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DRIVERS ASSESSMENT OF HIGH SPEED AVI/WIM SYSTEM AT A WEIGH STATION IN ILLINOIS

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A study report on

**Evaluation of Automatic Vehicle Identification
in a Weigh-in-Motion System for CVO-IHR 028**

Prepared for

The Illinois Department of Transportation

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16. Abstract This study analyzed truck drivers' opinions about application of intelligent transportation systems (ITS) technologies to commercial vehicle operations (CVO). As part of the evaluation of Automatic Vehicle Identification (AVI) and Weigh-In-Motion (WIM) systems at the Williamsville weigh station in Illinois, a survey of the participating truck drivers was conducted. The survey consisted of 37 questions inquiring about the driver's professional background, weigh station experience, and opinions about the AVI/WIM system. The majority of the drivers (86%) had schedules where time was important, and delays greater than 30 minutes were intolerable. For three-quarters of the drivers, time was "critical" or "very important." Eighty four percent of drivers said the AVI/WIM system benefits them by reducing trip delay. In addition, about 91% of drivers thought the AVI transponder system reduces the hazards of merging and diverging at weigh stations. The hazard level at weigh station entrances and exits were not significantly different than the hazard level at regular exit or entrance ramps. Some of the participating drivers experienced some frustration in using the system because they felt that the system simply did not work for them all the time. Although the drivers generally favored the adoption of the AVI system, slightly less than half were willing to pay up to one dollar. Eighty-eight percent of the drivers advocated the installation of AVI transponder systems at all Illinois weigh stations, and 88% wished to continue using the AVI transponder system.			
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1. INTRODUCTION

As part of the evaluation of Automatic Vehicle Identification (AVI) and Weigh-In-Motion (WIM) systems at the Williamsville weigh station, a survey was conducted among professional truck drivers. The intent of this survey was to examine the opinions and thoughts on the system by its primary users, and to find areas where the system could be improved. The Illinois Department of Transportation (IDOT) in cooperation with the Amtech Systems Corporation (Amtech) and International Road Dynamics Inc. (IRD) was interested in the evaluation of the effectiveness of an automated bypass system. The system consisted of roadside equipment and in-vehicle transponders. Approximately 300 transponders were placed in the participating trucks.

The survey consisted of 37 questions inquiring about the driver's professional background, weigh station experience, and opinions about the AVI/WIM system. From the 293 surveys that were distributed, 61 surveys were returned, but only 60 of them were used. One survey provided responses to only a few of the questions; thus, it was not used in data analysis. Fourteen different trucking companies participated in the survey. Table 1-1 shows the distribution of 60 returned surveys among 14 companies. The names of the trucking companies who participated are available upon request. The survey return rate of 20% was respectable compared to the average rate of return for mail-in surveys of around 15%. A copy of the survey is given in Appendix A.

Company	Surveys Sent	Surveys Returned
A	14	4
B	101	29
C	43	12
D	22	4
E	25	0
F	6	0
G	7	0
H	31	0
I	5	0
J	1	0
K	12	4
L	3	3
M	6	0
N	17	4

The study area is located on the southbound direction of I-55, about 10 miles north of Springfield in Sangamon County, Illinois, as shown in Figure 1-1. The total length of the study section is approximately 2.25 miles with three lanes in the southbound direction, and includes the Williamsville weigh station and the surrounding area. The average annual daily traffic was 31,200 in 1995.

This report is divided into the following sections: Introduction, Data Collection, Analyses of Responses, Conclusions, Appendix A, and Appendix B.



Figure 1-1. Location of Williamsville weigh station

2. DATA COLLECTION

A survey of the participating drivers' opinions about the AVI/WIM systems was conducted. The procedure to conduct the survey is described in the following steps.

2.1. Identify the Topical areas

The subject areas that should be covered in the survey were identified in collaboration with IDOT.

2.2. Prepare the Survey Forms

Based on the identified subject areas, the research team prepared a preliminary questionnaire and presented it to IDOT for review and comments. IDOT's comments and suggestions were incorporated in revising the survey form.

2.3. Pre-Test the Survey Forms

The survey was pre-tested. The purpose of doing the pre-test was to check clarity and understanding of the questions and the responses. The findings from this step were used for further revision of the questionnaires.

2.4. Identify Survey Participants

There were nearly 300 tags distributed to participants. Drivers of all the participating trucks were included in this survey.

2.5. Conduct the Survey

The survey was sent to operations manager of each company for distribution among the company drivers. A cover letter explained how to complete the survey. For each survey, one self-addressed and stamped return envelope was included. Drivers were asked to directly send back the survey forms to the research team. Follow-up letter and telephone calls were made to those who had not responded.

2.6. Reduce the Data

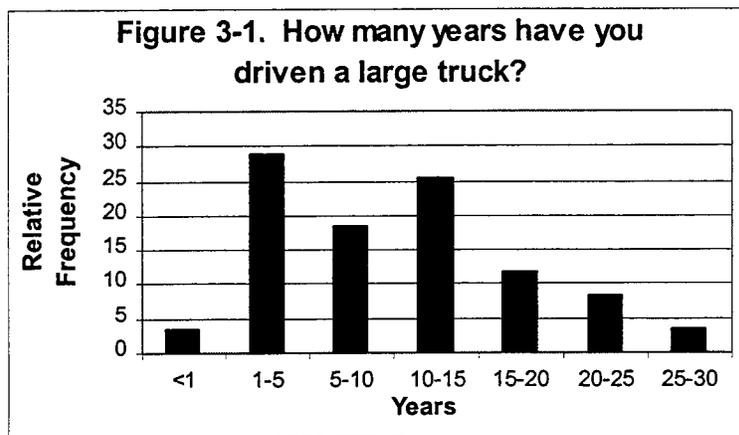
The survey responses were coded in a spreadsheet format for further analysis. The survey results were checked for input errors, completeness, and consistency. Inappropriate responses were excluded in the statistical analysis. The verbatim responses for open-ended questions where respondents were asked to provide suggestions and comments were also typed in the spreadsheet.

3. ANALYSES OF RESPONSES

In this section, the responses to each survey question were analyzed in detail. The conclusions reached from the results of these questions are explained in Section 4.

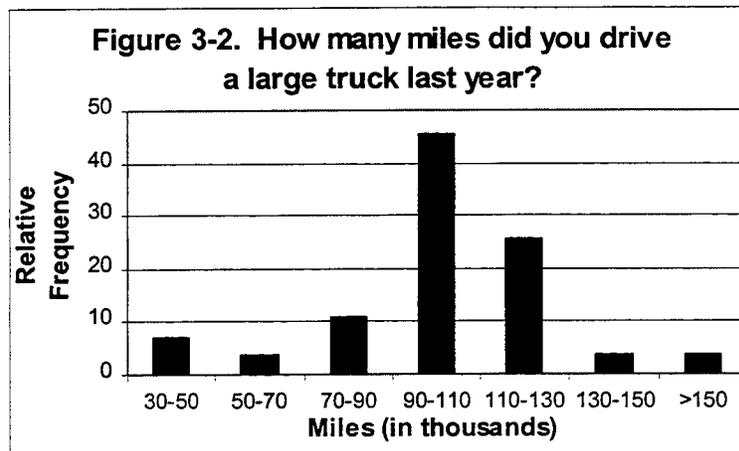
3.1. Question #1: How many years have you driven a large truck?

Fifty nine drivers responded to this question. The average level of experience for these drivers was 11 years. The distribution of the responses is shown Figure 3-1. Although the majority of drivers had between 1 and 15 years of experience, drivers with up to 30 years experience participated in the survey.



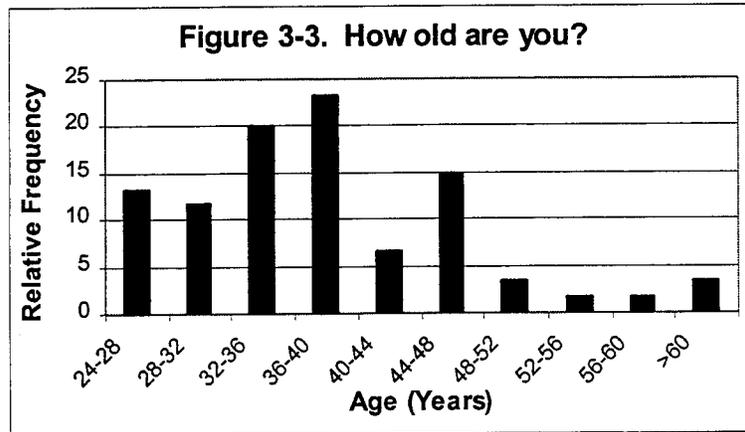
3.2. Question #2: How many miles did you drive a large truck last year?

Of those surveyed, 55 drivers answered this question. In addition, two drivers said they drove zero miles last year, but their responses are not included here. A frequency plot for the 55 drivers is shown in Figure 3-2. On the average, each driver logged approximately 104,000 miles during the past year. While the majority of drivers (70%) logged between 90,000-130,000 miles last year, the numbers ranged from 30,000 miles to 225,000 miles for all drivers surveyed.



3.3. Question #3: How old are you?

The average age of the 60 respondents to this question was 38.5 years. The age distribution for drivers participating in the survey is shown below in Figure 3-3. The youngest driver was 24 years old and the eldest driver was 70 years old.



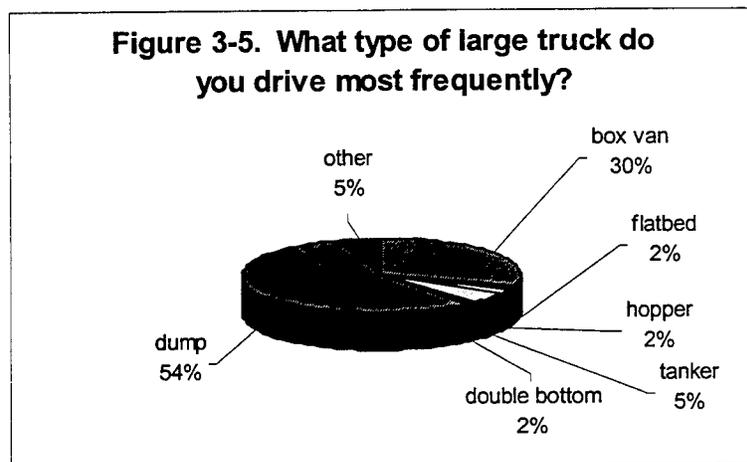
3.4. Question #4: Do you own your own large truck?

