OREGON TRAFFIC SAFETY RESEARCH ROADMAP

by

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16. Abstract

To address the rising increase in fatal and serious traffic injuries, the ODOT Traffic Safety Research Roadmap establishes a structured, five-year research agenda listing research concepts for funding through ODOT Research Unit's annual funding cycle as well as other funding opportunities. The study identifies 51 priority traffic safety research needs, spanning the Safe Systems topics of safe people, safe vehicles, safe speeds, safe roads, and post-crash care. An implementation playbook suggests pathways of achieving the desired research needs to support transportation safety practice.

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SI* (Modern Metric) Conversion Factors
Approximate Conversions to SI Units

Physical Quantity	Symbol	When You Know	Multiply By	To Find	Symbol
Length	n	inches	25.4	millimeters	mm
Length	ft	feet	0.305	meters	m
Length	yd	yards	0.914	meters	m
Length	mi	miles	1.61	kilometers	km
Area	in2	square inches	645.2	square millimeters	mm2
Area	ft2	square feet	0.093	square meters	m2
Area	yd2	square yard	0.836	square meters	m2
Area	ac	acres	0.405	hectares	ha
Area	mi2	square miles	2.59	square kilometers	km2
Volume	fl oz	fluid ounces	29.57	milliliters	mL
Volume	gal	gallons	3.785	liters **	L
Volume	ft3	cubic feet	0.028	cubic meters	m3
Volume	yd3	cubic yards	0.765	cubic meters	m3
Mass	oz	ounces	28.35	grams	g
Mass	lb	pounds	0.454	kilograms	kg
Mass	T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
Temperature (exact degrees)	oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	oC
Illumination	fc	foot-candles	10.76	lux	lx
Illumination	fl	foot-Lamberts	3.426	candela/m2	cd/m2
Force and Pressure or Stress	lbf	poundforce	4.45	newtons	N
Force and Pressure or Stress	lbf/in2	poundforce per square inch	6.89	kilopascals	kPa

*SI is the symbol for the International System of Measurement

** Volumes greater than 1000 L shall be shown in m^3

SI* (Modern Metric) Conversion Factors
Approximate Conversions from SI Units

Physical Quantity	Symbol	When You Know	Multiply By	To Find	Symbol
Length	mm	millimeters	0.039	inches	in
Length	m	meters	3.28	feet	ft
Length	m	meters	1.09	yards	yd
Length	km	kilometers	0.621	miles	mi
Area	mm2	square millimeters	0.0016	square inches	in2
Area	m2	square meters	10.764	square feet	ft2
Area	m2	square meters	1.195	square yards	yd2
Area	ha	hectares	2.47	acres	ac
Area	km2	square kilometers	0.386	square miles	mi2
Volume	mL	milliliters	0.034	fluid ounces	fl oz
Volume	L	liters	0.264	gallons	gal
Volume	m3	cubic meters	35.314	cubic feet	ft3
Volume	m3	cubic meters	1.307	cubic yards	yd3
Mass	g	grams	0.035	ounces	oz
Mass	kg	kilograms	2.202	pounds	lb
Mass	Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
Temperature (exact degrees)	oC	Celsius	1.8C+32	Fahrenheit	oF
Illumination	lx	lux	0.0929	foot-candles	fc
Illumination	cd/m2	candela/m2	0.2919	foot-Lamberts	fl
Force and Pressure or Stress	N	newtons	0.225	poundforce	lbf
Force and Pressure or Stress	kPa	kilopascals	0.145	poundforce per square inch	lbf/in2

For More Information see: https://www.fhwa.dot.gov/publications/convtabl.cfm

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DISCLAIMER

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1.0 INTRODUCTION

Since the early 2000s the number of fatal and serious injuries has risen by 58%, going from an average of 2,293 per year to more than 3,600 per year between 2021 to 2025, with increases observed in for all road users.

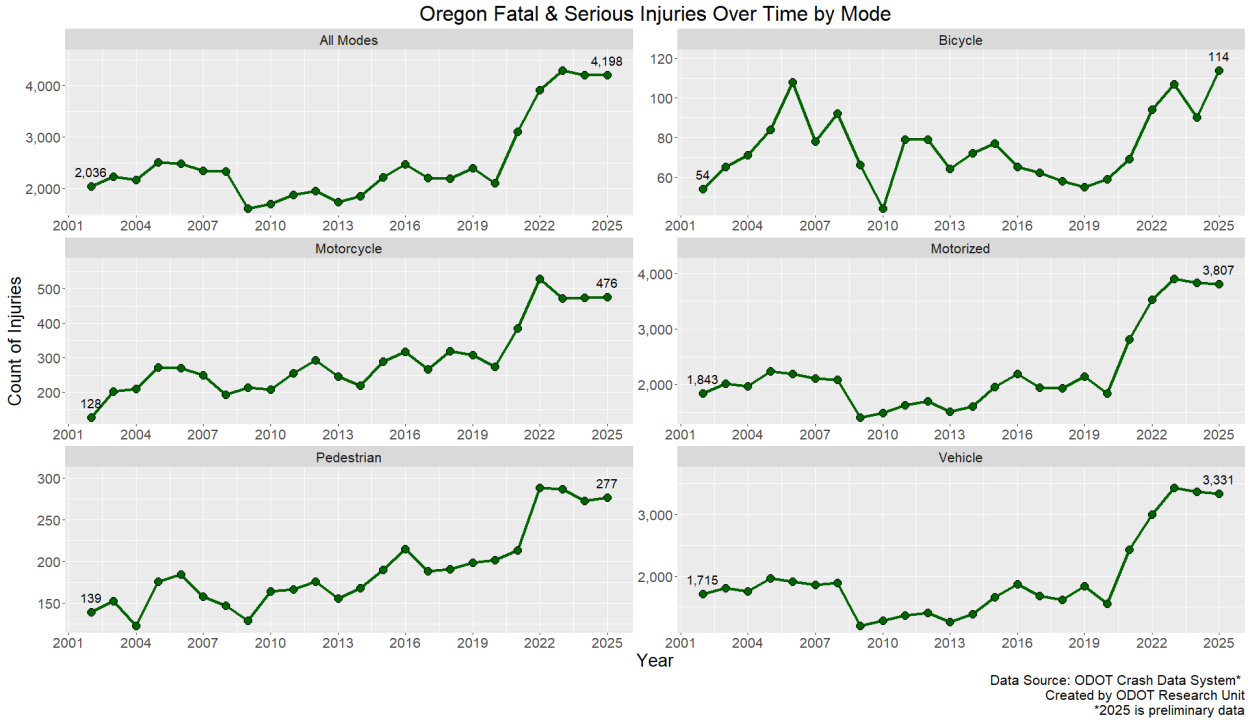

Figure 1. Fatal and Serious Injuries by Mode, Oregon 2001-2025

To address the rising increase in fatal and serious traffic injuries, this Oregon Department of Transportation (ODOT) Traffic Safety Research Roadmap builds a structured, five-year research agenda listing research concepts for funding through ODOT Research Unit's annual funding cycle as well as other funding opportunities available like National Highway Transportation Safety Administration. These research concepts will nest with the US Department of Transportation's (USDOT) Safe System Approach (SSA) shown below.

Figure 2. USDOT Safe System Approach
Source: https://www.transportation.gov/safe-system-approach

This structured approach will help ODOT and partner agencies translate research into actionable improvements that will help to meet the state's goal of zero fatal and serious injuries on Oregon roadways.

This report introduces the concepts and need for traffic safety research grounded in the Safe System Approach and describes the formulation of research concepts based on engagement with safety practitioners in Oregon, presenting the results from each engagement effort and the synthesized five-year framework for research needs statements.

1.1 THE TRAFFIC SAFETY CRISIS

Globally, around 1.19 million people die annually from roadway crashes, with 92% of them in low and middle-income countries, despite having around 60% of the world's vehicles (World Health Organization, 2023). Motor vehicle fatalities in the United States cost $1.9 trillion in 2022, including quality of life impacts (Transportation Research Board et al., 2024), killing over 40,000 people annually. "Normalized by the annual amount of vehicle travel, the U.S. fatality rate is still between 1.6 and 4.6 times higher than the set of comparable countries—Australia, Canada, France, Germany, Japan, the Netherlands, Norway, Sweden, and the United Kingdom" (Transportation Research Board et al., 2024, p. 18).

Nationwide, Figure 3 shows that national traffic fatalities remain unchanged compared to 30 years ago, despite spending more than $3 billion annually from the Highway Safety

Improvement Program, including at least $1 billion through the new Safe Streets and Roads for All, and other significant infrastructure grants and investments in behavioral, vehicle, and motor carrier safety (Peterman, 2024),

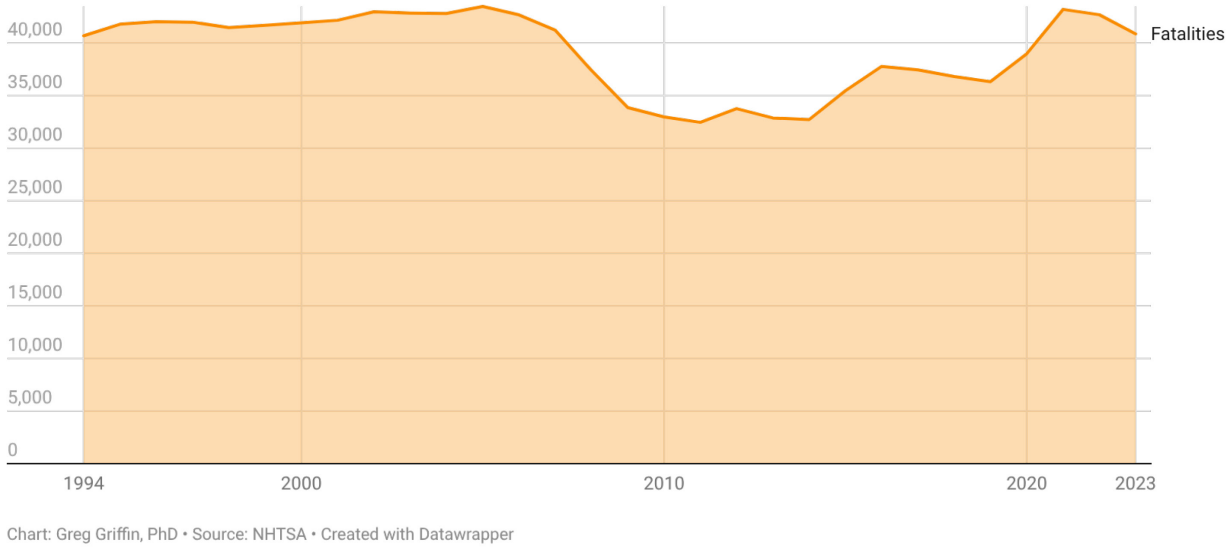

Figure 3 Traffic Fatalities, 1994-2023, USA (NHTSA, 2025)

Research shows some of the reasons why traffic safety investments fail to reverse trends at the state level and include policies and investments that counteract traffic safety goals, such as increasing speed limits, blanketed safety investments, driver behavior and lack of traffic enforcement, trends in vehicle purchases. Nationwide, “a 5 mph increase in the maximum state speed limit was associated with an 8% increase in fatality rates on interstates and freeways and a 4% increase on other roads. In total, there were an estimated 33,000 more traffic fatalities during the years 1995–2013 than would have been expected if maximum speed limits had not increased” (Farmer, 2017). Cost-effectiveness for traffic safety investments changes across states, suggesting that targeting the most cost-effective interventions by state is more effective than providing it equally across states (Ecola et al., 2015). International research suggests that treating traffic safety as an appendage to transportation, rather than as a public health crisis deserving greater investment, leads to the US trailing other developed nations (Evans, 2014). Intuitively, research also shows that “reduced driving leads to fewer traffic fatalities” (Puentes & Tomer, 2008, p. 30), which logically supports increased transit use to reduce motor vehicle fatalities (Stimpson et al., 2014), and compact land uses that reduce vehicle miles traveled (VMT) (Yeo et al., 2015). Additionally, US trends in vehicle design with larger mass, disparities in bumper height from light trucks, and choice of truck vs. car-based vehicles increases risk, despite other vehicle safety innovations (Wenzel, 2013).

