Road Departure Crash Warning System Field Operational Test: Methodology and Results

Volume 2: Appendices

Prepared by
The University of Michigan
Transportation Research Institute
2901 Baxter Road, Ann Arbor, MI 48109-2150

In Partnership with
Visteon Corporation
and
AssistWare Technology Inc.

June 2006

This page was left blank intentionally.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
Road Departure Crash Warning System Field Operational Test: Methodology and Results	June 2006
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
LeBlanc, D., Sayer, J., Winkler, C., Ervin, R., Bogard, S., Devonshire, J. Mefford, M., Hagan, M., Bareket, Z., Goodsell, R., and Gordon, T.	UMTRI-2006-9-2

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
The University of Michigan Transportation Research Institute 2901 Baxter Road, Ann Arbor, MI 48109-2150	11. Contract or Grant No. DTFH61-01-X-00053

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Highway Traffic Safety Administration U.S. Department of Transportation 400 Seventh Street S.W. Washington D.C.	Final research report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report summarizes results from the Intelligent Vehicle Initiative (IVI) Road Departure Crash Warning System Field Operational Test (RDCW FOT) project. This project was conducted under a cooperative agreement between the U.S. Dept. of Transportation and the University of Michigan Transportation Research Institute, along with its partners, Visteon Corporation and AssistWare Technologies. Road departure crashes account for 15,000 fatalities annually in the U.S. This project developed, validated, and field-tested a set of technologies intended to warn drivers in real time when the driver was drifting from their lane, and a curve-speed warning system designed to provide alerts to help driver slow down when approaching a curve too fast to safely negotiate the curve This report describes the field operational test of the system and subsequent analysis of the data to address the suitability of similar systems for widespread deployment within the U.S. passenger-vehicle fleet. Two areas were addressed: safety-related changes in driver performance including behavior that may be attributed to the system, and levels of driver acceptance in key areas. Testing used 11 passenger sedans equipped with RDCW and a data acquisition system that compiled a massive set of numerical, video, and audio data. Seventy-eight drivers each drove a test vehicle, unsupervised, for four weeks. The resulting data set captured 83,000 miles of driving, with over 400 signals captured at 10 Hz or faster.

Analysis of the data shows that with the RDCW system active, relative to the baseline condition, drivers improved lane-keeping by remaining closer to the lane center and reducing the number of excursions near or beyond the lane edges. In addition, turn signal use increased dramatically. The data, however, were unable to confirm a change in driver's curve-taking behaviors that could have been attributed to the curve speed warning system. Driver acceptance was generally positive in relation to the lateral drift component of the system, with reactions to the curve speed warning system being rather mixed. Many additional results and insights are documented in the report.

17. Key Word	18. Distribution Statement
Lane departure warning, curve speed warning, crash avoidance, crash warning, road departure, lateral control, driver assistance systems	Unrestricted

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
None	None	358	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

This page was left blank intentionally.

Table of Contents

Appendices

This page was left blank intentionally.

Appendix A

RDCW Pilot Testing

This page was left blank intentionally.

RDCW Pilot Testing

Pilot testing was a multi-stage process that helped to influence the final development of the RDCW system. The pilot-testing sequence commenced with laypersons driving an RDCW-equipped vehicle along a predetermined route while accompanied by UMTRI research staff, and it concluded with laypersons driving RDCW-equipped vehicles for a 12-day unsupervised period. All pilot testing participants were licensed drivers.

Stage 1 Pilot Test

The Stage 1 pilot test involved a mixed-factors design in which the between-subjects variables were driver age and gender and the within-subject variable was the state of the RDCW system (LDW-only enabled, CSW-only enabled, or both LDW and CSW enabled). Three levels of age were examined, 20 to 30, 40 to 50 and 60 to 70. Gender was only partially balanced in each age group because various hardware and software problems prevented some participants from completing the test.

An RDCW prototype-phase vehicle, a 2002 Nissan Altima, was employed for Stage 1 testing. Eleven layperson drivers, accompanied by a researcher, drove at least one of three traversals of the same 52-mile route (only six drivers experienced all three circuits of the route, again due to hardware and software problems). During the first and second traversals, only one subsystem was enabled: LDW or CSW (the order of presentation was counterbalanced across drivers). For the final trip both LDW and CSW were fully functional. The route consisted of freeways, major arterials, and surface streets in urban, suburban and rural settings.

Prior to beginning their drives, participants were given a general orientation to the vehicle that included a guided explanation of the vehicle's controls and stationary demonstrations of the DVI display, sensitivity controls, availability icons, and the different types of RDCW warnings they might receive during the drives.

All drives were completed during daylight hours (in June) between 9AM and 8 PM. Participants were instructed to avoid "chatting" with the experimenter (in order to remain focused on their experience of RDCW), but were encouraged to ask questions or add any relevant comments about the system. Drivers were also instructed to drive as they normally would despite being accompanied by a researcher. The sensitivity level for each system was kept at three (the midpoint) throughout the entire test.

After each traversal of the route, the driver completed a 10-15 minute questionnaire. The questionnaire explored the areas of acceptance and perceived safety of the particular component of RDCW that he/she just experienced. The results of the preliminary investigation of RDCW were reported to Visteon and Assistware for consideration in ongoing development.

Stage 1.5 Pilot Test

In order to evaluate the modifications that were made to the RDCW system after Stage 1 pilot testing, twelve new (inexperienced) laypersons were recruited for Stage 1.5 testing. Stage 1.5 also consisted of an accompanied drive. In fact, the method of Stage 1.5 testing was identical to Stage 1 except for the following modifications: the route was slightly changed (making it roughly 59 miles in length) and only one treatment (both LDW and CSW enabled) was investigated, requiring only one traversal of the route per driver. Again, the between-subject factors were age and gender. However, in Stage 1.5 all twelve participants completed the testing so gender was balanced across age groups (20 to 30, 40 to 50 and 60 to 70). At the conclusion of testing, a detailed questionnaire was completed by each driver (similar to the FOT post-drive questionnaire). The RDCW sensitivity level for was kept at three (the midpoint) throughout the entire test.

With minor subsequent changes to the RDCW design, it was determined that the system was suitable for unaccompanied driving by laypersons as the final step in pilot testing prior to the launch of the FOT.

Stage 2 Pilot Test

As in Stages 1 and 1.5, the experimental design for Stage 2 was a mixed-factors design in which the between-subjects variables were driver age and gender, and the within-subject variable was the experimental treatment (i.e. driving with and without RDCW enabled). There were eight paid participants, recruited from an advertisement in a local newspaper. Two were in a younger age group (between 20 and 30 years old with a mean age of 21.5 years), three were in a middle-age age group (between 40 and 50 years old with a mean age of 43.3 years), and three were in an older age group (between 60 and 70 years old with a mean age of 65.3 years). The groups were quasi-balanced for gender (the middle-age group had two males and one female while the older age group had one male and two females).

Each participant's driving record was reviewed prior to his or her participation in the study. Participants were required to have no driving felonies within 36 months of

their participation. In addition, each participant was given a telephone screening to ensure that he or she met other requirements of the study, such as a minimum average miles driven per year. During the phone screening, participants scheduled a time to arrive at UMTRI to attend an orientation and pick up the vehicle. At the orientation, participants had the opportunity to ask questions regarding the study, watch a 20-minute instructional video about the research vehicle, and take an accompanied test drive. The test drive was a prescribed route that included city and freeway driving. A research assistant accompanied the participant while he or she drove the route and had a chance to experience some of the RDCW warnings. Before, during, and after the test drive, participants were given information about the vehicle and how to contact UMTRI researchers if needed.

Participants were given the research vehicle for a total of 12 days. Participants were instructed that for the first four days, the RDCW system would be disabled, and the research vehicle would behave like a normal Nissan Altima. On the fifth day of driving, the RDCW system became enabled, and each participant experienced eight days of RDCW-enabled driving.

Participants returned to UMTRI after the 12-day period to fill out a questionnaire regarding their impressions of the RDCW system, and to attend a debriefing interview. During this interview, participants' answers to the questionnaire were reviewed in detail, allowing the researchers to obtain elaboration and/or clarification on many aspects of the participants' experience. The last two participants also had the opportunity to review video episodes from their driving experience. For each episode (an RDCW warning event), the participant was asked to give feedback regarding the usefulness of that particular warning event.

This page was left blank intentionally.

Appendix B

Information Letter

This page was left blank intentionally.

Information Letter

Dear Driver,

The University of Michigan Transportation Research Institute and the National Highway Traffic Safety Administration are conducting a study of crash warning systems for passenger vehicles. The two particular devices of interest are referred to as curve speed warning (CSW) and lateral drift warning (LDW). We are examining the impact of these devices on driving safety, comfort, and convenience.

The goal of the project is to field test two technologies designed to prevent or mitigate road departure crashes – which are defined as a vehicle crash where a car leaves the roadway. Road departure crashes are the most serious of type of crash, accounting for over 20% of all police-reported crashes (1.2 million / year) and over 41% of all in-vehicle fatalities (15,000 / year). This research focuses on preventing road departure crashes through use of lateral drift warning (LDW) and curve speed warning (CSW) systems. The LDW system is designed to warn the driver when the vehicle begins to unintentionally drift from the roadway or the lane. If the likelihood of departing the road exceeds a certain threshold, the LDW system will alert the driver of the danger. The CSW system is designed to warn the driver when the vehicle is traveling too fast for the upcoming curve. If the vehicle's speed exceeds the safe speed, the CSW system will alert the driver of the danger.

You have qualified to participate in a research study in which you are being asked to drive a research vehicle that is equipped with both curve speed warning (CSW) and lateral drift warning (LDW) systems on public roadways. Participation in this study requires traveling to UMTRI, participating in 2 hours of training on use of the systems, use of the research vehicle as your personal vehicle for 26 days, completing some questionnaires, and taking part in a debriefing session when you return the vehicle (completing the questionnaires and the debriefing session will take approximately 2.5 hours).

In addition, we would like to use information contained in your State of Michigan driving record to examine how accident history and driver behavior correlate. With your permission, and through an agreement between the University of Michigan and the Michigan Secretary of State, your driving record in the State of Michigan would become part of this study.

For the first six (6) days you have the research vehicle it will operate just like any other car (i.e., it will not have the CSW or LDW systems activated). For the remaining twenty (20) days of your participation the research vehicle will have the CSW and LDW system activated. The activation of the systems will take place automatically on the sixth night you have the vehicle, and only when the vehicle is turned off. The specific date and time that the activation of the CSW and LDW systems will take place will be told to you in advance, and recorded in the glove compartment of your vehicle.

Upon arriving at UMTRI you will be asked to review a document very similar to this one which is known as an informed consent form (it will list all of the same requirements and conditions of being a participant). You will be asked to acknowledge reading the informed consent form and agreeing to the conditions outlined in the form by providing your signature. You will also be required to show us your driver's license. A copy of the informed consent has been provided for you to review.

You alone will be trained to use the research vehicle. As such, **no one other than you is permitted to drive the vehicle** during your participation. While there are no limitations on where you chose to drive the research vehicle within the continental United States, you are not permitted to take the research vehicle outside of the continental United States for any reason. In addition, to participate in this study you must also agree to abide by the following:

1. The research vehicle cannot be used to tow any form of trailer, or haul any material greater than what the vehicle was designed to accommodate.
2. You may not, or allow others to, remove, modify, or tamper with any components of the research vehicle, CSW or LDW systems, or data collection system. You must receive verbal permission from the researchers prior to allowing any mechanical work to be performed on the research vehicle.
3. The research vehicle cannot be used to transport flammable materials (e.g., gasoline).
4. You are responsible for purchasing fuel for the research vehicle for the duration which it is assigned to you.
5. You are solely responsible for all tickets and violations for the duration which the research vehicle is assigned to you.
6. You agree to report as early as possible to UMTRI any problems, malfunctions, or accidents with the research vehicle.

7. If at any time, and for any reason, the researchers deem it necessary that the research vehicle be returned to UMTRI, you must either return the vehicle or make arrangements for UMTRI personnel to retrieve it.
8. You must return the research vehicle at the specified date and time your participation is scheduled to end.

In this study you will be instructed on how to use the curve speed warning and lateral drift warning systems prior to testing. You will be asked to watch an instructional video, receive instruction from a researcher, and take the vehicle for a demonstration drive with a researcher present. During the demonstration drive a researcher will instruct you on where to drive and point out aspects of the CSW and LDW systems. The researcher will also be present to answer any questions you may have.

Whenever the engine of the research vehicle is running, an on-board computer will be recording information about the car and how it is being operated. In addition, video cameras will be used to record images of the road and other traffic in front of the vehicle as well as images of your face. The video images of your face will include audio in order to record comments you make about the way the research vehicle operates. All of this data is being recorded in order to understand not only how you operate a vehicle with the curve speed warning (CSW) and lateral drift warning (LDW) systems, but also to gain greater insights on driver behavior in general. Video images of your driving (continuous or single framed) may be used for scientific, educational, and outreach purposes. You will be asked for unrestricted permission to use the video recordings of your driving. You may decline to permit unrestricted use of the recordings without penalty or compromise to your participation in this study, recognizing that these images and audio will still be collected and used by the research team to examine your use of, and responses to, the CSW and LDW systems.

At no time during this study will you be asked to perform any unsafe driving actions. The University of Michigan requires you to abide by the following conditions in order to participate in this study.

1. You must possess a valid operator's license, display such a license, and comply with all license restrictions.

2. **<u>You may not allow anyone else to drive the research vehicle</u>**

3. Properly use safety belts.

4. Obey all applicable motor vehicle laws, codes, and regulations.

5. You must not operate the research vehicle while under the influence of alcohol or any medications that may impair your ability to drive.

RISKS: While participating in this study, you will be subject to all the risks that are normally present when driving a passenger car on public roads. It is believed that using the curve speed warning (CSW) or lateral drift warning (LDW) systems will not make driving any more hazardous than normal. However, caution should be used when operating a vehicle with which you are not familiar. Both the CSW and LDW systems will present visual, vibratory and auditory warnings to you in instances where the system determines you should take corrective action in order to avoid the potential for an accident.

Be aware that accidents can happen at any time when driving, and that you cannot rely on any test device being studied to prevent an accident. In the unlikely event that an accident occurred; you, the test vehicle, as well as any other persons or property involved, would be covered under an insurance policy held by The University of Michigan. However, that does not preclude other insurance coverage from involvement: including your personal injury protection (PIP) insurance - otherwise referred to as no-fault insurance, and your personal health insurance. The specifics of a claim cannot be stated before hand because it is a coordination of benefits issue involving various carriers. The University insurance coverage is coordinated with other insurances, the priorities being determined to a large extent by the insurance laws of the State of Michigan. You may want to consult your personal automotive insurance provider(s) with any additional questions regarding insurance coverage. A participant may be held liable for damages resulting from an accident if afterwards it is determined that the participant knowingly misrepresented his/her eligibility to take part in the study.

In the unlikely event of physical injury resulting from participating in this study, the University will provide medical treatment in accordance with the determination by the University of its responsibility to provide such treatment. If an accident occurs, the standard procedure should be to remove yourself and others from harms way and call for emergency services (police and emergency medical technicians). The research vehicle is equipped with a fire extinguisher, first aid kit, and cellular telephone. Only after you and any passengers are out of harms way should you contact researchers at UMTRI using the

cellular phone provided with the vehicle. The research team at UMTRI will be available via pager on a 24 hour-a-day basis to answer questions or assist you should a need arise.

BENEFITS: The results of this study will provide valuable guidance for the development of crash warning systems for passenger cars. By participating in this study, you will be lending your experience and expertise to support highway safety research. The direct benefit to you as an individual for participating is use of a new vehicle that can be used for unlimited travel (other than the previously mentioned restrictions).

COMPENSATION: You will be compensated $250 for participating in this study. Your participation in the study will require approximately seven (7) hours of your time outside of your regular or planned driving. Your time commitment is being estimated on the basis of how much time you will spend traveling to and from UMTRI (up to 2 hours), being trained to drive the vehicle (2 hours), completing questionnaires (1.5 hour), and participating in a debriefing upon returning the research vehicle (1 hour). While the researchers retain the right to terminate your participation in the study at any time, you will be compensated in full should the study be terminated prior to its planned completion. In addition, you will also be compensated in full should you withdraw from participating in the study for any reason.

CONFIDENTIALITY: The University of Michigan Transportation Research Institute and the National Highway Traffic Safety Administration are gathering information on the use of curve speed warning and lateral drift warning systems in passenger cars. While we are interested in driver behavior, we are not testing you or your skills. If you agree to participate in this study, your name will not be voluntarily released to anyone who does not work on this project. Your name will not appear in any reports or papers written about the project. Any identifying information contained in your State of Michigan driving record will also be treated with strict confidentiality. Should the researchers choose to use an image of your face or recorded comments in a presentation or publication your identity will be concealed unless you permit unrestricted use of the recordings.

Optional use of video images: If you agree, video images of your driving (continuous or single framed) may be used for scientific, educational, and outreach purposes. You will be asked for unrestricted permission to use the video recordings of your driving, which will contain images of your face and audio recordings of your voice. You may

decline to permit unrestricted use of the recordings without penalty or compromise to your participation in this study.

Recall that you have the right to withdraw from the study at any time without penalty.

The University of Michigan Transportation Research Institute and the National Highway Traffic Safety Administration hope that you will agree to participate in this study. If you have any questions, please feel to contact us.

RDCW FOT
Attn: Joel Devonshire
2901 Baxter Road, Ann Arbor, MI 48109-2150
Phone (734) 936-0410
Fax (734) 764-1221, Email: jdev@umich.edu

Appendix C

Informed Consent

This page was left blank intentionally.

Informed Consent

CONDITIONS OF PARTICIPATION

The University of Michigan Transportation Research Institute and the National Highway Traffic Safety Administration are conducting a study of crash warning systems for passenger vehicles. The two particular devices of interest are referred to as curve speed warning (CSW) and lateral drift warning (LDW). We are examining the impact of these devices on driving safety, comfort, and convenience.

The goal of the project is to field test two technologies designed to prevent or mitigate road departure crashes – which are defined as a vehicle crash where a car leaves the roadway. Road departure crashes are the most serious type of crash, accounting for over 20% of all police-reported crashes (1.2 million / year) and over 41% of all in-vehicle fatalities (15,000 / year). This research focuses on preventing road departure crashes through use of lateral drift warning (LDW) and curve speed warning (CSW) systems. The LDW system is designed to warn the driver when the vehicle begins to unintentionally drift from the roadway or the lane. If the likelihood of departing the road exceeds a certain threshold, the LDW system will alert the driver of the danger. The CSW system is designed to warn the driver when the vehicle is traveling too fast for the upcoming curve. If the vehicle's speed exceeds the safe speed, the CSW system will alert the driver of the danger.

You have qualified to participate in a research study in which you are being asked to drive a research vehicle that is equipped with both curve speed warning (CSW) and lateral drift warning (LDW) systems on public roadways. Participation in this study requires traveling to UMTRI, participating in two hours of training on use of the systems, use of the research vehicle as your personal vehicle for 26 days, completing a questionnaire, and taking part in a debriefing session when you return the vehicle.

In addition, we would like to use information contained in your State of Michigan driving record to examine how accident history and driver behavior correlate. With your permission, and through an agreement between the

University of Michigan and the Michigan Secretary of State, your driving record in the State of Michigan would become part of this study.

For the first six (6) days you have the research vehicle it will operate just like any other car (i.e., it will not have the CSW or LDW systems activated). For the remaining twenty (20) days of your participation the research vehicle will have the CSW and LDW system activated. The activation of the systems will take place automatically on the sixth night you have the vehicle, and only when the vehicle is turned off. The specific date and time that the activation of the CSW and LDW systems will take place will be told to you in advance, and recorded in the glove compartment of your vehicle.

You alone will be trained to use the research vehicle. As such, **no one other than you is permitted to drive the vehicle** during your participation. While there are no limitations on where you chose to drive the research vehicle within the continental United States, you are not permitted to take the research vehicle outside of the continental United States for any reason. In addition, to participate in this study you must also agree to abide by the following:

1. The research vehicle cannot be used to tow any form of trailer, or haul any material greater than what the vehicle was designed to accommodate.
2. You may not, or allow others to, remove, modify, or tamper with any components of the research vehicle, CSW or LDW systems, or data collection system. You must receive verbal permission from the researchers prior to allowing any mechanical work to be performed on the research vehicle.
3. The research vehicle cannot be used to transport flammable materials (e.g., gasoline).
4. You are responsible for purchasing fuel for the research vehicle for the duration which it is assigned to you.
5. You are solely responsible for all tickets and violations for the duration which the research vehicle is assigned to you.
6. You agree to report as early as possible to UMTRI any problems, malfunctions, or accidents with the research vehicle.
7. If at any time, and for any reason, the researchers deem it necessary that the research vehicle be returned to UMTRI, you must either return the vehicle or make arrangements for UMTRI personnel to retrieve it.

8. You must return the research vehicle at the specified date and time your participation is scheduled to end.

In this study you will be instructed on how to use the lateral drift warning and curve speed warning systems prior to testing. You will be asked to watch an instructional video, receive instruction from a researcher, and take the vehicle for a demonstration drive with a researcher present. During the demonstration drive a researcher will instruct you on where to drive and point out aspects of the CSW and LDW systems. The researcher will also be present to answer any questions you may have.

Whenever the engine of the research vehicle is running, an on-board computer will be recording information about the car and how it is being operated. In addition, video cameras will be used to record images of the road and other traffic in front of the vehicle as well as images of your face. The video images of your face will include audio in order to record comments you make about the way the research vehicle operates. All of this data is being recorded in order to understand not only how you operate the curve speed warning (CSW) and lateral drift warning (LDW) systems, but also to gain greater insights on driver behavior in general. Video images of your driving (continuous or single framed) may be used for scientific, educational, and outreach purposes. You will be asked for unrestricted permission to use the video recordings of your driving. You may decline to permit unrestricted use of the recordings without penalty or compromise to your participation in this study, recognizing that these images and audio will still be collected and used by the research team to examine your use of, and responses to, the CSW and LDW systems.

At no time during this study will you be asked to perform any unsafe driving actions. The University of Michigan requires you to abide by the following conditions in order to participate in this study.

1. You must possess a valid operator's license, display such a license, and comply with all license restrictions.
2. **You may not allow anyone else to drive the research vehicle**
3. Properly use safety belts.
4. Obey all applicable motor vehicle laws, codes, and regulations.
5. You must not operate the research vehicle while under the influence of alcohol or any medications that may impair your ability to drive.

INFORMED CONSENT

I agree to the conditions of participation as outlined above regarding my responsibilities when using this vehicle.

1. As a participant, I will drive an instrumented car that is equipped with curve speed warning (CSW) and lateral drift warning (LDW) systems on public roads as part of my regular or planned driving.

    a. I will have an opportunity to experience and practice the use of the lateral drift warning and curve speed warning systems in the presence of a researcher.

    b. I will be asked to drive the research vehicle and to experience the curve speed warning and lateral drift warning systems.

    c. During my participation in this study, **no one other than me is permitted to drive the research vehicle**.

    d. At the conclusion of participation, I will be asked to complete a questionnaire regarding my impressions of these systems and take part in a debriefing about my experience with the curve speed warning (CSW) and lateral drift warning (LDW) systems.

    e. Video cameras will be used to record the traffic and roadway conditions in front of the research vehicle as well as an image of me driving the vehicle. Both my voice and my face will be included on this video recording.

2. A researcher will provide me hands-on instruction on use of the curve speed warning (CSW) and lateral drift warning (LDW) systems, and take part in a demonstration drive in which I will be able to experience these systems while a researcher is present. The researcher will familiarize me with the curve speed warning and lateral drift warning systems, as well as the test vehicle in which they are installed. The researcher will provide me with specific instructions on where to drive during this demonstration.

3. At no time in this study will I be asked to perform any unsafe driving actions.

4. While driving in this study, I will be subject to all risks that are normally present while driving a passenger car on public roads. The use of curve speed warning (CSW) and lateral drift warning (LDW) are intended to make driving safer and more comfortable. However, caution should be exercised when operating a vehicle with equipment with which one is not familiar. I understand that the existence of the curve speed warning and lateral drift warning systems on the test vehicle will not eliminate the possibility of an accident occurring.

5. Should an accident occur; I the driver, the test vehicle, as well as any other persons or property involved, would be covered under an insurance policy held by The University of Michigan. However, that does not preclude other insurance coverage from involvement: including my personal injury protection (PIP) insurance - otherwise referred to as no-fault insurance and my health insurance. The specifics of a claim cannot be stated before hand because it is a coordination of benefits issue involving various carriers. The University insurance coverage is coordinated with other insurances, the priorities being determined to a large extent by the insurance laws of the State of Michigan. I may want to consult my personal automotive insurance provider(s) with any additional questions regarding insurance coverage. I understand that I may be held liable for damages resulting from an accident if afterwards it is determined that I knowingly misrepresented my eligibility to take part in the study.

6. In the unlikely event of physical injury resulting from participating in this study, the University will provide medical treatment in accordance with the determination by the University of its responsibility to provide such treatment. If an accident occurs, the standard procedure should be to remove myself and others from harms way and call for emergency services (police and emergency medical technicians). The research vehicle is equipped with a fire extinguisher, first aid kit, and cellular telephone. Only after I and any passengers are out of harms way should I contact researchers at UMTRI using the cellular phone provided with the vehicle. The research team at UMTRI will be available via pager on a 24 hour-a-day basis to answer questions or assist you should a need arise.

7. The results of this study will provide the University of Michigan Transportation Research Institute and the National Highway Traffic Safety Administration with valuable information for the development of future crash warning and safety systems. By participating in this study, I am lending my experience and

expertise as a driver to support safety research regarding the future use of crash warning systems in passenger cars. I understand that I will not be informed as to the results of this study, and that the only direct benefit to me as an individual for participating is use of a new vehicle that can be used for unlimited travel during my participation in the study (other than the previously mentioned restrictions).

8. I will be compensated $250 for participating in this study. I understand that participation in this experiment will take approximately six (6) hours of my time outside of my regular or planned driving. While the researchers retain the right to terminate my participation in the study at any time, I will be compensated in full should the study be terminated prior to its planned completion.

9. The University of Michigan Transportation Research Institute is gathering information on crash warning systems, and not testing me. My name will not be released to anyone who is not working on the project. My name will not appear in any reports or papers written about the project. Any identifying information contained in my State of Michigan driving record will also be treated with strict confidentiality. It is possible, should I be involved in an accident during testing, that The University of Michigan Transportation Research Institute will have to release data on my driving in response to a court order.

10. The researchers, employees of The University of Michigan Transportation Research Institute, will answer any questions that I may have about this study. The researcher in charge of this testing is:

    James R. Sayer, Ph.D.
    The University of Michigan Transportation Research Institute
    Human Factors Division
    2901 Baxter Rd., Ann Arbor, MI 48109-2150
    Phone (734) 764-4159
    Fax (734) 764-1221
    Email: jimsayer@umich.edu

Information about the approval of this study and your rights as a participant can be obtained from:

IRB Behavioral Sciences Committee, Human Subjects Protection Office
540 East Liberty Street, Suite 202
Ann Arbor, Michigan 48104-2210
Telephone: 734 936-0933 FAX: 734 647-9084
Email: IRB-Behavsci-Health@umich.edu

11. If information becomes available which might reasonably be expected to affect my willingness to continue participating in this study, this information will be provided to me.

12. Participation in this study is voluntary. I understand that I may withdraw from this study at any time, and for any reason, without penalty. Should I withdraw, I will be compensated in full ($250). The researchers also retain the right to terminate the study at any time. However, should the study be terminated by the researcher prior to its planned completion I will be compensated in full.

13. I understand that if at any time, and for any reason, the researchers deem it necessary that the research vehicle be returned to UMTRI, I must either return the vehicle or make arrangements for UMTRI personnel to retrieve it. I agree to return the research vehicle after 26 days at the specified date and time my participation is schedule to end.

I HAVE READ AND UNDERSTAND THE TERMS OF THIS AGREEMENT. I VOLUNTARILY CONSENT TO PARTICIPATE IN THIS STUDY.

_____	_____	_____/_____/_____
Name (Print)	Signature	Date

_____	_(_____)_____
Address	Telephone Number

Optional use of video images: I agree to permit the unrestricted use of the video recordings of my driving (continuous or single framed) to be used for scientific, educational, and outreach purposes. I am aware that these recordings will contain images of my face and audio recordings of my voice. I am aware that I may decline to permit the unrestricted use of the recordings without penalty or compromise to my participation in this study.

Signed: _____ Date: _____

This page was left blank intentionally.

Appendix D

Driver Characteristics and Demographic Data

This page was left blank intentionally.

Driver Characteristics and Demographic Data

Driver	Gender	Age	AgeGroup	Years of Education	Education	Occupation	Zip Code	Median Family Income
1	Female	44	Middle	16	Bachelor's	IT Auditor	48124	67860
2	Female	45	Middle	12	HS	Hairstylist	48065	70000
3	Female	45	Middle	14	Some College	Admin. Asst.	48035	57224
4	Male	70	Older	14	Some College	Process Eng.	48307	76424
5	Male	43	Middle	14	Some College	Area Supervisor	48192	56106
6	Female	70	Older	14	Some College	Retired	48855	45655
7	Female	50	Middle	14	Some College	Disbursement Analyst	48035	57224
8	Male	49	Middle	12	HS	Mechanic	48190	87647
9	Female	63	Older	12	HS	Draftsman (ret.)	48036	55716
10	Male	69	Older	14	Some College	Building Inspector (ret.)	48342	31935
11	Female	20	Younger	14	Some College	Sales Rep.	48235	46903
12	Male	64	Older	18	Master's	Engineer	48042	82379
13	Female	49	Middle	18	Master's	Teacher	48236	96282
14	Female	49	Middle	14	Some College	Clerical	48135	58635
16	Male	64	Older	16	Bachelor's	Consultant	48167	98346
17	Female	45	Middle	14	Some College		48195	56710
19	Female	40	Middle	20	P.h.D.	Physician	48105	73103
20	Female	24	Younger	12	HS		48203	26491
21	Male	46	Middle	14	Some College	Real Estate Broker	48001	60700
22	Female	22	Younger	16	Bachelor's		48224	45397
23	Female	46	Middle	14	Some College	Inspector	48356	73938
24	Male	25	Younger	14	Some College	Student (Hist., Jap.)	48198	47308
25	Female	66	Older	14	Some College	Retired	48346	76856
26	Female	24	Younger	12	HS	Homemaker	48382	85873
27	Male	28	Younger	18	Master's	Teacher	48239	56856
28	Male	45	Middle	12	HS	Sales Rep.	48183	67354
29	Female	28	Younger	16	Bachelor's	Homemaker	48066	49118
30	Female	46	Middle	16	Bachelor's	Research Coord.	48067	67614
31	Male	62	Older	16	Bachelor's	Real Estate Broker	48307	76424
32	Male	29	Younger	14	Some College	Police Officer	48203	26491
33	Female	24	Younger	14	Some College	Student (Child Devel.)	48127	56647
34	Female	30	Younger	14	Some College	Nursing Asst.	48197	64385
35	Male	41	Middle	14	Some College	Machine Set-up	48178	79842
36	Female	64	Older	12	HS	Homemaker	48220	50028
37	Male	66	Older	12	HS	V.P. Operations (ret.)	48116	82851
38	Female	67	Older	18	Master's	Econ. Devel. Specialist	48235	46903
39	Male	20	Younger	14	Some College	Server	48187	83356
40	Female	63	Older	14	Some College	Small Bus. Owner	48239	56856
41	Male	47	Middle	16	Bachelor's	Account Exec.	48324	96568
42	Male	30	Younger	16	Bachelor's	Software Engineer	48197	64385
43	Male	44	Middle	12	HS	Sweaper	48091	46808
44	Female	27	Younger	16	Bachelor's	Teacher	48855	45655
46	Male	42	Middle	14	Some College	Ford Motor Co.	48141	41176

Driver	Gender	Age	AgeGroup	Years of Education	Education	Occupation	Zip Code	Median Family Income
47	Female	20	Younger	14	Some College	Student	48207	26372
48	Male	61	Older	16	Bachelor's	Retired	48158	69199
49	Male	67	Older	16	Bachelor's	Rights Specialist	48167	98346
50	Female	67	Older	14	Some College	Hostess	48309	95516
53	Male	61	Older	16	Bachelor's	Manufacturer's Rep	48301	128274
54	Female	65	Older	14	Some College	Homemaker	49267	60122
55	Male	27	Younger	18	Master's	Writer	48230	104331
56	Female	65	Older	18	Master's	CPA	48188	83609
58	Male	27	Younger	16	Bachelor's	Development Engineer	48180	48304
59	Female	42	Middle	16	Bachelor's	Director of Relocation	49270	62500
60	Female	27	Younger	14	Some College	Homemaker	48843	70851
61	Female	60	Older	14	Some College	Housewife	48160	63938
62	Female	63	Older	14	Some College	Clerk	48235	46903
63	Male	62	Older	12	HS	Owner	48346	76856
64	Female	22	Younger	14	Some College		48073	68331
66	Female	24	Younger	12	HS	Office Assistant	48137	65027
67	Female	61	Older	14	Some College		48083	71303
68	Male	20	Younger	14	Some College	Student	48125	50898
70	Male	23	Younger	14	Some College	Student	48323	116893
71	Female	46	Middle	14	Some College	Accountant	48223	39363
72	Male	49	Middle	14	Some College	Safety Manager	48044	76857
73	Male	68	Older	20	P.h.D.	Dentist	48334	96568
74	Male	25	Younger	20	P.h.D.	Student	48021	55282
75	Male	66	Older	18	Master's	Buyer	48154	76915
76	Male	41	Middle	14	Some College	Toolmaker	48240	54371
77	Male	25	Younger	14	Some College	Labor worker	48228	33698
78	Female	48	Middle	16	Bachelor's	Director of Internet Strat.	48044	76857
79	Female	22	Younger	14	Some College	Retail	48126	35938
80	Female	62	Older	14	Some College	Ret. Secretary	48082	55836
81	Male	24	Younger	14	Some College	Shipping/Receiving	48386	72554
82	Male	62	Older	18	Master's		48036	55716
83	Male	46	Middle	16	Bachelor's	Accountant	48206	27420
84	Male	25	Younger	14	Some College	Student	48162	56296
85	Male	46	Middle	18	Master's	Teacher	48103	80468
87	Male	46	Middle	14	Some College	Purchasing Manager	48045	67735

Driver	Primary Year	Primary Make	Primary Model	Secondary Year	Secondary Make	Secondary Model
1	2001	GMC	Sierra			
2	1986	Chevy	Astrovan			
3	2002	Ford	Explorer	2003	Mercury	
4	2001	Dodge	Ram			
5	2004	Chevy	Cavalier	2002	Chevy	Venture
6	1996	Buick	Grand Sport			
7	1992	Dodge	Shadow	1995	GMC	Jimmy
8	2004	Chevy	Impala	1995	Ford	E150
9	2000	Buick	Century			
10	2003	Ford	Windstar			
11	1995	Plymouth	Neon			
12	1998	Pontiac	Firebird	1985	Cadillac	Seville
13	1996	Audi	A6			
14	1996	Dodge	Caravan	1993	Ford	Escort
16	2004	Pontiac	Gran Prix	2003	Pontiac	Aztec
17	1993	Buick	Le Sabre			
19	2004	Dodge	Caravan	1997	Plymouth	Voyager
20	1991	Mercury	Sable			
21	2002	Ford	F-350	1994	Cadillac	Concourse
22	1998	Chevy	Malibu			
23	1997	Chevy	Astrovan	1989	Ford	Escort
24	2003	Chevy	Blazer	1995	Chevy	Corsica
25	1998	Cadillac	DeVille			
26	2001	Dodge	Durango			
27	2002	Pontiac	Grand Am			
28	1986	Cadillac	Fleetwood	1994	Olds	Cavalier
29	2002	Honda	Odyssey	1996	Ford	Mustang
30	2001	Jeep	Grand Cherokee	2003	Saturn	Stationwagon
31	1996	Buick	Le Sabre	1996	Pontiac	Grand Prix
32	1993	Mercury	Sable			
33	1995	Ford	Ranger			
34	2001	Chevy	Malibu			
35	1998	Chevy	Lumina	2003	Chevy	Van-Express
36	2002	Mercury	Sable		Ford	
37	2004	Dodge	Ram	2004	Buick	Park Ave.
38	1993	Mercedes	190E			
39	1994	Pontiac	Grand Am			
40	1997	Buick	Le Sabre	2002	Chevy	Venture
41	2001	Chrysler	Town & Country	2004	Chrysler	Town & Country
42	2002	Acura	RSX			
43						
44	1999	Olds	Alero	2004	Ford	Escape
46	1996	Lincoln	Towncar	2000	Chevy	Corvette

Driver	Primary Year	Primary Make	Primary Model	Secondary Year	Secondary Make	Secondary Model
47	2004	Honda	Civic			
48	1998	Ford	F150	2003	Mercury	Mountaineer
49	1997	Ford	Explorer	2002	Chrysler	300M
50						
53	2002	Lincoln	LS	2002	Ford	Escape
54	2001	Chrysler	Sebring	2003	Chevy	Impala
55	2001	Audi	A4			
56	2000	Honda	Odyssey			
58	2002	Dodge	Durango			
59	2003	Ford	Windstar			
60	2001	Jeep	Cherokee			
61	1996	BMW				
62	1996	Chrysler	Concord			
63	2004	Ford	F150			
64	2004	Chevy	Malibu	2003	Chevy	Trailblazer
66	2002	Chevy	Blazer	2000	Chevy	S10
67	2003	Mercedes	C240	2000	Buick	Regal
68	1989	Ford	F150			
70						
71	1989	Olds		1988	Ford	F150
72	1997	Pontiac	Sunfire	1996	Dodge	Ram
73	2004	Chrysler	Sebring	2000	Lexus	GS-400
74	1999	Chrysler	Concord			
75	1994	Chevy	Full size van	2003	Chevy	Impala
76	1998	Toyota	Tacoma			
77	1994	Buick	Skylark	1991	Olds	Cutlass
78	2003	Toyota	Camry	2001	GMC	Jimmy
79	1990	Toyota	Corolla			
80	2004	Buick	Century			
81	2003	Pontiac	Grand Am			
82						
83	2002	Ford	Taurus	1994	Ford	E150 Conv. Van
84	1995	Ford	Probe	1997	Ford	Ranger
85	1995	BMW	525i	2005	Ford	Escape
87	1991	Honda	Accord	1999	Honda	Odyssey

Driver	Years Driving	Mileage Last Year	Smokes	Glasses	Contacts	Restrticted Use Of Face Camera Video	Date of Release
1	28	10000		yes			5/6/2004
2	29	25000	yes	yes			5/7/2004
3	28	15000	yes	no	no		5/14/2004
4	54	15000		yes			5/14/2004
5	27	14000	no	no	no		5/27/2004
6	54	12500	no	yes	no		5/27/2004
7	34	12000	no	yes	no		6/3/2004
8	30	14000	no	yes			6/4/2004
9	45			yes			6/11/2004
10	54	15000	no		yes		6/11/2004
11	5		no	no	no		6/17/2004
12	40	13000	no	yes			6/18/2004
13	33	15000	no	yes	no		6/24/2004
14	35	20000	no	yes	no		6/25/2004
16	48	20000	no	no	no	X	7/1/2004
17	29	10000	yes	no	no		7/1/2004
19	25	12000	no	no	no		7/9/2004
20	4		no	no	no		7/15/2004
21	30	32500	no	no	no		7/15/2004
22	7	12500	no	no	no		7/16/2004
23	30		yes	no			7/22/2004
24	8	40000	yes	yes	yes		7/23/2004
25	50	3500	no	no	no	X	7/29/2004
26	9	4860	no	yes	no		7/30/2004
27	13	22000	no	no	no		8/5/2004
28	30	50000	yes	no	no		8/12/2004
29	11	16000	no	yes	yes		8/12/2004
30	30	25000	no	yes	no		8/13/2004
31	46	20000	no	yes	no		8/19/2004
32	13	14000	no	yes	yes		8/20/2004
33	8	8000	no	no	no		8/20/2004
34	15	10000	yes	no	no		8/26/2004
35	25	15000		no	no		9/2/2004
36	41	10000	no	yes	no	X	9/3/2004
37	50	12000	no	yes	no		9/9/2004
38	52	5000	no	yes	no		9/10/2004
39	4	10000	no	no	no	X	9/10/2004
40	42	10000	yes	no	no		9/16/2004
41	31	15000	no	yes	no	X	9/16/2004
42	14	25000	no	no	no		9/17/2004
43	28	25000	no	yes			10/1/2004
44	11	19000	no	yes	yes		10/1/2004
46	26	20000	yes	no	no		10/7/2004

Driver	Years Driving	Mileage Last Year	Smokes	Glasses	Contacts	Restrticted Use Of Face Camera Video	Date of Release
47	2.5	15000	no	no	no		10/7/2004
48	45	15000	no	yes			10/8/2004
49	50	20000	no	no	no		10/15/2004
50	50	4500	no	no	no		10/15/2004
53	43	14000	no	yes			10/29/2004
54	40	7000	no	yes	no		10/29/2004
55	11	18000	no	no	no		11/4/2004
56	40	20000	no	yes	no		11/5/2004
58	11	35000	no	no	no		11/11/2004
59	27	30000	no	yes	yes		11/11/2004
60	11	17500	no	no	no		11/12/2004
61	44	9000	no	yes			11/19/2004
62	45	10000	no	yes			11/24/2004
63	47	15000	no	yes			11/24/2004
64	6	12000	no	no	no		11/24/2004
66	8	20000	no	yes	yes	X	12/3/2004
67	45	15000	no	no	no		12/3/2004
68	4	15000	no	no	no		12/9/2004
70			no				12/16/2004
71	30	12000	yes	yes	no		12/17/2004
72	33	10000	no	no	no		12/24/2004
73	53	18000	no	yes	no		12/24/2004
74	9	15000	no	no	no		1/6/2005
75	50	20000	no	yes	no		1/7/2005
76	25	18000	no	yes	yes	X	1/7/2005
77	8	18000	no				1/7/2005
78	32	10000	no	yes	yes		1/12/2005
79	4	12000	no	yes	no		1/13/2005
80	46	20000	no	yes	yes		1/13/2005
81	8	16000	yes	yes			1/14/2005
82	43		no	yes	no	X	1/21/2005
83	31	18000	yes	no	no		1/26/2005
84	8	16500	no	no	no		2/3/2005
85	30	15000	no	no	no		2/3/2005
87	30	20000				X	2/5/2005

Appendix E

Driver Behavior Questionnaire (DBQ)

This page was left blank intentionally.

Driver Behavior Questionnaire (DBQ)

The questionnaire below requires you to judge the frequency of your own driving errors and violations. For each item you are asked to indicate *how often*, if at all, this kind of thing has happened to you. Base your judgements on what you remember of your own driving over the past year.

Please indicate your judgements by circling the response that best

	Never	Hardly Ever	Occasionally	Quite Often	Frequently	Nearly All The Time
Attempt to drive away from traffic lights in the wrong gear.	0	1	2	3	4	5
Become impatient with a slow driver in the fast lane and pass on the right.	0	1	2	3	4	5
Drive especially close to a car in front as a signal to the driver to go faster or get out of the way.	0	1	2	3	4	5
Attempt to pass someone that you hadn't noticed to be making a left turn.	0	1	2	3	4	5
Forget where you left your car in a parking lot.	0	1	2	3	4	5
Turned on one thing, such as your headlights, when you meant to switch on something else, such as the windshield wipers.	0	1	2	3	4	5
Realize that you have no clear recollection of the road along which you have just been traveling.	0	1	2	3	4	5
Cross an intersection knowing that the traffic lights have already changed from yellow to red.	0	1	2	3	4	5
Fail to notice that pedestrians are crossing when turning onto a side street from a main road.	0	1	2	3	4	5
Angered by another driver's behavior, you caught up to them with the intention of giving him/her “a piece of your mind.”	0	1	2	3	4	5
Misread the signs and turn the wrong direction on a one-way street.	0	1	2	3	4	5
Disregard the speed limits late at night or early in the morning.	0	1	2	3	4	5
When turning right, nearly hit a bicyclist who is riding along side of you.	0	1	2	3	4	5
Attempting to turn onto a main road, you pay such close attention to traffic on the road you are entering that you nearly hit the car in front of you that is also waiting to turn.	0	1	2	3	4	5
Drive even though you realize you might be over the legal blood alcohol limit.	0	1	2	3	4	5
Have an aversion to a particular class of road user, and indicate your hostility by whatever means you can.	0	1	2	3	4	5
Underestimate the speed of an oncoming vehicle when attempting to pass a vehicle in your own lane.	0	1	2	3	4	5
Hit something when backing up that you had not previously seen.	0	1	2	3	4	5
Intending to drive to destination A, you 'wake up' to find yourself on a road to destination B, perhaps because destination B is a more common destination.	0	1	2	3	4	5
Get into the wrong lane approaching an intersection.	0	1	2	3	4	5
Miss “Yield” signs, and narrowly avoid colliding with traffic having the right of way.	0	1	2	3	4	5
Fail to check your rearview mirror before pulling out, changing lanes, etc.	0	1	2	3	4	5
Get involved in unofficial 'races' with other drivers.	0	1	2	3	4	5
Brake too quickly on a slippery road, or steer the wrong way into a skid	0	1	2	3	4	5

This page was left blank intentionally.

Appendix F

Driver Style Questionnaire (DSQ)

This page was left blank intentionally.

Driver Style Questionnaire (DSQ)

The questionnaire below requires you to judge the frequency of your own driving errors and violations. For each item you are asked to indicate *how often*, if at all, this kind of thing has happened to you. Base your judgements on what you remember of your own driving over the past year.

Please indicate your judgements by circling the response that best describes your behavior	Never	Hardly Ever	Occasionally	Quite Often	Frequently	Nearly All The Time
Sometimes when driving, things happen very quickly. Do you remain calm in such situations?	0	1	2	3	4	5
Do you plan long journeys in advance, including places to stop and rest?	0	1	2	3	4	5
Do you dislike people giving you advice about your driving?	0	1	2	3	4	5
Do you exceed the 70 mph speed limit on the expressway?	0	1	2	3	4	5
Do you ever drive through a traffic light after it has turned to red?	0	1	2	3	4	5
Do you exceed the speed limit on surface streets in urban areas?	0	1	2	3	4	5
Do you ignore passengers urging you to lower your speed?	0	1	2	3	4	5
Do you become flustered when faced with sudden dangers while driving?	0	1	2	3	4	5
How often do you set out on an unfamiliar trip without first looking at a map?	0	1	2	3	4	5
Are you happy to get advice from people about your driving?	0	1	2	3	4	5
Do you drive cautiously?	0	1	2	3	4	5
Do you find it easy to ignore distractions while driving?	0	1	2	3	4	5
Do you drive fast?	0	1	2	3	4	5
Do you pass other vehicles on the right, given the opportunity?	0	1	2	3	4	5
Is your driving affected by pressure from other motorists?	0	1	2	3	4	5

This page was left blank intentionally.

Appendix G

Sensation Seeking Scale

This page was left blank intentionally.

Sensation Seeking Scale

Directions: Each of the items below contains two choices, A and B. Please indicate on your answer sheet which of the choices most describes your likes or the way you feel. In some cases you may find items in which both choices describe your likes or the way you feel. Please choose the one which better describes your likes or feelings. In some cases, you may find items in which you do not like either choice. In these cases mark the choice you dislike least.

It is important you respond to all items with only one choice, A or B. We are interested only in your likes or feelings, not in how others feel about these things or how one is supposed to feel. There is no right or wrong answer as in other kinds of tests. Be frank and give your honest appraisal of yourself.

1. A. I like "wild" parties.
   B. I prefer quiet parties with good conversation.
2. A. There are some movies I enjoy seeing a second or even a third time.
   B. I can't stand watching a movie that I've seen before.
3. A. I often wish I could be a mountain climber.
   B. I can't understand people who risk their necks climbing mountains.
4. A. I dislike all body odors.
   B. I like some of the earthy body smells.
5. A. I get bored seeing the same old faces.
   B. I like the comfortable familiarity of everyday friends.
6. A. I like to explore a strange city or section of town by myself, even if it means getting lost.
   B. I prefer a guide when I am in a place I don't know well.
7. A. I dislike people who do or say things just to shock or upset others.
   B. When you can predict almost everything a person will do and say, he or she must be a bore.
8. A. I usually don't enjoy a movie or play where I can predict what will happen in advance.
   B. I don't mind watching a movie or play where I can predict what will happen in advance.

9. A. I have tried marijuana or would like to.
   B. I would never smoke marijuana.
10. A. I would not like to try any drug which might produce strange and dangerous effects on me.
    B. I would like to try some of the new drugs that produce hallucinations.
11. A. A sensible person avoids activities that are dangerous.
    B. I sometimes like to do things that are a little frightening.
12. A. I dislike "swingers."
    B. I enjoy the company of real "swingers."
13. A. I find that stimulants make me uncomfortable.
    B. I often get high (drinking liquor or smoking marijuana).
14. A. I like to try new foods that I have never tasted before.
    B. I order the dishes with which I am familiar, so as to avoid disappointment and unpleasantness.
15. A. I enjoy looking at home movies or travel slides.
    B. Looking at someone's home movies or travel slides bores me tremendously.
16. A. I would like to take up the sport of water-skiing.
    B. I would not like to take up water-skiing.
17. A. I would like to try surf-board riding.
    B. I would not like to try surf-board riding.
18. A. I would like to take off on a trip with no pre-planned or definite routes, or timetable.
    B. When I go on a trip I like to plan my route and timetable fairly carefully.
19. A. I prefer the "down-to-earth" kinds of people as friends.
    B. I would like to make friends in some of the "far-out" groups like artists or "hippies."
20. A. I would not like to learn to fly an airplane.
    B. I would like to learn to fly an airplane.
21. A. I prefer the surface of the water to the depths.
    B. I would like to go scuba diving.

22. A. I would like to meet some persons who are homosexual (men or women).
B. I stay away from anyone I suspect of being "queer."

23. A. I would like to try parachute jumping.
B. I would never want to try jumping out of a plane with or without a parachute.

24. A. I prefer friends who are excitedly unpredictable.
B. I prefer friends who are reliable and predictable.

25. A. I am not interested in experience for its own sake.
B. I like to have new and exciting experiences and sensations even if they are a little frightening, unconventional or illegal.

26. A. The essence of good art is in its clarity, symmetry of form and harmony of colors.
B. I often find beauty in the "clashing" colors and irregular forms of modern painting.

27. A. I enjoy spending time in the familiar surroundings of home.
B. I get very restless if I have to stay around home for any length of time.

28. A. I like to dive off the high board.
B. I don't like the feeling I get standing on the high board (or I don't go near it at all).

29. A. I like to date members of the opposite sex who are physically exciting.
B. I like to date members of the opposite sex who share my values.

30. A. Heavy drinking usually ruins a party because some people get loud and boisterous.
B. Keeping the drinks full is the key to a good party.

31. A. The worst social sin is to be rude.
B. The worst social sin is to be a bore.

32. A. A person should have considerable sexual experience before marriage.
B. It's better if two married persons begin their sexual experience with each other.

33. A. Even if I had the money I would not care to associate with flighty persons like those in the "jet set."

B. I would conceive of myself seeking pleasure around the world with the "jet set."

34. A. I like people who are sharp and witty even if they do sometimes insult others.

B. I dislike people who have their fun at the expense of hurting the feelings of others.

35. A. There is altogether too much portrayal of sex in the movies.

B. I enjoy watching many of the "sexy" scenes in movies.

36. A. I feel best after taking a couple of drinks.

B. Something is wrong with people who need liquor to feel good.

37. A. People should dress according to some standards of taste, neatness, and style.

B. People should dress in individual ways even if the effects are sometimes strange.

38. A. Sailing long distances in small sailing crafts is foolhardy.

B. I would like to sail a long distance in a small but seaworthy sailing craft.

39. A. I have no patience with dull or boring persons.

B. I find something interesting in almost every person I talk with.

40. A. Skiing fast down a high mountain slope is a good way to end up on crutches.

B. I think I would enjoy the sensations of skiing very fast down a high mountain slope.

Appendix H

Locus of Control

This page was left blank intentionally.

Locus of Control

Based on J.B. Rotter (1966) Generalized expectancies for internal versus external control of reinforcement, Psychological Monographs, 80, (1, Whole No. 609).

Instructions:

For each question, select the one statement that best describes how you feel.

1.

Many of the unhappy things in people's lives are partly due to bad luck

People's misfortunes result from the mistakes they make.

2.

One of the major reasons why we have wars is because people don't take enough interest in politics.

There will always be wars, no matter how hard people try to prevent them.

3.

In the long run, people get the respect they deserve in this world.

Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

4.

The idea that teachers are unfair to students is nonsense.

Most students don't realize the extent to which their grades are influenced by accidental happenings.

5.

Without the right breaks, one cannot be an effective leader.

Capable people who fail to became leaders have not taken advantage of their opportunities.

6.

No matter how hard you try, some people just don't like you.

People who can't get others to like them don't understand how to get along with others.

7.

I have often found that what is going to happen will happen.

Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

8.

In the case of the well prepared student, there is rarely, if ever, such a thing as an unfair test.

Many times exam questions tend to be so unrelated to course work that studying is really useless.

9.

Becoming a success is a matter of hard work; luck has little or nothing to do with it.

Getting a good job depends mainly on being in the right place at the right time.

10.

The average citizen can have an influence in government decisions.

This world is run by the few people in power, and there is not much the little guy can do about it.

11.

When I make plans, I am almost certain that I can make them work.

It is not always wise to plan too far ahead because many things turn out to be a matter of luck anyway.

12.

In my case, getting what I want has little or nothing to do with luck.

Many times we might just as well decide what to do by flipping a coin.

13.

What happens to me is my own doing.

Sometimes I feel that I don't have enough control over the direction my life is taking.

Appendix J

Driving Risk Perception Questionnaire

This page was left blank intentionally.

Driving Risk Perception Questionnaire

Please rate the following behaviors by marking your answer along the appropriate scale. For each behavior, we ask that you rate it by: (1) how frequently you engage in that behavior; (2) How likely you think will be pulled over by the police and cited for doing the behavior; and (3) How likely you think you will be involved in an accident as a result of doing the behavior.

Driving 10-20 MPH over the speed limit

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Not yielding to a pedestrian

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Driving too fast for the road conditions

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Blood alcohol level slightly over the legal limit

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Driving without a seat belt

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Not yielding the right of way

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Driving more than 20 MPH over the speed limit

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Tailgating

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Driving with badly worn tires

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Not stopping at a red light

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Performing an illegal U-turn

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Turning with using a signal

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Blood alcohol level 50% over the legal limit

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Driving with under-inflated tires

How often do you engage in this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7
Never Occasionally Most of the time

Passing where visibility is obscured

How often do you engage in this behavior?

1 2 3 4 5 6 7

Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7

Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7

Never Occasionally Most of the time

Not making a full stop at a stop sign

How often do you engage in this behavior?

1 2 3 4 5 6 7

Never Occasionally Most of the time

How likely are you to get a ticket while doing this behavior?

1 2 3 4 5 6 7

Never Occasionally Most of the time

How likely are you to get in an accident while doing this behavior?

1 2 3 4 5 6 7

Never Occasionally Most of the time

Note: Based upon a questionnaire developed by DeJoy (DeJoy, D.M, 1990, Gender differences in traffic accident risk perception. In *Proceedings of the Human Factors Society 34th Annual Meeting*, 1032-1036.)

Appendix K

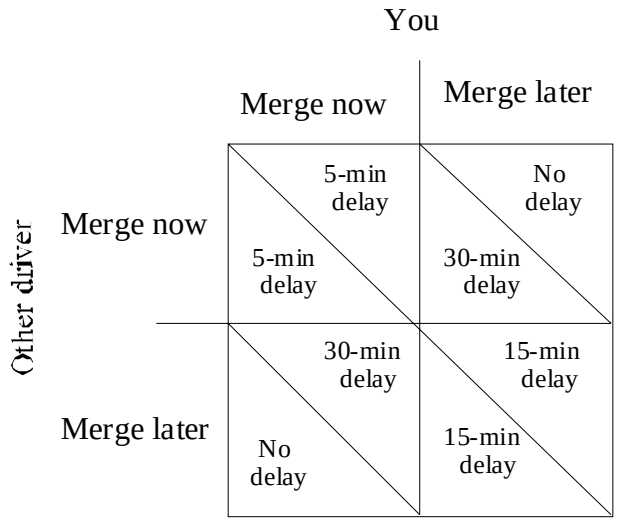
Driving Dilemma Questionnaire

This page was left blank intentionally.

Driving Dilemma Questionnaire

Based on the classic "Prisoners' Dilemma" devised by A.W. Tucker in the 1950's. This element of game theory is presented and discussed by Robert Axelrod in his book "*The Evolution of Cooperation"*, New York: Basic Books, 1984.

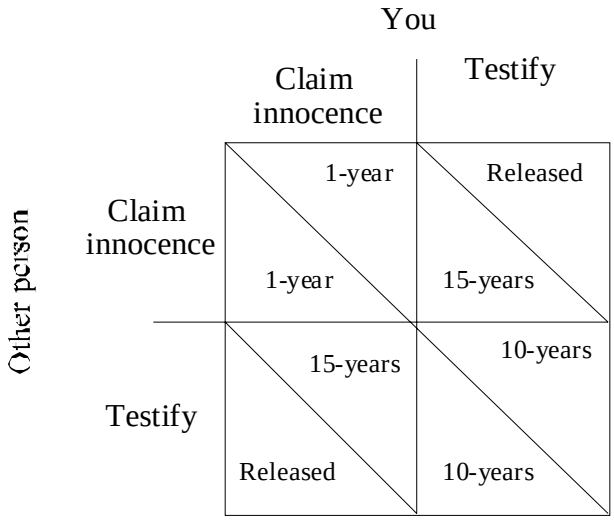
Suppose you see a sign informing you that you need to merge to the left because of construction ahead. Cars in the left lane are beginning to queue up. You and another driver have the choice of either merging to the left now or continuing in the right lane until forced to merge. If you and the other driver merge now you both will have a 5 min delay and if you both merge later you both will have a 15 min delay. If, however, one of you merges now and the other merges later, the one who merges later will have no delay while the one who merges now will have a 30 min delay. This situation is shown in the diagram below.



What choice would you make:

A. Merge now
B. Merge later

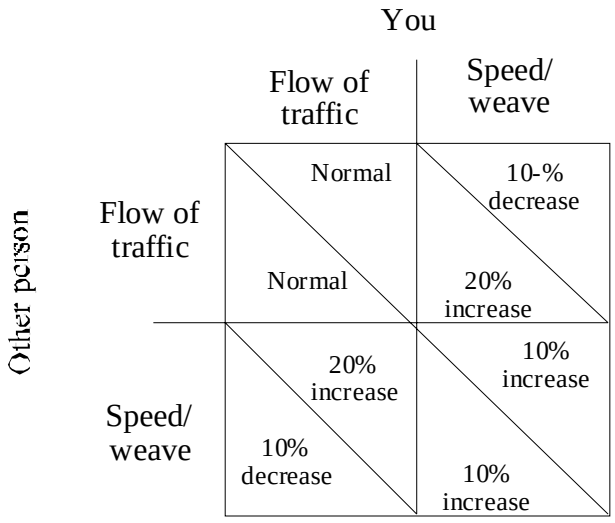
Suppose you and another person are arrested on a minor charge and placed in separate rooms. Although the authorities believe that both of you are guilty of a more serious crime, there is no proof. You and the other person have the choice of continuing to claim your innocence or testifying against the other person. If you both claim your innocence than you both will received 1-year in prison. If you both testify against each other you both will received 10-years in prison. If, however, one of you testifies while the other claims innocence, the one who testifies will go free while the other will received a 15-year sentence. This situation is shown in the diagram below.



Would choice would you make?

A. Continue to claim your innocence
B. Testify against the other person?

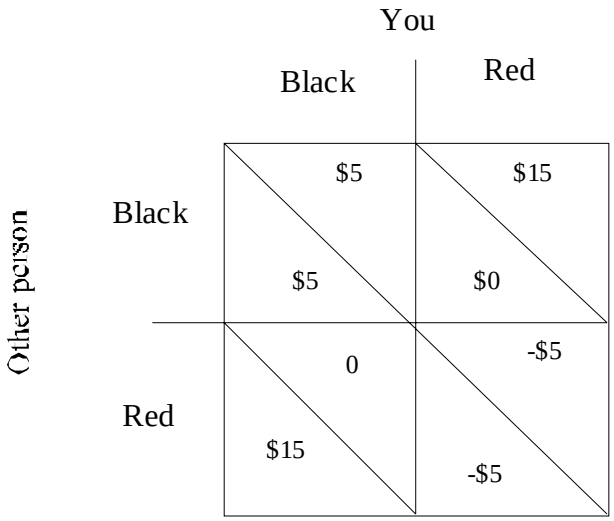
Suppose you are driving in fairly heavy traffic and are late for an appointment. You and another driver on the road have the choice of either driving with the flow of traffic or speeding up and weaving through the traffic. If you and the other driver both drive at the speed of the flow of traffic, then you and the other driver will have a normal risk of getting into a crash. If both you and the other driver decide to speed up and weave through traffic, then you both will have a 10 percent increased chance of being in a crash. If, however, one drives the flow of traffic while the other speeds up and weaves, the one who speeds up and weaves will have a 10 percent decrease in their chance of being in a crash while the other will have 20 percent increase in their chance of being in a crash. This situation is shown in the diagram below.



What would you do in this situation?

A. Drive with the flow of traffic.
B. Speed up and weave through traffic.

Suppose you are playing a game for money against one another person. You and another person have the choice of playing either a red card or a black card. If you both play the black card then you both win $5. If you both play the red card, then you both lose $5. If, however, one plays the black card and one plays the red card, then the one who plays the red card wins $15 while the other wins nothing. This situation is shown in the diagram below.



What card would you play?

A. Black card.
B. Red card.

Appendix L

Instructional Video Script

This page was left blank intentionally.

Instructional Video Script

INTRODUCTION

Welcome to the University of Michigan Transportation Research Institute. Thank you for finding the time to participate in the road departure crash warning system's field operational test. For this study, we are asking you to drive a 2003 Nissan Altima that is equipped with a new crash avoidance technology known as Road Departure Crash Warning (or RDCW). After several weeks of driving, we will ask you to provide feedback that will help us to evaluate many different aspects of the RDCW system. Because RDCW is a new technology, only you are authorized to drive the vehicle during the duration of the study. Only in an emergency should another person drive the vehicle, and during such times, the driver should *not* rely on the RDCW system.

The Road Departure Crash Warning System is composed of two major subsystems, lateral drift warning (LDW) and curve speed warning (CSW). Both LDW and CSW are meant to alert you to the potential for a run-off-road crash.

Lateral drift warning provides warnings if you are drifting from the road, or drifting out of your lane without using your turn signal. Lateral drift warning is meant to alert you to the potential for a run-off-road crash, and does not actively control the vehicle in any way.

Curve speed warning provides warnings if you are traveling too fast to safely negotiate an upcoming curve. Like the LDW system, CSW is only a warning system, and it will not take control of the vehicle.

The Road Departure Crash Warning system works by continuously gathering data about the vehicle and its surroundings. These data includes such things as vehicle speed, lane position, the location of lane markings and road edges, road curvature, and objects around the vehicle (such as other cars). The data are collected in a number of ways: from radar sensors mounted on the front and sides of the vehicle, from video cameras mounted near the interior rear-view mirror, and from GPS antennas mounted on the trunk and roof of the vehicle. Additional video and audio recordings of you, the driver, will be collected to help us interpret and observe your responses to using the new systems.

Information about the RDCW system will be presented on a monitor located on the left side of the vehicle's instrument panel.

BASIC CAR OPERATION

For the most part, the Nissan Altima is similar to other cars with which you are familiar. The basic operation of this vehicle is very similar to your own car. However, as with any new vehicle, please take some time to familiarize yourself with all of the features specific to this car. In addition to the summary that follows, a research assistant will provide you with an orientation to the car, and will answer any questions that you may have.

The Nissan Altima is equipped with side airbags, a front driver and passenger airbag, and three-point safety belts. You will be required to wear your seat belt whenever you are operating the research vehicle. If installing a child restraint or car seat, please refer to the Nissan Altima's owner's manual located in the glove compartment.

Controls for adjusting the outside rear-view mirrors are located on the driver-side door. The steering wheel can be tilted to a comfortable position by pulling the black lever on the steering column toward you. The seat position controls are located on the bottom-left side of the driver-seat. Controls for the headlamps and windshield wipers are located on the steering column. On the center console are controls for the radio and air conditioning system. Should you wish to use cruise control while you have the Altima, all of the controls can be found on the steering wheel, and they are described in the owner's manual.

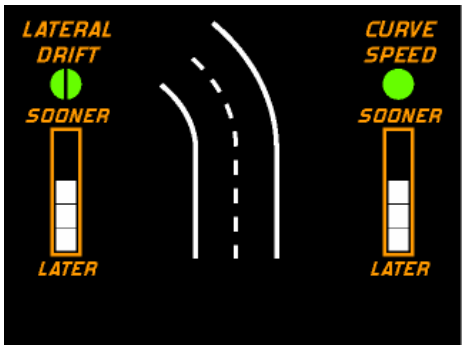
In the event that you need to change a flat tire, please refer to the owner's manual for instructions. The spare tire can be removed from the trunk without disturbing the research equipment installed there. Please note that the vehicle's hazard light switch is located near the ashtray beneath the air conditioning controls. The emergency brake is also located in this area.

The various icons relating to the car's operation and status will be located on the bottom of the RDCW monitor. You will see these icons appear on the screen whenever conditions warrant them.

Please review the owner's manual before you drive and take a few moments to make any necessary adjustments to your seat and mirror positions.

LATERAL DRIFT WARNING

Information about the LDW component of the RDCW system will be presented on the RDCW monitor. While you are driving, the display will look very similar to this:



Notice that the display shows an image of a roadway. On either side of the roadway are two orange vertical bars that are labeled *Sooner* and *Later*. The number of white squares in each orange bar ranges from one to five and indicates the sensitivity setting for each system. One white square represents the minimum sensitivity setting and five white squares represent the maximum sensitivity setting.

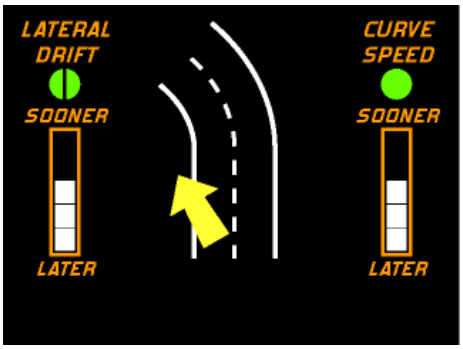
The sensitivity setting for the lateral drift warning affects how soon you will be presented with warnings. If you adjust the sensitivity toward *Sooner*, you will not need to drift as much from your lane to experience a warning. If you adjust the sensitivity toward *Later*, you will receive warnings later (or further outside the lane boundaries).

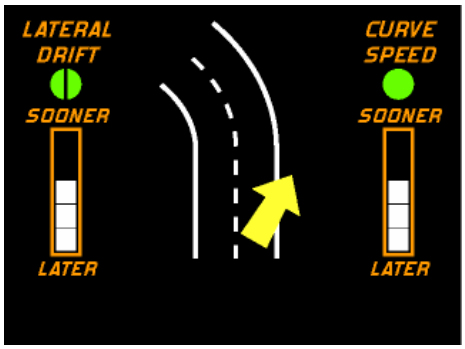
You can adjust the sensitivity of the lateral drift warning system by using the button located to the left of the steering wheel that is labeled "LDW." Pressing the top half of this button will increase the lateral drift warning sensitivity, and pressing the bottom half will decrease the sensitivity. The sensitivity that you select is remembered when you turn the car off. The next time you start the car, the previously selected sensitivity will be displayed.

Based upon your lane position, your rate of lateral (sideways) movement, the sensitivity you select, and the type of lane boundary that you cross, the lateral drift warning system will display one of two different alert levels.

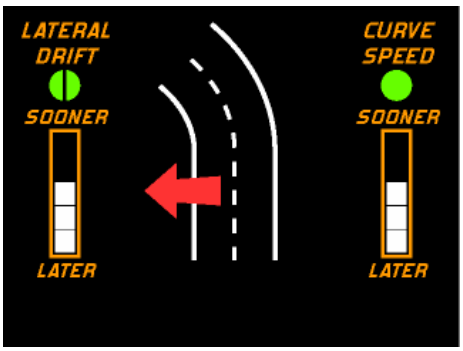
The first level of warning is cautionary. For this level of warning, a yellow icon is displayed on the roadway graphic in the RDCW display to indicate what direction

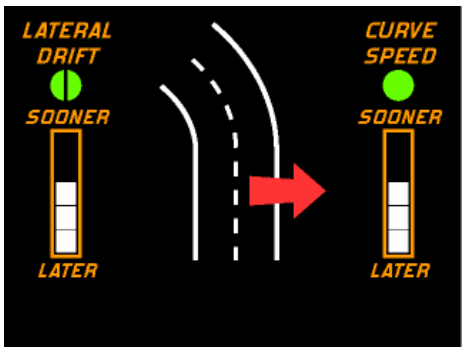
you are drifting. The warning is also accompanied by a seat vibration on the left or right side of the seat, also depending on which direction you are drifting. You will receive a cautionary warning when you have crossed a dashed-line boundary (such as a lane change on a freeway) and there are no vehicles or other objects directly around you.





The second level is an imminent warning, and is designed to be more urgent than the cautionary warning. The visual icon is red and more severely pointed off the road for the imminent warning. The imminent lateral drift warning is accompanied by an auditory tone (as opposed to a seat vibration). The tone will sound on either the left or the right, depending on which direction you are drifting. The imminent warning occurs when you have crossed a solid-line boundary. You will also receive an imminent warning if you cross a dashed-lined boundary and there are vehicles or other objects directly around you. This imminent level of warning indicates that driver control is likely required in order to prevent a run-off-road crash.





Above the lateral drift warning sensitivity bar is the lateral drift warning availability indicator, represented by two half-circles. The half-circles indicate the availability of the lateral drift warning system on the left and right sides of the vehicle respectively. When both sides of the lateral drift warning system are available, both half-circles will be green in color. The half-circles will be gray in color whenever the LDW system is unavailable (meaning that no LDW warnings will be provided). The

lateral drift warning system can become unavailable on one or both sides of the vehicle for the following reasons: poor road surface conditions (such as snow cover), poor lane marking quality, reflections from the road caused by low sun angles, poorly defined road edges, or low speeds (below 25 mph). Once the vehicle reaches 25 mph or higher, part or the entire indicator may turn green, signifying lateral drift warning system availability.

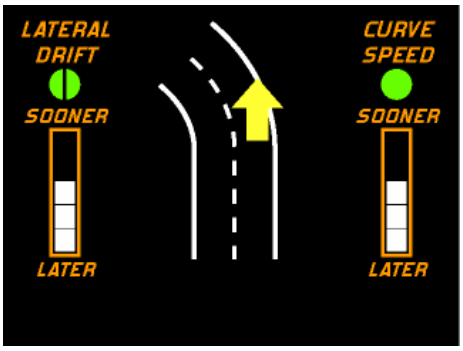
Please note also that the lateral drift warning system becomes temporarily unavailable whenever you use your turn signal or apply the brake pedal. When you use the turn signal or apply the brakes, there will be about four seconds during which no warnings will be given, even if you are outside of your lane. This allows you to change lanes or to maneuver around obstacles in the road without eliciting a warning.

CURVE SPEED WARNING

CSW information is presented on the same display as LDW. The sensitivity for curve speed warning is indicated by the orange bar to the right of the roadway graphic. You can adjust the sensitivity by pressing the button labeled "CSW," located to the left of the steering wheel. Pressing the top half of this button increases the curve speed warning sensitivity, while pressing the bottom half decreases the sensitivity. The higher the sensitivity, the sooner you are likely receive warnings about upcoming curves. Again, the sensitivity that you select is remembered when you turn the car off.

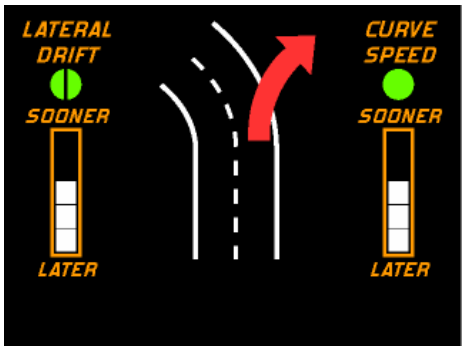
The CSW system uses GPS to identify the degree of curvature ahead in the road as you drive. Based upon the speed you are traveling, the degree of curvature in the road and the sensitivity setting that you select, the CSW system will determine whether you are traveling too fast to safely negotiate the upcoming curve and may provide a warning. There are two levels of curve speed warning.

The first warning is cautionary, and is letting you know that a sharp curve is ahead. When you receive this level of warning, a yellow icon will appear in the RDCW display:



Notice that the icon appears toward the curve in the roadway graphic. A seat vibration is also presented toward the front of the driver's seat for this level of warning.

The second level is an imminent warning, and indicates that driver control is required in order to avoid a run-off-road crash. The color of the icon changes to red and becomes larger. In addition to the visual icon, a voice warning accompanies this level. However, there is no seat vibration for the imminent warning.



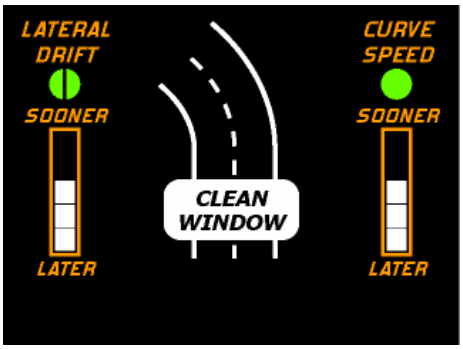
Above the curve speed warning sensitivity bar is a circular icon. This is the curve speed warning availability icon and is similar to the lateral drift warning availability icons in that it indicates when the curve speed warning system is active. The availability of the curve speed warning system depends mainly on how well mapped the area is. If the curve speed warning system does not have sufficient information, then it will not be able to provide warnings about upcoming curves. Curve speed warning is also unavailable at speeds below 18 mph. When the system is unavailable, no warnings will be provided.

On occasion, you might experience a false curve speed warning. In other words, there are infrequent instances when the curve speed warning system may present an alert in conditions when you are not about to enter a curve. This can happen when you pass a sharp curve on the road without actually driving toward it. Examples of this include passing an exit ramp on a freeway, passing some side streets, or approaching a “T”-type intersection.

ADDITIONAL SYSTEM ATTRIBUTES

There are two messages that the road departure crash warning (RDCW) system might display: RDCW Service and Clean Window.

The RDCW Service message will be displayed whenever there is a technical problem with the RDCW system. While this icon is present, the RDCW will not function correctly. If restarting the research vehicle does not correct the problem, please contact UMTRI researchers.



If you are driving in conditions of heavy rain, or if the windshield becomes dirty, the Clean Window message might be displayed. The message indicates that the forward-looking video camera cannot adequately see through the windshield and therefore cannot gather all the information that it needs to function correctly. If you receive this message, simply turn on the vehicle's windshield wipers. If the message does not go away, you can clean the windshield with the materials we have provided.

System performance may be degraded if there is a buildup of snow or other debris near the radars. Periodic cleaning may be necessary.

Located on the center console to the left of the air conditioning controls is the comment button. The comment button has been installed so that drivers can provide comments or suggestions on how the lateral drift warning and curve speed warning systems work. This button can be pressed at any time the vehicle is running and there is no limit to the number of comments you may provide. When pressed, the driver will have their spoken comments recorded for 20 seconds. The comment button should be used whenever the driver feels that it is warranted. This may help to relieve the burden of remembering all of one's comments when returning the vehicle.

EMERGENCY PROCEDURES

In the event of an accident, your first priority should be your safety and the safety of any passengers. If there are any injuries, seek immediate medical attention. When you feel that it is safe to do so, call or page UMTRI researchers using the cellular telephone provided to you and located in the center console of the car. This telephone should be used only to contact UMTRI researchers and only if there has been an accident, a vehicle breakdown, or you need additional information about how to use the vehicle. Should an accident occur, you will be asked to complete a driver incident report. A copy of this document is located in the red envelope inside the glove compartment of the vehicle. Proof of insurance and the vehicle's registration are also located in this envelope. The pager and telephone numbers for contacting UMTRI researchers are located on the outside of this envelope.

Please feel free at any time to contact the researchers if you have questions regarding the research vehicle or your participation in this study. UMTRI researchers are available via pager 24 hours a day should there be an emergency or a vehicle breakdown. For less urgent matters, please contact us using the toll free number or email address provided. All contact information is located in the glove compartment. As a reminder, please remember that you are the only person authorized to drive the research vehicle.

Again, thank you for taking the time to participate in our study. We hope that you enjoy your experience. Your participation is providing us with valuable insights and allowing us to design better road departure crash warning systems.

Appendix M

Post-Drive Questionnaire With Descriptive Statistics

This page was left blank intentionally.

Post-Drive Questionnaire With Descriptive Statistics

Participant #_____

Date _____

Road Departure Crash Warning (RDCW) System Questionnaire and Evaluation

Please answer the following questions about the Road Departure Crash Warning system. If you like, you may include comments alongside the questions to clarify your responses.

Example:
A.) Strawberry ice cream is better than chocolate.

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

If you prefer chocolate ice cream over strawberry, you would circle the "1", "2" or "3" according to how strongly you like chocolate ice cream, and therefore disagree with the statement.

However, if you prefer strawberry ice cream, you would circle "5", "6" or "7" according to how strongly you like strawberry ice cream, and therefore agree with the statement.

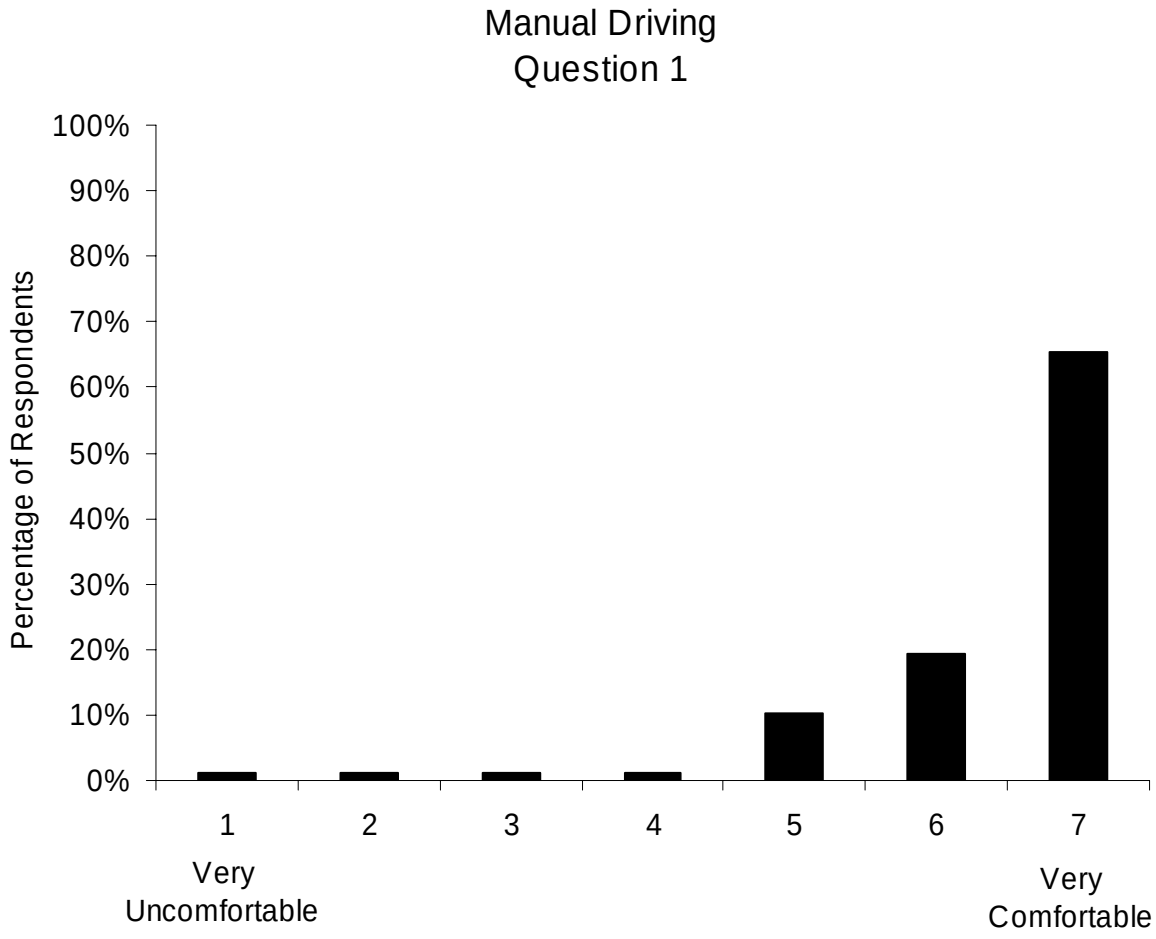
If a question does not apply:

Write "NA," for "not applicable," next to any question which does not apply to your driving experience with the system. For example, you might not experience every type of warning the questionnaire addresses.

Manual Driving

Manual driving refers to driving the research vehicle without the use of RDCW.

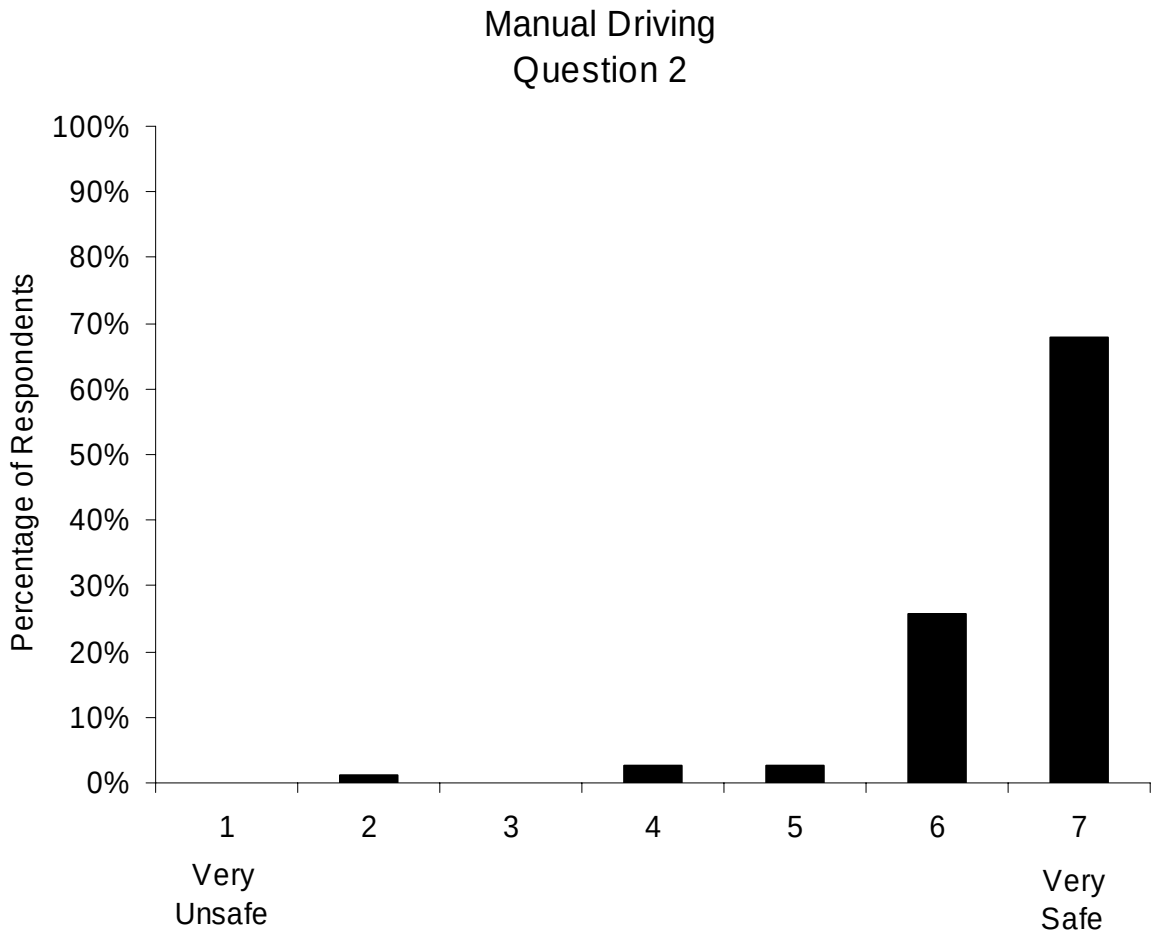
1. How comfortable did you feel driving the car manually?



	Males	Females	Overall
Younger (20-30)	6.8 (0.6)	6.5 (1.4)	6.7 (1.0)
Middle-Aged (40-50)	6.1 (1.9)	4.8 (2.9)	6.5 (0.8)
Older (60-70)	5.5 (2.3)	6.1 (1.0)	6.0 (1.3)
Overall	6.1 (1.8)	5.8 (2.0)	6.4 (1.1)

Values in cells represent the mean response and (standard deviation)

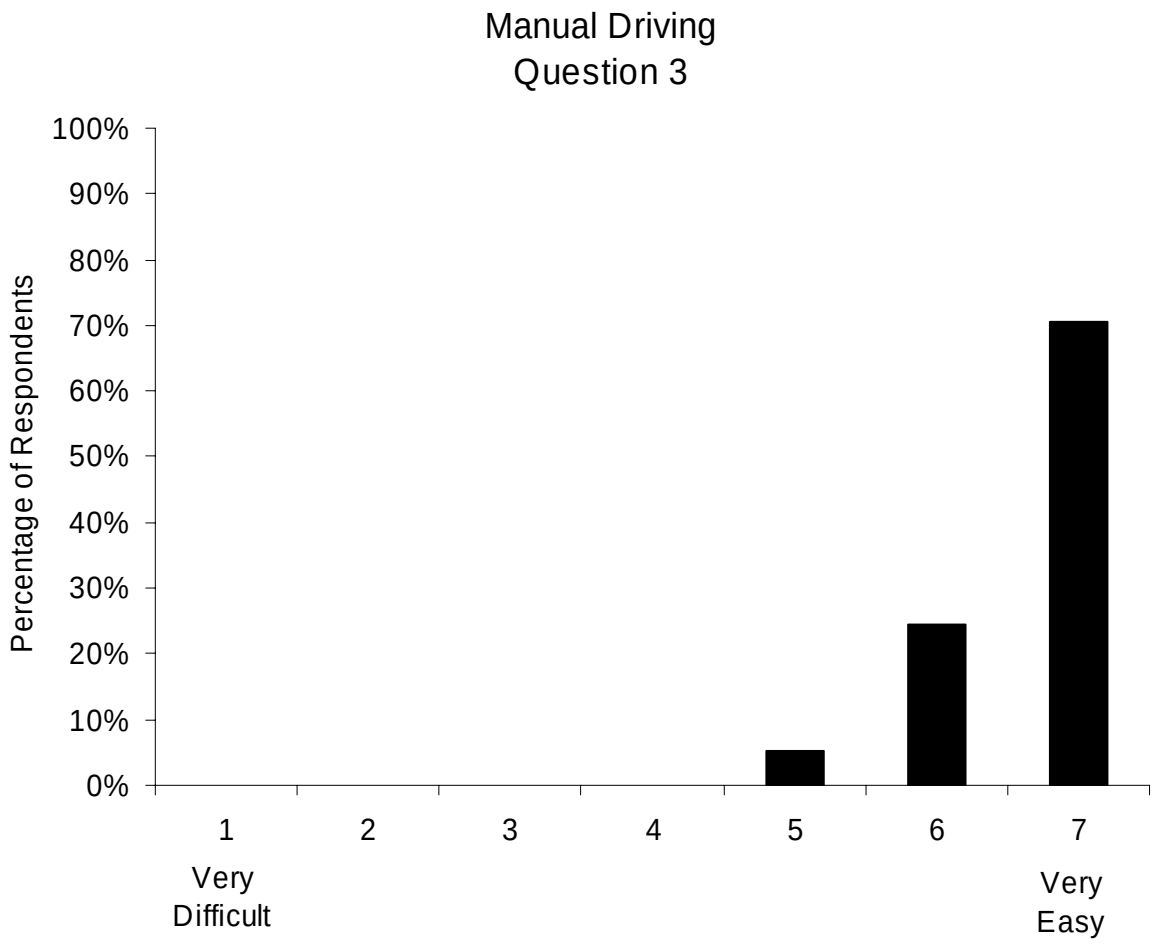
2. How safe did you feel driving the car manually?



	Males	Females	Overall
Younger (20-30)	6.6 (0.5)	6.6 (1.4)	6.6 (1.0)
Middle-Aged (40-50)	6.7 (0.5)	6.5 (1.0)	6.6 (0.8)
Older (60-70)	6.4 (0.9)	6.5 (0.7)	6.4 (0.8)
Overall	6.6 (0.6)	6.5 (1.0)	6.6 (0.8)

Values in cells represent the mean response and (standard deviation)

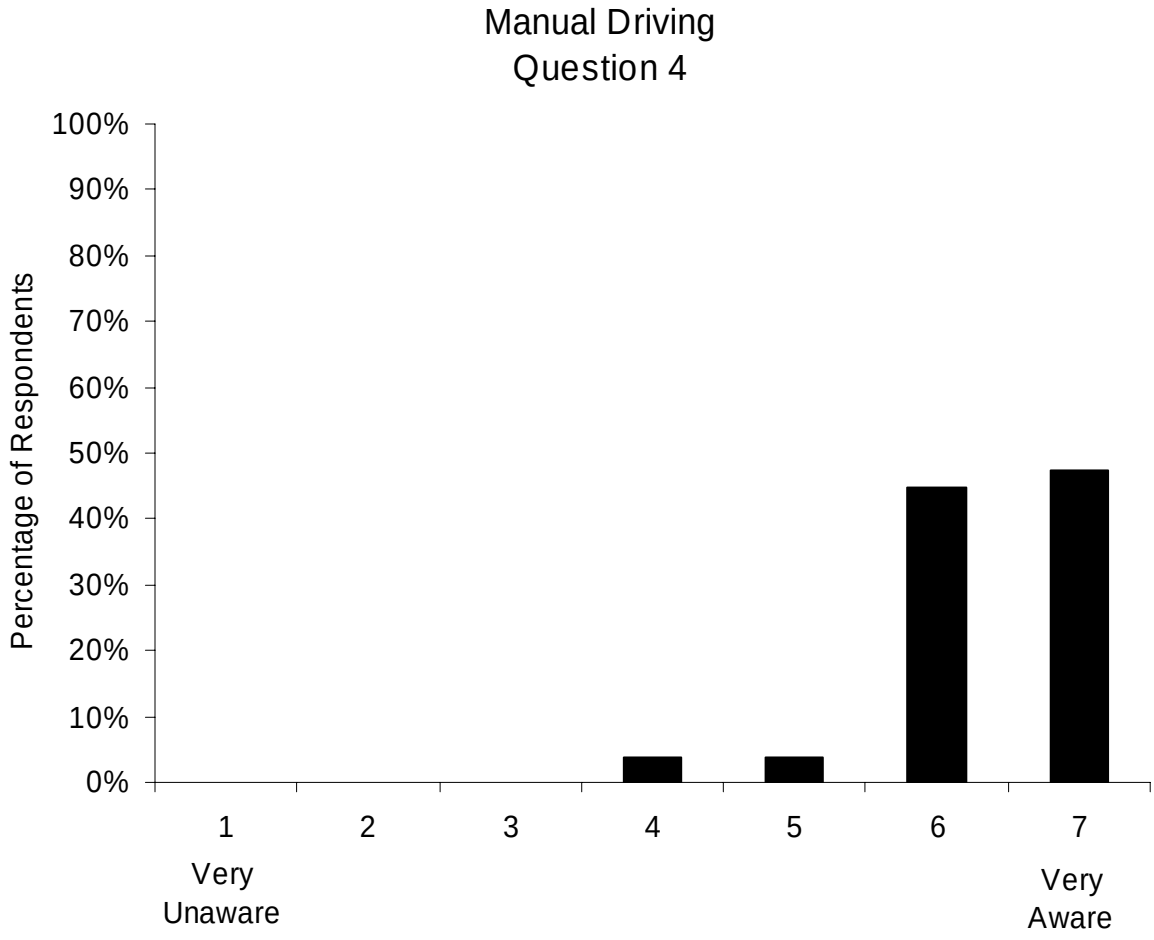
3. How easy or difficult was it to drive the car manually?



	Males	Females	Overall
Younger (20-30)	6.7 (0.5)	6.8 (0.4)	6.8 (0.4)
Middle-Aged (40-50)	6.8 (0.4)	6.2 (2.0)	6.8 (0.5)
Older (60-70)	6.5 (0.7)	6.4 (0.8)	6.5 (0.7)
Overall	6.7 (0.5)	6.5 (1.2)	6.7 (0.6)

Values in cells represent the mean response and (standard deviation)

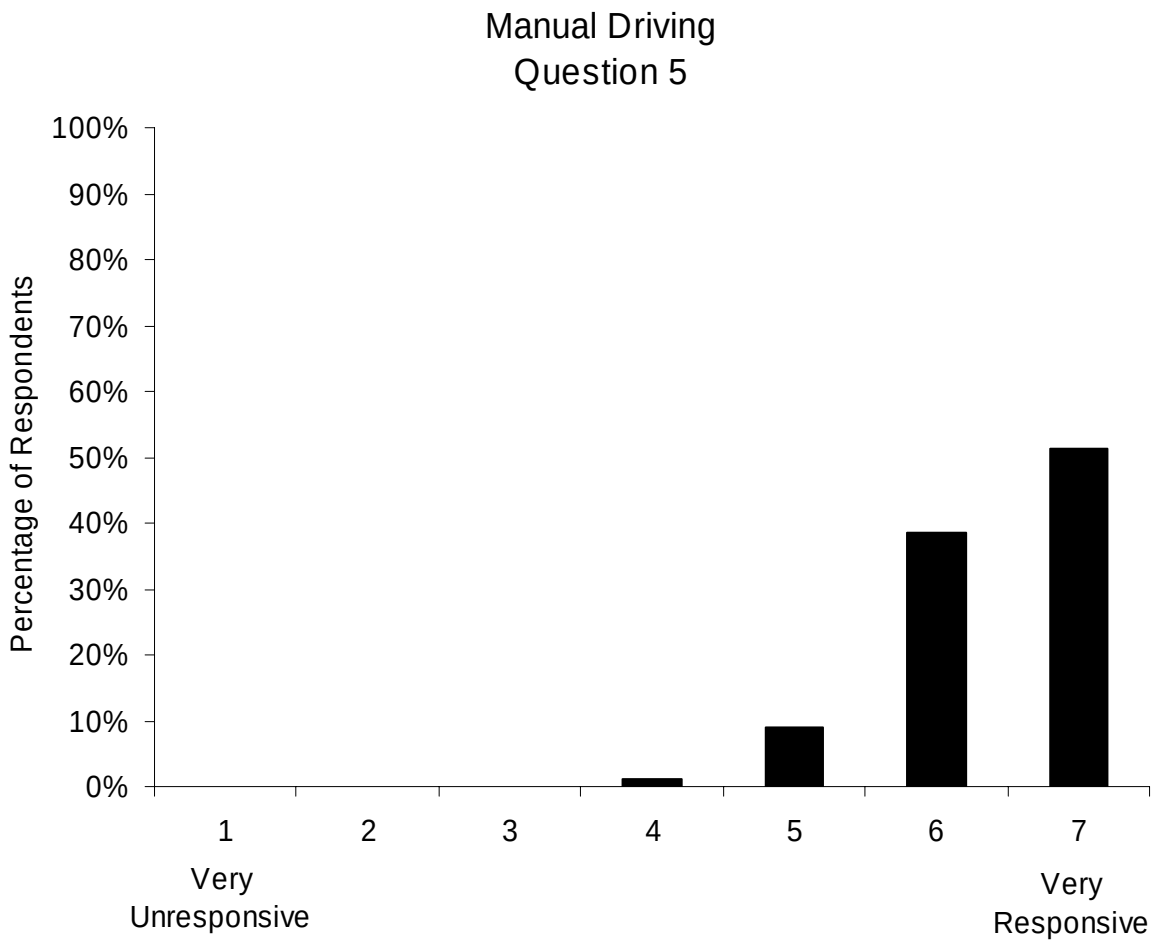
4. When driving manually, how aware were you of the driving situation (surrounding traffic, posted speed, traffic signals, etc)?



	Males	Females	Overall
Younger (20-30)	5.9 (1.0)	6.5 (0.7)	6.2 (0.9)
Middle-Aged (40-50)	6.7 (0.5)	5.9 (1.9)	6.6 (0.6)
Older (60-70)	6.2 (0.9)	6.5 (0.5)	6.3 (0.7)
Overall	6.3 (0.8)	6.3 (1.2)	6.4 (0.7)

Values in cells represent the mean response and (standard deviation)

5. When driving manually, how responsive were you to the actions of vehicles around you?



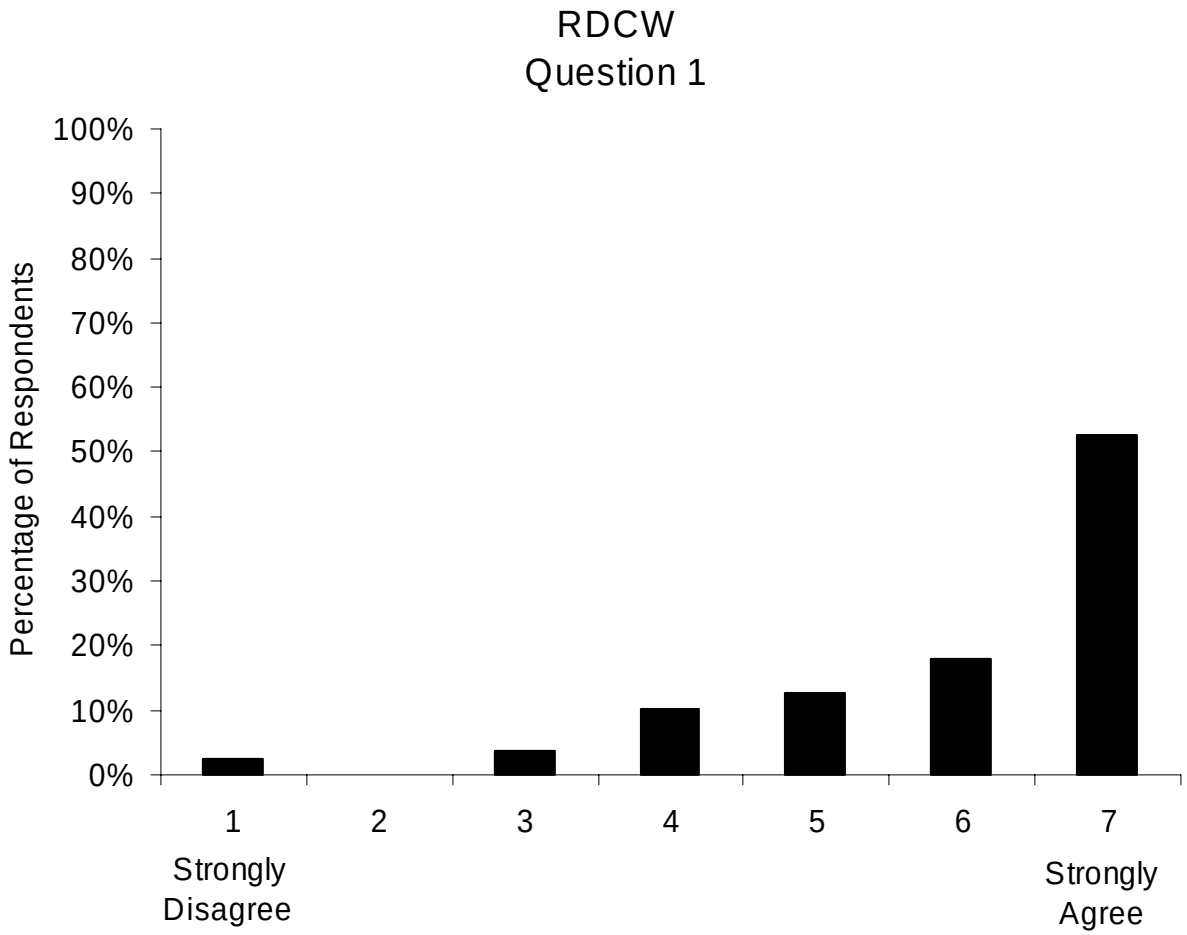
	Males	Females	Overall
Younger (20-30)	6.0 (0.8)	6.5 (0.7)	6.3 (0.8)
Middle-Aged (40-50)	6.7 (0.5)	6.0 (2.0)	6.6 (0.6)
Older (60-70)	6.1 (0.8)	6.6 (0.5)	6.3 (0.7)
Overall	6.3 (0.8)	6.4 (1.2)	6.4 (0.7)

Values in cells represent the mean response and (standard deviation)

Overall RDCW (LDW & CSW) System Questionnaire and Evaluation

RDCW Display – General Characteristics

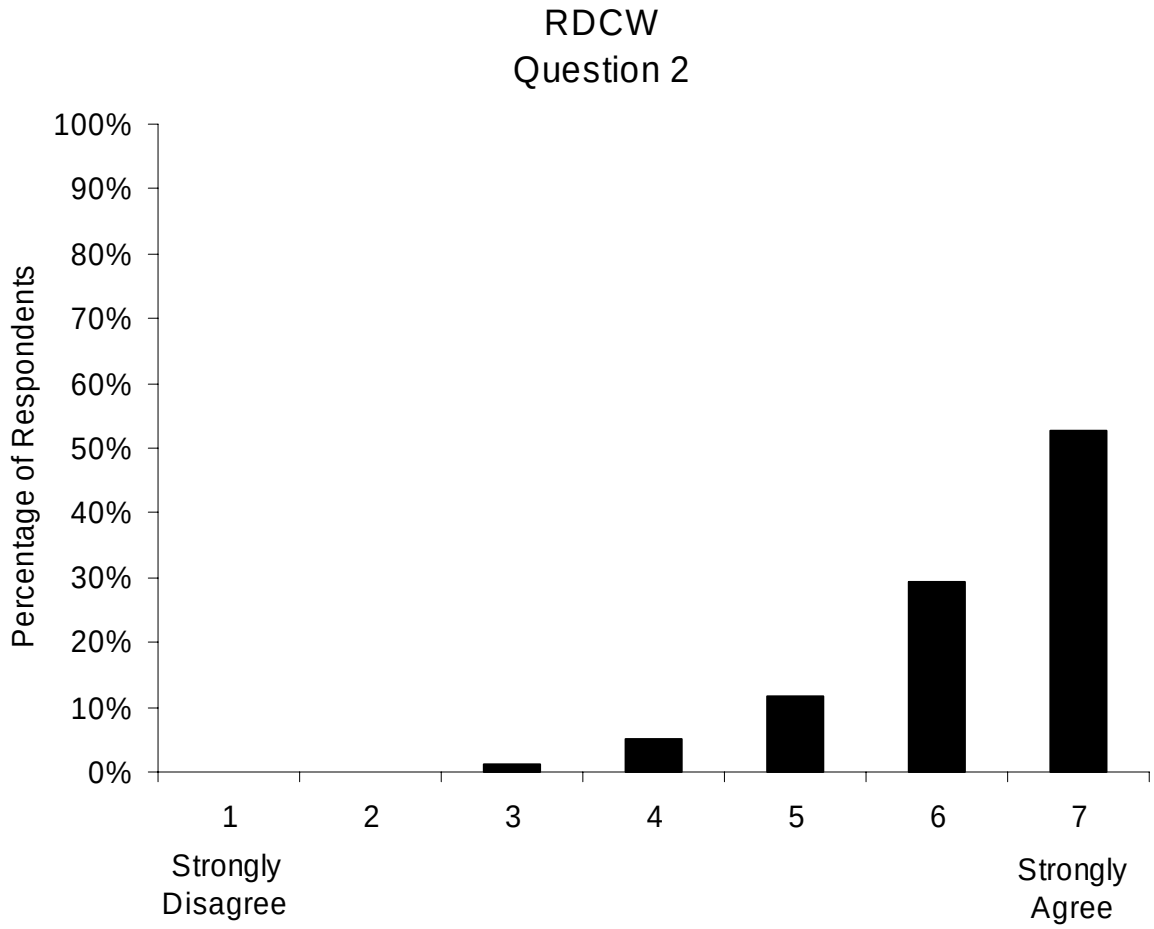
1. The RDCW display was in a convenient location on the instrument panel (i.e., I did not have to change my posture to see it).



	Males	Females	Overall
Younger (20-30)	6.1 (1.3)	5.8 (1.1)	6.0 (1.2)
Middle-Aged (40-50)	6.0 (1.2)	5.9 (1.9)	6.0 (1.6)
Older (60-70)	5.3 (1.9)	6.5 (1.0)	5.9 (1.6)
Overall	5.8 (1.5)	6.1 (1.4)	5.9 (1.4)

Values in cells represent the mean response and (standard deviation)

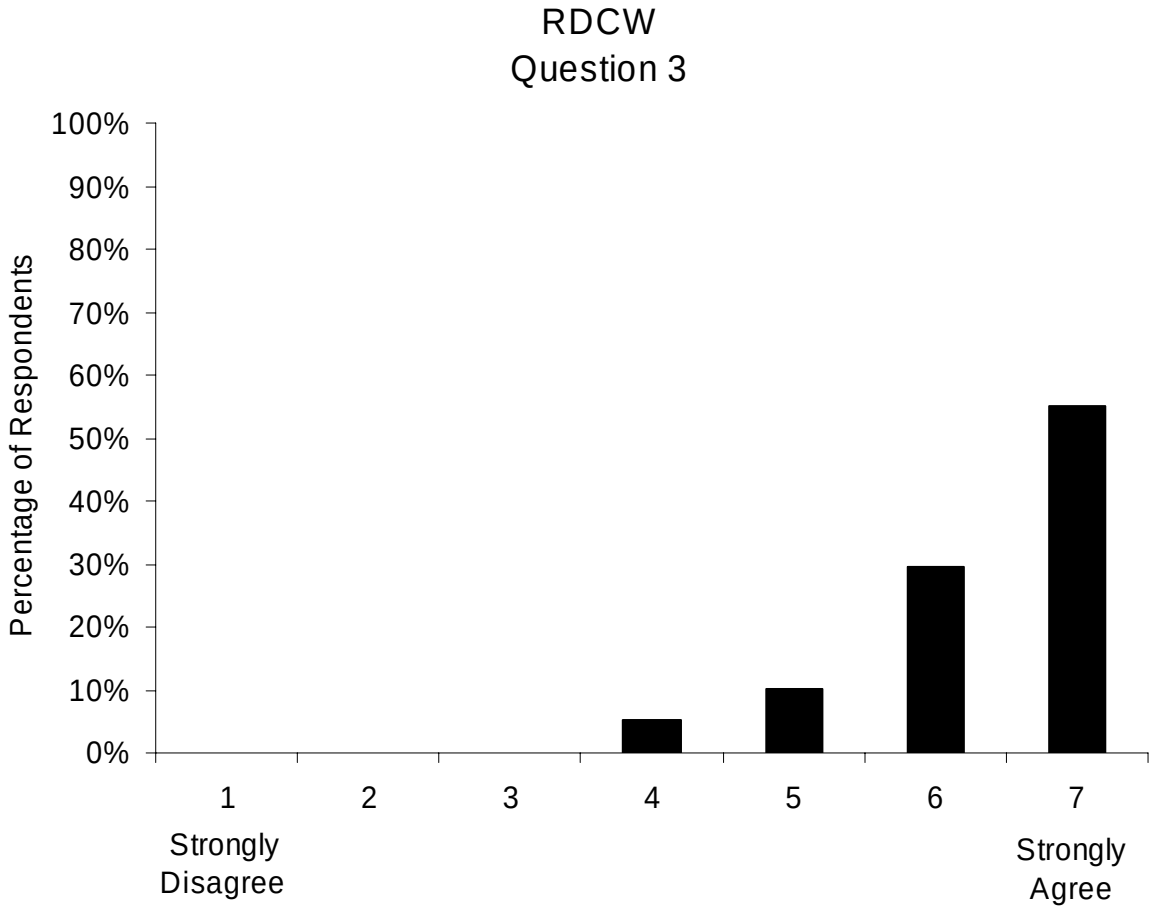
2. It was easy to understand the RDCW system operation from the information displayed in the instrument cluster.



	Males	Females	Overall
Younger (20-30)	6.2 (0.8)	6.1 (1.2)	6.2 (1.0)
Middle-Aged (40-50)	6.5 (0.5)	5.8 (1.3)	6.2 (1.0)
Older (60-70)	6.3 (1.0)	6.6 (0.5)	6.5 (0.8)
Overall	6.4 (0.8)	6.2 (1.1)	6.3 (0.9)

Values in cells represent the mean response and (standard deviation)

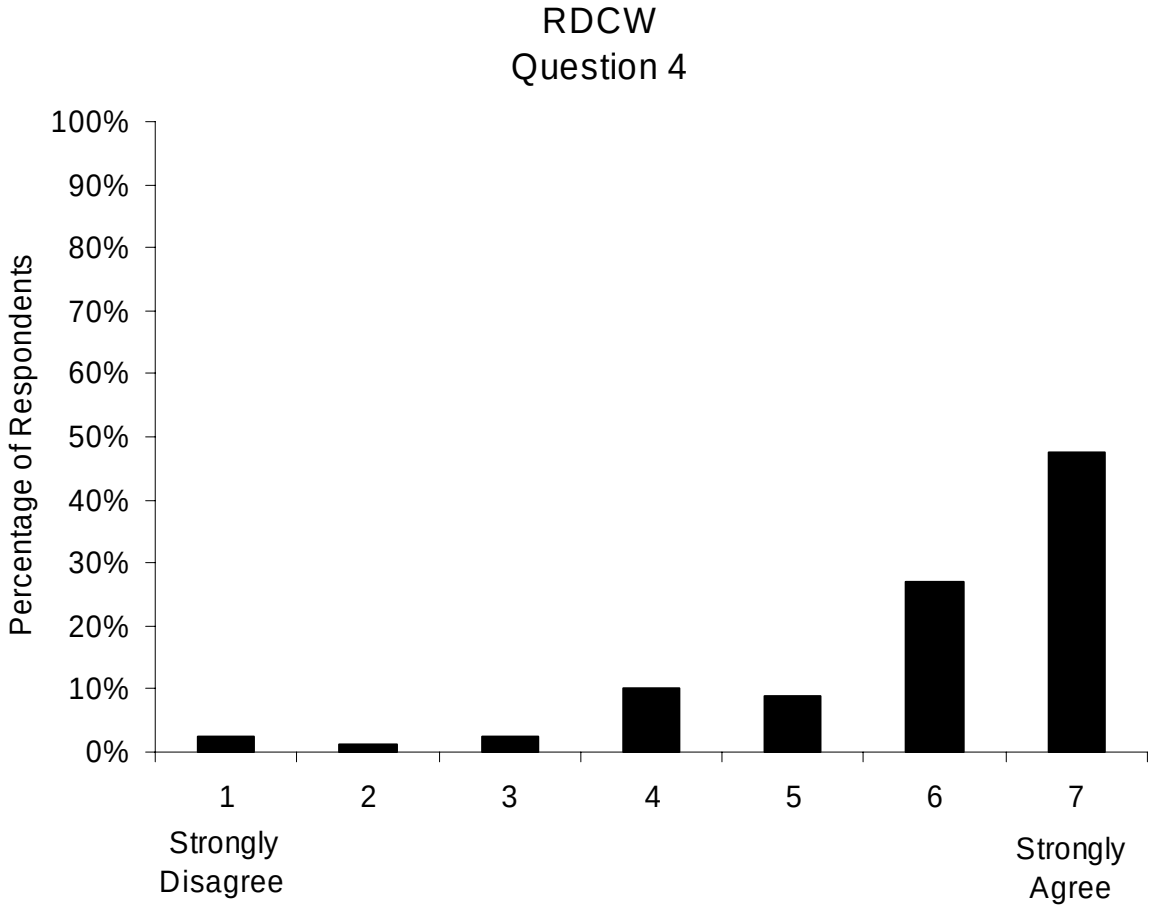
3. The graphics presented on the RDCW display were about the right size.



	Males	Females	Overall
Younger (20-30)	6.2 (0.7)	6.4 (1.0)	6.3 (0.9)
Middle-Aged (40-50)	6.6 (0.7)	6.2 (1.1)	6.4 (0.9)
Older (60-70)	6.2 (1.1)	6.6 (0.5)	6.4 (0.9)
Overall	6.3 (0.8)	6.4 (0.9)	6.3 (0.9)

Values in cells represent the mean response and (standard deviation)

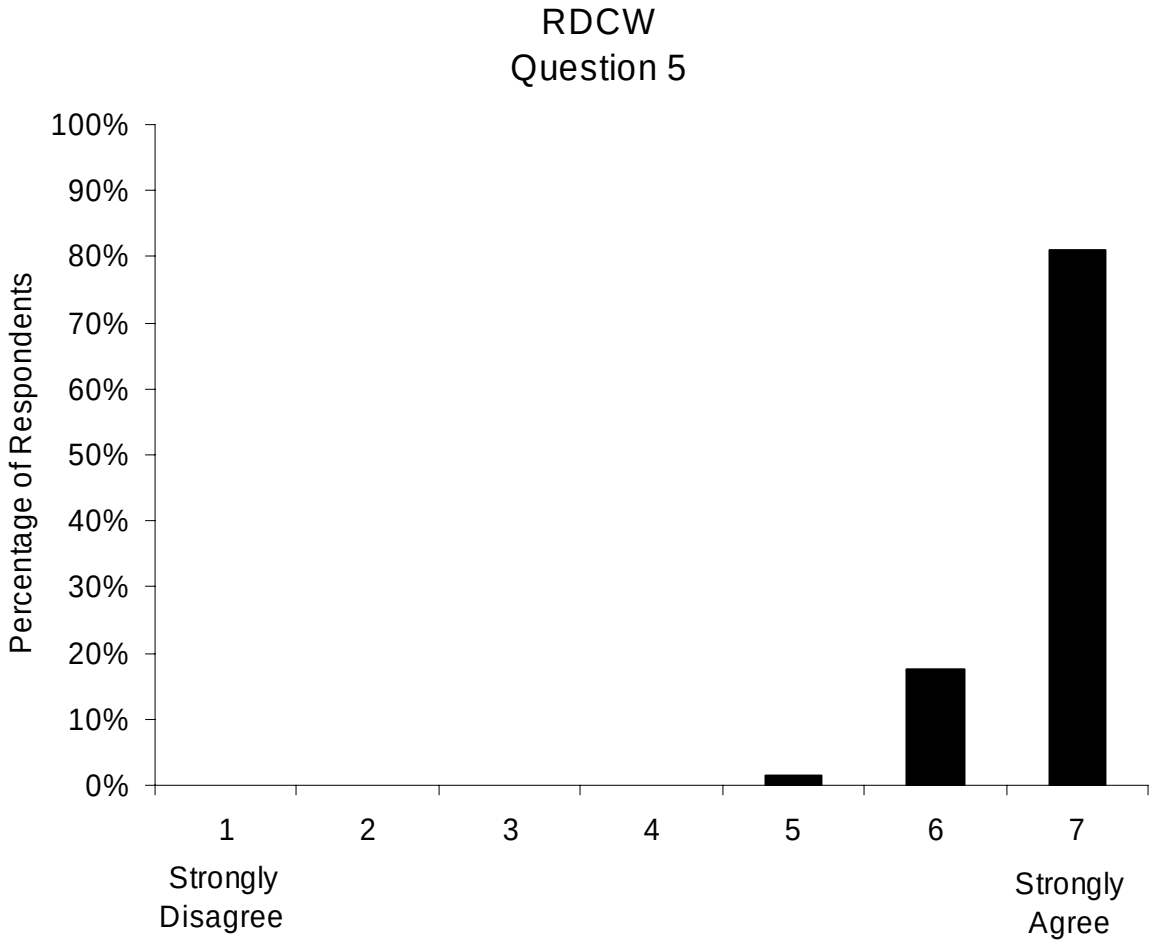
4. I was not confused by the fact that the curve on the RDCW display always pointed to the left, regardless of the direction of the curve ahead in the roadway.



