# TRANSPORTATION COMMITTEE 7/10/24
LIST OF BOARD PACKET DOCUMENTS

1. Agenda for July 10, 2024, and Plan of Action.
2. Draft Minutes of May 7, 2024.
3. Report - Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0.
4. Infographic - U.S. Federal Highway Administration Safety Proven Countermeasures / Roundabouts.
5. Report- City and County of Honolulu, Oahu Vision Zero Action Plan, Public Draft, June 2024.
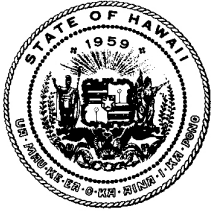
DISABILITY AND COMMUNICATION ACCESS BOARD

1010 Richards Street, Room 118 • Honolulu, Hawaii 96813
Ph. (808) 586-8121 (V) • TTY (808) 586-8162 • Fax (808) 586-8129

NOTICE OF MEETING

Disability and Communication Access Board

Standing Committee on Transportation Meeting

July 10, 2024
10:00 a.m.

AGENDA

The Disability and Communication Access Board will be meeting remotely using interactive conference technology. The public is welcome to participate as follows.

Public In-Person Meeting Location

Kamamalu Building
1010 Richards Street, Room 118
Honolulu, Hawaii 96813

Participate Virtually via Zoom

Click on the link below or copy and paste it into your browser window:
https://us02web.zoom.us/j/81946791326?pwd=2rAHK7kCC9jTaggqsNi58SpiaI1rzH.1
and enter Meeting ID: 819 4679 1326; Passcode: 123

To join by phone

Dial 1 669 900 6833 and enter Meeting ID: 819 4679 1326, Passcode: 123

Public Testimony

Oral testimony - Testimony or comments presented by members of the public during Committee meetings shall be limited to three minutes per agenda item. In compliance with the Americans with Disabilities Act, a reasonable amount of additional time shall be afforded to persons with a communication disability to present testimony or comments, if needed. Any person who needs additional time to present testimony or comments is encouraged to contact the DCAB office in advance of the meeting. This rule shall be placed at the beginning of all Committee meeting agendas. Members of the public may present comment or testimony during Committee meetings on each agenda item. Public comment or testimony, if any, shall be presented on each agenda item before the Committee deliberates on the item. After all public comment or testimony is presented, the Committee shall deliberate on the agenda item without further comment or testimony from the public unless further public comment or testimony is requested by the Committee.

Written Testimony - To ensure the public as well as its Committee members are able to review testimony prior to the meeting, written testimony should be submitted 48 hours prior

to the scheduled meeting date and time. Any written testimony submitted after such time will be distributed to the members and the public at the meeting.
Written testimony may be submitted by one the methods listed below:

- By email to: dcab@doh.hawaii.gov

- By U.S. Postal Mail:
Kirby Shaw, Disability and Communication Access Board, 1010 Richards Street, Room 118, Honolulu, HI 96813

- By facsimile to: (808) 586-8129

AGENDA

I. Call to Order
Review Remote Meeting Procedures
- This meeting is being recorded.
- A quorum of Committee members is required to be visible on screen.
- Raise hand to speak unless called upon.
- Identify yourself before speaking.

II. Roll Call/Introductions

III. Written Public Testimonies Submitted - Review

IV. Approval of Meeting Minutes of May 7, 2024

V. Old Business

A. Review of Fiscal Year 2023-2024 Plan of Action and Proposed 2024-2025 Plan of Action (see attachment).

B. Standing Agenda Items

1. Public Transit and Paratransit
   a. City and County of Honolulu's low income rate for paratransit.
   b. City and County of Honolulu's Taxi Voucher Program.
   c. Concern from Honolulu Fire Department – Wheelchair users dropped curbside calling 911 for assistance to get to door.
2. Streets and Highways
   a. Autonomous (Driverless) vehicles / Ensuring American leadership in Automated Vehicle Technologies: Automated Vehicles 4.0
   b. U.S. Federal Highway Administration Safety Countermeasures / Roundabouts
3. Pedestrian Mobility and Built Environment
   a. Vision Zero Draft Plan
4. Air Transportation/Airports
   a. Universal Access in Aviation Biennial Conference – Sept. 24-26, 2024, Seattle Washington.
   b. Daniel K Inouye International Airport New Electric Miki Shuttle (update on PIG timeline only)
5. Water Transportation and Harbors

6. Update from Standing Committee on Parking
    a. Meeting with enforcement agencies / Volunteer Special Enforcement Officer (VSEO) programs. KITV-4 VSEO Segment (2017)

VI.   Open Forum: Public comment on issues not on the agenda for consideration on a future Committee agenda.

VII.   Next Meeting

IX.   Adjournment

If you need an auxiliary aid/service or other accommodation due to a disability, contact Cindy Omura at (808) 586-8121 or dcab@doh.hawaii.gov as soon as possible. Requests made as early as possible have a greater likelihood of being fulfilled.

Upon request, this notice is available in alternate/accessible formats.

The agenda and meeting materials for this meeting are available for inspection at the DCAB office located at 1010 Richards Street, Room 118, Honolulu, Hawaii 96813 and on the DCAB website at: https://health.hawaii.gov/dcab/dcab-agendas-and-minutes/.

7.   Transportation and Travel

Transportation and Travel includes all means of public and private transit both intrastate and interstate. Persons with disabilities must have equal access to transportation services to secure and maintain employment, utilize community resources, and participate in social and recreational activities.

The goals and objectives in the area of **Transportation and Travel** are:

7.1   When provided, public and private ground transportation systems in all counties will be fully accessible, as provided by law.

        Objectives:

        7.1.1   Provide technical assistance to public and private transportation providers on the requirements for accessible vehicles and transportation services under Titles II and III of the Americans with Disabilities Act, to include but not be limited to the fixed-route bus, paratransit, shuttle, taxi services, and ride hailing services. (**Priority 2**)

        Attended five meetings of the City and County of Honolulu's Rate Commission and one meeting of the City and County of Honolulu's Committee on Accessible Transportation.

        FY 2025 recommendation: No change.

        7.1.2   Provide technical assistance to the City and County of Honolulu and the Honolulu Authority for Rapid Transportation to ensure the train cars and services adequately serve persons with disabilities. The Section 103-50, Hawaii Revised Statutes review process already covers the facility, but not the actual transit vehicles. (**Priority 3**)

        FY 2025 recommendation: No change.

