ASSESSMENT OF OREGON DEPARTMENT OF TRANSPORTATION (ODOT) CONNECTED VEHICLE POSITION THROUGH INTERNAL SURVEY

TASK 1 OF PREPARING A POSSIBLE OREGON ROAD MAP FOR CONNECTED VEHICLE/COOPERATIVE SYSTEMS DEPLOYMENT SCENARIOS

Task 1 Report

SPR 764

Assessment of Oregon Department of Transportation (ODOT) Connected Vehicle Position through Internal Survey

Task 1of Preparing a Possible Oregon Road Map for Connected Vehicle/Cooperative Systems Deployment Scenarios

Task 1 Report

SPR 764

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Abstract: The goal of this project was to lay the groundwork for Oregon to be prepared to lead in the implementation of a connected vehicle/cooperative systems transportation portfolio, and/or to avoid being caught by surprise as developments in this area evolve quickly. The project assessed ODOT's internal mechanisms for addressing connected vehicle/cooperative systems, scanned, reviewed and assessed the technical maturity of potential connected vehicle/cooperative system applications, developed preliminary goals, linked to prospective connected vehicle/cooperative systems applications, and refined/ranked/prioritized those that fit with potential ODOT role in advancing/leading these initiatives. The project identified opportunities for linking ODOT's current programs with national and international connected vehicle/cooperative system research, testing and deployment initiatives, and recommended a final shared vision and "road map" for Oregon's priority connected vehicle/cooperative system applications. This volume summarizes the results of a detailed internal-only assessment and inventory of current technical and "cultural" status of ODOT activities and gain sense of interest and readiness for potential alignment with potential applications and the future of connected and automated vehicles. A survey was distributed to agency staff in order to gauge perception of connected and automated vehicle technology. The empirical results of the survey are described in detail. In general, most respondents had heard of these technologies and were in favor of their application. However, many had concerns about cyber security and system failure having catastrophic consequences. Likewise, many voiced concerns about ODOT's preparedness for connected or automated vehicles. ODOT and other agencies can use these findings to help prepare for a better future of connected and automated vehicles.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	millimeters squared	mm^2
ft^2	square feet	0.093	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	ml
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3
NOTE: Volumes greater than 1000 L shall be shown in m^3.				
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit	(F-32)/1.8	Celsius	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
m^2	meters squared	1.196	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
ml	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius	1.8C+32	Fahrenheit	°F

*SI is the symbol for the International System of Measurement

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DISCLAIMER

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1.1 INTRODUCTION

The U.S. DOT plans to fund future pilot deployments of mobility and environmentally related applications in the coming years. With connected vehicle research transitioning into the deployment stage, the private sector, MPOs, and state, local, and transit agencies will start experiencing pressure to incorporate these vehicles into the public fleet. This pressure is due to aftermarket devices, mobile devices, and infrastructure with DSRC and other wireless connectivity at their cores.

The goal of this project is to lay the groundwork for Oregon to be prepared for the future implementation of a connected vehicle/cooperative systems transportation portfolio. It is essential that ODOT consider whether to take an early national leadership role and/or to avoid being caught by surprise as developments in this area evolve quickly. This has been done by assessing ODOT's current internal mechanisms for addressing connected vehicle/cooperative systems including consideration of technical readiness/compatibility, planning, operational, maintenance, and governance perspectives. Included is attention to ODOT's fleet, and potential for connection to DMV operations. With this in mind, Oregon can determine whether or not to pursue the next phases of federal connected vehicle application funding.

The objective of this survey is to contribute towards an internal inventory of the current technical and "cultural" status of ODOT activities. From this assessment, we will gain a sense of interest and readiness for potential alignment with potential applications and the future of connected vehicles. Existing internal organizations were leveraged for input on survey questions and will receive the survey results.

The research team worked closely with the TAC and ODOT staff on these elements. The first set of surveys were distributed at meetings of the ITS Opportunities Team (ITOT), the Technical Leadership Team, the Planning Business Leadership Team, the Maintenance and Operations Meeting, the Traffic Operations Leadership Team and key players from the Intermodal Leadership Team. Further contacts with ODOT staff from all regions (urban/rural) performed via an online version of the survey. Survey and meeting results, including key opportunity areas will be listed and documented later in this chapter. In total, there are 115 survey responses collected including 47 paper-based survey and 68 online responses, a detailed presentation of the responses to each survey question is presented in sections 3.0 and 4.0. As a caveat, we note that there are about 4,600 total ODOT employees, so this was not a scientific or random sample of employees, but rather a means of providing education about the research project and obtaining feedback from key staff.

1.2 METHODOLOGY

A survey (see survey form in Section 2.0) was distributed comprised of two sections. The first section provided background information regarding connected vehicle (CV) technologies and the benefits that will be available with CV implementation. The subjects were asked detailed questions concerning connected vehicles. These questions were used to gauge ODOT's diverse personal knowledge, the general perception, and concerns regarding CVs and their prospective deployment. In terms of a person's ready knowledge of CVs, the team asked questions about the subject's awareness of the needed technologies needed to implement CVs, the opinion whether ODOT was prepared for CVs to be on public roads, and if they had heard about CVs before this survey was conducted. To assess a subject's general perception of CVs, a series of questions were directed towards how the subject rated CVs benefits. They were then asked about the readiness of ODOT for the implementation, and ODOT's technical preparedness for the arrival of CVs. Lastly, to address the subject's concerns about CVs, the survey outlined detailed potential concerns that the public, ODOT managers, and the team may have about CVs.

The second portion of this survey was focused on automated vehicles (AVs). This section of the survey provided some background information by including the definition, the technologies, the taxonomy of automation levels, and the functions of vehicle to driver interactions. The questions that were asked aimed to gauge the diverse knowledge base of ODOT staff, the general perceptions, and concerns regarding AVs. In terms of a person's ready knowledge of AVs, the team asked questions about the subject's awareness of the needed technologies needed to implement AVs, the opinion if ODOT was prepared for AVs to be on public roads, and if they had heard about AVs before this survey was conducted. To assess a subject's general perception of AVs, a series of questions were directed towards how the subject rated AV benefits, the readiness of ODOT for the implementation, and ODOT's technical preparedness for the arrival of AVs. Lastly, to address potential concerns about AVs, the survey outlined detailed potential concerns that the public, ODOT managers, and the team may have about AVs.

Embedded in the survey was an option offered to each question for any specific comments that the respondent had. The survey also included a question about which division or section within ODOT the subject worked. Lastly, the team posed a question towards the subjects to identify which division within ODOT that should have the highest priority for preparing for CVs and AVs.

1.3 RESULTS

The survey results of the potential benefits and envisioned issues with connected vehicles are reported in great detail in Sections 3.0 and 4.0; here follows some highlights of the major findings. Survey question 8 (see Section 2.0 for the question and Section 3.0 for the responses) indicates that of the 115 survey respondents, the largest number works in the Highway Division (37%), followed by Central Services and the Transportation Development Division at 9% each.

1.3.1 Connected Vehicles

The majority (93%) of the respondents had prior knowledge of connected vehicles and had generally positive opinions regarding them (37% very positive and 45% somewhat positive) with

only a very small proportion (2%) holding a very negative opinion. As far as the potential for benefits of using connected vehicles, more than half of the respondents believe that they are somewhat or very likely; with the exceptions of reduced driver distraction (61% somewhat or very unlikely) and reduced agency costs (55% somewhat or very unlikely). A total of 92% of respondents indicate that the safety benefits (reduced crashes) are somewhat or very likely. Opinions were divided regarding the potential for reduced insurance rates, where 40% of the respondents believe they are somewhat likely and 34% of the respondents believe they are somewhat unlikely.

Next, respondents were asked about concerns related to connected vehicles. Overall system cybersecurity was the largest concern with 40% moderately concerned and 39% very concerned. A total of 44% were very concerned about driver overreliance on technology. Other notable concerns included safety consequences of system failure (39% very concerned and 35% moderately concerned) and vehicle cybersecurity (37% very concerned and 34% moderately concerned). Nearly 40% expressed high levels of concern for both data privacy and interacting with pedestrians/bicyclists. Only 6% are very concerned about learning to use connected vehicles.

More than 70% of the respondents held a positive attitude (very promising to somewhat promising) for the involvement of ODOT in the development of the infrastructure of connected vehicles with 22% of the respondents remaining neutral.

About 45% of the respondents are skeptical regarding ODOT's technical preparedness for connected vehicles, with 24% having a neutral stand and 28% considering it somewhat promising. For ODOT's cultural preparedness, 55% of the respondents believe that the agency is not prepared, and interestingly, 16% of the respondents did not answer the question.

When asked about which division of ODOT should receive the highest priority for connected vehicle preparation, the largest response was for the Transportation Development Division (TDD), at 26%. TDD includes sections and units related to Research, Planning, Transportation Data and Active Transportation. A total of 23% of the respondents indicated "None," with the next largest groups mentioning Safety, Central Services and the Office of the Director. Respondents were asked to think about choosing one area to invest in for technical preparation for connected vehicles. A total of 13% of respondents chose None/Don't Know or did not answer. The next largest groupings aimed at efforts to monitor technology, invest in Intelligent Transportation Systems (ITS) and/or traffic signals, planning/research, safety/security and data management/GIS.

In terms of cultural preparation for connected vehicles, 23% of respondents mentioned training and education, and 12% mentioned outreach and public information. The area of safety and enforcement received an 8% response. Others emphasized the need to examine potential legislation, regulation and liability issues.

A question was asked about potential ODOT investment in preparation for connected vehicles—no specific dollar amounts were specified here, but the notion of investment could take many forms. Examples could include allocation of staff for monitoring technological developments and inclusion of extra space and power sockets in traffic signal controller cabinets or other roadside

hardware construction. Investment could also include "in kind" participation and contribution to a potential U.S. DOT CV Pilot project. Approximately three quarters (73%) of the respondents believe that ODOT should invest financially into preparing for connected vehicles. Along these lines 75% of respondents felt that ODOT should in fact play a role in upcoming U.S. DOT connected vehicle pilots. One fourth of respondents felt that safety/security would be a worthwhile and promising area to pursue for a connected vehicle pilot. Some specifically mentioned an urban pilot (7%), others mentioned a rural pilot (7%) and others favored a pilot focusing on a corridor (5%). Other categories receiving notable responses included planning/bicycle/pedestrian (5%), fleets/freight (5%) and ITS/traffic management (7%).

1.3.2 Automated Vehicles

Almost all respondents had prior knowledge of automated vehicles and 70% express a positive attitude towards them. Regarding the potential benefits of automated vehicles, 88% believe in the potential to reduce the number of crashes, and 86% think that reduced crash severity will result. Better fuel economy and improved emergency response also received large responses. For the other surveyed benefits, nearly half express a somewhat likely stand. However, the respondents are less convinced that there will be a reduction in traffic congestion due to the introduction of automated vehicles as compared to the other cited benefits.

As far as the potential issues to be considered related to automated vehicles, the respondents main concerns are related to the consequences of equipment/system failure (52% very concerned, 29% moderately concerned), system and vehicle security (nearly 45% very concerned plus approximately 30% moderately concerned), and the idea of riding in a vehicle without a driver was a great concern for 41% of the participants. Liability is also a noteworthy issue for respondents with 39% very concerned and 42% moderately concerned.

The potential issue with the lowest level of concern was found to be learning how to use automated vehicles, with nearly a quarter expressing no concern at all. Interactions with pedestrians and bicyclists was a concern, as a mere 5% stated no concern.

A total of 55% of the respondents indicate that their skepticism regarding ODOT’s technical preparedness in regard to automated vehicles, whereas 21% were neutral. As for the cultural preparedness, a similar distribution to the technical preparedness response was observed, with a higher percentage of participants taking a neutral stand (28%). The prioritization of a division for preparing for automated vehicles within ODOT resulted in fragmented responses, with the highest response for the Highway Division (26%), followed by the Transportation Development Division (19%) and the Transportation Safety Division (13%).

For the open-ended question regarding where ODOT should choose to invest time or resources for technical preparation for automated vehicles, there was a wide range of responses. The largest groupings were around legal/legislation/regulatory/standards (14%), training/education (9%), information technology/data management (9%) and safety (9%). For the similar open ended question regarding ODOT's investment in cultural preparation, a sizable proportion of respondents focused on training/education/outreach (34%), followed by policy/legislation (18%), safety (9%) and pilot testing/demonstrations (9%).

1.4 DISCUSSION

The focus of this component of this project was to gather in-depth responses from a set of selected ODOT employees regarding their opinions on both connected and automated vehicles, as well as how technically and culturally ready ODOT is to handle these new technologies.

A total of 115 questionnaires were collected, 68 of which were online and the remaining 47 were paper-based. When the participants were asked their general opinion regarding connected vehicles, their responses were mixed. A large number of responses were concerned with the computer on board taking control from the driver and controlling the vehicle at any time. From this, they are concerned with the ability for an outside entity to have the ability to take control of the vehicle. There was also the mention of privacy and "big brother," mentions of implications for personal responsibility of drivers, in addition to needing funding to upgrade current facilities to accommodate this new technology.

However, other participants felt that there would be a large decrease in crashes. For those participants who have grown up around technology, they felt no qualms about turning over personal privacy in exchange for increased safety on roads. Some said that having the vehicles controlled by computer would be much better than some drivers in the general public. This was in large part contributed to by the speed at which computers can respond compared to human reaction time.

Another question that the participants were asked was: if the Oregon DOT were to become engaged with the development of connected vehicle related infrastructure, how promising do you think this development would be? Many responses were focused on how this could negatively affect current levels of funding in order to retrofit current roadway systems for these vehicles. Multiple participants proposed that ODOT should look into third party/private developers. Participants also expressed concerns about the failure of a project this size, in that if anything were to go wrong, Oregonians and the nation would never forget. However, along with these concerns, there was expressed interest on the gains in data collection that could be obtained for future vehicle studies (speed, usage priority, travel paths, etc.).

This study also revealed whether or not ODOT's employees felt that the Oregon DOT is technically prepared for the arrival of connected vehicles. Some expressed that as an agency, they have a spirit of openness to innovation, but were not sure whether they have the technical capacity for this specific work or funding for this kind of retrofit, regarding the increase in time and money that would need to be generated to get the software to work across the state and at the standards of ODOT. Participants even conveyed how ODOT would not be prepared for the implementation of this new technology. There was expressed concern that state agencies are notorious for not handling implementation of large information technology (IT) projects very well.

This survey also asked participants to what extent they believe that the Oregon DOT is culturally prepared for the arrival of connected and/or automated vehicles. There were some participants who are very reluctant to rely on any form of technology, and there are others who had never heard of CV/AV before taking the study. Concerning rural communities, they tend to receive less consideration because of the relatively sparse population balance, however it is anticipated that

the large and widespread rural communities will be culturally resistant to adoption of CV/AV, even within the agency. Regarding the aspect of tracking the movement of an individual's vehicle, there was increased concern for the public being willing to participate for any reason other than criminal investigation due to privacy rights being infringed upon. ODOT personnel provided details about how organizational change will be needed, and that is never easy for the agency or for the public to accept these new changes. Overall, those participants who are in favor of this change stated that the society that we are currently living in wants the newest technology that simplifies work, and this will in turn improve public safety.

The last subject focused on for this survey was asking participants to identify one area that needed to be invested in, through time or resources, for preparing culturally for the arrival of connected and automated vehicles. The ODOT employees surveyed stated that there were three areas that need to be focused on in order to implement connected and/or automated vehicles: education, training of ODOT personnel, and ODOT's stance on the implementation of connected and/or automated vehicles.

When focused on education, ODOT employees suggested using videos or public service announcements (PSAs) to get people excited about the new changes to come, and persuade the public on how the use of these technologies would not result in a constant watching of the public activities. Additionally, the PSAs would enable the public to understand how these technologies can help ODOT, as well as discussing the technology's strong and weak points. ODOT participants felt that implementation outreach programs, including demonstrations and materials that clearly demonstrate both the promises and the limitations (transparency builds trust), would need to be completed.

Pertaining to the training ODOT personnel would need on connected and automated vehicles, there will need to be clearly defined duties that match the responsibilities within their division, such as the impact of cars on infrastructure and interaction with other vehicles, field staff for maintenance and operations, and recognize the generational issue that is consistent with these new technologies. There will need to be increased communication between those personnel working in the field and designers focusing on understanding how current "roadside equipment" will be affected by this change, and what will be needed and included in ODOT's maintenance work.

The research team reviewed other similar surveys *(UMTRI 2014A; UMTRI 2014B),* and worked closed with the Technical Advisory Committee (TAC) and ODOT staff on these elements. Then, they need to start development of a comprehensive plan that identifies all affected organizational areas. This document should identify what ODOT units will be affected, how it will affect them, when it will affect them, and what the staff should be doing now to get ready. Participants believe that IT would benefit greatly from this technology. However, there was expressed concern on the needed safeguards currently in place to minimize information security risks.

2.0 SURVEY QUESTIONNAIRE

PREPARING A POSSIBLE OREGON ROAD MAP FOR CONNECTED VEHICLE/COOPERATIVE SYSTEMS DEPLOYMENT SCENARIOS

The objective of this survey is to contribute toward an internal inventory of the current technical and "cultural" status of ODOT activities and gain a sense of interest and readiness for potential alignment with potential applications and the future of connected and automated vehicles.

Connected Vehicles Background

Connected-vehicle technologies are envisioned to ultimately encompass safety, mobility, and environmental applications.

Connected-vehicle safety applications would enable vehicles to have 360-degree awareness to inform a vehicle operator of hazards and situations they cannot see. These safety applications have the potential to reduce crashes through advisories and warnings. For instance, vehicle operators may be advised of a school zone, sharp curve, or slippery patch of roadway ahead, and may be warned in more imminent crash situations, such as during merging operations or if the vehicle ahead stops suddenly. Vehicles can also be warned of bicycles and pedestrians through connected-vehicle technology, enhancing the safety of these travel modes.

Connected-vehicle mobility applications are intended to provide a connected, data-rich travel environment based on information transmitted anonymously from thousands of vehicles that are using the transportation system at a particular time. This information could help transportation managers monitor and manage transportation system performance by adjusting traffic signals, transit operations, or dispatching maintenance crews or emergency services, for example.

Providing travelers with real-time information about traffic congestion and other travel conditions is expected to help them make more informed decisions that can reduce the environmental impact of their trip. Informed travelers may decide to avoid congestion by taking alternate routes or public transit, or by rescheduling their trip, all of which can make their trip more fuel-efficient and ecofriendly. The ability for vehicles to "talk to" the infrastructure could provide information to the vehicle operator so that he/she can drive through a traffic signal network at optimum speeds to reduce stopping.

Connected Vehicles Questions

1. Had you heard about connected vehicles before today?
   - ☐ Yes
   - ☐ No

2. What is your general opinion regarding connected vehicles?
   - ☐ Very positive
   - ☐ Somewhat positive
   - ☐ Neutral
   - ☐ Somewhat negative
   - ☐ Very negative
   - ☐ Specific comments: _____

3. How likely do you think it is that the following benefits will occur when using connected vehicles?

	Very likely	Somewhat likely	Somewhat unlikely	Very unlikely
a. Fewer crashes	☐	☐	☐	☐
b. Reduced crash severity	☐	☐	☐	☐
c. Improved emergency response to crashes	☐	☐	☐	☐
d. Less traffic congestion	☐	☐	☐	☐
e. Lower vehicle emissions	☐	☐	☐	☐
f. Shorter travel times	☐	☐	☐	☐
g. Better fuel economy	☐	☐	☐	☐
h. Lower insurance rates	☐	☐	☐	☐
i. Fewer driver distractions	☐	☐	☐	☐
j. Improved agency operations	☐	☐	☐	☐
k. Reduced agency costs	☐	☐	☐	☐

4. How concerned are you about the following issues related to connected vehicles?

	Very concerned	Moderately concerned	Slightly concerned	Not at all concerned
a. Safety consequences of equipment failure or system failure	☐	☐	☐	☐
b. Legal liability for drivers/owners	☐	☐	☐	☐
c. System security (from hackers)	☐	☐	☐	☐
d. Vehicle security (from hackers)	☐	☐	☐	☐
e. Data privacy (location and speed tracking)	☐	☐	☐	☐
f. Interacting with non-connected vehicles	☐	☐	☐	☐
g. Interacting with pedestrians and bicyclists	☐	☐	☐	☐
h. Learning to use connected vehicles	☐	☐	☐	☐
i. Increased distractions for drivers	☐	☐	☐	☐
j. System performance in poor weather	☐	☐	☐	☐
k. Drivers will rely too much on the technology	☐	☐	☐	☐

5. If the Oregon DOT were to become engaged with the development of connected vehicle related infrastructure how promising do you think this development would be?
   - ☐ Very promising
   - ☐ Somewhat promising
   - ☐ Neutral
   - ☐ Not very promising
   - ☐ Not at all promising
   - ☐ Specific comments: _____

6. To what extent do you believe that the Oregon DOT is technically prepared for the arrival of connected vehicles in our state?
   - ☐ Very prepared
   - ☐ Somewhat prepared
   - ☐ Neutral
   - ☐ Somewhat unprepared
   - ☐ Very unprepared
   - ☐ Specific comments: _____

7. To what extent do you believe that the Oregon DOT is culturally prepared for the arrival of connected vehicles in our state?
   - ☐ Very prepared
   - ☐ Somewhat prepared
   - ☐ Neutral
   - ☐ Somewhat unprepared
   - ☐ Very unprepared
   - ☐ Specific comments: _____

8. In which division of ODOT do you work?
   - ☐ Central Services
   - ☐ Office of Civil Rights
   - ☐ Office of the Director
   - ☐ Driver and Motor Vehicle
   - ☐ Highway Division
   - ☐ Motor Carrier Transportation
   - ☐ Transportation Development Division
   - ☐ Transportation Safety Division
   - ☐ Rail/Transit Division
   - ☐ Other: _____

9. In which division of ODOT do you think the highest priority should be placed for preparing for connected vehicles?
   - ☐ Central Services
   - ☐ Office of Civil Rights
   - ☐ Office of the Director
   - ☐ Driver and Motor Vehicle
   - ☐ Highway Division
   - ☐ Motor Carrier Transportation
   - ☐ Transportation Development Division
   - ☐ Transportation Safety Division
   - ☐ Rail/Transit Division
   - ☐ Other: _____

10. If ODOT could choose one area to invest in time or resources for preparing technically for the arrival of connected vehicles what should that be?

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11. If ODOT could choose one area to invest in time or resources for preparing culturally for the arrival of connected vehicles what should that be?

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12. Do you think ODOT should be willing to invest financially in preparation for connected vehicles (e.g. a marginal cost in construction or maintenance projects)? '
    - ☐ Yes
    - ☐ No
    - ☐ Other: _____

13. Do you think ODOT should play a role in an upcoming connected vehicle pilot funded by the U.S. DOT? If so which areas of opportunity would be most promising?

Automated Vehicles Background

Automated vehicles are those in which at least some aspects of a safety-critical control (such as steering, throttle, or braking) operate without direct driver input. Vehicles that provide safety warnings to drivers (for example, a forward-crash warning) but do not take control of the vehicle are not considered automated. Automated vehicles may use on-board sensors, cameras, GPS, and telecommunications to obtain information in order to make decisions regarding safety critical situations and act appropriately by taking control of the vehicle at some level. Examples of automated-vehicle technologies range from those that take care of basic functions such as cruise control, to completely self-driving vehicles with no human driver required.

