in the regional range (100-499 miles per trip), and only one was in the long-haul category (over 1000 miles per trip).

Four of the fleet managers had ever driven a truck ACC system, and only one was a frequent user, while only two had any experience with collision warning systems, so even at the management level there is still not much experience with driver assistance technologies.

The fleet managers were considerably more positive about the driver reactions to CACC than the drivers were. Two of them thought that it would have a somewhat or very positive impact on driver retention, while only one thought it would have a very negative impact. Three of them thought that the drivers would be likely or very likely to want to use the technology, and only one thought it not likely at all that drivers would want to use the technology. It's hard to know whether the managers are just out of touch with the drivers' opinions or whether the managers are representing different parts of the industry where the drivers are more receptive to technology than the drivers who responded to the survey.

The attitudes of the fleet managers to transfer payments between leaders and followers were diverse, but somewhat more receptive than the drivers. Three of them were somewhat willing to delay a departure to facilitate coupling with another CACC truck. They were willing to couple with trucks from other fleets as well as their own fleets, but not with owner-operators.

Among the fleet managers, 75% were willing to pay for the system, which is considerably higher than the proportions of drivers or owner-operators. They were willing to pay an average of \$1017 (median of \$750) to install the system, or an average of \$528 (median of \$500) for annual use of the system as a service, within a similar range to the owner-operators. The break-even periods that the fleet managers wanted to see varied considerably. For the medium-size fleets these values were in the range of 11 to 18 months, while the two managers of the largest fleets (1000 power units and above) were willing to acquire the systems with a 36 month break-even period.

Summary of Results

Based on the limited results of the national survey, we can draw several conclusions:

- The trucking industry people have limited understanding of ACC, much less CACC, so considerable attention needs to be devoted to educating them about these systems so that they can make informed decisions about its suitability for their use.
- The larger fleet operators are likely to be more receptive to CACC than the owner-operators, so they should be the initial focus of attention.
- The concept of transfer payments between leaders and followers appears sufficiently acceptable that it should be developed further.
- The concept of delaying truck departures to facilitate CACC coupling does not appear to be appealing except perhaps in large fleet operations.
- The drivers need to be educated about CACC in addition to the fleet managers because the drivers' opinions appear to be significantly more negative at this point, and their concerns need to be addressed before this can become well accepted in the industry.

3. Needs and Opportunities Along the I-710 Corridor

Cambridge Systematics administered a very similar survey to trucking industry stakeholders in Southern California between January 5 and February 5, 2015. This survey was distributed chiefly to members of the Harbor Trucking Association (HTA). The digital survey was publicized via several emails to the association mailing list throughout January 2015 from HTA President Mike Johnson. Furthermore, Cambridge Systematics sent a representative to the HTA meeting on the evening of January 28, 2015, to promote the survey and encourage attendees to participate. At this event, the representative distributed and collected several printed surveys to audience members before and after the meeting, gave a five-minute presentation about the survey and its significance during the meeting agenda, and distributed dozens of fliers to introduce the concept of truck platooning and to highlight the importance of the survey to them. A copy of this flier is included in Appendix C as part of the complete report on the results of the survey. The flier and briefing provided more information about the truck platooning concept than the ATRI survey reported in Section 2 above, so these respondents should be considered somewhat better informed than the respondents to the other survey.

Seventeen responses were received, of which eleven were online and six in hard copies. They represented the views of one owner-operator, three company drivers and 13 fleet managers. Because of character of the trucking industry segment represented by the HTA, these were predominantly short-haul operations, approximately evenly distributed between local (trips less than 100 miles) and regional (100 to 499 mile trips), with only one inter-regional and one long-haul operator. Two of the respondents were frequent users of ACC and collision warning

systems, and one was an infrequent user of ACC. Most of the others had either seen or heard of ACC and collision warning systems, but had not had direct experience with them.

The responses regarding willingness to pay for a truck platooning capability were somewhat inconsistent because the respondents appeared to misunderstand the concept of the payback period that was used in the survey. The longest payback period that was cited by a respondent was 60 months, but that respondent only indicated a willingness to pay \$1000 for the system. On the other hand, a respondent who was willing to pay the highest price for the system (\$5000) cited a payback period of nine months. Some cited payback periods as short as one month and a purchase price as low as \$100. The mean value of payback period in the responses was 14 months (distorted by one outlier at 60 months), but among the fleet managers it was 8 months.

Most were willing to pay between \$100 and \$1000 to purchase the system, but two respondents at \$3000 and one at \$5000 brought the mean value up to \$1268. Of the nine respondents who showed an interest in paying for the system, the median price was \$1000. There also seemed to be some confusion about the question regarding paying an annual subscription cost to use the system versus a one-time purchase cost, because five respondents cited the same cost for both. The preferences among the different types of subscription payment were scattered across the alternatives (fees per hour or per mile while in a platoon and fixed monthly and annual fees).

The opinions about forming platoons with other trucks were also quite diverse, with similar numbers expressing willingness to form platoons with any fleet, with specific fleets with whom they have partnerships, and only within their own fleet. These respondents were also quite receptive to paying transfer fees among platooned truck operators to compensate for differences in energy savings. Two of the respondents were "very willing" and two others were "somewhat willing" to delay their departures to facilitate platooning. Although these are still a minority of the respondents, it was a more favorable response to this question than in the ATRI survey.

The most dramatic contrast with the ATRI national survey results was in the responses on driver retention and driver likelihood of using the truck platooning technology. On the question of driver retention, three respondents thought that platooning would have a "very positive" effect and three more expected a "somewhat positive" effect, while only one thought the effect would be negative and four were neutral. Similarly, on the likelihood that drivers will use the platooning technology, three thought it "very likely" and three more thought it "likely", while two said only "somewhat likely" and three said "unlikely" or "not likely at all".

The responses to this survey were somewhat more favorable toward truck platooning than the responses to the national survey, even though the short-haul operations of the truckers who were represented here are less well suited to platooned operations. This is probably attributable to the more complete descriptions of the truck platooning concept that they were provided with when

the survey was administered. This reinforces the importance of providing a clearer explanation of the concept and helping the industry representatives to visualize how it would operate in practice.

4. Volvo and Mack Fleet Customer Interactions

In October, 2014, some Volvo and Mack fleet customers were interviewed at the 2014 ATA Management Conference and Exhibition in San Diego, CA.

Summary of Results

Based on the limited results of the face-to-face interviews, the following observations were made:

- The larger fleet operators are likely to form the set of “early adopters” of the CACC technology.
- While most of the fleet managers had heard of the ACC and CACC, there seemed to be a limited understanding of the possibilities or implications of using the technology, so considerable attention needs to be devoted to educating them about these systems so that they can make informed decisions about its suitability for their use.
- Business models for enabling different operator-owned fleets to participate in a platoon were an issue of concern.
- Security of the futuristic information technology-based infrastructure that could support “ad hoc” platooning remained an issue for concerns, especially among competitor fleet operators.
- Modulating truck route times (e.g., departures, wait periods, etc.) to facilitate CACC coupling along the route did not appeal to the fleet operators, except when under some circumstances where all the vehicles from the fleet were for the same vendor.
- While the concepts of forming, joining, and dismembering a CACC coupled platoon of trucks appealed to the majority of the fleet operators, there was skepticism about its implementation and seamless operation on all routes (i.e., for all traffic on all freeways).

5. Peloton Technology Findings

Peloton has developed an understanding of trucking fleets' interests and concerns regarding CACC based on face-to-face meetings with over 100 fleets during site visits and trade conferences. In general, fleets with relatively high densities of trucks along major freight corridors are most interested in near-term truck platooning, as they could deploy CACC with confidence in immediate savings and with minimal disruption to their existing operations. Of course, the largest private and for-hire U.S. fleets typically have high truck densities on freight

corridors nationwide, yet some smaller fleets also maintain high truck densities on regional highways.

Fleets of all types have expressed strong interest in using a single vehicle technology or integrated system to manage both active safety and fuel economy in trucks, particularly as these focus areas are becoming more data-intensive for fleet managers. Also, the bundling of safety and fuel economy benefits would potentially simplify the return on investment analysis and therefore speed up the current rate of safety technology adoption. A CACC system could be a suitable comprehensive solution for fleets.

Other favorable perspectives about CACC offered by fleets include its tie-in to trucks' on-board data bus, a connection that is technically simple and requires low power; its foundational use of Adaptive Cruise Control (ACC) technology, as virtually all fleets Peloton has met with are familiar with ACC today (several fleets familiar with ACC are already installing it on 100% of their new trucks, while others see ACC as borderline cost-effective and could be swayed by additional savings leveraged by ACC); and CACC's elimination of human error and delay from certain braking decisions. These perspectives are mentioned as notable aspects of fleets' general interest in CACC's safety and fuel savings potential.

Regarding concerns held by fleets, Peloton was interested to find that uncertainty about liability stands out as the reason for some fleets' reluctance to join platoons with trucks from other fleets. Even so, only two fleets – close competitors – expressed unwillingness to pair with one another, and even those indicated that it might be possible in the future.

Likewise, knowing that the second truck in a two-truck platoon benefits from higher fuel savings, some fleets were hesitant about their truck being the front truck in an inter-fleet platoon. After being presented with data showing front-truck fuel savings – roughly on par with side skirts, for example – and the logic that truck ordering could be based objectively on safety factors (i.e. risk reduction), fleets became less concerned about whether their truck would be in the front or rear.

Among fleets with fixed dispatch schedules, there was a roughly even mix between those that stated that their dispatch could not be easily changed to accommodate schedule adjustments for coordination with other CACC-equipped trucks, and those that said it could be changed easily. Peloton likely discussed dispatch scheduling with a skewed sample of larger fleets with more trucks and perhaps more sophisticated dispatch software than the industry in general. Even so, Peloton's findings contrast with the above national survey results indicating greater unwillingness to modify scheduling.

Finally, with respect to their drivers, fleets commonly express two apparently conflicting views. On one hand, fleets noted the technology truism that CACC will only be effective if drivers accept it, while on the other hand, fleets were confident that drivers would use CACC if the fleet management called for it.

6. Conclusions

This initial round of interactions with the trucking industry stakeholders has revealed a generally low level of acquaintance with ACC and a lack of understanding of CACC, leading to skepticism about its benefits and acceptability to truck drivers. One of the surveys provided a more complete introduction and explanation of the system and its performance, and in that survey the ratings were noticeably more favorable. The more in-depth interviews that Peloton conducted with fleets also produced significantly more favorable reactions. This indicates a need for effective outreach tools to explain the CACC and platooning technologies and operational concepts to drivers and fleet operators in ways that they can easily understand. If the project resources permit, it would be desirable to produce a short video to show the experience of operating a truck using CACC and to present the results of the benefit estimates that will be done later in the project (especially estimating the fuel savings that could be possible).

Based on the low level of comprehension of CACC, the respondents indicated a limited level of willingness to pay for this new capability and did not appear to understand the concept of the payback period to recover the initial investment through fuel cost savings. Based on limited information about CACC at the national level, they were also quite negative about the attractiveness of CACC to drivers and the implications it could have for driver retention.

The fleet managers were substantially more receptive to CACC than the drivers in the survey, probably because they could see an economic benefit. In the national survey, they showed limited willingness to delay departures to couple electronically with other trucks, indicating a limited potential for the implementation of “global coordination” of truck departures to facilitate clustering them into CACC strings or platoons, unless this is mandated by management. The respondents who were given the more complete description of the CACC concept were more receptive to coupling their trucks with trucks operated by other fleets than the respondents who only received a couple of sentences of text describing the system, reinforcing the importance of public outreach and education to enhance understanding. In addition, the larger fleets with sufficient flexibility and smaller fleets with high volume routes and good fleet management tools that were interviewed by Peloton Technology indicated the ability to adapt their dispatching to allow for coordination to facilitate truck platooning.

Appendix A – ATRI Survey Instrument

Identifying Industry Needs for Truck Platooning – Technology & Cost/Benefits

Working in collaboration with two FHWA-sponsored project teams, the American Transportation Research Institute (ATRI) is conducting research to explore trucking industry perspectives on the use of automated truck platooning, also known as Driver Assistive Truck Platooning. This concept is based on a system that controls inter-vehicle spacing based on information from forward-looking radars and direct vehicle-to-vehicle communications. Braking and other operational data is constantly exchanged between the trucks, enabling the control system to automatically adjust engine and brakes in real-time.

This allows equipped trucks to travel closer together than manual operations would safely allow. Similar to currently deployed cruise control technology, the system still requires drivers to steer the truck and maintain situational awareness should any evasive maneuvers become necessary. An additional safety buffer is typically provided by integrating this with on-board active safety systems on the trucks.

These systems are intended for use on multi-lane divided highways at cruising speed.

When trucks are platooning at highway speed, several academic and industry studies have demonstrated fuel economy improvements in the range of 4-8% for the lead truck and 10-12% for the following trucks (compared to driving the same route without platooning).