        7.1.3   Monitor and provide testimony in accordance with the Disability and Communication Access Board guiding principles on public transit fixed-route bus and paratransit service on proposed federal, State, and county legislation and regulations relating to transportation services, including public transit, paratransit, and alternate transportation modes that impact people with disabilities, including fare and fare categories for paratransit service and for fixed route service. (**Priority 1**)

        Standing Committee on Transportation drafted amendments to the Guiding Principles on Public Transit Fixed Route Bus and Paratransit Service.

        FY 2025 recommendation: No change.

        7.1.4   Monitor private transportation network companies and encourage them to utilize accessible vehicles as part of their fleet. (**Priority 2**)

      7.1.5   Advocate for additional seating and transit safety measures for persons with disabilities beyond the minimum requirements of the Americans with Disabilities Act. (**Priority 3**)

         FY 2025 recommendation: No change.

7.2   Travel to, from and within the State of Hawaii for travelers with disabilities shall comply with the provisions of the Air Carrier Access Act and the Americans with Disabilities Act.

    Objectives:

      7.2.1   Provide technical assistance to the Department of Transportation Airports Division and other agencies working at the airport to increase accessibility for all air carrier passengers with disabilities to ensure compliance with the Air Carrier Access Act and the Americans with Disabilities Act, while advocating they exceed minimum standards when possible. (**Priority 2**)

         FY 2025 recommendation: No change.

      7.2.2   Update the "Hawaii Traveler Tips" annually, post on the Disability and Communication Access Board website, and encourage links to the site from other travel or visitor websites. (**Priority 3**)

         Updated the Traveler Tips for each county.

         FY 2025 recommendation: No change.

      7.2.3   Monitor and provide comments, as appropriate, to the proposed federal changes in the Air Carrier Access Act. (**Priority 3**)

         Provided written testimony to the Department of Justice on their proposed rule titled "Ensuring Safe Accommodations for Air Travelers With Disabilities Using Wheelchairs."

         FY 2025 recommendation: No change.

      7.2.4   Provide testimony in support of the State authorizing the creation of an Airport Authority, with the goal of it being more responsive to the public and able to implement changes at State airports in a timely manner. (**Priority 3**)

7.3   Pedestrian safety efforts shall adequately consider the needs of people with disabilities.

    Objectives:

      7.3.1   Monitor and provide comment on proposed federal, State, and county legislation and regulations relating to pedestrian safety. (**Priority 2**)

         Standing Committee on Transportation drafted amendments to the Guiding Principles on the Mobility and Safety of Pedestrians with Disabilities.

7.3.2   Participate in public education efforts and committees in accordance with the Disability and Communication Access Board's guiding principles on pedestrian safety for persons with disabilities. (**Priority 2**)

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Ph. (808) 586-8121 (V) • Fax (808) 586-8129 • (808) 586-8162 TTY

DRAFT MINUTES
Standing Committee on Transportation Meeting

Location: Virtual via Zoom and 1010 Richards Street, Room 118
Date: May 7, 2024
Time: 10:00 a.m.

PRESENT: Violet Horvath, Chairperson; Gerald Ohta, Teri Spinola-Campbell, Charlotte Townsend, Board Members; Elizabeth Pearson, Bryan Mick, Sue Radcliffe, Staff

GUESTS: Donald Sakamoto, Gita Nofieka Dwijayati

I. Chairperson Violet Horvath called the meeting to order at 10:14 a.m.

II. Committee members, staff, and guests introduced themselves.

III. Chairperson Violet Horvath reported no written public testimony was submitted.

IV. Chairperson Violet Horvath stated the minutes needed to be amended under guests as Ricky's last name is spelled "Hyunh." The Committee approved the March 19, 2024, meeting minutes as amended (M/S/P Townsend/Spinola-Campbell).

V. <u>Unfinished Business</u>

A. <u>Review of DCAB Guiding Principles on Public Transit Fixed Route Bus Service and Paratransit Services and DCAB Guiding Principles on the Mobility and Safety of Pedestrians with Disabilities and proposed amendments</u>

The Committee had adopted revised language at its last meeting. Before presentation to the full Board, staff realized the word advocate would be better placed in the mission statement and not in certain individual principles. That kept the document consistent.

B. <u>Review of DCAB Guiding Principles on Public Transit Fixed Route Bus Service and Paratransit Services and DCAB Guiding Principles on the Mobility and Safety of Pedestrians with Disabilities and proposed amendments</u>

Committee member Teri Spinola-Campbell commented that she had brought up the principle regarding the removal of accessible features such as a curb cut in the Standing Committee on Facility Access meeting. She suggested DCAB provide the counties with guidance on how to effectively communicate

to people with communication related disabilities when changes to infrastructure are made.

Bryan Mick mentioned that the City and County of Honolulu always refers to a study which indicated mid-block marked crosswalks were more dangerous than unmarked ones, as the unmarked ones induce pedestrians to walk to the nearest intersection to cross. This ignored the fact that for some people with disabilities, walking to an intersection is a challenge. It also ignores the overall conclusion of the study which was simple safety improvements at mid-block marked crosswalks make them safer than unmarked crosswalks.

Guest Donald Sakamoto commented he has been advocating for audible pedestrian signals at the Pearl City Highlands rail station crosswalk and at the Kailua roundabout.

C.   Kauai County Suspension of Bus and Paratransit Service on Sundays

Bryan Mick reported that the County of Kauai Transportation Department had just responded to a letter the Committee submitted requesting additional information about the suspension of Sunday services. The main reason for the suspension is a shortage of drivers, there are eleven (11) vacancies out of seventy four (74) authorized positions. Sunday was selected as the day to suspend service as it had the lowest ridership of any day, and it is the only day that the island's dialysis clinics are closed. When the vacancy count drops to three (3) or lower, Sunday service will be resumed. Bryan Mick added that staff informed the Department that DCAB would support them in efforts to fill their vacancies, including advocating to the County Council to increase driver pay, if requested.

VI.   New Business

A.   Standing Agenda Items

Public Transit and Paratransit

Bryan Mick reported that he did not have any updates on the City and County of Honolulu low income fare program for paratransit riders or for a possible pilot taxi voucher program.

House Bill (HB) 2082 House Draft (HD) 1 establishes standards for public education bus services, including an equity assessment; the bill did not pass this legislative session.

Senate Bill (SB) 2769 Senate Draft (SD) 1 requires counties to purchase zero emission buses; the bill did not pass this legislative session.

Pedestrian Mobility and Built Environment

Bryan Mick reported that:

[HB 2071 HD1 SD1](#) which would clarify enforcement for red light photos, passed and was awaiting the Governor's action.

