# AGGRESSIVE DRIVING VIDEO AND NON-CONTACT ENFORCEMENT

## (ADVANCE)

## *Drivers' Reaction to Violation Notices*

### ***SUMMARY OF SURVEY RESULTS***

## Final Report

Submitted to

**Maryland State Police**

By

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Under Contract to

**SCIENCE APPLICATIONS INTERNATIONAL CORPORATION**

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DANIEL CONSULTANTS, INC.

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## LIST OF ACRONYMS

| | | |
|---|---|---|
| ADVANCE | - | Aggressive Driving Video And Non-Contact Enforcement |
| ATC | - | Aberdeen Test Center |
| DCI | - | Daniel Consultants, Inc. |
| FHWA | - | Federal Highway Administration |
| FMCSA | - | Federal Motor Carrier Safety Administration |
| JPL | - | Jet Propulsion Laboratory |
| MDSHA | - | Maryland State Highway Administration |
| MSP | - | Maryland State Police |
| UDA | - | Unsafe Driver Action |
| USDOT | - | United States Department of Transportation |

# "ADVANCE" PROJECT: DRIVERS' REACTION TO VIOLATION NOTICES

## BACKGROUND

Aggressive driving involves deliberate, unsafe driver actions (UDAs) such as driving over the speed limit, following too closely, and unsafe lane changing. Aggressive driving has been recognized as a major contributing factor to freeway crashes in the U.S. In an effort to reduce aggressive driving, the Maryland State Police (MSP) – in collaboration with the Maryland State Highway Administration (MDSHA), the Federal Motor Carrier Safety Administration (FMCSA), and the U.S. Army Aberdeen Test Center (ATC) – embarked on an effort to develop the Aggressive Driving Video And Non-Contact Enforcement (ADVANCE) system. ADVANCE is an integration of state of the practice, off-the-shelf technologies – which include video, speed measurement, distance measurement, and digital imaging – that detects UDAs in the traffic stream and subsequently notifies violators by mail of their UDA. The system is capable of obtaining sharp digital images of vehicle registration numbers, United States Department of Transportation (USDOT) registration numbers, vehicle paths, and UDAs. The system is permanently installed in a vehicle and operated by a trained officer. Field records of violators are saved on computer discs for later processing by an information system in the office. This ADVANCE system is being modified to access motor vehicle records at the roadside to identify the owners of the violating vehicles to whom violation notices are sent by mail.

Daniel Consultants, Inc. (DCI) has been tasked to conduct mail and telephone surveys on the drivers who were caught with aggressive driving behaviors during the test phase of the ADVANCE Project. The purpose of the survey is to understand whether or not the issued violation warnings have had any influence on the drivers' behavior. To fulfill this purpose, the following objectives were defined:

a. For non-commercial vehicle drivers, find out what kind of influence the ADVANCE system would have on the violators' safe driving practice.

b. For non-commercial vehicle drivers, assess the influence of the ADVANCE system on their family members or friends.

c. Understand the violators' perception of the effectiveness of the program in influencing their driving behaviors.

d. For commercial vehicle drivers, find out what type of actions employers have taken to positively influence the violators' driving behaviors.

In this survey, three types of vehicle were considered:

1. Private vehicles. These are passenger vehicles for private usage.
2. Commercial trucks. These are business vehicles that have USDOT numbers.
3. Commercial passenger vehicles. These are passenger-type vehicles (not trucks) used by businesses and do not have USDOT numbers.

MSP supplied names and addresses of violation notice recipients during the three most recent months; October 2000 (177 notices), June 2000 (188 notices) and May 2000 (300 notices). Out of these 665 available names, mail surveys were sent out to 200 subjects with the following distribution:

a. Private vehicles – 140
b. Commercial trucks – 30
c. Commercial passenger vehicles – 30.

The remainder of the list was used to select some 30 subjects (10 in each of the three categories) for telephone surveys. DCI used the telephone directory services to look up the telephone numbers.

Appendix A and Appendix B show the survey forms that were used in the mail survey and the telephone survey, respectively. Out of the 200 forms that were sent out, 74 responses were received; and out of 42 telephone calls, 18 telephone interviews were granted. Thus, there are 92 responses in total. The greatest challenge to telephone interviews was the ability to make contact with the potential interviewees. Because only the interviewees' home telephone numbers were available, it was very difficult to contact them during daytime at home. DCI then decided to call the potential interviewees during weekends, which resulted in more interviews. Table 1 shows the breakdown of the successful and unsuccessful telephone calls during this phase of the data collection. In the next section, a summary of the survey results is presented. This summary is followed by a summary of the observations and recommendations.

***Table 1 — Breakdown of Telephone Call Results***

| Result of Telephone Calls | Trucking Companies | Businesses | Private Vehicles | Total No. of Events | % of Total |
|---|---|---|---|---|---|
| Number of surveys completed | 5 | 6 | 7 | 18 | 43% |
| Number of surveys could not be filled out because: | | | | | |
| Employee's name or tag/trailer number needed | 2 | | | 2 | 5% |
| Calls not returned | 2 | 3 | 2 | 7 | 17% |
| Phone not in service, changed, or wrong number | 1 | 2 | 4 | 7 | 17% |
| No answer | | | 4 | 4 | 10% |
| Answering machine in a foreign language | | | 1 | 1 | 2% |
| Person not home | | | 1 | 1 | 2% |
| Phone was always busy | | | 1 | 1 | 2% |
| Refuse to grant interview | | | 1 | 1 | 2% |
| **Total Number of Calls** | 10 | 11 | 21 | 42 | |

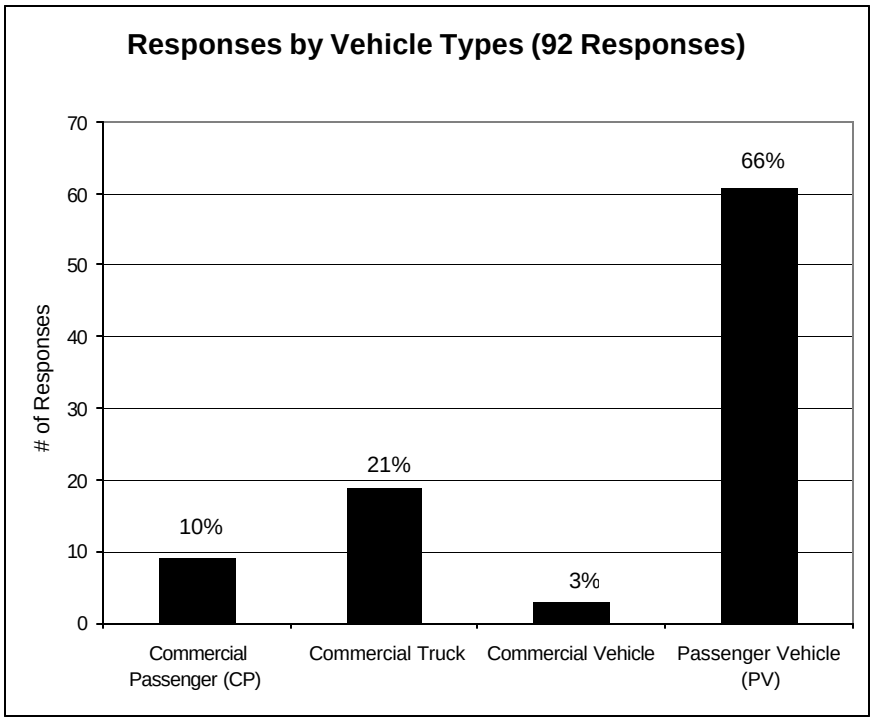
## SURVEY RESULTS

In this section, the combined results of the questionnaire and telephone surveys are presented. This presentation follows the following order:

a. Responses by Vehicle Types and Violation Types
b. Effectiveness Ratings
c. Indication of Influences on Driving Behavior
d. Actions Taken by Employers
e. Comments Provided by Respondents

Responses by Vehicle Types and Violation Types

Figure 1 shows that out of 92 responses, 66% of the survey responses are from passenger vehicles and 34% from commercial vehicles. There were a few commercial-vehicle responses that did not indicate the specific vehicle type involved (that is, a truck or a passenger-type vehicle). Thus, they were grouped in the "Commercial Vehicle" category as shown in Figure 1.




