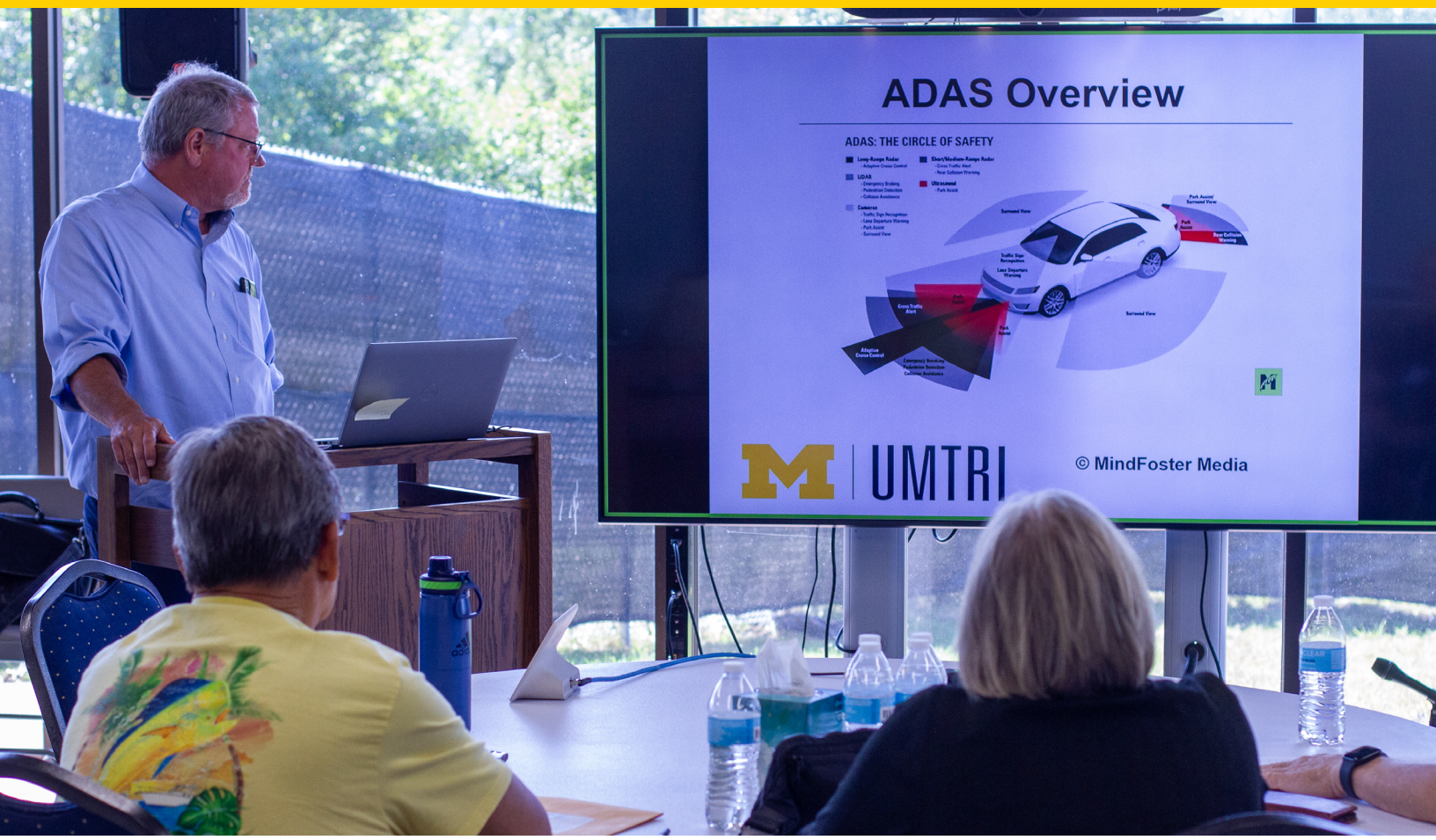
CENTER FOR CONNECTED AND AUTOMATED TRANSPORTATION

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Older Adults and Advanced Transportation Technologies: Developing a Training Curriculum

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Older Adults and Advanced Transportation Technologies:

Developing a Training Curriculum

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16. Abstract

This project developed, pilot-tested, and evaluated an in-person training program targeted for older adults, that included demonstrations on a closed-course track in a real automobile. The program had the following goals: Provide a background for understanding how to use ADAS and AV technologies; Provide resources for learning about how to use specific technologies.; Demonstrate how some of the technologies work in a vehicle on the Mcity test track. The resulting training program took less than one-hour to complete. Twenty-nine active older drivers were recruited to participate in the pilot test of the training and participants completed pre- and post-questionnaires that allowed us to assess changes in attitudes, thoughts, and intentions to use ADAS and AV technologies. The post-questionnaire also included a section for participants to provide feedback on the training program itself. These results showed that the program achieved its goal of successfully providing resources for learning about how to use specific transportation technologies and increased people's confidence in their ability to use these sources. Results also showed that after the training self-reported trust in AVs increased, perceived safety risk of AV use decreased, and reported intention to use AVs in the future increased. Attitudes toward AVs and perceived usefulness increased while perceived privacy concerns decreased, but these changes were not statistically significant. Collectively, these results suggest that the classroom discussion about advanced transportation technologies and getting hands-on experience with some of these technologies can help overcome some of the barriers for older adults to use ADAS and AVs in the future.

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Introduction

The development of advanced driver assistance system (ADAS) and automated vehicle (AV) technologies, poised to be one of the most transformative transportation advances in recent history, holds promise for reducing traffic crashes and maintaining mobility among older adults. Once fully automated vehicles are available and widely deployed – that is, AVs that can take a person anywhere they want to go, at any time, in any weather – many of the barriers to adult mobility will be overcome (Eby, Molnar, & St. Louis, 2019). Among these barriers are the gradual declines in perceptual and psychomotor abilities that many older drivers experience as they age. These declines can lead to serious consequences at intersections with a stop-sign control, where a significantly higher crash rate by older drivers than other age groups has been observed due to poor gap selection; older drivers were more likely to be involved in a crash when making turns than going straight (e.g., Eby, Molnar, & St. Louis, 2019; Tarawneh & McCoy, 1996). The total number of traffic crashes involving older drivers is on the rise in recent years and the increased frailty of older drivers makes them more likely to be killed or injured in a crash than other driver age groups (Bureau of Transportation Statistics, 2017). One purpose of ADAS and AV technology applications is to improve traffic safety by reducing human-factor-related traffic crashes; the technology advancement is expected to provide direct benefits to those, such as older drivers, who would need them the most.

At the current time however, challenges remain in ensuring that ADASs and AVs are accessible, acceptable, affordable, and otherwise inclusive for older adults. Research studies (e.g., Eby et al., 2018; Hulse, Xie, & Galea, 2018; Schoettle & Sivak, 2015) suggest that while older adults recognize, perhaps more than drivers of other ages, the potential value of advanced transportation technologies, they have mixed feelings about them, and these feelings are moderated by their trust and acceptance of the technologies as well as their experiences (Eby et al., 2019). Further, they appear to be more reluctant than drivers of other ages to use these systems, particularly those that take over at least some control of the vehicle (e.g., Molnar, Eby, & St. Louis, 2022). Some of this hesitancy may be due to a lack of understanding of these types of technologies. For example, results from a recent study of nearly 3,000 older adults in five states found that many older drivers were not aware of the advanced technologies in their vehicle and about one-third did not use the technologies (Eby et al., 2021; St. Louis et al., 2023).

Thus, there is an opportunity to improve the disconnect between older drivers' needs and their understanding of the ADAS and AV technologies that could help meet these needs through training. The overarching objective of this project is to develop and pilot-test a curriculum to help older adults become more familiar with the functioning and operation of ADASs and AVs through classroom and closed-track demonstrations. The project's specific aims are: 1) to conduct an ADAS-AV training program for older adults that includes a demonstration of ADAS and AV technologies; and 2) to evaluate changes in older adults' intentions to use, perceptions of, and attitudes toward ADAS/AVs after participating in the training.

Methods

Development of Training Program

Program development was guided by the results of two previous studies. The first was titled

Promoting Inclusive Design and Deployment of Connected and Automated Vehicles for Older Adults through Education and Training of Engineering Students and Older Drivers (Molnar et al., 2023) and included focus groups with older adults about barriers and facilitators to their use of advanced transportation technologies and a University engineering student class project and survey related to AV use by older adults. The second project titled *Educating Older Drivers to Improve Acceptance and Utilization of CAV technologies* (Yi, Marovic, & Whittenberger, 2023), included the development of an ADAS-AV training program for older adults in the form of a PowerPoint slide deck and included information about 29 ADAS features (name, dashboard icon, purpose, how to use, etc.).

Two relevant findings were derived from these studies: 1) there are too many types of ADAS and AVs to provide meaningful and detailed training on each of them; and 2) while very useful, classroom training alone does not provide a full understanding of some ADAS technologies—understanding of these technologies can be greatly enhanced by experiencing them as they operate normally in a vehicle. To these ends, the current training program was designed to:

- Provide a background for understanding how to use ADAS and AV technologies.
- Provide resources for learning about how to use specific technologies.
- Demonstrate how some of the technologies work in a vehicle on the Mcity test track.

The training program was designed for older adults (age 65 or older) and was implemented at the University of Michigan Mcity test facility. Mcity is an interdisciplinary public-private partnership that offers early-stage testing and deployment, funding for a wide range of mobility research and data collection, and a commitment to education and outreach. Using Mcity as the environment in which to conduct the training allowed us to provide hands-on training to participants using a real vehicle with ADAS and AV features. The training program was delivered to participants during a single training session which took about 1 hour. Each training session included up to 3 participants. This number was limited by the number of participants who could ride in the test vehicle along with a safety-driver (a research associate) who conducted all of the demonstrations.