	Males	Females	Overall
Younger (20-30)	5.3 (1.8)	6.0 (1.7)	5.7 (1.7)
Middle-Aged (40-50)	6.0 (1.8)	5.9 (1.3)	6.0 (1.5)
Older (60-70)	6.2 (1.1)	6.1 (0.9)	6.2 (1.0)
Overall	5.8 (1.6)	6.0 (1.3)	5.9 (1.4)

Values in cells represent the mean response and (standard deviation)

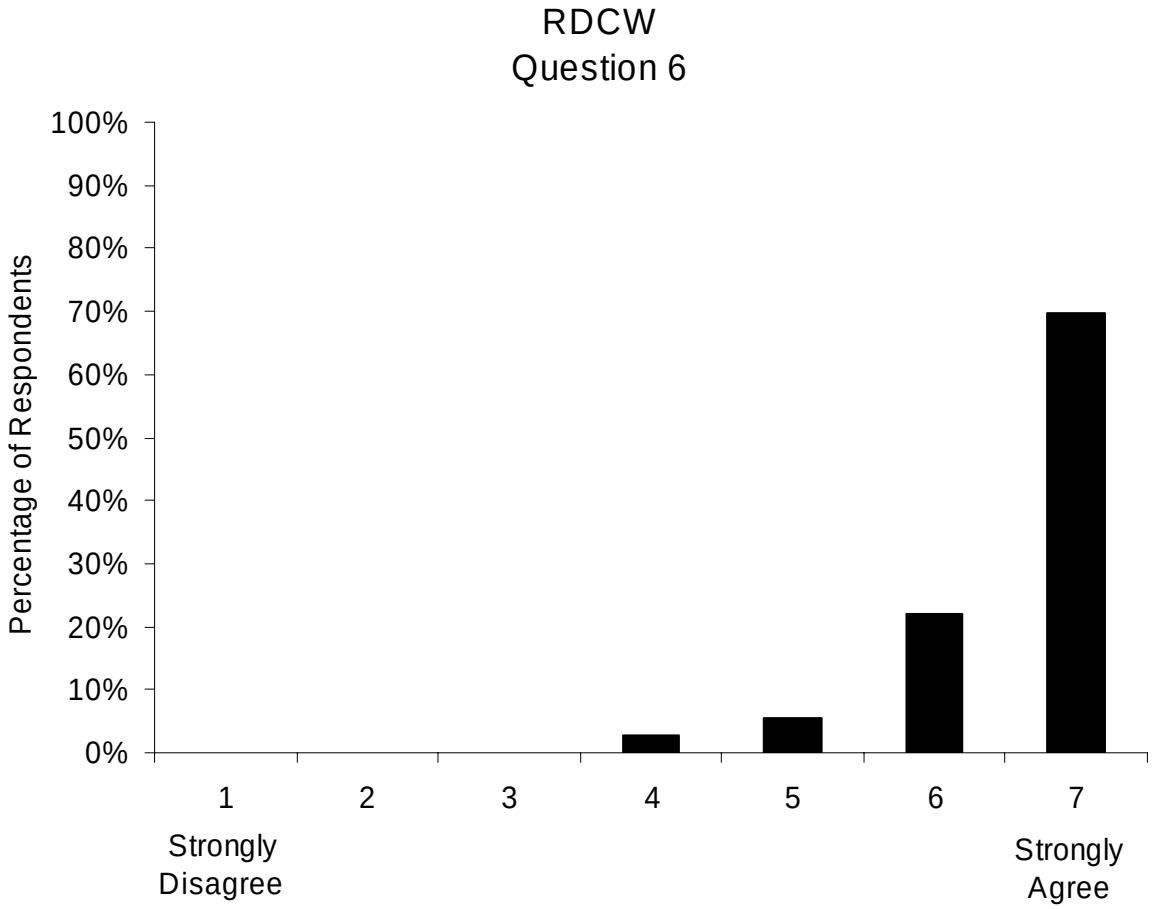
5. It was easy to use the RDCW (LDW & CSW) sensitivity adjustment switches.



	Males	Females	Overall
Younger (20-30)	7.0 (0.0)	6.8 (0.4)	6.9 (0.3)
Middle-Aged (40-50)	6.6 (0.7)	6.9 (0.3)	6.8 (0.5)
Older (60-70)	6.8 (0.4)	6.6 (0.5)	6.7 (0.5)
Overall	6.8 (0.5)	6.8 (0.4)	6.8 (0.4)

Values in cells represent the mean response and (standard deviation)

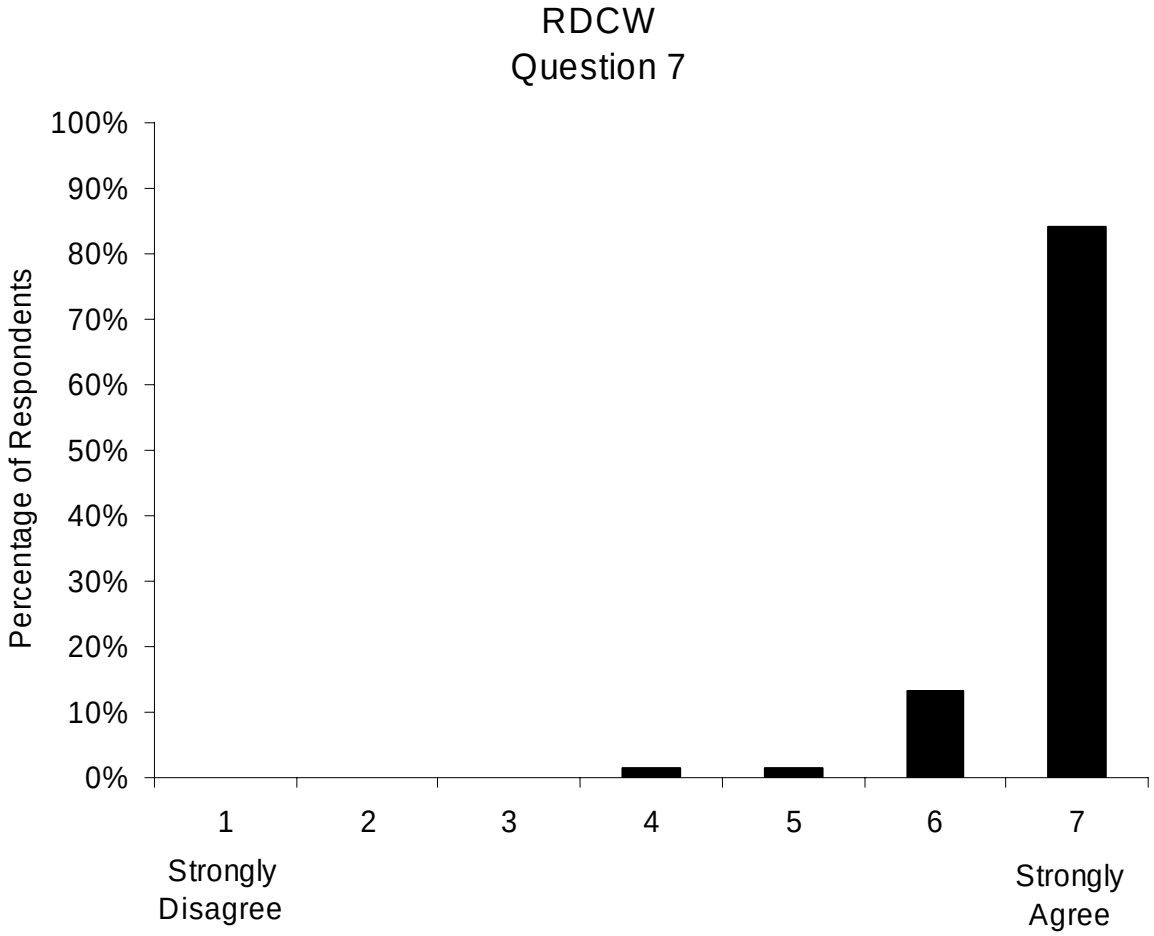
6. It was easy for me to locate the sensitivity switches when I needed them.



	Males	Females	Overall
Younger (20-30)	6.8 (0.6)	6.5 (1.0)	6.6 (0.8)
Middle-Aged (40-50)	6.6 (0.5)	6.8 (0.4)	6.7 (0.5)
Older (60-70)	6.2 (0.9)	6.6 (0.7)	6.4 (0.8)
Overall	6.5 (0.7)	6.7 (0.7)	6.6 (0.7)

Values in cells represent the mean response and (standard deviation)

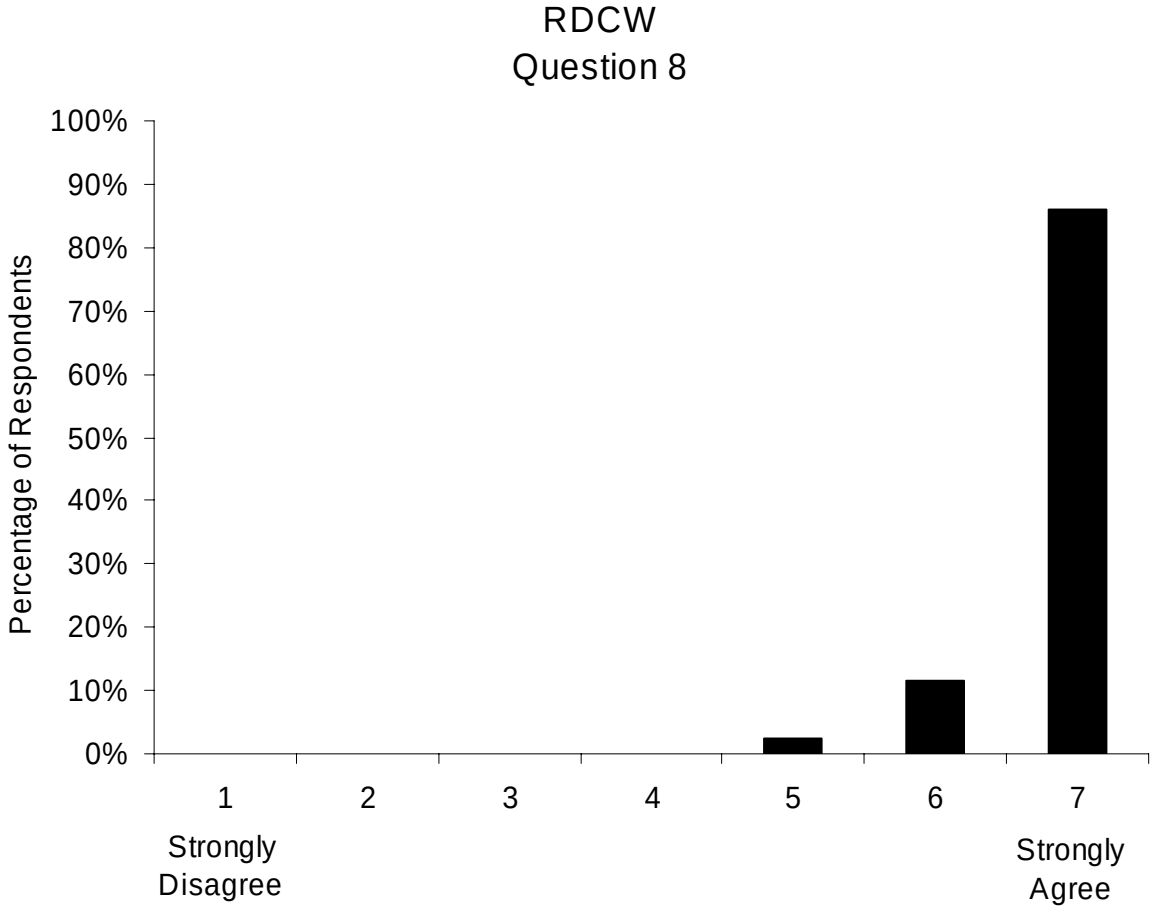
7. It was easy was to understand which switch controlled the LDW sensitivity and which controlled the CSW sensitivity.



	Males	Females	Overall
Younger (20-30)	6.8 (0.4)	7.0 (0.0)	6.9 (0.3)
Middle-Aged (40-50)	6.8 (0.4)	6.9 (0.3)	6.8 (0.4)
Older (60-70)	6.5 (1.0)	6.8 (0.4)	6.6 (0.8)
Overall	6.7 (0.7)	6.9 (0.3)	6.8 (0.5)

Values in cells represent the mean response and (standard deviation)

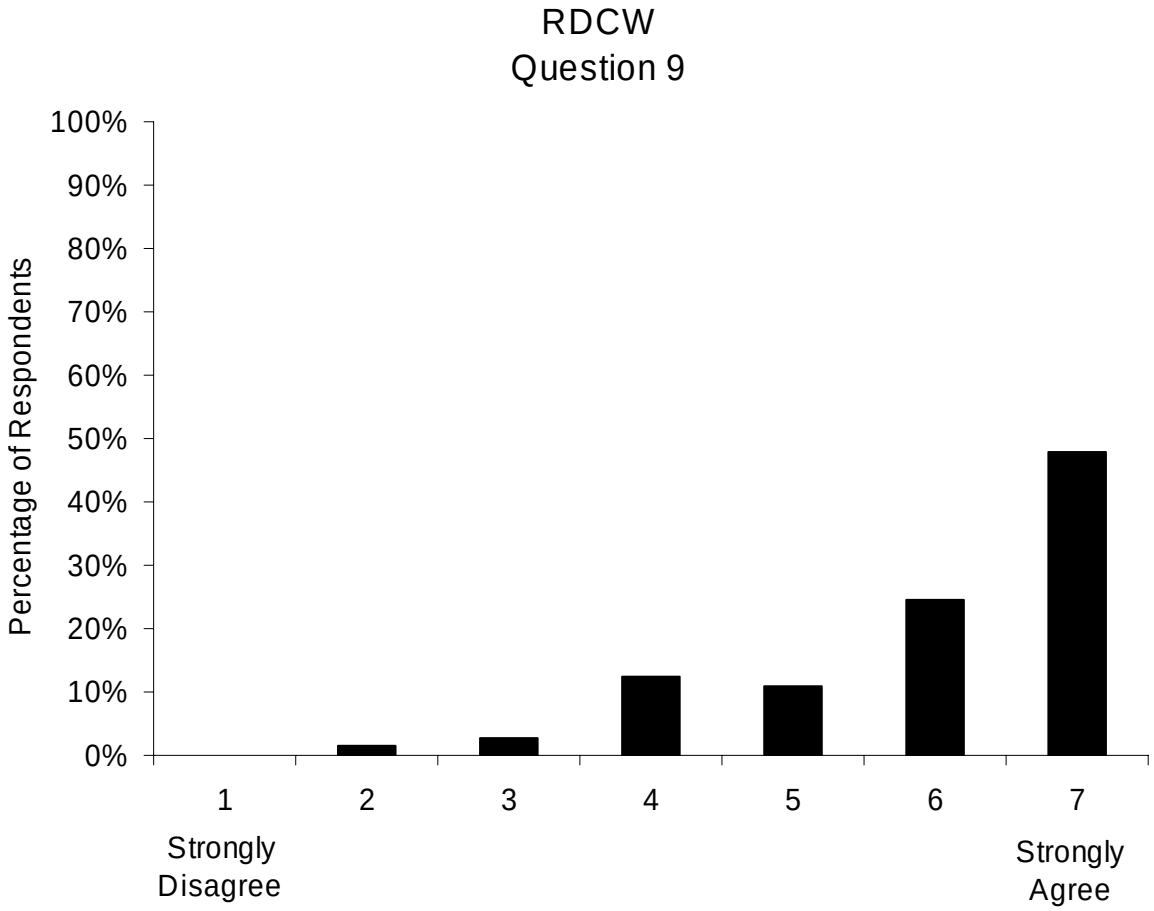
8. It was easy to determine the existing sensitivity settings for both LDW and CSW by looking at the display.



	Males	Females	Overall
Younger (20-30)	7.0 (0.0)	6.9 (0.3)	7.0 (0.2)
Middle-Aged (40-50)	6.9 (0.3)	6.6 (0.8)	6.8 (0.6)
Older (60-70)	6.8 (0.4)	6.8 (0.4)	6.8 (0.4)
Overall	6.9 (0.3)	6.8 (0.5)	6.8 (0.4)

Values in cells represent the mean response and (standard deviation)

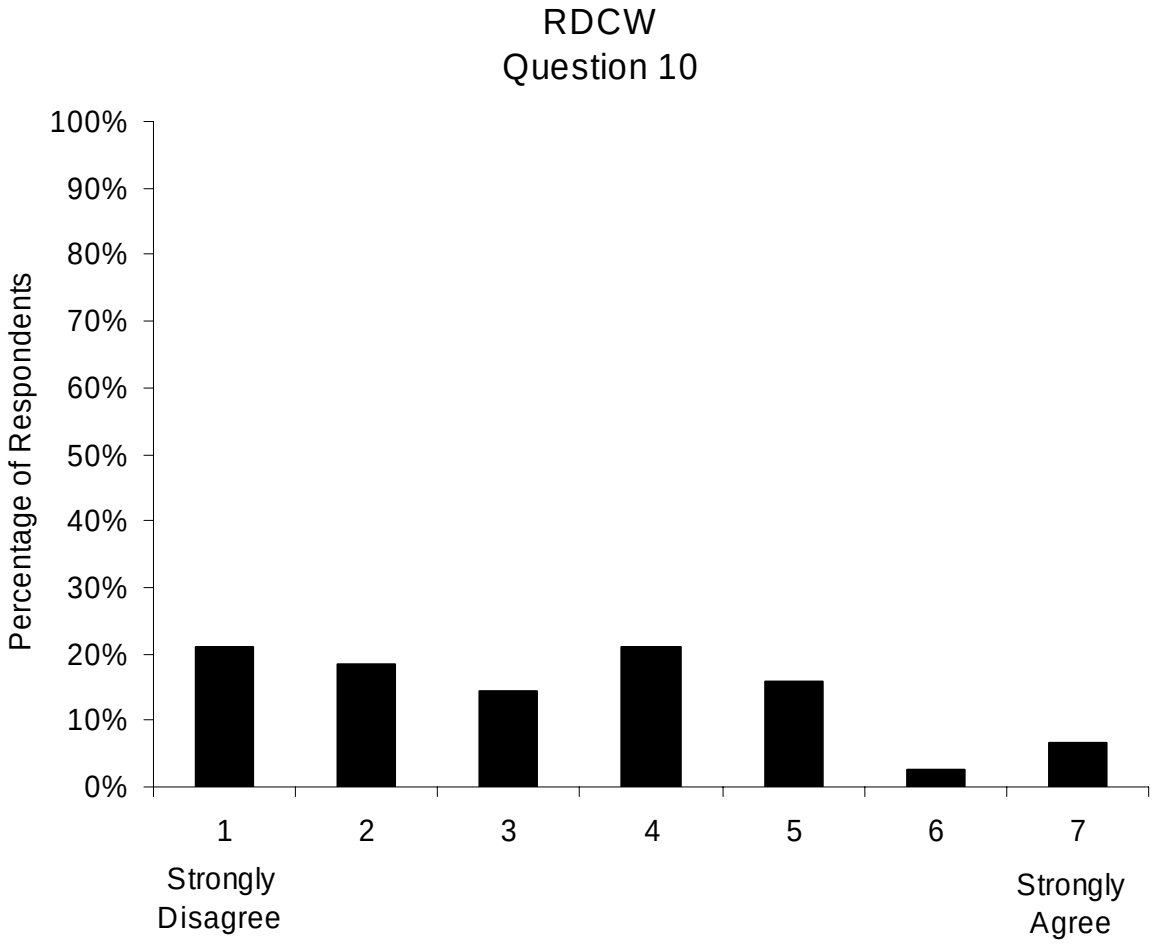
9. It was easy to determine how changes to the LDW sensitivity setting affected LDW warnings.



	Males	Females	Overall
Younger (20-30)	5.7 (1.6)	6.7 (0.6)	6.2 (1.3)
Middle-Aged (40-50)	5.8 (1.3)	5.8 (1.3)	5.8 (1.2)
Older (60-70)	5.6 (1.5)	6.3 (0.9)	5.9 (1.3)
Overall	5.7 (1.4)	6.3 (1.0)	6.0 (1.3)

Values in cells represent the mean response and (standard deviation)

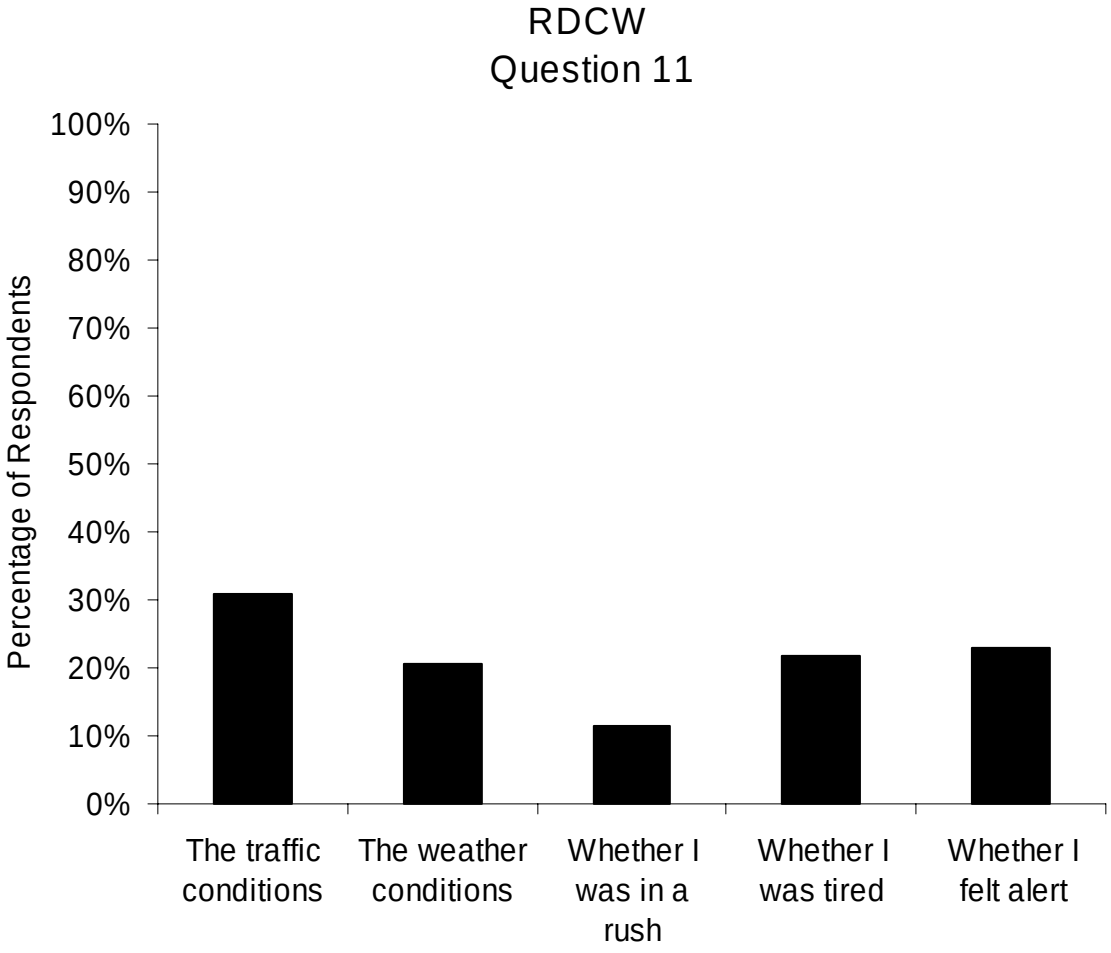
10. I frequently adjusted the LDW sensitivity setting during my drive.



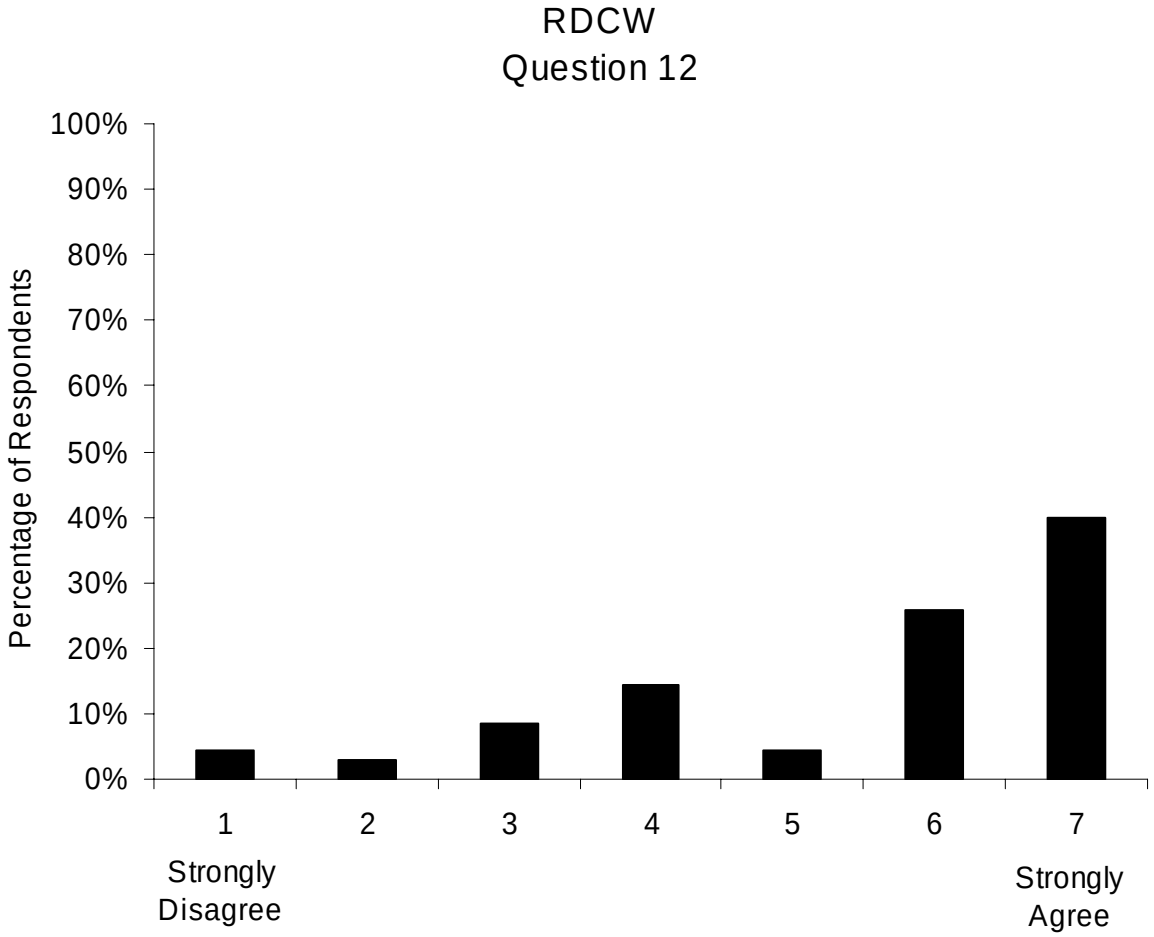
	Males	Females	Overall
Younger (20-30)	3.3 (1.9)	4.6 (1.3)	4.0 (1.8)
Middle-Aged (40-50)	2.7 (1.7)	3.0 (2.1)	2.8 (1.9)
Older (60-70)	3.4 (1.4)	2.5 (1.5)	3.0 (1.5)
Overall	3.1 (1.7)	3.4 (1.9)	3.3 (1.8)

Values in cells represent the mean response and (standard deviation)

11. If you did change the LDW sensitivity, which of the following factors caused you to change the setting. Please check all that apply.



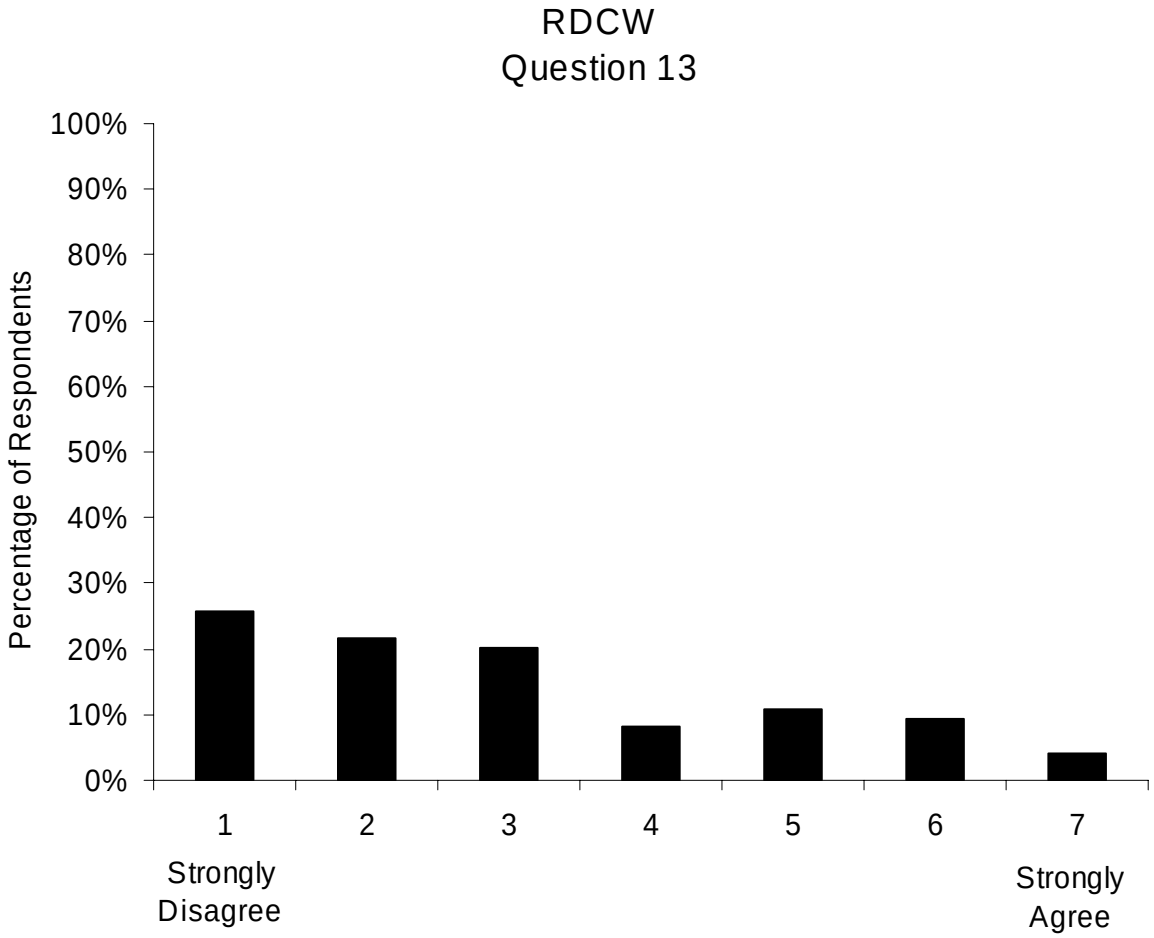
12. It was easy to determine how changes to the CSW sensitivity setting affected CSW warnings.



	Males	Females	Overall
Younger (20-30)	5.8 (1.4)	6.2 (1.3)	6.0 (1.3)
Middle-Aged (40-50)	5.0 (2.0)	5.6 (1.6)	5.3 (1.8)
Older (60-70)	4.6 (2.3)	5.8 (1.5)	5.1 (2.1)
Overall	5.1 (1.9)	5.9 (1.4)	5.5 (1.8)

Values in cells represent the mean response and (standard deviation)

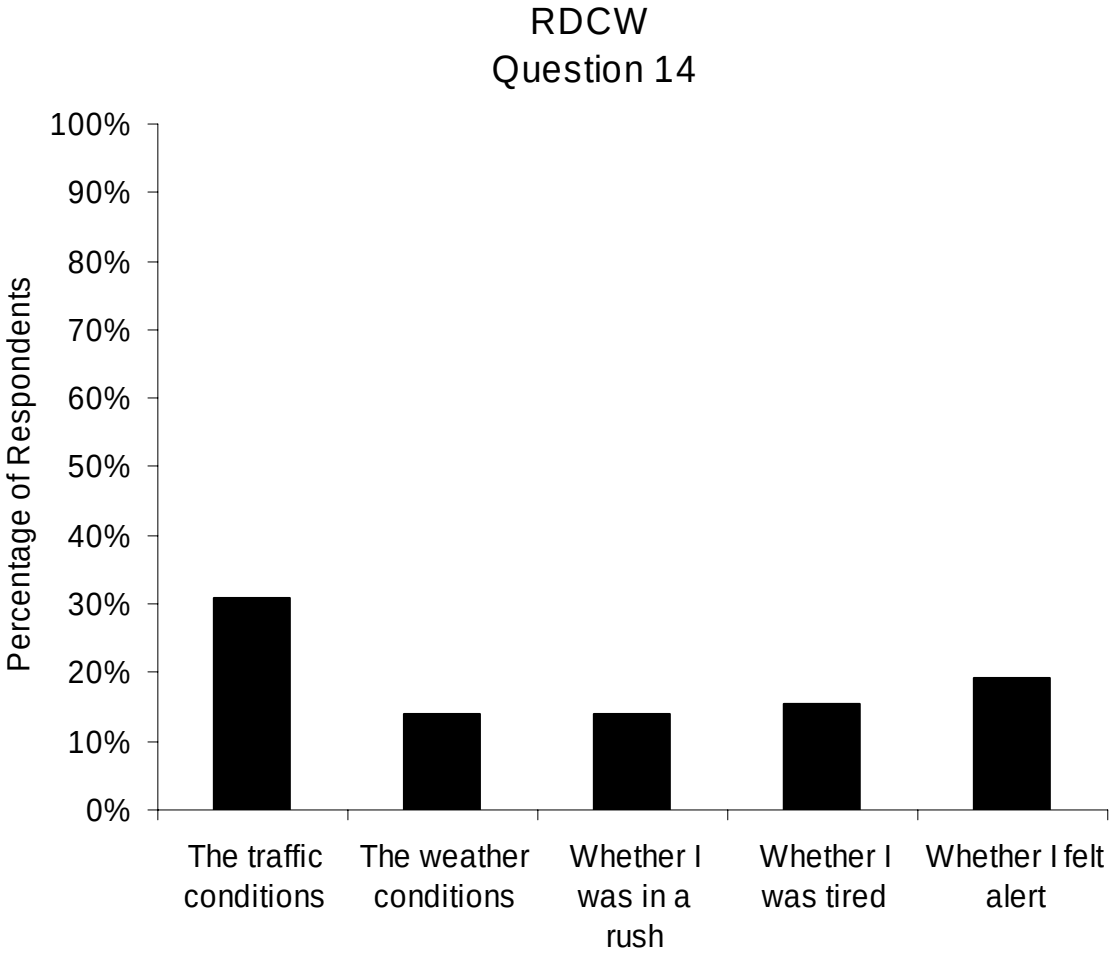
13. I frequently adjusted the CSW sensitivity setting during my drive.



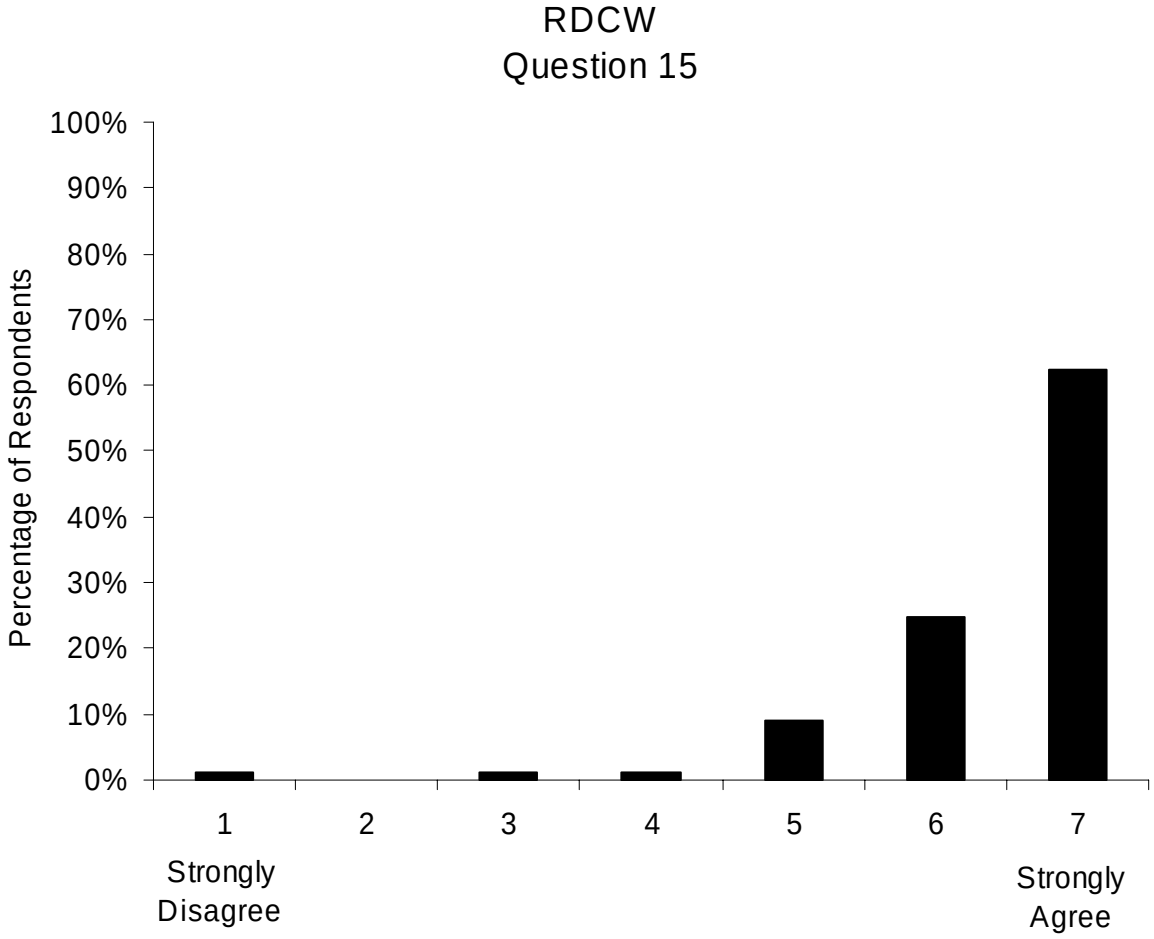
	Males	Females	Overall
Younger (20-30)	3.2 (1.9)	4.4 (1.4)	3.8 (1.8)
Middle-Aged (40-50)	2.7 (2.0)	2.6 (1.8)	2.6 (1.9)
Older (60-70)	2.7 (1.6)	2.4 (1.7)	2.6 (1.6)
Overall	2.8 (1.8)	3.2 (1.9)	3.0 (1.8)

Values in cells represent the mean response and (standard deviation)

14. If you did change the CSW sensitivity, which of the following factors caused you to change the setting. Please check all that apply.



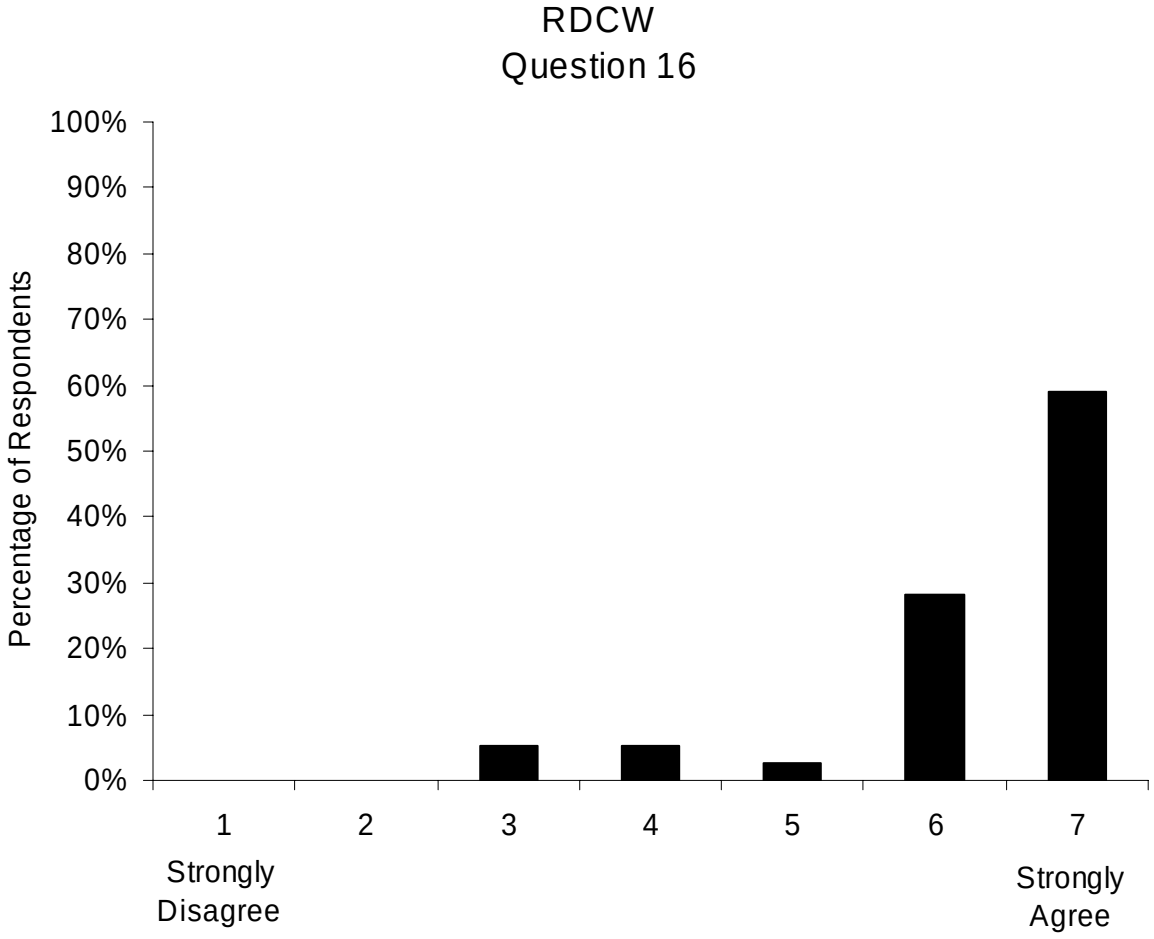
15. It was easy to become familiar with the layout of the RDCW display (distinguishing between where the LDW and CSW system information was presented).



	Males	Females	Overall
Younger (20-30)	6.4 (0.8)	6.6 (0.7)	6.5 (0.7)
Middle-Aged (40-50)	6.8 (0.4)	5.8 (1.9)	6.3 (1.4)
Older (60-70)	6.3 (0.9)	6.6 (0.7)	6.4 (0.8)
Overall	6.5 (0.8)	6.3 (1.3)	6.4 (1.0)

Values in cells represent the mean response and (standard deviation)

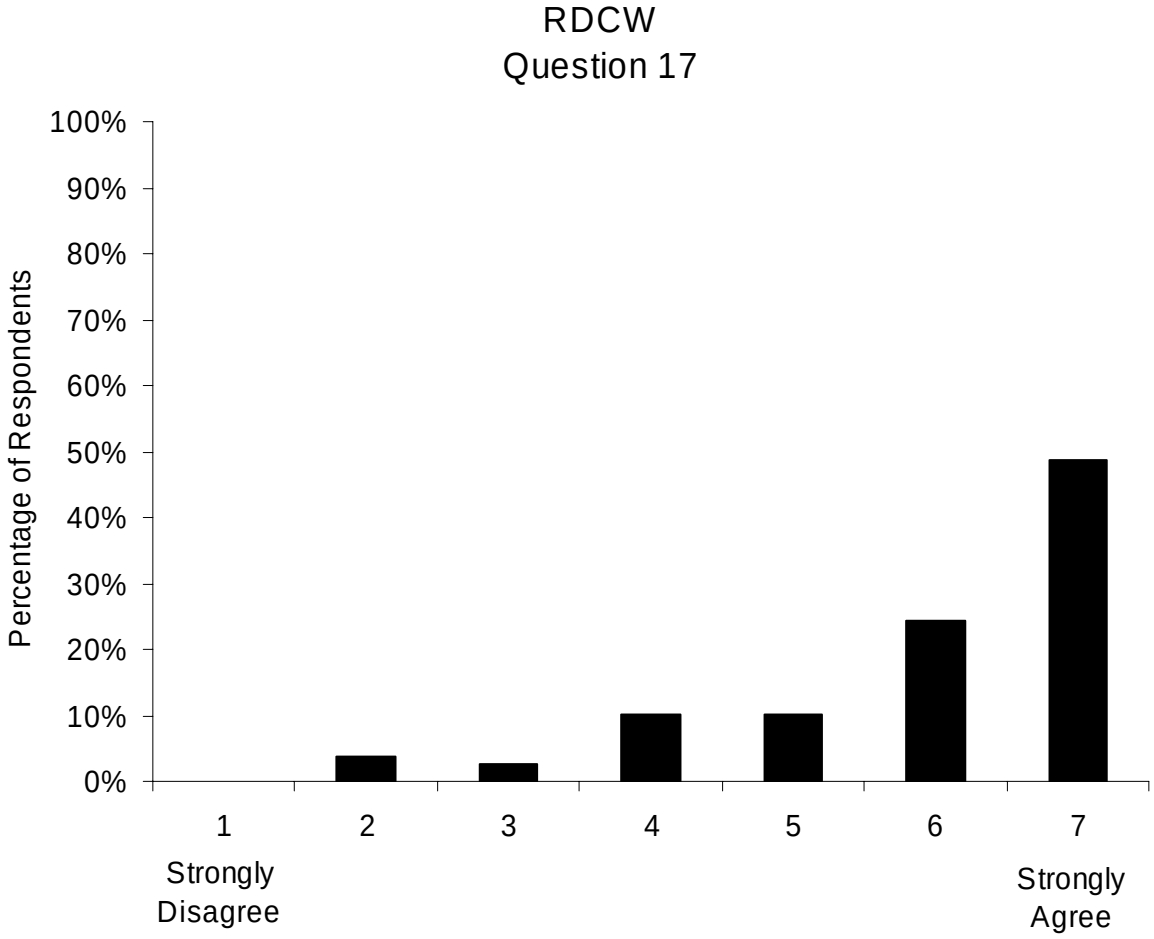
16. I could easily distinguish between RDCW auditory warnings (i.e., as being an LDW or a CSW warning).



	Males	Females	Overall
Younger (20-30)	6.1 (1.0)	5.9 (1.7)	6.0 (1.4)
Middle-Aged (40-50)	6.2 (1.3)	6.5 (0.9)	6.4 (1.1)
Older (60-70)	6.4 (0.9)	6.7 (0.5)	6.5 (0.7)
Overall	6.2 (1.0)	6.4 (1.2)	6.3 (1.1)

Values in cells represent the mean response and (standard deviation)

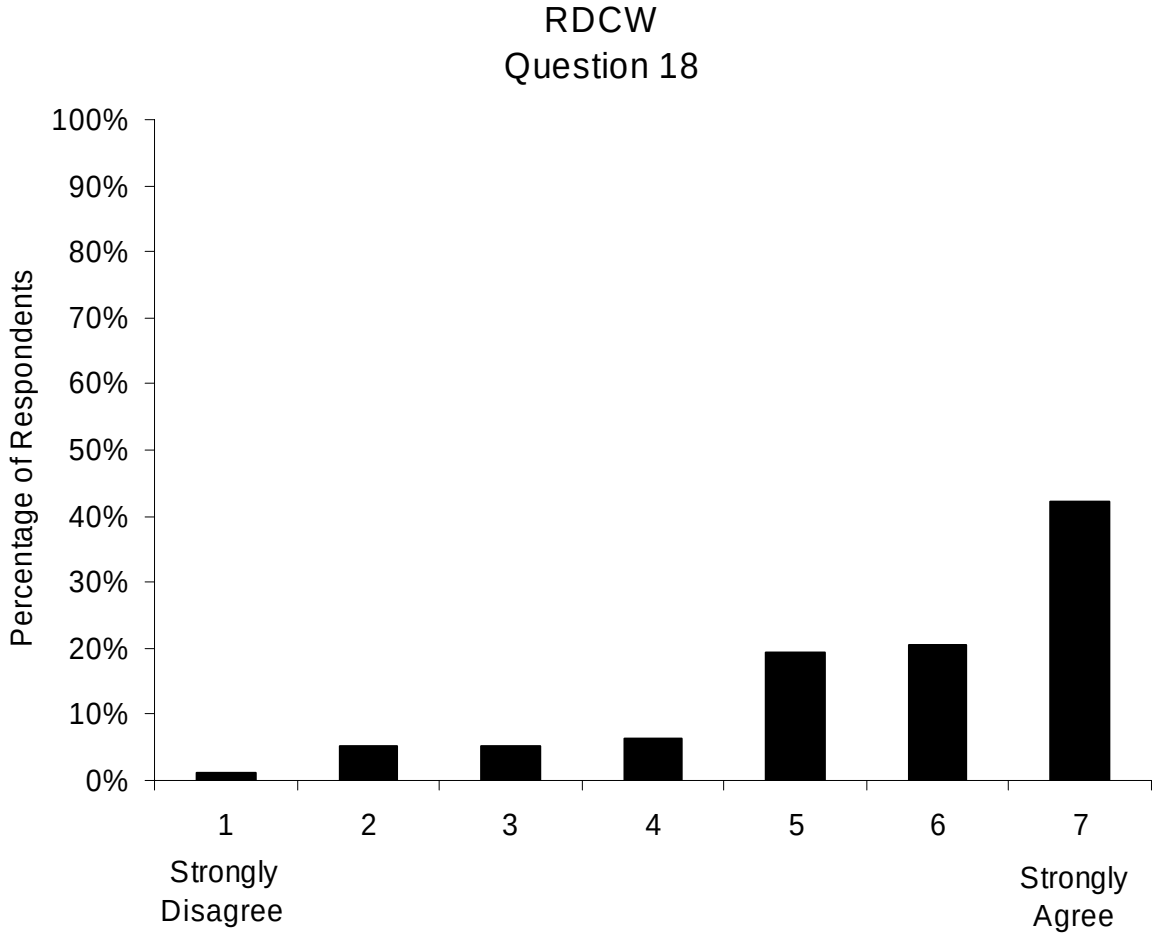
17. I understood the meaning and required response of each auditory warning when they occurred.



	Males	Females	Overall
Younger (20-30)	5.9 (1.4)	5.5 (1.5)	5.7 (1.5)
Middle-Aged (40-50)	6.2 (1.1)	6.2 (1.3)	6.2 (1.2)
Older (60-70)	5.5 (1.9)	6.4 (0.7)	6.0 (1.4)
Overall	5.9 (1.5)	6.0 (1.2)	5.9 (1.4)

Values in cells represent the mean response and (standard deviation)

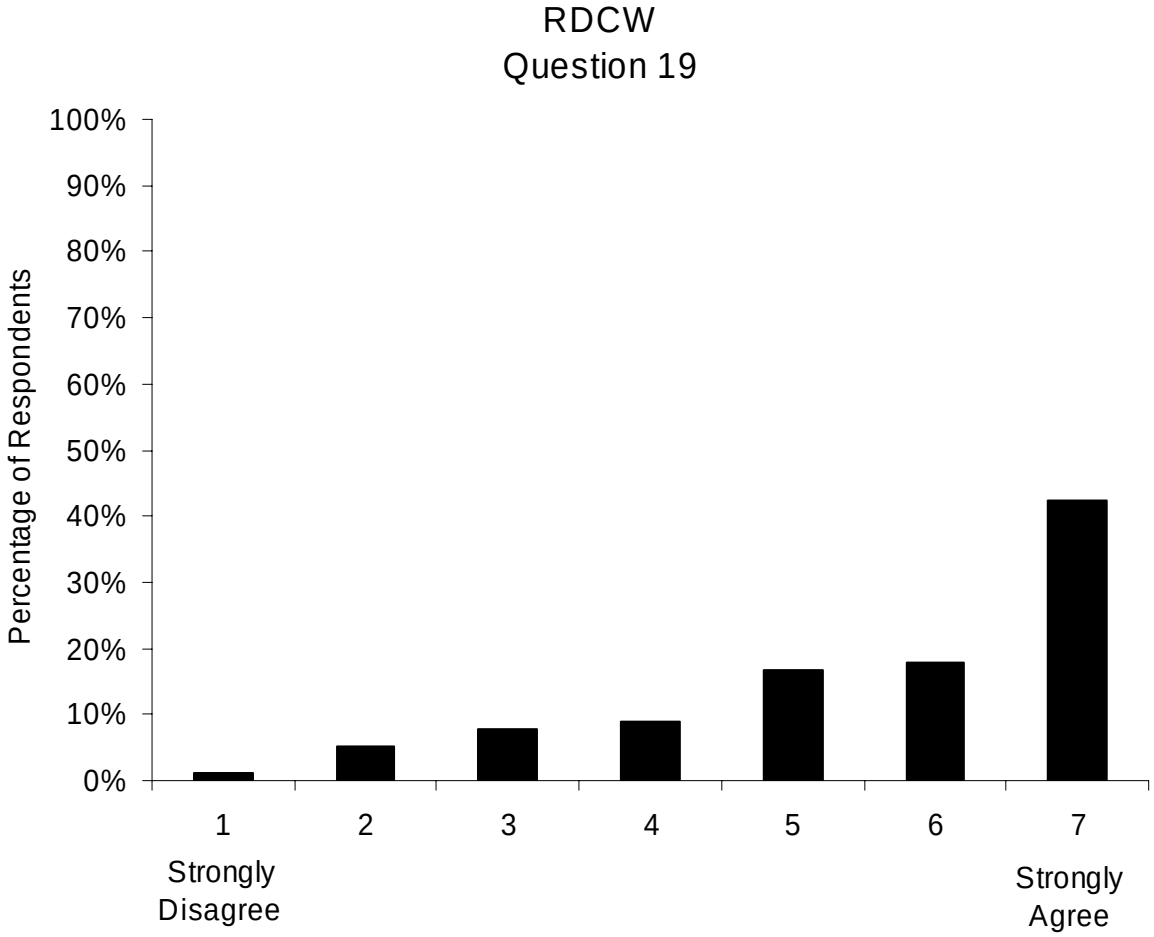
18. I could easily distinguish between the RDCW seat vibration warnings (i.e., as being an LDW or a CSW warning).



	Males	Females	Overall
Younger (20-30)	5.2 (1.9)	5.9 (1.3)	5.6 (1.7)
Middle-Aged (40-50)	5.8 (1.1)	5.8 (1.3)	5.8 (1.2)
Older (60-70)	4.8 (2.2)	6.5 (0.7)	5.7 (1.8)
Overall	5.3 (1.8)	6.1 (1.1)	5.7 (1.5)

Values in cells represent the mean response and (standard deviation)

19. I understood the meaning and required response of each seat vibration warning when they occurred.

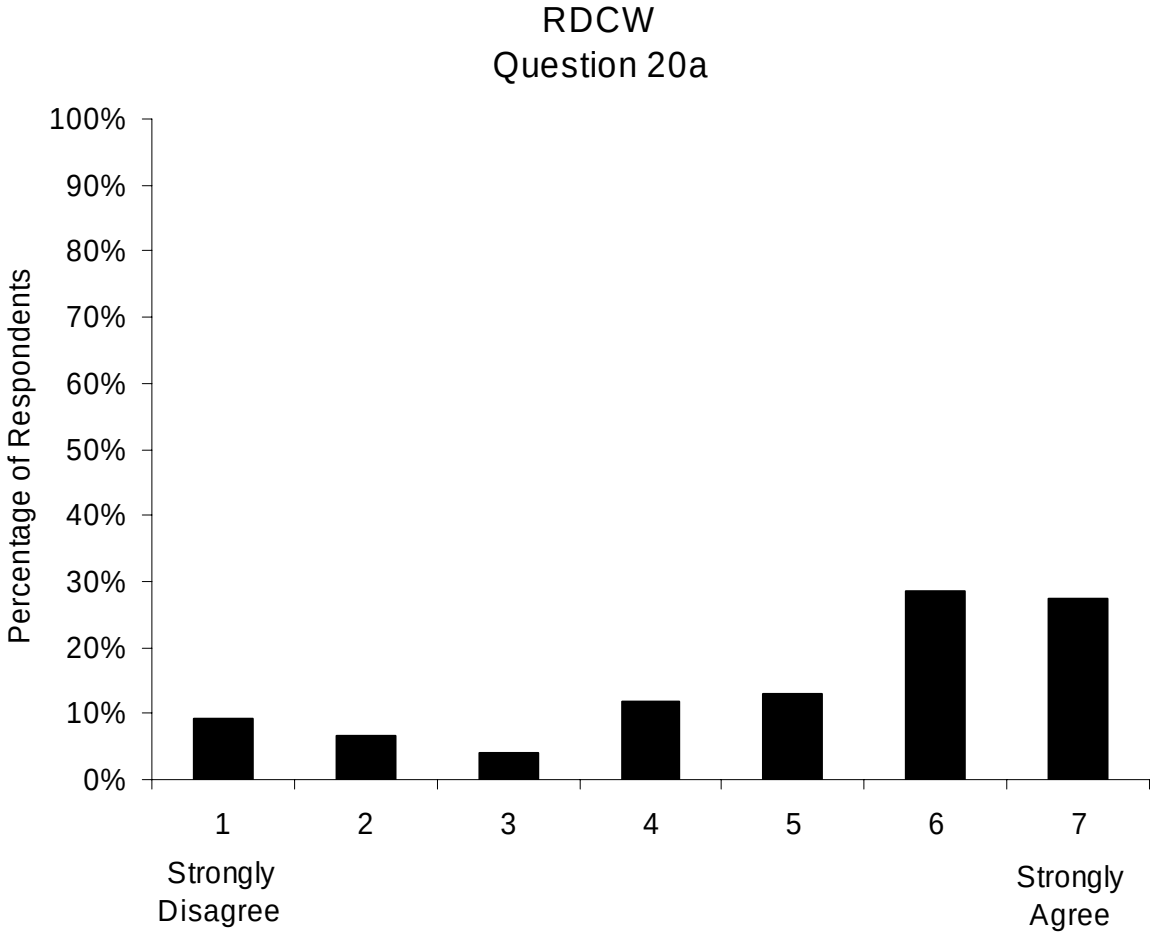


	Males	Females	Overall
Younger (20-30)	5.4 (1.7)	5.5 (1.8)	5.5 (1.7)
Middle-Aged (40-50)	5.5 (1.8)	5.4 (1.4)	5.5 (1.6)
Older (60-70)	5.3 (2.1)	6.3 (0.8)	5.8 (1.6)
Overall	5.4 (1.8)	5.7 (1.4)	5.6 (1.6)

Values in cells represent the mean response and (standard deviation)

20. It was easy for me to recognize what warning condition the RDCW was attempting to convey (e.g., LDW Left Cautionary, CSW Imminent, etc.).

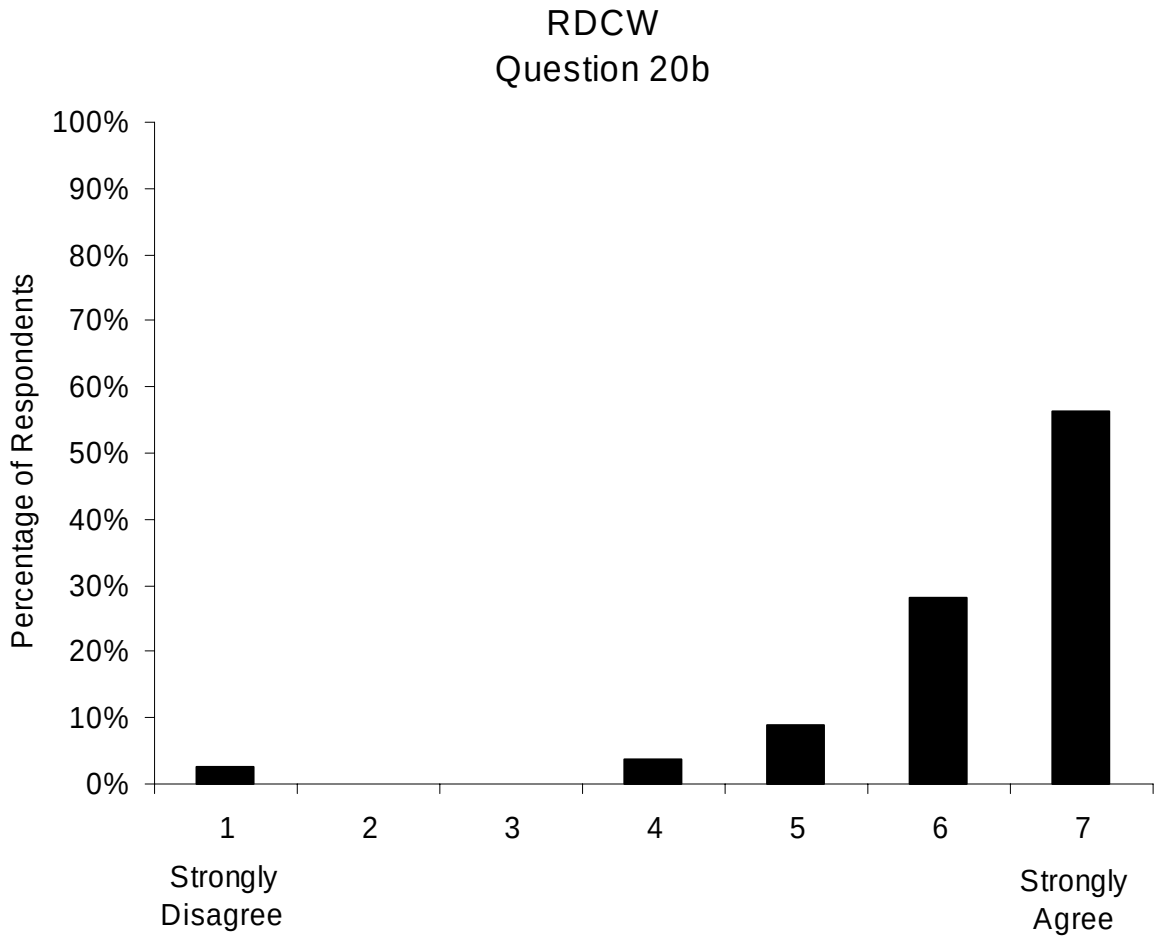
a.) from the visual warnings



	Males	Females	Overall
Younger (20-30)	5.2 (1.7)	5.2 (1.8)	5.2 (1.8)
Middle-Aged (40-50)	5.7 (1.8)	3.9 (2.1)	4.8 (2.1)
Older (60-70)	5.2 (2.3)	5.3 (1.5)	5.2 (2.0)
Overall	5.4 (1.9)	4.8 (1.9)	5.1 (1.9)

Values in cells represent the mean response and (standard deviation)

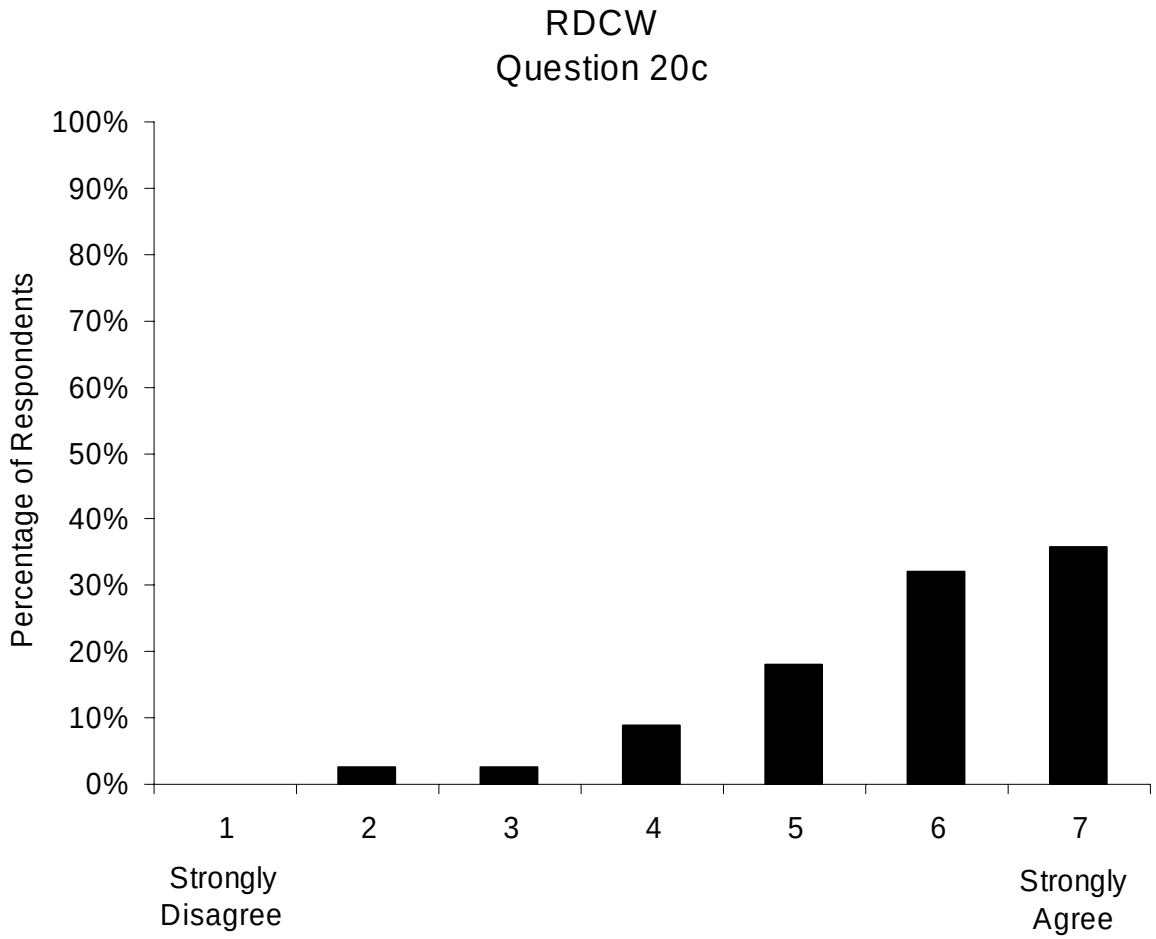
b.) from the auditory warnings



	Males	Females	Overall
Younger (20-30)	6.3 (0.8)	6.4 (0.8)	6.3 (0.7)
Middle-Aged (40-50)	5.8 (1.8)	6.2 (1.6)	6.0 (1.7)
Older (60-70)	6.4 (1.1)	6.5 (0.7)	6.4 (0.9)
Overall	6.2 (1.3)	6.4 (1.1)	6.3 (1.2)

Values in cells represent the mean response and (standard deviation)

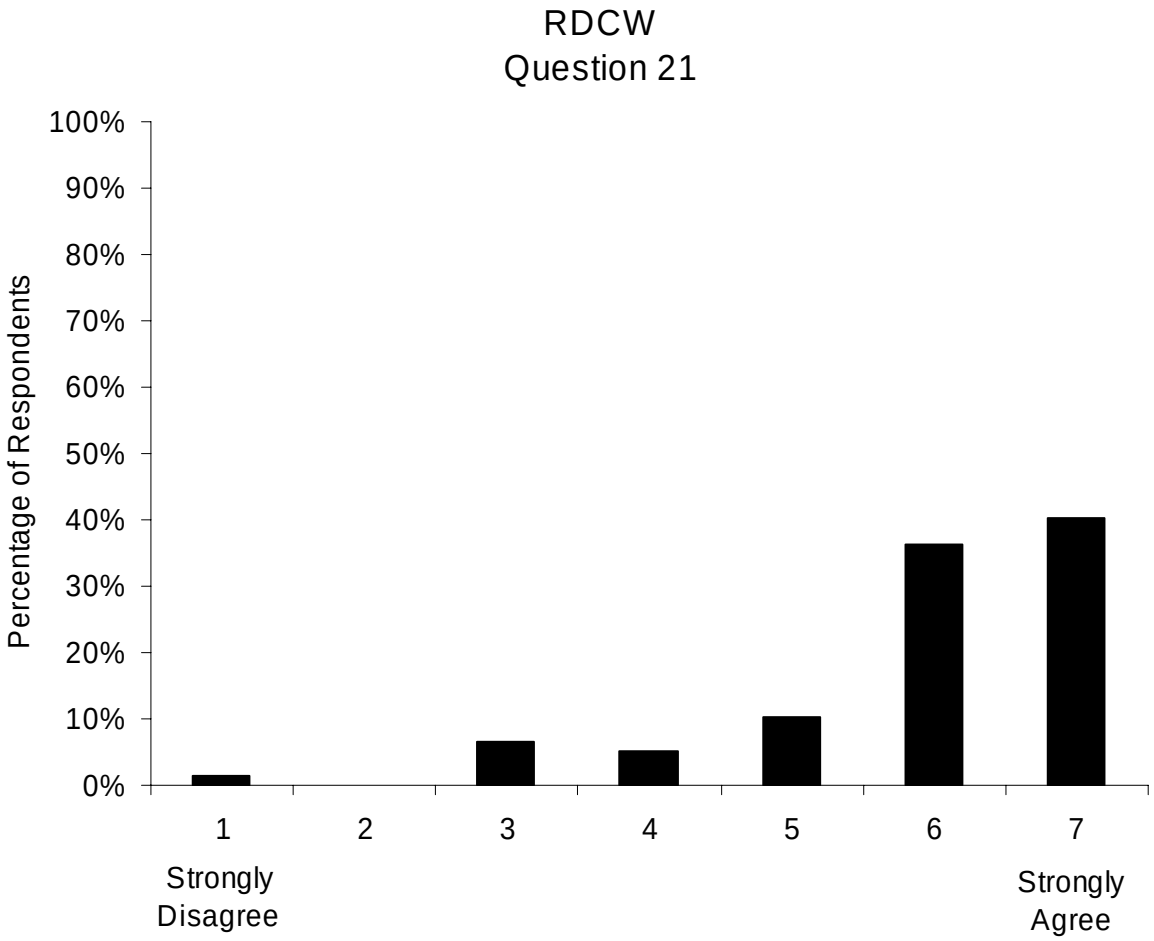
c.) from the seat vibration warnings



	Males	Females	Overall
Younger (20-30)	5.5 (1.6)	6.0 (0.9)	5.7 (1.3)
Middle-Aged (40-50)	5.8 (1.1)	6.0 (1.0)	5.9 (1.0)
Older (60-70)	5.4 (1.8)	6.2 (0.7)	5.8 (1.4)
Overall	5.6 (1.5)	6.1 (0.9)	5.8 (1.2)

Values in cells represent the mean response and (standard deviation)

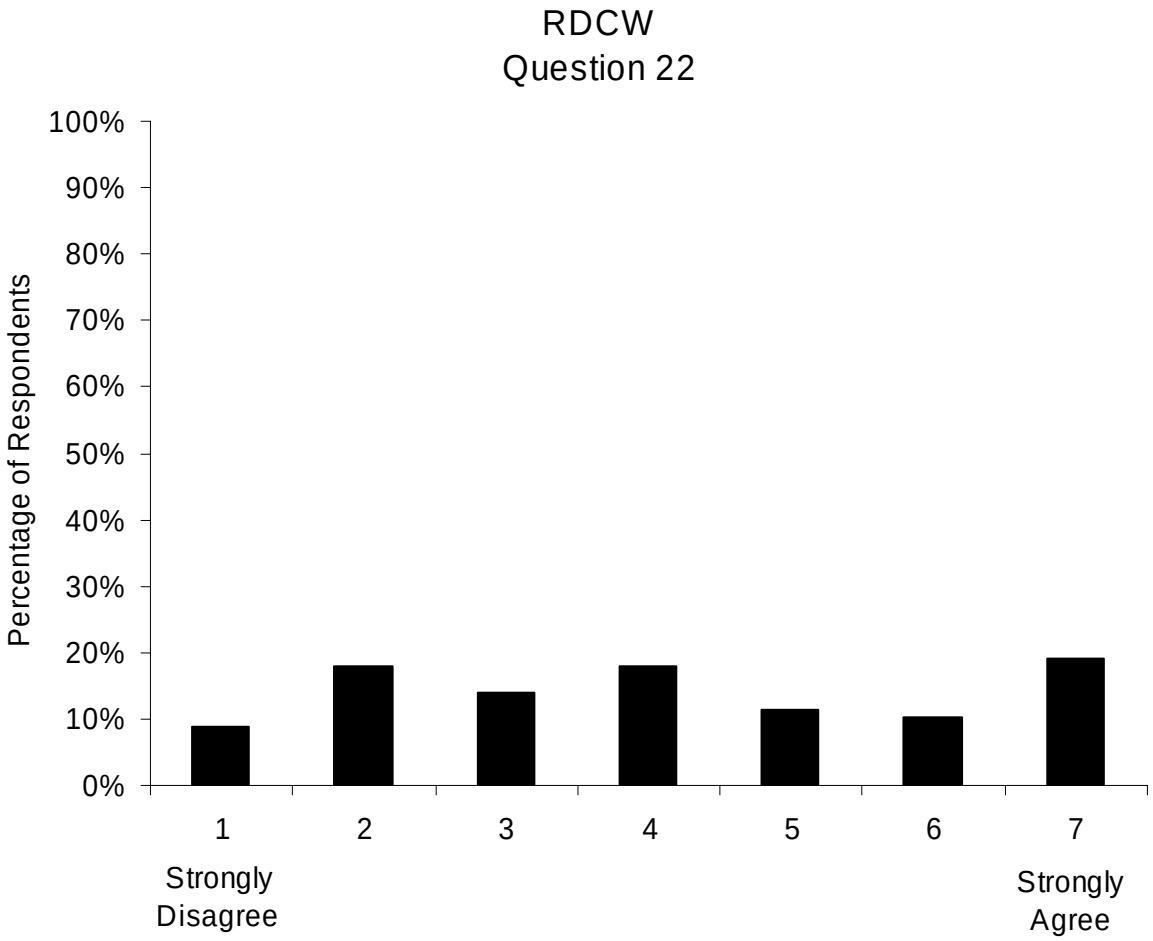
21. Overall, I could easily identify the urgency of the RDCW warnings.



	Males	Females	Overall
Younger (20-30)	5.5 (1.4)	6.4 (0.8)	6.0 (1.2)
Middle-Aged (40-50)	5.5 (1.9)	6.0 (1.0)	5.8 (1.5)
Older (60-70)	5.8 (1.4)	6.3 (0.7)	6.1 (1.1)
Overall	5.6 (1.6)	6.2 (0.8)	5.9 (1.3)

Values in cells represent the mean response and (standard deviation)

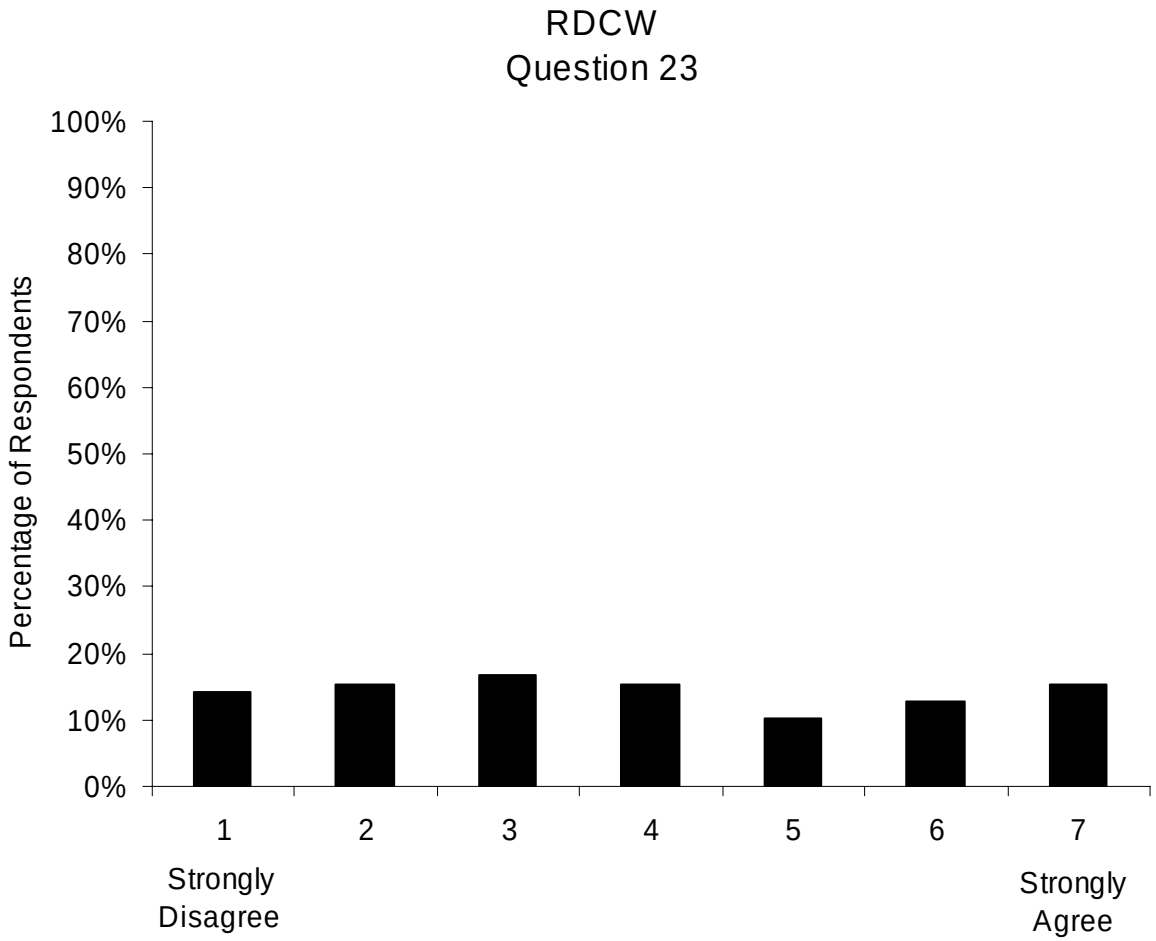
22. I always understood why the RDCW system was providing a warning.



	Males	Females	Overall
Younger (20-30)	3.3 (1.7)	3.8 (1.9)	3.5 (1.8)
Middle-Aged (40-50)	3.8 (2.2)	4.1 (2.1)	4.0 (2.1)
Older (60-70)	4.8 (2.1)	4.9 (1.8)	4.9 (1.9)
Overall	4.0 (2.1)	4.3 (1.9)	4.1 (2.0)

Values in cells represent the mean response and (standard deviation)

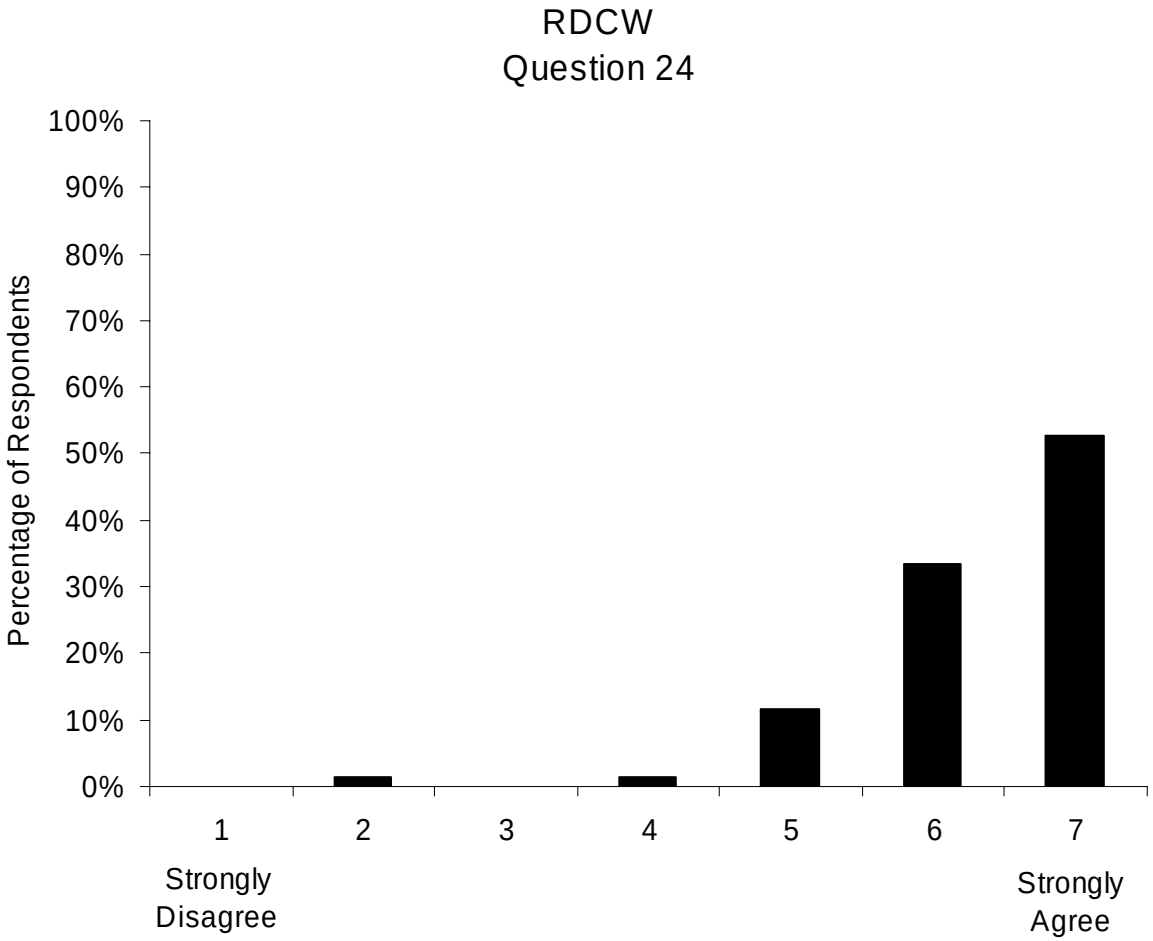
23. The RDCW system always provided me a warning when I thought it should.



	Males	Females	Overall
Younger (20-30)	3.9 (2.0)	3.6 (2.1)	3.8 (2.0)
Middle-Aged (40-50)	3.8 (2.4)	3.2 (1.5)	3.5 (2.0)
Older (60-70)	4.2 (2.0)	4.9 (2.0)	4.5 (2.0)
Overall	3.9 (2.1)	3.9 (2.0)	3.9 (2.0)

Values in cells represent the mean response and (standard deviation)

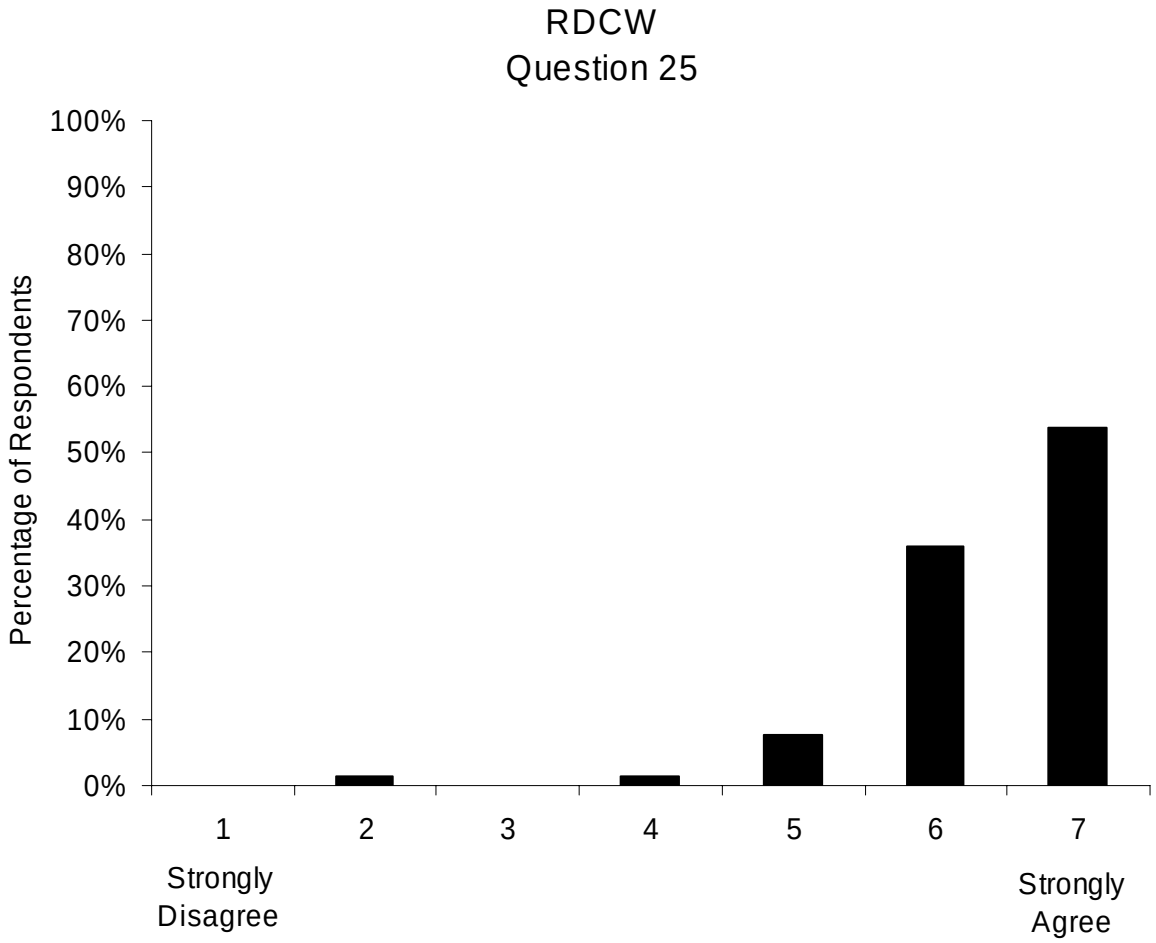
24. I felt comfortable driving the car with RDCW.



	Males	Females	Overall
Younger (20-30)	6.1 (1.0)	6.0 (1.4)	6.0 (1.2)
Middle-Aged (40-50)	6.5 (0.7)	6.3 (0.8)	6.4 (0.7)
Older (60-70)	6.5 (0.7)	6.6 (0.7)	6.5 (0.6)
Overall	6.4 (0.8)	6.3 (1.0)	6.3 (0.9)

Values in cells represent the mean response and (standard deviation)

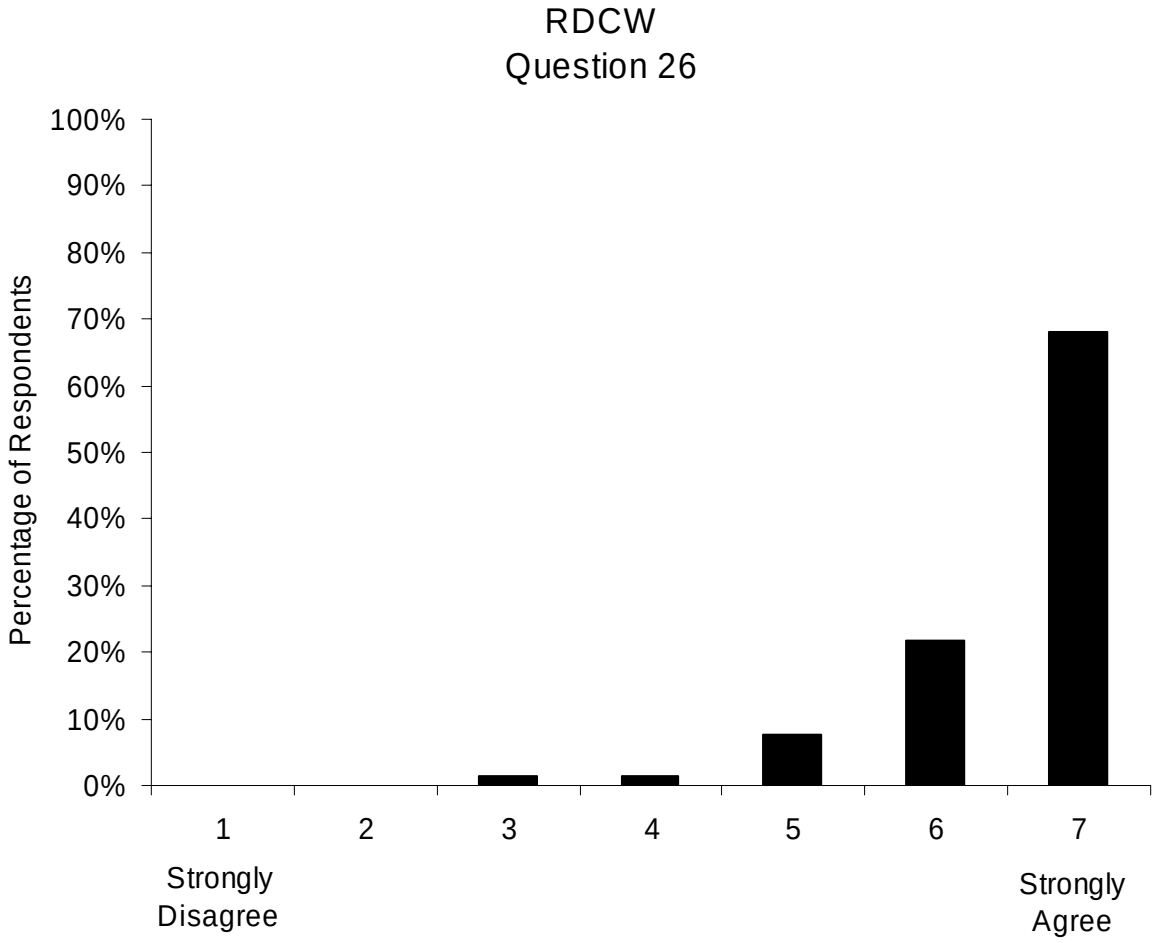
25. Overall, it was easy to become familiar with the RDCW system.



	Males	Females	Overall
Younger (20-30)	6.0 (0.9)	6.2 (1.4)	6.1 (1.2)
Middle-Aged (40-50)	6.7 (0.5)	6.5 (0.7)	6.6 (0.6)
Older (60-70)	6.2 (0.7)	6.7 (0.5)	6.5 (0.6)
Overall	6.3 (0.8)	6.5 (0.9)	6.4 (0.9)

Values in cells represent the mean response and (standard deviation)

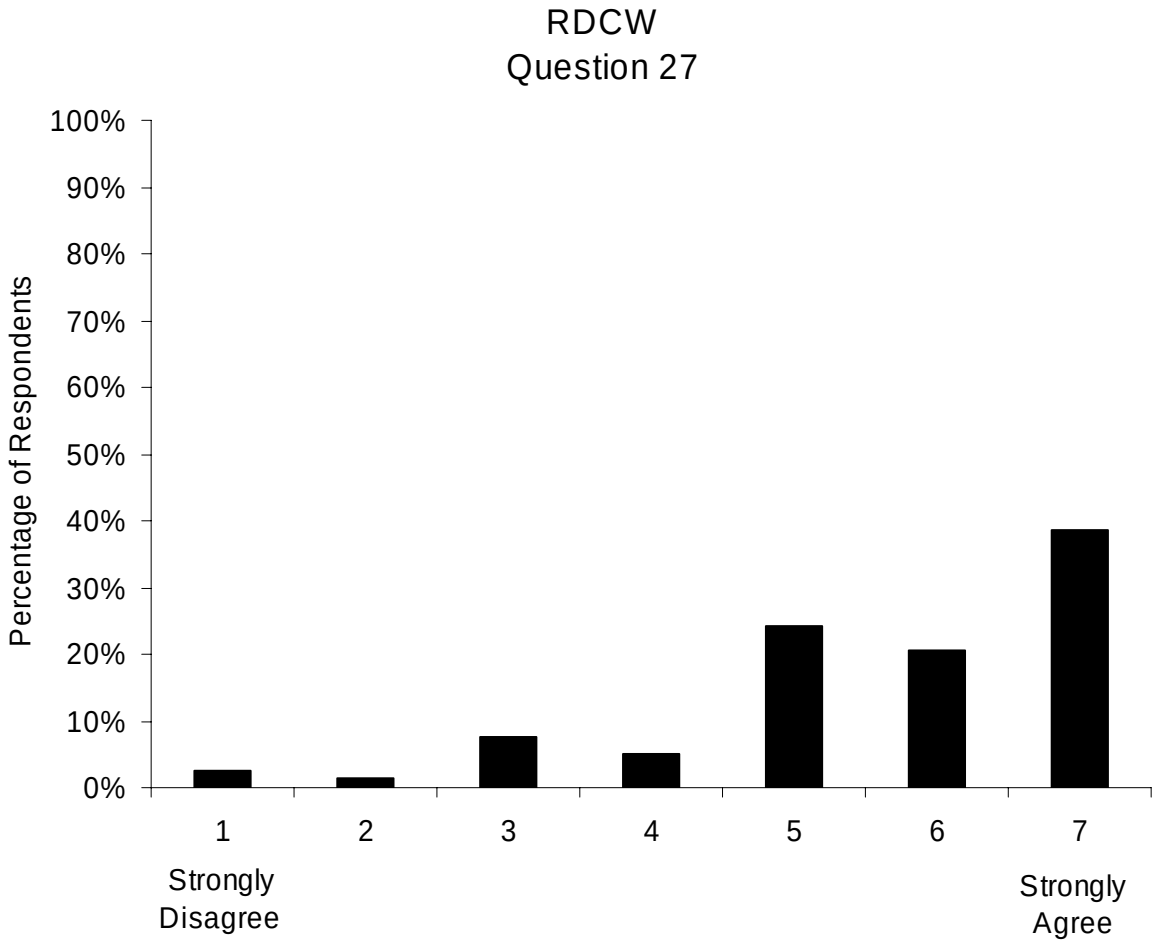
26. I developed a good understanding of how the RDCW system worked after hearing a brief description, and after I had the chance to drive with the system.



	Males	Females	Overall
Younger (20-30)	6.5 (1.0)	6.3 (1.3)	6.4 (1.1)
Middle-Aged (40-50)	6.7 (0.5)	6.5 (0.8)	6.6 (0.6)
Older (60-70)	6.6 (0.7)	6.6 (0.5)	6.6 (0.6)
Overall	6.6 (0.7)	6.5 (0.9)	6.5 (0.8)

Values in cells represent the mean response and (standard deviation)

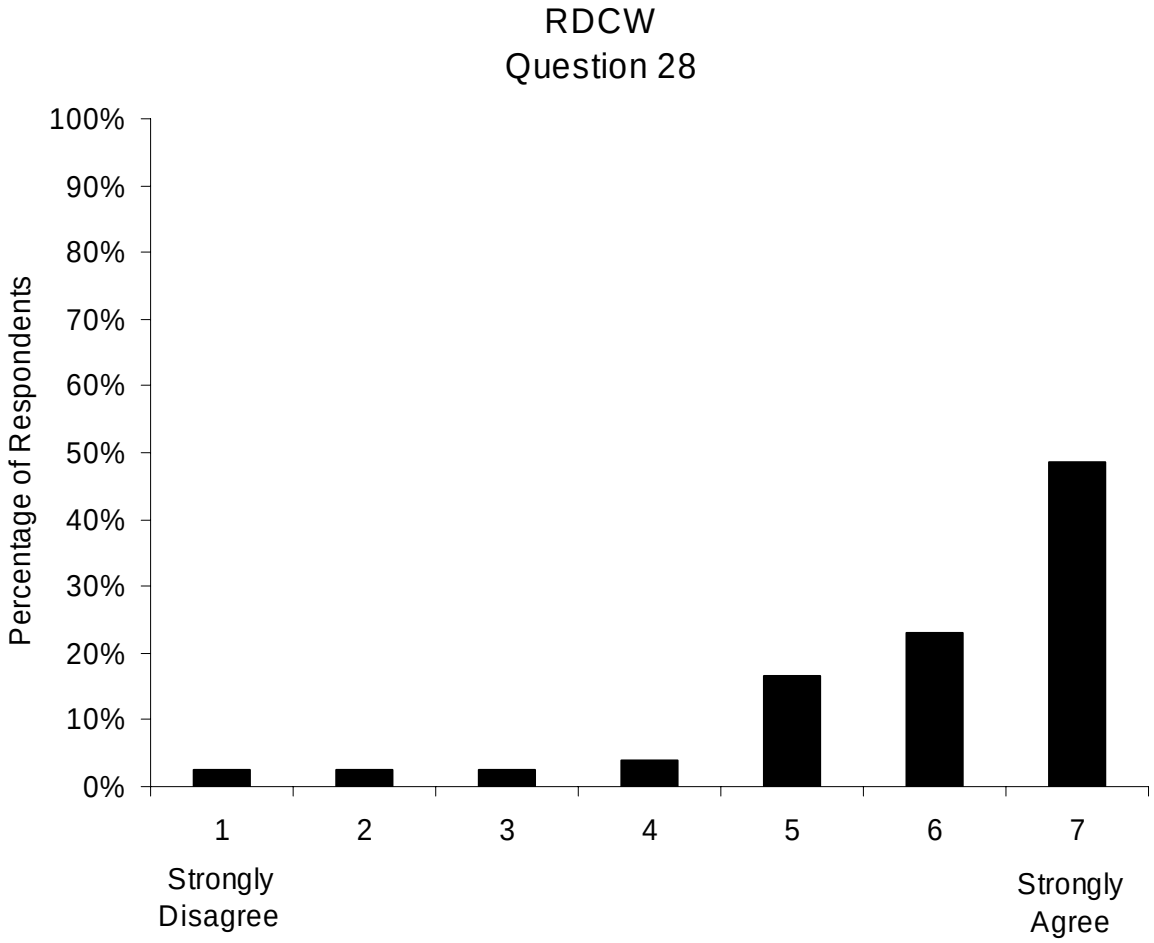
27. I was not distracted by RDCW system components (e.g., alerts, displays or controls).



	Males	Females	Overall
Younger (20-30)	4.9 (1.9)	5.4 (1.7)	5.2 (1.8)
Middle-Aged (40-50)	5.9 (1.1)	5.1 (1.5)	5.5 (1.4)
Older (60-70)	5.9 (1.5)	6.5 (0.5)	6.2 (1.1)
Overall	5.6 (1.6)	5.7 (1.4)	5.6 (1.5)

Values in cells represent the mean response and (standard deviation)

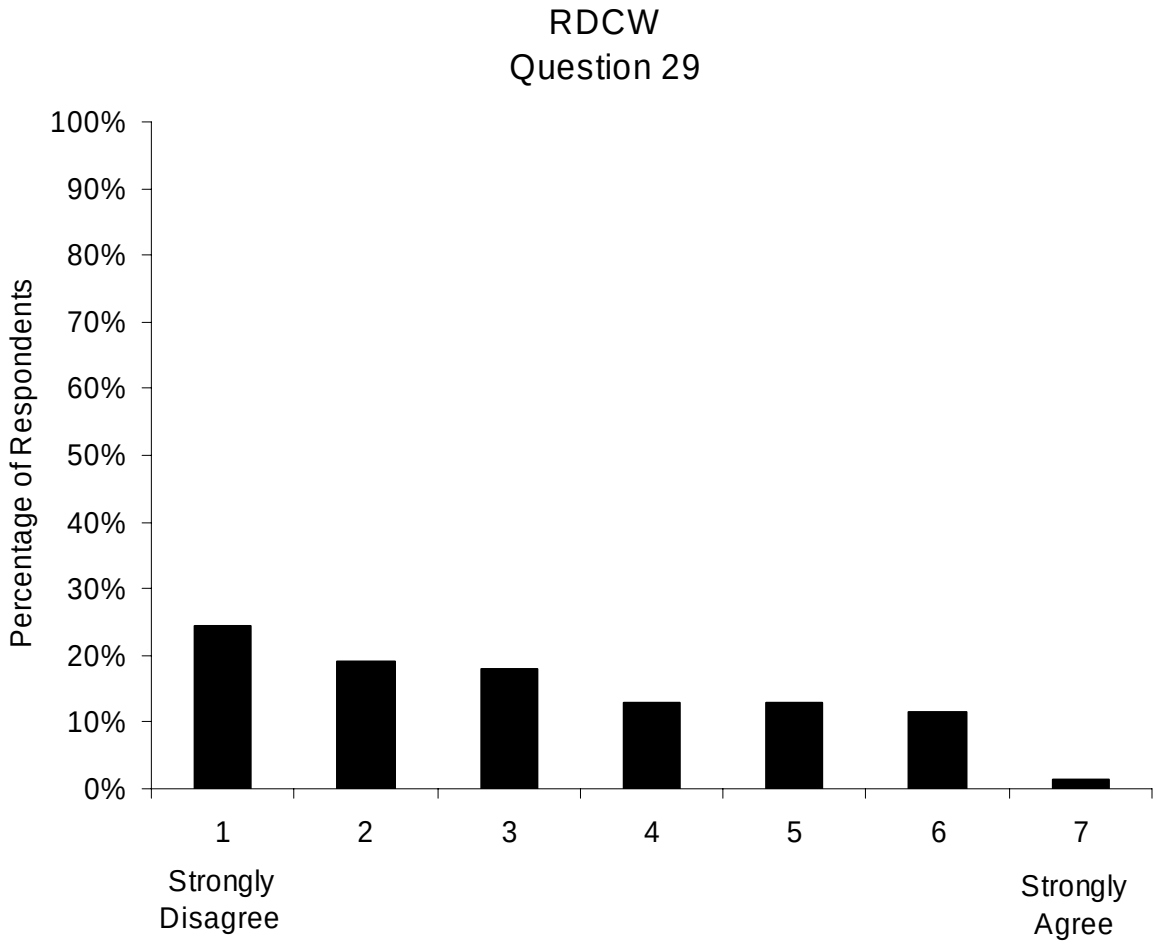
28. Driving with the RDCW system made me more aware of the position of my car on the road and of upcoming curves.



	Males	Females	Overall
Younger (20-30)	5.2 (1.4)	6.1 (1.7)	5.7 (1.5)
Middle-Aged (40-50)	5.8 (1.8)	6.1 (1.0)	5.9 (1.4)
Older (60-70)	6.2 (1.4)	6.2 (1.4)	6.2 (1.4)
Overall	5.7 (1.6)	6.1 (1.3)	5.9 (1.5)

Values in cells represent the mean response and (standard deviation)

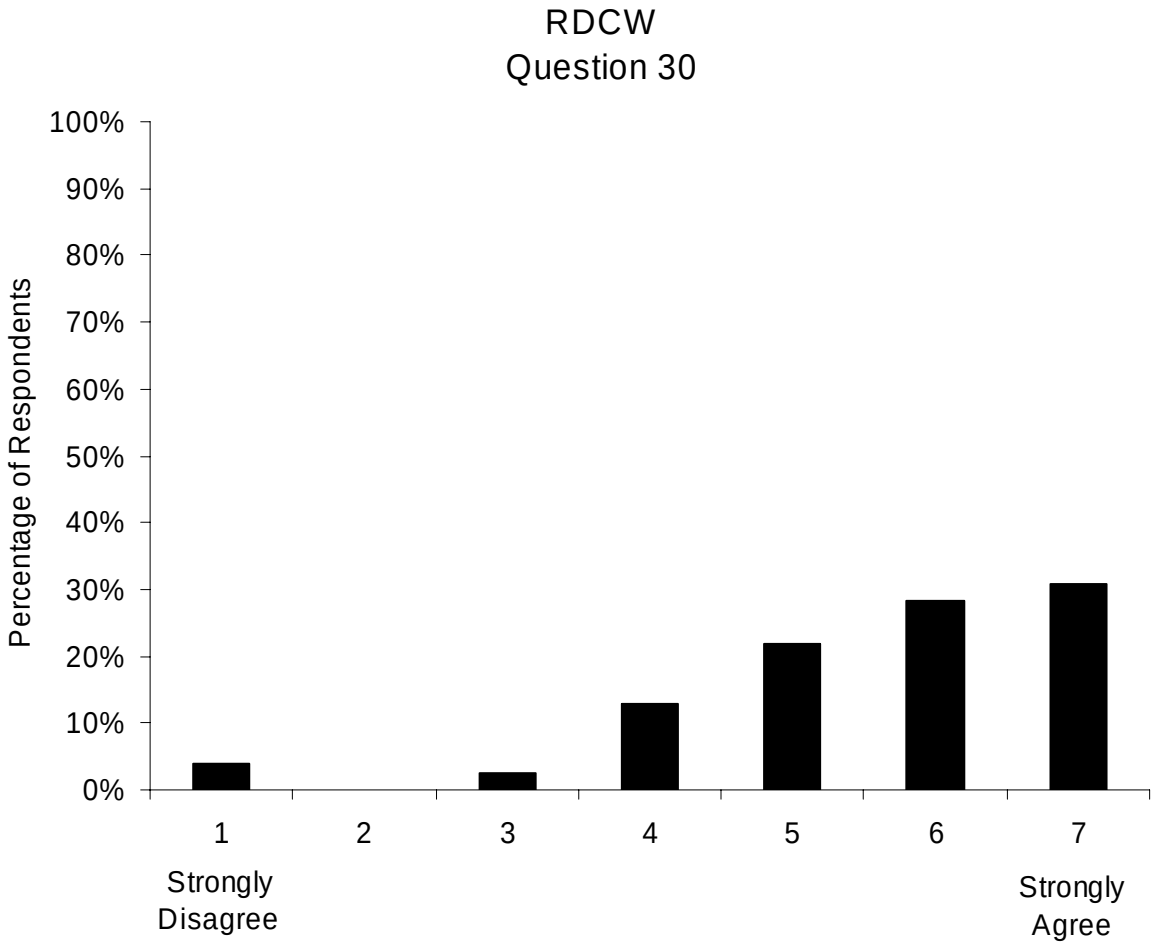
29. I relied on the RDCW system.



	Males	Females	Overall
Younger (20-30)	2.2 (1.0)	3.8 (2.0)	3.0 (1.8)
Middle-Aged (40-50)	2.0 (1.7)	3.5 (1.7)	2.7 (1.8)
Older (60-70)	3.5 (1.7)	3.8 (1.6)	3.6 (1.6)
Overall	2.5 (1.6)	3.7 (1.8)	3.1 (1.8)

Values in cells represent the mean response and (standard deviation)

30. I think RDCW is going to increase driving safety.



	Males	Females	Overall
Younger (20-30)	5.0 (1.5)	5.4 (1.7)	5.2 (1.6)
Middle-Aged (40-50)	5.7 (1.9)	5.5 (1.4)	5.6 (1.6)
Older (60-70)	6.3 (0.9)	5.5 (1.0)	5.9 (1.0)
Overall	5.7 (1.5)	5.5 (1.4)	5.6 (1.4)

Values in cells represent the mean response and (standard deviation)

31. Can you suggest any changes or modifications to the RDCW system in the following areas?

Visual Warnings _____

_____

Auditory Warnings _____

_____

Vibration Warnings _____

_____

Timing of Warnings_____

_____

Controls and Display_____

_____

Other _____

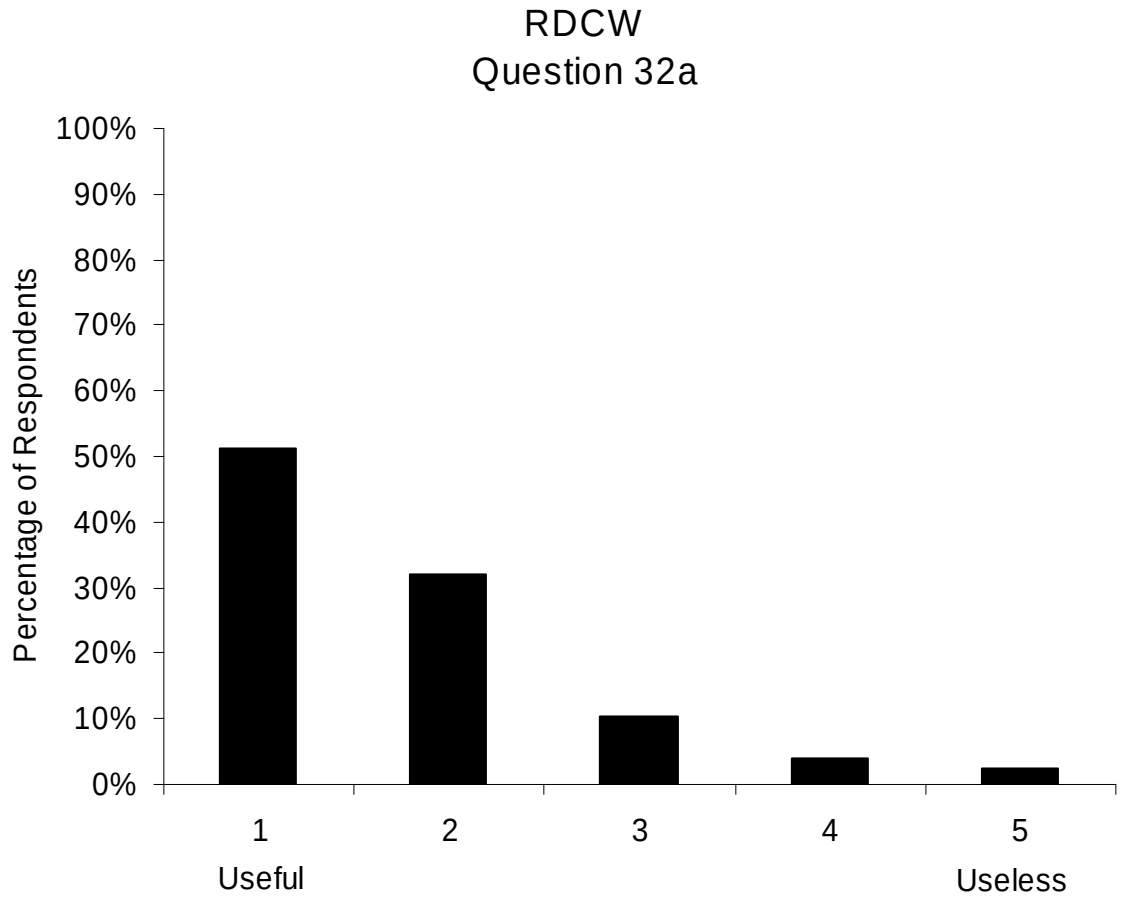
_____

32. Please indicate your overall acceptance rating of the RDCW (LDW & CSW) system.

For each choice you will find 5 possible answers. When a term is completely appropriate, please put a check (√) in the square next to that term. When a term is appropriate to a certain extent, please put a check to the left or right of the middle at the side of the term. When you have no specific opinion, please put a check in the middle.