The purpose of this survey is to identify how truck fleets could potentially make use of truck platooning and what constraints to adoption may exist.

All responses to this survey will be kept strictly confidential and will only be reported in aggregate form. Due to the sensitivity of this research, under NO circumstances will we release any of your personal or organizational information.

A. Please select whether you are a:

- Owner-Operator/Independent Contractor (I.)
- Company Driver (II.)
- Fleet Management (III.)

I. You have selected **owner-operator/independent contractor**.

1. Which of the following best describes you?

- Owner-operator (O-O) with own authority
- Leased O-O/Independent Contractor

2. Which sector of the trucking industry do you primarily operate in?

- Truckload
- Less –than-truckload
- Specialized, flatbed
- Specialized, tanker
- Express/Parcel Service
- Intermodal Drayage
- Other (please specify): _____

3. How many total power units does your fleet operate?

- 1-5
- 6-15
- 16-30
- 31-60
- 61-100
- 100+

4. What is the primary truck configuration you operate?

- 5-axle Dry Van
- 5-axle Refrigerated Trailer
- 5-axle Flatbed
- 5-axle Tanker
- Straight Truck
- Longer Combination Vehicle (Double, Triple, etc.)
- Other (please specify): _____

5. What is your average length of haul?

- Local (less than 100 miles per trip)
- Regional -Short/Line Haul (100-499 miles per trip)
- Inter-regional (500-999 miles per trip)
- Long- Haul (1000 or more miles per trip)

6. How many years have you been driving professionally?

- Less than 1 year
- 1-3 years
- 4-6 years
- 7-15 years
- More than 15 years

7. On what type of roads do you typically operate?

	% of annual mileage
Limited-access Interstate and similar class highways, \geq 3+ lanes in the same direction	
Limited-access Interstate and similar class highways, 2 lanes in the same direction	
Undivided rural highways, urban and suburban roads and streets	

8. Please indicate the departure/arrival times of a typical operation day.

	%
Start early morning and end in the afternoon	
Start late morning/afternoon and end in the evening	
Start in the evening and end next day in the morning	

9. How fixed are your routes?

	%
Often the same route every day for driver	
Mixture of new routes and regular routes	
Very mixed, often new routes	

Constantly changing routes	
----------------------------	--

10. What is the route planning horizon?

	%		%
Route always planned before trip		Weeks ahead	
		Days ahead	
		Hours ahead	
		Minutes	
Sometimes change routes while driving			
Often change routes while driving			
Specific route is not planned in advance			

11. Who is responsible for route planning?

Driver	
Carrier / Dispatcher	
Other	

12. How frequently is the driver bound to the planned route?

- Always
- Mostly
- Sometimes
- Rarely
- Never

13. How familiar are you with the use of truck adaptive cruise control (ACC)?

- Never heard of
- Heard of
- Seen
- Used Once
- Used infrequently
- Used Frequently

14. How familiar are you with the use of collision warning systems?

- Never heard of
- Heard of
- Seen
- Used Once
- Used infrequently
- Used Frequently

15. Considering an estimated fuel saving of 5-10%, what is the maximum amount per truck you would be willing to pay to purchase this system?

\$___ / Truck (one-time cost)

16. What is the maximum amount per truck you would be willing to pay to operate this system (per year)?

\$___ / Truck per year (ongoing cost after purchase)

17. What is the necessary payback / break-even time period you would need from this system?

___Months

18. If a subscription based model were proposed for this system, which of the following would best suit you?

- Higher hardware price, with lower subscription fee
- Lower hardware price, with higher subscription fee
- Significantly higher hardware price, with no subscription fee
- Other (please specify): _____

19. What subscription payment structure would you prefer most?

- Per-platooned-hour
- Per-platooned-mile
- Per-month
- Per-year

20. When operating in the vicinity of other platoon-capable trucks, who would you be willing to platoon with? Check all that apply.

- Other Owner Operators
- Any Large Fleet
- Specific Fleets with whom you have already partnered
- Your own fleet trucks
- Other (please specify): _____

21. If your truck is in a follower position and saving more energy than the leader truck, how willing would you be to pay a small fee (electronically) to the leader to compensate for part of the difference in energy saving (e.g., a percentage of fuel savings)? (Or, alternatively, to be paid a fee if your truck is in the lead).

- Very willing
- Somewhat willing
- Neutral
- Not very willing
- Not willing at all

22. With the assumption of 5-10% potential fuel savings and no additional constraints (hours of service or critical time delivery), how willing would you be to delay your departure time to facilitate platooning?

- Very willing
- Somewhat willing
- Neutral
- Not very willing
- Not willing at all

23. Please rank the following options on how drivers should be trained on this system (1 being most preferred, 5 being least preferred):

- System based self-training on the road
- On-site driver training room
- On-line training
- Driving simulator
- Other _____

24. What impact do you think truck platooning will have on driver retention?

- Very Positive
- Somewhat Positive
- No Impact
- Somewhat Negative
- Very Negative

25. How likely do you think drivers are to want to use the technology?

- Very likely
- Likely
- Moderately Likely
- Unlikely
- Not likely at all

Please leave any additional comments you have about truck platooning below:

Thank you! We greatly appreciate your participation.

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For questions, please contact Ford Torrey at: ftorrey@trucking.org

II. You have selected **company driver**.

1. Which sector of the trucking industry do you primarily operate in?

- Truckload
- Less –than-truckload
- Specialized, flatbed
- Specialized, tanker
- Express/Parcel Service
- Intermodal Drayage
- Other (please specify): _____

2. How many total power units does your fleet operates?

- 0-6
- 6-20
- 21-50
- 51-500
- 501-1000
- 1001-5000
- 5001 +

3. What is the primary truck configuration you operate?

- 5-axle Dry Van
- 5-axle Refrigerated Trailer
- 5-axle Flatbed
- 5-axle Tanker
- Straight Truck
- Longer Combination Vehicle (Double, Triple, etc.)
- Other (please specify): _____

4. What is your average length of haul?

- Local (less than 100 miles per trip)
- Regional -Short/Line Haul (100-499 miles per trip)
- Inter-regional (500-999 miles per trip)
- Long- Haul (1000 or more miles per trip)

5. How many years have you been driving professionally?

- Less than 1 year
- 1-3 years

- 4-6 years
- 7-15 years
- More than 15 years

6. On what type of roads do you typically operate?

	% of annual mileage
Limited-access Interstate and similar class highways, \geq 3+ lanes in the same direction	
Limited-access Interstate and similar class highways, 2 lanes in the same direction	
Undivided rural highways, urban and suburban roads and streets	

7. Please indicate the departure/arrival times of a typical operation day.

	%
Start early morning and end in the afternoon	
Start late morning/afternoon and end in the evening	
Start in the evening and end next day in the morning	

8. How fixed are your routes?

	%
Often the same route every day for driver	
Mixture of new routes and regular routes	
Constantly changing routes	
Always dynamic	

9. What is the route planning horizon?

	%		%
Route always planned before trip		Weeks ahead	
		Days ahead	
		Hours ahead	
		Minutes	
Sometimes change routes while driving			
Often change routes while driving			
Specific route is not planned in advance			

10. Who is responsible for route planning?

Driver	
Carrier / Dispatcher	
Other	

11. How frequently are you bound to the planned route?

- Always
- Mostly
- Sometimes
- Rarely
- Never

12. How familiar are you with the use of truck adaptive cruise control (ACC)?

- Never heard of
- Heard of
- Seen
- Used Once
- Used infrequently
- Used Frequently

13. How familiar are you with the use of collision warning systems?

- Never heard of
- Heard of

- Seen
- Used Once
- Used infrequently
- Used Frequently

14. Considering an estimated fuel saving of 5-10%, what is the maximum amount per truck you would be willing to pay to purchase this system?

\$___ / Truck (one-time cost)

15. What is the maximum amount per truck you would be willing to pay to operate this system (per year)?

\$___ / Truck per year (ongoing cost)

16. What is the necessary payback / break-even time period you would need from this system?

___Months

17. If a subscription based model were proposed for this system, which of the following would best suit you?

- Higher hardware price, with lower subscription fee
- Lower hardware price, with higher subscription fee
- Significantly higher hardware price, with no subscription fee
- Other (please specify): _____

18. What subscription payment structure would you prefer most??

- Per-platooned-hour
- Per-platooned-mile
- Per-month
- Per-year

19. When operating in the vicinity of other platoon-capable trucks, who would you be willing to platoon with? Check all that apply.

- Other Owner Operators
- Any Large Fleet
- Specific Fleets with whom you have already partnered
- Your own Fleet trucks
- Other (please specify): _____

20. If your truck is in a follower position and saving more energy than the leader truck, how willing would you be to pay a small fee (electronically) to the leader to compensate for part of the difference in energy saving (e.g., a percentage of fuel savings)? (Or, alternatively, to be paid a fee if your truck is in the lead).

- Very willing

- Somewhat willing
- Neutral
- Not very willing
- Not willing at all

21. With the assumption of 5-10% potential fuel savings and no additional constraints (hours of service or critical time delivery), how willing would you be to delay your departure time to facilitate platooning?

- Very willing
- Somewhat willing
- Neutral
- Not very willing
- Not willing at all

22. Please rank the following options on how drivers should be trained on this system (1 being most preferred, 5 being least preferred):

- System based self-training on the road
- On-site driver training room
- On-line training
- Driving simulator
- Other _____

23. What impact do you think truck platooning will have on driver retention?

- Very Positive
- Somewhat Positive
- No Impact
- Somewhat Negative
- Very Negative

24. How likely do you think drivers are to want to use the technology?

- Very likely
- Likely
- Moderately Likely
- Unlikely
- Not likely at all

Please leave any additional comments you have about truck platooning below:

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III. You have chosen **fleet manager**.

1. Which sector of the trucking industry do you operate in? (check one)

- For –hire
- Private
- Other (please specify): _____

2. If you operate in the for-hire sector, what is your primary type of business? (check one)

- Truckload
- Less –than-truckload
- Specialized
- Other (please specify): _____

3. How many total power units does your fleet operates?

- 0-6
- 6-20
- 21-50
- 51-500
- 501-1000
- 1001-5000
- 5001 +

4. What is the primary truck configuration you operate?

- 5-axle Dry Van
- 5-axle Refrigerated Trailer
- 5-axle Flatbed
- 5-axle Tanker
- Straight Truck
- Longer Combination Vehicle (Double, Triple, etc.)
- Other (please specify): _____

5. What is your average length of haul?

- Local (less than 100 miles per trip)
- Regional -Short/Line Haul (100-499 miles per trip)
- Inter-regional (500-999 miles per trip)
- Long- Haul (1000 or more miles per trip)

6. On what type of roads do you typically operate?

	% of annual mileage
Limited-access Interstate and similar class highways, $\geq 3+$ lanes in the same direction	
Limited-access Interstate and similar class highways, 2 lanes in the same direction	
Undivided rural highways, urban and suburban roads and streets	

7. Please indicate the departure/arrival times of a typical operation day.

	%
Start early morning and end in the afternoon	
Start late morning/afternoon and end in the evening	
Start in the evening and end next day in the morning	

8. How fixed are your routes?

	%
Often the same route every day for driver	
Mixture of new routes and regular routes	
Very mixed, often new routes	
Constantly changing routes	

9. What is the route planning horizon?

	%		%
Route always planned before trip		Weeks ahead	

		Days ahead	
		Hours ahead	
		Minutes	
Sometimes change routes while driving			
Often change routes while driving			
Specific route is not planned in advance			

10. Who is responsible for route planning?

Driver	
Carrier / Dispatcher	
Other	

11. How frequently is the driver bound to the planned route?

- Always
- Mostly
- Sometimes
- Rarely
- Never

12. How familiar are you with the use of truck adaptive cruise control (ACC)?

- Never heard of
- Heard of
- Seen
- Used Once
- Used infrequently
- Used Frequently

13. How familiar are you with the use of collision warning systems?

- Never heard of
- Heard of
- Seen
- Used Once
- Used infrequently
- Used Frequently

14. Considering an estimated fuel saving of 5-10%, what is the maximum amount you would be willing to pay to purchase this system?

\$___ / Truck (one time cost)

15. What is the maximum amount you would be willing to pay to operate this system (per year)?

\$___ / Truck per year (ongoing costs)

16. What is the necessary payback / break-even time period you would need from this system?

___ Months

17. If a subscription based model were proposed for this system, which of the following would best suit you?

- Higher hardware price, with lower subscription fee
- Lower hardware price, with higher subscription fee
- Significantly higher hardware price, with no subscription fee
- Other (please specify): _____

18. What subscription payment structure do you prefer most?

- Per-platooned-hour
- Per-platooned-mile
- Per-month
- Per-year

19. When operating in the vicinity of other platoon-capable trucks, who would you be willing to platoon with? Check all that apply?