The training program consisted of the following:

- Participants were greeted and directed to sit together at a table where refreshments and packets of information were placed.
- Using a PowerPoint presentation and a large screen, the project's principal investigator provided about 30 minutes of training. The training included introductions of staff and the Mcity facility; an overview of the training program goals; an introduction to ADAS including a 3 minute video (MindFoster Media: https://youtu.be/89IYV4-LO1s); a discussion of the progression of automated vehicle technology; a 2.5 minute video on connected and automated vehicles (Minnesota Department of Transportation's Connected Vehicles program: https://youtu.be/Y7R0fyS5uXY); a discussion of why learning about these technologies is important; general facts about ADAS and AVs; an overview of several sources of information for learning about specific ADAS technologies; and an introduction to the upcoming demonstrations. The PowerPoint for the classroom portion of the training program can be found in Appendix A.
- Participants had a short walk to the vehicle used for the demonstrations (See Figure 1).

One participant sat in the front passenger seat and the other two sat in the back. A research associate sat in the driver seat and implemented the demonstration portion of the training.



Figure 1: Instrumented Mach-E used to demonstrate AV and ADAS technologies.

- The AV demonstration was first. Using the drive-by-wire and obstacle detection technologies installed in the Ford Mustang Mach-E to simulate AV functioning, the team recorded an approximate 5-minute route through the entirety of the Mcity test track. This route included several turns, roundabouts, and changes in speed. There was also a railroad crossing gate on the route that was activated by the research associate before the ride began so that it was down when the vehicle approached. The vehicle detected the crossing gate, stopped, and waited until it was raised before proceeding. The route is shown in Figure 2.

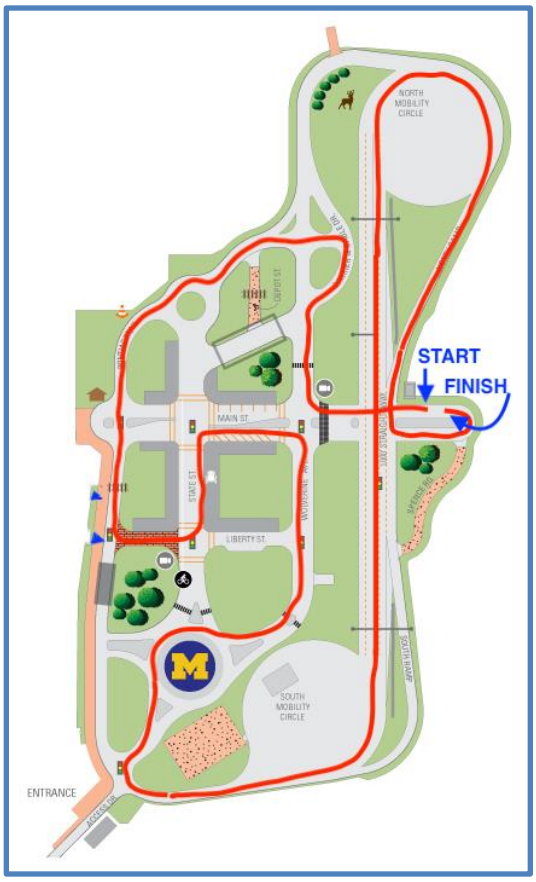


Figure 2: Mcity route used to demonstrate AV functioning.

- Two ADAS technologies were demonstrated next—back-up cross-traffic alert and automatic emergency braking. The research associate drove the Mach-E onto the test track so that the straight portion of the track was behind the vehicle. With the brake pedal engaged, the research associate put the Mach-E in reverse. Another research associate then drove a vehicle along the straight roadway behind the Mach-E twice. In the MachE, participants could hear the alerts and see the flashing symbols on the cluster display, central touchscreen, and the side-view mirrors alerting them to the presence of the second vehicle.
- Automatic emergency braking was demonstrated using the straight portion of the Mcity track. At the north end of the straightaway a “soft-car” was placed on one side of the road. The soft-car is a surrogate vehicle that will not harm the test vehicle if they collide. The research associate drove the Mach-E directly at the soft car at a speed of 10-12 mph without braking and the automatic emergency braking system abruptly stopped the vehicle without colliding with the soft-car.
- Participants were then driven back to the Mcity auxiliary building where they were thanked for their involvement in the study.

Procedures

To evaluate the training program, participants completed pre- and post-training questionnaires that included questions about demographics, experience using ADAS/AV technologies, awareness and perceptions of information about ADAS/AV technologies, and attitudes toward ADAS/AVs. Feedback was also obtained from participants during the post-training survey about the usefulness of the training program. After consenting electronically to participate in the study, the pre-training questionnaire was completed online by all participants before their training session. The post-training questionnaire was completed by participants within 2 days following their training session (participants were sent a link to the questionnaires via email). Once participants completed the post-training questionnaire, they were prompted to complete an incentive payment form, and they were mailed an incentive check for $25.

Recruitment

Our goal was to recruit up to 30 older drivers. The inclusion criteria were:

- Be age 65 or older at time of enrollment.
- Have a valid driver's license at time of enrollment.
- Drive at least 3 days per week.
- Be available to attend one of the 1-hour training sessions at Mcity.
- Be willing and able to complete pre- and post-training questionnaires and provide feedback on the training program.

Participants were recruited by distributing a study description via online postings (e.g. social media sites such as Craiglist.com), posting on a university listserver (UM post-ITS-notes); and posting information on UMHealthResearch.org. The study team used REDCap, a web-based data capture system that is secure and HIPAA-compliant, and U-M Dropbox cloud storage, to manage participant recruitment for the study, schedule appointments, and track participants' completion of study activities.

Pre-training questionnaire

Prior to their training session appointment at Mcity, and after providing their consent electronically to participate in the study, participants were emailed a link via REDCap and asked to complete a pre-training questionnaire to gather background demographics and assess perceptions of and attitudes about advanced vehicle technologies. The pre-training questionnaire can be found in Appendix B. The following areas were assessed in the pre-training questionnaire:

- Demographics.
- Confidence in knowing where to look for advanced vehicle technology information.
- Perceived value of various sources of vehicle technology information.
- Attitudes about vehicle automation.

All participants completed the pre-training questionnaire online before arriving for their training session appointment. The questionnaire required about 10 minutes to complete.

Post-training questionnaire

Participants completed a post-training questionnaire within 2 days of completing the training program. The post-training questionnaire included items from the pre-training questionnaire that could potentially have changed during the study (e.g., confidence in knowing where to look for information about, perceived value of information about, and attitudes about ADAS technology and vehicle automation) and debriefing items to obtain participants' feedback about the training session. The post-training questionnaire can be found in Appendix C.

Data management

All recruitment and study data, including Personal Identifiable Information (PII) (e.g., names and contact information), were stored in REDCap and U-M Dropbox. PII was stored separately from study data and was linked to the study data by a participant number.

Results

Participants

A total of 29 older adults participated in the study. Participants' mean age was 73.4 years (standard deviation=5.4), with a range of 66-87 years. As shown in Table 1, nearly one-half identified as a man, nearly all were white and non-Hispanic, about 90% had completed at least some college education, about 60% were married or living with a partner, and about one-half had an annual household income of $80K or more.

Table 1: Participant Demographics.

	%	n
Gender		
Man	48.3	14
Woman	51.7	15
Race		
White	96.6	28
Other (White/Middle Eastern)	3.4	1
Hispanic		
No	100.0	29
Education		
No schooling	0	0
1st-8th grade	0	0
9th-12th grade (no diploma)	3.4	1
HS graduate (diploma/equivalent)	3.4	1
Vocational/Technical/Business/Trade school	3.4	1
Some college, no degree	0	0
Associate degree	10.3	3
Bachelor's degree	48.3	14
Master's/doctoral degree	31.0	9
Marital Status		
Married	48.3	14
Living with a partner	10.3	3

Separated	0	0
Divorced	24.1	7
Widowed	6.9	2
Never married	10.3	3
Annual Household Income		
Less than $20,000	3.4	1
$20,000 - $49,999	20.7	6
$50,000 - $79,999	3.4	1
$80,000 - $99,999	20.7	6
$100,000 or more	31.0	9
Don't know	3.4	1
Refused	17.2	5

Exposure to ADAS and AV Technologies

The pre-training questionnaire included several questions about the types of advanced technology installed in participants' vehicles and whether they had used them in the past month. Note that the questionnaire included descriptions of each technology. Of the 10 technologies we asked about, overall participants reported having an average of 3.4 (standard deviation=2.7) technologies in their vehicle (range: 0-8). About 83% had at least one technology.

Table 2 shows the results for the 10 technologies. Back-up assist technology was the most commonly reported technology (59%), followed by automatic high-beam headlights (48%), adaptive cruise control (45%) and lane keeping assist (45%). The least commonly reported technology was the Level 2 AV system (3%) followed by automatic parallel parking (14%) and road sign assist (17%). For each technology about 7-21% of participants did not know if their vehicle included that specific technology. If a participant reported having a technology, they were asked if they had used it in the past month. Overall, use was high. Depending on the technology, use ranged from 25%-100%. However, some of the technologies that had lower use were ones that reasonably may not be needed over a month of driving, such as automatic high-beam headlights (if the participants avoids driving at night) and automatic parallel parking (if the participant does not need to parallel park).

Table 2: Reported Technologies in Participants' Vehicles and Use in the Past Month.

Technology	**Is the technology in the participant's vehicle?**			**Has the participant used the technology in the past month (if it is in the vehicle)?**		
	Yes % (n)	**No % (n)**	**Don't know % (n)**	**Yes % (n)**	**No % (n)**	**Don't know % (n)**
Level 2 AV system	3.4 (1)	86.2 (25)	10.4 (3)	100 (1)	0	0
Forward collision avoidance	37.9 (11)	51.7 (15)	10.4 (3)	54.6 (6)	45.4 (5)	0
Adaptive cruise control	44.8 (13)	44.8 (13)	10.4 (3)	53.8 (7)	46.2 (6)	0
Road sign assist	17.2 (5)	72.4 (21)	10.4 (3)	80.0 (4)	20.0 (1)	0

Automatic high-beam lights	48.3 (14)	41.4 (12)	10.4 (3)	50.0 (7)	50.0 (7)	0
Lane keeping assist	44.8 (13)	48.3 (14)	6.9 (2)	69.2 (9)	30.8 (4)	0
Cross-traffic alerts	37.9 (11)	44.8 (13)	17.2 (5)	100 (11)	0	0
Back-up assist	58.6 (17)	31.0 (9)	10.4 (3)	88.2 (15)	5.9 (1)	5.9 (1)
Voice control	34.5 (10)	44.8 (13)	20.7 (6)	70.0 (7)	30.0 (3)	0
Automatic parallel parking	13.8 (4)	79.3 (23)	6.9 (2)	25.0 (1)	75.0 (3)	0

A primary goal of this project was to assess how the training program impacted older adults' thoughts and attitudes toward advanced technology as well as their intention to use these technologies in the future. To that end, the pre- and post-questionnaires asked several identical questions that could be analyzed to determine changes in responses before and after participation in the training program.