Automated Vehicles Questions

14. Had you heard about automated vehicles before today?
    - ☐ Yes
    - ☐ No

15. What is your general opinion regarding automated vehicles?
    - ☐ Very positive
    - ☐ Somewhat positive
    - ☐ Neutral
    - ☐ Somewhat negative
    - ☐ Very negative
    - ☐ Specific comments: _____

16. How likely do you think it is that the following benefits will occur when using completely self-driving vehicles?

	Very likely	Somewhat likely	Somewhat unlikely	Very unlikely
a. Fewer crashes	☐	☐	☐	☐
b. Reduced crash severity	☐	☐	☐	☐
c. Improved emergency response to crashes	☐	☐	☐	☐
d. Less traffic congestion	☐	☐	☐	☐
e. Lower vehicle emissions	☐	☐	☐	☐
f. Shorter travel times	☐	☐	☐	☐
g. Better fuel economy	☐	☐	☐	☐
h. Lower insurance rates	☐	☐	☐	☐
j. Improved agency operations	☐	☐	☐	☐
k. Reduced agency costs	☐	☐	☐	☐

17. How concerned are you about the following issues related to completely self-driving vehicles?

	Very concerned	Moderately concerned	Slightly concerned	Not at all concerned
a. Safety consequences of equipment failure	☐	☐	☐	☐

or system failure				
b. Legal liability for "drivers"/owners	☐	☐	☐	☐
c. System security (from hackers)	☐	☐	☐	☐
d. Vehicle security (from hackers)	☐	☐	☐	☐
e. Data privacy (location and speed tracking)	☐	☐	☐	☐
f. Interacting with non-self-driving vehicles	☐	☐	☐	☐
g. Interacting with pedestrians and bicyclists	☐	☐	☐	☐
h. Learning to use self-driving vehicles	☐	☐	☐	☐
i. System performance in poor weather	☐	☐	☐	☐
j. Self-driving vehicles getting confused by unexpected conditions	☐	☐	☐	☐
k. Riding in a vehicle with no driver controls	☐	☐	☐	☐
l. Self-driving vehicles traveling by themselves from one location to another while unoccupied	☐	☐	☐	☐
m. Commercial vehicles that are completely self-driving	☐	☐	☐	☐
n. Self-driving public transportation vehicles (buses)	☐	☐	☐	☐
o. Self-driving taxis	☐	☐	☐	☐

18. To what extent do you believe that the Oregon DOT is technically prepared for the arrival of automated vehicles in our state?
    - ☐ Very prepared
    - ☐ Somewhat prepared
    - ☐ Neutral
    - ☐ Somewhat unprepared
    - ☐ Very unprepared
    - ☐ Specific comments: _____

19. To what extent do you believe that the Oregon DOT is culturally prepared for the arrival of automated vehicles in our state?
    - ☐ Very prepared
    - ☐ Somewhat prepared
    - ☐ Neutral
    - ☐ Somewhat unprepared
    - ☐ Very unprepared
    - ☐ Specific comments: _____

20. In which division of ODOT do you think the highest priority should be placed for preparing for automated vehicles?
    - ☐ Central Services
    - ☐ Office of Civil Rights
    - ☐ Office of the Director
    - ☐ Driver and Motor Vehicle
    - ☐ Highway Division
    - ☐ Motor Carrier Transportation
    - ☐ Transportation Development Division
    - ☐ Transportation Safety Division
    - ☐ Rail/Transit Division
    - ☐ Other: _____

21. If ODOT could choose one area to invest in time or resources for preparing technically for the arrival of automated vehicles what should that be?

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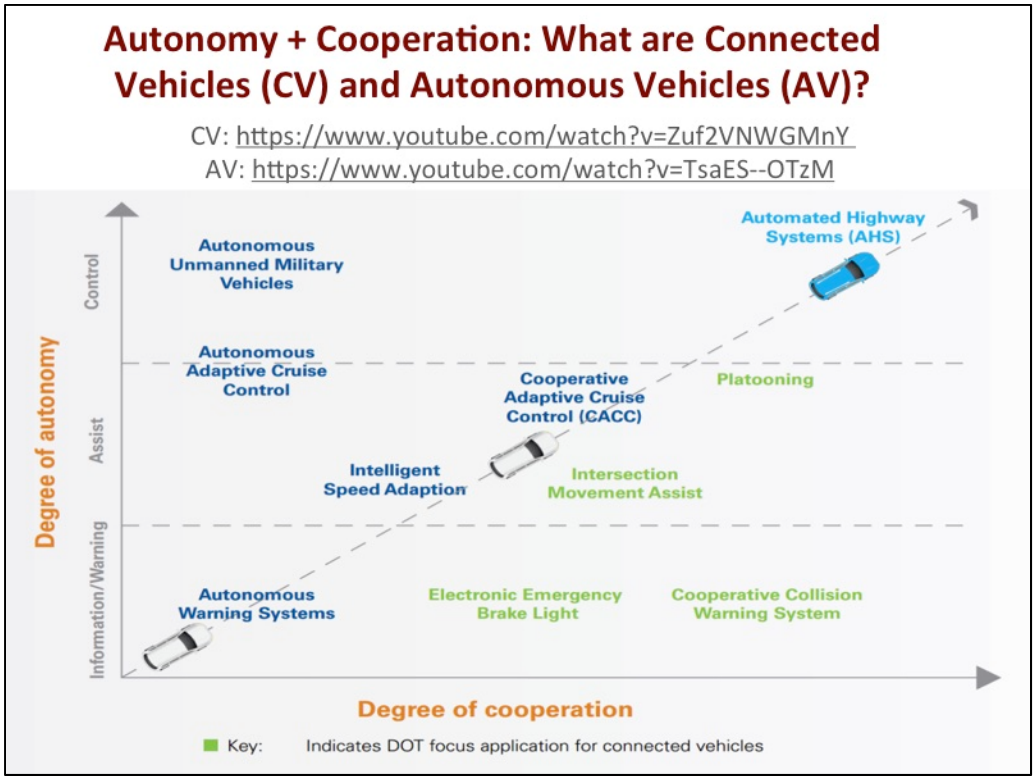
22. If ODOT could choose one area to invest in time or resources for preparing culturally for the arrival of automated vehicles what should that be?

THANK YOU!

If you have questions please contact Robert (bertini@pdx.edu) or Tony Knudson (Anthony.H.KNUDSON@odot.state.or.us)

PRESENTATION MATERIALS USED TO INTRODUCE SURVEY

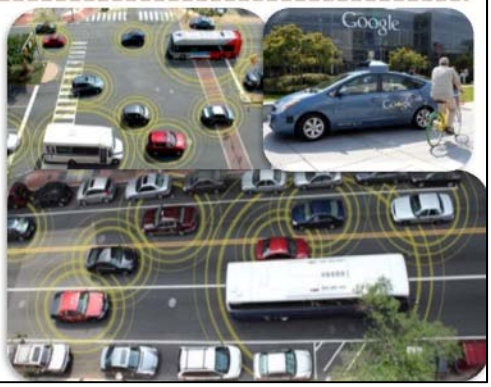


SPR 764: Purpose of This Project/Survey
Is ODOT technically and culturally prepared?

October 1, 2013 – June 1, 2015

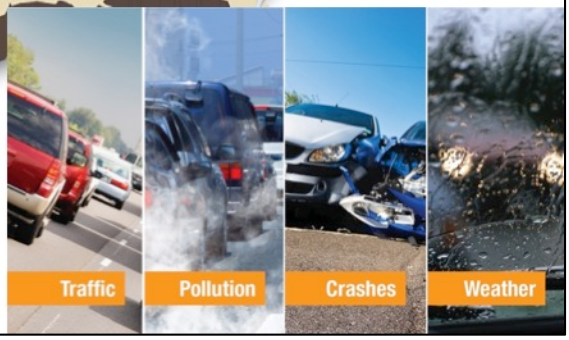
Objective: lay groundwork for Oregon to be prepared for future implementation of connected vehicle/cooperative systems transportation portfolio, consider whether to take an early national leadership role and/or to avoid being caught by surprise as developments in this area evolve quickly.

- *Assess ODOT Connected Vehicle Position*
- *Autonomous Vehicle Desk Scan*
- *Inventory of Global and State Level*
- *Connected Vehicle Applications & Capacity*
- *Stakeholder Inventory and Outreach*
- *Connected Vehicle Application Roadmap*
- *Selected Application Demonstrations*
- *Final Recommendations*
- *Final Report*

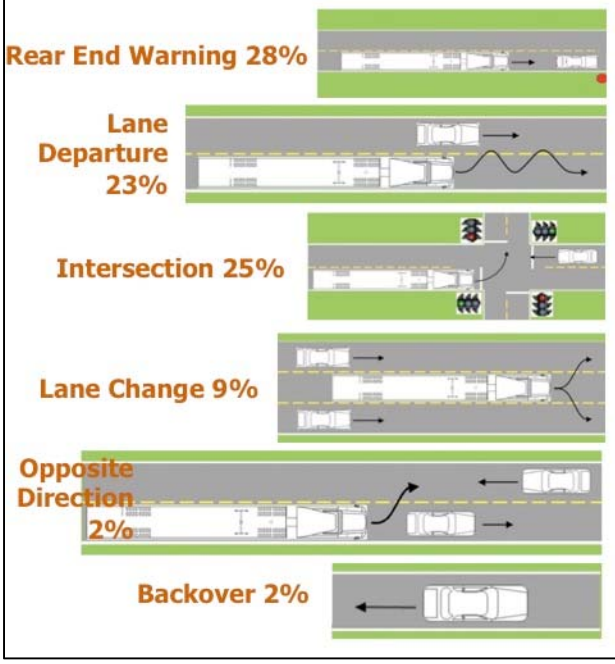


Purpose of Today: Why we are conducting this survey?

To Address: Where is Oregon and where does Oregon want to be?



Benefits to ODOT: Safety, Mobility, Environmental

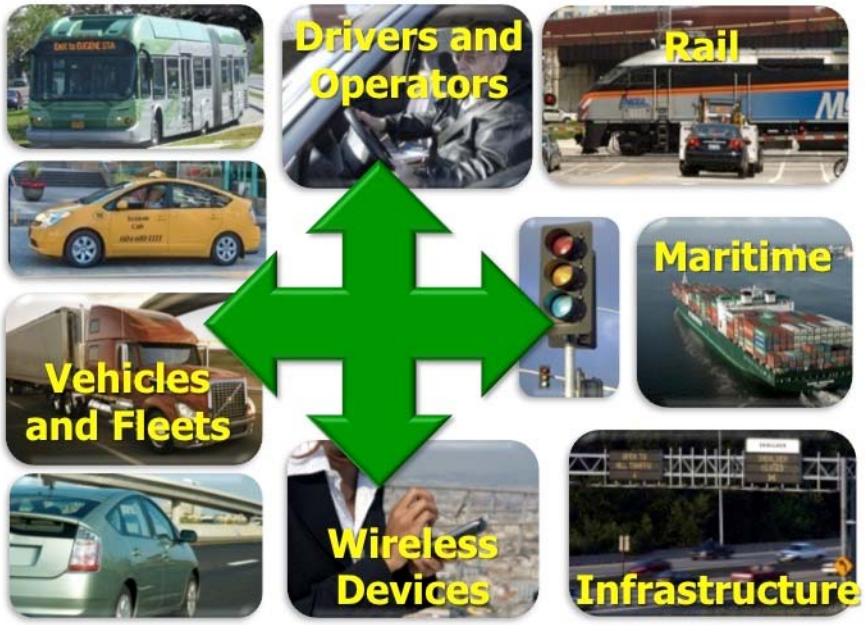


Connected vehicles have the potential to address up to 81% of unimpaired crash scenarios.

Arrival of Autonomous Vehicles

- 2015: Audi plans to market vehicles that can autonomously steer, accelerate and brake at lower speeds, such as in traffic jams.
- 2015: Cadillac plans vehicles with "super cruise": autonomous steering, braking and lane guidance.
- 2015: Nissan plans to sell vehicles with autonomous steering, braking, lane guidance, throttle, gear shifting, and, as permitted by law, unoccupied self-parking after passengers exit.
- Mid-2010s: Toyota plans to roll out near-autonomous vehicles dubbed Automated Highway Driving Assist with Lane Trace Control and Cooperative-adaptive Cruise Control.
- 2016: Tesla expects to develop technology that operates autonomously for 90 percent of distances driven.
- 2018: Google expects to release their autonomous car technology.
- 2020: Volvo envisages having cars in which passengers would be immune from injuries.
- 2020: Mercedes-Benz, Audi, Nissan and BMW all expect to sell autonomous cars.
- 2025: Daimler and Ford expect autonomous vehicles on the market.

Vision: Multimodal Connected Future



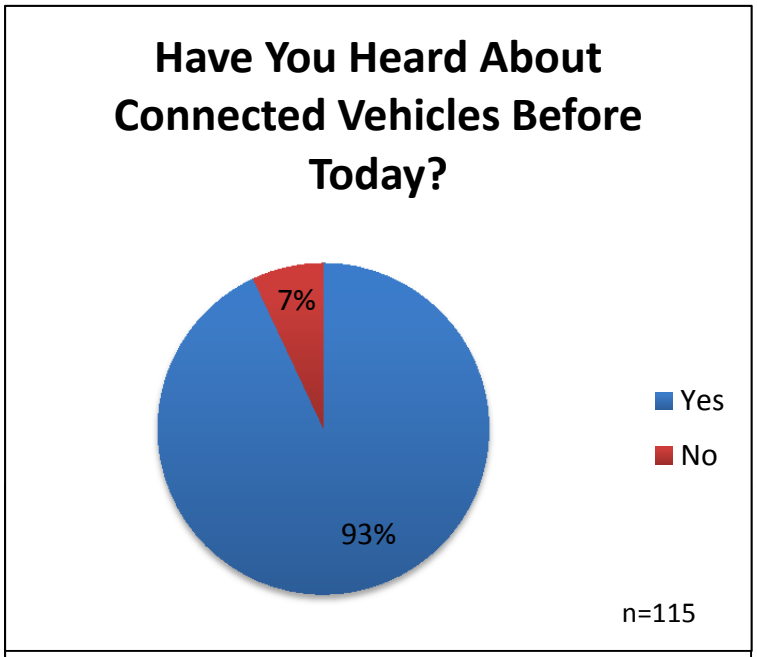
7

Thank You for Your Time and Assistance!

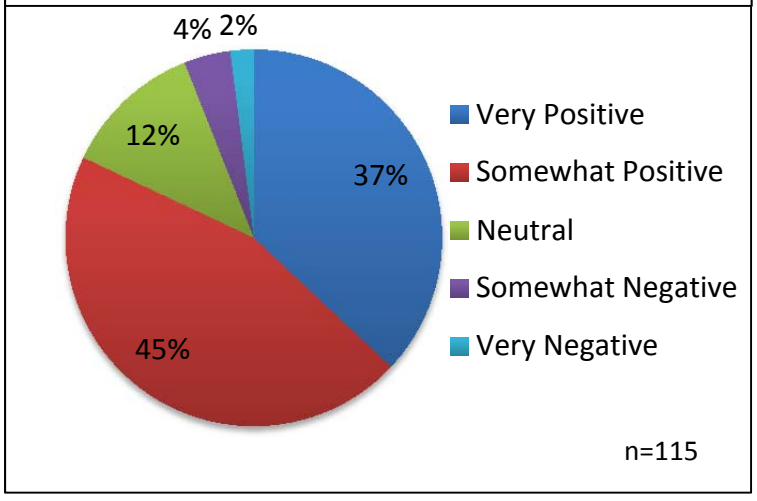
8

3.0 RESULTS FOR 2014 ODOT SURVEY ON CONNECTED VEHICLES

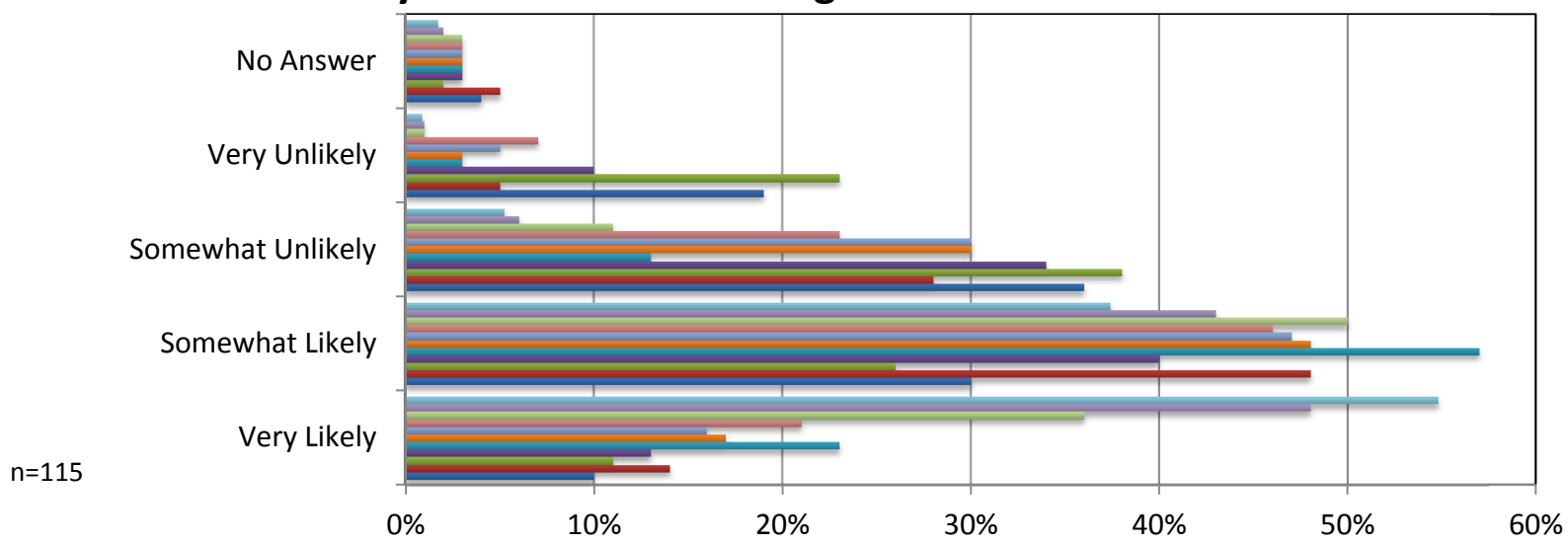
1. Have you heard about connected vehicles before today?



2. What is your general opinion regarding connected vehicles?

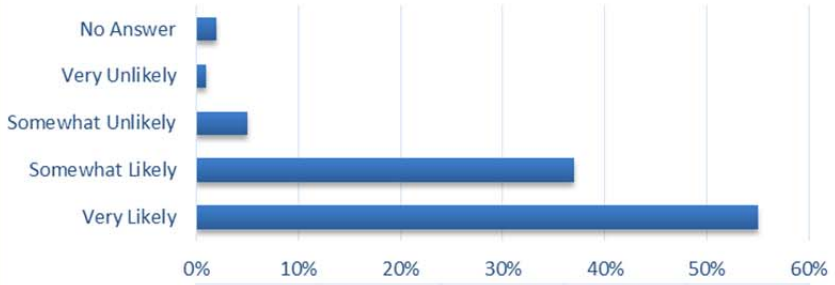


3. How likely do you think it is that the following benefits will occur when using connected vehicles?



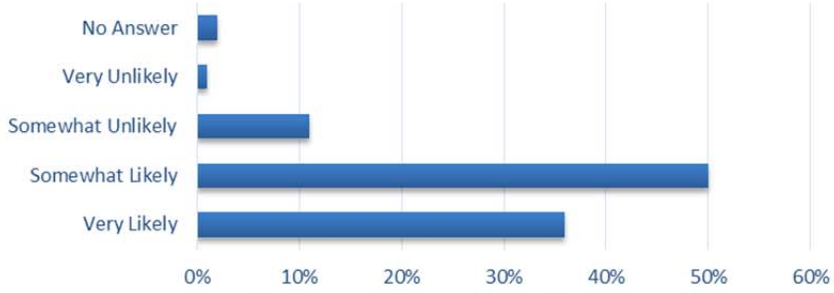
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Reduced Crashes	55%	37%	5%	1%	2%
Reduced Crash Severity	48%	43%	6%	1%	2%
Improved Emergency Response	36%	50%	11%	1%	3%
Less Traffic Congestion	21%	46%	23%	7%	3%
Lower Vehicle Emissions	16%	47%	30%	5%	3%
Shorter Travel Times	17%	48%	30%	3%	3%
Better Fuel Economy	23%	57%	13%	3%	3%
Lower Insurance Rates	13%	40%	34%	10%	3%
Fewer Driver Distractions	11%	26%	38%	23%	2%
Improved Agency Operations	14%	48%	28%	5%	5%
Reduced Agency Costs	10%	30%	36%	19%	4%

Fewer Crashes



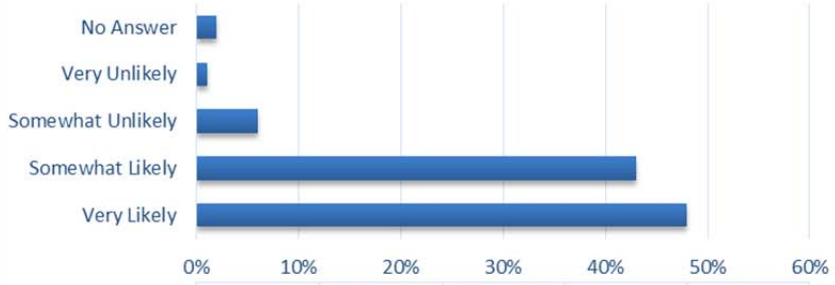
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	55%	37%	5%	1%	2%

Improved Emergency Response



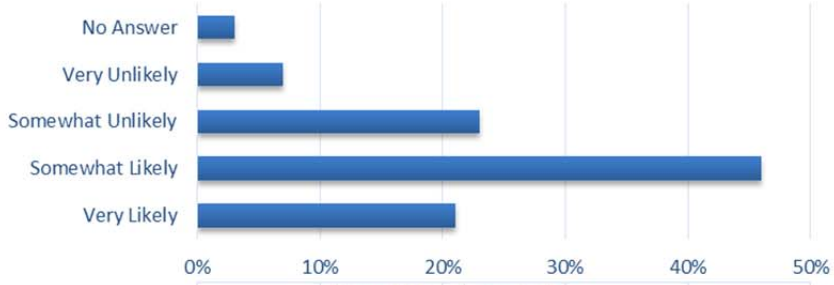
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	36%	50%	11%	1%	2%

Reduced Crash Severity



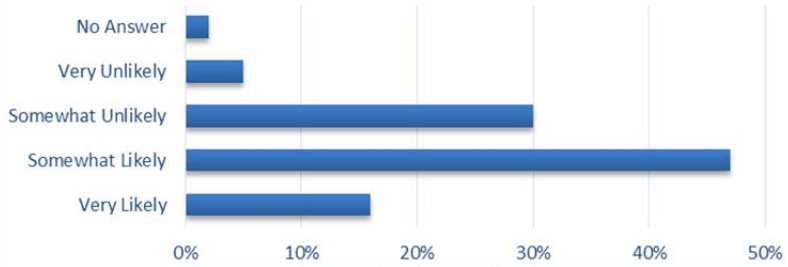
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	48%	43%	6%	1%	2%