[SB 2443 SD2 HD2 Conference Draft (CD) 1](#) which stablishes automated speed enforcement program also is awaiting Governor's action.

[SB 2738 SD1](#) which would have established a 3 year pilot program to examine signalized intersections did not pass this legislative session.

[SB 3002 SD1 HD2](#) which would have made an appropriation to implement recommendations of the task force on mobility management did not pass this legislative session.

Air Transportation and Airports

Bryan Mick mentioned that staff is unable to attend the Universal Access in Aviation Biennial Conference, but he recommends it to anyone who is interested in accessibility and airports.

Bryan Mick reported that the Board packet included information on the new automated shuttle service at Honolulu International Airport called Miki. Based on photos, staff had concerns with shuttle accessibility. The State Department of Transportation (DOT) provided DCAB additional information. DOT explained this is just a pilot project, and the vehicle is smaller than what would be ordered in a permanent program. There are attendants on the vehicles to assist wheelchair users with loading and securing tie downs. There is a portable ramp the attendant would need to install for loading and unloading persons with disabilities. DOT raised some concerns with the vendor during a recent test run.

Bryan Mick commented he was surprised a press release was issued for something which is apparently still in its beta test phase. This is an example of why DCAB thinks DOT should establish an advisory committee of airport users with disabilities. It seems like the DOT Office of Civil Rights, who provided the response, was not engaged early on in this project.

Committee member Charlotte Townend asked if staff could request a site visit for the Committee. Bryan Mick replied he would figure out the logistics for a visit.

Guest Donald Sakamoto commented he also had a concern with the accessibility of the planned pedestrian bridge between the rail station to the airport.

Bryan Mick reported that the Federal Department of Transportation recently released a revised flying with a service animal form. The revised form is concise and less burdensome to fill out, and uses terminology found in the actual federal regulations.

Update from Standing Committee on Parking

HB 2446 HD2 SD2 / SB 3135 SD1 would have allowed suspension of a driver license if a person is caught using a deceased persons parking permit, remitted 50 percent of fines to agency that issues the citation, and authorized counties to enforce design requirements. These bills did not pass this legislative session.

HB 2447 HD1 / SB 3136 would have created a travel placard. These bills did not pass this legislative session.

SB 370 SD1 would have allowed a property owner of multiple lots to aggregate the required number of electric vehicle charging spaces. DCAB did not want this to decrease the number of accessible charging spaces. The bill did not past this legislative session.

Chairperson Violet Horvath commented she is seeing more and more articles about people with disabilities being unable to use charging stations. Bryan Mick replied this is an unsettled area of the law, but the U.S. Access Board has indicated regulations will be issued soon. The basic question is do you view these as parking spaces or charging stations, which would make them akin to a gas pump. Either way has accessibility requirements, but exactly what those are depends on that decision. DCAB currently has an interpretive opinion that views them as a general feature akin to a gas pump.

Maui County - Bill 65 (2023) would expand the Volunteer Special Enforcement Officer (VSEO) Program. Staff has previously testified in support as it would likely kickstart the dormant VSEO program in Maui County. Currently there is no scheduled hearing.

B. Review of Fiscal Year 2023-2024 Plan of Action and Proposed 2024-2025 Plan of Action

The Committee did not have any proposed changes to the Plan of Action.

VII. The next meeting will be on July 10, 2024, at 10:00 a.m.

VIII. Adjournment

The meeting adjourned at 11:09 a.m.

NOTE: All votes were unanimous unless otherwise noted.

Respectfully submitted,

BRYAN K. MICK

Ensuring American Leadership in Automated Vehicle Technologies

Automated Vehicles 4.0

A Report by the
NATIONAL SCIENCE & TECHNOLOGY COUNCIL
and the
UNITED STATES DEPARTMENT OF TRANSPORTATION

January 2020

AS the world leader in technology, American innovation and ingenuity have historically transformed how we travel and connect with one another. Under this Administration, President Donald J. Trump has stressed the importance of ensuring America's continued leadership in emerging technologies, including Automated Vehicles (AVs). With the development of AVs, America has the potential to once again transform the future of transportation, while also increasing economic growth and overall productivity. AVs—if developed properly- also have the potential to make our roadways safer by reducing crashes caused by human error, including crashes involving impaired or distracted drivers.

The release of *Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0* (AV 4.0) marks another milestone in American innovation. The White House and the U.S. Department of Transportation (USDOT) developed AV 4.0 to unify efforts in automated vehicles across 38 Federal departments, independent agencies, commissions, and Executive Offices of The President, providing high-level guidance to Federal agencies, innovators, and all stakeholders on the U.S. Government's posture towards AVs.

The USDOT is actively preparing for emerging technologies by engaging with new technologies to address legitimate public concerns about safety, security, and privacy without hampering innovation. With the release of *Automated Driving Systems 2.0: A Vision for Safety* (ADS 2.0) in September 2017, the USDOT provided voluntary guidance to industry, as well as technical assistance and best practices to States, offering a path forward for the safe testing and integration of Automated Driving Systems. In October 2018, *Preparing for the Future of Transportation: Automated Vehicles 3.0* (AV 3.0) introduced guiding principles for AV innovation for all surface transportation modes, and described the USDOT's strategy to address existing barriers to potential safety benefits and progress.

Building upon these efforts, AV 4.0 details 10 U.S. Government principles to protect users and communities, promote efficient markets, and to facilitate coordinated efforts to ensure a standardized Federal approach to American leadership in AVs. It also presents ongoing Administration efforts supporting AV technology growth and leadership, as well as opportunities for collaboration including Federal investments in the AV sector and resources for AV sector innovators.

The landscape for AV innovation is complex and evolving. While significant investments and achievements are being made by industry, academia, and nonprofit organizations, further development of the technology itself is needed. Therefore, this Administration continues to evaluate its priorities for Federal research and development to ensure that investments advance AV innovations without duplicating industry efforts.

The future of transportation holds tremendous promise to strengthen the U.S. economy and make life safer and more mobile for all Americans. We look forward to continued efforts to ensure America leads the world in automated vehicle technologies.

Elaine L. Chao
United States Secretary of Transportation

Michael Kratsios
United States Chief Technology Officer

Contents

Executive Summary

The United States Government is committed to fostering surface transportation innovations to ensure the United States leads the world in automated vehicle (AV) technology development and integration while prioritizing safety, security, and privacy and safeguarding the freedoms enjoyed by Americans. The U.S. Government recognizes the value of industry leadership in the research, development, and integration of AV innovations. Such innovation requires appropriate oversight by the Government to ensure safety, open markets, allocation of scarce public resources, and protection of the public interest. Realizing the full potential of AVs will require collaboration and information sharing among stakeholders from industry, State, local, tribal, and territorial governments, academia, not-for-profit organizations, standards development organizations (SDO), and the Federal Government.