Note Commercial Vehicle refers to responses that did not indicate whether the vehicle is a truck or a passenger-type vehicle

***Figure 1. Survey Responses by Vehicle Types***

The survey responses by violation types are shown in Figure 2. The majority of the violation is in the category of speeding (91%). Other types of violation make up a very small percentage of the sample size. None of the reported violation was in the "Following Too Close" category. (The raw data collected by MSP might contain information on Following-Too-Close violations. This information, unfortunately, was not included in the data set provided to DCI for analysis.) It is interesting to note that the majority of the violators for speeding used the excuse that they had to keep up with the traffic stream speed and got caught.

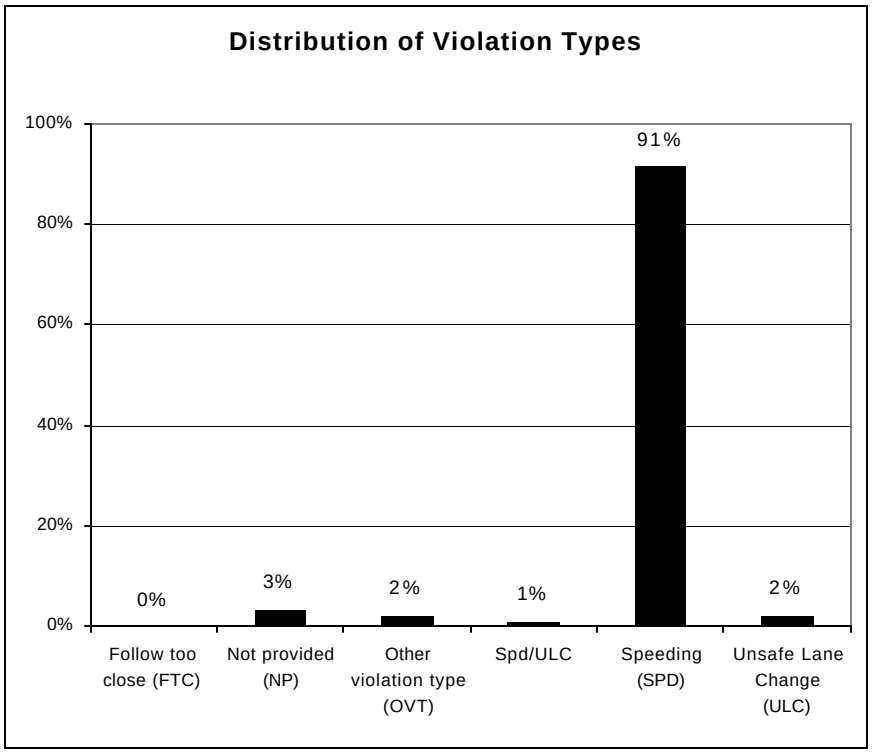



***Figure 2. Survey Responses by Violation Types***

Effectiveness Ratings

The *Effectiveness Ratings* represent an attempt to understand how much an impact the violation warnings have had on the violators' driving behavior. The following question was asked of the private vehicle drivers:

> *On a scale from 1 to 5, with 1 being "less cautious" and 5 being "very cautious", how would you rate the effects of the warning notice on your (or your family/friend's) safe driving practice?*

A similar question was asked of the commercial vehicle owners/operators.

> *On a scale from 1 to 5, with 1 being "less cautious" and 5 being "very cautious", how would you rate the effects of the warning notice on the safe driving practice of your driver?*

The *Effectiveness Ratings* responses from the private vehicle drivers are shown in Figure 3. They indicate that this group tends to be more cautious, knowing that their aggressive driving may be monitored.

For commercial vehicle drivers, a similar trend is also indicated but not as strong as that of the private vehicle drivers (refer to Figure 4). It should be noted that five of the seven commercial-vehicle respondents did not provide the ratings because they needed the driver's name, or tag number, or trailer number to look up the driver's records.