Of the 60 respondents to the survey, only one owned his large truck.

3.5. Question #5: What type of large truck do you drive most frequently?

- | | | |
|------------------|------------------------|--------------|
| A) Box Van | B) Flatbed or Platform | C) Hopper |
| D) Grain | E) Tanker | F) Livestock |
| G) Double Bottom | H) Dump | I) Other |

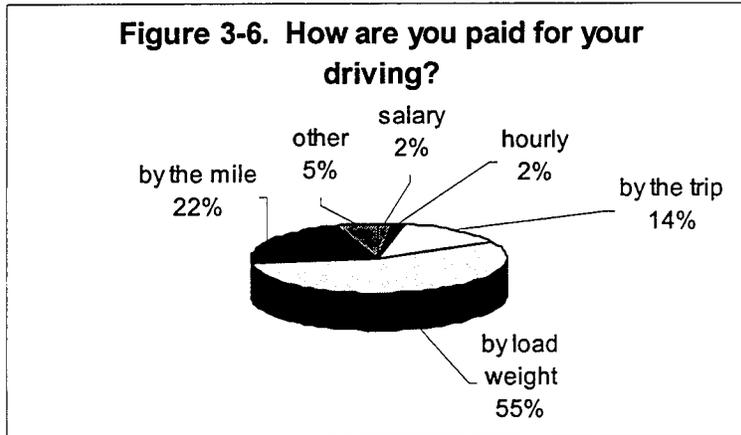
The responses to this question are shown in Figure 3-5. Of the 60 respondents, 30% drove box vans and 54% drove dump trucks. These two truck types dominated the results, as only 16% of the respondents drove types other than box van or dump trucks.



3.6. Question #6: How are you paid for your driving?

- A) Salary
- B) Hourly
- C) By the Trip
- D) By Load Weight
- E) By the Mile
- F) Other

Responses are shown in the Figure 3-6. The three most common forms of payment were “By Load Weight”, followed by “By the Mile”, and “By the Trip”. Of 58 respondents, 55% were paid based on load weight, 22% by the mile, and 14% were paid by the trip. The three categories

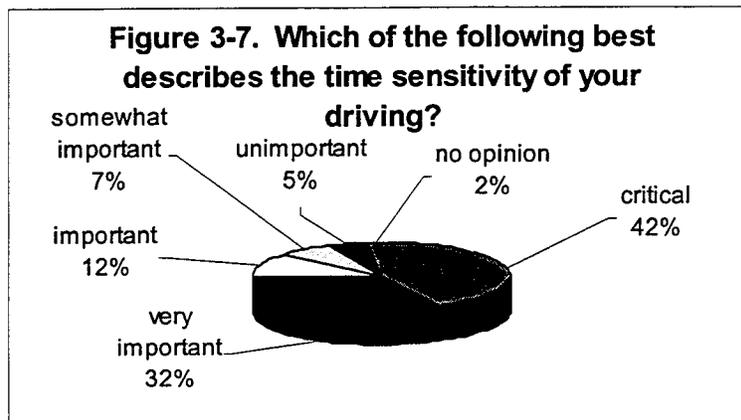


constituted 91% of the drivers.

3.7. Question #7: Which of the following best describes the time sensitivity of your driving?

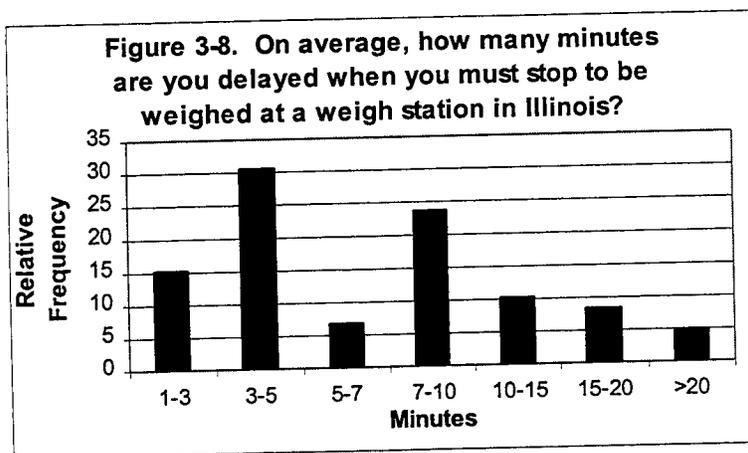
- A) *Critical – every minute of delay costs me money*
- B) *Very Important – can tolerate small delays*
- C) *Important – can tolerate delays of up to 30 minutes*
- D) *Somewhat Important– can tolerate delays of up to 1 hour*
- E) *Unimportant – my schedule is at my own pace & not time-dependent*
- F) *No Opinion*

Of the 59 respondents to this question, 42% answered “Critical”, indicating that every minute of delay costs them money. Thirty-two percent circled “Very Important”, indicating that they can tolerate a small delay. Thus for 74% of drivers surveyed, time was “Critical” or “Very Important.” Another 12% said that time was “Important” to them, but they could tolerate delays of up to 30 minutes. For the remaining 14% of drivers, time was somewhat important, unimportant, or they had no opinions. As seen in Figure 3-7, the majority of the drivers (86%) had schedules where time was important, and delays greater than 30 minutes were intolerable.



3.8. Question #8: On average, how many minutes are you delayed when you must stop to be weighed at a weigh station in Illinois?

For the 59 respondents to this question, the average delay at a weigh station was nine minutes. The responses ranged from one minute to as much as 30 minutes. The results are shown in Figure 3-8. Over half (54%) of the drivers reported delays of more than 5 minutes, 23% delays of more than 10 minutes, 13% delays of more than 15 minutes, and 5% delays of more than 20 minutes when stopping to be weighed.



3.9. Question #9: In the past year, have you ever experienced an unsafe driving situation when entering, exiting, or stopping at a weigh station?

The response to this question was related to weigh stations in general. Thus, they reflect the drivers' experiences for all weigh stations that they have gone through in Illinois and outside of Illinois. Sixty percent of the 60 respondents to this question said "Yes", indicating that they had experienced an unsafe driving situation in the proximity of a weigh station. The remaining 40% said "no."

3.10. Question #10: If yes, how many times? Please describe the unsafe situation at the weigh station.

Similar to Question 3.9, the response to this question was related to weigh stations in general. Thus, they reflect the drivers' experiences for all weigh stations that they have gone through in Illinois and outside of Illinois. Of the 36 drivers who had experienced an unsafe driving situation in question #9, only 18 of them quantified the number of times that it had occurred. These values ranged from 2 to 50 times. Fifty-six percent of the 18 drivers reported that the unsafe conditions had occurred less than five times, 33% reported between 5 and 20 occurrences, and 11% had experienced unsafe conditions more than twenty times.

The majority of respondents who had experienced unsafe conditions at weigh stations had problems while diverging into the weigh station. Out of the 36 drivers who had experienced an unsafe weigh station situation, 24 drivers described these conditions. Of these 24 drivers, 88% reported that queues of trucks extending to the highway due to delays at the weigh station had

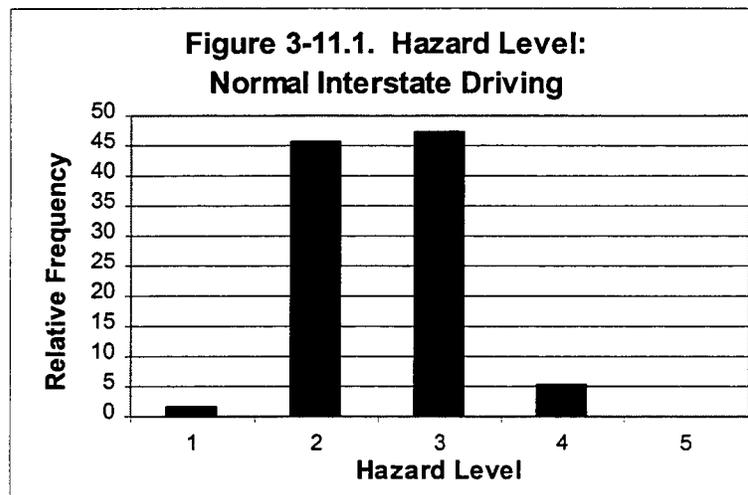
caused the hazardous conditions. Eight percent of the sample (two respondents) detailed merging problems from the weigh station into free flowing traffic and 4% experienced problems due to foggy road conditions. A listing of driver's verbatim responses to this question are listed in Appendix B.

3.11. Question: #11 Please rate the hazard level of the following driving conditions on an interstate highway: normal interstate driving, interstate rush hour traffic, interstate exit ramp, interstate entrance ramp, weigh station entrance & exit, interstate work zone.

- | | | |
|---------------|-----------|--------------|
| 0) No Opinion | 2) Low | 4) High |
| 1) None | 3) Medium | 5) Very High |

3.11.1. Relative Hazard Level

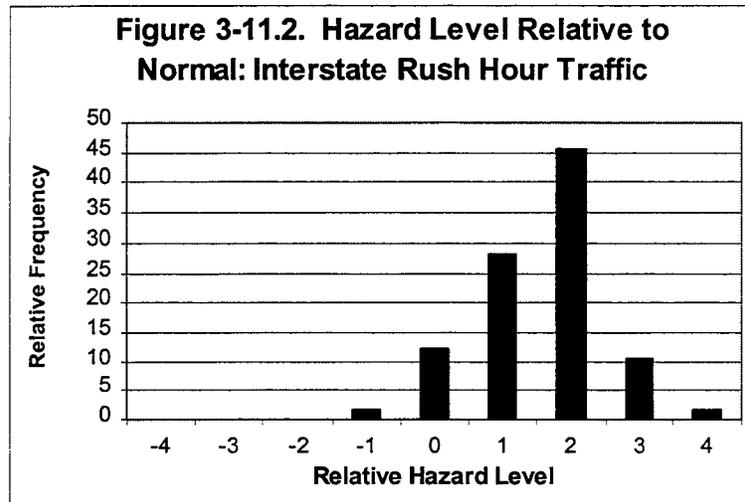
The hazard level that drivers felt under normal interstate driving conditions was used as a baseline for analysis. Out of the 60 drivers, 57 drivers expressed their opinions on the normal interstate driving hazard levels. The distribution of these 57 responses is shown in Figure 3-11.1. It shows that 93% of drivers felt the hazard level of normal interstate driving is low or medium.