Changes in Confidence in Learning About Technologies and Perceived Usefulness of Information Sources.

In both questionnaires, participants were asked: "If there was an advanced technology on your vehicle that you did not know how to use, how confident are you that you could find information about how that technology works?" Participants responded on a scale from 1 (not at all confident) to 7 (extremely confident). The average response prior to training was 5.6 (standard deviation=1.0) and post training was 6.2 (standard deviation=0.9). This increase in confidence after participating in the training program was significant (Wilcoxon Signed Rank Test = 56; p=0.03).

Part of the training program focused on sources of information that participants could utilize to learn more information about specific advanced technologies in their vehicle. Both the pre- and post-questionnaires asked about the usefulness of 8 sources of information about ADAS operations. Participants responded using a scale from 1 (not at all useful) to 7 (extremely useful). Table 3 shows the results for the 8 information sources. Overall, the owner's manual was judged to be the most useful source of information prior to the training event. After the training program, however, hands-on training events was reported as the most useful way to learn about ADAS, although changes in perceived usefulness from pre- to post-training were not significant for either information source. The perceived usefulness of using a trial and error method for learning about ADAS by oneself significantly decreased after the training program. The perceived usefulness also decreased for family/friends and the owner's manual although those changes only approached significance. The perceived usefulness of car dealerships increased after the training program, but this change also only approached being significant.

Table 3: Perceived Usefulness of Several Sources of Information for Learning How to Use ADAS.

	Pre-Training	Post-Training	Wilcoxon Signed Rank Test	
Information Source	**Mean (SD)**	**Mean (SD)**	**Test statistic**	**p**
Owner's manual	5.7 (1.7)	5.4 (1.4)	-37.0	0.08
Hands-on training event	5.5 (1.8)	6.0 (1.2)	35.0	0.12
Internet videos (e.g., YouTube)	5.4 (1.9)	5.4 (1.4)	-11.5	0.69
Websites	5.1 (1.6)	5.6 (1.3)	26.5	0.26
Figure it out myself/trial & error	**4.7 (1.4)**	**4.0 (1.3)**	**-72.0**	**0.002**
Family/friends	4.4 (1.8)	3.9 (1.5)	-48.0	0.07
Car dealership	4.4 (2.0)	4.9 (1.5)	57.0	0.07
Television/news program	2.6 (1.7)	2.6 (1.2)	11.0	0.67

Attitudes, Thoughts, and Intention to Use AVs

Attitudes and intention to use AVs were measured based on constructs from the *Extended Technology Acceptance Model* (Zhang et al., 2019) and the *Usability, Safety, Easiness, and Anxiety Model* (Motemedi et al., 2021). The constructs we measured related to AVs were: attitudes, trust, perceived privacy risk, perceived safety risk, perceived usefulness, perceived ease of use, and behavioral intentions. Each construct was assessed using a set of 3-5 statements resulting in 23 total statements for which the participant reported their level of agreement (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree). A score for each construct was calculated as the mean of the responses across the 3-5 statements within the construct. A higher score indicates stronger support for the construct. The results for each statement in the pre- and post-questionnaires can be found in Appendix C.

Paired t-tests were conducted for each construct to determine if participants' scores changed from before to after training. The results are shown in Table 4 with significant differences shown in bold. Three constructs changed significantly after participants attended the training program: self-reported trust in AVs increased, perceived safety risk of AV use decreased; and reported intention to use AVs in the future increased. The change in two other constructs approached significance--attitudes were more positive and concerns about privacy were reduced.

Table 4: Means, Standard Deviations, and t-Scores Statistics Comparing Changes in Attitudes Toward, Thoughts About, and Intentions to Use AVs.

	Mean (SD)	n	Mean (SD)	n	DF	*t*-value (DF)	p
Attitudes	3.5 (0.8)	27	3.6 (1.0)	28	25	1.76 (25)	0.09
Trust	**2.9 (0.9)**	**26**	**3.3 (0.9)**	**28**	**24**	**2.15 (24)**	**0.04**
Perceived Privacy Risk	3.0 (0.8)	29	2.7 (1.1)	29	28	-1.46 (28)	0.15
Perceived Safety Risk	**4.0 (0.8)**	**29**	**3.3 (1.0)**	**29**	**28**	**-3.44 (28)**	**0.002**

Perceived Usefulness	2.8 (0.9)	29	3.0 (0.7)	29	28	1.13 (28)	0.27
Perceived Ease Of Use	3.4 (0.8)	27	3.4 (0.7)	29	26	0.48 (26)	0.64
Behavioral Intention	**2.9 (1.1)**	**28**	**3.3 (1.2)**	**28**	**26**	**2.46 (26)**	**0.02**

Feedback on the Training Program

The post-training questionnaire included a series of items about the training program itself. Participants were asked to rate the overall usefulness of the training program. Nearly all participants reported that it was "extremely useful" (45%) or "moderately useful" (45%), with the other 10% reporting that it was "somewhat useful". Participants were also asked to report their level of agreement with several statements related to the training. Table 5 shows participants' level of agreement with several statements about the training program. The feedback was strongly positive:

- More than half of the participants strongly agreed that the training made them more confident about knowing where to go to locate information about how to use advanced vehicle technologies.
- 83% agreed or strongly agreed that they were more excited about the future of automotive technologies after completing the training.
- 83% agreed or strongly agreed that the training was a useful reminder of things that they already knew.
- All but one participant (97%) agreed or strongly agreed that the hands-on demonstration helped them to better understand the advanced technologies.
- 82% agreed or strongly agreed that they will consider or increased their use of ADAS technology.
- 79% agreed or strongly agreed that they will consider or increased their use of Level 2 AV technology.
- All but one participant (97%) agreed or strongly agreed that they would recommend the training program to friends and family.

Table 5: Older Drivers' Level of Agreement with Statements about the Training Program

	Strongly agree % (n)	**Agree % (n)**	**Disagree % (n)**	**Strongly disagree % (n)**
The training made me more confident about knowing where to locate information about advanced vehicle technologies	55.2 (16)	37.9 (11)	6.9 (2)	0
I'm more excited about the future of automative technologies now that I have learned more about them	20.7 (6)	62.1 (18)	13.8 (4)	3.4 (1)
The training served as a useful reminder of things I already knew	20.7 (6)	62.1 (18)	17.2 (5)	0

Experiencing the advanced vehicle technologies on a test track helped me better understand how they operated	31.0 (9)	65.5 (19)	3.4 (1)	0
As a result of the training, I plan to consider or increase my use of ADAS	10.3 (3)	72.4 (21)	17.2 (5)	0
As a result of the training, I plan to consider or increase my use of Level 2 AV	13.8 (4)	65.5 (19)	20.7 (6)	0
I would recommend this training to friends or family members	24.1 (7)	72.4 (21)	3.4 (1)	0

Discussion

This project built on previous research that has found that adults aged 65 and older often have difficulty knowing how to use advanced transportation technologies and understanding how they work. Previous work also showed that older adults preferred to have an in-person training about advanced transportation technologies that was interactive and included hands-on demonstrations. To these ends, the current project developed, pilot-tested, and evaluated an in-person training program targeted for older adults, that included demonstrations on a closed-course track in a real automobile. The program had the following goals:

- Provide a background for understanding how to use ADAS and AV technologies.
- Provide resources for learning about how to use specific technologies.
- Demonstrate how some of the technologies work in a vehicle on the Mcity test track.

The resulting training program took less than one-hour to complete. Twenty-nine active older drivers were recruited to participate in the pilot test of the training and participants completed pre- and post-questionnaires that allowed us to assess changes in attitudes, thoughts, and intentions to use ADAS and AV technologies. The post-questionnaire also included a section for participants to provide feedback on the training program itself.

Overall, the older adult participants in the study had moderate to low exposure to the 10 advanced transportation technologies we asked about in our questionnaire, but those who had the systems in their vehicles generally used them frequently. Only one participant reported having a Level 2 AV in their vehicle (3 did not know), and they had used it in the past month. Thus, the majority of participants in the study were likely to be unfamiliar with how to use advanced transportation technology or how they worked.

One section of the training program was designed to familiarize participants with various sources of information about how to use ADAS and AV technologies and how they worked. We found a significant increase in participants confidence in their ability to find information about ADAS and AV technology after completing the training program. However, analyses of specific sources showed that the perceived value of several sources of information did not change significantly after the training, except the value of trial-and-error as a source significantly decreased. The perceived value of hands-on training, websites, and car dealerships as sources of information about ADAS and AV technologies increased after the training but not significantly—all of these sources were discussed in the training program. These results collectively showed that the

program achieved its goal of successfully providing resources for learning about how to use specific transportation technologies and increased people's confidence in their ability to use these sources.

It is well known that acceptance of technology and its ultimate use is influenced by several factors including: attitudes, trust, perceived privacy risk, perceived safety risk, perceived usefulness, perceived ease of use, and behavioral intention to use the technology (e.g., Motemedi et al., 2021; Zhang et al., 2019). Each of these constructs related to AVs were measured before and after training and analyses assessed changes after completing the program. We found that three constructs changed significantly after the training program: self-reported trust in AVs increased, perceived safety risk of AV use decreased, and reported intention to use AVs in the future increased. Attitudes toward AVs and perceived usefulness increased while perceived privacy concerns decreased, but these changes but were not statistically significant. Collectively, these results suggest that the classroom discussion about advanced transportation technologies and getting hands-on experience with some of these technologies can help overcome some of the barriers for older adults to use ADAS and AVs in the future.