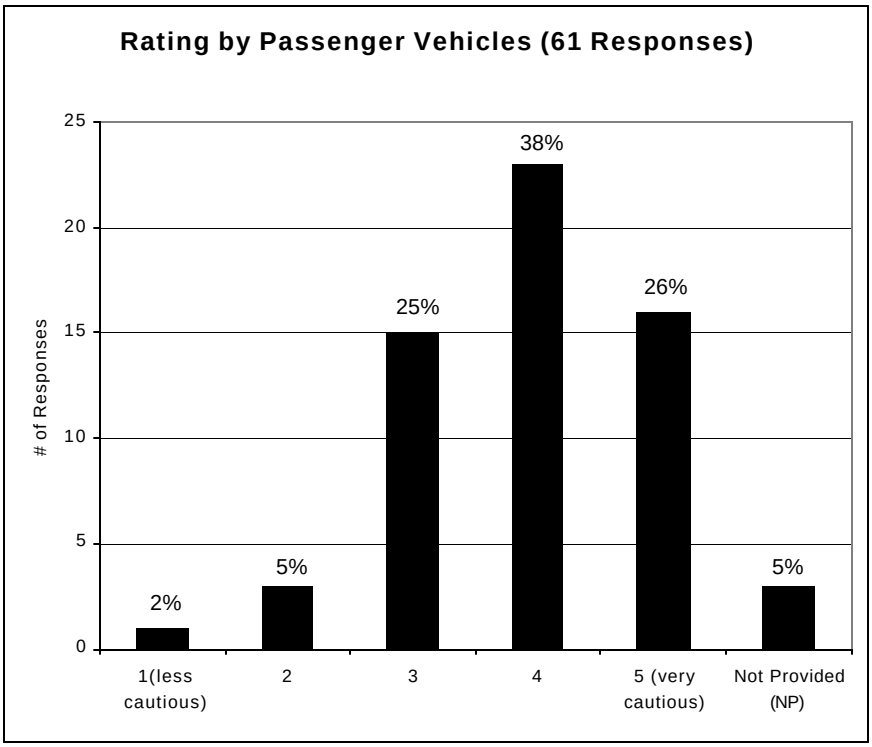



*Figure 3. Effectiveness Ratings Provided by Private Vehicle Drivers*

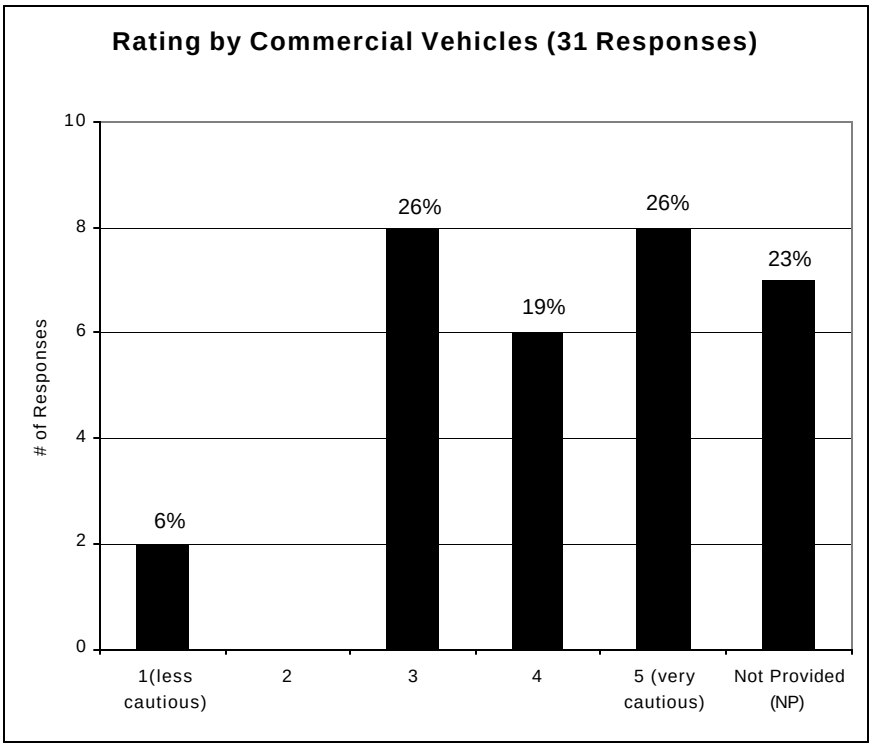



*Figure 4. Effectiveness Ratings Provided by Commercial Vehicle Owners/Operators*

The overall effectiveness ratings of all respondents are shown in Figure 5. As shown in this figure, more than 80% of the respondents tend to think that the violation warning makes them drive more cautiously.

Indication of Influences on Driving Behavior

In addition to the effectiveness ratings described above, the survey also aimed at obtaining information on the potential, positive influence of the warnings on the private-vehicle drivers' safe-driving behaviors, as well as those of their family members and friends.

For private vehicle drivers, the following questions were asked:

*Did the warning notice make you drive more safely?*

*Did the warning notice make your family members/friends drive more safely?*
*? Yes ? No ? Don't know*

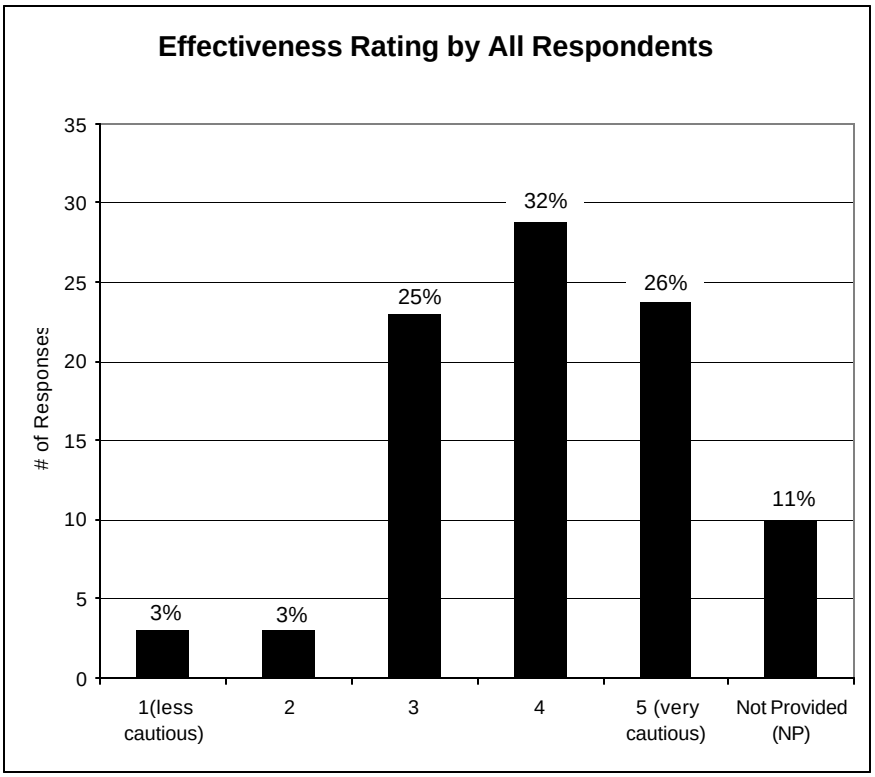



***Figure 5. Effectiveness Ratings Provided by All Respondents***

Figure 6 shows that most drivers indicated that the warnings have made them drive more safely (84% of the responses). Only 8% (or five responses) of the responses indicated negatively. For the five respondents who indicated that the warning did not make them

drive more safely; three indicated that the warning did not have an influence on their family members or friends, one did not provide an answer, and one indicated "not applicable."

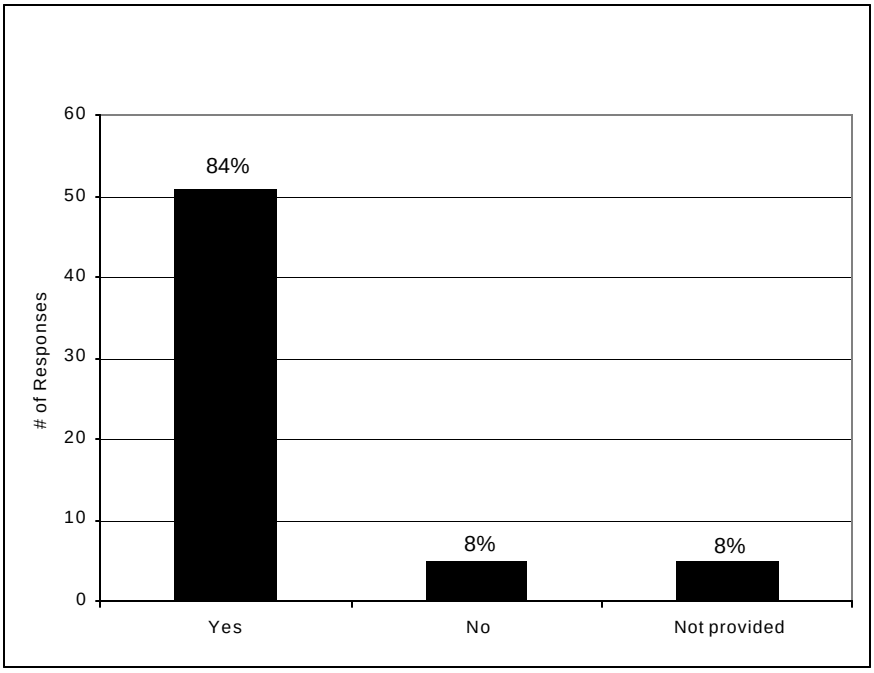



***Figure 6. Responses to the Question Whether or Not the Warnings Make Private Vehicle Drivers Drive More Safely***

For those people who indicated that the warnings have made them drive more safely, 35% indicated that the warnings also made their family members or friends drive more safely, too; and 27% said they did not know, as shown in Figure 7. There were 14% of the responses indicated that their situation did not apply, and 18% did not provide an answer.