- Other Owner Operators
- Any Large Fleet
- Specific Fleets with whom you have already partnered
- My own fleet trucks
- Other (please specify): _____

20. If your truck is in a follower position and saving more energy than the leader truck, how willing would you be to pay a small fee (electronically) to the leader to compensate for part of the difference in energy saving (e.g., a percentage of fuel savings)? (Or, alternatively, to be paid a fee if your truck is in the lead).

- Very willing
- Somewhat willing
- Neutral
- Not very willing
- Not willing at all

21. With the assumption of 5-10% potential fuel savings and no additional constraints (hours of service or critical time delivery), how willing would you be to delay your departure time to facilitate platooning?

- Very willing
- Somewhat willing
- Neutral
- Not very willing
- Not willing at all

22. Please rank the following options on how drivers should be trained on this system (1 being most preferred, 5 being least preferred):

- System-based self-training over the road
- On-site driver training room
- On-line training
- Driving simulator
- Other _____

23. What impact do you think truck platooning will have on driver retention?

- Very Positive
- Somewhat Positive
- No Impact
- Somewhat Negative
- Very Negative

24. How likely do you think drivers are to want to use the technology?

- Very likely
- Likely
- Moderately Likely
- Unlikely
- Not likely at all

Please leave any additional comments you have about truck platooning below:

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DATP Survey Results

I. Overall Response Demographic

- 37.6% of responses were owner-operator/independent contractors
- 40.4% of responses were company drivers
- 22.0% of responses were fleet management

II. Owner-Operators/Independent Contractors

- Mainly operate in the TL sector (64%), are traveling 500+ miles per trip (71%), have been driving for 7+ years (75%), and operate on limited access interstates and similar class highways with more than 2 lanes in the same direction (73%)
- 45% of the time they start early morning and end in the afternoon, 39% of the time they start late morning/afternoon and end in the evening, and 25% of the time they start in the evening and end the morning of the next day
- 75% of the time they are often traveling new routes or the routes are constantly changing
- 72% of the time the route is always planned before the trip, however when that is the case, 83% of the time the route changes while driving, and the driver is almost always the one who plans the route (87%) and is bound to that route only 10% of the time
- Approximately 25% of drivers have never heard of adaptive cruise control, and all drivers are familiar with collision warning, however only 19% have ever used it
- Drivers *willing to pay for the system* would be willing to pay (*Note: Averages and medians based on the 30% of owner-operators indicating a willingness to pay for the system; values such as \$0 or \$1 were excluded from calculations*):
 - An average of \$1,511 (median of \$850) to install the system,
 - An average of \$497 (median of \$500) a year to operate the system,
 - and would need an average break even period of 10 (median of 6) months.
- 79% would want the subscription to be structured per-month or per-year, however a majority (67%) would not be willing to pay for a subscription service
- When asked who they would platoon with:
 - 17% with other owner-operators (n=5)
 - 7% with any large fleet (n=2)
 - 10% specific fleet with whom they have already platooned (n=3)
 - 17% their own fleet's trucks (n=5)
 - 48% responded they would not use the system (n=14)
- 71% reported they would not be very willing or not willing at all to pay the lead truck in the platoon for fuel savings, and 95% reported they would not be very willing or not willing at to delay departure times for the opportunity to platoon
- The preferred method of training for the system would be a driving simulator while the least preferred would be system based self-training on the road
- 86% believe it will have a somewhat or very negative impact on driver retention, and 81% think drivers are unlikely or not likely at all to use the system

III. Company Drivers

- Mainly operate in the TL sector (65%), are traveling less than 500 miles per trip (57%), have been driving for 7+ years (79%), and operate on limited access interstates and similar class highways with more than 2 lanes in the same direction (83%)
- 59% of the time they start early morning and end in the afternoon, 40% of the time they start late morning/afternoon and end in the evening, and 23% of the time they start in the evening and end the morning of the next day
- 91% of the time they are often traveling the same routes or a mixture of the same routes and new routes
- 70% of the time the route is always planned before the trip, however when that is the case, 75% of the time the route changes while driving, and the route is planned by both the driver and carrier 66% and 42% of the time respectively. The driver is mostly or sometimes bound to that route 68% of the time
- Approximately 14% of drivers have never heard of adaptive cruise control, and all drivers are familiar with collision warning, and 36% have ever used it
- Drivers *willing to pay for the system* would be willing to pay (Note: Averages and medians based on the 22% of company drivers indicating a willingness to pay for the system; values such as \$0 or \$1 were excluded from calculations):
 - An average of \$1,040 (median of \$850) to install the system,
 - And average of \$350 (median of 525) year to operate the system,
 - and would need an average break even period of 20 (median of 12) months.
- 88% would want the subscription to be structured per-month or per-year, however a majority (85%) would not be willing to pay for a subscription service
- When asked who they would platoon with:
 - 9% with other owner-operators (n=3)
 - 9% with any large fleet (n=3)
 - 19% specific fleet with whom they have already platooned (n=6)
 - 38% their own fleet's trucks (n=12)
 - 25% responded they would not use the system (n=8)
- 50% reported they would not be very willing or not willing at all to pay the lead truck in the platoon for fuel savings, 18% reported they would be very or somewhat willing, and 32% had no opinion. 82% reported they would not be very willing or not willing at to delay departure times for the opportunity to platoon, while 9% said they would be somewhat willing.
- The preferred method of training for the system would be a driving simulator or an on-site driver training room, while the least preferred would be system based self-training on the road
- 68% believe it will have a somewhat or very negative impact on driver retention, and 87% think drivers are unlikely or not likely at all to use the system

IV. Fleet Management

- 62% operate for-hire while 31% are private carriers
- Spread fairly evenly throughout the sectors
 - 38% TL
 - 38% LTL
 - 25% Specialized
- Mainly operate in a 100-1000 mile range (78%), and operate on limited access interstates and similar class highways with more than 2 lanes in the same direction (71%)
- 56% of the time they start early morning and end in the afternoon, 23% of the time they start late morning/afternoon and end in the evening, and 27% of the time they start in the evening and end the morning of the next day
- 71% of the time they are often traveling the same routes or a mixture of the same routes and new routes
- 75% of the time the route is always planned before the trip, however when that is the case, 69% of the time the route changes while driving, and the route is planned by both the driver and carrier evenly. The driver is always or mostly bound to that route 69% of the time
- Only 8% of fleet managers have never heard of adaptive cruise control, however only 31% have every used it in any regard. All fleet managers are familiar with collision warning, however only 15% have ever used it
- Fleet managers would be willing to pay (*Note: Averages and medians based on the 75% of fleet managers indicating a willingness to pay for the system; values such as \$0 or \$1 were excluded from calculations*):
 - An average of \$1,017 (median of \$750) to install the system,
 - An average of \$528 (median of \$500) a year to operate the system,
 - and would need an average break even period of 18 (median of 18) months.
- 92% would want the subscription to be structured per-platooned-mile or per-month, and would want the subscription type to be as follows:
 - High install, lower subscription: 31%
 - Low install, higher subscription: 23%
 - Significantly higher install, no subscription: 39%
- When asked who they would platoon with:
 - 5% with other owner-operators (n=1)
 - 27% with any large fleet (n=6)
 - 18% specific fleet with whom they have already platooned (n=4)
 - 46% their own fleet's trucks (n=10)
 - 5% responded they would not use the system (n=1)
- 39% reported they would not be very willing or not willing at all to pay the lead truck in the platoon for fuel savings, 31% reported they would be somewhat willing, and 31% had no opinion. 54% reported they would not be very willing or not willing at to delay departure times for the opportunity to platoon, while 23% said they would be somewhat willing.

- The preferred method of training for the system would be an on-site driver training room, while the least preferred would be system based self-training on the road
- 46% believe it will have a somewhat or very negative impact on driver retention, 15% very or somewhat positive, and 39% believe no impact.
- 62% think drivers are unlikely or not likely at all to use the system
 - 23% think drivers are very likely or likely to use the system
 - 15% think drivers are moderately likely to use the system
- Willingness to pay points cross-tabulated with fleet size:

N	Fleet Size	WTP Install (\$)	WTP Maintenance (\$)	Break Even Period (months)
0	0-6	-	-	-
1	7-20	1000	1000	1
2	21-50	750	400	18
5	51-500	1120	422	10.8
0	501-1000	-	-	-
1	1001-5000	2000	250	36
1	5001+	1000	250	36

DATP Survey Results – Number of Responses for Each Question

A. Please select whether you are a:

Job Title	Number	Percentage
Owner-Operator/Independent Contractor	41	37.6%
Company Driver	44	40.4%
Fleet Management	24	22.0%
Total	109	

I. Owner Operators

1. Which of the following best describes you?

Type	Number	Percent
Leased O-O/Independent Contractor	13	59.1%
Owner-operator (O-O) with own authority	9	40.9%
Total	22	

2. Which sector of the trucking industry do you primarily operate in?

Sector	Number	Percent
Truckload	14	63.6%
Less –than-truckload	2	9.1%
Specialized, flatbed	1	4.5%
Specialized, tanker	1	4.5%
Express/Parcel Service	0	0.0%
Intermodal Drayage	1	4.5%
Other (please specify)	3	13.6%
Total	22	

3. How many total power units does your fleet operate?

Total Power Units	Number	Percent
1-5	16	72.7%
6-15	0	0.0%
16-30	0	0.0%
31-60	0	0.0%
61-100	2	9.1%
100+	4	18.2%
Total	22	

4. What is the primary truck configuration you operate?

Truck Configuration	Number	Percent
5-axle Dry Van	9	42.9%
5-axle Refrigerated Trailer	4	19.0%
5-axle Flatbed	4	19.0%
5-axle Tanker	1	4.8%
Straight Truck	1	4.8%
Longer Combination Vehicle (Double, Triple, etc.)	1	4.8%
Other (please specify)	1	4.8%
Total	21	

5. What is your average length of haul?

Average Length of Haul	Number	Percent
Local (less than 100 miles per trip)	1	4.8%
Regional -Short/Line Haul (100-499 miles per trip)	5	23.8%
Inter-regional (500-999 miles per trip)	4	19.0%
Long- Haul (1000 or more miles per trip)	11	52.4%
Total	21	

6. How many years have you been driving professionally?

Year Driving	Number	Percent
Less than 1 year	0	0.0%
1-3 years	1	5.0%
4-6 years	4	20.0%
7-15 years	3	15.0%
More than 15 years	12	60.0%
Total	20	

7. On what type of roads do you typically operate?

Road Type	Number of Responses
Limited-access Interstate and similar class highways, \geq 3+ lanes in the same direction	18
Limited-access Interstate and similar class highways, 2 lanes in the same direction	21
Undivided rural highways, urban and suburban roads and streets	20

8. Please indicate the departure/arrival times of a typical operation day.

Departure/Arrival Times	Number of Responses
Start early morning and end in the afternoon	21
Start late morning/afternoon and end in the evening	18
Start in the evening and end next day in the morning	18

9. How fixed are your routes?

Fixed Route Status	Number of Responses
Often the same route every day for driver	17
Mixture of new routes and regular routes	17
Very mixed, often new routes	15
Constantly changing routes	13

10. What is the route planning horizon?

Route Planning Horizon	Number of Responses
Route always planned before trip	20
Sometimes change routes while driving	16
Often change routes while driving	13
Specific route is not planned in advance	15

11. Who is responsible for route planning?

Who Plans the Route?	Number of Responses
Driver	21
Carrier / Dispatcher	11
Other	10

12. How frequently is the driver bound to the planned route?

Driver Bound to Route	Number	Percent
Always	2	9.5%
Mostly	7	33.3%
Sometimes	4	19.0%
Rarely	2	9.5%
Never	6	28.6%
Total	21	

13. How familiar are you with the use of truck adaptive cruise control (ACC)?

How Familiar with ACC	Number	Percentage
Never heard of	5	25.0%
Heard of	6	30.0%
Seen	2	10.0%
Used Once	2	10.0%
Used infrequently	2	10.0%
Used Frequently	3	15.0%
Total	20	

14. How familiar are you with the use of collision warning systems?

How Familiar with Collision Warning	Number	Percentage
Never heard of	0	0.0%
Heard of	13	61.9%
Seen	4	19.0%
Used Once	1	4.8%
Used infrequently	2	9.5%
Used Frequently	1	4.8%
Total	21	

15. Considering an estimated fuel saving of 5-10%, what is the maximum amount per truck you would be willing to pay to purchase this system?

- 8 responses

16. What is the maximum amount per truck you would be willing to pay to operate this system (per year)?

- 9 responses

17. What is the necessary payback / break-even time period you would need from this system?

- 6 responses

18. If a subscription based model were proposed for this system, which of the following would best suit you?

Subscription Type	Number	Percentage
Higher hardware price, with lower subscription fee	4	19.0%
Lower hardware price, with higher subscription fee	1	4.8%
Significantly higher hardware price, with no subscription fee	2	9.5%
Other (please specify)	14	66.7%
Total	21	

*Note: 'Other' write in responses were indicating the respondent would not use the system.