The feedback on the training program was positive and extremely encouraging. The vast majority of participants agreed or strongly agreed with several positive statements about the training. Our older adult participants reported that the training made them more confident in knowing where to go to learn about these technologies, they thought that the in-vehicle technology demonstrations on the Mcity test track helped them to better understand how the technologies worked, they are planning to start or increase their use of these technologies, and they are planning to recommend this training to their family and friends.

Recommendations

Based on the positive feedback and the positive changes in the factors that influence use of advanced transportation technologies, particularly trust, perceived safety, and behavioral intentions to use, we conclude this pilot-test of the training program was successful. While the present results were positive, our sample size limited our ability to analyze results by demographics. The training program should be evaluated with a larger number of older adults that vary across several sociodemographics including education level, income, and experience with previous transportation technologies.

These results suggest several recommendations for developing programs to train older adults on the use of ADAS and AV technologies:

- Hands-on opportunity to interact with and to experience ADAS and AV technology is crucial for older adult learning. Anecdotally, many participants commented on the utility of the demonstrations and mentioned that it was hard to visualize how some of these technologies worked without having used them previously.
- In-person training is recommended for this older adult demographic. This age group values personal interactions and we have found that many come to the training with specific concerns about an ADAS and want to engage in a discussion.
- Training on several individual ADAS and AV technologies is not practical nor

recommended for several reasons: there are too many technologies to cover them all while maintaining the interest of the participants; each manufacturer has slightly different interfaces and technology operation; new ADAS is constantly being introduced; and many older adults have questions and are seeking knowledge about specific technologies in their vehicles.

- It is useful to consider the barriers known to influence older adults use of new advanced transportation technologies (attitudes, trust, perceived privacy risk, perceived safety risk, perceived usefulness, perceived ease of use, and behavioral intention to use the technology) and to acknowledge these constructs in the development of the training curriculum.
- It is recommended that training programs integrate multiple forms of presentation (instructor presentation, websites, and videos) to maintain the interest of participants and to afford them multiple ways to process the information.

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Zhang, T., Tao, D., Qu, X., Zhang, X., Lin, R., & Zhang, W. (2019). The roles of initial trust and perceived risk in public's acceptance of automated vehicles. *Transportation Research Part C, 98*, 207-220.

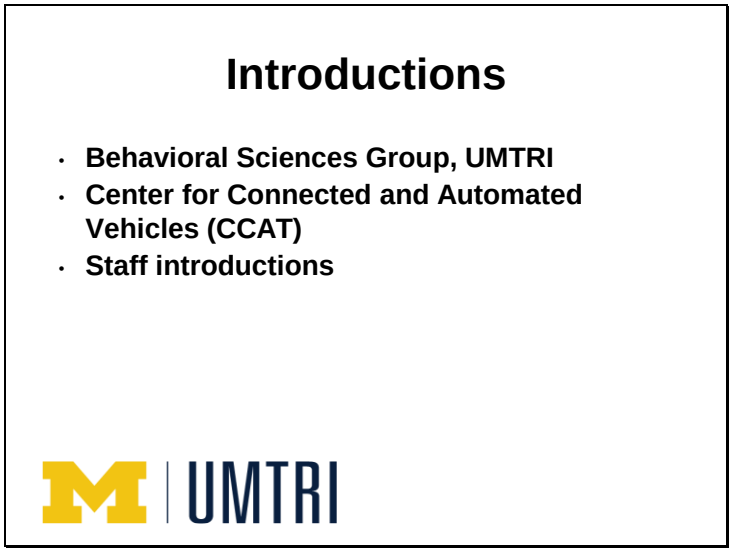
Appendix A: Training Program PowerPoint

Slide 1



Welcome to the University of Michigan and the Mcity test track auxiliary building. We will first go through a 30-minute presentation here in the auxiliary building and then we will go out onto the test track so that you can experience some of the advanced automotive technologies that are in development or newly developed.

Slide 2



This training program and evaluation project was developed by the University of Michigan Transportation Research Institute's (UMTRI) Behavioral Sciences Group with sponsorship from the Center for Connected and Automated Vehicles (CCAT), which is a regional University Transportation Center housed at UMTRI.
(RESEARCH STAFF WERE INTRODUCED)

Slide 3



Mcity was established in 2013 as the first automated vehicle test facility in the world. Mcity is a test environment with a collective of about 3 miles roads with intersections, roundabouts, traffic signs and signals, sidewalks, benches, simulated buildings, railway crossing, and obstacles. Mcity is administered by the U-M College of Engineering.

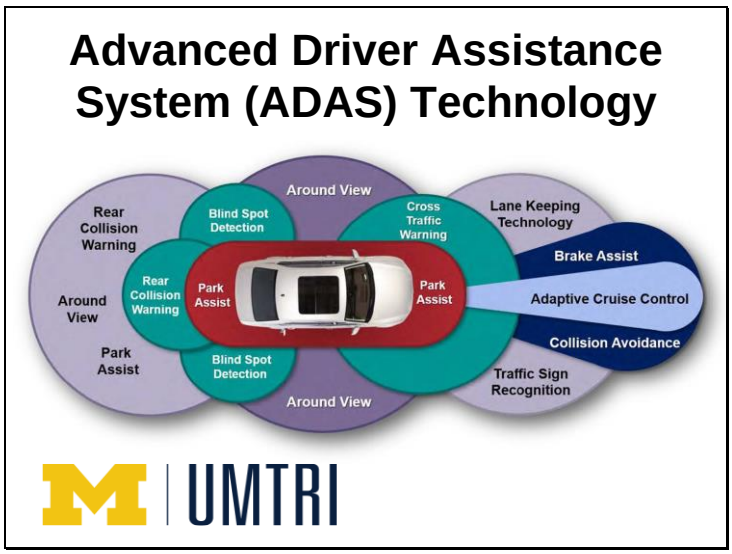
Slide 4



We have three goals for this training program:

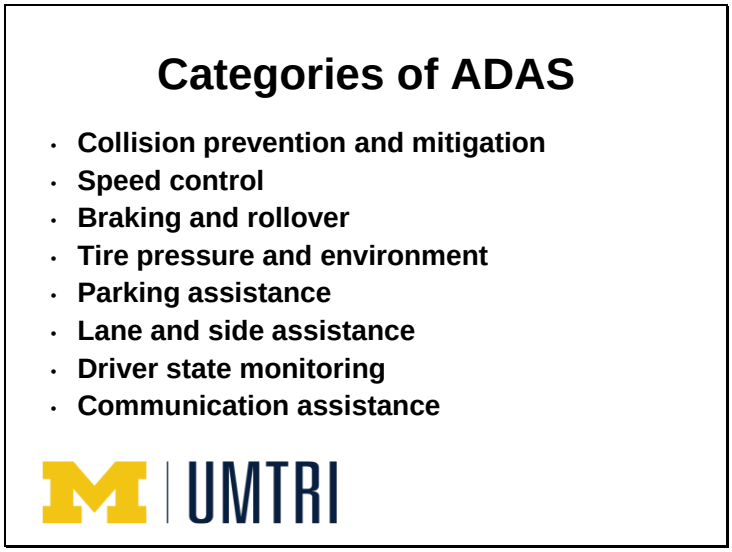
- Provide you with a background for understanding how to use advanced driver assistance and automated driving technologies.
- Provide you with resources for learning about how to use specific technologies.
- Show you how some of the technologies work in a vehicle on the Mcity test track.

Slide 5



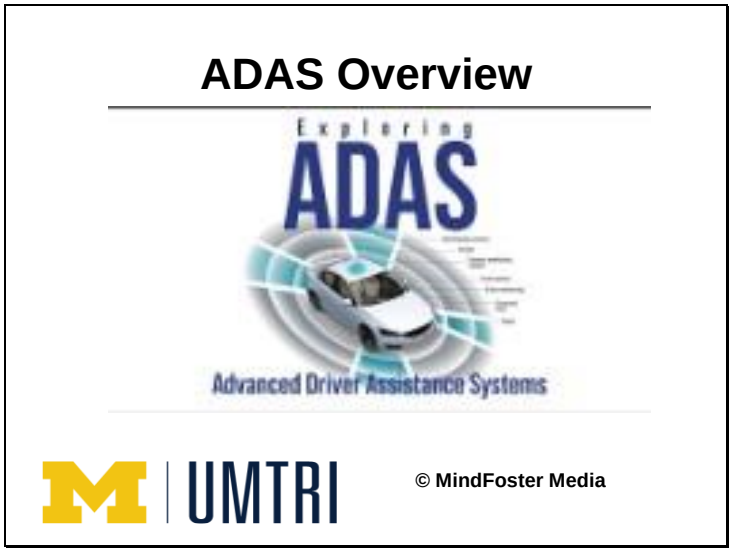
Advanced Driver Assistance System (ADAS) technologies are designed to reduce crashes and make it easier to drive, by helping the driver with certain tasks, and in some systems, automatically taking over control of part of the driving task like braking. ADAS technologies are becoming more common in vehicles and new ADAS are constantly being developed. ADAS technologies are built into vehicles as standard equipment and/or as part of a trim package. The use of ADAS technologies has been proposed as a potential way to keep older adults driving for as long as they can safely do so, by helping them overcome the common declines in functional abilities they may experience.