Actions Taken by Employers

The survey results indicate that most employers gave warnings to the employees who were caught with the violations (71% of the responses), as shown in Figure 8. Some of the warnings are accompanied by disciplinary actions, including driving restriction, threat of discharge, or written notification in the employee's file. One respondent indicated that the employee's employment was terminated.

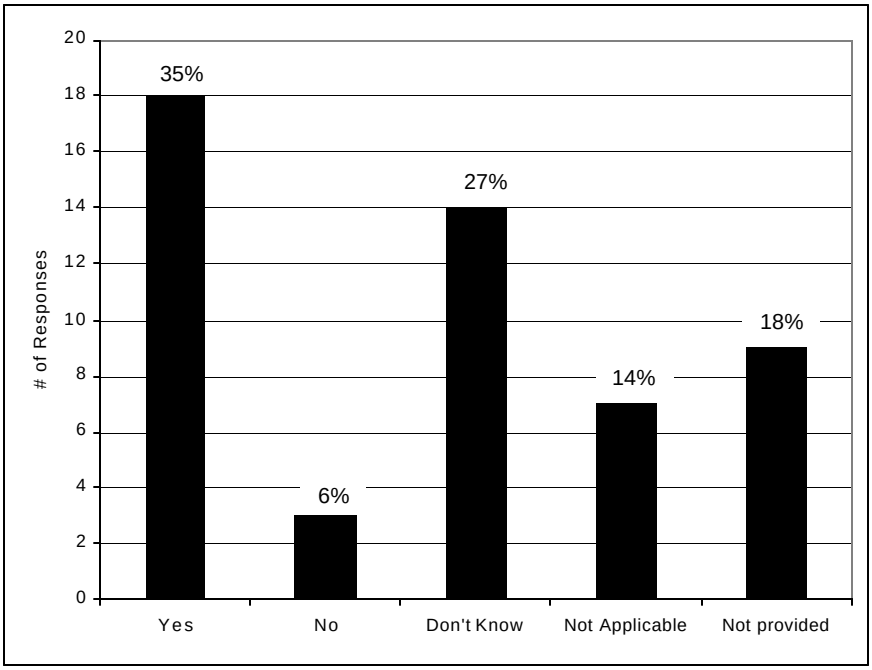



***Figure 7. Potential Secondary Effect of the Warnings on Family Members and Friends***

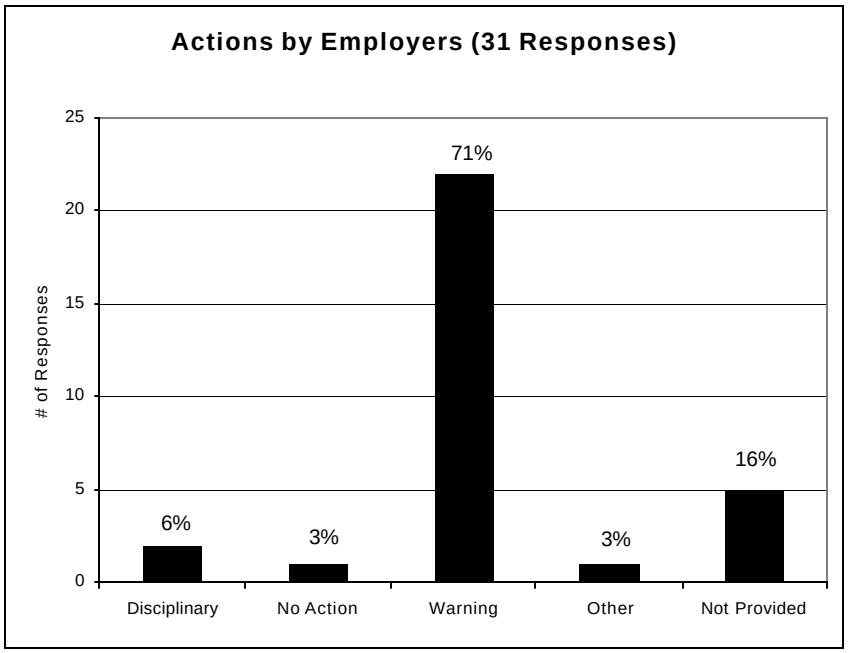



***Figure 8. Actions Taken by Employers against Drivers with the Warnings***

Comments Provided by Respondents

There were 46 responses with comments (which is 50% of the respondents) as shown in Appendix C. To help generalize the comments, five categories of comments were

defined and the distribution of the comments summarized as shown in Figure 9. As shown in this figure, 37% of the comments praise this effort by MSP while 9% criticizes it. Twenty percent (20%) of the respondents provided various excuses for their violations. A majority said that they had to follow the speed of the traffic stream. The majority of responders who asked for more information were commercial vehicle owners/operators who needed the vehicle tag number and/or trailer tag number to identify their drivers' names in order to complete the survey.

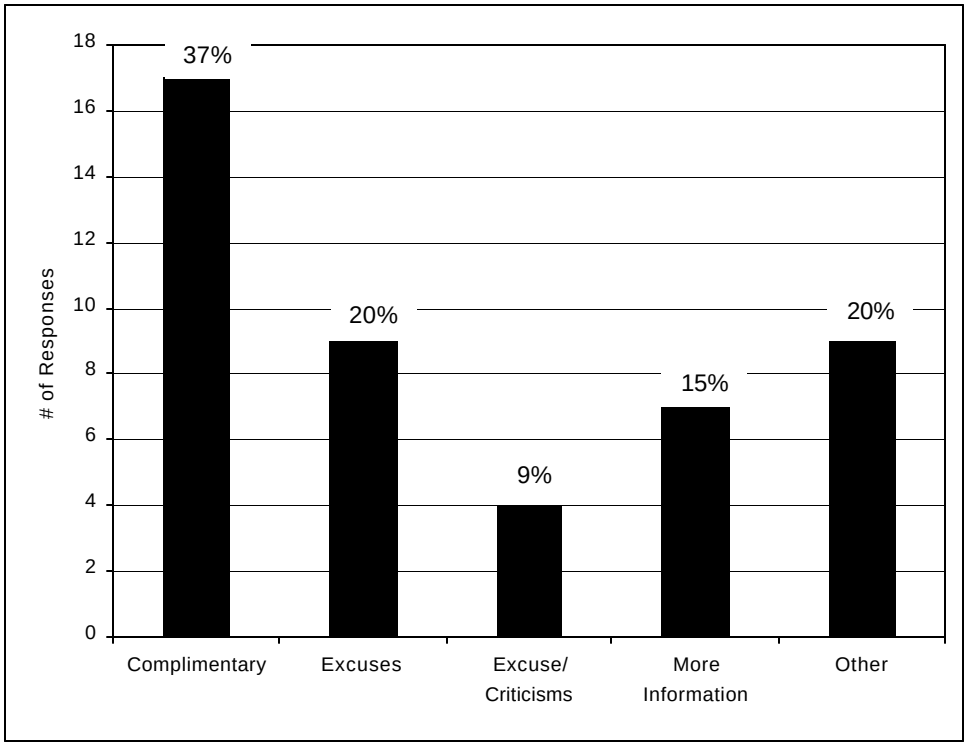



***Figure 9. Summary of Comments provided by the Respondents***

## OBSERVATIONS AND RECOMMENDATIONS

The survey results have indicated that operators and/or owners of commercial vehicles are willing to exercise corrective measures to positive influence the safe driving behavior of their employees. These corrective actions are more likely if the operators/owners can positively identify the drivers who committed the violation. Many commercial vehicle operators/owners in the survey indicated that they needed more information (such as the vehicle's tag number or the trailer's tag number) in order to identify the employee who committed the violation. The problem, as indicated by these respondents, was that they could not correlate the USDOT number reported in the violation warning notice to the individual vehicle. The vehicle/trailer identification is necessary for identifying the driver of that vehicle on the day of the violation. Many respondents said that they have the same USDOT number for all the vehicles they operate. It is, therefore, recommended that the vehicle's tag number or the trailer's tag number, or both, be included in the violation warning notice.