Despite the attention to traffic safety at global, international, and state levels, the topic is notably missing or under-evaluated in academic and political discourse. A recent edited volume published by the Oregon State University Press called “Toward Oregon 2050”

(Horst, 2024) reviewed how Oregon should plan to improve by the year 2050, looking back over the state's legacy of innovative planning, and did not include traffic safety as a specific issue for the future, despite a chapter devoted to transportation (MacArthur, 2024). A search of news coverage in the Oregonian from 2020-2029 using the NewsBank database shows "traffic safety" appears in only 40 articles, compared to 137 with the worlds "gas tax" in their full text. This inattention in scholarly and public media may be linked to traditional knowledge about what can—and cannot be done about traffic safety.

1.2 TRADITIONAL APPROACH TO TRAFFIC SAFETY RESEARCH PROBLEMS

All sectors of the transportation industry—including government, academia, nonprofits, and commercial industry—have a role in developing and funding transportation safety research in the United States. However, the order and primacy of how transportation sub-fields work together has changed over time. One could argue that a federal government-first approach is the traditional way traffic safety research is identified, funded, and delivered in the US. President Lyndon Johnson's 1966 speech to the American Trial Lawyers Association that "highway deaths were second only to the Vietnam War as the 'gravest problem before the nation'" guided congressional action to create the Highway Safety Act of 1966, which required states to create highway safety programs following federal guidance (Weiner, 2008, p. 45). Subsequent transportation acts and safety funding has involved federal and state governments cooperating through a variety of organizations such as the nonprofit American Association of State Highway and Transportation Officials (AASHTO) and notably for research, the Transportation Research Board (TRB) and its influential Annual Meeting. Federal funding of University Transportation Centers (UTC) within universities provides a critical pipeline of knowledge between research for national and regional goals with faculty and students who become the nation's transportation workforce.

The TRB meeting, and its technical committees, have served a primary role in disseminating safety research needs and scientific findings throughout these diverse communities. However, the cost and time of attendance in the Washington, D.C. location limits the proportion of transportation safety practitioners that can meaningfully contribute to transportation safety research ideas that influence research funding at the federal and state levels. Furthermore, dramatic restructuring of TRB committees and shifts in research priorities has drawn critiques of TRB's role in convening and funding transportation research with scientific integrity (Karner et al., 2025). Additionally, disciplinary traditions within academia tends to narrow research methods and topics, leaving important knowledge gaps as "undone" science that is needed, but unfunded (Lowe, 2021).

State DOTs develop a State Research Work Program, which prioritizes state needs for context and goals, subject to FHWA Division office review and approval. State DOT research development and technology transfer is required by federal law to be at least 25% of its annual State Planning and Research (SPR) funding, granted through the Federal

Highway Administration (23 CFR 420.107, 2002). Under this subsection 420, states must provide a 20% funding match, which can include in-kind matches, or be provided through university partnerships or toll revenues.

Oregon DOT's Research program bridges the practical needs of the state with SPR funding through Expert Task Groups (ETGs) who develop research problem ideas with research coordinators and a Research Advisory Committee (RAC), who identifies the top priority projects for funding (Oregon Department of Transportation, 2026). Annually, practitioners and researchers submit problem statements that form the basis for each year's cycle. This process reflects the state's key priorities for each year. Additionally, separate programs at ODOT address timely research problems on an as-needed basis with consulting scholar contracts.

Overall, the traditional approach to transportation research funding provides a strong basis for partnerships, particularly with academia and government needs, but leaves gaps in engagement of safety practitioners who do not typically engage directly in research, funding amounts, timeliness of needs and solutions, and the systemic nature of traffic safety that extends beyond the boundaries of disciplines and annual funding cycles.

1.3 WHY THIS APPROACH IS NEEDED NOW

A knowledge gap exists between the safety practitioners who address daily challenges, such as law enforcement and maintenance staff, and researchers and staff who typically write research problem statements. The Traffic Safety Research Roadmap process includes direct engagement with Oregon practitioners who have relevant experience with these problems first-hand, who may uniquely highlight the 'undone' research that could make a difference in their work.

The Traffic Safety Research Roadmap can look beyond the annual funding cycle to organize research needs that could be addressed with multiple funding sources over the next five years. Instead of funding only a smaller project that fits within a year's budget, the broader view may prioritize addressing a bigger challenge with a larger pool of funding. This approach can support timely interventions to safe lives, while addressing

Some research problems can be clearly identified as a specific need and solution that fits well within an annual funding cycle. Many are technical in nature, and can be solved with sufficient attention and resources. This introduction suggests, however, that work on the traffic safety crisis at the national and state levels have not made adequate progress to this huge task. Transportation safety is a wicked problem in the sense that it involves "complex issues that are difficult to define and solve due to their interdependencies, uncertainties, and multifaceted nature" that "involve multiple stakeholders, varying scales of impact, and a host of economic, social, and technological factors" (Griffin, 2025, pp. 116–117). Safety researchers also call this "systemic" because crashes often have more than one cause, with human behavior interacting with varying safety systems of vehicle technology,

infrastructure conditions, weather, and other issues. Sometimes we need to see the forest and the trees, and how they change over time. The traffic safety research roadmap is an approach to take this broader view of what problems we know need attention, which ones are answerable, and how to prioritize work that addresses both the technical and systemic problems over the next five years.

2.0 RESEARCH ROADMAP PROCESS

Identifying and prioritizing research for improving traffic safety in Oregon involves human behavior, engineering and construction, funding and politics, emerging technologies, and challenges of combining all these factors across a complex geography over time. To begin to approach addressing these challenges in a meaningful way, this study took a five-step process: surveying safety practitioners in Oregon, conducting in-depth focus groups with a subset of those practitioners, conducting a workshop to prioritize the known challenges, and constructing research needs statements using a combination of those methods.

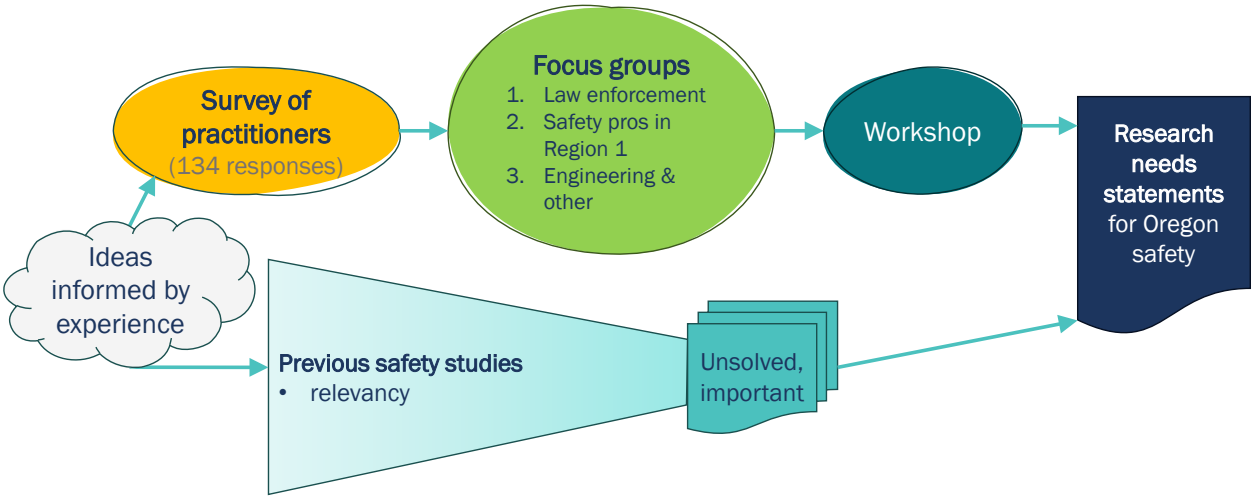

Figure 4. Study process study process

To provide information about the purpose of the study to prospective respondents, researchers published a web page to quickly share the purpose and how to get involved, at https://rpubs.com/ODOT_Research/TSRRM. Figure 5 depicts the web page status during participant recruitment, which was linked in emailed invitations to the practitioner survey.

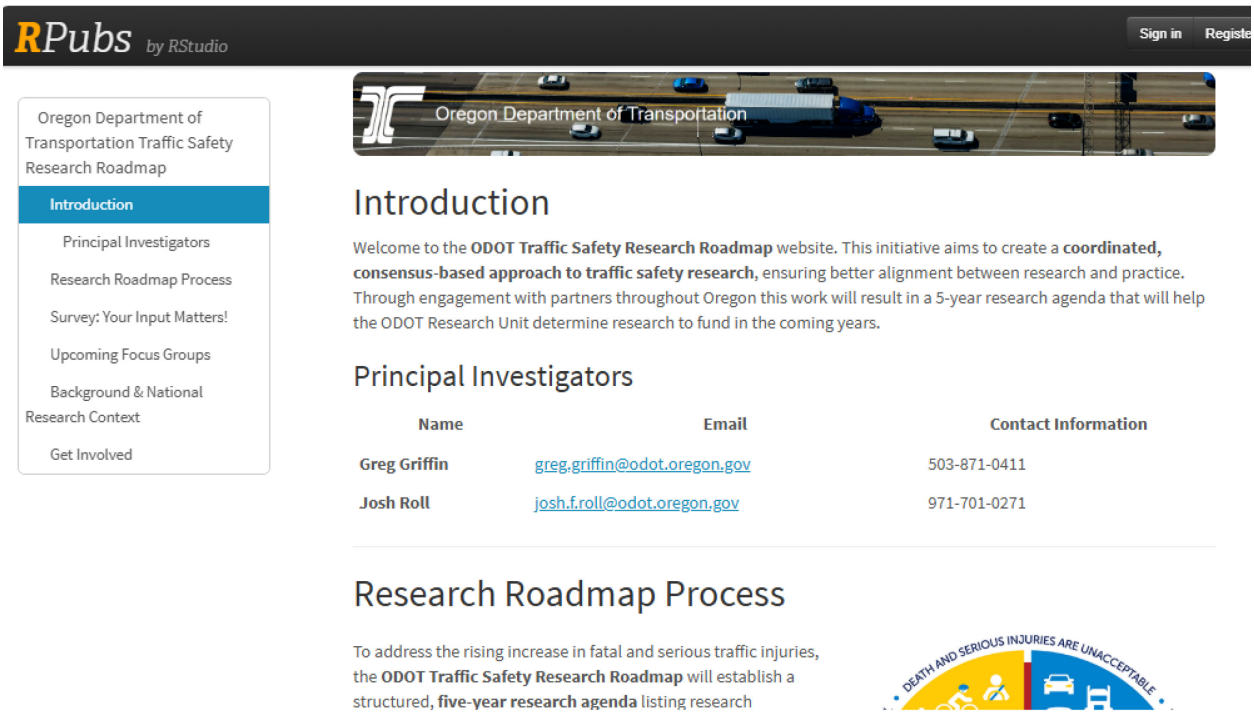

Figure 5. ODOT Traffic Safety Research Roadmap web page

2.1 PRACTITIONER SURVEY

ODOT Research staff conducted a brief survey of transportation safety practitioners in Oregon to help understand partner needs for research around the safe systems approach. Specifically, this survey was developed to:

- solicit traffic safety research ideas from those directly involved in the work daily—traffic safety practitioners;
- gauge attitudes about traffic safety against a national survey on traffic safety culture; and
- identify practitioners who are interested in focus groups to further develop research topics.