19. What subscription payment structure would you prefer most?

Payment Structure	Number	Percentage
Per-platooned-hour	0	0.0%
Per-platooned-mile	3	21.4%
Per-month	7	50.0%
Per-year	4	28.6%
Total	14	

20. When operating in the vicinity of other platoon-capable trucks, who would you be willing to platoon with? Check all that apply.

Willing to Platoon	Number	Percentage
Other Owner-Operators	5	17.2%
Any Large Fleet	2	6.9%
Specific Fleets with whom you have already partnered	3	10.3%
Your own fleet trucks	5	17.2%
Other (please specify)	14	48.3%
Total	29	

*Note: 'Other' write in responses were indicating the respondent would not use the system.

21. If your truck is in a follower position and saving more energy than the leader truck, how willing would you be to pay a small fee (electronically) to the leader to compensate for part of the difference in energy saving (e.g., a percentage of fuel savings)? (Or, alternatively, to be paid a fee if your truck is in the lead).

WTP Lead Driver	Number	Percent
Very willing	2	9.5%
Somewhat willing	2	9.5%
Neutral	2	9.5%
Not very willing	2	9.5%
Not willing at all	13	61.9%
Total	21	

22. With the assumption of 5-10% potential fuel savings and no additional constraints (hours of service or critical time delivery), how willing would you be to delay your departure time to facilitate platooning?

Willing to Delay	Number	Percent
Very willing	0	0.0%
Somewhat willing	1	4.8%
Neutral	0	0.0%
Not very willing	5	23.8%
Not willing at all	15	71.4%
Total	21	

23. Please rank the following options on how drivers should be trained on this system (1 being most preferred, 5 being least preferred):

Training Type	Number Ranked				
	1st	2nd	3rd	4th	5th
System based self-training on the road	0	3	1	1	5
On-site driver training room	3	3	2	3	0
On-line training	2	0	5	2	3
Driving simulator	4	4	1	1	4
Other	4	0	0	1	4

24. What impact do you think truck platooning will have on driver retention?

Driver Retention Impact	Number	Percentage
Very Positive	0	0.0%
Somewhat Positive	0	0.0%
No Impact	3	14.3%
Somewhat Negative	4	19.0%
Very Negative	14	66.7%
Total	21	

25. How likely do you think drivers are to want to use the technology?

Likelihood to Use	Number	Percentage
Very Likely	0	0.0%
Likely	1	4.8%
Moderately likely	3	14.3%
Unlikely	4	19.0%
Not likely at all	13	61.9%
Total	21	

II. Company Drivers

1. Which sector of the trucking industry do you primarily operate in?

Sector	Number	Percent
Truckload	13	65.0%
Less –than-truckload	0	0.0%
Specialized, flatbed	1	5.0%
Specialized, tanker	5	25.0%
Express/Parcel Service	0	0.0%
Intermodal Drayage	0	0.0%
Other (please specify)	1	5.0%
Total	20	

2. How many total power units does your fleet operates?

Total Power Units	Number	Percent
0-6	2	8.3%
6-20	2	8.3%
21-50	1	4.2%
51-500	10	41.7%
501-1000	3	12.5%
1001-5000	4	16.7%
5001+	2	8.3%
Total	24	

3. What is the primary truck configuration you operate?

Truck Configuration	Number	Percent
5-axle Dry Van	8	33.3%
5-axle Refrigerated Trailer	5	20.8%
5-axle Flatbed	1	4.2%
5-axle Tanker	6	25.0%
Straight Truck	0	0.0%
Longer Combination Vehicle (Double, Triple, etc.)	2	8.3%
Other (please specify)	2	8.3%
Total	24	

4. What is your average length of haul?

Average Length of Haul	Number	Percent
Local (less than 100 miles per trip)	2	8.3%
Regional -Short/Line Haul (100-499 miles per trip)	11	45.8%
Inter-regional (500-999 miles per trip)	6	25.0%
Long- Haul (1000 or more miles per trip)	5	20.8%
Total	24	

5. How many years have you been driving professionally?

Year Driving	Number	Percent
Less than 1 year	0	0.0%
1-3 years	1	4.2%
4-6 years	4	16.7%
7-15 years	5	20.8%
More than 15 years	14	58.3%
Total	24	

6. On what type of roads do you typically operate?

Road Type	Number of Responses
Limited-access Interstate and similar class highways, $\geq 3+$ lanes in the same direction	22
Limited-access Interstate and similar class highways, 2 lanes in the same direction	24
Undivided rural highways, urban and suburban roads and streets	24

7. Please indicate the departure/arrival times of a typical operation day.

Departure/Arrival Times	Number of Responses
Start early morning and end in the afternoon	20
Start late morning/afternoon and end in the evening	22
Start in the evening and end next day in the morning	19

8. How fixed are your routes?

Fixed Route Status	Number of Responses
Often the same route every day for driver	17
Mixture of new routes and regular routes	20
Very mixed, often new routes	16
Constantly changing routes	18

9. What is the route planning horizon?

Route Planning Horizon	Number of Responses
Route always planned before trip	22
Sometimes change routes while driving	18
Often change routes while driving	16
Specific route is not planned in advance	14

10. Who is responsible for route planning?

Who Plans the Route?	Number of Responses
Driver	22
Carrier / Dispatcher	17
Other	12

11. How frequently are you bound to the planned route?

Driver Bound to Route	Number	Percent
Always	0	0.0%
Mostly	10	45.5%
Sometimes	5	22.7%
Rarely	2	9.1%
Never	5	22.7%
Total	22	

12. How familiar are you with the use of truck adaptive cruise control (ACC)?

How Familiar with ACC	Number	Percentage
Never heard of	3	13.6%
Heard of	12	54.5%
Seen	1	4.5%
Used Once	0	0.0%
Used infrequently	1	4.5%
Used Frequently	5	22.7%
Total	22	

13. How familiar are you with the use of collision warning systems?

How Familiar with Collision Warning	Number	Percentage
Never heard of	1	4.5%
Heard of	11	50.0%
Seen	2	9.1%
Used Once	2	9.1%
Used infrequently	2	9.1%
Used Frequently	4	18.2%
Total	22	

14. Considering an estimated fuel saving of 5-10%, what is the maximum amount per truck you would be willing to pay to purchase this system?

- 4 responses

15. What is the maximum amount per truck you would be willing to pay to operate this system (per year)?

- 2 responses

16. What is the necessary payback / break-even time period you would need from this system?

- 5 responses

17. If a subscription based model were proposed for this system, which of the following would best suit you?

Subscription Type	Number	Percentage
Higher hardware price, with lower subscription fee	2	10.0%
Lower hardware price, with higher subscription fee	1	5.0%
Significantly higher hardware price, with no subscription fee	8	40.0%
Other (please specify)	9	45.0%
Total	20	

*Note: 'Other' write in responses were indicating the respondent would not use the system.

18. What subscription payment structure would you prefer most?

Payment Structure	Number	Percentage
Per-platooned-hour	1	5.9%
Per-platooned-mile	1	5.9%
Per-month	5	29.4%
Per-year	10	58.8%
Total	17	

19. When operating in the vicinity of other platoon-capable trucks, who would you be willing to platoon with? Check all that apply.

Willing to Platoon	Number	Percentage
Other Owner-Operators	3	9.4%
Any Large Fleet	3	9.4%
Specific Fleets with whom you have already partnered	6	18.8%
Your own fleet trucks	12	37.5%
Other (please specify)	8	25.0%
Total	32	

*Note: 'Other' write in responses were indicating the respondent would not use the system.

20. If your truck is in a follower position and saving more energy than the leader truck, how willing would you be to pay a small fee (electronically) to the leader to compensate for part of the difference in energy saving (e.g., a percentage of fuel savings)? (Or, alternatively, to be paid a fee if your truck is in the lead).

WTP Lead Driver	Number	Percent
Very willing	1	4.5%
Somewhat willing	3	13.6%
Neutral	7	31.8%
Not very willing	3	13.6%
Not willing at all	8	36.4%
Total	22	

21. With the assumption of 5-10% potential fuel savings and no additional constraints (hours of service or critical time delivery), how willing would you be to delay your departure time to facilitate platooning?

Willing to Delay	Number	Percent
Very willing	0	0.0%
Somewhat willing	2	9.1%
Neutral	1	4.5%
Not very willing	2	9.1%
Not willing at all	16	72.7%
Total	21	

22. Please rank the following options on how drivers should be trained on this system (1 being most preferred, 5 being least preferred):

Training Type	1st	2nd	3rd	4th	5th
System based self-training on the road	3	3	2	2	7
On-site driver training room	5	3	4	3	0
On-line training	0	3	5	4	1
Driving simulator	6	3	4	1	1
Other	4	0	2	1	6

23. What impact do you think truck platooning will have on driver retention?

Driver Retention Impact	Number	Percentage
Very Positive	0	0.0%
Somewhat Positive	2	9.1%
No Impact	5	22.7%
Somewhat Negative	6	27.3%
Very Negative	9	40.9%
Total	22	

24. How likely do you think drivers are to want to use the technology?

Likelihood to Use	Number	Percentage
Very Likely	0	0.0%
Likely	0	0.0%
Moderately likely	3	13.0%
Unlikely	9	39.1%
Not likely at all	11	47.8%
Total	23	

III. Fleet Management

1. Which sector of the trucking industry do you operate in? (check one)

Sector	Number	Percentage
For-hire	8	61.5%
Private	4	30.8%
Other (please specify)	1	7.7%
Total	13	

2. If you operate in the for-hire sector, what is your primary type of business? (check one)

Sector	Number	Percentage
Truckload	3	37.5%
Less-than-truckload	3	37.5%
Specialized	2	25.0%
Total	8	

3. How many total power units does your fleet operates?

Total Power Units	Number	Percent
0-6	1	7.7%
6-20	1	7.7%
21-50	2	15.4%
51-500	6	46.2%
501-1000	0	0.0%
1001-5000	1	7.7%
5001+	2	15.4%
Total	13	

4. What is the primary truck configuration you operate?

Truck Configuration	Number	Percent
5-axle Dry Van	4	30.8%
5-axle Refrigerated Trailer	1	7.7%
5-axle Flatbed	2	15.4%
5-axle Tanker	0	0.0%
Straight Truck	2	15.4%
Longer Combination Vehicle (Double, Triple, etc.)	2	15.4%
Other (please specify)	2	15.4%
Total	13	

5. What is your average length of haul?

Average Length of Haul	Number	Percent
Local (less than 100 miles per trip)	2	15.4%
Regional -Short/Line Haul (100-499 miles per trip)	7	53.8%
Inter-regional (500-999 miles per trip)	3	23.1%
Long- Haul (1000 or more miles per trip)	1	7.7%
Total	13	

6. On what type of roads do you typically operate?

Road Type	Number of Responses
Limited-access Interstate and similar class highways, $\geq 3+$ lanes in the same direction	13
Limited-access Interstate and similar class highways, 2 lanes in the same direction	13
Undivided rural highways, urban and suburban roads and streets	13

7. Please indicate the departure/arrival times of a typical operation day.

Departure/Arrival Times	Number of Responses
Start early morning and end in the afternoon	13
Start late morning/afternoon and end in the evening	11
Start in the evening and end next day in the morning	12

8. How fixed are your routes?

Fixed Route Status	Number of Responses
Often the same route every day for driver	8
Mixture of new routes and regular routes	12
Very mixed, often new routes	6
Constantly changing routes	6

9. What is the route planning horizon?

Route Planning Horizon	Number of Responses
Route always planned before trip	12
Sometimes change routes while driving	10
Often change routes while driving	4
Specific route is not planned in advance	4

10. Who is responsible for route planning?

Who Plans the Route?	Number of Responses
Driver	10.0
Carrier / Dispatcher	10.0
Other	2.0

11. How frequently is the driver bound to the planned route?

Driver Bound to Route	Number	Percent
Always	2	15.4%
Mostly	7	53.8%
Sometimes	1	7.7%
Rarely	1	7.7%
Never	2	15.4%
Total	13	

12. How familiar are you with the use of truck adaptive cruise control (ACC)?

How Familiar with ACC	Number	Percentage
Never heard of	1	7.7%
Heard of	5	38.5%
Seen	3	23.1%
Used Once	1	7.7%
Used infrequently	2	15.4%
Used Frequently	1	7.7%
Total	13	

13. How familiar are you with the use of collision warning systems?

How Familiar with Collision Warning	Number	Percentage
Never heard of	0	0.0%
Heard of	6	46.2%
Seen	5	38.5%
Used Once	1	7.7%
Used infrequently	1	7.7%
Used Frequently	0	0.0%
Total	13	

14. Considering an estimated fuel saving of 5-10%, what is the maximum amount you would be willing to pay to purchase this system?