The second observation, and its associated recommendation, pertains to the statistical significance of the survey sample size. For the sample size received, the survey results are statistically significant at 95% confidence level, as shown in the summary of the statistical analysis contained in Appendix D. At this 95% confidence level, the sampling errors of almost all the results are at most 7% from the mean value. If a higher confidence level were desired, the required sample size would be too large to be economically feasible for data collection. (Appendix D shows that about three times as large a sample size would be required in most cases to achieve a 97% confidence level.) It is, therefore, recommended that no additional survey questionnaires be sent out for the purposes of this study.

## CONCLUSION

The survey results have indicated that the majority of the people support the ADVANCE initiative to reduce aggressive driving. This support is notable among the commercial vehicle operators/owners who have a vested interest in the safe driving behavior and practice of their employees. The positive influence of the warning on the violator's family members and friends has also been indicated, but its significance is inconclusive.

## APPENDIX A

## AGGRESSIVE DRIVER IMAGING ON CAPITAL BELTWAY SURVEY QUESTIONNAIRE

In order to enhance public safety, Maryland State Police (MSP) has undertaken a test program called **Aggressive Driving Video and Non Contact Enforcement (ADVANCE**) to detect aggressive driving actions. MSP has authorized DANIEL CONSULTANTS, INC. (DCI) to conduct this survey to evaluate the program's effectiveness. Our record shows that as a registered vehicle owner, you recently received a warning notice for aggressive driving, generated by the ADVANCE Program. This violation might have resulted from improper driving by you, your family/friend (in case of private vehicle) or a driver of your company (in case of business vehicle). Since the violation was detected during this test program, no penalty was imposed. However, we would like to ask for your cooperation by answering and returning the enclosed postage-paid questionnaire. **You need to simply re-fold the questionnaire in a way the return address is on the front side**. Any response you provide will be kept strictly confidential and be used for analysis purposes only.

**Please respond by February 4, 2000.** If you have any question regarding this solicitation or the ADVANCE Test Program, please call the Maryland State Police at (410) 653-4236.

---

1. Check the vehicle type that was involved in the violation.
   - ? Private vehicle
   - ? Business vehicle
     - _____ Commercial Truck
     - _____ Passenger vehicle (including pickups and vans)

2. Please indicate the type of violation warning notice that you or the driver of your company received.
   - ? Speeding
   - ? Following Too Closely
   - ? Unsafe Lane Change
   - ? Other Violation Type. Please specify _____

3. **ANSWER TO THIS QUESTION ONLY IF IT WAS A PRIVATE VEHICLE** (i.e., the violation was committed by you or your family/friend).
   a. Did the warning notice make you drive more safely? ? Yes ? No
   b. Did the warning notice make your family members/friends drive more safely, if applicable?

      ? Yes ? No ? Don't know ? Not applicable
   c. On a scale from 1 to 5, with 1 being "less cautious" and 5 being "very cautious", how would you rate the effects of the warning notice on your (or your family/friend's) safe driving practice (please circle one number)?

      1 2 3 4 5

4. **ANSWER TO THIS QUESTION ONLY IF IT WAS A BUSINESS VEHICLE** (i.e., the violation was committed by a driver of your company).

   a. Has there been any action to influence the safe driving practice of your driver?
      - ? Warning from management
      - ? Disciplinary action. Please describe _____
      - ? Other action. Please describe _____
      - ? No action

   b. On a scale from 1 to 5, with 1 being "less cautious" and 5 being "very cautious", how would you rate the effects of the warning notice on the safe driving practice of your driver (please circle one number)?

      1 2 3 4 5

5. Any other comments you would wish to provide_____
   _____
   _____

## APPENDIX B

## AGGRESSIVE DRIVER IMAGING ON CAPITAL BELTWAY TELEPHONE SURVEY QUESTIONNAIRE

- My Name is ____. I am with Daniel Consultants. We are conducting a survey for Maryland State Police.
- Maryland State Police has a project to detect traffic violations on Capital Beltway using imaging. It's called **ADVANCE**. The State Police has appointed us to evaluate the effectiveness of this program.
- Our record shows that as a registered vehicle owner, **YOU/YOUR COMPAN**Y recently received a warning notice for aggressive driving, generated by this Program. I would like to ask you a few questions which will take less than 5 minutes. We appreciate your time to do this. We will use your responses for research purposes only. *Any response you provide will be kept strictly confidential.*

**If they ask for verification or have any questions regarding this solicitation or the ADVANCE Test Program, they can call Maryland State Police at (410) 653-4236.**

---

NAME_____ Telephone # _____ Violation Date _____

Date Called _____Time _____

1. What is the vehicle type that was involved in the violation (**FILL OUT AND VERIFY**).

   ? Private vehicle

   ? Business vehicle

   _____ Commercial Truck

   _____ Passenger vehicle (including pickups and vans)

2. What is the type of violation warning notice that YOU/THE DRIVER OF YOUR COMPNAY received. (**FILL OUT AND VERIFY**)

   ? Speeding ? Following Too Closely

   ? Unsafe Lane Change ? Other Violation Type. Please specify _____

3. **ASK THIS QUESTION ONLY IF IT WAS A PRIVATE VEHICLE, OR ELSE SKIP.**

   a. Did the warning notice make you drive more safely? ? Yes ? No

   b. Did the warning notice make your family members/friends drive more safely?

      ? Yes ? No ? Don't know

   c. How would you rate the effects of the warning notice on you (or your family/friend's) safe driving practice, on a scale from 1 to 5, with 1 being "less cautious" and 5 being "very cautious"?

      1 2 3 4 5

4. **ASK THIS QUESTION ONLY IF IT WAS A BUSINESS VEHICLE, OR ELSE SKIP.**

   a. Has there been any action to influence the safe driving practice of your driver?
      - ? Warning from management
      - ? Disciplinary action, please describe _____
      - ? Other actions, please describe _____
      - ? No action

   b. How would you rate the effects of the warning notice on the safe driving practice of your driver, on a scale from 1 to 5, with 1 being "less cautious" and 5 being "very cautious"?