AV 4.0 presents a unifying posture to inform collaborative efforts in automated vehicles for all stakeholders and outlines past and current Federal Government efforts to address these areas of concern. AV 4.0 establishes U.S. Government principles that consist of three core interests, each of which is comprised of several sub-areas.

I.   Protect Users and Communities
   1. Prioritize Safety
   2. Emphasize Security and Cybersecurity
   3. Ensure Privacy and Data Security
   4. Enhance Mobility and Accessibility
II. Promote Efficient Markets
   5. Remain Technology Neutral
   6. Protect American Innovation and Creativity
   7. Modernize Regulations
III. Facilitate Coordinated Efforts
   8. Promote Consistent Standards and Policies
   9. Ensure a Consistent Federal Approach
   10. Improve Transportation System-Level Effects

While AV 4.0 cannot practically address all areas related to AVs, our intent is to facilitate and guide future efforts in a safe and consistent way in order to embolden AV innovators and entrepreneurs and enable the public.

I.   Automated Vehicles

The United States Government is committed to fostering surface transportation innovations to ensure the United States leads the world in automated vehicle (AV) technology development and integration while prioritizing safety, security, and privacy and safeguarding the freedoms enjoyed by Americans. The U.S. Government recognizes the value of industry leadership in the research, development, and integration of AV innovations. Such innovation requires appropriate oversight by the Government to ensure safety, open markets, allocation of scarce public resources, and protection of the public interest. Realizing the full potential of AVs will require collaboration and information sharing among stakeholders from industry, State, local, tribal, and territorial governments, academia, not-for-profit organizations, standards development organizations (SDO), and the Federal Government.

This document is not intended to be an exhaustive catalog of Federal efforts, roles, or responsibilities. Rather, it outlines certain past and current Federal efforts, and compiles available key resources for innovators and entrepreneurs in the surface transportation AV domain. Our purpose is to document a sample of U.S. Government investments and resources related to AVs in order to support American leadership in AV and AV-related research and development (R&D).

As such, the U.S. Government AV principles outlined here may align to a greater or lesser extent with any given Federal agency's mission and areas of responsibilities. They are not intended to define the extent of concerns, but rather to inform efforts to work together in the AV domain.

Potential Benefits of Automated Vehicle Technology

There are many potential benefits to increasing R&D efforts for AV technology and furthering its broad adoption and use in the U.S. surface transportation system. Potential benefits to the American public could include improved safety and a reduction in roadway fatalities; improved quality of life, access, and mobility for all citizens; lower energy usage; and improved supply chain management.[1] Today's Advanced Driver Assistance Systems (ADAS) that help vehicles avoid collisions form the building blocks for tomorrow's Automated Driving Systems (ADS). Advances in these technologies can reduce roadway crashes, fatalities, and injuries and assist the USDOT in "managing safety risks along the path to the full commercial integration of AV technology."[2]

The National Highway Traffic Safety Administration (NHTSA) has highlighted four main areas of potential benefit with regard to AVs: safety, economic and societal benefits, efficiency and convenience, and mobility.[3] AVs also have great potential benefit for improving public safety on roadways. NHTSA's Fatality Analysis Reporting System report of traffic fatalities for 2018 found that 36,560 people died from motor vehicle crashes in the U.S.[4] By eliminating the possibility of human error or poor human choices (e.g., impairment or distraction) while driving, ADS has enormous potential to save lives and reduce the economic burden associated with crashes.

The potential economic and societal benefits of AVs could also be substantial, including increased economic productivity and efficiency, reduced commuting time, and even the potential reduction of the environmental impact of conventional surface vehicles while increasing overall system energy efficiency.[5] In addition, adoption of AVs may provide mobility to citizens who currently face transportation challenges, increasing their access to jobs and services and their ability to live independently.[6]

AVs also have strong potential for increased benefits in more specialized operational design domains (ODD) such as, the agricultural domain, automated tractors and farm equipment have the potential to allow American farmers to track multiple vehicles and monitor field operations remotely. In addition, continued improvements in sensor technologies and software increasingly will allow equipment to operate in more complex environments and make precise observational decisions, deploying herbicides only when weeds are detected, for example.[7] In the arena of commercial freight transport, AVs have the potential to safely haul freight long distances, which could decrease long-haul transport times and improve

1   U.S. Congressional Research Service. Autonomous Vehicles: Emerging Policy Issues (IF10658 VERSION 3; May 23, 2017), by Bill Canis. https://crsreports.congress.gov/product/pdf/IF/IF10658

2   Chao, Elaine L. "AV 3.0 Roll Out remarks by USDOT Secretary of Transportation Elaine L. Chao" https://www.transportation.gov/briefing-room/av-30-roll-out

3   National Highway Traffic Safety Administration. Automated Vehicles for Safety. https://www.nhtsa.gov/technology-innovation/automated-vehicles#topic-benefits

4   National Highway Traffic Safety Administration. Automated Vehicles for Safety. https://www.nhtsa.gov/technology-innovation/automated-vehicles#topic-benefits

5   Groshen, Erica, John Paul Macduffie, Susan Helper, and Charles Carson. 2018. America's Workforce and the Self-Driving Future: Realizing Productivity Gains and Spurring Economic Growth. Washington, DC: Securing America's Future Energy. https://avworkforce.secureenergy.org/wp-content/uploads/2018/06/Americas-Workforce-and-the-Self-Driving-Future_Realizing-Productivity-Gains-and-Spurring-Economic-Growth.pdf

6   For more information, see the following NSTC report: https://www.whitehouse.gov/wp-content/uploads/2019/03/Emerging-Tech-to-Support-Aging-2019.pdf

7   McMahon, Karen. 2018. "Automated Farm Equipment Poised to Transform Production Practices." http://www.syngenta-us.com/thrive/research/automated-farm-equipment.html

supply chain management efficiencies. AV technology also has the potential to dramatically reduce congestion—one of the highest costs for freight movement—and to enable platooning technology that can reduce energy costs.[8]

Given that ADS are still currently in the R&D phase and not available for consumer purchase, data on collision rates for ADS under real-world conditions are limited at this time and a standardized vocabulary and methodology for evaluating and regulating their safety is still being developed by NHTSA, State regulators, and other stakeholders.[9] However, numerous technologies that are related to ADS, such as automatic emergency braking, lane departure warning, and adaptive cruise control, are already being incorporated into conventional vehicles and their effect on collision rates can be evaluated.