The 11-question survey (attached as Appendix A) was developed to address three topics: participants' thoughts on Safe System research, traffic safety culture, and individual background. Responses were anonymous, unless participants chose to provide contact information to participate in a later focus group.

133 practitioners responded to the survey, which was open March 4 - April 8, 2025. Participants were recruited via email from a variety of ODOT databases, including ODOT Technology Transfer Center customers. The survey link was shared with an invitation email, and no codes were linked to the identity of individuals. Therefore, participants could have shared the link with others, and the exact response rate cannot be calculated. As a convenience sample, responses do not represent the entirety of transportation safety

practitioners in Oregon but include those interested in responding about the topic of traffic safety research.

Analysis included descriptive statistics, and manual classification of 113 research ideas written as open-ended responses into one of five Safe System elements: Safe Roads, Safe Speeds, Safe Road Users, Safe Vehicles, and Post-Crash Care.

Participation in the survey lacked significant representation from law enforcement, so the team coordinated with Tiana Tozer in the ODOT Traffic Safety Office to plan a focus group with law enforcement next.

2.2 FOCUS GROUPS

Focus groups compliment the brief and broad survey responses with in-depth discussion that encourages learning between contributors, in addition to further probes from the facilitators. The main purpose of the focus groups was to to facilitate discussion with transportation safety professionals to identify problems that ODOT Research can develop into research to support effective traffic safety interventions. The team facilitated three focus groups, summarized in Table 1.:

Table 1. Focus Group Summary

Focus Group	Date	Location	Participants	Problems Identified
Law Enforcement	June 3, 2025	Portland Police Bureau East Precinct Community Room	5	22
ODOT Region 1 Area	July 10, 2025	Portland Metro Regional Center	9	22
Rural and Other	August 20, 2025	Online via MS Teams	28	14

In each focus group, participants were invited from the pool of survey respondents who indicated willingness to join a focus group, and others were invited directly—such as the law enforcement participants. The research team sent invitees an introductory handout, 'What are research questions about Safe Systems?,' which is included in Appendix B. Also in the appendix is a bank of questions and discussion prompts used by the facilitators.

Following each focus group, the research team re-described notes into a listing of problems for traffic safety and organized them into the five Safe System topics: safer people, safer vehicles, safer speeds, safer roads, and post-crash care. These traffic safety problems were then re-written as research needs statements, informed by the researchers' review of literature and interpreted needs within Oregon and the nation.

The survey and three focus groups yielded a significant set of preliminary results, including 58 traffic safety problem statements across the five Safe Systems topics. To integrate ideas and prioritize needs, the researchers facilitated a workshop of key informants.

2.3 ONLINE WORKSHOP

On September 23, 2025, the research team convened 9 key safety practitioners and researchers, including several from ODOT's Traffic Safety and Human Factors Expert Task Group to:

1. Share what was learned from the Oregon safety practitioner survey, 3 focus groups, and review of literature;

2. Identify current challenges and gaps in knowledge that could support transportation safety in Oregon; and

3. Prioritize draft research needs statements for potential funding.

2.4 REVIEW OF PREVIOUS SAFETY STUDIES

The research team leveraged an existing collection of related research and searched for recent studies under six categories: the Safe System topics (safer people, safer vehicles, safer speeds, safer roads, and post-crash care), and research methods studies that sought to improve approaches to expand and deepen knowledge about traffic safety. This review is intended to introduce the reader to some of the key topics in traffic safety that have already been covered but is not intended to be comprehensive of the topic, nor for conditions in Oregon.

Safer People research includes human factors in traffic safety, attitudes from any stakeholders in the systems, and behaviors that impact safety outcomes. Human factors frameworks inform research based on sensory perception, reaction time, and interaction of humans with technological systems, including guidelines for research and design (Campbell et al., 2025), specificity for highway engineering (Tsyganov, 2025), and approaches for safety prediction models (Porter et al., 2023). Recent work on design approaches to reduce behavioral conflicts for drivers and non-motorists inform safety (Fink et al., 2024). A vast literature spanning public health, epidemiology, and transportation address driving under the influence as human factors for safety, recently emphasizing cannabis use, especially post-legalization by many states (Voy, 2023). Traffic safety culture represents vast opportunities for research (Kumfer et al., 2024; Otto et al., 2022), with recent indications of driver attitudes and 'motornormativity' as important for traffic safety (Sousa" et al., 2026). Some human factors research necessarily bridges humans and technology, but a separate literature focusing on vehicles is also important.

Safer vehicles research focuses on the design and engineering of how vehicles interact with humans and the transportation environment, spanning personal motor vehicles,

commercial trucks, bicycles and e-bikes, and a growing span of micromobility devices. Government and manufacturer testing of new systems, such as forward collision warning (FCW) alert and crash imminent braking (CIB) interventions support new opportunities to improve safety redundancies to support human drivers (Snyder et al., 2019). Electric vehicle market penetration has highlighted the need for continued work on battery protection, regenerative braking control, and other topics (Indu & Aswatha Kumar, 2023). In the US market particularly, the increase in mass of EVs and hood heights of trucks and SUVs are a major thrust of recent safety research (Hu et al., 2024). Research on automated vehicles "suggest that AVs hold the potential to improve the overall safety on roads, although the existing evidence is not mainly based on real data but assumptions regarding vehicles' capabilities and behavior," indicating real safety impacts of AVs are still emergent (Tafidis et al., 2022, p. 245). Systematic reviews of bicycle safety technologies highlight smart sensing and collision-warning systems (accelerometers, LIDAR, V2X), now at advanced technology readiness levels, which indicate promising potential for reducing cyclist injuries once mature and field-tested (Kapousizis et al., 2023). This body of research underscores a systems-based approach: integrating structural safeguards, visibility enhancements, assistive sensors, and rigorous engineering standards across travel modes to promote safer interactions among vehicle occupants and vulnerable road users in increasingly complex environments.

Safer speeds includes research that addresses the increasing risk of fatality in higher-speed crashes. FHWA explains the safe speeds approach as "reducing speeds can accommodate human injury tolerances in three ways: reducing impact forces, providing additional time for drivers to stop, and improving drivers' ability to see the surrounding roadway" (Kumfer et al., 2023, p. 7). Speed management research includes not only the interaction between speed limit setting approaches and roadway design, but also sociopolitical factors and legal constraints, including technologies such as speed safety cameras. Innovations in speed monitoring using vehicle monitoring technologies support accurate tools to quantify the risk of injury and frequency with speed limit changes (Dean et al., 2025). Decades of speed enforcement studies show that drivers tend to slow down with visible enforcement, but then return to previous speeds in both distance and time from the visible enforcement (Dart & Hunter, 1976; Hajbabaie et al., 2011). Speed safety cameras show promise in solving problems with visibility and expense of extensive enforcement (Guerra et al., 2024; Hirst et al., 2005), and ODOT research addressed public acceptance and implementation guidance for successful implementation (Figliozzi et al., 2025). However, concerns related to public surveillance and equity remain important to address (Rennert, 2023), though public messaging on the danger of speeding may increase support for automated enforcement (Ralph, 2025). Though speed and road design are inter-related, other research issues of the roadway context are important for safety.

Safer roads research to improve traffic safety by accommodating human error and limited abilities to tolerate crash forces includes a diverse range of aspects from planning, design, construction, operation, and maintenance of the roadway systems. Research on safe roads design strategies address speed and direction through roundabouts and other

intersection safety approaches (e.g. Claros et al., 2021), straightaways and curve design (Khan et al., 2013), vulnerable road users (Zegeer et al., 2001), lighting conditions (Ferenchak et al., 2022), and standardizing and disseminating research results through crash modification factors (CMSs) (e.g Zhao et al., 2023). Little evidence of full compliance of road safety design standards exists, with a study of Norway showing that almost a quarter of curves had a tighter radius than required (Elvik & Haugvik, 2023). Land use, roadside maintenance, and traffic calming practice and research include conflicts, and merit further study and update of roadway standards. Land uses such as commercial development along arterial streets are associated with higher crash rates, but are often outside the purview of transportation authorities (Dumbaugh & Rae, 2009). More recent evidence from Florida suggests relocating household-sustaining land uses (Dumbaugh & Stiles, 2026), but this study was lacks control of bicycling and walking traffic volume, and the evidence may not be transferable to an Oregon context. DOTs follow clear zone guidance to remove trees at a large scale, even though evidence from a large-scale removal of trees did not decrease crash fatalities (White & Meixler, 2024). Wider lanes are considered an approach to reduce collisions from driver errors, yet controlled before-and-after studies show traffic calming implementation reduces risk of death and injury from crashes (Bunn et al., 2003). Recognizing the rich information available from crash reports and sites, emerging work uses vision-language models and street-view imagery to infer root crash causes often missing from agency crash data (Wu et al., 2026). Major gaps in roadway design include traffic calming that works for motorcycles, addressing barriers to implementing higher mixed land use density, and addressing needs of pedestrians near high-speed roadways (Goel et al., 2024).

Post-crash care research is inherently interdisciplinary, often requiring merging databases between transportation authorities, emergency responders, and hospitals to reduce the risk of fatalities after a crash has occurred. Response time from police to the crash site is associated with crash consequences (Liu, 2022), suggesting challenges with limited enforcement budgets and policy directions. Rural areas with high driving speeds are particular locations of concern, with further distances to travel to high-level trauma centers within the “golden hour” most likely to save lives (Kommineni & Aziz, 2025). Inter-agency coordination can provide a unified command with shared resources, but these agreements vary by location, in addition to the value of coordinated prehospital treatment systems and trauma centers (Cuthbertson & Drummond, 2025). Recent work seeks to address disparities, including innovations such as training commercial drivers to provide first-responder care at crash sites (Rustagi et al., 2023). A recent panel of experts in post-crash care identified “74 high-priority consensus research questions,” addressing health care disparities, system issues, resuscitation, vehicle technology, prehospital medical terminology, and several other topics (Goolsby et al., 2025).