Hazard levels of very high, high, medium, low, and none were quantified according to the number next to their option shown in the question description. By subtracting the rating they provided for normal driving conditions from ratings for each of the remaining five conditions, a relative hazard level was determined. The possible range for a relative hazard rating is from -4 to +4. A negative relative hazard level indicates that a driver feels a particular movement is less hazardous than normal interstate driving, while a positive relative hazard level shows that the respondent feels that a movement is more hazardous than normal interstate driving. Therefore, the higher the relative hazard level, the greater the danger a driver has indicated they feel during a particular situation. For example, if a driver felt that the hazard level for normal interstate driving was "low" (a value of 2) and for interstate rush hour traffic was "medium" (a value of 3), the relative hazard level of interstate rush hour traffic for this driver would be +1. These relative hazard levels are presented in the following sections.

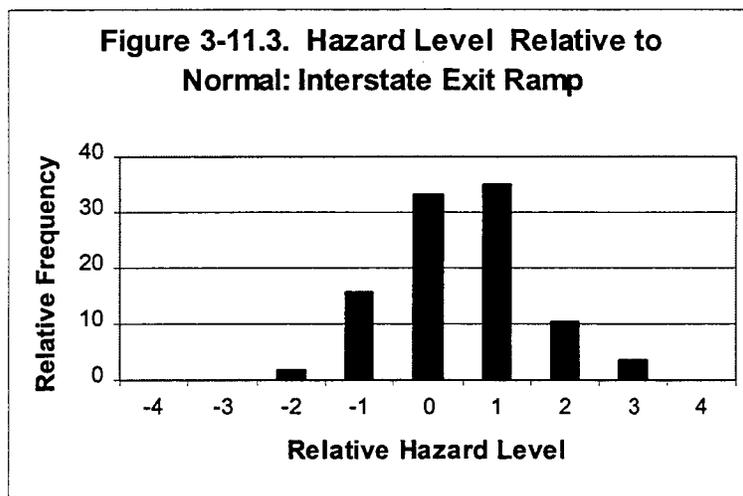
3.11.2. Interstate Rush Hour Traffic

For interstate rush hour traffic, 28% of the 57 respondents had a relative hazard level of +1. Another 46% gave a relative hazard level of +2, and 12% gave relative hazard levels of +3 or greater. Therefore, 86% of drivers felt that rush hour interstate traffic was more hazardous than normal interstate driving conditions. The remaining 14% felt that rush hour interstate traffic was not more hazardous than normal interstate traffic. Figure 3-11.2 shows the distribution of these results.



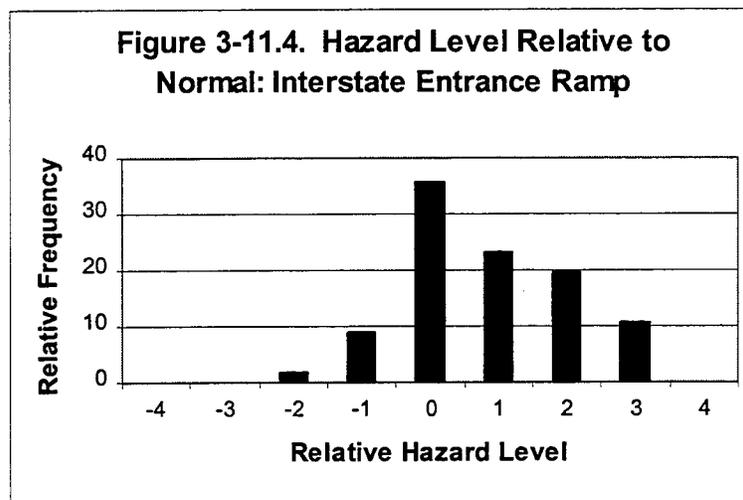
3.11.3. Interstate Exit Ramps

About 49% of the 57 respondents to this question felt that diverging from interstate traffic was more hazardous than normal interstate driving. Of the sample, 33% rated the diverging motions to interstate exit ramps as being equally hazardous as normal interstate driving, and 18% felt that exiting the interstate was less hazardous than normal interstate driving. Figure 3-11.3 shows the relative frequency distribution of these results.



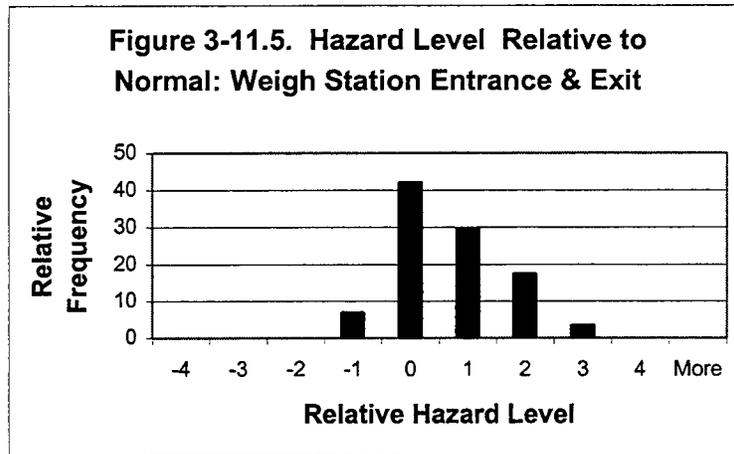
3.11.4. Interstate Entrance Ramps

For interstate entrance ramps, about 54% of the 57 respondents felt that merging into traffic was more hazardous than normal interstate driving. About 36% had a relative hazard level of zero, 23% had a relative hazard level of +1, 20% had a relative hazard level of +2, and 11% had a relative hazard level of +3 or higher. The remaining 10% had a negative rating. The distribution of these results is shown in Figure 3-11.4. The relative hazard levels shown for interstate entrance ramps were similar to those for interstate exit ramps, though more drivers responded with higher relative hazard levels for interstate entrance ramps. For entrance ramps, 31% of drivers responded with relative hazard levels of 2 or greater, while only 15% gave relative hazard levels of 2 or greater for exit ramps. Thus, while similar proportions of drivers felt that diverging to an exit ramp and merging from an entrance ramp were more hazardous than normal interstate driving, these drivers felt that merging from entrance ramps produced a higher degree of hazard than diverging to exit ramps.



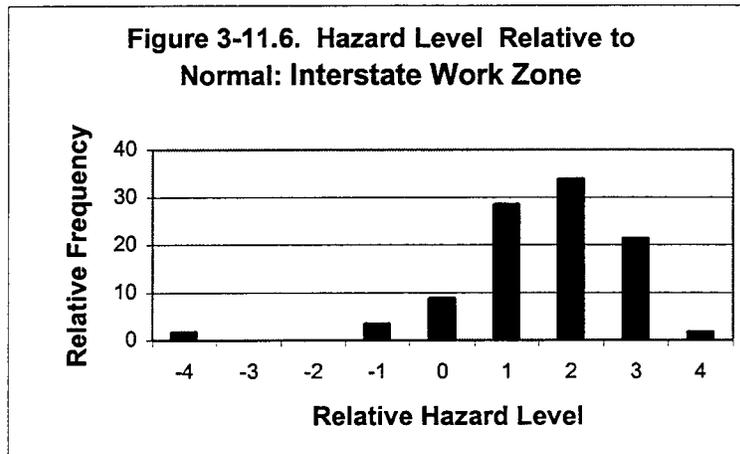
3.11.5. Weigh Station entrance and exit

In developing the questionnaire, it was decided to ask the driver's opinions on the combined entrance and exit maneuvers to weigh stations. This was done to get the driver's assessment of the hazard of going in and out of the weigh station as a single maneuver. The hazards at weigh station entrances and exits were considered to be slightly greater than that of normal interstate driving. Out of the 57 respondents, 51% felt that exiting and entering weigh stations was more hazardous than normal interstate driving. About 42% of the drivers had a relative hazard level of zero, and 7% (four individuals) had a relative hazard rating of -1. Figure 3-11.5 shows the distribution of these responses. Comparing these responses to those for interstate entrance and exit ramps, the drivers felt that hazard levels at weigh station entrances and exits were similar to those experienced at interstate entrance and exit ramps.



3.11.6. Work Zones

Finally, 86% of the 57 respondents gave a positive relative hazard rating for work zone safety indicating that driving in work zones was more hazardous than normal interstate driving. Another 9% of the drivers had a rating of zero to indicate it was as hazardous as normal interstate driving. The remaining 5% had negative ratings. Figure 3-11.6 shows the distribution of these results.



3.11.7. Comparison of Conditions

Relative hazard levels were used to compare the hazard of driving at the condition in question to normal interstate driving. A weighted average relative hazard level was computed for each question. To obtain these weighted averages, the sum of the product of number of responses for each hazard level multiplied by the hazard level was divided by the total number of responses. The following equation shows how weighted average hazard levels were computed.

$$\text{Weighted Average Hazard Level} = \frac{\sum (\text{hazard level} \times \text{frequency})}{\text{total no. of respondents}}$$

Table 3-1 shows the relationship between the weighted average hazard levels for these driving conditions. From these values, it appears that the drivers surveyed felt that interstate work zone and interstate rush hour conditions were the most hazardous, followed by merging from entrance ramps, entering/exiting weigh stations, and diverging to exit ramps.

Table 3-1. Weighted average hazard levels	
Rush hour	1.56
Diverging to exit ramp	0.47
Merging from entrance ramp	0.82
Entrance and exit of weigh stations	0.68
Work zone	1.57

To further compare the hazards felt by drivers in these various situations, a paired t-test was performed for each driving situation to compare it to normal interstate traffic. Furthermore, a paired t-test was performed to compare the hazards at entrance ramps to exit ramps. Paired t-tests were also used to compare rush hour, exit ramp, entrance ramp, and work zone conditions to hazards at the entrances and exits of weigh stations. Results of these paired t-tests are shown in Table 3-2.