Slide 6



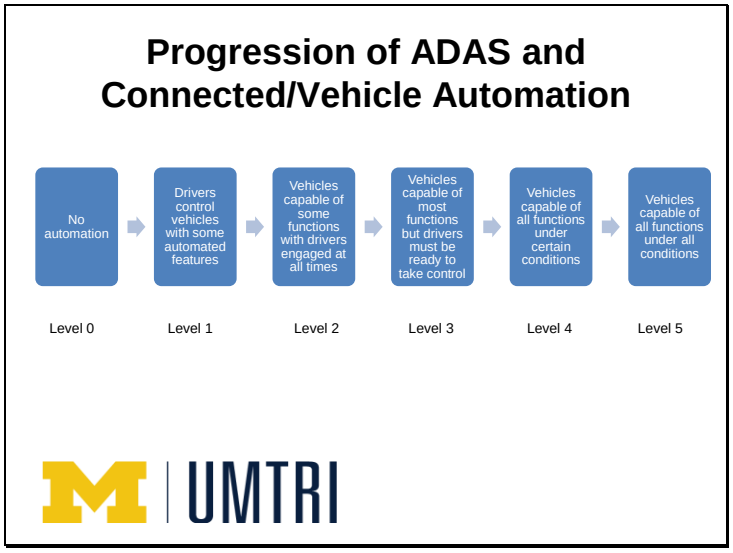
- There are numerous ADAS technologies and most newer vehicles have at least some (and some are not required by law).
- Here we categorize ADAS into several types based on their function.
    - Collision prevention/mitigation: e.g., automatic emergency braking
    - Speed control: e.g., Adaptive cruise control
    - Braking/rollover: e.g., Anti-lock braking, Electronic stability control
    - Tire pressure/environment: e.g., tire pressure monitoring, freeze/frost warning
    - Parking assistance: e.g., automatic parallel parking, parking spot location
    - Lane and side assistance: e.g., cross-traffic alert, blind-spot monitoring
    - Driver state monitoring: e.g., Drowsy driver alert
    - Communication assistance: e.g., voice controls, Bluetooth phone connection

Slide 7



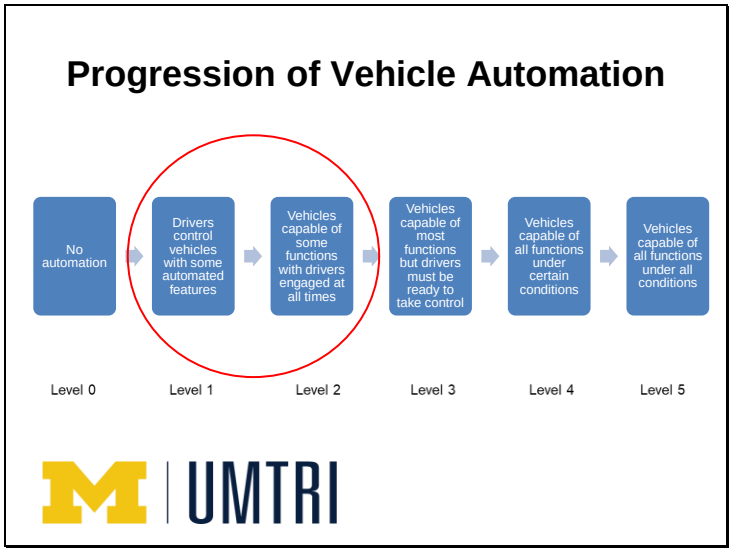
(VIDEO IS SHOWN)

Slide 8



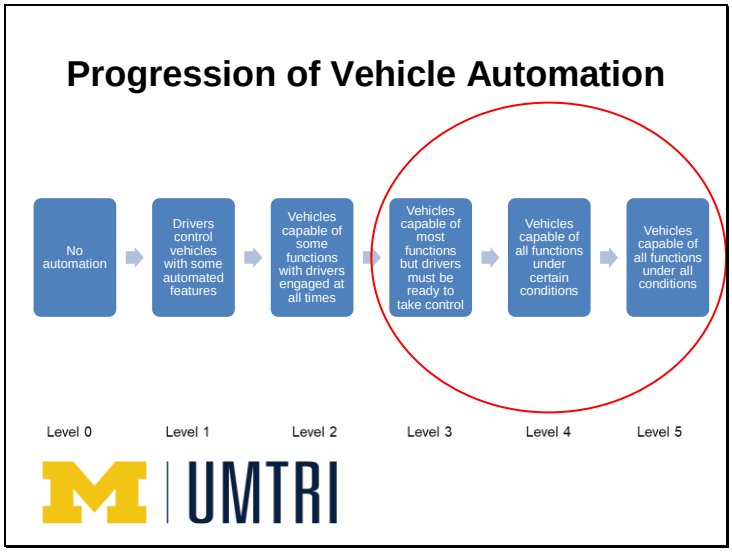
We hear about self-driving cars a lot in relation to vehicle automation. The technology that makes vehicles automated is still being developed now and that development is a long process that started with no automation and is expected to go all the way to vehicles that are capable of operating most vehicle functions, at all times, without drivers intervening. This progression of vehicle automation is often referred to the 6 Levels of Automation (0-5), based on Society of Automotive Engineers definitions.

Slide 9



Here's where we are now in that development process. All vehicles currently being sold in the US still require drivers to be engaged in the vehicle's operation at all times.

Slide 10



We expect that the next developments will produce vehicles with technology that takes complete control of driving without human supervision. However, at first [point to the Level 3 box] drivers will still need to be prepared to take control of the vehicle if the vehicle alerts them to.

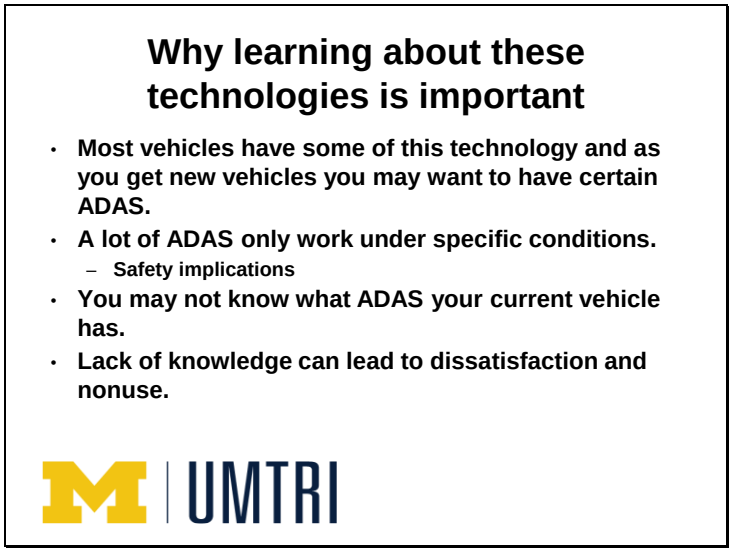
Slide 11



UMTRI

The Michigan Department of Transportation's Connected Vehicles program is coordinating some of this development in Michigan. Minnesota has a similar program. Here is video from Minnesota that provides a nice description and examples of CAVs.
(VIDEO IS SHOWN)

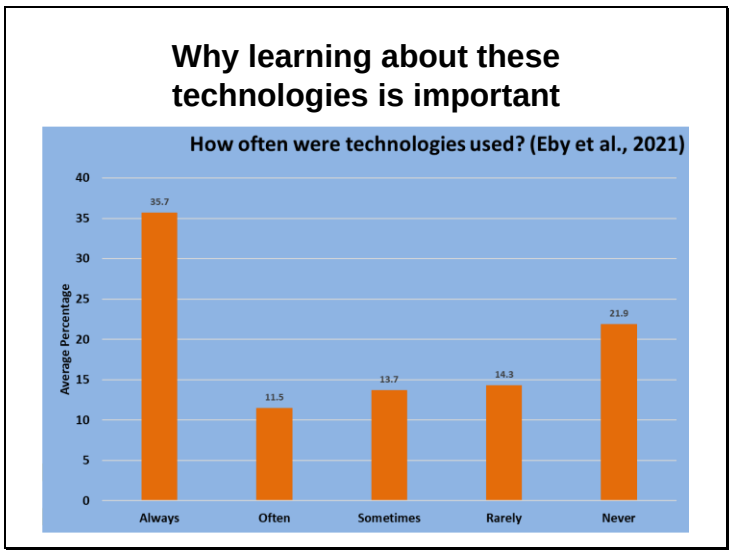
Slide 12



There are several reasons why it is a good idea for you to learning more about how advanced transportation technologies operate and are used:

- Most vehicles have some of this technology and as you get new vehicles you may want to have certain ADAS.
- A lot of ADAS only work under specific conditions. Use could be unsafe if you don't understand when ADAS works and when it does not.
- You may not know what ADAS your current vehicle has.
- Lack of knowledge can lead to dissatisfaction and nonuse. Lack of use prevents the many potential benefits of ADAS and AVs.

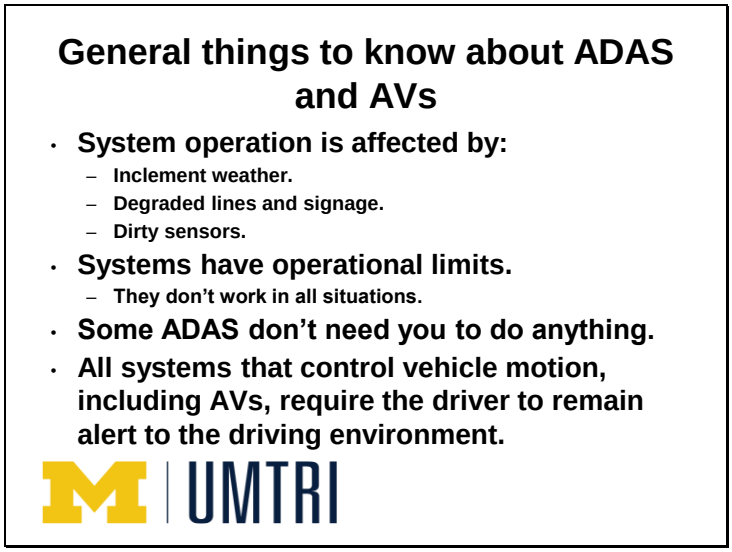
Slide 13



- These data are from a study we conducted of nearly 3,000 drivers age 65 and older. We asked them about ADAS in their vehicles and how often they used them. About one-third always used them, one-third rarely or never used them, and rest were part-time users.The technologies cannot provide safety or mobility benefits if they are not used.