- 6 responses

15. What is the maximum amount you would be willing to pay to operate this system (per year)?

- 7 responses

16. What is the necessary payback / break-even time period you would need from this system?

- 7 responses

17. If a subscription based model were proposed for this system, which of the following would best suit you?

Subscription Type	Number	Percentage
Higher hardware price, with lower subscription fee	4	30.8%
Lower hardware price, with higher subscription fee	3	23.1%
Significantly higher hardware price, with no subscription fee	5	38.5%
Other (please specify)	1	7.7%
Total	13	

*Note: 'Other' write in responses were indicating the respondent would not use the system.

18. What subscription payment structure do you prefer most?

Payment Structure	Number	Percentage
Per-platooned-hour	1	8.3%
Per-platooned-mile	6	50.0%
Per-month	5	41.7%
Per-year	0	0.0%
Total	12	

19. When operating in the vicinity of other platoon-capable trucks, who would you be willing to platoon with? Check all that apply?

Willing to Platoon	Number	Percentage
Other Owner-Operators	1	4.5%
Any Large Fleet	6	27.3%
Specific Fleets with whom you have already partnered	4	18.2%
Your own fleet trucks	10	45.5%
Other (please specify)	1	4.5%
Total	22	

*Note: 'Other' write in responses were indicating the respondent would not use the system.

20. If your truck is in a follower position and saving more energy than the leader truck, how willing would you be to pay a small fee (electronically) to the leader to compensate for part of the difference in energy saving (e.g., a percentage of fuel savings)? (Or, alternatively, to be paid a fee if your truck is in the lead).

WTP Lead Driver	Number	Percent
Very willing	0	0.0%
Somewhat willing	4	30.8%
Neutral	4	30.8%
Not very willing	3	23.1%
Not willing at all	2	15.4%
Total	13	

21. With the assumption of 5-10% potential fuel savings and no additional constraints (hours of service or critical time delivery), how willing would you be to delay your departure time to facilitate platooning?

Willing to Delay	Number	Percent
Very willing	0	0.0%
Somewhat willing	3	23.1%
Neutral	3	23.1%
Not very willing	4	30.8%
Not willing at all	3	23.1%
Total	13	

22. Please rank the following options on how drivers should be trained on this system (1 being most preferred, 5 being least preferred):

Training Type	Number Ranked				
	1st	2nd	3rd	4th	5th
System based self-training on the road	1	1	4	2	4
On-site driver training room	5	5	2	0	0
On-line training	2	1	2	4	1
Driving simulator	2	2	1	3	2
Other	1	0	1	0	3

23. What impact do you think truck platooning will have on driver retention?

Driver Retention Impact	Number	Percentage
Very Positive	1	7.7%
Somewhat Positive	1	7.7%
No Impact	5	38.5%
Somewhat Negative	5	38.5%
Very Negative	1	7.7%
Total	13	

24. How likely do you think drivers are to want to use the technology?

Likeliness to Use	Number	Percentage
Very Likely	2	15.4%
Likely	1	7.7%
Moderately likely	2	15.4%
Unlikely	7	53.8%
Not likely at all	1	7.7%
Total	13	

Appendix C – Results of Southern California Survey

Identifying Industry Needs for Truck Platooning: Technology and Cost/Benefits Survey Results

PURPOSE:

Identify how truck fleets could potentially make use of truck platooning and what constraints to adoption may exist.

METHOD:

An online survey was used to collect feedback and perspectives from various stakeholders in the Southern California area. This was supplemented by a printed version of the survey that could be distributed to respondents in situations where the online survey might be impractical to distribute. Additionally, an incentive program was established to encourage participants to provide thoughtful feedback and thorough responses; specifically, all respondents who returned a completed survey (either online or in printed form) that reflected a good faith effort to provide useful and honest feedback were eligible to receive a \$15 Amazon gift card if their responses were received by the closing date. The survey was formally opened on January 5, 2015, and closed a month later, on February 5.

AUDIENCE:

This survey was distributed chiefly to members of the Harbor Trucking Association (HTA). The digital survey was publicized via several emails to the association mailing list throughout January 2015 from HTA President Mike Johnson. These email announcements briefly introduced the survey and its purpose, and also mentioned the incentive program to encourage respondents to participate.

Furthermore, the consulting team sent a representative to the HTA meeting on the evening of January 28, 2015, to promote the survey and encourage attendees to participate. At this event, the representative distributed and collected several printed surveys to audience members before and after the meeting, gave a five-minute presentation about the survey and its significance during the meeting agenda, and distributed dozens of fliers to introduce the concept of truck platooning and to highlight the importance of the survey to them. A copy of this flier is included on the following page for reference.

RESULTS:

A total of 17 responses (11 online surveys and 6 hard copies) were collected between January 5 and February 5, 2015. The remainder of this memo summarizes the results, including:

- ❑ The precise wording of the question.
- ❑ A chart summarizing the responses collected, whenever relevant.
- ❑ A data table providing details about individual responses, when such a table provided additional insights beyond those conveyed by the summary chart alone.
- ❑ Notes about the question or responses, whenever appropriate.
- ❑ Interpretive comments and insights based on the responses.

Truck Platooning

and the proposed I-710 Freight Corridor

PLATOONING BASICS

A **platoon** is a series of trucks following each other on the road, with acceleration and braking controlled automatically (steering is still manual). When any truck's speed changes, the others behind it are instantly notified wirelessly, and those trucks respond immediately by braking or accelerating. This allows for much closer following distances, which reduces wind resistance and increases the number of trucks that can fit on the road at high speeds, thereby increasing roadway capacity.



Large gaps are needed to ensure the following driver has enough time to react.



Automatic control means shorter gaps are possible without compromising safety.

BENEFITS



Less Congestion

Capacity improvements result in less delays and better travel time reliability.



Cost Savings

Typical fuel savings average 5-10% for all trucks when platooning.



Improved Safety

Automated control of braking and accelerating reduces crash frequency and severity.



Enhanced Driver Comfort

Platooning technology takes much of the stress out of stop-and-go driving.

I-710 FREIGHT CORRIDOR

A dedicated four-lane freight corridor parallel to the 710 freeway is currently proposed as part of the Gateway Cities Strategic Transportation Plan. Caltrans estimates that this 18-mile truck-only facility would be completed by 2025. Key characteristics of the proposed system are indicated below.

Cars prohibited (they must use the existing freeway).

Trucks use automated driving technologies, including truck platooning.

Vehicle-to-
roadside
communications

Dedicated
four-lane
roadway

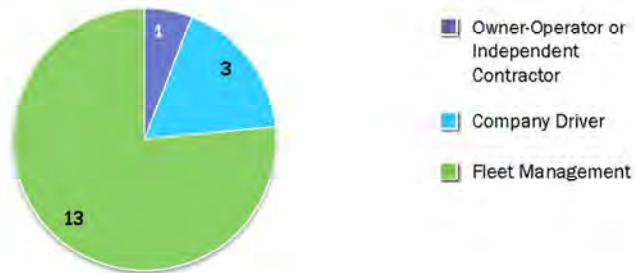


Your feedback is crucial to providing the most relevant and useful I-710 freight corridor possible.

Visit https://www.surveymonkey.com/s/hta_platooning to fill out a survey today (takes approx. 10-15 minutes)

QUESTION:

What is your primary role?

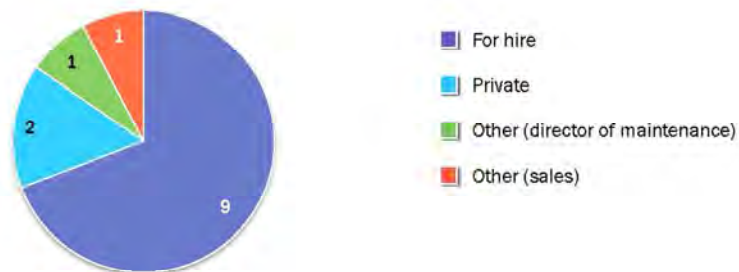


DETAILS:

Respondents identifying themselves as Owner-Operators or Independent Contractors were asked a follow-up question to more precisely define their roles. Specifically, they were presented with the following alternatives, and asked to select one. The results to this question are shown in parentheses.

- Owner-operator with own authority (1 response)
- Leased owner-operator or independent contractor (No responses)

Fleet Management respondents were also asked a follow-up question to more precisely define their roles. The results of this additional question are shown below. As before, respondents were only allowed to select one category.

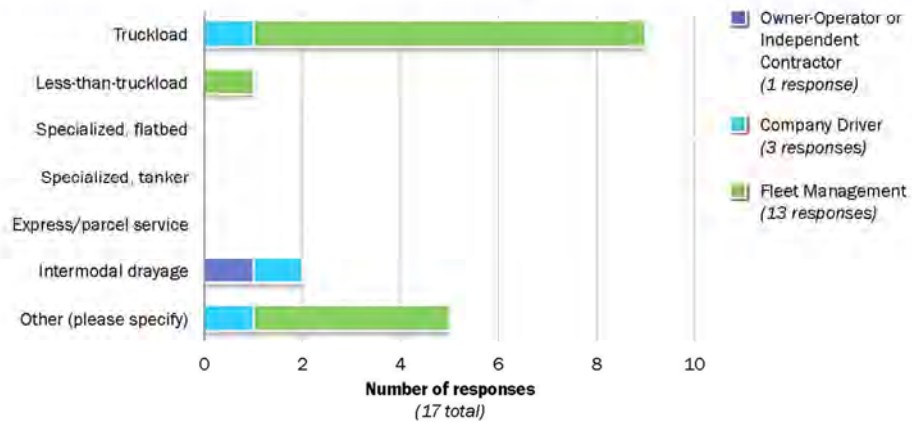


COMMENTS:

As this survey was primarily distributed to the Harbor Trucking Association (HTA) membership, it is expected that the responses would reflect a high concentration of fleet management roles relative to the other two types.

QUESTION:

Which sector of the trucking industry do you primarily operate in? (select one)



DETAILS:

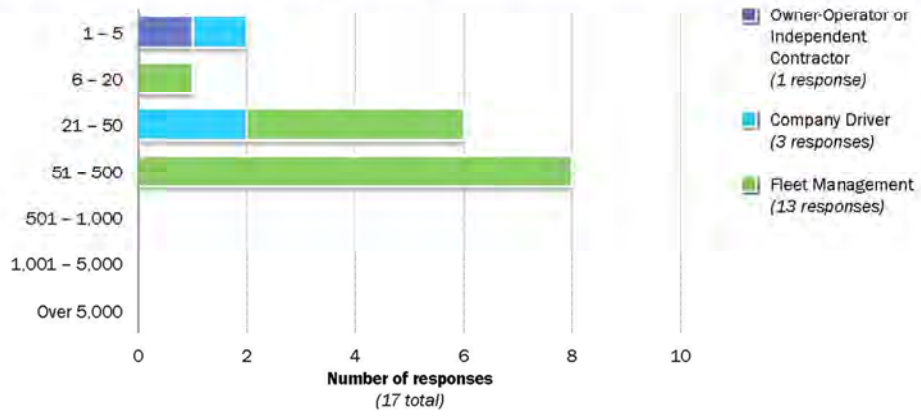
For those that selected "other," the responses by role were:

- Company Drivers:
 - "All except less-than-truckload and express/parcel service"
- Fleet Management:
 - "Intermodal and less-than-truckload"
 - "Drayage – ports of LA/LB and Oakland"
 - "Drayage"
 - "Intermodal"

COMMENTS:

Because respondents were largely oriented toward trips from the ports, it is not surprising that there is an emphasis on five-axle dry van and intermodal/drayage trips. Note that the "other" responses reflect combinations or generalizations of the listed configurations, rather than entirely new types.

QUESTION:
How many total power units does your fleet operate?

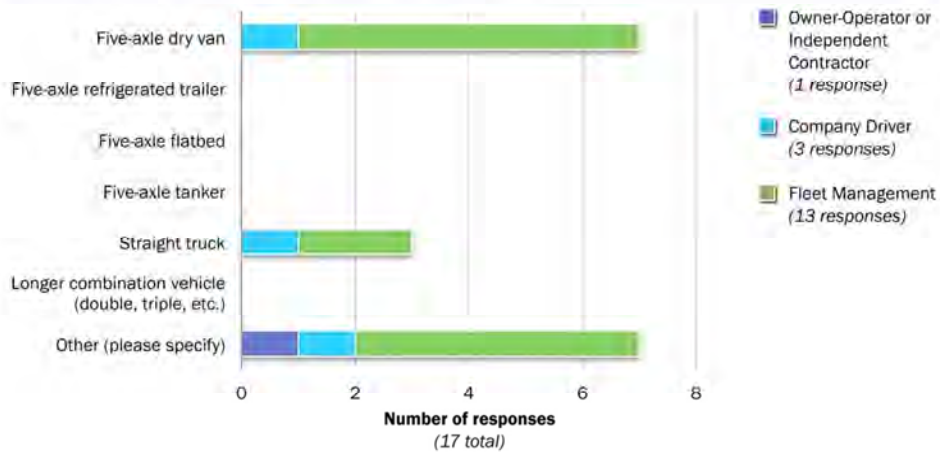


COMMENTS:

One respondent commented (casually, in a conversation) that the HTA audience is composed of a small handful of very large fleets, and a much large number of smaller fleets, which this person informally defined as being less than 100 power units. These results reflect that distribution expectation.