Table 3-2. Paired t-tests for weighted hazard levels	
Comparisons	t-values
Rush hour vs normal	12.23
Exit ramp vs normal	3.39
Entrance ramp vs normal	5.03
Entrance and exit of weigh stations vs normal	5.34
Work zone vs normal	8.91
Entrance ramp vs exit ramp	2.32
Rush hour vs weigh station	5.40
Exit ramp vs weigh station	-1.29
Entrance ramp vs weigh station	0.40
Work zone vs weigh station	4.65

The paired t-tests indicate that the driving hazard at rush hour traffic, at exit ramps, at entrance ramps, at weigh station entrances and exits, and at work zones are all significantly higher than the driving hazard in normal interstate conditions, with 95% confidence. In addition, the hazards from merging at highway entrance ramps were determined to be significantly higher than the hazards from diverging to highway exit ramps. The hazards from rush hour traffic and work zone conditions were found to be significantly higher than the hazards at the entrances and exits of weigh stations. On the other hand, hazards at highway exit as well as entrance ramps were determined to be statistically equal to hazards at weigh station entrances and exits.

Yet another test (ratio test) was performed to examine the differences in the hazards experienced by drivers in the described situations. In this test, a ratio was calculated by dividing the value each driver gave for a particular hazard situation by the value the same driver gave for normal driving conditions. By relating the hazard level to the normal condition, a better picture of the degree of difference between hazard conditions can be gained. With this method, rush hour, exit

ramp, entrance ramp, weigh station, and work zone hazard values of each individual driver were divided by that driver's normal hazard condition value. The average hazard level ratios found by this method are shown in Table 3-3.

Table 3-3. Average hazard level ratios	
Comparisons	Ratios
Rush hour/normal	1.70
Diverging to exit ramp/normal	1.24
Merging from entrance ramp/normal	1.37
Entrance and exit of weigh stations/normal	1.32
Work zone/normal	1.77

A paired t-test was performed on the hazard ratios of particular driving conditions relative to the normal interstate driving condition. The results of those tests are shown in Table 3.4. The test results shown in Table 3.4 support the test results presented in Table 3.2. Table 3.4 indicates that the driving hazard at rush hour traffic, at highway exit ramps, at highway entrance ramps, at weigh station entrances and exits, and at work zones are all significantly higher than the driving hazard in normal interstate condition. Similarly, the hazards from merging at highway entrance ramps were significantly higher than the hazards from diverging to highway exit ramps. The hazards of driving in rush hour and work zone traffic conditions were significantly higher than the hazards at the entrances and exits of weigh stations. On the other hand, hazards at highway exit as well as entrance ramps were statistically equal to hazards at weigh station entrances and exits.

Table 3-4. Paired t-tests for average hazard level ratios	
Comparisons	t-values
Rush hour/normal	8.37
Diverging to exit ramp/normal	3.71
Merging from entrance ramp/normal	4.55
Entrance and exit of weigh stations/normal	5.00
Work zone/normal	8.36
Entrance ramp/exit ramp	1.75
Exit ramp/weigh station	-1.19
Entrance ramp/weigh station	0.65
Rush hour/weigh station	5.10
Work Zone/weigh station	5.89

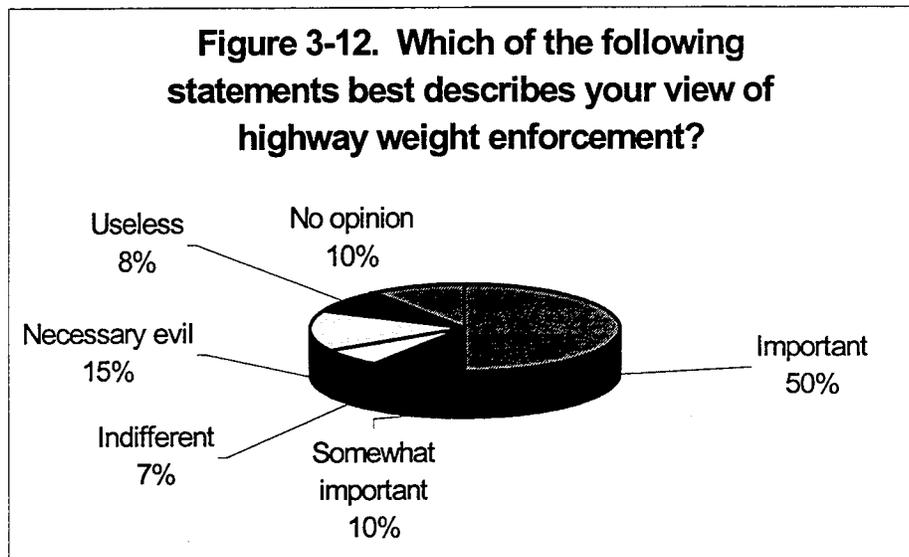
3-12. *Question #12: Which of the following statements best describes your view of highway weight enforcement?*

- A) Important – for safety and road maintenance*
- B) Somewhat Important – benefits outweigh costs*
- C) Indifferent – benefits equal costs*
- D) Necessary Evil – some benefits but large cost*

E) Useless – a complete waste of time and money

F) No Opinion

Half (50%) of the 60 respondents who had an opinion felt that highway weight enforcement was important for safety and road maintenance. The majority (75%) felt that highway weight enforcement was necessary or had some degree of importance. About 7% were indifferent and 10% had no opinions. Only 8% of the respondents felt that highway weight enforcement was “Useless.” The results are quantified in Figure 3-12.

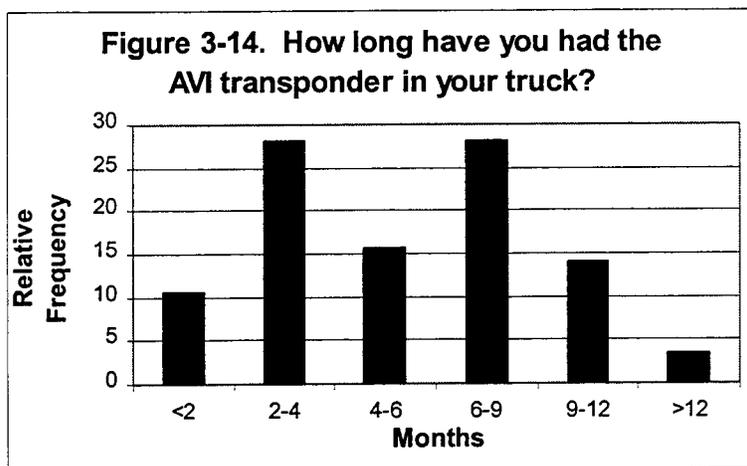


3-13. Question #13: In the past year, have you been cited for being overweight? If yes, how many times?

In the past year, 18% of the 60 respondents to this question had been cited for being overweight. The remaining 82% had not been cited for being overweight during the past year. All of the drivers who had been cited for being overweight stated that they had been cited only once throughout the year.

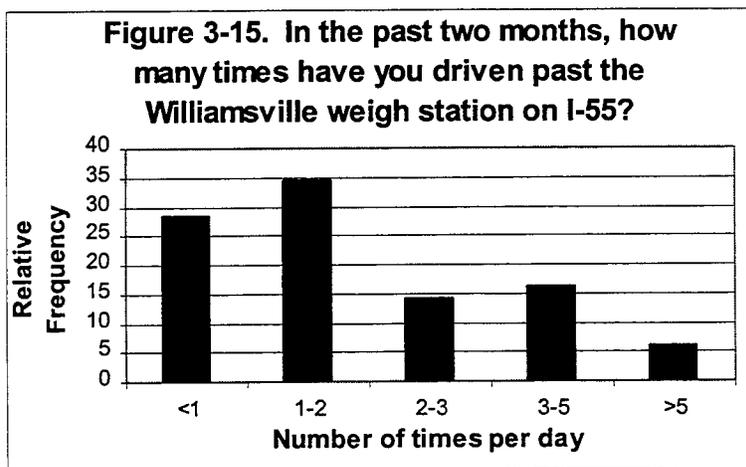
3-14. Question #14: How long have you had the AVI transponder in your truck?

The 57 responses to this question ranged from one month to two years. The average amount of time that drivers had the AVI in their truck was approximately 6.4 months. As Figure 3-14 shows, 46% of the 57 drivers had the transponders in their trucks for more than 6 months. Over half of them (57%) had the transponders for at least six months (not shown in the figure). Only 11% (6 drivers) of the 57 drivers had the transponders for less than 2 months.



3-15. Question #15: In the past two months, how many times have you driven past the Williamsville weigh station on I-55?

Out of the 51 drivers who had transponders for at least 2 months, 49 drivers responded to this question. Responses given in this question were converted to the number of passes per day. There was a fairly large range of passing frequencies given by the respondents; values were from 0-10 times per day. On average, respondents passed the Williamsville weigh station about 2.3 times each day. A plot of replies from 49 drivers is given in Figure 3-15. About 71% of them passed at least once per day, 35% passed between one and two times and 36% passed more than 2 times (14% passed between 2 and 3 times, 16% passed between 3 and 5 times, and 6% passed more than 5 times per day).

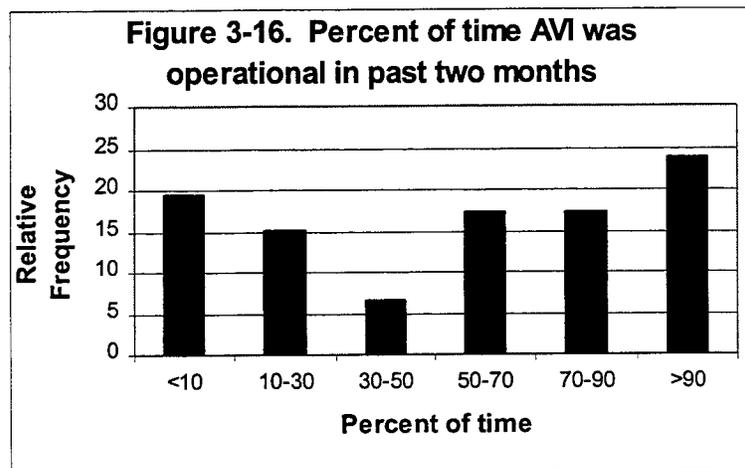


3-16. Question #16: In the past two months, what fraction of the time has your AVI transponder been operational?