AVs hold enormous potential to promote the independence, economic opportunities, and social well-being of older Americans and persons with disabilities by offering independent mobility for daily activities. Reducing transportation related obstacles would enable new employment opportunities for individuals with disabilities and could save billions annually in healthcare expenditures from missed medical appointments.[10] Ensuring that AVs will meet the needs of Americans of all abilities will require carefully thought-out inclusive design to ensure widespread usability and market potential for persons with all types of disabilities—visual, auditory, cognitive, mobility, and others.[11]

The introduction of AVs in the coming decades has the potential to substantially affect many sectors of daily life. The U.S. Government's deliberate and forward engagement of all stakeholders—including industry, government, the workforce, and the public—could help fulfill the potential for AVs to improve the quality of life for all Americans and grow the U.S. economy.

U.S. Government Automated Vehicle Technology Principles

USDOT, through *Preparing for the Future of Transportation: Automated Vehicles 3.0,*[12] developed principles that encompassed the equities of USDOT. In order for the American public to fully reap the individual, societal, and economic benefits of AV technology, the National Science and Technology Council's (NSTC) Automated Vehicle Fast Track Action Committee (AV FTAC) expanded upon USDOT's principles and adopted a total of 10 principles to protect users and communities, promote efficient markets, and facilitate coordinated efforts. Together, these principles will foster research, development, and integration of AVs in the United States and guide consistent policy across the U.S. Government.

The U.S. Government will be proactive about AVs and will provide guidance, best practices, conduct research and pilot programs, and other assistance to help stakeholders plan and make the investments needed for a dynamic and flexible future for all Americans. We will also prepare for complementary technologies that enhance the benefits of AVs, such as communications between vehicles and the surrounding environment, but will not assume universal implementation of any particular approach.

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8   DOE, Office of Energy Efficiency & Renewable Energy, Platooning Trucks to Cut Cost and Improve Efficiency. https://www.energy.gov/eere/articles/platooning-trucks-cut-cost-and-improve-efficiency

9   Fraade-Blanar, Laura, Marjory S. Blumenthal, James M. Anderson, and Nidhi Kalra. 2018. Measuring Automated Vehicle Safety: Forging a Framework. Santa Monica, CA: RAND Corporation. https://www.rand.org/pubs/research_reports/RR2662.html

10   Claypool, Henry, Amitai Bin-Nun, and Jeffrey Gerlach. 2017. Self-Driving Cars: The Impact on People with Disabilities. Boston, MA: Ruderman Family Foundation. https://rudermanfoundation.org/wp-content/uploads/2017/08/Self-Driving-Cars-The-Impact-on-People-with-Disabilities_FINAL.pdf

11   Bierstedt, Jane et al., 2014, "Effects of Next-Generation Vehicles on Travel Demand and Highway Capacity," Princeton University. https://www.fehrandpeers.com/wp-content/uploads/2015/07/FP_Think_Next_Gen_Vehicle_White_Paper_FINAL.pdf

12   Preparing for the Future of Transportation: Automated Vehicle 3.0, USDOT. https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/320711/preparing-future-transportation-automated-vehicle-30.pdf

I. Protect Users and Communities

AVs have the potential to improve physical safety for vehicle operators and occupants, pedestrians, bicyclists, motorcyclists, and other travelers sharing the road. To realize these benefits, we must attend to the public's safety, security, and privacy.

1. Prioritize Safety

The U.S. Government will lead efforts to facilitate the safe integration of AV technologies, address potential safety risks, enhance the life-saving potential of AVs, and strengthen public confidence in these emerging technologies. The U.S. Government will also enforce existing laws to ensure entities do not make deceptive claims or mislead the public about the performance capabilities and limitations of AV technologies including, for example, deceptive claims relating to vehicle safety or performance.

2. Emphasize Security and Cybersecurity

The U.S. Government will support the design and implementation of secure AV technologies, the systems on which they rely, and the functions that they support to adequately safeguard against the threats to security and public safety posed by criminal or other malicious use of AVs and related services. The U.S. Government will work with developers, manufacturers, integrators, and service providers of AVs and AV services to ensure the successful prevention, mitigation, and investigation of crimes and security threats targeting or exploiting AVs, while safeguarding privacy, civil rights, and civil liberties. These efforts include the development and promotion of physical and cybersecurity standards and best practices across all data mediums and domains of the transportation system to deter, detect, protect, respond, and safely recover from known and evolving risks.

3. Ensure Privacy and Data Security

The U.S. Government will use a holistic, risk-based approach to protect the security of data and the public's privacy as AV technologies are designed and integrated. This will include protecting driver and passenger data as well as the data of passive third-parties—such as pedestrians about whom AVs may collect data—from privacy risks such as unauthorized access, collection, use, or sharing.

4. Enhance Mobility and Accessibility

The U.S. Government embraces the freedom of the open road, which includes the freedom for Americans to drive their own vehicles. The U.S. Government envisions an environment in which AVs operate alongside conventional, manually driven vehicles and other road users; therefore, the U.S. Government will protect the ability of consumers to make the mobility choices that best suit their needs. The U.S. Government will support AV technologies that enhance freedom by providing additional options for consumers to access goods and services, allowing individuals to live and work in places that fit their families' needs and expanding access to safe, affordable, accessible, and independent mobility options to all people, including those with disabilities and older Americans.

II. Promote Efficient Markets

AVs offer a dynamic area for R&D. To promote rapid development of the technologies underlying AVs, the U.S. Government will promote market efforts for American investment and innovation.

5. Remain Technology Neutral

The U.S. Government will adopt—and promote the adoption on an international level of—flexible, technology-neutral policies that will allow the public, not the Federal Government or foreign governments, to choose the most economically efficient and effective transportation and mobility solutions.

6. Protect American Innovation and Creativity

The U.S. Government will continue to advance pro-growth policies to protect our economic prosperity and innovative competitiveness, promote new engines of growth, and to prioritize America's innovative and creative capacity in all sectors, including AVs. The U.S. Government will continue to promote sensitive emerging technologies through the protection and enforcement of intellectual property rights—patents, trademarks, copyrights, and trade secrets—technical data, and sensitive proprietary communications and will continue to work to prevent other nations from gaining unfair advantage at the expense of American innovators.