QUESTION:

What is the primary truck configuration you operate? (select one)



DETAILS:

For those that selected "other," the responses by role were:

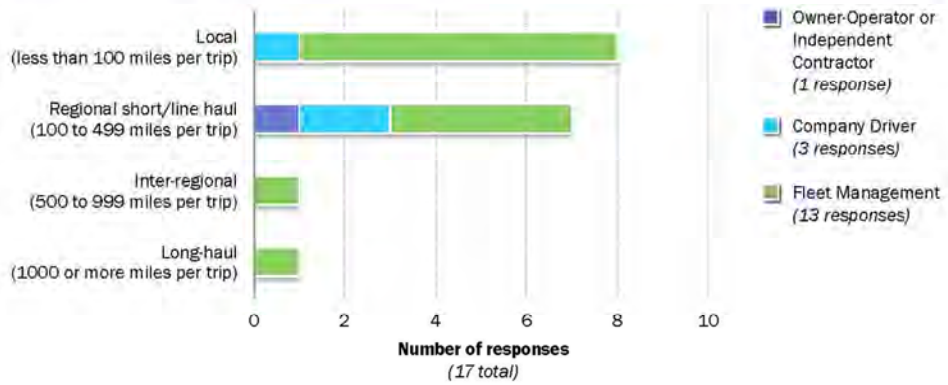
- Owner-Operators or Independent Contractors:
 - "Tractor semi trailer"
- Company Drivers:
 - "Five-axe flatbed or tanker"
- Fleet Management:
 - "All types, except tanker."
 - "Five-axe dry van and five-axe refrigerated trailer"
 - "Container, and five-axe dry van"
 - "Five axle container"
 - "Tractor and intermodal container unit"

COMMENTS:

Because respondents were largely oriented toward intermodal/drillage trips from the ports, it is not surprising that there is an emphasis on five-axe dry van and straight truck configurations. Note that the "other" responses largely reflect combinations of the listed configurations, rather than entirely new types.

QUESTION:

What is your average length of haul? (*select one*)

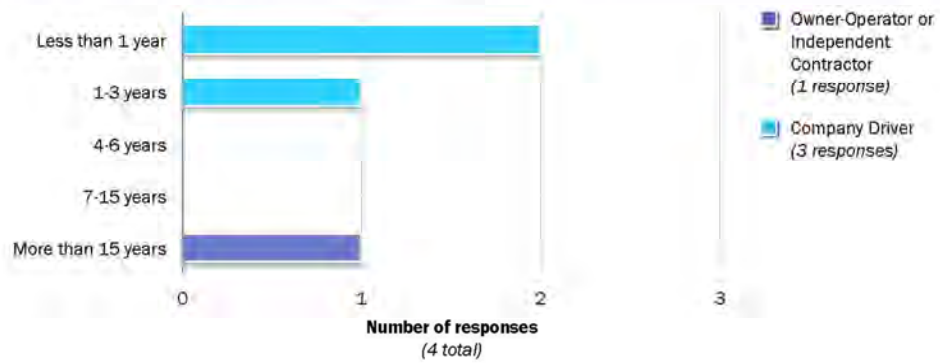


COMMENTS:

Because the surveyed audience was largely oriented toward intermodal/drayage trips from the ports, it is expected that trip lengths would show a greater emphasis on shorter distances.

QUESTION:

How many years have you been driving professionally?



NOTES:

This question was not asked of fleet managers.

COMMENTS:

Potential respondents that did not have at least a couple months of professional driving experience were not allowed to take the survey, as they would not have had sufficient background to answer many of the later questions (e.g., typical breakdown of annual mileage by roadway type).

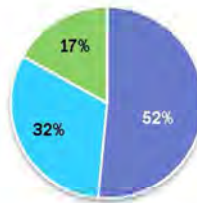
QUESTION:

What percent of your annual mileage occurs on each type of road?

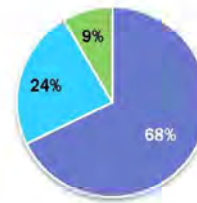
Owner-Operators or Independent Contractors
(1 response)



Company Drivers
(2 responses)



Fleet Managers
(10 responses)



- Limited-access Interstate and similar-class highways, with three or more lanes in the same direction.
- Limited-access Interstate and similar-class highways, with two lanes in the same direction.
- Undivided rural highways, urban, and suburban roads and streets.

DATA TABLE:

Respondent type	Percent of workdays by schedule type		
	80%	18%	2%
Owner-Operator or Independent Contractor	80	18	2
Company Driver	70	30	0
Company Driver	34	33	33
Fleet Management	90	10	0
Fleet Management	50	50	0
Fleet Management	80	10	10

Respondent type	Percent of workdays by schedule type		
	45%	45%	10%
Fleet Management	78	17	5
Fleet Management	60	30	10
Fleet Management	50	45	5
Fleet Management	75	25	0
Fleet Management	50	5	45
Fleet Management	100	0	0

NOTES:

If any respondent's answers did not sum to 100%, those answers were rescaled to satisfy this condition.

COMMENTS:

For all respondents, higher-capacity freeways built to Interstate standards were the most common roadway type used. With one exception in the Fleet Management respondent category, the second most common roadway type used was lower-capacity freeways built to Interstate standards. This result is intuitive, as higher roadway classes and capacities are typically greater trip attractors than their lower capacity counterparts.

QUESTION:

What percent of your workdays follow each of the following schedules, regarding departure and arrival times?

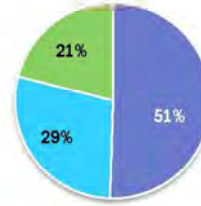
Owner-Operators or Independent Contractors
(1 response)



Company Drivers
(2 responses)



Fleet Managers
(11 responses)



- Start early in the morning, and end in the afternoon.
- Start in the late morning/early afternoon, and end in the evening.
- Start in the evening, and end in the morning of the following day.

DATA TABLE:

Respondent type	Percent of workdays by schedule type		
Owner-Operator or Independent Contractor	60	35	5
Company Driver	80	20	0
Company Driver	34	33	33
Fleet Management	100	0	0
Fleet Management	50	50	0
Fleet Management	10	20	70
Fleet Management	70	10	20

Respondent type	Percent of workdays by schedule type		
Fleet Management	50	50	0
Fleet Management	25	0	75
Fleet Management	50	40	10
Fleet Management	50	40	10
Fleet Management	50	25	25
Fleet Management	50	50	0
Fleet Management	50	0	50

NOTES:

If any respondent's answers did not sum to 100%, those answers were rescaled to satisfy this condition.

COMMENTS:

For most respondent types, the typical morning-to-afternoon work schedule was most common, followed by a similar schedule shifted a few hours later in the day, and finally an overnight work schedule (least common). However, two of the 11 Fleet Management respondents indicated that overnight work schedules were in fact their most common types, and for another two respondents (one Fleet Management respondent and one company driver), an overnight schedule was just as likely as a typical morning-to-afternoon schedule.

QUESTION:
How fixed are your routes?

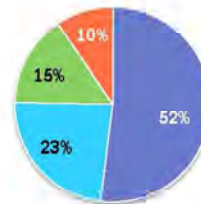
Owner-Operators or Independent Contractors
(1 response)



Company Drivers
(2 responses)



Fleet Managers
(11 responses)



- Often the same routes every day for each driver.
- Combination of new routes and regular routes.
- Very mixed, often new routes
- Constantly changing routes

DATA TABLE:

Respondent type	Percent of routes by consistency			
	Often the same routes every day for each driver	Combination of new routes and regular routes	Very mixed, often new routes	Constantly changing routes
Owner-Operator or Independent Contractor	100	0	0	0
Company Driver	80	20	0	0
Company Driver	0	0	100	0
Fleet Management	50	25	25	0
Fleet Management	25	25	25	25
Fleet Management	0	30	30	40
Fleet Management	100	0	0	0

Respondent type	Percent of routes by consistency			
	Often the same routes every day for each driver	Combination of new routes and regular routes	Very mixed, often new routes	Constantly changing routes
Fleet Management	75	25	0	0
Fleet Management	65	35	0	0
Fleet Management	35	15	25	25
Fleet Management	30	45	20	5
Fleet Management	90	8	2	0
Fleet Management	50	25	25	0
Fleet Management	0	0	50	50

NOTES:

If any respondent's answers did not sum to 100%, those answers were rescaled to satisfy this condition.

COMMENTS:

For most respondents, the greatest proportion of their routes (50% across all respondents) were described as being relatively consistent from day to day, with the remaining 50% of routes described as changing over time to varying degrees: 20% of their routes on average were reported to be a mix of new and regular routes, another 20% on average were reported to have a moderate bias toward new routes, and the remaining 10% were reported to be in constant flux with little consistency across days.

QUESTION:
What percent of trips use each type of route planning?

Owner-Operators or Independent Contractors
(1 response)



Company Drivers
(2 responses)



Fleet Managers
(11 responses)



- Route planned before trip, with no en-route changes.
- Route planned before trip, with occasional en-route changes.
- Route planned before trip, with frequent en-route changes.
- No route is planned before trip.

DATA TABLE:

Respondent type	Percent of routes by consistency			
	96%	4%	0%	0%
Owner-Operator or Independent Contractor	96	4	0	0
Company Driver	0	0	0	100
Company Driver	0	80	0	20
Fleet Management	95	5	0	0
Fleet Management	33	33	34	0
Fleet Management	80	20	0	0
Fleet Management	0	0	0	100

Respondent type	Percent of routes by consistency			
	90%	10%	0%	0%
Fleet Management	90	10	0	0
Fleet Management	90	10	0	0
Fleet Management	59	18	14	9
Fleet Management	10	70	10	10
Fleet Management	90	5	5	0
Fleet Management	25	25	25	25
Fleet Management	0	0	0	100

NOTES:

If any respondent's answers did not sum to 100%, those answers were rescaled to satisfy this condition.

COMMENTS:

Although company drivers reported having none of their trips rigidly planned ahead of time, these trip types were the majority for the remaining two roles: fleet management and owner-operators/independent contractors. However, the individual responses show a high degree of variability, with three of the 14 respondents indicating that no routes are planned in advance, five of the respondents indicating that at least 90% of their routes are planned in advance with no changes occurring, and four of the respondents indicating that at least half of their trips were planned in advance with en-route changes occurring.

QUESTION:

For routes that are planned in advance, what percentage are planned... (see answer choices)

Owner-Operators or Independent Contractors
(1 response)



Company Drivers
(1 response)



Fleet Managers
(10 responses)



- ...weeks ahead of time.
- ...days ahead of time.
- ...hours ahead of time.
- ...only minutes ahead of time.

DATA TABLE:

Respondent type	Percent of routes by consistency			
	Weeks	Days	Hours	Minutes
Owner-Operator or Independent Contractor	0	0	0	100
Company Driver	0	0	0	100
Fleet Management	0	50	50	0
Fleet Management	0	25	75	0
Fleet Management	0	70	30	0
Fleet Management	0	0	0	100

Respondent type	Percent of routes by consistency			
	Weeks	Days	Hours	Minutes
Fleet Management	10	90	0	0
Fleet Management	0	100	0	0
Fleet Management	44	22	17	17
Fleet Management	5	60	30	5
Fleet Management	0	50	50	0
Fleet Management	0	25	75	0

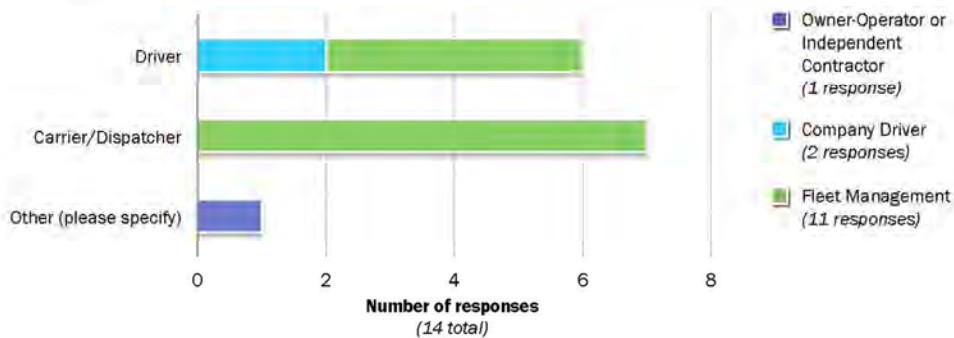
NOTES:

If any respondent's answers did not sum to 100%, those answers were rescaled to satisfy this condition.