Out of the 49 drivers from question 15, 46 drivers responded to this question. The range of responses to this question was very wide, with responses given between zero to one hundred

percent. Figure 3-16 displays these trends. Nearly 20% of the 46 respondents said that in the past two months their AVI transponder worked for less than ten percent of the time. Fifty-eight percent of the drivers said that it was operational more than half of the time and 24% said it was operational more than 90% of the time. For 22% of the drivers it was operational 100% of the time (not shown in figure).

It should be noted that this was a pilot study and some changes and improvements were being made throughout the testing period. For instance, the original transponders were replaced with a new set of transponders and that improved the performance of the system to some degree. Also, the software “bugs” were fixed as they were detected. At the time of this survey, the drivers had the original transponders. The nature of the improvements did not warrant a follow-up survey.



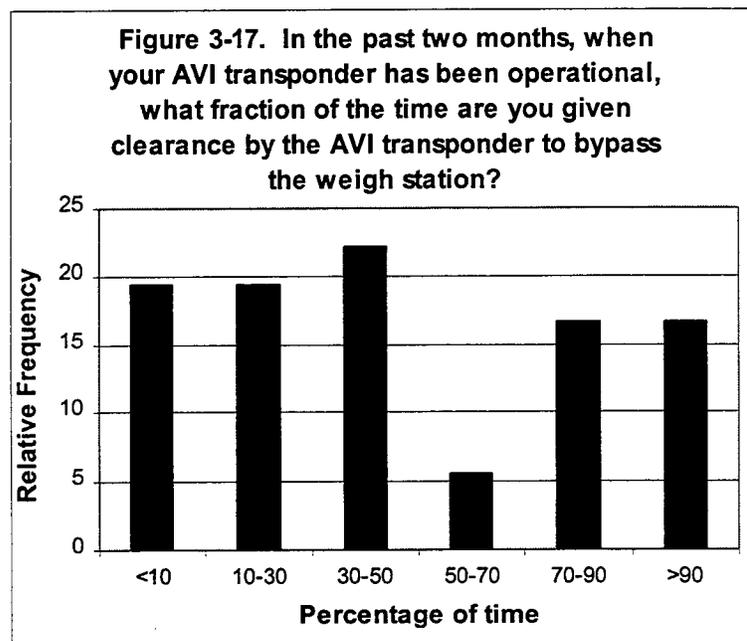
3-17. Question #17: In the past two months, when your AVI transponder has been operational, what fraction of the time are you given clearance by the AVI transponder to bypass the weigh station?

The intent of this question was to quantify how often the AVI transponder system allowed drivers to bypass the weigh station. There are several reasons why a truck may be called into the weigh station by the AVI transponder. The most obvious reason is when a truck exceeds legal weight limits. Legal weight limits are imposed on single axles, axle groups, or gross vehicle weight. If the truck that was called into the weigh station was in compliance with legal weight limitations, a number of other factors could have been the cause. The high-speed WIM system may be set to bring in tagged trucks at random, or call in trucks if their axle, axle group, or gross weights are a certain percentage of legal limits.

Trucks may also be called into the weigh station if their tag ID was not in the database, or the database indicated that the truck was to be called into the station. A truck may also be brought into the weigh station if the WIM technology was unable to accurately weigh the vehicle. If a truck is moving too quickly for the high-speed WIM scales to accurately measure the truck's weight, the transponder would give a red signal. Or, if the truck is unevenly distributed over the WIM apparatus, its weight will be in error and the truck would be called into the weigh station.

In addition, if the truck runs off the shoulder of the road and misses the high-speed WIM apparatus completely, it would be called into the station. Finally, if the transponder system was turned off or was in error, trucks would be signaled to enter the weigh station.

Out of the 46 drivers in question 16, 36 drivers estimated the fraction of the time they were able to bypass the weigh station when their AVI transponder was operational. The results ranged from zero to one hundred percent. Nineteen percent of the drivers reported that they were given clearance to bypass less than 10% of the time. Sixty-two percent were given clearance more than 30% of the time, 40% were allowed to bypass more than 50% of the time, and 34% more than 70% of the time. For 17% it gave clearance 100% of the time (not shown in the figure). Figure 3-17 shows the distribution of the responses.



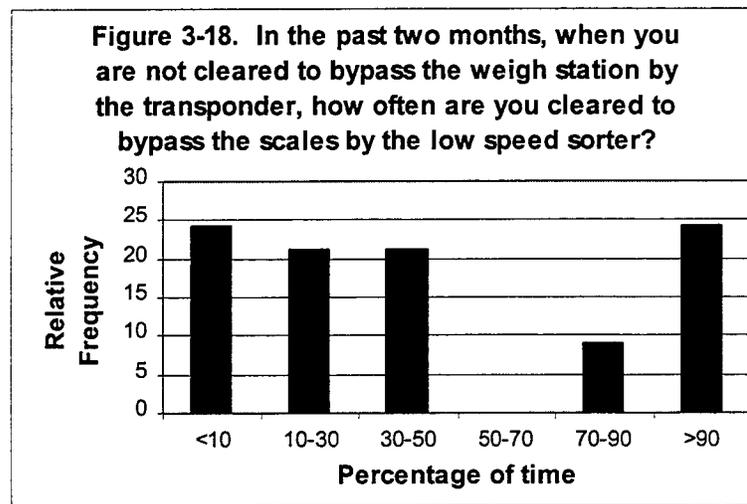
3-18. Question #18: In the past two months, when you are not cleared to bypass the weigh station by the transponder, how often are you cleared to bypass the scales by the low speed sorter?

Question 17 examined the frequency that drivers were allowed to bypass the weigh station as a result of the AVI transponder and high-speed WIM. This question focuses on the low-speed sorter. Specifically, it seeks to quantify how often a driver received a call to enter the weigh station, but was then cleared to bypass the static scale by the low-speed sorter.

As with the previous question, there are several explanations for why a truck may be called to enter a weigh station but be allowed to bypass static scales. First, the scalmaster can set the low-speed WIM to sort trucks in the same manner as the high-speed system. Discrepancies between the high-speed and low-speed axle, axle group, and gross weight percentages (of legal limits) may lead to a truck being called in by high-speed WIM, and cleared by the low-speed WIM. Second, if error caused an inaccurate high-speed WIM reading, then this error may be corrected when passing through the low-speed WIM zone. Finally, an error in the high-speed

system could result in the scenario detailed in this question. If the high-speed WIM is inaccurate, then more trucks will be passed on to the low-speed WIM system. Then, these trucks would be given clearance by the low-speed sorter.

Out of the 36 drivers in question 17, 33 drivers specified how often the low-speed WIM scales allowed them to bypass the static scales after being pulled into the weigh station by the high-speed WIM. The range of answers was again between zero and one hundred percent, as shown in Figure 3-18. About 24% of them were allowed to bypass the static scales less than 10% of the time. This means that one-quarter of them were asked to be weighed on static scales over 90% of the time. About 55% were allowed to bypass more than 30% of the time, 33% more than 70% of the time, and 24% more than 90% of the time. In fact 21% of the drivers were allowed to bypass static scale 100% of the time (not shown in the figure).

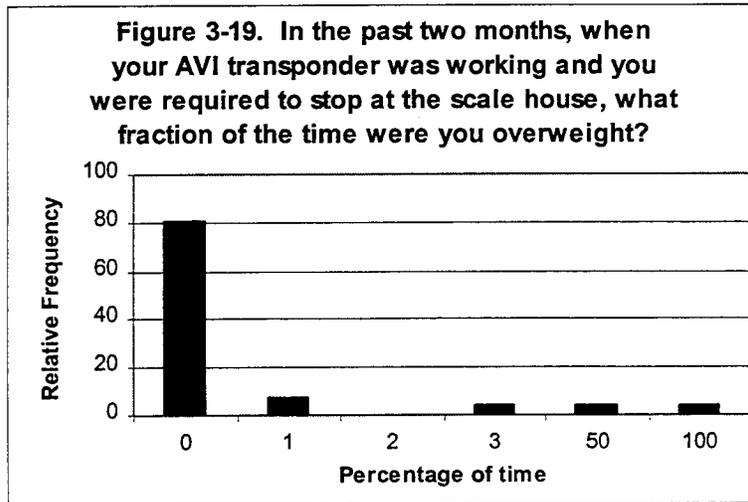


3-19. Question #19: In the past two months, when your AVI transponder was working and you were required to stop at the scale house, what fraction of the time were you overweight?

Ideally, all trucks that are brought to the static scale by the AVI transponder system should be overweight. However, there are a few reasons why a truck would be required to stop at the scalehouse even though it was not overweight.

First, due to the setting of the system by the scalemaster, the WIM system may be set to pull in trucks weighing a certain percentage of legal limits. These trucks will be called to the static scale regardless if they are overweight or not. The second reason an underweight truck may be called to the static scale is if its tag ID was noted in the database to indicate that the truck should be called to the weigh station. Third, if the AVI transponder system is set by the scalemaster to randomly call trucks to the weigh station, an underweight truck may have to pass through the static scales simply due to chance. Fourth, if a truck is not centered over the low-speed WIM apparatus, an error in WIM weights may result. This would give a driver the signal to proceed to the static scale, even if the truck is actually below legal weight limits. One final reason that a legal truck may be called to the static scales is error in the AVI/WIM system, whereby the system has erroneously pulled in a truck that is clearly underweight.

Out of the 33 drivers who responded to Question 18, 26 drivers were asked to go on the static scales be weighed. About 80% of the 26 drivers were never overweight when they were weighed on the static scales. About 8% of the drivers said they were overweight 1% of the time, 4% were overweight 3% of the time, 4% were overweight 50% of the time, and 4% admitted being overweight 100% of the time. Figure 3.19 shows the distribution.