The RDCW system was:

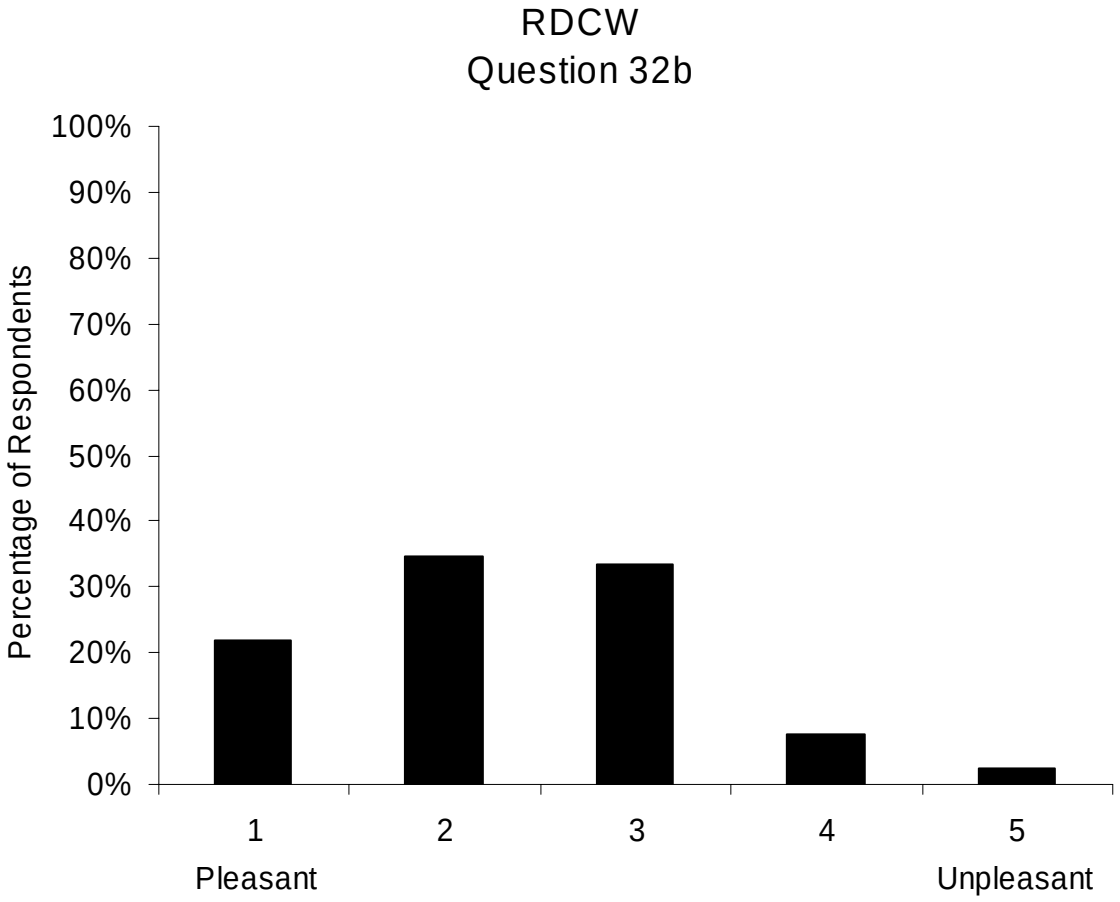
useful | | | | | useless



	Males	Females	Overall
Younger (20-30)	2.1 (1.0)	1.7 (1.2)	1.9 (1.1)
Middle-Aged (40-50)	1.8 (1.2)	1.8 (1.0)	1.8 (1.1)
Older (60-70)	1.7 (0.8)	1.4 (0.7)	1.5 (0.7)
Overall	1.8 (1.0)	1.6 (1.0)	1.7 (1.0)

Values in cells represent the mean response and (standard deviation)

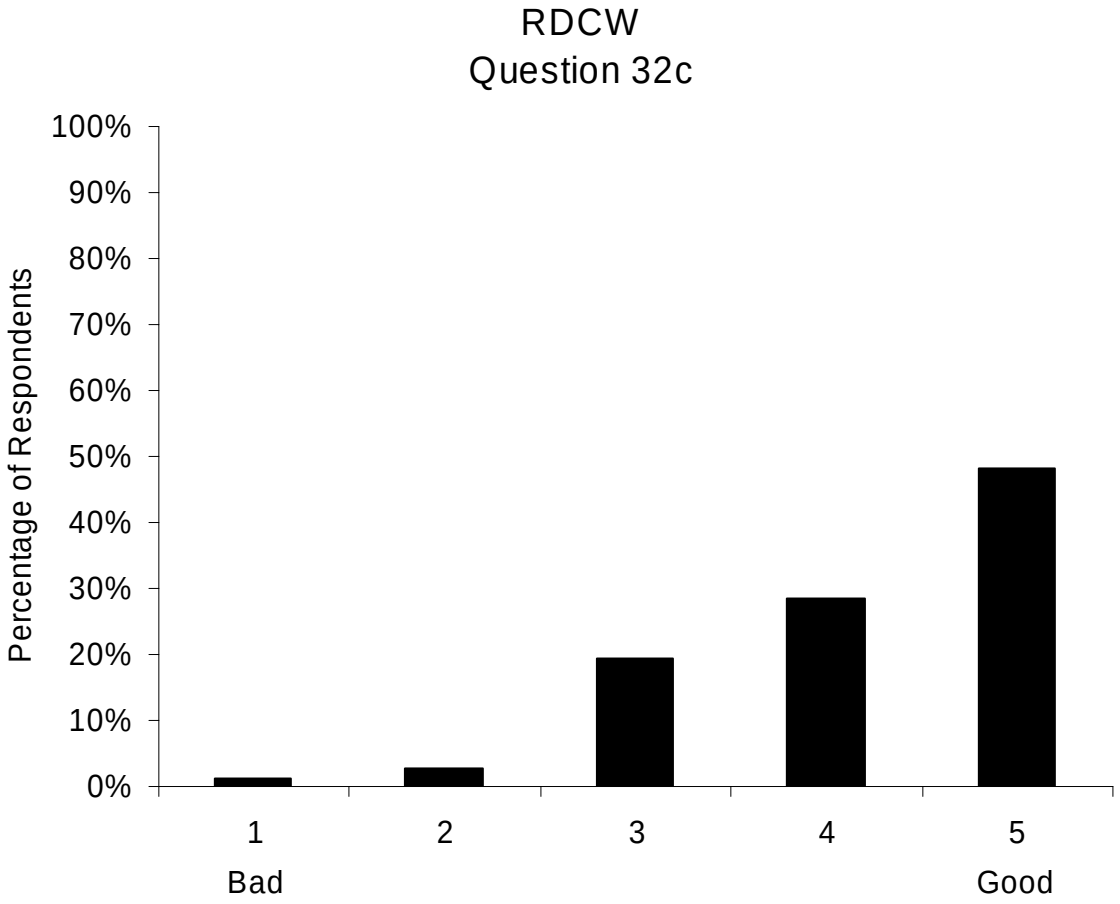
pleasant | | | | | | unpleasant



	Males	Females	Overall
Younger (20-30)	2.5 (1.0)	2.5 (1.3)	2.5 (1.1)
Middle-Aged (40-50)	2.2 (1.1)	2.5 (0.7)	2.3 (0.9)
Older (60-70)	2.2 (1.1)	2.2 (0.9)	2.2 (1.0)
Overall	2.3 (1.0)	2.4 (1.0)	2.3 (1.0)

Values in cells represent the mean response and (standard deviation)

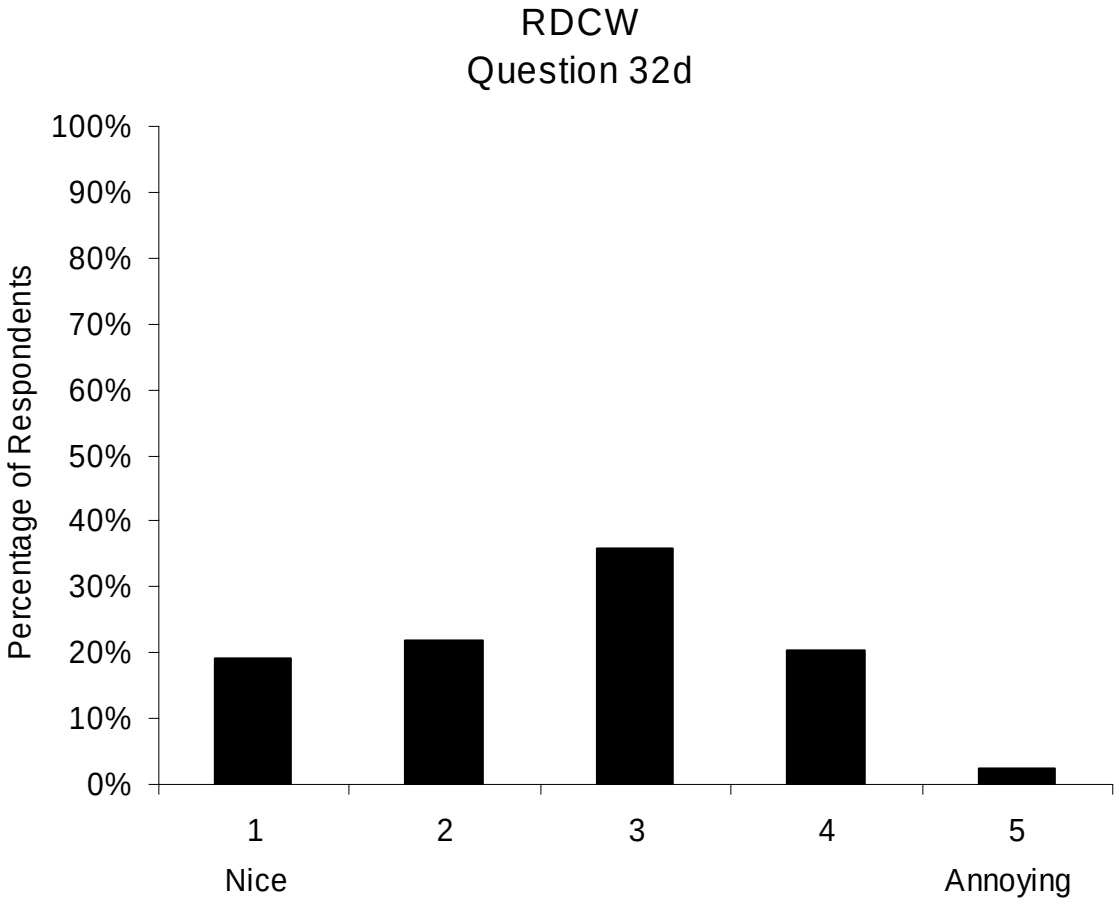
bad | | | | | | good



	Males	Females	Overall
Younger (20-30)	4.0 (0.7)	4.2 (1.2)	4.1 (1.0)
Middle-Aged (40-50)	4.5 (0.8)	4.2 (0.8)	4.3 (0.8)
Older (60-70)	4.1 (1.0)	4.2 (1.1)	4.1 (1.1)
Overall	4.2 (0.9)	4.2 (1.0)	4.2 (0.9)

Values in cells represent the mean response and (standard deviation)

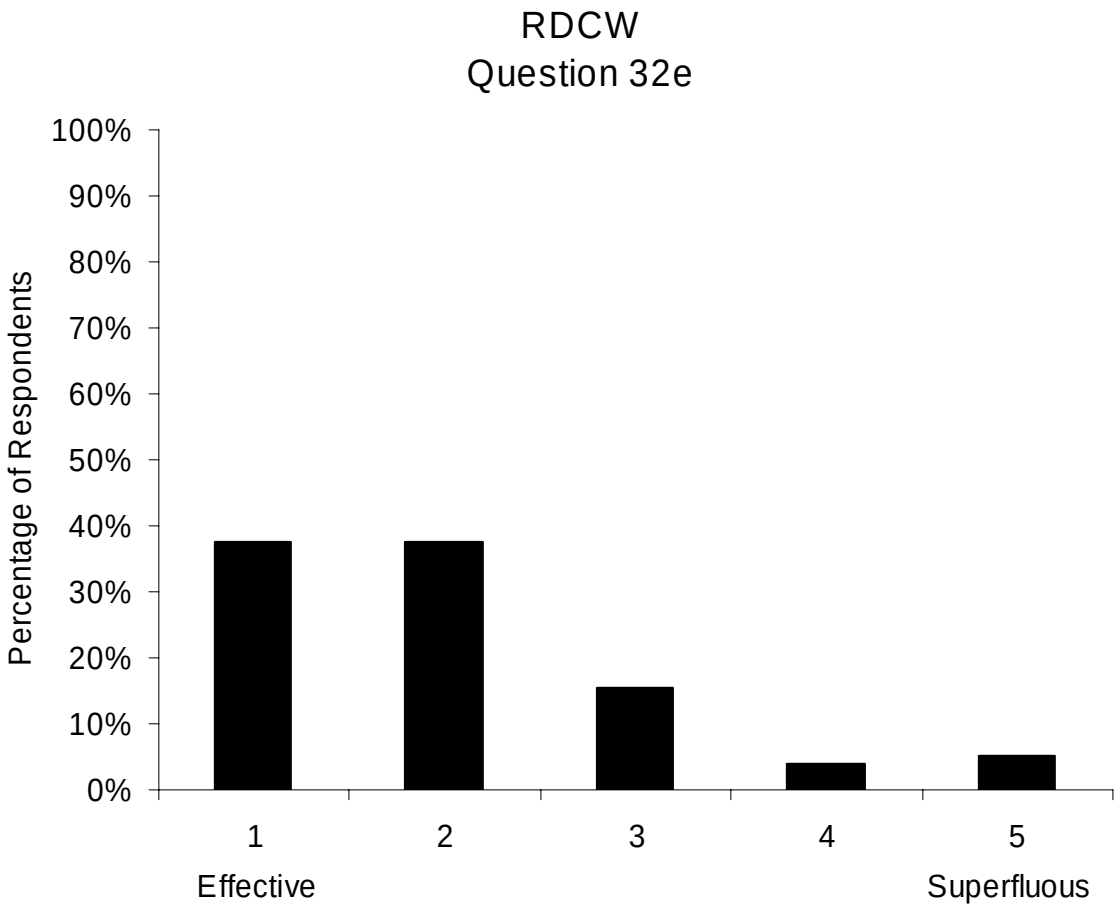
nice annoying



	Males	Females	Overall
Younger (20-30)	2.8 (1.2)	3.4 (1.2)	3.1 (1.2)
Middle-Aged (40-50)	2.5 (1.1)	2.8 (0.9)	2.6 (1.0)
Older (60-70)	2.2 (1.1)	2.4 (0.8)	2.3 (1.0)
Overall	2.5 (1.1)	2.8 (1.0)	2.7 (1.1)

Values in cells represent the mean response and (standard deviation)

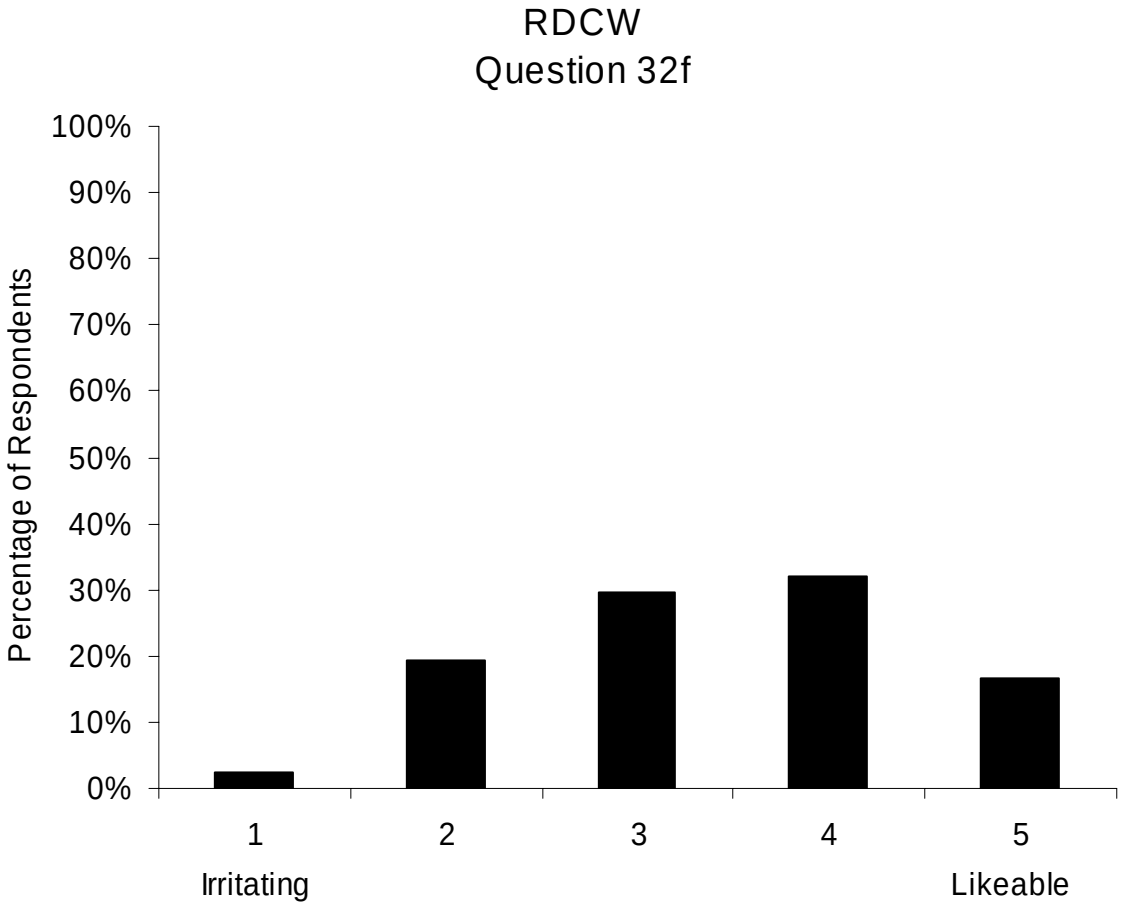
effective | | | | | superfluous



	Males	Females	Overall
Younger (20-30)	2.5 (1.1)	1.9 (1.2)	2.2 (1.1)
Middle-Aged (40-50)	2.3 (1.3)	1.8 (0.9)	2.1 (1.1)
Older (60-70)	2.1 (1.2)	1.5 (0.7)	1.8 (1.0)
Overall	2.3 (1.2)	1.7 (0.9)	2.0 (1.1)

Values in cells represent the mean response and (standard deviation)

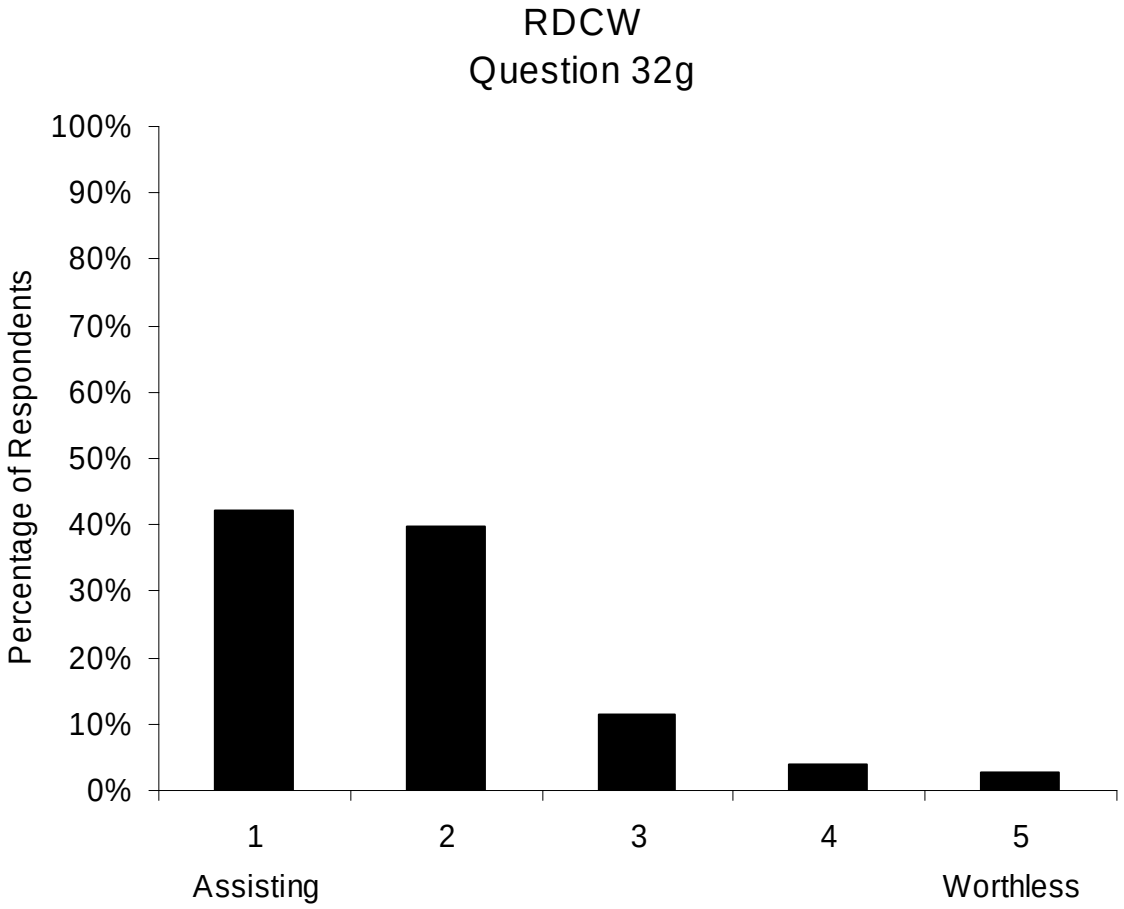
irritating | | | | | | likeable



	Males	Females	Overall
Younger (20-30)	3.2 (1.2)	3.0 (1.3)	3.1 (1.2)
Middle-Aged (40-50)	3.2 (0.9)	3.2 (1.0)	3.2 (1.0)
Older (60-70)	3.8 (1.0)	4.0 (0.7)	3.9 (0.9)
Overall	3.4 (1.0)	3.4 (1.1)	3.4 (1.1)

Values in cells represent the mean response and (standard deviation)

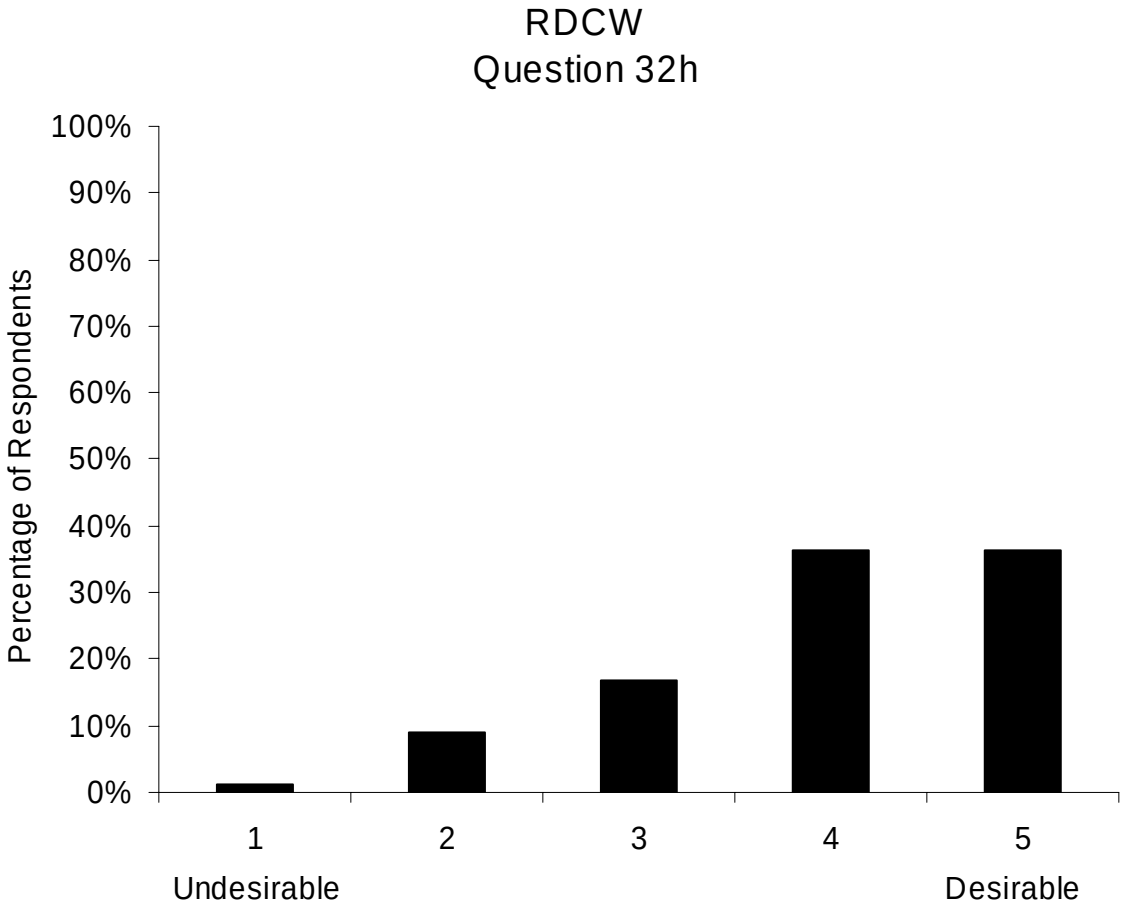
assisting worthless



	Males	Females	Overall
Younger (20-30)	2.1 (1.0)	1.8 (1.3)	2.0 (1.2)
Middle-Aged (40-50)	1.8 (0.8)	1.8 (0.9)	1.8 (0.8)
Older (60-70)	1.7 (0.6)	1.8 (1.0)	1.7 (0.8)
Overall	1.9 (0.8)	1.8 (1.1)	1.8 (1.0)

Values in cells represent the mean response and (standard deviation)

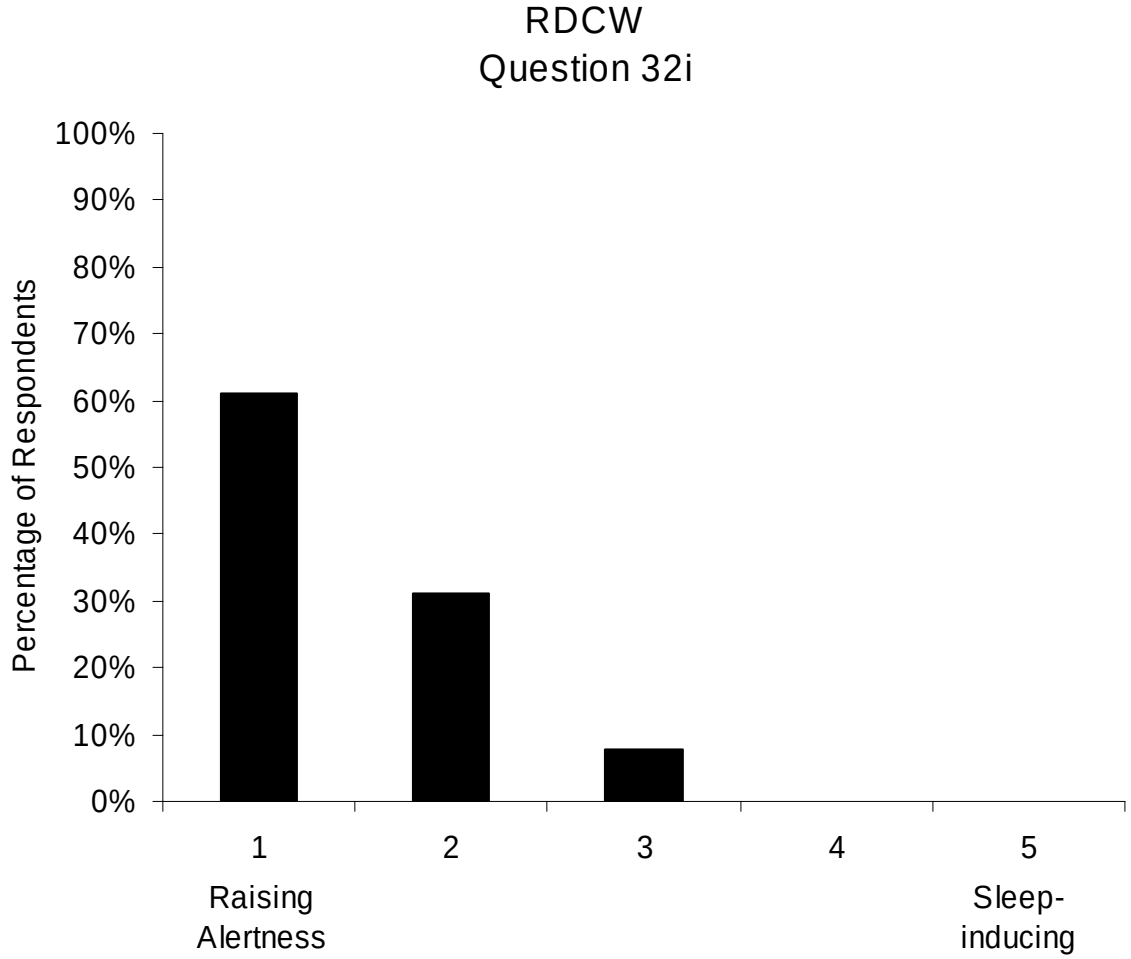
undesirable | | | | | | desirable



	Males	Females	Overall
Younger (20-30)	3.8 (0.8)	3.5 (1.3)	3.7 (1.1)
Middle-Aged (40-50)	4.2 (1.1)	3.9 (1.1)	4.1 (1.1)
Older (60-70)	4.3 (0.9)	4.1 (0.8)	4.2 (0.8)
Overall	4.1 (0.9)	3.8 (1.1)	4.0 (1.0)

Values in cells represent the mean response and (standard deviation)

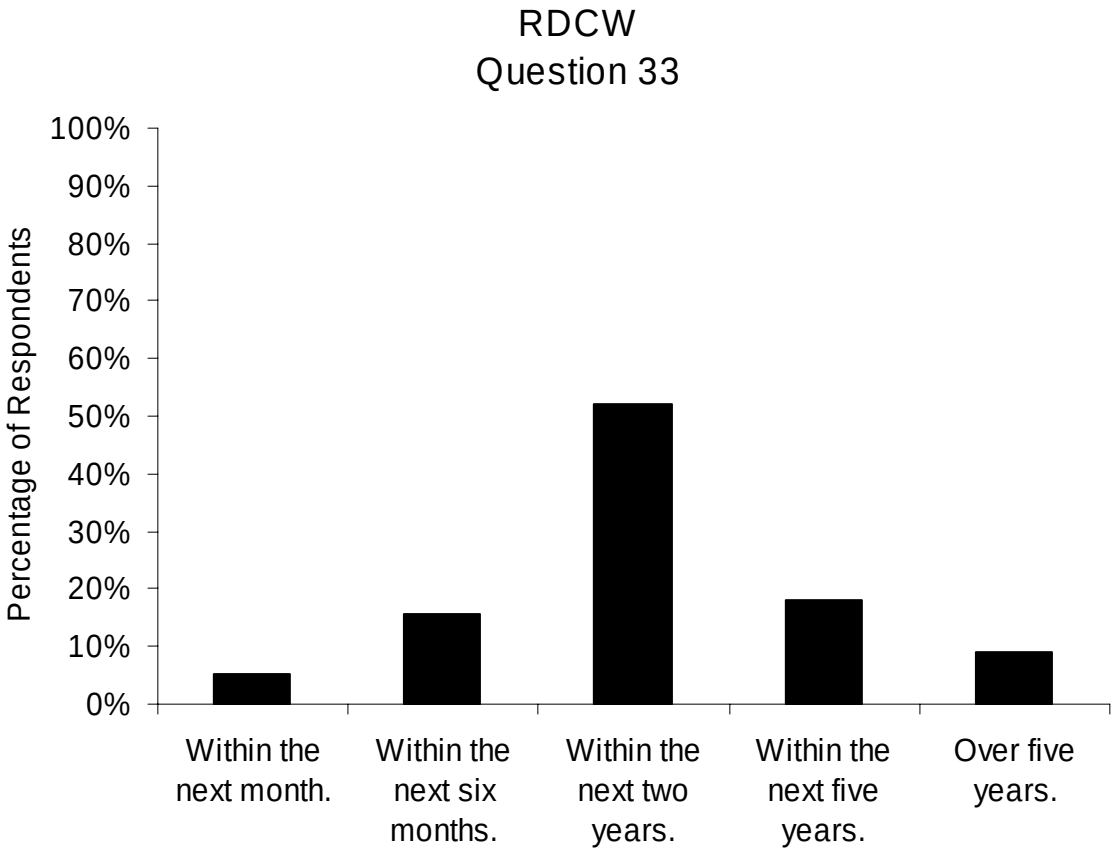
raising alertness | | | | | | sleep-inducing



	Males	Females	Overall
Younger (20-30)	2.0 (0.7)	1.3 (0.6)	1.7 (0.7)
Middle-Aged (40-50)	1.6 (0.8)	1.4 (0.5)	1.5 (0.6)
Older (60-70)	1.4 (0.5)	1.2 (0.4)	1.3 (0.5)
Overall	1.7 (0.7)	1.3 (0.5)	1.5 (0.6)

Values in cells represent the mean response and (standard deviation)

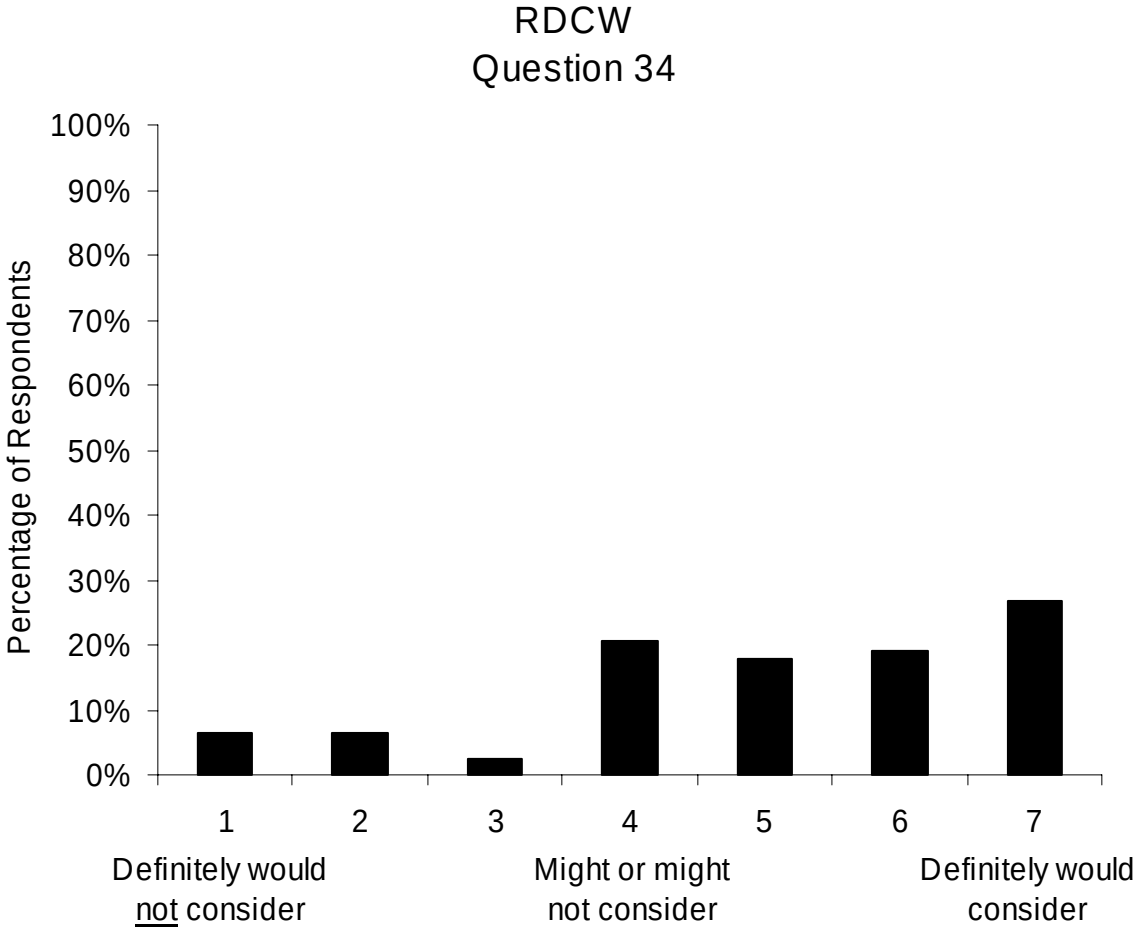
33. Approximately how soon might you consider purchasing a new vehicle?



	Males	Females	Overall
Younger (20-30)	2.9 (1.0)	3.1 (1.1)	3.0 (1.1)
Middle-Aged (40-50)	2.9 (0.8)	3.4 (1.1)	3.2 (1.0)
Older (60-70)	2.9 (1.0)	3.4 (0.7)	3.2 (0.8)
Overall	2.9 (0.9)	3.3 (1.0)	3.1 (1.0)

Values in cells represent the mean response and (standard deviation)

34. Cost aside, if you were purchasing a new vehicle, how likely would you be to consider purchasing the RDCW (LDW & CSW) system?



	Males	Females	Overall
Younger (20-30)	4.4 (1.7)	4.6 (1.8)	4.5 (1.7)
Middle-Aged (40-50)	5.5 (2.3)	4.6 (1.8)	5.0 (2.1)
Older (60-70)	5.7 (1.1)	5.4 (1.8)	5.5 (1.5)
Overall	5.2 (1.8)	4.9 (1.8)	5.0 (1.8)

Values in cells represent the mean response and (standard deviation)

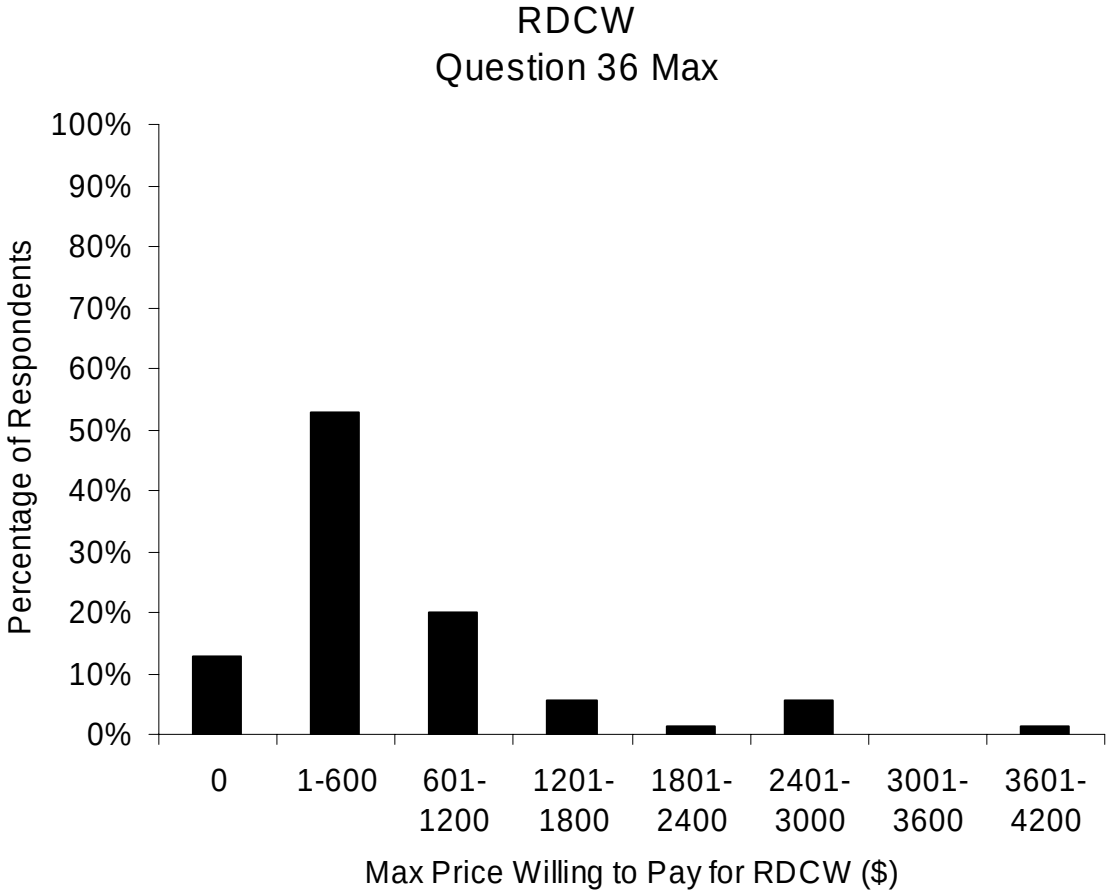
35. Regarding question 34, what is your primary reason for providing the answer you did?

_____

_____

_____

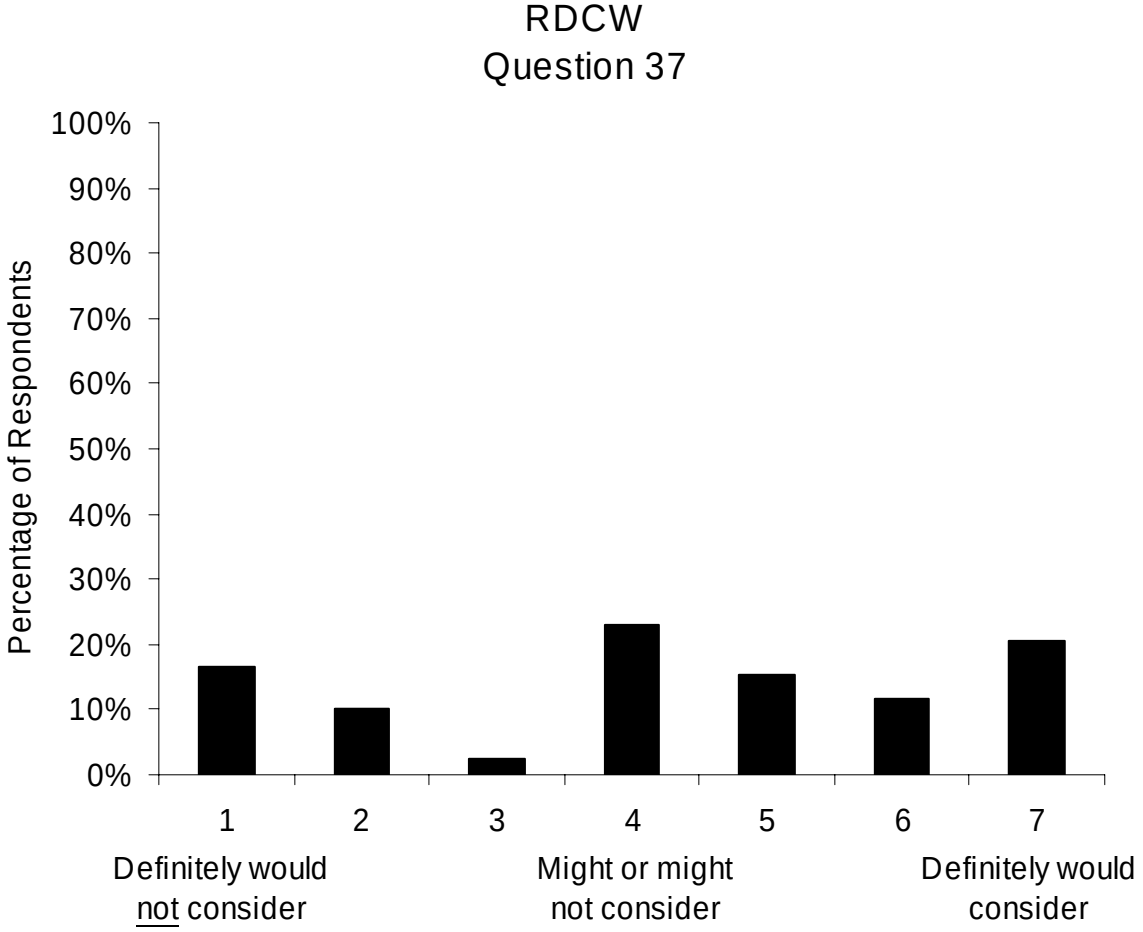
36. What is the maximum amount you would pay for the RDCW (LDW & CSW) system?



	Males		Females		Overall	
Younger (20-30)	611.5	(834.2)	1383.3	(1387.5)	982.0	(1176.9)
Middle-Aged (40-50)	708.3	(611.2)	581.8	(462.2)	647.8	(536.7)
Older (60-70)	562.5	(263.8)	533.3	(887.6)	550.0	(345.3)
Overall	627.0	(609.1)	868.8	(984.1)	739.1	(807.9)

Values in cells represent the mean response and (standard deviation)

37. At the actual price of $800, how likely would you be to consider purchasing RDCW (LDW & CSW) if you were purchasing a new vehicle?



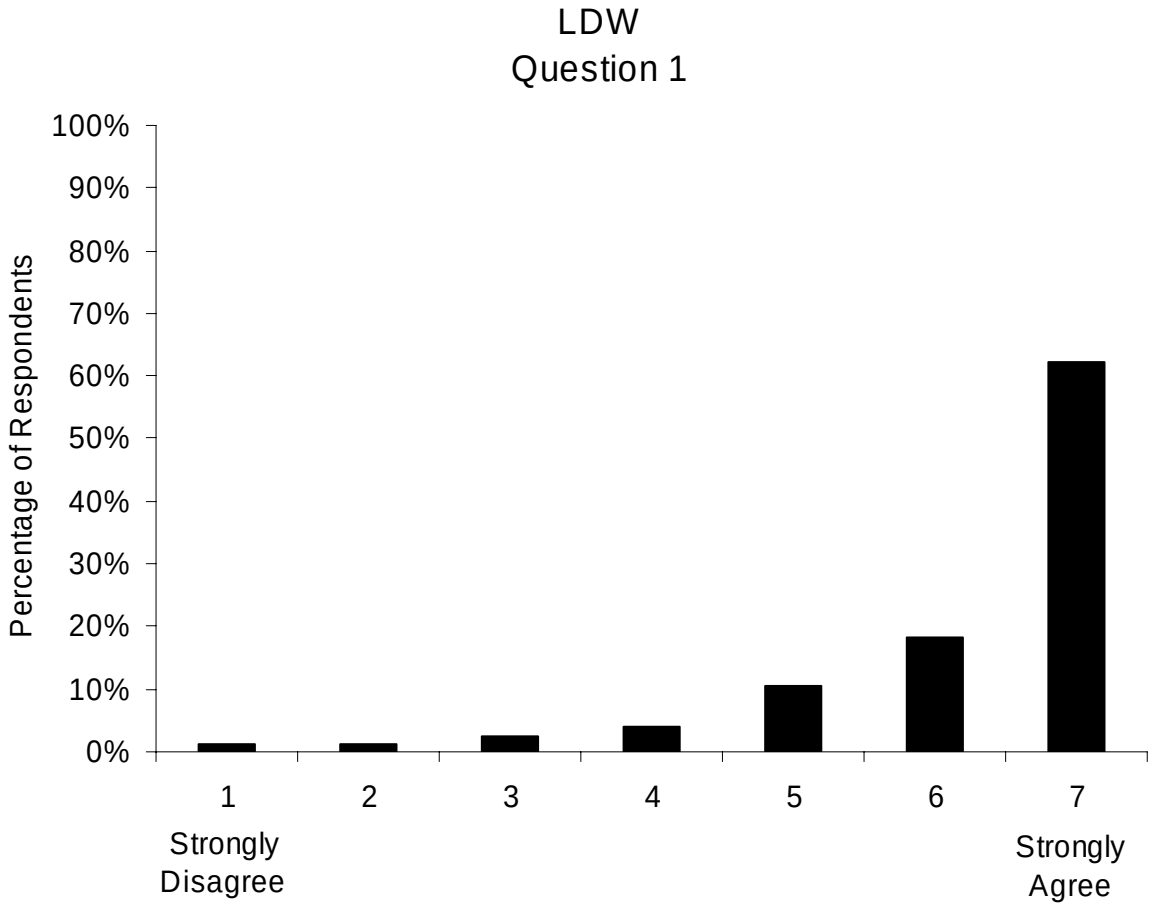
	Males	Females	Overall
Younger (20-30)	3.5 (2.0)	4.8 (2.4)	4.2 (2.3)
Middle-Aged (40-50)	4.4 (2.3)	3.8 (2.2)	4.1 (2.2)
Older (60-70)	5.0 (1.6)	4.1 (1.9)	4.5 (1.8)
Overall	4.3 (2.0)	4.2 (2.2)	4.3 (2.1)

Values in cells represent the mean response and (standard deviation)

Lateral Drift Warning (LDW) System Questionnaire and Evaluation

LDW Display – General Characteristics

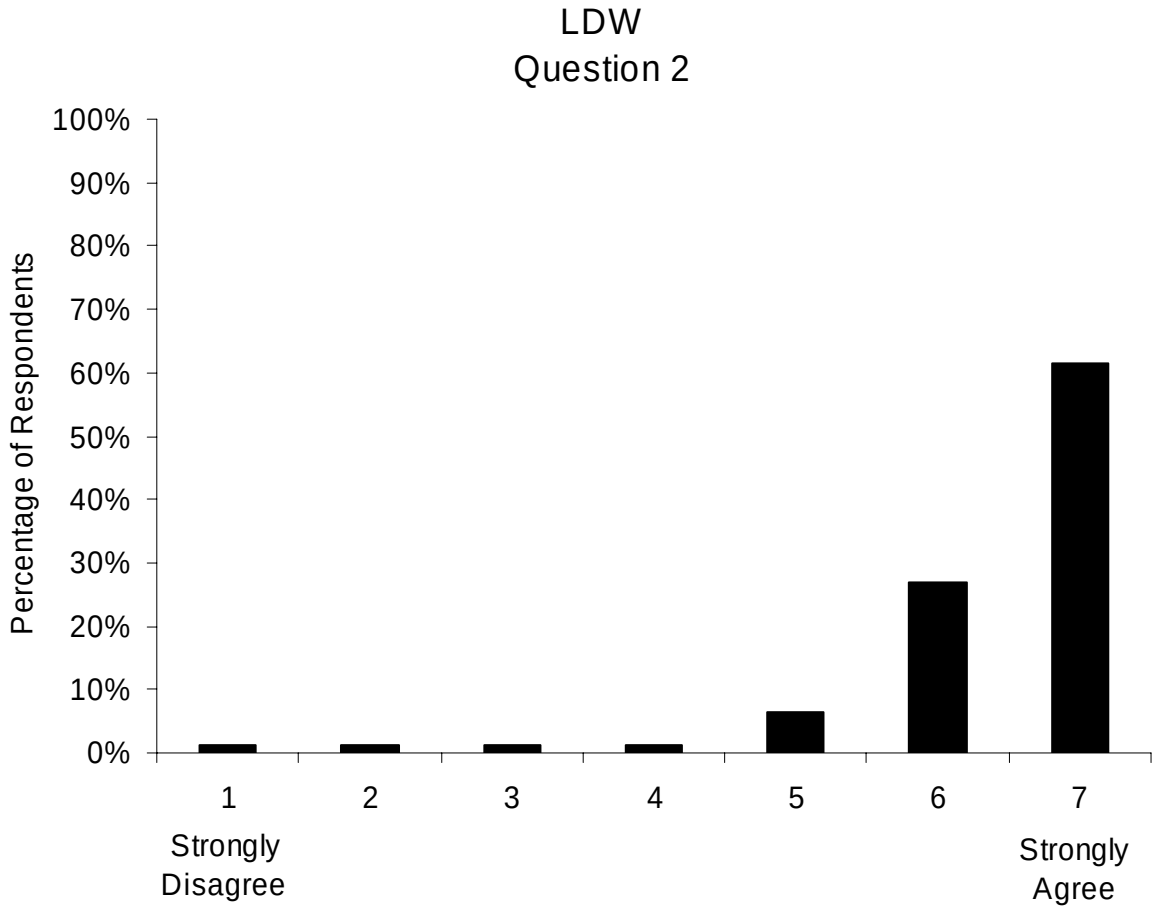
1. It was easy to see the graphics in the LDW display (i.e., there was no glare, and the graphics were neither too light nor too dark).



	Males	Females	Overall
Younger (20-30)	6.0 (1.4)	6.5 (0.9)	6.2 (1.2)
Middle-Aged (40-50)	6.5 (1.0)	6.3 (1.7)	6.4 (1.4)
Older (60-70)	5.8 (1.6)	6.4 (1.0)	6.1 (1.3)
Overall	6.1 (1.3)	6.4 (1.2)	6.2 (1.3)

Values in cells represent the mean response and (standard deviation)

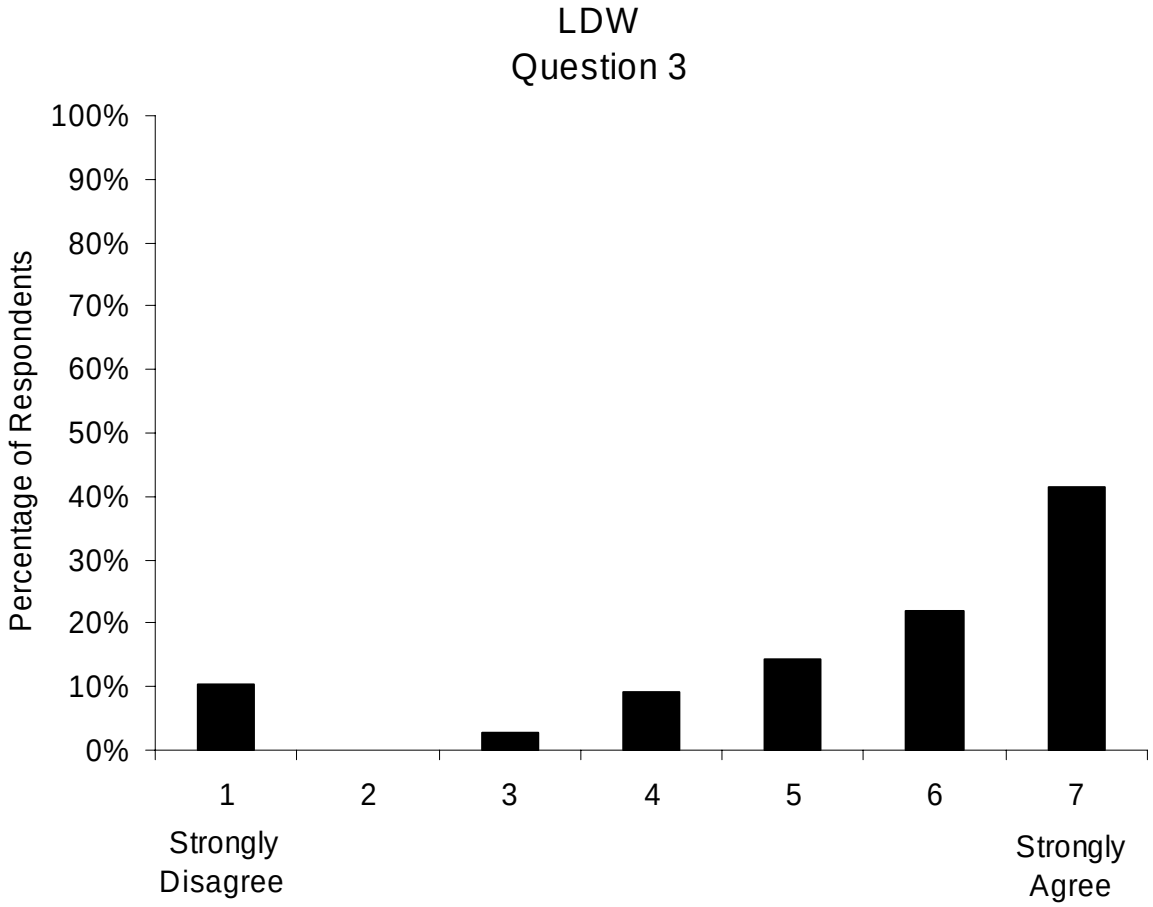
2. The graphics presented on the LDW display were about the right size.



	Males	Females	Overall
Younger (20-30)	6.1 (1.2)	6.8 (0.4)	6.4 (0.9)
Middle-Aged (40-50)	6.7 (0.6)	6.2 (1.7)	6.4 (1.3)
Older (60-70)	6.0 (1.5)	6.5 (0.5)	6.3 (1.1)
Overall	6.3 (1.2)	6.5 (1.1)	6.4 (1.1)

Values in cells represent the mean response and (standard deviation)

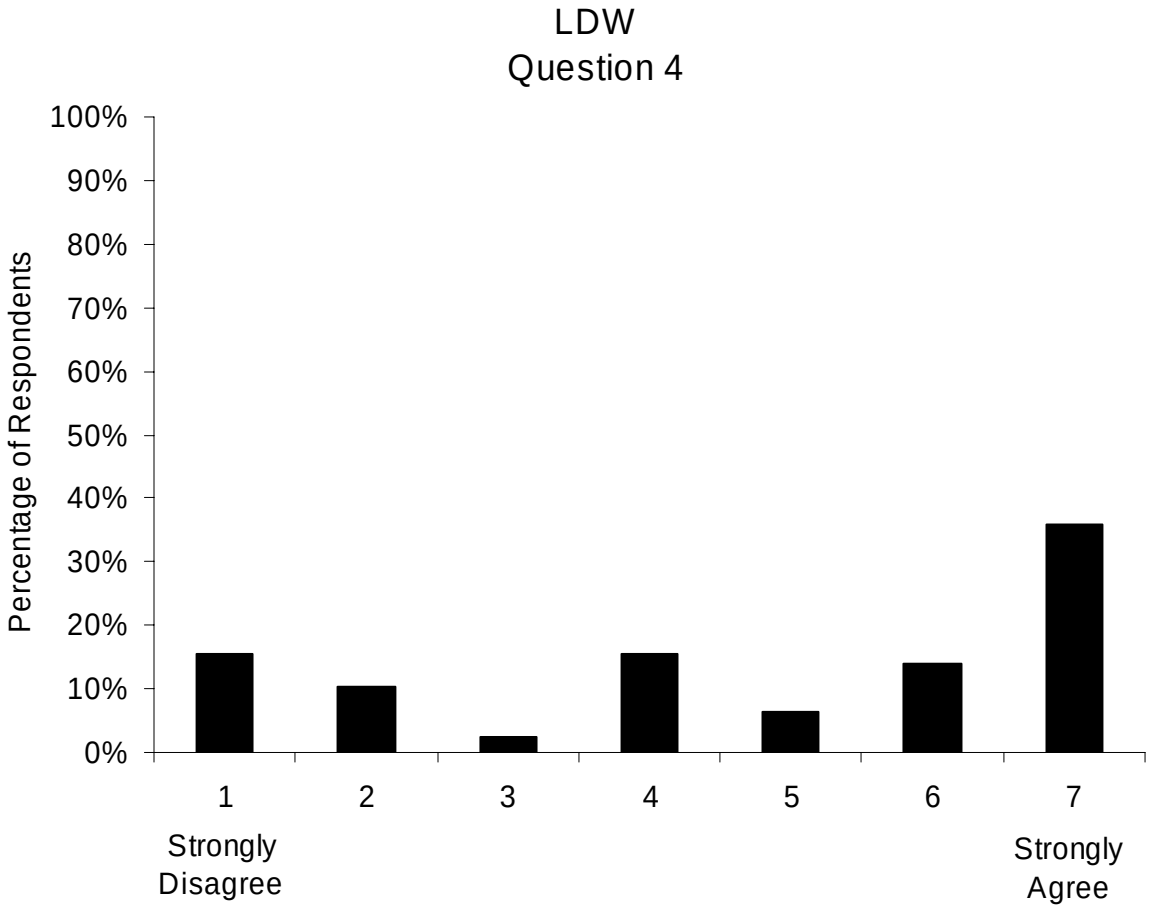
3. It was easy to distinguish between the different LDW visual warnings toward the Left and toward the Right (Cautionary and Imminent warnings).



	Males	Females	Overall
Younger (20-30)	5.2 (1.9)	5.9 (1.7)	5.6 (1.8)
Middle-Aged (40-50)	5.9 (1.3)	5.0 (2.6)	5.5 (2.0)
Older (60-70)	5.2 (2.1)	5.7 (1.7)	5.4 (1.9)
Overall	5.4 (1.8)	5.6 (2.0)	5.5 (1.9)

Values in cells represent the mean response and (standard deviation)

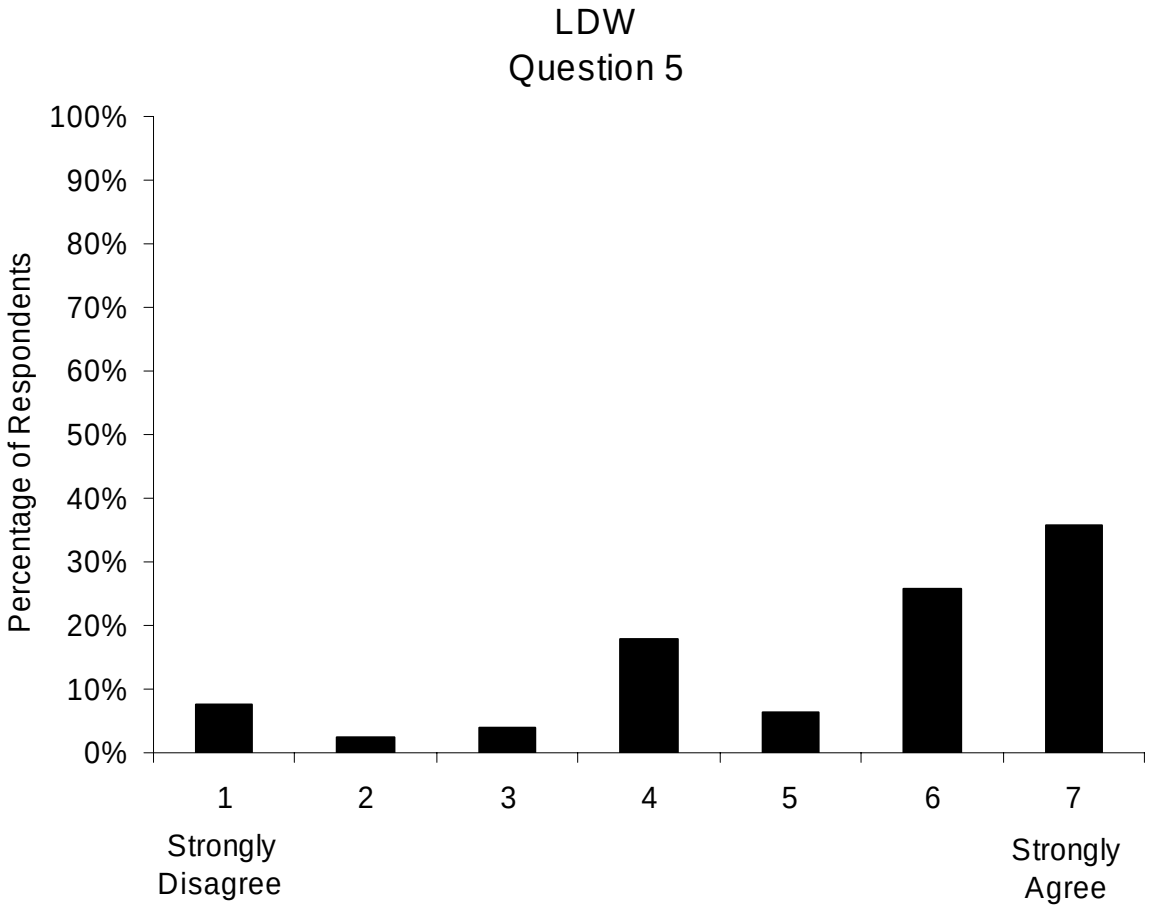
4. The LDW visual warnings got my attention.



	Males	Females	Overall
Younger (20-30)	4.3 (2.1)	5.9 (2.1)	5.1 (2.2)
Middle-Aged (40-50)	5.2 (1.8)	4.2 (2.8)	4.7 (2.3)
Older (60-70)	4.3 (2.5)	4.5 (2.3)	4.4 (2.3)
Overall	4.6 (2.1)	4.9 (2.5)	4.7 (2.3)

Values in cells represent the mean response and (standard deviation)

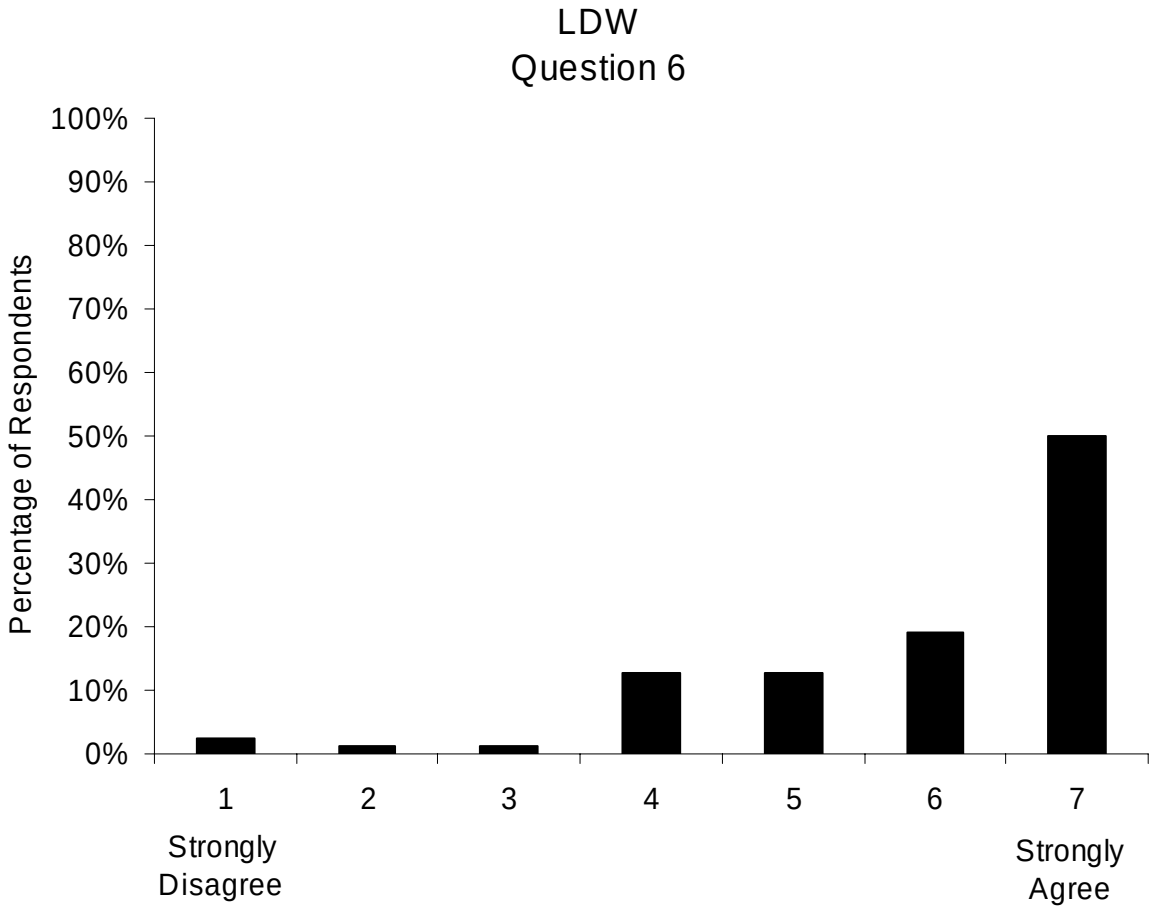
5. I knew what to do when I saw the LDW visual warnings.



	Males	Females	Overall
Younger (20-30)	5.2 (1.7)	5.9 (1.6)	5.6 (1.7)
Middle-Aged (40-50)	5.6 (1.7)	4.9 (1.8)	5.3 (1.8)
Older (60-70)	5.4 (2.3)	4.9 (2.1)	5.2 (2.1)
Overall	5.4 (1.9)	5.3 (1.8)	5.3 (1.8)

Values in cells represent the mean response and (standard deviation)

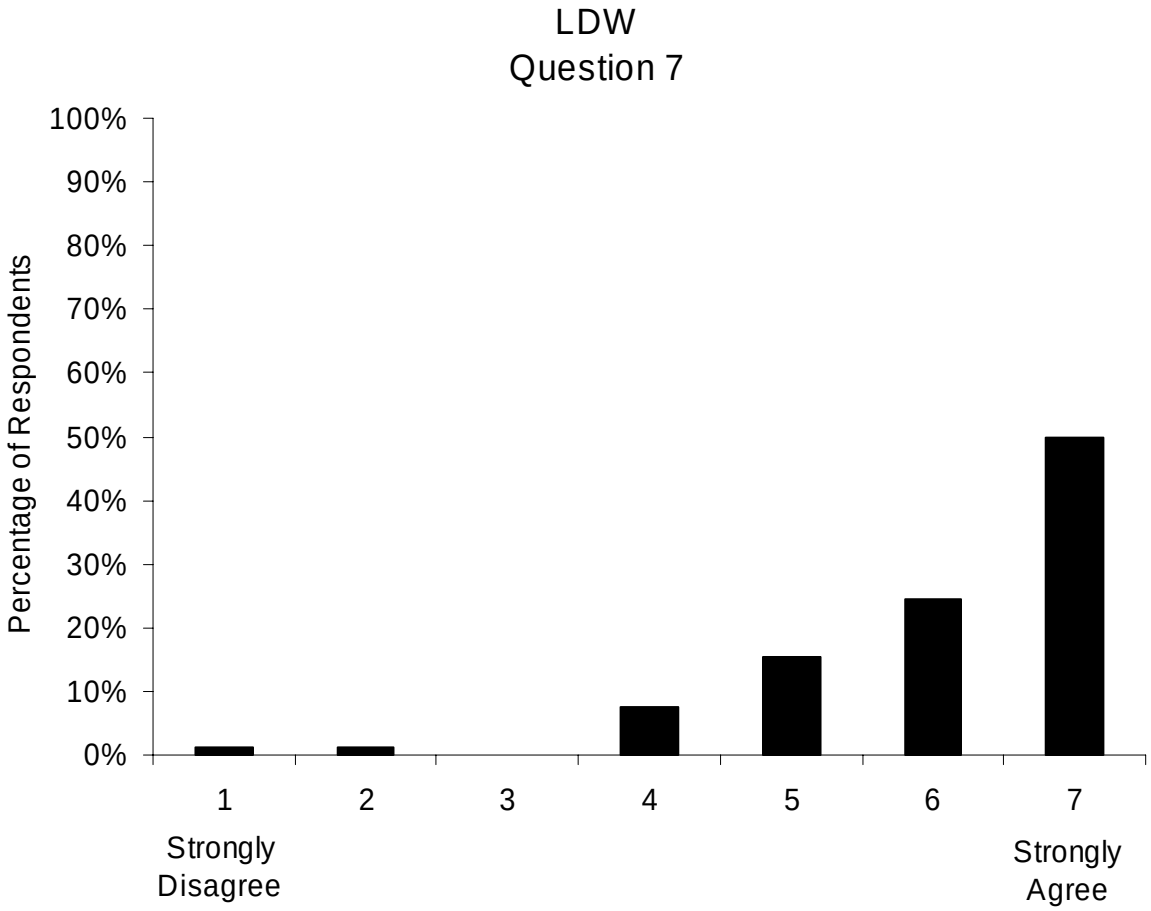
6. The visual LDW warnings were not distracting.



	Males	Females	Overall
Younger (20-30)	5.6 (1.7)	5.9 (1.8)	5.8 (1.7)
Middle-Aged (40-50)	5.9 (1.4)	6.2 (1.1)	6.1 (1.2)
Older (60-70)	5.7 (1.7)	6.0 (1.2)	5.8 (1.4)
Overall	5.7 (1.6)	6.1 (1.4)	5.9 (1.5)

Values in cells represent the mean response and (standard deviation)

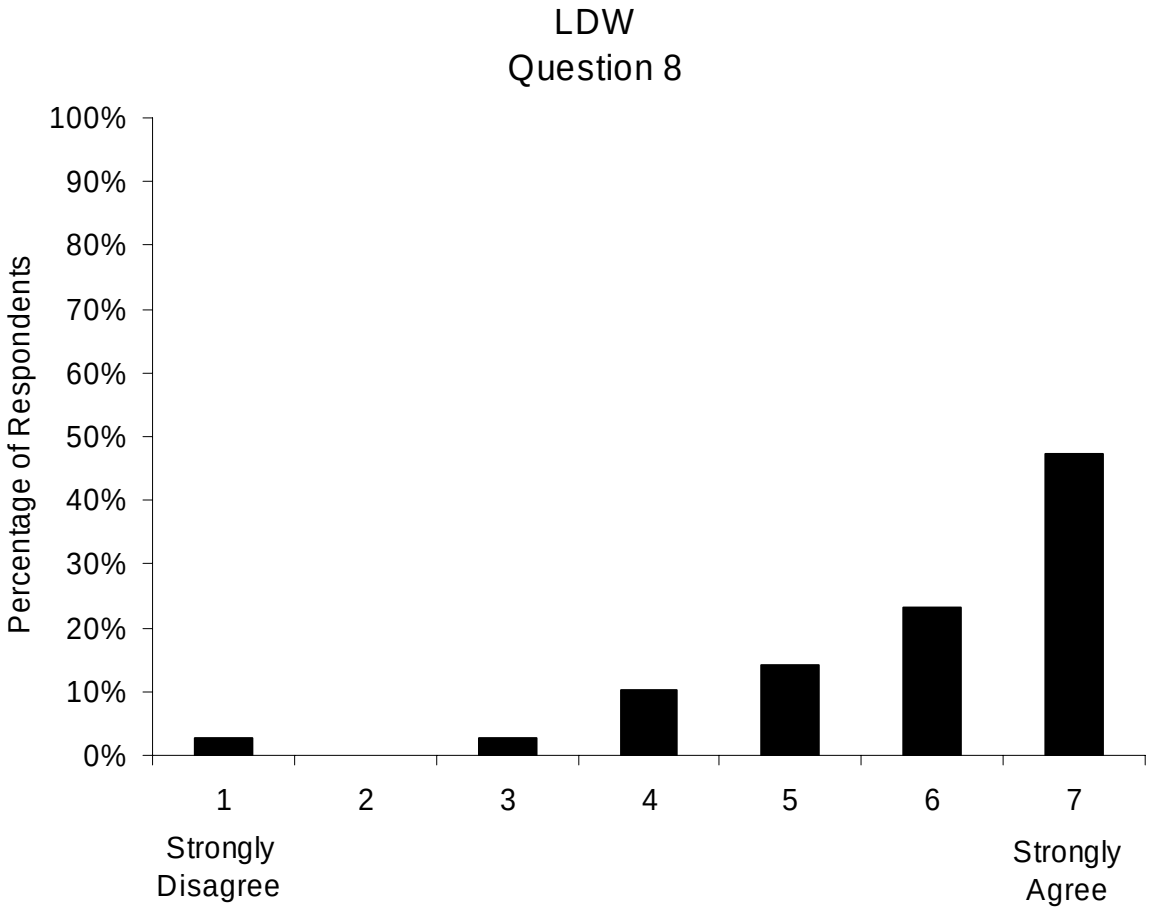
7. The LDW Availability icons were not distracting.



	Males	Females	Overall
Younger (20-30)	6.2 (0.9)	6.0 (1.8)	6.1 (1.4)
Middle-Aged (40-50)	6.3 (0.9)	6.1 (1.0)	6.2 (1.0)
Older (60-70)	5.6 (1.6)	6.2 (0.9)	5.9 (1.3)
Overall	6.1 (1.2)	6.1 (1.3)	6.1 (1.2)

Values in cells represent the mean response and (standard deviation)

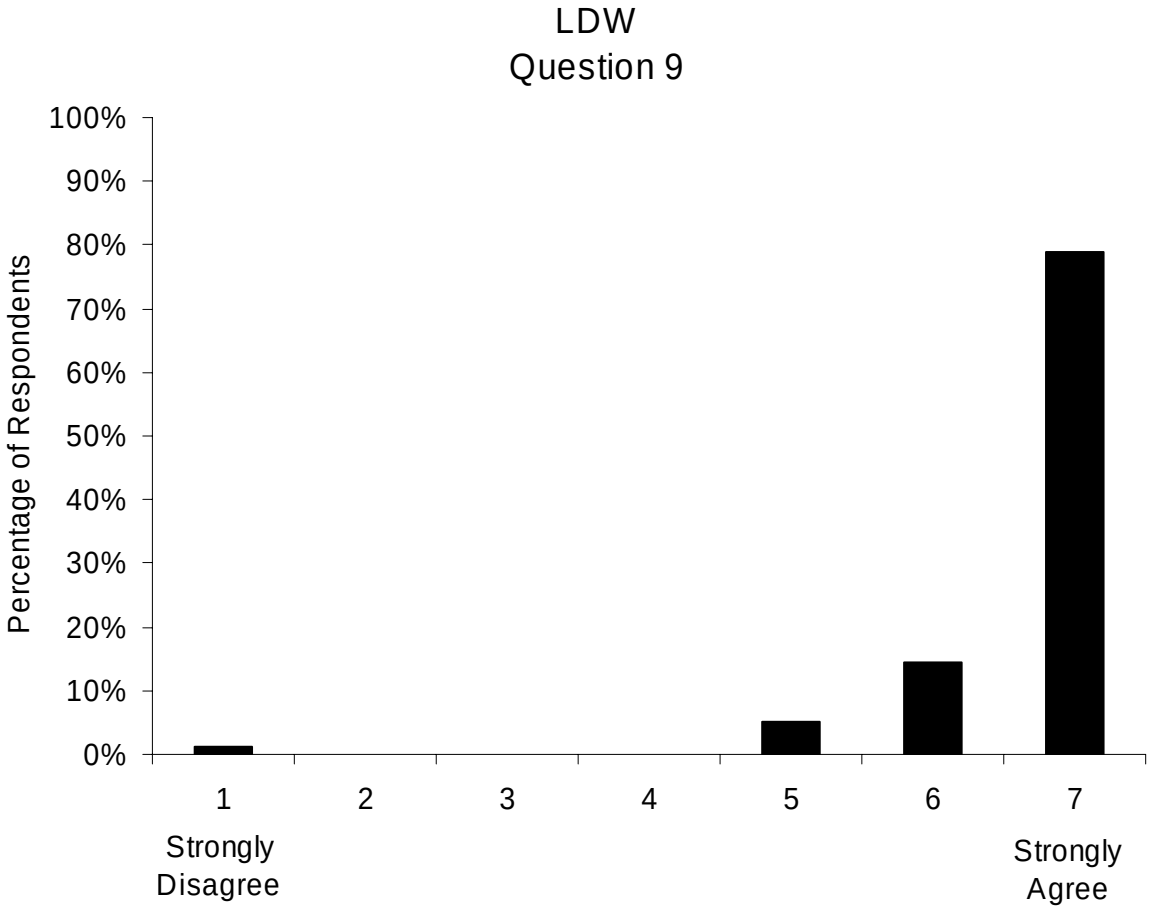
8. The LDW Availability icons helped me to understand and to use the LDW system.



	Males	Females	Overall
Younger (20-30)	5.7 (1.4)	6.1 (1.7)	5.9 (1.5)
Middle-Aged (40-50)	6.3 (1.0)	6.2 (1.0)	6.2 (1.0)
Older (60-70)	5.6 (1.4)	5.7 (1.8)	5.7 (1.5)
Overall	5.9 (1.3)	6.0 (1.5)	5.9 (1.4)

Values in cells represent the mean response and (standard deviation)

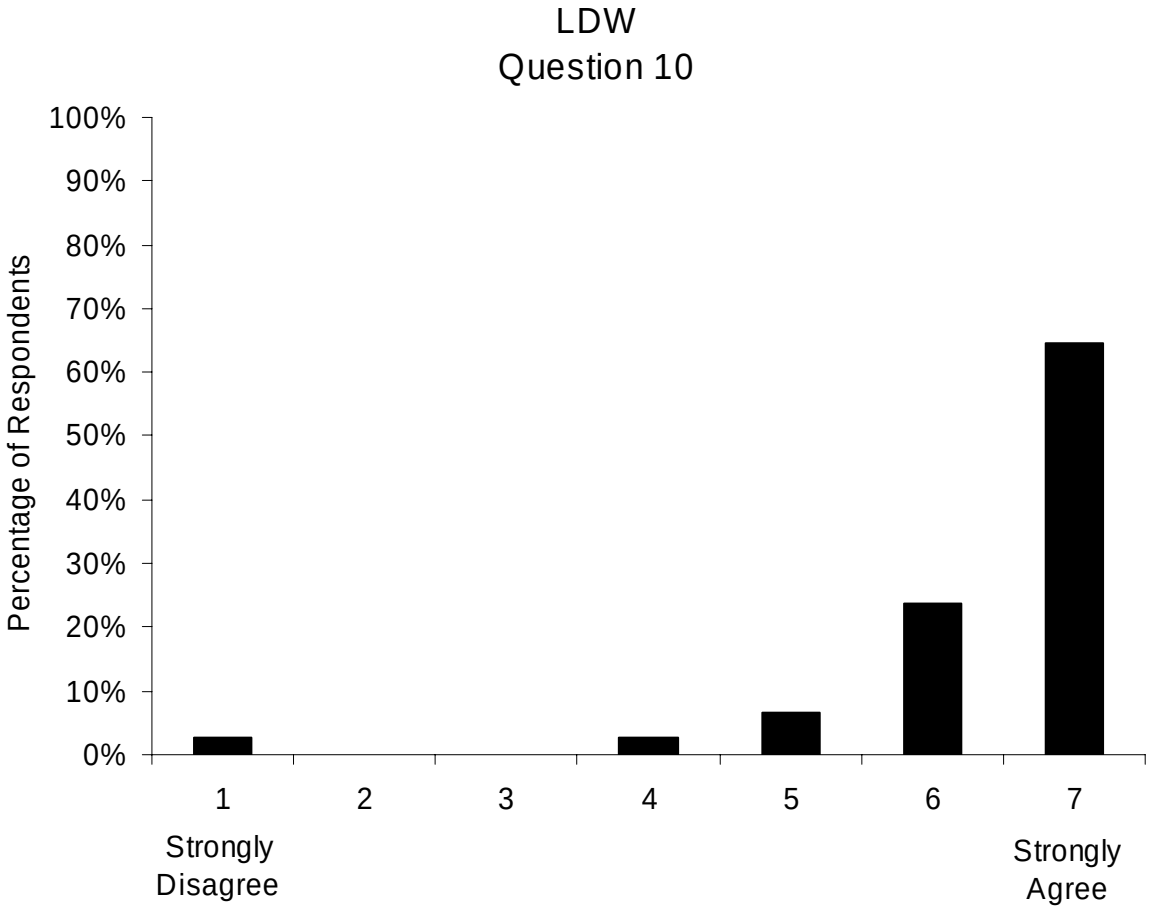
9. The LDW auditory warnings got my attention.



	Males	Females	Overall
Younger (20-30)	6.5 (0.8)	6.9 (0.3)	6.7 (0.6)
Middle-Aged (40-50)	6.5 (1.7)	6.8 (0.6)	6.6 (1.3)
Older (60-70)	6.8 (0.4)	6.6 (0.7)	6.7 (0.5)
Overall	6.6 (1.1)	6.8 (0.5)	6.7 (0.9)

Values in cells represent the mean response and (standard deviation)

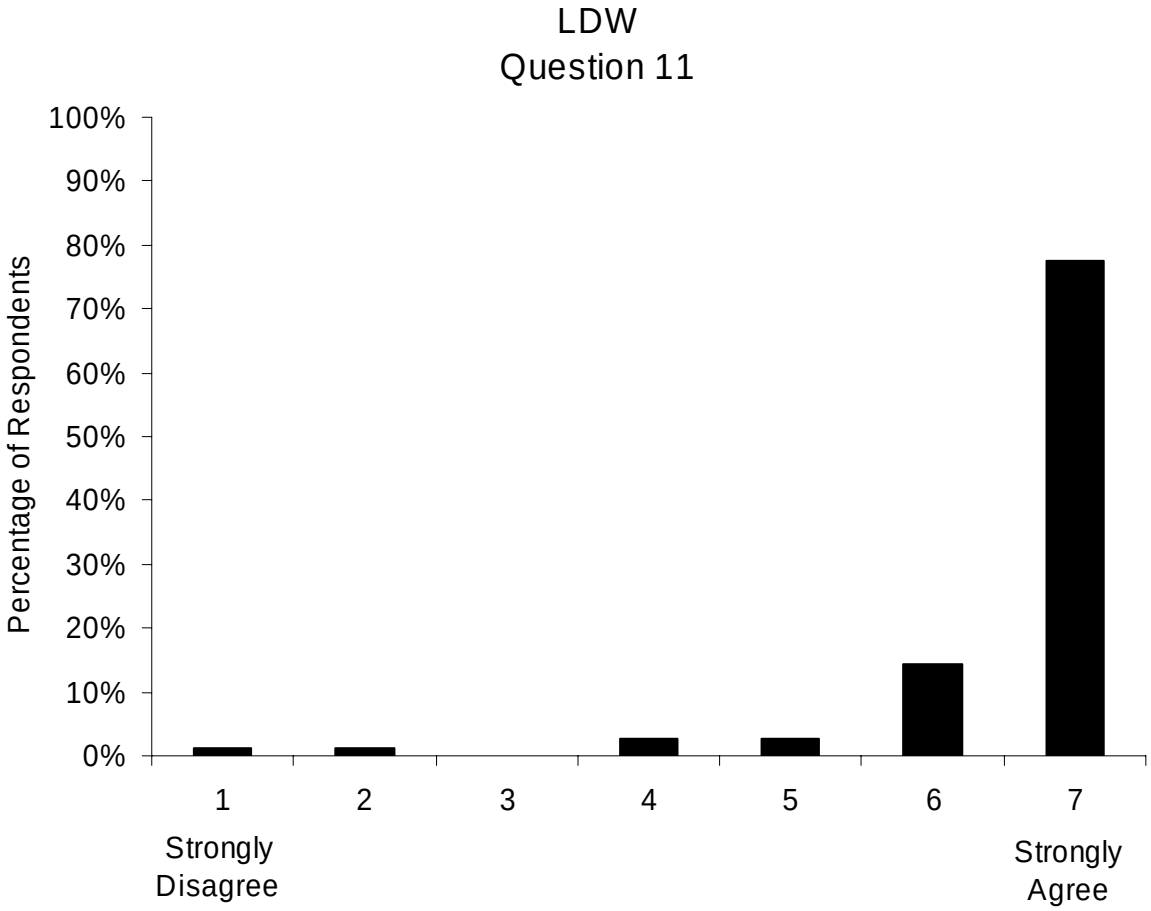
10. I knew what to do when I heard the LDW auditory warnings.



	Males	Females	Overall
Younger (20-30)	6.2 (1.0)	6.7 (0.9)	6.4 (0.9)
Middle-Aged (40-50)	5.8 (2.2)	6.5 (0.7)	6.2 (1.7)
Older (60-70)	6.6 (0.7)	6.6 (0.7)	6.6 (0.6)
Overall	6.2 (1.4)	6.6 (0.7)	6.4 (1.2)

Values in cells represent the mean response and (standard deviation)

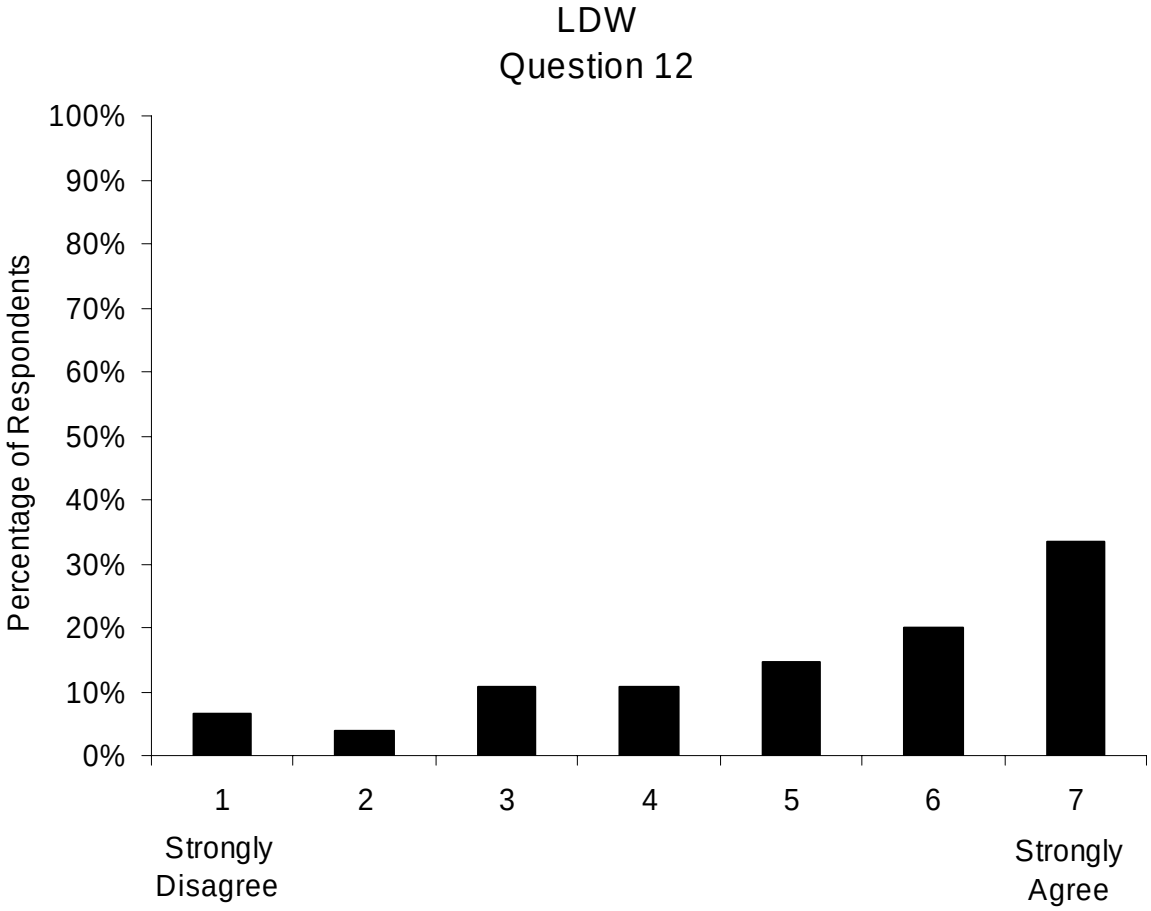
11. I could easily hear the LDW auditory warnings while I was driving.



	Males	Females	Overall
Younger (20-30)	6.1 (1.6)	6.9 (0.3)	6.5 (1.2)
Middle-Aged (40-50)	6.5 (1.7)	6.7 (0.5)	6.6 (1.2)
Older (60-70)	6.8 (0.6)	6.5 (0.9)	6.7 (0.7)
Overall	6.5 (1.4)	6.7 (0.6)	6.6 (1.1)

Values in cells represent the mean response and (standard deviation)

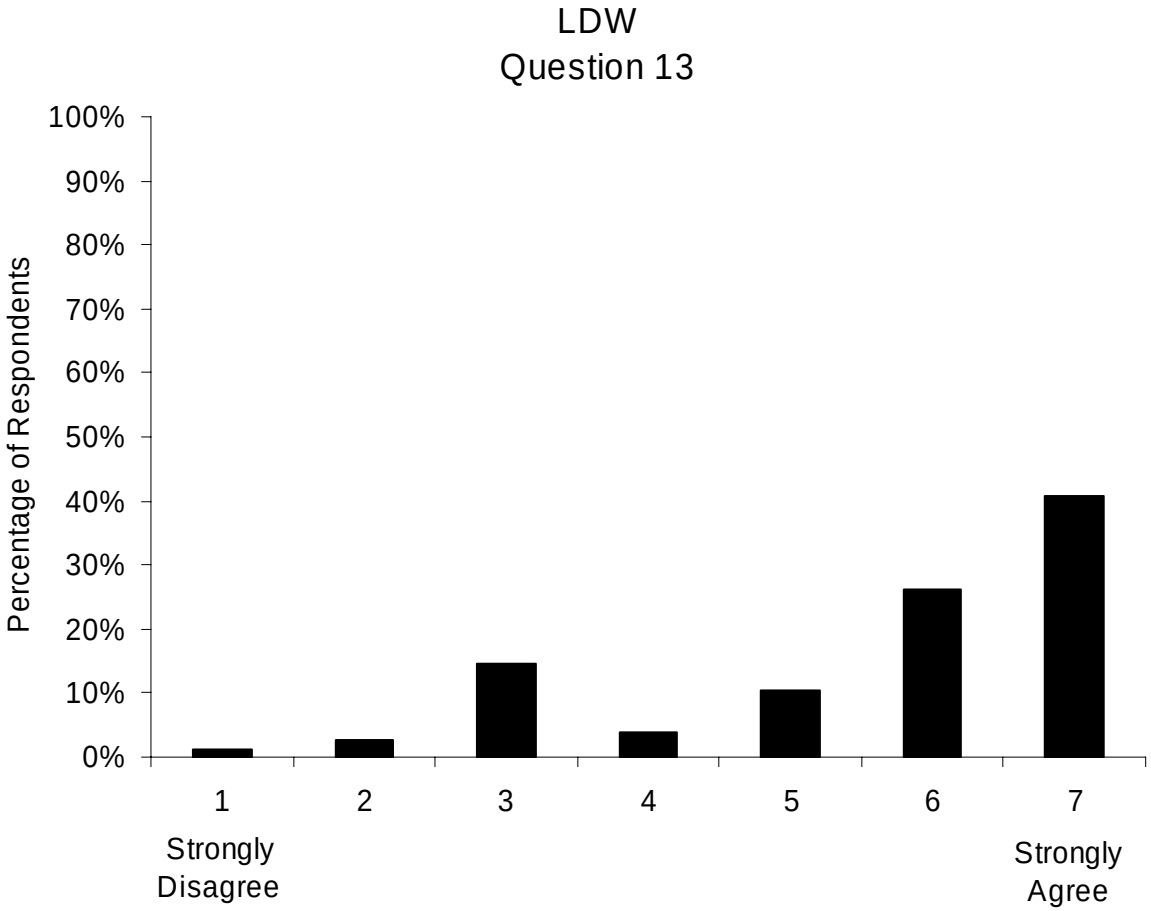
12. I could easily recognize which direction the LDW auditory warning was coming from (the left or the right speakers).



	Males	Females	Overall
Younger (20-30)	5.4 (1.9)	5.8 (1.8)	5.6 (1.8)
Middle-Aged (40-50)	5.0 (2.2)	4.8 (1.8)	4.9 (2.0)
Older (60-70)	5.1 (1.9)	4.9 (1.8)	5.0 (1.8)
Overall	5.2 (2.0)	5.2 (1.8)	5.2 (1.9)

Values in cells represent the mean response and (standard deviation)

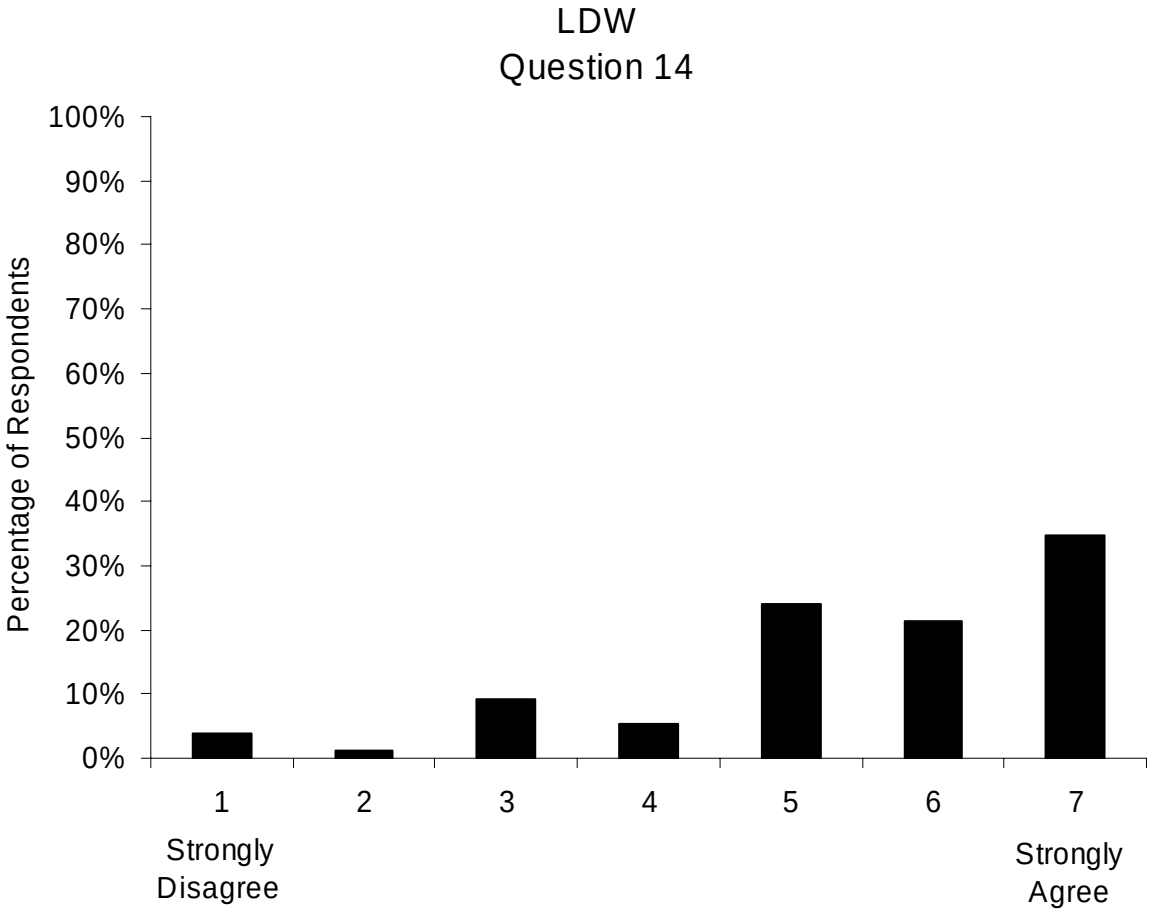
13. The auditory LDW warnings were not distracting.



	Males	Females	Overall
Younger (20-30)	5.0 (2.0)	4.9 (1.9)	5.0 (1.9)
Middle-Aged (40-50)	5.7 (1.7)	5.3 (1.7)	5.5 (1.6)
Older (60-70)	6.5 (0.8)	6.3 (0.6)	6.4 (0.7)
Overall	5.7 (1.6)	5.5 (1.6)	5.6 (1.6)

Values in cells represent the mean response and (standard deviation)

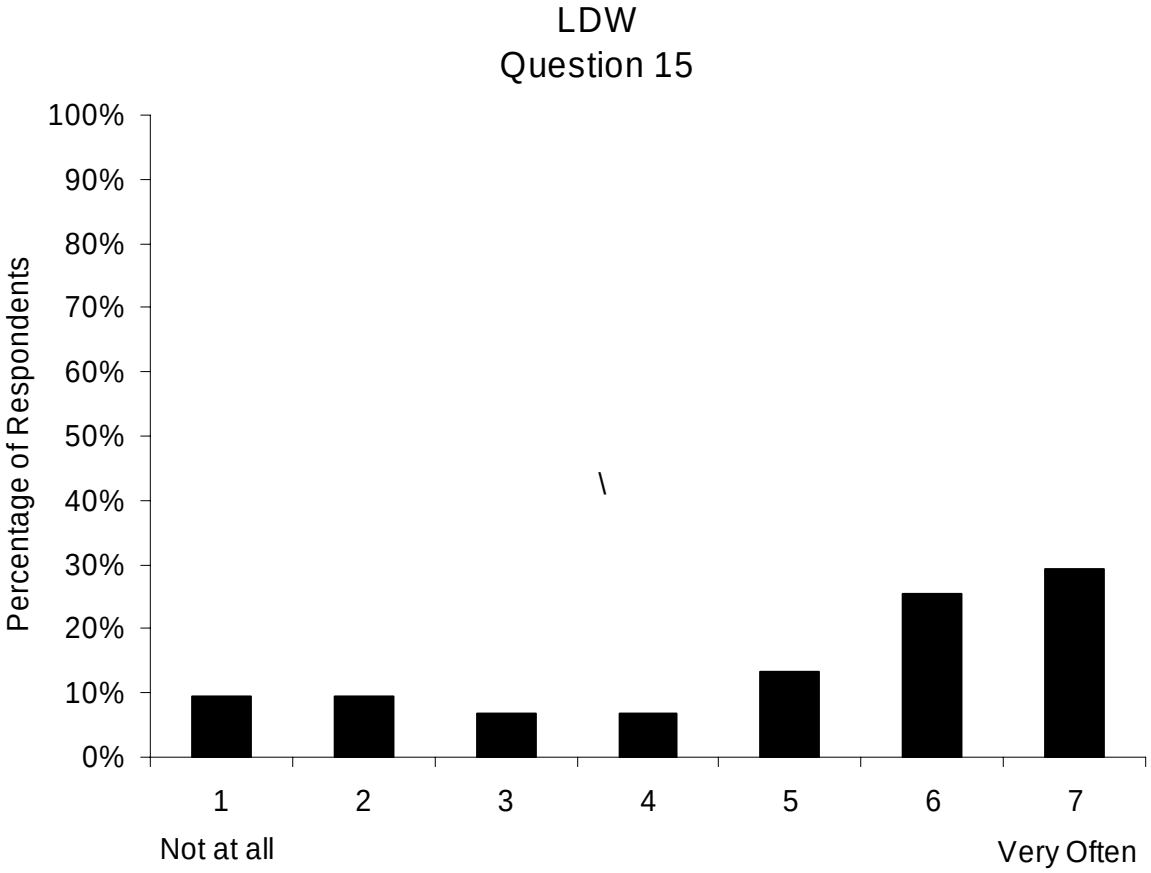
14. The frequency with which I received auditory LDW warnings was not annoying.



	Males	Females	Overall
Younger (20-30)	4.8 (1.7)	5.2 (1.6)	5.0 (1.6)
Middle-Aged (40-50)	5.1 (2.0)	5.2 (1.7)	5.1 (1.9)
Older (60-70)	6.3 (1.0)	6.4 (0.8)	6.3 (0.9)
Overall	5.3 (1.7)	5.6 (1.5)	5.5 (1.6)

Values in cells represent the mean response and (standard deviation)

15. How often did passengers in the car comment on the auditory LDW warnings when they occurred?



	Males	Females	Overall
Younger (20-30)	4.5 (2.1)	6.2 (1.5)	5.3 (2.0)
Middle-Aged (40-50)	4.4 (2.2)	5.2 (2.1)	4.8 (2.1)
Older (60-70)	5.9 (1.0)	3.6 (2.3)	4.9 (2.0)
Overall	4.9 (1.9)	5.1 (2.2)	5.0 (2.0)

Values in cells represent the mean response and (standard deviation)

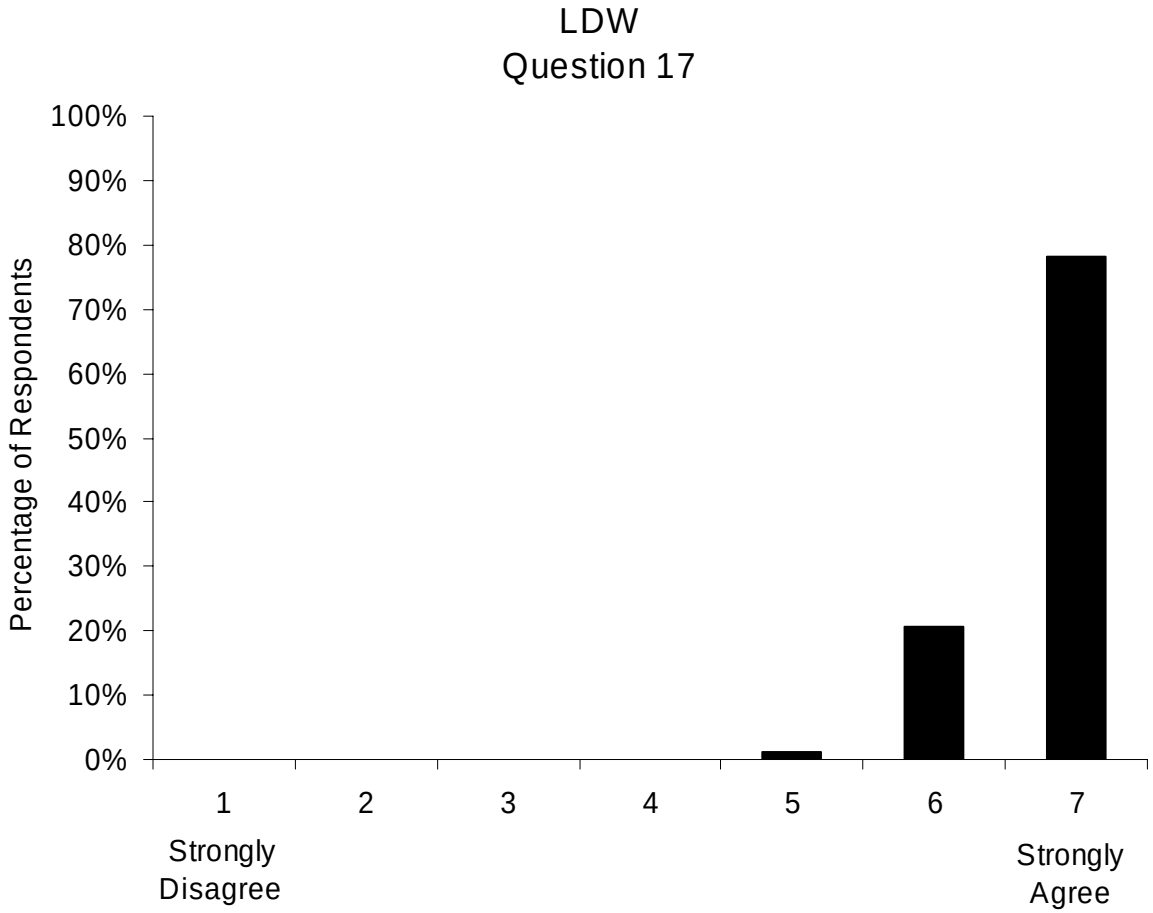
16. If passengers did comment on the auditory LDW warnings, what kinds of comments were made?

_____

_____

_____

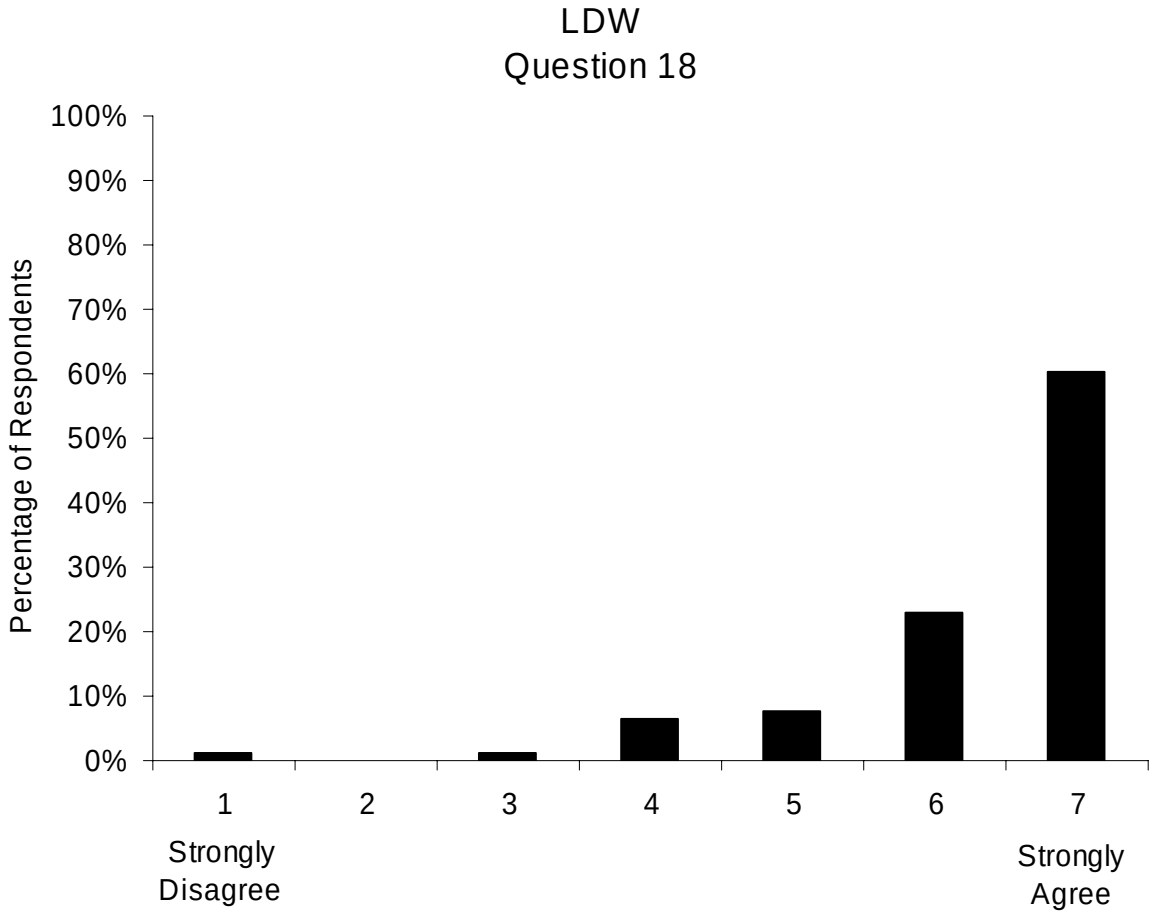
17. The LDW seat vibration warnings got my attention.



	Males	Females	Overall
Younger (20-30)	6.5 (0.7)	6.8 (0.4)	6.7 (0.5)
Middle-Aged (40-50)	6.8 (0.4)	6.8 (0.4)	6.8 (0.4)
Older (60-70)	6.8 (0.4)	6.8 (0.4)	6.8 (0.4)
Overall	6.7 (0.5)	6.8 (0.4)	6.8 (0.5)

Values in cells represent the mean response and (standard deviation)

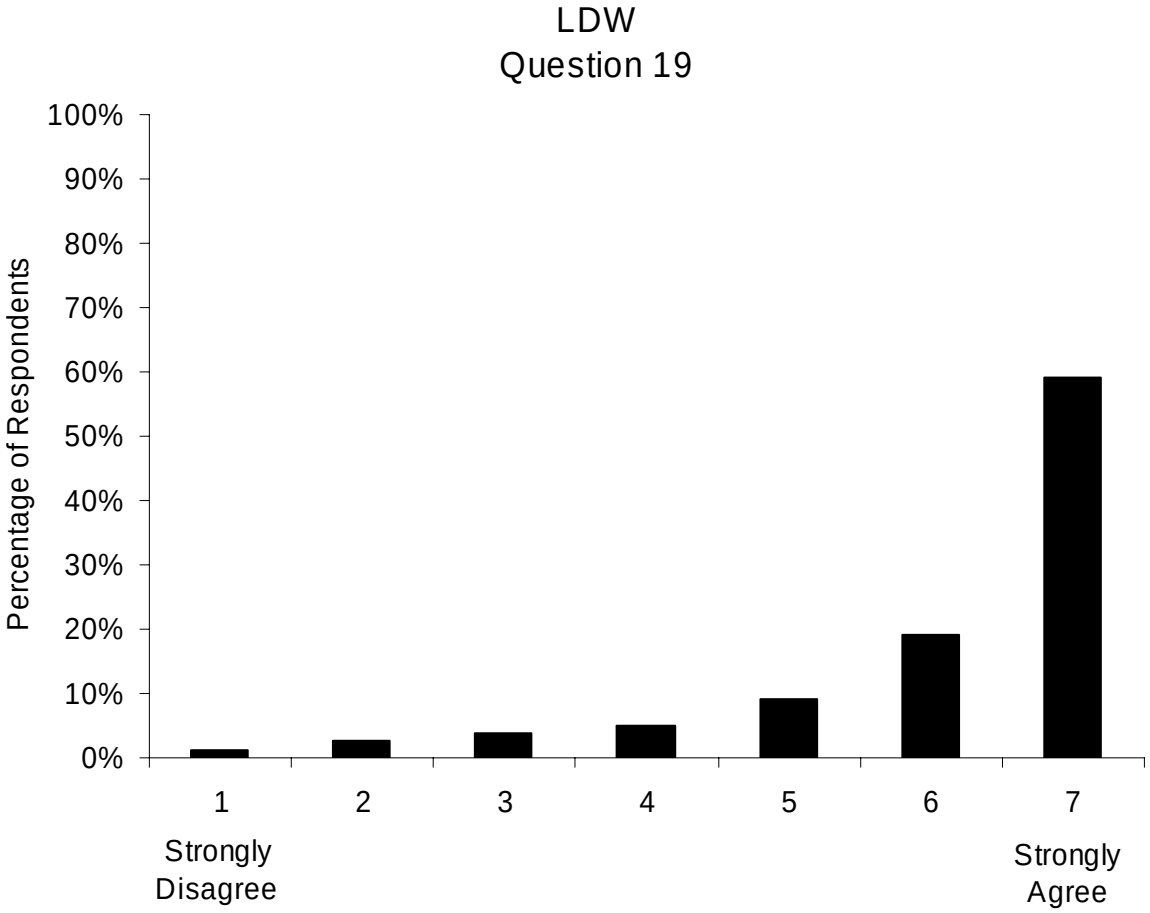
18. I knew what to do when I felt the LDW seat vibration warnings.



	Males	Females	Overall
Younger (20-30)	5.8 (1.4)	6.3 (1.1)	6.0 (1.3)
Middle-Aged (40-50)	6.0 (1.7)	6.5 (0.7)	6.3 (1.3)
Older (60-70)	6.5 (0.9)	6.6 (0.7)	6.6 (0.8)
Overall	6.1 (1.4)	6.5 (0.8)	6.3 (1.1)

Values in cells represent the mean response and (standard deviation)

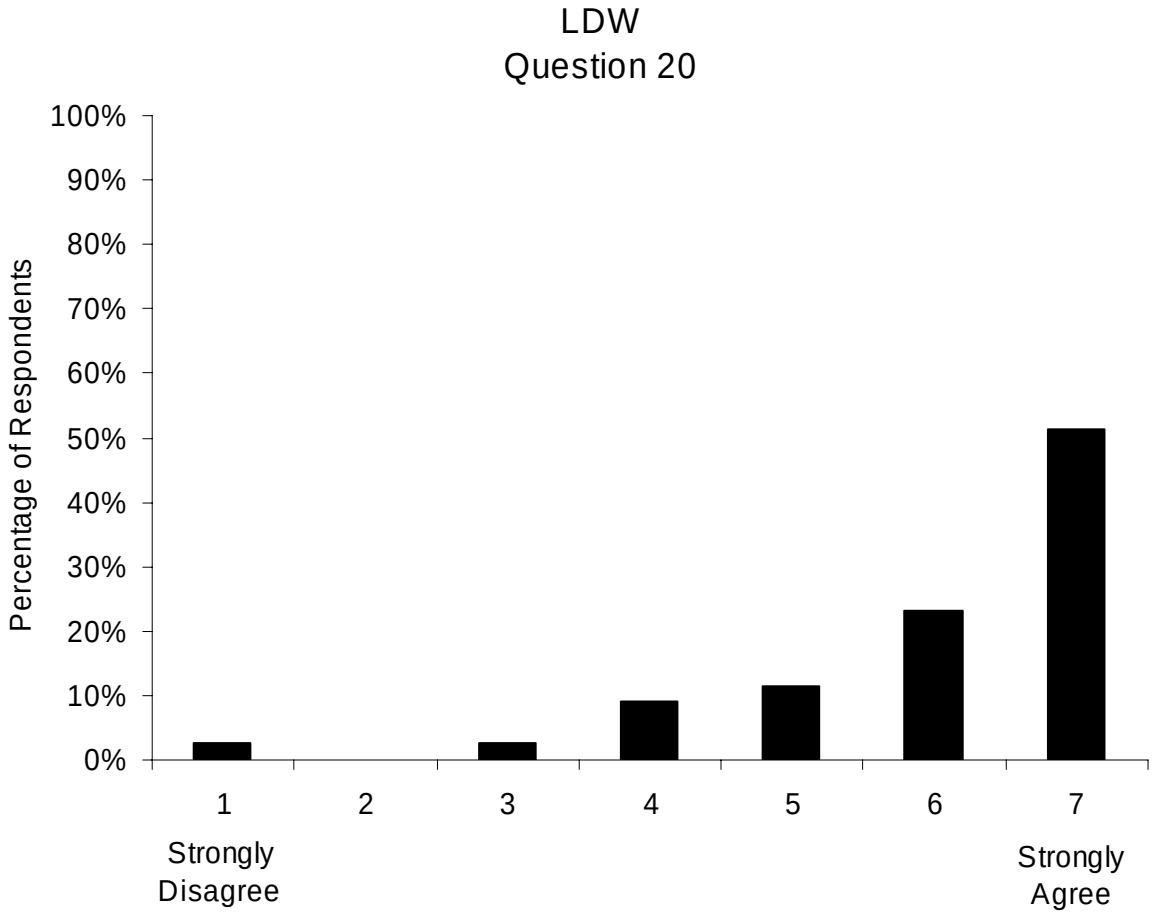
19. I could easily recognize under which leg the LDW seat vibration warnings were being presented (under my left leg or my right leg).



	Males	Females	Overall
Younger (20-30)	5.4 (2.0)	6.1 (1.9)	5.7 (1.9)
Middle-Aged (40-50)	6.3 (0.9)	6.2 (1.1)	6.2 (1.0)
Older (60-70)	6.1 (1.3)	6.7 (0.6)	6.4 (1.0)
Overall	5.9 (1.5)	6.3 (1.3)	6.1 (1.4)

Values in cells represent the mean response and (standard deviation)

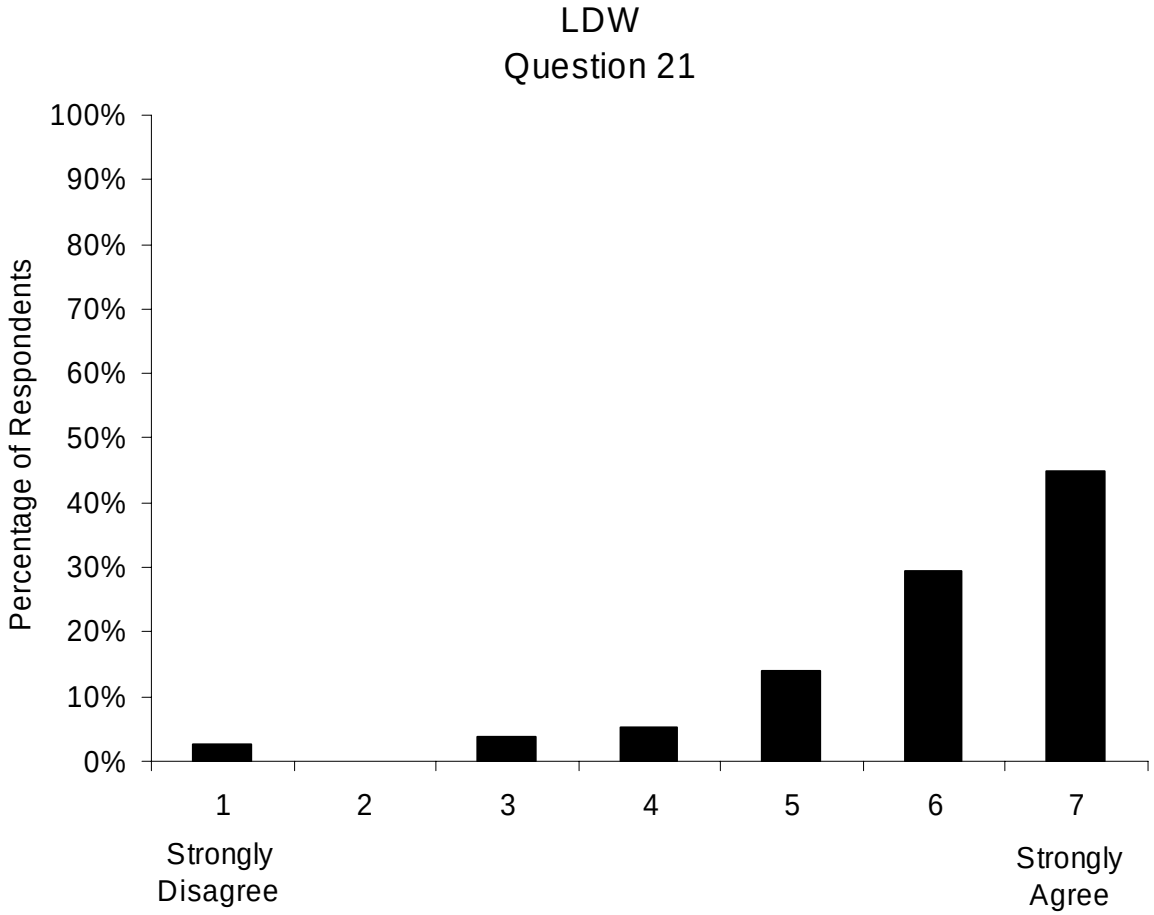
20. The LDW seat vibration warnings were not distracting.



	Males	Females	Overall
Younger (20-30)	5.6 (1.8)	5.8 (1.8)	5.7 (1.8)
Middle-Aged (40-50)	6.0 (1.4)	5.5 (1.3)	5.7 (1.3)
Older (60-70)	6.6 (0.7)	6.5 (0.7)	6.6 (0.6)
Overall	6.1 (1.4)	5.9 (1.4)	6.0 (1.4)

Values in cells represent the mean response and (standard deviation)

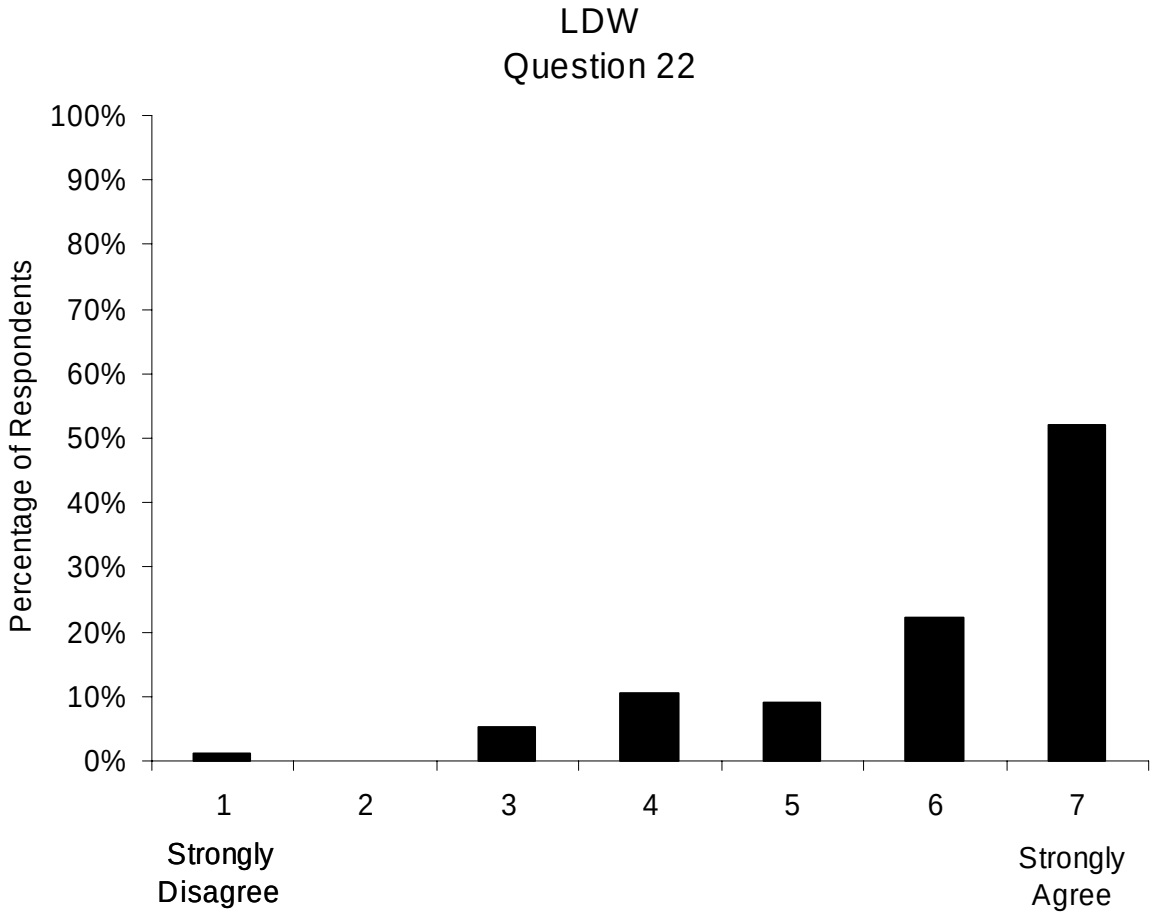
21. The frequency with which I received LDW seat vibration warnings was not annoying.