- Eby, D.W., Kostyniuk, L.P., Molnar, L.J., Zakrajsek, J., Zanier, N., St. Louis, R.M., Smith, J., Yung, R., Nyquist, L., DiGuiseppi, C., Jones, V., Li, G., Mielenz, T.J., & Strogatz, D., on behalf of the LongROAD Research Team. (2021). *Advanced Driver Assistance System Technologies among Older Drivers: Changes in Prevalence, Use, and Perceptions Over 3 Years of the AAA LongROAD Study. (Research Brief.)* Washington, DC: AAA Foundation for Traffic Safety. https://aaafoundation.org/advanced-driver-assistance-systems-and-older-drivers-changes-in-prevalence-use-and-perceptions-over-3-years-of-the-aaa-longroad-study/

Slide 14



There are several general issues with advanced transportation technologies are useful to keep in mind.

- System operation is affected by a number of things including Inclement weather (snow, heavy rain, etc.); degraded or hard-to-read roadways lines and signage; sensors, such as camera and radars, that are dirty or snow covered; all systems have operational limits outside of which they may not perform as expected; some ADAS don't need you to do anything, they operate in the background and engage when needed such Electronic stability Control; and all systems that control vehicle motion, including AVs, require the driver to remain alert to the driving environment.

Slide 15

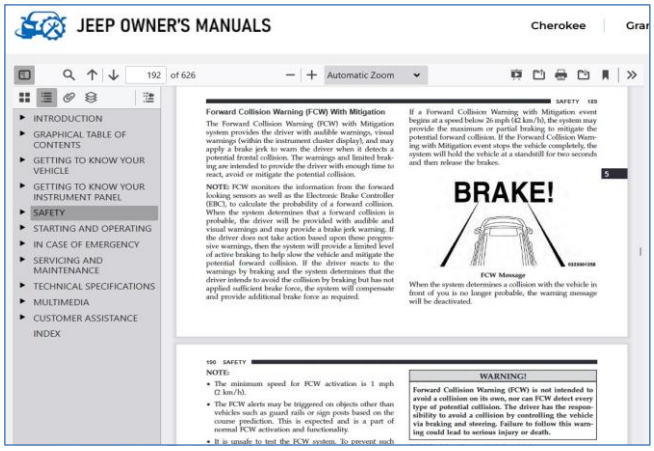


There are too many ADAS for us to go through each one and tell you about them. Instead, we point you to several sources where you can learn about the technologies you have in your vehicle. There are several sources.

- Dealership are increasingly understanding that their customers are interested in ADAS but are having difficulty learning how to use the system.

Slide 16

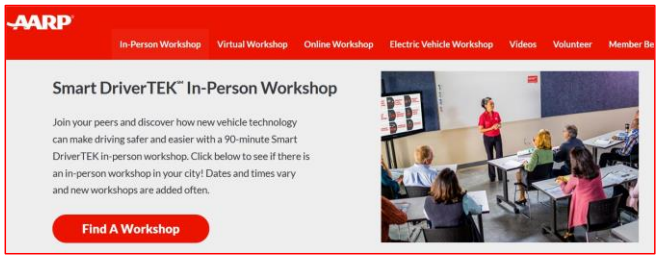
Sources: Owner's Manual



- Your vehicle's owner's manual will include text about each technology in your vehicle. Most manuals are now only available on-line. They generally have detailed information about how the technology works and how to use it.
- Cons:
    - These manuals are big, and it can be difficult to find what you are looking for if you don't the name of the technology.
    - If ADAS are available as trim package options, there may be technologies described in the manual that you don't have.
    - The explanations may be too technical.

Slide 17

Sources: Training



UMTRI

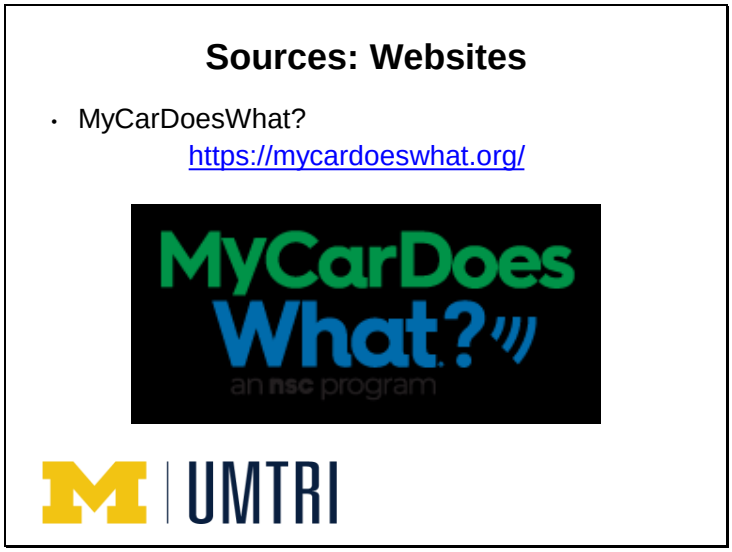
- There are several on-line and in-person training courses that you can take. Some are tailored to older populations such as the AARP Smart DriverTek workshop.
- https://www.aarp.org/membership/benefits/auto/smart-driver-tek/

Slide 18



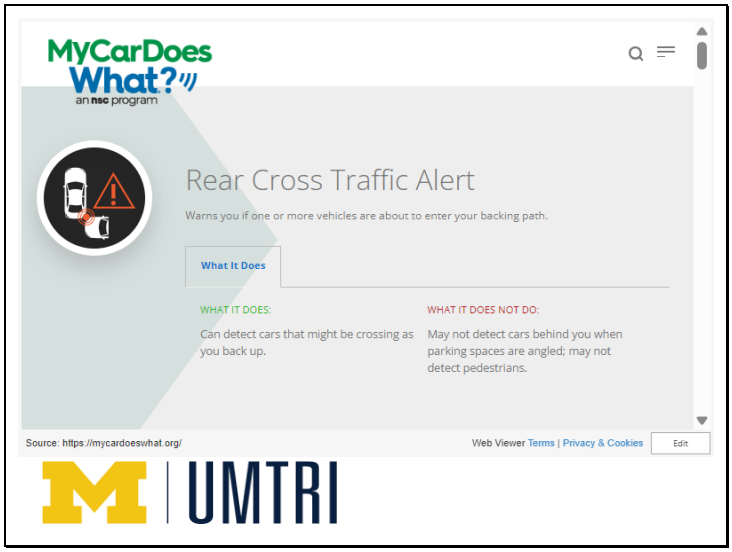
- This website is designed to enhance older driver safety and mobility in Michigan. It has a section on ADAS that includes a description and links to a dozen resources that can help you learn about ADAS and automated vehicles.
- https://www.michigan.gov/agingdriver/drivers/keeping-you-driving-safely

Slide 19



- The MyCarDoesWhat website offers easy-to-understand information about several individual ADAS technologies, including what is does and does not do; a quick guide on how to use the ADAS (sometimes with a video); brief discussion on how the technology works including tips for using the technology; a set of common questions and answers; and further information for those who want to learn more.

Slide 20



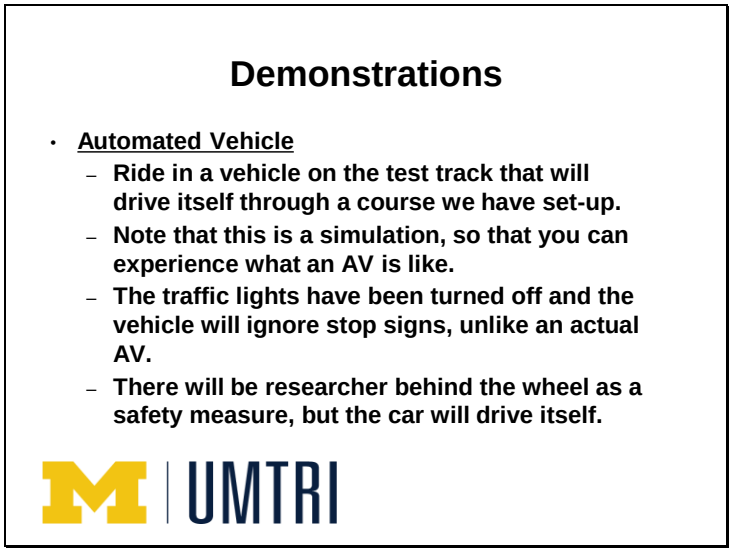
- (THE TRAINER SHOWS THE WEBSITE AND GOES THROUGH THE INFORMATION FOR AT LEAST ONE ADAS).

Slide 21



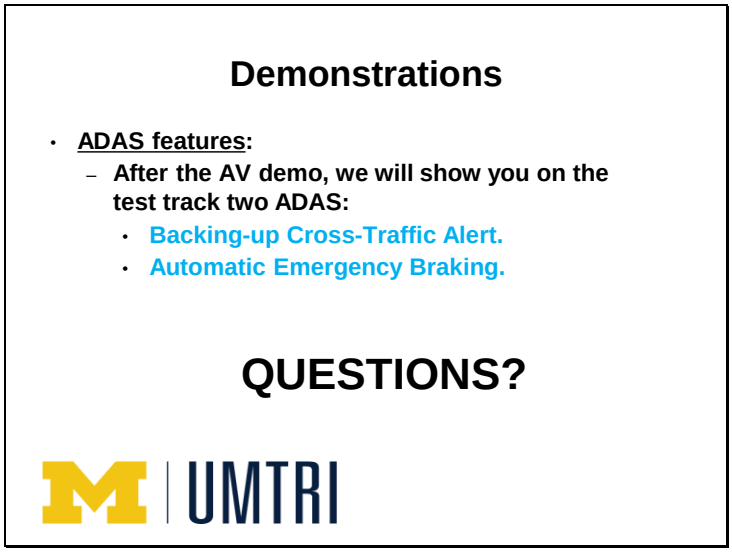
- (THE TRAINER ENCOURAGES AND ANSWERS QUESTIONS).