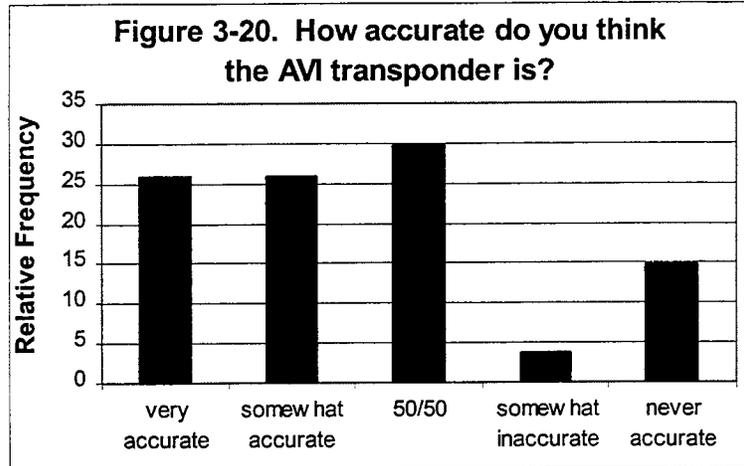


It should be noted the Truck Weight Inspectors or other weigh enforcement officials could change the settings of WIM scales from one of the computers in the weigh station, if they so desire. Changing the WIM settings will alter the percentage of drivers that are called to go to the static scales.

3-20. Question #20: How accurate do you think the AVI transponder system is?

- A) *Very Accurate* B) *Somewhat Accurate* C) *50/50*
D) *Somewhat Inaccurate* E) *Never Accurate* F) *Don't Know/ No Opinion*

More than half (52%) of the 54 respondents to this question felt that the AVI transponder system was either "Very Accurate" or "Somewhat Accurate." Twenty-nine percent of the respondents felt that the transponder was accurate 50% of the time. However, 19% of the respondents indicated that the AVI transponder system was only "Somewhat Inaccurate" or "Never Accurate." The results are illustrated in Figure 3-20.



3-21. Question #21: Over the past two months, how many times has the AVI device given you a signal that you did not understand?

Nine out of the 51 drivers who answered this question (18%) had received a signal that they did not understand at least once in the past two months. For these nine respondents, the average number of unintelligible signals was 20 over the two months. The number of unintelligible signals ranged from 1 to 40. Still, the majority (82%) did not have any problems understanding the signals from the AVI device.

3-22. Question #22: Have you ever been stopped by Illinois law enforcement for illegally bypassing the Williamsville weigh station after your AVI transponder cleared you to bypass the station?

Fifty-eight drivers answered this question. Of the group, 9% had been stopped by Illinois law enforcement after being given clearance by the AVI transponder to bypass the station. The vast majority, 91%, had not experienced this situation. There were not unique characteristics associated with the drivers or trucks that were stopped. These drivers may have not received any signal on their transponder and may have interpreted that as a bypass. Also, the law enforcement officers may have stopped them for other reasons than weight enforcement.

3-23. Question #23: During the day, how well can you see the visual indicators (the red and green LED lights) on the AVI transponder?

- A) Too Dim B) Just Right C) Too Bright D) No Opinion**

Most of the drivers had no difficulty seeing the visual LED lights on the transponder during the day. Of the 60 respondents who answered the question, 69% felt that the red LED light was "Just Right" during the day, 18% said "Too Dim", and 13% had no opinion. None of the drivers felt that the red light was "Too Bright" under daylight conditions. For the green LED light, 58% of drivers said that the light was "Just Right" under daylight conditions, 26% of the respondents replied that it was "Too Dim", and 16% had no opinion. As with the red light, no operators indicated that the green light was "Too Bright" in daylight.

3-24. Question #24: During the night, how well can you see the visual indicators (the red and green LED lights) on the AVI transponder?

- A) Too Dim B) Just Right C) Too Bright D) No Opinion**

The survey results showed that both the red and green lights were satisfactory during nighttime conditions. Of the 59 respondents, 78% indicated that the red light was "Just Right" during the night, 2% said it was "Too Dim", and 20% had no opinion. Of the 58 respondents, 76% indicated that the green light was "Just Right" during the night, 2% said it was "Too Dim", and 22% had no opinion.

3-25. Question #25: How well can you hear the audible indicators (the "red" and "green" sounds) on AVI transponder?

- A) Too Soft B) Just Right C) Too Loud D) No Opinion**

Of the 60 drivers who answered the first part of the question, 43% of them found the "Red Sound" to be "Just Right", 43% said it was "Too Soft", and 14% had no opinion. For the "Green Sound," 41% of the 59 respondents felt that the green tone was "Just Right", 42% said that the tone was "Too Soft", 2% said it was "Too Loud", and 15% had no opinion.

3-26. Question #26: How convenient is the size of the AVI transponder for mounting in your truck?

- A) Too Small B) About Right C) Too Large D) No Opinion**

Of the 59 drivers who had an opinion about the size of the AVI transponder, 90% felt that the size was "About Right", 3% felt that the transponder was too small, 2% said it was too large, and 5% had no opinion.

3-27. Question #27: Has the battery in your transponder failed since you have been using it (no signal for an extended period of time)?

The battery failed at least once for 25% of the 51 respondents to this question. The remaining 75% did not experience a battery failure. The transponders were issued to the drivers in January of 1997, and most surveys were returned by March of 1998. From the return dates of the surveys, it was determined that most transponder batteries had a life of at least a year.

3-28. Question #28: Overall, how easy is the AVI transponder to use?

- A) Easy B) Moderate C) Hard D) No Opinion**

None of the drivers felt that the transponder was hard to use. In fact, 79% of the 60 respondents felt that the transponder was easy to use, 8% felt it was moderately difficult, and 13% had no opinion.

3-29. Question #29: What do you think of the instruction and training you received regarding the AVI transponder?

- A) Not enough instruction B) Just Right
C) Too Much Instruction D) No Opinion**

About one half (54%) of the 59 respondents to this question felt that the amount of training they received was "Just Right", 14% felt that they did not receive enough training, and no drivers felt that there was too much instruction. Thirty-two percent of the respondents had no opinion about the amount of training given to them.

3-30. Question #30: How is the location of the AVI transponder system on the interstate highway?

- A) Too far from the weigh station B) Too close to the weigh station**
C) Good placement of the system D) No Opinion

About two-thirds (66%) of the 59 respondents felt that the AVI transponder system was placed properly on the interstate highway. None of the drivers felt that the system was too far from the weigh station, but 15% felt that the AVI transponder was placed too close to the weigh station. Nineteen percent had no opinion.

3-31. Question #31: Should the state of Illinois install AVI transponder systems at all weigh stations?

Eighty-eight percent of the 58 respondents answered "yes" to this question. Twelve percent did not advocate the installation of AVI systems at all weigh stations.

3-32. Question #32: Have you used similar systems in other states?

Only 10% of the 60 respondents to this question had used similar systems in other states. The remaining 90% had not used similar systems in other states.

3-33. Question #33: If given the choice, would you continue to use the AVI transponder?

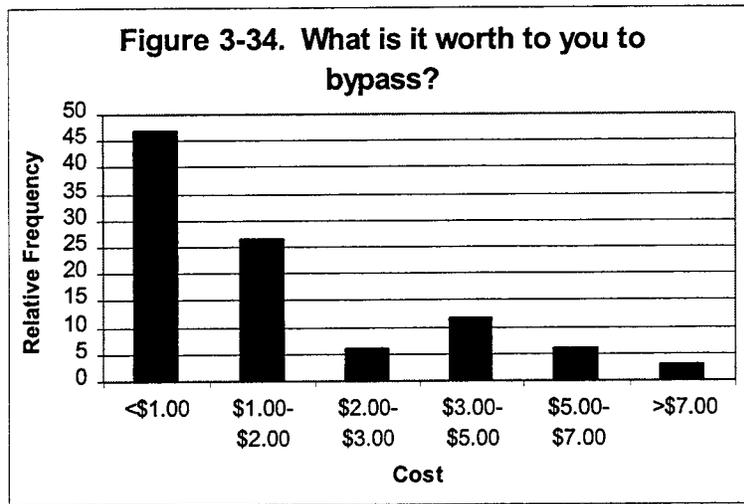
The majority of drivers would like to continue using the AVI transponder system, if given the choice. Fifty-eight drivers responded to this question. Of the sample, 88% (51 drivers) wished to continue using the system, while 12% (7 drivers) did not want to continue using the AVI transponder. Of the 10% of respondents from question #32 who had used AVI transponder systems in other states, all responded that they would like to continue using the system.

3-34. Question #34: If yes (to #33) what fee would you be willing to pay each time you were able to bypass the weigh station? (What is it worth to you to bypass?)

- A) < \$1.00 B) \$1.00-2.00 C) \$2.00-3.00**
D) \$3.00-5.00 E) \$5.00-7.00 F) > \$7.00

Fifty-one drivers wished to continue using the AVI transponder system. However, of those 51, only 34 indicated how much they were willing to pay for its continuation. Forty-seven percent of the drivers felt that the service was worth less than one dollar for each time they bypassed a weigh station. Twenty-six percent of the sample was willing to pay between one and two dollars and 6% between two and three dollars each time they were able to bypass a weigh station. Only 21% of respondents to this question were willing to pay greater than three dollars each time they were able to bypass a weigh station using the AVI transponder system (12% would pay between

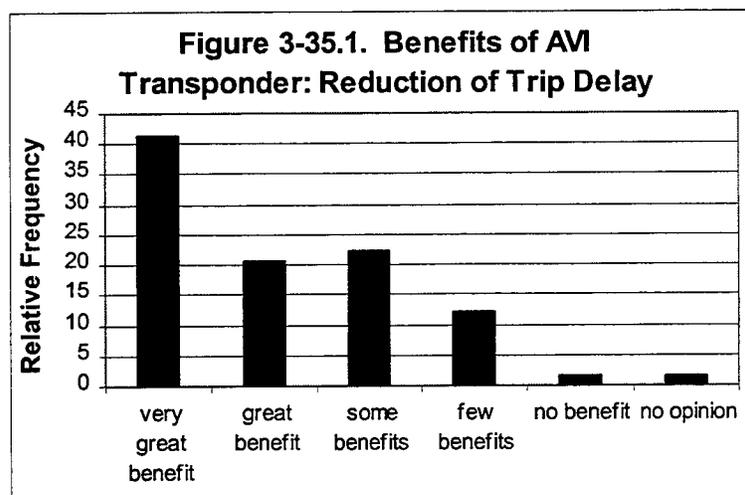
three and five dollars, 6% would pay between five and seven dollars, and 3% would pay over seven dollars). These results are shown in Figure 3-34.