	Males	Females	Overall
Younger (20-30)	5.6 (1.8)	5.7 (1.8)	5.7 (1.8)
Middle-Aged (40-50)	5.9 (1.3)	5.5 (1.3)	5.7 (1.3)
Older (60-70)	6.5 (0.7)	6.5 (0.7)	6.5 (0.6)
Overall	6.0 (1.3)	5.9 (1.4)	6.0 (1.3)

Values in cells represent the mean response and (standard deviation)

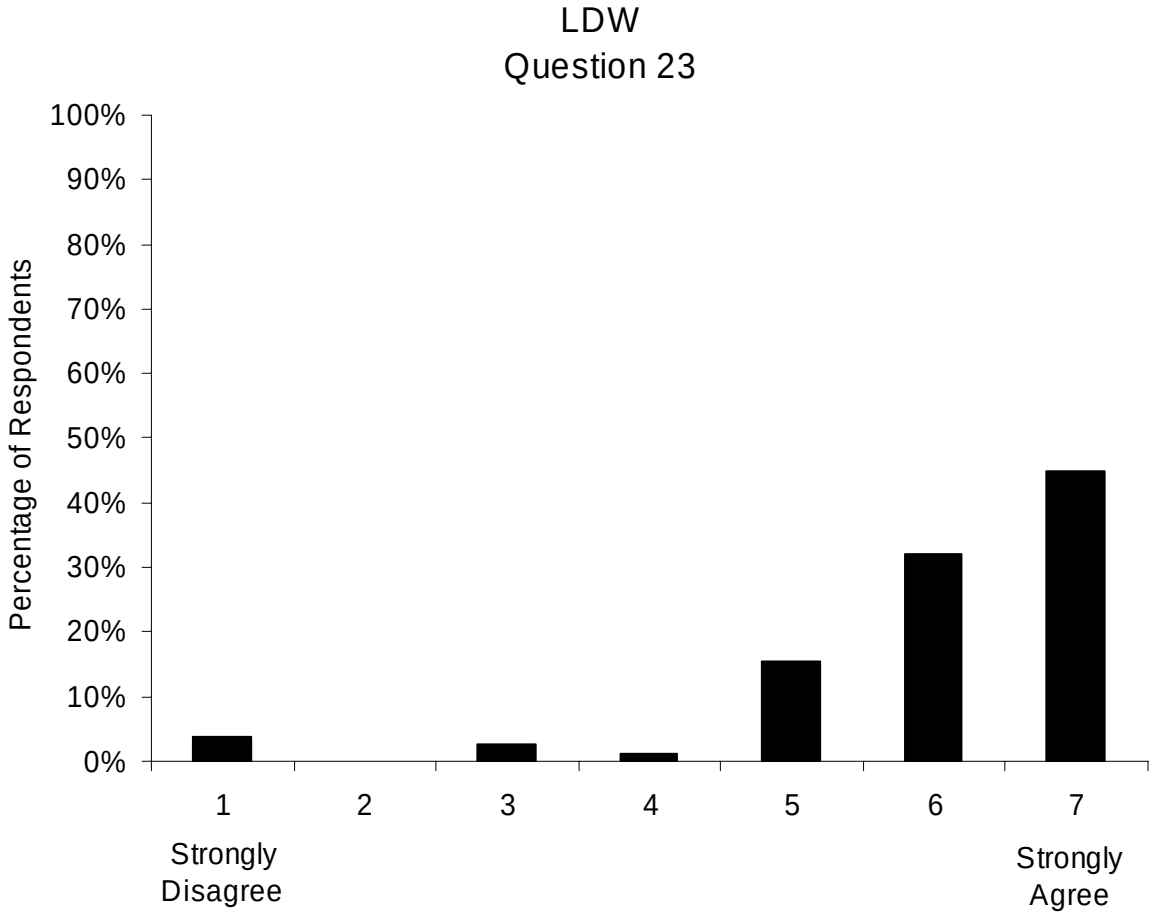
22. Passengers in the car did not notice the LDW seat vibration warnings when they occurred.



	Males	Females	Overall
Younger (20-30)	5.5 (1.3)	6.0 (1.5)	5.8 (1.4)
Middle-Aged (40-50)	5.9 (1.8)	6.3 (1.2)	6.1 (1.5)
Older (60-70)	5.8 (1.4)	6.5 (0.8)	6.1 (1.2)
Overall	5.7 (1.5)	6.3 (1.2)	6.0 (1.4)

Values in cells represent the mean response and (standard deviation)

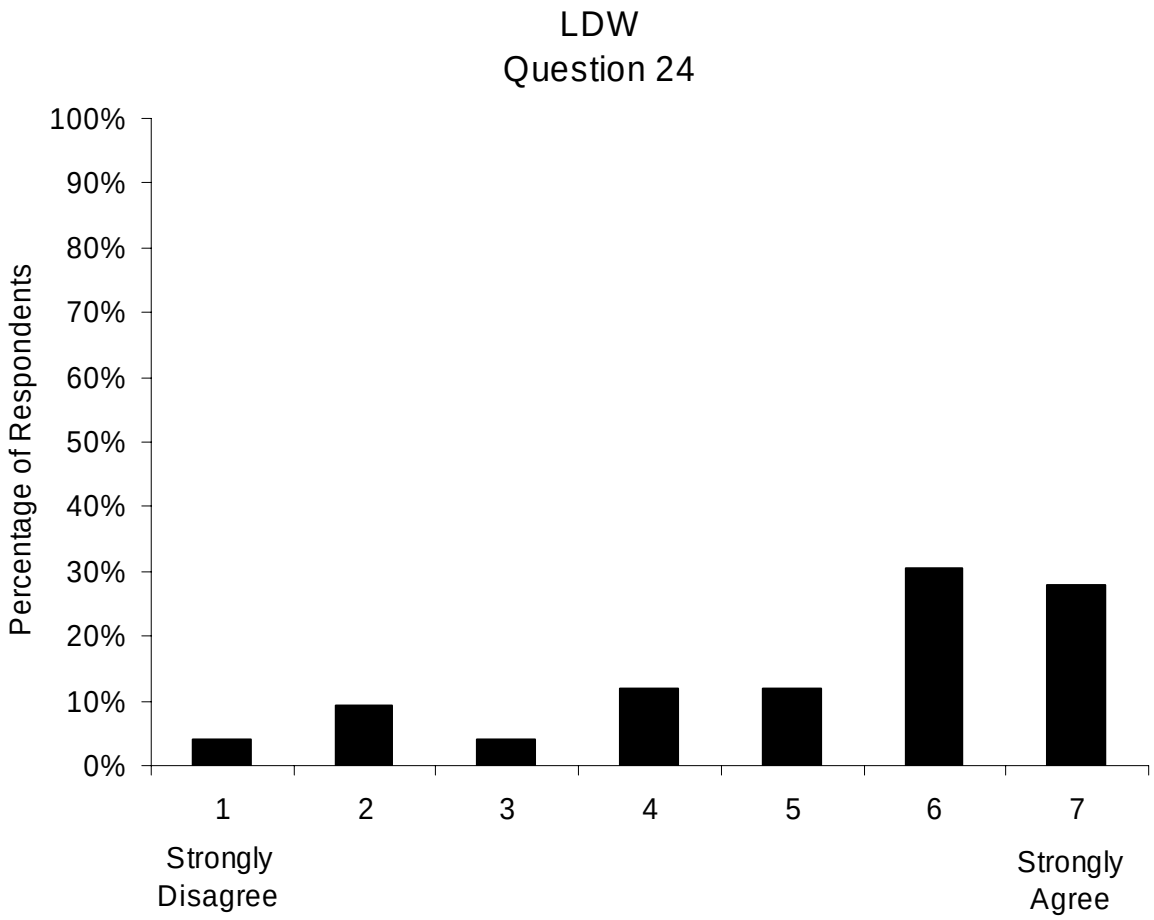
23. Overall, I could easily identify the urgency of the LDW warnings.



	Males	Females	Overall
Younger (20-30)	5.8 (1.2)	5.6 (1.7)	5.7 (1.4)
Middle-Aged (40-50)	5.2 (2.2)	6.5 (0.7)	5.8 (1.7)
Older (60-70)	6.5 (0.7)	6.5 (0.7)	6.5 (0.6)
Overall	5.8 (1.6)	6.2 (1.1)	6.0 (1.4)

Values in cells represent the mean response and (standard deviation)

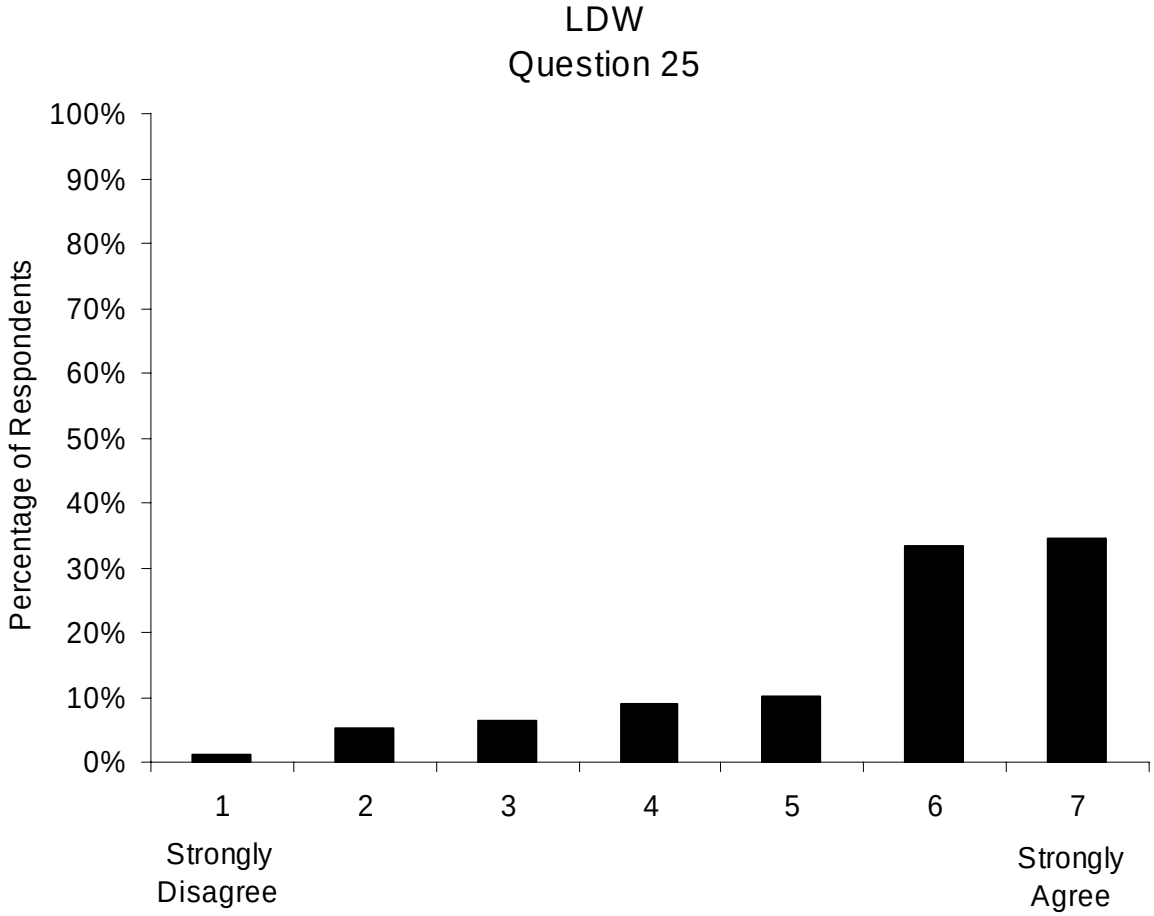
24. Overall, I thought the LDW auditory warnings were provided at the right time (i.e., they were not presented too early or too late).



	Males	Females	Overall
Younger (20-30)	5.0 (1.7)	5.2 (1.8)	5.1 (1.7)
Middle-Aged (40-50)	5.2 (2.1)	5.4 (1.6)	5.3 (1.8)
Older (60-70)	5.2 (2.0)	5.3 (1.8)	5.3 (1.9)
Overall	5.1 (1.9)	5.3 (1.7)	5.2 (1.8)

Values in cells represent the mean response and (standard deviation)

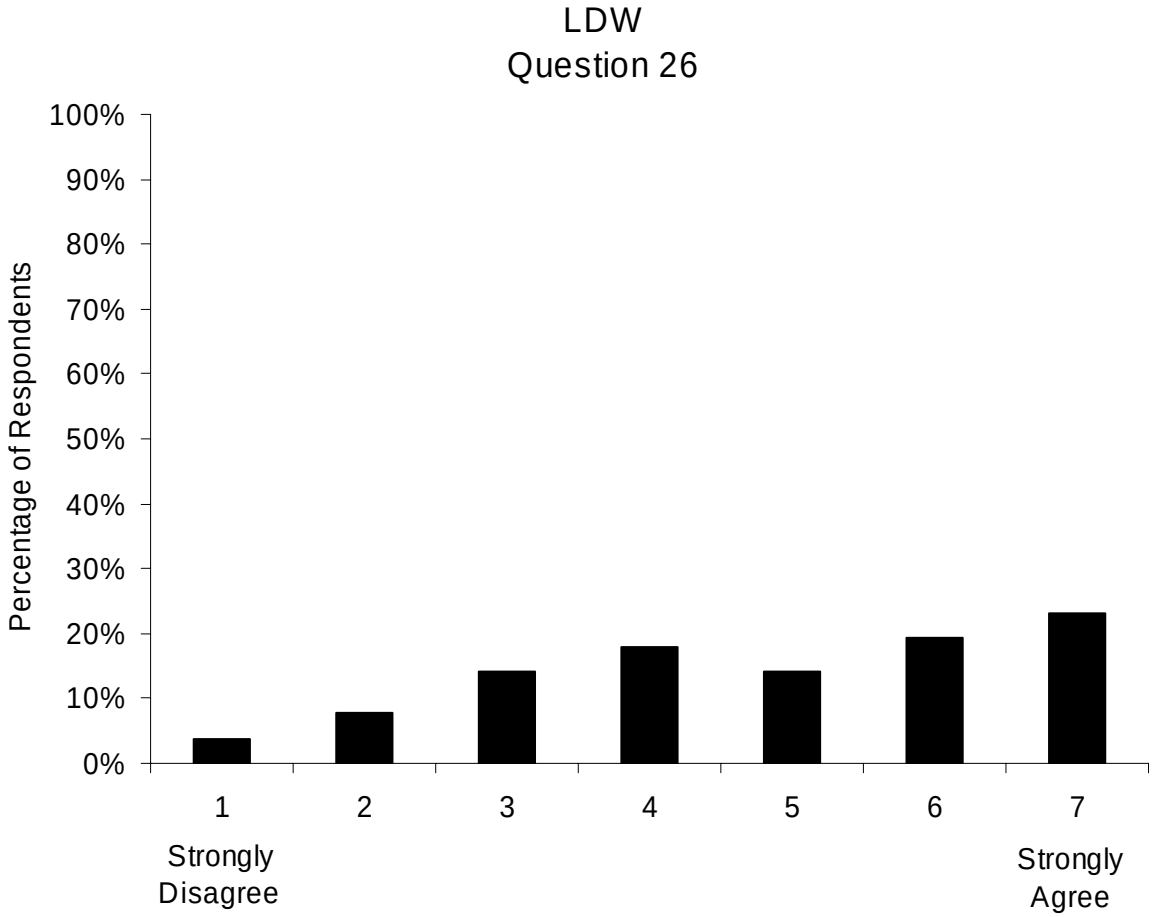
25. Overall, I thought the LDW seat vibration warnings were provided at the right time (i.e., they were not presented too early or too late).



	Males	Females	Overall
Younger (20-30)	5.2 (1.5)	5.3 (2.0)	5.3 (1.7)
Middle-Aged (40-50)	5.8 (1.5)	5.5 (1.4)	5.7 (1.4)
Older (60-70)	5.6 (1.8)	6.2 (1.1)	5.9 (1.5)
Overall	5.6 (1.6)	5.6 (1.5)	5.6 (1.5)

Values in cells represent the mean response and (standard deviation)

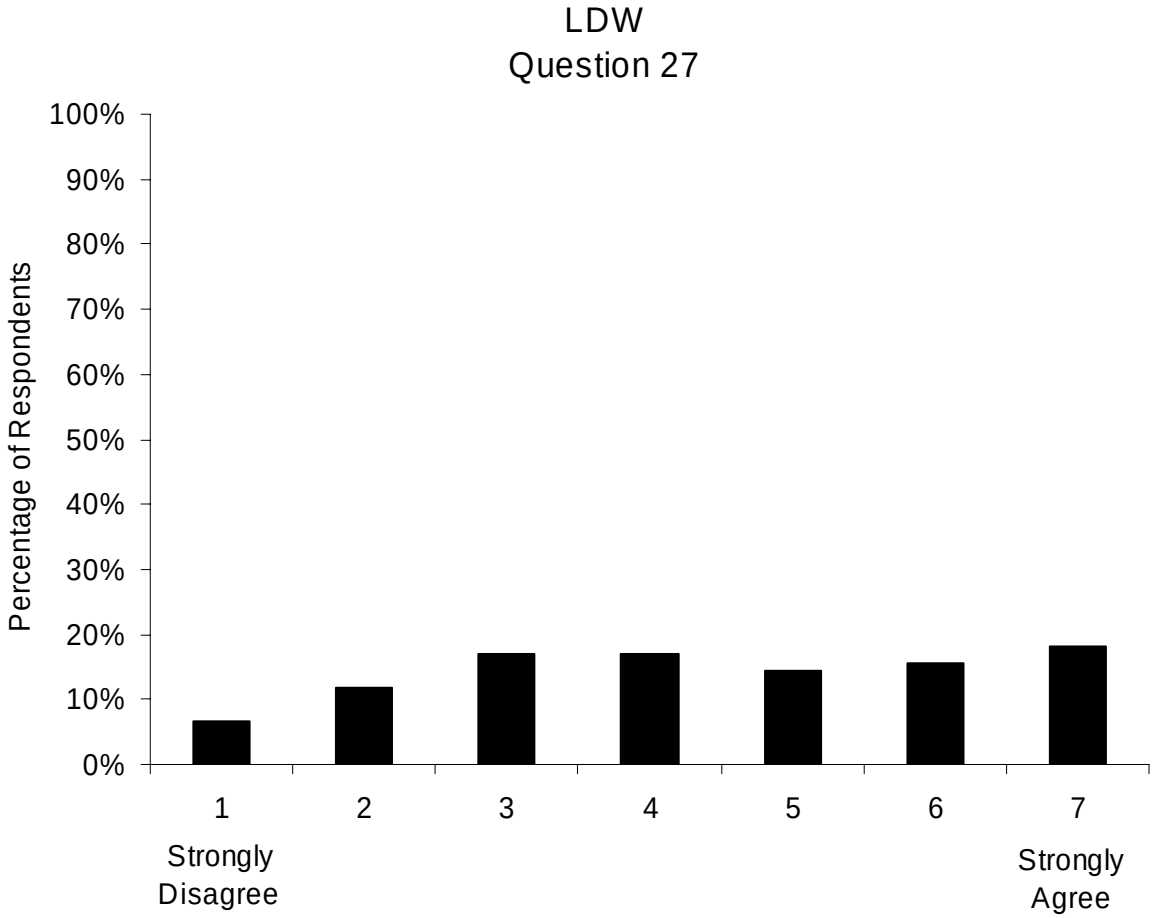
26. I always understood why the LDW system was providing a warning.



	Males	Females	Overall
Younger (20-30)	4.5 (1.8)	5.0 (1.8)	4.7 (1.8)
Middle-Aged (40-50)	4.6 (2.4)	4.4 (1.6)	4.5 (2.0)
Older (60-70)	5.1 (1.8)	5.3 (1.4)	5.2 (1.6)
Overall	4.7 (2.0)	4.9 (1.6)	4.8 (1.8)

Values in cells represent the mean response and (standard deviation)

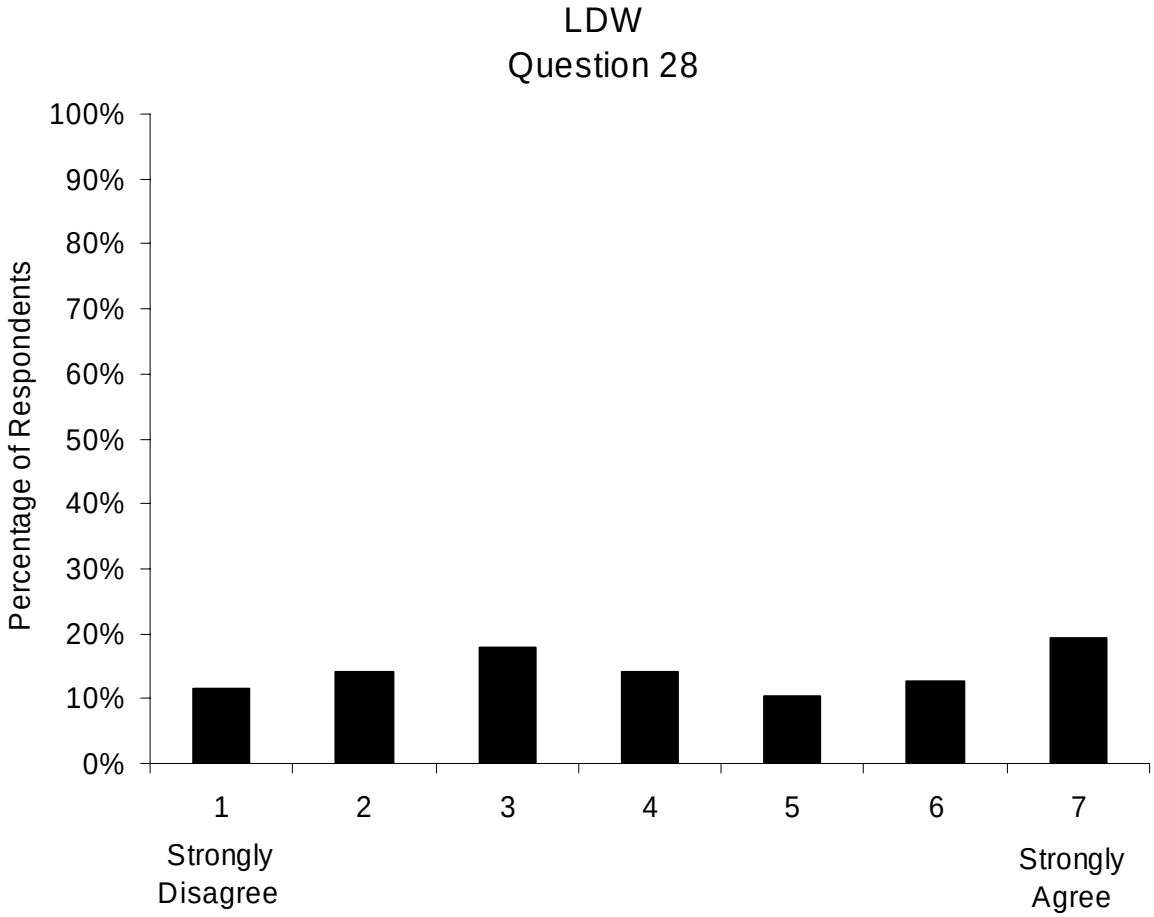
27. The LDW always provided a warning when I thought it should.



	Males	Females	Overall
Younger (20-30)	3.8 (1.5)	4.3 (2.0)	4.0 (1.8)
Middle-Aged (40-50)	4.4 (2.4)	4.5 (1.6)	4.4 (2.0)
Older (60-70)	4.7 (1.9)	4.8 (1.9)	4.8 (1.9)
Overall	4.3 (1.9)	4.5 (1.8)	4.4 (1.9)

Values in cells represent the mean response and (standard deviation)

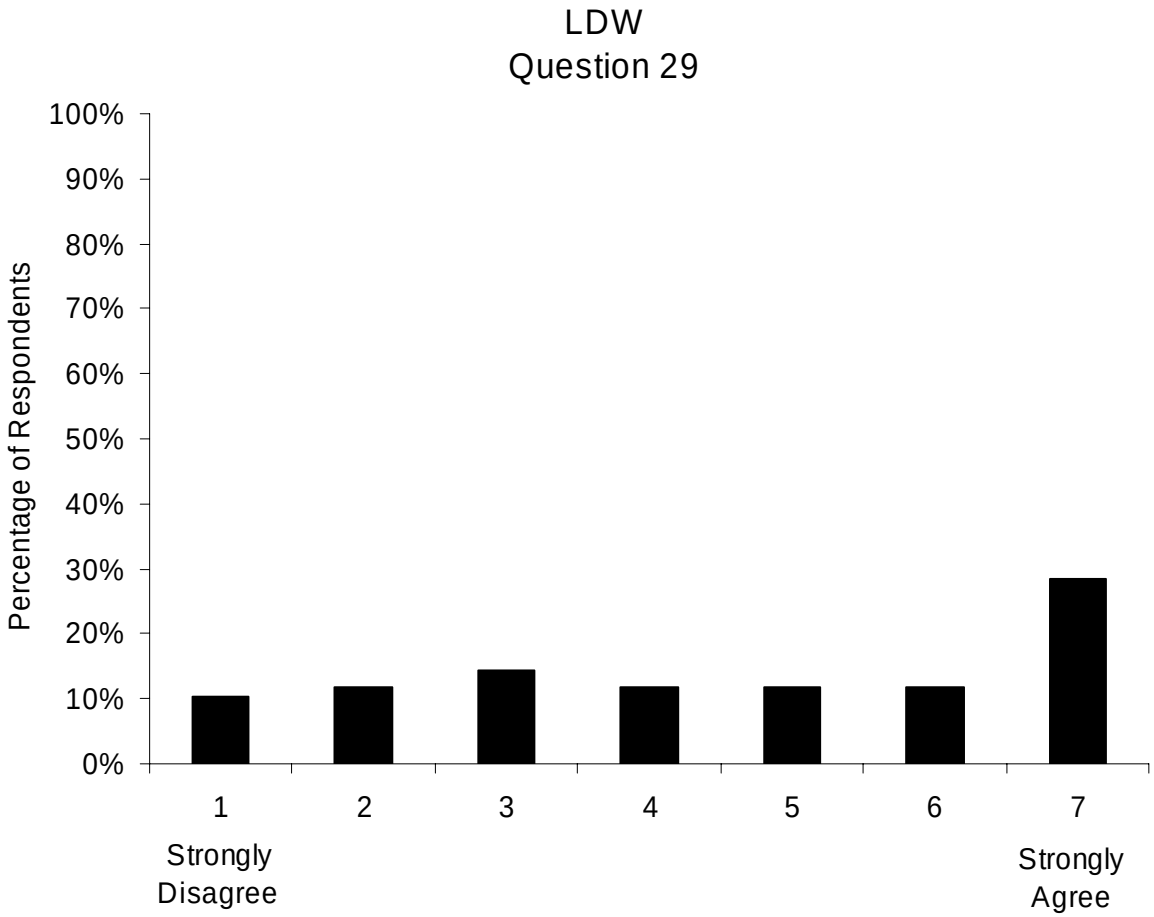
28. I did not receive any unnecessary LDW warnings.



	Males	Females	Overall
Younger (20-30)	4.1 (2.1)	4.6 (2.1)	4.3 (2.1)
Middle-Aged (40-50)	4.8 (2.2)	3.1 (2.2)	3.9 (2.3)
Older (60-70)	4.0 (1.7)	4.2 (1.9)	4.1 (1.8)
Overall	4.3 (2.0)	4.0 (2.1)	4.1 (2.0)

Values in cells represent the mean response and (standard deviation)

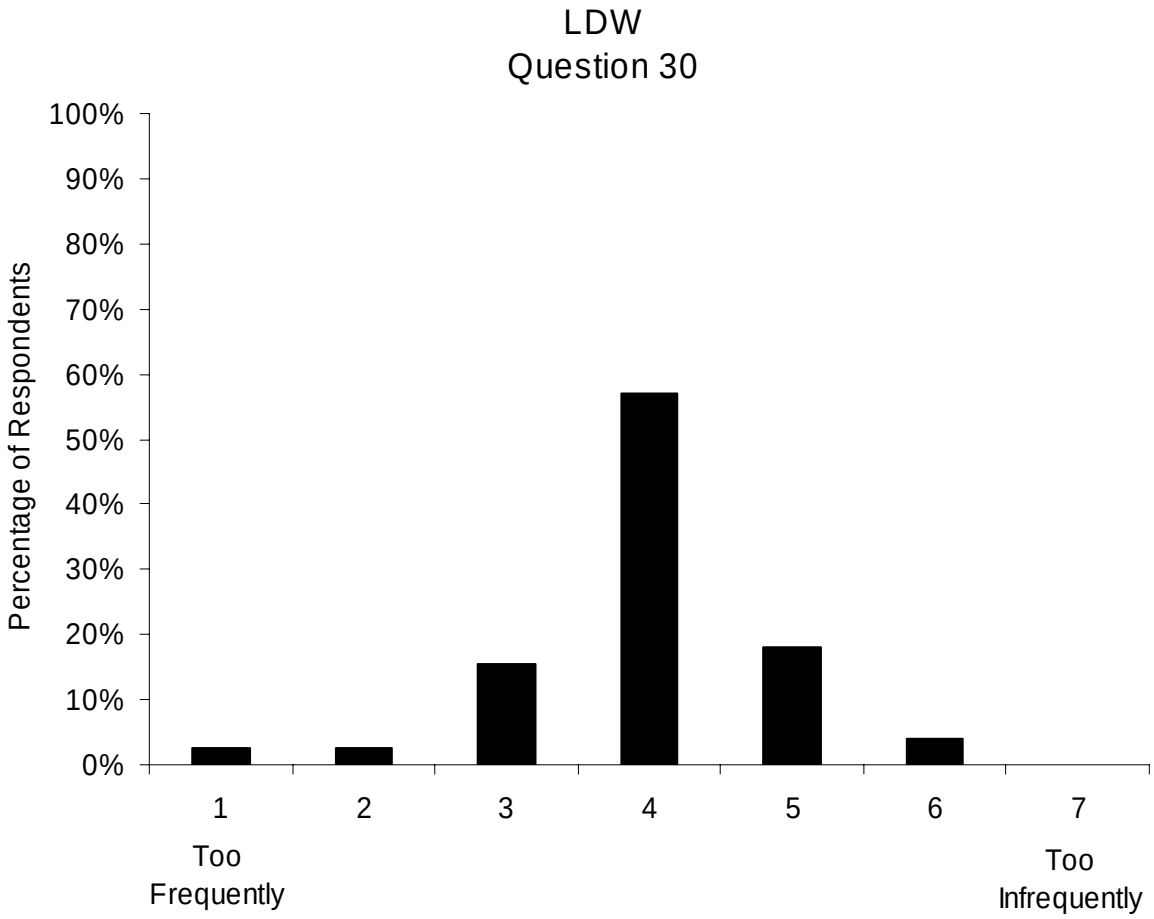
29. I did not receive any false LDW warnings.



	Males	Females	Overall
Younger (20-30)	3.7 (2.1)	5.0 (2.2)	4.3 (2.2)
Middle-Aged (40-50)	4.6 (2.3)	4.5 (2.1)	4.5 (2.2)
Older (60-70)	3.8 (1.8)	5.6 (2.0)	4.7 (2.1)
Overall	4.1 (2.1)	5.0 (2.1)	4.5 (2.1)

Values in cells represent the mean response and (standard deviation)

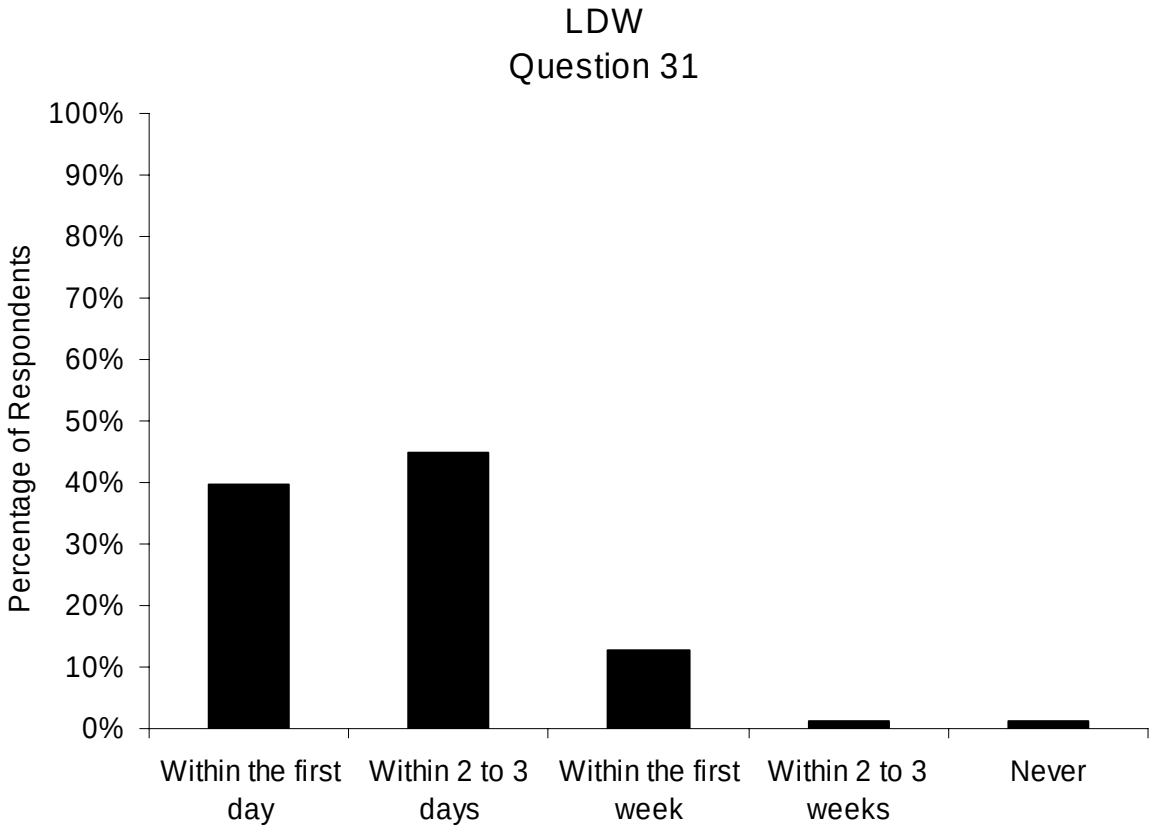
30. Overall, I received LDW warnings . . . . . .



	Males	Females	Overall
Younger (20-30)	3.5 (0.7)	3.9 (1.1)	3.7 (0.9)
Middle-Aged (40-50)	4.0 (1.2)	3.8 (0.9)	3.9 (1.1)
Older (60-70)	4.3 (0.5)	4.3 (0.8)	4.3 (0.6)
Overall	3.9 (0.9)	4.0 (0.9)	4.0 (0.9)

Values in cells represent the mean response and (standard deviation)

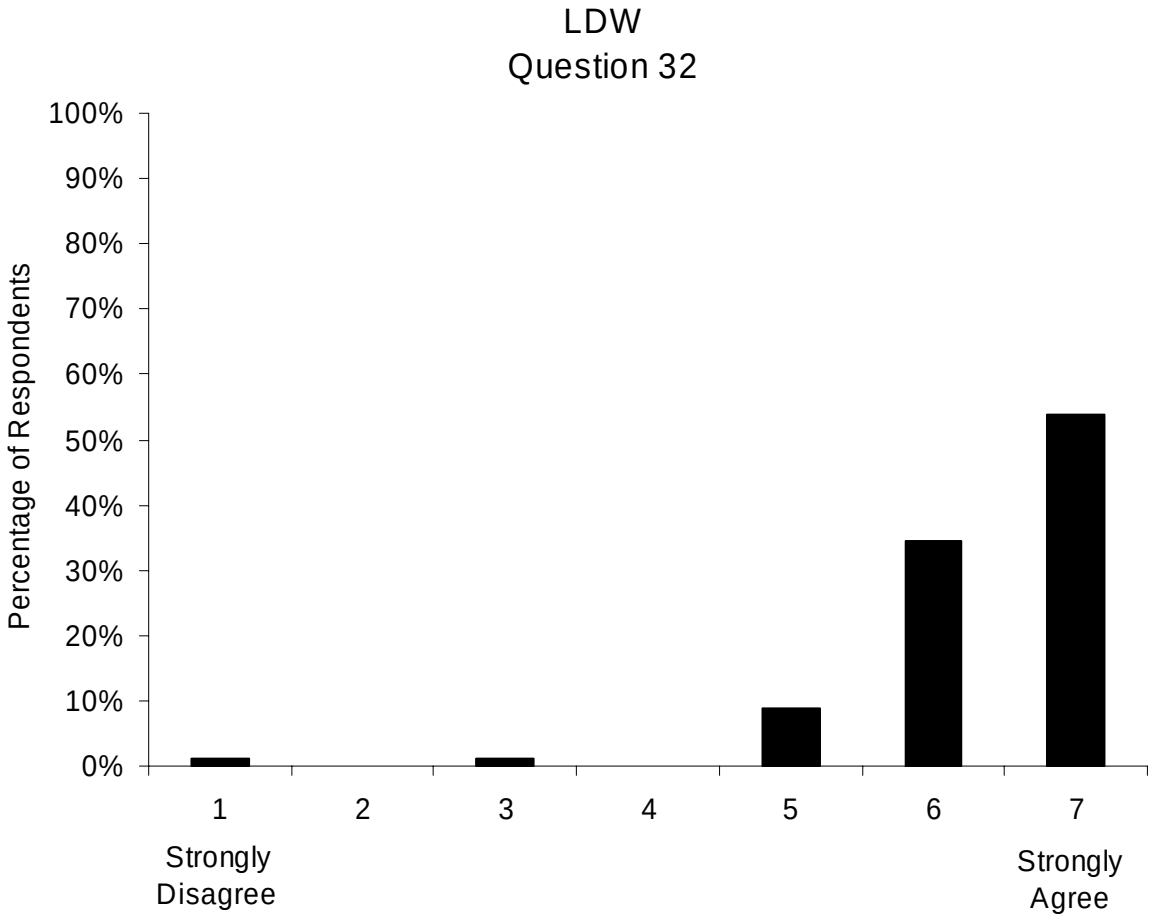
31. How long did it take before you became comfortable driving the car with LDW? (check one)



	Males	Females	Overall
Younger (20-30)	1.8 (1.2)	2.1 (1.0)	1.9 (1.1)
Middle-Aged (40-50)	1.7 (0.9)	1.8 (0.7)	1.8 (0.8)
Older (60-70)	1.6 (0.5)	1.8 (0.6)	1.7 (0.5)
Overall	1.7 (0.9)	1.9 (0.8)	1.8 (0.8)

Values in cells represent the mean response and (standard deviation)

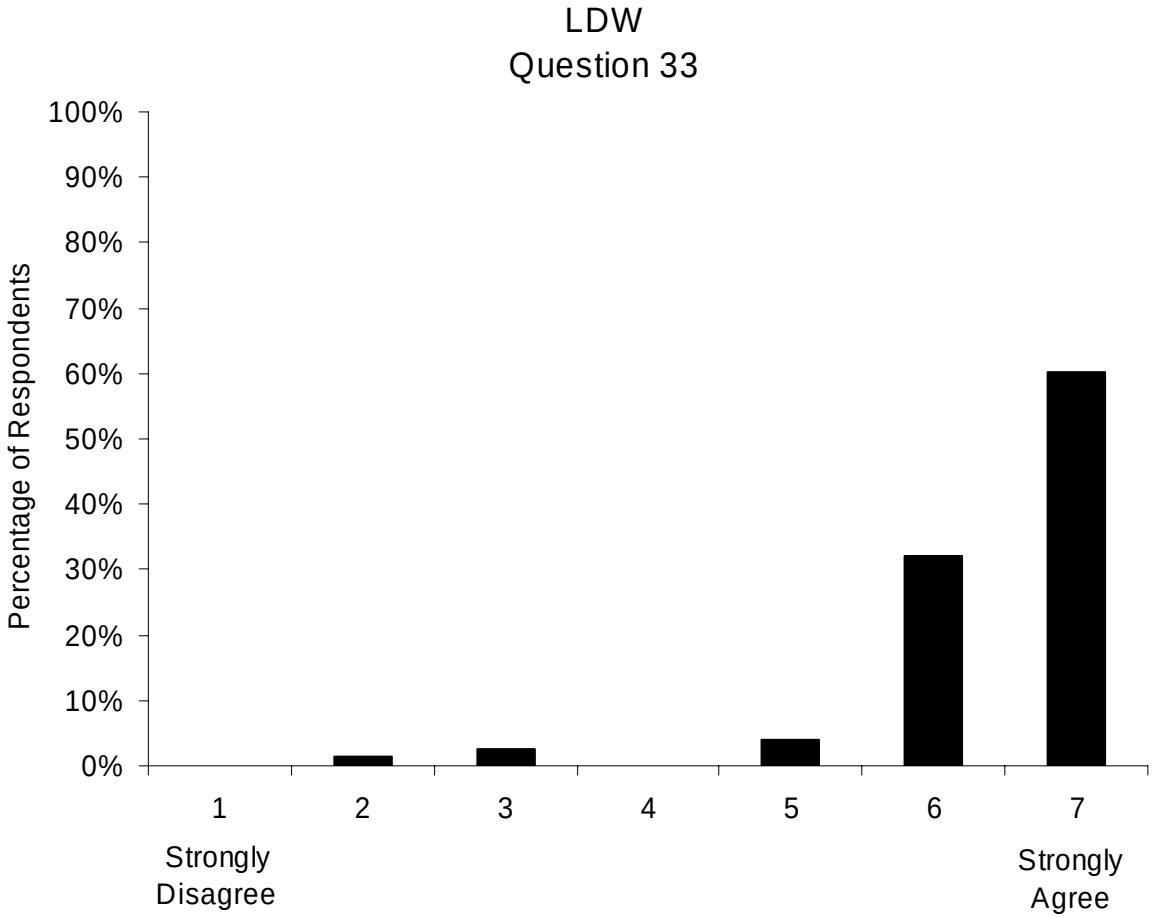
32. Overall, it was easy to become familiar with the LDW system.



	Males	Females	Overall
Younger (20-30)	6.1 (1.3)	6.2 (1.6)	6.2 (1.4)
Middle-Aged (40-50)	6.5 (0.7)	6.3 (0.8)	6.4 (0.7)
Older (60-70)	6.6 (0.7)	6.4 (0.5)	6.5 (0.6)
Overall	6.4 (0.9)	6.3 (1.1)	6.3 (1.0)

Values in cells represent the mean response and (standard deviation)

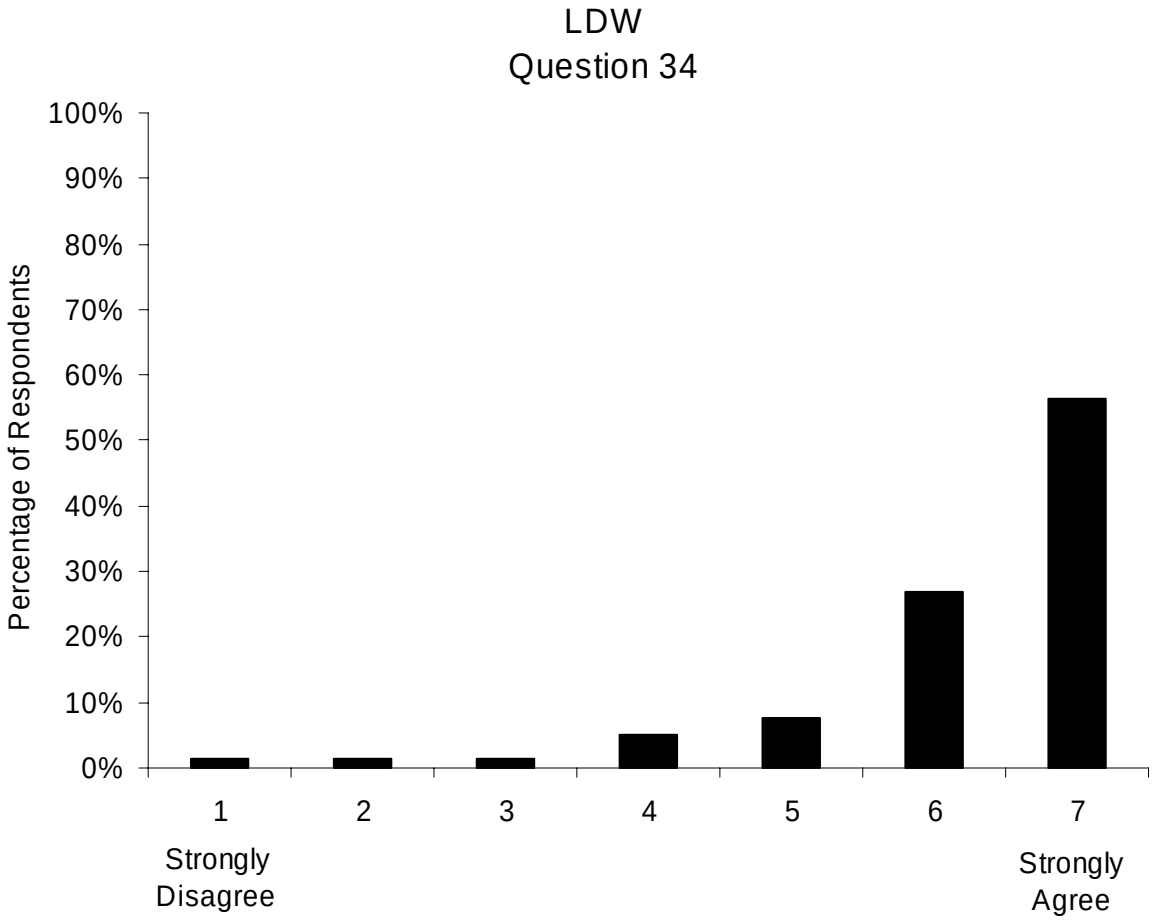
33. I developed a good understanding of how the LDW system worked after hearing a brief description, and after I had the chance to drive with the system.



	Males	Females	Overall
Younger (20-30)	6.2 (1.5)	6.3 (1.4)	6.3 (1.4)
Middle-Aged (40-50)	6.5 (0.7)	6.6 (0.7)	6.5 (0.6)
Older (60-70)	6.6 (0.5)	6.4 (0.5)	6.5 (0.5)
Overall	6.4 (1.0)	6.4 (0.9)	6.4 (0.9)

Values in cells represent the mean response and (standard deviation)

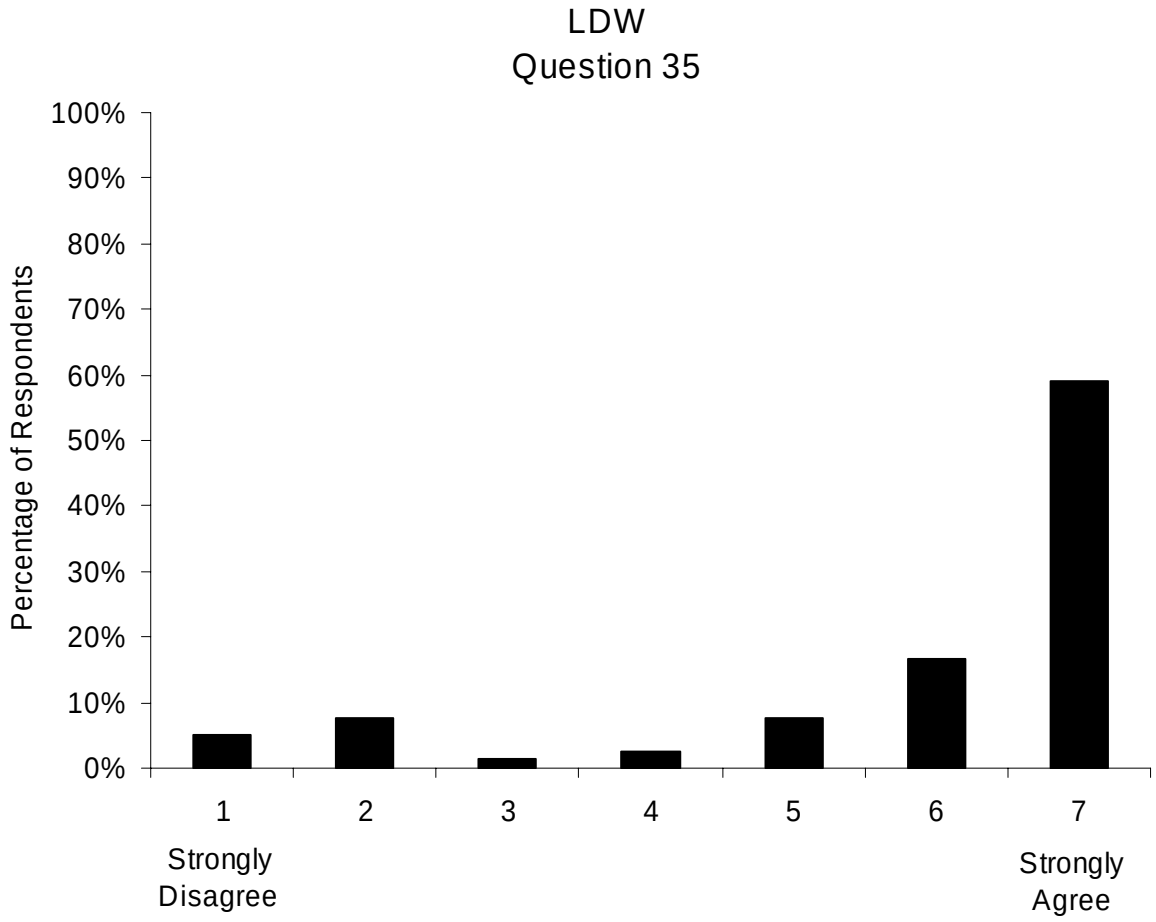
34. Driving with the LDW system made me more aware of the position of my car on the road.



	Males	Females	Overall
Younger (20-30)	5.3 (1.5)	6.7 (0.6)	6.0 (1.3)
Middle-Aged (40-50)	6.4 (1.7)	6.5 (0.7)	6.4 (1.2)
Older (60-70)	6.3 (0.9)	6.2 (1.2)	6.3 (1.0)
Overall	6.0 (1.5)	6.5 (0.9)	6.2 (1.2)

Values in cells represent the mean response and (standard deviation)

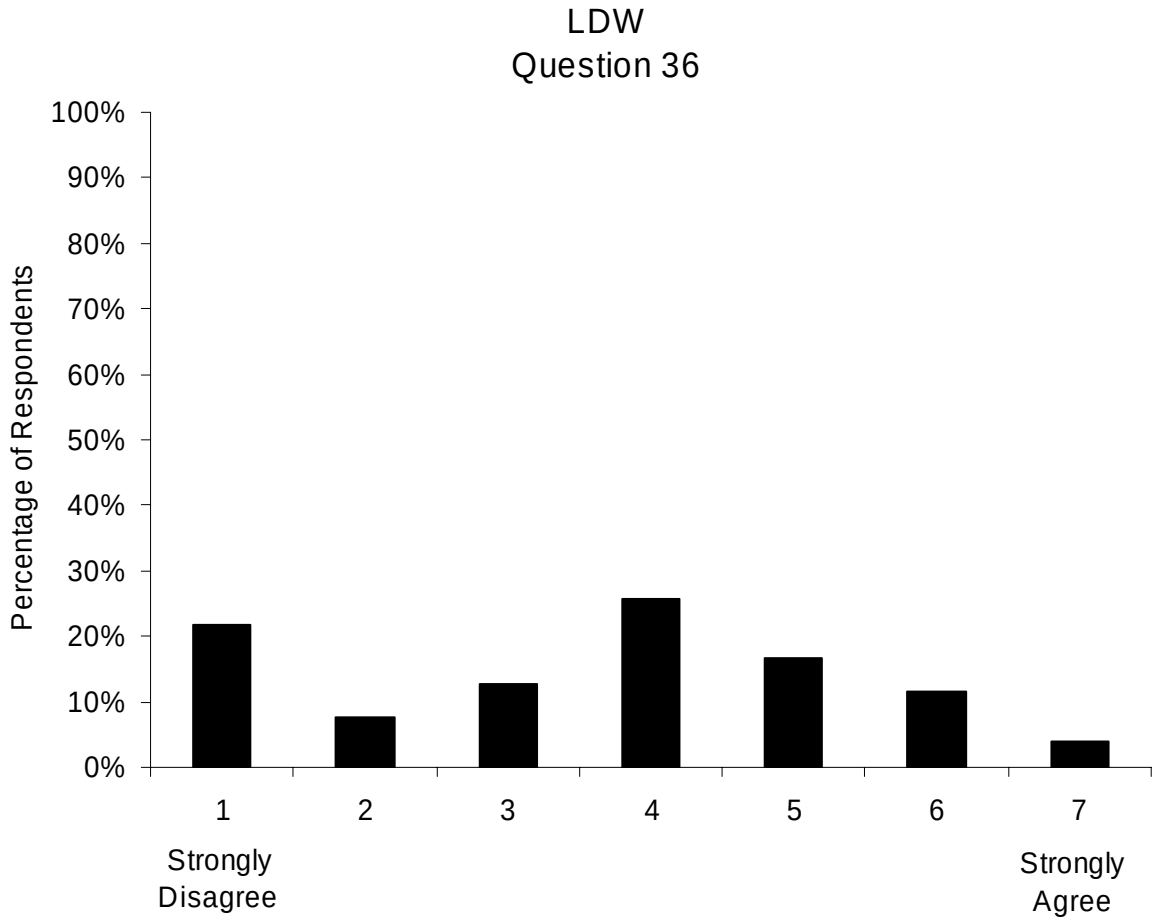
35. The LDW system made me more attentive to using my turn signals when changing lanes.



	Males	Females	Overall
Younger (20-30)	5.2 (1.7)	6.6 (0.9)	5.9 (1.5)
Middle-Aged (40-50)	5.4 (2.5)	4.8 (2.6)	5.1 (2.5)
Older (60-70)	6.8 (0.4)	6.3 (1.1)	6.6 (0.9)
Overall	5.8 (1.9)	5.9 (1.8)	5.9 (1.8)

Values in cells represent the mean response and (standard deviation)

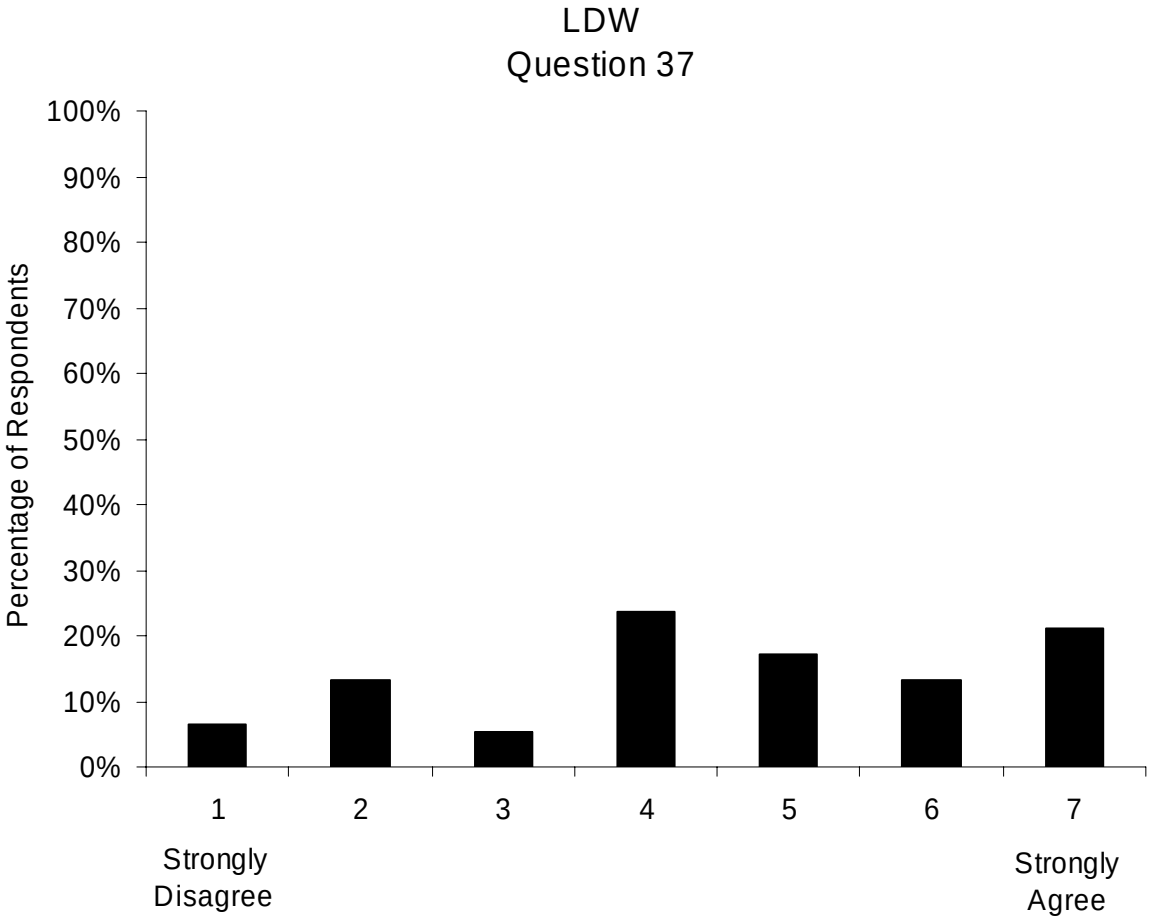
36. I relied on the LDW system.



	Males	Females	Overall
Younger (20-30)	2.6 (1.2)	3.9 (2.1)	3.3 (1.8)
Middle-Aged (40-50)	2.8 (1.9)	3.9 (2.1)	3.4 (2.0)
Older (60-70)	4.3 (1.2)	3.8 (1.7)	4.1 (1.4)
Overall	3.3 (1.6)	3.9 (1.9)	3.6 (1.8)

Values in cells represent the mean response and (standard deviation)

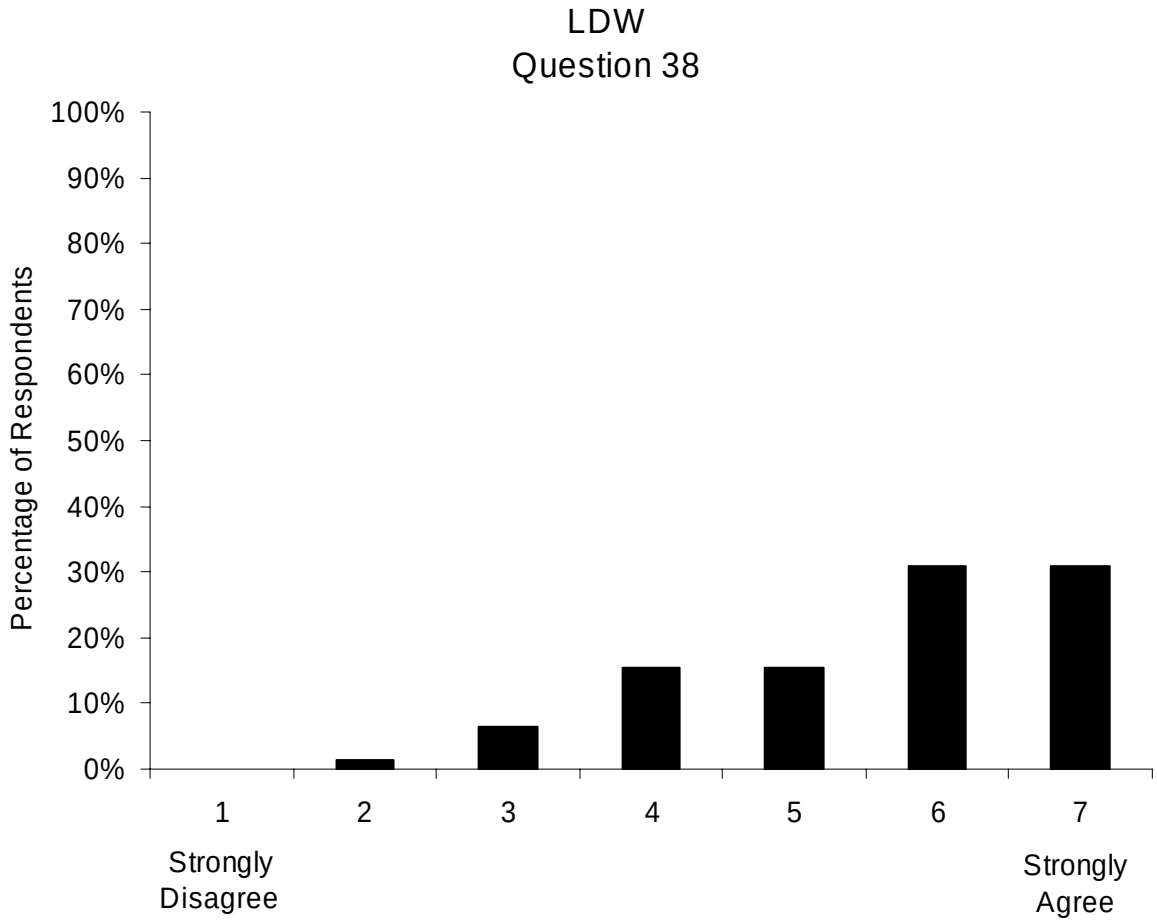
37. I found the LDW system useful in providing warnings about situations that might have resulted in collisions.



	Males	Females	Overall
Younger (20-30)	3.7 (1.4)	4.7 (1.9)	4.2 (1.7)
Middle-Aged (40-50)	4.1 (2.4)	4.7 (2.0)	4.4 (2.2)
Older (60-70)	5.1 (1.4)	5.2 (1.9)	5.1 (1.6)
Overall	4.3 (1.8)	4.8 (1.9)	4.6 (1.9)

Values in cells represent the mean response and (standard deviation)

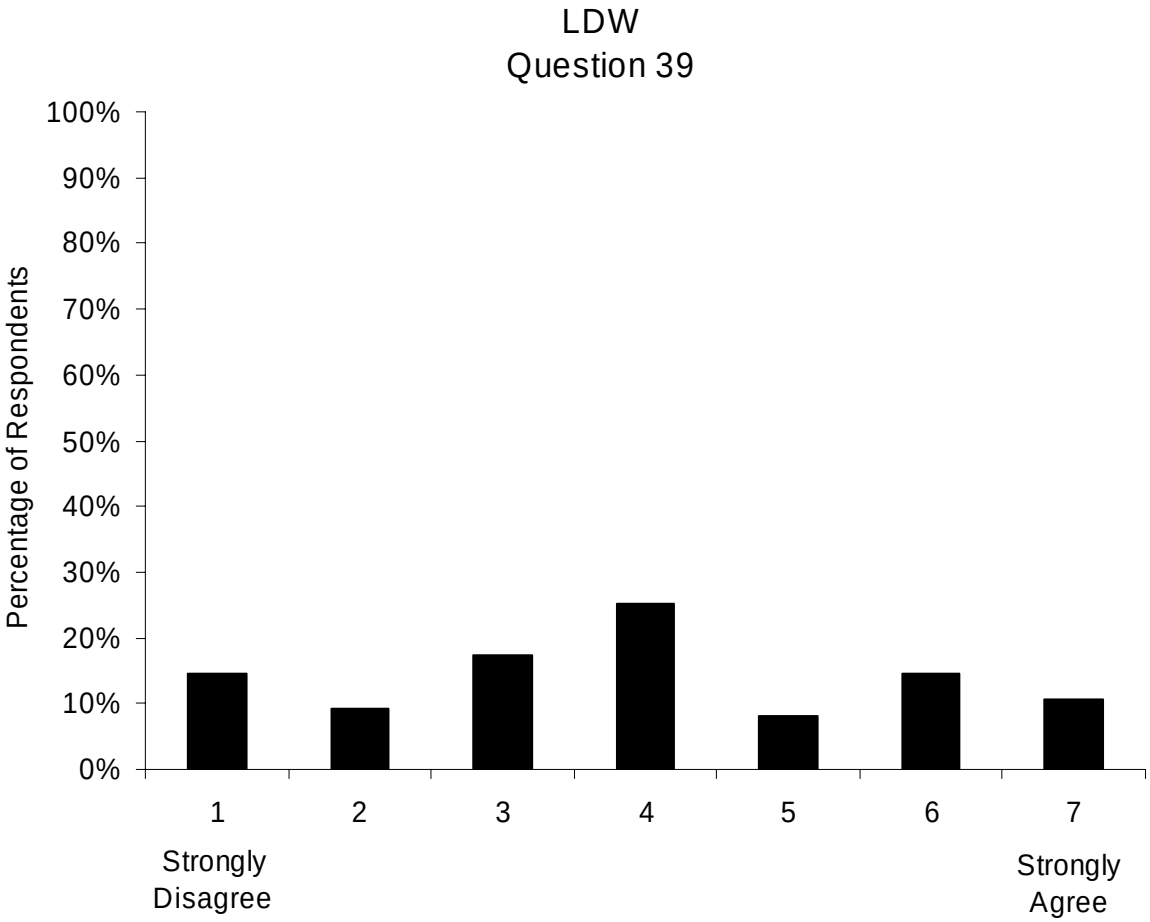
38. LDW is going to increase driving safety.



	Males	Females	Overall
Younger (20-30)	5.2 (1.1)	5.4 (1.6)	5.3 (1.3)
Middle-Aged (40-50)	5.7 (1.6)	5.5 (1.5)	5.6 (1.5)
Older (60-70)	6.3 (0.6)	5.5 (1.2)	5.9 (1.0)
Overall	5.7 (1.2)	5.5 (1.4)	5.6 (1.3)

Values in cells represent the mean response and (standard deviation)

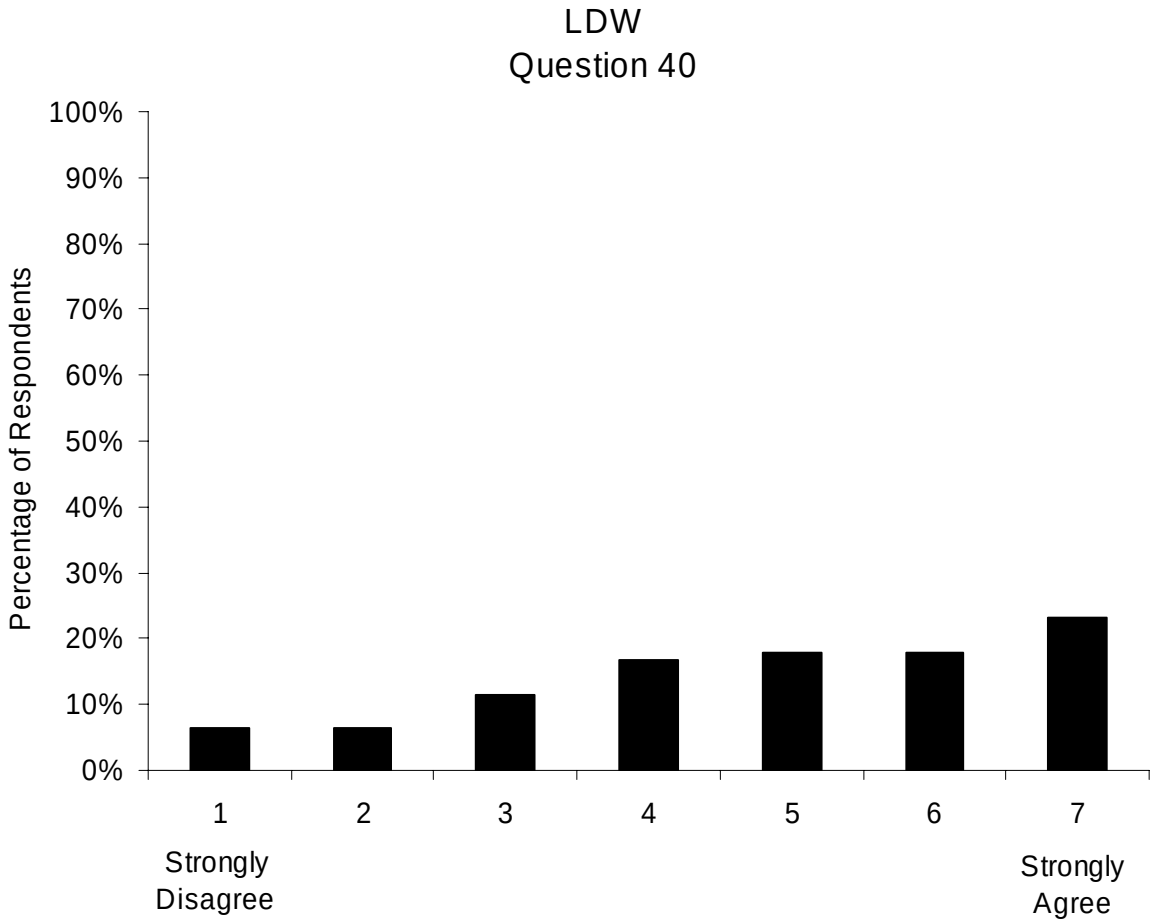
39. I found the LDW system useful in adverse weather conditions.



	Males	Females	Overall
Younger (20-30)	2.9 (1.6)	3.8 (2.5)	3.4 (2.1)
Middle-Aged (40-50)	2.9 (1.3)	4.8 (1.6)	3.8 (1.7)
Older (60-70)	4.4 (1.7)	4.5 (1.8)	4.5 (1.7)
Overall	3.4 (1.7)	4.4 (2.0)	3.9 (1.9)

Values in cells represent the mean response and (standard deviation)

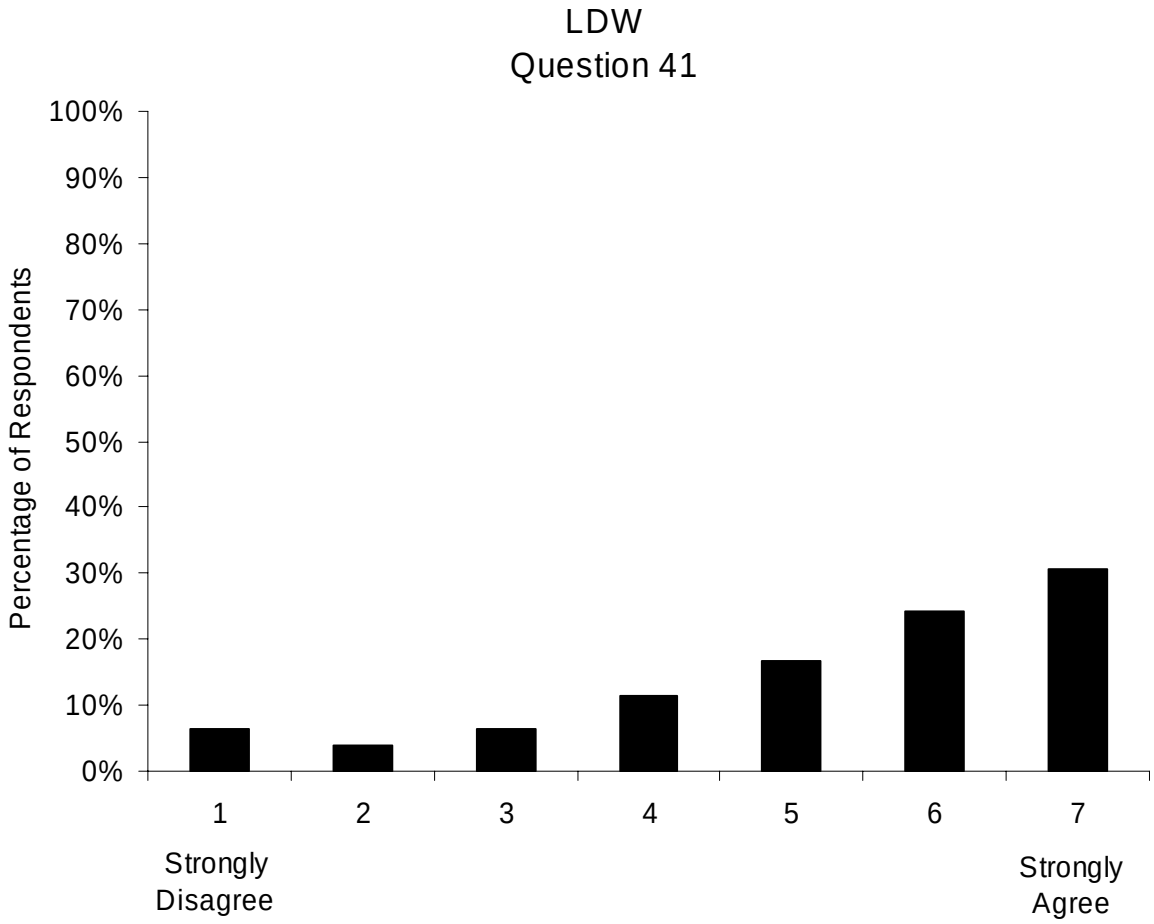
40. I found the LDW system useful in light traffic.



	Males	Females	Overall
Younger (20-30)	4.5 (1.8)	5.1 (2.0)	4.8 (1.9)
Middle-Aged (40-50)	4.6 (1.8)	4.5 (2.3)	4.6 (2.0)
Older (60-70)	5.2 (1.4)	4.8 (1.9)	5.0 (1.6)
Overall	4.8 (1.7)	4.8 (2.0)	4.8 (1.8)

Values in cells represent the mean response and (standard deviation)

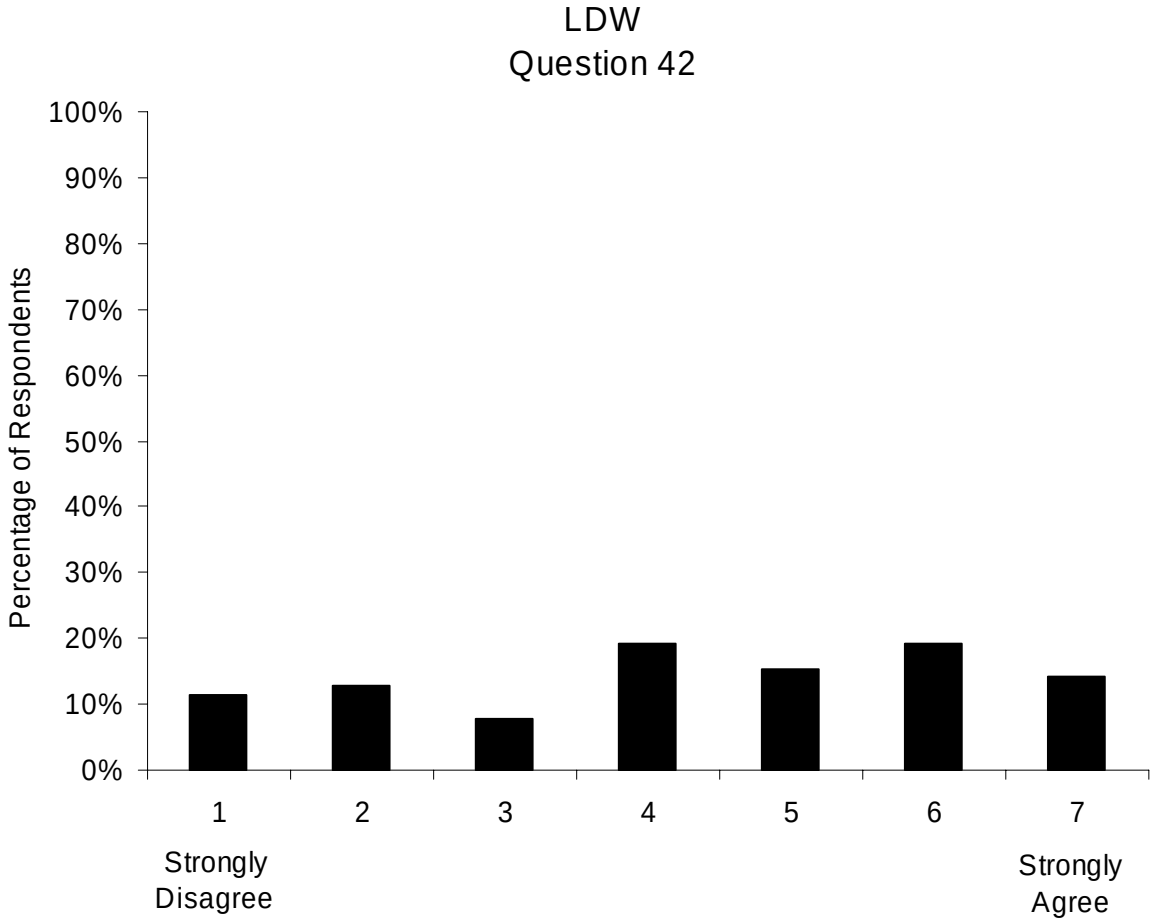
41. I found the LDW system useful in heavy traffic.



	Males	Females	Overall
Younger (20-30)	4.8 (1.9)	5.2 (2.0)	5.0 (1.9)
Middle-Aged (40-50)	5.0 (1.9)	5.5 (1.9)	5.2 (1.9)
Older (60-70)	5.5 (1.5)	5.5 (1.8)	5.5 (1.6)
Overall	5.1 (1.8)	5.4 (1.8)	5.2 (1.8)

Values in cells represent the mean response and (standard deviation)

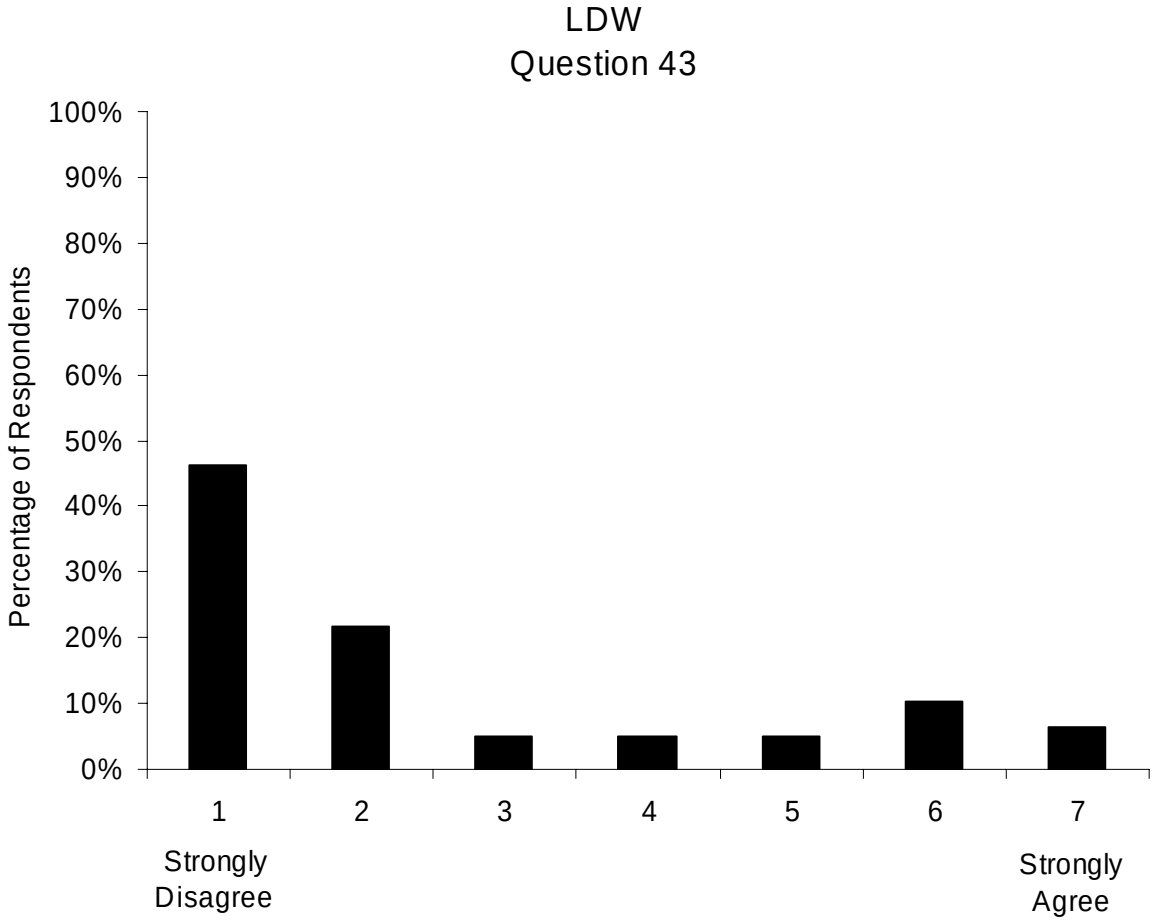
42. I felt more comfortable performing additional tasks, (e.g., adjusting the heater, operating the radio, talking on a cellular telephone, etc.) while using LDW as compared to manual driving.



	Males	Females	Overall
Younger (20-30)	4.8 (1.6)	5.2 (1.9)	5.0 (1.7)
Middle-Aged (40-50)	2.7 (2.0)	4.0 (2.1)	3.3 (2.1)
Older (60-70)	4.9 (1.5)	4.2 (1.8)	4.5 (1.7)
Overall	4.1 (2.0)	4.4 (1.9)	4.3 (1.9)

Values in cells represent the mean response and (standard deviation)

43. I would have used an on/off switch at some point, had it been provided, to turn off the LDW for the rest of my experience.



	Males	Females	Overall
Younger (20-30)	3.3 (2.4)	4.0 (2.3)	3.7 (2.3)
Middle-Aged (40-50)	2.5 (2.0)	1.8 (1.3)	2.2 (1.7)
Older (60-70)	1.8 (1.7)	1.9 (1.6)	1.9 (1.6)
Overall	2.6 (2.1)	2.6 (2.0)	2.6 (2.0)

Values in cells represent the mean response and (standard deviation)

44. If you would have turned off the LDW, how long into your experience would you have kept the LDW on?

_____

_____

45. Can you suggest any changes or modifications to the LDW system in the following areas?

Visual Warnings _____

_____

Auditory Warnings _____

_____

Vibration Warnings _____

_____

Timing of Warnings_____

_____

Controls and Display _____

_____

Other _____

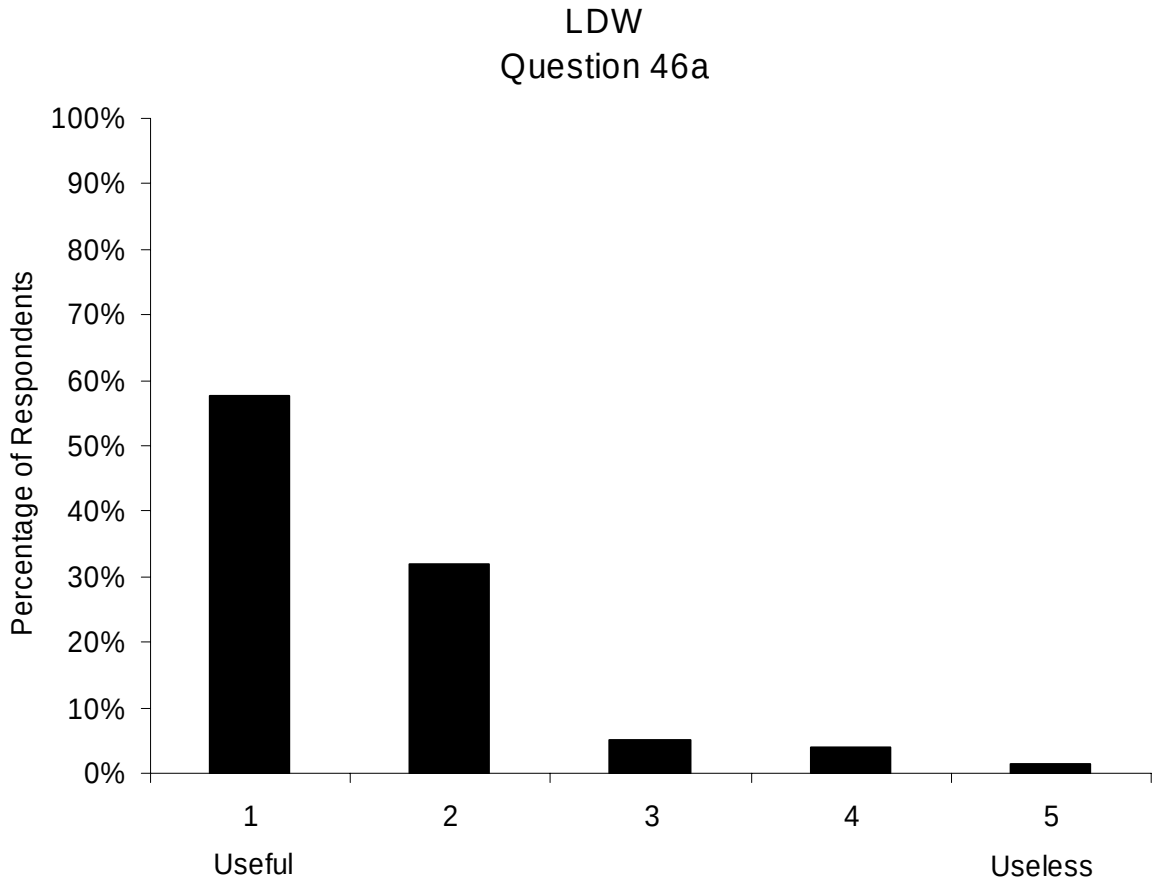
_____

46. Please indicate your overall acceptance rating of the LDW system.

For each choice you will find 5 possible answers. When a term is completely appropriate, please put a check (√) in the square next to that term. When a term is appropriate to a certain extent, please put a check to the left or right of the middle at the side of the term. When you have no specific opinion, please put a check in the middle.

The LDW system was:

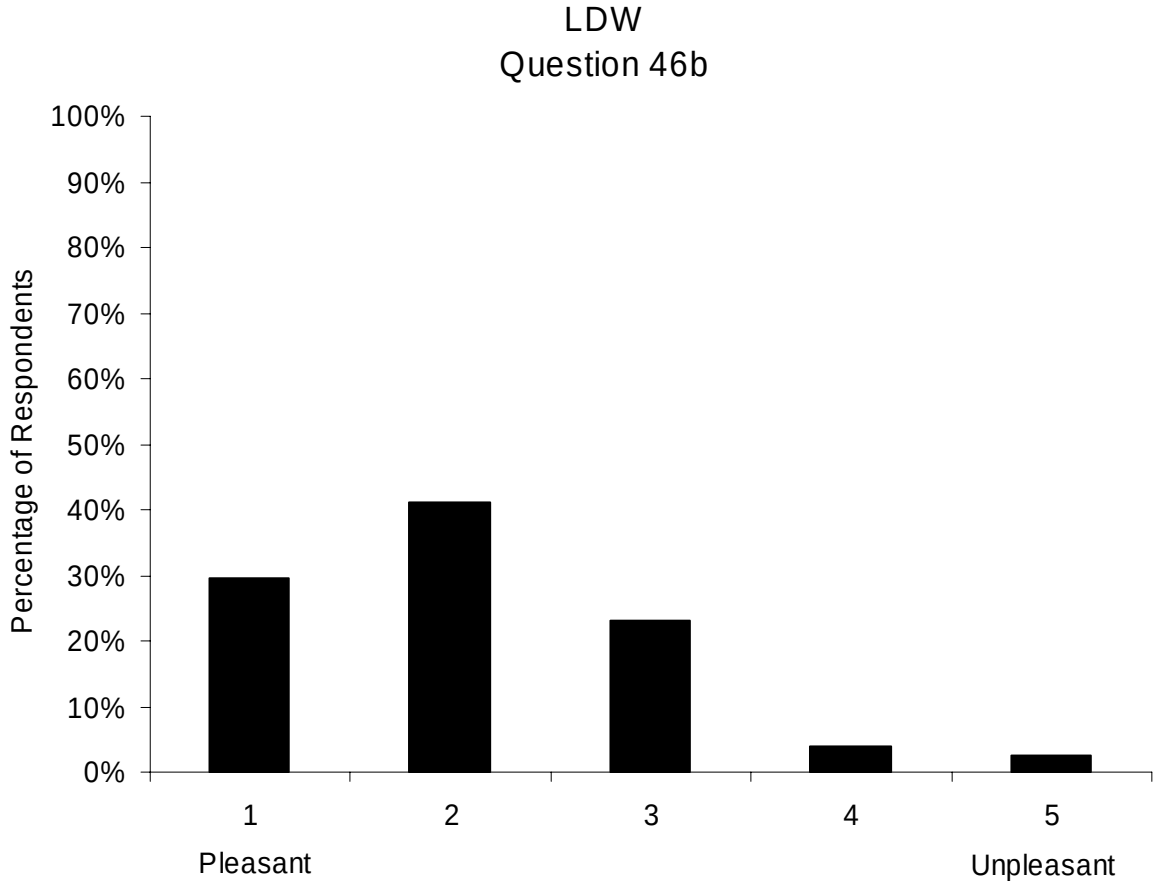
useful | | | | | useless



	Males	Females	Overall
Younger (20-30)	1.9 (0.9)	1.6 (1.1)	1.8 (1.0)
Middle-Aged (40-50)	1.6 (0.8)	1.8 (1.2)	1.7 (1.0)
Older (60-70)	1.4 (0.5)	1.2 (0.4)	1.3 (0.5)
Overall	1.6 (0.7)	1.5 (1.0)	1.6 (0.9)

Values in cells represent the mean response and (standard deviation)

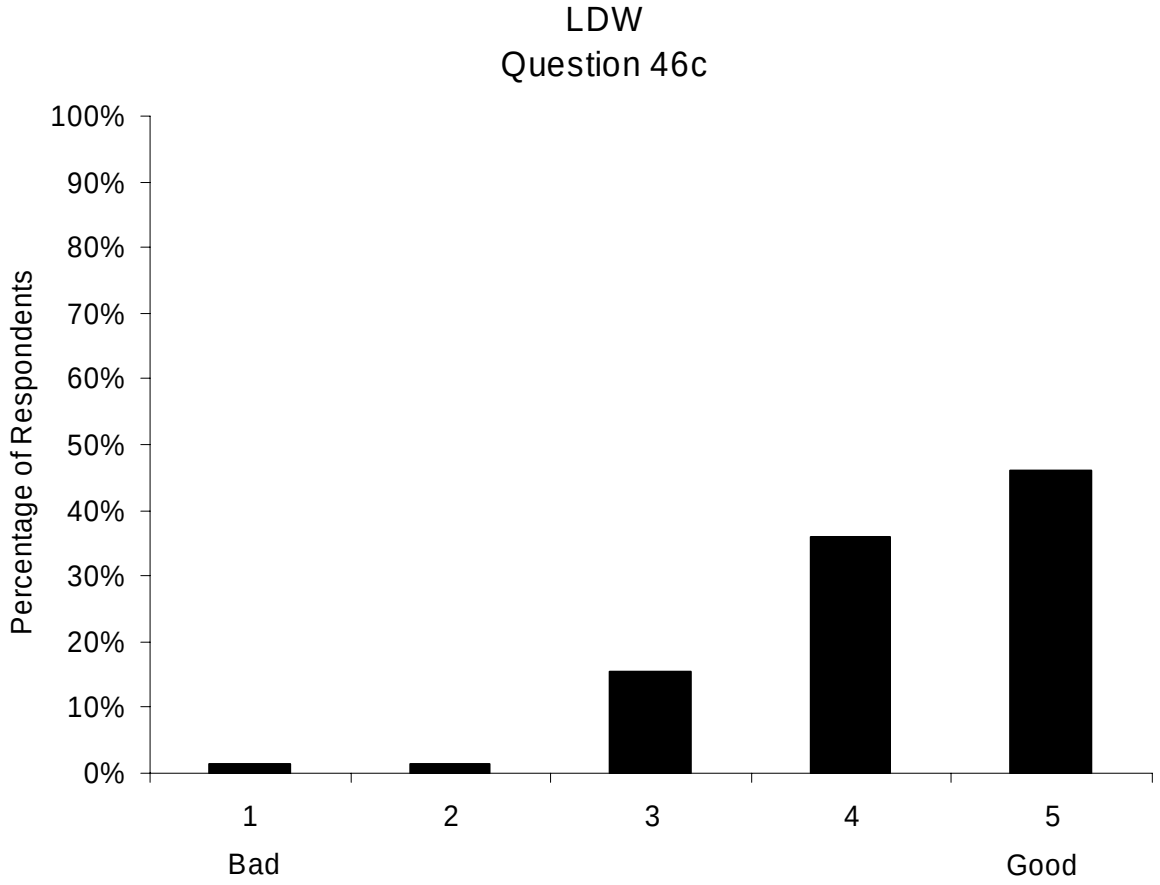
pleasant | | | | | unpleasant



	Males	Females	Overall
Younger (20-30)	2.3 (1.2)	2.2 (1.1)	2.3 (1.1)
Middle-Aged (40-50)	1.9 (1.0)	2.4 (0.8)	2.2 (0.9)
Older (60-70)	1.8 (1.0)	1.8 (0.6)	1.8 (0.8)
Overall	2.0 (1.1)	2.2 (0.8)	2.1 (1.0)

Values in cells represent the mean response and (standard deviation)

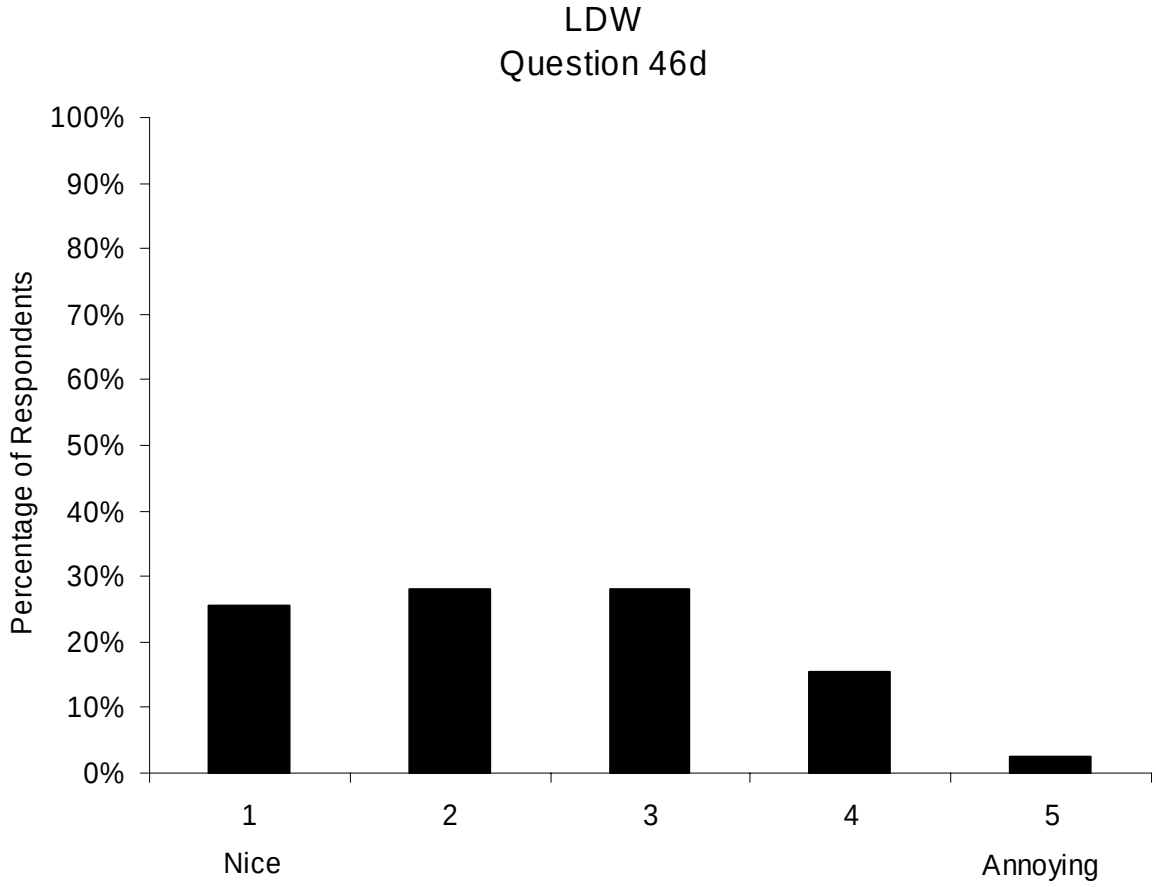
bad good



	Males	Females	Overall
Younger (20-30)	4.0 (1.0)	4.2 (1.2)	4.1 (1.1)
Middle-Aged (40-50)	4.4 (0.8)	4.1 (0.9)	4.2 (0.8)
Older (60-70)	4.5 (0.5)	4.3 (0.6)	4.4 (0.6)
Overall	4.3 (0.8)	4.2 (0.9)	4.2 (0.9)

Values in cells represent the mean response and (standard deviation)

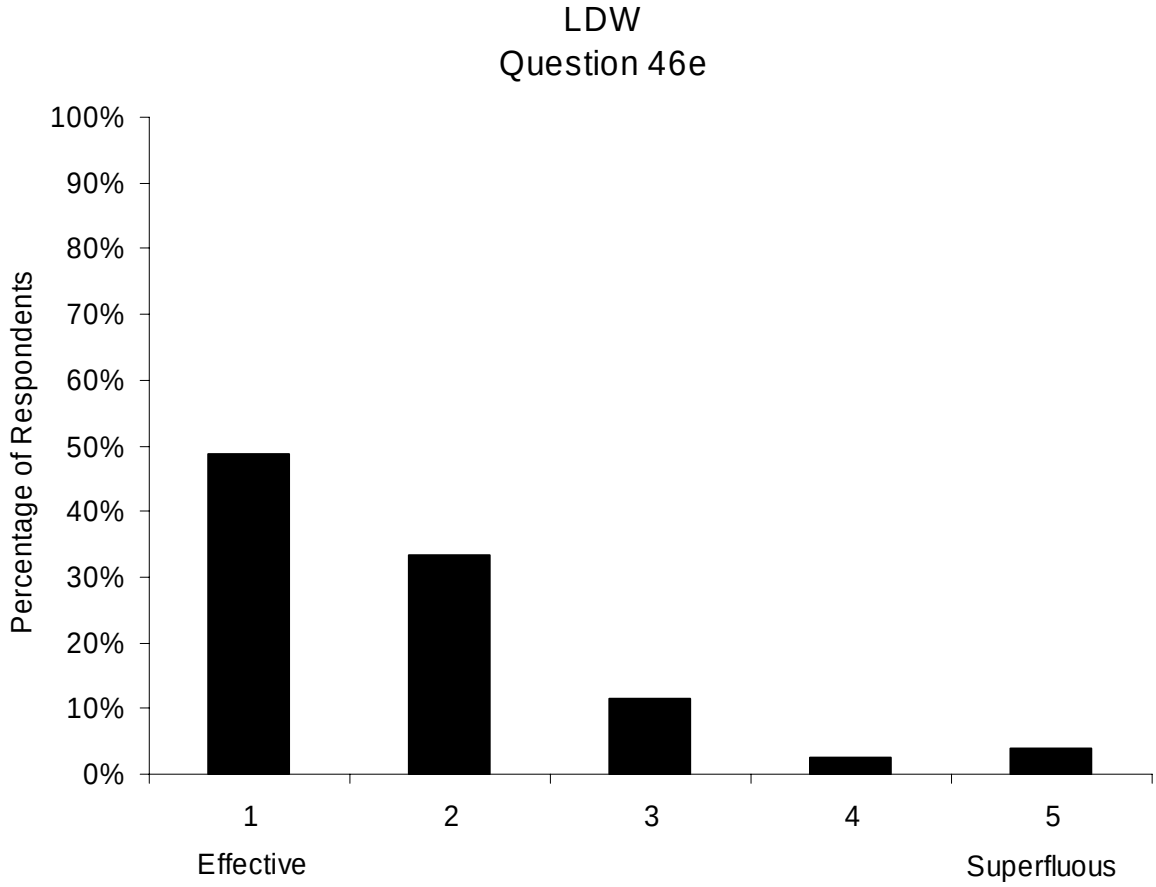
nice | | | | | annoying



	Males	Females	Overall
Younger (20-30)	2.6 (1.2)	2.5 (1.4)	2.6 (1.3)
Middle-Aged (40-50)	2.2 (1.1)	2.9 (1.0)	2.6 (1.1)
Older (60-70)	1.8 (0.9)	2.4 (0.8)	2.1 (0.9)
Overall	2.2 (1.1)	2.6 (1.1)	2.4 (1.1)

Values in cells represent the mean response and (standard deviation)

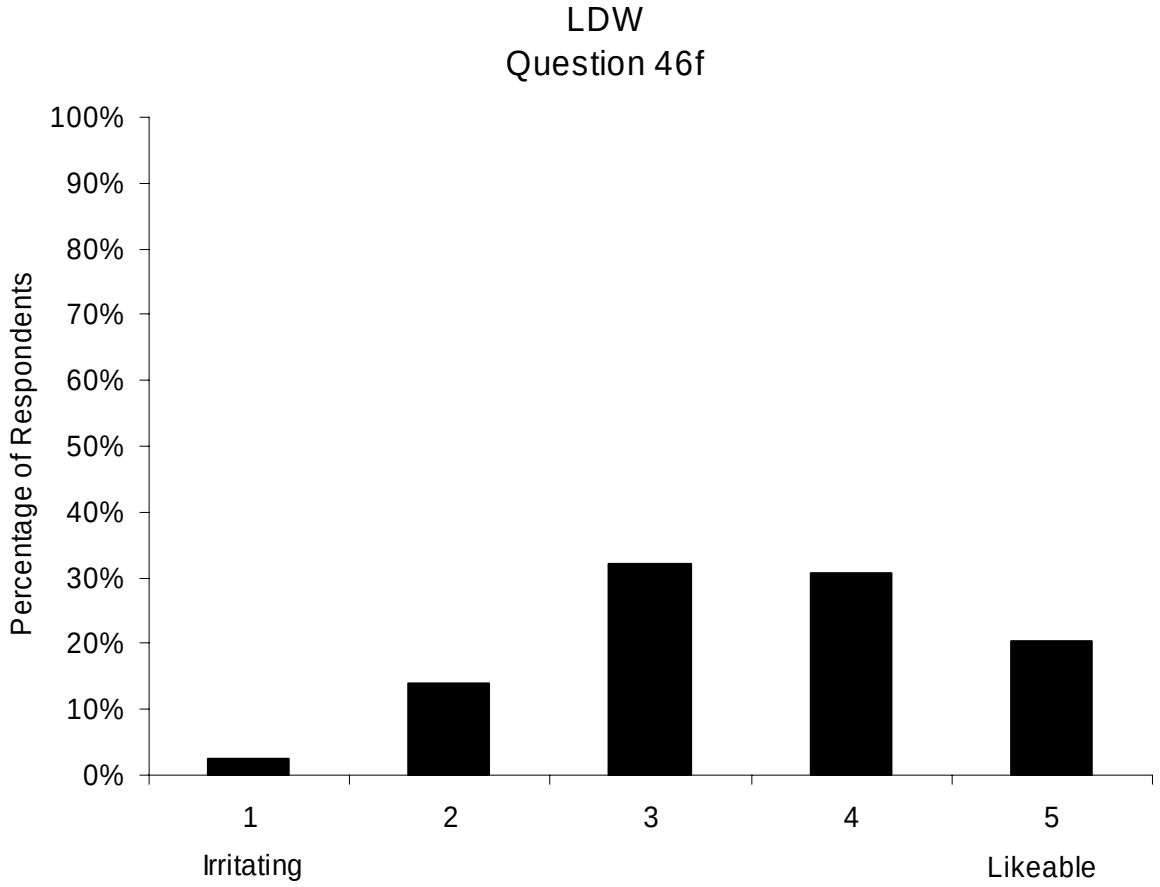
effective | | | | | | superfluous



	Males	Females	Overall
Younger (20-30)	2.3 (1.0)	1.8 (1.3)	2.1 (1.2)
Middle-Aged (40-50)	1.8 (1.2)	1.8 (1.0)	1.8 (1.1)
Older (60-70)	1.5 (0.7)	1.6 (0.8)	1.5 (0.7)
Overall	1.8 (1.0)	1.7 (1.0)	1.8 (1.0)

Values in cells represent the mean response and (standard deviation)

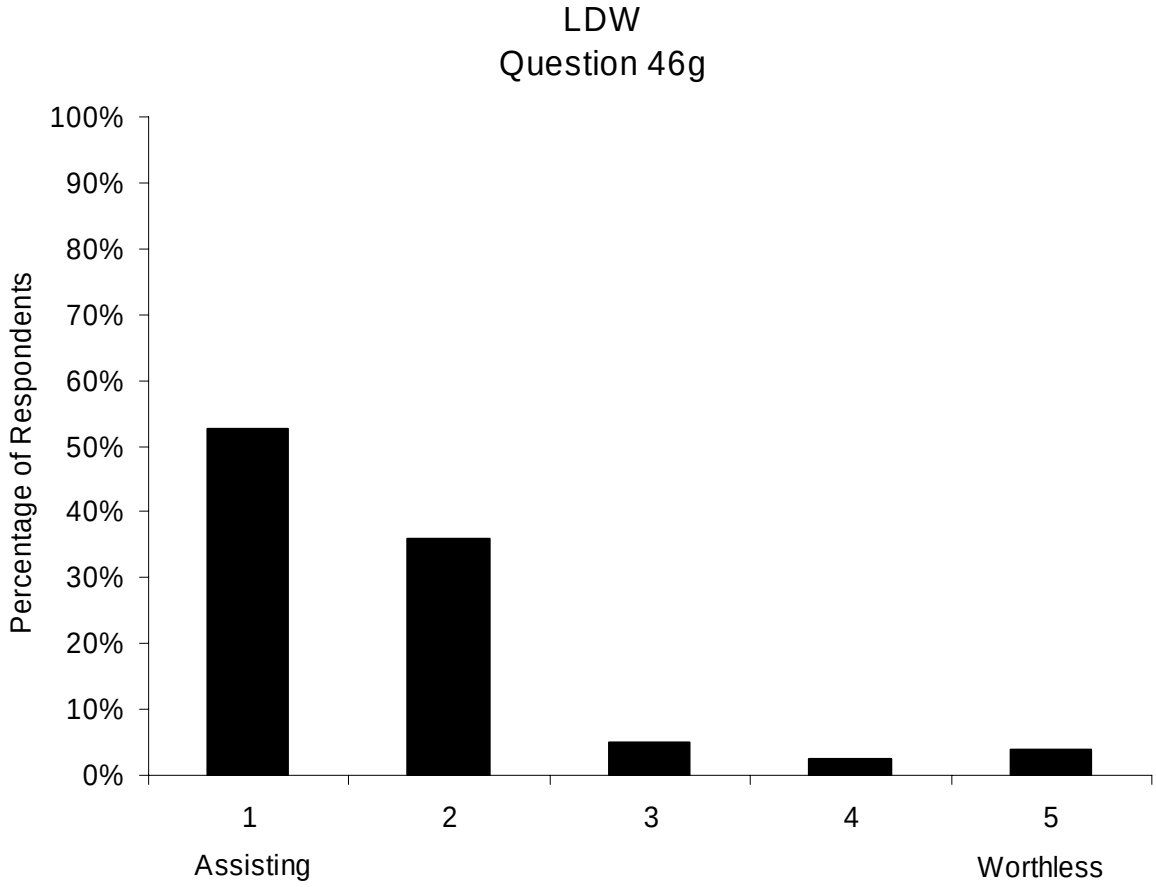
irritating | | | | | | likeable



	Males	Females	Overall
Younger (20-30)	3.5 (1.1)	3.1 (1.1)	3.3 (1.1)
Middle-Aged (40-50)	3.6 (1.1)	3.2 (0.9)	3.4 (1.0)
Older (60-70)	3.9 (1.0)	3.8 (1.0)	3.9 (1.0)
Overall	3.7 (1.1)	3.4 (1.0)	3.5 (1.1)

Values in cells represent the mean response and (standard deviation)

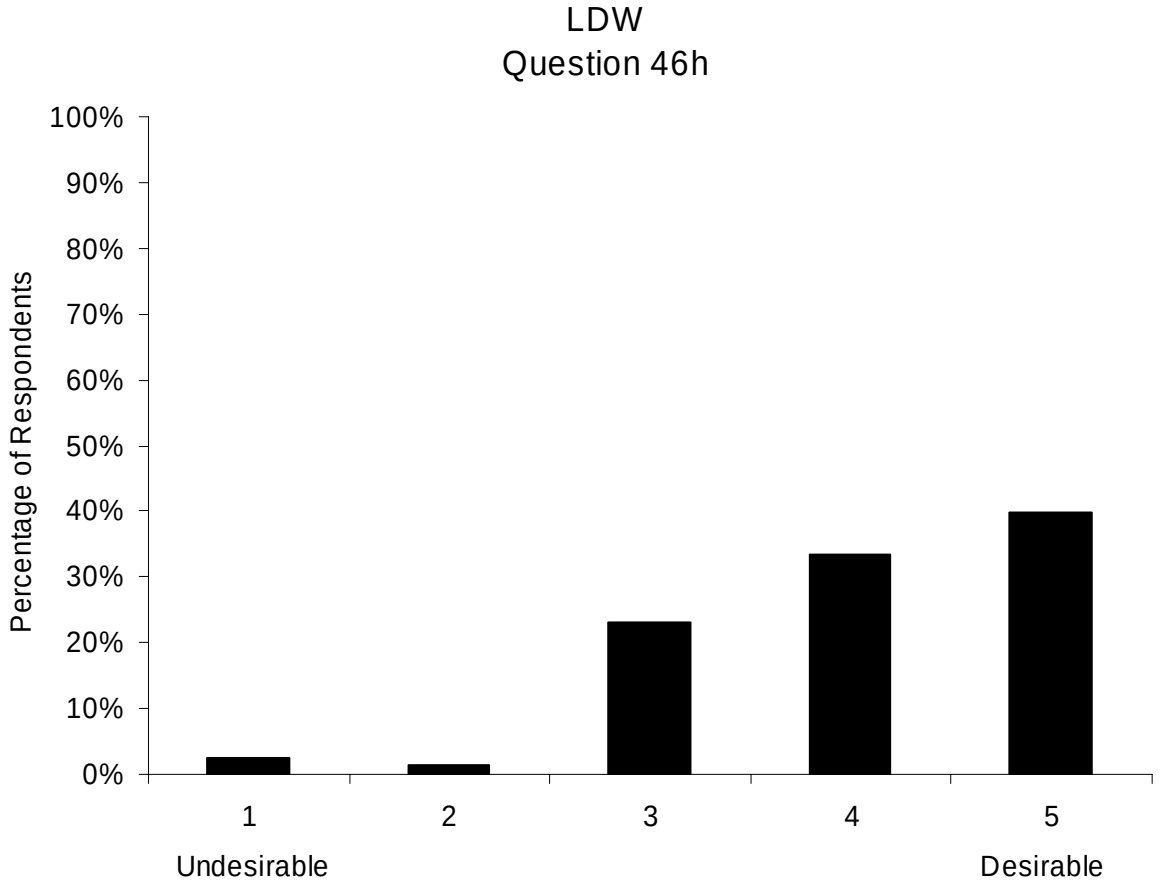
assisting | | | | | worthless



	Males	Females	Overall
Younger (20-30)	1.8 (0.9)	1.7 (1.1)	1.8 (1.0)
Middle-Aged (40-50)	1.8 (1.2)	2.0 (1.2)	1.9 (1.2)
Older (60-70)	1.5 (0.7)	1.3 (0.6)	1.4 (0.6)
Overall	1.7 (0.9)	1.7 (1.0)	1.7 (1.0)

Values in cells represent the mean response and (standard deviation)

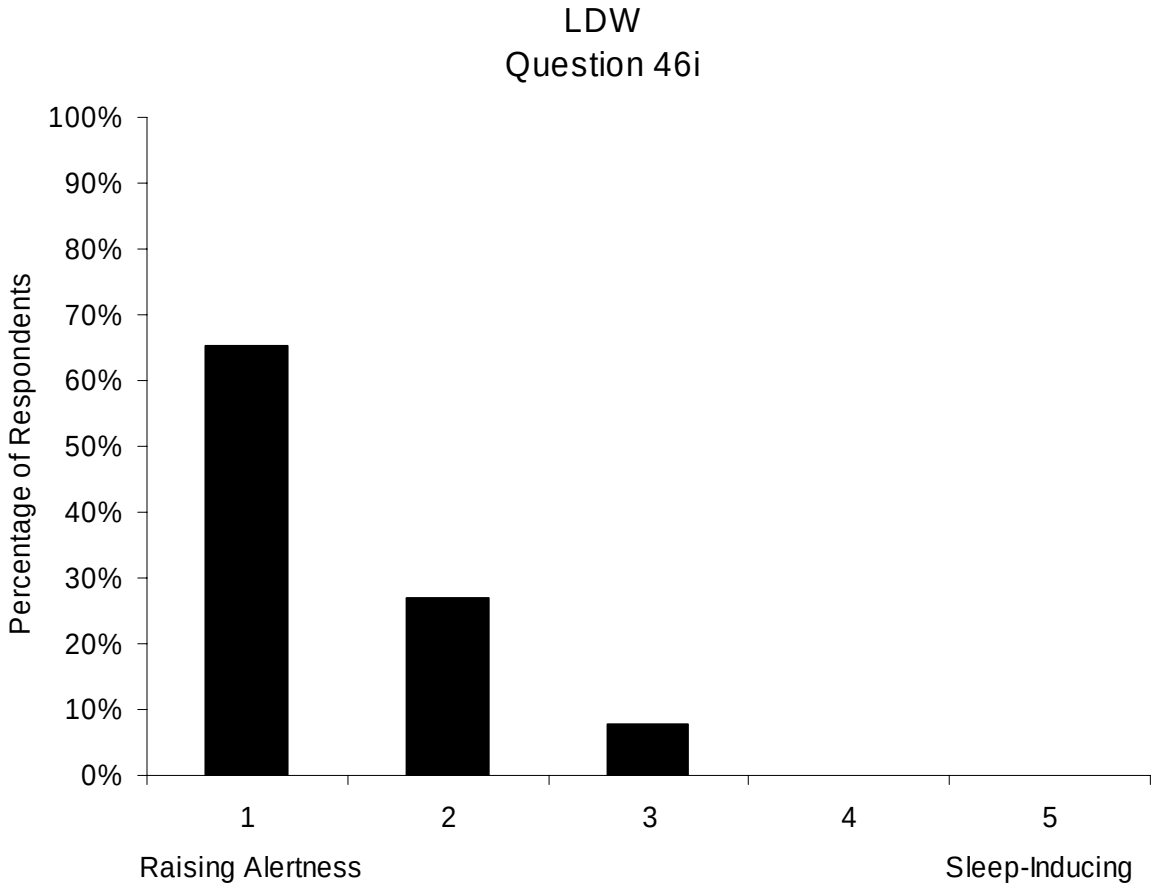
undesirable | | | | | | desirable



	Males	Females	Overall
Younger (20-30)	3.6 (1.1)	3.8 (1.1)	3.7 (1.1)
Middle-Aged (40-50)	4.2 (1.0)	4.0 (0.8)	4.1 (0.9)
Older (60-70)	4.6 (0.5)	4.2 (0.9)	4.4 (0.8)
Overall	4.1 (1.0)	4.0 (0.9)	4.1 (1.0)

Values in cells represent the mean response and (standard deviation)

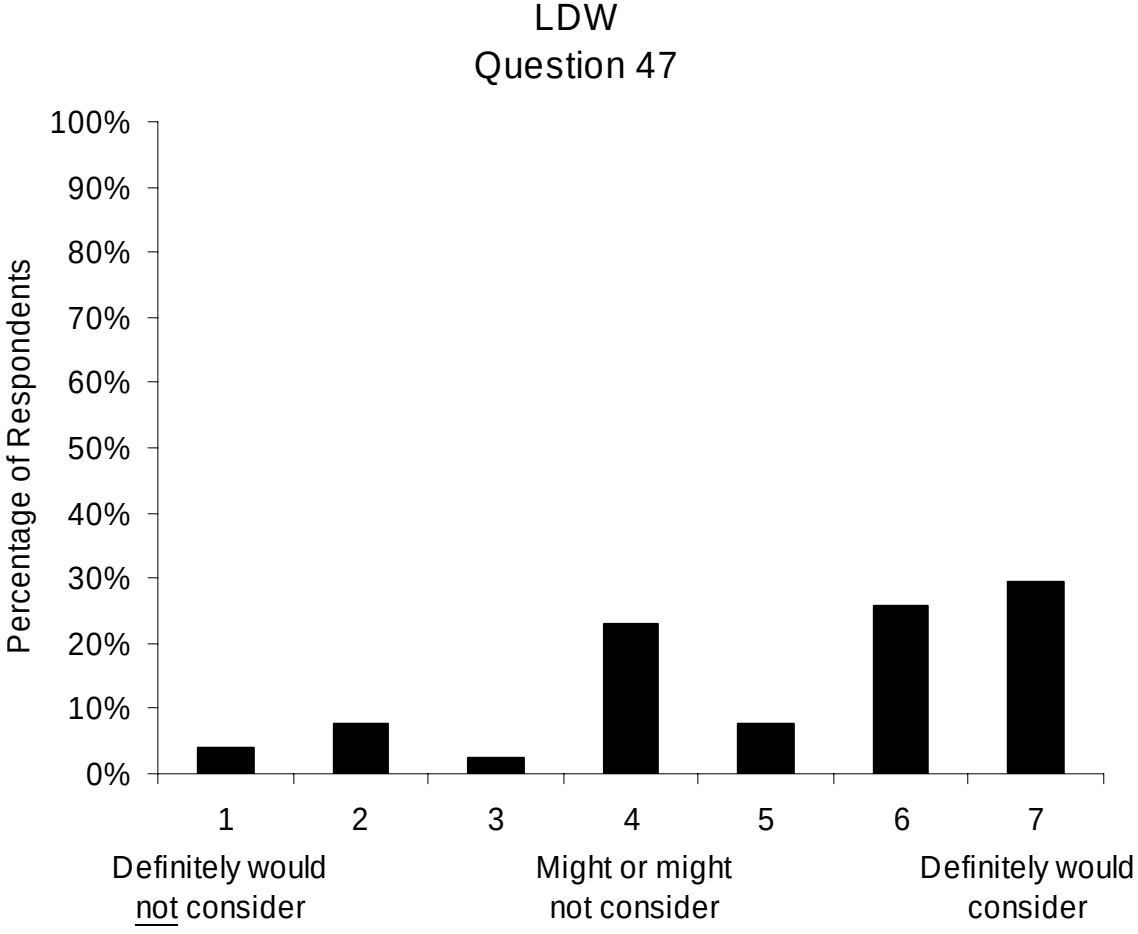
raising alertness | | | | | | sleep-inducing



	Males	Females	Overall
Younger (20-30)	1.9 (0.6)	1.2 (0.6)	1.6 (0.7)
Middle-Aged (40-50)	1.4 (0.8)	1.5 (0.7)	1.4 (0.7)
Older (60-70)	1.3 (0.5)	1.2 (0.4)	1.3 (0.5)
Overall	1.5 (0.7)	1.3 (0.6)	1.4 (0.6)

Values in cells represent the mean response and (standard deviation)

47. Cost aside, if you were purchasing a new vehicle, how likely would you be to consider purchasing the LDW system?



	Males	Females	Overall
Younger (20-30)	4.8 (1.6)	5.1 (2.0)	4.9 (1.8)
Middle-Aged (40-50)	5.3 (2.1)	4.9 (1.9)	5.1 (1.9)
Older (60-70)	5.6 (1.5)	5.4 (1.7)	5.5 (1.6)
Overall	5.2 (1.7)	5.1 (1.8)	5.2 (1.8)

.Values in cells represent the mean response and (standard deviation)

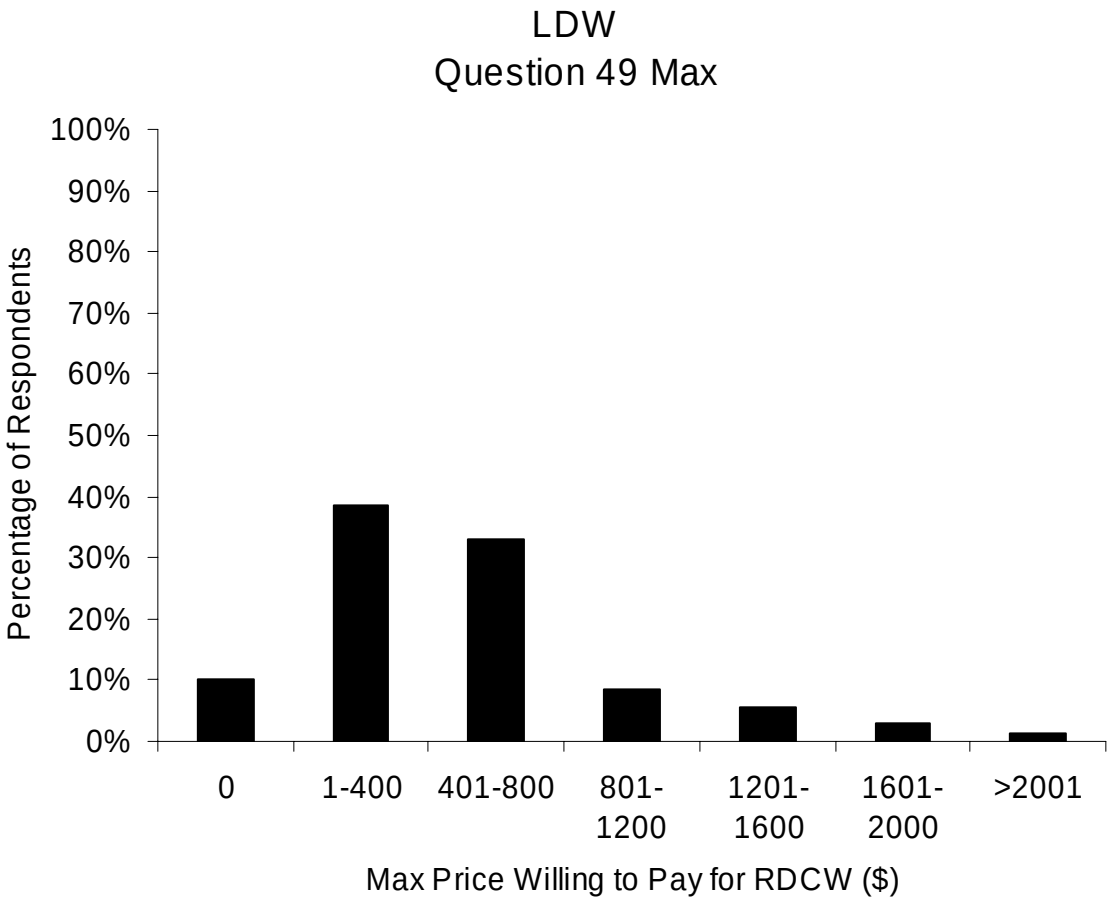
48. Regarding question 47, what is your primary reason for providing the answer you did?