Less Traffic Congestion



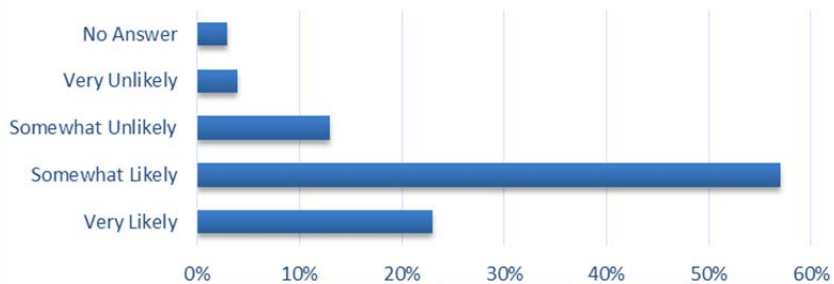
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	21%	46%	23%	7%	3%

Lower Vehicle Emissions



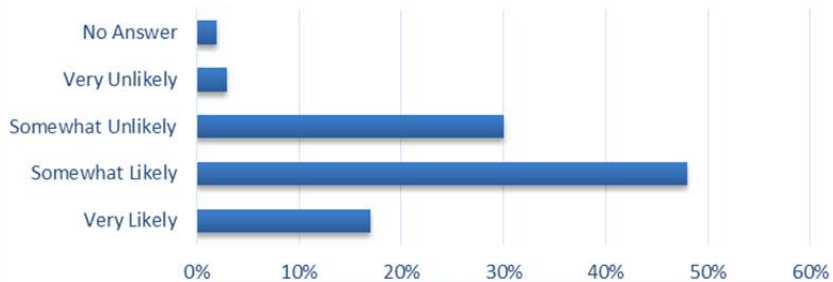
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	16%	47%	30%	5%	2%

Better Fuel Economy



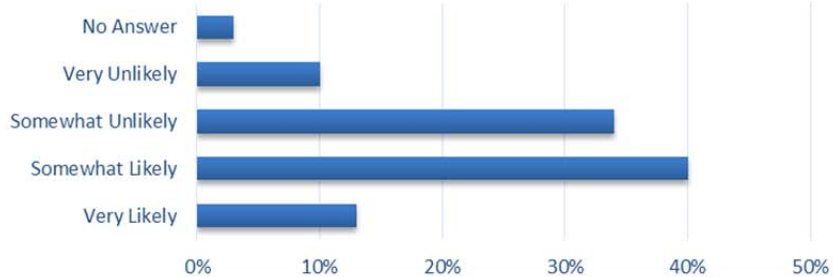
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	23%	57%	13%	4%	3%

Shorter Travel Times

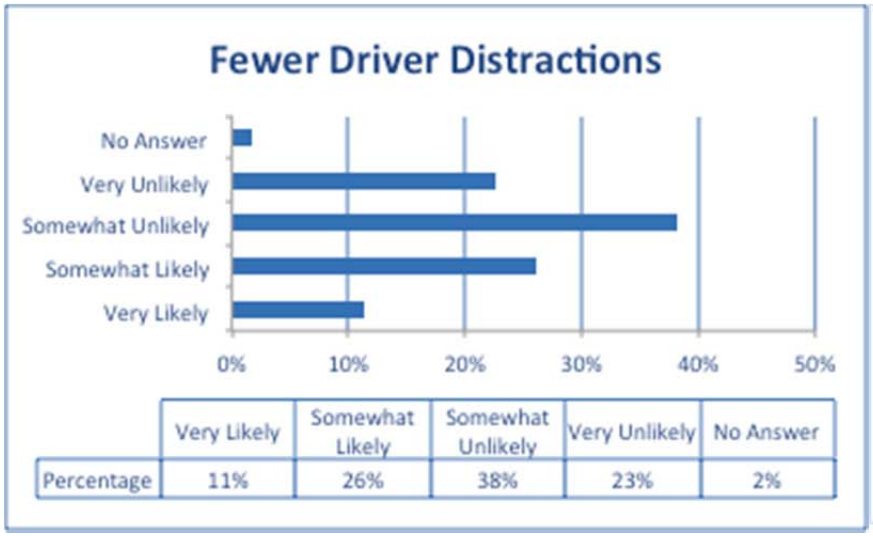


	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	17%	48%	30%	3%	2%

Lower Insurance Rates



	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	13%	40%	34%	10%	3%

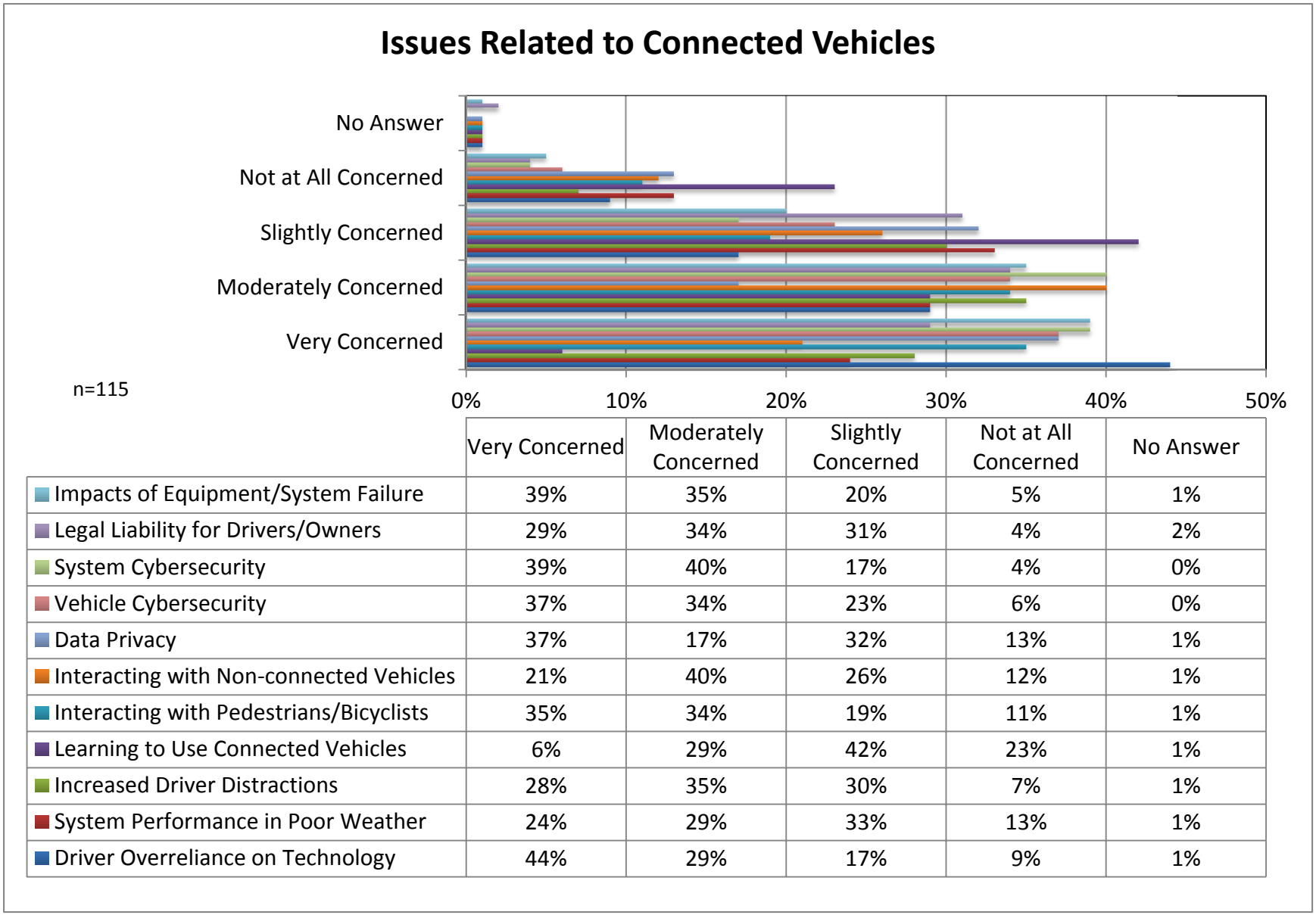


	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	11%	26%	38%	23%	2%

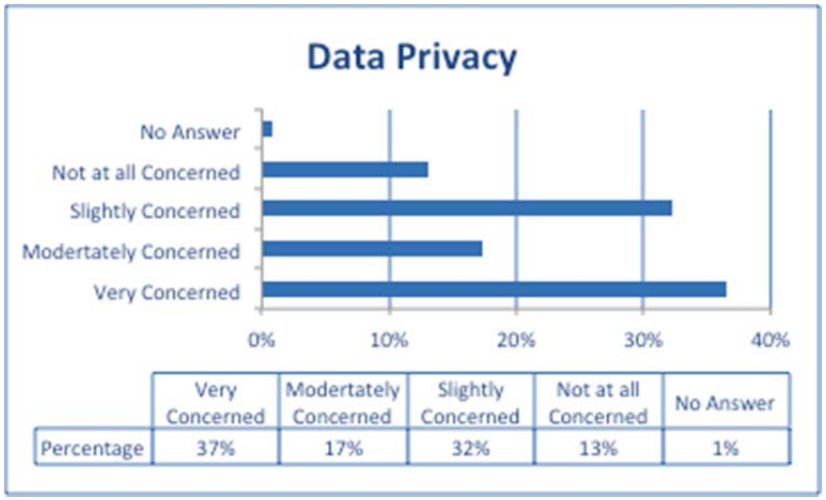
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	10%	30%	36%	19%	5%

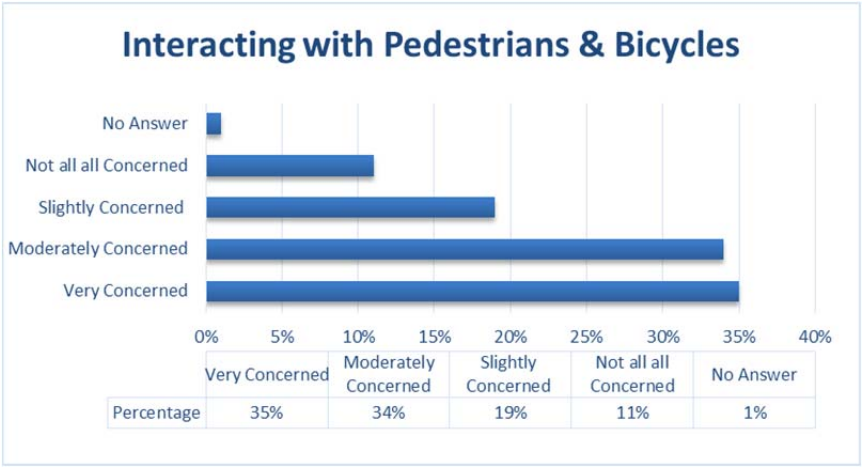
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	14%	48%	28%	5%	5%

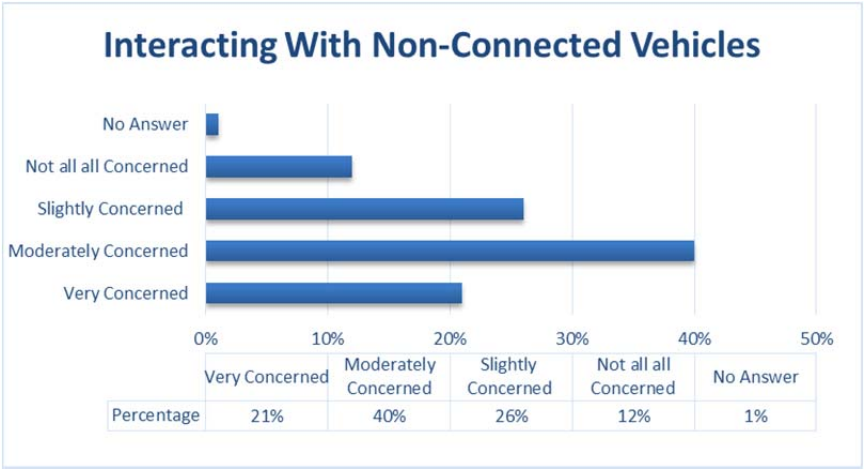
4. How concerned are you about the following issues related to connected vehicles?

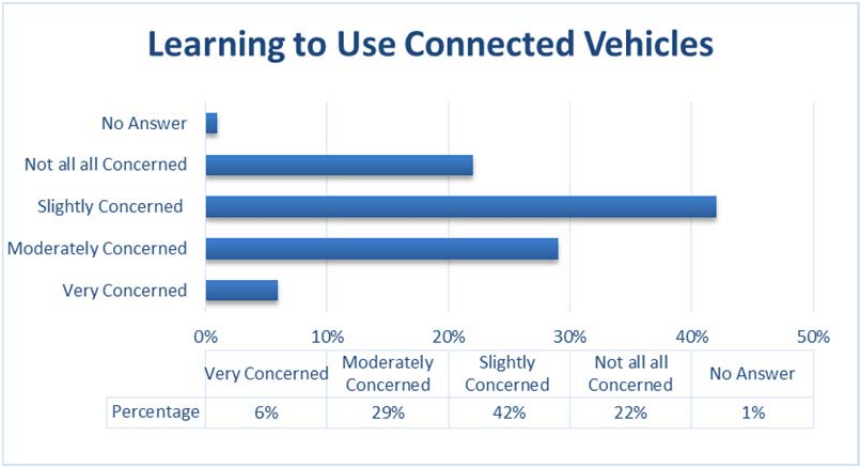


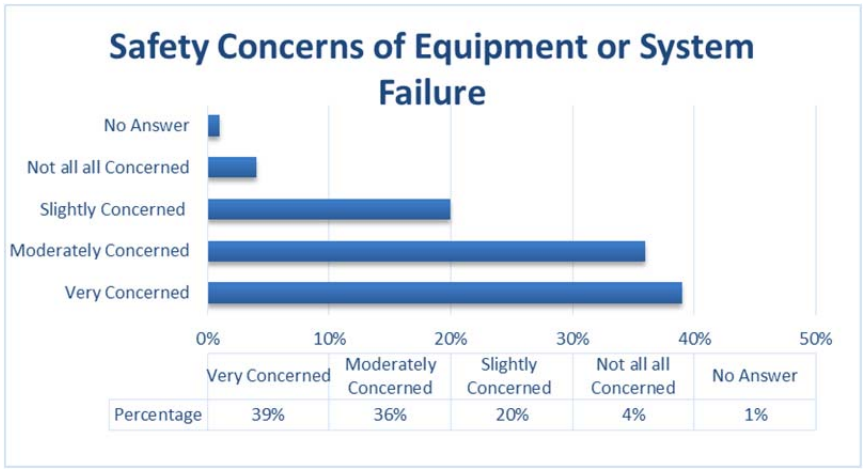
	Very Concerned	Moderately Concerned	Slightly Concerned	Not at All Concerned	No Answer
Impacts of Equipment/System Failure	39%	35%	20%	5%	1%
Legal Liability for Drivers/Owners	29%	34%	31%	4%	2%
System Cybersecurity	39%	40%	17%	4%	0%
Vehicle Cybersecurity	37%	34%	23%	6%	0%
Data Privacy	37%	17%	32%	13%	1%
Interacting with Non-connected Vehicles	21%	40%	26%	12%	1%
Interacting with Pedestrians/Bicyclists	35%	34%	19%	11%	1%
Learning to Use Connected Vehicles	6%	29%	42%	23%	1%
Increased Driver Distractions	28%	35%	30%	7%	1%
System Performance in Poor Weather	24%	29%	33%	13%	1%
Driver Overreliance on Technology	44%	29%	17%	9%	1%

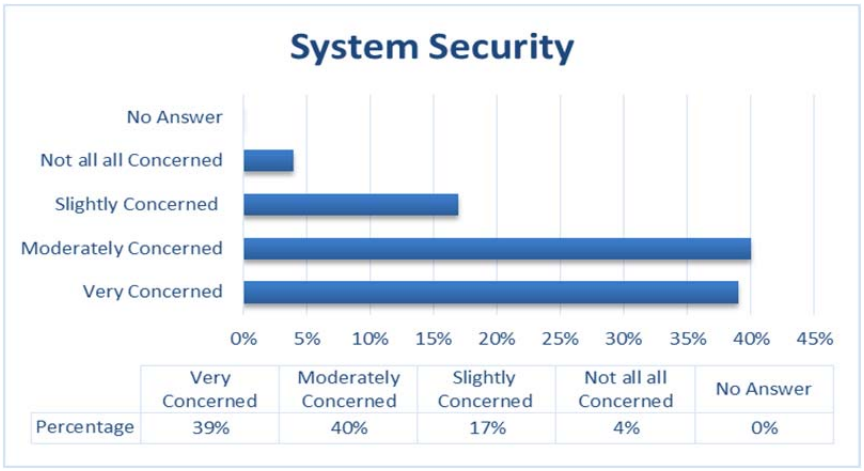

Data Privacy
No Answer
Not at all Concerned
Slightly Concerned
Modertately Concerned
Very Concerned
0%
10%
20%
30%
40%
Very Concerned
Modertately Concerned
Slightly Concerned
Not at all Concerned
No Answer
Percentage
37%
17%
32%
13%
1%


Interacting with Pedestrians & Bicycles
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
35%
34%
19%
11%
1%

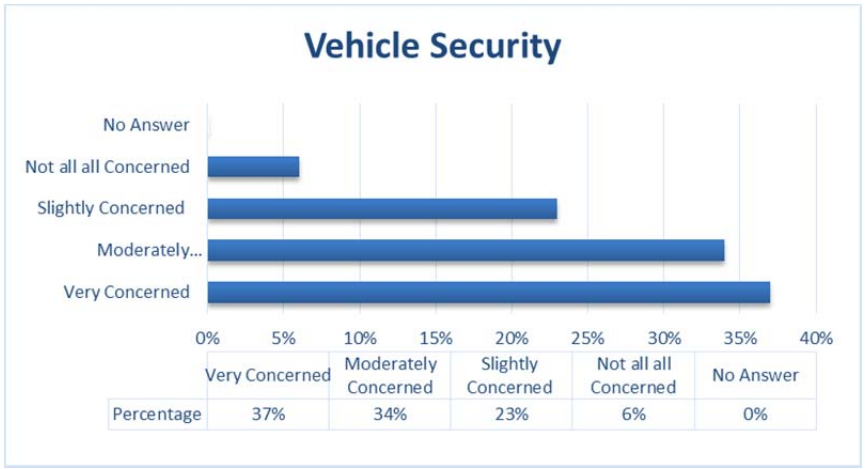

Interacting With Non-Connected Vehicles
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
10%
20%
30%
40%
50%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
21%
40%
26%
12%
1%

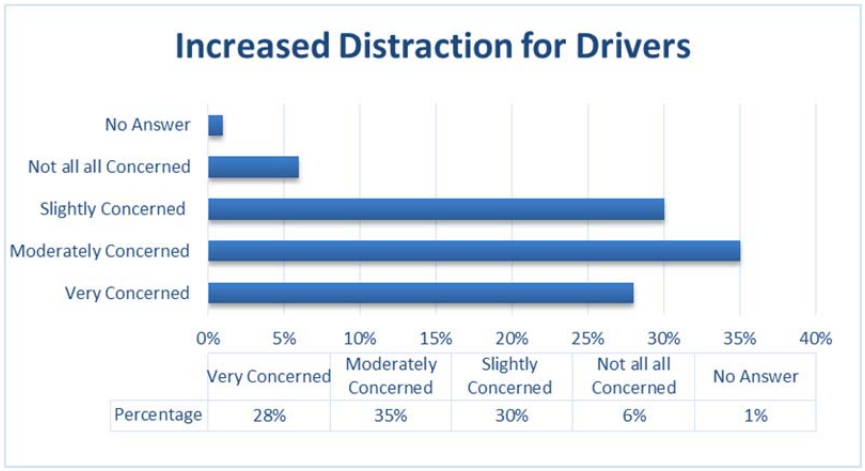

Learning to Use Connected Vehicles
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
10%
20%
30%
40%
50%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
6%
29%
42%
22%
1%

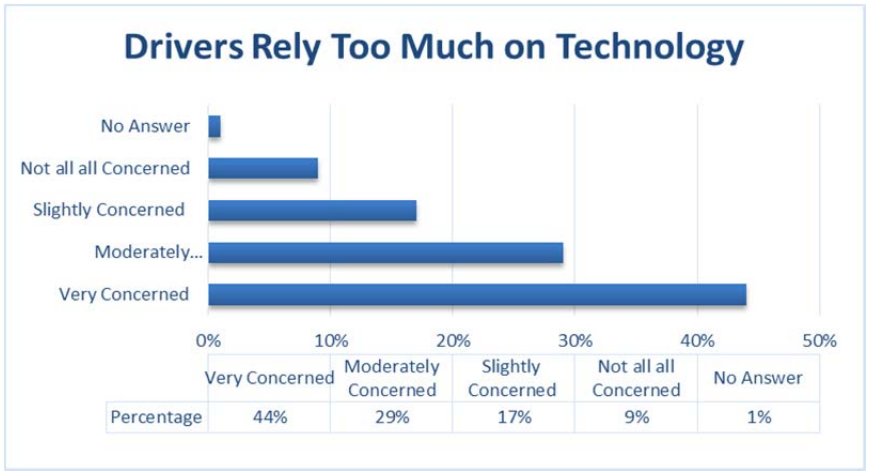

Safety Concerns of Equipment or System Failure
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
10%
20%
30%
40%
50%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
39%
36%
20%
4%
1%

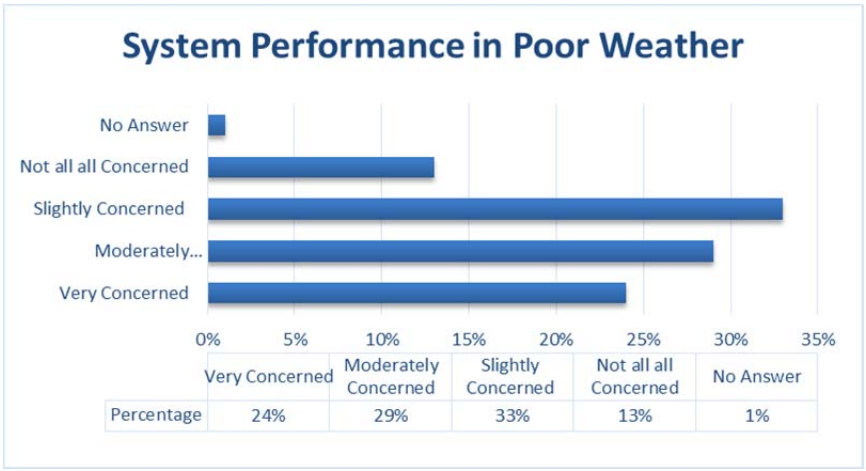

System Security
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
39%
40%
17%
4%
0%


Legal Liability for Drivers/Owners
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
29%
34%
31%
4%
2%