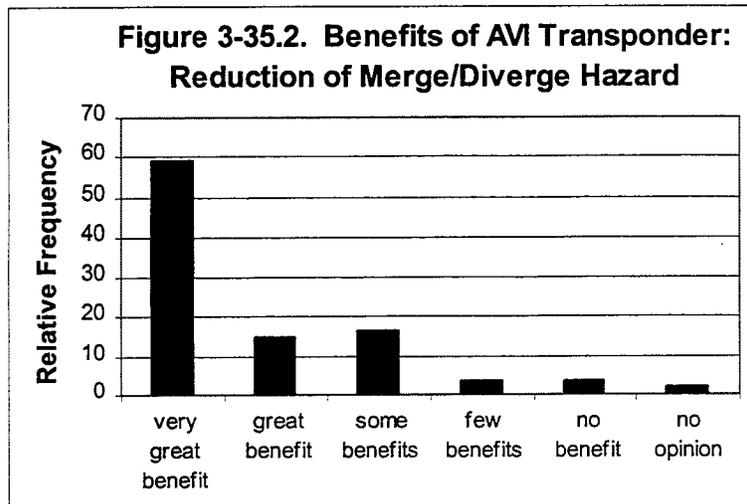
3-35. Question #35: Please rate the benefits of the AVI transponder on a scale of 1 to 5.

- 0) No Opinion 1) No Benefit 2) Few Benefits
 3) Some Benefits 4) Great Benefit 5) Very Great Benefit

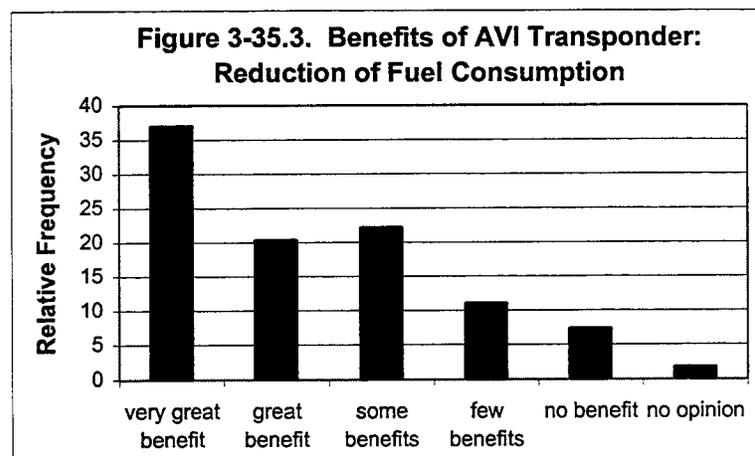
Reduces Trip Delay – As demonstrated by Figure 3-35.1, most of the respondents to this question felt that use of the AVI transponder system reduces trip delay. Of the 58 drivers who responded, 41% thought the system brought very great benefits, 21% said great benefits, and 22% said some benefits. A total of 84% thought that the AVI system had benefits. Only 14% of the sample believed that the AVI transponder system had few or no benefits in reducing trip delay, and 2% had no opinion.



Reduce Merge/Diverge Hazard – Similar to trip delay, drivers were positive about the effect of the AVI system on merge/diverge hazards. Figure 3-35.2 below shows that around 59% of the 54 respondents to this question believed that the system brought very great benefits in reducing hazards. Another 32% of drivers indicated that the system had either great benefit or some benefit. Therefore, 91% of those drivers who replied thought that the AVI transponder system does reduce merge/diverge hazards to some extent. Only 7% said few or no benefits, and 2% had no opinion.



Reduces Fuel Consumption – Fifty-four drivers responded to the question of whether the AVI transponder system reduces fuel consumption. Thirty-seven percent answered that the system had very great benefit, 21% said great benefits, and 22% said some benefits. As seen in Figure 3-35.3, only 18% of drivers felt that the AVI transponder system had few or no benefits in lowering fuel consumption, and 2% had no opinion.



3-36. Question #36: Do you have any additional comments regarding installation, training, placement or operation of the AVI transponder or transponder system?

Twenty-six drivers provided additional comments on the AVI transponder system. Of these individuals, 37% used the space to say that the AVI transponder system did not work, and 22% simply wanted the system to be “turned on” at the scalehouse. The remaining replies were more varied in nature. Three individuals indicated the need for a better way of attaching the transponder to the windshield or visor. Another respondent addressed the positioning of the transponder, stating that it was “positioned about 1-2 inches too close to the center of the windshield.” One driver commented that the use of the system should not cost anything, while another called for better instruction on the system. Other issues addressed by individual drivers were compatibility with other states’ systems, and brighter lights and louder audible signals on the transponder. A list of verbatim responses to this question can be found in Appendix B.

3-37. Question #37: How can the AVI/WIM system be improved?

Thirty-seven drivers provided suggestions for improving the AVI/WIM system. As with question 36, the answers showed a large range of topics. Twenty four percent of the sample wanted the system to work, while another 22% suggested that the scalemaster turn on the system. Eleven percent suggested nationwide installation of the system, with compatibility with other states’ WIM systems. Other answers covered different topics. These topics included: make the system affordable, have the transponder give an earlier warning to ease lane changing, increasing the weight limit, bigger and brighter lights on the transponder, louder audible signals from the transponder, and a problem with changing the battery on the transponder. A list of verbatim responses to this question can be found in Appendix B.

4. CONCLUSIONS

As the primary end users of the system, the feedback from truck drivers is important in identifying benefits of using the AVI/WIM system as well as the improvements that would make the system more effective. The overwhelming majority of drivers surveyed (91%) are paid by load weight, by the trip, or by the mile. The majority of the drivers (86%) had schedules where time was important, and delays greater than 30 minutes were intolerable. For three-quarters of the drivers, the time was "critical" or "very important." The average length of time the drivers felt they were delayed at weigh stations was nine minutes, but 13% of them said they were delayed more than 15 minutes. Eighty four percent of drivers said the AVI/WIM system benefits them by reducing trip delay.

In addition to saving time, drivers indicated the AVI system also has a potential for improving traffic safety. Sixty percent of the drivers had experienced an unsafe driving condition while entering, exiting or stopping in weigh stations. The majority of respondents who had experienced unsafe conditions at weigh stations had problems while diverging into the weigh station. When describing unsafe situations at the weigh stations, several drivers reported that delays at the weigh station caused trucks to back up while waiting in line, sometimes all the way onto the interstate. The drivers recognized the benefits of using the AVI system to reduce this sort of problem. About 91% of drivers thought the AVI transponder system reduces the hazards of merging and diverging at weigh stations.

The hazard level at weigh station entrances and exits were not significantly different than the hazard level at regular exit or entrance ramps. Drivers felt that interstate work zone and interstate rush hour conditions were the most hazardous, followed by merging from entrance ramps, entering/exiting weigh stations, and diverging to exit ramps. Driving hazards for these conditions were all significantly higher than the driving hazard in normal interstate conditions. In addition, the hazards from merging at entrance ramps were determined to be significantly higher than the hazards from diverging to exit ramps.

Some of the participating drivers experienced some frustration in using the system because they felt that the system simply did not work for them all the time. In the drivers' opinions, the reliability of the AVI transponder system was in question because some drivers were not given clearance by the AVI transponder to bypass the station when the system was operational. Drivers felt that the system was not turned on at times.

Drivers felt that the transponder should have brighter lights, a louder audible indicator, and easier access to the battery compartment. Most drivers were satisfied with the size of the transponder. Driver felt that the red and green LED lights were sufficiently visible, but several did feel that the LED lights were too dim to be easily viewed in daylight conditions. About half of the drivers felt that the audible indicators of the transponder were not loud enough. The transponder battery failed for one-quarter of the surveyed drivers. As for the design of the transponder itself, they seemed generally satisfied and proposed a few changes to the design that would make the device more convenient. For the most part, drivers seemed to be in favor of using the system, and believed that it would improve safety as well as save time and money.

Although the drivers were generally in favor of the adoption of the AVI system, slightly less than half were willing to pay up to one dollar, and one-quarter were willing to pay no more than two dollars per bypass. Eighty-eight percent of the drivers surveyed advocated the installation of AVI transponder systems at all Illinois weigh stations, and eighty-eight percent wished to continue using the AVI transponder system.

APPENDIX A

Survey of Professional Truck Drivers' Opinion of AVI and WIM Systems at Williamsville Weigh Station

Instructions: PLEASE COMPLETE AND RETURN IN ENCLOSED ENVELOPE

This survey is being conducted by a research team from the University of Illinois. All respondents will remain completely anonymous. Your name will not be recorded in the survey, nor will your driving records be affected in any way by your completion of this questionnaire. Please fill in the blanks or circle the response that best answers each question. Your opinions of the AVI system are critical to this project. Please answer all questions and return the survey in the enclosed envelope.

Thank you for your help.

Background

1. How many years have you driven a large truck? _____ years
2. How many miles did you drive a large truck last year? _____ miles
3. How old are you? _____ years
4. Do you own your own large truck? _____ (yes/no)
5. What type of large truck do you drive most frequently? **(Choose one only)**
 - a) Box Van
 - b) Flatbed or Platform
 - c) Hopper
 - d) Grain
 - e) Tanker
 - f) Livestock
 - g) Double Bottom
 - h) Dump
 - i) Other _____
6. How are you paid for your driving?
 - a) Salary
 - b) Hourly
 - c) By the trip
 - d) By load weight
 - e) By the mile
 - f) Other _____
7. Which of the following statements best describes the time sensitivity of your driving schedule?
 - a) Critical - every minute of delay costs me money
 - b) Very important - can tolerate small delays
 - c) Important - can tolerate delays of up to 30 minutes
 - d) Somewhat - can tolerate delays of up to 1 hour
 - e) Unimportant - my schedule is at my own pace and not time dependent
 - f) no opinion

Weigh Station Experience

8. On average, how many minutes are you delayed when you must stop to be weighed at a weigh station in Illinois? _____ minutes
9. In the past year, have you ever experienced an unsafe driving situation when entering, exiting, or stopping at a weigh station? _____ (yes/no)
10. If yes, how many times? _____ times
Please describe the unsafe situation at weigh station: _____
11. Please rate the **hazard level** of the following driving conditions on an interstate highway:

(circle a number for each situation)