Researchers are tailoring methods for improvements in safe systems, including approaches to link the disparate disciplines and data types that are not traditionally integrated in engineering, public administration, or communication alone. New work on the robustness of CMF development shows that statistical skewness of case and control

data can result in different CMF values depending on data sampling, and that re-sampling control data can result in a more robust measure (Khavarian & Sahebi, 2026). Qualitative research methods including surveying and focus group discussions (the same used in the present Research Roadmap) addresses "underlying perceptions and motives" of road users that are not measurable in traditional crash data, and help address emerging issues such as e-scooter safety (Anke et al., 2025). Researcher memoing about emerging data as an analytical approach "serves to assist the researcher in making conceptual leaps from raw data to those abstractions that explain research phenomena in the context in which it is examined" (Birks et al., 2008, p. 68), helping to answer the 'why' and 'how' questions around causal factors in human-caused issues. Researchers deploy mixed-methods approaches, such as combining quantitative data from documents or surveys and qualitative interview data, to explain both the prevalence and growth of Vision Zero work by cities, in addition to how staff first developed the programs and how traffic safety involvement later changed since deploying Vision Zero (Evenson et al., 2023). Creative approaches to research methods are addressing silos of thinking and action that hold back reductions in traffic deaths. The next section reports how we ranked ideas for near and longer-term implementation.

2.5 PRIORITIZING RESEARCH NEEDS

Briefly, the process to prioritize research needs involved:

1. a broad sweep of ideas in the statewide survey,
2. collaborative and critical thinking through focus groups,
3. reflecting against a review of literature, and finally
4. prioritizing through an ODOT-led workshop.

The resulting research needs matrix approach summarizes the results of Oregon's Safe System Research Roadmap, following an example provided by the AASHTO Council on Active Transportation (Dill et al., 2021).

3.0 RESULTS

3.1 PRACTITIONER SURVEY

The brief survey of transportation safety practitioners in Oregon solicited traffic safety research ideas, gauged attitudes about traffic safety against a national survey on traffic safety culture, and

identified practitioners who are interested in focus groups to further develop research topics. 133 practitioners responded to the survey, which was open March 4 - April 8, 2025.

Figure 6 shows that the Oregon practitioner respondents are similar to the national AAA survey, perceiving that driving while using a cell phone is dangerous. However, Oregon practitioners perceived the practice to be slightly less dangerous overall.

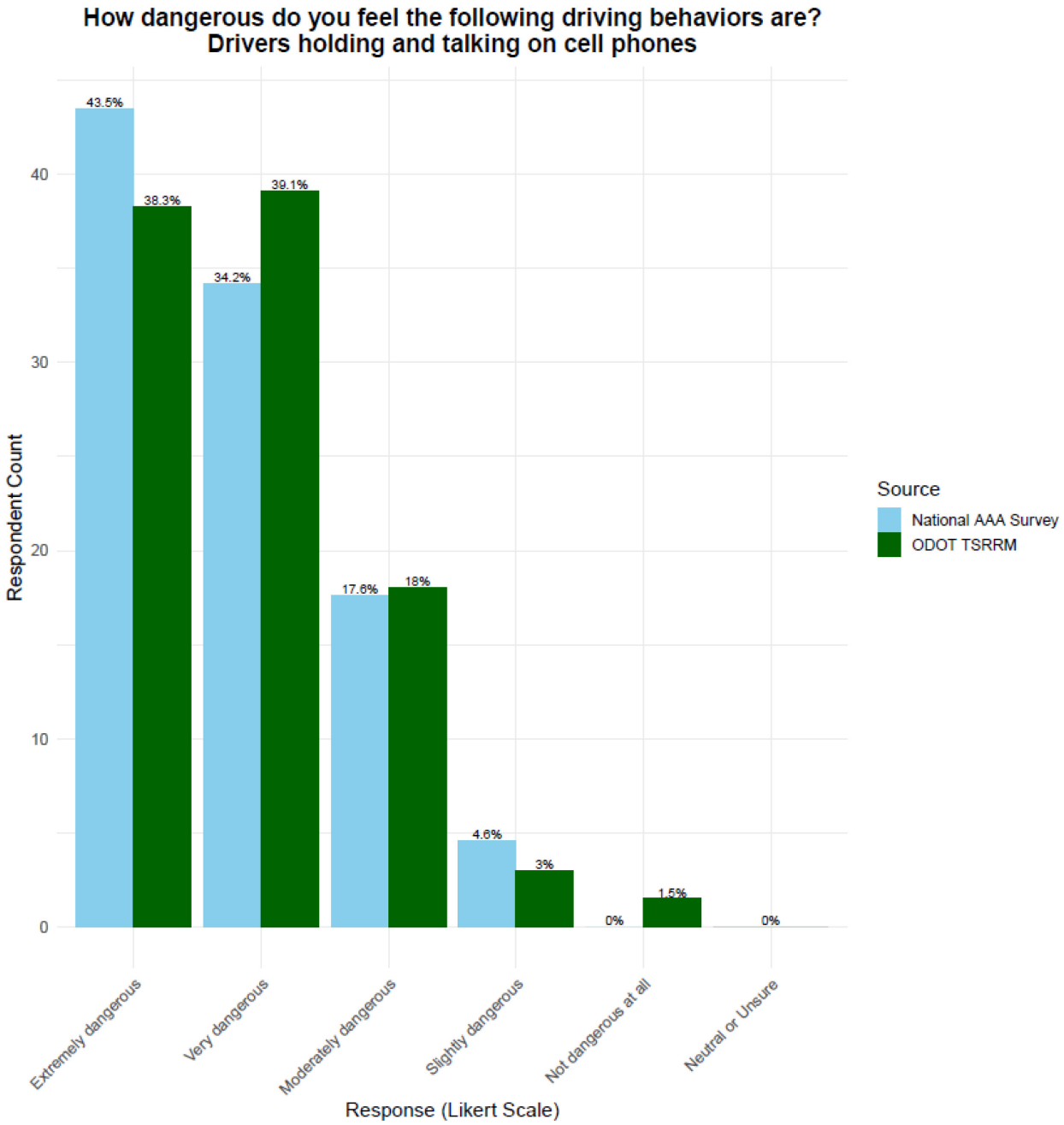

Figure 6. Survey responses on drivers holding and talking on cell phones

Nearly a third of responding Oregon traffic safety practitioners are not familiar with the Safe System approach to traffic safety, as shown in Figure 7.

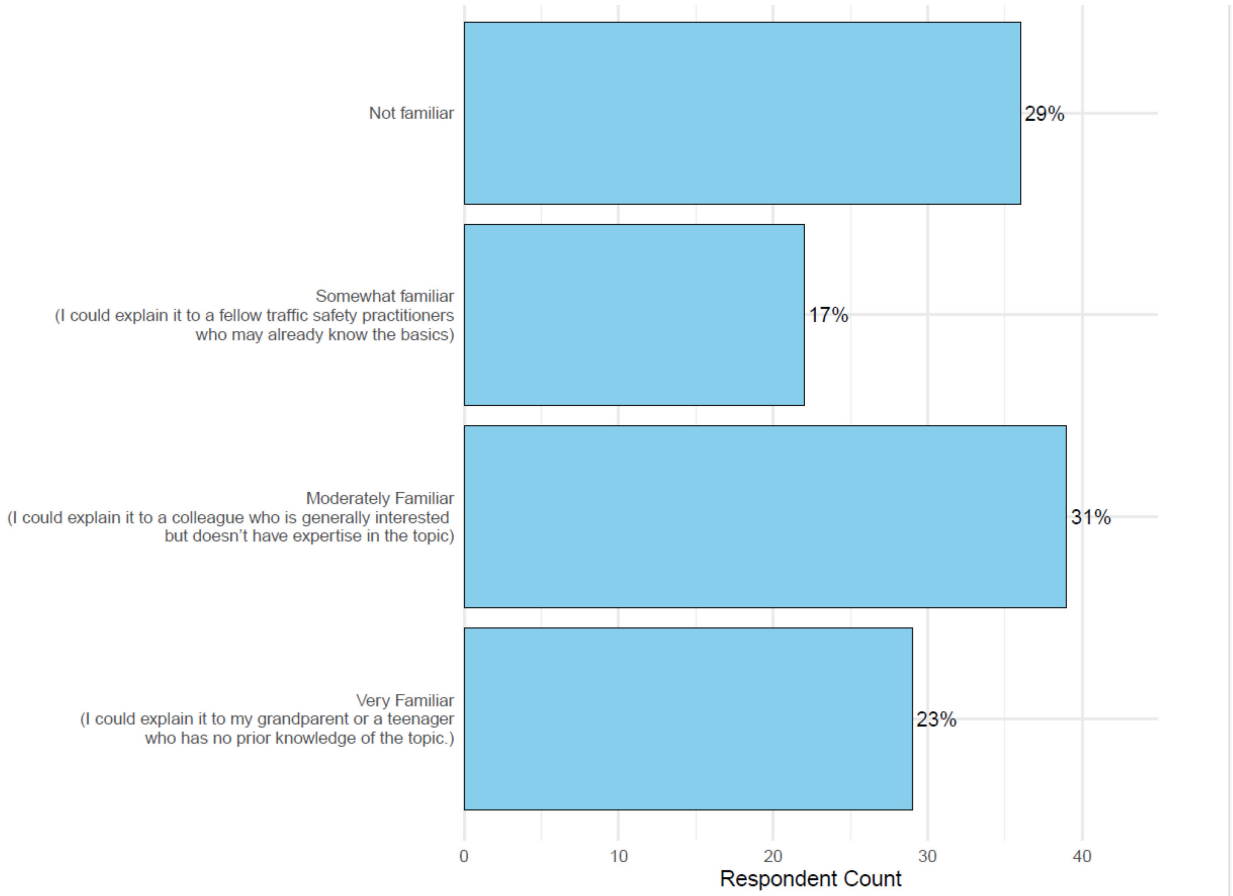

Figure 7. Responses to "How familiar are you with the Safe System Approach to traffic safety?"

Most contributed research ideas deal with road safety and design, also considering speeds and road user behavior, as shown in Figure 8.