Slide 22



- This concludes the classroom portion of the training. The next part is the demonstrations on the Mcity test track.
- The first demonstration will be an automated vehicle. There are several things to know before we start:
    - You will ride in a vehicle on the test track that will drive itself through a course we have set-up.
    - Note that this is a simulation, so that you can experience what an AV is like.
    - The traffic lights have been turned off and the vehicle will ignore stop signs, unlike an actual AV.
    - There will be researcher behind the wheel as a safety measure, but the car will drive itself.

Slide 23



- After the AV demonstration, we will show you how two ADAS operate, and you will get to experience them while riding in the same vehicle while it is being driven by a researcher.
- The two technologies are:
    - Backing-up Cross-Traffic Alert.
    - Automatic Emergency Braking.
- (QUESTIONS ABOUT THE DEMONSTRATIONS ARE ANSWERED AND THEN THE OLDER ADULTS ARE BROUGHT OUT TO THE ADJACENT TEST TRACK WHERE THEY SIT AS PASSENGERS IN THE EXPERIMENTAL VEHICLE).

Appendix B: Pre-Training Questionnaire

Presence and use of ADAS in current vehicle

For the following questions, please indicate whether a vehicle that you drive regularly has the technology that is described, and if so, whether you have used that technology in the past month?

Description of Advanced Vehicle Technology	Does your vehicle have this technology			Have you used it in the past month		
	Yes	No	Don't know	Yes	No	Don't know
1. Technology that will steer and adjust speed at the same time so that you only need to monitor the driving, even over short periods of time (sometimes called a Level 2 automated driving system)?						
2. Technology that monitors what is ahead of your vehicle and will warn you and/or automatically brake if you are about to hit something (sometimes called forward collision warning or automatic braking)?						
3. Cruise control technology where you set the following distance and the technology will monitor what is ahead of you and automatically adjust the vehicle speed to maintain a set distance to the next vehicle (sometimes called adaptive cruise control)?						
4. Technology that can read speed limit signs, display the speed limit on your dashboard, and alert you when you are over the speed limit (sometimes called road sign assist)?						
5. Technology that will automatically switch your headlights from high-beam to normal and back when driving at night with oncoming traffic (sometimes called automatic high-beam headlights)?						
6. Technology that monitors your lane positioning and warns you when you are driving out-of-lane and/or automatically helps your vehicle stay in the center of the lane (sometime called lane keeping assist or lane departure warning)?						
7. Technology that will alert you to oncoming traffic and pedestrians when you are backing up (sometimes called cross-traffic alerts)?						
8. Technology that monitors the distances to objects behind your vehicle when you are backing up and provides alerts when you are too close (sometimes called back-up assist)?						

9. Technology that lets you control some vehicle features, such as the stereo, by using voice commands (sometimes called voice control)?						
10. Technology that will help you parallel park (sometimes called automatic parallel park)?						

Confidence in knowing where to look for information on ADAS use

11. If there was an advanced technology on your vehicle that you did not know how to use, how confident are you that you could find information about how that technology works? 1=not at all confident; 7=extremely confident.

Ratings of value for various sources of ADAS training.

12. On a scale of 1 (not at all) to 7 (extremely), how useful are the following for learning about how to use advanced technology in your vehicle?

	Not at all useful						Extremely useful
12a. Websites	1	2	3	4	5	6	7
12b. Family/friends	1	2	3	4	5	6	7
12c. Figure it out myself by trial-and-error	1	2	3	4	5	6	7
12d. Car dealership	1	2	3	4	5	6	7
12e. Owner's manual	1	2	3	4	5	6	7
12f. Television/news program	1	2	3	4	5	6	7
12g. Internet videos (e.g., YouTube)	1	2	3	4	5	6	7
12h. Attending a hands-on training event	1	2	3	4	5	6	7
12i. Other	1	2	3	4	5	6	7

_____

Attitude toward automated vehicles (level 2 and higher)

In this section we would like to know what you think about automated vehicles. Currently, some vehicles, such as the Tesla, can automatically drive the vehicle under limited circumstances without the driver needing to steer or use the brake/accelerator, but the driver still needs to pay attention in case the

vehicle needs the driver to take over driving. Future technologies may be able to drive automatically under more conditions and ultimately drive itself under all conditions. Please indicate your level of agreement with the statements about automated driving technology.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
13. I predict I would use automated vehicles in the future					
14. I plan to use automated vehicles in the future					
15. I will purchase or lease an automated vehicle for my next car					
16. Using automated vehicles is a good idea					
17. Using automated vehicles is a wise idea					
18. Using automated vehicles is pleasant					
19. Automated vehicles are dependable					
20. Automated vehicles are reliable					
21. Overall, I can trust automated vehicles					
22. I am concerned that automated vehicles will collect too much personal information from me					
23. I am concerned that automated vehicles will use my personal information for other purposes without my authorization					
24. I am concerned that automated vehicles will share my personal information with other entities without my authorization					
25. I'm worried about the general safety of automated vehicle technology					
26. I'm worried that the failure or malfunction of automated vehicles may cause accidents					

27. Using automated vehicles will be useful in meeting my driving needs					
28. Automated vehicles will allow me to do other tasks, such as eat, watch a movie, or be on a cell phone during my trip					
29. Using automated vehicles will decrease my accident risk					
30. Using automated vehicles will relieve my stress of driving					
31. I find automated vehicles to be useful when I'm impaired (e.g., drowsy, drunk, drugs)					
32. Learning to use automated vehicles will be easy for me					
33. I will find it easy to get an automated vehicle to do what I want it to do					
34. It will be easy for me to become skillful at using automated vehicles					
35. I will find automated vehicles easy to use					

Demographics

36. How do you identify?

01 Man
02 Woman
03 Nonbinary
04 Prefer to self-describe:_____

96 Other
98 Don't know
99 Refused/prefer not to answer

37. What race do you consider yourself to be? (select all that apply)

01 White
02 Black/African American
03 American Indian
04 Alaska Native
05 Asian
06 Native Hawaiian
07 Pacific Islander
08 Other (Specify)

98 Don't know
99 Refused

38. Are you Hispanic, Latinx, or of Spanish origin?
01 Yes
02 No

98 Don't know
99 Refused

39. From the following options, what is the highest degree or level of school you completed?
01 No schooling completed
02 1st – 8th grade
03 9th – 12th grade (No diploma)
04 High school graduate (high school diploma or equivalent)
05 Vocational, Technical, Business or Trade school certificate or diploma (beyond high school level)
06 Some college but no degree
07 Associate's degree
08 Bachelor's degree
09 Master's or doctoral degree

98 Don't know
99 Refused

40. Are you currently married, living with a partner, separated, divorced, widowed, or never married?
01 Married
02 Living with a partner
03 Separated
04 Divorced
05 Widowed
06 Never married

98 Don't know
99 Refused

41. Which of the following income groups includes your total household income last year before taxes?
01 Less than $20,000
02 $20,000 to $49,999
03 $50,000 to $79,999
04 $80,000 to $99,999
05 $100,000 or more

98 Don't know
99 Refused

Appendix C: Post-Training Questionnaire

Confidence in knowing where to look for information on ADAS use

1. If there was an advanced technology on your vehicle that you did not know how to use, how confident are you that you could find information about how that technology works? 1=not at all confident; 7=extremely confident.

Ratings of value for various sources of ADAS training.

2. On a scale of 1 (not at all) to 7 (extremely), how useful are the following for learning about how to use advanced technology in your vehicle?

	Not at all useful						Extremely useful
2a. Websites	1	2	3	4	5	6	7
2b. Family/friends	1	2	3	4	5	6	7
2c. Figure it out myself by trial-and-error	1	2	3	4	5	6	7
2d. Car dealership	1	2	3	4	5	6	7
2e. Owner's manual	1	2	3	4	5	6	7
2f. Television/news program	1	2	3	4	5	6	7
2g. Internet videos (e.g., YouTube)	1	2	3	4	5	6	7
2h. Attending a hands-on training event _____	1	2	3	4	5	6	7
2i. Other	1	2	3	4	5	6	7

_____

Attitude toward automated vehicles (level 2 and higher)

In this section we would like to know what you think about automated vehicles. Currently, some vehicles, such as the Tesla, can automatically drive the vehicle under limited circumstances without the driver needing to steer or use the brake/throttle, but the driver still needs to pay attention in case the vehicle needs the driver to take over driving. Future technologies may be able to drive automatically under more conditions and ultimately drive itself under all conditions. Please indicate your level of agreement with the statements about automated driving technology.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
3. I predict I would use automated vehicles in the future					
4. I plan to use automated vehicles in the future					
5. I will purchase or lease an automated vehicle for my next car					
6. Using automated vehicles is a good idea					
7. Using automated vehicles is a wise idea					
8. Using automated vehicles is pleasant					
9. Automated vehicles are dependable					
10. Automated vehicles are reliable					
11. Overall, I can trust automated vehicles					
12. I am concerned that automated vehicles will collect too much personal information from me					
13. I am concerned that automated vehicles will use my personal information for other purposes without my authorization					
14. I am concerned that automated vehicles will share my personal information with other entities without my authorization					
15. I'm worried about the general safety of automated vehicle technology					
16. I'm worried that the failure or malfunction of automated vehicles may cause accidents					
17. Using automated vehicles will be useful in meeting my driving needs					

18. Automated vehicles will allow me to do other tasks, such as eat, watch a movie, or be on a cell phone during my trip					
19. Using automated vehicles will decrease my accident risk					
20. Using automated vehicles will relieve my stress of driving					
21. I find automated vehicles to be useful when I'm impaired (e.g., drowsy, drunk, drugs)					
22. Learning to use automated vehicles will be easy for me					
23. I will find it easy to get an automated vehicle to do what I want it to do					
24. It will be easy for me to become skillful at using automated vehicles					
25. I will find automated vehicles easy to use					

Feedback on training session

	Strongly Agree	Agree	Disagree	Strongly Disagree
26. The training made me more confident about knowing where to locate information about advanced vehicle technologies.	[ ]	[ ]	[ ]	[ ]
27. I'm more excited about the future of automotive technologies now that I have learned more about them.	[ ]	[ ]	[ ]	[ ]
28. The training served as a useful reminder of things I already knew.	[ ]	[ ]	[ ]	[ ]
29. Experiencing the advanced vehicle technologies on a test track helped me better understand how they operated.	[ ]	[ ]	[ ]	[ ]
30. As a result of the training, I plan to consider or increase my use of advanced driver assistance systems.	[ ]	[ ]	[ ]	[ ]

31. As a result of the training, I plan to consider or increase my use of Level 2 automated vehicle technology.	[ ]	[ ]	[ ]	[ ]
32. I would recommend this training to friends or family members.	[ ]	[ ]	[ ]	[ ]

33. Overall, I would rate the usefulness of the training as:	**Extremely Useful** [ ]	**Moderately Useful** [ ]	**Somewhat Useful** [ ]	**Not at All Useful** [ ]

Appendix D: Level of Agreement with Statements about AVs Organized by Behavioral Intentions, Attitudes, Trust, Perceived Privacy Risk, Perceived Safety Risk, Perceived Usefulness, and Perceived Ease of Use Before and After Training.