      1 2 3 4 5

5. Are their any other comments you would wish to provide _____

   _____

# APPENDIX C

## SUMMARIZED SURVEY DATA

| Response ID no. | Veh type | Violation type | Question 3a | Question 3b | Question 3c | Quest 3 comment | Question 4a | Question 4b | Quest 4 comment | Question 5: other comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | PV | SPD | N | N | 2 | | | | | This highway is always congested so when it is not the camera clicks frustrated drivers. |
| 7 | PV | SPD | N | NA | 3 | | | | | Having spoken to police who maintains that "flow of traffic" is an appropriate speed. I question the "Advance" ability to judge such situations. My driving (with 76-year old stroke victim as a passenger) could hardly be called "Aggressive". Preposterous. |
| 8 | PV | SPD | Y | DK | 4 | | | | | |
| 10 | PV | SPD | Y | Y | 5 | | | | | Good Program - opened my eyes - however at times on I-495 to keep up with traffic you must speed |
| 11 | PV | SPD | Y | Y | 5 | | | | | |
| 13 | PV | SPD | Y | Y | 5 | | | | | |
| 18 | PV | SPD | Y | Y | 5 | | | | | |
| 20 | PV | SPD | N | N | 2 | | | | | Traffic on the 495 Beltway moves at times at 65-70 mph. If you do not want to disrupt this flow you must keep pace. If I was driving dangerously so were 1000 of other motorists. I think this warning is a waste of taxpayers' money to send a warning for going 67. |
| 24 | PV | SPD | N | N | 3 | No difference | | | | This w as not, in my opinion, aggressive driving. I was not near another car. I was traveling 65 mph on the Washington Beltway. While over the posted limit, this is mild for the beltway. More, to call this aggressive driving weakens the idea of the plan. |
| 26 | PV | SPD | Y | NA | 4 | | | | | |
| 27 | PV | SPD | NP | Y | 5 | | | | | |
| 28 | PV | SPD | Y | NA | 4 | | | | | |
| 29 | PV | SPD | Y | Y | 5 | | | | | This type of surveillance is making my family worry all the time, thinking that if they go somewhere in a Maryland state highway that somebody is watching them and their every move. |
| 33 | PV | SPD | Y | N | 3 | | | | | |
| 37 | PV | SPD | Y | NA | 5 | | | | | |
| 38 | PV | SPD | Y | DK | 4 | | | | | I think the system helps in general but I still feel it is safest to drive "with the flow" of traffic, which was what the driver was doing in this instance. |

| Response ID no. | Veh type | Violation type | Question 3a | Question 3b | Question 3c | Quest 3 comment | Question 4a | Question 4b | Quest 4 comment | Question 5: other comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 42 | PV | SPD | N | NP | 3 | | | | | The notice failed to account for the prevailing conditions and traffic - other behavior would have been more dangerous. Traffic in that area routinely exceeds that speed. |
| 44 | PV | SPD | Y | Y | 4 | | | | | |
| 46 | PV | SPD | Y | Y | 4 | | | | | My husband, Terrance K. Mullins, was driving my car that day, so he is the one who answered the survey and not me. |
| 51 | PV | SPD | Y | DK | 3 | | | | | |
| 52 | PV | SPD | Y | NP | 5 | Rating of 5 or as close as possible | | | | |
| 59 | PV | SPD | Y | Y | 4 | | | | | The truck behind me was tailgating and forced me to go faster than I would have. I never had a speeding ticket or any moving violation in my 35 years of driving. To go 55 mph at this section is very dangerous. |
| 60 | PV | SPD | Y | NP | 2 | | | | | It's dangerous to drive 55 on the beltway. When the photo was taken I was going more slowly than many of the cars around me. I don't think it's fair to select cars at random to photograph. |
| 61 | PV | SPD | Y | N | 4 | | | | | |
| 64 | PV | SPD | Y | NA | 4 | | | | | Our daughter was driving and it is our hope that it made her more safety conscious. The warning made us a little annoyed because neither of us had been driving and we did not want our records affected. |
| 66 | PV | SPD | Y | Y | 3 | | | | | I was targeted because I was the lead car in a pack of cars going @ 70 mph on I-495. I wonder if any of the vehicles were targeted. |
| 68 | PV | SPD | Y | Y | 5 | | | | | |
| 73 | PV | SPD | Y | Y | 4 | | | | | |
| 75 | PV | SPD | Y | Y | 4 | | | | | |
| 76 | PV | SPD | Y | NP | 4 | | | | | I am a cautious driver anyway |
| 79 | PV | SPD | NP | NP | NP | | | | | |
| 80 | PV | Ovt | Y | NA | 3 | | | | | |
| 82 | PV | SPD | Y | DK | 4 | | | | | |
| 87 | PV | SPD | Y | Y | 4 | | | | | |
| 88 | PV | SPD | Y | DK | 5 | | | | | |
| 89 | PV | SPD | Y | Y | 4 | | | | | Thank you for the warning and not a ticket, which would have made me angry and more aggressive. |
| 90 | PV | SPD | Y | N | 4 | | | | | |
| 91 | PV | SPD | Y | DK | 4 | | | | | I thought the warning was effective |

| Response ID no. | Veh type | Violation type | Question 3a | Question 3b | Question 3c | Quest 3 comment | Question 4a | Question 4b | Quest 4 comment | Question 5: other comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 69 | PV | SPD | Y | Y | 5 | | | | | I applaud you for the initiative, and sincerely hope that this use of technology will lead to safer driving on Maryland roads. I can tell you that receiving the warning notice was a real "wake up" call for my family, and we have been very careful to adhere to speed limits wherever we are. However, I fail to see any effect on all aggressive drivers in general. We have taken three trips to and from the Eastern Shore over the past three weeks, traveling on both the Capital Beltway and Route 50 on each trip. While we have been traveling close to the posted speed limits, we were passed by literally hundreds of cars, many of which (judging from the speeds at which they passed our car) were easily traveling at speeds of 85 mph or higher. Since this has happened so consistently at a time of supposedly greater scrutiny from the police, we question whether the technology is having any salutary effect on speeders. Until you can demonstrate that all of these unsafe drivers who have been exceeding the speed limits recklessly, are getting tickets and piling up points on the way to losing their licenses, it's fairly premature to be crowing about the initiative. All you have to do is get in your car and hit the beltway. If the technology were working, you wouldn't see the excesses that are so evident today. All I can say is that I support the police, but wish they would enforce the law to start with. |
| 92 | PV | SPD | Y | Y | 4 | | | | | |
| 93 | PV | SPD | NP | Y | 5 | | | | | I strongly support this program. My daughter was given a wakeup call, thanks. |
| 95 | PV | SPD | NP | NP | NP | | | | | |
| 102 | PV | SPD | Y | Y | 4 | | | | | |
| 110 | PV | Ovt | Y | DK | 3 | | | | | |
| 110 | PV | SPD | Y | NA | 3 | | | | | It makes me cautious to know that I am being watched from some points. I have been trying to keep the speed limit, thank you. |
| 113 | PV | SPD | Y | DK | 3 | | | | | |
| 115 | PV | SPD | Y | NP | 3 | | | | | |
| 117 | PV | SPD | Y | DK | 5 | | | | | |
| 126 | PV | SPD | Y | DK | 3 | | | | | |
| 129 | PV | SPD | Y | DK | 3 | | | | | Is it legal to take pictures of me without my permission? |
| 132 | PV | SPD | Y | NA | 3 | | | | | |
| 133 | PV | SPD | Y | Y | 5 | | | | | |