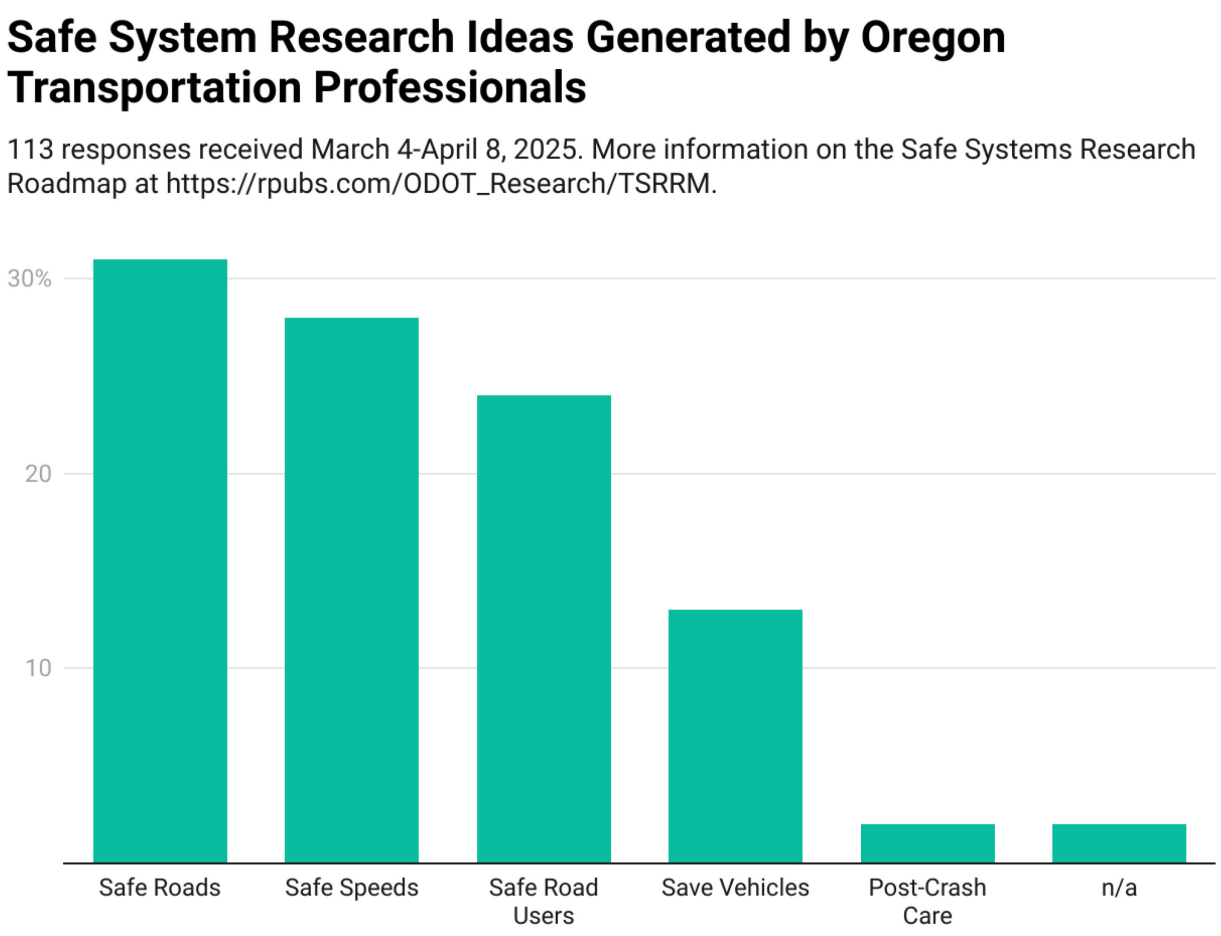

Figure 8. Safe System Research Ideas

Following are examples of one research topic submitted for each of the five Safe System elements:

- Safe Roads—*How do pilot traffic calming and other traffic improvement related pilot programs impact safety on roadways in the short and long term?*
- Safe Speeds—*How effective are lane reduction projects at slowing top-end speeding, speeding, and 50th percentile speeds?*
- Safe Road Users—*How many repeat reckless drivers are there in Oregon? What is their collective impact?*
- Safe Vehicles—*Taller front ends on newer vehicles are known to increase the severity of pedestrian crashes. What interventions can state and county transportation authorities introduce to address this growing issue?*

- Post-Crash Care—*How much does the quality and responsiveness of rural medicine affect health outcomes in our serious injury and fatal crashes*.

Traffic safety culture responses from Oregon practitioners are similar to a national survey by AAA[1], except Oregon practitioners expressed more caution on speeding and use of technology:

- Oregon practitioners were more likely to consider *driving 10 mph over the speed limit on a residential street* to be "extremely dangerous" (37%), compared with a national survey from AAA (28%).
- Fewer Oregon practitioners considered *drivers using technology that allows hands–free use of their phone (Bluetooth, CarPlay, Android Auto, etc.)* to be "not dangerous at all" (3%), compared with the national survey from AAA (15%).

3.2 FOCUS GROUPS

Researchers conducted three focus groups to maximize input from safety professionals from around the state, including one for law enforcement on June 3, 2025, ODOT Region 1 on July 10, and an online opportunity for rural areas and others on August 20.

3.2.1 Law Enforcement Focus Group

Law enforcement participants discussed 22 potential problem statements, that were not verified or cross-validated with statistics, but reflect the discussion from at least one participant. Generally, neither participants nor facilitators intervened or countered points, but rather listened and moved on to other topics.

In response to a prompt on how officers decide where to patrol, participants listed citizen complaints, spots identified by traffic teams, and high-crash areas. One officer responded, "I'm like a fisherman; if there's nothing in the hole, we just move to the next one."

The research team later analyzed and consolidated into eleven research questions, fitting into each Safe System topic area, shown in Table 1..

[1] AAA Foundation for Traffic Safety. (2024). *2023 Traffic Safety Culture Index*. AAA Foundation for Traffic Safety. https://aaafoundation.org/2023-traffic-safety-culture-index/

Table 2. Initial Research Questions from Law Enforcement Focus Group

Safer People
What programs are most effective at removing risky drivers from Oregon roadways?
Which enforcement strategies are most effective at reducing fatal crashes?
What role does social media play in influencing unsafe roadway behaviors?
What are the barriers to higher ignition-interlock device compliance?
Safer Vehicles
How are drivers that have been sanctioned working around the requirement for IIDs?
How are vehicle modifications (window tinting, lift kits, grill guards, etc.) implicated in crashes?
Safer Speeds
What are the most effective, equitable, and sustainable criteria for prioritizing speed enforcement missions across jurisdictions with variable staffing and community needs?
Safer Roads
How are the latest Vision Zero engineering treatments performing and have there been unintended consequences to safety and enforcement?
How do certain road design elements (e.g., medians, protected bike lanes) affect the ability of law enforcement to conduct traffic safety operations?
Post-Crash Care
What are the barriers to coordination between hospital staff and law enforcement regarding road user toxicology?
How does law enforcement and EMS response time impact the likelihood of secondary crashes?

3.2.2 ODOT Region 1 Focus Group

Region 1 focus group participants included more diverse professions, including a transportation planner, geospatial data specialist, two community development associates with an immigrant and refugee nonprofit, a Vision Zero Analyst, and a production plant safety specialist.

The focus group covered all the safe system elements with a fair amount of research problems statements derived. However, the safer vehicles element was less represented, as shown in the resulting research questions in Table 3.

Table 3. Initial Research Questions from Region 1 Focus Group

Safer People
What are the impacts of decreased enforcement levels on traffic violations and crash outcomes?
How do driver behaviors differ across race/ethnicity in yielding to pedestrians?
What is the efficacy of peer-led education models on youth micromobility behavior?
Do video games influence aggressive or distracted driving behaviors?
What is the role of vehicle theft in crash risk across different jurisdictions?
What proportion of crashes are not caused by egregious behaviors?
Does free parking on weekends impact DUI rates?
Safer Vehicles
Would smaller EMS vehicles improve acceptance of traffic calming by EMS drivers while maintaining EMS service levels?
At what frequency could increase of automatic emergency braking (AEB) with pedestrian detection in the vehicle fleet improve equity outcomes by race and other factors?
Safer Speeds
How do freeway interchanges in urban areas contribute to high crash rates, and are there geographic or demographic patterns?
Does shoulder width or road clearance zone design lead to more or fewer crashes?
What is the role of "daylighting" intersections in reducing pedestrian crashes?
How do street network connectivity affect EMS response time and safety outcomes?
Does a police department's 'safe pursuit policy' change crash risks?
Safer Roads
How does street network connectivity affect EMS response time and safety outcomes?
What is the extent and safety impact of traffic diversion strategies?
Does clear zone design guidance reflect current safety impacts of trees?
What is the role of land use in clear zones for trees?
How frequent do lane markings need to be re-marked before losing significant visibility in rain?
How can planners balance safety as a priority with economy and climate?
How do maintenance backlogs affect safety outcomes?
Post-Crash Care
How does the availability of blood in EMS vehicles reduce crash fatalities?
How effective are citizen first-aid trainings in improving crash survival outcomes?
How can linking health system data with crash data improve understanding of injury mechanisms?
How can we re-design for safety without impacting response times?

3.2.3 Online Focus Group

Participation online was the most numerous and diverse, yet the total output volume of the focus group was similar to in-person meetings. This suggests value in hosting both in-

person and online engagement, and that smaller groups may offer more in-depth discussion. Online participation supported easy screen sharing of visual materials, allowed some to 'meet' online for the first time (see Figure 9), and eliminated travel time and costs.

Figure 9. Online Focus Group Screenshot

The focus group covered all the safe system elements with a fair amount of research problems statements derived. However, the post-crash care element was less represented.

Table 4. Initial Research Questions from Online Focus Group

Safer People
How do clever billboards, feedback systems, or ongoing driver education influence driver behavior and compliance?
To what extent can public opinion shape acceptance of mobility trade-offs (e.g., road diets, left-turn restrictions) for safety improvements?
What lessons from the decline in serious bicycle crashes can be applied to pedestrian safety?
How valid are railroad companies' claims about pedestrian crossing risks, and how can safer designs or more frequent crossings improve safety at these locations?
How can crash data systems be enhanced to better capture the safety impacts on vulnerable populations, including low-income, non-English-speaking, and non-motorized road users?
Safer Vehicles
What is the crash risk differential between vehicles with and without modern crash-avoidance technologies, and how can policy address disparities in fleet modernization?
How does over-tinted glass affect crash risk, particularly during low-light conditions (dusk/dawn)?
Safer Speeds
How can rational, evidence-based methods be applied to set speed limits consistent with the Safe System Approach?
What role do speed feedback systems and public perception of speed limits play in compliance and crash reduction?
What are the safety impacts of changes in truck speed limits on all road users?
How do drivers interpret and respond to posted speed limits, and what messaging strategies can align public perception with statutory definitions?
Safer Roads
What is the safety impact of controlled intersection spacing on speeding and speeding-related crashes?
How do freeway-to-arterial transitions contribute to crashes, and what infrastructure changes can mitigate risk?
Which underused, low-cost roadway treatments could agencies deploy to reduce crashes, and what barriers exist to adoption?
How effective are different raised crosswalk designs (with/without aprons) in reducing speeds and crashes in conflict-prone areas such as ramps and arterials?
What standards are needed for crash attenuators to ensure consistent quality and effectiveness across installations?
How does a lack of streetlight replacement and other deferred maintenance impact roadway safety and agency liability?
Post-Crash Care
Do vehicles equipped with automatic calling systems improve emergency response times and survival outcomes?
Would health department epidemiologists provide complementary or improved traffic injury surveillance and analysis compared with an engineering approach?

What are the technical and institutional barriers to linking EMS, hospital, and crash data, and how can integrated systems improve safety research and policy?

3.2.4 Post-Focus Group Feedback

Researchers solicited feedback from participants on the draft research needs statements after the focus group, yielding insights to improve the concepts as they are developed further.

The Safer People category drew the most feedback, often reflecting complications of researching human behavior in socio-economic contexts, and challenges of phrasing effective research questions. On the topic of 'the impacts of decreased enforcement levels on traffic violations and crash outcomes,' a transportation planner suggested it was "important to understand what threshold decreases or increases in law enforcement are measured against. That is, is there an 'optimal' level of law enforcement, and how does that relate to traffic safety?... For example, looking at police budget per person[2], Massachusetts spends less per person than Oregon and has a lower traffic death rate[3], whereas Florida spends more per person and has a higher traffic death rate compared to Oregon." A safety data analyst noted that the question 'What proportion of crashes are not caused by egregious behaviors?' "assumes that many crashes happened just because someone was driving badly, when there were likely many causes at play. Similarly, the question 'Do video games influence aggressive, or distracted driving behaviors' insinuates that it's 'bad' to play video games and without context places blame on people who play them. I agree that addressing behavior like driving recklessly, speeding, red light running, etc. is crucial, but isolating the behavior of the individual from the physical/social environment does not seem useful or Safe Systems centered."