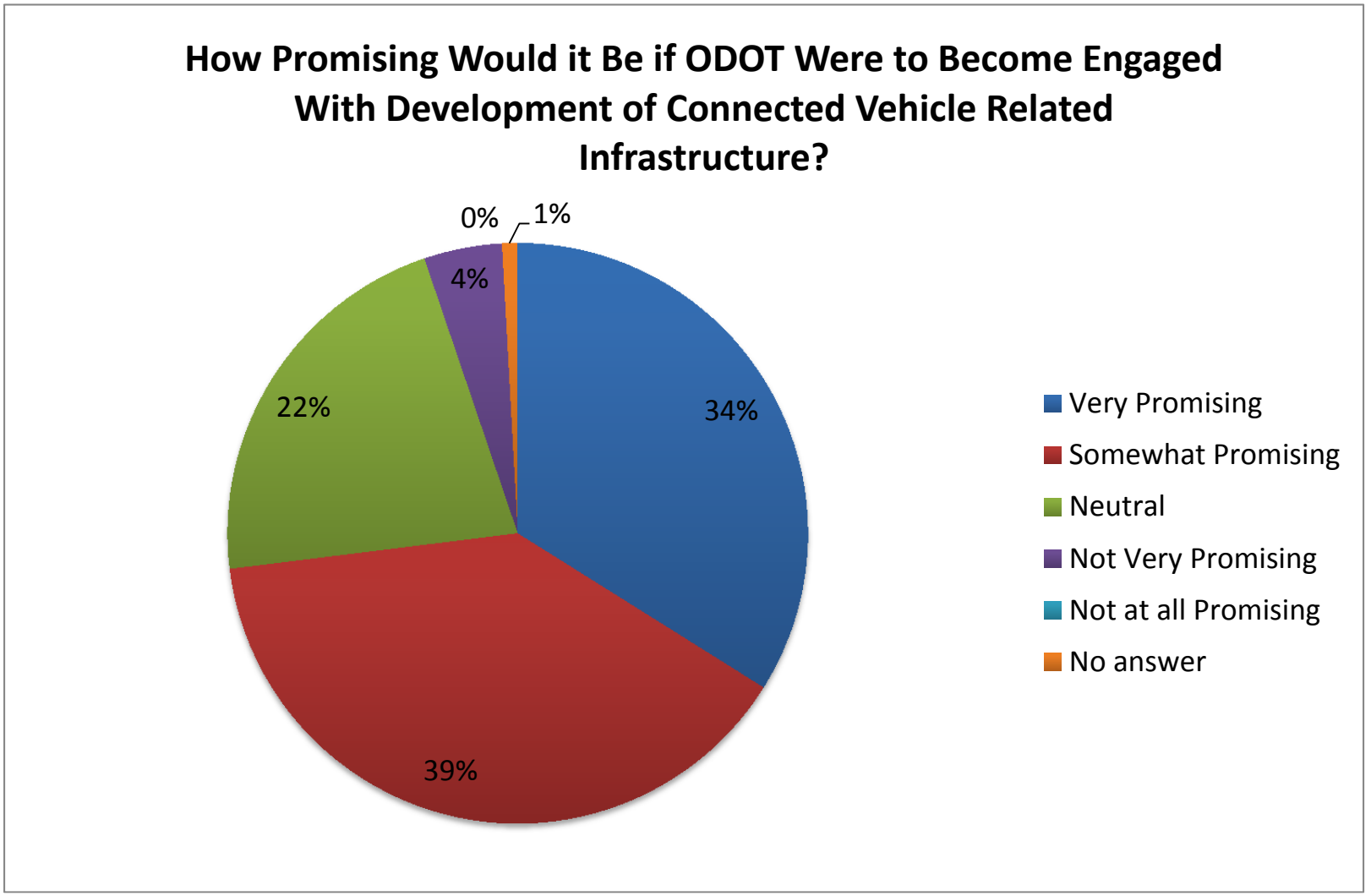

Vehicle Security
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
37%
34%
23%
6%
0%


Increased Distraction for Drivers
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
28%
35%
30%
6%
1%

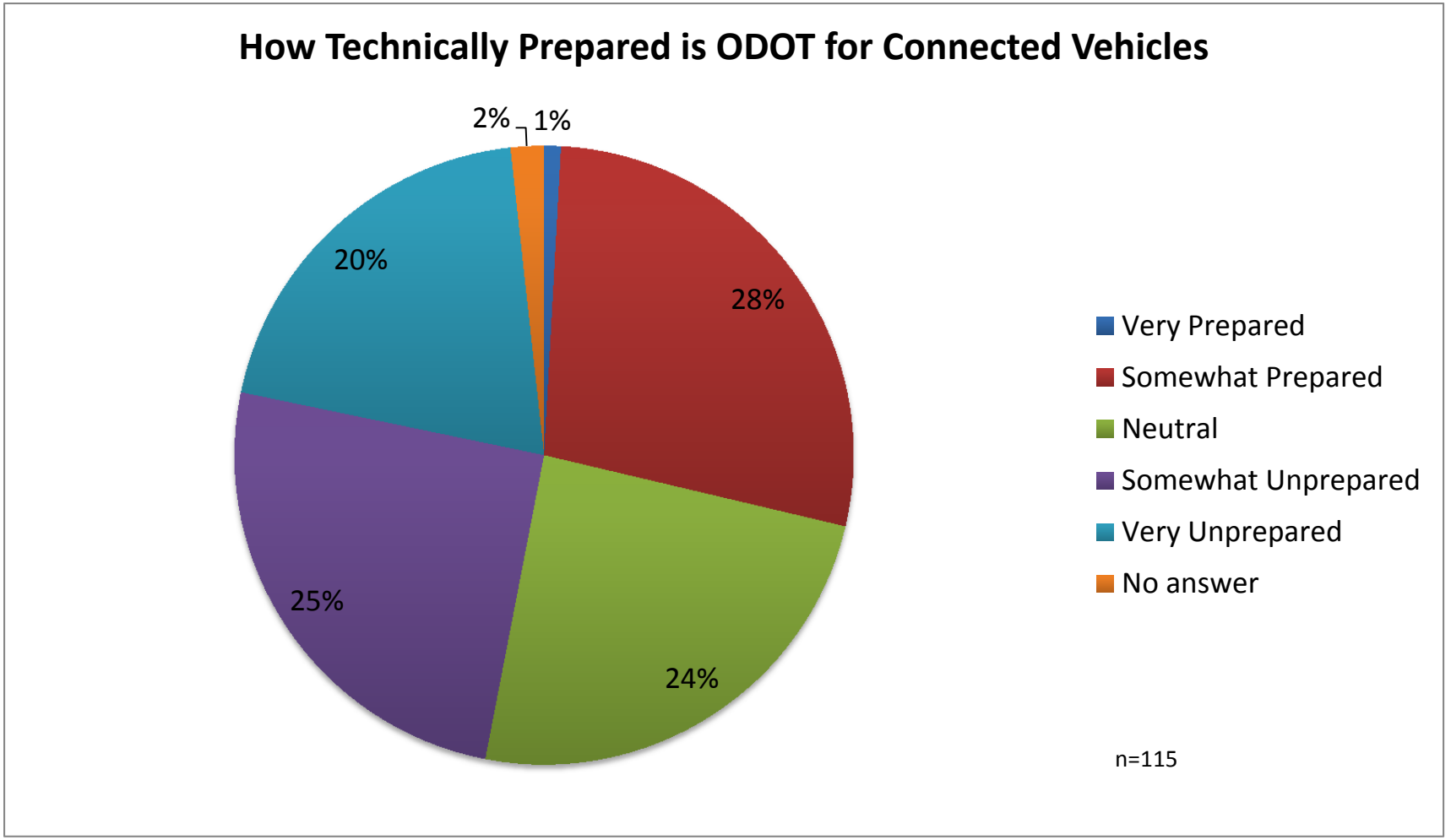

Drivers Rely Too Much on Technology
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
10%
20%
30%
40%
50%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
44%
29%
17%
9%
1%


System Performance in Poor Weather
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
24%
29%
33%
13%
1%

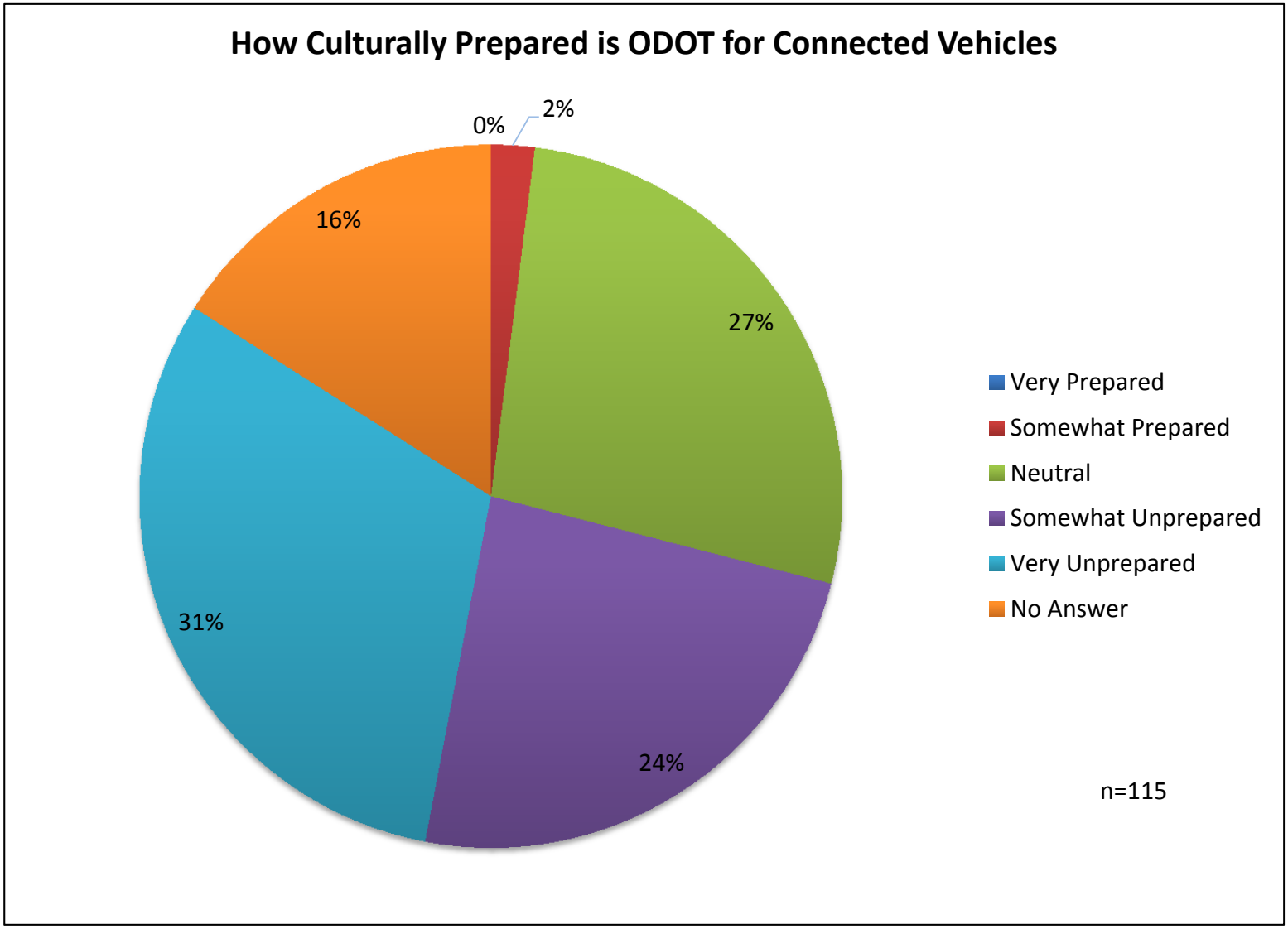
5. If the Oregon DOT were to become engaged with the development of connected vehicle related infrastructure how promising do you think this development would be?



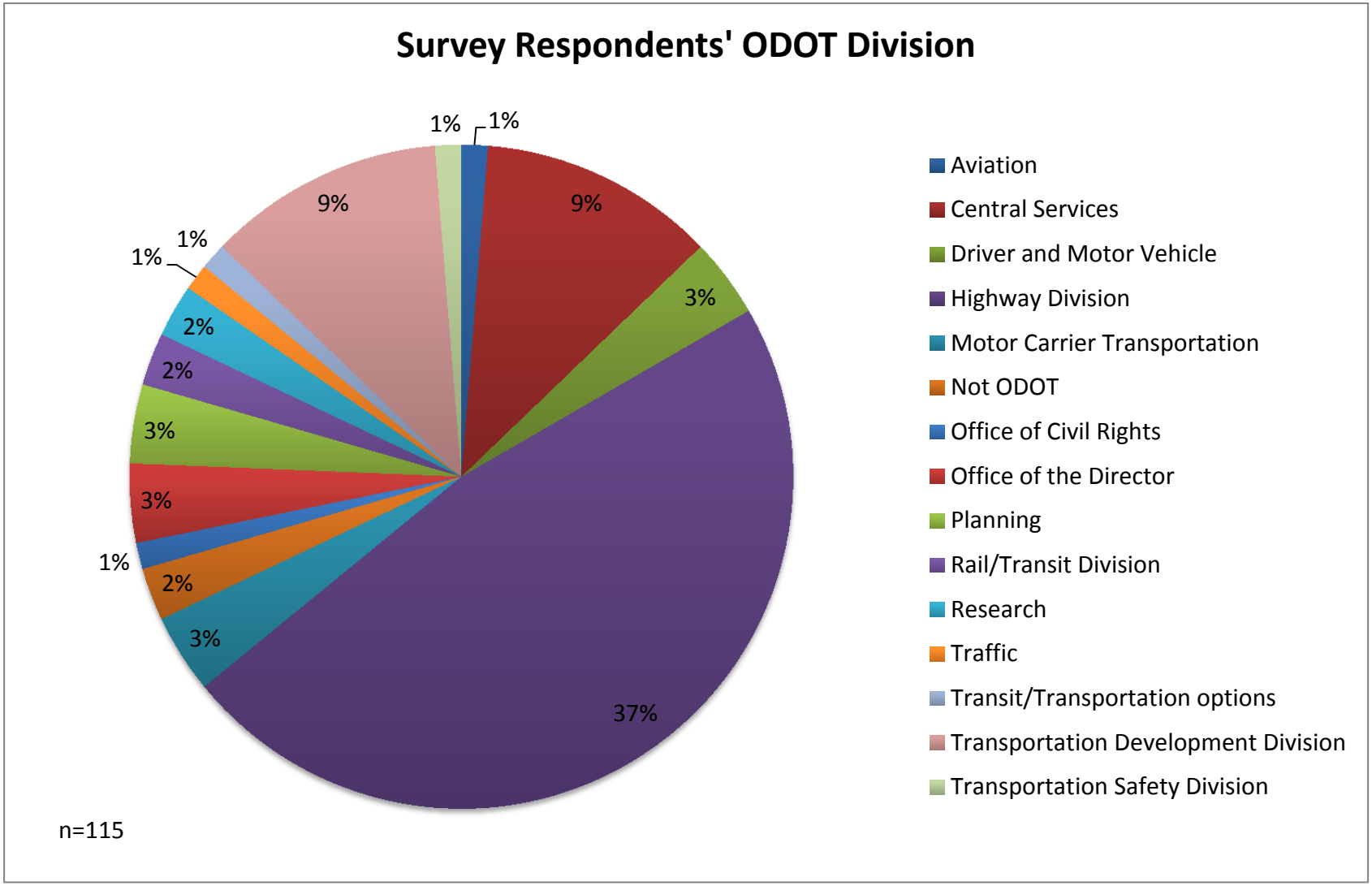
6. To what extent do you believe that the Oregon DOT is technically prepared for the arrival of connected vehicles in our state?



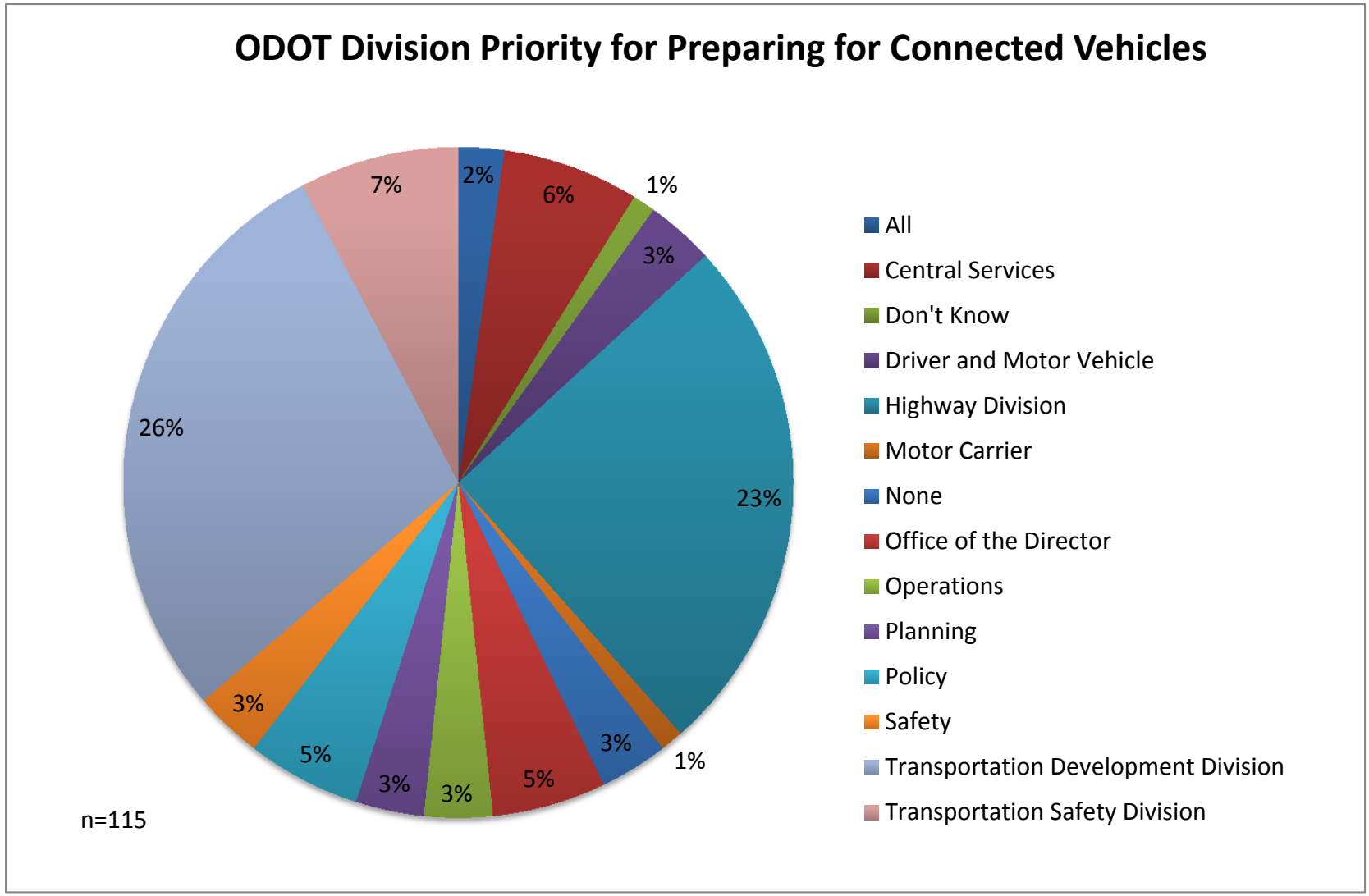
7. To what extent do you believe that the Oregon DOT is culturally prepared for the arrival of connected vehicles in our state?



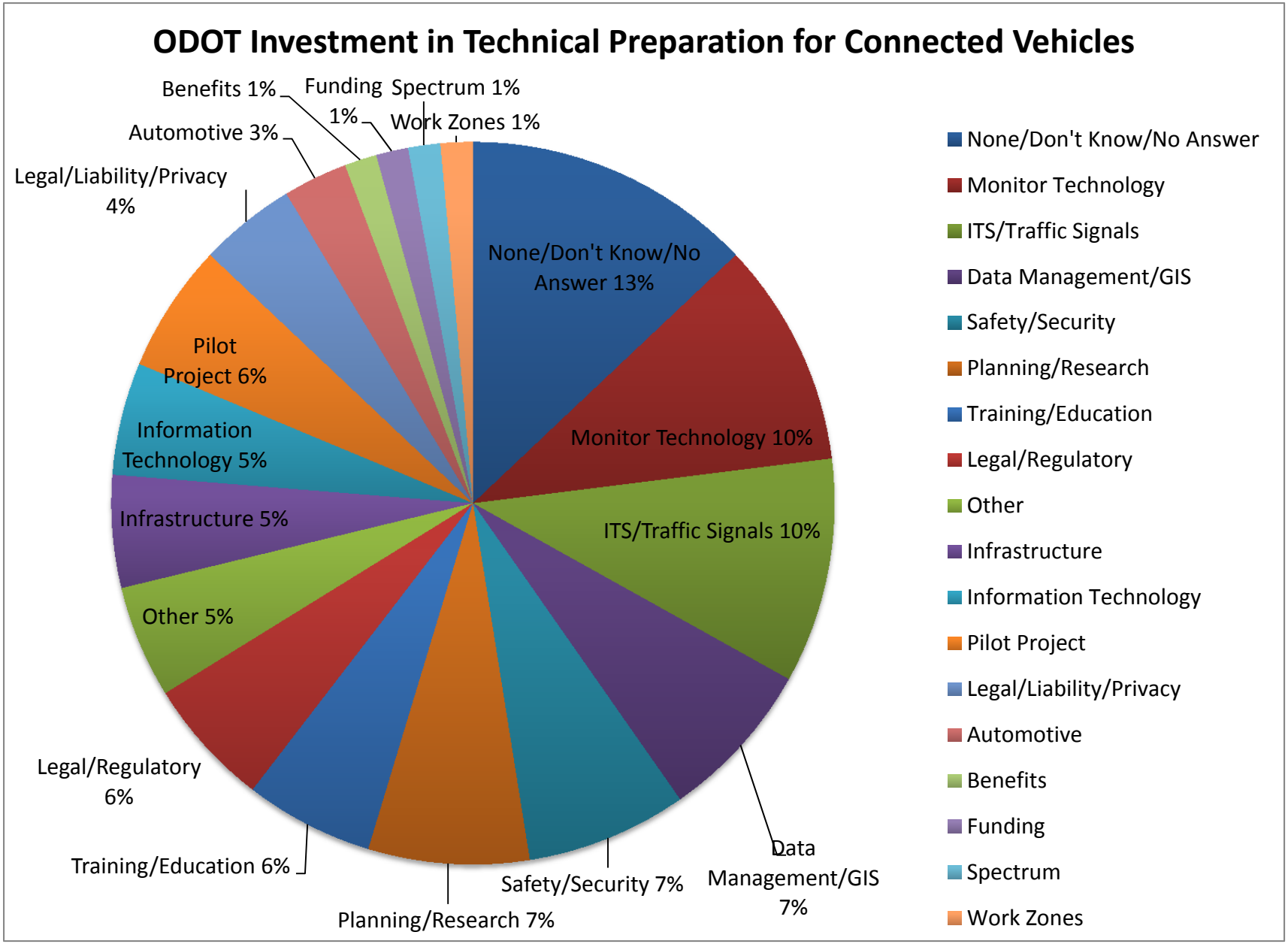
8. In which division of ODOT do you work?