_____

_____

_____

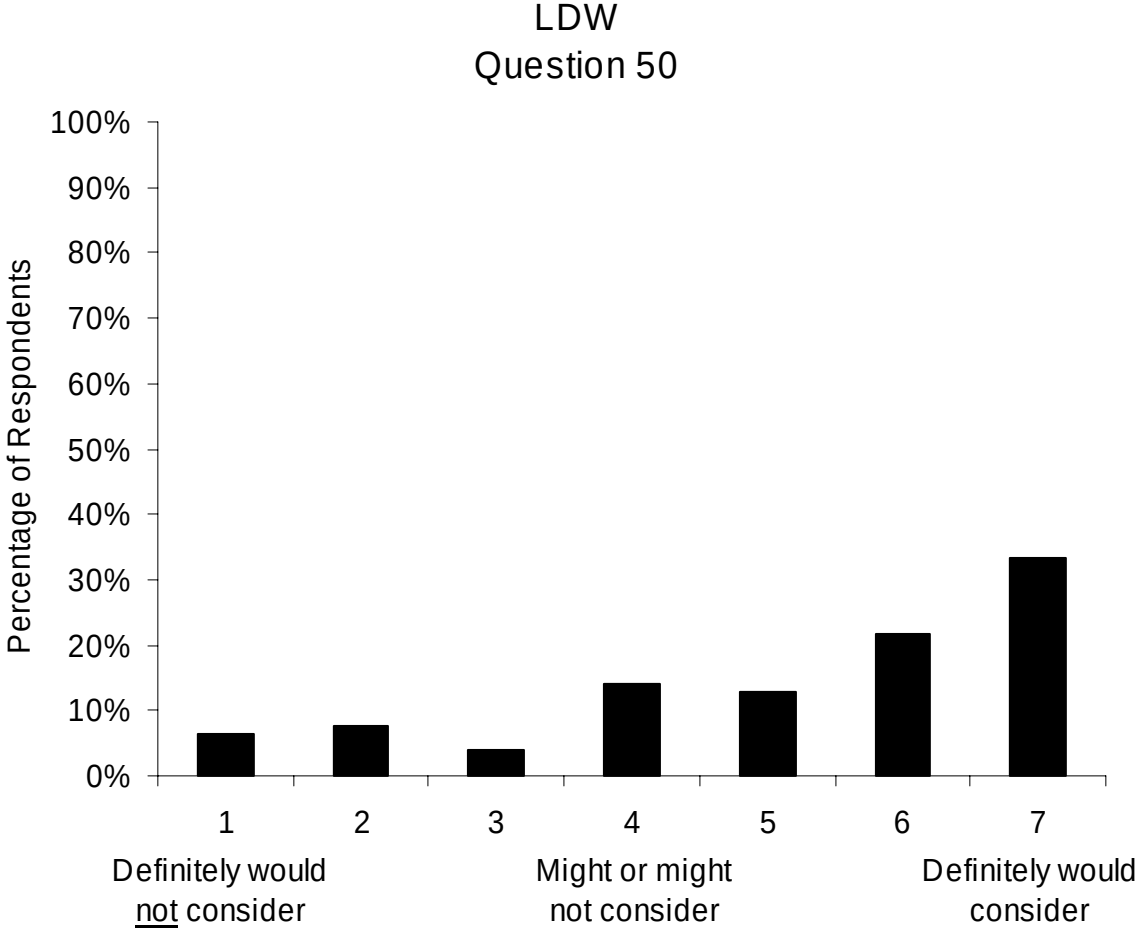
49. What is the maximum amount you would pay for the LDW system?



	Males		Females		Overall	
Younger (20-30)	358.3	(381.3)	825.0	(835.7)	578.0	(671.9)
Middle-Aged (40-50)	554.2	(571.1)	450.0	(401.1)	502.1	(485.5)
Older (60-70)	441.7	(155.0)	483.3	(380.0)	459.5	(267.2)
Overall	445.9	(403.4)	595.5	(453.4)	516.4	(508.7)

Values in cells represent the mean response and (standard deviation)

50. At the actual price of $300, how likely would you be to consider purchasing LDW if you were purchasing a new vehicle?



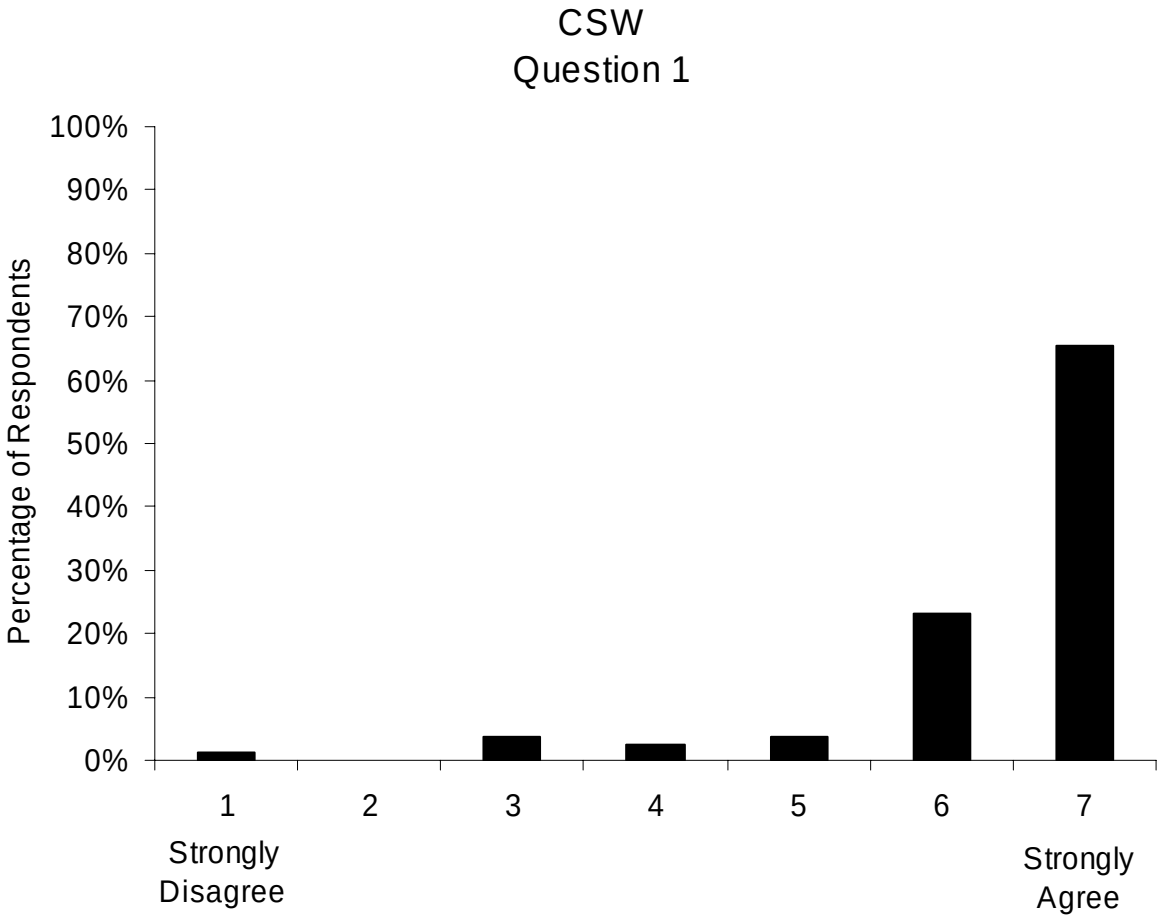
	Males	Females	Overall
Younger (20-30)	4.6 1.8	5.2 2.2	4.9 1.9
Middle-Aged (40-50)	5.3 2.1	4.8 2.2	5.1 2.1
Older (60-70)	5.9 1.3	5.2 1.9	5.6 1.6
Overall	5.3 1.8	5.1 2.0	5.2 1.9

Values in cells represent the mean response and (standard deviation)

Curve Speed Warning (CSW) System Questionnaire and Evaluation

CSW Display – General Characteristics

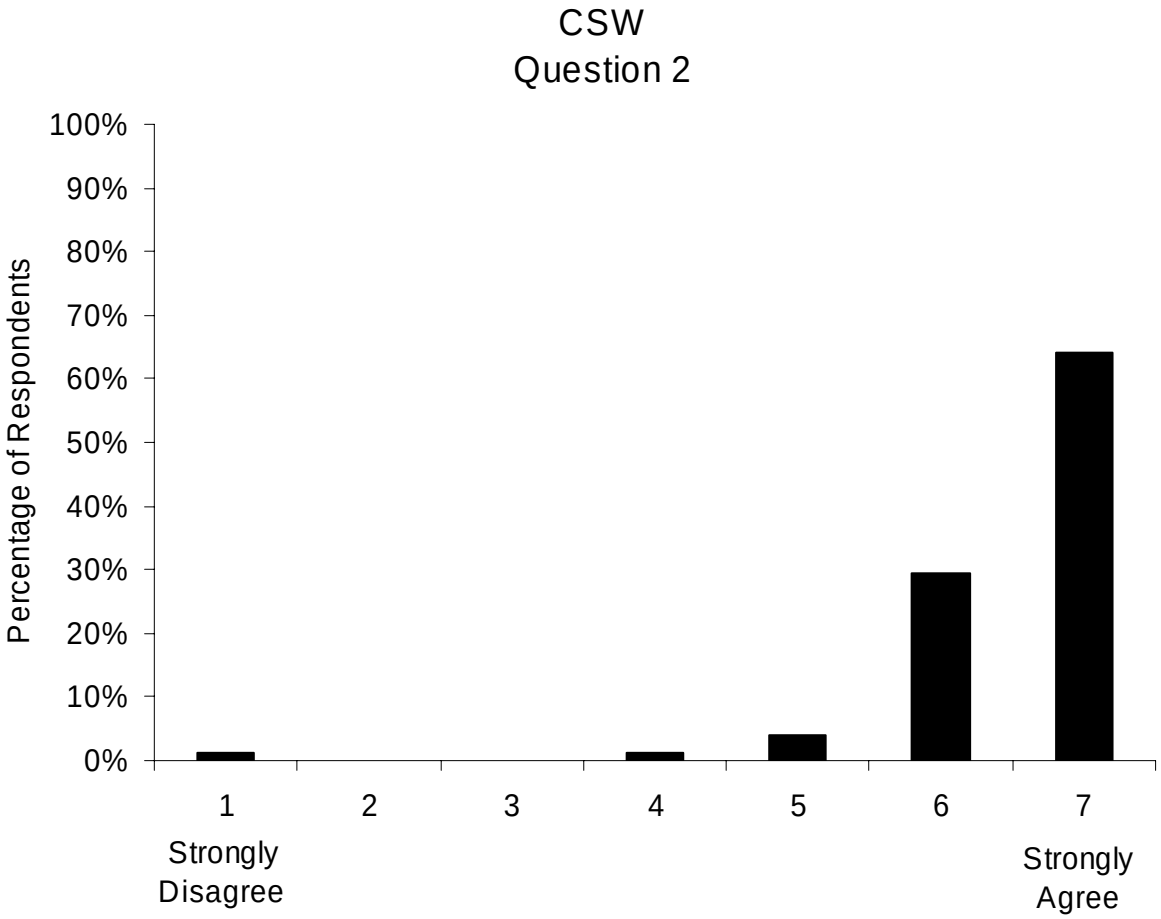
1. It was easy to see the graphics in the CSW display (i.e., there was no glare, and the graphics were neither too light nor too dark).



	Males	Females	Overall
Younger (20-30)	6.1 (1.5)	6.7 (0.6)	6.4 (1.2)
Middle-Aged (40-50)	6.5 (0.9)	6.5 (1.0)	6.5 (0.9)
Older (60-70)	5.9 (1.8)	6.6 (0.5)	6.3 (1.4)
Overall	6.2 (1.4)	6.6 (0.7)	6.4 (1.2)

Values in cells represent the mean response and (standard deviation)

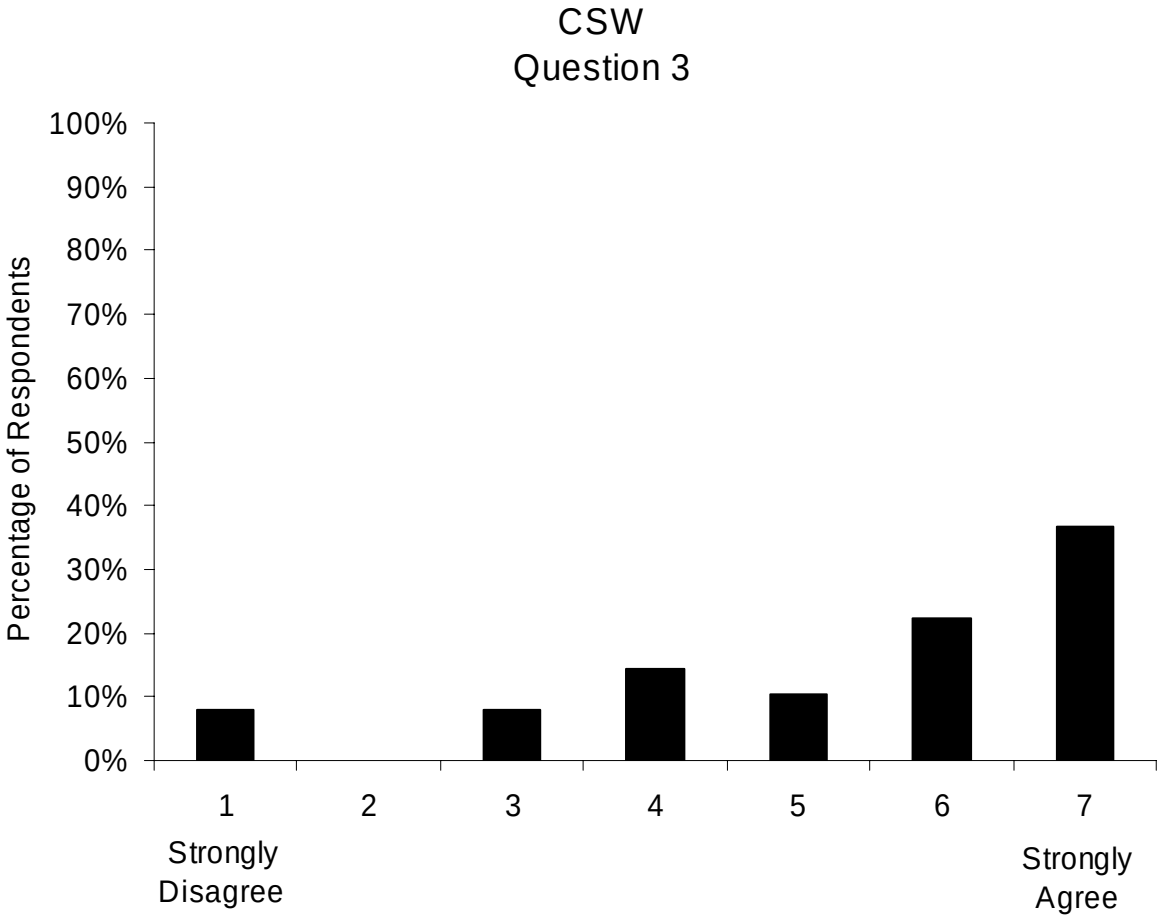
2. The graphics presented on the CSW display were about the right size.



	Males	Females	Overall
Younger (20-30)	6.3 (0.8)	6.7 (0.6)	6.5 (0.7)
Middle-Aged (40-50)	6.8 (0.4)	6.5 (0.9)	6.7 (0.7)
Older (60-70)	6.2 (1.6)	6.6 (0.5)	6.4 (1.2)
Overall	6.4 (1.1)	6.6 (0.7)	6.5 (0.9)

Values in cells represent the mean response and (standard deviation)

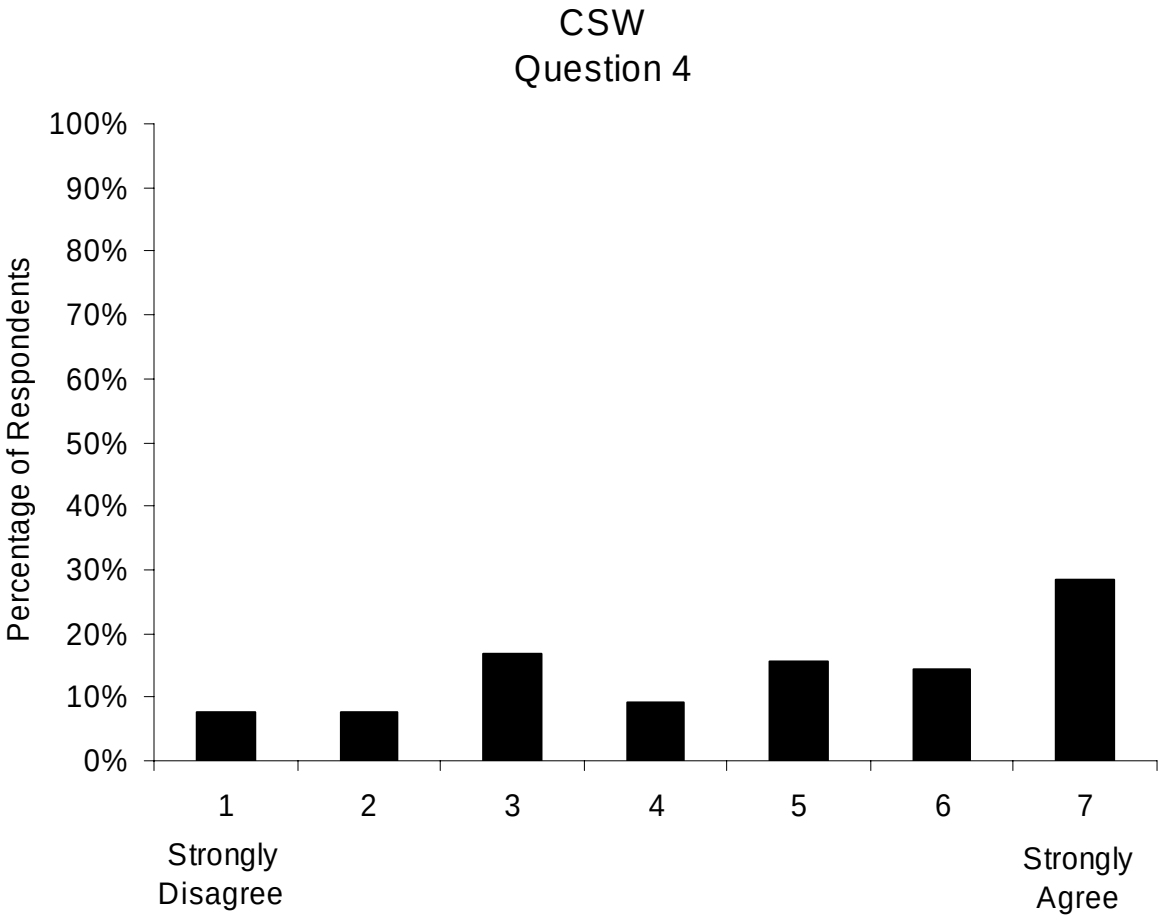
3. It was easy to distinguish between the different CSW visual warnings (Cautionary and Imminent warnings).



	Males	Females	Overall
Younger (20-30)	5.3 (1.8)	5.8 (1.6)	5.5 (1.7)
Middle-Aged (40-50)	5.3 (1.8)	4.8 (2.1)	5.1 (1.9)
Older (60-70)	5.6 (1.9)	5.2 (2.0)	5.4 (1.9)
Overall	5.4 (1.8)	5.3 (1.9)	5.3 (1.8)

Values in cells represent the mean response and (standard deviation)

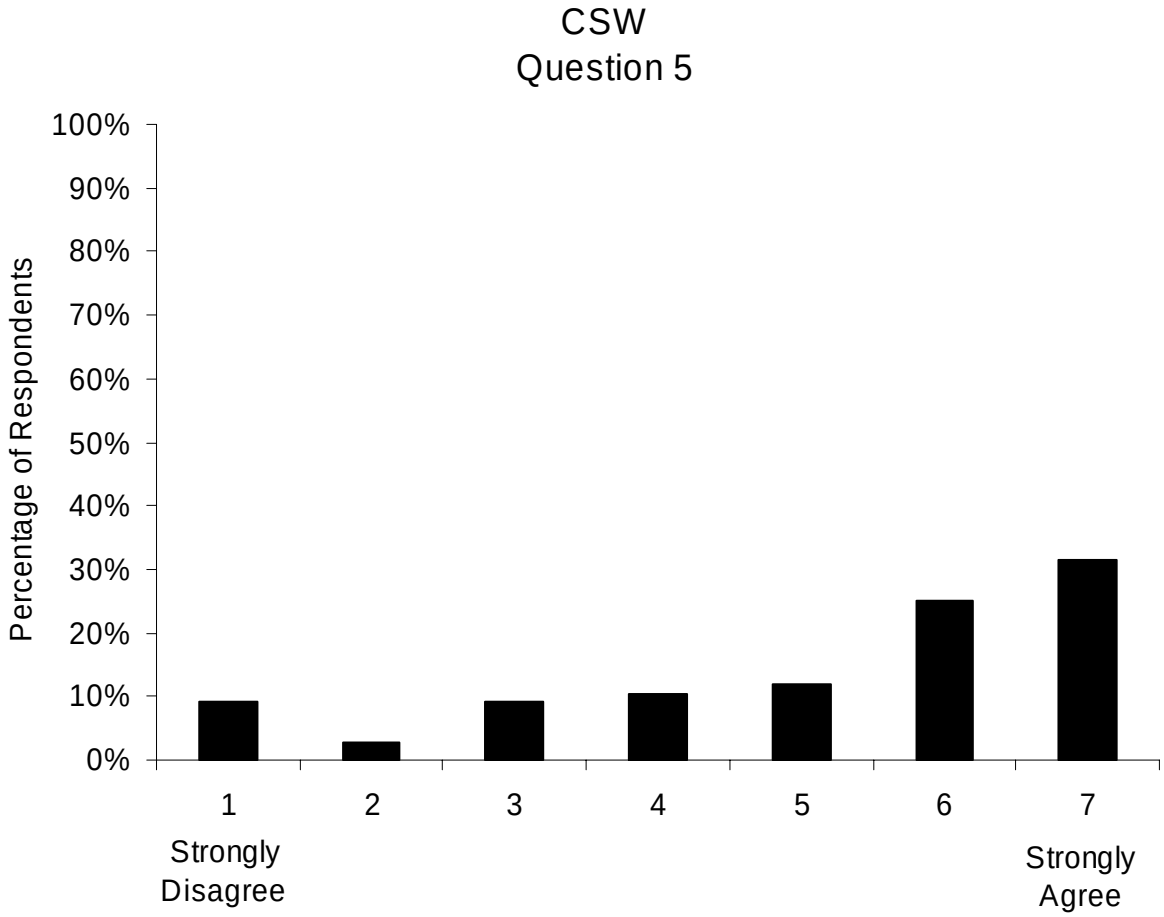
4. The CSW visual warnings got my attention.



	Males	Females	Overall
Younger (20-30)	4.8 (1.7)	6.2 (1.4)	5.5 (1.7)
Middle-Aged (40-50)	4.7 (1.9)	3.6 (2.0)	4.2 (2.0)
Older (60-70)	4.4 (2.3)	4.8 (2.0)	4.6 (2.1)
Overall	4.6 (1.9)	4.9 (2.1)	4.7 (2.0)

Values in cells represent the mean response and (standard deviation)

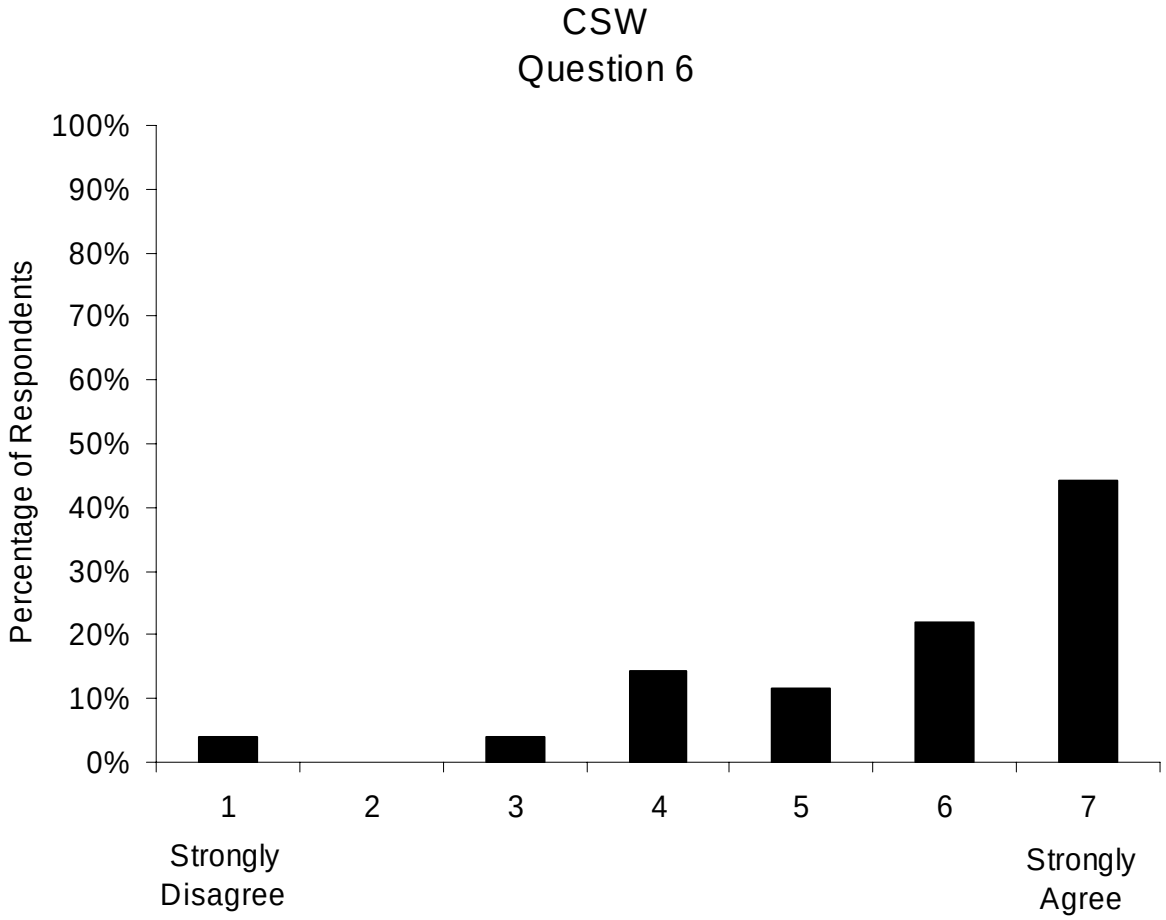
5. I knew what to do when I saw the CSW visual warnings.



	Males	Females	Overall
Younger (20-30)	5.6 (1.3)	5.9 (1.5)	5.8 (1.4)
Middle-Aged (40-50)	4.9 (2.1)	3.8 (2.0)	4.4 (2.1)
Older (60-70)	5.4 (2.1)	5.0 (2.1)	5.2 (2.1)
Overall	5.3 (1.8)	5.0 (2.0)	5.1 (1.9)

Values in cells represent the mean response and (standard deviation)

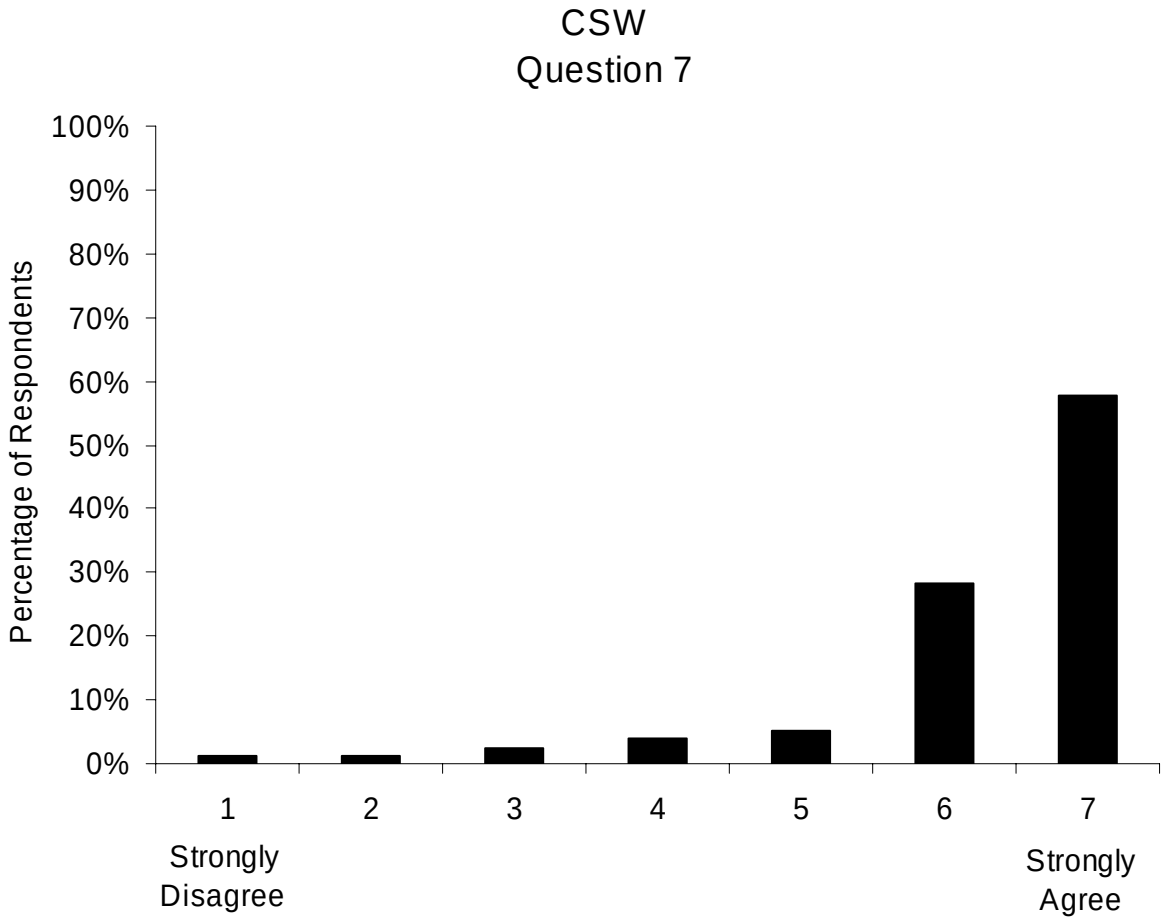
6. The visual CSW warnings were not distracting.



	Males	Females	Overall
Younger (20-30)	5.5 (1.8)	5.5 (1.8)	5.5 (1.7)
Middle-Aged (40-50)	6.0 (1.2)	5.8 (1.5)	5.9 (1.3)
Older (60-70)	5.5 (1.9)	6.0 (1.3)	5.8 (1.6)
Overall	5.7 (1.6)	5.8 (1.5)	5.7 (1.6)

Values in cells represent the mean response and (standard deviation)

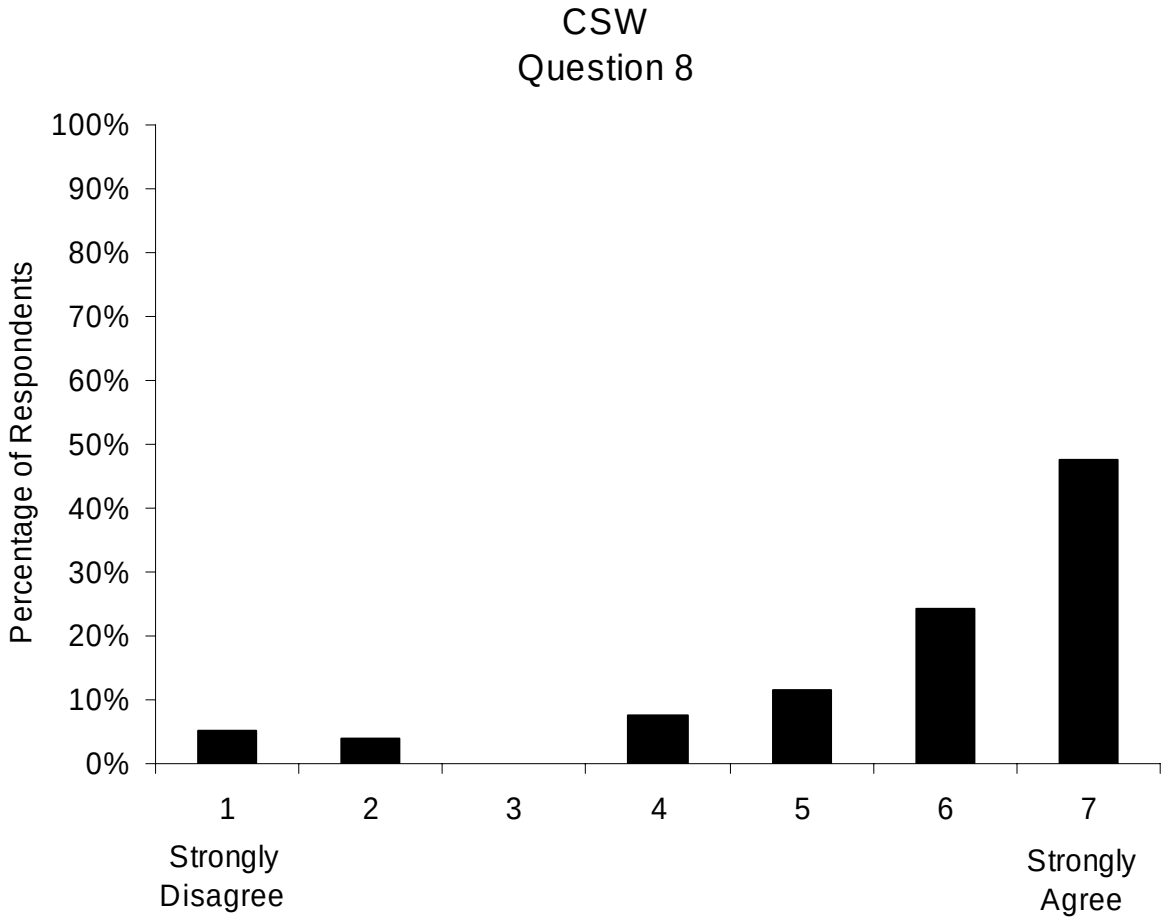
7. The CSW Availability icons were not distracting.



	Males	Females	Overall
Younger (20-30)	6.4 (1.4)	6.0 (1.7)	6.2 (1.5)
Middle-Aged (40-50)	6.4 (0.9)	6.5 (0.9)	6.4 (0.9)
Older (60-70)	5.9 (1.3)	6.4 (1.1)	6.2 (1.2)
Overall	6.2 (1.2)	6.3 (1.3)	6.3 (1.2)

Values in cells represent the mean response and (standard deviation)

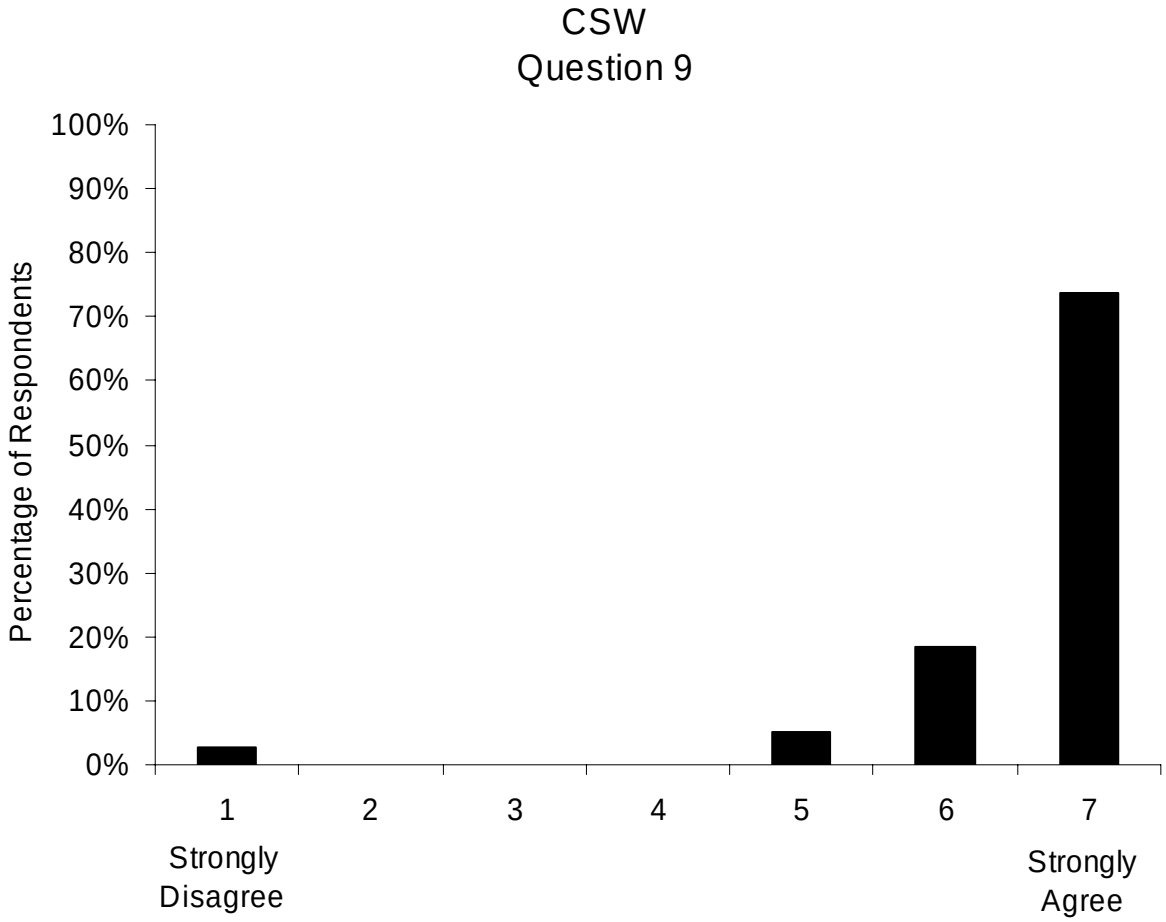
8. The CSW Availability icons helped me to understand and to use the CSW system.



	Males	Females	Overall
Younger (20-30)	5.7 (1.7)	6.2 (1.7)	5.9 (1.7)
Middle-Aged (40-50)	5.9 (1.6)	5.9 (1.3)	5.9 (1.4)
Older (60-70)	5.5 (2.0)	5.5 (1.9)	5.5 (1.9)
Overall	5.7 (1.7)	5.9 (1.6)	5.8 (1.7)

Values in cells represent the mean response and (standard deviation)

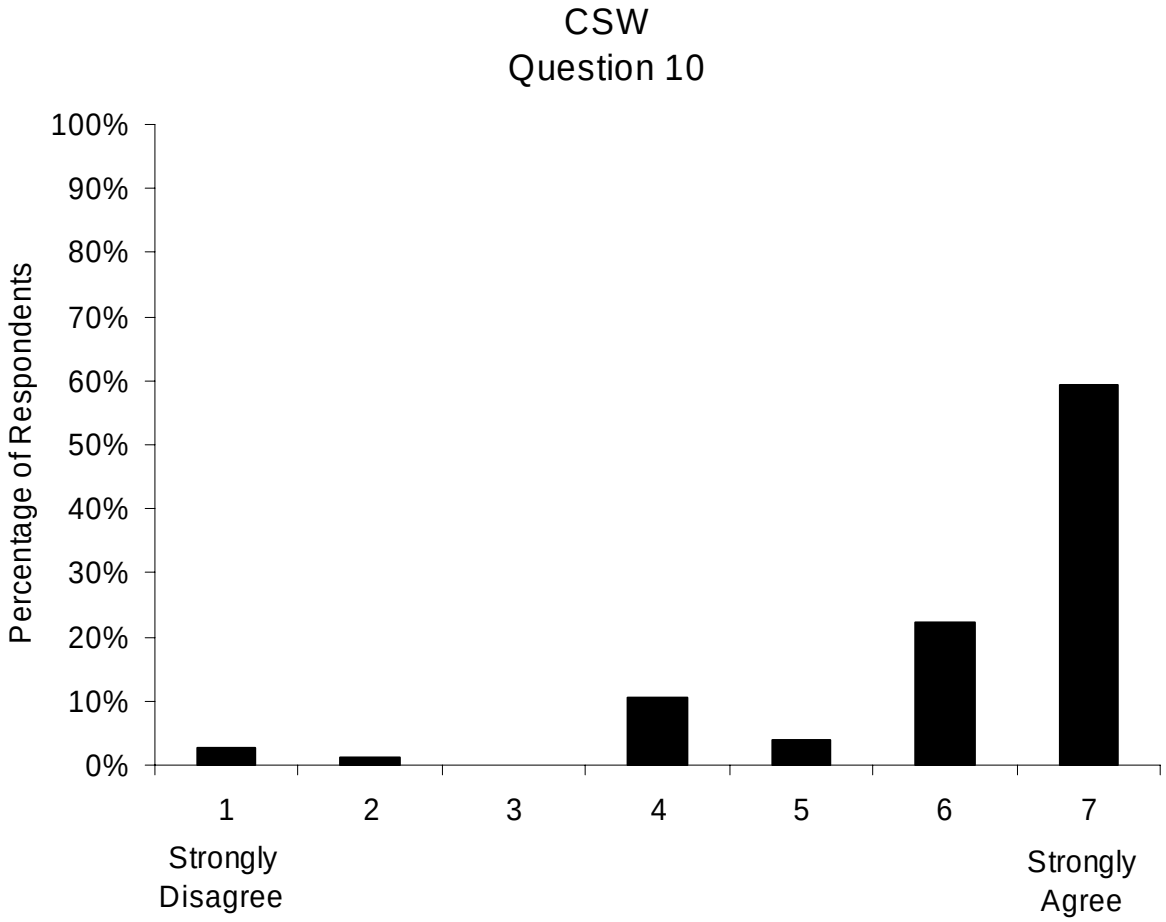
9. The CSW auditory warnings got my attention.



	Males	Females	Overall
Younger (20-30)	6.4 (0.9)	6.8 (0.4)	6.6 (0.7)
Middle-Aged (40-50)	6.3 (1.7)	6.8 (0.4)	6.6 (1.2)
Older (60-70)	6.3 (1.7)	6.6 (0.7)	6.5 (1.2)
Overall	6.3 (1.4)	6.8 (0.5)	6.6 (1.1)

Values in cells represent the mean response and (standard deviation)

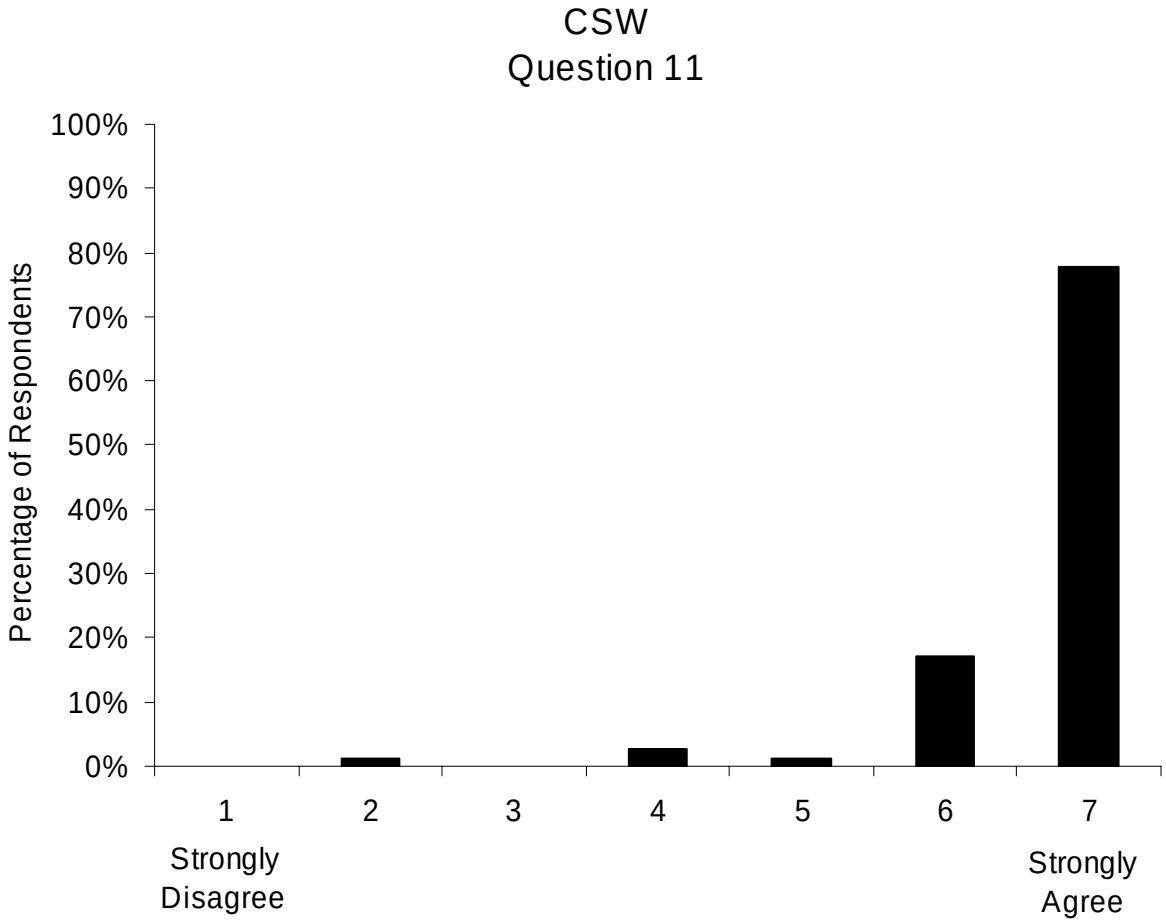
10. I knew what to do when I heard the CSW auditory warnings.



	Males	Females	Overall
Younger (20-30)	5.9 (1.5)	6.4 (1.2)	6.2 (1.3)
Middle-Aged (40-50)	5.3 (1.9)	6.6 (0.7)	6.0 (1.5)
Older (60-70)	6.2 (1.6)	6.5 (0.9)	6.3 (1.3)
Overall	5.8 (1.7)	6.5 (0.9)	6.2 (1.4)

Values in cells represent the mean response and (standard deviation)

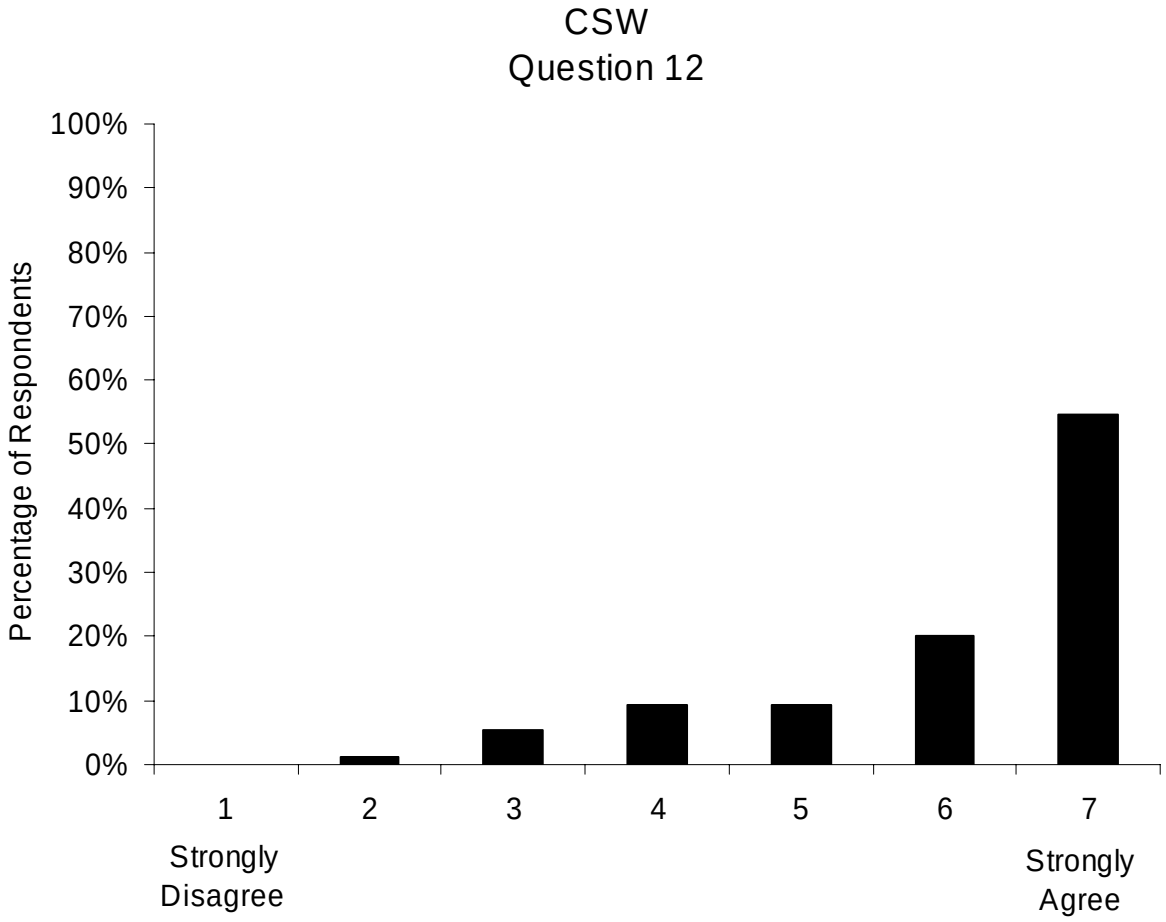
11. I could easily hear the CSW auditory warnings while I was driving.



	Males	Females	Overall
Younger (20-30)	6.1 (1.6)	6.9 (0.3)	6.5 (1.2)
Middle-Aged (40-50)	6.8 (0.4)	6.8 (0.5)	6.8 (0.4)
Older (60-70)	6.8 (0.4)	6.5 (0.9)	6.7 (0.7)
Overall	6.6 (1.0)	6.7 (0.6)	6.7 (0.8)

Values in cells represent the mean response and (standard deviation)

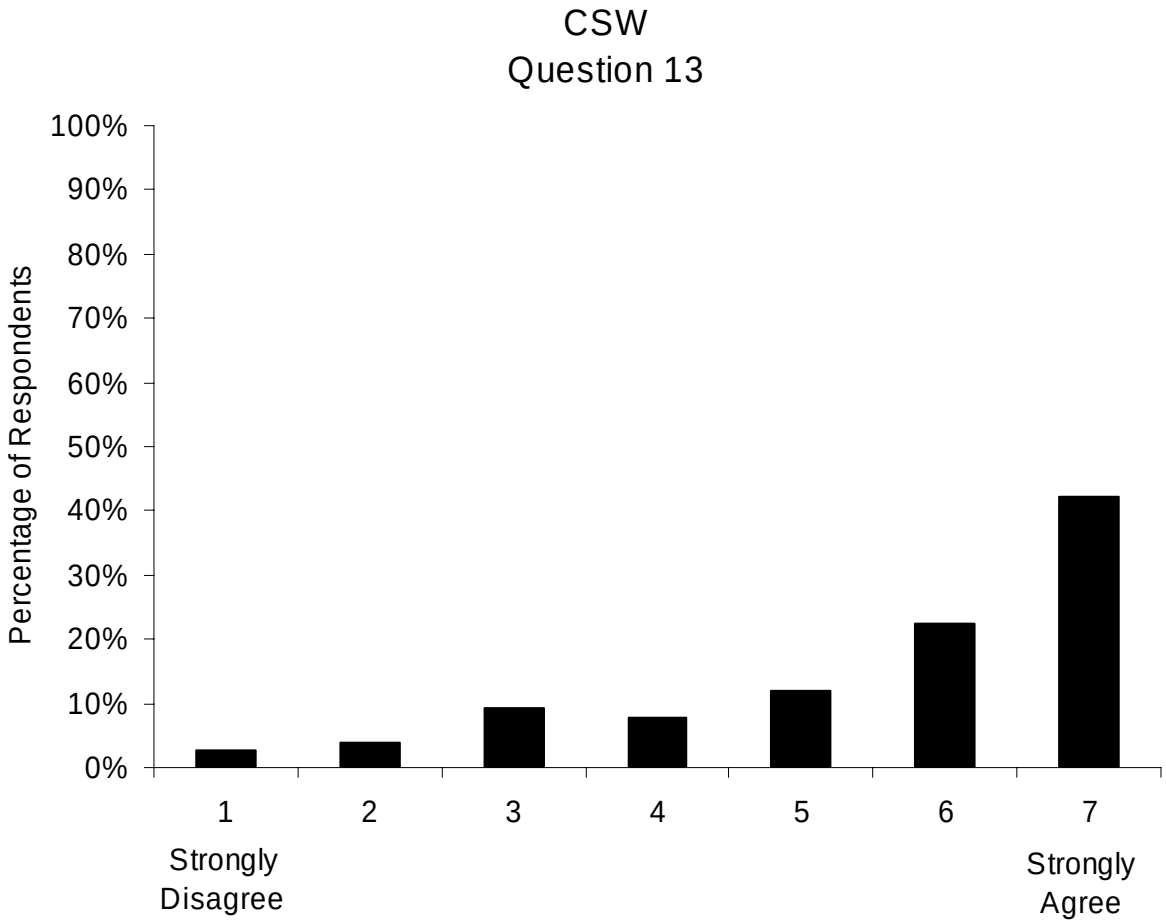
12. I could easily recognize that the CSW auditory warning was coming from the front speakers.



	Males	Females	Overall
Younger (20-30)	5.8 (1.5)	6.7 (0.6)	6.3 (1.2)
Middle-Aged (40-50)	5.8 (1.3)	6.1 (1.3)	6.0 (1.3)
Older (60-70)	6.2 (1.4)	5.6 (1.5)	5.9 (1.4)
Overall	6.0 (1.4)	6.1 (1.3)	6.1 (1.3)

Values in cells represent the mean response and (standard deviation)

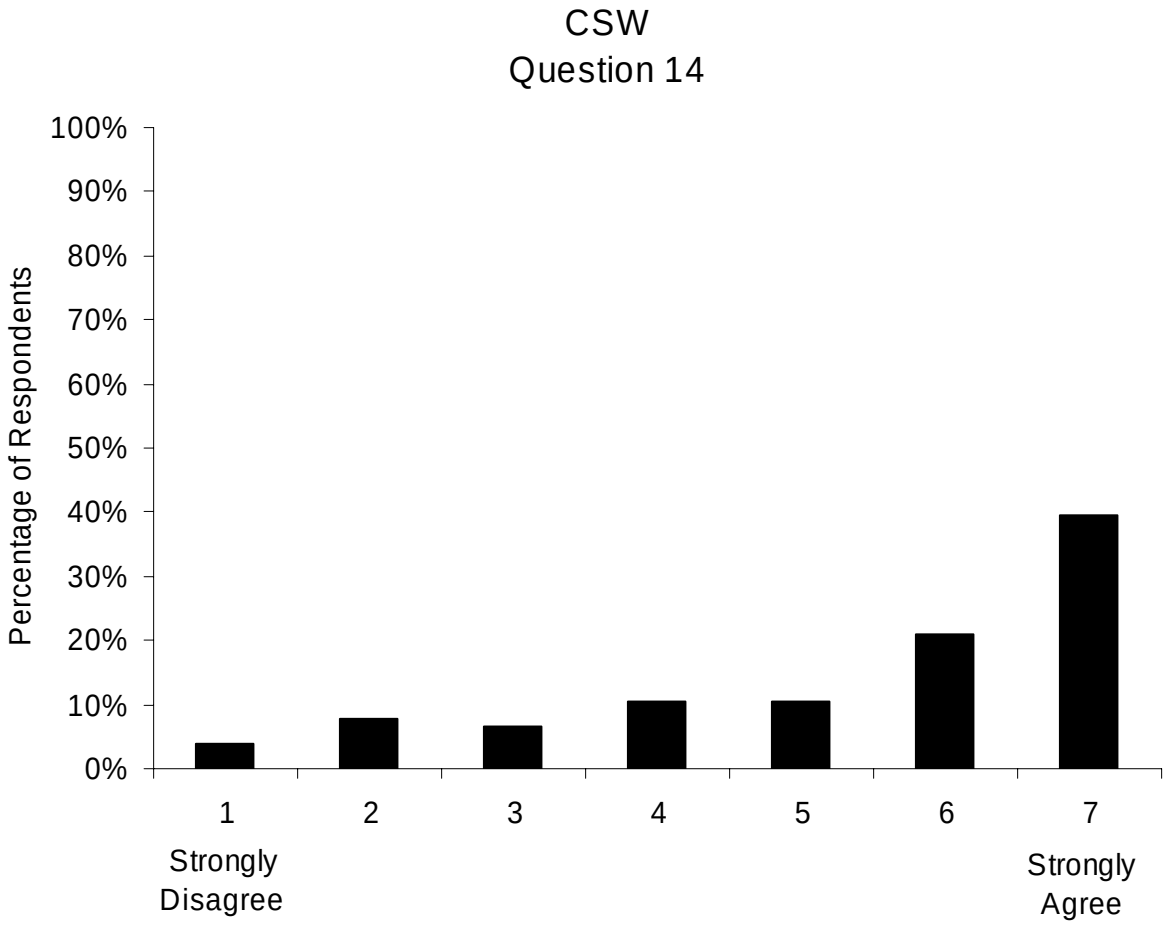
13. The auditory CSW warnings were not distracting.



	Males	Females	Overall
Younger (20-30)	4.7 (2.1)	5.1 (1.8)	4.9 (1.9)
Middle-Aged (40-50)	5.8 (1.4)	5.4 (1.8)	5.6 (1.6)
Older (60-70)	6.2 (1.7)	6.4 (0.7)	6.3 (1.3)
Overall	5.5 (1.8)	5.6 (1.6)	5.6 (1.7)

Values in cells represent the mean response and (standard deviation)

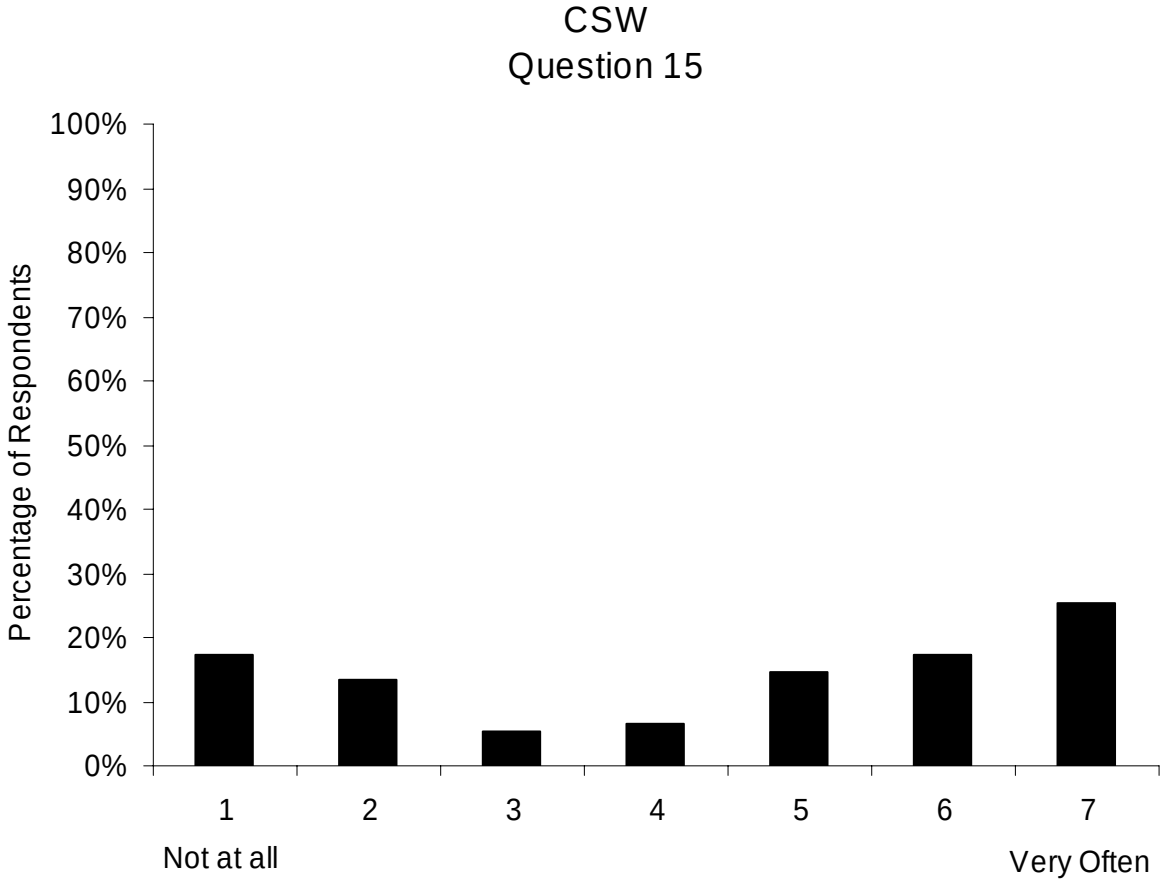
14. The frequency with which I received auditory CSW warnings was not annoying.



	Males	Females	Overall
Younger (20-30)	4.7 (2.1)	5.0 (2.1)	4.8 (2.1)
Middle-Aged (40-50)	5.3 (2.1)	5.2 (1.9)	5.2 (2.0)
Older (60-70)	5.8 (1.5)	6.3 (0.8)	6.0 (1.2)
Overall	5.2 (1.9)	5.5 (1.8)	5.4 (1.8)

Values in cells represent the mean response and (standard deviation)

15. How often did passengers in the car comment on the auditory CSW warnings when they occurred?



	Males	Females	Overall
Younger (20-30)	4.6 (2.1)	4.6 (1.9)	4.6 (2.0)
Middle-Aged (40-50)	4.1 (2.3)	4.8 (2.5)	4.4 (2.4)
Older (60-70)	4.5 (2.5)	3.9 (2.5)	4.2 (2.5)
Overall	4.4 (2.3)	4.4 (2.3)	4.4 (2.3)

Values in cells represent the mean response and (standard deviation)

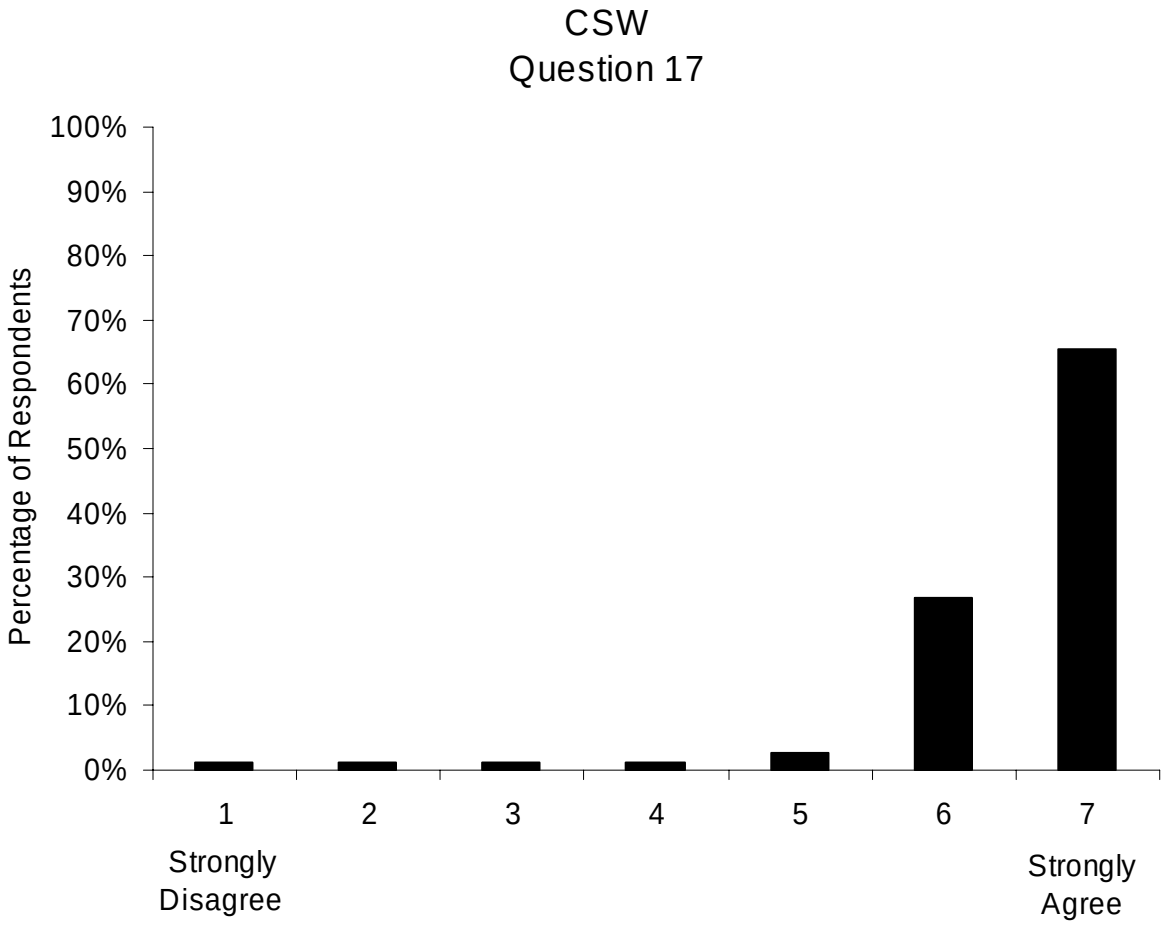
16. If passengers did comment on the auditory CSW warnings, what kinds of comments were made?

_____

_____

_____

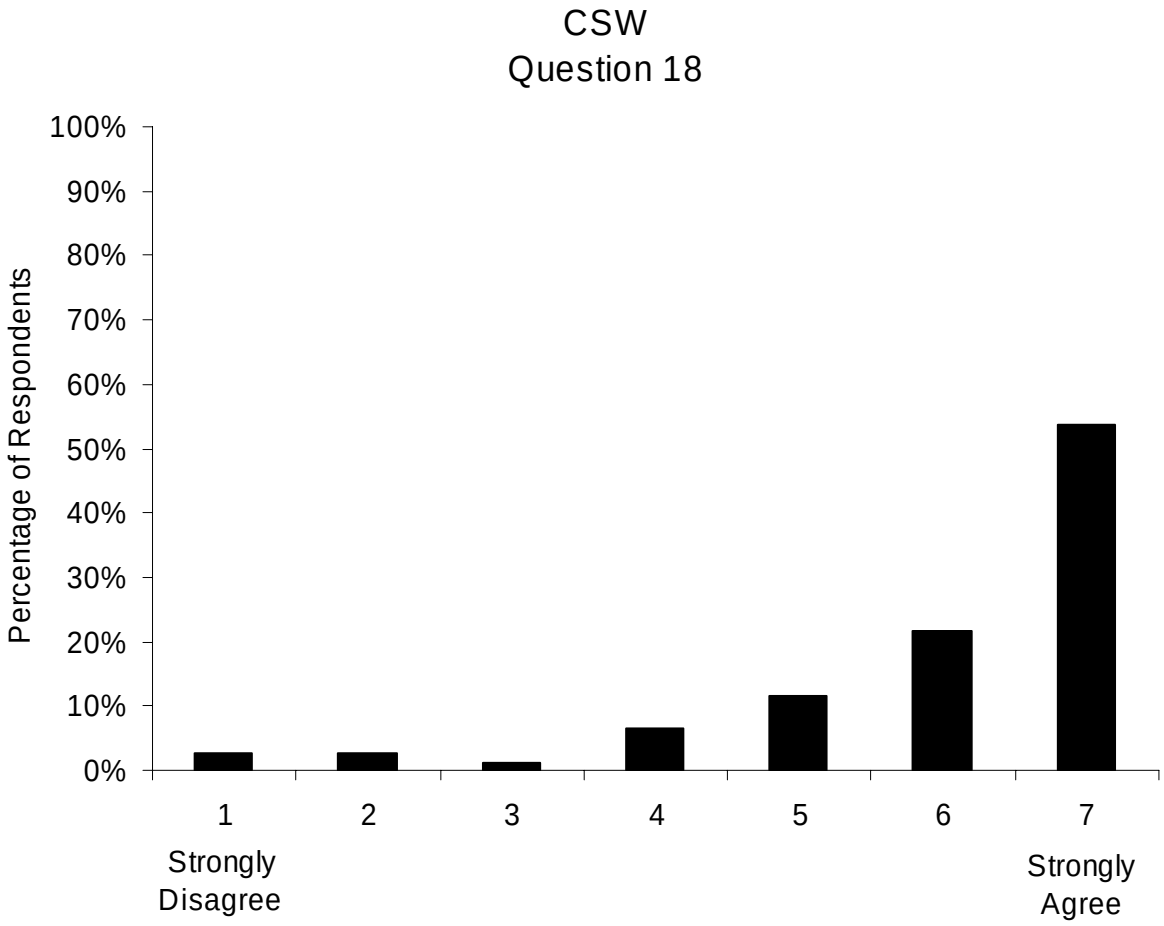
17. The CSW seat vibration warnings got my attention.



	Males	Females	Overall
Younger (20-30)	6.2 (1.2)	6.7 (0.6)	6.5 (0.9)
Middle-Aged (40-50)	6.5 (0.5)	6.5 (0.9)	6.5 (0.7)
Older (60-70)	6.0 (2.0)	6.7 (0.5)	6.3 (1.5)
Overall	6.3 (1.4)	6.6 (0.7)	6.4 (1.1)

Values in cells represent the mean response and (standard deviation)

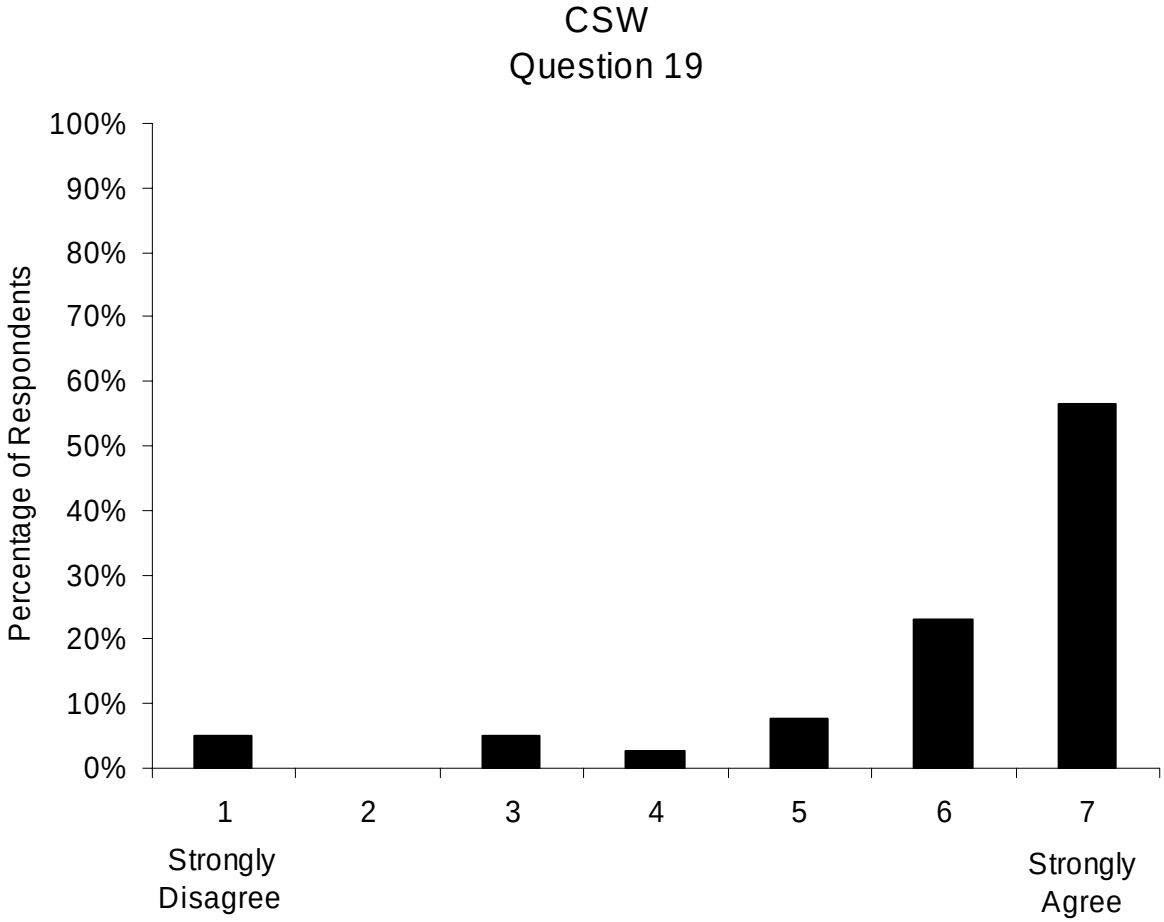
18. I knew what to do when I felt the CSW seat vibration warnings.



	Males	Females	Overall
Younger (20-30)	5.7 (1.7)	6.4 (1.0)	6.0 (1.4)
Middle-Aged (40-50)	5.8 (1.8)	6.1 (1.1)	5.9 (1.5)
Older (60-70)	5.8 (2.0)	6.4 (0.8)	6.1 (1.5)
Overall	5.8 (1.8)	6.3 (1.0)	6.0 (1.5)

Values in cells represent the mean response and (standard deviation)

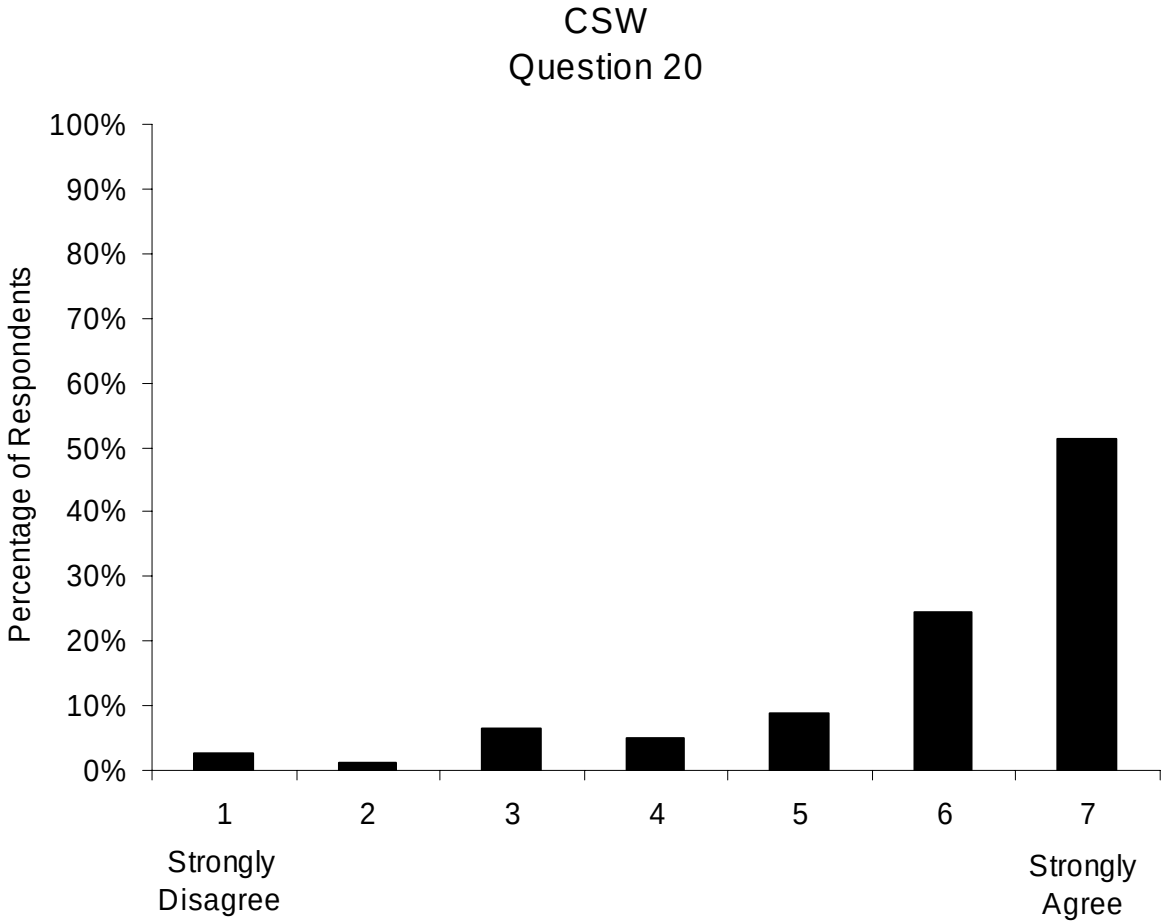
19. I could easily recognize that the CSW seat vibration warnings were being presented under my legs on the front portion of the seat.



	Males	Females	Overall
Younger (20-30)	5.8 (1.9)	6.4 (1.0)	6.1 (1.5)
Middle-Aged (40-50)	6.5 (0.7)	5.4 (2.0)	6.0 (1.6)
Older (60-70)	5.6 (2.3)	6.5 (0.7)	6.0 (1.7)
Overall	6.0 (1.8)	6.1 (1.4)	6.0 (1.6)

Values in cells represent the mean response and (standard deviation)

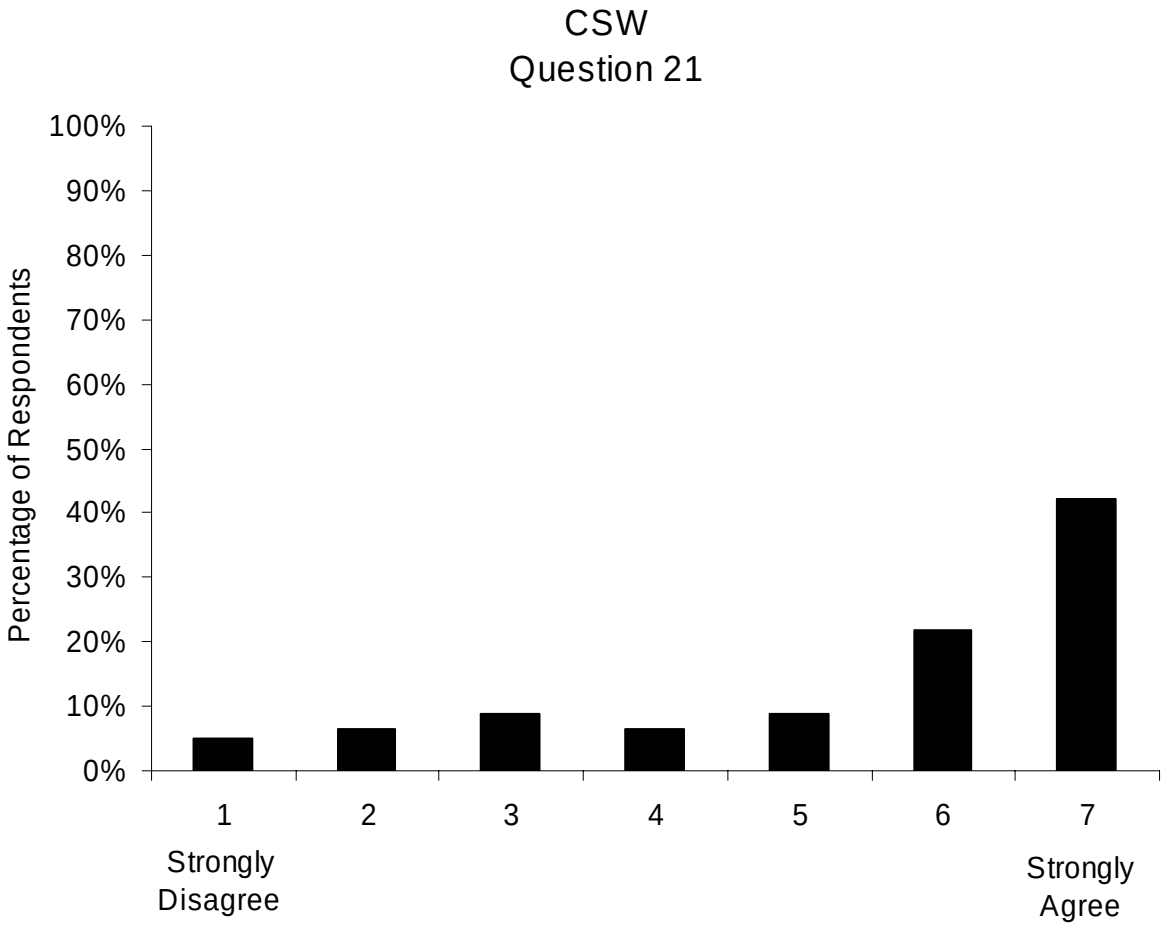
20. The CSW seat vibration warnings were not distracting.



	Males	Females	Overall
Younger (20-30)	5.2 (2.0)	6.0 (1.9)	5.6 (2.0)
Middle-Aged (40-50)	5.8 (1.6)	5.8 (1.4)	5.8 (1.4)
Older (60-70)	6.5 (0.9)	6.5 (0.7)	6.5 (0.8)
Overall	5.8 (1.6)	6.1 (1.4)	5.9 (1.5)

Values in cells represent the mean response and (standard deviation)

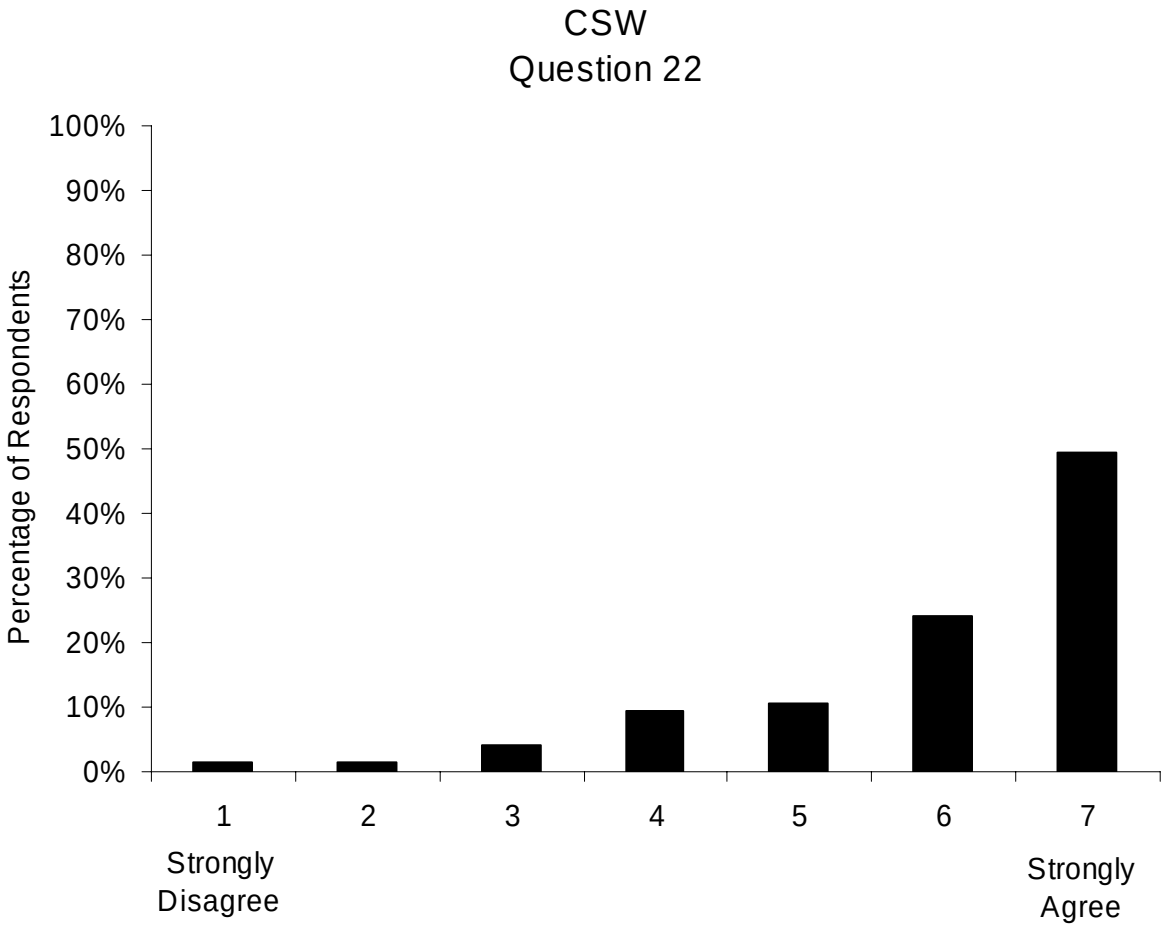
21. The frequency with which I received CSW seat vibration warnings was not annoying.



	Males	Females	Overall
Younger (20-30)	4.7 (2.2)	5.5 (2.0)	5.1 (2.1)
Middle-Aged (40-50)	4.6 (2.0)	5.3 (2.1)	5.0 (2.0)
Older (60-70)	6.0 (1.6)	6.4 (0.8)	6.2 (1.3)
Overall	5.1 (2.0)	5.7 (1.7)	5.4 (1.9)

Values in cells represent the mean response and (standard deviation)

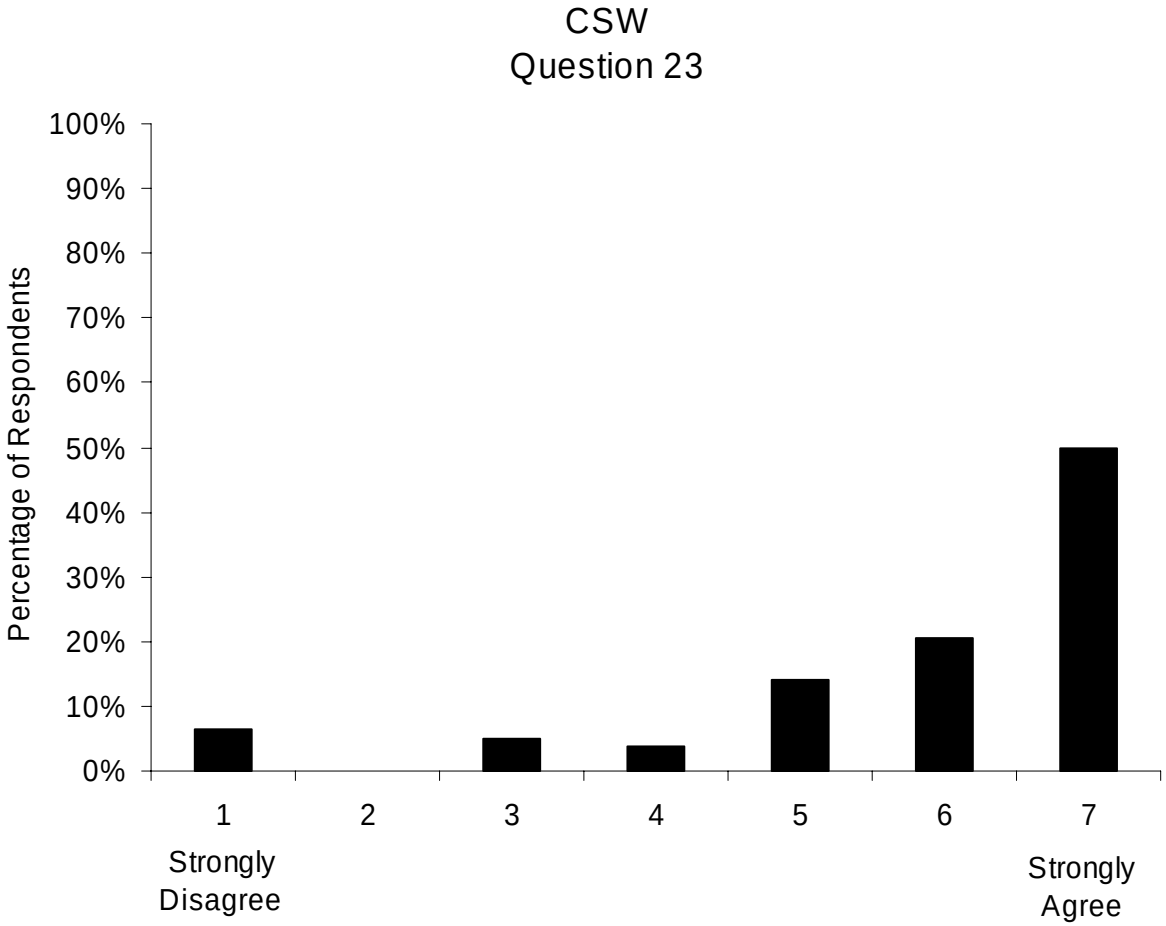
22. Passengers in the car did not notice the CSW seat vibration warnings when they occurred.



	Males	Females	Overall
Younger (20-30)	5.6 (1.1)	5.7 (1.9)	5.6 (1.6)
Middle-Aged (40-50)	5.7 (1.9)	6.1 (1.2)	5.9 (1.6)
Older (60-70)	6.0 (1.0)	6.7 (0.6)	6.4 (0.9)
Overall	5.8 (1.4)	6.2 (1.4)	6.0 (1.4)

Values in cells represent the mean response and (standard deviation)

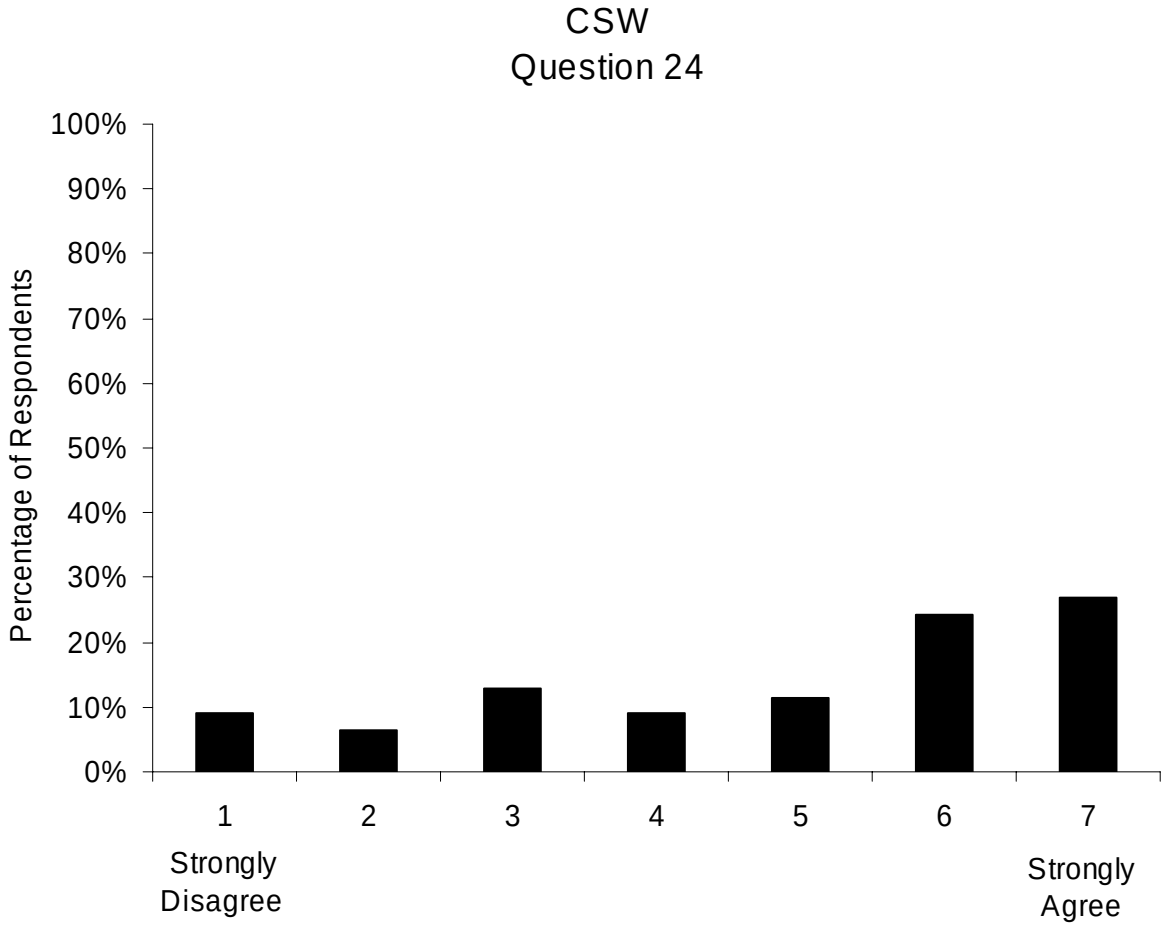
23. Overall, I could easily identify the urgency of the CSW warnings.



	Males	Females	Overall
Younger (20-30)	5.4 (1.9)	6.2 (1.1)	5.8 (1.5)
Middle-Aged (40-50)	5.2 (2.5)	6.2 (1.2)	5.7 (2.0)
Older (60-70)	5.7 (2.1)	6.2 (0.9)	6.0 (1.6)
Overall	5.4 (2.1)	6.2 (1.0)	5.8 (1.7)

Values in cells represent the mean response and (standard deviation)

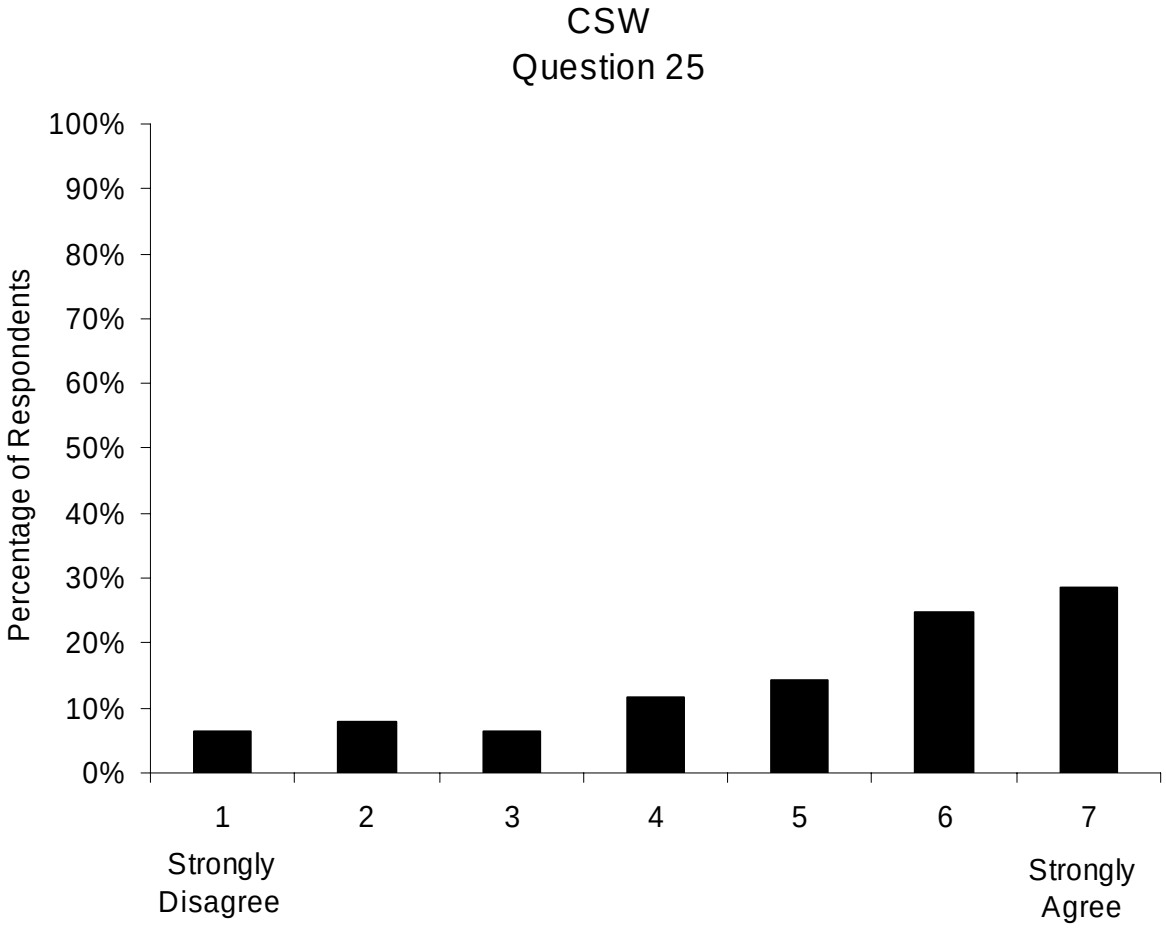
24. Overall, I thought the CSW auditory warnings were provided at the right time (i.e., they were not presented too early or too late).



	Males	Females	Overall
Younger (20-30)	4.8 (1.9)	5.0 (2.0)	4.9 (1.9)
Middle-Aged (40-50)	4.1 (2.3)	5.0 (2.1)	4.5 (2.2)
Older (60-70)	5.1 (2.0)	5.3 (1.8)	5.2 (1.9)
Overall	4.7 (2.1)	5.1 (1.9)	4.9 (2.0)

Values in cells represent the mean response and (standard deviation)

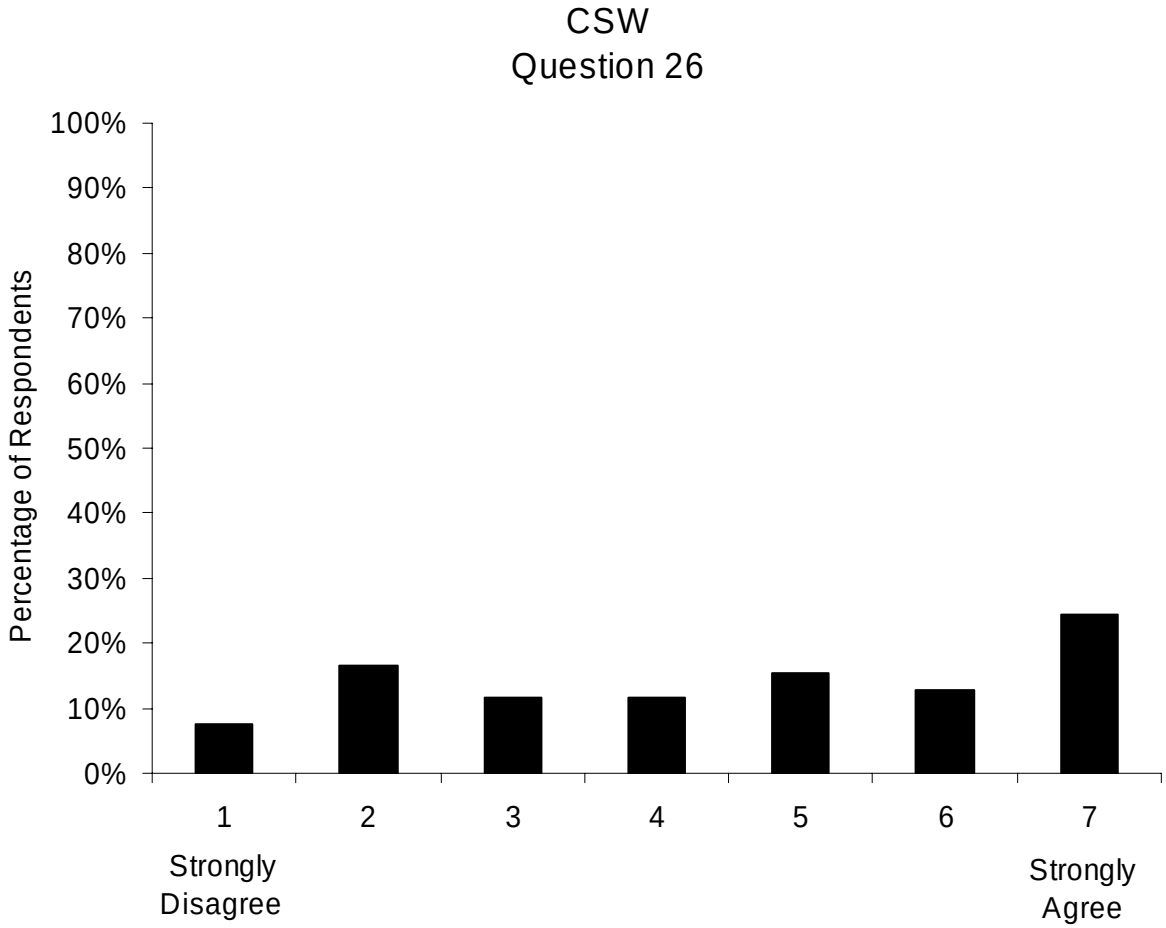
25. Overall, I thought the CSW seat vibration warnings were provided at the right time (i.e., they were not presented too early or too late).



	Males	Females	Overall
Younger (20-30)	4.9 (1.9)	5.5 (1.9)	5.2 (1.9)
Middle-Aged (40-50)	4.5 (1.9)	5.6 (1.6)	5.1 (1.8)
Older (60-70)	4.7 (2.2)	5.2 (1.8)	5.0 (2.0)
Overall	4.7 (2.0)	5.4 (1.8)	5.1 (1.9)

Values in cells represent the mean response and (standard deviation)

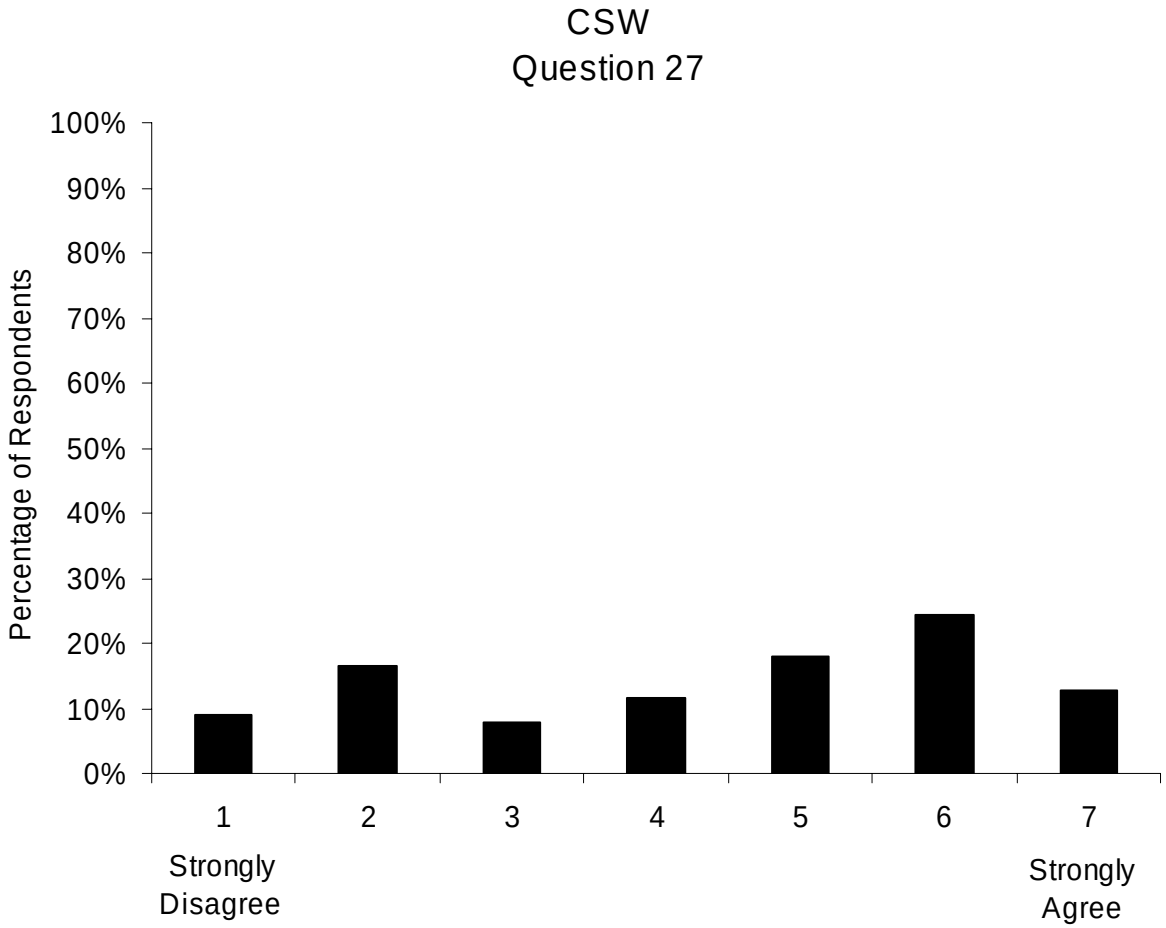
26. I always understood why the CSW system was providing a warning.



	Males	Females	Overall
Younger (20-30)	4.1 (2.2)	4.2 (1.9)	4.2 (2.0)
Middle-Aged (40-50)	4.3 (2.3)	4.3 (2.2)	4.3 (2.2)
Older (60-70)	4.5 (2.3)	5.4 (1.4)	4.9 (1.9)
Overall	4.3 (2.2)	4.6 (1.9)	4.5 (2.0)

Values in cells represent the mean response and (standard deviation)

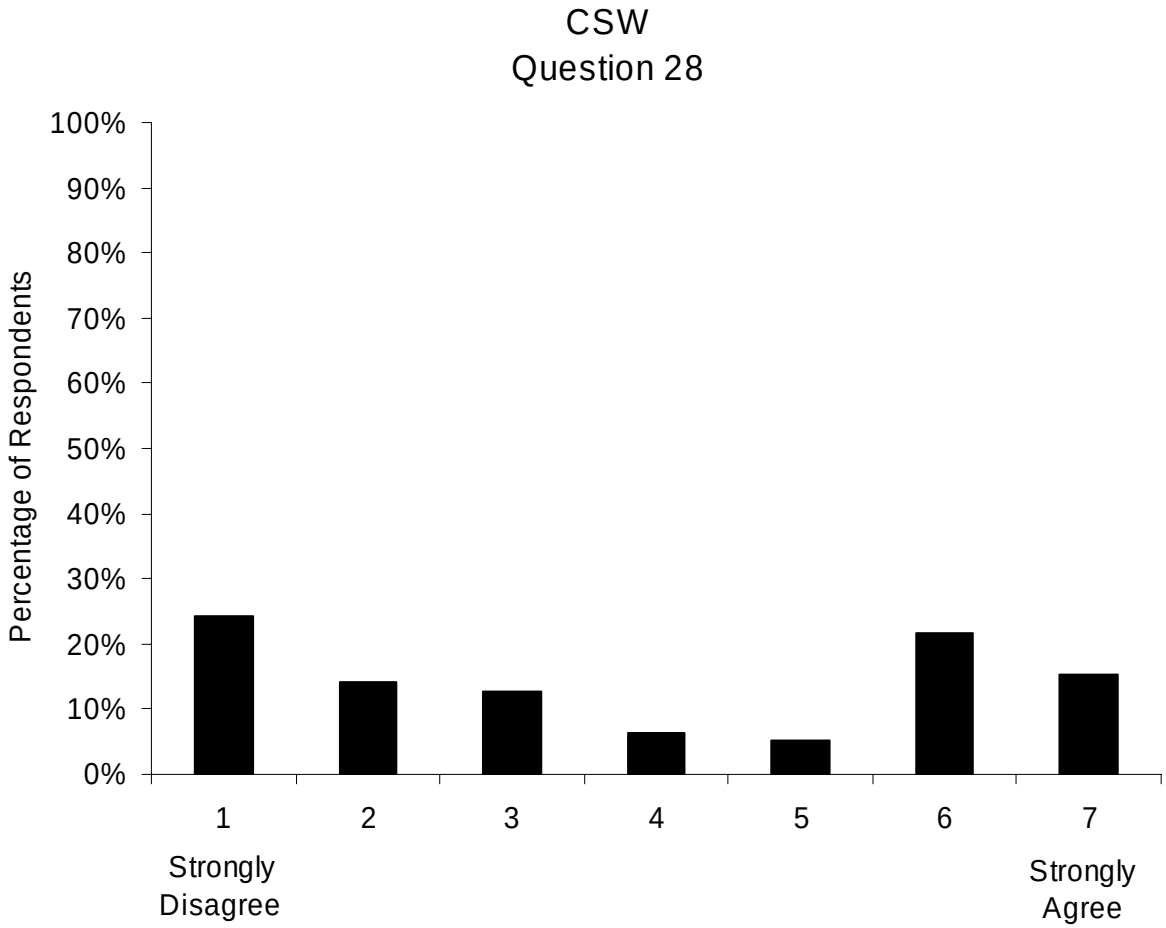
27. The CSW always provided a warning when I thought it should.



	Males	Females	Overall
Younger (20-30)	4.2 (2.0)	4.8 (2.0)	4.5 (2.0)
Middle-Aged (40-50)	3.4 (2.1)	4.4 (1.5)	3.9 (1.8)
Older (60-70)	4.1 (2.2)	5.3 (1.5)	4.7 (2.0)
Overall	3.9 (2.1)	4.8 (1.7)	4.4 (1.9)

Values in cells represent the mean response and (standard deviation)

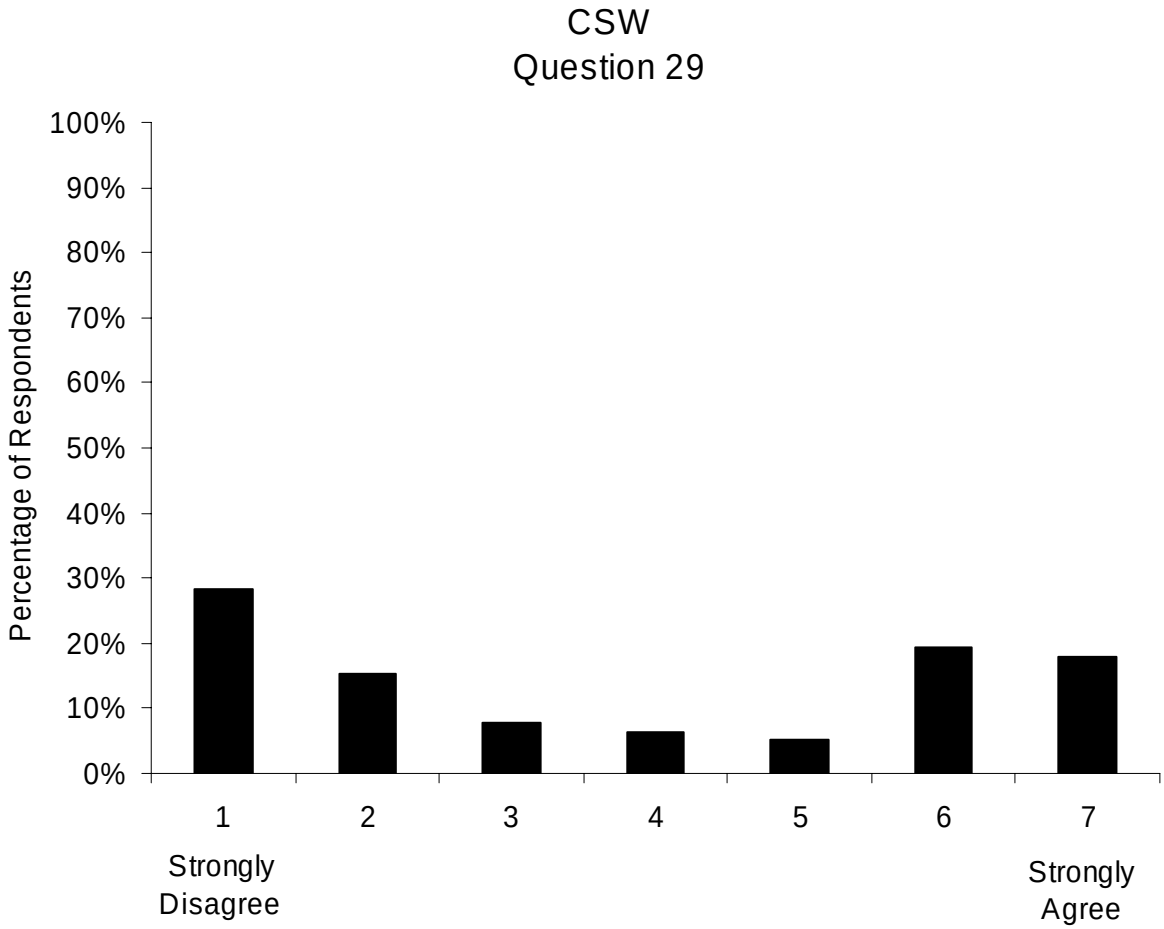
28. I did not receive any unnecessary CSW warnings.