Safer Vehicles included several questions, and the safety data analyst suggested additional idea after feedback: "How have increasing large (ie SUV, small truck) vehicle sales in Oregon correlated with increasing deadly/life altering injuries for people walking and biking? Have they disproportionately affected people under age 17 walking and biking?" An ODOT active transportation liaison who could not attend in-person provided feedback that additional research was needed on the impact of increased vehicle size on "daylighting/sight lines for people walking around parked cars near crosswalks and intersections."

Safer Roads also involve challenges with understanding when design issues may or may not cause tradeoffs. For 'how can planners balance safety as a priority with economy and climate?', the planner suggested the "question could be reworded to be more neutral; it seems to assume inherent trade-offs. Are there? It could be that improving safety outcomes could enhance the economy and support climate mitigation and action."

[2] https://policescorecard.org/ma

[3] https://www.iihs.org/research-areas/fatality-statistics/detail/state-by-state

Additionally, the ODOT active transportation liaison mentioned challenges for visually impaired people navigating roadways, wanting "…to determine what tools can be implemented on projects which can allow people with visual impairments to safely navigate our system, [such as] 3D printed models of roundabouts, near-field communication to locate pedestrian activated signals, or improved, consistent signage that can be read by assistive AI tools."

Post-crash care also drew helpful comments. The planner suggested 'how can we re-design for safety without impacting response times?' drew interest "in case studies where adding in safe streets features improve emergency response times and access. For example, use of buffered bike lanes to bypass traffic, [and] would also be interested in understanding how transit mode share and transit priority treatments such as bus only lanes impact serious crash rates."

3.3 ONLINE WORKSHOP

Finally, researchers conducted an online workshop with nine key safety practitioners and researchers, including several from ODOT's Traffic Safety and Human Factors Expert Task Group, to identify current challenges and gaps in knowledge that could support transportation safety in Oregon and begin prioritizing research needs statements for potential funding.

Researchers presented summaries of themes in each Safe System topic, drawn from review of each of the previous suggestions. Safe People topics included effective enforcement strategies, safety outcomes of education investments, and human factors of multimodal transportation. Safe Vehicles addressed vehicle modifications and safety outcomes, enforcement of vehicle standards, and use of telematics to identify safety problems. Safe Speeds involved effective enforcement prioritization, interpretation and responses to posted speed limits, speeding behavior and road design. The theme of Safe Roads addressed life cycle costs of roadway safety features, non-motorized traffic monitoring for exposure comparison with motorized risk and reducing roadway departure crashes. Post-crash care involved coordination barriers between hospital staff and law enforcement, vehicle technologies and transportation design that reduces response time, effectiveness of post-crash care strategies. These themes may succinctly describe what participants considered the most important Safe Systems research topics for Oregon.

Researchers facilitated discussion about which of the research topics were the highest priority to improve safety in Oregon, and tabulated recommendations from participants for each research topic.

Results from the online workshop provide the primary mechanism to prioritize this Research Roadmap, by sorting research questions into those with two or more recommendations from workshop participants as "high-priority," those with one recommendation as "medium priority," and others participants suggested as "lower priority."

4.0 RESEARCH NEEDS MATRICES

Following are the five Safe Systems research needs matrices, with each row representing a tentative research question, as described as outcomes of this study. Priority indicates an assessment of perceived need, where “high” priority projects may be needed in 2026-2027, “medium” studies approximately 2028-2030, and lower priority after then. However, funding availability is unlikely to support completing all these research ideas, even if federal, state, local, and philanthropic resources were coordinated. Complexity may refer to either the overall cost or time needed to conduct the research, and is only intended as a rough indication of how much attention to resource availability is needed during development of the project. Collaborators include key groups at ODOT or others that could provide knowledge or funding to accomplish the work. These partners may include possible technical advisory committee members that could guide the study to successful completion and possible implementation.

Finally, and perhaps most importantly, these matrices are the product of the work and time available during this research roadmap study, and should neither be assumed to be comprehensive, or static. Needs and priorities can and should change based on an assessment of safety knowledge and resources available at the time.

Table 5. Safer People Research Needs Matrix

Priority	Tentative Research Question	Complexity	Collaborators
High	What programs are most effective at removing risky drivers from Oregon roadways?	Medium	DMV OSP DA offices
High	What are the impacts of enforcement levels on traffic violations and crash outcomes?	Medium	OSP OHA
Medium	How can crash data systems be enhanced to better capture the safety impacts on vulnerable populations, including low-income, non-English-speaking, and non-motorized road users?	Medium	ODOT Crash Analysis & Reporting Unit ODOT Office of Social Equity
Medium	How effective is traffic-law enforcement at reducing fatal and serious-injury crashes?	High	OSP
Medium	What is the "tipping point" for behavior change from safety projects and campaigns?	Medium	TSO
Lower	What proportion of crashes are not caused by driver behaviors, of those that can be separated from socio-environmental conditions?	Medium	ODOT Crash Analysis & Reporting Unit
Lower	How do clever billboards, feedback systems, or ongoing driver education influence driver behavior and compliance?	High	TSO
Lower	To what extent do messaging, community outreach, and public education measurably change driver behaviors?	Medium	TSO
Lower	How do gaps in mental-health treatment access affect risky driving (DUII, dual diagnosis, repeat offenses), and are high-risk drivers screened, referred, and seen in time?	High	OHA
Lower	Which education efforts (lane discipline, crosswalk laws) most improve driver compliance, and how does transit performance factor into safety?	High	TSO ODOT Public Transportation
Lower	How many repeat reckless drivers are there in Oregon, and what would automated speed limiters save in crashes, costs, and lives?	Medium	OSP TSO
Lower	Which strategies are most effective at reducing distracted driving, and which campaigns have demonstrated reductions?	Medium	TSO

Note: DMV=Oregon Department of Motor Vehicles, OSP=Oregon State Patrol, DA=district attorney, OHA=Oregon Health Authority, TSO=ODOT Traffic Safety Office

Table 6. Safer Vehicles Research Needs Matrix

Priority	Tentative Research Question	Complexity	Collaborators
High	What are the safety implications of e-bikes, e-scooters, and other micromobility in bike lanes, and what designs/enforcement improve outcomes?	Medium	ODOT Innovative Mobility
High	How prevalent are unsafe vehicles on Oregon roads, and which policies most effectively remove or remediate them?	Medium	DMV
High	What design, regulatory, consumer-information, and education actions would most reduce pedestrian harm from taller, higher-front-end vehicles?	High	TSO DMV
High	How have vehicle size/weight trends contributed to rising pedestrian deaths, and which design or regulatory changes would reduce harm?	High	TSO DMV
Medium	How are vehicle modifications (window tinting, lift kits, grill guards, etc.) implicated in crashes?	Medium	DMV
Medium	Could phones and vehicles be designed to detect driver use or impairment and automatically disable/limit functions to prevent crashes?	High	NHTSA
Medium	Do LED headlight color/brightness degrade oncoming drivers' visibility, and what mitigations are effective?	High	NHTSA
Lower	At what frequency could increase of automatic emergency braking (AEB) with pedestrian detection in the vehicle fleet improve equity outcomes by race and other factors?	Medium	ODOT Office of Social Equity
Lower	How does over-tinted glass affect crash risk, particularly during low-light conditions (dusk/dawn)?	Low	DMV TSO
Lower	Would higher registration/licensing fees or federal regulation for very large vehicles reduce risks to people walking and bicycling?	High	CCD
Lower	Would wider use of truck-mounted attenuators and better emergency communications reduce work-zone harms, and how do "road diets" affect driver frustration and safety?	Medium	CCD

Note: DMV=Oregon Department of Motor Vehicles, TSO=ODOT Traffic Safety Office, NHTSA=National Highway Traffic Safety Administration, CCD=ODOT Commerce & Compliance Division

Table 7. Safer Speeds Research Needs Matrix

Priority	Tentative Research Question	Complexity	Collaborators
High	What are the most effective, equitable, and sustainable criteria for prioritizing speed enforcement missions across jurisdictions with variable staffing and community needs?	High	OSP
High	What role do speed feedback systems and public perception of speed limits play in compliance and crash reduction?	Medium	DMV
High	Which measures most effectively reduce speeds and improve compliance in school zones?	Medium	TSO
High	Which low-cost pilot infrastructure projects most effectively reduce vehicle speeds, and which outreach/engagement techniques best influence road-user behavior?	Medium	TSO
Medium	Does shoulder width or road clearance zone design lead to more or fewer crashes?	Low	ODOT Crash Analysis & Reporting Unit
Lower	What are the safety impacts of changes in truck speed limits on all road users?	Medium	CCD
Lower	How do drivers interpret and respond to posted speed limits, and what messaging strategies can align public perception with statutory definitions?	Medium	TSO

Note: DMV=Oregon Department of Motor Vehicles, TSO=ODOT Traffic Safety Office, CCD=ODOT Commerce & Compliance Division

Table 8. Safer Roads Research Needs Matrix (continued next page)

Priority	Tentative Research Question	Complexity	Collaborators
High	How should SSA be operationalized within ODOT engineering standards and project delivery?	Medium	ODOT Roadway Engineering Section
High	What proactive intersection safety measures should be implemented before sites reach top-10% SPIS status?	High	ODOT Traffic Engineering Section
High	How do maintenance backlogs affect safety outcomes?	Medium	ODOT Maintenance and Operations Branch
Medium	How effective are different raised crosswalk designs (with/without aprons) in reducing speeds and crashes in conflict-prone areas such as ramps and arterials?	Medium	ODOT Traffic Engineering Section
Medium	How does a lack of streetlight replacement and other deferred maintenance impact roadway safety and agency liability?	Medium	ODOT Maintenance and Operations Branch
Medium	Is increased enforcement more cost-effective than infrastructure-only approaches, or what is the optimal mix?	High	TSO
Medium	How can ODOT most effectively help legislators understand how freeway projects may exacerbate safety, climate, and equity problems?	Low	ODOT Government Relations
Medium	Which striping/retroreflective treatments maintain visibility in heavy rain and darkness?	Low	ODOT Maintenance and Operations Branch
Lower	How are the latest Vision Zero engineering treatments performing and have there been unintended consequences to safety and enforcement?	Medium	ODOT Traffic Engineering Section OSP
Lower	Does clear zone design guidance reflect current safety impacts of trees?	Medium	ODOT Roadway Engineering Section
Lower	How do freeway-to-arterial transitions contribute to crashes, and what infrastructure changes can mitigate risk?	Low	ODOT Traffic Engineering Section
Lower	What are the full lifecycle safety, fiscal, environmental, and livability impacts of common	Medium	ODOT Traffic Engineering Section

Priority	Tentative Research Question	Complexity	Collaborators
	traffic-engineering measures such as wider lanes, breakaway poles, and wide shoulders?		
Lower	By how much—and for whom—do curb extensions, protected lanes, islands, and lane reductions reduce speeds and crashes?	Medium	ODOT Traffic Engineering Section
Lower	How can roadside-repair/maintenance work be designed to minimize crew risk amid rising volumes?	Medium	ODOT Maintenance and Operations Branch
Lower	What methods can fill the exposure-data gap for walking and biking so that non-motorized risk can be compared with motorized risk?	Medium	ODOT Pedestrian and Bicycle Program
Lower	How effective is automated speed enforcement across different speed zones?	Medium	DMV

Note: DMV=Oregon Department of Motor Vehicles, TSO=ODOT Traffic Safety Office, OSP=Oregon State Patrol

Table 9. Post-crash Care Research Needs Matrix

Priority	Tentative Research Question	Complexity	Collaborators
High	How can linking health system data with crash data improve understanding of injury mechanisms?	Medium	OHA
High	What are the technical and institutional barriers to linking EMS, hospital, and crash data, and how can integrated systems improve safety research and policy?	Medium	OHA
High	How does law enforcement and EMS response time impact the likelihood of secondary crashes?	High	OSP OHA
High	Which post-crash care strategies (EMS response, rural medicine capacity, equipment, training) most reduce fatal and serious-injury outcomes?	Medium	OHA
Lower	How effective are citizen first-aid trainings in improving crash survival outcomes?	Medium	OHA

Note: DMV=Oregon Department of Motor Vehicles, OSP=Oregon State Patrol, DA=district attorney, OHA=Oregon Health Authority, TSO=ODOT Traffic Safety Office

5.0 IMPLEMENTATION PLAYBOOK

A variety of strategies and funding approaches support accomplishing the most important research needs to improve safety in Oregon. These include tailoring and combining research questions from the matrices, seeking support from the ODOT Research program or federal sources, and standalone projects.