COMMENTS:

All owner-operator, independent contractor, and company driver respondents (two total) indicated that all of their trips are planned at the time of the trip itself, while the same was true of only one of the 10 fleet management respondents. Across all roles, 5% of trips were reported to be planned weeks ahead of time, 41% were reported to be planned days in advance, 27% were planned hours in advance, and the remaining 27% were planned at the time of the trip.

QUESTION:
Who is responsible for route planning? (select one)

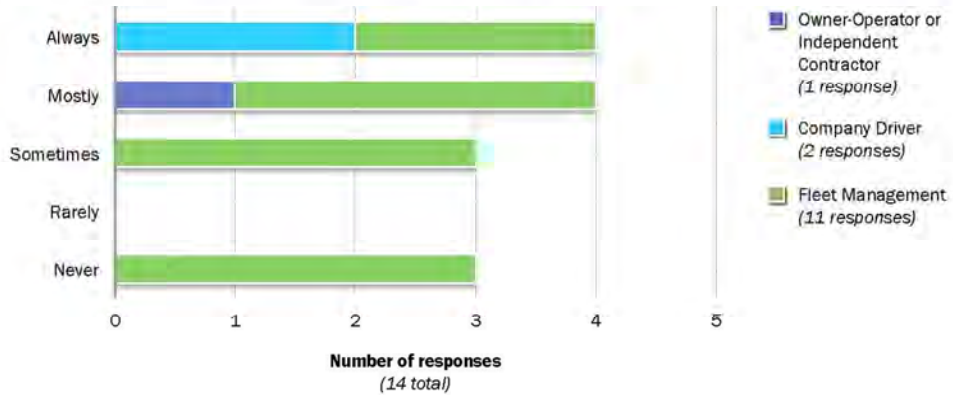


DETAILS:
For those that selected "other," the responses were:
■ "Owner operator"

COMMENTS:
While all company drivers reported being responsible for their own route planning, the majority of fleet management respondents indicated that the carrier or dispatcher was responsible for this function. Overall, there was an approximate balance between the assignment of route planning responsibility to either drivers or carriers/dispatchers—and this becomes a perfectly even split if the solitary "other" response is considered a form of driver-side route planning.

QUESTION:

How frequently is the driver bound to the planned route?

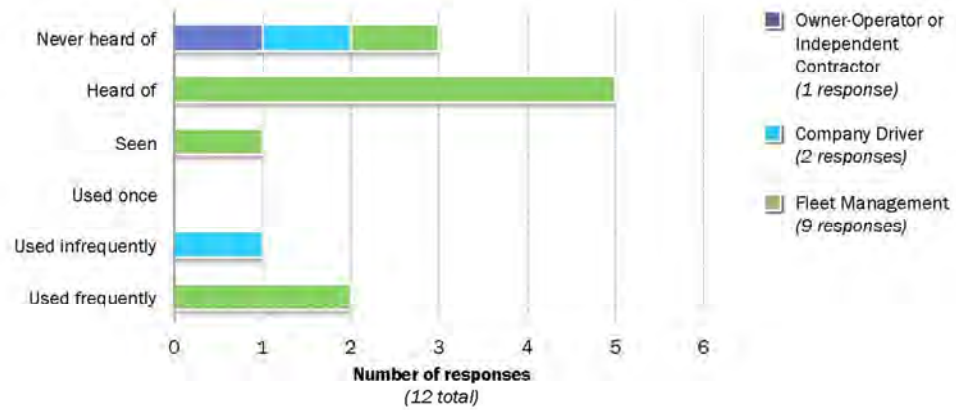


COMMENTS:

All company drivers reported being constrained to their planned routes, despite also reporting that an average of 40% of their trips involve occasional en-route changes (see earlier question about route planning). This may imply that alternate routes are also planned in advance, and that company drivers are merely selecting a different pre-planned alternative en route 40% of the time. Fleet management respondents, on the other hand, showed a wide range of flexibility regarding planned routes, with some indicating that drivers are never constrained to follow planned routes, and others indicating that drivers are always expected to do so.

QUESTION:

How familiar are you with the use of truck adaptive cruise control (ACC)? *(select one)*

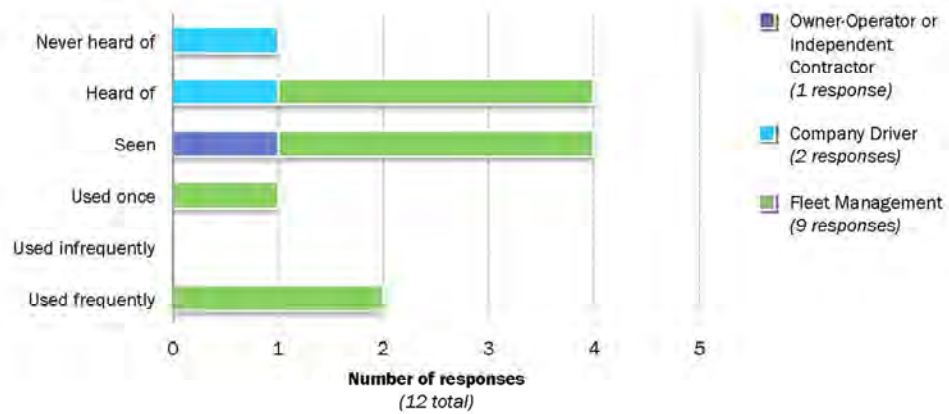


COMMENTS:

One fourth of respondents indicated having experience using ACC, just as many reported having never heard of the technology before, and the remaining 50% indicated that they had heard of the technology (and in one case, seen it in action) but had never used it.

QUESTION:

How familiar are you with the use of collision warning systems? (*select one*)



COMMENTS:

As with the responses about ACC, one fourth of respondents indicated experience using collision warning systems (though these were not the same three respondents who had indicated firsthand experience with ACC). However, respondents revealed a greater overall familiarity with collision warning systems relative to ACC, as only one respondent (a company driver) out of 12 had never heard of such systems before.

QUESTION:

Assuming an estimated fuel savings of 5-10%, what is the maximum amount per truck you would be willing to pay to purchase a system that would provide ACC, collision warnings, and truck platooning capabilities?



DATA TABLE:

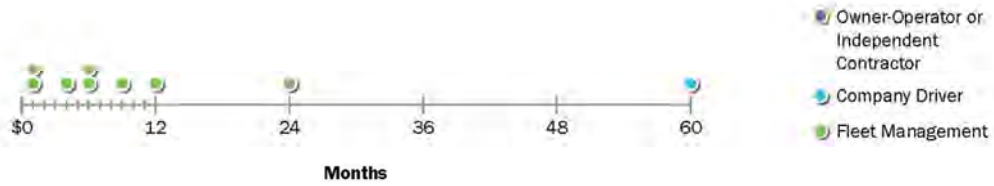
Respondent type	One-time cost per truck (maximum)	Annual subscription cost per truck (maximum)	Maximum payback period (in months)
Owner-Operator or Independent Contractor	\$0	\$0	No response
Company Driver	1,000	\$1,000	60
Company Driver	\$0	\$0	No response
Fleet Management	\$500	\$500	6
Fleet Management	\$3,000	\$300	6
Fleet Management	\$1,000	\$40	1
Fleet Management	\$3,000	\$3,000	4
Fleet Management	\$250	\$300	24
Fleet Management	\$5,000	\$1	9
Fleet Management	\$100	\$100	1
Fleet Management	\$100	\$100	12

COMMENTS:

As revealed in the above data table, which shows individual responses for this question and the following two questions, respondents that were willing to pay a higher up-front cost per truck for the technology were also generally more willing to pay a higher recurring subscription cost, and vice versa. However, three fleet management respondents went against this trend by indicating a willingness to pay between \$1,000 and \$5,000 per truck up front, while simultaneously indicating that they would only pay an average of \$114 annually for a subscription. The average willingness-to-pay to purchase the system (one-time initial cost) across all role types was \$1,268.

QUESTION:

What is the necessary payback or break-even time period you would need from this system?



NOTES:

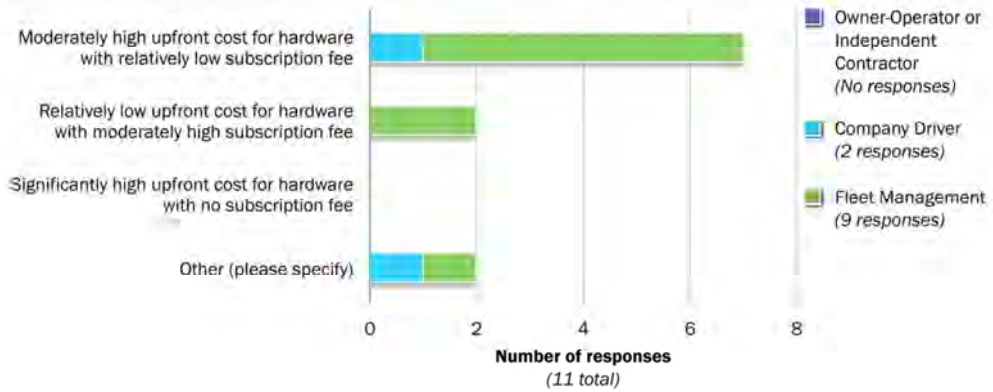
There were no responses to this question from Owner-Operator or Independent Contractor respondents.

COMMENTS:

The average upper-limit on payback period across all respondents was 14 months, though only two respondents indicated a willingness to wait over a year for the system to have paid for itself. By respondent type, however, a clear divergence in response patterns is seen: while the maximum acceptable payback period for fleet managers was 8 months on average, the maximum for company drivers (with only one respondent) was 60 months.

QUESTION:

If a subscription-based model were proposed for this system, which of the following would best suit you?



DETAILS:

For those that selected "other," the responses by role were:

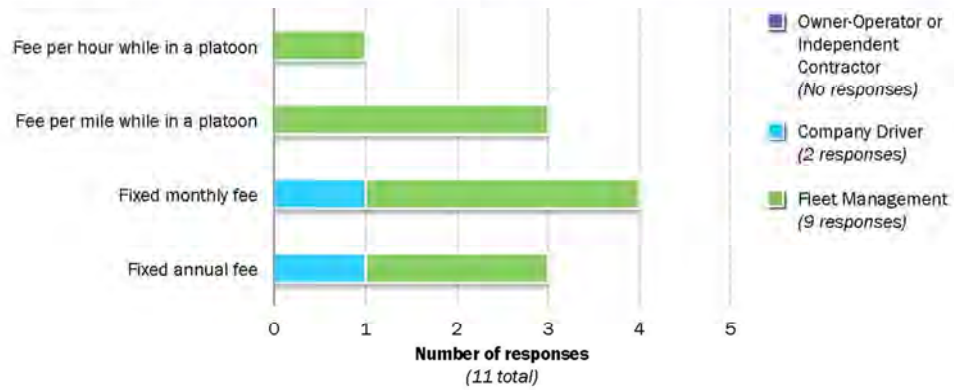
- Company Drivers:
 - "Not interested"
- Fleet Management:
 - "I see very little application in our operation"

COMMENTS:

Two of the 11 respondents (one company driver and one fleet management respondent) indicated an unwillingness to entertain the idea of a platooning system at all, while the others strongly favored a payment model involving a moderately high up-front cost and a relatively low recurring/subscription cost. This finding is consistent with the responses to the previous questions. None of the respondents indicated a preference for paying all costs up front (i.e., no subscription fee).

QUESTION:

What subscription payment structure would you prefer? *(select one)*

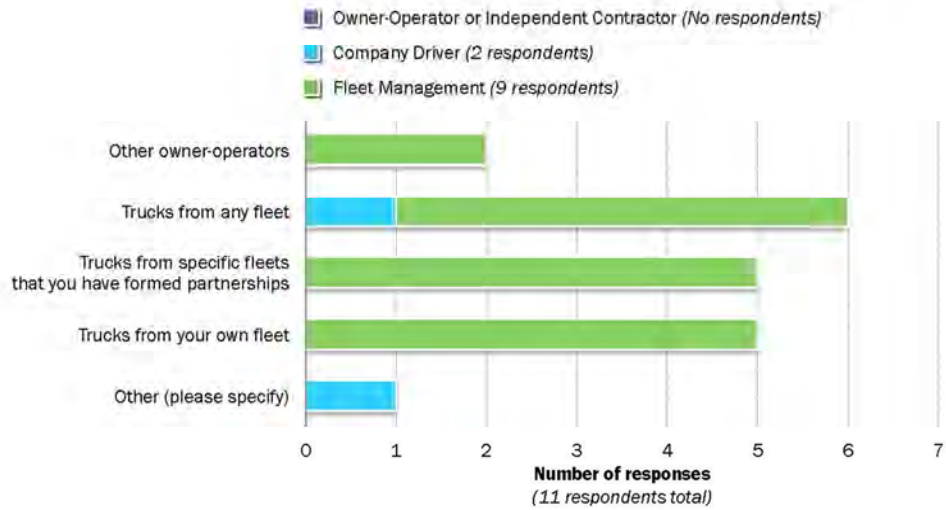


COMMENTS:

Company driver respondents showed a preference for fixed fees, while fleet manager responses spanned all payment structure options (i.e., fixed fee structure vs. pay-as-you-go arrangement) to approximately the same degree.