| Response ID no. | Veh type | Violation type | Question 3a | Question 3b | Question 3c | Quest 3 comment | Question 4a | Question 4b | Quest 4 comment | Question 5: other comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 137 | CP | SPD | | | | | WRN | 4 | | |
| 138 | PV | SPD | Y | DK | 5 | | NP | NP | | |
| 146 | CP | SPD | | | | | DIS | 5 | She was fired | This is an excellent enforcement program |
| 147 | CT | SPD | | | | | WRN | 3 | Warned all employees | We copied the warning you sent to us, and put a memo on it to all employees saying that unsafe driving is unacceptable. |
| 149 | CP | SPD | | | | | WRN | 3 | | |
| 151 | CT | SPD/ULC | | | | | WRN | 3 | The matter was reviewed with the driver | Program is a good idea - it will have a positive effect on safe driving for our drivers. |
| 154 | CP | SPD | | | | | WRN/OTH | 3 | | I do not think "Safe" fits for this test, our Driver says he was going with the flow of traffic and was not in the fast lane. |
| 162 | CT | SPD | | | | | WRN | 4 | | |
| 163 | C? | SPD | NP | NP | NP | | WRN | 3 | | |
| 166 | PV | SPD | Y | DK | 4 | | | | | |
| 175 | CT | ULC | | | | | WRN/DIS | NP | Threat of discharge on next offense | A better description of what occurred, i.e., 3 lane changes in a mile rather than improper lane change |
| 176 | CT | NP | | | | | NP | 1 | | We received a picture 4 months ago - don't know what it was about. We are sending this back as requested but unsure what it was about |
| 179 | CT | NP | NP | NP | NP | | NP | NP | | Unaware of violation. Copy of warning is requested. |
| 180 | CT | SPD | | | | | WRN | 5 | | |
| 182 | CT | ULC | | | | | WRN/DIS | 3 | letter place in file | |
| 184 | CP | SPD | | | | | WRN/DIS | 4 | Driving restrictions | |
| 187 | CT | SPD | | | | | WRN | 5 | | |
| 191 | CT | SPD | | | | | WRN | 5 | | Actually the number was unavailable. Management issued a company bulletin to all 40 employees. |
| 192 | CT | SPD | | | | | WRN | 3 | | |
| 193 | CT | SPD | | | | | WRN | 1 | | |
| 197 | CT | SPD | | | | | WRN | 3 | | |
| 200 | C? | NP | NP | NP | NP | | WRN | 5 | | A good program |

| Response ID no. | Veh type | Violation type | Question 3a | Question 3b | Question 3c | Quest 3 comment | Question 4a | Question 4b | Quest 4 comment | Question 5: other comments |
|---|---|---|---|---|---|---|---|---|---|---|
| TEL1 | CP | SPD | | | | | WRN | NP | Would not be tolerated | Doesn't make any sense to have cameras on the beltway. I'm passed all the time like when I am going 60 on the beltway. I wasn't aware of the cameras for speeding until I got the notice. I knew about the red light cameras. |
| TEL2 | CT | SPD | NP | NP | NP | | NP | NP | | Don't do a lot of traveling in the DC area. The only reason they were there was for ice products. Without knowing whom it was for, they can't answer the questions. |
| TEL3 | CT | SPD | NP | NP | NP | | OTH | 4 | Driver notified and posted for other drivers that they are to obey the speed limit down there. | Good Idea. |
| TEL4 | CT | SPD | NP | NP | NP | | NP | NP | | Needs driver's name |
| TEL5 | CT | SPD | NP | NP | NP | | WRN | 5 | Wrote up driver | Very effective |
| TEL6 | CT | SPD | NP | NP | NP | | NP | NP | | Respondent tried to help but could not answer the questionnaire without the driver's name. |
| TEL7 | PV | SPD | Y | NP | 4 | | | | | Something like that only has an effectiveness over time. |
| TEL8 | PV | SPD | Y | NP | 4 | NP | | | | He was speeding but he admits it is a good program. Something has to be done about the way people are driving on the road. |
| TEL9 | PV | SPD | Y | NP | 5 | NP | | | | Yes it is very good that there is something like this out there. |
| TEL10 | PV | SPD | NP | N | 1 | | | | | Could be useful if it was someone weaving or dangerous. No harmful driving according to his standards. A lot of energy on this and it has no benefit, especially people following too closely. This is the exact opposite of what took place and he would not consider it aggressive driving. Doesn't think much of the program. |
| TEL11 | PV | SPD | Y | NP | 3 | | | | | If someone is driving recklessly. A moderate driver that is careful and cautious, this shouldn't go against them. |
| TEL12 | PV | SPD | Y | NP | 4 | | | | | |
| TEL13 | PV | SPD | Y | DK | NP | | | | | Should but made other drivers more annoyed, not sure if any safer. |
| TEL14 | CP | SPD | | | | | WRN/DIS | 5 | | On the Capital Beltway, unless you are doing the speed limit, you will get yourself killed. |
| TEL15 | C? | SPD | NP | NP | NP | | NOA | NP | | No way to verify without the persons name |

| Response ID no. | Veh type | Violation type | Question 3a | Question 3b | Question 3c | Quest 3 comment | Question 4a | Question 4b | Quest 4 comment | Question 5: other comments |
|---|---|---|---|---|---|---|---|---|---|---|
| TEL16 | CP | SPD | | | | | DIS | 4 | He is managemen t - he was just told not to do it again | |
| TEL17 | CT | SPD | | | | | WRN | 4 | Revaluated policy for safety, gave a verbal reprimand and it was filed in employee file. | First few weeks everyone is very cautious. It is worth it, but after a few weeks, people s eem to slide back into their old habits. |
| TEL18 | CP | SPD | | | | | WRN | 5 | | He thought it was a joke. It was very effective to know somebody is watching him. |

## Legends:

Vehicle type:
- PV: private vehicle
- CT: commercial truck
- CP: commercial passenger
- NP: if an answer is not provided

Question 3a on Survey Form
- Y: yes
- N: no
- NP: if an answer is not provided

Question 3b on Survey Form
- Y: yes
- N: no
- DK: don't know
- NA: not applicable
- NP: if an answer is not provided

Question 3c on Survey Form
- 1 to 5: value circled
- NP: if an answer is not provided

Violation type
- SPD: speeding
- ULC: unsafe lane change
- FTC: following too close
- OVT: other violation type
- NP: if an answer is not provided

Question 4a on Survey Form
- WRN: warning
- DIS: disciplinary action
- OTH: other action
- NOA: no action
- NP: if an answer is not provided

Question 4b on Survey Form
- 1 to 5: value circled
- NP: if an answer is not provided

# APPENDIX D

## Statistical Analysis of Survey Sample

The purpose of this analysis is to determine the statistical significance of the survey results in order to decide whether or not additional sampling is needed. To achieve this purpose, the following items were estimated for the selected variables in the survey that serve the purposes of the ADVANCE Project.

a. Error of the Estimated Proportion. The Estimated Proportion, in this case, is the percentage of the occurrences of a variable in the sample, for example, the percent of speeding violation. This error is calculated using a 95% confidence level.

b. The required sample size to achieve a 3% error of the estimated proportion at 95% confidence. This estimated sample size illustrates what it would take to improve the statistical significance of the survey sample.

The result of the statistical analysis is presented for the following topics of interest of the ADVANCE Project.

a. Violation Types

b. Effectiveness ratings by Private Vehicle Drivers and by Commercial Vehicle Owners/Operators

c. Impacts of the warnings on the drivers' safe driving behaviors

d. Impacts of the warnings on the safe driving behaviors of the drivers' friends and/or family members

e. Employers' actions against the drivers with a violation warning

Violation Types

Table D-1 shows that the Estimated Proportion for Speed Violation at 91% with an error of 6%. This means that at 95% confidence, between 85% and 97% of the violations are Speeding. In order to achieve a 3% error (i.e., the proportion of speed violation is between 88% and 94%) at 95% confidence, the required sample size is 339, which may be too large to justify the cost required to gather the additional responses.