Each of these plays are fundamentally a human-driven process, involving critical thinking and collaboration about approaches that are needed beyond current practices to implement Safe Systems. Implementing Safe Systems research involves an understanding of current transportation safety culture (Otto et al., 2022), and change management. As the survey in this study showed, perceptions among transportation safety professionals in Oregon are relatively similar to the US population—in general, our professionals do not currently think differently about appropriate safety behaviors. As described in the NCHRP Guide to Applying the Safe System Approach to Transportation Planning, Design, and Operations (LaJeunesse et al., 2025), change management for safety involves (1), communicating the need and urgency for change, (2) leaders to invite organization members to commit to accomplishing a desired safer state, (3) leaders need to provide the focus and resources to implement the needed changes, and (4) to manage space for the organization staff to continually communicate, improve quality safety tools, and manage task completion over time.

5.1 MIX-AND-MATCH

This study's matrices of research questions reflect the input from a variety of Oregon safety professionals in 2025, but they should be tailored to individual needs at the time. Additionally, a combination of the research questions may be needed, and indeed mixing research methods may provide a more comprehensive and accurate understanding of issues (Creamer, 2018; Evenson et al., 2023). Quantitative correlations and related methods can relate phenomena like traffic safety probabilistically, but they often fail to determine whether one factor causes an outcome, or how to solve the problem.

Combining more than one research method on a topic may be more likely to lead to a comprehensive understanding of the issues and causes in the real world. Mixed methods often refer to quantitative and qualitative approaches, which can then describe not only 'how much' of a problem, but also clarify 'how' and 'why' questions, including complicated safety solutions from the people who have enacted them in different contexts. Essentially, mixing research approaches can expand from data and information about a traffic safety issue to intelligence and even wisdom to address our most challenging problems.

In practice, this could mean reviewing statewide crash data to develop a concept for why a crash type is a continual problem, and then interviewing experts on that topic with

examples of that data to gain a more comprehensive knowledge about why that issue is difficult to solve. Combining questions may also be appropriate in some instances. Considering a Safe Roads topic with a Post-crash Care question, in order to relate roadway conditions with the speed and resources of emergency services, may help deal with problems that stem from combinations of environmental and program service factors.

Machine learning (ML) and artificial intelligence (AI) approaches provide a new frontier for mixing research methods, such as combining the exploratory insights of AI with traditional quantitative methods or qualitative evaluation of results from a range of experts, for instance. Following a contention "that many social science research problems are too 'wicked' to be suitably studied using conventional statistical and regression-based methods of data analysis," a combination of spatial analysis and AI on traffic safety showed more comprehensive understanding and prioritization of solutions consistent with existing theories of traffic safety (Effati et al., 2015). Combining research questions and different types of data and methods may be more effective at solving complex safety problems, but may also require additional time and resources.

5.2 STATE PLANNING AND RESEARCH

Oregon DOT's Research Unit facilitates studies through a combination of federal state planning and research (SPR) funding with a required state match, and can provide nimble resources through 'Quick Hit' projects. These opportunities constitute a 'go-to' set of internal resources for ODOT and our transportation partners in Oregon.

SPR funding is allocated to transportation problem statements on an annual basis, and is the primary source of support for transportation research tailored to Oregon's needs. Generally, this process involves generation of brief problem statements, often by ODOT staff or university researchers familiar with ODOT needs. Next, an Expert Task Group composed of ODOT professionals and university researchers evaluates the potential need and feasibility of the problem, called 'Stage 1' problem statements. The top Stage 1 statements are further developed into a more refined 'Stage 2' statement that is reviewed by the ODOT Research Advisory Committee (RAC) for funding. Most of these projects involve principal investigators from universities and take 1-2 years from beginning to publication. More information about the project life cycle and the 8-step process for SPR projects is available from the ODOT Research page.[4]

Quick Hit projects take a smaller time and budget and are usually performed by ODOT staff researchers in partnership with an internal client. Funding can come from SPR, another ODOT expense account, or a combination. Usually taking from a few months to a year, these types of projects answer a sufficiently narrow research question that can quickly support an individual change to an ODOT process or manual, and can typically be quickly

[4] https://www.oregon.gov/odot/programs/pages/research.aspx

implemented. Quick Hits can also take the form of a white paper that informs a planning process or policy issue.

ODOT's planning functions in aligning policy directions with statewide needs have a major impact in safety outcomes. Creating a stronger link between ODOT's planning and research programs could support maximizing safety effectiveness. Agency leaders can explore approaches to leverage research to support planning outcomes with short and long-term improvements in safety, while planning functions can inform research needs on an ongoing basis to produce studies and guides that improve planning processes. FHWA policy on using planning and research funds is to support the "maximum possible flexibility…to meet highway and local public transportation planning and RD&T needs at the national, State, and local levels…" subject to the other requirements of 23 CFR Part 420 Subpart A (USDOT, 2026).

5.3 TRANSPORTATION RESEARCH BOARD AND FEDERAL SUPPORT

Problems that many states share are likely best addressed through federal sources or one of the programs of the Transportation Research Board (TRB). National Cooperative Highway Research Program (NCHRP) projects are developed through TRB committees, and include full research projects that often take two years or more to complete, or Synthesis projects that "reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals."[5] Synthesis projects are more than literature reviews, often including original qualitative research methods like interviews with expert practitioners or analysis of documents and transportation processes.

The USDOT Office of the Assistant Secretary for Research and Technology (OST-R) coordinates a wide range of other federal research funding, including university transportation centers (UTCs). At this writing, both Oregon State University and Portland State University are part of regional and Tier 1 UTCs that perform research on transportation safety and other topics. Research support from TRB and federal sources can be widely impactful, but may not be tailored or responsive as ODOT Research or impromptu approaches.

5.4 AD-HOC AND CONSULTING RESEARCH

ODOT programs and local agencies sometimes need studies of limited scope to address specific needs, that might require external expertise from university researchers, consulting businesses, or independent scholars. Sponsoring groups may have independent funding available for project-based needs, or a larger project may support a specific study.

[5] https://www.trb.org/SynthesisPrograms/SynthesesNCHRP.aspx

In some cases, a transportation unit may need a quick deliverable that serves a single project and does not support other agencies or wider public needs. These may fit a single consulting contract well.

However, ODOT Research staff may be requested to coordinate the work if it could serve others. Advantages of coordinating safety research through ODOT Research include:

1. Review and evaluation of interim deliverables, serving as an internal peer-review to support validity and reliability of the study;

2. Accessibility formatting of the study to conform to Section 508 compliance meeting Americans with Disabilities Act (ADA) requirements for studies with federal support;

3. Publication and entry the federal repository ROSA-P, which is indexed in research databases like Google Scholar, making the work permanently available and supporting building new knowledge, rather than wasting resources re-answering the same research question; and

4. Implementation is a priority of the ODOT Research unit, with an Implementation Memo completed towards the end of each study, and follow-up discussions about meeting implementation needs with staff support, additional implementation funding, or both.

5.5 ONGOING ENGAGEMENT AND LEARNING LOOPS

The focus groups conducted for this study provide a valuable point-in-time opportunity, but a more continuous approach could increase the frequency of learning between practitioners and researchers. To inform research based on practice, recurring listening sessions or structured feedback loops could pair current or emerging data analysis (such as preliminary crash data) could help identify evolving issues and keep the research agenda responsive over time. To inform practitioners, researchers could provide periodic syntheses or disseminating emerging safety research, which is often overwhelming and not always accessible. There may also be opportunities to more formally connect research insights with existing or future committee structures. Integrating a stronger research lens into safety or design-focused committees, or establishing additional overarching safety committees) could help ensure that evolving evidence and questions are reflected in policy, guidance, and practice.

Contact ODOT Research at odotnewresearch@odot.oregon.gov with questions about the Traffic Safety Research Roadmap or other needs.

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APPENDIX A

Safe Systems Transportation Research Needs Survey

This 11-question survey of practitioners helps us understand partner needs for research around the safe systems approach. Responses are anonymous, unless you choose to provide contact information on the survey. This survey will close April 8, 2025 at 11:45 pm.
If you have questions or concerns, you may contact the ODOT research team at:
Greg Griffin, Ph.D.: greg.GRIFFIN@odot.oregon.gov, Josh Roll: josh.f.ROLL@odot.oregon.gov

When you submit this form, it will not automatically collect your details like name and email address unless you provide it yourself.

Safe System Research

1. **How effective** is each Safe System Approach (SSA) element is in reducing fatal and serious injuries in your community?

	Not Effective at All	Slightly Effective	Neutral or Unsure	Very Effective	Extremely Effective
Safe Road Users How Effective are current efforts in promoting responsible road user behavior (e.g., speed compliance, seat belt use, safe pedestrian and cyclist behavior) in preventing fatal and serious injuries?	○	○	○	○	○
Safe Vehicles How effective are existing vehicle safety technologies and policies (e.g., crash avoidance systems, federal vehicle design standards) in in preventing fatal and serious injuries?	○	○	○	○	○
Safe Speeds How effective are speed management strategies (e.g., speed limits, automated enforcement, traffic calming measures) in preventing fatal and serious injuries?	○	○	○	○	○
Safe Roads How effective are the design and engineering of roads and intersections (e.g., protected bike lanes, road diets, pedestrian crossings, roundabouts) in preventing fatal and serious injuries?	○	○	○	○	○
Post-Crash Care How effective is your community's emergency response and trauma care system in reducing fatal and serious injuries following a crash?	○	○	○	○	○

2. **How important is new research** in each Safe System Approach (SSA) element for reducing fatal and serious injuries in your community? Please move each option up or down to place your first choice on top, second choice below, and so on.

Safe Road Users How effective are current efforts in promoting responsible road user behavior (e.g., speed compliance, seat belt use, safe pedestrian and cyclist behavior) in preventing fatal and serious injuries?