QUESTION:

When operating near other platoon-capable trucks, whom would you be willing to form platoons with? *(select all that apply)*



DATA TABLE:

Respondent type	Willingness to platoon with...				
	Other owner-operators	Trucks from any fleet	Trucks from partner fleets	Trucks from own fleet	Other (specify)
Company Driver		✓			
Company Driver					✓
Fleet Management				✓	
Fleet Management		✓			
Fleet Management			✓	✓	
Fleet Management			✓		
Fleet Management	✓	✓	✓	✓	
Fleet Management		✓			
Fleet Management	✓	✓	✓	✓	
Fleet Management		✓			
Fleet Management			✓	✓	

DETAILS:

For those that selected "other," the responses were:

- "None"

NOTES:

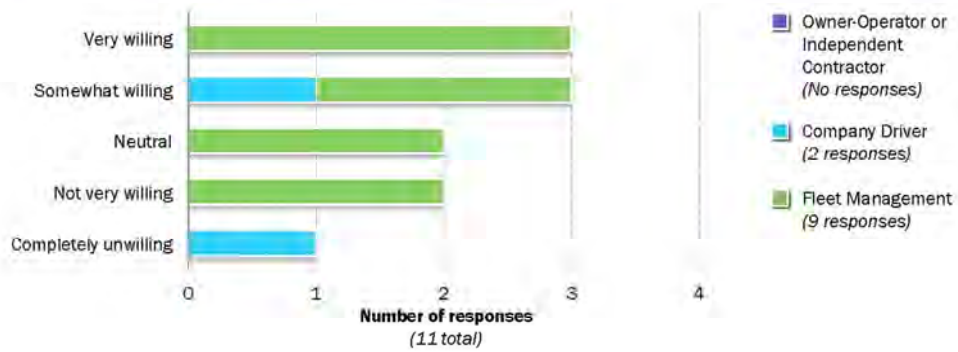
Because respondents were allowed to select multiple responses for this question, the number of responses may exceed the number of respondents.

COMMENTS:

Only one respondent (a company driver) indicated a complete unwillingness to platoon with other truck drivers by selecting none of the available options (this respondent even used the "other" field to explicitly state "none"). All other respondents (10 out of 11) selected at least one of the answer options. In two cases, respondents provided somewhat redundant answers by selecting "trucks from any fleet" and subsequently selecting "trucks from specific fleets..." and "trucks from your own fleet" as well.

QUESTION:

If your truck is in a follower position and saving more energy than the leader truck, how willing would you be to pay a small fee (electronically) to the leader to compensate for part of the difference in energy saving (e.g., a percentage of fuel savings)? (Or, alternatively, to be paid a fee if your truck is in the lead).

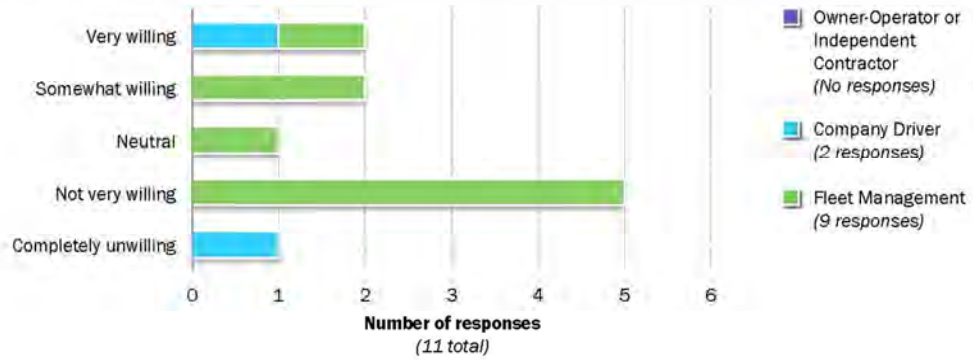


COMMENTS:

The respondent who indicated a complete unwillingness to compensate the lead truck was the same respondent who indicated an unwillingness to platoon with anyone in the previous question. Both of the fleet management respondents who indicated that they would be “not very willing” to compensate the lead truck had previously indicated that they would only platoon with trucks of their own fleet, or with other fleets that they had established partnerships with in advance. Thus, it is possible that such compensation would have been accounted for in some way as part of the arranged partnerships, which could explain their responses here.

QUESTION:

Assuming a 5-10% fuel savings while platooned, and no schedule constraints regarding hours of service or critical time delivery, how willing would you be to delay your departure time to facilitate platooning?

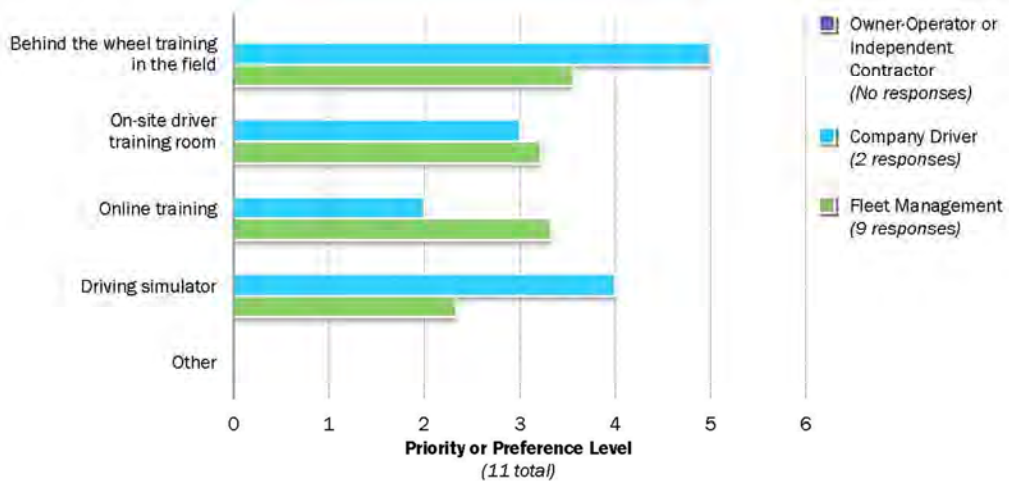


COMMENTS:

Only one respondent (a company driver) indicated a complete unwillingness to adjust departure times to accommodate platooning; this was the same respondent who also indicated a complete unwillingness to platoon with anyone in a previous question. Overall, respondents showed a reduced willingness to adjust departure times to accommodate truck platooning, relative to their willingness to compensate lead trucks and their willingness to platoon with other trucks in general. This reflects a sentiment expressed by one fleet management respondent in the "comments" section at the end of the survey, who wrote that truck platooning may not be widely appealing to users of I-710 because "they are very competitive getting to their locations as soon as possible."

QUESTION:

Please rank the following training methods for truck platooning systems.



DATA TABLE:

Training Method	Number of responses by ranking					Not applicable	
	Top choice	Second choice	Third choice	Fourth choice	Fifth choice		
Company Driver	Behind the wheel training in the field	2	0	0	0	0	0
	On-site driver training room	0	0	2	0	0	0
	Online training	0	0	0	2	0	0
	Driving simulator	0	2	0	0	0	0
	Other (please specify)	0	0	0	0	0	2
Fleet Management	Behind the wheel training in the field	4	1	2	1	0	1
	On-site driver training room	2	3	1	2	0	1
	Online training	1	4	3	0	0	1
	Driving simulator	2	0	1	4	0	2
	Other (please specify)	0	0	0	0	0	9

NOTES:

Respondents were asked to rank the four answer choices and the "other" category (if applicable) on a numeric scale. Respondents also had the ability to mark any answer choice as "not applicable," meaning that it was excluded from the ranking for that respondent. Each answer choice was required to receive a unique ranking by the respondent; that is, "ties" were not allowed.

The above chart provides a unitless horizontal scale to indicate the relative levels of preference or priority for each of the answer choices. Preference levels were quantified by assigning a value of 5 to each respondent's top choice, a value of 4 to the respondent's second-highest choice, and so on. If any choice was marked as "not applicable" by the respondent, it was assigned a value of zero. The results were then aggregated and averaged across all respondents by role to produce the chart above.

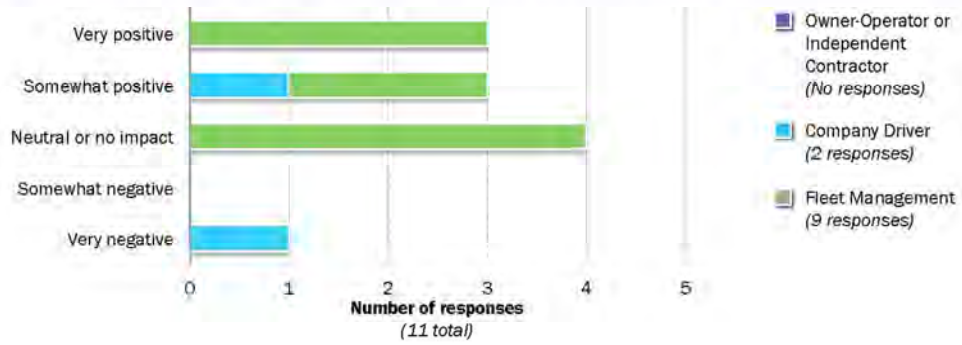
COMMENTS:

One fleet management respondent identified both behind-the-wheel training and the driving simulator as being unsuitable for truck platooning, while another fleet management respondent answered that on-site driver training, online training, and a driving simulator were all irrelevant. The remaining nine respondents considered all four methods of training as valid for truck platooning. Overall, the methods ranked from highest choice to lowest are:

1. Behind-the-wheel training in the field.
2. On-site driver training room.
3. Online training.
4. Driving simulator.

QUESTION:

What impact do you think truck platooning will have on driver retention?

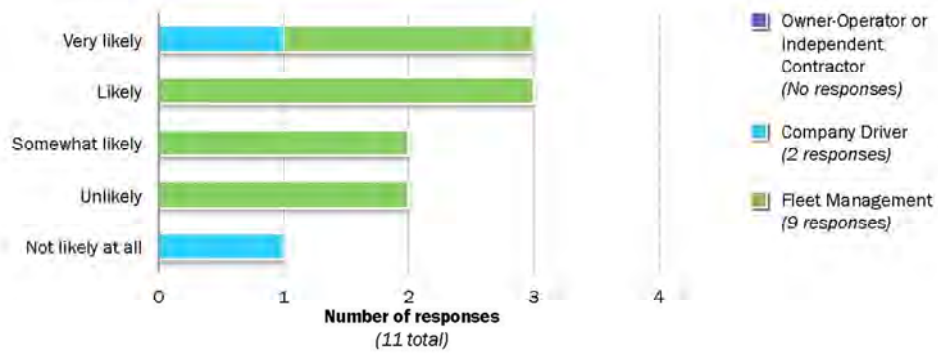


COMMENTS:

Only one respondent (a company driver) took a negative position on the impact of truck platooning on driver retention; this was the same respondent who earlier indicated a complete unwillingness to platoon with other trucks, and was a respondent who had never heard of ACC and had never used collision warning systems. The majority (53%) of respondents predicted that truck platooning would have a positive impact on driver retention.

QUESTION:

How likely do you think drivers will be to use truck platooning technology?



COMMENTS:

Three respondents expressed considerable doubt that truck platooning technology would be embraced by drivers, with one respondent indicating that rejection was a near certainty; this was the same respondent who predicted a very negative impact of truck platooning on driver retention in the previous question. A majority (55%) of respondents predicted that truck platooning technology was likely or very likely to be adopted by drivers. These were the same six respondents who expressed an expectation that truck platooning technology would have a positive impact on driver retention in the previous question.

QUESTION:

Please provide any additional comments or thoughts about the survey questions or truck platooning in general.

The open-ended responses by role were:

- **Company Drivers:**
 - "Don't like the idea of truck platooning."
- **Fleet Management:**
 - "Most drivers on the 710 South leading to the terminals are owner-operators. This will not help them due to the fact that they are very competitive getting to their locations ASAP. Furthermore, congestion on this section of the freeway is commonly from passenger vehicles. Other alternatives are used."
 - "The short haul nature of the business we handle and the sporadic destinations makes it difficult to envision an application for our business model."