***Table D-1. Statistical Analysis Results for Violation Types***

| VIOLATION TYPE | Number of Occurrences | Estimated Proportion* | Error @ 95% Confidence | Required sample size to achieve 3% error of Proportion |
|---|---|---|---|---|
| Follow too close (FTC) | 0 | 0% | - | - |
| Not provided (NP) | 3 | 3% | - | - |
| Other violation type (OVT) | 2 | 2% | - | - |
| SPD/ULC | 1 | 1% | - | - |
| Speeding (SPD) | 84 | 91% | 6% | 339 |
| Unsafe Lane Change (ULC) | 2 | 2% | - | - |
| Total Number of Occurrences | 92 | | | |

* Total does not add up to 100% due to rounding

Effectiveness Ratings

There were 92 responses on the overall effectiveness ratings from private vehicle drivers and commercial vehicle owners/operators. However, out of these responses, there were 10 responses in which the ratings had not been provided (see Table D-2). These 10 responses were, therefore, removed from the sample, leaving 82 legitimate effectiveness ratings for the statistical analysis.

***Table D-2. Distribution of Occurrences for Effectiveness Ratings by all Respondents***

| EFFECTIVENESS RATING | Number of Occurrences | Estimated Proportion |
|---|---|---|
| 1(less cautious) | 3 | 3% |
| 2 | 3 | 3% |
| 3 | 23 | 25% |
| 4 | 29 | 32% |
| 5 (very cautious) | 24 | 26% |
| Not Provided (NP) | 10 | 11% |
| Total Occurrences | 92 | |

For the purposes of the ADVANCE Project, it seems reasonable for all responses with a rating of 3 or above to be combined to represent those people who tend to be cautious because of the violation warnings. With this approach, the statistical analysis results of the effectiveness ratings by all respondents, by private vehicle drivers, and by commercial vehicle owners/operators are summarized in Tables D-3, D-4, and D-5, respectively. As shown in Table D-3, at a confidence level of 95%, one can say that at least 87% (that is, 93% minus 6%) of all respondents said that they tended to be more cautious in their driving because of the violation warnings. About the same proportions of private vehicle drivers and commercial vehicle owners/operators said the same thing. Also shown in these tables are the required sample sizes to reduce the estimation errors to 3% of the observed Estimated Proportions. These required sample sizes are many times larger than the current sample size.

***Table D-3. Statistical Analysis Results for Effectiveness Rating by All Respondents***

| EFFECTIVENESS RATING | Number of Occurrences | Estimated Proportion | Error @ 95% Confidence | Required sample size to achieve 3% error of Proportion |
|---|---|---|---|---|
| 1(less cautious) | 3 | | | |
| 2 | 3 | | | |
| 3 or Greater | 76 | 93% | 6% | 289 |
| Total Occurrences | 82 | | | |

***Table D-4. Statistical Analysis Results for Effectiveness Rating by Private Vehicle Drivers***

| EFFECTIVENESS RATING | Number of Occurrences | Estimated Proportion | Error @ 95% Confidence | Required sample size to achieve 3% error of Proportion |
|---|---|---|---|---|
| 1(less cautious) | 1 | 2% | - | - |
| 2 | 3 | 5% | - | - |
| 3 or Greater | 54 | 93% | 7% | 274 |
| Total Occurrences | 58 | | | |

***Table D-5. Statistical Analysis Results for Effectiveness Rating by Commercial Vehicle Owners/Operators***

| EFFECTIVENESS RATING | Number of Occurrences | Estimated Proportion | Error @ 95% Confidence | Required sample size to achieve 3% error of Proportion |
|---|---|---|---|---|
| 1(less cautious) | 2 | 8% | - | - |
| 2 | 0 | 0% | - | - |
| 3 or Greater | 22 | 92% | 6% | 326 |
| Total Occurrences | 24 | | | |

Impacts on Safe Driving Behaviors

Table D-6 shows the distribution of the 56 responses to the question: Did the warning notice make you drive more safely? At a 95% confidence level, at least 84% (i.e., 91% minus 7%)of the respondents said that it did.

***Table D-6. Statistical Analysis Results for the Question on the Driver's Safe Driving Practice***

| RESPONSE | Number of Occurrences | Estimated Proportion | Error @ 95% Confidence | Required sample size to achieve 3% error of Proportion |
|---|---|---|---|---|
| Yes | 51 | 91% | 7% | 347 |
| No | 5 | 9% | 7% | 347 |
| Total Occurrences | 56 | | | |

Impacts on the Drivers' Friends and/or Family Members

At 95% confidence, about 28% of the people said that the warnings had a positive impact on the safe driving behavior of their family members and or friends (see Table D-7). About the same proportion of the respondents said that they did not know. Because the sample size for this question is relatively small and there are four possible answers, the errors at 95% confidence level are higher than those in the previous cases. To achieve a target of 3% error, the required sample size is roughly 1,000.

***Table D-7. Statistical Analysis Results for the Question on Family Members' or Friends' Safe Driving Practice***

| RESPONSE | Number of Occurrences | Estimated Proportion | Error @ 95% Confidence | Required sample size to achieve 3% error of Proportion |
|---|---|---|---|---|
| Yes | 18 | 43% | 15% | 1045 |
| No | 3 | 7% | - | - |
| Don't Know | 14 | 33% | 14% | 949 |
| Not Applicable | 7 | 17% | - | - |
| Total Occurrences | 42 | | | |

Employer' s Actions

There were 26 responses regarding the actions taken by employers after the warning notice was received. Table D-8 shows the various types of actions taken and the proportions of the survey results.

***Table D-8. Distribution of Employers' Actions***

| ACTIONS | Number of Occurrences | Estimated Proportion* |
|---|---|---|
| Disciplinary | 2 | 8% |
| No Action | 1 | 4% |
| Warning | 22 | 85% |
| Other | 1 | 4% |
| Total | 26 | |

* Total does not add up to 100% due to rounding

For the purposes of the ADVANCE Project, the issue is whether or not employers would take any actions to positively reinforce the safe driving behaviors of their employees. With this reasoning, one may combine all types of responses shown in Table D-8, except the "No Action" type of response, into one category. Thus, the survey results for this question and the associated statistical analysis results may be summarized as shown in Table D-9. It may be said that at 95% confidence level, at least 89% of the employers indicated that they have used some forms of reinforcing actions to influence their employees' safe driving practice.

***Table D-9. Statistical Analysis Results for Employers' Actions***

| RESPONSE | Number of Occurrences | Estimated Proportion | Error @ 95% Confidence | Required sample size to achieve 3% error of Proportion |
|---|---|---|---|---|
| No Actions | 1 | 4% | 7% | 158 |
| Reinforcing Actions | 25 | 96% | 7% | 158 |
| Total Occurrences | 26 | | | |

Conclusion

Based on the results of the above statistical analysis of the survey sample, it can be concluded that the current sample size is sufficient to support the purposes of the ADVANCE Project. The results have shown that, at 95% confidence level, the patterns of all the decision variables are clearly shown, except that of the impact of the warnings on the drivers' family members and/or friends. The analysis results also show that a much larger sample sizes would be needed to reduce the error of the estimated proportions to 3% of their observed values.