7. Modernize Regulations

The U.S. Government will modernize or eliminate outdated regulations that unnecessarily impede the development of AVs—or that do not address critical safety, mobility, and accessibility needs—to encourage a consistent regulatory and operational environment. In doing so, it will promote regulatory consistency among State, local, tribal and territorial, and international laws and regulations so that AVs can operate seamlessly nationwide and internationally. When regulation is needed, the U.S. Government will seek rules, both at home and abroad, that are as performance-based and non-prescriptive as possible and do not discriminate against American technologies, products, or services.

III. Facilitate Coordinated Efforts

AVs touch upon areas of concern to Federal, State, local, tribal, and territorial governments, while also directly affecting international cooperation. This complex governance environment offers opportunities for collaboration, facilitation, and information sharing.

8. Promote Consistent Standards and Policies

The U.S. Government will prioritize participation in and advocate abroad for voluntary consensus standards and evidence-based and data driven regulations. The U.S. Government will engage State, local, tribal and territorial authorities as well as industry to promote the development and implementation of voluntary consensus standards, advance policies supporting the integration of AVs throughout the transportation system, and seek harmonized technical standards and regulatory policies with international partners.

9. Ensure a Consistent Federal Approach

The U.S. Government will proactively facilitate coordination of AV research, regulations, and policies across the Federal Government to ensure maximum effectiveness and leverage inter-agency resources. The U.S. Government will ensure all Federal dollars used for automated and connected vehicle research, grants, and any other Federal funding opportunities will comply with Executive Order 13788 (Buy American and Hire American), Executive Order 13881 (Maximizing Use of American-Made Goods, Products, and Materials), and all current laws, regulations, and Executive orders to ensure American growth and leadership in AV technology.

10. Improve Transportation System–Level Effects

The U.S. Government will focus on opportunities to improve transportation system-level performance, efficiency, and effectiveness while avoiding negative transportation system-level effects from AV technologies.

II. Administration Efforts Supporting Automated Vehicle Technology Growth and Leadership

The Administration has prioritized the development of AVs, including them as part of the Fiscal Year (FY) 2021 Administration Research and Development Budget Priorities.[13, 14]

The Administration, through the NSTC and the White House Office of Science and Technology Policy (OSTP), has convened workshops and published strategy documents to inform efforts in a number of building blocks for AV technology growth, outlined below. Moreover, the U.S. Government addresses a wide range of concerns related to AVs from conceptualization, through R&D, to support of commercialization. A sample of those efforts is provided here to outline these broad investments.

Advanced Manufacturing

The NSTC released *A Strategy for American Leadership in Advanced Manufacturing* in October 2018, which presents the Administration's vision for American leadership in advanced manufacturing across industrial sectors to ensure national security and economic prosperity.[15] Advanced manufacturing offers the promise of increasing productivity and efficiency for existing product types, as well as allowing for entirely new production methods.

Artificial Intelligence and Machine Learning

On February 11, 2019, President Donald J. Trump signed Executive Order 13840 *Maintaining American Leadership in Artificial Intelligence* (AI), which launched the American AI Initiative. This initiative implements a whole-of-government national strategy in collaboration and engagement with the private sector, academia, the public, and like-minded international partners. It directs Federal agencies to pursue a multipronged approach to advance AI, including: promoting sustained AI R&D investment, enhancing access to high-quality cyberinfrastructure and data, removing barriers to AI innovation, providing education and training opportunities to prepare the American workforce for AI, and fostering an international environment favorable to American AI innovation.

Connected Vehicles and Spectrum

In June 2018, the Federal Communications Commission (FCC) released the *Facilitate America's Superiority in 5G Technology Plan* (also known as the *5G FAST Plan*). This plan includes three key components: (1) pushing more spectrum into the marketplace; (2) updating infrastructure policy; and (3) modernizing outdated regulations.[16] High-speed communications support Vehicle-to-Vehicle (V2V) and Vehicle-to-Everything (V2X) environment data exchange. Such data exchange allows AVs to receive and contribute data beyond their on-board sensors' physical range. Wireless technologies that complement the capabilities of automated vehicle technologies are a priority of the current administration.[17]

STEM Education

AVs are an application of a variety of contributing and complementary technologies, including advanced manufacturing, high-speed communications technologies, advanced computational capabilities, computer vision, advanced sensors, data science, machine learning, and artificial intelligence. As such, education in science, technology, engineering, and mathematics (STEM) and computer science plays a critical role in these technological advancements. The NSTC released

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13   "Additional R&D is needed to safely and efficiently integrate autonomous driving systems and unmanned aircraft systems (UAS), including urban air mobility aircraft, onto our roadways and into the national airspace. Specifically, agencies should prioritize R&D to lower barriers to the deployment of autonomous vehicles and to develop operating standards and a traffic management system for UAS" (M-18-22, July 2018).

14   https://www.whitehouse.gov/wp-content/uploads/2019/08/FY-21-RD-Budget-Priorities.pdf

15   For the full text, see https://www.whitehouse.gov/wp-content/uploads/2018/10/Advanced-Manufacturing-Strategic-Plan-2018.pdf

16   The FCC's 5G FAST Plan. https://www.fcc.gov/5G

17   Emerging Technologies and Their Expected Impact on Non-Federal Spectrum Demand, https://www.whitehouse.gov/wp-content/uploads/2019/05/Emerging-Technologies-and-Impact-on-Non-Federal-Spectrum-Demand-Report-May-2019.pdf

Charting a Course for Success: America's Strategy for STEM Education in December 2018, which sets out a Federal strategy for the next 5 years based on a vision for a future in which all Americans have lifelong access to high-quality STEM education, and the United States is a global leader in STEM literacy, innovation, and employment.[18]

STEM Workforce

Advances in innovation are dependent on a vibrant, scientifically literate workforce. Federal STEM strategy encourages expansion of educator-employer partnerships that promote work-based learning experiences to offer powerful, relevant ways to ensure that STEM learning is authentic and engaging and that learners are prepared to succeed. The July 19, 2018, *Executive Order Establishing the President's National Council for the American Worker* created the Council to develop recommendations for the President on policy and strategy related to the American workforce, building upon the June 2017 Presidential Executive Order *Expanding Apprenticeships in America* intended to promote the development of apprenticeship programs by third parties and to prioritize the use of apprenticeships by Federal agencies.[19]

Supply Chain Integration

The May 15, 2019, *Executive Order on Securing the Information and Communications Technology and Services Supply Chain* banned any new acquisition, importation, transfer, installation, dealing in, or use of any information and communications technology or service (transaction) by any person subject to the jurisdiction of the United States of any products or services from a foreign-owned company or foreign person subject to a determination by the Secretary of Commerce, in consultation with the heads of other departments and agencies.[20]