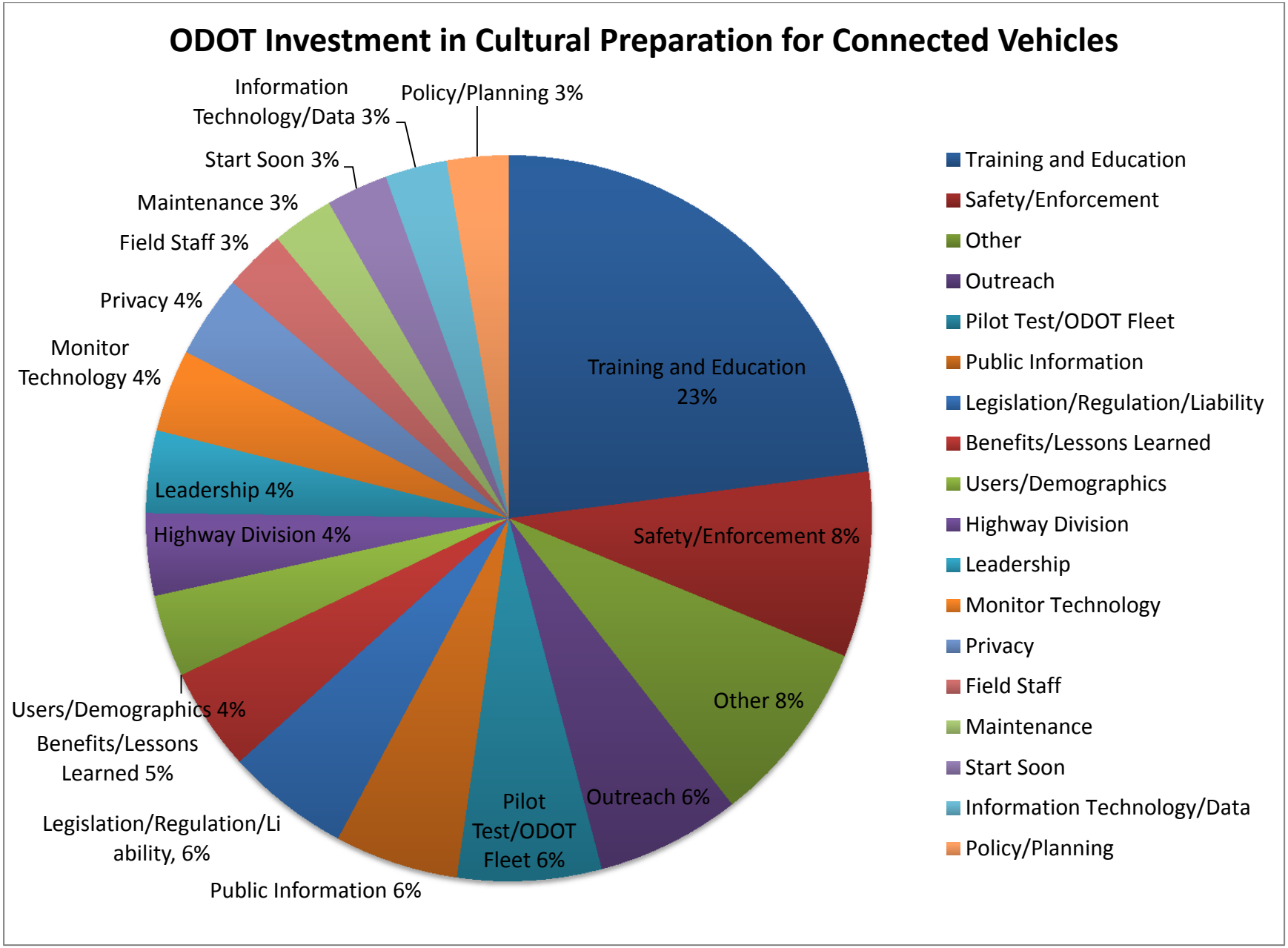
9. In which division of ODOT do you think the highest priority should be placed for preparing for connected vehicles?



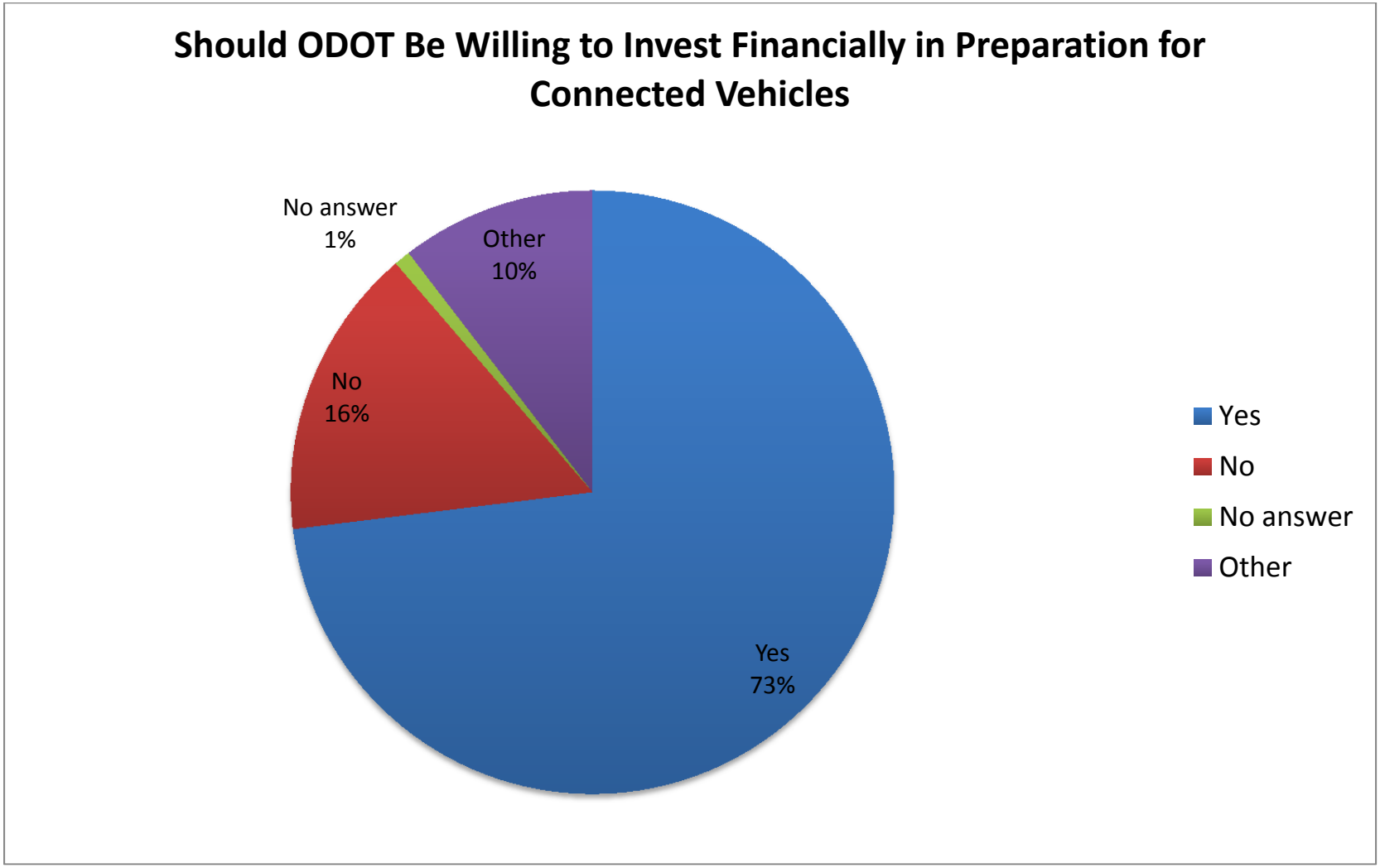
10. If ODOT could choose one area to invest in time or resources for preparing technically for the arrival of connected vehicles what should that be?


ODOT Investment in Technical Preparation for Connected Vehicles
None/Don't Know/No Answer 13%
Monitor Technology 10%
ITS/Traffic Signals 10%
Data Management/GIS 7%
Safety/Security 7%
Planning/Research 7%
Training/Education 6%
Legal/Regulatory 6%
Other 5%
Infrastructure 5%
Information Technology 5%
Pilot Project 6%
Legal/Liability/Privacy 4%
Automotive 3%
Benefits 1%
Funding 1%
Spectrum 1%
Work Zones 1%
None/Don't Know/No Answer
Monitor Technology
ITS/Traffic Signals
Data Management/GIS
Safety/Security
Planning/Research
Training/Education
Legal/Regulatory
Other
Infrastructure
Information Technology
Pilot Project
Legal/Liability/Privacy
Automotive
Benefits
Funding
Spectrum
Work Zones

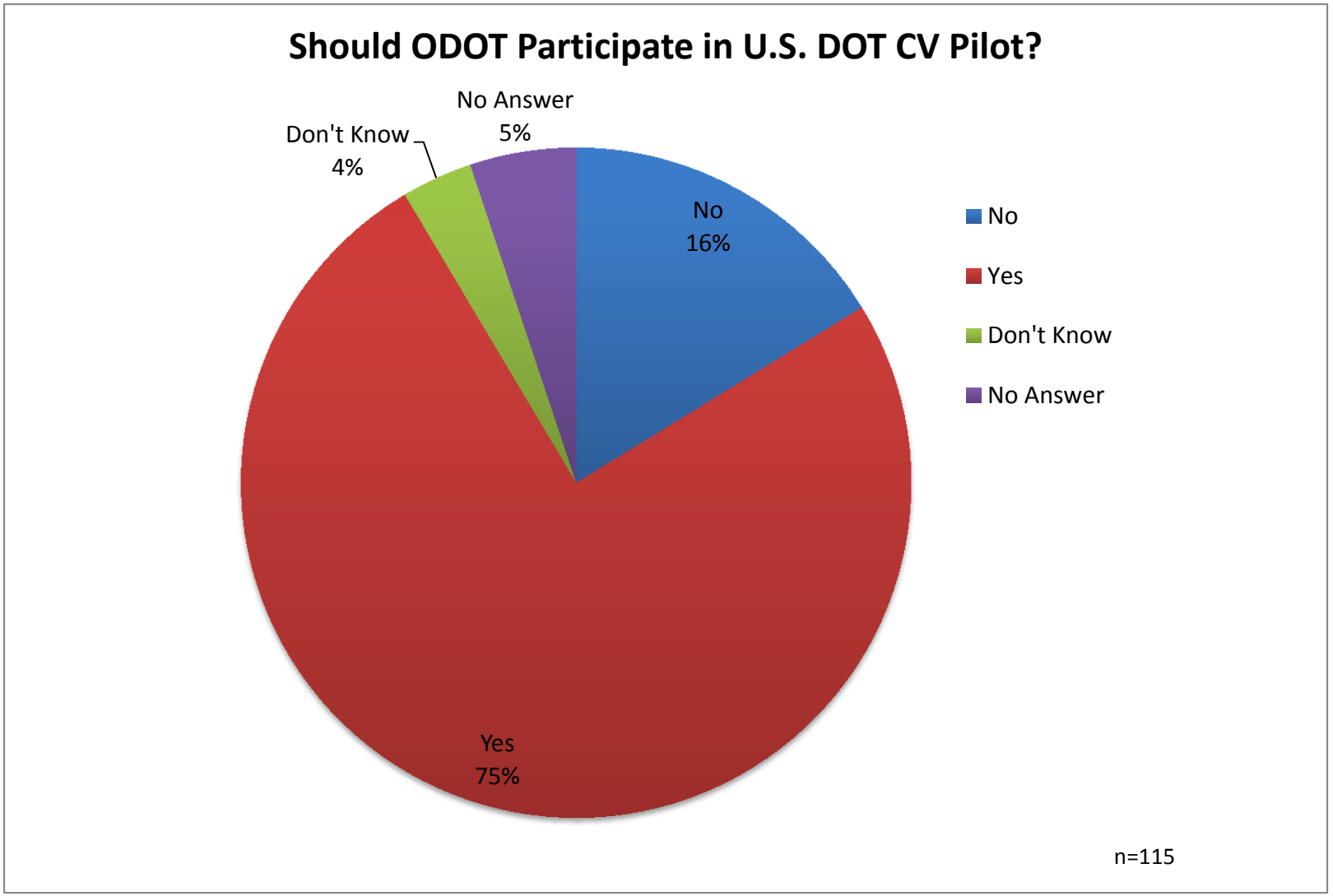
11. If ODOT could choose one area to invest in time or resources for preparing culturally for the arrival of connected vehicles what should that be?


ODOT Investment in Cultural Preparation for Connected Vehicles
Information Technology/Data 3%
Policy/Planning 3%
Start Soon 3%
Maintenance 3%
Field Staff 3%
Privacy 4%
Monitor Technology 4%
Leadership 4%
Highway Division 4%
Users/Demographics 4%
Benefits/Lessons Learned 5%
Legislation/Regulation/Liability, 6%
Public Information 6%
Pilot Test/ODOT Fleet 6%
Outreach 6%
Other 8%
Safety/Enforcement 8%
Training and Education 23%
Training and Education
Safety/Enforcement
Other
Outreach
Pilot Test/ODOT Fleet
Public Information
Legislation/Regulation/Liability
Benefits/Lessons Learned
Users/Demographics
Highway Division
Leadership
Monitor Technology
Privacy
Field Staff
Maintenance
Start Soon
Information Technology/Data
Policy/Planning

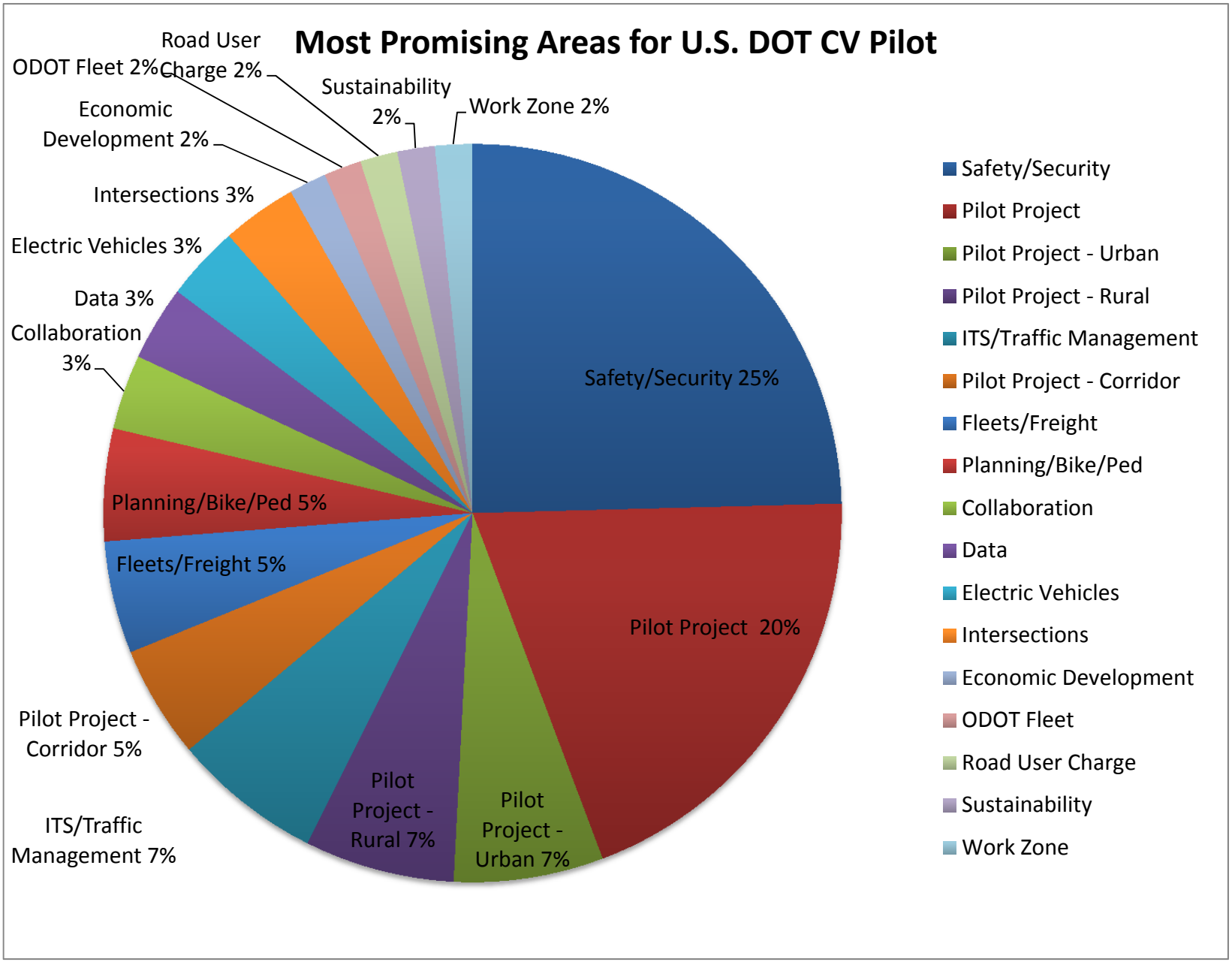
12. Do you think ODOT should be willing to invest financially in preparation for connected vehicles (e.g. a marginal cost in construction of maintenance projects)?



13. Do you think ODOT should play a role in an upcoming connected vehicle pilot funded by the U.S. DOT? If so which areas of opportunity would be most promising?

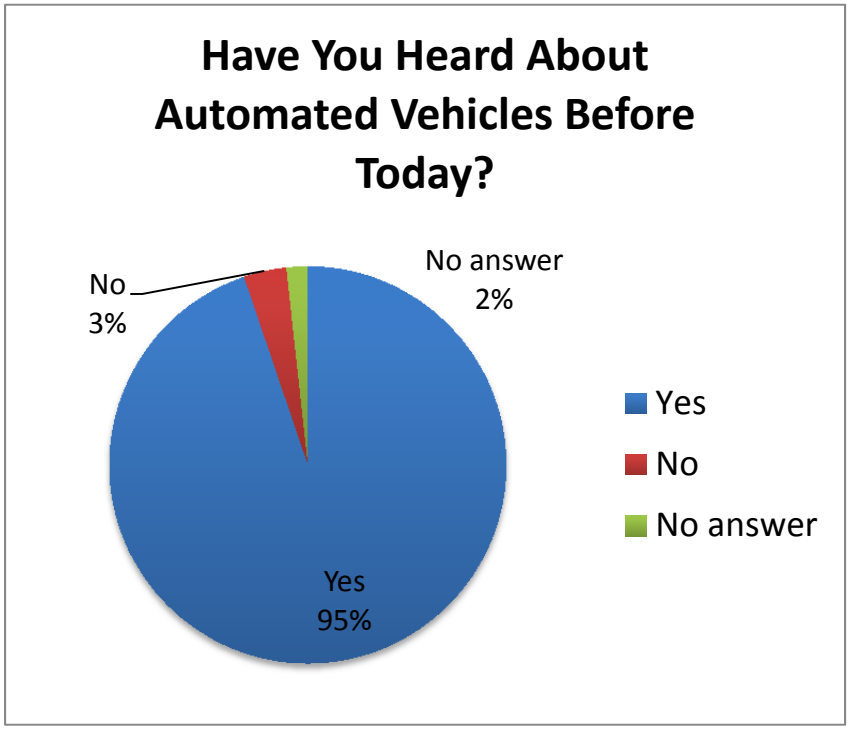



Pilot
ODOT
Safety
Data
Road
Vehicle
Need
Provide
Test
State
Congested
Realistic
Economic
Development
Usage
Interface
Intermodal
Sure
Scale
Media
Ready
Communities
Prevent
Location
Shape
Key
Cost
Limited
Really
Culture
Traffic
Signal
Capture
Decrease
Intersection
Situations
Bike
Waiting
Question
Miles
Governments
Feedback
Don
North
Allow
Spent
Know
Make
Good
Application
Staff
Come
Truly
Infrastructure
Platform
Enough
Portland
Engage
Frieght
Alternate
Combined
Effective
Participation
Security
Getting
Lead
Up
Out
Sustainability
Research
Identify
Duration
Focus
Hard
Sector
Major
Set
Mean
Intelligent
Beyond
Great
Use
Demonstration
Well
Managment
Wireless
Technology
Detection
Planning
Private
Increase
Resume
Educated
Bugs
Crashes
Due
Pay
Populated
Ped
Way
Action
Policy
Large
Last
Capable
Project
Electric
Sensors
Tie
Canopies
One
Input
Route
Users
Put
Adapt
Ve
GPS
Firms
Gather
Find
Collect
Vs
Walk
Urban
Transprotation
More
Agency
Charge
Trial
Trained
Upper
Open
Opportunities
Higher
Devices
Perhaps
Listed
Offered
Course
Start
Feds
Product
Capacity
Departure
Within
Final
Ability
Options
See
Anything
High
Oregon
Delays
Think
Already
Goals
New
Appropriate
Lazer
Information
Challenge
Real
Mobility
Such
System
Fleet
Operation
Drivers
Type
Look
Being
Work
Actually
Learn
Commuter
Pose
Address
Rural
Dot
Tree
Partners
Improvement
Pdx
Wilsonville
Travel
Reach
Level
Better
Time
Mask
Benefits
Vitality
First
Distance

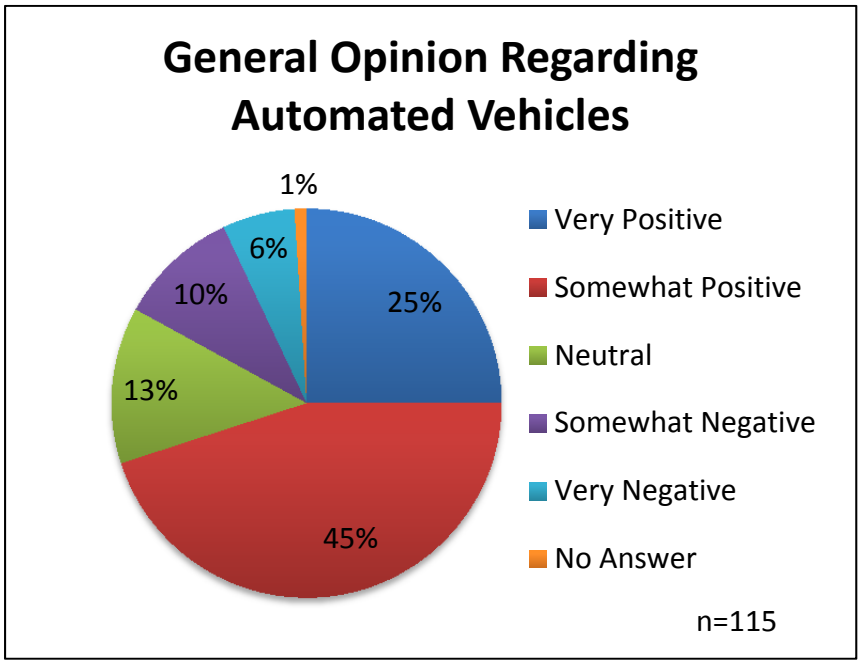

Most Promising Areas for U.S. DOT CV Pilot
Road User Charge 2%
ODOT Fleet 2%
Sustainability 2%
Work Zone 2%
Economic Development 2%
Intersections 3%
Electric Vehicles 3%
Data 3%
Collaboration 3%
Safety/Security 25%
Planning/Bike/Ped 5%
Fleets/Freight 5%
Pilot Project 20%
Pilot Project - Corridor 5%
ITS/Traffic Management 7%
Pilot Project - Rural 7%
Pilot Project - Urban 7%
Safety/Security
Pilot Project
Pilot Project - Urban
Pilot Project - Rural
ITS/Traffic Management
Pilot Project - Corridor
Fleets/Freight
Planning/Bike/Ped
Collaboration
Data
Electric Vehicles
Intersections
Economic Development
ODOT Fleet
Road User Charge
Sustainability
Work Zone