Safe Vehicles How effective are existing vehicle safety technologies and policies (e.g., crash avoidance systems, federal vehicle design standards) in in preventing fatal and serious injuries?

Safe Speeds How effective are speed management strategies (e.g., speed limits, automated enforcement, traffic calming measures) in preventing fatal and serious injuries?

Safe Roads How effective are the design and engineering of roads and intersections (e.g., protected bike lanes, road diets, pedestrian crossings, roundabouts) in in preventing fatal and serious injuries?

Post-Crash Care How effective is your community's emergency response and trauma care system in preventing fatal and serious injuries following a crash?

3. Each year Oregon DOT funds research aimed at tackling unanswered questions related to traffic safety. Recent topics the ODOT Research Unit addressed are: *'Safety Implications of Speed Variation in Work Zones'* and *'Safety Impacts of Mixing Zones and Bike Boxes on Bicycle Safety'*.

Thinking about the work you do: **What is a problem or research question** related to traffic safety that you want us to know about? Consider how your questions fits in to one of the Safe System Approach elements (Safe Roads, Safe Road Users, Safe Speeds, Post-Crash, or Safe Vehicles).

Enter your answer

4. The Oregon DOT Research Unit is interested in learning more about your research priorities and want to convene focus groups to better understand your research needs. Would you attend a focus group if:

- ◯ A virtual/online focus group was convened
- ◯ An in-person focus group was convened at the Oregon Department of Transportation Regional office nearest you
- ◯ I would not be interested in attending a focus group.

Next

Microsoft 365

APPENDIX B

Focus Group Invitation

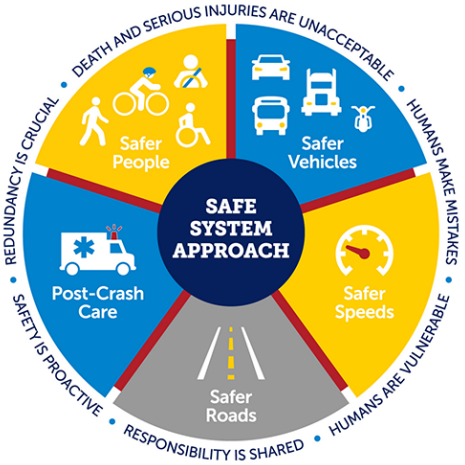
ODOT Traffic Safety Research Roadmap

Focus Group Details

- **Date:** June 10th, 2025
- **Time:** 1:30 to 3:00 pm
- **Location:** Metro Regional Center room 228 (600 NE Grand Avenue, Portland, OR)

Facilitators:

- Greg Griffin, greg.griffin@odot.oregon.gov
- Josh Roll, josh.f.roll@odot.oregon.gov



About the Research Roadmap

The **ODOT Traffic Safety Research Roadmap** is a statewide initiative to build a coordinated, data-driven, and practitioner-informed research agenda for traffic safety in Oregon. The goal is to identify and prioritize research ideas that support the Safe System Approach and help move Oregon toward zero fatalities and serious injuries on our roadways. More information can be found on the web site below:

https://rpubs.com/ODOT_Research/TSRRM

Developing Research Ideas for Future Research – What's your Question?

What we want from participation in our focus group are research problem statements that we can develop into a research project that would produce findings to help guide traffic safety interventions. You can help us with this because you are on the front lines of traffic safety and thinking about these issues every day. A strong traffic safety research problem statement defines a key issue or knowledge gap, highlights its relevance, and leaves room to explore different approaches—including evaluating a proposed intervention—without assuming its effectiveness. Some examples of ODOT problem statements that were developed into fully funded research projects are below:

- *What is the relationship between levels of law enforcement presence and vehicle speeds on Oregon roadways, and can an optimal level of enforcement be identified to improve safety and better allocate limited enforcement resources?* SPR 304-161 Report (2003)

- *What traffic flow characteristics—such as speed, volume, and occupancy—measured upstream and downstream of crash sites are most strongly associated with increased crash risk on Oregon highways, and how can real-time traffic data be used to better predict and prevent crash occurrences?* – SPR 793 Report (2018)
- *What is the relationship between the lateral offset of crosswalks at intersections and pedestrian safety, considering how curb ramp placement may affect driver and pedestrian behavior?* - SPR 840 Report (2023)

🗺 Why Your Voice Matters

As a front-line traffic safety practitioner, your insights and experiences are vital. This focus group is your opportunity to:

- Share real-world challenges and emerging concerns
- Discuss what's working and what's missing
- Help guide ODOT's research priorities for the next five years

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💬 Key Focus Group Topics

1. What traffic safety challenges are most urgent in your role or community?
2. Where do you see gaps in research, evidence or guidance?
3. What kinds of research would help improve your ability to save lives?
4. How do the elements of the Safe System Approach show up in your daily work?
5. What cross-sector partnerships are needed to address these challenges?

⚖ Oregon Department of Transportation Research Service Unit

The ODOT Research Service Unit coordinates and conducts research related to all domains of transportation including geotechnical, pavements, bridges, sustainability, commerce, and of course traffic safety. We work with researchers at universities around the state and the country to conduct high quality research that informs state of the art practices at ODOT and our partner agencies.

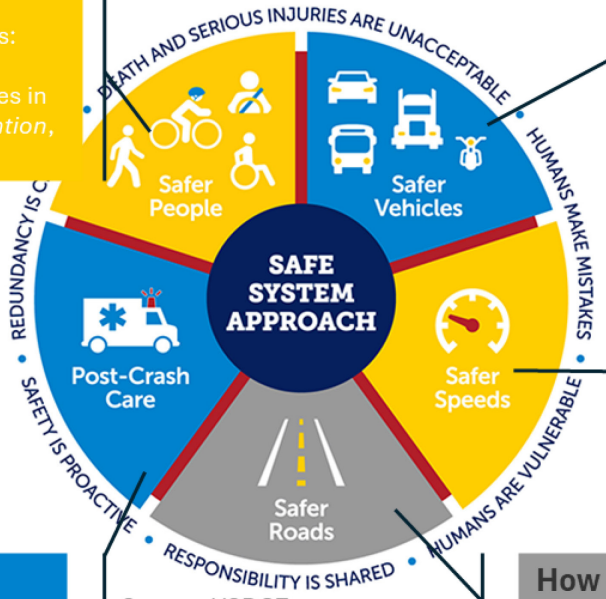
Thank you for contributing your expertise to help shape a safer transportation future for Oregon!

What are research questions about Safe Systems?

The ODOT Traffic Safety Research Roadmap is a statewide initiative to build a coordinated, data-driven, and practitioner-informed research agenda for traffic safety in Oregon. Learn more at https://rpubs.com/ODOT_Research/TSRRM.

How did legalizing recreational cannabis in Washington impact collisions?

Voy, A. (2023). Collisions and cannabis: Measuring the effect of recreational marijuana legalization on traffic crashes in Washington State. *Traffic Injury Prevention*, *24*(7), 527–535.



Source: USDOT https://www.transportation.gov/safe-system-approach

How do vehicle front-end profiles impact pedestrian fatality risk?

Hu, W., Monfort, S. S., & Cicchino, J. B. (2024). The association between passenger-vehicle front-end profiles and pedestrian injury severity in motor vehicle crashes. *Journal of Safety Research*, 90, 115–127.

What is the relationship between posted speed limits and injury risk based on maximum change in vehicle velocity during a crash?

Dean, et al. (2025). A Safe System Approach to Setting Speed Limits Through the Development of Injury Modification Factors. *Transportation Research Record.*

What factors impact police response time to crashes?

Liu, C. (2022). Exploration of the police response time to motor-vehicle crashes in Pennsylvania, USA. *Journal of Safety Research*, 80, 243–253.

How does road design impact drivers' preferred speed, safe speed and actual driving speed on urban roads?

van Eggermond, et al.. (2025). Quantifying the effect of road design on urban road driving speed. *Transportation Research Part F: Traffic Psychology and Behaviour*, 112, 148–169.

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Oregon Department of Transportation

Focus Group Plan

Introductions – 10 minutes – Josh

a. ODOT
    i. ODOT Research program overview
b. Participants

Motivation for Focus Group – 5 minutes - Josh

c. Rise in traffic injury
d. Need for better connection of research and practice
e. Need LE help informing ODOT research
f. Build some partnerships with interested LE

1. **Start off Questions**

- Has anyone ever been involved in research or evaluation of a LE program or in research more generally?
- What traffic safety challenges are most urgent in your role or community and what kinds of research would be helpful to you for targeting interventions?
- How do the elements of the Safe System Approach show up in your daily work?

2. **Specific topics to ask about**
    a. Interface with EMS
        i. Research has documented the discordance between medical professionals and how common is it to base injury severity on medical reports or diagnoses?
    b. Evaluation
        i. How do you develop and evaluate your patrol strategy? Any differences for how/when you deploy high visibility missions?

3. **Safe Road Users**

- What risky driving behaviors are you seeing more often in your area, and what do you think is driving those trends?
- Are there behaviors (e.g., impaired driving, distracted driving) that feel especially difficult to enforce or mitigate right now?

4. **Safe Speeds**

- In your experience, where and when is speeding most dangerous? How effective are current enforcement strategies in managing speed?
- Do posted speed limits generally align with the conditions you observe on the ground?

5. **Safe Roads**

- Are there road designs or infrastructure features that make your job harder or seem to encourage unsafe behavior?

- Have you seen any low-cost road design changes (e.g., signage, narrowing, speed humps) that have made a noticeable difference in driver behavior?

6. **Post-Crash Care**

- Do you have the guidance you need for responding to crash participants following an incident?
- What have you noticed about response times or coordination after crashes, especially in rural or high-risk areas?
- Are there challenges in communicating crash details to EMS or trauma care providers that research could help address?
- For Portland area did the 911 system changes impact your ability to do your jobs?

7. **Safe Vehicles**

- Are there specific vehicle types (e.g., lifted trucks, electric scooters, delivery vans) that you think pose increased safety risks?
- Would more research into vehicle modifications and their crash impacts help inform enforcement or policy?
- How do tinted windows impact traffic safety

8. **Data and Evidence Use**

- What crash or citation data do you collect that you wish were being used more to inform decision-making?
- What data elements on the crash report do you find the hardest to fill. Do any of the pieces on information seem pointless to collect.
- Is there any information you'd want to have access to when evaluating high-crash areas or repeat offenders?

9. **Community Engagement**

- How could traffic enforcement be more transparent or aligned with community safety goals?

  What would help law enforcement better communicate the "why" behind enforcement priorities to the public?

10. **Enforcement Gaps**

- Where do you see the biggest gaps between laws on the books and what is actually enforceable?
- Are there types of violations or behaviors where a research-backed solution would make enforcement more consistent or fair?

11. **Technology in Enforcement**

- What technologies (e.g., automated enforcement, ALPRs, body cams) are helping or hindering your traffic safety efforts?

- Are there technology-related issues where research could help improve outcomes or guide implementation?

12. Cross-Sector Collaboration

- Are there examples of successful partnerships or joint initiatives you've been part of—or wish existed?
- What cross-sector partnerships are needed to address existing challenges?

13. Wrap up

- What are the challenges to doing more evaluation of traffic safety interventions?
- What are the challenges to doing more research of traffic safety interventions?