HAZARD LEVEL

	None	Low	Medium	High	Very High	No Opinion
Normal Interstate Driving	1	2	3	4	5	0
Interstate Rush Hour Traffic	1	2	3	4	5	0
Interstate Exit Ramp	1	2	3	4	5	0
Interstate Entrance Ramp	1	2	3	4	5	0
Weigh Station Entrance & Exit	1	2	3	4	5	0
Interstate Work Zone	1	2	3	4	5	0

12. Which of the following statements best describes your view of highway weight enforcement?
- a) Important – for safety and road maintenance
 - b) Somewhat Important – benefits outweigh costs
 - c) Indifferent – benefits equal costs
 - d) Necessary Evil – some benefits but large cost
 - e) Useless – a complete waste of time and money
 - f) No opinion
13. In the past year, have you been cited for being overweight? If so, how many times?
 _____(yes/no) _____times

Automatic Vehicle Identification / Weigh In Motion System

14. How long have you had the AVI transponder in your truck? _____ months
15. In the past **two** months, how many times have you driven past the Williamsville weigh station on Interstate - 55? (**answer one only**)
 _____times / day _____times / week _____times / month
16. In the past **two** months, what fraction of the time has your AVI transponder been operational? (operational means you get a red or green signal)
- a) _____ % of the time
 - b) Don't recall / no opinion
17. In the past **two** months, when your AVI transponder system is operational, what fraction of the time are you given clearance by the AVI transponder to **bypass** the **weigh station**?
- a) _____% of time cleared to bypass by AVI
 - b) Don't recall / no opinion
18. In the past **two** months, when you are **not** cleared to bypass the weigh station by the transponder, how often are you cleared to bypass the **scales** by the **low speed sorter**?
- a) _____% of time cleared to bypass scale hous
 - b) Don't recall / no opinion
19. In the past **two** months, when your AVI transponder was working and you were required to **stop** at the **scale house**, what fraction of the time were you overweight?
- a) _____% of time overweight
 - b) Don't recall / no opinion
20. How accurate do you think the AVI transponder system is?
- a) Very accurate
 - b) Somewhat accurate

- c) 50/50
- d) Somewhat inaccurate
- e) Never accurate
- f) Don't know / No opinion

21. Over the past **two** months, how many times has the AVI device given you a signal that you did not understand? _____ times

22. Have you ever been stopped by Illinois law enforcement personnel for illegally bypassing the Williamsville weigh station after your AVI transponder cleared you to bypass the weigh station? _____(yes/no)

23. During the day, how well can you see the **visual** indicators (the red and green LED lights) on the AVI transponder?

Red LED light

- a) too dim
- b) just right
- c) too bright
- d) no opinion

Green LED light

- a) too dim
- b) just right
- c) too bright
- d) no opinion

24. During the night, how well can you see the **visual** indicators (the red and green LED lights) on the AVI transponder?

Red LED light

- a) too dim
- b) just right
- c) too bright
- d) no opinion

Green LED light

- a) too dim
- b) just right
- c) too bright
- d) no opinion

25. How well can you hear the **audible** indicators (the "red" and "green" sounds) on the AVI transponder?

"Red Sound"

- a) too soft
- b) just right
- c) too loud
- d) no opinion

"Green Sound"

- a) too soft
- b) just right
- c) too loud
- d) no opinion

26. How convenient is the size of the AVI transponder for mounting in your truck?

- a) too small
- b) about right
- c) too large
- d) no opinion

27. Has the battery in your transponder failed since you have been using it (no signal for extended period of time)? _____(yes/no)

28. Overall, how easy is the AVI transponder system to use?

- a) Easy
- b) Moderate
- c) Hard

- d) No opinion
29. What do you think of the instruction and training you received regarding the AVI transponder?
- a) Not enough instruction
 b) Just right
 c) Too much instruction
 d) No opinion
30. How is the location of the AVI transponder system on the interstate highway?
- a) Too far from the station
 b) Too close to the station
 c) Good placement of the system
 d) No opinion
31. Should the State of Illinois install AVI transponder systems at all weigh stations? _____(yes/no)
32. Have you used similar systems in other states? _____(yes/no)
33. If given the choice, would you continue to use the AVI / WIM system? _____(yes/no)
34. If yes (to # 33), what fee would you be willing to pay each time you were able to bypass the weigh station? (What is it worth to you to bypass?)
- a) < \$1.00 c) \$2.00-\$3.00 e) \$5.00-\$7.00
 b) \$1.00-\$2.00 d) \$3.00-\$5.00 f) >\$7.00

35. Please rate the benefits of the AVI / WIM system on a scale of 1 to 5

<u>Benefit</u>	<u>no benefits</u>	<u>few benefits</u>	<u>some benefit</u>	<u>great benefit</u>	<u>very great benefit</u>	<u>no opinion</u>
a) Reduces trip delay	1	2	3	4	5	0
b) Reduce merge / diverge hazard	1	2	3	4	5	0
c) Reduces fuel consumption	1	2	3	4	5	0
d) Other _____	1	2	3	4	5	0

36. Do you have any additional comments regarding installation, training, placement, or operation of the AVI transponder or transponder system? _____

37. How can the AVI / WIM system be improved?

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APPENDIX B

Verbatim Responses to Survey Question #10: "Please describe the unsafe situation at weigh station"

1. Traffic before scale usually back up on interstate
2. Backed out on the highway
3. Trucks backed up all the way including on the highway, stopped
4. Scales packed and on shoulder of highway
5. Trucks backed up on the highway along side of road, sometimes as far as the open/closed sign
6. Having to stop on the highway because there is no room to get into scale house
7. Traffic flow trying to merge back into traffic
8. Truck backed up on highway. Cars not letting you get back on highway after weighing
9. When the lanes are backed up all the way past entrance ramp & on the interstate
10. Rough entrance/exit, too much traffic
11. Traffic backed up on interstate or out on road and stopped in all weather conditions
12. Long lines entering weigh station backed up onto road
13. When it is foggy
14. Merging back into traffic and sitting in road waiting to be weighed
15. Entering the scale and the trucks are back out to the road I feel is unsafe for other motorists. When a truck is waiting to get into weigh.
16. Ramp was full, almost hit from behind
17. Merging into traffic. Being in middle lane and unavailable to exit for scale.
18. Backed up on highway, cars coming up behind you
19. Too many trucks waiting to scale at Lebanon, backing up down the entrance ramp
20. Truck traffic backing up on highway because scalemaster not using by-pass or closing scale to clear traffic problem
21. Trucks backed up at ramp on to highway at night
22. Stopping on the side of the highway because traffic is backed up because the scale is still open
23. Back up on ramp
24. Trucks backed up on highway. Person in charge neglected to close scales. No where for trucks to go.

APPENDIX B (continued)

Verbatim Responses to Survey Question #36: "Do you have any additional comments regarding installation, training, placement, or operation of the AVI transponder system?"

1. Good idea
2. No
3. Never seen it work
4. I think it could be more sensitive. Most of the time if I have anything at all on my trailer I receive the red even when hauling a few racks of bread.
5. No
6. No
7. Works only if turned on by weighmaster. Needs a better way to attach to windshield or visor.
8. The only opinion I have so far is "it doesn't work"
9. Why should it have to cost a person to use the AVI? If there has to be a charge, then I think you should just take it out.
10. No
11. Make them compatible with other states
12. It has never worked
13. My system has never worked. I can not really help out. The bypass (roll over) scale is very sufficient.
14. Leave on at scale house at all times. Night time it is off.
15. None
16. Does not work
17. Use it. Make it work.
18. Make it work.
19. Just needs to be used by the scale house.
20. Turn it on.
21. For the operation of it. They could leave the thing on for us that have it so they do not cause a hazard to the traffic.
22. No
23. No
24. Very good system if bugs are worked out of system
25. the lights could be larger and brighter for daytime use. Audible indicator must be louder. Didn't even know its there.
26. Positioned about 1-2- inches too close to center of windshield, interference from divider. Ensure that operator does not have ability to choose trucks at random.
27. Better installed in trucks.
28. Get something to really keep it in the window. The heat from the sun melts the stick-glue on the back of the velcro. Right now I use glad bag tied up to visor.
29. System needs to work better each day. System greatly reduces trucks getting backed up on main road.
30. Good for all weigh stations
31. No
32. No
33. No
34. No
35. No
36. Need to instruct more on and utilize more
37. No
38. Teach scalehouse to turn it on and have to use
39. If legal should get green light

APPENDIX B (continued)

Verbatim Responses to Survey Question #37: "How can the AVI / WIM system be improved?"

1. Just keep it updates
2. The AVI system has never worked for me. I stopped at the weigh stations and exchanged it twice, but still never worked
3. Have the signal sound further away from station so we can change lanes sooner, opening up lane nearest scale for traffic coming out of the scale house
4. I think that it needs to be in operation more. I get the red light for no reason. I was even told by scale masters that they forget to turn it on.
5. Keep it turned on at the scale. Many \$'s spent and not being used (even bobtailing gets a red signal, even at 50mph, no cell phone or c.b.) I hope they keep trying. It's a good idea
6. I don't know if the scalemaster doesn't know how to read the scale meter or not, but if you only have 20,000 lbs on your trailer or gross weight, I don't think that you should have to enter with an AVI system unless they want to give you a D.O.T. inspt.
7. Make it affordable. Make them compatible with other states
8. It should worked
9. Install state and nation wide
10. Set weight limit up to 33,500 instead of 32,500
11. At weigh station should work faster
12. Remove it
13. Turn it on
14. Turn it on
15. It's fine
16. Better or more accurate scale readings so as to be able to stay on interstate
17. When you are legal you shouldn't have to come off the highway
18. Put system in place at all scales nationwide
19. The unit should not be sealed so that battery can be replaced
20. Works fine
21. Calibrate and keep operator's hands off except when to turn it on/off for the days of operation
22. Just make sure its working all the time. Too many times it seems like you get a red light or no light at all.
23. Use the way B-4 scale. Use a primary and secondary, to get accurate results.
24. Take the system power switch (on & off) out of the scalehouse
25. Ok the way it is
26. Use spacing between trucks
27. Needs to work more often
28. Leave on
29. Leave it turned on
30. AVI transponder in right place
31. From question 29 -- not enough instruction per terminal
32. Put them in every truck
33. Good
34. Red on empty loads
35. Better or bigger lights to see or brighter & sound louder. Placement of transponder in right bottom corner
36. Make it nationwide
37. If legal should get green light (same answer)