4.0 RESULTS FOR 2014 ODOT SURVEY ON AUTOMATED VEHICLES

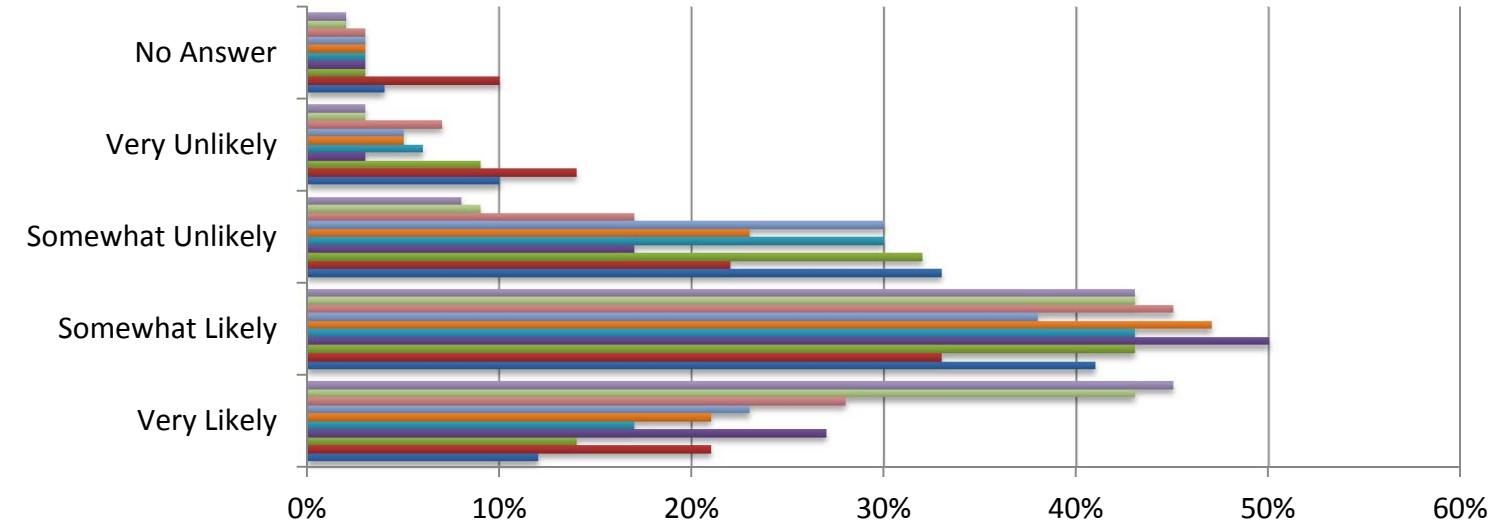
14. Have you heard about automated vehicles before today?



15. What is your general opinion regarding automated vehicles?

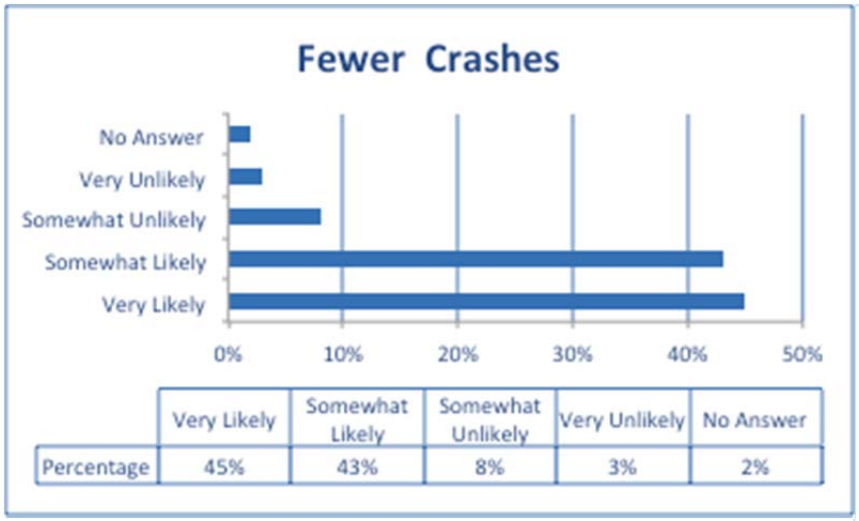


16. How likely do you think it is that the following benefits will occur when using automated vehicles?

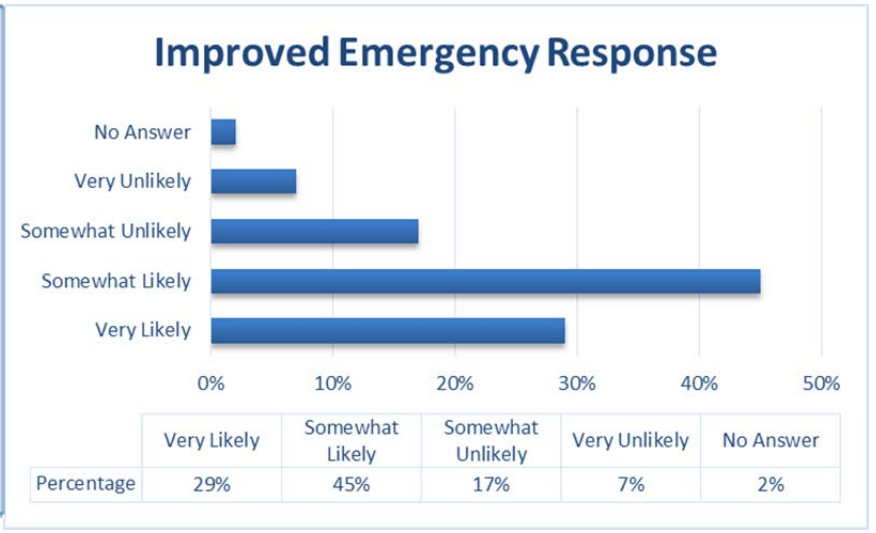


n=115

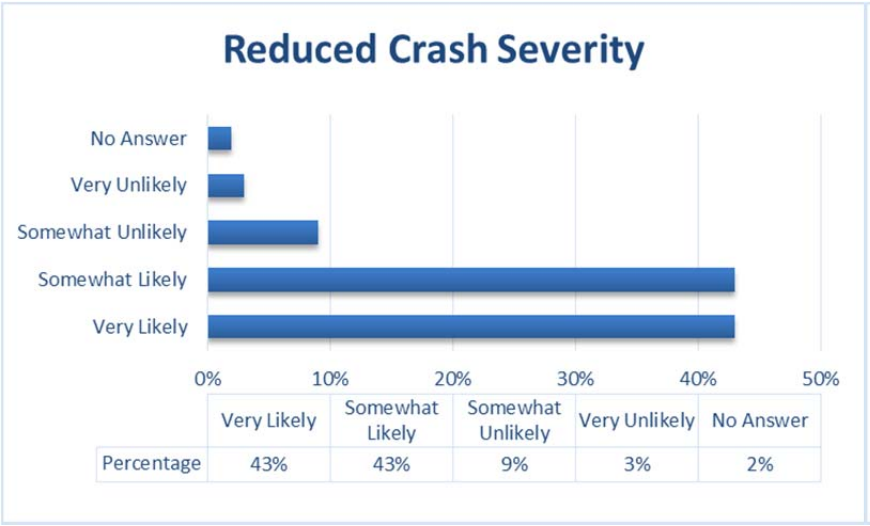
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Fewer Crashes	45%	43%	8%	3%	2%
Reduced Crash Severity	43%	43%	9%	3%	2%
Improved Emergency Response	28%	45%	17%	7%	3%
Less Traffic Congestion	23%	38%	30%	5%	3%
Lower Vehicle Emissions	21%	47%	23%	5%	3%
Shorter Travel Times	17%	43%	30%	6%	3%
Better Fuel Economy	27%	50%	17%	3%	3%
Lower Insurance Rates	14%	43%	32%	9%	3%
Improved Agency Operations	21%	33%	22%	14%	10%
Reduced Agency Costs	12%	41%	33%	10%	4%



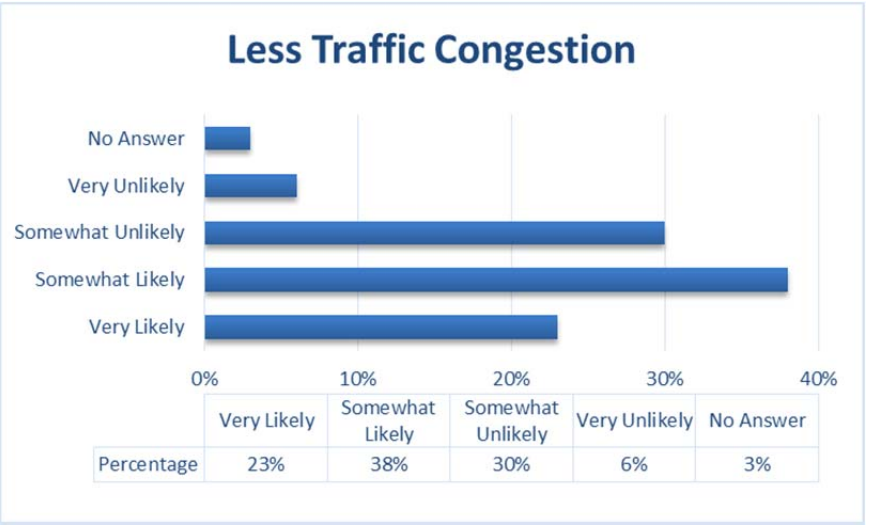
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	45%	43%	8%	3%	2%



	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	29%	45%	17%	7%	2%

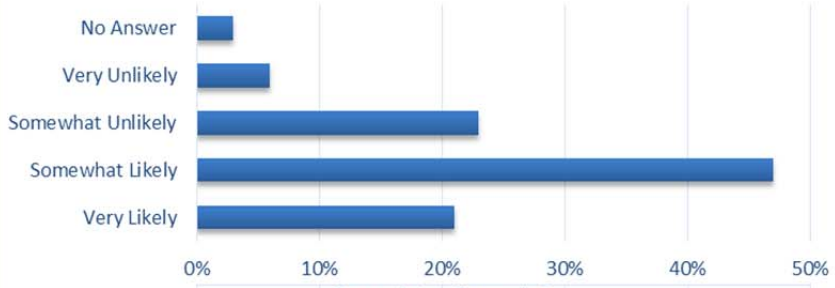


	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	43%	43%	9%	3%	2%



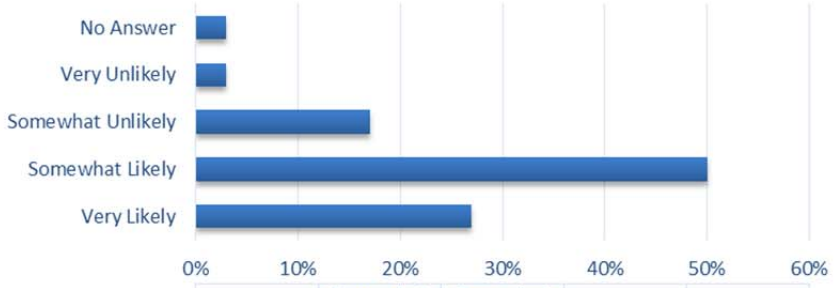
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	23%	38%	30%	6%	3%

Lower Vehicle Emissions



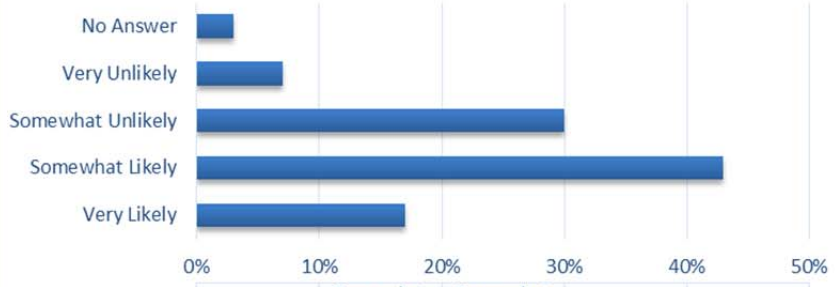
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	21%	47%	23%	6%	3%

Better Fuel Economy



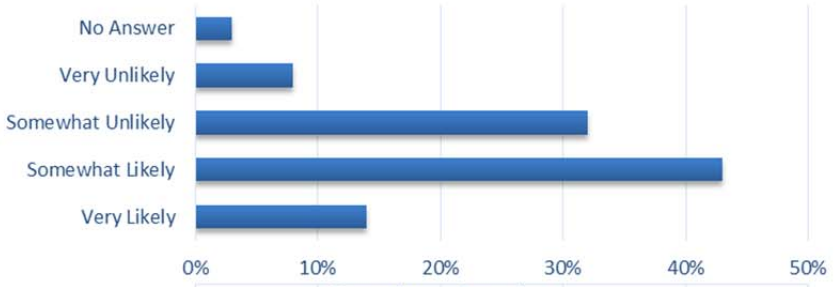
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	27%	50%	17%	3%	3%

Shorter Travel Times

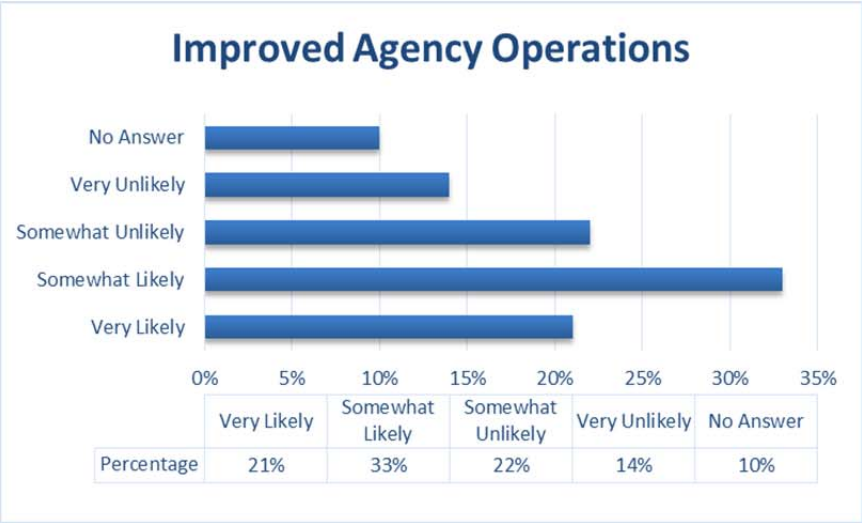


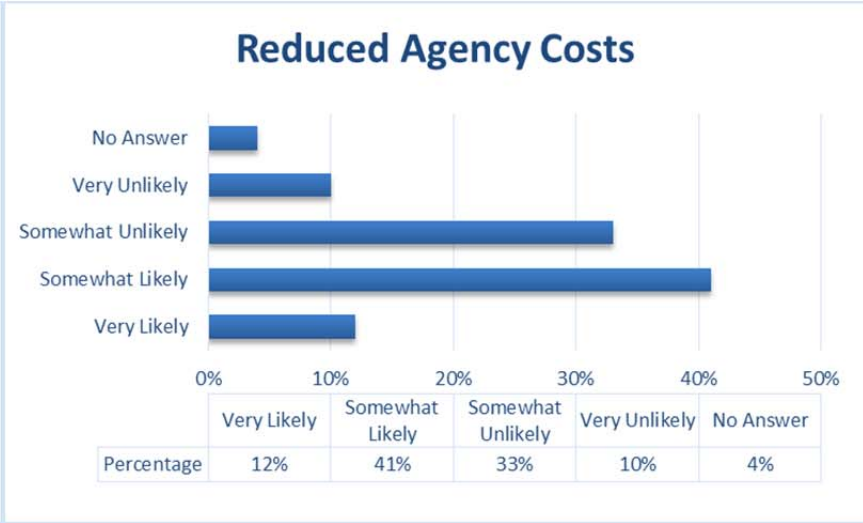
	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	17%	43%	30%	7%	3%

Lower Insurance Rates

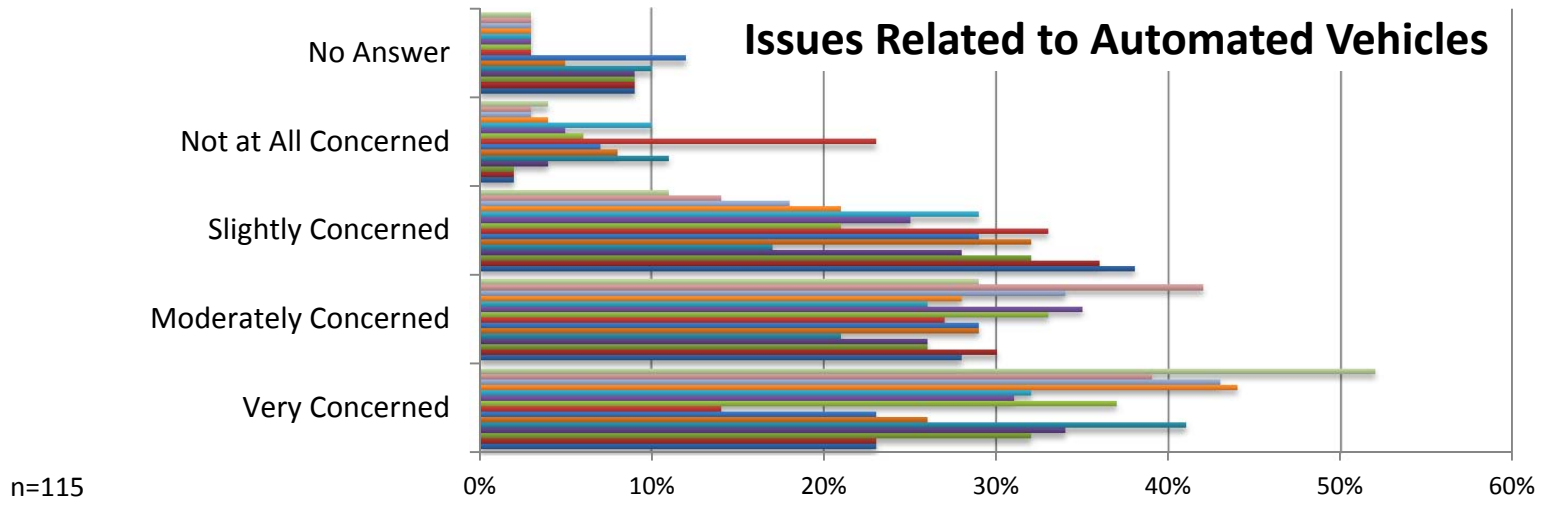


	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely	No Answer
Percentage	14%	43%	32%	8%	3%


Improved Agency Operations
No Answer
Very Unlikely
Somewhat Unlikely
Somewhat Likely
Very Likely
0%
5%
10%
15%
20%
25%
30%
35%
Very Likely
Somewhat Likely
Somewhat Unlikely
Very Unlikely
No Answer
Percentage
21%
33%
22%
14%
10%

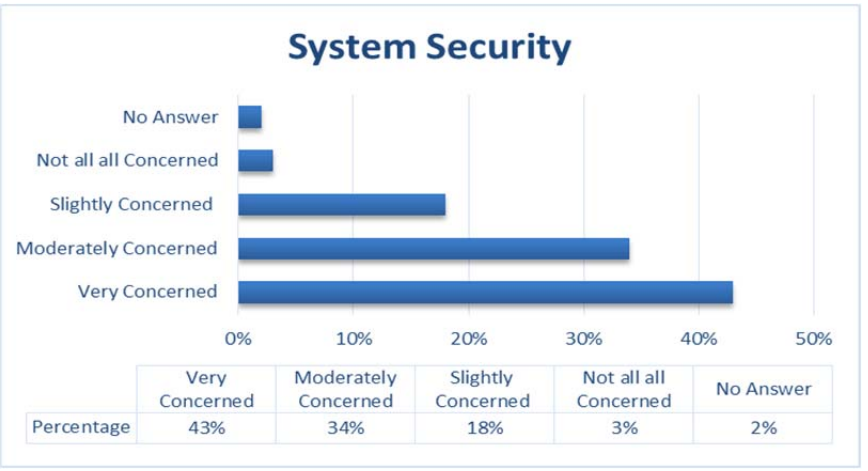

Reduced Agency Costs
No Answer
Very Unlikely
Somewhat Unlikely
Somewhat Likely
Very Likely
0%
10%
20%
30%
40%
50%
Very Likely
Somewhat Likely
Somewhat Unlikely
Very Unlikely
No Answer
Percentage
12%
41%
33%
10%
4%