Quantum Information Science

The NSTC released the *National Strategic Overview for Quantum Information Science* in September 2018, which lays out a visible, systematic, national approach to quantum information research and development.[21] Congress passed and the President signed into law the National Quantum Initiative Act in December 2018, which, among other activities, established the Subcommittee on Quantum Information Science within NSTC, and the National Quantum Initiative Advisory Committee. The Advisory Committee advises the President and the Subcommittee on the national quantum program and trends and developments in quantum information science and technology.[22] In addition, the economic and national security implications of quantum science are highlighted by additional coordination and funding in the National Defense Authorization Act of 2018.[23] Sensors, optimization, and security are areas where overlaps exist between the R&D interests for AVs and quantum information science. For example, the Global Positioning System (GPS) is a well-developed example of how quantum technologies, in this case atomic clocks in space, have revolutionized navigation. Additional sensors based on quantum technologies are transforming inertial navigation, a key backup technology to GPS. At the same time, new approaches for solving challenging multi-vehicle scheduling and optimization of machine learning systems may benefit from developments in quantum computing. Finally, the cybersecurity of automated platforms will require appropriate standards that are resistant to attack from a quantum computer, as covered in the National Institute of Standards and Technology (NIST) cybersecurity framework.[24]

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18   For the full text, see https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf

19   For the full text, see https://www.whitehouse.gov/presidential-actions/3245; https://www.whitehouse.gov/presidential-actions/executive-order-establishing-presidents-national-council-american-worker/

20   For the full text, see https://www.whitehouse.gov/presidential-actions/executive-order-securing-information-communications-technology-services-supply-chain/

21   National Strategic Overview for Quantum Information Science. https://www.whitehouse.gov/wp-content/uploads/2018/09/National-Strategic-Overview-for-Quantum-Information-Science.pdf

22   Public Law No: 115-368 (12/21/2018) National Quantum Initiative Act.

23   https://www.congress.gov/bill/115th-congress/house-bill/2810

24   NIST Cybersecurity Framework. https://www.nist.gov/cyberframework

III. U.S. Government Activities and Opportunities for Collaboration

The U.S. Government has invested in the development of foundational and complementary technologies for AVs to advance novel science and technology and provide support to innovators and entrepreneurs bringing technological advances to market. This continued investment will ensure public safety in a rapidly changing technological landscape, promote greater economic productivity and more efficient consumption of available resources, protect intellectual property, and safeguard the privacy of individuals and the security of the Nation.

A. U.S. Government Investments in the Automated Vehicle Sector

The U.S. Government is actively funding AV R&D and investing in the development of technologies to enable and complement an efficient transition toward a transportation system in which AVs and conventional surface vehicles operate seamlessly and safely. These investment areas include safety, mobility, security and cybersecurity, infrastructure, and connectivity.

Safety

Safety is a key component for the development of a transportation system that efficiently and effectively incorporates AVs. The U.S. Government prioritizes safety for vehicle operators—including low-speed vehicles, motorcycles, passenger vehicles, medium-duty vehicles, and heavy-duty commercial motor vehicles (CMVs), such as large trucks and buses—and vehicle occupants, pedestrians, bicyclists, and all other road users.

Department of Transportation

USDOT's mission is to ensure our Nation has the safest, most efficient, and modern transportation system in the world, which improves the quality of life for all American people and communities, from rural to urban, and increases the productivity and competitiveness of American workers and businesses. As a steward of the Nation's roadway transportation system, the Federal Government plays a significant role in facilitating the safe and effective integration of AVs into the existing transportation system, alongside conventional vehicles, pedestrians, bicyclists, motorcyclists, and other road users. Furthermore, USDOT is provided with significant research, regulatory, and enforcement authority to protect the safety of the American public pertaining to various aspects of AVs, to include establishing manufacturing, performance, and operational standards and supporting research that explores societal implications and interactions as AVs development and testing matures and eventually integration becomes increasingly common. Key modal agencies that are most relevant to surface transportation AVs are NHTSA, Federal Motor Carrier Safety Administration (FMCSA), Federal Transit Administration (FTA), and Federal Highway Administration (FHWA):

- NHTSA's mission is to save lives, prevent injuries, and reduce the economic costs of road traffic crashes through education, research, safety standards, and enforcement activity. NHTSA sets and enforces safety performance standards for motor vehicles and motor vehicle equipment, identifying safety defects, and through the development and delivery of effective highway safety programs for State and local jurisdictions.
- FMCSA's mission is to reduce crashes, injuries, and fatalities involving large trucks and buses. FMCSA partners with industry, safety advocates, and State and local governments to keep the Nation's roads safe and improve CMV safety through regulation, education, enforcement, research, and technology.
- FTA provides financial and technical assistance to local public transit systems, including buses, subways, light rail, commuter rail, trolleys, and ferries. FTA also oversees safety measures and helps develop next-generation technology research.

- FHWA is responsible for providing stewardship over the construction, maintenance, and preservation of the Nation's highways, bridges, and tunnels. Through research and technical assistance, the FHWA supports its partners in Federal, State, and local agencies to accelerate innovation and improve safety and mobility.

National Transportation Safety Board

The National Transportation Safety Board (NTSB) was established to determine the cause of certain crashes and to apply the lessons discovered in each investigation through recommendations to prevent future crashes. The NTSB selects and prioritizes highway safety investigations by the likelihood of gaining new knowledge. It has been focusing considerable resources on crashes involving AV control systems. The NTSB investigates crashes of vehicles under automated control and applies systemic lessons from other modes of transportation where human control has been replaced with automation in human-centric environments.

For the foreseeable future, motorists are expected to have many options for transportation, including shared AVs and AVs for personal use. The NTSB's work to investigate and prevent crashes could enhance public confidence by providing an accurate public perception that failures are taken seriously and corrected. This confidence, in turn, will help support more accurate public understanding of AV technology.

The NTSB will also continue to advocate favorable action on recommendations germane to AVs and their building blocks, such as promoting the use of collision avoidance systems that confer a proven safety benefit and high potential to improve safety.

Ensuring Mobility for All Americans

Freedom of mobility is fundamental to the American way of life. AVs—whether passenger vehicles or State, local, and private transportation systems—have the potential to expand access and ease of movement and travel, particularly for people with limited mobility due to disability, injury, or age. Therefore, the U.S. Government is dedicated to ensuring that AVs are designed to offer independent mobility for daily activities as well as promote economic opportunities and overall social well-being for all Americans.