	Males	Females	Overall
Younger (20-30)	4.1 (2.3)	3.6 (2.1)	3.8 (2.2)
Middle-Aged (40-50)	3.0 (2.0)	2.7 (2.4)	2.8 (2.1)
Older (60-70)	4.3 (2.5)	5.2 (1.9)	4.7 (2.2)
Overall	3.8 (2.3)	3.8 (2.3)	3.8 (2.3)

Values in cells represent the mean response and (standard deviation)

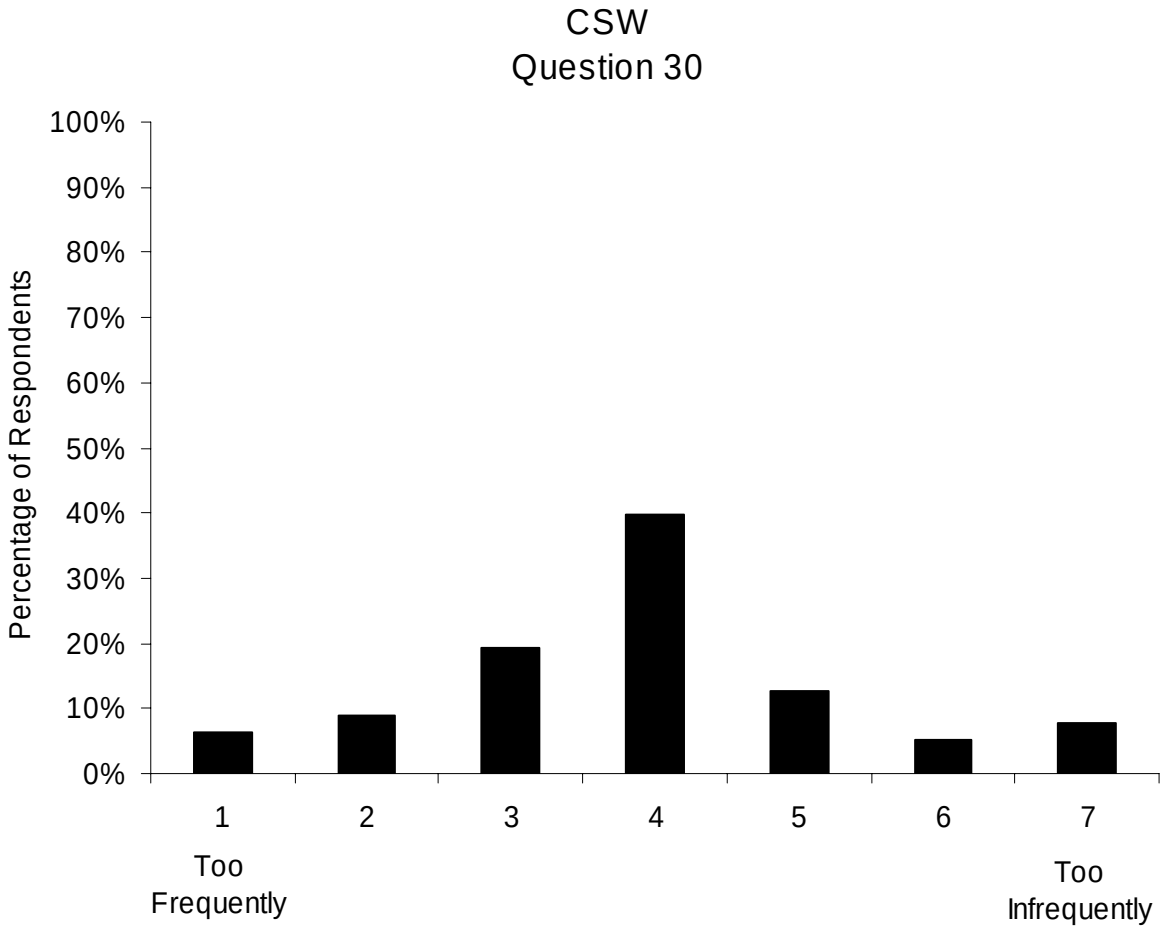
29. I did not receive any false CSW warnings.



	Males	Females	Overall
Younger (20-30)	3.2 (2.3)	4.1 (2.4)	3.6 (2.3)
Middle-Aged (40-50)	2.8 (2.2)	3.2 (2.3)	3.0 (2.2)
Older (60-70)	3.8 (2.5)	5.4 (2.1)	4.6 (2.4)
Overall	3.3 (2.3)	4.2 (2.4)	3.7 (2.4)

Values in cells represent the mean response and (standard deviation)

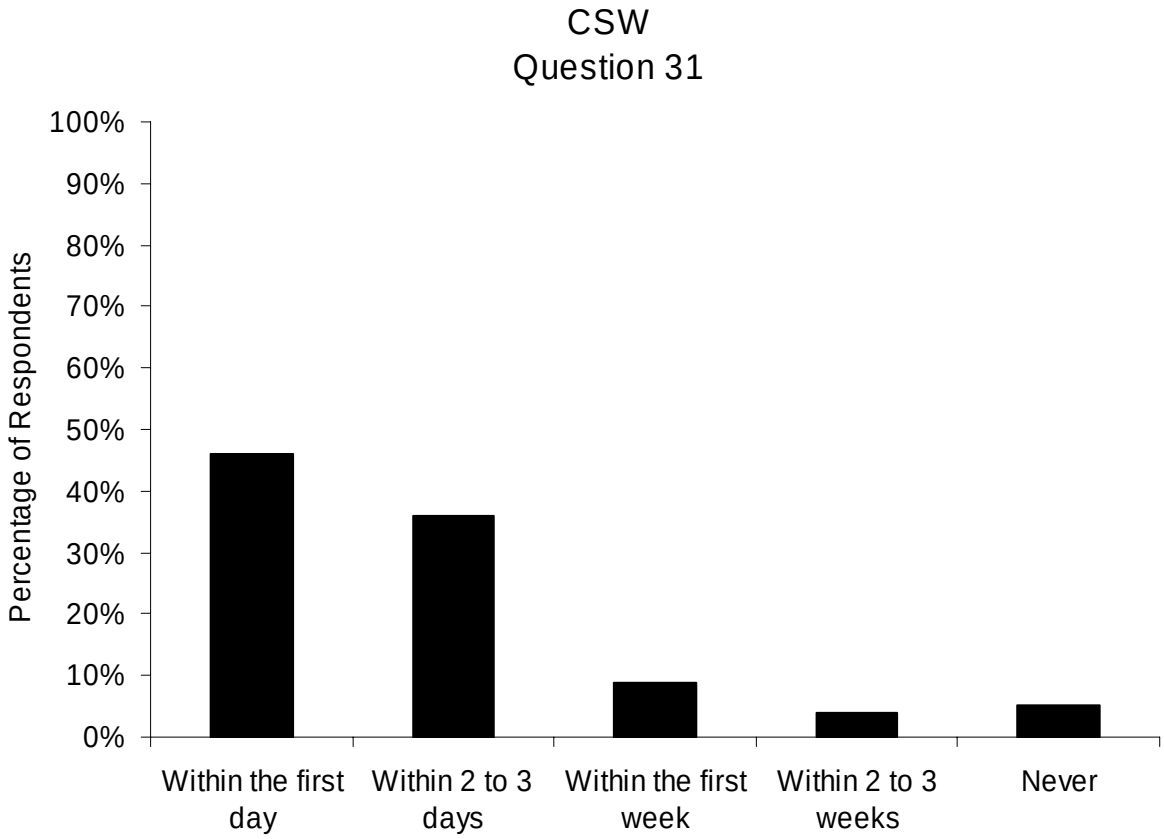
30. Overall, I received CSW warnings . . . . . .



	Males	Females	Overall
Younger (20-30)	2.9 (1.3)	3.5 (1.0)	3.2 (1.1)
Middle-Aged (40-50)	3.7 (1.6)	3.6 (1.1)	3.7 (1.4)
Older (60-70)	5.2 (1.5)	4.5 (1.4)	4.8 (1.5)
Overall	3.9 (1.7)	3.9 (1.2)	3.9 (1.5)

Values in cells represent the mean response and (standard deviation)

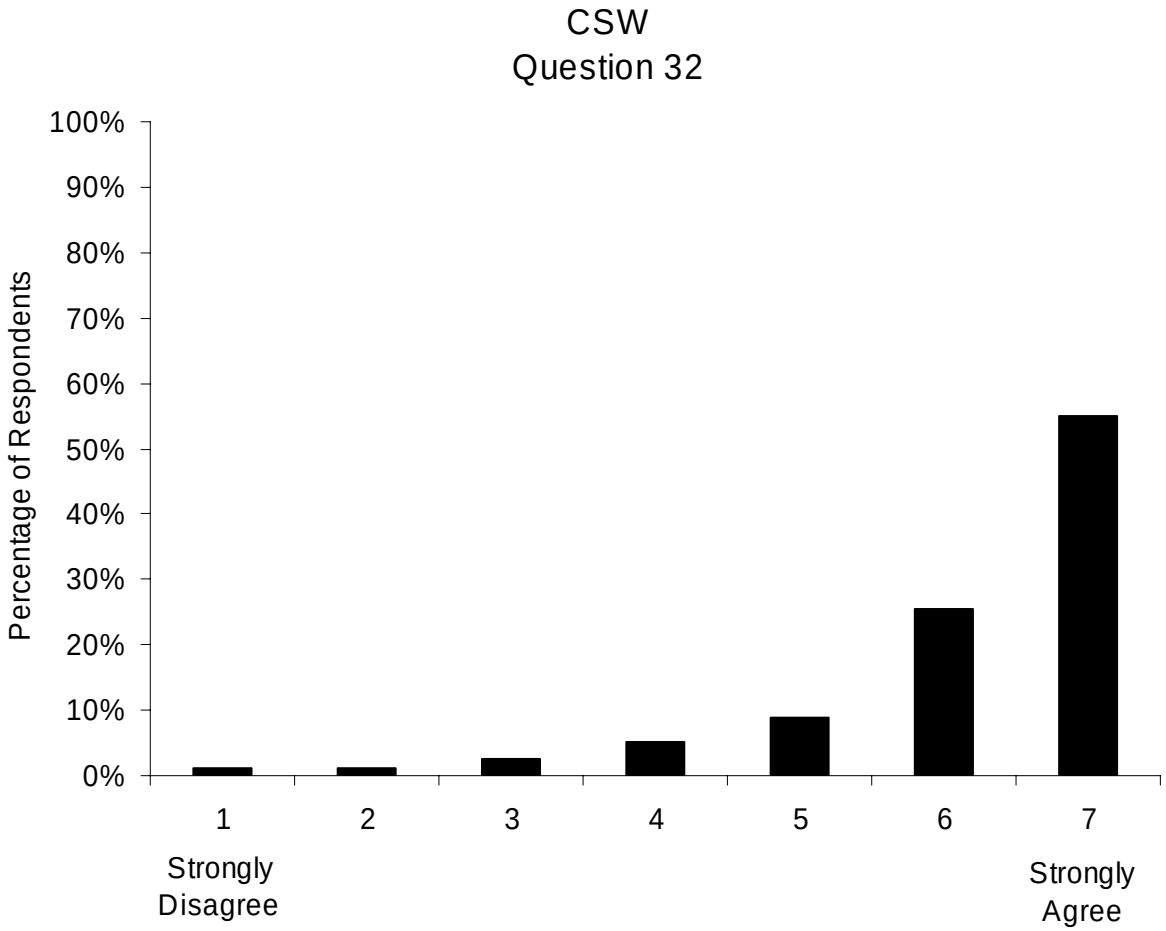
31. How long did it take before you became comfortable driving the car with CSW? (check one)



	Males	Females	Overall
Younger (20-30)	2.2 (1.5)	2.0 (1.2)	2.1 (1.3)
Middle-Aged (40-50)	1.6 (0.9)	1.9 (1.1)	1.8 (1.0)
Older (60-70)	1.8 (1.1)	1.6 (0.7)	1.7 (0.9)
Overall	1.9 (1.2)	1.8 (1.0)	1.9 (1.1)

Values in cells represent the mean response and (standard deviation)

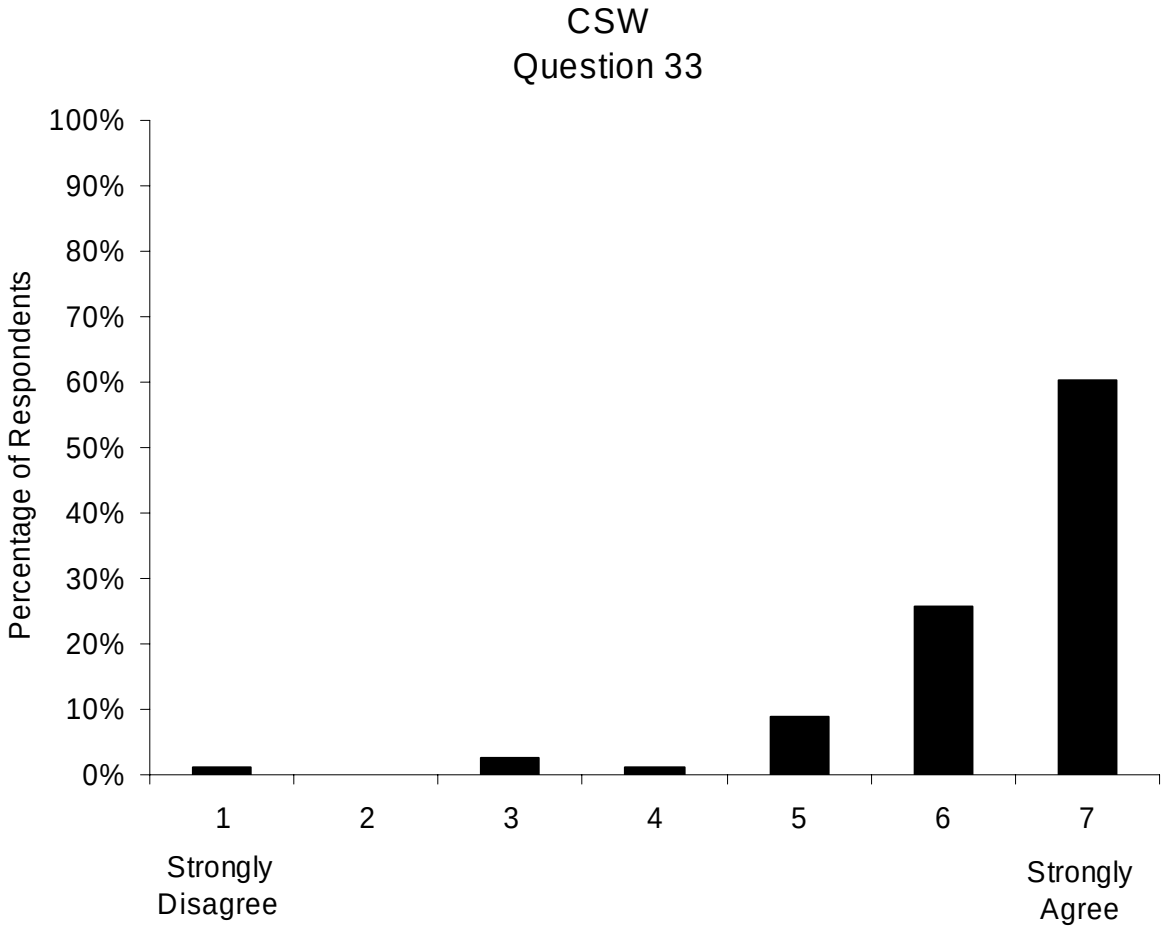
32. Overall, it was easy to become familiar with the CSW system.



	Males	Females	Overall
Younger (20-30)	5.8 (1.7)	6.3 (1.1)	6.0 (1.4)
Middle-Aged (40-50)	6.6 (0.7)	6.5 (0.9)	6.6 (0.8)
Older (60-70)	5.8 (1.6)	5.9 (1.3)	5.9 (1.4)
Overall	6.1 (1.4)	6.3 (1.1)	6.2 (1.3)

Values in cells represent the mean response and (standard deviation)

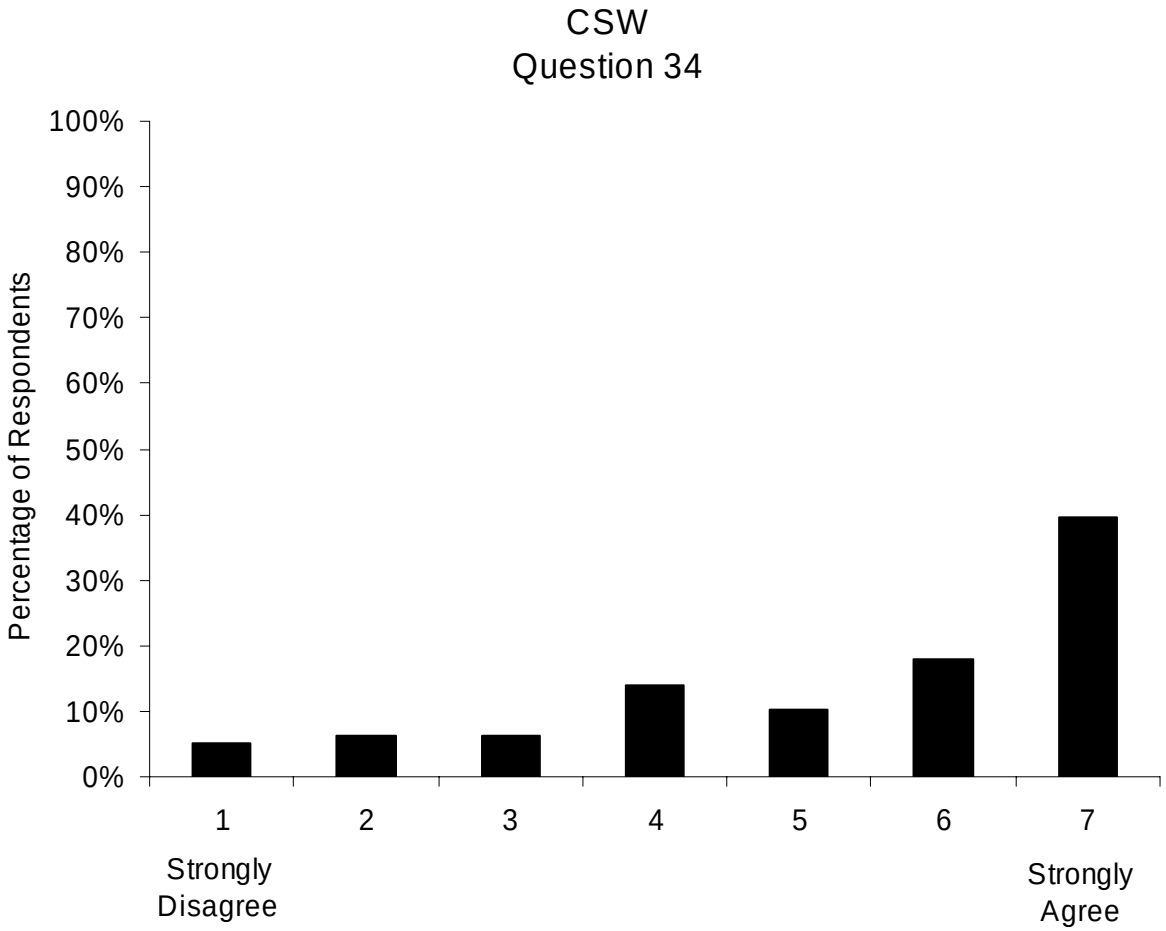
33. I developed a good understanding of how the CSW system worked after hearing a brief description, and after I had the chance to drive with the system.



	Males	Females	Overall
Younger (20-30)	6.2 (1.4)	6.5 (0.9)	6.3 (1.1)
Middle-Aged (40-50)	6.5 (0.7)	6.5 (1.1)	6.5 (0.9)
Older (60-70)	6.1 (1.7)	6.3 (0.6)	6.2 (1.2)
Overall	6.3 (1.3)	6.4 (0.9)	6.3 (1.1)

Values in cells represent the mean response and (standard deviation)

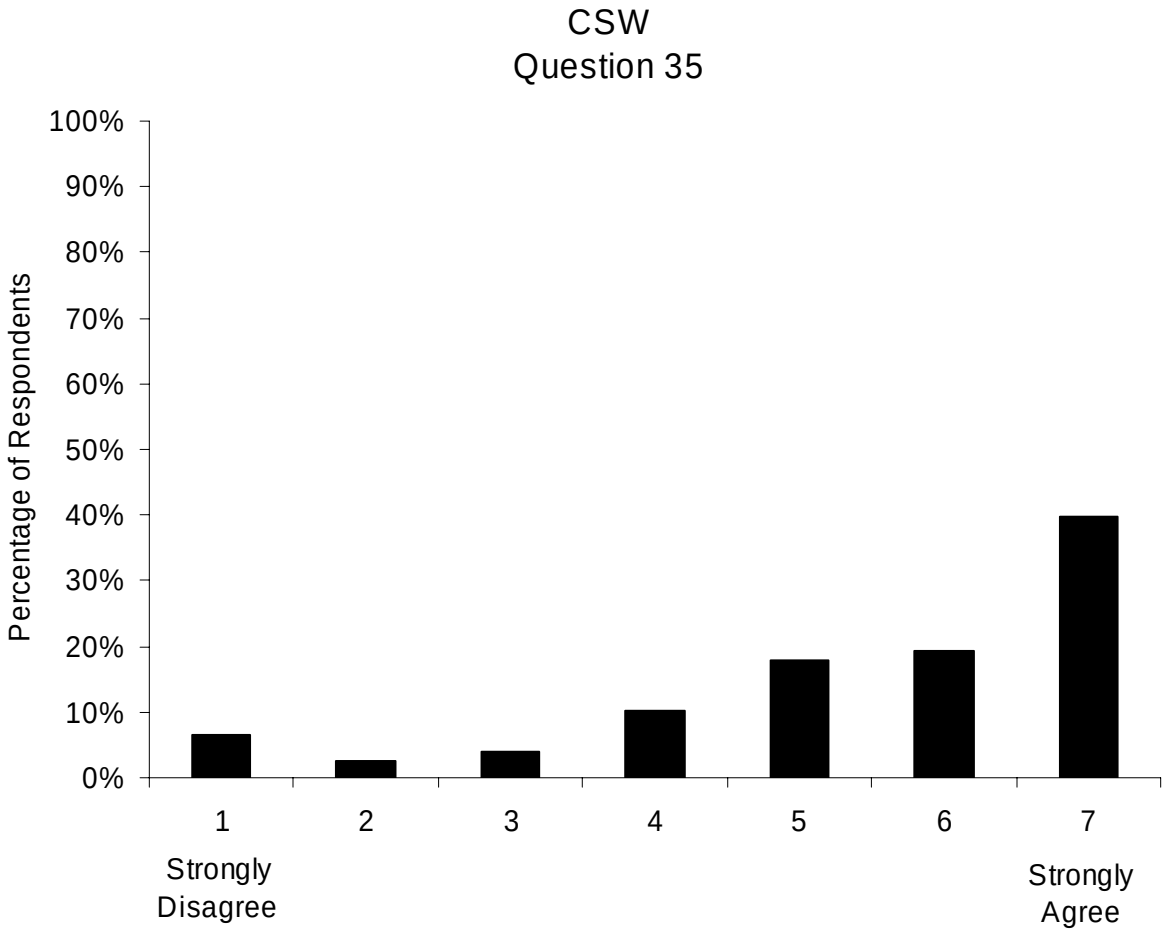
34. Driving with the CSW system made me more aware of upcoming curves.



	Males	Females	Overall
Younger (20-30)	4.9 (1.8)	5.7 (1.6)	5.3 (1.7)
Middle-Aged (40-50)	4.8 (2.3)	5.5 (1.6)	5.2 (2.0)
Older (60-70)	5.2 (2.1)	5.7 (1.8)	5.5 (1.9)
Overall	5.0 (2.1)	5.6 (1.6)	5.3 (1.9)

Values in cells represent the mean response and (standard deviation)

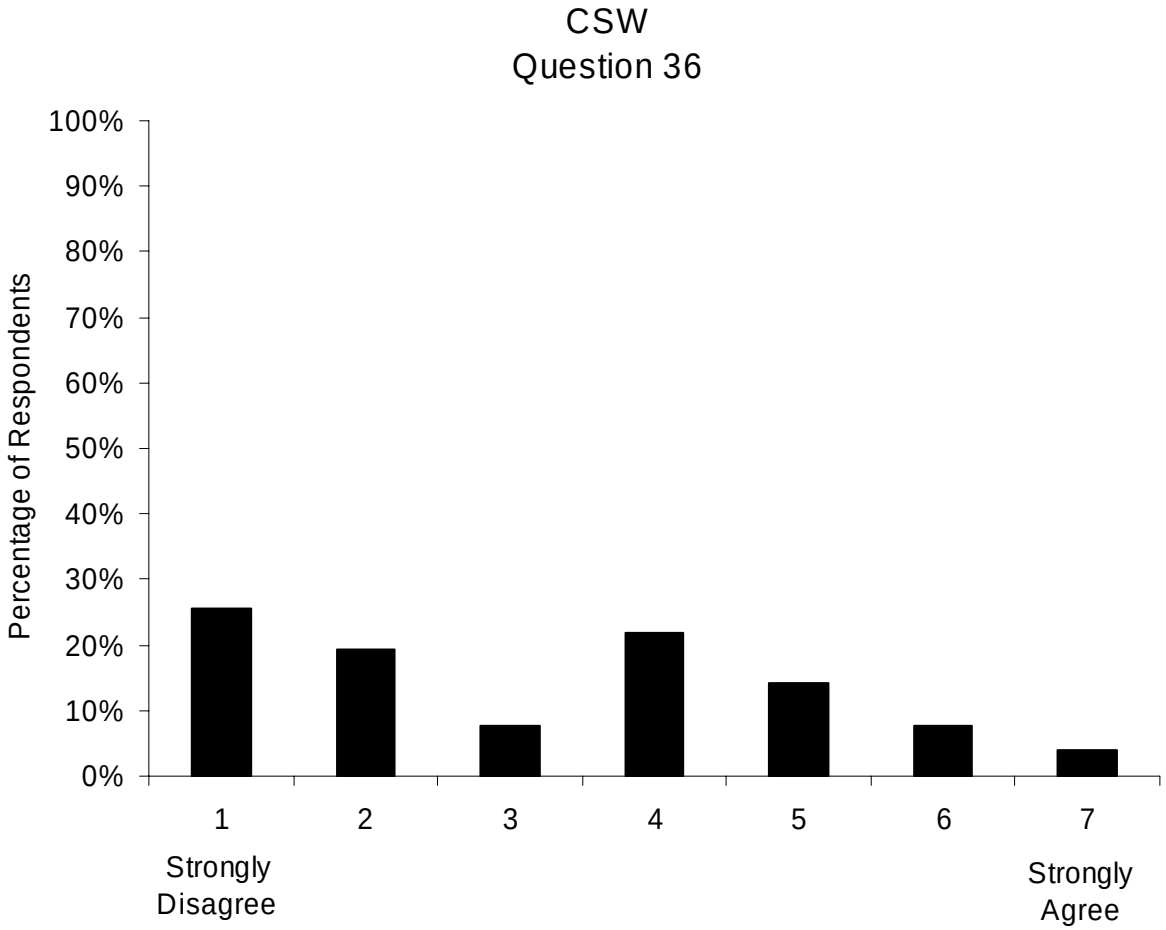
35. The CSW system made me more attentive to slowing down for curves.



	Males	Females	Overall
Younger (20-30)	5.2 (1.9)	6.4 (1.0)	5.8 (1.6)
Middle-Aged (40-50)	4.7 (2.0)	5.6 (1.4)	5.2 (1.8)
Older (60-70)	5.2 (2.0)	5.8 (1.8)	5.5 (1.9)
Overall	5.0 (2.0)	5.9 (1.4)	5.5 (1.8)

Values in cells represent the mean response and (standard deviation)

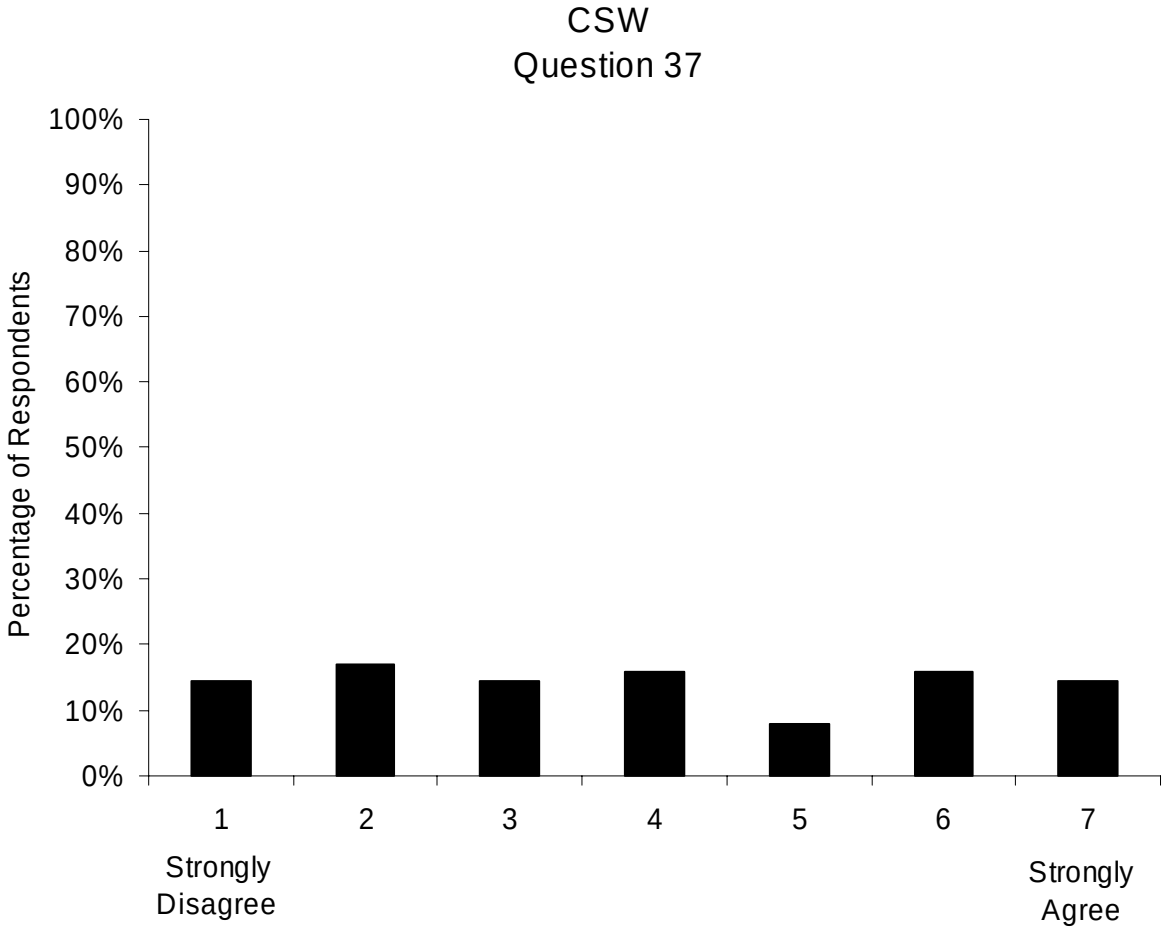
36. I relied on the CSW system.



	Males	Females	Overall
Younger (20-30)	2.8 (1.6)	3.6 (1.9)	3.2 (1.8)
Middle-Aged (40-50)	1.9 (1.4)	3.2 (1.5)	2.5 (1.6)
Older (60-70)	3.6 (1.9)	3.9 (2.1)	3.8 (2.0)
Overall	2.8 (1.7)	3.6 (1.8)	3.2 (1.8)

Values in cells represent the mean response and (standard deviation)

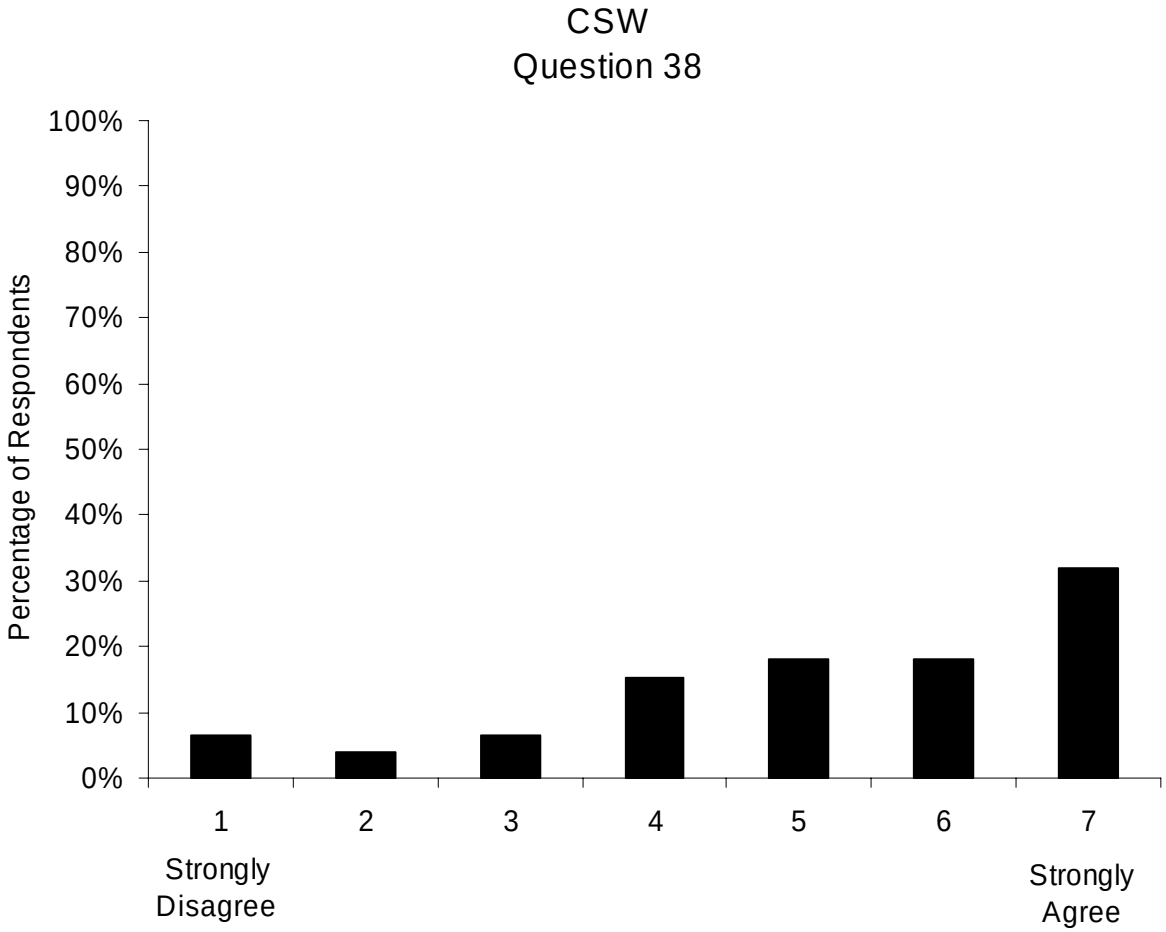
37. I found the CSW system useful in providing warnings about situations that might have resulted in collisions.



	Males	Females	Overall
Younger (20-30)	4.0 (2.0)	5.2 (2.1)	4.6 (2.1)
Middle-Aged (40-50)	3.5 (1.8)	3.1 (1.9)	3.3 (1.8)
Older (60-70)	3.7 (2.1)	4.0 (2.1)	3.8 (2.1)
Overall	3.7 (1.9)	4.1 (2.2)	3.9 (2.0)

Values in cells represent the mean response and (standard deviation)

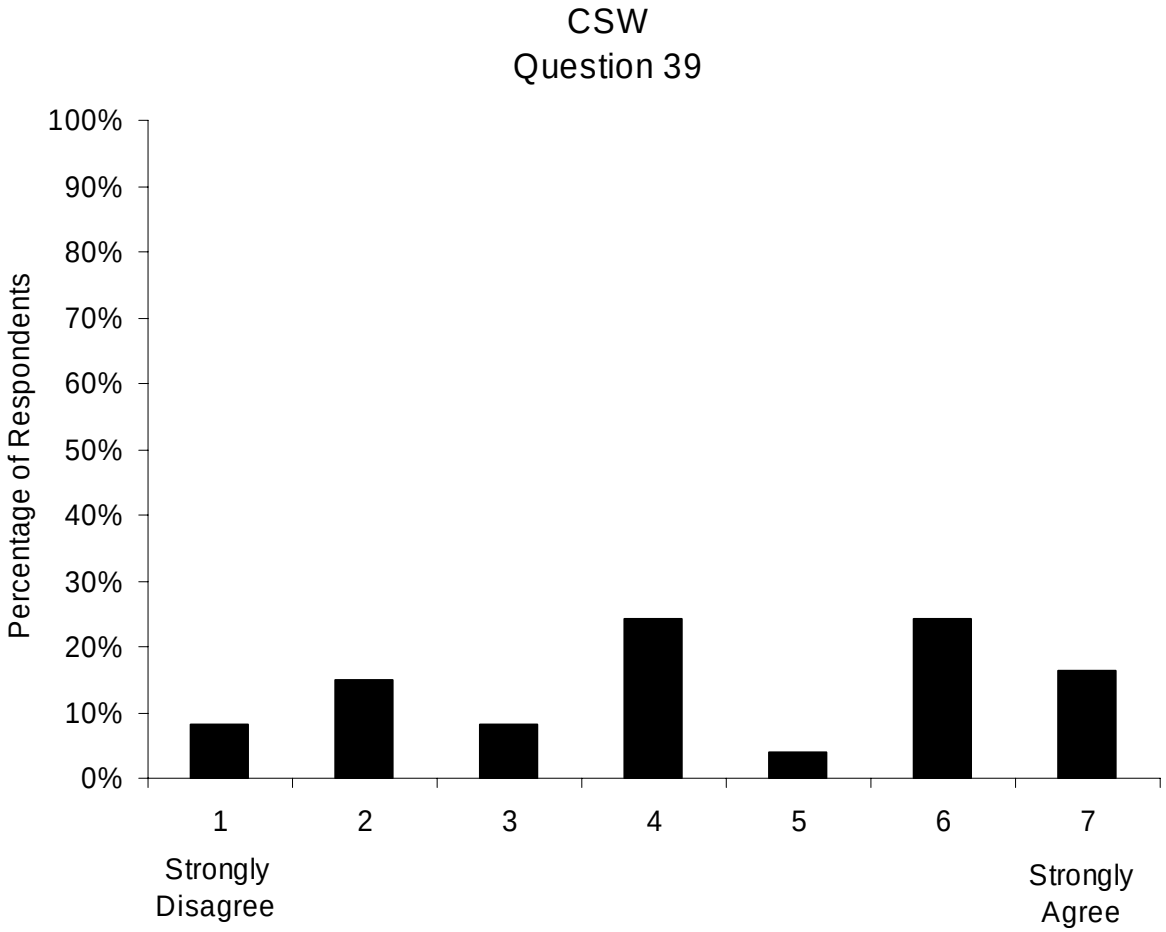
38. CSW is going to increase driving safety.



	Males	Females	Overall
Younger (20-30)	4.8 (1.8)	5.5 (1.8)	5.2 (1.8)
Middle-Aged (40-50)	5.0 (2.2)	5.2 (1.7)	5.1 (2.0)
Older (60-70)	5.2 (2.0)	5.2 (1.4)	5.2 (1.7)
Overall	5.0 (2.0)	5.3 (1.6)	5.2 (1.8)

Values in cells represent the mean response and (standard deviation)

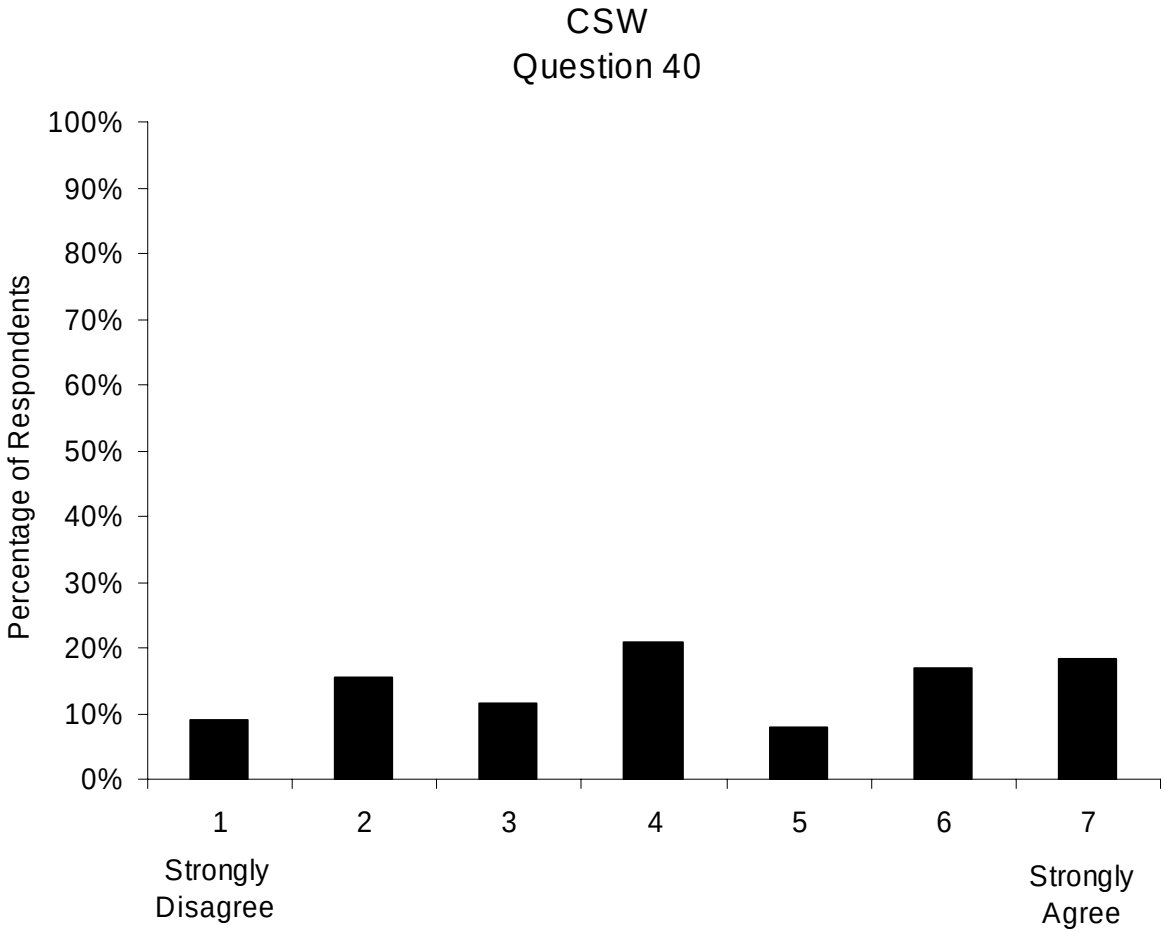
39. I found the CSW system useful in adverse weather conditions.



	Males	Females	Overall
Younger (20-30)	4.7 (1.8)	4.3 (2.2)	4.5 (2.0)
Middle-Aged (40-50)	3.2 (1.9)	4.9 (1.8)	4.0 (2.0)
Older (60-70)	4.8 (1.9)	4.5 (1.9)	4.7 (1.8)
Overall	4.2 (2.0)	4.6 (1.9)	4.4 (1.9)

Values in cells represent the mean response and (standard deviation)

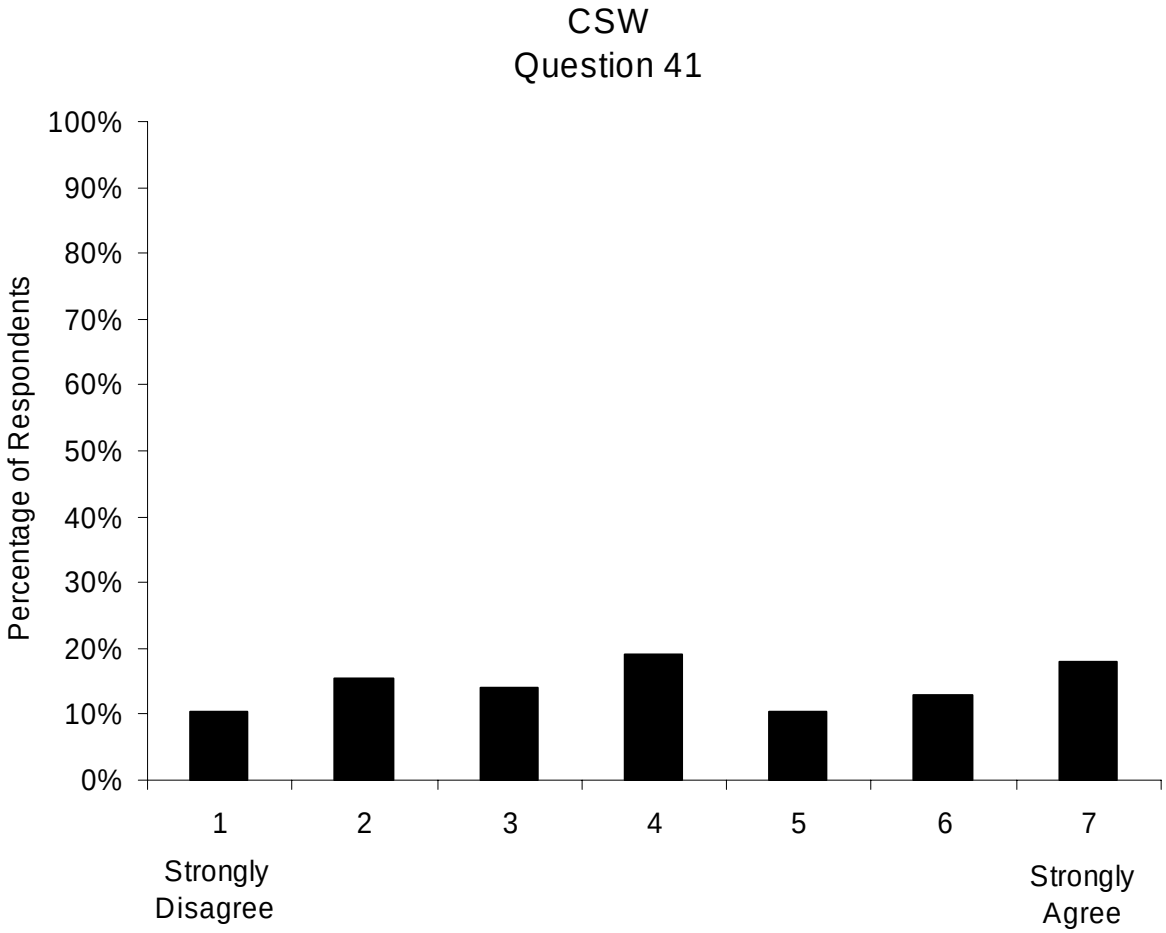
40. I found the CSW system useful in light traffic.



	Males	Females	Overall
Younger (20-30)	4.0 (1.7)	4.9 (2.1)	4.5 (1.9)
Middle-Aged (40-50)	4.0 (2.4)	4.0 (1.9)	4.0 (2.1)
Older (60-70)	4.2 (2.1)	4.5 (1.9)	4.3 (2.0)
Overall	4.1 (2.0)	4.5 (1.9)	4.3 (2.0)

Values in cells represent the mean response and (standard deviation)

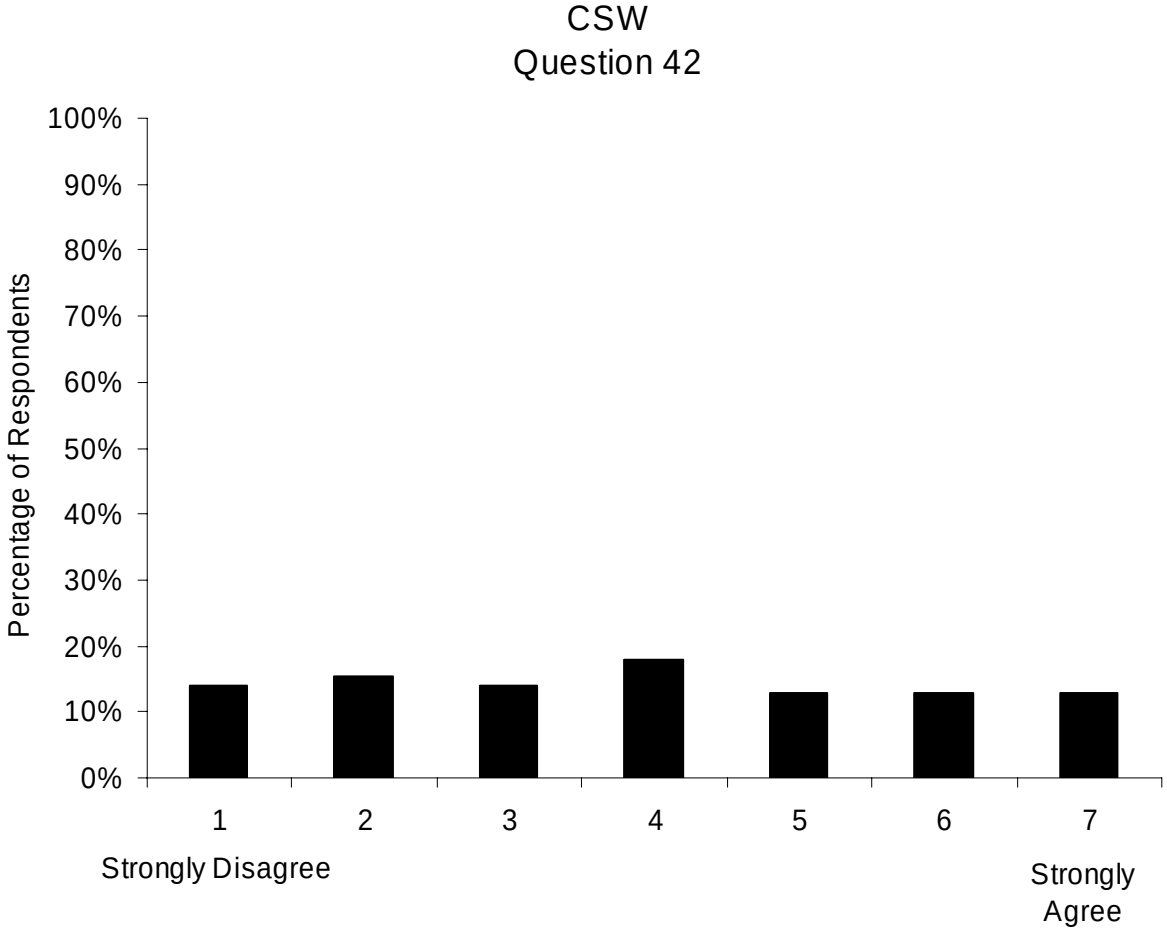
41. I found the CSW system useful in heavy traffic.



	Males	Females	Overall
Younger (20-30)	3.7 (1.8)	4.7 (2.1)	4.2 (1.9)
Middle-Aged (40-50)	3.5 (2.4)	4.2 (1.6)	3.9 (2.0)
Older (60-70)	4.4 (2.3)	4.3 (1.8)	4.3 (2.0)
Overall	3.9 (2.1)	4.4 (1.8)	4.1 (2.0)

Values in cells represent the mean response and (standard deviation)

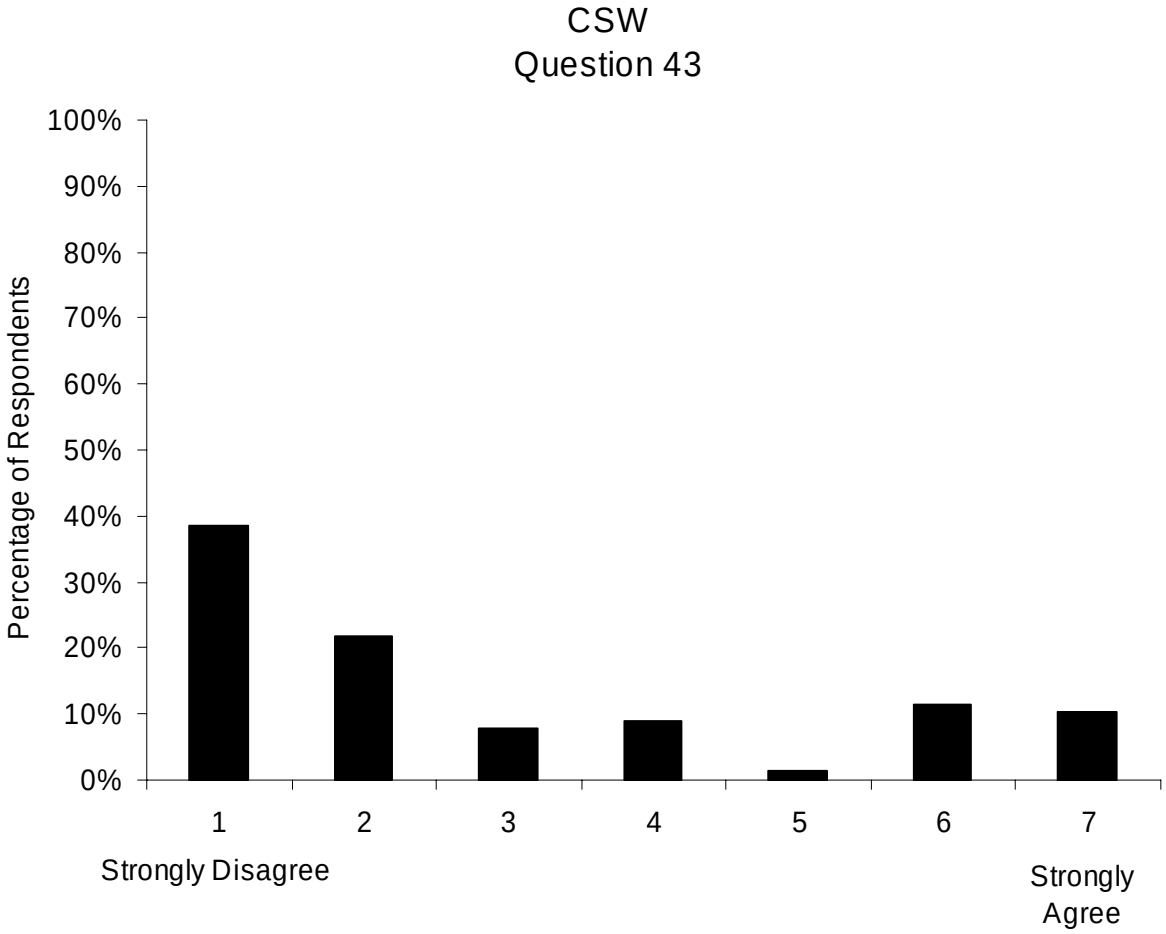
42. I felt more comfortable performing additional tasks, (e.g., adjusting the heater, operating the radio, talking on a cellular telephone, etc.) while using CSW as compared to manual driving.



	Males	Females	Overall
Younger (20-30)	4.1 (1.8)	5.0 (2.0)	4.5 (1.9)
Middle-Aged (40-50)	2.5 (1.6)	3.8 (1.7)	3.1 (1.8)
Older (60-70)	4.3 (2.2)	3.8 (1.8)	4.0 (2.0)
Overall	3.6 (2.0)	4.2 (1.9)	3.9 (2.0)

Values in cells represent the mean response and (standard deviation)

43. I would have used an on/off switch at some point, had it been provided, to turn off the CSW for the rest of my experience.



	Males	Females	Overall
Younger (20-30)	3.5 (2.3)	4.2 (2.5)	3.8 (2.4)
Middle-Aged (40-50)	2.8 (2.2)	2.5 (1.8)	2.7 (2.0)
Older (60-70)	2.0 (1.7)	2.4 (1.9)	2.2 (1.8)
Overall	2.8 (2.1)	3.0 (2.2)	2.9 (2.2)

Values in cells represent the mean response and (standard deviation)

44. If you would have turned off the CSW, how long into your experience would you have kept the CSW on?

_____

_____

45. Can you suggest any changes or modifications to the CSW system in the following areas?

Visual Warnings _____

_____

Auditory Warnings _____

_____

Vibration Warnings _____

_____

Timing of Warnings _____

_____

Controls and Display _____

_____

Other _____

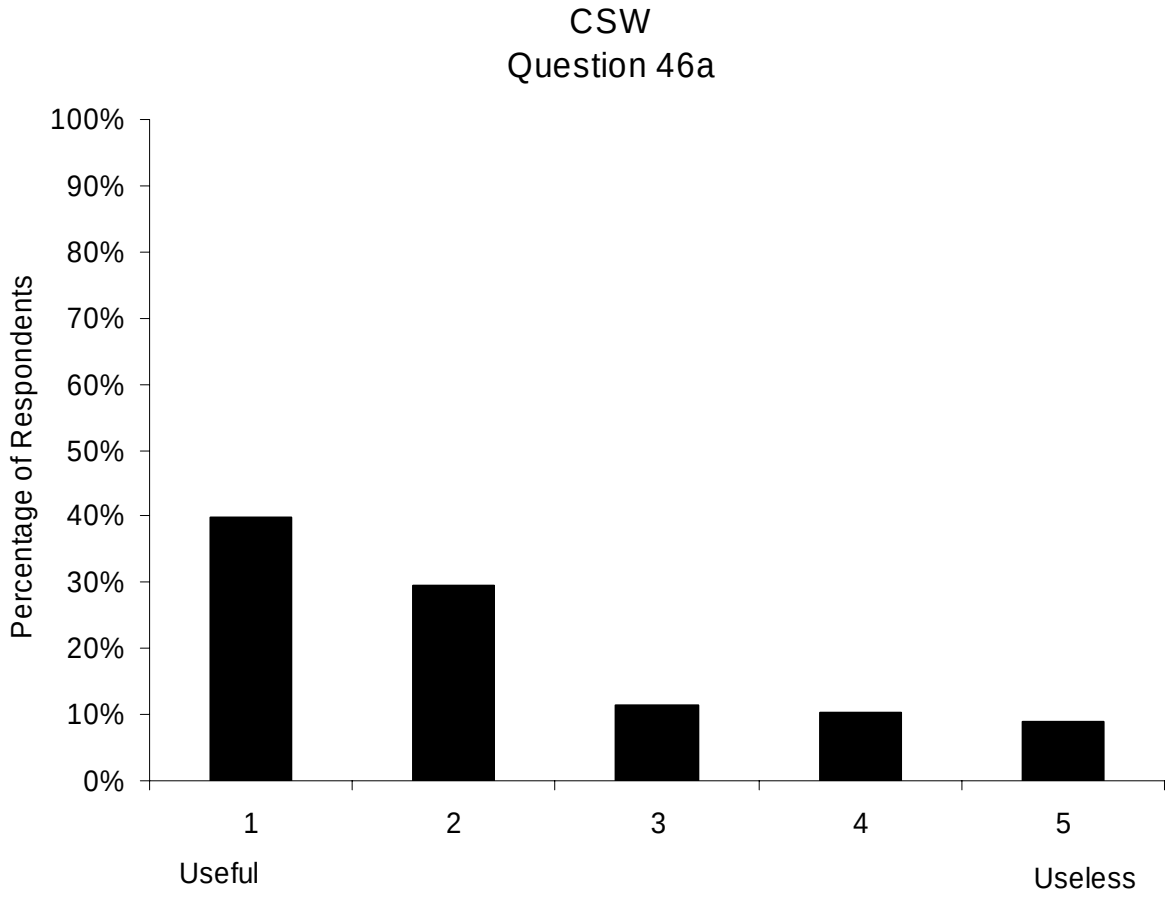
_____

46. Please indicate your overall acceptance rating of the CSW system.

For each choice you will find 5 possible answers. When a term is completely appropriate, please put a check (√) in the square next to that term. When a term is appropriate to a certain extent, please put a check to the left or right of the middle at the side of the term. When you have no specific opinion, please put a check in the middle.

The CSW system was:

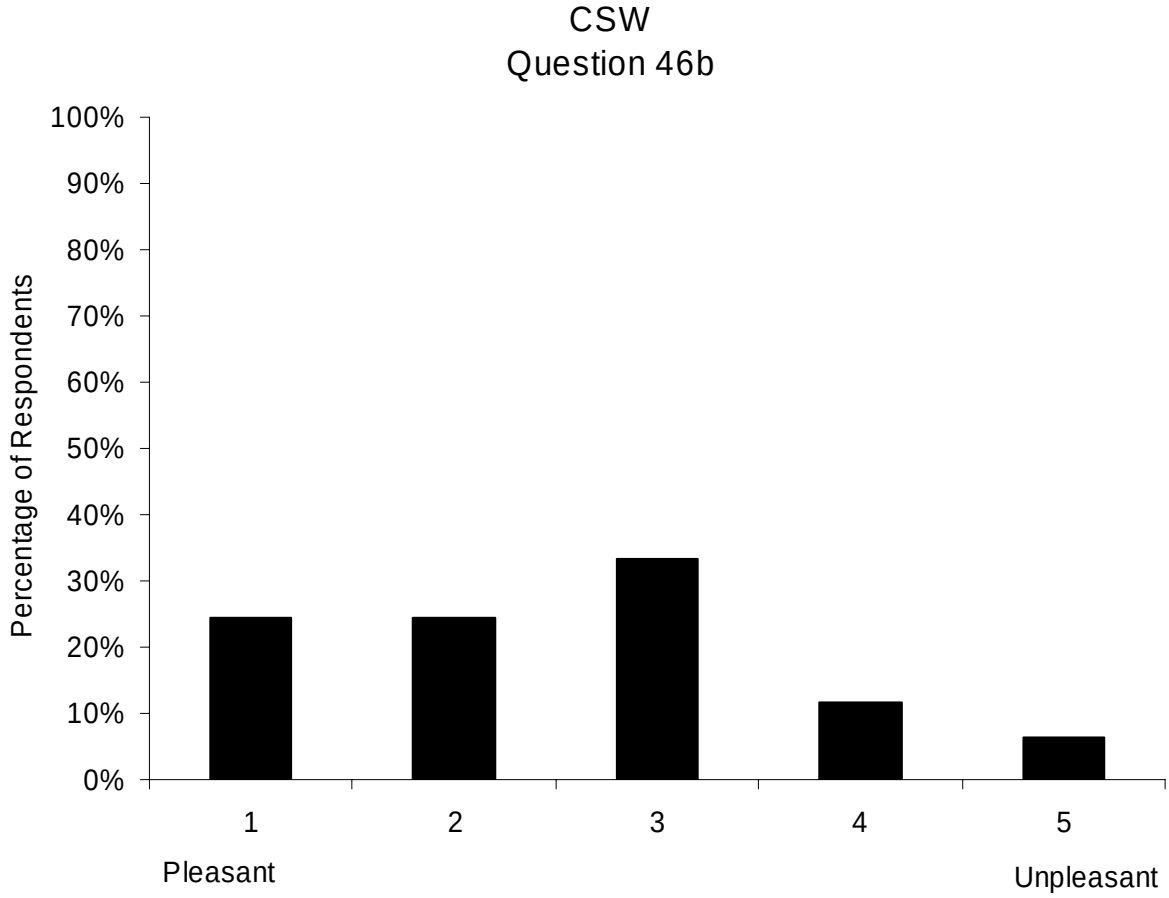
useful | | | | | useless



	Males	Females	Overall
Younger (20-30)	2.7 (1.5)	1.7 (1.2)	2.2 (1.4)
Middle-Aged (40-50)	2.7 (1.6)	2.1 (1.0)	2.4 (1.4)
Older (60-70)	2.2 (1.3)	1.8 (1.0)	2.0 (1.1)
Overall	2.5 (1.5)	1.9 (1.1)	2.2 (1.3)

Values in cells represent the mean response and (standard deviation)

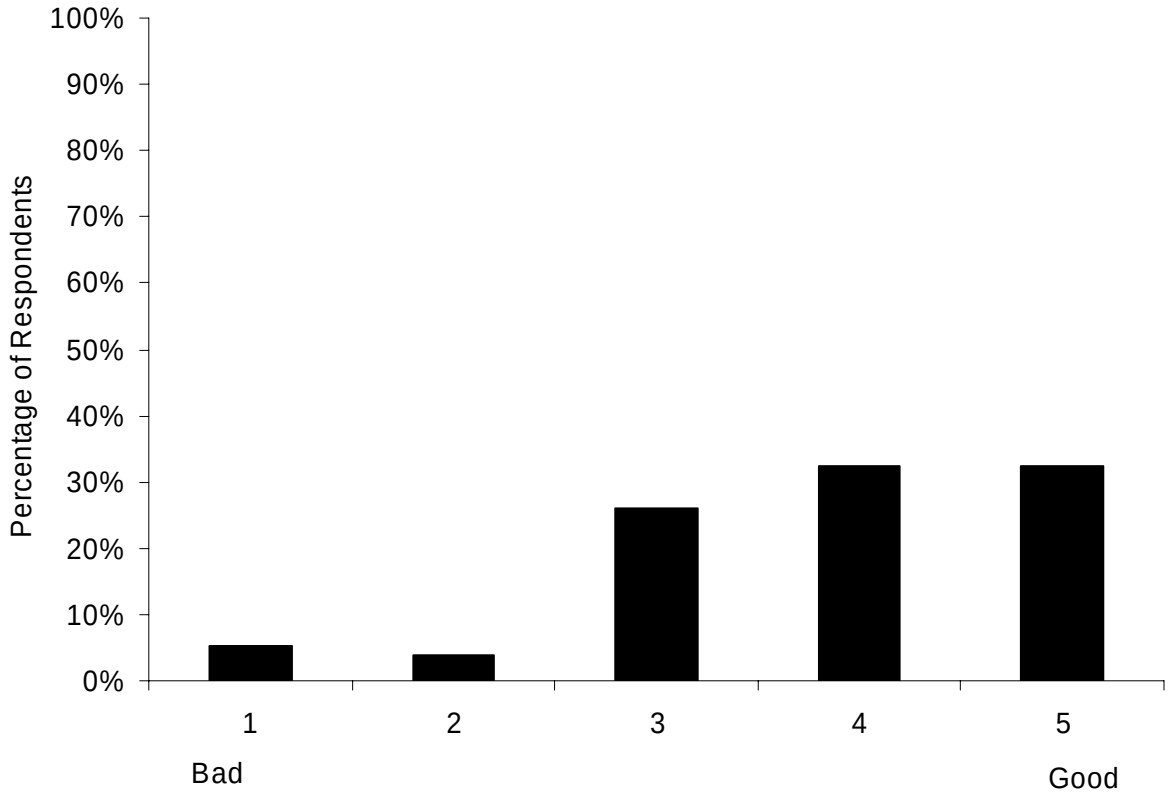
pleasant | | | | | | unpleasant



	Males	Females	Overall
Younger (20-30)	2.8 (1.3)	2.3 (1.3)	2.6 (1.3)
Middle-Aged (40-50)	2.5 (1.4)	2.5 (0.8)	2.5 (1.1)
Older (60-70)	2.3 (1.4)	2.5 (0.9)	2.4 (1.1)
Overall	2.6 (1.3)	2.5 (1.0)	2.5 (1.2)

Values in cells represent the mean response and (standard deviation)

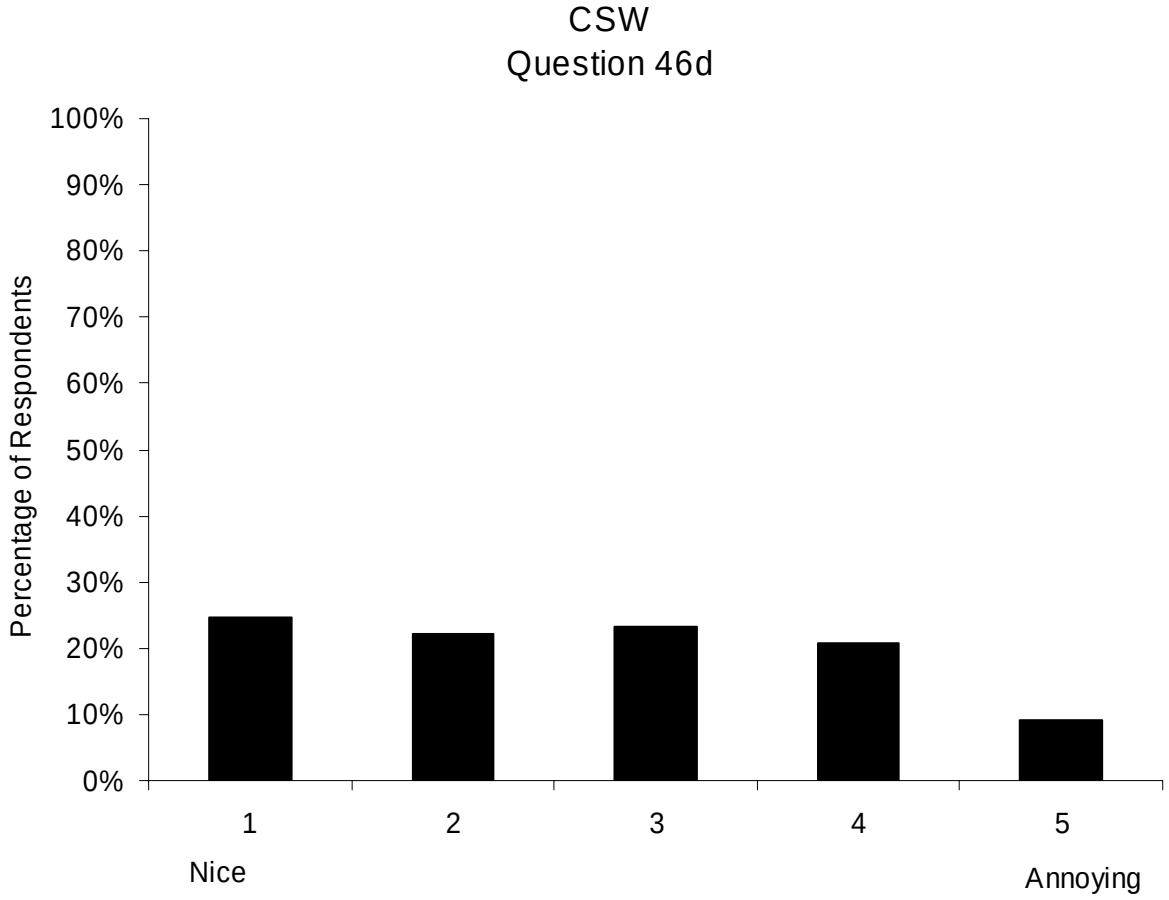
bad good



	Males	Females	Overall
Younger (20-30)	3.5 (1.2)	3.9 (1.3)	3.7 (1.2)
Middle-Aged (40-50)	3.8 (1.3)	3.8 (0.8)	3.8 (1.1)
Older (60-70)	3.9 (1.2)	4.0 (0.9)	4.0 (1.0)
Overall	3.8 (1.2)	3.9 (1.0)	3.8 (1.1)

Values in cells represent the mean response and (standard deviation)

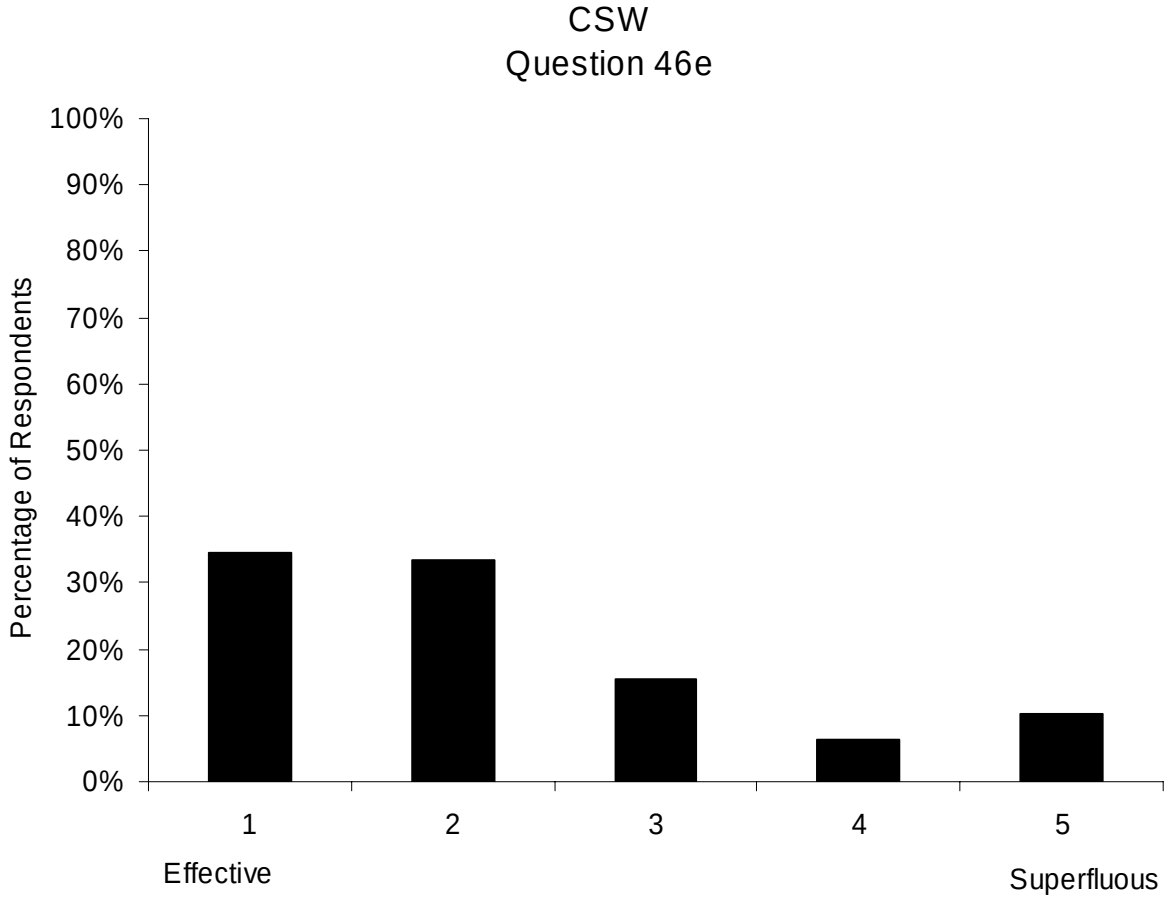
nice | | | | | | annoying



	Males	Females	Overall
Younger (20-30)	2.8 (1.5)	2.9 (1.3)	2.9 (1.4)
Middle-Aged (40-50)	2.6 (1.4)	2.9 (1.3)	2.8 (1.3)
Older (60-70)	2.5 (1.5)	2.3 (1.0)	2.4 (1.2)
Overall	2.6 (1.4)	2.7 (1.2)	2.7 (1.3)

Values in cells represent the mean response and (standard deviation)

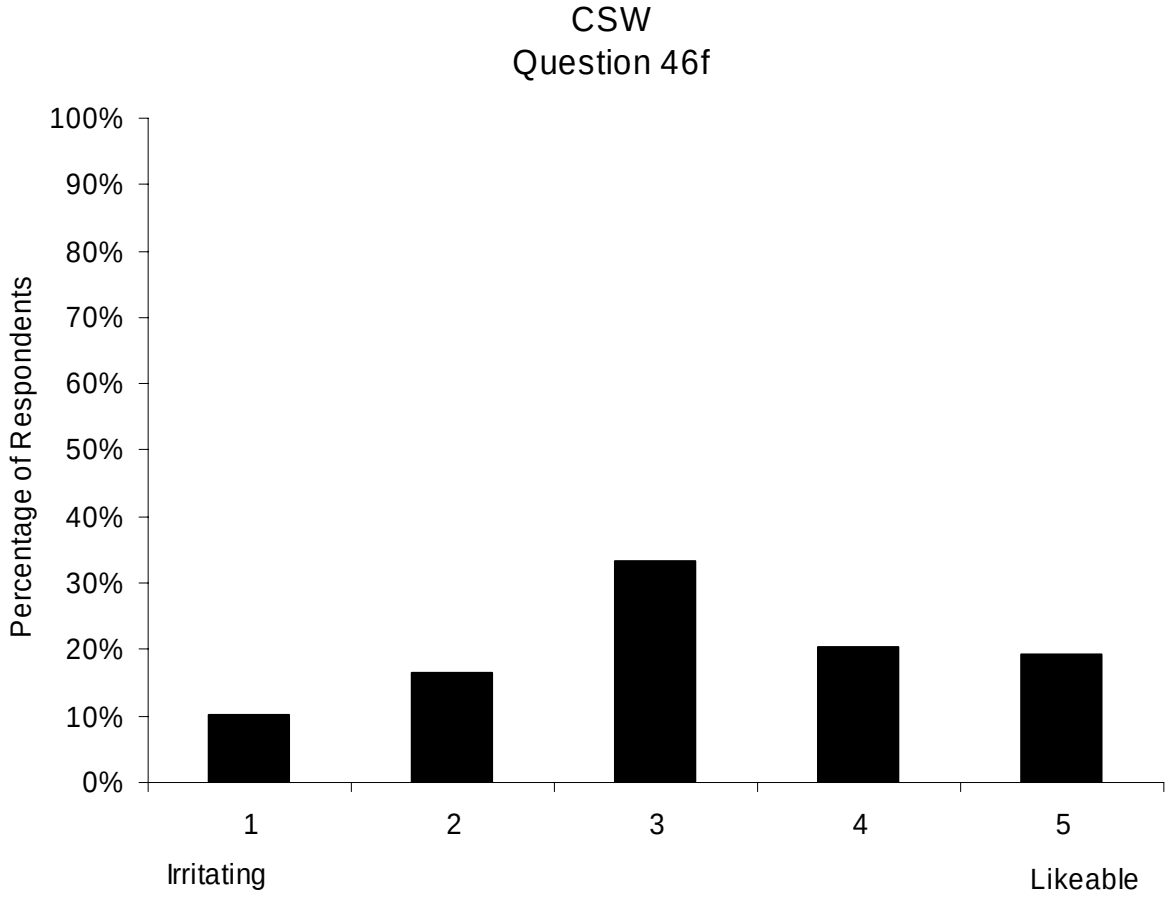
effective | | | | | | superfluous



	Males	Females	Overall
Younger (20-30)	2.6 (1.4)	1.9 (1.3)	2.3 (1.3)
Middle-Aged (40-50)	2.8 (1.6)	2.3 (0.9)	2.5 (1.3)
Older (60-70)	2.1 (1.3)	1.8 (1.0)	1.9 (1.1)
Overall	2.5 (1.4)	2.0 (1.1)	2.2 (1.3)

Values in cells represent the mean response and (standard deviation)

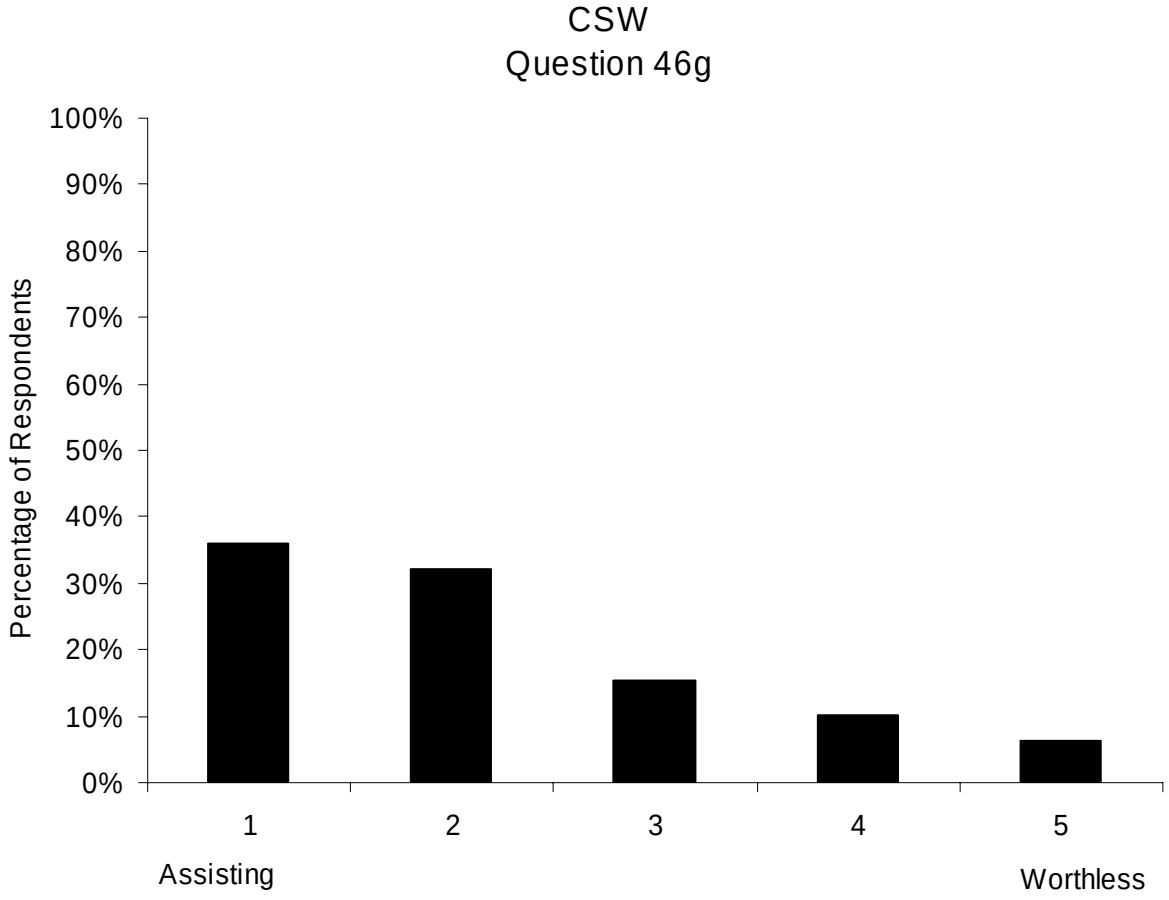
irritating | | | | | | likeable



	Males	Females	Overall
Younger (20-30)	2.9 (1.6)	3.2 (1.2)	3.0 (1.4)
Middle-Aged (40-50)	3.2 (1.2)	3.0 (1.0)	3.1 (1.1)
Older (60-70)	3.7 (1.4)	3.4 (1.0)	3.5 (1.2)
Overall	3.3 (1.4)	3.2 (1.1)	3.2 (1.2)

Values in cells represent the mean response and (standard deviation)

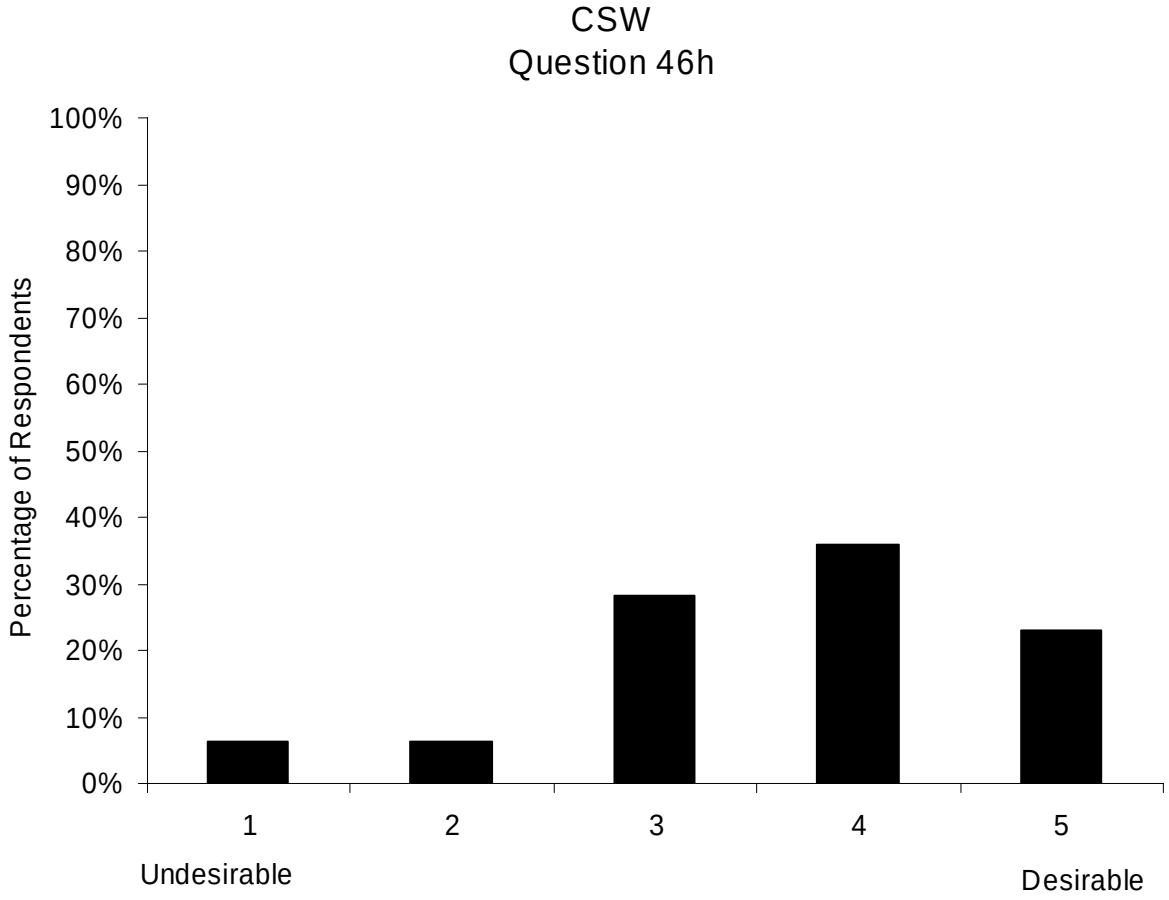
assisting worthless



	Males	Females	Overall
Younger (20-30)	2.5 (1.2)	1.8 (1.2)	2.1 (1.2)
Middle-Aged (40-50)	2.6 (1.4)	2.3 (1.1)	2.5 (1.2)
Older (60-70)	2.2 (1.4)	1.8 (1.0)	2.0 (1.2)
Overall	2.4 (1.3)	1.9 (1.1)	2.2 (1.2)

Values in cells represent the mean response and (standard deviation)

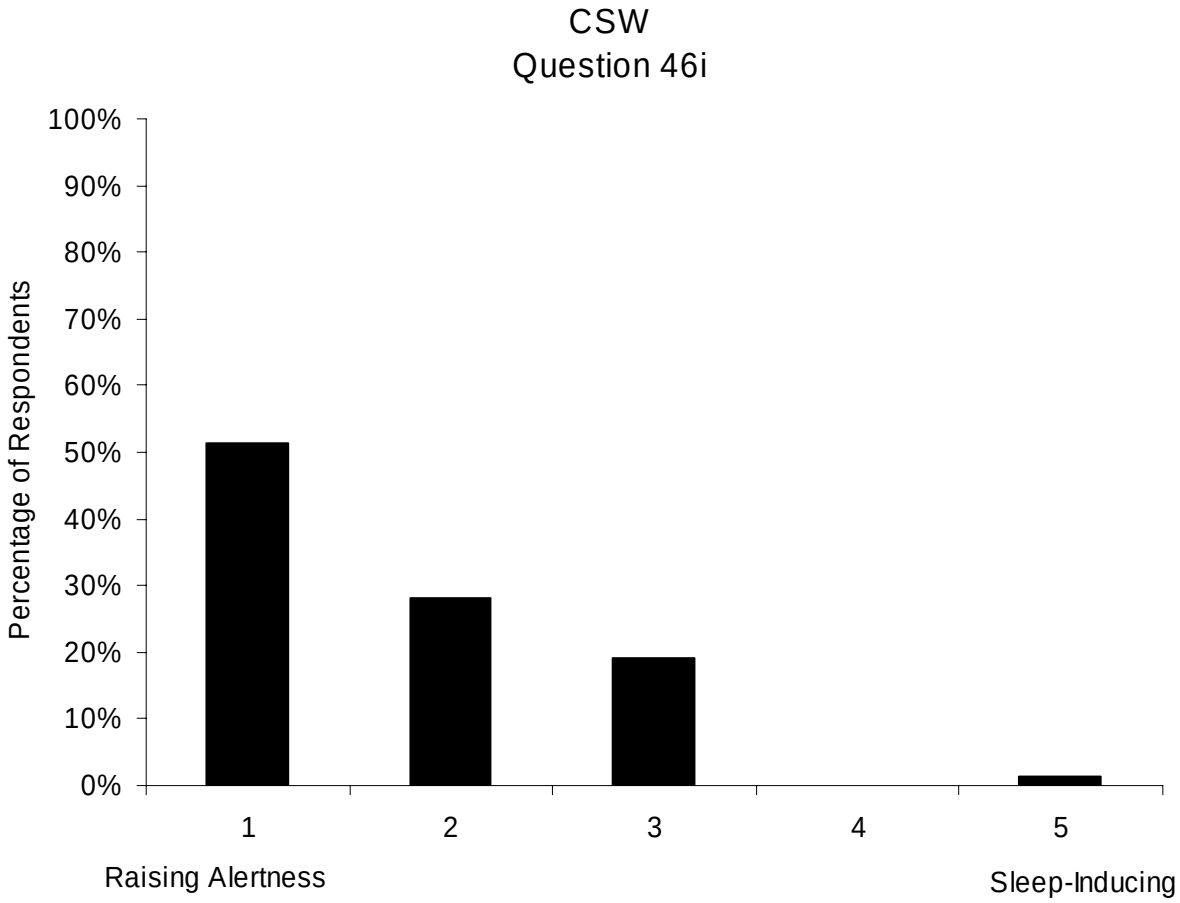
undesirable | | | | | | desirable



	Males	Females	Overall
Younger (20-30)	3.5 (1.3)	3.8 (1.2)	3.6 (1.2)
Middle-Aged (40-50)	3.6 (1.2)	3.5 (0.9)	3.5 (1.0)
Older (60-70)	3.9 (1.3)	3.5 (1.0)	3.7 (1.1)
Overall	3.7 (1.2)	3.6 (1.0)	3.6 (1.1)

Values in cells represent the mean response and (standard deviation)

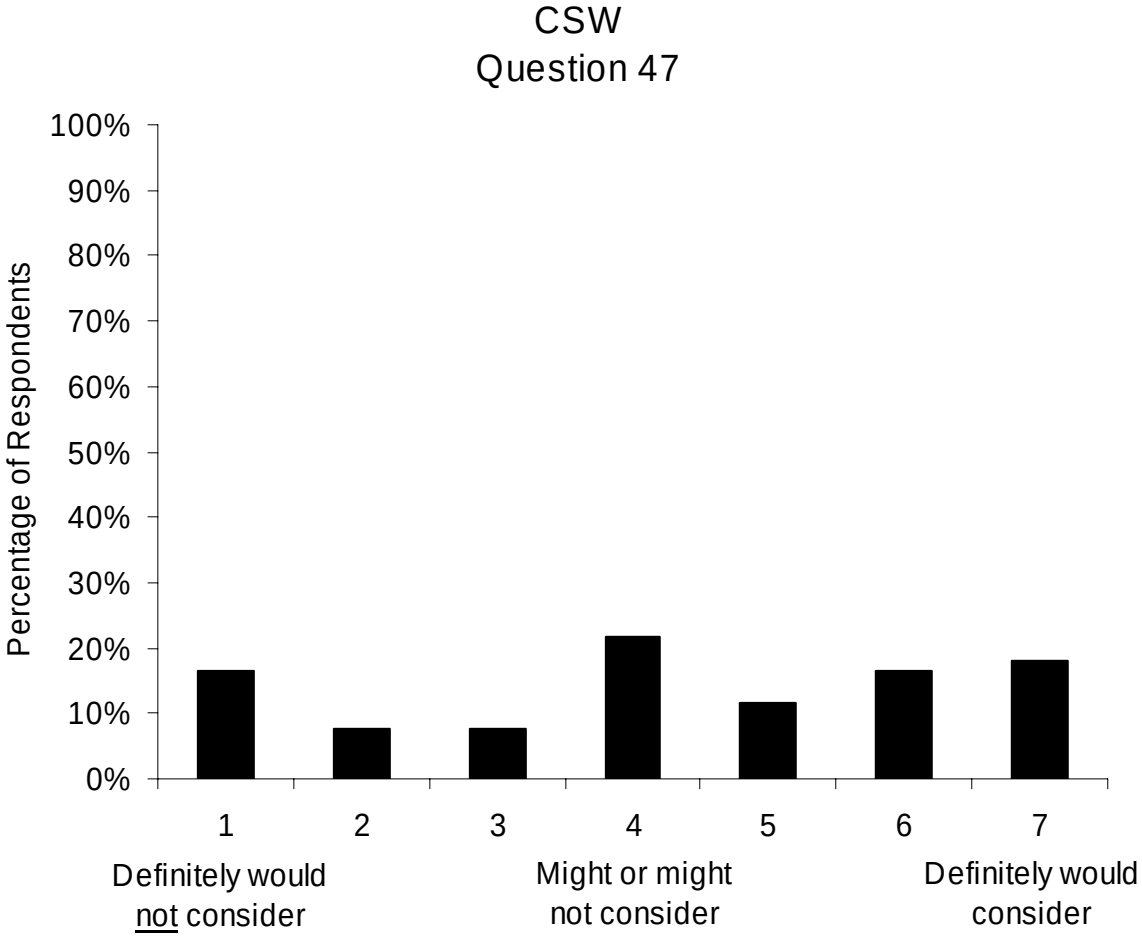
raising alertness | | | | | | sleep-inducing



	Males	Females	Overall
Younger (20-30)	2.2 (0.8)	1.5 (0.7)	1.8 (0.8)
Middle-Aged (40-50)	1.8 (1.2)	1.7 (0.8)	1.8 (1.0)
Older (60-70)	1.7 (0.9)	1.5 (0.8)	1.6 (0.8)
Overall	1.9 (1.0)	1.5 (0.7)	1.7 (0.9)

Values in cells represent the mean response and (standard deviation)

47. Cost aside, if you were purchasing a new vehicle, how likely would you be to consider purchasing the CSW system?



	Males	Females	Overall
Younger (20-30)	3.8 (2.5)	4.5 (1.9)	4.2 (2.2)
Middle-Aged (40-50)	4.3 (2.1)	3.8 (1.8)	4.0 (1.9)
Older (60-70)	4.7 (2.2)	4.5 (2.1)	4.6 (2.1)
Overall	4.3 (2.2)	4.2 (1.9)	4.3 (2.1)

Values in cells represent the mean response and (standard deviation)

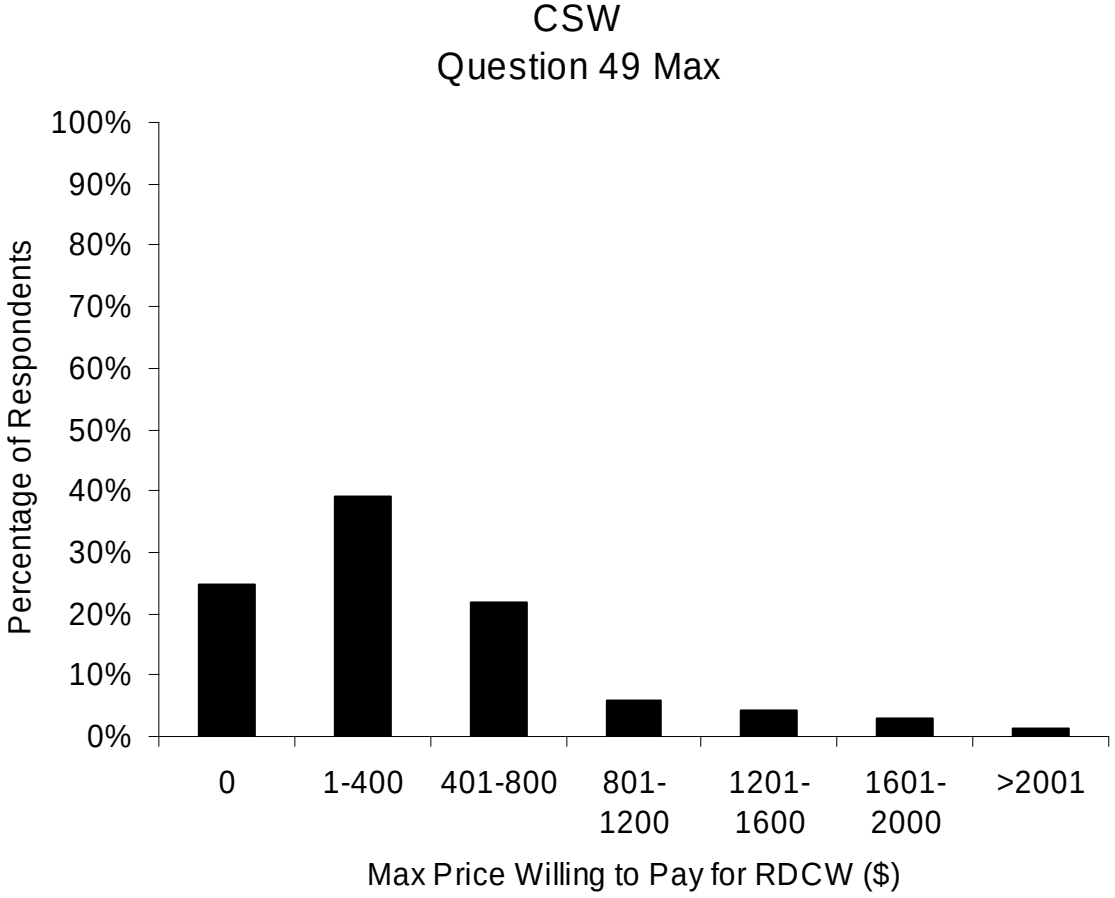
48. Regarding question 47, what is your primary reason for providing the answer you did?

_____

_____

_____

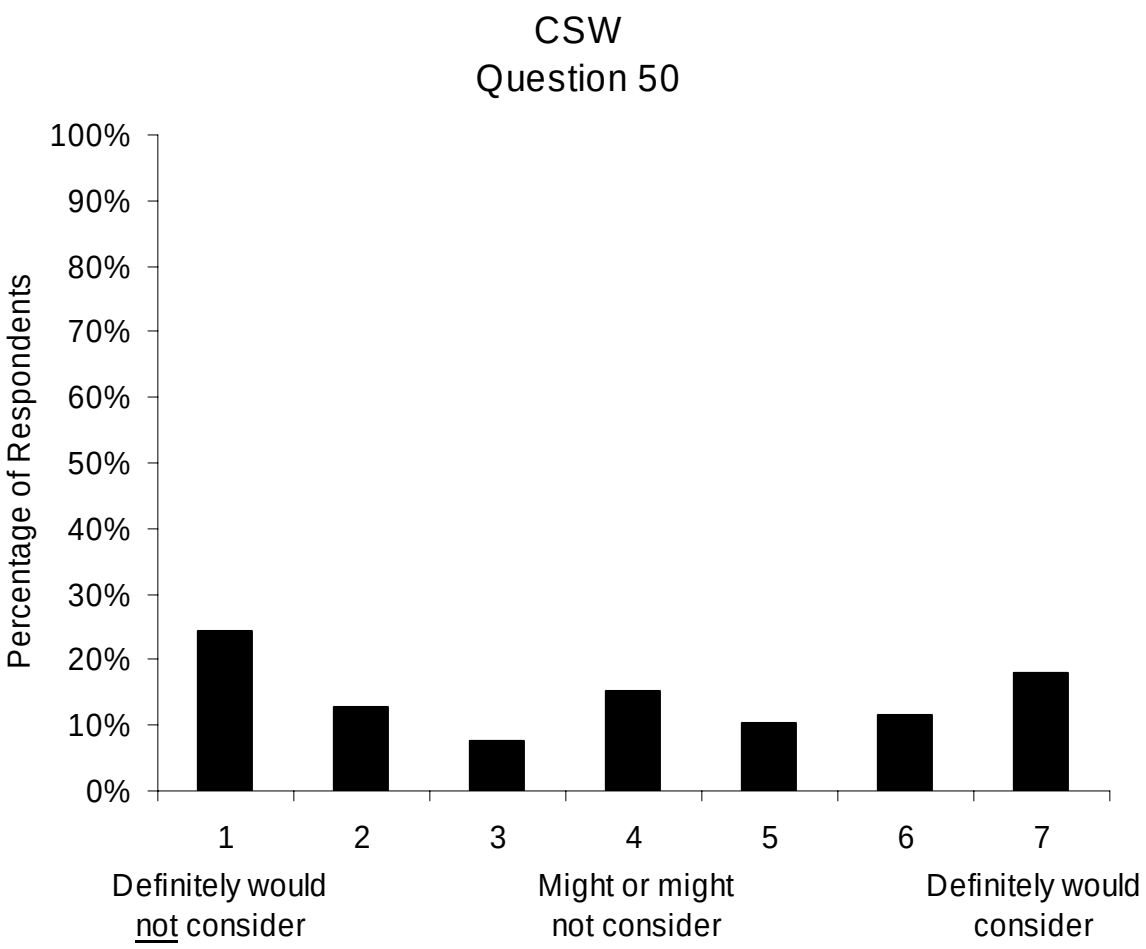
49. What is the maximum amount you would pay for the CSW system?



	Males		Females		Overall	
Younger (20-30)	316.7	(433.3)	833.3	(866.9)	566.0	(712.1)
Middle-Aged (40-50)	479.2	(596.0)	215.4	(191.9)	342.0	(446.4)
Older (60-70)	318.2	(207.7)	312.5	(321.5)	315.8	(253.3)
Overall	372.2	(440.7)	463.6	(613.8)	415.9	(528.6)

Values in cells represent the mean response and (standard deviation)

50. At the actual price of $500, how likely would you be to consider purchasing CSW if you were purchasing a new vehicle?



	Males	Females	Overall
Younger (20-30)	3.5 (2.4)	4.6 (2.2)	4.0 (2.3)
Middle-Aged (40-50)	3.8 (2.4)	3.0 (2.1)	3.4 (2.2)
Older (60-70)	4.2 (2.3)	3.8 (2.0)	4.0 (2.1)
Overall	3.8 (2.3)	3.8 (2.2)	3.8 (2.2)

Values in cells represent the mean response and (standard deviation)

Participant Handling

1. **What could the researchers have done differently to improve your understanding of the LDW system and how it operated?**

   _____

   _____

   _____

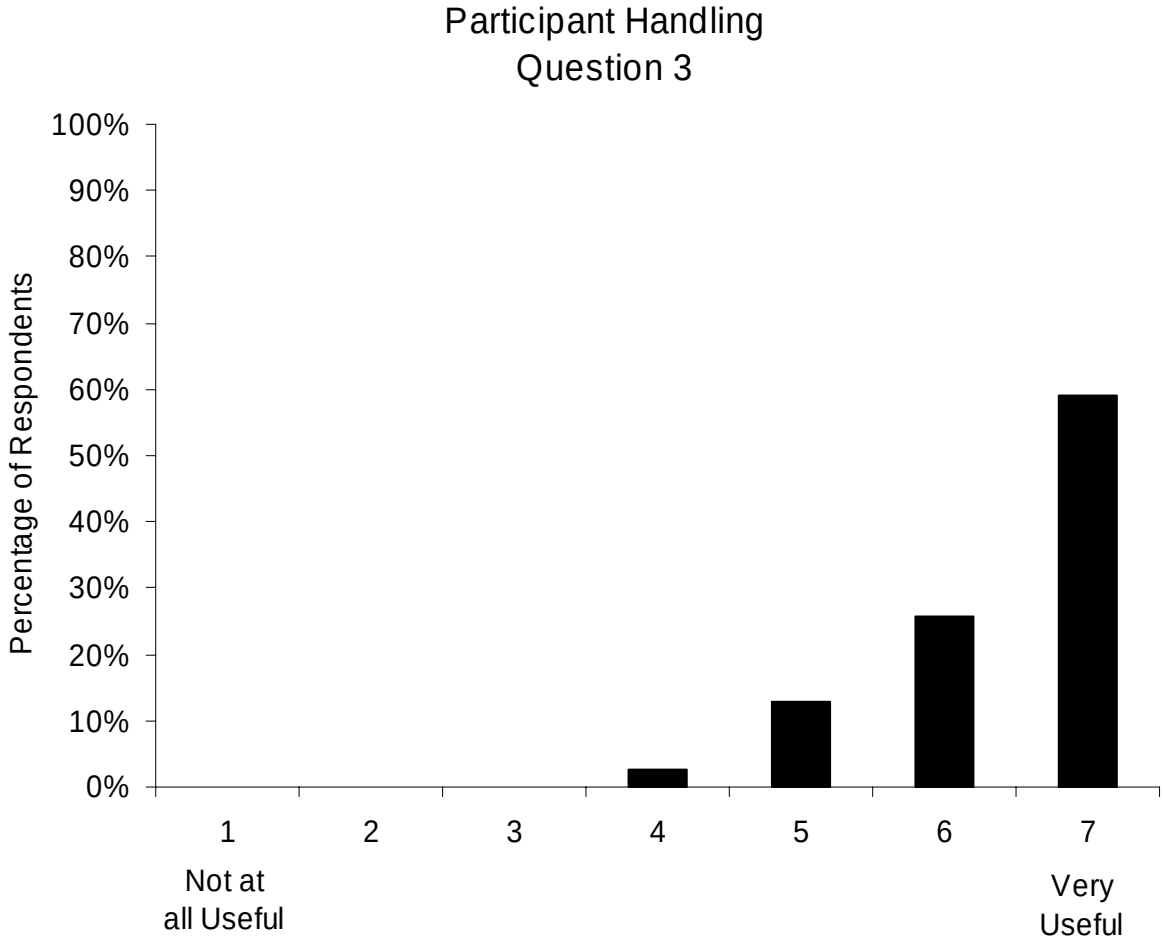
2. **What could the researchers have done differently to improve your understanding of the CSW system and how it operated?**

   _____

   _____

   _____

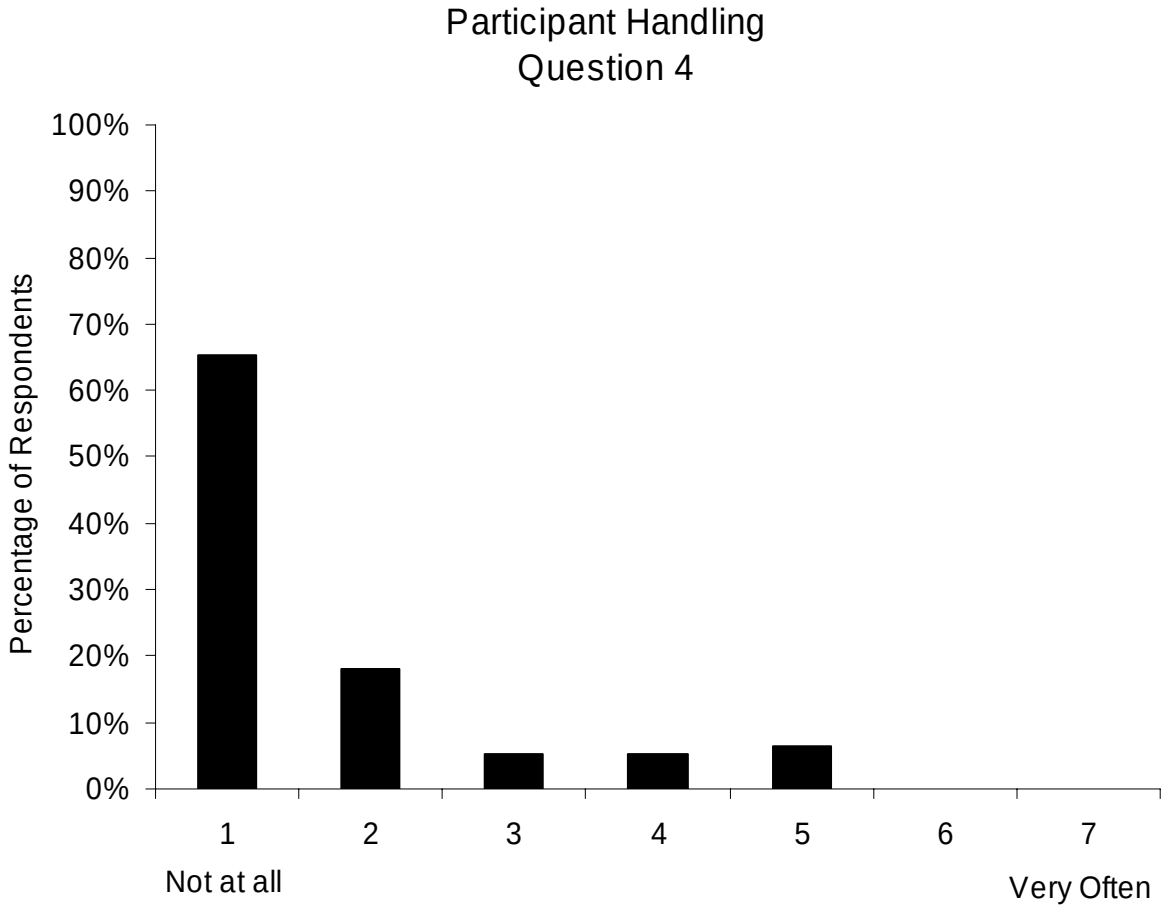
3. How useful was the training video in understanding how to use LDW and CSW?



	Males	Females	Overall
Younger (20-30)	6.3 (1.0)	6.5 (0.9)	6.4 (0.9)
Middle-Aged (40-50)	6.5 (0.5)	6.6 (0.7)	6.6 (0.6)
Older (60-70)	6.2 (0.7)	6.3 (1.0)	6.3 (0.9)
Overall	6.4 (0.8)	6.5 (0.9)	6.4 (0.8)

Values in cells represent the mean response and (standard deviation)

4. How often, if ever, did you refer to the training video materials (VHS, CD-ROM, or written transcript) after the initial orientation to the systems?



	Males	Females	Overall
Younger (20-30)	1.2 (0.6)	1.4 (0.9)	1.3 (0.7)
Middle-Aged (40-50)	1.2 (0.4)	1.5 (1.2)	1.4 (0.9)
Older (60-70)	2.5 (1.5)	2.3 (1.5)	2.4 (1.5)
Overall	1.6 (1.1)	1.7 (1.3)	1.7 (1.2)

Values in cells represent the mean response and (standard deviation)

This page was left blank intentionally.

Appendix N

Focus Group Questions

This page was left blank intentionally.

Focus Group Questions

The RDCW System

- Overall, did you feel more or less comfortable in a vehicle with the RDCW system?
- Overall, did you feel more or less safe using the RDCW system?
- Was the system intuitive to use?
- Overall, what did you think about how the information was conveyed (e.g., visual display, vibrating seat, audio warnings)?
- How easy was it to remember what each warning meant?

Utility of LDW

- How many times a month do you come close to leaving your lane unintentionally?
- How often did you encounter situations where you felt the LDW system was useful?
- Were there situations when you got an alert when you were not paying enough attention?
- Were there any situations when the LDW system may have prevented an accident?
- When (if ever) did you find false alarms annoying? What false alarm situations did you find most/least annoying? If you received false alarms, how did they affect your driving?
- Were there situations when you did not get an alert when you felt one was required?
- Overall, did you think LDW warnings were useful? When (if ever) were the LDW warnings useful?
- Would you have turned LDW off if you could have? If so, when and why?

Response to LDW alerts

- When you got an imminent LDW alert, what did you typically do (e.g., apply the brakes, check the traffic, check your position in the lane or simply ignore the alert)?
- Did the way you responded to the alerts change with more LDW experience? If so, how?
- Do you think the LDW cautionary alert (when the seat vibrated) affected how you stayed in your lane? If so, how?

LDW alert timing

- What did you think of the timing of the LDW imminent alert (when you heard the rumbling sound)? Was it too early, just right, too late?

LDW and safety

- Do you think that LDW will prevent drivers from leaving their lane?
- Do you think LDW made you a safer driver (e.g., did you drive more or less aggressively)?
- Are there other ways you think LDW may have changed the way you drove?

LDW as a product

- Did LDW perform in the way you would expect it to if you bought this feature? If not, how should LDW perform differently?
- What needs to be different before LDW becomes a product?
- Would you buy an LDW system? If not, why not? If so, why?

Suggested LDW improvements

- How would you suggest improving the LDW system?

Utility of CSW

- How many times a month do you approach a curve too fast (i.e., you are surprised at the sharpness of the curve)?
- How often did you encounter situations where you felt the CSW system was useful?
- Were there situations when you got an alert when you were not paying enough attention?
- Were there any situations when the CSW system may have prevented an accident?
- When (if ever) did you find false alarms annoying? If you received false alarms, how did they affect your driving? What false alarm situations did you find most/least annoying?
- Were there situations when you did not get an alert when you felt one was required?
- Overall, did you think CSW warnings were useful? When (if ever) were the CSW warnings useful?
- Would you have turned CSW off if you could have? If so, when and why?

Response to CSW alerts

- When you got an imminent CSW alert, what did you typically do (e.g., apply the brakes, check the road geometry, or simply ignore the alert)?
- Did the way you responded to the alerts change with more CSW experience? If so, how?
- Do you think the CSW cautionary alert (when the seat vibrated) affected your speed as you approached a curve? If so, how?

CSW alert timing

What did you think of the timing of the CSW imminent alert (when you heard "Curve, Curve")? Was it too early, just right, too late?

CSW and safety

- Do you think that CSW will prevent drivers from approaching curves too fast?
- Do you think CSW made you a safer driver (e.g., did you drive more or less aggressively)?
- Are there other ways you think CSW may have changed the way you drove?

CSW as a product

- Did CSW perform in the way you would expect it to if you bought this feature? If not, how should CSW perform differently?
- What needs to be different before CSW becomes a product?
- Would you buy a CSW system? If not, why not? If so, why?

Suggested CSW improvements

- How would you suggest improving the CSW system?

This page was left blank intentionally.

Appendix P

Data Signals Collected Onboard The Vehicles

This page was left blank intentionally.

Data Signals Collected Onboard The Vehicles

This appendix lists the numerical data signals collected onboard the vehicle during the FOT experiment. Section 5 presented an overview of the data archive, and this appendix addresses only one component of the archive –the numerical data collected onboard the vehicle – and does not address the video or audio data directly. (That is described in some detail in section 5.) This section also does not list all tables collected, but addresses the "minimal set" of data that could be used to re-create other tables not listed here. Example of tables not included here are 1-, 2-, and 3-dimensional histograms that are created onboard for convenience in analysis, such as one that records the number of data samples per trip that occur within specific bins of vehicle speed, on particular road types. This can be re-created using the time-stamped variables of vehicle speed and road type.

The onboard-data archive is organized into a set of database tables, each of which is comprised of a collection of individual "records" (or rows, using the analogy of a table being a matrix of data). Each record contains several fields (or variables, or – using the matrix analogy – columns). The set of primary tables in the database are described in tables 1, 2, and 3. Table 1 describes the most-used tables, and includes the table name, the trigger for adding new data (records) to the table, and a general description of the type of data within the table. Table 2 is very similar, and describes tables containing data from the radar data buses. Table 3 describes three of the event-driven summary tables collected in the FOT. Each of these tables is elaborated upon in subsequent tables, which list the fields within each table.

Table 4 below lists the fields within each of the primary data tables of Table 1. Included are the table name, the signal ID (an UMTRI index to the field), the signal name and description, the units within the data archive, and a so-called style index. A *style* maps the value of a discrete-valued signal to a meaningful label, such as mapping a confidence variable valued 3, 2, 1, and 0 into "high confidence," "moderate confidence," "low confidence," and "no confidence," respectively. The mapping for the styles is presented in a later table.

Table 5 and 6 are similar listings that address the radar-return tables listed in table 2 and the event-triggered summaries of table 3. Finally, table 7 presents the styles, as described earlier.