17. How concerned are you about the following issues related to automated vehicles?

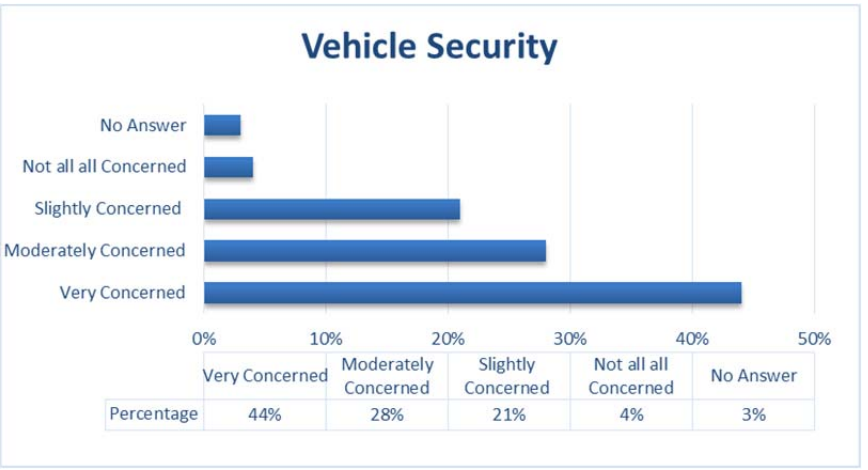


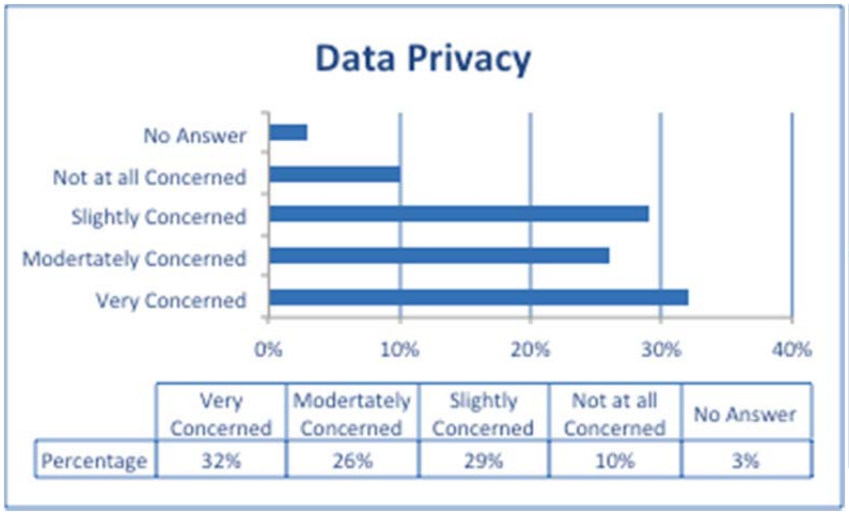
	Very Concerned	Moderately Concerned	Slightly Concerned	Not at All Concerned	No Answer
Consequences of Equipment/System Failure	52%	29%	11%	4%	3%
Legal Liability	39%	42%	14%	3%	3%
System Security	43%	34%	18%	3%	3%
Vehicle Security	44%	28%	21%	4%	3%
Data Privacy	32%	26%	29%	10%	3%
Interacting With Non-Self-Driving Vehicles	31%	35%	25%	5%	3%
Interacting with Pedestrians and Bicyclists	37%	33%	21%	6%	3%
Learning to Use Self-driving Vehicles	14%	27%	33%	23%	3%
System Performance in Poor Weather	23%	29%	29%	7%	12%
Confused by Unexpected Conditions	26%	29%	32%	8%	5%
Riding in a Vehicle With No Driver Controls	41%	21%	17%	11%	10%
Vehicles Traveling While Unoccupied	34%	26%	28%	4%	9%
Self-driving Commercial Vehicles	32%	26%	32%	2%	9%
Self-driving Public Transportation Vehicles	23%	30%	36%	2%	9%
Self-driving Taxis	23%	28%	38%	2%	9%

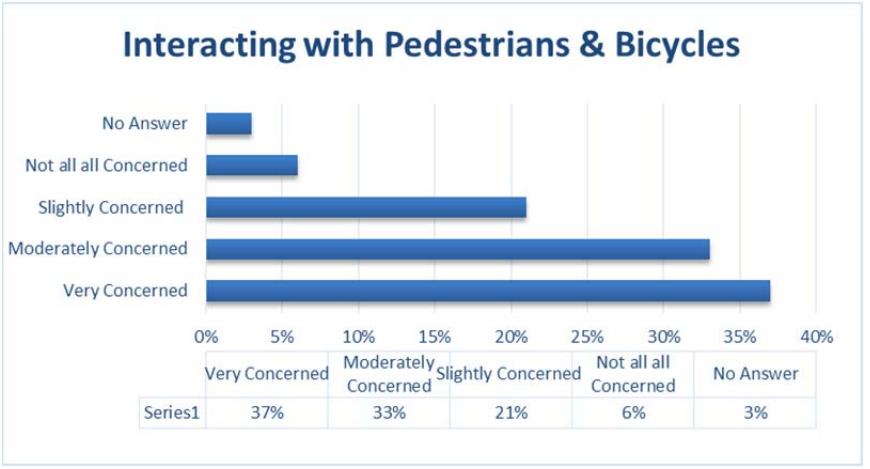

Safety Concerns
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
10%
20%
30%
40%
50%
60%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
52%
29%
11%
5%
3%

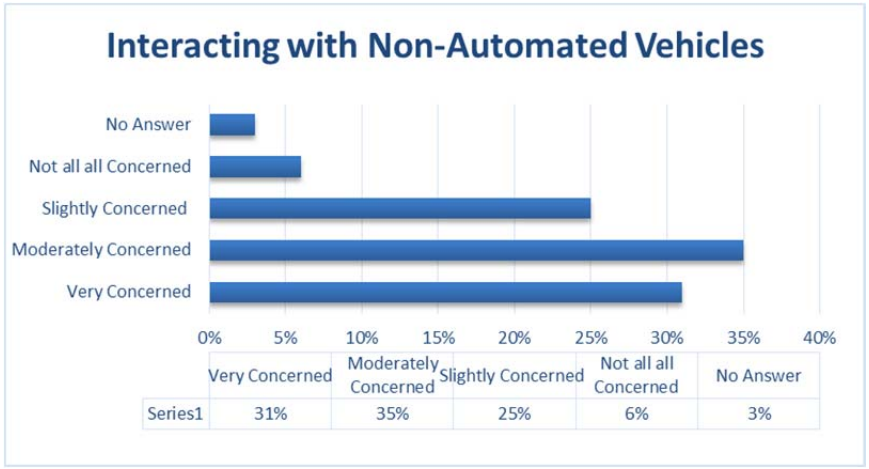

System Security
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
10%
20%
30%
40%
50%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
43%
34%
18%
3%
2%

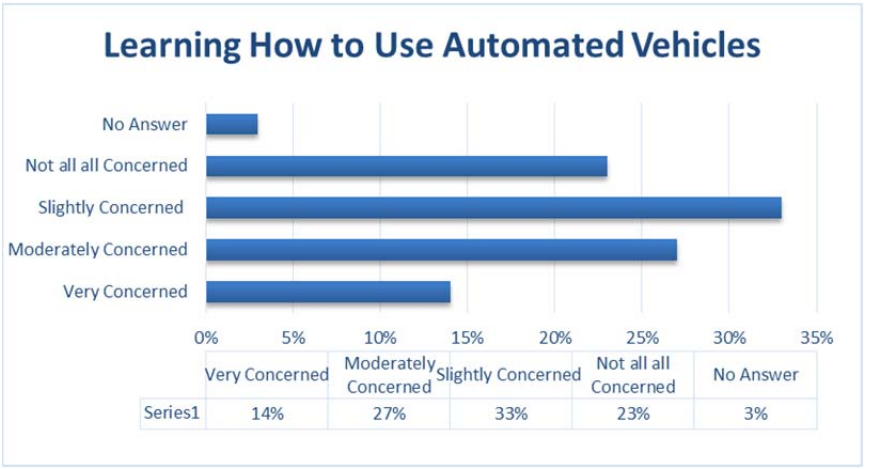

Legal Liability
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
10%
20%
30%
40%
50%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
39%
42%
14%
3%
2%

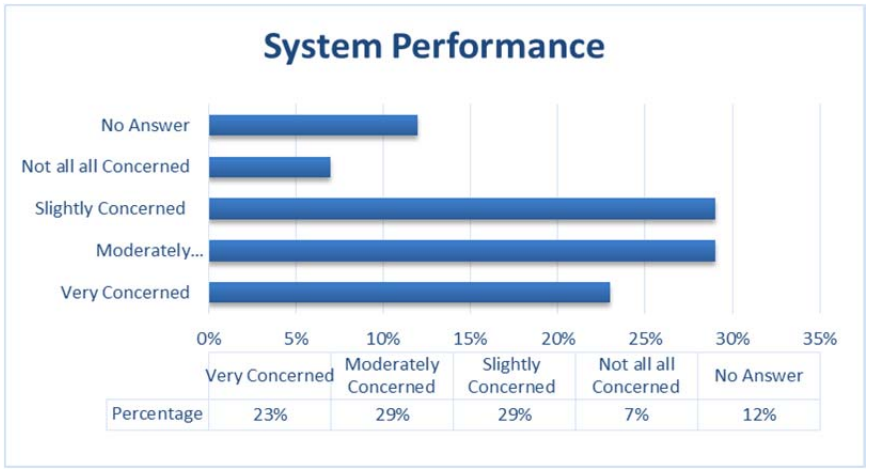

Vehicle Security
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
10%
20%
30%
40%
50%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
44%
28%
21%
4%
3%

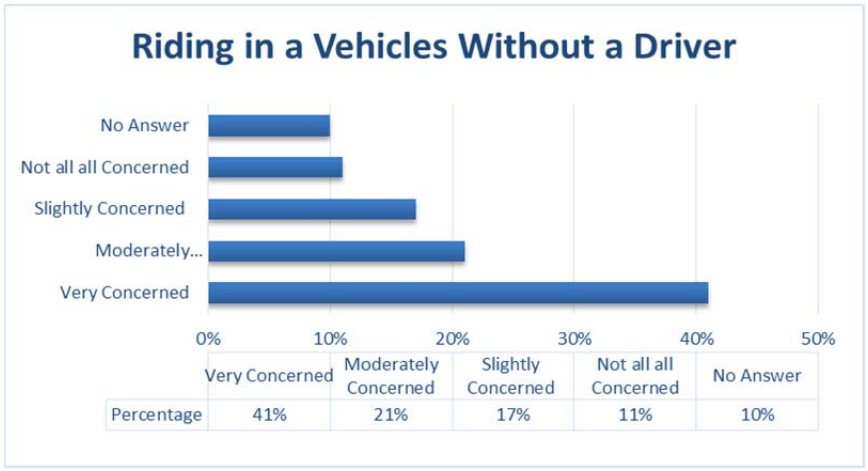

Data Privacy
No Answer
Not at all Concerned
Slightly Concerned
Modertately Concerned
Very Concerned
0%
10%
20%
30%
40%
Very Concerned
Modertately Concerned
Slightly Concerned
Not at all Concerned
No Answer
Percentage
32%
26%
29%
10%
3%

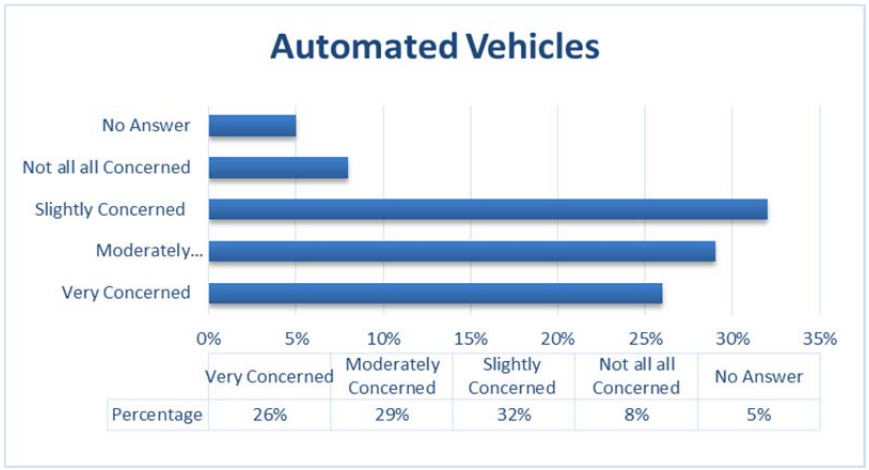

Interacting with Pedestrians & Bicycles
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Series1
37%
33%
21%
6%
3%

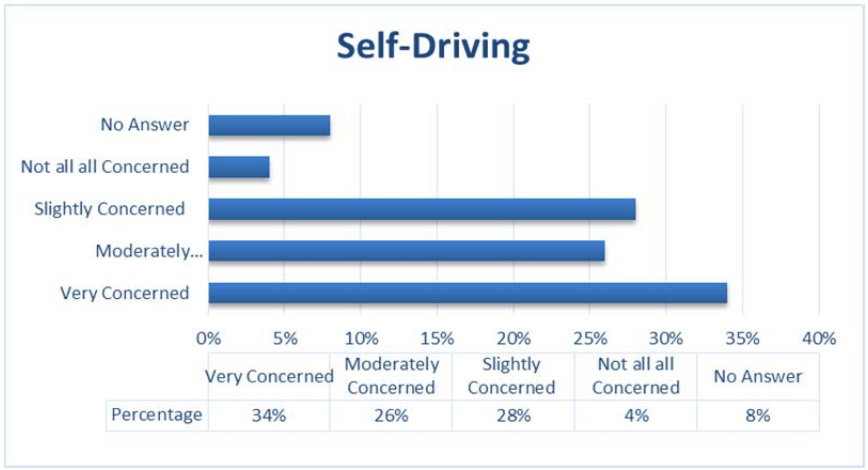

Interacting with Non-Automated Vehicles
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Series1
31%
35%
25%
6%
3%

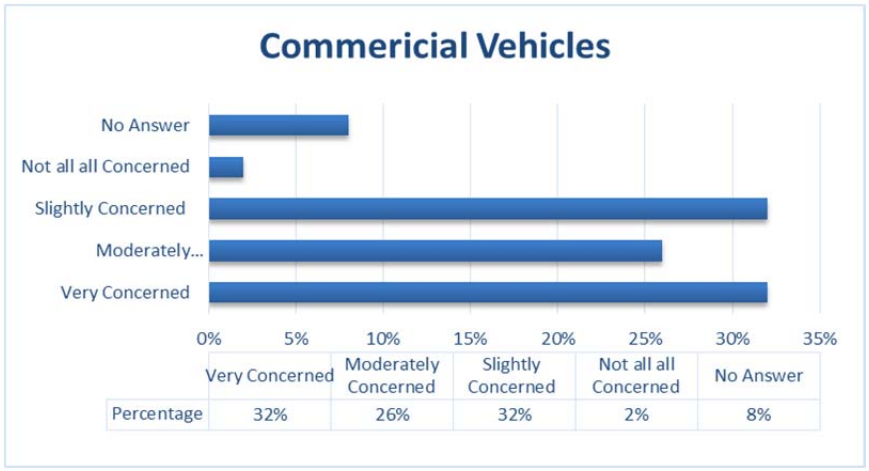

Learning How to Use Automated Vehicles
No Answer
Not all all Concerned
Slightly Concerned
Moderately Concerned
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Series1
14%
27%
33%
23%
3%

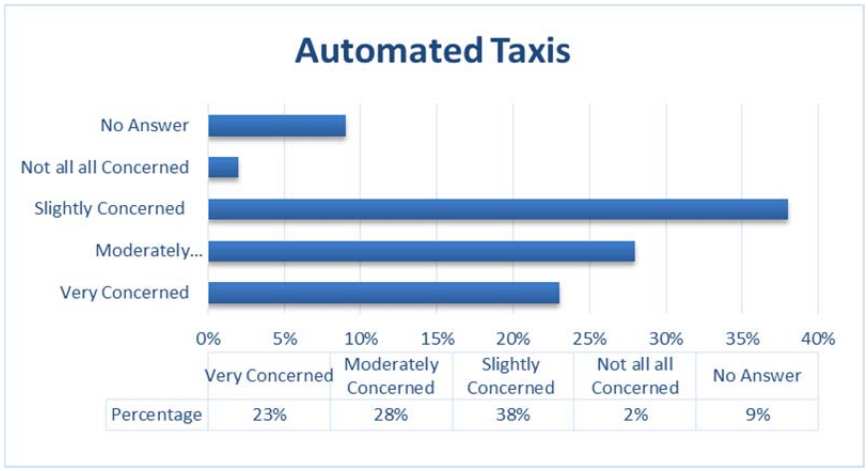

System Performance
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
23%
29%
29%
7%
12%

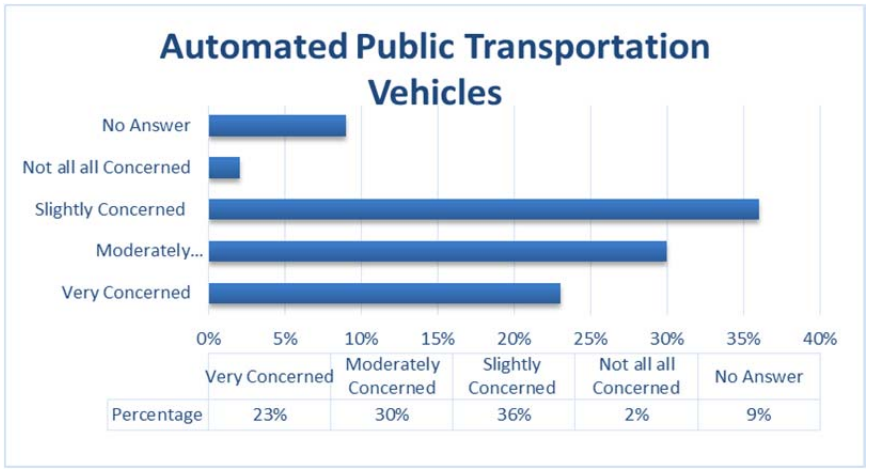

Riding in a Vehicles Without a Driver
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
10%
20%
30%
40%
50%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
41%
21%
17%
11%
10%


Automated Vehicles
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
26%
29%
32%
8%
5%

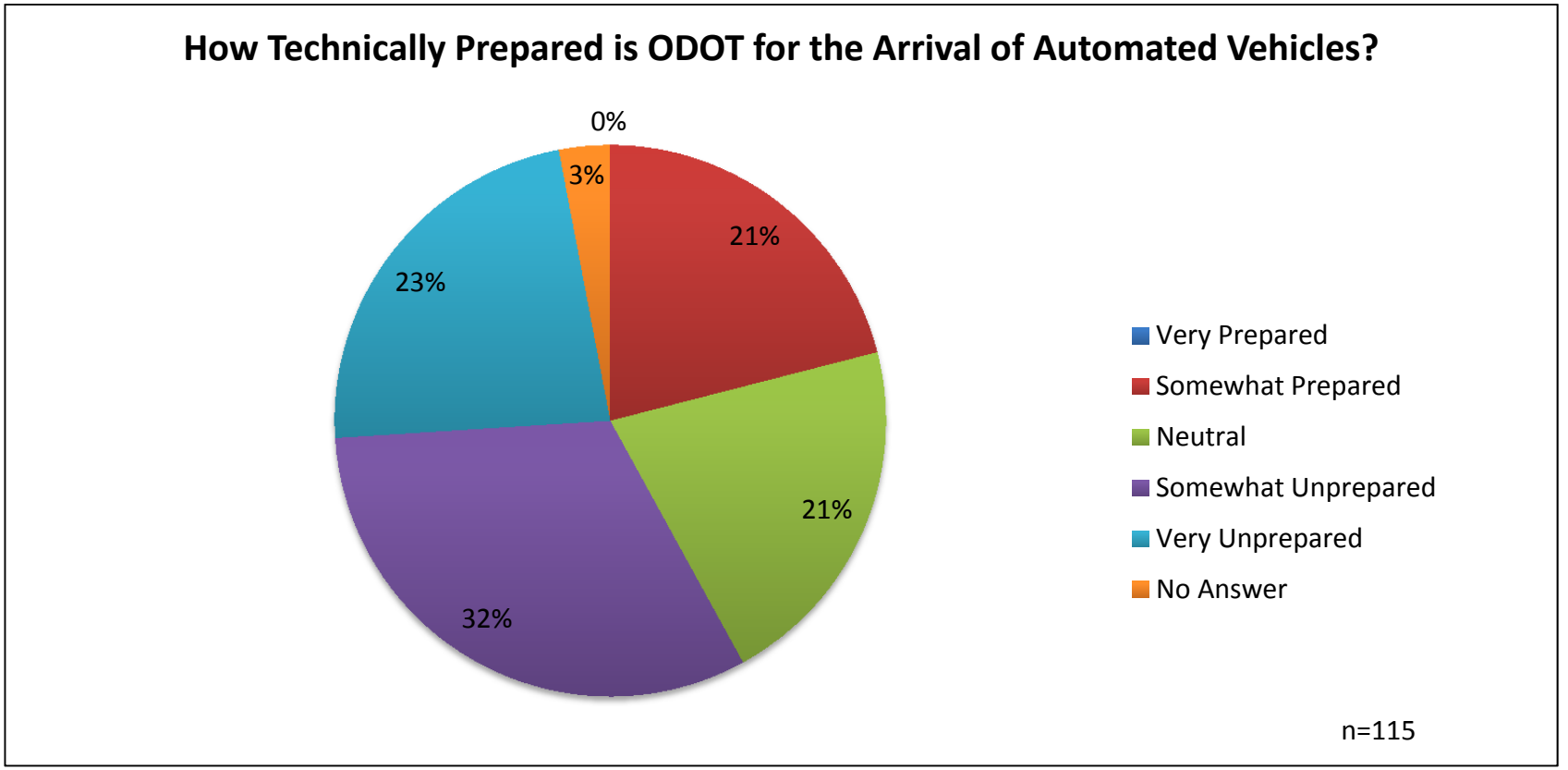

Self-Driving
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
34%
26%
28%
4%
8%


Commericial Vehicles
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
32%
26%
32%
2%
8%

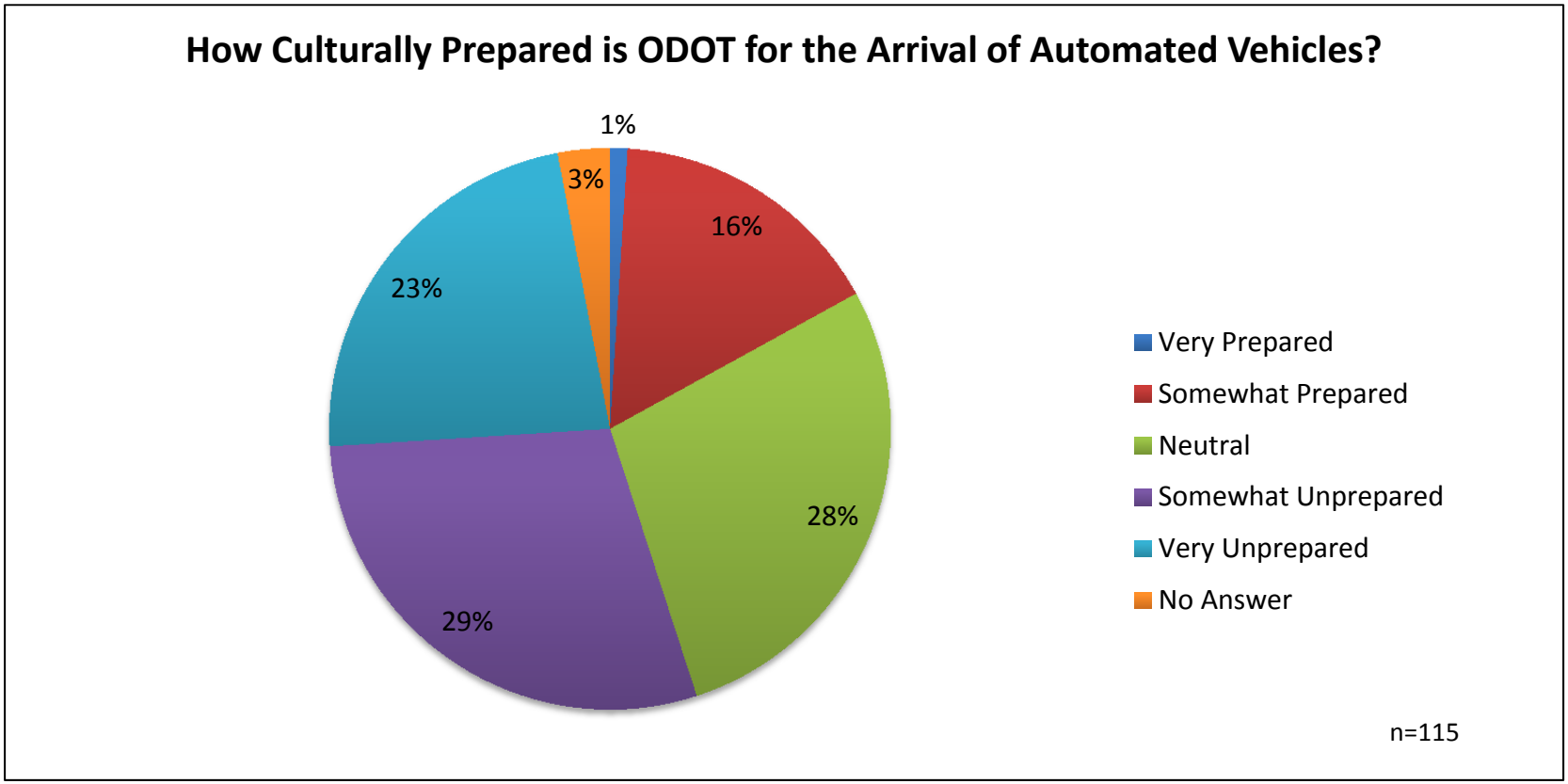

Automated Taxis
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
23%
28%
38%
2%
9%