	Pre-Training						Post-Training					
Behavioral Intentions	Strongly disagree 1	Disagree 2	Neither agree/ disagree 3	Agree 4	Strongly agree 5	Don't know 6	Strongly disagree 1	Disagree 2	Neither agree/ disagree 3	Agree 4	Strongly agree 5	Don't know 6
I predict I would use AVs in the future	6.9 (2)	20.7 (6)	31.0 (9)	13.8 (4)	20.7 (6)	6.9 (2)	6.9 (2)	20.7 (6)	17.2 (5)	31.0 (9)	20.7 (6)	3.4 (1)
I plan to use AVs in the future	7.1 (2)	25.0 (7)	28.6 (8)	17.9 (5)	10.7 (3)	10.7 (3)	6.9 (2)	17.2 (5)	24.1 (7)	24.1 (7)	24.1 (7)	3.4 (1)
I will purchase or lease an AV for my next car	17.9 (5)	35.7 (10)	21.4 (6)	7.1 (2)	3.6 (1)	14.3 (4)	10.3 (3)	20.7 (6)	34.5 (10)	17.2 (5)	13.8 (4)	3.4 (1)
Attitudes												
Using AVs is a good idea	0	10.3 (3)	34.5 (10)	31.0 (9)	17.2 (5)	6.9 (2)	3.4 (1)	10.3 (3)	13.8 (4)	48.3 (14)	20.7 (6)	0
Using AVs is a wise idea	0	10.3 (3)	41.4 (12)	24.1 (7)	17.2 (5)	6.9 (2)	3.4 (1)	10.3 (3)	24.1 (7)	34.5 (10)	20.7 (6)	0
Using AVs is pleasant	0	10.3 (3)	41.4 (12)	20.7 (6)	3.4 (1)	24.1 (7)	0	10.3 (3)	37.9 (11)	31.0 (9)	17.2 (5)	0
Trust												
AVs are dependable	0	13.8 (4)	41.4 (12)	17.2 (5)	3.4 (1)	24.1 (7)	3.4 (1)	13.8 (4)	48.3 (14)	17.2 (5)	10.3 (3)	3.4 (1)
AVs are reliable	0	17.2 (5)	41.4 (12)	17.2 (5)	3.4 (1)	20.7 (6)	3.4 (1)	13.8 (4)	44.8 (13)	24.1 (7)	6.9 (2)	3.4 (1)
Overall, I can trust AVs	6.9 (2)	27.6 (8)	27.6 (8)	17.2 (5)	3.4 (1)	17.2 (5)	3.4 (1)	10.3 (3)	34.5 (10)	31.0 (9)	13.8 (4)	0

	Pre-Training						Post-Training					
Perceived Privacy Risk	Strongly disagree 1	Disagree 2	Neither agree/ disagree 3	Agree 4	Strongly agree 5	Don't know 6	Strongly disagree 1	Disagree 2	Neither agree/ disagree 3	Agree 4	Strongly agree 5	Don't know 6
I am concerned that AVs will collect too much personal info from me	6.9 (2)	27.6 (8)	44.8 (13)	10.3 (3)	6.9 (2)	3.4 (1)	17.2 (5)	34.5 (10)	31.0 (9)	6.9 (2)	10.3 (3)	0
I am concerned that AVs will use my personal info for other purposes without my authorization	3.4 (1)	20.7 (6)	51.7 (15)	20.7 (6)	3.4 (1)	0	13.8 (4)	31.0 (9)	37.9 (11)	6.9 (2)	10.3 (3)	0
I am concerned that AVs will share my personal info with other entities without my authorization	3.4 (1)	20.7 (6)	44.8 (13)	20.7 (6)	6.9 (2)	3.4 (1)	13.8 (4)	27.6 (8)	27.6 (8)	20.7 (6)	10.3 (5)	0
Perceived Safety Risk												
I'm worried about the general safety of AV technology	0	10.3 (3)	10.3 (3)	48.3 (14)	27.6 (8)	3.4 (1)	3.4 (1)	41.4 (12)	13.8 (4)	31.0 (9)	10.3 (3)	0
I'm worried that the failure or malfunction of AVs may cause accidents	0	7.1 (2)	17.9 (5)	46.4 (13)	28.6 (8)	0	3.4 (1)	17.2 (5)	13.8 (4)	55.2 (16)	10.3 (3)	0

	Pre-Training						Post-Training					
Perceived Usefulness	Strongly disagree 1	Disagree 2	Neither agree/ disagree 3	Agree 4	Strongly agree 5	Don't know 6	Strongly disagree 1	Disagree 2	Neither agree/ disagree 3	Agree 4	Strongly agree 5	Don't know 6
Using AVs will be useful in meeting my driving needs	7.4 (2)	25.9 (7)	25.9 (7)	22.2 (6)	11.1 (3)	7.4 (2)	3.4 (1)	27.6 (8)	24.1 (7)	27.6 (8)	17.2 (5)	0
AVs will allow me to do other tasks, such as eat, watch a movie or be on a cell phone during my trip	17.2 (5)	44.8 (13)	20.7 (6)	6.9 (2)	0	10.3 (3)	17.2 (5)	48.3 (14)	13.8 (4)	20.7 (6)	0	0
Using AVs will decrease my accident risk	0	13.8 (4)	34.5 (10)	24.1 (7)	13.8 (4)	13.8 (4)	0	6.9 (2)	27.6 (8)	48.3 (14)	17.2 (5)	0
Using AVs will relieve my stress of driving	10.3 (3)	20.7 (6)	34.5 (10)	17.2 (5)	10.3 (3)	6.9 (2)	6.9 (2)	24.1 (7)	34.5 (10)	27.6 (8)	6.9 (2)	0
I find AVs to be useful when I'm impaired (e.g., drowsy, drunk, drugs)	17.2 (5)	24.1 (7)	24.1 (7)	20.7 (6)	3.4 (1)	10.3 (3)	20.7 (6)	34.5 (10)	13.8 (4)	27.6 (8)	0	3.4 (1)

	Pre-Training						Post-Training					
Perceived Ease Of Use	Strongly disagree 1	Disagree 2	Neither agree/ disagree 3	Agree 4	Strongly agree 5	Don't know 6	Strongly disagree 1	Disagree 2	Neither agree/ disagree 3	Agree 4	Strongly agree 5	Don't know 6
Learning to use AVs will be easy for me	0	13.8 (4)	37.9 (11)	31.0 (9)	10.3 (3)	6.9 (2)	0	6.9 (2)	44.8 (13)	41.4 (12)	6.9 (2)	0
I will find it easy to get an AV to do what I want it to do	0	13.8 (4)	37.9 (11)	20.7 (6)	6.9 (2)	20.7 (6)	0	13.8 (4)	41.4 (12)	31.0 (9)	3.4 (1)	10.3 (3)
It will be easy for me to become skillful using AVs	0	10.3 (3)	34.5 (10)	31.0 (9)	10.3 (3)	13.8 (4)	0	6.9 (2)	48.3 (14)	41.4 (12)	3.4 (1)	0
I will find AVs easy to use	0	13.8 (4)	34.5 (10)	20.7 (6)	10.3 (3)	20.7 (6)	0	13.8 (2)	37.9 (11)	44.8 (4)	0	3.4 (1)

Appendix E: Outputs, Outcomes, and Impacts

Synopsis of Performance Indicators Part I and II

This project involved the participation of 29 active older adults residing in the greater Ann Arbor area. These older adults participated in a newly developed training program to help them learn about advanced transportation technology, specifically Advanced Driver Assistance System (ADAS) and Automated Vehicle (AV) technology. The training program took place at Mcity and entailed both a classroom portion and a portion that was a demonstration of several technologies on the Mcity test track.

Outputs

Peer-reviewed Papers at Conferences

None.

Presentations at Conferences and Meetings

- The project PI will present results of the project at the UMTRI PI meeting in October, 2024.
- A project Co-I, will present the results at the Annual Meeting of the Gerontological Society of America conference in November, 2024.

Other Outputs

This project resulted in several important research outputs that have the potential to improve the effectiveness and safety of the transportation system, particularly in the areas of accessibility and acceptance by older adults of advanced transportation system technology. These are highlighted below.

- We developed a curriculum that can be used/modified as a training tool to help older adults learn about ADAS and AV technologies.
- Survey instruments were developed to evaluate effectiveness of the ADAS/AV training programs, including the effects of several barrier to use based on the extended technology acceptance Model.
- Recommendation for the development of new training programs for older adult learning about advanced transportation technologies were developed.

Outcomes

- The project team's pilot test activities resulted in strengthening the body of knowledge relative to older adults learning about advanced transportation technologies and how hands-on training can help overcome some of the barriers to use among older adults.

Impacts

We hope to see important long-term impacts from this project and any further projects based on it. Specifically, we hope to see important impacts on transportation education (resulting in an increase in the pool of trained professionals and available training programs for older adults) and ultimately increased use of ADAS and AVs among older adults.