Table 1. Onboard data archive: main database tables

Database table names	Trigger for adding records to table	Description of table data
Amr	Updated by DAS at 10 Hz	LDW available maneuvering room information
Bytes	Transition-logged, monitored at 10 Hz	Selected slowly-varying signals that can be encoded within a byte
Csw	Updated by DAS at 10 Hz	Additional details from the CSW system
Curve	Updated by DAS at 10 Hz	CSW predictions of upcoming curvature values
Data	Updated by DAS at 10 Hz	Primary data table containing variables that are most-used in analysis
Data20	Updated at 20 Hz	20 Hz vehicle-motion variables (analog sensors for analysis)
Doubles	Transition-logged, updated by DAS at 10 Hz	Selected slowly-varying signals whose values require double precision
Floats	Transition-logged, updated by DAS at 10 Hz	Selected slowly-varying signals whose values require floating point (single-precision)
Mlp	Updated by DAS at 10 Hz	CSW most-likely path details
SamLdw	Updated by DAS at 10 Hz	Additional details from the SAM and LDW
Summary	Once per trip	Variables with values only needed once per trip
TimeCheck	Upon logging a video frame, updated at 10 Hz	Relation between data time stamps and video time stamps (synching separate computers)

Table 2. Onboard data archive: database tables containing radar data

Database table names	Trigger for adding records to table	Description of table data
RadarIndices	Monitored at 10 Hz	LDW available maneuvering room information
InfoLF	Last radar message received, checked with 20 Hz cycling	Left-front radar status
InfoLS	Last radar message received, checked with 20 Hz cycling	Updates of left-side radar status
InfoRF	Last radar message received, checked with 20 Hz cycling	Right-front radar status
InfoRS	Last radar message received, checked with 20 Hz cycling	Updates of right-side radar status
TargetsLF	Last radar message received, checked with 20 Hz cycling	Radar track information (e.g., range, range rate)
TargetsLS	Last radar message received, checked with 20 Hz cycling	Radar return information
TargetsRF	Last radar message received, checked with 20 Hz cycling	Radar track information (e.g., range, range rate)
TargetsRS	Last radar message received, checked with 20 Hz cycling	Radar return information

Table 3. Onboard data archive: database tables containing selected "events" summaries

Database table names	Trigger for adding records to table	Description of table data
Csws	Upon occurrence of a CSW alert event, monitored at 20 Hz	Data associated with CSW event
Ldws	Upon occurrence of a LDW alert, monitored at 20 Hz	Data associated with LDW event
Comms	Upon occurrence of a driver comment button press, monitored at 20 Hz	Data associated with driver comment button event

Table 4. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Amr	248	AmrLeft2	Available Maneuvering room left, 2	m	
Amr	252	AmrLeft3	Available Maneuvering room left, 3	m	
Amr	256	AmrLeft4	Available Maneuvering room left, 4	m	
Amr	260	AmrLeft5	Available Maneuvering room left, 5	m	
Amr	264	AmrLeft6	Available Maneuvering room left, 6	m	
Amr	268	AmrLeft7	Available Maneuvering room left, 7	m	
Amr	272	AmrLeft8	Available Maneuvering room left, 8	m	
Amr	246	AmrLeftConf2	Available Maneuvering room left confidence, 2	none	68
Amr	250	AmrLeftConf3	Available Maneuvering room left confidence, 3	none	68
Amr	254	AmrLeftConf4	Available Maneuvering room left confidence, 4	none	68
Amr	258	AmrLeftConf5	Available Maneuvering room left confidence, 5	none	68
Amr	262	AmrLeftConf6	Available Maneuvering room left confidence, 6	none	68
Amr	266	AmrLeftConf7	Available Maneuvering room left confidence, 7	none	68
Amr	270	AmrLeftConf8	Available Maneuvering room left confidence, 8	none	68
Amr	245	AmrLeftSource2	Available Maneuvering room left source, 2	none	69
Amr	249	AmrLeftSource3	Available Maneuvering room left source, 3	none	69
Amr	253	AmrLeftSource4	Available Maneuvering room left source, 4	none	69
Amr	257	AmrLeftSource5	Available Maneuvering room left source, 5	none	69
Amr	261	AmrLeftSource6	Available Maneuvering room left source, 6	none	69
Amr	265	AmrLeftSource7	Available Maneuvering room left source, 7	none	69
Amr	269	AmrLeftSource8	Available Maneuvering room left source, 8	none	69
Amr	280	AmrRight2	Available Maneuvering room right, 2	m	
Amr	284	AmrRight3	Available Maneuvering room right, 3	m	
Amr	288	AmrRight4	Available Maneuvering room right, 4	m	
Amr	292	AmrRight5	Available Maneuvering room right, 5	m	
Amr	296	AmrRight6	Available Maneuvering room right, 6	m	
Amr	300	AmrRight7	Available Maneuvering room right, 7	m	
Amr	304	AmrRight8	Available Maneuvering room right, 8	m	
Amr	278	AmrRightConf2	Available Maneuvering room right confidence, 2	none	68
Amr	282	AmrRightConf3	Available Maneuvering room right confidence, 3	none	68
Amr	286	AmrRightConf4	Available Maneuvering room right confidence, 4	none	68
Amr	290	AmrRightConf5	Available Maneuvering room right confidence, 5	none	68
Amr	294	AmrRightConf6	Available Maneuvering room right confidence, 6	none	68

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Amr	298	AmrRightConf7	Available Maneuvering room right confidence, 7	none	68
Amr	302	AmrRightConf8	Available Maneuvering room right confidence, 8	none	68
Amr	277	AmrRightSource2	Available Maneuvering room right source, 2	none	69
Amr	281	AmrRightSource3	Available Maneuvering room right source, 3	none	69
Amr	285	AmrRightSource4	Available Maneuvering room right source, 4	none	69
Amr	289	AmrRightSource5	Available Maneuvering room right source, 5	none	69
Amr	293	AmrRightSource6	Available Maneuvering room right source, 6	none	69
Amr	297	AmrRightSource7	Available Maneuvering room right source, 7	none	69
Amr	301	AmrRightSource8	Available Maneuvering room right source, 8	none	69
Amr	17	Time	Time in centiseconds since das started	csec	
Bytes	94	Alert	Imminent alert	none	1
Bytes	668	AlternatorFailure	Alternator Failure	none	1
Bytes	67	Brake	Brake active	none	11
Bytes	698	CellPhone	Cell Phone Detector	none	11
Bytes	637	CleanWindow	True if windshield needs cleaning	none	1
Bytes	145	Comment	Comment button	none	11
Bytes	618	Cruise	Cruise control enabled	none	2
Bytes	640	CswAlert	Csw alert from DVI	none	60
Bytes	610	CswComFault	CSW communications fault	none	1
Bytes	609	CswStatus	CSW status byte	none	
Bytes	685	Differential	True if Gps fix is differential	none	1
Bytes	644	DviByte8	Dvi info byte 8	none	
Bytes	643	DviDisplayMode	Dvi non indexed display mode	none	70
Bytes	646	HeadLamps	Head lamps	none	72
Bytes	599	LaneChange	Lane change from LdwEvent	none	66
Bytes	600	LdwAlertEvent	from LdwEvent	none	66
Bytes	641	LdwAlertLeft	Ldw alert left from DVI	none	60
Bytes	642	LdwAlertRight	Ldw alert right from DVI	none	60
Bytes	611	LdwComFault	LDW communications fault	none	1
Bytes	586	LdwDay	True if daytime	none	1
Bytes	634	LdwSensitivity	Ldw sensitivity	none	77
Bytes	667	LowOilPressure	Low Oil Pressure	none	1
Bytes	647	ml	ABSactive	none	11
Bytes	49	PRNDL	PRNDL	none	12
Bytes	607	RadarStatus	SAM radar status byte	none	
Bytes	638	RdcwDisabled	True if rdcw is disabled	none	1
Bytes	636	RdcwServiceRequired	True if rdcw system needs service	none	1
Bytes	791	RdcwStatusByte3	Rdcw status (Icd byte3)	none	
Bytes	792	RdcwStatusByte4	Rdcw status (Icd byte 4)	none	
Bytes	649	SamServiceRequired	True if Sam system needs service	none	1

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Bytes	831	SamTimeFrozen	True if SamTimeLockTime > 40 deciseconds	none	1
Bytes	669	ServiceEngine	Service Engine Soon	none	1
Bytes	648	TcActive	Traction control active	none	11
Bytes	55	TurnSignal	Turn signals	none	32
Bytes	608	Unpaved	True if unpaved road	none	1
Bytes	52	Wipers	Wiper switch state	none	13
Csw	564	CswAlertRequest	Alert requested by CSW	none	60
Csw	566	CswAx	Vehicle acceleration computed by CSW fro speed	m/sec2	16
Csw	567	CswAxExpected	Vehicle deceleration response assumed by CSW alert	m/sec2	16
Csw	568	CswAy	Vehicle lateralacceleration computed by CSW	m/sec2	16
Csw	580	CswDop	Csw dilution of precision * 10	none	
Csw	161	CswGpsSpeed	Csw gps speed	m/sec	
Csw	162	CswGpsTime	Csw gps time in deciseconds	sec	
Csw	581	CswHeading	Csw gps heading	deg	19
Csw	157	CswLatitude	Csw lattitude	deg	15
Csw	156	CswLongitude	Csw longitude	deg	15
Csw	569	CswMaxDesiredSpeed	Max desired speed in upcoming curve	m/sec	36
Csw	579	CswNumberOfSats	Csw number of satellites	none	
Csw	160	CswReactionTime	Csw reaction time	sec	
Csw	563	CswThreatConf	CSW Threat Level Confidence	%	
Csw	562	CswThreatLevel	CSW Threat Level	%	
Csw	163	CswVehicleSpeed	Csw vehicle speed	m/sec	
Csw	683	LookAhead	Lookahead Distance	m	
Csw	565	MapPositions	Number of possible map positions on map	none	
Csw	684	MapUsed	Map used	none	
Csw	657	MlpAccessRoad	Mlp Access Road	none	1
Csw	573	MlpAdvisorySpeed	Advisory speed from ADAS	m/sec	36
Csw	146	MlpBranchDistance	Mlp distance to next branch/intersection	m	
Csw	658	MlpFrontage	Mlp Frontage Road	none	1
Csw	577	MlpLaneCategory	Mlp lane category from SDAL	none	62
Csw	656	MlpLimitedAccess	Mlp Controlled access	none	1
Csw	576	MlpNumLanesSame	Mlp Number of lanes in same direction	none	
Csw	572	MlpPostedSpeed	Mlp posted speed	m/sec	36
Csw	655	MlpRamp	Mlp Ramp	none	1
Csw	578	MlpRoadClass	Mlp road function class	none	63
Csw	659	MlpRouteType	Mlp RouteType	none	73
Csw	654	MlpUrban	Mlp Urban	none	1
Csw	663	SopAccessRoad	Sop Access Road	none	1
Csw	147	SopAdvisorySpeed	Sop advisory speed from ADAS	m/sec	36
Csw	148	SopBranchDistance	Sop distance to next branch/intersection	m	
Csw	149	SopConfidence	Sop confidence	none	9
Csw	664	SopFrontage	Sop Frontage Road	none	1

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Csw	154	SopLaneCategory	Sop lane category from SDAL	none	62
Csw	662	SopLimitedAccess	Sop Controlled access	none	1
Csw	153	SopNumLanesSame	Sop Number of lanes in same direction	none	
Csw	150	SopPostedSpeed	Sop posted speed	m/sec	36
Csw	661	SopRamp	Sop Ramp	none	1
Csw	155	SopRoadClass	Sop road function class	none	63
Csw	665	SopRouteType	Sop RouteType	none	73
Csw	660	SopUrban	Sop Urban	none	1
Csw	17	Time	Time in centiseconds since das started	csec	
Curve	68	Curv01	Mlp curvature at point 1	1/m	
Curve	69	Curv02	Mlp curvature at point 2	1/m	
Curve	70	Curv03	Mlp curvature at point 3	1/m	
Curve	71	Curv04	Mlp curvature at point 4	1/m	
Curve	72	Curv05	Mlp curvature at point 5	1/m	
Curve	73	Curv06	Mlp curvature at point 6	1/m	
Curve	74	Curv07	Mlp curvature at point 7	1/m	
Curve	75	Curv08	Mlp curvature at point 8	1/m	
Curve	76	Curv09	Mlp curvature at point 9	1/m	
Curve	77	Curv10	Mlp curvature at point 10	1/m	
Curve	78	Curv11	Mlp curvature at point 11	1/m	
Curve	79	Curv12	Mlp curvature at point 12	1/m	
Curve	80	Curv13	Mlp curvature at point 13	1/m	
Curve	81	Curv14	Mlp curvature at point 14	1/m	
Curve	82	Curv15	Mlp curvature at point 15	1/m	
Curve	83	Curv16	Mlp curvature at point 16	1/m	
Curve	84	Curv17	Mlp curvature at point 17	1/m	
Curve	85	Curv18	Mlp curvature at point 18	1/m	
Curve	86	Curv19	Mlp curvature at point 19	1/m	
Curve	87	Curv20	Mlp curvature at point 20	1/m	
Curve	17	Time	Time in centiseconds since das started	csec	
Data	38	AccelPedal	accelerator pedal	%	
Data	244	AmrLeft1	Available Maneuvering room left, 1	m	
Data	242	AmrLeftConf1	Available Maneuvering room left confidence, 1	none	68
Data	241	AmrLeftSource1	Available Maneuvering room left source, 1	none	69
Data	276	AmrRight1	Available Maneuvering room right, 1	m	
Data	274	AmrRightConf1	Available Maneuvering room right confidence, 1	none	68
Data	273	AmrRightSource1	Available Maneuvering room right source, 1	none	69
Data	67	Brake	Brake active	none	11
Data	570	CPOI	Curvature point of interest index	none	
Data	680	CpoiCurv	Cpoi curvature	1/m	
Data	682	CpoiDistance	Distance to Cpoi	m	
Data	640	CswAlert	Csw alert from DVI	none	60
Data	633	CswSensitivity	Csw sensitivity	none	77
Data	609	CswStatus	CSW status byte	none	

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Data	653	CswUnavailable	Csw Unavailable	none	1
Data	165	Engaged	Cruise control active	none	1
Data	589	FodLeft	Future offset distance, left	m	
Data	590	FodRight	Future offset distance, right	m	
Data	591	FodThresholdLeft	Future offset distance threshold, left	m	
Data	592	FodThresholdRight	Future offset threshold, right	m	
Data	61	GpsHeading	Gps heading from Trimble Gps	deg	19
Data	867	GpsNewEven	True if new gps fix since last even time	none	1
Data	63	GpsSpeed	Speed from gps	m/sec	36
Data	240	GpsTime	Gps millisecs in week from Gps	msec	
Data	582	LaneOffset	Vehicle offset from lane center	m	
Data	585	LaneOffsetConf	Lane offset confidence	%	9
Data	584	LaneWidth	Lane width	m	
Data	58	Latitude	Latitude from Trimble Gps	deg	15
Data	641	LdwAlertLeft	Ldw alert left from DVI	none	60
Data	642	LdwAlertRight	Ldw alert right from DVI	none	60
Data	597	LdwAlertStatus	Ldw alert status	none	64
Data	634	LdwSensitivity	Ldw sensitivity	none	77
Data	588	LdwTimeStamp	Ldw time stamp	csec	
Data	650	LdwUnavailable	Ldw Unavailable	none	1
Data	651	LdwUnavailableLeft	Ldw Unavailable Left	none	1
Data	652	LdwUnavailableRight	Ldw Unavailable Right	none	1
Data	59	Longitude	Longitude from Trimble Gps	deg	15
Data	681	MaxCurv	Max curvature	1/m	
Data	571	MlpConfidence	Mlp Confidence	none	9
Data	60	NumberOfSats	Number of sattelites from Gps	none	
Data	645	PomNotVerified	Position on map verified	none	71
Data	607	RadarStatus	SAM radar status byte	none	
Data	791	RdcwStatusByte3	Rdcw status (Icd byte3)	none	
Data	792	RdcwStatusByte4	Rdcw status (Icd byte 4)	none	
Data	624	SamTime	SAM time stamp	dsec	
Data	543	Speed	Vehicle Speed	m/sec	36
Data	17	Time	Time in centiseconds since das started	csec	
Data	55	TurnSignal	Turn signals	none	32
Data	52	Wipers	Wiper switch state	none	13
Data	43	YawRate	Yaw rate	deg/sec	
Data20	670	Ax	Longitudinal acceleration	m/sec2	
Data20	671	Ay	Lateral acceleration	m/sec2	
Data20	677	PitchRate	Corrected Pitch Rate	deg/sec	
Data20	674	RollAngle	Roll Angle	deg	
Data20	675	RollRate	Corrected Roll Rate	deg/sec	
Data20	738	Steer	Steering wheel angle -corrected	none	
Data20	17	Time	Time in centiseconds since das started	csec	
Doubles	40	Odometer	Odometer reading	m	
Floats	41	OutsideTemperature	Outside air temperature	deg C	76
Floats	678	PitchRateZero	Pitch Rate Correction	deg/sec	
Floats	676	RollRateZero	Roll Rate Correction	deg/sec	

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Mlp	616	Dx02	MLP delta east coordinate, point 2	m	
Mlp	95	Dx03	MLP delta east coordinate, point 3	m	
Mlp	96	Dx04	MLP delta east coordinate, point 4	m	
Mlp	97	Dx05	MLP delta east coordinate, point 5	m	
Mlp	98	Dx06	MLP delta east coordinate, point 6	m	
Mlp	99	Dx07	MLP delta east coordinate, point 7	m	
Mlp	100	Dx08	MLP delta east coordinate, point 8	m	
Mlp	101	Dx09	MLP delta east coordinate, point 9	m	
Mlp	102	Dx10	MLP delta east coordinate, point 10	m	
Mlp	103	Dx11	MLP delta east coordinate, point 11	m	
Mlp	104	Dx12	MLP delta east coordinate, point 12	m	
Mlp	105	Dx13	MLP delta east coordinate, point 13	m	
Mlp	106	Dx14	MLP delta east coordinate, point 14	m	
Mlp	107	Dx15	MLP delta east coordinate, point 15	m	
Mlp	108	Dx16	MLP delta east coordinate, point 16	m	
Mlp	109	Dx17	MLP delta east coordinate, point 17	m	
Mlp	110	Dx18	MLP delta east coordinate, point 18	m	
Mlp	111	Dx19	MLP delta east coordinate, point 19	m	
Mlp	112	Dx20	MLP delta east coordinate, point 20	m	
Mlp	617	Dy02	MLP delta north coordinate, point 2	m	
Mlp	113	Dy03	MLP delta north coordinate, point 3	m	
Mlp	114	Dy04	MLP delta north coordinate, point 4	m	
Mlp	115	Dy05	MLP delta north coordinate, point 5	m	
Mlp	116	Dy06	MLP delta north coordinate, point 6	m	
Mlp	117	Dy07	MLP delta north coordinate, point 7	m	
Mlp	118	Dy08	MLP delta north coordinate, point 8	m	
Mlp	119	Dy09	MLP delta north coordinate, point 9	m	
Mlp	120	Dy10	MLP delta north coordinate, point 10	m	
Mlp	121	Dy11	MLP delta north coordinate, point 11	m	
Mlp	122	Dy12	MLP delta north coordinate, point 12	m	
Mlp	123	Dy13	MLP delta north coordinate, point 13	m	
Mlp	124	Dy14	MLP delta north coordinate, point 14	m	
Mlp	125	Dy15	MLP delta north coordinate, point 15	m	
Mlp	126	Dy16	MLP delta north coordinate, point 16	m	
Mlp	127	Dy17	MLP delta north coordinate, point 17	m	
Mlp	128	Dy18	MLP delta north coordinate, point 18	m	
Mlp	129	Dy19	MLP delta north coordinate, point 19	m	
Mlp	130	Dy20	MLP delta north coordinate, point 20	m	
Mlp	17	Time	Time in centiseconds since das started	csec	
Pilot	587	LdwLightLevel	Ldw ambient light level	none	
Pilot	39	SteerRaw	Steering wheel angle- raw	deg	
Pilot	17	Time	Time in centiseconds since das started	csec	
Pilot	55	TurnSignal	Turn signals	none	32
Pilot	52	Wipers	Wiper switch state	none	13
RadarIndices	705	LeftFrontIndex	Left front radar index	none	
RadarIndices	742	LeftSideIndex	Left side radar extended index	none	
RadarIndices	704	RightFrontIndex	Right front radar index	none	

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
RadarIndices	743	RightSideIndex	Right side radar extended index	none	
RadarIndices	17	Time	Time in centiseconds since das started	csec	
SamLdw	744	BatteryVoltage	Battery voltage	none	18
SamLdw	601	BoundaryLeft	Lane boundary type, left	none	67
SamLdw	602	BoundaryRight	Lane boundary type, right	none	67
SamLdw	623	LadbCurvature	Ladb curvature at point	1/m	
SamLdw	619	LadbShoulderLeft	Ladb visible shoulder width, left	m	
SamLdw	620	LadbShoulderLeftConf	Ladb Shoulder width confidence, left	none	
SamLdw	621	LadbShoulderRight	Ladb visible shoulder width, right	m	
SamLdw	622	LadbShoulderRightConf	Ladb Shoulder width confidence, right	none	
SamLdw	583	LateralSpeed	Vehicle speed lateral to lane direction	m/sec	
SamLdw	598	LdwEvent	Ldw event	none	65
SamLdw	587	LdwLightLevel	Ldw ambient light level	none	
SamLdw	593	LdwThreatLeft	Ldw threat level, left	none	
SamLdw	595	LdwThreatLeftConf	Ldw threat level confidence, left	none	
SamLdw	594	LdwThreatRight	Ldw threat level, right	none	
SamLdw	596	LdwThreatRightConf	Ldw threat level confidence, right	none	
SamLdw	666	LdwTimeToAvail	Ldw time to available	sec	
SamLdw	832	SamTimeFrozenCount	Count of SamTimeFrozen	none	
SamLdw	603	ShoulderLeft	Ldw visible shoulder width, left	m	
SamLdw	605	ShoulderLeftConf	Ldw Shoulder width confidence, left	none	
SamLdw	604	ShoulderRight	Ldw visible shoulder width, right	m	
SamLdw	606	ShoulderRightConf	Ldw Shoulder width confidence, right	none	
SamLdw	17	Time	Time in centiseconds since das started	csec	
Summary	859	AxHist	Ax Histogram	none	
Summary	858	AySpeedHist	Ay and speed histogram	none	
Summary	745	BatteryVoltageHist	Battery voltage histogram	none	
Summary	856	BoundariesHist	Boundaries histogram	none	
Summary	519	BrakeCount	Count of manual brake applications	none	
Summary	765	CleanWindowHist	CleanWindow histogram	none	
Summary	202	CommentCount	Comment count	none	
Summary	824	CswChecksumFaultCount	Count of CswChecksumFault	none	
Summary	798	CswChecksumFaultHist	CswChecksumFault Histogram	none	
Summary	813	CswComFaultCount	Count of CswComFault	none	
Summary	766	CswComFaultHist	CswComFault histogram	none	
Summary	825	CswComRateFaultCount	Count of CswComRateFault	none	
Summary	799	CswComRateFaultHist	CswComRateFault Histogram	none	
Summary	817	CswDeadReckFaultCount	Count of CswSpeedFault	none	
Summary	759	CswDeadReckFaultHist	CswSpeedFault histogram	none	
Summary	711	CswDistanceUnav	Distance csw not available	m	
Summary	159	CswHwVersion	Csw hardware version	none	
Summary	818	CswMapFaultCount	Count of CswMapFault	none	
Summary	779	CswMapFaultHist	CswMapFault Histogram	none	
Summary	719	CswMlp_1Count	Number of CswMlp_1 can messages	none	
Summary	720	CswMlp_2Count	Number of CswMlp_2 can messages	none	

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Summary	718	CswMlpCount	Number of CswMlp can messages	none	
Summary	721	CswNavCount	Number of CswNav can messages	none	
Summary	815	CswNavFaultCount	Count of CswNavFault	none	
Summary	757	CswNavFaultHist	CswNavFault histogram	none	
Summary	814	CswPositioningFaultCount	Count of CswGpsFault	none	
Summary	756	CswPositioningFaultHist	CswGpsFault histogram	none	
Summary	852	CswSensitivityCount	Csw sensitivity setting changes	none	
Summary	853	CswSensitivityHist	Csw Sensitivity Histogram	none	
Summary	816	CswSoftwareFaultCount	Count of CswSoftwareFault	none	
Summary	758	CswSoftwareFaultHist	CswSoftwareFault histogram	none	
Summary	850	CswSpeedGateDistance	Distance above csw speed	m	
Summary	158	CswSwVersion	Csw software version	none	
Summary	722	CswThreatCount	Number of CswThreat can messages	none	
Summary	714	CswUnavailableHist	Csw Unvailable Histogram	none	
Summary	23	Das	Das number 0-15	none	
Summary	425	DasTemperatureHist	Das temperature Histogram	none	
Summary	25	DasVersion	Das software version	none	
Summary	537	DasVoltageHist	Das Voltage Hist	none	
Summary	137	Distance	Trip distance	m	
Summary	193	DistanceDay	Distance in the dark	m	
Summary	191	DistanceEngaged	Distance engaged	m	
Summary	821	DviComFaultCount	Count of DviComFault	none	
Summary	795	DviComFaultHist	DviComFault Histogram	none	
Summary	767	DviDisplayHist	DviDisplayMode histogram	none	
Summary	629	DviHwMajor	DVI major hardware revision level	none	
Summary	630	DviHwMinor	DVI minor hardware revision level	none	
Summary	723	DviInfoCount	Number of DviInfo can messages	none	
Summary	631	DviSwMajor	DVI major software revision level	none	
Summary	632	DviSwMinor	DVI minor software revision level	none	
Summary	375	EmergencyShutDown	Shut down request from Blue Earth micro because of out-of-range temp or volatge	none	
Summary	196	EndTime	Last time for test	csec	
Summary	197	Engagements	Count of enagagements	none	
Summary	200	FirstSamCount	First sequence count from SAM	none	
Summary	822	GyroComFaultCount	Count of GyroComFault	none	
Summary	796	GyroComFaultHist	GyroComFault Histogram	none	
Summary	823	GyroHardwareFaultCount	Count of GyroHardwareFault	none	
Summary	797	GyroHardwareFaultHist	GyroHardwareFault Histogram	none	
Summary	724	LadbCount	Number of Ladb can messages	none	
Summary	707	LaneOffsetHist	Lane offfset versus boudaries	none	
Summary	189	LastLatitude	Last Latitude where NumberOfSats >=3	deg	15
Summary	190	LastLongitude	Last Longitude where NumberOfSats >=3	deg	15
Summary	725	Ldw_1Count	Number of Ldw_1 can messages	none	
Summary	726	Ldw_2Count	Number of Ldw_2 can messages	none	

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Summary	727	Ldw_3Count	Number of Ldw_3 can messages	none	
Summary	812	LdwComFaultCount	Count of Ldw Com faults	none	
Summary	804	LdwComFaultHist	LdwComFault histogram	none	
Summary	741	LdwEventHist	Ldw event histogram	none	
Summary	712	LdwLeftDistanceUnav	Distance ldw left not available	m	
Summary	713	LdwRightDistanceUnav	Distance ldw right not available	m	
Summary	851	LdwSensitivityCount	Ldw sensitivity setting changes	none	
Summary	854	LdwSensitivityHist	Ldw Sensitivity Histogram	none	
Summary	849	LdwSpeedGateDistance	Distance above ldw speed	m	
Summary	710	LdwStatusHist	Ldw status histogram	none	
Summary	715	LdwUnvailableLeftHist	Ldw left unvailable Histogram	none	
Summary	716	LdwUnvailableRightHist	Ldw right unvailable Histogram	none	
Summary	770	LeftClosestHist	LeftClosest Histogram	none	
Summary	826	LeftFrontComFaultCount	Count of LeftFrontComFault	none	
Summary	800	LeftFrontComFaultHist	LeftFrontComFault Histogram	none	
Summary	760	LeftFrontDirtyHist	LeftFrontDirty histogram	none	
Summary	772	LeftFrontObjectsHist	LeftFrontObjects Histogram	none	
Summary	728	LeftFrontRadarCount	Number of LeftFrontRadar can messages	none	
Summary	762	LeftFrontServiceHist	LeftFrontService histogram	none	
Summary	806	LeftRadarBusErrors	Total error frame count on left radar can bus	none	
Summary	809	LeftRadarBusOverruns	Total overrun count onleft radar can bus	none	
Summary	828	LeftSideComFaultCount	Count of LeftSideComFault	none	
Summary	802	LeftSideComFaultHist	LeftSideComFault Histogram	none	
Summary	729	LeftSideRadarCount	Number of LeftSideRada can messages	none	
Summary	730	MlpCount	Number of Mlp can messages	none	
Summary	819	NissanComFaultCount	Count of NissanComFault	none	
Summary	793	NissanComFaultHist	NissanComFault Histogram	none	
Summary	861	PitchRateHist	PitchRate Histogram	none	
Summary	805	RdcwBusErrors	Total error frame count on rdcw can bus	none	
Summary	808	RdcwBusOverruns	Total overrun count on rdcw can bus	none	
Summary	638	RdcwDisabled	True if rdcw is disabled	none	1
Summary	764	RdcwServiceHist	RdcwService histogram	none	
Summary	731	RdcwStatusCount	Number of RdcwStatus can messages	none	
Summary	820	RduComFaultCount	Count of RduComFault	none	
Summary	794	RduComFaultHist	RduComFault Histogram	none	
Summary	732	RduCount	Number of Rdu can messages	none	
Summary	771	RightClosestHist	RightClosest Histogram	none	
Summary	827	RightFrontComFaultCount	Count of RightFrontComFault	none	
Summary	801	RightFrontComFaultHist	RightFrontComFault Histogram	none	
Summary	761	RightFrontDirtyHist	RightFrontDirty histogram	none	
Summary	773	RightFrontObjectsHist	RightFrontObjects Histogram	none	
Summary	733	RightFrontRadarCount	Number of RifghtFrontRada can messages	none	

Table 4 *(Continued)*. Onboard data archive: Signals (fields) within database tables, excluding the radar tables

Table	Signal ID	Signal name	Description	Units	Style ID
Summary	763	RightFrontServiceHist	RightFrontService histogram	none	
Summary	807	RightRadarBusErrors	Total error frame count on right radar can bus	none	
Summary	810	RightRadarBusOverruns	Total overrun count on left radar can bus	none	
Summary	829	RightSideComFaultCount	Count of RightSideComFault	none	
Summary	803	RightSideComFaultHist	RightSideComFault Histogram	none	
Summary	734	RightSideRadarCount	Number of RifghtSideRadar can messages	none	
Summary	862	RollAngleHist	RollAngle Histogram	none	
Summary	860	RollRateHist	RollRate Histogram	none	
Summary	735	RoomLeftCount	Number of RoomLeft can messages	none	
Summary	736	RoomRightCount	Number of RoomRight can messages	none	
Summary	626	SamHwDay	Sam hardware revision level - days	none	
Summary	625	SamHwMonth	Sam hardware revision level - months	none	
Summary	737	SamInfo1Count	Number of SamInfo1 can messages	none	
Summary	811	SamServiceRequiredHist	SamServiceRequired histogram	none	
Summary	628	SamSwDay	Sam sofware revision level - days	none	
Summary	627	SamSwMonth	Sam software revision level - months	none	
Summary	832	SamTimeFrozenCount	Count of SamTimeFrozen	none	
Summary	535	SpeedRoadHist	Vehicle Speed histogram	none	
Summary	371	StartTime	First time for test	csec	
Summary	540	SteerSpeedHist	Steer and speed histogram	none	
Summary	44	TODTripStart	Absolute date/time corresponding to test time = 0 in access date/time format based on computer clock	none	
Summary	22	TripStart	Absolute date/time corresponding to test time = 0 in access date/time format	none	
Summary	855	TurnSignalCount	Turn signal count	none	
Summary	24	Vehicle	Vehicle number 0-13	none	
Summary	201	WarmStart	True if ignition happened with the das running	none	1
Summary	518	WiperHist	Wiper Histogram	none	
Summary	539	YawRateSpeedHist	Yaw rate and speed histogram	none	
TimeCheck	17	Time	Time in centiseconds since das started	csec	
TimeCheck	209	VideoTime	Time of video system	csec	
VideoSummary	381	FaceLeft	Left column of face video capture rectangle	none	
VideoSummary	380	FaceTop	Top row of face video capture rectangle	none	
VideoSummary	379	ForwardTop	Top row of forward video capture rectangle	none	

Table 5. Onboard data archive: Signals (fields) within the radar tables

Table	Signal	Description	Units
InfoLF	TestTime	Data time stamp	csec
InfoLF	RadarIndex	Radar index	
InfoLF	DeltaTime	Time since previous radar message	
InfoLF	NumberOfObjects	Num. of tracks in message	
InfoLF	Status	Radar health status	
InfoRF	TestTime	Data time stamp	csec
InfoRF	RadarIndex	Radar index	
InfoRF	DeltaTime	Time since previous radar message	
InfoRF	NumberOfObjects	Num. of tracks in message	
InfoRF	Status	Radar health status	
InfoLS	TestTime	Data time stamp	sec
InfoLS	RadarIndex	Radar index	
InfoLS	NumberOfTargets	Number of targets	
InfoRS	TestTime	Data time stamp	sec
InfoRS	RadarIndex	Radar index	
InfoRS	NumberOfTargets	Number of targets	
TargetsLF	TestTime	Data time stamp	sec
TargetsLF	RadarIndex	Radar scan index	
TargetsLF	TargetId	Index of a target within the scan	
TargetsLF	Range	Range of that target	m
TargetsLF	Rangerate	Range rate of that target	m/sec
TargetsLF	Transversal	Transverse distance of target	m
TargetsLF	Acceleration	Acceleration of target rel to radar	m/sec/sec
TargetsRF	TestTime	Data time stamp	sec
TargetsRF	RadarIndex	Radar scan index	
TargetsRF	TargetId	Index of a target within the scan	
TargetsRF	Range	Range of that target	m
TargetsRF	Rangerate	Range rate of that target	m/sec
TargetsRF	Transversal	Transverse distance of target	m
TargetsRF	Acceleration	Acceleration of target rel to radar	m/sec/sec
TargetsLS	TestTime	Data time stamp	sec
TargetsLS	RadarIndex	Radar scan index	
TargetsLS	TargetId	Index of a target within the scan	
TargetsLS	Range	Range of that target	m
TargetsLS	Amplitude	Radar return strength of that target	dB
TargetsRS	TestTime	Data time stamp	sec
TargetsRS	RadarIndex	Radar scan index	
TargetsRS	TargetId	Index of a target within the scan	
TargetsRS	Range	Range of that target	m
TargetsRS	Amplitude	Radar return strength of that target	dB

Table 6. Onboard data archive: signals associated with the event-driven summary tables

Table	Signal ID	Signal	Description	Units	Style Id
Csws	680	CpoiCurv	Cpoi curvature	1/m	
Csws	682	CpoiDistance	Distance to Cpoi	m	
Csws	640	CswAlert	Csw alert from DVI	none	60
Csws	567	CswAxExpected	Vehicle deceleration response assumed by CSW alert	m/sec2	16
Csws	847	CswEventNumber	Csw Event number	none	
Csws	569	CswMaxDesiredSpeed	Max desired speed in upcoming curve	m/sec	36
Csws	633	CswSensitivity	Csw sensitivity	none	77
Csws	58	Latitude	Latitude from Trimble Gps	deg	15
Csws	59	Longitude	Longitude from Trimble Gps	deg	15
Csws	573	MlpAdvisorySpeed	Advisory speed from ADAS	m/sec	36
Csws	572	MlpPostedSpeed	Mlp posted speed	m/sec	36
Csws	655	MlpRamp	Mlp Ramp	none	1
Csws	578	MlpRoadClass	Mlp road function class	none	63
Csws	638	RdcwDisabled	True if rdcw is disabled	none	1
Csws	543	Speed	Vehicle Speed	m/sec	36
Csws	17	Time	Time in centiseconds since das started	csec	
Ldws	844	AlertLaneOffset	Vehicle offset from lane center at alert onset	m	
Ldws	845	AlertLaneWidth	Lane width at alert onset	m	
Ldws	833	AmrCritical	Critical Available Maneuvering at alert onset	m	
Ldws	857	AmrCriticalBin	Critical available maneuvering room bin at alert onset	none	
Ldws	834	AmrCriticalSource	Critical available maneuvering room source at alert onset	none	69
Ldws	835	Boundary	Lane boundary type at alert onset	none	67
Ldws	840	Fod	Future offset distance at alert onset	m	
Ldws	841	FodThreshold	Future offset distance threshold at alert onset	m	
Ldws	838	LdwAlertSide	Side of Ldw alertt	none	66
Ldws	836	LdwAlertSpeed	Vehicle Speed at ldw alert onset	m/sec	36
Ldws	837	LdwAlertValue	Ldw alert value from DVI at alert onset	none	60
Ldws	842	LdwLatitude	Latitude at Ldw alert onset	deg	15
Ldws	843	LdwLongitude	Longitude at Ldw alert onset	deg	15
Ldws	846	LdwRoadClass	Mlp road function class at onset of ldw alert	none	63
Ldws	634	LdwSensitivity	Ldw sensitivity	none	77
Ldws	638	RdcwDisabled	True if rdcw is disabled	none	1
Comms	58	Latitude	Latitude from Trimble Gps	deg	15
Comms	59	Longitude	Longitude from Trimble Gps	deg	15
Comms	638	RdcwDisabled	True if rdcw is disabled	none	1

Table 7. Onboard data archive: mapping numerical values of signals into labels, using styles

StyleId	Value	Name
1	0	False
1	1	True
2	0	Disabled
2	1	Enabled
4	0	Auto
4	1	Manual
5	0	Stopped
5	1	Paused
5	2	Running
5	3	Initialized
5	4	Stopping
5	5	Starting
11	0	Off
11	1	On
12	0	Unknown
12	1	Park
12	128	Drive1
12	16	Drive4
12	2	Reverse
12	32	Drive3
12	4	Neutral
12	64	Drive2
12	8	Drive
13	0	Off
13	1	Low
13	2	High
13	3	invalid
18	0	p10pt0
18	1	p10pt4
18	10	p14pt0
18	11	p14pt4
18	12	p14pt8
18	13	p15pt2
18	14	p15pt6
18	15	p16pt0
18	2	p10pt8
18	3	p11pt2
18	4	p11pt6
18	5	p12pt0
18	6	p12pt4
18	7	p12pt8
18	8	p13pt2
18	9	p13pt6
32	0	None
32	1	Left
32	2	Right

Table 7 *(Continued)*. Onboard data archive: mapping numerical values of signals into labels, using styles

StyleId	Value	Name
32	3	Both
37	0	< 9
37	1	9 to 11
37	2	11 to 13
37	3	13 to 15
37	4	>15
53	0	Non-Artery
53	1	Collector
53	2	Secondary
53	3	Primary
53	4	Inter-Metro
54	0	Unknown
54	1	Limited Access
54	10	Ferry Lane
54	11	Walkway
54	2	Limited Access@grade
54	3	Thruway
54	4	Local Street
54	5	Frontage
54	6	Ramp
54	7	Access Road
54	8	Connector
54	9	Alley
56	0	2to4
56	1	4to6
56	10	22to24
56	11	24to26
56	12	26to28
56	13	28to30
56	14	30to32
56	15	32to34
56	16	34to36
56	2	6to8
56	3	8to10
56	4	10to12
56	5	12to14
56	6	14to16
56	7	16to18
56	8	18to20
56	9	20to22
59	0	Zero
59	1	One
59	2	Two
59	3	Three
59	4	Four
59	5	Five
59	6	Six

Table 7 *(Continued)*. Onboard data archive: mapping numerical values of signals into labels, using styles

StyleId	Value	Name
59	7	Seven
59	8	Eight
60	0	None
60	1	Advisory
60	2	Caution
60	3	Imminent
61	0	gt80
61	1	65to80
61	2	55to64
61	3	41to54
61	4	31to40
61	5	21to30
61	6	6to20
61	7	lt6
62	0	none
62	1	1Lane
62	2	2to3Lanes
62	3	gt4Lanes
63	0	None
63	1	FC1
63	2	FC2
63	3	FC3
63	4	FC4
63	5	FC5
64	0	Invalid
64	1	Enabled
64	10	DriverInterface
64	11	VehicleSignal
64	12	StartSup
64	13	ExtStartup
64	14	TurnedOff
64	15	WeirdCondition
64	2	LowConf
64	3	ExtLowConf
64	4	MissingBnds
64	5	HighLatSpeed
64	6	Reset
64	7	LowSpeed
64	8	AppStopped
64	9	NoSpeed
65	0	NoEvent
65	1	CalibrationStarted
65	10	LeftButton
65	11	SelectButton
65	12	RightButton
65	13	CalibrationRefined
65	14	ParmsSaved

Table 7 *(Continued)*. Onboard data archive: mapping numerical values of signals into labels, using styles

StyleId	Value	Name
65	15	ImageLogged
65	16	TakeBreak
65	17	CalibrationReport
65	18	TimeReport
65	19	Message
65	2	CalibrationSuccessful
65	20	startup
65	21	StatusChange
65	22	ImageReport
65	23	InvalidInput
65	3	CalibrationFailed
65	4	LefLaneChange
65	5	RightLaneChange
65	6	LeftDrift
65	7	RightDrift
65	8	DrowsyDriver
65	9	CleanWindow
66	0	none
66	1	left
66	2	right
67	0	missing
67	1	dashed
67	2	solid
67	3	virtual
68	0	Default
68	1	Low
68	2	Medium
68	3	High
69	0	default
69	1	camera
69	2	radar
69	3	Ladb
70	0	AllOn
70	1	PowerUp
70	2	PowerUpFailure
70	3	CallUmtri
70	4	Demo
70	5	EndOfDemo
70	6	RdcwDisabled
70	7	LdwSelfServe
70	8	Res2
70	9	AllOff
71	0	Verified
71	1	NotVerified
72	0	Off
72	1	Parking
72	2	Low

Table 7 *(Continued)*. Onboard data archive: mapping numerical values of signals into labels, using styles

StyleId	Value	Name
72	3	High
73	0	Intersate
73	1	Federal
73	2	State
73	3	County
74	0	Unknown
74	1	0D
74	2	2DHold
74	3	2D
74	4	3D
74	5	OverDetermined
75	0	LmRm
75	1	LmRd
75	10	LsRs
75	11	LsRv
75	12	LvRm
75	13	LvRd
75	14	LvRs
75	15	LvRv
75	2	LmRs
75	3	LmRv
75	4	LdRm
75	5	LdRd
75	6	LdRs
75	7	LdRv
75	8	LsRm
75	9	LsRd
77	0	Unknown
77	1	one
77	2	two
77	3	three
77	4	four
77	5	five
78	0	Off
78	1	Delay
78	2	Low
78	3	High
78	4	Invalid

Appendix Q

Corrected Data Signals In The FOT Data

This page was left blank intentionally.

Corrected Data Signals In The FOT Data

This appendix documents issues with specific data signals collected by the DAS on the FOT vehicles. All of these quality issues were addressed during the data collection phase of the project and corrected, when possible, before the analysis task. Each of the quality issues is highlighted below with a short description of the problem and an outline of the steps necessary to correct the problem.

Headlamp

Due to an incorrectly mapped CAN message, some changes of battery voltage (save as a triggered transition, see section 4.5) caused incorrect readings of head-lamp state (also a triggered transition variable). The particular values of battery voltage that resulted in these faulty data were identified and the headlamp data were corrected accordingly.

Wipers

Determining the state of the wiper setting for recording in the data record was done by observing the state and timing of the 12-volt power input to the wiper motor. With intermittent wiper settings, the interpretation of power pulses was complicated by the fact that wiper frequency was determined by a combination of wiper setting and the forward speed of the vehicle. (Time delay between wiper swipes increased at lower speeds.) The initial interpretation algorithms did not handled especially long delays properly and recorded what amounted to a series of on/off cycles rather than a constant intermittent setting. The data record was scanned and corrected accordingly.

GPS Time Lag

There were two GPS units onboard the RDCW vehicles – the RDCW system's GPS unit, and the data collection system's differential GPS unit that was used only for analysis and was not an input into the crash warning system. This latter unit was found to return time-shifted results after July 18, 2004 (about one-third of the way through the FOT). This did not affect the crash warnings at all. The *Latitude*, *Longitude*, and *GpsSpeed* signals were time-lagged for a substantial percentage of the trips after this date. Comparing *GPSSpeed* with data from the car's speedometer indicated a lag of approximately 2.5 seconds. The cause of the problem has not yet been determined, but it appears to have started uniformly in all cars on July 18, 2004. It was not evident during any trips before then and appeared in at least part of almost all trips beginning after that date.

An easy way to visualize the problem was to plot speed (from the vehicle CAN bus) and *GPSSpeed* versus *Time*. However, to fix the problem it was easier to analyze by looking at

the “offset” between time and *GPSTime* and how it varied during a trip. Ideally, the offset would be a constant and small throughout a trip, but in these instances it was common for trips to have any number of offset values.

Looking at the post July 18 trips, somewhere around 40% were in phase some of the time and out of phase some of the time. A few were in phase all of the time, but most of the rest were out of phase all of the time. For trips that were in phase some of the time, the in-phase portions corresponded to higher offset values than did the out-of-phase portions. Using these higher values to calculate corrected times worked to bring these trips into phase throughout. This indicated that for the trips that were entirely out of phase, something needed to be added to the offset as a correction. Again using the partially in-phase trips as a guide, the value of 250 centi-seconds was far and away the most common difference between their substantial high offsets and substantial low offsets, with 240 and 260 being the next most common. Using the formula time=*GPSTime*/10 – (offset + 250) brought most of the out-of-phase trips into phase. This formula also worked for the partially in-phase trips, using the minimum substantial offset (i.e., more than 5% of the trip) in the calculation.

Curvature

The sign and offset values for the 20 curvature values from CSW system need to be corrected using the following convention:

If Old_Value > 0.0 Then New_Value = -Old_Value - 0.00088

If Old_Value < 0.0 Then New_Value = -Old_Value + 0.00088

Outside Temperature

There were two problems with the recording of temperature in the outside temperature data channel. (1) The transducers was located in the engine compartment and therefore tended to produce inappropriately warm readings when a warm vehicle came to a stop, and (2) transitions from -1 C to 0 deg C sometimes produced anomalous temporary readings of 16 degrees C, before returning to 0 deg C.

To correct for the high temperatures caused by engine heating for purposes of analysis, specific vehicle test were conducted to determine representative heating and cooling transients (for the standing vehicle and for the vehicle moving off after standing, respectively). These transient functions were applied in “reverse” at the appropriate places in the data recorded as identified by the *Speed* data. In the case of the spurious 16-degree readings, the false readings were simply identified by there proximity to zero readings and replaced as appropriate.

Left-side radar

The data record for approximately 7.2 percent of the trips with speed > 25 mph had no left-side or left-front radar data. There is no fix for this problem these data simply were not recorded by the DAS. The underlying problem was traced to a software driver for the two, dual-channel CAN cards from supplier Softig in Germany. While the first CAN card properly booted up, the second card would occasionally boot up in a (Note: this problem did not affect the RDCW system functionality since the radar worked properly for the system)

20 Hz time sync problem

A time shift was present in the 20 Hz transducer data for drivers 1 through 4. This included the accelerometer and steering wheel sensor. The problem was addressed by calculating longitudinal acceleration from the 10 Hz Speed channel and performing an autocorrelation on the 20 Hz *Ax* channel to determine the phase difference and hence, time lag of the 20 Hz data. The lag time correction was then used to correct the *Time* channel of the 20 Hz data. Typically the correction was less than 0.5 s but could be as large as 2.3 s

This page was left blank intentionally.

Appendix R

Coding Key for RDCW Alerts

This page was left blank intentionally.

Coding Key for RDCW Alerts

LDW and CSW alerts were coded using different criteria; however, driver behavior was rated in the same way for each set of alerts. Those criteria are listed first below. Specific categories regarding scenario details were different for each of the systems. Each of the scenario coding keys is described after the driver behavior key.

Driver Behaviors

Location of eyes during the last non-forward glance (and time from the last non-forward glance)

(If the driver's eyes were on the forward scene at the moment of the alert, but they had looked away during some portion of the clip previous to the alert, this location was recorded. The reviewers also recorded the amount of time between when the driver's gaze began to return to the forward scene and the moment of the alert, according to the DVI display on the computer monitor. We did not count the actual moment of the alert; the time represents the time between the change in gaze and the alert. Time was recorded in tenths of seconds. If the driver was always looking forward, then the time from the last non-forward glance was left null, as that category was not applicable. If the driver was looking away one tenth of a second before the alert and then was looking forward at the time of the alert, the time from the last non-forward glance was recorded as 0. If their eyes were not visible, typically because of glare, for any portion of the clip, the location was coded as a 9, because one could not be certain there was not a glance away. The only exception to this rule is when the reviewers could not see the driver's eyes and then the eyes became visible so that the reviewers could see the eyes and there was a glance away before the alert. This situation negates the fact that the reviewers could not see the eyes at the beginning of the clip because there was a non-forward glance after the portion where the eyes were unclassifiable. Of course, if the eyes were then unclassifiable again, before the alert but after the glance, the eyes were coded as a 9, because the reviewers could not be certain what happened during that portion of the clip. If one eye location could be determined and the other eye's location could not, location was still coded. Reviewers felt confident in coding eye position when only one eye could be seen because normally eyes move in parallel. If the driver's eyes were away before the alert and were in transition at the time of the alert, the last non-forward glance code reflected where they were looking at the time of the alert, not where they had previously been looking. For more details on eye location see the information on eye location at the time of the alert. The criteria for classifying a glance as a specific location are the same as the criteria for eye location at the time of the alert.)

0 = Always looking forward at the forward scene
1 = Left outside mirror or window
2 = Looking over left shoulder
3 = Right outside mirror or window
4 = Looking over right shoulder
5 = Interior rear-view mirror
6 = Head down, looking at instrument panel or lap area

7 = Head down, looking at center console area (*Console* means the area where the stereo, thermostat, and clock are located)
8 = Driver wearing sunglasses or glasses with glare (Glare prohibited the ability to classify where the eyes are looking)
9 = Cannot accurately evaluate eye location (A *9* is chosen when the reviewer was unsure of the eye position and/or classification within a reasonable level of confidence though not because of glasses. Typically the reviewer could see the actual eye, but could not determine where the gaze was directed. Eyes in transition were often coded as *9*, as it was unclear where the driver's gaze was at that particular moment.)
10 = Other (For example the driver may clearly be looking at passenger side floor. When a glance was coded as *other*, the location was noted in the notes section. The most common position recorded as *other* was the rear-view mirror.)

Location of eyes at time of the alert

(This category was coded at the actual time of the alert. Eye location was coded by what the reviewers could see of the driver's eyes at the time of the alert, even if they could not see the eyes preceding the alert. The reviewers coded the location of the driver's eyes even if they could only see one eye, as it was assumed that the driver's eyes moved in parallel. Because of the absence of an eye-tracking camera and the limitations of the face-camera, there was often some ambiguity about where the drivers were looking. The reviewers needed to be very confident in the location of the driver's eyes in order to code as a specific location. There were many instances when the reviewers were confident that the driver's eyes were not looking forward, but could not tell specifically where the eyes were looking. These instances were coded as 9s. One such example is when the driver appeared to be looking at the camera. In this situation it was difficult to determine if the driver was looking at the camera intentionally, glancing out the corner, or looking slightly out the left window; therefore, it was coded as an 9. Another example of this is when the driver was looking toward the curve that elicited the alert. The exact location of the driver's eyes could not be determined in these instances, although a notation was made in the "notes" field. The determination of whether glances were still forward or it they were glances away was also very difficult and subjective. The reviewers agreed upon an area or "box" which they considered to be looking forward, this allowed for slight glances but even many scans across the forward scene were considered glances away. This process defined "looking forward" very narrowly and essentially meant straight forward. Glances toward the right of the forward scene, the right area of the windshield, were glances away and were coded as 9s.)

0 = Looking forward at forward scene (*Looking forward* included looking at the HUD.)
1 = Left outside mirror or window
2 = Looking over left shoulder (The driver's gaze needed to look over the driver's shoulder, though the driver's chin did not necessarily need to cross over the driver's shoulder.)
3 = Right outside mirror or window
4 = Looking over right shoulder (The driver's gaze needed to look over the driver's shoulder, though the driver's chin did not necessarily need to cross over the driver's shoulder.)
5 = Interior rear-view mirror
6 = Head down, looking at instrument panel or lap area (Looking at the HUD was not considered part of the instrument panel.)

7 = Head down, looking at center console area (*Console* means the area where the stereo, thermostat, and clock are located)

8 = Driver wearing sunglasses or glasses with glare (The glare prohibited the ability to classify where the eyes are looking. There were instances where drivers were wearing sunglasses but the reviewers felt that they could confidently identify the location of the drivers' eyes. In these instances eye location was recorded.)

9 = Cannot accurately evaluate eye location (A *9* was chosen when the reviewer was unsure of the eye position and/or classification within a reasonable level of confidence though not because of glasses. Typically the reviewer could see the actual eye, but could not determine where the gaze was directed. Eyes in transition were often coded as *9*, as it was unclear where the driver's gaze was at that particular moment.)

10 = Other (For example the driver may clearly be looking at passenger side floor. When a glance was coded as *other*, the location was noted in the notes section. The most common position recorded as *other* was the rear-view mirror.)

Eyes on task at time of the alert

0 = No (The classification of *no* was only used when the reviewer could confidently determine that the driver's eyes were off the task of driving at the time of the alert, i.e. they were looking at a friend, the stereo system, etc.)

1= Yes (The classification of *yes* does not mean looking forward, it means that the driver's eyes were on the task of driving. Looking at the instrument panel, for example, was considered to be "on task").

2 = Cannot determine (For instance, the driver was wearing glasses with glare or the reviewer could not see the driver's eyes for some other reason. This classification was also used when the reviewer could not tell if the eye location was on task. For instance, the driver was looking out the window (e.g., toward a curve in the road) but it was unclear whether the driver was looking at the road/traffic or at a fancy building that was distracting the driver's attention. In any case, the reviewer did not KNOW whether the driver was on task or not.)

Eyes in transition

(In order to classify the eyes as in transition, the driver's eyes must have been in transition at the time of the alert and they must have started the transition at least 0 .1 sec before the alert. The eyes could not be at the very beginning of a transition or the very end of one, they must have been IN the transition at the time of the alert.)

0 = No

1 = Yes, towards forward scene

2 = Yes, away from forward scene

3 = Cannot tell (*Cannot tell* was selected when the driver was wearing sunglasses or the reviewer could not see the driver's eyes for some other reason; therefore it was uncertain whether they were in transition.)

Visual response to alert (and time to visual response)

(Reviewer coded the time that it took the driver to initiate a visual response to the alert, if a response was initiated, by filling in the number of 10ths of a second the response took. The time counted was the time between the alert and when the look was initiated, not including the moment of the alert nor the moment of response. If the response was initiated within 1.0 second then the driver was considered to have looked in response to the alert. The amount of time it took to look in response was always recorded for applicable situations, even if this was greater than 1.0 second. If the driver was already looking at the road and continued to look forward the code was null (not applicable). If the reviewer was not sure of the location of the driver's eyes then the time to visual response was left as null. The time to visual response was recorded for week one, even though there was no alert to respond to. The rationale for coding this was that a baseline would provide an idea of what a normal time to visual response was, as compared to the time to response with an alert.)

0 = Looked in response (The driver initiated a look in response to the alert within 1.0 seconds. Glances qualified as a look in response.)
1 = Did not look in response to alert (The driver did not look within 1.0 seconds of the alert.)
2 = NA (This option was always used for week one because there was no alert during week one, thus we could not code this category (although we still coded the *time to visual response*). This option was also selected when the driver was already looking forward at the time of the alert this category was not applicable.)
3 = Cannot tell (The driver was wearing sunglasses or other glasses with glare etc. and therefore the reviewer could not tell where the driver's eyes were.)

Visual Occlusion

(Occlusion was coded with regard to the driver as well as to the reviewer. For instance heavy rain or bright sun might have occluded the scene for both parties, whereas blurry video only occluded the scene for the reviewer. The occlusion did not necessarily have to impact the reviewer's ability to code the scene.)

0 = None
1 = Sun or headlight glare (This classification includes when the scene was white washed from the sun. Only headlight glare was included in this section, taillight glare was coded as other.)
2 = Other, specified in notes section (The most common entry was taillight glare.)

Startle response

(This was very subjective and the classification as such was often hotly debated. The driver had to be visibly rattled. The driver's startle was observed by body response and/or dialogue. Cursing was not sufficient to be coded as startle, as this may have been anger or frustration, not startle. This category tried to capture startle either to the situation or to the alert.)

0 = No
1 = Yes

Steering in response

0 = No steering in response to alert (Small jerky reactions or slight wiggling in response to the alert or to the situation was classified as a *0* and was not considered steering.)
1 = Driver steered partially or fully in response to the alert (Steering, for review purposes, was an evasive maneuver in an attempt to prevent striking a vehicle, thus there must have been a significant amount of steering.)

Hand location at time of alert

(Both hands were not often visible, so the reviewer coded what could confidently be inferred from the scene. At times, playing the video further helped to determine what was ambiguous in a still frame at the time of the alert. For instance, at the time of the alert there may have been a small blur near the steering wheel. Upon continuation of the video the blur may have moved and come into view as a hand.)
0 = Cannot see the position of either hand or cannot determine the position of either hand (The reviewer coded *0* if a hand could be seen but the reviewer could not tell if it was on the wheel).
1 = At least one hand on steering wheel (This was coded when the position of one hand could not be determine but one could see that at least one hand was on the steering wheel).
2 = Both hands are on the steering wheel.
3 = At least one hand off the steering wheel (This was coded when the position of one hand could not be determine but at least one hand was clearly off the steering wheel.)
4 = One hand on, one hand off the steering wheel. (A *4* was classified when the reviewer could clearly see both hands, and one was on the wheel while the other was off.)
5 = Both hands off the steering wheel. (A *5* was classified when the reviewer could clearly see both hands, and both were off of the wheel.)

Secondary Driving Behaviors

(Audio was utilized to assist in coding whenever possible. For instance, the reviewer may have heard the radio station change and also have seen the driver look at the counsel; this would indicate in-car system use. The default for non-driving behaviors was none.)

0 = None
Cell phone:
10 = Conversation, in use (C*onversation* could be coded for listening, talking, or both while using the cell phone)
11 = Reaching for phone (This classification refers to when the driver reached for the handheld phone in order to speak on that phone. If the driver reached for the phone simply to answer the phone and talk on the headset the driver was wearing then the classification was *other*. Simply answering the phone involves far less physical activity by the driver than reaching for the phone and holding it during a conversation.)
12 = Dialing phone
Headset, hands free phone:
20 = Conversation (This was selected when the reviewer could tell that the driver was in

a conversation)

21 = Reaching for headset

22 = Unsure of activity level (The driver was wearing a headset but it was not clear whether the headset was in use. The driver may have been listening to someone or wearing it in case of an incoming call.)

Eating:

30 = High involvement (*High involvement* includes eating a burger, unwrapping food, etc.)

31 = Low involvement (*Low involvement* includes eating candy, grabbing chips etc.)

Drinking:

40 = High involvement (*High involvement* includes situations where the driver was trying to open a straw or bottle, blowing on a hot drink, etc.)

41 = Low involvement (*Low involvement* includes situations where the driver was sipping a drink, drinking without looking, etc.)

50 = Conversation (The driver and someone in the car are carrying on a conversation. The driver can be listening during clip, talking during clip, or doing both)

60 = In-car system use (The driver was actively adjusting something. For example, the driver was not just listening to the stereo; the driver was also adjusting the stereo etc. The car lighter was coded under the smoking section.)

Smoking:

70 = Lighting (This classification includes the in-car lighter)

71 = Reaching for cigarettes or lighter (This classification includes the in-car lighter)

72 = Smoking

Grooming:

80 = High involvement (*High involvement* includes applying makeup, brushing hair, etc.)

81 = Low involvement (*Low involvement* includes scratching, running one's fingers Through his or her hair, etc.)

90 = Other/multiple behaviors, specified in notes section (These may include behaviors like whistling or classifications that the reviewer was unsure of, i.e. if the driver's lips were moving but there was no audio the behavior might be singing or conversation.)

Seatbelt

0 = Yes

1 = No

2 = Cannot tell

CSW Scenario Elements

Road type

0 = Freeway/interstate
1 = Ramp (A "ramp" was defined as an entrance/exit ramp from a freeway, or any ramp that connected two arterial roads.)
2 = Ramp near merge point (Near was defined as being within 10 seconds of the merge point or within 10 seconds of arriving at the straightening of the ramp leading to a merge.)
3 = Surface road
4 = Other (enter in notes)

Road condition

(Glare and reflection helped to determine whether the road was dry or wet.)

0 = Dry
1 = Wet (Any moisture on the road led to the classification as wet; there did not need to be standing water etc. The road was classified as *wet* if it was wet from snow but was not snow covered.)
2 = Snow covered (*Snow covered* would have included ice covered if it was observed, but it was never observed. If any portion of the road, including turn lanes, was covered in snow then the classification was *snow covered*.)

Precipitation

(Spots on the windshield or wiper activity helped determine if there was in fact precipitation.)

0 = None
1 = Rain (Light rain and drizzle were classified as rain, as were downpours.)
2 = Snow (This category included sleet. There were several cues which helped to indicate that the precipitation was in fact snow. Snow tended to be larger and fall more slowly than rain, snow looked like white flurries, snow was also present on the ground and this reinforced the classification as snow. Also, precipitation which occurred in December through February was assumed to be snow, and not rain. Snow could be could be coded in other months, but the assumption that the precipitation was snow was not as strong.)

Number of through lanes

(*Turn lanes and dedicated exit lanes are not included in the count.)*

1 = 1
2 = 2
3 = 3
4 = 4 or more

Recent lane change

(In order to be considered a recent lane change, the lane change had to occur no more than 5 seconds before the alert or the car had to be in the process of a lane change at the time of the alert.)

0 = No
1 = Yes, toward branch that triggered the alert
2 = Yes, away from the branch that triggered the alert
3 = Yes, but there was no branch triggering the alert or the branch triggering the alert is unknown

Curve confidence

(*This field was used to indicate when the reviewer could not accurately determine which branch/curve triggered the alert. The majority of the "confidence not high" events resulted from CSW behavior that stems from artifacts of the map or the CSW implementation details.)*

0 = Confidence not high
1 = Confidence high

Nearby overpass or underpass

(*The criteria were that the driver had to pass an overpass/underpass five seconds before the alert or 10 seconds after).*

0 = No
1 = Yes

Change in the number of through lanes
0 = No
1 = Yes

Does the vehicle branch

(*This addresses whether the vehicle is or will be taking a branch that triggers the CSW alert)*

0 = Not branching, and the alert is not triggered by a branch. (This can occur on a curvy rural road, for instance, or it could occur after the vehicle has exited onto a ramp and is approaching a curve.)
1 = Not branching, but passing branch that triggers alert
2 = Branching onto segment that triggers alert (e.g. taking an exit or driving in a dedicated exit lane.)
3 = Branching but alert was triggered by curve on initial roadway
9 = No confidence in identifying the curve

Branch type when branch is triggering alert

(*If the roadway is a ramp, the ramp being traveled is not considered a branch. For instance, if the vehicle has exited the freeway onto an exit ramp, and the roadway classification is "ramp", then an alert triggered by a curve along that ramp would be coded here as "0", no branch since the vehicle is already on the ramp.)*

0 = A branch does not trigger the alert
1 = Ramp
2 = Turn lane
3 = Michigan left
4 = Intersection
5 = Other
9 = No confidence in identifying the curve

Road geometry
0 = Straight
1 = Curve
2 = Approaching curve (The classification of *approaching curve* constituted situations where the driver was approaching, but not in a curve at the time of the alert. The driver had to be driving through the curve within five seconds after the alert in order to be classified as *approaching curve*.)

Notes

A notes section recorded any unusual events or ambiguous situations not covered by categories for a particular question. This section also contains general notes on the clip if there was anything significant taking place that was not adequately covered by the coding process. Examples of items that will be captured in notes section are below, though other unforeseen events will also be noted.

- Visual Occlusion**:** Rear taillights, glare from rain and wetness on the road, blurry video, dirty windshield, temporary incapacitation, sneezing, flying debris, faulty wiper/defroster, and object in or over eyes

- Non-driving behaviors*: Whistling,* two or more behaviors, if there is no audio and the driver is clearly talking or singing but we could not tell which, insect in car, adjusting mirrors, reading map, reading other materials, checking watch, and yawning

LDW Scenario Elements

Road type

0 = Freeway/interstate
1 = Ramp
2 = Ramp near merge point (Near is defined as being within 10 seconds of the merge point or within 10 seconds of arriving at the straightening of the ramp leading to a merge.)
3 = Surface road
4 = Other (enter in notes)

Road condition

(Glare and reflection helped to determine whether the road was dry or wet.)

0 = Dry
1 = Wet (Any moisture on the road led to the classification as wet; there did not need to be standing water etc. The road was classified as *wet* if it was wet from snow but was not snow covered.)
2 = Snow covered (*Snow covered* would have included ice covered if it was observed, but it was never observed. If any portion of the road, including turn lanes, was covered in snow then the classification was *snow covered*.)

Precipitation

(Spots on the windshield or wiper activity helped determine if there was in fact precipitation.)

0 = None
1 = Rain (Light rain and drizzle were classified as rain, as were downpours.)
2 = Snow (This category included sleet. There were several cues which helped to indicate that the precipitation was in fact snow. Snow tended to be larger and fall more slowly than rain, snow looked like white flurries, snow was also present on the ground and this reinforced the classification as snow. Also, precipitation which occurred in December through February was assumed to be snow, and not rain. Snow could be could be coded in other months, but the assumption that the precipitation was snow was not as strong.)

Road curvature

0 = Straight
1 = Right-hand curve
2 = Left-hand curve

Lane marking change

0 = No
1 = Yes

Boundary type

(*This field refers to what type of boundary was on the side of the alert. For example, for an imminent LDW to the left in which there was a solid lane boundary to the left, it would be coded as "0". Options "4" and "5" refer to double-boundary situations.*)

0 = Solid
1 = Dashed
2 = Double-solid
3 = No marking
4 = Solid/dashed
5 = Dashed/solid
6 = Curb
7 = Cannot tell

Continuous incidental feature

(*This feature applies to continuous markings on the road which are not lane lines but may appear as a lane line to the LDW system, for example tar markings, shadows or tire marks on wet pavement)*

0 = No
1 = Yes

Badly placed boundary

(*At times, the LDW system's real or virtual boundary was not properly placed according to the actual conditions on the roadway*.)

0 = No
1 = Yes

Boundary interaction

(*Ultimately, the position of the vehicle's tires was used to determine its position in the lane. At the time of the alert, if the tires were on or over the lane line, then the "crossed/straddled line" option was selected.)*

0 = Crossed/straddled line at alert
1 = Lane change at alert
2 = Centered/slightly off-center in lane
3 = Drifted in lane

Post- boundary maneuver

(*This field evaluates the first maneuver that the vehicle makes after the alert. For example, if the vehicle was drifting in the lane at the time of the alert, then crossed the lane line, and finally returned to its original lane, only the "eventually crossed" option would be selected. The fact that the vehicle had ultimately returned to its original lane was addressed in the "Additional driving circumstances" field, option "corrected per alert" which is detailed below.)*

0 = Eventually crossed
1 = Eventually returned to original lane
2 = Stayed in lane

Beyond the boundary

(*The area within two-thirds of a lane width and outside of the boundary in question was considered in this evaluation. While the choices were not mutually exclusive, there was no attempt to quantify everything beyond the boundary. If the alert was propagated by the camera, then the area directly to the right or left of the vehicle was evaluated. If, however, information from the radar produced the alert, then every effort was made to discern which object(s) had provoked the alert based upon AMR bin information.)*

0 = Median/open space
1 = Solid barrier
2 = Turning lane
3 = Empty lane
4 = Adjacent same-direction vehicle
5 = Fixed, discrete objects
6 = Construction zone
7 = Stalled/slow traffic in adjacent lane
8 = Curb
9 = Other/unknown
10 = Adjacent opposing-direction vehicle

Additional driving circumstances

(*These circumstances are intentional maneuvers by the driver which help to explain why the vehicle crossed the boundary or in the case of "corrected per the alert" the action that the driver took after the alert).*

0 = None
1 = Cut behind a car
2 = Clear a temporary obstacle
3 = Make room for a large truck
4 = Corrected per the alert
5 = Early or late exit/merge

False alert comments

0 = None
1 = Cannot identify target (For a radar-induced alert).
2 = Target seems far (For a radar-induced alert. The target had to be within two-thirds of lane width from the vehicle in order to be considered valid).
3 = Appears too sensitive (Usually when it appeared that the driver was not drifting).
4 = Other (List in Notes)

Lighting issues

0 = None
1 = Possible road reflection
2 = Recent change in road illumination

Notes

A notes section recorded any unusual events or ambiguous situations not covered by categories for a particular question. This section also contains general notes on the clip if there was anything significant taking place that was not adequately covered by the coding process. Examples of items that will be captured in notes section are below, though other unforeseen events will also be noted.

This page was left blank intentionally.

Appendix T

Characteristics Of Curves And Turns In The FOT Data

This page was left blank intentionally.

Characteristics Of Curves And Turns In The FOT Data

1 Definitions of a turn, a curve and related events

The following discussion employs the terms *turn* and *curve* and the related terms *turn event* and *curve event* in specific ways. Turns and curves are defined as physical locations and turn events and curve events are episodes in the FOT data. A *turn event* is an event during which an FOT vehicle was observed to turn on a path whose radius was 1000 m or less for at least 3 seconds. The path radius could vary during the three-second period, but could not exceed a magnitude of 1000 m. This definition of a turn event was used in a previous FOT that studied a heavy vehicle rollover prevention device (Winkler et al., 2002), and has been shown to identify deliberate, sustained turning as opposed to lane-change or lane-keeping maneuvers. A *turn* is the physical location where a turn event took place. *Curves* are also physical locations, and are intended to be different from turns in that curves are located on roadways with lanes (as opposed to parking lots, for instance) and curves are not meant to include intersections. In practice, curves are identified as the subset of turns that are located on roadways of known type (i.e., not parking lots, etc.) and for which there is at least one event whose minimum speed was 25 mph (40 kph) or greater. *Curve events* are the subset of turn events that took plane on curves.

Turn events and curve events were first identified, and then their locations were defined as turns and curves. Each turn event identified in the data set was characterized by a set of five numerics that summarized the physical and geometric characteristics of the turn. These characteristics then served in the important task of grouping or clustering turn events and subsequently assigning each turn or curve location a unique identification number, which could be used in the analysis of traversals over that turn or curve. This number was an important aid in addressing questions like: How many times did a driver traverse a particular turn? Which turn (or set of turns) did different drivers pass through at least once? Or many times? (Clearly, given the naturalistic nature of the experiment, the answer to the this last question sometimes involved turns in the neighborhood of UMTRI, which was the only common location frequented by all the FOT drivers). The five numerics used to cluster turning events for the assignment of turn identification numbers were:

- Start location—the latitude and longitude location of curve entry
- End location—the latitude and longitude location of curve exit
- Start heading—the heading angle at the time of curve entry

- Heading change—the magnitude and direction of the heading change while in the curve (derived by integrating yaw rate while in the curve)
- Minimum radius—the minimum curve radius

Note: special attention to stopping while in a curve or turn was also considered in the processing of the above summary numerics and in the grouping of traversals over discrete turns and curves. Drivers stop in a curve or turn for many reasons including traffic signals, yielding to on-coming vehicles, traffic congestion, etc. So special algorithms were developed to bridge the stopping event and continue the curve or turn until its true, geometric end, regardless of vehicle speed.

2 Exposure to all turns and curves

Table 1 shows the total number of distinct turns by direction (left or right) in the RDCW data set of 78 drivers; recall that turns include curves as well. For the entire data set there were over 93,000 turns identified, with 52% to the right and 48% to the left. A more detailed discussion of this bias is given in the section below that addresses exposure by road type.

Table 1 Total number of distinct turns for all 78 drivers

Left	*Right*	*All*
44861	48252	93113

Table 2 summarizes how often a give turn was traversed during the FOT. The majority of turns (80 percent) were traversed only once during the entire FOT. Approximately 18 percent of the turns include between 2 and 10 traversals. Only two percent of the turns (or 1,553 of 93,113 turns) had eleven or more traversals, and only 0.13 percent (or 123) had than 30 or more traversals.

Generally, for turns that had multiple traversals, most traversals are due to one or two drivers, rather than being distributed across many drivers. Among the exceptions to this observation, however, are several turns approaching and leaving UMTRI, where drivers picked up and returned their test vehicles. These turns were traversed by most drivers.

Table 2 Number of turns with different numbers of traversals

Traversals per Turn	*Turns to Left*	*Turns to Right*	*All Turns*
1	36089	38601	74690
2 to 10	8045	8825	16870
11 to 20	547	596	1143
21 to 30	131	156	287
30 or more	49	74	123
All traversals	44,861	48,252	93,113
Left vs. Right	48%	52%	100%

3 Exposure to roadway curves

Since the rules for identifying a turn event were based only on path radius and duration, many of these events occurred in parking lots or at intersections where the driver was changing roadways. These are not of interest in the evaluation of the CSW system. As stated earlier, curves are defined as the subset of turns that meet two criteria: the roadway type had to be known (to eliminate parking lots, for instance), and at least one traversal of the curve had to be done with a minimum speed of at least 25 mph (40 kph).

Table 3 shows that a total number of 18,525 distinct curves were identified from the 93,113 turns in the RDCW data set. That is, 19.9% of the locations previously identified as turns are computed to be curves. Curves to the right account for 53% of the curves, which is a similar to the fraction of turns that are to the right.

Table 3 Total number of distinct curves for all 78 drivers

Curves to Left	*Curves to Right*	*All Curves*
8723	9802	18525

Table 4 shows the number of traversals over any given curve. The majority of curves, 62 percent, were identified as having just a single traversal while approximately 34 percent of the curves showed between 2 and 10 traversals. The remaining four percent of the curves had eleven or more traversals with only 0.5 percent having more than 30 traversals. Again, when a curve is traversed several times in the FOT, it is almost always due to a handful of drivers and not a wide set of drivers . This is significant because it prevents analyses that use specific curves to study the effects of CSW on curve-taking performance across a significant number of drivers. Furthermore, it is difficult to compare curve-taking performance across drivers based on specific curves.

Table 4 Number of curves with different numbers of traversals

Number of traversals per curve	*Curves to Left*	*Curves to Right*	*All curves*
1	5360	6038	11398
2 to 10	2943	3265	6208
11 to 20 s	306	353	659
21 to 30 s	78	90	168
30 or more	36	56	92
Number of curves	8723	9802	18,525
Left vs. Right	47%	53%	100%

4 Exposure to roadway curves by week and road type

Table 5 examines the exposure of the FOT drivers to a subset of the traversals of the roadway curves and relates that exposure to all driving both by week and road type. The table shows, by direction and as a whole, the total distance and time spent in all the curve events that had a minimum velocity greater than 25 mph (40 Kph) as a function of week and road type. While traversals of curves reported earlier can include ones with minimum speeds below 25 mph (40 kph), here we are interested in traversals that might possibly be related to CSW activity. The top of table 5 shows the total distribution of distance and time to be relatively consistent over the enabled period of weeks 2, 3, and 4, but about 20 percent higher, based on distance, for week 1. For all weeks, the 8,540 km and 108 hrs of exposure in curves represents approximately 7 percent of the total distance and time spent above 25 mph for all travel distance and time by the FOT drivers, respectively.

Table 6 shows a similar distance and time exposure to roadway curves, but as a function of road type. There is considerable variation in both time and distance between the different road types given in the table. Not surprisingly, freeway curve-taking dominates both distance and time in these candidate curves. This may be a result of the long andsweeping nature of freeway curves, so that the time in a given curve is usually several seconds or a fraction of a minute. Freeway curves constitute approximately 39 percent of the distance spent on roadway curves. Ramps provide the next largest fraction of exposure, again based on distance, representing about 21 percent of the distance in curves. Furthermore, with the exception of freeways, traversals on ramps have the highest average speed of 77 kph (48 mph). Ramps are also unique in their asymmetry with traversals on right-hand curves accounting for 64% of the ramp-curve traversals. This right-curve bias reflects the fact that ramps primarily fall into two categories: a) strictly curves to the right or b) S-type ramps with a combination of a right and left curve connecting a surface road to a freeway, and thus not contributing to a bias in either turn direction.

Minor arterial roads are the next largest group and represent approximately 20 percent of the traversals in curves with an average speed of 65 kph (41 mph). Major arterials and local roads are the least traveled, representing about 12 percent and 8 percent of distance exposure, respectively. They do have markedly different average speeds with 70 kph (43 mph) for major arterials and 55 kph (35 mph) for local road types.

Table 5 Number of turns and the travel time and distance in those turns, by turn direction and by FOT week

	Left			*Right*			*All*		
Week	*Count*	*Distance, km*	*Time, hrs.*	*Count*	*Distance, km*	*Time, hrs.*	*Count*	*Distance, km*	*Time, hrs.*
1	6164	1105	14	7120	1368	17	13284	2473	31
2	5538	955	12	6255	1132	15	11793	2087	27
3	5049	901	11	5806	1069	14	10855	1970	25
4	4881	903	11	5869	1107	14	10750	2010	25
All	21632	3864	48	25050	4676	60	46682	8540	108
Travel in turns as fraction of distance and time > 25 mph (40 Kph)								7%	7%

Table 6 Number of turns and the travel time and distance in those turns, by turn direction and road type

	Left			*Right*			*All*		
Road type	*Count*	*Distance, km*	*Time, hrs.*	*Count*	*Distance, km*	*Time, hrs.*	*Count*	*Distance, km*	*Time, hrs.*
Freeway	5847	1572	15	6445	1720	17	12292	3292	32
Arterial	3730	498	7	4230	548	8	7960	1046	15
Minor Arterial	6120	798	12	6280	836	13	12400	1634	25
Local	3066	323	6	3185	342	6	6251	665	12
Ramp	2650	650	8	4697	1208	16	7347	1858	24
Unknown	219	23	0	213	22	0	432	45	0
All road types	21,632	3,864	48	25,050	4,676	60	46,682	8,540	108

Table 7 shows one approach of summarizing the overall rate of CSW alert events that occur near these curves, as a function of road type. There were 2,606 CSW alert events associated with the curves that are being discussed. This is out of the 4,819 CSW alert events that occurred during the FOT; the remaining alerts were not associated with curves. The first two columns of the table show the number of curve traversals and the number of CSW alerts[1]

[1] The count of alerts for this normalization includes the 'silent' alerts from the baseline period. The rationale behind including these alerts follows from the fact that the curve-traversal counts shown in table 8.2.3.4-1 for road type include the baseline exposure period.

for each known road type. The third column, *Alerts per traversal*, is the ratio of these two numbers. The fourth column shows the relative rate for each road type divided by the rate on the freeways.

Table 7 CSW alert-rate per curve traversal by road type for passes with minimum velocity > 25 mph (40 kph)

	Count			
Road type	*Traversals*	*Alert events*	*Alerts per traversal*	*Normalized by freeway*
Freeway	12292	241	0.020	1.0
Minor Arterial	12400	423	0.034	1.7
Local	6251	286	0.046	2.3
Arterial	7960	445	0.056	2.9
Ramp	7347	1211	0.165	8.4
All road t ypes	46,250	2,606	0.056	2.8

As expected, drivers are far more likely to receive a CSW alert on ramps, which as section 7.3 discussed, often involve both significant curvature and decreasing speeds. Surface street curves are more likely than freeway curves to have CSW alert events associated with them; this is due of course to the higher curvatures found on surface roads.

5 Geometric properties of curves traveled in the FOT

This section characterizes the radii and arc lengths of the curves traveled in the FOT.

Figure 1 shows a histogram of heading change for right and left curves. The distribution is dominated by curves with a heading change between 5 and 50 degrees. The average heading change is 29.9 and 25.3 degrees for right and left curves, respectively. The only slight discontinuities in the graph are slight increases for 90 degree curves to the right and left, as well as a slight increase at 270 degree right-hand curves.

Curves with heading changes beyond 120 degrees are so relatively scarce that they are imperceptible in the figure.

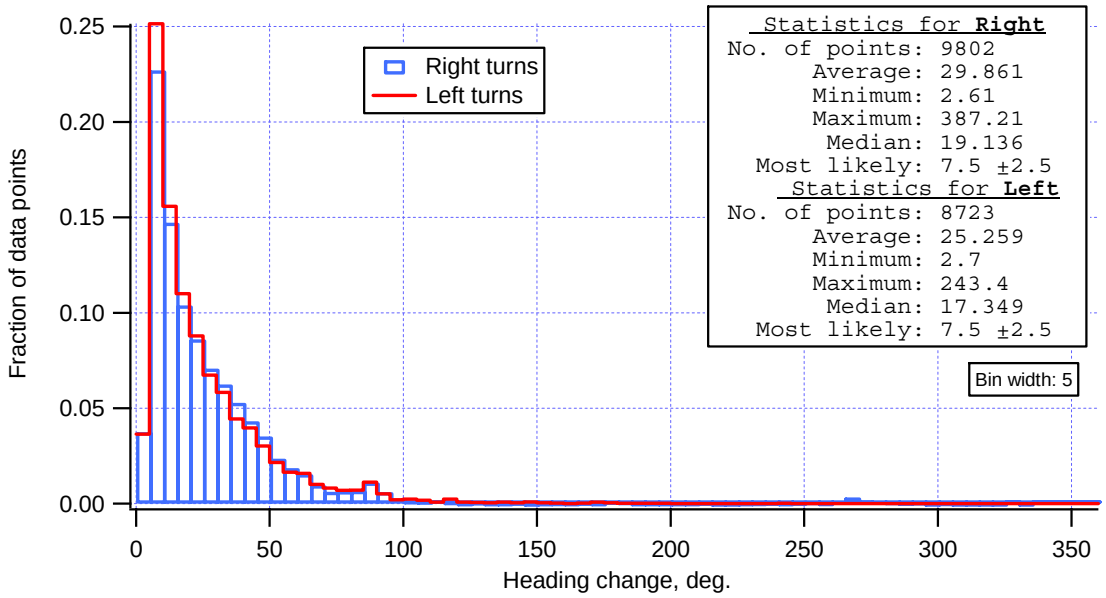


Figure 1 Histogram of heading change for all right and left roadway curves

Figure 2 presents the same histogram as figure 1, but highlights the distribution of heading change between 100 and 360 degrees. This figure clearly shows the dominance of 270-degree turns to the right over 270-degree turns to the left. These curves are almost exclusively clover-leaf exchanges between two orthogonal freeways or between a divided arterial and a freeway. Also shown in the figure is a slight increase in the distribution around 180 degrees for both right and left curves. Similar to the 270 degree turns, many of the curves are ramps that connect an arterial and freeway road types.

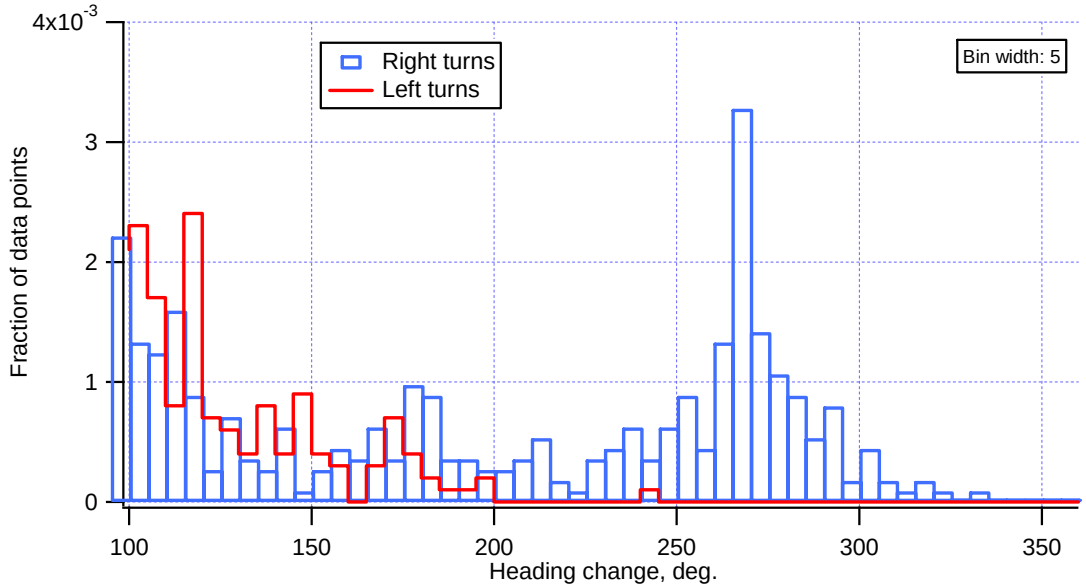


Figure 2 Distribution of heading change highlighting 270 degree ramps

Figure 3 shows a histogram of curve length for both right and left curves. The distributions look very similar for both directions. The average curve length is 157 m and 150 m for right and left curves, respectively.

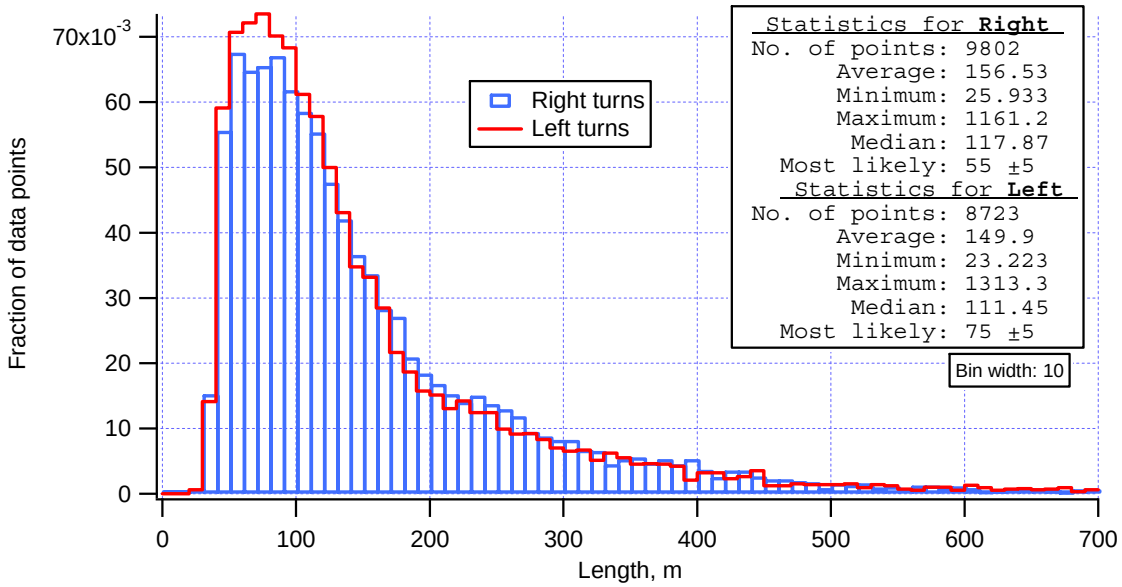


Figure 3 Distribution of length for roadway curves

Figure 4 shows a histogram of minimum curve radius for right and left curves. The distributions for both directions are broad and distributed for minimum radius values between 50 and 500 m. Below 50 m both distributions show a step gradient with virtually no values below 20 m. (Dynamically, this makes sense since given a minimum speed threshold of 40 kph, a 20 m curve would result in a peak lateral acceleration of approximately 0.6 g.) Above 500 m both distributions decrease linearly to approximately 800 m. There are virtually no curves with a minimum radius value greater then 800 m.

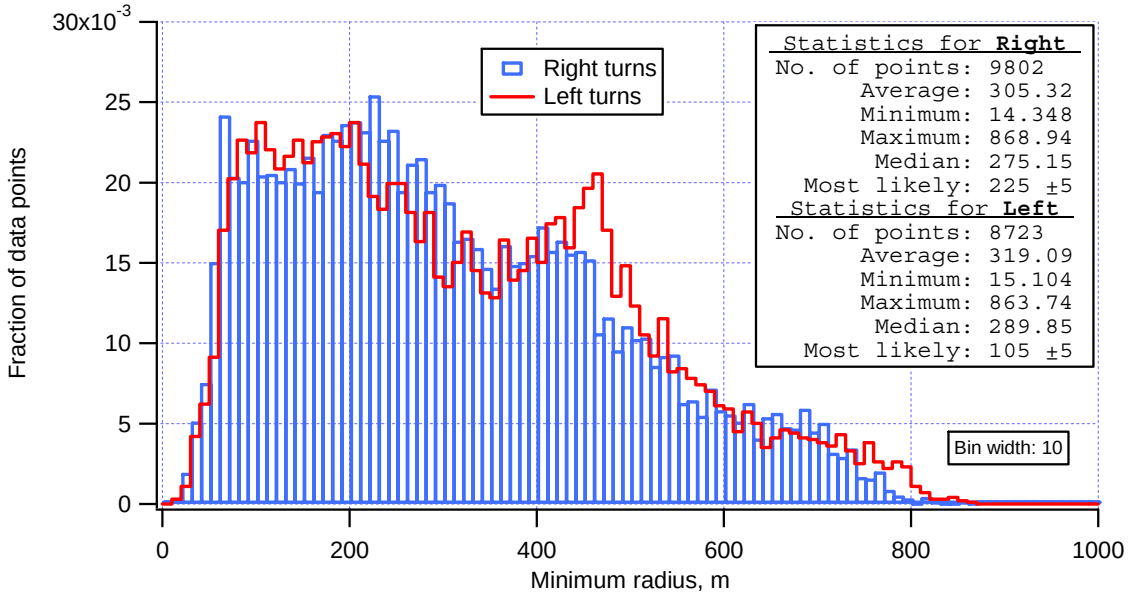


Figure 5 Distribution of minimum radius for roadway curves

There are differences in the right and left distributions of figure 5 for minimum radius values between 200 and 500 m. Curves to the right are more prevalent than curves to the left for minimum radius value between 220 and 310 m, while curves to the left are more common than those to the right for minimum radius values between 440 and 510 m. To explore these differences, consider figure 8.2.3.5-5. This figure shows the fraction of all curves as a function of direction and road type. The top of the figure is for curves with a minimum radius between 220 and 310 m, while the bottom contains only curves with a minimum radius between 440 and 510 m.

The top of figure 6 shows that the difference in direction for curves with a minimum radius between 220 and 310 m can be almost exclusively be explained by the fact that there are almost 4 times more ramps to the right than to the left. Although, there are smaller increases in Freeway, Arterial and Minor surface, none of these road types show the same magnitude of difference as ramps.

The bottom of figure 6 shows that for minimum curve radii between 440 and 510 m the prevalence of curves to the left comes from Freeway and Minor surface and ramp road types. While the overall difference in count of curves is greatest on Freeways, the largest difference as a percentage (134 vs. 122 for Freeway) comes from the Minor surface road type.

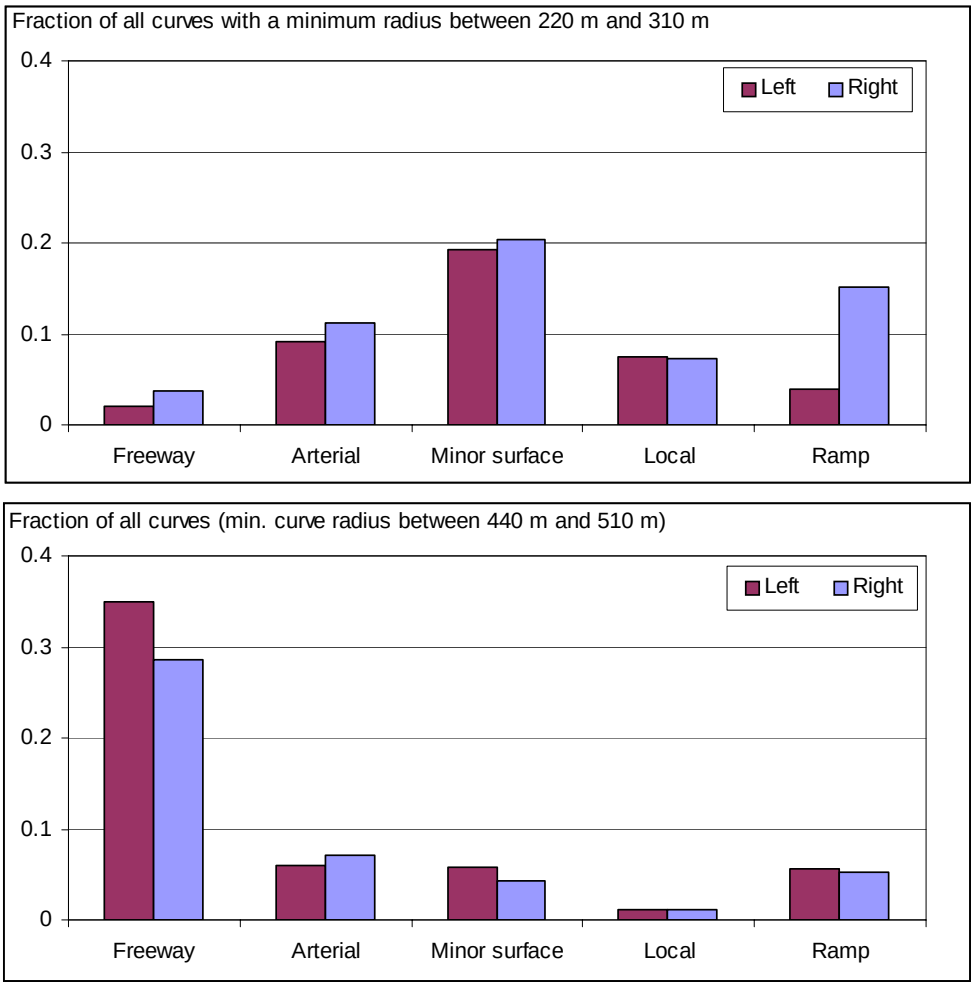


Figure 6 Directional and road type differences for curves with selected minimum radii values

Appendix U

Coding Key: Exposure Videos

This page was left blank intentionally.

Coding Key: Exposure Videos

Precipitation

0 = None

1 = Rain

2 = Snow/Sleet

Road Condition

0 = Dry

1 = Wet

2 = Snow covered

Seatbelt

0 = Yes

1 = No

2 = Cannot tell

Location of eyes at first frame

(Eye location was coded by what the reviewers could see of the driver's eyes at the first frame. The reviewers coded the location of the driver's eyes even if they could only see one eye, as it was assumed that the driver's eyes moved in parallel. The reviewers needed to be very confident in location of the driver's eyes in order to code as a specific location. There were many instances when the reviewers were confident that the driver's eyes were not looking forward, but could not tell specifically where the eyes were looking. These instances were coded as 8s. One such example is when the driver appeared to be looking at the camera. In this situation it was difficult to determine if the driver was looking at the camera intentionally, glancing out the corner, or looking slightly out the left window; therefore, it was coded as an 8. The determination of whether glances were still forward or it they were glances away was also very difficult and subjective. The reviewers agreed upon an area or "box" which they considered to be looking forward, this allowed for slight glances but even many scans across the forward scene were considered glances away. This process defined "looking forward" very narrowly and essentially meant straight forward. Glances toward the right of the forward scene, the right area of the windshield, were glances away and were coded as 8s.)

0 = Looking forward at forward scene

1 = Left outside mirror or window

2 = Looking over left shoulder (The driver's gaze needed to look over the driver's shoulder, though the driver's chin did not necessarily need to cross over the driver's shoulder.)

3 = Right outside mirror or window

4 = Looking over right shoulder (The driver's gaze needed to look over the driver's shoulder, though the driver's chin did not necessarily need to cross over the driver's shoulder.)

5 = Head down, looking at instrument panel or lap area

6 = Head down, looking at center stack counsel area (*Counsel* means the area where the stereo, thermostat, and clock are located)

7 = Driver wearing sunglasses or glasses with glare (The glare prohibited the ability to classify where the eyes are looking. There were instances where drivers were wearing sunglasses but the reviewers felt that they could confidently identify the location of the drivers' eyes. In these instances eye location was recorded.)

8 = Cannot accurately evaluate eye location (An *8* is chosen when the reviewer was unsure of the eye position and/or classification within a reasonable level of confidence though not because of glasses. Typically the reviewer could see the actual eye, but could not determine where the gaze was directed. Eyes in transition were often coded as *8*, as it was unclear where the driver's gaze was at that particular moment.)

9 = Other (For example the driver may clearly be looking at passenger side floor. When a glance was coded as *other*, the location was noted in the notes section. The most common position recorded as *other* was the rear-view mirror.)

Eyes on task at first frame

0 = No (The classification of *no* was only used when the reviewer could confidently determine that the driver's eyes were off the task of driving.)

1= Yes (The classification of *yes* does not mean looking forward, it means that the driver's eyes were on the task of driving.)

2 = Cannot determine (For instance, the driver was wearing glasses with glare or the reviewer could not see the driver's eyes for some other reason. This classification was also used when the reviewer could not tell if the eye location was on task. For instance, the driver was looking out the window but it was unclear whether the driver was looking at traffic or at a fancy building that was distracting the driver's attention. In any case, the reviewer did not KNOW whether the driver was on task or not.)

Hand location at time first frame

(Both hands were not often visible, so the reviewer coded what could confidently be inferred from the scene. At times, playing the video farther helped to determine what was ambiguous in a still frame. For instance, at the first frame there may have been a small blur near the steering wheel. Upon continuation of the video the blur may have moved and come into view as a hand.)

0 = Cannot see the position of either hand or cannot determine the position of either hand (The reviewer coded *0* if a hand could be seen but the reviewer could not tell if it was on the wheel).

1 = At least one hand on steering wheel (This was coded when the position of one hand could not be determine but one could see that at least one hand was on the steering wheel).

2 = Both hands are on the steering wheel.

3 = At least one hand off the steering wheel (This was coded when the position of one hand could not be determine but at least one hand was clearly off the steering wheel.)

4 = One hand on, one hand off the steering wheel. (A *4* was classified when the reviewer could clearly see both hands, and one was on the wheel while the other was off.)

5 = Both hands off the steering wheel. (A *5* was classified when the reviewer could clearly see both hands, and both were off of the wheel.)

Eyes in transition

0 = No

1 = Yes, towards forward scene

2 = Yes, away from forward scene

3 = Yes, both towards and away from forward scene

4 = Cannot tell (*Cannot tell* was selected when the driver was wearing sunglasses or the reviewer could not see the driver's eyes for some other reason; therefore it was uncertain whether they were in transition.)

Time away from forward scene, glances 1-4

Up to four glances away from the forward scene were coded in tenths of seconds. If a driver was in the process of directing his/her gaze away from the forward scene and in the first frame of that movement he/she was blinking, the blink was counted as a tenth of a second away. If the driver was always looking forward, then these fields were left null, as that category was not applicable.

Non-driving behaviors

0 = None

Cell phone

10 = Conversation, in use (C*onversation* could be coded for listening, talking, or both while using the cell phone)

11 = Reaching for phone (This classification refers to when the driver reached for the handheld phone in order to speak on that phone. If the driver reached for the phone simply to answer the phone and talk on the headset the driver was wearing then the classification was *other*.)

12 = Dialing phone

Headset, hands free phone

20 = Conversation (This was selected when the reviewer could tell that the driver was in a conversation)

21 = Reaching for headset

22 = Unsure of activity level (The driver was wearing a headset but it was not clear whether the headset was in use. The driver may have been listening to someone or wearing it in case of an incoming call.)

Eating

30 = Highly involved (*High involvement* includes eating a burger, unwrapping food, etc.)

31 = Low involvement (*Low involvement* includes eating candy, grabbing chips etc.)

Drinking

40 = Highly involved (*High involvement* includes situations where the driver was trying to open a straw or bottle, blowing on a hot drink, etc.)

41 = Low involvement (*Low involvement* includes situations where the driver was sipping a drink, drinking without looking, etc.)

50 = Conversation (The driver and someone in the car are carrying on a conversation. The driver can be listening during clip, talking during clip, or doing both)

60 = In-car system use (The driver was actively adjusting something. For example, the driver was not just listening to the stereo; the driver was also adjusting the stereo etc. The car lighter was coded under the smoking section.)

Smoking

70 = Lighting (This classification includes the in-car lighter)

71 = Reaching for cigarettes or lighter or ashtray (This classification includes the in-car lighter)

72 = Smoking

Grooming

80 = Highly involved (*High involvement* includes applying makeup, brushing hair, etc.)

81 = Low involvement (*Low involvement* includes scratching, running one's fingers Through his or her hair, etc.)

90 = Other/multiple behaviors, specified in notes section (These may include behaviors like whistling or classifications that the reviewer was unsure of, i.e. if the driver's lips were moving but there was no audio the behavior might be singing or conversation.)

Notes

A notes section recorded any unusual events or ambiguous situations not covered by categories for a particular question. This section also contains general notes on the clip if there was anything significant taking place that was not adequately covered by the coding process.

This page was left blank intentionally.

Appendix V

Post-Drive Questionnaire Open-Ended Responses

This page was left blank intentionally.

Post-Drive Questionnaire Open-Ended Responses

Manual Driving

Manual driving refers to driving the research vehicle without the use of RDCW.

1. How comfortable did you feel driving the car manually?

Please describe situations or conditions that made you feel uncomfortable.

- 1: Too low; normal vehicle is full size truck
- 6: Car was stiff in using the tilt. Difficulty in setting the heat, using the wipers
- 7: unfamiliarity with the car; also, it is a larger car than what I am used to so it was difficult to gauge parking at times
- 13: Not having a rear window wiper as I'm used to
- 16: Front suspension noisy on low speed bumps
- 22: It drove very smoothly
- 23: First few days just getting used to the car
- 26: no
- 31: none
- 34: Having camera in the car
- 39: had none
- 48: seat was not comfortable
- 49: experienced engine surge once at approx 20 miles after receiving vehicle
- 55: Inclement weather, specifically Wednesday, No. 24 when it rained, snowed and other stuff
- 60: none
- 62: longer than my car
- 68: no problems
- 71: just getting used to a new car in very snowy winter weather
- 75: Getting familiar with a new vehicle
- 77: The way it handled the Michigan roads were very impressive

Overall RDCW (LDW & CSW) System Questionnaire and Evaluation

31. Can you suggest any changes or modifications to the RDCW system in the following areas?

A.) Visual Warnings

- 1: Didn't really use
- 2: no
- 5: Hard to pick up on. Relied more on vibrations
- 7: I was sometimes confused between the CSW & LDW arrows, except when there was an auditory warning
- 11: none
- 12: I felt a heads-up display might be better since I did not look at the display during warnings…I was concentration on why the warning
- 13: is it necessary - a warning means to look ahead, not at dashboard
- 17: They don't stay on the screen long enough
- 19: on steering wheel or upper windshield deck
- 20: none
- 21: should remain on-until lane violation is corrected
- 22: The visual arrows should stay on the monitor longer before turning off so the driver has enough time to see what he/she was doing
- 23: no
- 24: sometimes it confused me with the arrow pointing in other directions
- 25: since I was watching where I traveled, visual signs were not always seen
- 26: I don't think visual warning is all that great because I've noticed I wanted to see what or why it was going off
- 27: Change sides if possible to see which side is being affected
- 31: I did not pick up on any visual warnings
- 33: They show longer
- 35: Location of RDCW is ok, but you still need to look down - driver should be able to look straight ahead to see warnings. Possible reflection on the glass/windshield
- 37: Could these be put in the windshield as some displays are on some cars today (Buicks)
- 38: maybe different colors for warnings
- 42: Visual warnings were not necessary
- 44: A heads up display may be more effective; I often didn't see the visual warning because I was paying attn. to the road
- 47: N/A
- 48: Must be in an area easier to view. Requires you to take your eyes off the road
- 50: fine
- 53: never focused on arrow
- 59: none
- 61: none
- 67: Brighter - intense shades of the color used
- 68: Make the visual warnings last a little longer
- 72: Perhaps indicating arrow for either direction on curve warning
- 73: Color changes on screen
- 77: Maybe the difference when snow is on the ground or slush

- 78: These didn't help - hard to see - would be better to have on the right side of the driver's instrument panel
- 79: They were too short on the screen whenever I looked down they weren't there
- 84: I did not use the visual warnings as they required me to take my eyes off the road.
- 85: no changes

B.) Auditory Warnings

- 1: LDW was mistaken for a truck horn by passenger
- 2: no
- 7: Very good!
- 11: none
- 12: were fine
- 13: "curve" sort of annoying
- 17: Very good
- 20: none
- 21: only had "curve ahead" no "drifting" or "lane violation"
- 22: no
- 23: no
- 27: good
- 31: LDW requires a left or right auditory warning?
- 36: More intensity when in danger zone, less intensity of voice when just approaching line or curve
- 38: using male & female voices for LDW & CSW respectively could provide easier distinctions of warnings
- 41: When LD sensitivity was set to "sooner" this auditory warning became annoying, to the point I started to ignore it
- 47: N/A
- 48: Use a different tone for left and right, have a volume control
- 50: fine
- 53: "Curve, Curve" came on at least a dozen times driving straight ahead
- 58: With the radio on, it is hard to hear some warnings. Integrate the radio volume into the RDCW system and turn the volume low when a warning occurs
- 59: Suggestion to tone down the auditory warnings or be able to adjust loudness of warnings
- 60: I would prefer the CSW to not say "curve" in my own car just for passengers' sake. They don't need to hear it
- 61: none
- 67: good commanding tone that always got my attention
- 68: no problems
- 73: Increase (decrease) Volume
- 77: Auditory is very excellent. It helps big time
- 78: Perhaps having and initial warning with the caution arrows would make you notice it more
- 79: To be able to control the volume of them
- 84: Make these optional. On/off switch. They can startle you or others causing distraction.
- 85: not enough lower level warnings, always seemed to be higher level

C.) Vibration Warnings

- 1: none
- 2: I don't think you really need both types of warning, visual & auditory worked for me
  7: Had to think about whether it was a CSW or LDW warning
- 11: none
- 12: These were the warnings I counted on most and like the best
- 13: I didn't seem to get many vibration warnings for curve - seemed to right to voice warning
- 14: I think this of all warnings is one that could be easily ignored with time - maybe more pronounced?
- 16: CSW was too much like LDW
- 17: didn't always know which was which
- 20: none
- 21: should remain on-until corrected (see visual above)
- 22: no
- 23: no
- 24: couldn't really distinguish whether it was curve or lateral drift
- 27: steering wheel vibration?
- 31: good
- 32: The vibration can scare the hell out of you
- 36: its shocking enough
- 41: Depending on how I was sitting in the driver's seat it was sometimes difficult to detect the difference between the lateral drift vibration and the curve speed vibration
- 42: I felt the vibration warning seemed more noticeable than the auditory
- 47: N/A
- 48: Make it possible to use vibration only - No sound - Horns could wake up little sleeping children
- 50: OK
- 53: Was there difference for lateral/curve?
- 59: none
- 60: Actually, I prefer the seat vibrations versus auditory so that only I know when I need to adjust my driving
- 61: none
- 67: OK
- 68: Different warnings for the two systems
- 71: I only had vibration warnings and these were good although it is my belief that some warnings were wrong
- 75: Hard to distinguish which side of seat was vibrating
- 77: N/A
- 79: The curve warning seemed to vibrate for a long time, perhaps shorter
- 84: I liked these the best for warning.
- 85: I did not like vibration warnings I would prefer audio/visual

D.) Timing of Warnings

- 1: none
- 2: Since you can change the sensitivity the driver already kind of controls this!
- 7: The LDW seemed unavailable when I thought it would be available
- 11: none
- 12: Fine in general but some were a little late as they related to the "CSW"
- 17: were good. But did pick up a lot of exit ramps and turnarounds

- 20: none
- 21: curve-all messed up! Not reliable, I began to ignore it
- 22: no
- 23: no
- 24: sometimes it was too quick from vibration to audio
- 27: very inconsistent
- 31: I had many false warnings both on LDW & CSW
- 36: The adjustment system took care of that
- 41: I felt the visual warnings didn't stay on the screen long enough. I would feel the vibration or hear the audio warning, but by the time I could take my eyes off the road, the visual warning was gone
- 47: Make the timing more accurate because there were times when nothing was going on and it still warned me.
- 48: Great for LDW very poor for CSW
- 50: OK
- 53: Lateral drift should be quicker
- 59: none
- 60: They just didn't seem to occur at the right time. Either too late or too early even if I adjusted the sensitivity level
- 61: Curves could come a little sooner
- 67: OK
- 68: No problems
- 72: Right side seemed more sensitive than left relating to lateral…
- 76: When exiting a curve to merge onto a freeway the warning should not sound
- 77: N/A
- 78: Sometimes a little slow - coming up with something not so dependent on weather would help
- 79: The timing should be sooner, the curve seemed to go off while I'm in the turn, not before so it seemed annoying
- 85: I could not get the sensitivity quite right.

E.) Controls and Display

- 1: none
- 2: no
- 4: Display would be nice as a heads up display so you don't have to take your eyes off the road
- 7: Make the differentiation between the LDW & CSW stronger in the display
- 11: none
- 12: I do not see the need for the visual display. If you were to look at the screen during a CSW you would be taking your eyes off the road putting you in even greater danger
- 13: ok
- 17: visual display didn't stay on long enough
- 20: none
- 21: great-good design. East to ease and use
- 22: no
- 23: no
- 27: Good
- 31: all good
- 32: Should be put in the middle
- 41: I think the display should be moved to the center of the dash for improved viewing
- 44: see above

- 47: N/A
- 48: Controls good
- 50: OK
- 59: none
- 61: no
- 62: Sometimes I could not see the arrows because the steering wheel blocked my view
- 67: OK
- 68: No problems
- 73: As above ~ Color changes
- 74: After a warning I always had to look down to the dash, it might be better if the display was closer to the driver's line of sight
- 75: Because of my height, the steering wheel kind of restricted my sight sometimes
- 77: N/A
- 78: See visual warnings above
- 79: Have a few warnings appear for a few seconds longer
- 81: The display seemed to be a little distracting when alerted of any warnings
- 84: Add option switch for warning type. Relocate visual display to center of console.
- 85: none

F.) Other

- 2: no
- 3: Overall I fell the system is very well developed - Good design
- 5: Many False warnings. I-75 S. by Livernois always gave me a curve warning and it is a straightaway w/no exits for 1/4-1/2 mile. The system made me judge other drivers quite often. If I saw them drifting I though they could REALLY use this.
- 7: Where both of these systems performed best was on the freeway. On surface roads, the LDW was often unavailable and I rarely got CSW warnings
- 8: Gave false warning on freeway while in fast moving traffic
- 11: none
- 20: I thought that all the warning controls were great
- 21: CSW needs major improvements. CSW-move vibration to seat back! LDW- left quad/right quad
- 22: Maybe there should be the letters CSW or LDW instead of the arrows or they could be inside the arrows because at first I was trying to figure out which was which that's the reason why I made the comment at the top of the page
- 23: System doesn't deal well with divided roads in certain situations
- 30: Heavy rain (maybe on after dark w/ reflections) seems to cause a lot of false LDW's
- 31: It did not activate the LDW system many times until 50+ MPH
- 32: The overall sensitivity of the system is too high
- 42: Radiated emissions of the computers were horrible (?) Radio reception was poor & key fob functionality was impaired until the computers shut down. Fan noise was audible after key off. Radio on time (time until first sound was heard from radio) was often slow. Lack of tachometer is disappointing
- 43: Needs to be moor accurate
- 46: Twice system said curve and I was going straight
- 47: make it where you could use it in the rain
- 48: I do not believe it is necessary to have visual controls. I would hope the LDW system someday would be on all cars. It forces you to use your blinker
- 49: modify system to read speed signs
- 50: Except for wider left turns the curve warning came on unnecessarily I thought. After the second time experiencing it I expected the warning

- 55: Take into account the time of day. I was more prone to listening and heeding the warnings later in the night
- 56: I think that the vibration warning is more effective for LDW than the auditory warning if a person was dozing off
- 61: I found somewhat inconsistent
- 64: I did not like the system at all
- 70: The system was very useful. I liked that for the first 6 days it was off and then the rest of the time it was on, but it might be good if you gave the driver the car for a full month (30 days) and have them experience the car with no system for the first 4-5 days, the have the system turn on for about 20 -21 days, then have the system turn off again for the last 4-5 days, so the driver can understand the need for the system. After it is turned off the second time, the driver might notice what he/she has made an incorrect error without the system
- 74: I personally found the vibrations more attention grabbing and would suggest they be applied for the more serious warnings and the auditory tones for the less severe warnings
- 75: Because of weather conditions I didn't really get used to the system for much of my driving time
- 77: It's great that the sounds come through the speakers in case your music is too loud. Great Job :)
- 78: LDW - maybe make it less dependent on video; more on sensors - that may help in bad weather?? (I know they couldn't see the lines - but maybe mounting video cameras in the rear panels with the sensors
- 79: There should be a control for sooner/later and more/less warning. I would have liked more notice, but be able to control how often.
- 81: Maybe raise the display so it is easier to see while driving

35. Regarding question 34, what is your primary reason for providing the answer you did?

- 1: Lack of radio reception
- 2: If it was a lot more expensive, I would probably not add it. But if it was a stock thing on the car, that would be great!
- 3: Safety, Very useful
- 4: This system keeps you more alert and aware of the road
- 5: Safety. Even w/ false warnings, the system made me more aware
- 6: Would be helpful in some ways i.e. passing, drifting to the middle, less helpful on curves
- 7: It would depend on the cost
- 8: Kept you alert while drifting across lines
- 9: My type of driving would not really benefit having the system
- 10: cost
- 11: it helps with keeping me alert
- 12: I felt that the system made me a better driver causing me to signal my intent to change lanes to avoid the warnings
- 13: The warnings rarely indicated a need when I was warned, I didn't believe the warning was necessary most times
- 14: Sleeplessness is a big factor today in driving - good tool
- 16: In case of drowsiness or distraction
- 17: I think if you're driving in an unfamiliar place the curve warning in particular would be useful
- 19: warnings seemed unnecessary almost all of the time
- 20: I really thought the warnings was very useful
- 21: LDW-using my cell phone or looking for/at a map

- 22: I would consider the RDCW (90%) because it does help the driver be more aware of upcoming curves and drifting into other lanes. But I don't know if I 100% would consider.
- 23: LDW system was an eye opener for me - All cell phone users should have this on their vehicle
- 24: I think it's great for new drivers. Probably should have a law mandating drivers under 1 year experience have it installed.
- 25: I feel it is a very good system and would be of particular benefit in long term driving
- 26: it lets me know how I am driving and helps me stay safe
- 27: I felt that the warnings seemed inconsistent. The curve warnings were fine, but the LDW seemed to function at different times
- 28: I liked it made me better driver
- 29: It just depends on what my husband thinks and the cost
- 30: I would consider the LDW as I think it was very useful 90% of the time. There was a lot of false alarms on CSW or times when slowing down would result in someone rear ending me
- 31: It would depend on cost. I think very effective but I wouldn't pay much for option
- 32: the system is useless and worthless
- 33: Don't know if I would want to pay more for the car
- 34: The car makes you much more alert about your driving & where your car is on the road
- 35: Safety feature
- 36: Because it made me alert to how often I cross the line without putting my blinker on, how often I was on the lines and how often others were doing the same. I became, I hope, a more conscience driver
- 37: not impressed with the CSW (too many false signals)
- 38: The system could be helpful in driving long trips where the possibility of falling asleep is greater
- 39: I don't feel I need it
- 40: I think it is a useful system
- 41: I felt the RDCW system made me a better and safer driver
- 42: Although often the feature is unnecessary, it could occasionally prevent an accident
- 43: Don't need it
- 44: The LDW system was very useful because I tend to "zone out" while driving longer distances & drift. I was more alert driving using the LDW
- 46: system is very useful
- 47: It's a good system but it annoyed me at times
- 48: I am very pleased with LDW it raises your awareness and could save lives
- 49: The system has made me aware of how easily drivers (me) drift from their lane and I consider myself to be a safe and conscientious driver
- 50: I believe it keeps the driver more aware of what he or she is doing on the road
- 53: Can only help my safety
- 54: I felt the driving I do it really was not very useful
- 55: There are options more important to me (i.e. all wheel drive, airbags) and familiar to me. I feel I would be getting more for my money because these other safety features have a longer track record
- 56: I think the RDCW would especially be helpful at night to me since I have more difficulty seeing at night particularly if it has rained
- 58: As an option I wouldn't pay for it. If it was included in the vehicle, I would consider it
- 59: I would find the system more suitable for me if I was working a midnight shift and tended to fall asleep on the drive home
- 60: During times the system provided warning, I already knew what incorrect driving I was doing. I felt I didn't need a warning
- 61: I have problems driving long distances. I have dosed off behind the while driving
- 62: If I did a lot of out of town driving I would consider it more

- 63: Safety reasons, keeps you alert
- 64: I felt it was very annoying and it was basically useless to me
- 66: It was the curve warnings that annoyed me. I live in the country and when weather permits you can take the curves faster than it allows
- 67: Would need to improve accuracy. Cost would be a consideration
- 68: At this stage the systems are not 99% perfect needs more work before I would buy. Maybe a standard on the car would make it more reason to buy car
- 70: It was a well system to have, but I did noticed when driving their were warnings that went off when I wasn't even in a situation
- 71: I'm sure in time a driver would get used to these warnings, but in 26 days that I had the car they always surprised me
- 72: I'm not certain I would have the patience for it. I don't believe it is accurate enough at this point
- 73: It would be a good marketing factor for those interested in safety - also for "long-trip" drivers
- 74: Found the device somewhat annoying given all the warnings I felt unnecessary
- 75: The car we purchase will be primarily driven by my wife
- 76: It helped me become aware of my turn signal usage. The system assisted in my lane usage
- 77: Depending on the cost of it and maintaining it. The fact that, I think the system is absolutely great to have, and for the older drivers it could help BIG TIME (60-over age)
- 78: Because I think changes are needed to make it worth considering
- 79: There were false alarms that seemed annoying. I would also want to be able to turn it on/off if I owned the vehicle
- 80: Surprised to learn how often I pull to the left. Would keep me on track
- 81: not very sure it was to my liking yet I didn't think it was all too bad
- 82: lateral warning on dark night
- 83: This system would be very useful to me when driving on long trips
- 84: I found it useful when I was tired or distracted by things in the car. It raised my awareness to upcoming curves.
- 85: I found the systems to be more than I would need. Also, I thought there were too many false alerts on the CSW system.
- 87: safety

36. What is the maximum amount you would pay for the RDCW (LDW & CSW) system?

- 21: If it came standard vs. another model/make, I would consider it as an extra feature (maybe $300)
- 26: not sure
- 27: Added option up to $500
- 40: I don't know
- 41: Ideally I would like to see it as a standard option, but I would probably pay up to $500 for it
- 48: Varies with type of vehicle and how it's packaged. I would hope someday cost would be low enough to make it a standard option like airbags
- 54: it would improve resale value
- 55: I would like it part of standard equipment, but I wouldn't shell out extra money if I knew it was optional
- 56: 7
- 58: If included in the vehicle

- 60: I don't think I would want to pay an additional amount than the cost of the new car I was purchasing. If I purchased a car with the system on it functioning as it does currently, I would be pretty upset at the extra $ I spent. It seems as though there are many kinks to work out. It didn't seem to always work when it was supposed to. I do appreciate the item and effort put in by everyone who helped develop it. I am not criticizing their work. It is quite impressive.
- 61: I have no idea
- 62: Hope it would be standard
- 66: I wouldn't pay if it came with it then possibly
- 72: at this time
- 80: Not sure
- 87: for both

37. At the actual price of $800, how likely would you be to consider purchasing RDCW (LDW & CSW) if you were purchasing a new vehicle?