Automated Public Transportation Vehicles
No Answer
Not all all Concerned
Slightly Concerned
Moderately...
Very Concerned
0%
5%
10%
15%
20%
25%
30%
35%
40%
Very Concerned
Moderately Concerned
Slightly Concerned
Not all all Concerned
No Answer
Percentage
23%
30%
36%
2%
9%

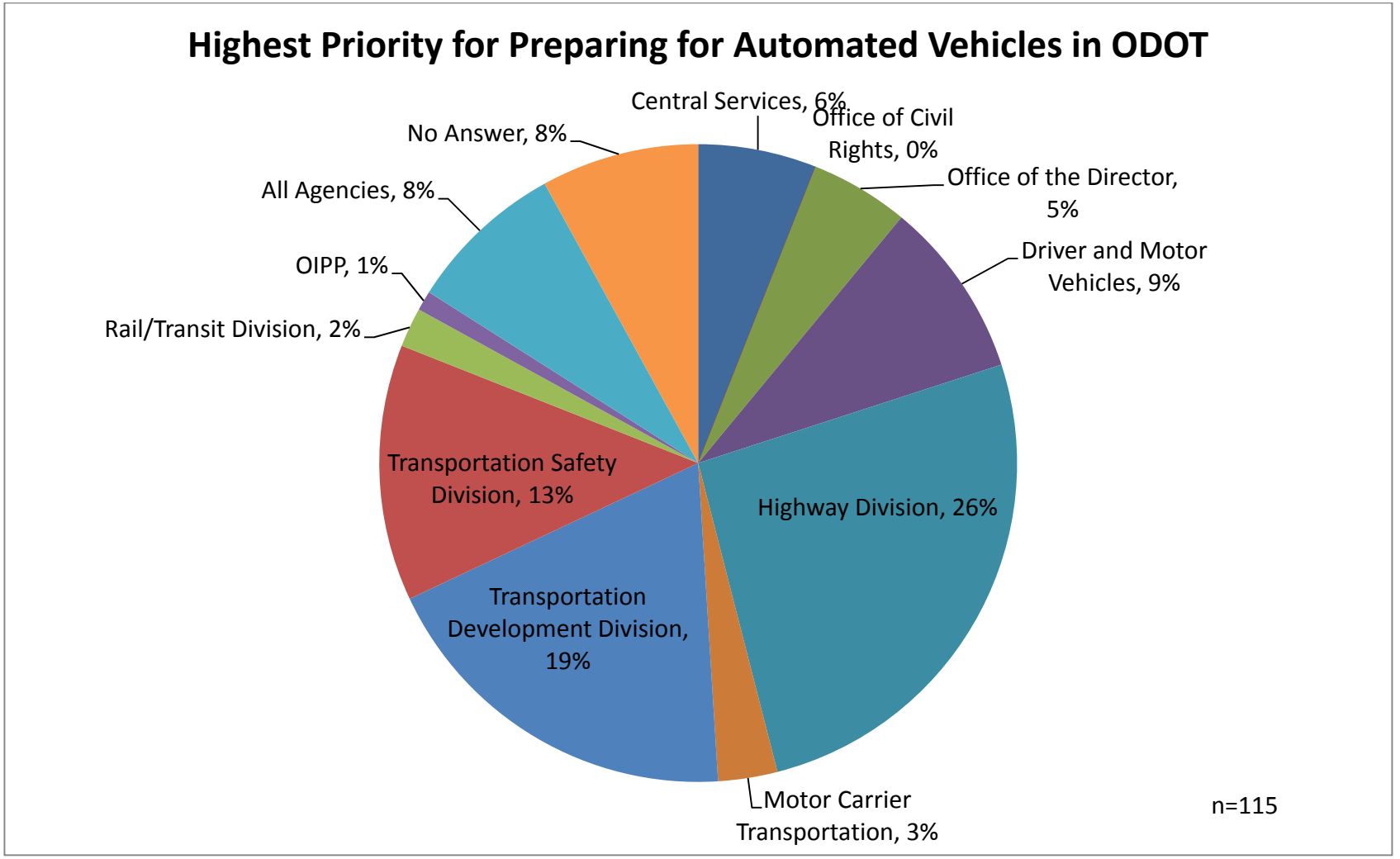
18. To what extent do you believe that the Oregon DOT is technically prepared for the arrival for automated vehicles in our state?



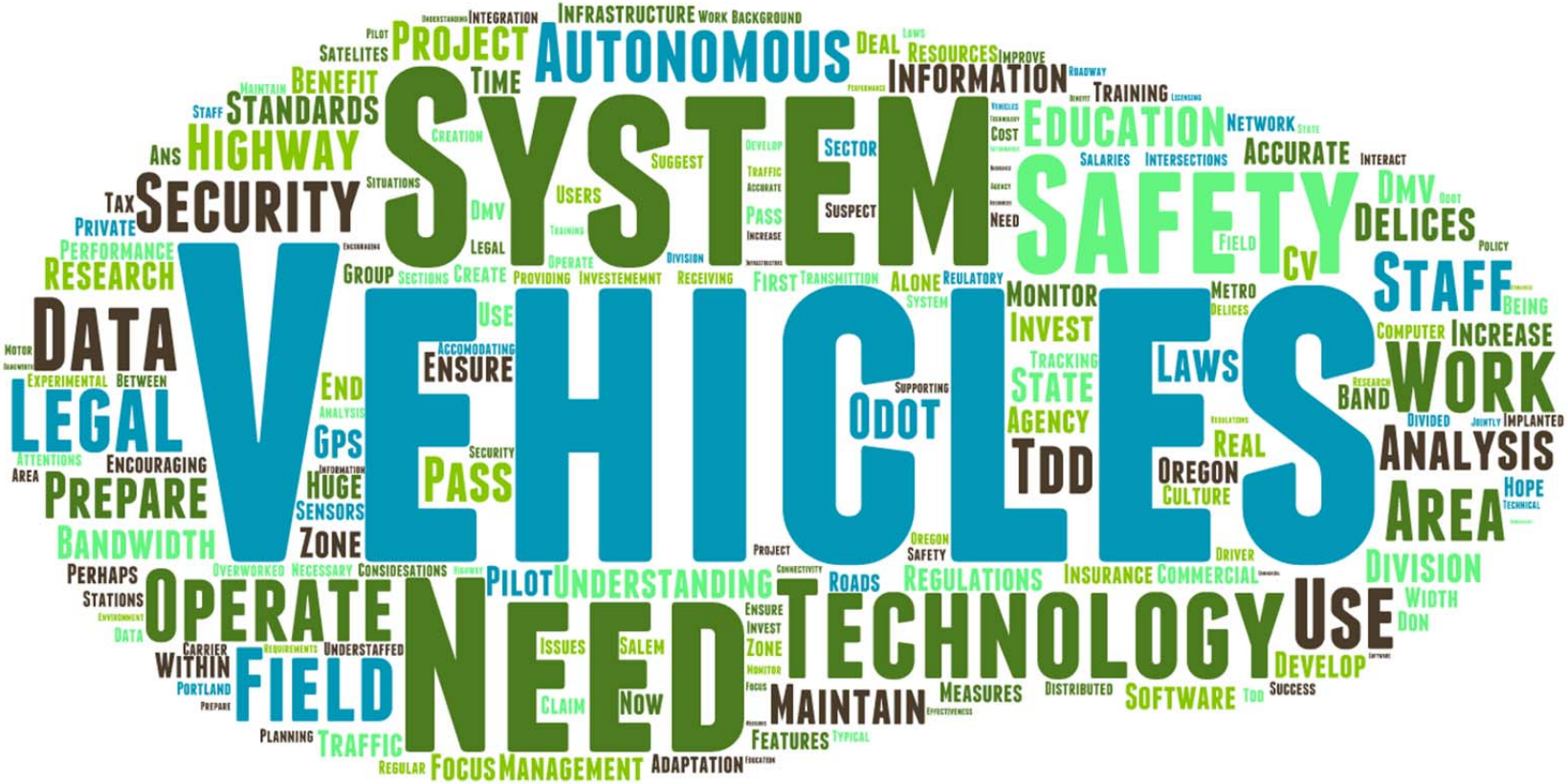
19. To what extent do you believe that the Oregon DOT is culturally prepared for the arrival of automated vehicles in our state?

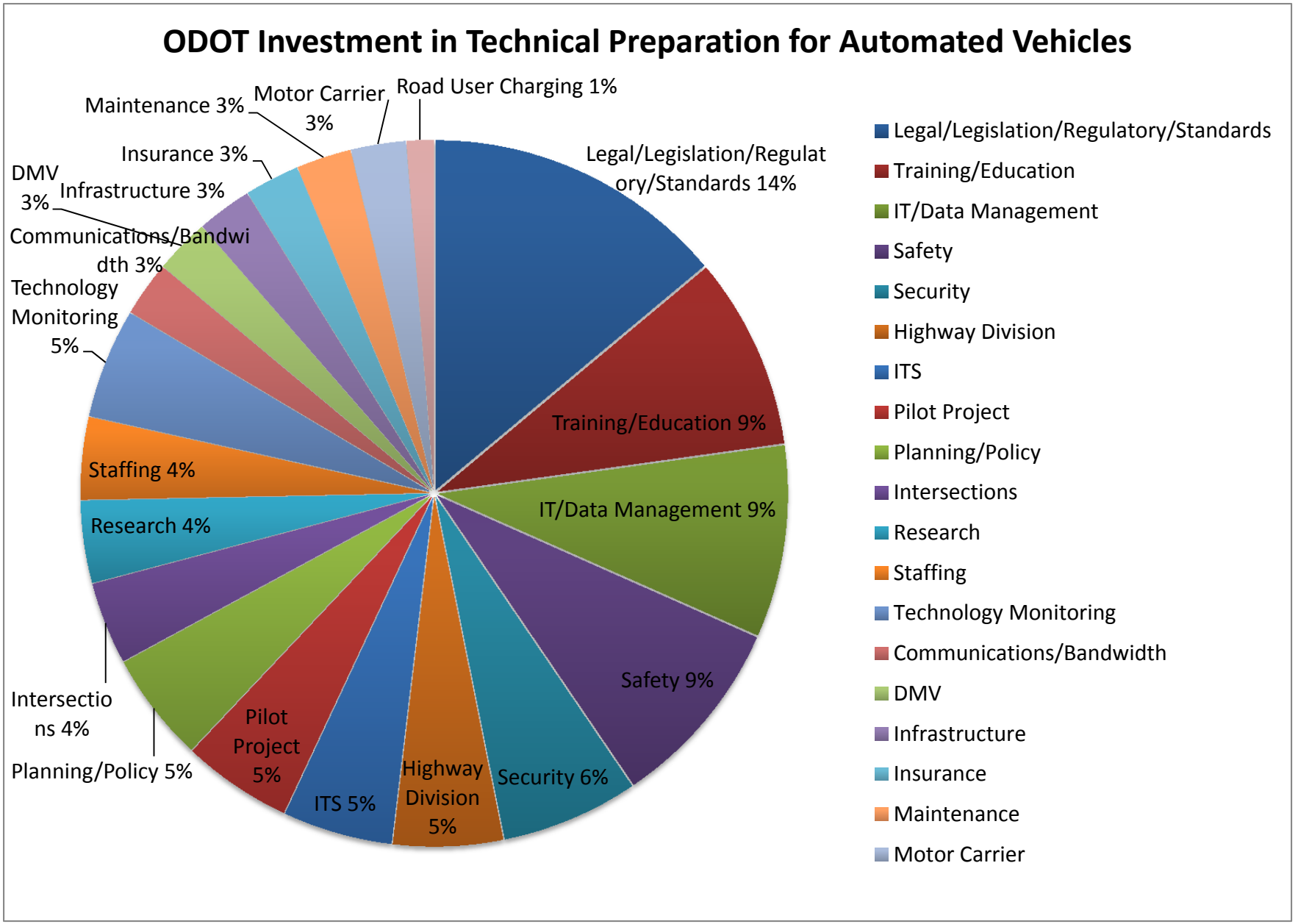

How Culturally Prepared is ODOT for the Arrival of Automated Vehicles?
1%
16%
28%
29%
23%
3%
Very Prepared
Somewhat Prepared
Neutral
Somewhat Unprepared
Very Unprepared
No Answer
n=115

20. In which division of ODOT do you think the highest priority should be placed for preparing for automated vehicles in our state?

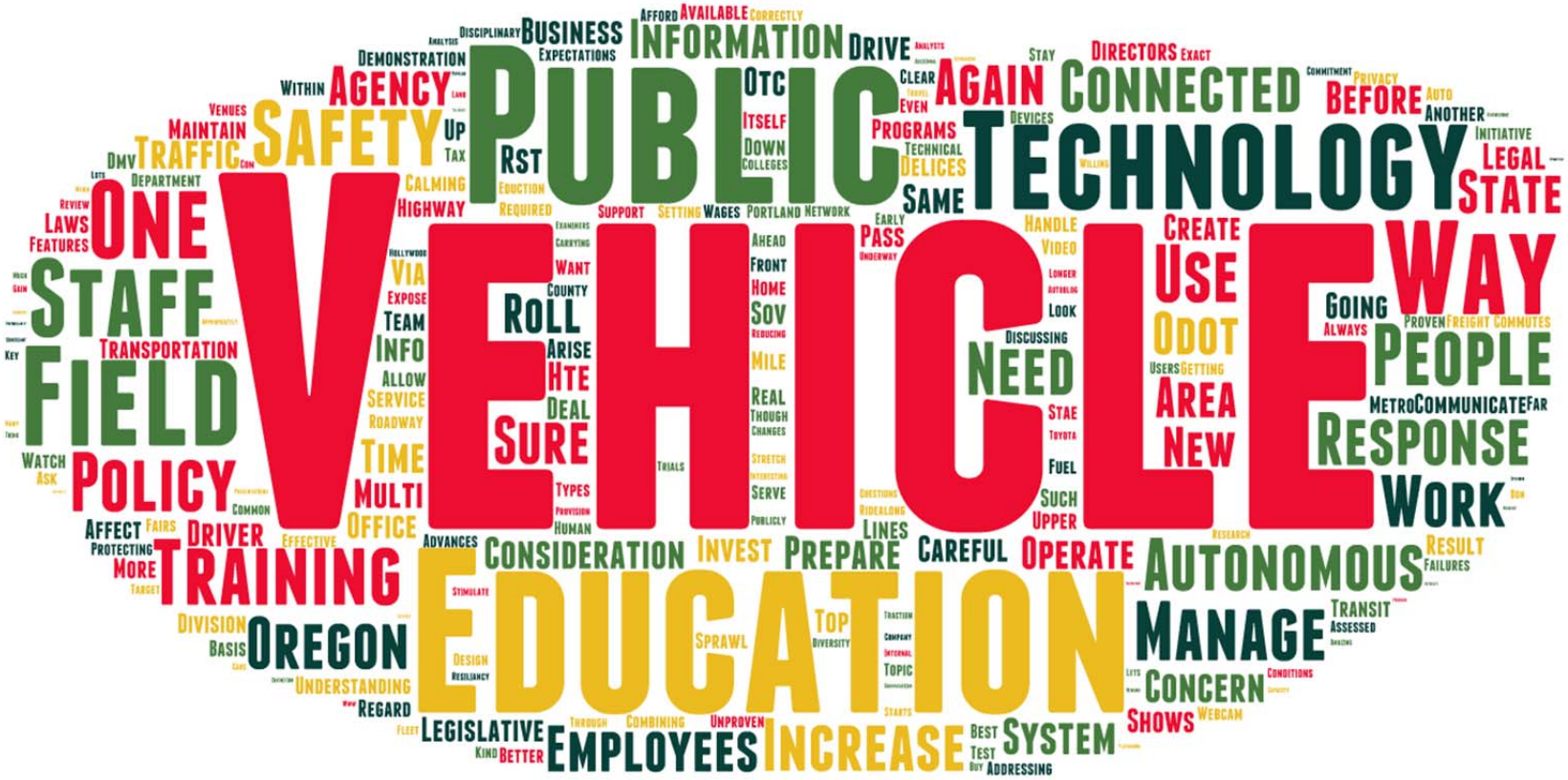


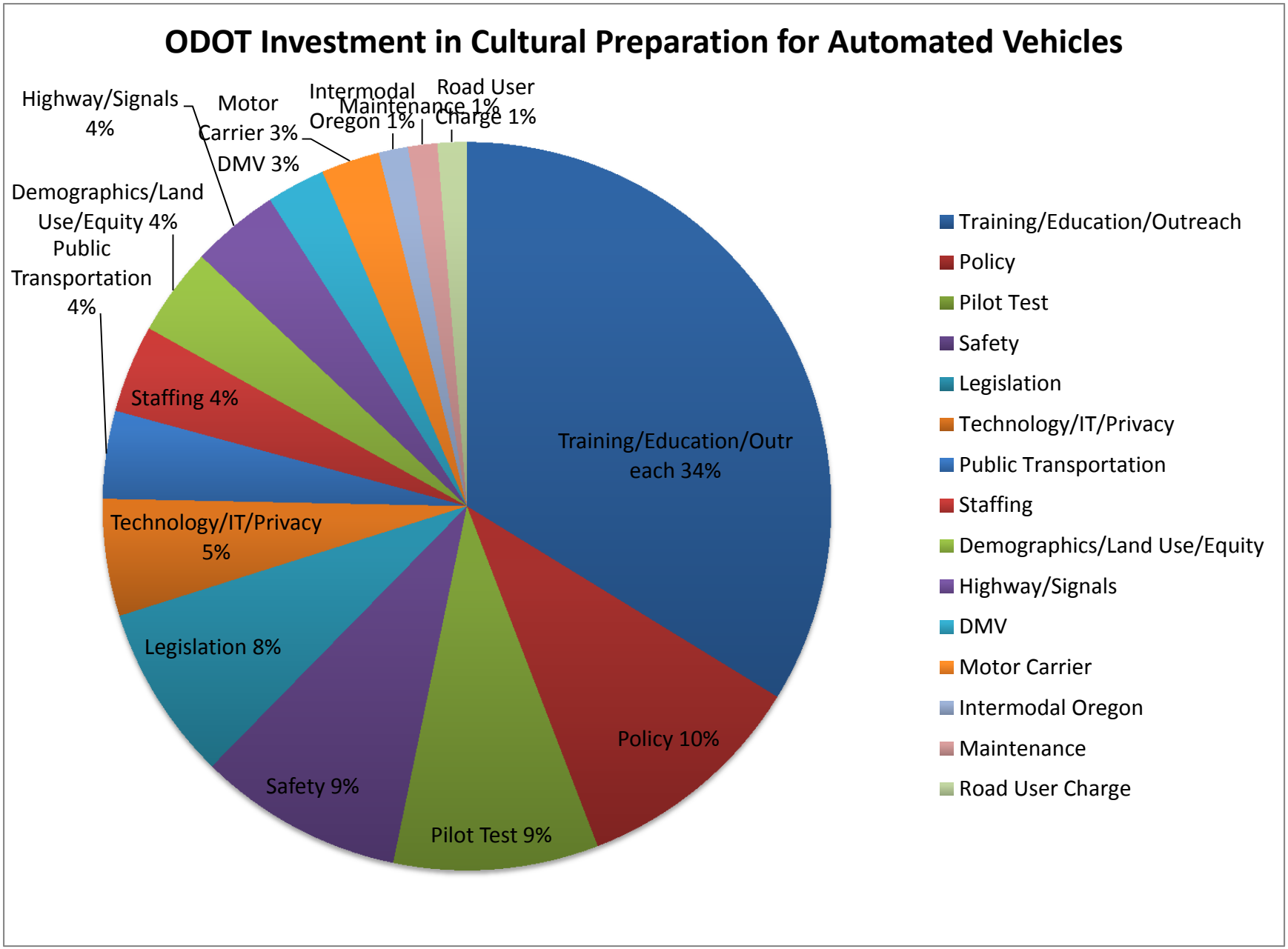
21. If ODOT could choose one area to invest in time or resources for preparing technically for the arrival of automated vehicles what should that be?




ODOT Investment in Technical Preparation for Automated Vehicles
Legal/Legislation/Regulatory/Standards 14%
Training/Education 9%
IT/Data Management 9%
Safety 9%
Security 6%
Highway Division 5%
ITS 5%
Pilot Project 5%
Planning/Policy 5%
Intersections 4%
Research 4%
Staffing 4%
Technology Monitoring 5%
Communications/Bandwidth 3%
DMV 3%
Infrastructure 3%
Insurance 3%
Maintenance 3%
Motor Carrier 3%
Road User Charging 1%
Legal/Legislation/Regulatory/Standards
Training/Education
IT/Data Management
Safety
Security
Highway Division
ITS
Pilot Project
Planning/Policy
Intersections
Research
Staffing
Technology Monitoring
Communications/Bandwidth
DMV
Infrastructure
Insurance
Maintenance
Motor Carrier

22. If ODOT could choose one area to invest in time or resources for preparing culturally for the arrival of automated vehicles what should that be?




ODOT Investment in Cultural Preparation for Automated Vehicles
Highway/Signals 4%
Motor Carrier 3%
DMV 3%
Intermodal Oregon 1%
Maintenance 1%
Road User Charge 1%
Demographics/Land Use/Equity 4%
Public Transportation 4%
Staffing 4%
Technology/IT/Privacy 5%
Legislation 8%
Safety 9%
Pilot Test 9%
Policy 10%
Training/Education/Outreach 34%
Training/Education/Outreach
Policy
Pilot Test
Safety
Legislation
Technology/IT/Privacy
Public Transportation
Staffing
Demographics/Land Use/Equity
Highway/Signals
DMV
Motor Carrier
Intermodal Oregon
Maintenance
Road User Charge

5.0 REFERENCES

UMTRI, *A Survey of Public Opinion about Connected Vehicles in the U.S., the U.K., and Australia*, Report No. UMTRI-2014-10. University of Michigan, 2014A.

UMTRI, *A Survey of Public Opinion about Automated and Self-Driving Vehicles in the U.S., the U.K., and Australia*, Report No. UMTRI-2014-21. University of Michigan, 2014B.