- 24: if it was included in the buyer's package
- 32: 0
- 82: need engineering parameters improved

Lateral Drift Warning (LDW) System Questionnaire and Evaluation

16. If passengers did comment on the auditory LDW warnings, what kinds of comments were made?

- 1: sounds like truck horn
- 2: "HA, HA, HA, you're going off the road again!"
- 3: What does that do? Is everything okay with the car.
- 4: Wow, that's great - A good idea
- 5: Dad, what are you doing?
- 6: just said it was working
- 7: My husband thought it was a cool feature
- 10: what is that sound for!?
- 11: "what was that?" or they would laugh
- 12: That it also made them aware of their surroundings. When some alarms went off they also asked why. We did not know if speed is factored into the warning when approaching or in a curve
- 13: teenage daughter found it annoying. Others just more curious about system
- 14: Were surprised they could hear so clearly - took notice when they did not activate vs. my failure to use indicator
- 16: "what was wrong?" "Was that speed?"
- 17: They just joked about it
- 19: What is that? That'll wake you up!
- 20: That it would be good for older people. That it would create better driving.
- 22: The passengers were just surprised at the kind of system that was installed in the vehicle, let alone the auditory warnings. Needless to say, they were comfortable with it and the noise reassured them that they were safer with this kind of system
- 23: Don't recall any passenger comments
- 24: That's pretty cool
- 25: comments made regarding cement barriers in area
- 26: What's that? Mom, why did it do that? Are you going to crash?
- 27: "That's cool," "Is that necessary?" "Do it again" "Does it help?"
- 28: They said they were startled
- 29: Lots of laughing
- 30: don't ride with many passengers regularly except my daughter (13) who was very amused but mostly at expense of mother. Others jumped in reaction although I always warned them before they rode with me
- 31: What was that or ask why it sounded. Passengers knew what was installed in the car
- 32: This is annoying
- 33: What's that?
- 34: What kind of car is this? What did you do wrong? Stay in your lane
- 36: No one made any comments that I remember
- 37: mainly asked questions about the system
- 38: the warnings were good for controlling driver habits (bad)
- 39: They just asked what it was and what it meant
- 41: "what is that?"
- 42: Curve! Curve! & laughter
- 44: "That's annoying" "so that's what it sounds like it's louder than I thought it would be"
- 46: N/A
- 47: Someone said that it was cute and wanted one in her car

- 48: too loud
- 49: too loud, annoying
- 50: That would drive me crazy - but I thought they were crazy if you're not behind the wheel they don't know what they are talking about
- 53: Scared the H out of me!! What was that?
- 54: None
- 55: They thought it was cool and a good idea
- 56: Just asked questions about the sound
- 58: why is the car talking?
- 59: "That's annoying," "that's loud," "when are you taking this car back?"
- 60: Very little in the car - conversations outside of the car were every so often. It was interesting what some people said
- 61: What was that? That would drive me crazy, but I guess you get used to it
- 62: N/A
- 63: Good program
- 64: "How annoying" "Is it broke" "That scared the crap out of me"
- 66: That that would be annoying to drive with. "Maybe you shouldn't drive so we don't have to listen to the car"
- 68: What is that?
- 72: Laughs, comments about loudness
- 73: Very positive
- 74: I didn't transport many passengers and comments were not very probable
- 75: what it meant
- 77: Asking what's that? What's that noise for? What did it say? What kind of system is that?
- 79: "That's annoying." "What was that?" "That curve one is cool"
- 80: What was that?
- 82: Cool
- 83: What happened or why did it do that-
- 84: Can you turn that off? What the hell was that?
- 85: That it was annoying.

24. Overall, I thought the LDW auditory warnings were provided at the right time (i.e., they were not presented too early or too late).

If you feel the timing should be adjusted, would you make it come sooner or later?

- 6: didn't always warn
- 11: earlier
- 13: seemed ok as is but hard to figure out difference between reason for vibration vs. auditory warning
- 21: earlier
- 22: earlier
- 24: earlier
- 25: later
- 27: Both!
- 29: later
- 30: later
- 31: Earlier warnings
- 32: maybe earlier
- 34: Earlier

- 40: earlier
- 41: on the "sooner" setting they came up too early and too often
- 48: Left side worked great, right side did not work well. Your sensitivity setting worked fine for timing on the left side
- 49: earlier
- 50: it was fine just the way it was
- 53: earlier
- 54: N/A
- 55: I had it turned down all the way and I felt most comfortable with that
- 60: At a lower sensitivity setting, I would make them come a little bit earlier
- 61: I feel the warning was not consistent all the time. Most of the time it was
- 63: earlier
- 67: earlier
- 72: later
- 73: earlier
- 77: earlier
- 78: earlier
- 79: earlier, they seemed to occur after the fact
- 81: earlier
- 82: earlier
- 85: I rarely got the cautionary warning. I thought the imminent warning came too early.

25. Overall, I thought the LDW seat vibration warnings were provided at the right time (i.e., they were not presented too early or too late).

If you feel the timing should be adjusted, would you make it come sooner or later?

- 4: Earlier
- 6: unable to say
- 13: same as #24
- 14: Re: for lane change, earlier if possible
- 19: earlier
- 22: earlier
- 24: should make time longer from vibration to audio to give driver time to compensate
- 29: later
- 31: It seemed ok, but frequently did not activate
- 32: earlier
- 34: Earlier
- 40: earlier
- 44: Earlier in the event of a slow drift. It didn't always warn me as early as I would've preferred.
- 48: did not receive many - most warnings were audible
- 49: earlier
- 50: its fine
- 55: I felt most comfortable with it turned down all the way
- 61: earlier on curves only
- 67: earlier
- 72: earlier on left side
- 77: earlier
- 79: earlier, they seemed to occur after the fact
- 81: earlier

- 84: They should come at the same frequency as auditory warnings.
- 85: earlier

27. The LDW always provided a warning when I thought it should.

If the LDW did not warn you when you though it should, please describe the situation(s).

- 2: a couple times I thought I weaved off a little and it didn't warn me- also a couple of curves I took kind of fast
- 4: The system was not picking up a painted line, so was not working
- 5: I tried to set if off a few times to show the family but it did not work
- 6: I couldn't say
- 11: actually gave me a warning when I thought it shouldn't have
- 12: Sometimes it went off when I pulled out to pass someone on a two lane highway. I "always" pulled back in to assess the situation
- 14: drifted from lane - lane change on expressway
- 17: I went over a line just to test it and did not get a warning
- 21: vibration-OK; Auditory-never or few
- 23: Divided road turn-arounds
- 27: Many times on older roads. It had a mind of its own
- 30: Did not work on several well-marked streets & did have problems during heavy rain (as prev. noted)
- 31: Many time on local bridge it activated for no reason. I would test to see if working and wouldn't come on
- 32: when I got in another lane it did not come one
- 35: Heavier/wider painted lines on the road affected the system
- 37: a few times felt there should have been a warning but it didn't
- 44: Slow drift…also when the road lines were clearly marked & I felt LDW should've been available
- 47: It was raining and I could barely see and it was dark and I was going over the line etc.
- 48: left - ok, right - no
- 49: most of the time
- 50: none
- 53: Wasn't on in many situations
- 54: several times I crossed the center line and received no warning
- 55: Inclement weather, poor visibility
- 58: Rain or snow on the road made the system constantly go off. A couple times when changing lanes quickly but I did use the turn signal
- 59: Sometimes when I was driving on the road the LDW system would not warn me, but I was drifting to the right or left
- 60: I can describe exactly. Sometimes the system just didn't function at all even though the green circles were lit
- 64: The visual "working circle" would be gray and it would still go off
- 66: I crossed the double yellow to show my friends the first day and it didn't go off
- 67: Lane change on the expressway - heavy traffic, no turn signal on - no warning
- 68: sometimes the roads had good lines and the system didn't work that's all
- 70: Having a yellow solid lane to the left, when the system was on, and I knew that I was drifting, it didn't warn me
- 72: The left side did not tell me nearly as often as right side, when I had drifted
- 73: Close to center-line did not provide enough warning time

- 77: Mostly on slushy grounds, rain, or snow mainly on the freeway, and not the streets (LDW did not work to good on the regular streets)
- 78: During heavy snow. On 2-lane roads etc. they were good on x-ways though
- 79: I didn't seem to get them often enough, there were times when it was inactive
- 80: a few times I thought I overcompensated my penchant for pulling to the left by being too far right, but no warning given
- 81: only when Active icons were not on, I sometimes saw them go off right when I would expect a warning
- 82: I was on lane divider and warning not triggered
- 84: There were a lot more times than I expected in which the system was offline.
- 85: At times I was trying to trigger the warning, especially if I received an imminent warning that I thought was not necessary.

For the next 2 questions, please consider the following definitions.

An LDW warning is defined as UNNECESSARY when a warning is generated while:
you happen to drive on, near or toward a lane or road boundary and
you do not perceive any threatening circumstances which warrant the warning

An LDW warning is defined to be FALSE when a warning is generated while:
you are not driving on, near or toward a lane or road boundary and
you do not perceive any threatening circumstances which warrant the warning

28. I did not receive any unnecessary LDW warnings.

If you received an unnecessary warning, describe the situation(s).

- 1: I-94, A truck on either side & no lane drift
- 2: Once when there was a turn around in the road I passed by it and got the warning - then it did it every time I passed that same spot (CSW)
- 3: While traveling in construction areas
- 4: Going around a car waiting to turn left in a RH passing lane
- 5: Construction barriers set it off sometimes
- 6: Following a lined detour
- 7: In a construction area where the lane markings caused the roadway to be very narrow
- 12: getting close to a road boundary
- 13: Driving in traffic on freeway - Most times the warning seemed unnecessary
- 16: I didn't think I was near enough
- 17: On the freeway in construction and it also picked up skid marks
- 19: Geddes Road, perhaps near the side boundary but no threatening situation
- 20: They're working on the road and it thought I was getting closer to the wall.
- 22: Sometimes I didn't think that I needed a warning and I got one
- 24: I wasn't close to either lines and the warning on more sensitive modes went off
- 25: usually near cement barriers and lines were not uniform--also when lane lines were not uniform or were non-existent.
- 26: like on the way here, there were old lines on the road
- 27: same as above
- 31: On local bridge and few times driving in correct position

- 32: when a car went pass me by going real fast
- 34: The road lines were faded (wouldn't get warnings)
- 35: Lines painted on the road heavy etc.
- 36: I received a false warning mostly on Greenfield, Grand River area- there were other places also (not many). No lines, yet vibrations mostly on the right, however it happened on the left once or twice, not sure
- 37: construction areas (false warnings)
- 39: A couple times I was driving & I got warnings that I felt were unnecessary
- 40: sometimes if a car was coming in the lane that I was in it would sound a warning
- 41: on the freeway there were many times this happened
- 42: Drifting onto or close to boundaries with no traffic nearby, esp. on curves
- 43: most of the time
- 44: While driving through a construction zone with multiple lines on the road, i.e. old lines that hadn't been painted over, or tape that was peeling off the road surface
- 47: I was just driving on the freeway and it just starts making noise and I am in the middle of the lane etc.
- 48: construction zones
- 49: I was clearly in my lane when I approached a "repair/test" section of highway
- 55: If I briefly came close to a solid line in the fast lane of the freeway, but didn't actually cross it
- 56: When moving over to a lane to exit onto freeway only touching the road boundary
- 61: I was driving in the middle of a lane and the warning went off. There were times when I was testing the system and I had to go over the line and it did not warn me of anything
- 62: Changed lanes and nothing was near me
- 64: All the time, especially in the rain
- 67: after the storm last week, road plowed but still slightly covered, passing car parked at curb
- 68: Driving near the lane lines but not going over made the system go off
- 71: One day I got four of them, 2 on the highway that said I'd passed over the line on my right, however my passenger and I both disagreed. That same day it went off twice in exactly the same spot on my right leg when there was no line even on the road
- 72: Driving toward right side of lane
- 73: Freeway exits with interrupted line gave warnings
- 74: For example when a vehicle is on my right so I drive close to the left shoulder solid line, I would often get an auditory warning. I found this slight drift on my behalf as the safer move and thus the warning was unnecessary
- 78: When people were in a turnaround to head the other way next to the left lane of traffic where I was driving
- 79: I received some in the snow; I also received auditory warnings for no reason.
- 80: driving near a road boundary where no threatening circumstances were observed
- 81: mostly freeway driving
- 82: no shift or minor shift in lane
- 83: Merging into heavy traffic or while on ramp
- 85: Some lane narrowing (3 to 2 lanes etc) would cause a warning.

29. I did not receive any false LDW warnings.

If you received a false warning, describe the situation(s).

- 1: see #28
- 3: traveling in construction areas
- 4: Same as 28
- 5: Received a couple while in the middle of lane
- 6: not that I was aware of
- 12: passing cars on a two lane highway
- 13: Once in a while I was warned when I believed I was not near the line
- 16: A couple of times I saw no apparent reason
- 22: Same as 28
- 25: [on lanes to freeway (entrance ramps). In some construction areas] = CSW
- 26: old lines on road
- 27: On I-96, it seemed to go off at the same time for no reason
- 30: Heavy rain at night (w/ reflections etc.) seemed to set off a lot of warnings & most seemed wrong
- 31: see #28
- 36: question 29
- 37: got close to white line but no warning
- 39: passing exit ramps, turning left on streets
- 40: A couple of times I received a warning for no reason at all
- 41: On the freeway sun cast shadows from center barriers causing a shadow line on the road which was interpreted as a line marking
- 43: most of the time
- 55: Inclement weather
- 58: heavy rain or snow on the roads, changing lanes quickly but while using the turn signal
- 59: I received several LDW warnings when driving when I was not drifting to the right or left
- 61: same as first part of question
- 68: Near lane lines not on or over. No threats
- 71: See #28. Another time I received a warning on the left and when I corrected, it gave me a warning on the right, probably because I didn't put on the turn signal to correct the left
- 74: During bad weather such as rain or snow I would sometimes get false warnings
- 75: As I looked at where the car was in position to the lane lines I thought I was in the middle of the lane
- 79: snow on highway, but lanes were clear. Construction zones. These seemed to be when I got them
- 83: While driving on surface streets during heavy rain, I received several warnings and couldn't determine why
- 85: lane narrowing

44. If you would have turned off the LDW, how long into your experience would you have kept the LDW on?

- 2: N/A
- 4: N/A

- 5: Would have used it whole time except during heavy rain or going through construction zones
- 20: until my experience was over. (Would have turned it off in light traffic; on in heavy)
- 22: I would have turned off the LDW when I wasn't in the mood and needed to get someplace in a hurry, but I would need it if I'm going to be rushing and I might not be paying close attention to all my actions on the road. This is and iffy situation.
- 24: probably after 2 weeks. Maybe turn it on on long trips
- 30: Most of time. Was only an issue last night during heavy 31: I would not shut off
- 32: within the 3rd day
- 35: N/A
- 37: N/A
- 39: Probably about a week into it
- 43: Till I realized it was not accurate
- 47: The first 2 weeks
- 50: all the time, it was not a problem
- 53: Whole time
- 55: I would've kept it on
- 58: But I would have turned it off briefly during bad road conditions
- 59: on the 18th day
- 60: I would have kept it on for the duration of the research time; however, I am glad to be getting my car back that doesn't have the system.
- 61: I would have not turned it off
- 64: I would have turned it off as soon as possible and kept it off!! (Maybe after a couple of days)
- 66: I think I would have kept it on for several weeks to give it a fair try, but if I had it all the time on my car I might use on/off switch for certain situations
- 68: I would of turned it off during weather conditions that caused faulty alerts
- 70: I would have kept it on for two weeks, or b/c the demonstration is for 26 days, I might have the system off the last 5 days to see if my driving has changed from having the system on to having it off
- 73: Color screen changes
- 75: not very long
- 79: would have kept it on most of the time except in snow, when road wasn't clear
- 82: Total time
- 85: 2 weeks
- 87: N/A

45. Can you suggest any changes or modifications to the LDW system in the following areas?

A.) Visual Warnings

- 1: Didn't use
- 2: no
- 7: Differentiate better between CSW & LDW
- 11: none
- 12: Eliminate it
- 13: Didn't seem necessary - in fact, if I used it, seems like it would have been a distraction
- 16: I usually did not look soon enough to see it
- 17: stay on screen longer

- 20: none
- 21: see page 9
- 22: no
- 23: no
- 25: Since I was watching the road and not the dash, they were not useful to me
- 30: Tended to look at them when I couldn't figure out why it went off which probably isn't too useful as delays reaction
- 31: Never used always vibration or sound
- 33: Show longer
- 36: Make people more aware of using the visual system, I forgot about it
- 37: see #31
- 42: unnecessary
- 47: N/A
- 48: I believe visual warnings are an unsafe distraction
- 50: fine
- 53: Don't think it's necessary
- 58: Yellow arrow across lanes was hard to see. Just use a line and an arrow
- 59: none
- 61: sooner on curves
- 68: Longer lasting visuals
- 71: I had none
- 76: The visual warnings could have remained on the display a couple seconds longer
- 77: See a little bit better in adverse weather
- 78: Same as overall comments
- 79: Have them on longer on the screen
- 84: These need to be moved to be effective
- 85: none

B.) Auditory Warnings

- 1: Sounds like truck horn
- 2: no
- 7: Very good
- 11: none
- 12: fine
- 13: May a little quieter - a beep maybe
- 17: were fine
- 20: none
- 21: see page 9
- 22: no
- 23: no
- 25: none
- 30: Sometimes seemed too quick w/o vibration first (when vibration would have been enough & urgency not high)
- 31: needs right or left warning
- 41: see #31
- 42: slightly louder
- 47: N/A
- 48: use different tone for right and left, have a volume control
- 50: OK
- 53: Fine
- 58: Turn radio volume low to hear warnings better

- 59: Being able to adjust the volume of the warning
- 60: I would prefer none
- 61: sooner on curves
- 68: No problems
- 71: I had none
- 77: Good
- 79: have a different tone like "left" or "right" auditory warnings
- 84: There should be an on/off switch for these.
- 85: none

C.) Vibration Warnings

- 2: skip these!
- 7: Sometimes confusing with CSW
- 11: none
- 12: fine
- 13: OK, but didn't really pay attention to side of seat
- 14: more apparent
- 17: sometimes hard to determine which was which
- 20: none
- 21: see page 9
- 22: no
- 23: no
- 25: none
- 27: It was tough for me to tell which leg was vibrating
- 31: no problems
- 32: lower the vibration a little bit
- 41: see #31
- 47: N/A
- 48: ok - have the option of vibration or sound
- 50: OK
- 53: Fine
- 58: CSW & LDW together make the driver think "was that a front vibration or a right vibration?"
- 59: none
- 61: sooner on curves
- 68: No problems
- 71: I kept mine on level 3 the whole
- 77: Good
- 85: Vibration was kind of strong; I could have used a lighter vibration.

D.) Timing of Warnings

- 2: this OK adjustable
- 7: Good, helped me pay better attention
- 11: none
- 12: fine
- 13: ok
- 17: was pretty good
- 19: earlier when appropriate

- 20: none
- 21: see page 9
- 22: Earlier at some points
- 23: no
- 25: none
- 27: More consistent
- 31: many false warnings
- 36: I liked the control system of deciding what setting I wanted
- 47: N/A
- 48: ok
- 50: OK
- 53: Earlier
- 59: none
- 61: sooner on curves
- 68: No problems
- 71: Good when they weren't false
- 72: I suggest a look at left side calibration
- 77: Good
- 79: Need to be sooner
- 85: A more subtle cautionary warning

E.) Controls and Display

- 1: Didn't really use
- 2: no
- 4: Heads up display
- 10: Position the system higher
- 11: none
- 12: fine
- 13: ok
- 17: if you’re concentrating on the road you miss visual
- 19: not behind the steering wheel
- 20: none
- 21: see page 9
- 22: no
- 23: no
- 25: As stated above
- 31: very good, could see at all times
- 32: put in the middle
- 35: Locate displays in filed of view so driver does not have to look down
- 37: see #31
- 41: see #31
- 47: N/A
- 48: ok
- 50: OK
- 53: OK
- 59: none
- 61: N/A
- 68: No problems
- 71: good
- 73: Horizontal in center of dashboard or possibly just below rear view mirror

- 77: Good
- 78: On the right, please!
- 84: Move display to center of console.
- 85: none

F.) Other

- 2: no
- 3: very worthwhile system needed in all vehicles
- 7: On surface roads, I had to get up to about 40mph before it became available. Also, it was not available in many circumstances where I thought it would be (i.e. the road markings were good.) But when it was available it performed very well. I think it is terrific if it would help people remember to use their turn signal on the freeway
- 8: need a lot more painted lines, old markings are hard to detect
- 20: none
- 21: see page 9
- 22: Maybe different color arrows
- 31: Sometimes did not seem to work correctly. I'll discuss
- 43: more accurate
- 46: system needs to be fine tuned, but it is a great idea
- 47: Don't give out false and unnecessary signals
- 48: It does not work on roads with a center line and no right side line. This has to be corrected
- 60: There is too much of a difference when you change the sensitivity level one notch. Either much too early or much too late
- 61: On the LDW was great though
- 62: I wish it would tell me when someone else is getting too close to my car
- 66: If it comes out on cars, the roads should tried to be kept up with the lines repainted
- 70: same as on page 9
- 74: As mentioned earlier, I would flip the auditory & vibrations warnings because the seat vibrations were much more attention grabbing
- 75: I didn't like to have to look at the display - I would prefer an auditory message like "you are to close to the left or right lane line"
- 78: System wasn't available very often
- 82: Sensitivity to lane conditions

48. Regarding question 47, what is your primary reason for providing the answer you did?

- 1: Didn't find it to be useful
- 2: Cost is my main objective. I don't like to pay for anything additional if I can help it - unless it's absolutely necessary. But if I had the money I would probably have it put on my car.
- 3: safety while traveling
- 4: cost
- 5: Have a 16 year old driver in house that this would help
- 6: Would be helpful
- 7: would depend on cost
- 8: need to upgrade for bad weather conditions especially snowy days
- 10: cost
- 11: alertness

- 12: It improved my driving & made me more aware of my surroundings
- 13: Cost - if each priced separately - would buy LDW system over CSW
- 14: Believe it would or could be useful tool for me
- 16: In case of drowsiness or distraction
- 17: it would be useful in unfamiliar surroundings
- 19: warnings seemed either unnecessary or too late
- 20: I thought the warning was very useful.
- 21: safety
- 22: Overall it is a helpful system to have in your car even though it might get on my nerves sometimes, but I'd rather be safe.
- 23: Safety
- 24: for new drivers
- 25: I feel it could be a benefit to the driver
- 26: It would be cool to see how it would work on my truck or my husbands driving
- 27: Based on the inconsistency I felt I don't know if it is worth it, although any warning will help drivers
- 28: Kept me in my own lane and off the shoulder
- 29: It was helpful
- 30: Made me much more aware of how I ride 1 side of lane & use blinker always
- 31: Cost of option
- 32: I think it is useless
- 33: If it would cost more for the car
- 34: Very useful system
- 35: Safety/prevention of crash
- 36: Same reason as the RDCW system, it made me more alert to be more correct in my driving habits
- 37: found it useful
- 38: Depends on cost
- 39: Cost aside would get it because it does help out in certain situations
- 40: I think that it could save lives
- 41: It encouraged me to use turn signals all the time and kept me more focused on my driving
- 42: same as RDCW
- 43: no need to have it
- 44: I felt safer when driving with the LDW
- 46: Great tool
- 47: Because it annoyed me at times
- 48: safety
- 49: I am convinced that the LDW system will increase driver safety and prevent accidents
- 50: I believe it would make better drivers more aware of what they are doing on the road
- 53: Safety
- 54: I feel I do not need it
- 55: Later in the night, it was good knowing I had it incase I needed it
- 56: I fell that is a safety factor and keeps you more alert
- 58: I would support raising the cost of all vehicles (within reason) to make this mandatory
- 59: I would find the system more useful if I was working a midnight shift and needed help staying awake for the drive home
- 60: I just don't feel it is entirely necessary. I've been driving all these years without it just fine
- 61: I have fallen asleep while driving
- 62: I would consider my driving habits at the time
- 63: Safety Factor

- 64: I do not feel the system would benefit my driving in any way
- 66: Out of the two warning systems I preferred the Lateral warning system more. They both are helpful, but the LDW was a lot less annoying
- 67: Cost, accuracy of system
- 68: Needs more work unwanted/faulty alerts too frequent
- 70: I might purchase a new vehicle with this system b/c it did make me aware when cars were either to the left of me or right of me, especially if they were in my blind spot & I didn't notice them
- 71: It surprised me each time and made me jump, but given more time a person should get used to it
- 72: I don't believe it's accurate enough at this point
- 73: Included in a safety package
- 74: I simply don't find it as necessary
- 75: As indicated earlier, the next vehicle we purchase will probably be for my wife's use - if it was my vehicle I would like the system if the economics were right
- 76: It improves lane awareness and turn signal usage
- 77: You can always use a second pair of eyes on the road
- 78: Had some benefit for low blood sugar issues while driving
- 79: When driving late at night, traveling, that's when I would use it
- 80: I learned how often I pull to the left. Will keep me on track!
- 81: at some points I found it helpful, at other times could be distracting
- 82: need additional engineering
- 83: The warning provided by the system could easily save lives
- 84: I found it useful when I was tired or distracted
- 85: I can see the use of such a system, but, I probably would not use the system.
- 87: safety

49. What is the maximum amount you would pay for the LDW system?

- 6: If I felt it was necessary, whatever terms I could get
- 13: both systems
- 14: both systems as a pkg.
- 50: no idea
- 54: Resale possibility, maybe if traveled by car more
- 61: I have no idea
- 66: If it came w/ the car then I might consider it
- 67: (don't know)
- 83: Both LDW and CSW

Curve Speed Warning (CSW) System Questionnaire and Evaluation

16. If passengers did comment on the auditory CSW warnings, what kinds of comments were made?

- 1: What was that? Who was that?
- 2: "I always take that curve fast!" "I had no idea THAT was TOO fast!?
- 3: wanted to make sure the car was okay
- 4: No body in car when warning went off
- 5: Stop it Dad!
- 6: said it was working
- 7: My husband thought it was a cool feature
- 10: what does that sound mean!?
- 11: laughing
- 12: They found the sound to be pleasant
- 13: annoying, startling, curiosity about the system, many thought it was a good idea
- 14: Discussion in general of how audio comes on, gets attention, etc.
- 16: "Why was that?" "Was that too fast?"
- 17: sometimes it happened when I didn't need it and didn't when I did
- 20: That it would be good for older people. That it will create better driving.
- 22: There really weren't any because I explained that the system might have warnings so they were prepared
- 27: "Better slow down" "Cool"
- 28: They laughed
- 29: Lots of laughter
- 30: Passengers tend to jump and be slightly annoyed - never had anyone sigh w/ relief that I was being warned to slow down
- 31: I don't think it ever activated the audio signal
- 32: this is annoying
- 33: What was that?
- 34: Isn't that distracting? What kind of car is this?
- 35: What is that?
- 36: I don't remember
- 37: ask questions about the system
- 39: they asked what it was
- 41: "what is that?"
- 42: see previous
- 44: "sounds like a computer. It needs personality" "Danger, will Robinson, danger"
- 46: N/A
- 47: Some thought the frequency was annoying when trying to hold a conversation
- 49: Daughter felt too loud and annoying
- 50: none
- 53: Shakes me up
- 54: actually they just laughed
- 55: They made smart alec responses due to the frequency
- 56: to ask what the sound was
- 58: why does the car think we are turning?
- 59: "what did that say?"
- 61: What was that. That would drive me crazy, but I guess I could get used to it
- 62: N/A
- 64: "That's annoying" There isn't even a curve"

- 66: same as the lateral warning
- 67: Once my mother wanted to know what it was - she is 86 years old
- 68: Uh…what was that
- 72: Geez…I don't remember exactly
- 73: They thought it was "alarming"
- 74: N/A
- 76: I did not receive an auditory CSW
- 77: Did it say curve. My son which is 6 said "Dada, did your car say Urve" that was funny
- 79: "that's annoying." "That's neat how it tells you curve."
- 80: slow down!
- 84: "Can you turn that off?" "What the hell was that?"
- 85: The system was annoying

24. Overall, I thought the CSW auditory warnings were provided at the right time (i.e., they were not presented too early or too late).

If you feel the timing should be adjusted, would you make it come sooner or later?

- 1: Too many false positives
- 5: Often it happened while in a turn around lane and it did not give you time to slow down when you changed lanes
- 6: can't say
- 7: Later. (But I could have also adjusted the sensitivity myself)
- 11: Later
- 12: earlier
- 21: Earlier
- 22: Probably earlier
- 24: earlier
- 29: Sometimes earlier and other times later
- 30: Later or not at all - false alarms
- 31: Seem not to activate when I tested. It should be more sensitive
- 32: earlier
- 37: too many false signals
- 46: False warnings sometimes
- 48: need earlier timing - system did not work
- 49: earlier
- 50: fine
- 54: maybe
- 55: I had it turned all the way down and wished I could turn it down later
- 58: When they were accurate, the timing was okay
- 62: earlier
- 64: Not at all!!
- 71: I only had one warning on this system and was totally surprised by it, as the curve that I was going through was totally familiar to me and I don't think I was driving too fast
- 72: Off ramps caused too many false alarms
- 73: Earlier - if you are required to slow down for a curve earlier is better
- 76: I did not receive any CSW auditory warnings
- 77: earlier
- 78: earlier
- 79: much earlier

- 81: earlier
- 84: Just a little later
- 85: later

25. Overall, I thought the CSW seat vibration warnings were provided at the right time (i.e., they were not presented too early or too late).

If you feel the timing should be adjusted, would you make it come sooner or later?

- 1: see #24
- 5: Same as above (24-open)
- 6: can't say
- 21: Earlier
- 22: It pretty much was a good time
- 24: earlier
- 29: both, depending on the situation
- 31: Earlier
- 32: earlier
- 35: Needs to be activated more often with curves in accordance with GPS
- 36: The auditory warnings seem to get my attention on the curves more than the vibration
- 37: too many false signals
- 43: For me too early
- 46: False warnings sometimes
- 49: earlier
- 50: ok the way it is
- 55: make it even later
- 58: When they were accurate, the timing was okay
- 61: just more consistent
- 66: some of the speeds of some of the curves could be adjusted
- 72: Depends on whether need is real or not
- 73: same as above #24
- 76: later
- 77: earlier
- 78: earlier
- 81: earlier
- 84: maybe I feel this way because the warning is a little less distracting / aggravating
- 85: a little earlier

27. The CSW always provided a warning when I thought it should.

If the LDW did not warn you when you though it should, please describe the situation(s).

- 1: Curve speed not marked - Jefferson Ave. entrance onto the Lodge
- 2: Sometimes it warned me when there was no curve at all!
- 5: Tried to set it off a couple of times w/ no luck
- 7: It would warn for some curves but not others. It didn't seem to be very consistent

- 8: should a warning come at certain speeds
- 12: Should have come sooner (if possible) depending on speed & intent
- 13: Warned too often with approaching ramp. Twice it seemed appropriate when I was actually on a ramp going too fast
- 16: I tried to demonstrate to a passenger, and it didn't work
- 17: going to the lake up north the road are curvy I didn't always get a warning
- 21: Too numerous to recount. Never or late all the time!
- 24: on some curves going 10 over speed limit.
- 29: Going around a fast curve, and merging onto one expressway and leaving another
- 30: Gave warnings on I-75 by Caniff routinely although not tight curve & slowing would cause accident. Did not give warnings at S-curve by 8 & 9 mile on I-75 that has reduced speed & lane restrictions even if I was going over posted curve speed.
- 31: Not many curves in my area. I tested on Avon rd. downhill 2 good curves and never activated. In my sub a large curve it would activate. False warning when moving out to pass on numerous occasions. It requires some work
- 36: No, several times I was in a curve in which I did not get a warning
- 37: coming into a curve without going off
- 39: one time curve came up & I wasn't paying my full attention to the road & I went off the road a little because I was going to fast for the curve
- 42: Warnings were not consistent; some small curves elicited warnings while some large curves did not
- 43: A few times I tried to show it off
- 47: When you're going past a curve it thinks you're about to exit on to it
- 49: approaching a curve at a speed that I though should have elicited a warning
- 50: N/A
- 53: Missed lots of curves
- 55: Some curves were rated at 55 mph but I was taking them at 70-75
- 56: A few times I though perhaps I should have slowed down more around a curve but received no warning
- 58: too many warnings
- 59: There were some circumstances where I thought I was going too fast coming to a curve but it didn't warn me
- 61: not always consistent
- 74: There are a couple of curves I take often that the CSW would only warn for every once in a while
- 78: On curves on Romeo Plank near my home - posted warning signs - no warning from CSW
- 79: Going under underpasses it would go off. Also halfway into the curve, should come before
- 80: sometimes I thought I was going at a speed appropriate for the situation
- 83: Based on warnings I had received I thought while driving in similar situation that I would receive a warning

For the next 2 questions, please consider the following definitions.

A CSW warning is defined as UNNECESSARY when a warning is generated while:
you happen to drive toward a curve or in a curve
you do not perceive any threatening circumstances which warrant the warning

A CSW warning is defined to be FALSE when a warning is generated while:
you are not driving toward or in a curve
you do not perceive any threatening circumstances which warrant the warning

28. I did not receive any unnecessary CSW warnings.

If you received an unnecessary warning, describe the situation(s).

- 1: Exit ramps that were passed
- 2: Yes there were times I felt I wasn't going too fast, But I got a warning
- 5: Lane changes into turn around lanes
- 6: going around a curve at the posted speed
- 7: On the freeway, it seemed to warn for every curve, even if it was a gentle, normal curve with no danger
- 8: CSW came on sometimes on straight road
- 13: usually w/ exit ramps (driving toward it but not going on it) occasionally on the freeway (once or twice)
- 16: A couple of times there was still plenty of time to slow down
- 17: picked up exit ramps and turnarounds
- 19: on ramps to interstate
- 21: Warning on straight always near overpasses. Bad system
- 22: The CSW is more sensitive than the LDW in my opinion so I would drive toward curves and get warned
- 28: On service ramps
- 29: Just driving along on the e-way I would get them and they weren't needed (only a slight curve)
- 31: when moving out to pass
- 32: Passing an on-ramp or off-ramp
- 33: I went over a bump and it said curve. I changed lanes and it said curve
- 36: Outer drive is mostly curves; you knew that you would be going into one
- 37: mainly in interstate (changing lanes near exit ramps) false signal
- 39: off-ramps set them off sometimes when unnecessary
- 40: It would sound even when I was on a straight road. I was making a right hand turn and it went off twice
- 42: many small curves gave warnings
- 43: coming in to merge curves and a few times while driving on the free way
- 46: system gave false warnings
- 47: going on curves that are not steep
- 55: The last turn into my offices driveway, it would always go off even though I was still decelerating and not even taking that turn on the road
- 58: Drivers have a wide range of abilities. It is difficult to say that I was driving too fast. But for some drivers it would have been too fast
- 60: Driving past an exit in which I wasn't getting off at. Seemed to malfunction as times. There seems to be a few kinks to work out on the whole system.

- 63: Same place 4-5 times as slow as I went
- 64: Driving on I-75 where there were absolutely no curves
- 66: I got a lot of warnings that in a line of traffic nobody braked - we all went the same speed through the curve and I got a warning
- 67: making a Michigan left, the curve would show right when I was actually bearing left
- 68: changing lanes near a turn
- 71: It is a curve near my house shaped more like an "L" and I was coasting into it at the time with my foot over the brake pedal
- 72: I thought I was driving slowly enough for the curve
- 73: A familiar curve in the neighborhood is one that is not a threat to the driver
- 75: I did receive some warnings when there was no curve
- 76: When preparing to merge on the freeway
- 79: It would go off when merging on freeway
- 80: see 27 above
- 81: seemed to activate at off ramps on the freeway
- 83: Approaching a curve I received a warning but didn't consider my driving speed to be excessive
- 85: I would receive a warning after I had applied the brakes and was slowing down for a curve, quite often.

29. I did not receive any false CSW warnings.

If you received a false warning, describe the situation(s).

- 1: see #28
- 2: yes, there were a couple times I got warned - But was on a straight away!
- 3: Passing exit ramps. Road running along side each other
- 5: I-75 south by Livernois always gave me a curve audible warning and there is not a curve there
- 6: as far as I know
- 7: On telegraph Rd. it said there was a curve when there wasn't
- 8: straight roads and sometimes behinds semi-trucks
- 13: I was driving toward a curve - just wasn't where I planned to go. False in that it wasn't my route. Correct in that there was a curve but I wasn't taking the curved part
- 16: Passing freeway exits
- 19: Dale Road to Cherry Hill off ramp from Interstate
- 21: Numerous
- 22: When driving I did receive false CSW warnings because there were not curves in sight
- 27: On/Off ramps or turnarounds
- 28: freeway ramps
- 29: Just going straight a couple of times
- 30: Often received warnings on I-75 at 696, 94& Davison & 375 interchanges even when in center lane
- 31: on numerous occasions vibrate only. I think I received audio warnings only once
- 32: the on and off ramps
- 36: I am not sure
- 37: see 28
- 38: no curves in sight in many cases
- 39: Driving by off-ramps sometimes set them off
- 40: I was going on a straight road

- 41: On the lodge freeway and also on I-96 I consistently received warnings at the same spots with no curve, no exit or anything that I could detect that caused the warning
- 42: entrance ramps or freeways, some Michigan lefts caused false warnings
- 43: same as 28
- 46: going straight, CSW said curve
- 49: occasionally when approaching/passing an exit/entrance ramp
- 53: Not on curve as warning sounded
- 55: I-75 south and the Davison. There is a slight left hand curve and it would go off when the road for the most part was straight
- 58: changing lanes, driving on a road with very minor turns (Southfield Fwy N going under I-96,) even just driving straight
- 64: All the time
- 67: previous display
- 68: changing lanes or going under overpasses
- 70: I received CSW warnings when I was going either straight or to the left, but the warning showed the arrow on the screen pointing to the right
- 71: See #28
- 72: At many off ramps, turn-offs
- 74: Often driving on I-94 I would get CSW warning while on relatively straight parts of the express way
- 79: Going under underpasses, passing on/off ramps, merging onto freeway
- 84: Usually near highway exit ramps and overpasses
- 85: Freeway exit ramps provided several false warnings.

44. If you would have turned off the CSW, how long into your experience would you have kept the CSW on?

- 4: N/A
- 19: If on her own car, same answer as LDW
- 20: until my experience was over
- 21: 1st week maybe
- 22: Same as LDW comment
- 23: 2
- 30: 1/2 way
- 31: Always I would not allow disconnect
- 32: the 3rd day
- 39: maybe near the end
- 40: 2 or 3 day
- 43: Till I realized it was not accurate
- 46: Highway driving only
- 47: The first 2 weeks
- 48: it did not work well at all
- 50: I don't think I'd ever turn it off, in fact it's there for a purpose
- 53: Whole time
- 55: two weeks in
- 58: 2-3 weeks. After I was confident that CSW had too many false warnings
- 59: the whole time
- 60: The duration of the research
- 61: I would not have turned it off
- 64: I would have turned it off ASAP
- 66: I think I would have turned it off about two weeks of using it
- 70: same as page 21

- 79: After the second week
- 81: about two weeks (would also turn it off in his own car)
- 85: 2 weeks

45. Can you suggest any changes or modifications to the CSW system in the following areas?

A.) Visual Warnings

- 1: Didn't really use
- 2: no
- 7: Differentiate between CSW and LDW
- 11: none
- 12: not necessary
- 13: Not necessary; possibly a distraction
- 17: didn't always see them
- 20: none
- 21: None needed, I want to look at the curve, not the dash
- 22: no
- 23: no
- 25: no
- 31: not noticed used vibration and sound
- 33: show longer
- 37: see #31 page 9
- 42: unnecessary
- 44: Add arrows to indicate in which direction the curve is
- 47: N/A
- 53: Unnecessary
- 59: none
- 61: curves not soon enough
- 68: last longer
- 71: Had none
- 73: Somehow the system should learn about the driver's familiar curves - those that are made routinely and thus are not a threat to the driver
- 76: The CSW visual warning could have remained on a second or two longer
- 77: Good
- 79: longer on screen
- 84: need to be moved to be effective
- 85: none

B). Auditory Warnings

- 1: None
- 2: no
- 7: Very good
- 11: none
- 12: no
- 13: "Curve" audio is annoying, less annoying sound might be better
- 17: very good. Got your attention
- 19: higher up

- 20: none
- 21: "Curve ahead- Slow Down" if traveling too fast for the curve
- 22: no
- 23: no
- 25: no
- 30: Too quick and too "threatening" (difference between hearing a tone and a deep voice saying "curve")
- 31: require curve audio
- 42: slightly louder
- 47: N/A - but its very annoying
- 53: Good
- 58: I still don't know which is more urgent auditory or vibration warnings
- 59: none
- 60: Maybe not have an auditory warning
- 61: curves not soon enough
- 68: No problems
- 71: Had none
- 77: Good
- 81: maybe telling you which direction the curve it is warning about is in
- 84: should have on/off switch
- 85: none

C.) Vibration Warnings

- 1: none
- 2: skip these - not really necessary
- 7: Sometimes confusing with LDW
- 11: none
- 12: no
- 13: OK - but couldn't tell why a vibration vs. audio warning
- 16: Make it less similar to LDW
- 17: couldn't always tell which was which
- 20: none
- 22: no
- 23: no
- 25: no
- 31: good
- 32: stop the vibration in the seat
- 47: N/A
- 53: Never did distinguish
- 58: Combined with LDW, this is too much info to the driver. Just use the auditory warnings
- 59: none
- 61: curves not soon enough
- 68: No problems
- 71: It seemed fine even though I consider my warning false
- 76: The vibration warning were a little too sensitive
- 77: Good
- 78: Maybe whole seat vibration instead of just front - might be easier to tell the 2 systems apart
- 79: shorter vibration
- 85: lighter vibration

D.) Timing of Warnings

- 1: see other
- 2: keep them adjustable
- 7: Often got warnings when I thought they were unnecessary
- 11: none
- 13: ok
- 17: good
- 20: none
- 21: Ahead of time
- 22: no
- 23: no
- 25: no
- 29: Definitely needs work. Sometimes too fast and sometimes too slow. Sometimes completely false and other times unnecessary
- 30: Goes to auditory too quickly
- 31: too many false warnings on no warning
- 47: N/A
- 53: About right
- 59: none
- 61: curves not soon enough
- 68: No problems
- 71: Fine
- 72: Get better about false alarms, minimize them
- 77: Good
- 79: much sooner than curve instead of during
- 85: too many false warnings

E.) Controls and Display

- 1: didn't really use
- 2: no
- 4: HUD
- 11: none
- 12: none
- 13: ok
- 17: don't stay on screen long enough
- 20: none
- 21: Vibration and auditory only, visual not needed
- 22: no
- 23: no
- 25: no
- 31: good
- 35: Possible reflection on glass for driver signal of warning
- 37: see #31 page 9
- 47: N/A
- 53: OK
- 55: The curved road to the left bugged me when the alert was for the other direction. Maybe have the display change

- 59: none
- 61: N/A
- 68: No problems
- 71: Good
- 77: Good
- 84: should be moved to center of dashboard
- 85: none

F.) Other

- 1: reduce false alerts
- 2: no
- 7: This feature did not seem to work consistently. Sometimes I would get warnings and sometimes not in similar situations
- 8: Some curves cannot be recognize down hill curves and bad weather
- 20: none
- 31: It did not activate when I thought it should
- 36: same as before
- 38: My CSW was more appropriate for speed, not related to curves
- 43: make it more accurate
- 46: Fine tune, great idea
- 47: N/A
- 48: The global positioning system, car speed, road conditions must all be computed instantly to be useful. I am not sure it is possible to get a timely warning
- 50: it was great
- 55: Have it learn your regular driving patterns to reduce the number of warnings. Also have it learn what speeds you were taking curves so it can figure out if it needs to re-adjust its own interpretations of the road
- 66: Let you go a little faster around curves you live by - the ones you know really well
- 67: improve accuracy
- 70: same as on page 9
- 75: As indicated previously I would prefer an auditory warning system

48. Regarding question 47, what is your primary reason for providing the answer you did?

- 1: Little added value
- 2: Maybe as I got older and had trouble driving - Also it might be considered if I had to drive a lot, especially to new places I'm unfamiliar with
- 3: Road safety
- 4 Cost
- 5: If false warning were some how corrected, would definitely consider buying
- 6: everything helps
- 7: I did not find it to be that useful
- 8: need more accurate detection on up-coming curves
- 9: For my type of driving it is not very useful
- 10: cost
- 11: safety & alertness
- 12: I liked the idea of being warned in some situations / locations that I was unfamiliar with
- 13: helps w/ speed warning anywhere - especially on a curve

- 14: Again, believe a good tool - especially when driving in unknown territory
- 16: Added Safety
- 19: seemed to work better than LDW, more likely to improve safety
- 20: I thought the warning was very useful.
- 22: It can help minimize going to fast around curves
- 23: I didn't fell as knowledgeable with CSW as with LDW
- 24: When the system worked. I unconsciously adjusted speed.
- 25: I feel it could benefit the driver
- 26: It would come in handy
- 27: I think the CSW is very worthwhile
- 28: I liked the system
- 29: It's not as accurate as the LDW system
- 30: Too many times it didn't seem necessary for warnings. Over time I think tendency would be to disconnect it or figure way to disable
- 31: Not many curves in my area, don't do a lot of long trip, unfamiliar roads and usually traffic congested area
- 32: useless
- 33: Car would cost more
- 34: I would consider purchasing the system, because it makes you aware of curves & where your car is on the road
- 35: Safety/alertness
- 36: I like the system, it was helpful, as already been stated
- 37: didn't find it effective at this time
- 38: My CSW was not accurate, perhaps if it measured speed and curve speed accurately, I may be interested
- 39: I think it would be very helpful in areas your not familiar with
- 40: I found that it did not work well
- 41: It would depend on the expense. I didn't feel it added as much value as the LDW system
- 42: I found few situations where I was unaware of upcoming curves
- 43: I would not need it
- 44: I'm more interested in the lateral drift…I can usually anticipate/ look for signs to warn of upcoming curves
- 46: Great idea
- 47: The auditory warning is annoying especially when conducting conversations
- 48: it did not work
- 49: driver safety
- 50: I feel it is a great safety thing in a car as well as seat belts
- 53: Safety
- 54: I don't feel I need it
- 55: I did not find it that useful. I usually disagreed with its readings of curves
- 58: Just annoying. If it was on my car I would pull the fuse to turn it off
- 59: I feel that my driving ability regarding slowing down when coming to a curve is sufficient
- 60: Don't feel it's necessary to me.
- 61: I have fallen asleep while driving
- 62: I'm not in an area that has a lot of curves
- 63: Safety Reasons
- 64: I feel it would not benefit my driving
- 66: The CSW would be useful on unfamiliar roads, if you could turn it off on roads near home that you know well - I would consider
- 67: accuracy of system
- 68: needs more work

- 70: The CSW system did assist me when I was going around a curve, but I felt as though I didn't use it as often as the LDW system
- 71: If all the kinks are out of it so that you don't receive false warnings it would be useful. Or perhaps moving the sensitivity would solve the problem
- 72: Too many false indicators
- 73: Did not provide "needed" cautions for my usual driving. However, if it was included or set up for "highway" driving it is good
- 74: Way too many false warnings. It's like the CSW was constantly crying wolf
- 75: The next vehicle will probably be my wife's & for me I think the LDW is a better economic value
- 76: I drove strictly in familiar territory it would be more useful on unfamiliar roads
- 77: In my use of the system, The CSW came in handy. I approached a curve, and it was steeper than I suspected and CSW helped
- 78: Helpful when driving on unfamiliar road
- 79: It's helpful at night when hard to see the road
- 80: I definitely need LDW - not sure about CSW
- 81: I did not find it useful in my normal everyday driving
- 83: The CSW system could easily save lives
- 85: Not was useful as LDW system. I wouldn't need the system.

49. What is the maximum amount you would pay for the CSW system?

- 6: what was necessary
- 13: both systems
- 42: perhaps bundling it w/ A full navigation system would differentiate the NAV from competitors. Alone it is of marginal value
- 46: LDW more useful
- 50: (equally as valuable as LDW)
- 54: resale issue
- 61: I have no idea 66: If it came with the car
- 83: Both

Participant Handling

1. What could the researchers have done differently to improve your understanding of the LDW system and how it operated?

- 1: Nothing
- 2: it was very easy to understand and use.
- 3: Very well presented
- 4: They did a good job
- 5: They were very helpful & gave me more than enough information to be successful
- 7: Nothing they were great
- 8: understanding the LDW was easy
- 10: Orientation was very easy to understand both systems
- 11: I understood everything
- 12: I felt they provided me with enough information so that I was comfortable with the system. (the right & left speaker setup I was unaware of…I may have been told but don't remember
- 13: ok as is, very well explained
- 14: Numerous times I questioned why warnings were not given - speed not fast enough (i.e. under 40mph) broken road lines vs. solid lines a factor? Could not seem to read a consistency
- 16: ok
- 19: N/A
- 20: I understand the LDW system very good. I think it will do good for drivers
- 21: Nothing, Joel was great
- 22: The researchers did an excellent job on making me understand how the LDW system operated
- 23: I believe researchers did an excellent job
- 24: nothing-very instructive and friendly
- 25: nothing
- 26: nothing, they made it all understandable
- 27: Nothing, I understood how it worked
- 28: Very clear
- 29: Nothing
- 30: Nothing
- 31: They explained and we test drive the car. I have no suggestions to improve
- 32: The researchers did a good job
- 33: Show more warnings when driving the car
- 35: add to video an operation of the car in use
- 36: Stressed the visual part a little more- mention to be sure an use the training video
- 37: good
- 39: understood fine
- 40: they were good at explaining how everything worked
- 42: nothing
- 43: nothing
- 44: nothing
- 46: nothing
- 47: N/A
- 48: very good job
- 49: orientation was adequate

- 50: nothing that I can think of
- 53: Too often it is not operative. You'd like to assume it works whenever there are lines
- 54: Nothing they explained it very well
- 55: I though everybody was great. I understood everything
- 58: The explanation was good
- 59: None - Joel did a good job at explaining it
- 60: 0
- 61: nothing
- 62: The display is fine, the right side would have been better
- 63: They did a great job
- 64: Nothing, they explained everything properly
- 66: I understood it well, they described how it operated well
- 68: no problems, researchers were very informative
- 71: Perhaps given out a pamphlet as an overview of the system
- 72: Nothing, the researchers answered questions and explained fully before I took the car
- 73: Relocate display closer to vision field of windshield window - alter color responses
- 74: The researchers did an excellent job in providing understanding. I would not change aspect of the introduction
- 76: They did an excellent job
- 77: Nothing
- 78: Nothing - Dylan and Joel were great
- 79: Nothing
- 81: all was explained well
- 82: N/A
- 84: Nothing. I understood the system fine
- 85: Nothing, it was well explained.

2. What could the researchers have done differently to improve your understanding of the CSW system and how it operated?

- 1: Nothing
- 2: Not a thing! Very easy to understand
- 3: Nothing
- 4: See above
- 5: same as 1
- 7: Nothing
- 8: They did pretty good
- 11: I understood everything
- 12: cannot think of anything
- 13: ok as is
- 14: I felt this to be an accurate system in my estimation
- 16: ok
- 19: N/A
- 20: I understand the CSW very good. I think it will do good for drivers
- 21: Told me it might not work
- 22: same as 1
- 23: Also, an excellent job
- 24: nothing
- 25: nothing
- 26: Nothing it was easy
- 27: Nothing, very self-explanatory

- 28: Very clear
- 29: Nothing
- 30: Nothing, it was clear
- 31: It was explained with test driver. I understood what was to happen. They did a fine job
- 32: nothing at all
- 33: Show more warnings when test driving the car
- 36: same as above
- 37: good
- 39: understood fine
- 41: I think it could be clearer as to the types of conditions & factors (e.g. speed, road conditions, and curve sharpness) which will result in the warning being produced.
- 42: nothing
- 43: nothing
- 44: nothing
- 46: nothing
- 47: N/A
- 48: The explanation was fine, the system simply did not perform
- 49: orientation was adequate
- 50: nothing
- 53: Didn't really distinguish seat vibration for curve ahead - perhaps verbal follow-up during test period could be done to check on this type of thing
- 54: Nothing
- 55: I thought everybody was great
- 58: Explanation was fine, it was the system that needs improvement
- 59: None - Joel did a good job at explaining it
- 60: 0
- 61: nothing
- 62: The vibration could have been different
- 63: Same as above
- 64: Nothing, they did a great job explaining everything
- 66: They explained it well, I understood
- 71: Perhaps given out a pamphlet as an overview of the system
- 72: Nothing, the researchers explained very well and answered all questions prior to me taking the car
- 73: Give it a learning ability to respond to the curves not usually encountered in the driver's history as recorded by the GPS
- 74: See above
- 76: nothing
- 77: Nothing
- 78: Nothing
- 79: Nothing
- 81: all was explained well
- 82: N/A
- 84: Nothing. I understood the system fine.
- 85: Nothing, it was well explained

Appendix W

Driver Comments For Utility Ratings

This page was left blank intentionally.

Driver Comments For Utility Ratings

Note: Because the drivers' comments were recorded manually by the researcher during the debriefing sessions, the comments are a mixture of verbatim quotes and paraphrasing by the researcher. For this reason, there is often a shift from first-person to third person from item to item.

Driver	AlertType	Utility Rating	Driver's explanation of rating
3	LDW-Cautionary	4	Didn't turn on the blinker in time before lane change
3	LDW-Cautionary	3	To alert driver that she was drifting w/o using signal
3	LDW-Cautionary	4	Speed was an issue, and driver was drifting
3	LDW-Imminent	4	Distracted because of person walking across the street
3	LDW-Imminent	4	The system indicated the presence of a car in the left lane
3	LDW-Imminent	4	It alerted the driver she was drifting to the right
3	CSW-Cautionary	5	Driver's speed was too high
3	CSW-Cautionary	4	Alerted driver about speed even though warning was false
3	CSW-Cautionary	2	Driver needs to accelerate to enter the freeway; warning was not necessary
3	CSW-Imminent	5	Speed was higher than posted speed for exit ramp
3	CSW-Imminent	1	False warning; not sure what it was reacting to
3	CSW-Imminent	5	Reacting to a curve coming ahead on 696
4	LDW-Cautionary	4	Makes you aware that turn signal should have been used
4	LDW-Cautionary	3	When you pull out across the line, people show know
4	LDW-Cautionary	4	Keeps you aware of what you're doing
4	LDW-Imminent	4	Because driver was getting close to center line
4	LDW-Imminent	5	Because driver shouldn't have made that maneuver, crossing the lines
4	LDW-Imminent	2	Driver ran out of road (had to get over) and merge into next lane
4	CSW-Cautionary	1	Intended to change lanes and approach the exit
4	CSW-Cautionary	1	Driver intentionally made that maneuver
4	CSW-Cautionary	1	False signal
4	CSW-Imminent	1	Not approaching a curve
4	CSW-Imminent	4	Alerts driver about the upcoming curve, but he also didn't feel like he was going too fast
5	LDW-Cautionary	5	Because it looked like the driver was drifting
5	LDW-Cautionary	3	Driver looked behind him to see if car was present but did not use turn signal
5	LDW-Cautionary	3	Didn't use turn signal; same as last one
5	LDW-Imminent	4	Being a narrow lane, you'd want more awareness of what's going on

5	LDW-Imminent	4	Driver intentionally provoked warning, but still thought it was useful
5	LDW-Imminent	2	Did not look like the driver drifted
5	CSW-Cautionary	2	Vehicles ahead (in curve) were speeding up, but system was telling driver to slow down
5	CSW-Cautionary	1	False Warning
5	CSW-Cautionary	1	Going with the flow of traffic
5	CSW-Imminent	1	Went off before driver was in the curve, and did not give the opportunity to slow down
5	CSW-Imminent	1	No curve there
5	CSW-Imminent	1	No curve apparent
6	LDW-Cautionary	3	No traffic around, warning not necessary
6	LDW-Cautionary	3	Nothing to use the turn signal for
6	LDW-Imminent	5	Because the driver crossed the solid line
6	LDW-Imminent	3	Reminded driver to stay in the lines, but not very useful in this situation
6	LDW-Imminent	2	Reacting to a tar marking
6	CSW-Cautionary	2	Nothing in the curve that was dangerous
6	CSW-Cautionary	1	Because there wasn't anything there
6	CSW-Imminent	1	Wasn't necessary; nothing coming up
6	CSW-Imminent	1	Just taking the exit ramp, not going that fast
7	CSW-Imminent	4	If the warning was on, then it made the driver more aware, but she didn't think she was drifting
7	LDW-Cautionary	3	Same reasons as last warning
7	LDW-Imminent	2	Driver did not feel like she was drifting, but "must have been or it wouldn't have gone off"
7	LDW-Imminent	2	The warning would make the driver look to see what was happening
7	LDW-Imminent	5	Indicating that turn signal was on too late
7	CSW-Cautionary	1	Because there was no curve
7	CSW-Cautionary	2	Driver didn't think she was going too fast
7	CSW-Imminent	1	No curve present
7	CSW-Imminent	1	No curve present
7	CSW-Imminent	4	Because there was a curve, but driver probably wasn't going too fast though
8	LDW-Cautionary	5	Two lane road, driver was drifting and was tired
8	LDW-Cautionary	5	Driver was keeping close to center line (same reasons last one)
8	LDW-Cautionary	4	Two lanes came into one, so the driver wasn't really drifting, but it let the driver know that he was crossing the line
8	LDW-Imminent	5	Shows that if you take your eyes off the road, you could be drifting and not know it
8	LDW-Imminent	5	Driver was approaching a curve and drifted over the line
8	LDW-Imminent	5	Driver was crossing a lane marking, and should have avoided it
8	CSW-Cautionary	3	Warning was too early, but still thought it was useful
8	CSW-Cautionary	1	Perhaps a false warning
8	CSW-Imminent	3	Hard to tell what it was responding to

8	CSW-Imminent	1	no curve
8	CSW-Imminent	1	no curve
9	LDW-Cautionary	4	It indicates that there's construction, and something was ahead in the road
9	LDW-Cautionary	3	Driver usually uses turn signal, but did not in this case, so the warning was somewhat useful
9	LDW-Cautionary	3	Driver's speed is fine and under control, and the warning wasn't all that necessary
9	LDW-Imminent	5	Driver did not feel that she was drifting over the line, but was perhaps moving to avoid the truck
9	LDW-Imminent	2	Driver didn't feel that there was any crash threat present
9	LDW-Imminent	2	Driver didn't feel like any threat existed, and wasn't drifting that much
9	CSW-Cautionary	2	Driver didn't see any purpose for the warning
9	CSW-Cautionary	1	Driver knows this particular curve well, and didn't need a warning then
9	CSW-Cautionary	3	Nothing dangerous was happening, driver knows this road
10	LDW-Cautionary	4	Driver likes to keep toward the center of the lane
10	LDW-Cautionary	3	Driver was just changing lanes
10	LDW-Cautionary	2	Driver didn't use turn signal when changing lanes
10	LDW-Imminent	2	Driver was changing lanes w/o turn signal
10	LDW-Imminent	4	Drifting into the right lane without intending to
10	LDW-Imminent	5	Made driver aware of position of car through the curve
10	CSW-Cautionary	2	Made the driver more aware, but there didn't seem to be any danger
11	LDW-Cautionary	3	The lanes were shifting over, but there wasn't much traffic around (construction area)
11	LDW-Cautionary	3	Even though the drift was intentional, the LDW did go off at the right time
11	LDW-Cautionary	4	It got the driver's attention, driver didn't think any threat existed really
11	LDW-Imminent	4	The shoulder's not that big there, and the warning got the driver back in line
11	LDW-Imminent	3	Another intentional warning, but it went off at the right time
11	LDW-Imminent	4	Again, shoulder was small, if driver would have drifted over too much, would have hit the wall
11	CSW-Cautionary	5	A "funny curve" if you go too fast you could hit a wall
11	CSW-Cautionary	4	If driver was going too fast a threat could have existed because the small shoulder and nature of merging lanes ahead
11	CSW-Cautionary	2	Although this was a curve, it wasn't a sharp curve, and there was plenty of maneuvering room
11	CSW-Imminent	1	This warning was one that the driver got all the time on the way to work; a false CSW
11	CSW-Imminent	1	It didn't look like there was a curve coming up
11	CSW-Imminent	1	There was no curve present
12	LDW-Cautionary	2	Driver would prefer that when intentionally making a maneuver that the system would not warn
12	LDW-Cautionary	3	Driver was making an intentional maneuver to pass the car in front
12	LDW-Imminent	4	Driver was a little closer to the line than he "should have been"
12	LDW-Imminent	3	Going to make a right hand turn and didn't signal
12	LDW-Imminent	4	Didn't think he was that close to the line at the time, but after reviewing it, thought it was more appropriate
12	CSW-Cautionary	1	Unless driver was "driving too fast," which he didn't feel was the case, then it was appropriate

12	CSW-Cautionary	1	Driver knew he was on a curve, and didn't feel he was going too fast
12	CSW-Imminent	2	Driver didn't see why it should go off there
12	CSW-Imminent	3	It's a little tighter of a curve; warning was well in advance and not annoying
12	CSW-Imminent	1	Driver did not see any curve present at all
13	LDW-Cautionary	1	Random warning, driver was changing lanes and thought she used the turn signal
13	LDW-Cautionary	1	Was annoying; changing lanes, and again was probably using turn signal
13	LDW-Cautionary	1	Same as previous two
13	LDW-Imminent	1	Driver should not have gone off in that situation
13	LDW-Imminent	3	Nothing too dangerous going on, but it still gave a warning in an appropriate situation
13	LDW-Imminent	1	It doesn’t look like any danger existed
13	CSW-Cautionary	1	Did not feel like she was going too fast
13	CSW-Cautionary	1	Barely a curve in the road; driver didn't know what it was for
13	CSW-Cautionary	2	Driver planned on slowing down, but didn't fell like any danger existed
13	CSW-Imminent	4	Driver was driving a little too fast and warning seemed a little appropriate
13	CSW-Imminent	1	Was passing a curve, not entering it
13	CSW-Imminent	1	False warning
14	LDW-Cautionary	3	Made the driver aware that the system was active, and it heightened the driver's general awareness of the road
14	LDW-Cautionary	3	Made driver aware of the need to use turn signal
14	LDW-Imminent	1	Driver couldn't understand why the warning happened, and she didn't think it should have gone off
14	LDW-Imminent	3	The video showed that the driver drifted to the left, so warning was useful
14	LDW-Imminent	4	Because the driver knew she was tired, and therefore depended on both systems more and knew they were there
14	CSW-Cautionary	1	Driver could not understand the warning; there was no curve
14	CSW-Cautionary	2	Not really useful, but because it went off , it made driver more aware in general
14	CSW-Imminent	1	False warning
14	CSW-Imminent	1	False warning, no curve present
14	CSW-Imminent	1	False warning
16	LDW-Cautionary	2	Reminding the driver that he didn't use turn signal
16	LDW-Cautionary	2	Same reason as last one; driver waited for car in adjacent lane to pass before moving over; also, no car directly behind
16	LDW-Cautionary	2	As a reminder to use the turn signal
16	LDW-Imminent	2	It's possible that the driver was closer to crossing the line than he thought
16	LDW-Imminent	3	Driver did get too close to the line in that instance
16	LDW-Imminent	1	Didn't perceive himself as approaching the line
16	CSW-Cautionary	4	Driver knew he was taking the curve fast, and so it was an appropriate warning
16	CSW-Cautionary	1	There is no curve present; FALSE
16	CSW-Cautionary	1	FALSE warning

16	CSW-Imminent	1	Wasn't much of a curve, and it was pretty far ahead
16	CSW-Imminent	1	Wasn't much of a curve; inappropriate warning
16	CSW-Imminent	2	If he had been thinking about taking the exit ramp, it might have been useful
17	LDW-Cautionary	4	Should have remembered to use turn signal when shifting to avoid object
17	LDW-Cautionary	3	Wasn't using turn signal when changing lanes
17	LDW-Imminent	5	Was changing lanes and if she wasn't paying attention, could have crashed into the wall
17	LDW-Imminent	2	Wasn't paying attention and drifted slightly
17	LDW-Imminent	3	Knew the barrels were there, and was aware that she was into the next lane.
17	CSW-Cautionary	1	Reacting to turn-around in the road
17	CSW-Cautionary	3	If she wasn't familiar with the road, it would have been very useful
17	CSW-Imminent	3	Driver is aware of the turn-around in the road and was going to take it
17	CSW-Imminent	3	Same as last
17	CSW-Imminent	5	Wasn't familiar with that part of the road
19	LDW-Cautionary	3	Lane change w/o signal, but no one around (i.e. wasn't going to crash, but wasn't the right thing to do)
19	LDW-Cautionary	3	Making a lane change, again same as last warning
19	LDW-Imminent	1	It wasn't necessary; didn't perceive any drifting
19	LDW-Imminent	4	Noticed that she was drifting, and had sensitivity high
19	LDW-Imminent	2	Might have been drifting a bit, but there was no danger there
19	CSW-Cautionary	2	Was familiar with the ramp, and was already slowing down
19	CSW-Cautionary	1	No curve present; going the same speed as car ahead
19	CSW-Cautionary	2	Had foot on the brake and was familiar with curve
19	CSW-Imminent	1	FALSE warning (Gale Rd.)
19	CSW-Imminent	2	Going the same speed as cars ahead; probably familiar with the curve
19	CSW-Imminent	2	Wasn’t completely useless; but didn't really see a curve and doesn’t remember having to slow down much
20	LDW-Cautionary	5	It let me know that I was drifting out of my lane
20	LDW-Cautionary	5	It let me know that I was drifting out of my lane
20	LDW-Imminent	5	I'm drifting out of my lane
20	LDW-Imminent	5	I'm drifting out of my lane
20	LDW-Imminent	5	I'm drifting out of my lane
20	CSW-Cautionary	5	Going too fast for the curve
20	CSW-Cautionary	5	Going too fast for the curve
20	CSW-Cautionary	5	Going too fast for the curve
20	CSW-Imminent	5	Going too fast for the curve
20	CSW-Cautionary	5	I went over without a signal
21	LDW-Cautionary	5	In light to moderate traffic, drifting while adjusting the radio
21	LDW-Cautionary	5	Talking on the phone; in heavy traffic; no turn signal
21	LDW-Imminent	2	Made him aware he was coming off the ramp early onto the freeway

21	LDW-Imminent	1	This was a curve, and he would expect a CSW, but no LDW because one needs maneuvering room
21	CSW-Cautionary	4	Posted speed was 25 mph, and was going 42. A little earlier would have been better
21	CSW-Cautionary	3	Should have been a LDW as opposed to CSW, curve wasn't that sharp
21	CSW-Cautionary	4	Because it is a severe curve, and driver was taking it too fast
21	CSW-Imminent	1	Way too late
21	CSW-Imminent	4	There's cars merging, and you have to slow down while looking at other cars
21	CSW-Imminent	3	Was looking at traffic on freeway, and CSW reminded him about the curve still on the entrance ramp
22	LDW-Cautionary	5	I don't know if I was using my turn signal
22	LDW-Cautionary	5	Bad weather
22	LDW-Cautionary	5	I think I was getting over due to the construction machinery. I may not have put on my turn signal
22	LDW-Imminent	1	I wasn't going anywhere, I wasn't drifting
22	LDW-Imminent	3	I was getting off the freeway and needed to get into left lane; I didn't use my turn signal
22	LDW-Imminent	2	I don't think I was doing anything
22	CSW-Cautionary	5	It was a curve and I needed to slow down
22	CSW-Cautionary	5	The curve and I was not going as slowly as I should have
22	CSW-Cautionary	1	There was no curve
22	CSW-Imminent	1	No curve
22	CSW-Imminent	5	There was a curve that I needed to slow down on
22	CSW-Imminent	5	There was a curve and I insisted that I was going to keep going. I needed the "curve, curve" to slow down
23	LDW-Cautionary	1	Because she was going to do it anyways (avoid the bicyclist in the road)
23	LDW-Cautionary	5	Because she was on the phone and "lane wandering" when the warning went off
23	LDW-Cautionary	5	Made a lane change w/o using turn signal
23	LDW-Imminent	4	Because it brought her attention to something that she could improve about her driving
23	LDW-Imminent	5	If she was drifting to the right, then it was useful to get the warnings
23	LDW-Imminent	5	Because it made her take corrective action and correct her lane position
23	CSW-Cautionary	3	Didn't understand this particular warning
23	CSW-Cautionary	5	Made her realize how tired she was
23	CSW-Cautionary	2	Didn't understand the warning, so she didn't take any corrective action
23	CSW-Imminent	1	Don't know why it went off, not in a curve
23	CSW-Imminent	1	Because she didn't know how to correct it
24	LDW-Cautionary	2	Made a lane change w/o signal; driver was aware of what he was doing, but still a little useful for the system to warn
24	LDW-Cautionary	1	Didn't perceive that he was drifted; driver ignored warning
24	LDW-Cautionary	1	Normal driving; If anything he took the curve a little too wide
24	LDW-Imminent	1	Was still within the lane
24	LDW-Imminent	1	Traffic was forced to cross line boundaries because of construction
24	LDW-Imminent	1	Driver could not tell why it was going off

24	CSW-Cautionary	3	Made the driver unconsciously aware of slowing down for the curve
24	CSW-Cautionary	3	Driver compensated for the warning by slowing down, but the warning could have come earlier
24	CSW-Cautionary	1	Because there was no curve present
24	CSW-Imminent	2	Probably reduced his speed coming up to the curve
24	CSW-Imminent	2	Same curve as last except this was at night; same rating as last event
24	CSW-Imminent	2	Probably slightly reduced his speed because of the warning, but was already almost through it
25	LDW-Cautionary	4	Changed lanes w/o using signal. If you're not using turn signal, you should be
25	LDW-Cautionary	4	Anytime it goes off it's useful; this situation was the same as the last warning
25	LDW-Imminent	4	Driver wasn't drifting, but the warning makes the driver more aware in general
25	LDW-Imminent	3	Didn't feel like she was doing anything wrong, but still made her more aware
25	LDW-Imminent	4	Truck was drifting close to her, and she was close to a barrier to the right
25	CSW-Cautionary	2	It was reacting to the exit ramp
25	CSW-Cautionary	4	Let her know that she may have been going too fast on the entrance ramp
25	CSW-Imminent	2	Not sure what it reacting to, but it makes the driver generally more aware of the driving situation
25	CSW-Imminent	2	Because of the exit ramp, but again, it makes the driver more aware
25	CSW-Imminent	4	Probably going a bit too fast, but is used to the curve and was going to slow down
26	LDW-Cautionary	4	Didn't use the turn signal, and was aware of that, but it was still useful to have gone off
26	LDW-Imminent	3	Assume that she did use the turn signal, but she may have done it late
26	LDW-Imminent	5	Was drifting over the line while talking, and the LDW made her more aware of that
26	LDW-Imminent	5	Was messing with the radio, which distracted her from the road
26	CSW-Cautionary	2	Knows the road well and always has foot on the gas, so it doesn't matter much if it goes off
26	CSW-Cautionary	4	That curve is one where you're supposed to slow down, and she didn't at all
26	CSW-Cautionary	1	Driver was aware of the drifting situation at that point
26	CSW-Imminent	1	Driver didn't think that she did anything wrong on that curve, and the warning came early
27	LDW-Cautionary	2	By the time it went off, he was already changing lanes, but if it went off, he wasn't using his turn signal
27	LDW-Cautionary	3	The driver ahead was going too slow, and the driver was changing lanes to pass
27	LDW-Imminent	5	Driver was looking down to change the radio
27	LDW-Imminent	3	Already making a maneuver to change lanes, but didn't use turn signal
27	LDW-Imminent	4	Was drifting to the right and could have run off the road. Caught the drifting, but maybe only because of alert
27	CSW-Cautionary	1	Because he wasn't going on the curve, and didn't need to know it was there
27	CSW-Cautionary	5	Was on the curve, and was going too fast
27	CSW-Imminent	5	Was probably speeding
28	LDW-Cautionary	5	It was useful to the extent that he wasn't using his turn signal
28	LDW-Cautionary	5	Same reason as the last
28	LDW-Imminent	3	Warning indicated that he "clipped the corner too fast"
28	CSW-Cautionary	5	On the way to see a client, and was going too fast around the curve
28	CSW-Cautionary	4	Knew he was speeding to enter the ramp, but he was purposely maneuvering to get ahead of a truck

28	CSW-Cautionary	3	Van behind him was speeding and causing him to speed up himself
28	CSW-Imminent	1	Going straight past exit ramp
28	CSW-Imminent	5	Mind on other things and was probably driving too fast
28	CSW-Imminent	3	At that point, he knew it was going to go off
29	LDW-Cautionary	5	Looked a little sleepy, but aware of driving situation and didn't use signal
29	LDW-Cautionary	5	As driver was looking over shoulder, she was drifting
29	LDW-Cautionary	4	Because driver didn't use turn signal
29	LDW-Imminent	5	Didn't use signal as merging
29	LDW-Imminent	5	Because she was "chit-chatting" and drifting to the left
29	LDW-Imminent	5	There's another lane and the LDW prevented her from drifting into it
29	CSW-Cautionary	2	Wouldn't be necessary but any warnings are good to keep you on your toes
29	CSW-Cautionary	1	Because she didn't need it (Michigan Left)
29	CSW-Cautionary	5	Going too fast for curve
29	CSW-Imminent	1	Because there was no curve present
29	CSW-Imminent	5	Going too fast for curve
29	CSW-Imminent	1	No curve present
30	LDW-Cautionary	2	Staying away from parked car (on the right), and there were no cars around, but warning made her more aware of checking for other cars
30	LDW-Cautionary	2	Doesn't seem like she was drifting, but it was late at night and the system made the driver more aware
30	LDW-Imminent	5	With a car in the left lane, the system was useful; face video shows driver frustrated w/ herself for "setting it off"
30	LDW-Imminent	2	With the rain, she would have stayed away from the trucks
30	LDW-Imminent	2	Heavy traffic; but the driver was aware of driving situation
30	CSW-Cautionary	5	Was going too fast for the curve on exit ramp
30	CSW-Cautionary	1	Didn't understand why it was going off
30	CSW-Imminent	4	Drew attention to the curve, but doesn't feel like she was going particularly fast
30	CSW-Imminent	1	Doesn't seem like there's any curve present
30	CSW-Imminent	5	Pretty bad curve; so if she was going too fast, it would have been very useful
31	LDW-Cautionary	1	Would have checked traffic around him while making lane change
31	LDW-Cautionary	3	Distracted on cell phone while changing lanes
31	LDW-Cautionary	1	Probably just changing lanes w/o signal and was aware of traffic situation
31	LDW-Imminent	2	There was no one in the lane that he was drifting into
31	LDW-Imminent	2	Getting over from the semi that was in the right lane, and system made him aware of drifting to left
31	CSW-Cautionary	2	Esp. w/ rainy conditions
31	CSW-Cautionary	3	He's on the phone, and there were some distractions involved
31	CSW-Cautionary	1	On straight road. No curve present
31	CSW-Imminent	3	Because it was a curve, but he was familiar w/ the road
31	CSW-Imminent	1	False warning; was not going to take the exit ramp

32	LDW-Cautionary	2	Was passing the car in front, and it didn't really help much
32	LDW-Cautionary	2	The system made you aware, but it would go off when not drifting
32	LDW-Imminent	1	Car was passing on the left, and he wasn't drifting
32	LDW-Imminent	1	Was not drifting
32	LDW-Imminent	2	The system made him aware, and that's the only reason it was useful
32	CSW-Cautionary	1	No danger coming; was not going too fast
32	CSW-Cautionary	1	It was reacting to the curve, but it was not needed
32	CSW-Imminent	1	There was no curve there
32	CSW-Imminent	1	Didn’t change driving at all in response to warning
32	CSW-Imminent	1	Didn’t need the warning
33	LDW-Cautionary	3	If there happened to be a car behind her, and she didn't use her turn signal, the it would have been useful
33	LDW-Cautionary	4	Because it's a 2 lane road, and if there was a car in the next lane, it would have been useful to get the warning
33	LDW-Cautionary	4	There was a car in the lane she was drifting into
33	LDW-Imminent	3	On a two-lane highway, if there was a car next to her
33	LDW-Imminent	4	There were cars in the lane next to her, and she was drifting
33	LDW-Imminent	3	Wasn't watching where she was going, and started to drift
33	CSW-Cautionary	2	Entering that particular curve, there was no need to slow down
33	CSW-Cautionary	4	There was a car in front of her, and she didn't know what was ahead.
33	CSW-Cautionary	3	There was a car on the side of her, and if she was speeding up, she might hit it
33	CSW-Imminent	2	There's no curve up ahead
33	CSW-Imminent	3	Because she was on a curve and probably going faster than she needed to
33	CSW-Imminent	1	Because there's no curve ahead
34	LDW-Cautionary	3	Made me more alert of where I was in my lane
34	LDW-Cautionary	2	Pretty aware just didn't put signal on
34	LDW-Imminent	2	understood why it was going off
34	LDW-Imminent	4	Made me alert that I was drifting, pretty sunshiny out
34	LDW-Imminent	4	Looked like if I hadn’t been alerted it would have been not so good a situation
34	CSW-Cautionary	4	Hair in my face, helpful letting me know curve was coming up
34	CSW-Cautionary	2	More of a turn than a curve. Made me more alert of where I was on the road
34	CSW-Cautionary	2	Wasn't that useful at that time, stopped before curve
34	CSW-Imminent	4	made her aware curve was coming up, helped at night when it was dark
34	CSW-Imminent	5	Looked like I was going fast, that curve comes up fast. Helpful, made me aware I was going fast and curve was coming up
34	CSW-Imminent	4	That curve is tricky, it comes up fast. Made me aware to slow down
35	LDW-Cautionary	2	To make the driver more aware of using turn signal
35	LDW-Cautionary	2	Getting out of the way of the car in the right shoulder, but probably should have used turn signal
35	LDW-Cautionary	4	Distracted in the car, and took his eyes off the road

35	LDW-Imminent	2	Think he drifted over a little bit. Driver was aware of situation
35	LDW-Imminent	3	Must have obviously went over the middle line
35	LDW-Imminent	3	Getting ready to drift off the road, and system prevented it
35	CSW-Cautionary	1	Driver's intention was to change lanes and not to take the exit ramp
35	CSW-Cautionary	2	If he was choosing to go right, then it would have been a useful warning to have
35	CSW-Cautionary	4	Was coming into the curve too fast, and it was a bad curve
35	CSW-Imminent	3	It's a pretty good curve in the road, and it gives the driver some caution; probably a little late
35	CSW-Imminent	3	Traveling at night, approaching a curve; system provided a precaution
35	CSW-Imminent	3	To provide a precaution, even though he was familiar
36	LDW-Cautionary	5	Made driver think ("I didn't put my blinker on")
36	LDW-Cautionary	4	It would let the driver know to move away from the lines
36	LDW-Imminent	4	When she heard the tone, she knew to get over
36	LDW-Imminent	5	Even when she was stressed, it made her conscious of how she was driving
36	LDW-Imminent	4	Felt the same about this warning as all others
36	CSW-Cautionary	3	Hard to say whether it was really useful because there were signs, and driver was aware
36	CSW-Cautionary	3	Driver saw the curve and was aware
36	CSW-Imminent	4	Made her more aware
36	CSW-Imminent	1	False warning
36	CSW-Imminent	1	False warning, no curve
37	LDW-Cautionary	4	Lanes were not too wide because of construction, and it made him aware of needing to pay attention
37	LDW-Cautionary	4	Even though he was aware, it reminded him that he should use the turn signal
37	LDW-Cautionary	4	He was drifting toward the exit ramp
37	LDW-Imminent	3	Had cruise on, and was aware of the timing of passing in mind, but failed to use the turn signal
37	LDW-Imminent	3	If someone wasn't aware of the surroundings, then it would be helpful, but the traffic was purposely directed to the left
37	LDW-Imminent	4	Road was extremely narrow, and the warning was helpful
37	CSW-Cautionary	3	Deliberately drove hard into the curve, so he knew that a warning should happen
37	CSW-Cautionary	5	Because there was a situation ahead that you need to be aware of (esp. at night)
37	CSW-Cautionary	1	It thought he was taking the exit, even though he wasn't
37	CSW-Imminent	5	Came into the curve hard, traffic was heavy, and it was a short distance going into the curve
37	CSW-Imminent	4	Was aware of the "Michigan left" and had to go into it fast, so it was useful
37	CSW-Imminent	1	There was no curve; it was a false warning and he couldn't see why it went off
38	LDW-Cautionary	5	With the construction truck in the right lane, she knew she should have used turn signal
38	LDW-Cautionary	5	Obviously should have used turn signal
38	LDW-Cautionary	5	Driver was drifting, and warning was discipline to stay in the lane
38	LDW-Imminent	5	Obviously something was distracting, probably not drifting
38	LDW-Imminent	5	Did not know she was drifting, and the warning made he aware

38	CSW-Cautionary	5	Going over speed limit
38	CSW-Cautionary	3	Can't remember speeding into that curve
38	CSW-Cautionary	2	Didn't see any curve, but did notice the overpass
38	CSW-Imminent	5	Was coming off freeway too fast
38	CSW-Imminent	1	There was no curve
38	CSW-Imminent	1	No curve present. Overpass
39	LDW-Cautionary	2	Switching lanes and not using turn signal
39	LDW-Cautionary	2	Was paying attention, but if he wasn't paying attention, the warning would have mad him look up
39	LDW-Cautionary	3	He might have been drifting a little, but not very much
39	LDW-Imminent	1	The left turn lane is what caused the warning, and he was avoiding the vehicle in front
39	LDW-Imminent	2	Didn't change his driving path that much in response to warning
39	LDW-Imminent	4	Was checking rear-view mirror when the warning went off, and it caused him to correct position
39	CSW-Cautionary	2	Driver knows the drive pretty well, but the warning may have slowed him down
39	CSW-Cautionary	2	Sees the face video reaction that the warning caused him to look forward
39	CSW-Cautionary	2	Warning didn’t cause the driver to change his driving at all
39	CSW-Imminent	3	Was paying attention, but not completely, and the warning caused him to pay better attention
39	CSW-Imminent	1	Driver was passing a Michigan left
39	CSW-Imminent	2	Was getting off the freeway and probably going a bit too fast
40	LDW-Cautionary	4	Probably didn't have the turn signal
40	LDW-Cautionary	5	Increased awareness
40	LDW-Cautionary	2	The rough pavement caused a warning, and wasn't drifting kept her aware of her surroundings
40	LDW-Imminent	4	Got too close to the white line, and was talking to her sister and not paying too much attention
40	LDW-Imminent	5	Taken her eyes off the road, and might have caused an accident if it hadn't gone off
40	LDW-Imminent	4	Forgot to turn the turn signal on, made her more aware
40	CSW-Cautionary	5	Made her slow down for the exit ramp
40	CSW-Cautionary	4	Because it made her slow down, even though she wasn't going very fast
40	CSW-Cautionary	1	There was no reason for it to go off
40	CSW-Imminent	1	Didn't think she was going that fast, and didn't think it was necessary
40	CSW-Imminent	1	Curve she was taking was a gentle curve, and was probably reacting to the other curve to the right
40	CSW-Imminent	1	It went off falsely, not going around a curve
41	LDW-Cautionary	4	Because it reinforces the use of the turn signal by increasing awareness
41	LDW-Cautionary	5	In that situation, it warned to the right, and there were construction barrels there, and LDW made the driver more aware of them
41	LDW-Imminent	5	Looks like he was distracted from the road when the warning happened
41	LDW-Imminent	3	It didn't seem like he was drifting, but the presence of construction barrels made it seem useful
41	LDW-Imminent	2	The road is a narrow road that’s he's familiar with, so the warning was not all that useful, buts its always good to have a reminder

41	CSW-Cautionary	1	The exit ramp was the only curve present, which he wasn't taking
41	CSW-Cautionary	1	Familiar with the road, and his eyes were on the road, so it wasn't useful
41	CSW-Imminent	2	A very sharp curve, but he's very familiar with that road
41	CSW-Imminent	3	Because of the particular condition (with an exit and a curve) it was somewhat useful
41	CSW-Imminent	1	No curve present
42	LDW-Cautionary	1	Forgot to use turn signal as he was exiting construction
42	LDW-Imminent	3	In the construction zone, and warning may have prevented drifting into barrels or shoulder
42	LDW-Imminent	1	Not sure why it went off
42	LDW-Imminent	4	Wasn't looking at the road
42	LDW-Imminent	1	In a curve and the tire was touching the line, no risk
42	CSW-Cautionary	1	The entrance ramp wasn't particularly sharp, and he was familiar with it
42	CSW-Cautionary	1	Same rating as last warning
42	CSW-Cautionary	1	Pulling into a parking lot that he's familiar with
42	CSW-Imminent	1	Didn't feel he was going too fast; was on an exit ramp
42	CSW-Imminent	1	Was making a turn onto 12 mile. Was of no value
42	CSW-Imminent	1	On the entrance ramp; same as the last warning
43	LDW-Cautionary	1	Thought that the overpass caused the warning
43	LDW-Cautionary	1	Same as last warning; thought it was a malfunction
43	LDW-Cautionary	1	He was driving fine; no reason for it to go off
43	LDW-Imminent	1	By the expression on his face; and it didn't make the driver change his driving (may have been getting close to the line)
43	LDW-Imminent	1	Not really necessary; aware of what he was doing
43	LDW-Imminent	1	Again, driving along and it went off for no reason
43	CSW-Cautionary	1	Went off when it didn't need to go off
43	CSW-Cautionary	1	Didn't see any need for it to go off
43	CSW-Cautionary	1	Didn't see any need for the warning
43	CSW-Imminent	1	No reason for it to go off; traveling at a safe speed and he was a ways from the curve
43	CSW-Imminent	1	Again, it went off and it didn't need to
43	CSW-Imminent	1	No apparent reason for it; he was reacting to the overpass
44	LDW-Cautionary	5	This was at night and it's harder to focus; was drifting to the left, and on a major road
44	LDW-Cautionary	4	Thinks she was unconsciously avoiding the barrels to the left, and was drifting
44	LDW-Imminent	3	Was in an area of traffic where she gets a little anxious because the traffic is going fast, with slow oncoming traffic
44	LDW-Imminent	3	Not too many cars around, but is warning about avoiding the curb
44	LDW-Imminent	5	On the cell phone and was drifting
44	CSW-Cautionary	3	Thinks she was tired and there was a big curve coming up
44	CSW-Cautionary	3	There was an exit sign clearly visible

44	CSW-Imminent	2	It was telling her there was a curve to the left, but the warning was unneeded because she wasn't going there
44	CSW-Imminent	2	Received a cautionary warning first, and that would have been sufficient; no imminent needed
44	CSW-Imminent	1	Doesn't see any curve worth warning about, and wasn't taking the exit ramp
46	LDW-Cautionary	4	Maybe potential threat caused glance
46	LDW-Cautionary	4	No threat of danger, kept him aware, may not have used it
46	LDW-Cautionary	4	makes you double check
46	LDW-Imminent	4	Made him look around again, "that's useful"
46	LDW-Imminent	5	Dangerous spot, telegraph onto I-75
46	LDW-Imminent	4	makes you double check
46	CSW-Cautionary	4	always double checking, making sure
46	CSW-Cautionary	4	be aware of your speed in the curve
46	CSW-Cautionary	4	Quite a few curves in this area, speed gets reduced (M-275 > M-5)
46	CSW-Imminent	1	False warning
46	CSW-Imminent	4	If I was going too fast for the curve, it made me slow down
46	CSW-Imminent	1	Wasn't necessary, wasn't going into a curve
47	LDW-Cautionary	5	On telephone, driving with one hand, drifting slightly
47	LDW-Cautionary	1	I didn't see me go into another lane
47	LDW-Cautionary	4	Turning on the heat, doing 2 things at once, "let me know I was drifting"
47	LDW-Imminent	1	Raining, doesn't act right, went off for no reason
47	LDW-Imminent	4	did see myself going off into should
47	LDW-Imminent	5	trying to eat and drive
47	CSW-Cautionary	5	I know that curve, tend to not slow down till last minute
47	CSW-Cautionary	1	wasn't going around curve at all
47	CSW-Cautionary	5	talking on telephone, tend to not pay attention
47	CSW-Imminent	5	Curve is rather steep, friends in car cause talking, laughing
47	CSW-Imminent	5	Another steep curve, drift caused by high speed, maybe tired
47	CSW-Imminent	1	wasn't going around curve at all (passing exit ramp)
48	LDW-Cautionary	2	Nothing coming the other way, and had to get over, so it wasn't incredibly
48	LDW-Cautionary	4	Tend to hug the center in a situation like that, and it's good to know that you're hugging the line
48	LDW-Cautionary	4	Lane chance w/o signal; should have used signal
48	LDW-Imminent	4	Was avoiding the truck, and hugging the line, but makes you aware
48	LDW-Imminent	4	Wasn’t paying as much attention as he should have
48	LDW-Imminent	4	Lanes were narrow and it keeps you more alert
48	CSW-Cautionary	4	Going 60 mph around that curve was too fast, and it went off at an appropriate time
48	CSW-Cautionary	1	Passing an exit ramp
48	CSW-Cautionary	2	Familiar with that curve, and it was useful in this instance, curve wasn't that sharp
48	CSW-Imminent	1	Was in the middle of curve when it went off

48	CSW-Imminent	1	Passing an exit ramp; not taking the curve
48	CSW-Imminent	1	Very, very slight curve
49	LDW-Cautionary	5	Taking eyes off the road, and was drifting
49	LDW-Cautionary	5	Changed lanes w/o signal
49	LDW-Imminent	5	Vehicle in the adjacent lane, and he was drifting
49	LDW-Imminent	5	Beck Rd. is only 2 lane road, and he might have gone into oncoming lane
49	LDW-Imminent	5	Noticed that he was looking to the right, and was drifting
49	CSW-Cautionary	3	Travel that route all the time and didn't feel like he was going too fast
49	CSW-Cautionary	5	Didn't think he was going too fast, but system increased awareness
49	CSW-Cautionary	5	Made him more aware of the situation, esp. merging traffic
49	CSW-Imminent	5	Curvature increases as the road goes, so it was useful because even though speed was appropriate, road gets more curvy
49	CSW-Imminent	5	Curve is almost a circle, and you need to slow down a lot
49	CSW-Imminent	4	Made him more alert, but wasn't sure why it was going off
50	LDW-Cautionary	3	Made her more alert as to what's going on around her
50	LDW-Cautionary	5	Because you should put signals on when changing lanes
50	LDW-Cautionary	5	Should have put blinker on
50	LDW-Imminent	5	Safety, keeps her more alert
50	LDW-Imminent	5	Very narrow and dangerous road
50	LDW-Imminent	5	Busy highway, and should have been more aware
50	CSW-Cautionary	3	Wasn't that big of a curve, and wasn't going that fast
50	CSW-Cautionary	3	Because she knew she wasn't speeding but it kept her aware of what was going on
50	CSW-Cautionary	3	Because she was tired and on the way home from work
50	CSW-Imminent	3	Makes you aware of what's going on
50	CSW-Imminent	3	Keeps you on your toes, but not a big curve
50	CSW-Imminent	3	Kept her awake and aware
53	LDW-Cautionary	3	It indicated that he wasn't using his turn signal. Driver was on the phone as well, so it was particularly useful there
53	LDW-Cautionary	4	Nighttime and driver was aware, but it was still useful as a confirmation of changing lanes
53	LDW-Cautionary	3	Same reasons as last two warnings
53	LDW-Imminent	4	Warning about lack of attention, and driver was drifting
53	LDW-Imminent	5	Looks like he was over the line, and from his expression, he didn’t look all that alert
53	LDW-Imminent	3	Was moving over because of truck in oncoming lane, and the warning was accurate
53	CSW-Cautionary	5	Was warning about the exit ramp, and it was useful even though he wasn’t taking the ramp
53	CSW-Cautionary	3	He's sure he slowed down, but he must have still been going too fast
53	CSW-Cautionary	2	Driver generally likes warnings, but this one was early and not particularly useful in warning about speed
53	CSW-Imminent	1	Didn't see curve present

53	CSW-Imminent	4	Was veering toward the curve
53	CSW-Imminent	1	Nothing on the road, no curve, makes him question the system
54	LDW-Imminent	4	Her mind was probably on something else, and she was drifting to the right
54	LDW-Imminent	1	Didn't pay attention to the warning; was just going to go in the other lane purposely
54	LDW-Imminent	1	Same answer as last warning; this one was only a few seconds later
54	LDW-Imminent	4	She tends to ride the outside line anyway, but the warning was saying "hey, you're at the edge"
55	LDW-Cautionary	4	on cell phone
55	LDW-Cautionary	1	lateral move to the right, warning on left side
55	LDW-Cautionary	2	for the most part, stayed centered in the lane, ran into a lot of problems that day
55	LDW-Imminent	3	because even though no lane dev., there was a large obstacle in the left lane
55	LDW-Imminent	4	primarily because it was late at night
55	LDW-Imminent	1	pretty much staying straight, ignoring most warnings at that point
55	CSW-Cautionary	1	not much of a curve
55	CSW-Cautionary	1	on an off ramp, already decelerating
55	CSW-Cautionary	1	no curve
55	CSW-Imminent	1	not that sharp of a curve
55	CSW-Imminent	3	because driver has a tendency to enter specific ramp a little fast
55	CSW-Imminent	3	same reason as above
56	LDW-Cautionary	3	She was rushing, and not aware of drifting, but there was no real crash threat
56	LDW-Cautionary	3	At that point, it didn't prevent an accident, but it reminds you of staying in the lane
56	LDW-Cautionary	4	Particularly at night it's useful, and it's useful as a reminder
56	LDW-Imminent	4	Not going to be a collision, but generally made her more aware
56	LDW-Imminent	4	Trying to get over because of lane merge, but no collision was imminent
56	LDW-Imminent	4	You could always hit things on the side of the road, and she stays over to the side when a truck is in the next lane
56	CSW-Cautionary	4	Speed limit is 25 and she was rushing, and it was a sharp curve, though probably didn't prevent a collision
56	CSW-Cautionary	4	Says " you better slow down" and there wasn't a time when there was going to be a collision
56	CSW-Cautionary	3	Need to be cautious, but no chance of a collision
56	CSW-Imminent	4	Not a lot of traffic, but a curvy road
56	CSW-Imminent	3	No imminent collision, but it makes you be careful and slow down
56	CSW-Imminent	4	More useful at night because it's hard to see curves, an same reasons as first imminent CSW
58	LDW-Cautionary	2	Knew what I was doing, didn't signal fast enough, did indicate you should use signal
58	LDW-Cautionary	1	False Warning
58	LDW-Imminent	4	Talking on phone, tight space between rail and truck, made him more aware
58	LDW-Imminent	1	Still within the lines
58	LDW-Imminent	1	Messing around with friend in passing car
58	LDW-Imminent	4	reminded to use turn signal

58	CSW-Cautionary	1	didn’t think he was going too fast
58	CSW-Cautionary	1	Very slight curve
58	CSW-Cautionary	3	on ramp sharper than it lets on
58	CSW-Imminent	1	Thought it was an error
58	CSW-Imminent	3	Something needs to help me slow down for that curve
59	LDW-Cautionary	4	Talking on phone, wasn't paying as much attention as I should have
59	LDW-Cautionary	1	I think I wasn't using signal
59	LDW-Cautionary	1	didn't look like I was drifting
59	LDW-Imminent	3	Think that it brought my attention to the road
59	LDW-Imminent	4	Talking on phone, drifting over
59	CSW-Cautionary	2	Brought my attention
59	CSW-Cautionary	4	probably taking curve too fast, sharp curve
59	CSW-Cautionary	3	probably needed to slow down a little bit
59	CSW-Imminent	2	probably taking it a little too fast
59	CSW-Imminent	1	False warning
59	CSW-Imminent	1	Thought I was slowing down, didn't need to slow down more
60	LDW-Cautionary	1	really wasn’t that far, wouldn’t put me in any danger
60	LDW-Cautionary	1	Because I didn't use a signal and knew it
60	LDW-Imminent	1	I didn't even touch the line
60	LDW-Imminent	2	must have been doing something
60	LDW-Imminent	3	Because if there is a car, and I wanted to change lanes, it's good to know
60	LDW-Imminent	1	I don’t see where I was drifting
60	CSW-Cautionary	2	Because I was going too fast
60	CSW-Cautionary	2	Because I was speeding
60	CSW-Cautionary	2	I was going too fast
60	CSW-Cautionary	1	I wasn't going too fast
60	CSW-Imminent	2	I was probably going way too fast
60	CSW-Imminent	1	Because I wasn't taking the curve, it sensed the exit (being passed)
61	LDW-Cautionary	5	Probably didn’t use the blinker as she was changing lanes
61	LDW-Cautionary	5	Because she was distracted and hugging the right side of the lane
61	LDW-Cautionary	3	Because she could have run off the road. Would probably have not run off the road
61	LDW-Imminent	5	She was really over to the right
61	LDW-Imminent	4	She could see where she was going over the line
61	LDW-Imminent	4	Because she was drifting to the right, but not getting over to the exit
61	CSW-Cautionary	5	Because it's a winding road. Warning timing was better than some, but still a little late
61	CSW-Cautionary	2	Was in the middle of a curve, so it was not all that useful
61	CSW-Cautionary	1	Don't see a curve, was already past it

61	CSW-Imminent	4	Warning still a little late, but not too bad
61	CSW-Imminent	1	Was already in the curve
61	CSW-Imminent	3	Imminent Warning was not early enough
62	LDW-Cautionary	3	Anytime it went off it went off for a reason, made you more aware
62	LDW-Cautionary	2	If it went off there was some helpfulness
62	LDW-Cautionary	3	No blinker
62	LDW-Imminent	4	Made her look up
62	LDW-Imminent	2	Didn't put blinker on, didn’t see car near me
62	LDW-Imminent	2	Makes you aware
62	CSW-Cautionary	5	I know it can be useful to have it on that particular curve
62	CSW-Cautionary	2	Couldn't figure out why it went off, made her aware
62	CSW-Cautionary	2	Didn't think I was going fast, not a deep curve
62	CSW-Imminent	4	Curve she knows is a deep curve
62	CSW-Imminent	4	If it was unfamiliar it would have been useful
62	CSW-Imminent	1	Reading an off ramp, straight as can be
63	LDW-Cautionary	5	Because I was drifting, wasn't alert enough
63	LDW-Cautionary	5	Got your attention
63	LDW-Cautionary	5	Got him back in his lane
63	LDW-Imminent	5	Makes you get back in your lane
63	LDW-Imminent	5	Still alerts you
63	CSW-Cautionary	2	Already going slow enough
63	CSW-Cautionary	4	Probably got him to slow down to speed limit
63	CSW-Cautionary	5	Should have been doing 25
63	CSW-Imminent	3	Knew he wasn't going that fast
63	CSW-Imminent	3	Getting on highway
64	LDW-Cautionary	1	No car in front of her
64	LDW-Cautionary	1	Don't think I was drifting enough
64	LDW-Cautionary	1	Don't think it helped
64	LDW-Imminent	1	Narrow lane
64	LDW-Imminent	1	Didn't think it helped her
64	CSW-Cautionary	1	Wasn't a curve
64	CSW-Cautionary	1	Familiar w/ curve
64	CSW-Cautionary	1	I know when a curve is coming, don’t need something telling me
64	CSW-Imminent	1	No Curve
64	CSW-Imminent	1	Slowed down anyways, short on-ramp onto I-75
64	CSW-Imminent	1	Slowed down, not as much as system though she should have
66	LDW-Imminent	4	It's a curvy, windy road and it helps you stay in the lane

66	LDW-Imminent	4	I was on the phone, it reminds you to keep your eyes on the road
66	LDW-Imminent	2	I was driving more to the left because the right edge line was icy. The middle was dry and no cars were coming in the opposite direction
66	LDW-Imminent	5	There was oncoming traffic
66	LDW-Imminent	5	It's raining. I'm on the phone and there's on-coming traffic. System made me aware of what's going on around me
66	CSW-Cautionary	3	Sharp curve, I was going straight. Need to slow down to make sure no on-coming traffic is coming
66	CSW-Cautionary	5	I don't travel that road much
66	CSW-Cautionary	5	This curve is rated 15 mph and I don't travel it as much
66	CSW-Imminent	4	It was raining and you need to be extra careful
66	CSW-Imminent	4	I don't travel that road all the time and there was a curve coming up
67	LDW-Cautionary	5	It got my attention to evaluate my surroundings
67	LDW-Cautionary	5	I was changing lanes w/o my turn signal
67	LDW-Cautionary	4	There was traffic and I was chatting. I was changing lanes w/o my turn signal
67	LDW-Imminent	5	I'm getting into center lane to make a left w/o turn signal
67	LDW-Imminent	5	I crossed 2 lanes w/o a turn signal
67	LDW-Imminent	5	Lane change w/o a turn signal
67	CSW-Cautionary	1	I was just preparing to turn into my subdivision. This is a problem area w/ this system. System doesn't understand that this isn't a curve
67	CSW-Cautionary	1	Michigan Left no need for a warning in this situation
67	CSW-Cautionary	1	Exact same location as previous warning
67	CSW-Imminent	1	Getting over to make a U turn. Well before the turn
68	LDW-Cautionary	4	Safety for other drivers if I'm leaving my lane
68	LDW-Cautionary	3	Changed lanes w/o turn signal
68	LDW-Cautionary	1	Didn't drift right
68	LDW-Imminent	5	Looking down when it happened
68	LDW-Imminent	2	Snow caused alert to go off
68	LDW-Imminent	4	Close to other car, no turn signal lane change
68	CSW-Cautionary	2	Car was under control, no need
68	CSW-Cautionary	4	Needed to slow down
68	CSW-Cautionary	4	Needed to slow down
68	CSW-Imminent	1	No curve
68	CSW-Imminent	4	Did need to slow down a little bit for the curve
68	CSW-Imminent	1	Wasn't making turn, not getting in lane to make U-turn
70	LDW-Cautionary	4	Noticed he moved out of lane
70	LDW-Cautionary	1	Knew what he was doing when he changed lanes
70	LDW-Imminent	1	Because I didn't look like I was going towards that way (no left drift)
70	LDW-Imminent	3	Made me aware I was moving into another lane

70	CSW-Cautionary	1	Because I was taking curve correctly, didn't need to slow down
70	CSW-Cautionary	4	Because it made me more aware of the curve and the speed I should have been going
70	CSW-Cautionary	1	Because of the fact that it wasn't a curve
70	CSW-Imminent	1	Because there was an opening and it thought I was going to turn
70	CSW-Imminent	4	Made me aware of the curve coming up
70	CSW-Imminent	1	There was no curve
71	LDW-Cautionary	5	Should have been paying attention to the road and not to the sky
71	LDW-Cautionary	5	Passengers were "tipsy" and she needed to pay more attention to the road
71	LDW-Cautionary	5	Made her more aware, and she moved over in response
71	CSW-Cautionary	2	Thought this was a LDW; and driver wasn't going around a curve, but system generally keeps you on your toes
71	CSW-Cautionary	1	False warning; This happened twice at the same location
71	CSW-Cautionary	1	Not going around any curve
71	CSW-Imminent	1	Unnecessary because she knows this curve well.
72	LDW-Cautionary	4	The two lanes were narrow and trucks were around in close proximity
72	LDW-Cautionary	3	It was warranted; he knew that he goofed up, and the warning helped prevent him from over-correcting
72	LDW-Imminent	4	Because he was thinking about something else, and warning helped bring attention back to the road
72	LDW-Imminent	3	In this situation (where lanes are "tight,") it helps you to refocus, although generally it warned too much in this scenario
72	LDW-Imminent	1	Didn’t feel like he was that close
72	CSW-Cautionary	2	Was not warranted; was going an adequate speed. It does "re-point" you though
72	CSW-Cautionary	5	He knew he was making a quick change of direction, but didn't think about how fast he was going
72	CSW-Imminent	1	Totally wrong, False warning
72	CSW-Imminent	1	Too far away and had plenty of time to slow down
72	CSW-Imminent	3	Could understand a warning here, but audible warning not warranted
73	LDW-Cautionary	4	A combination of wanting to go to a location and forgetting to turn on signal early enough
73	LDW-Cautionary	3	No real danger, but a car was to the right
73	LDW-Imminent	4	More of a distracting warning, but he noticed he was drifting to the left
73	LDW-Imminent	5	There was a double center line, and he generally appreciated warnings that were about avoiding oncoming traffic
73	CSW-Cautionary	5	Probably not a familiar curve; a good warning
73	CSW-Cautionary	1	Familiar with this curve, and it was not necessary
73	CSW-Cautionary	3	Was a definite curve, probably slow him down
73	CSW-Imminent	2	This wasn't annoying because it didn’t happen often, but he did really find it necessary
73	CSW-Imminent	1	Familiar with this curve, and it was not necessary
73	CSW-Imminent	1	Familiar with this curve, and it was not necessary
74	LDW-Cautionary	3	Talking on phone and probably distracted, but was purposely avoiding the puddle
74	LDW-Cautionary	1	He didn’t feel like he was drifting; possibly caused by the way the cross walk was painted

74	LDW-Cautionary	2	Forced you to look at the road, but for the most part didn't know why it went off
74	LDW-Imminent	3	Understood why it went off, but was in control and aware of his surroundings
74	LDW-Imminent	4	Was distracted at the time, and was drifting; not necessary that it was imminent
74	LDW-Imminent	1	Because he's not clear why it went off, no reason for it
74	CSW-Cautionary	1	Went off many times here at the exit; he was also in the center lane
74	CSW-Cautionary	3	Because it is a sharp curve, even though he knew it was there
74	CSW-Cautionary	1	Because there was no curve anywhere near him
74	CSW-Imminent	1	No curve anywhere near him
74	CSW-Imminent	1	For same reasons as last one
74	CSW-Imminent	1	Same reasons as last two
75	LDW-Cautionary	4	Don't think he was going to hit the car next to him, but it was a good warning - he was drifting
75	LDW-Cautionary	3	Knew what he was doing, but forgot to use the turn signal
75	LDW-Cautionary	3	Same as last warning
75	LDW-Imminent	3	Wouldn't have put signal on anyway, but he crossed the line early
75	LDW-Imminent	4	This warning helped him pay attention more; was looking somewhere else
75	LDW-Imminent	4	He was aware of what he was doing; not turning signal on quick enough though
75	CSW-Cautionary	3	No curve. It was confusing, but it generally raised his awareness
75	CSW-Cautionary	3	Probably confusing; didn't think he was going too fast
75	CSW-Cautionary	3	Wondering why he got this warning. But it’s a caution
75	CSW-Imminent	3	Completely straight there
75	CSW-Imminent	3	Got a warning, but he doesn't know why
75	CSW-Imminent	4	Didn't perceive that he was going too fast, but there was a curve
76	LDW-Cautionary	5	Was on the cell phone, and thought these kinds of warnings were very useful
76	LDW-Cautionary	5	Glad he got a warning, and it caused him to look over his shoulder to check traffic
76	LDW-Cautionary	5	Was distracted, and it caused him to get his eyes back on track
76	LDW-Imminent	4	Definitely approaching the line, but maybe not in danger of leaving the road
76	LDW-Imminent	5	Wasn't paying attention well and drifted
76	CSW-Cautionary	3	Real familiar with the curve, but it gave him an awareness of speed
76	CSW-Cautionary	4	The road conditions were a little icy, so he maybe should have slowed down
76	CSW-Cautionary	1	Not a necessary warning. No curve
76	CSW-Imminent	1	Didn't notice this warning. Wasn't exiting there; no curve present
76	CSW-Imminent	1	Unnecessary warning; didn't acknowledge
77	LDW-Cautionary	5	He was not sure if he should move over or keep going straight
77	LDW-Cautionary	5	Pickup the phone and leaning over to adjust the radio - drifted
77	LDW-Cautionary	5	Because there was a car to the right, and he was drifting into that lane
77	LDW-Imminent	5	He's drifting to the left and could have wound up in a ditch
77	LDW-Imminent	5	The road narrows and it's difficult to stay in the center

77	LDW-Imminent	3	Didn't seem like he was drifting, but sensitivity was higher
77	CSW-Cautionary	5	It picked up before the curve, and gave him the opportunity to slow down
77	CSW-Cautionary	1	It was reacting to an overpass
77	CSW-Cautionary	5	He know that curve, and it's sharp so if you misjudge it you could wind up on the curb
77	CSW-Imminent	1	It's reading the overpass again
77	CSW-Imminent	1	Reacting to an overpass
77	CSW-Imminent	1	No curve present
78	LDW-Cautionary	1	Lane was shifting, was alert and aware
78	LDW-Cautionary	5	Lights (oncoming traffic) were blinding her
78	LDW-Cautionary	1	No traffic coming, but was crossing the lines w/o signaling, so she knows why it went off
78	LDW-Imminent	1	Totally alert, nothing else going on
78	LDW-Imminent	2	Was over a little too far when the truck came by, and was looking for something
78	LDW-Imminent	4	Reaching over to get some directions
78	CSW-Cautionary	1	Not a very steep curve
78	CSW-Cautionary	5	This was a sharp ramp in an unfamiliar place
78	CSW-Cautionary	1	There was no potentially unsafe condition
78	CSW-Imminent	5	Talking on the phone; unfamiliar curve, was helpful
78	CSW-Imminent	1	No potentially unsafe conditions
79	LDW-Cautionary	2	Can tell why it went off b/c she was drifting, but it was weird driving conditions b/c of the snow
79	LDW-Cautionary	4	She had purposely moved over in response to the truck, but it could have been dangerous if there was a car there
79	LDW-Cautionary	4	There was a curve in the highway, and it's hard to tell where the lanes are
79	LDW-Imminent	2	A lot of snow that it was reacting to, but probably not a very dangerous situation
79	LDW-Imminent	5	Was probably drifting, and there was a car next to her. Was also adjusting the radio
79	LDW-Imminent	3	Was getting a little too close to the snow and stuff on the right
79	CSW-Cautionary	2	Got this warning every time, regardless of speed
79	CSW-Cautionary	4	This was a very sharp curve, and she had to slow down
79	CSW-Cautionary	3	Was exiting the freeway, and so was slowing down
79	CSW-Imminent	3	Were merging; could see a little curve, but nothing too major. Would go off every time.
79	CSW-Imminent	3	Was getting off on the freeway anyway, but was relatively unfamiliar with this curve
79	CSW-Imminent	1	Was no curve there; False alarm
80	LDW-Cautionary	3	Was purposely going to left because of the truck on the right
80	LDW-Cautionary	5	No traffic around, and was drifting to the left
80	LDW-Cautionary	2	Looked to the left to check traffic, but put the signal on late when changing lanes
80	LDW-Imminent	5	Again, pulling to the left, and there was a car there, and was "yacking" w/ friends
80	LDW-Imminent	5	Was giving a "hawk" and pulled to the left severely
80	LDW-Imminent	2	Wasn't concerned about a threatening circumstance here, no danger of drifting to the right

80	CSW-Cautionary	2	Was going w/ the flow of traffic, and a warning wasn't completely necessary here
80	CSW-Cautionary	2	In no danger; going with the flow of traffic
80	CSW-Cautionary	5	Was probably going too fast on this interchange
80	CSW-Imminent	2	Brings attention to the road, but there was no curve present
80	CSW-Imminent	3	Going with the flow of traffic, but it was useful to bring her speed to her attention
80	CSW-Imminent	5	Was going too fast around the curve
81	LDW-Cautionary	4	Was looking down a little bit and drifting a bit to the left
81	LDW-Cautionary	4	Again was steering off to the right
81	LDW-Cautionary	5	Started going off because he was paying attention to something else
81	LDW-Imminent	2	Don't think an imminent warning was warranted
81	LDW-Imminent	5	He was swerving from the road when he coughed
81	LDW-Imminent	3	Wasn't too far over; imminent warning not required
81	CSW-Cautionary	1	He knows that road well
81	CSW-Cautionary	2	Didn't think he was going too fast; but it wasn't totally unnecessary
81	CSW-Cautionary	3	That curve comes up quick, and it was good to be warned
81	CSW-Imminent	3	A really tricky curve, and the warning made him slow down
81	CSW-Imminent	1	It was not reacting to a curve he was going to take
82	LDW-Cautionary	2	Being generous; indicating that he got too close to the line, but it didn't really matter
82	LDW-Cautionary	1	Doesn't look like he moved
82	LDW-Cautionary	2	Indicated that he should have used signal
82	LDW-Imminent	3	Drifted a little, but didn't provide much of a benefit
82	LDW-Imminent	1	It would have been useful if he had been half asleep
82	LDW-Imminent	1	He's awake; knows what's going on around him
82	CSW-Cautionary	2	Was maybe going too fast, but head the car under control
82	CSW-Cautionary	1	This one was irrelevant; reacting to an exit ramp
82	CSW-Cautionary	1	Went into curve too fast(it's not even that much of a curve)
82	CSW-Imminent	2	A controlled speed for that curve
82	CSW-Imminent	1	No curve present
82	CSW-Imminent	2	Familiar with the curve, so he would know when to brake
83	LDW-Cautionary	5	Probably wasn't looking around and was drifting to avoid a truck, and could have caused and accident
83	LDW-Cautionary	5	Didn't use turn signal when changing lanes
83	LDW-Imminent	5	Was on the phone and wasn't paying attention
83	LDW-Imminent	1	Nothing to warrant the warning
83	CSW-Cautionary	4	Probably going a little too fast
83	CSW-Cautionary	4	Probably going a little fast
83	CSW-Cautionary	2	Really no curve. Didn't understand it, but it made him a little more aware
83	CSW-Imminent	2	Approaching a curve, but not there yet. (too early)

83	CSW-Imminent	3	Maybe a little too fast, but not much
83	CSW-Imminent	1	No curve present
84	LDW-Cautionary	1	Because he was just changing lanes, and forgot to use turn-signal; not a safety issue.
84	LDW-Cautionary	2	It's nighttime, and it was at highest sensitivity, and he was getting close to the line.
84	LDW-Cautionary	2	Was making him aware of drifting, and sensitivity was at max
84	LDW-Imminent	2	Was not in any danger, but it's good to know if you're leaving your lane, esp. onto the shoulder.
84	LDW-Imminent	3	Eyes were off the road; and was drifting to the left.
84	LDW-Imminent	1	A narrow road, and going around the curve, it's almost impossible not to cross
84	CSW-Cautionary	3	Conditions were wet, would often leave the lane on the curve for traction, and CSW made him more aware.
84	CSW-Cautionary	1	This was coming off the highway, and CSW thought he should be going more slowly.
84	CSW-Cautionary	1	Not much of a curve, or he is comfortable with that curve.
84	CSW-Imminent	1	Coming up on an exit, and was merging, and got a warning there every time.
84	CSW-Imminent	1	On the exit ramp, at highway speed.
84	CSW-Imminent	2	Roads aren't wet, but it's good to be paying attention more because he usually doesn't.
85	LDW-Cautionary	2	Warning was a reminder to use turn signal.
85	LDW-Cautionary	4	The lower (cautionary) warning in this kind of scenario is useful (drifting to the right)
85	LDW-Cautionary	2	For the same reasoning as warning #1
85	LDW-Imminent	1	No traffic; two-lane road was narrow- situation didn't warrant an imminent warning
85	LDW-Imminent	4	Given the conditions (dark and rainy), this was useful.
85	LDW-Imminent	2	Would have preferred a cautionary warning here.
85	CSW-Cautionary	3	Sometimes take this particular curve too fast.
85	CSW-Cautionary	3	This is a tight curve
85	CSW-Cautionary	2	Unnecessary or false because he wasn't going that fast.
85	CSW-Imminent	3	Driving faster than usual because it was early morning.
85	CSW-Imminent	3	The curve is kind of tight, and was going a bit too fast.
85	CSW-Imminent	1	Given the situation, there is a curve that he's aware of
87	LDW-Cautionary	2	Wasn't really drifting, was making a lane change.
87	LDW-Cautionary	4	Was distracted by something wasn't looking at the road.
87	LDW-Imminent	1	It was annoying; it could become distracting. It wasn't doing what it was supposed to.
87	LDW-Imminent	3	It's night time, it helped alert to what was happening on the road.
87	LDW-Imminent	4	It was doing what it was supposed to do at high sensitivity- went off at slightest shift in the lane.
87	CSW-Cautionary	2	On the highest setting, and in a curve, but it didn't alert until well into the curve.
87	CSW-Cautionary	1	There's no curve there.
87	CSW-Cautionary	3	Was getting ready to get off on the ramp, and might have been going faster than it wanted him to.
87	CSW-Imminent	2	On the highest setting, and it's a merging condition.
87	CSW-Imminent	4	Probably he was taking the curve a little too fast.
87	CSW-Imminent	3	A ramp condition, and it's going to curve, but you have to accelerate to merge onto the freeway.

This page was left blank intentionally.