Department of Health and Human Services

The National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) is the primary research arm of the Administration for Community Living (ACL) within the Department of Health and Human Services (HHS). Its mission is to generate new knowledge and promote its effective use to improve the abilities of individuals with disabilities to perform activities of their choice in the community, and to expand society's capacity to provide full opportunities and accommodations for citizens with disabilities.

Department of the Interior

The National Park Service (NPS) in the Department of the Interior (DOI) is dedicated to conserving the natural and cultural resources and values of the NPS for the enjoyment, education, and inspiration of this and future generations. NPS sees AV opportunities in the near future as potential mobility aids in key locations. Exploration of AV technology will provide contexts to learn how it can be integrated into NPS operations, what hurdles exist for future automation opportunities, and how automation will best fit within the agency's mission. Currently, NPS is establishing program and technical connections with USDOT for support of information on technical and programmatic opportunities regarding AVs, support for information gathering, and potential pilot testing at National Park sites.

Department of Justice

The Department of Justice (DOJ) enforces regulations under the Americans with Disabilities Act (ADA) that ensure equal access to private transportation systems for persons with disabilities. DOJ also investigates complaints regarding disability discrimination in public transportation that it receives directly or that are referred by USDOT. The precise applicability of the ADA's regulations and DOJ's role will depend on the type of AV at issue, who is providing or using it, and how the vehicle is being used. However, covered entities that choose to adopt AVs would need to do so in compliance with the ADA.

USDOT hosted the Access and Mobility for All Summit to raise awareness of USDOT and government-wide efforts to improve access and mobility for persons with disabilities, older adults, and individuals of low income and identify priority Federal and non-Federal activities and innovations that can provide more efficient, affordable, and accessible vehicles and mobility services such as transit and ridesharing.

The following announcements were made by Secretary Elaine L. Chao during this summit:

1. Up to $40 Million for a Complete Trip Deployment Solicitation
2. $5 million in cash prizes for a planned Inclusive Design Challenge
3. Notice of Funding Opportunity for FTA's FY 2020 Mobility for All Pilot Program
4. A strategic plan for the Coordinating Council on Access and Mobility (CCAM)

For reference: (https://www.transportation.gov/accessibility)

Department of Transportation

USDOT encourages AV developers and operators to work proactively with the disability community to support efforts that focus on the array of accommodations needed for different types of *disabilities* and ways to improve mobility as a *whole*. [25]

NHTSA has the authority to set performance requirements for adaptive motor vehicle equipment and develop exemptions that permit the modification of motor vehicles used by persons with disabilities.[26] Additionally, ADA regulations require accessible, timely public transportation service for passengers with disabilities, including wheelchair users.[27] FTA works to ensure nondiscriminatory and integrated mobility services in support of FTA's mission to enhance the social and economic quality of life for all Americans.[28] Additionally, USDOT's Accessible Transportation Technologies Research Initiative[29] (ATTRI) is a joint USDOT initiative, co-led by the FHWA, FTA, and the Intelligent Transportation Systems Joint Program Office[30] (ITS JPO), with support from NIDILRR and other Federal partners. The ATTRI Program is leading efforts to develop and implement transformative applications to improve mobility options for all travelers, particularly those with disabilities.

National Council on Disability

The National Council on Disability (NCD) is an independent Federal agency comprised of Presidential and congressional appointees. Pursuant to its statutory mandate, 29 U.S.C. § 781, the Council is charged with reviewing Federal laws,

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25   https://www.transportation.gov/accessibility

26   https://one.nhtsa.gov/cars/rules/adaptive/index.html

27   https://www.fmcsa.dot.gov/regulations/americans-disabilities-act-reporting-and-other-requirements-over-road-bus-companies

28   https://www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/americans-disabilities-act

29   https://www.its.dot.gov/research_areas/attri/index.htm

30   https://www.its.dot.gov/automated_vehicle/avr_plan.htm

regulations, programs, and policies affecting persons with disabilities to assess the effectiveness of such laws, regulations, programs, and policies in meeting the needs of individuals with disabilities, and making recommendations to the President, Congress, officials of Federal agencies, and other Federal entities regarding ways to better promote equal opportunity, economic self-sufficiency, independent living, and inclusion and integration into all aspects of society for Americans with disabilities.

The NCD provided policy recommendations on the advantages of AVs for persons with disabilities in its 2015 publication: *Self-Driving Cars: Mapping Access to a Technology Revolution*.[31] The report explores the emerging revolution in automobile technology and the promise it holds for persons with disabilities, as well as the obstacles the disability community faces.

U.S. Access Board

The U.S. Access Board is an independent Federal agency that promotes equality for persons with disabilities through leadership in accessible design and the development of accessibility guidelines and standards. While the Access Board does not have rulemaking authority in the area of AVs, the agency has hosted presentations by USDOT and the Department of Labor (DOL) on issues related to ensuring AV accessibility for individuals with disabilities and has provided technical assistance on making AVs accessible to them. In addition, the Board has a Frontiers Committee that engages partners on many aspects of AVs and released the 2018 Final Rule on Section 508 for access to technology procured and used by the U.S. Government.

Fundamental Research

The U.S. Government fosters research, development, and integration of AVs and supports many ongoing and future Federal investments. Advancing AV innovation and expanding the potential role of AVs in daily life requires thoughtful and effective design, research, demonstration, testing, and validation. Numerous Federal agencies carry out or support academic research on AVs and complementary technologies.

A new generation of automated high clearance tractor is being equipped for crop field-based trait analyses with an array of sensors for use by breeders at the USDA Agricultural Research Service (ARS) Arid Land Agricultural Research Center (ALARC) in Maricopa, AZ. This technology will replace the human piloted sensor platform shown below that is tasked with analyzing wheat for multiple traits simultaneously. *(Photo credit: USDA)*

Department of Agriculture

The U.S. Department of Agriculture (USDA) conducts research on AVs related to agricultural production and processing. The research areas include unmanned ground vehicles (UGV), and autosteer equipment. The USDA is heavily involved in the design and development of numerous AVs, supporting technologies and tools for precision agriculture and for crop breeding such as: sensor development, lighting systems, voice response systems, predictive modeling, AI/machine learning, rapid response control systems, robotics, big data analytics, and best management practice decision support tools.

The USDA's research includes a focus on developing AV tools and systems that decrease labor requirements for managing animals in ranching operations.

Robotics is another primary research area. Much of this research is funded through USDA's National Institute of Food and Agriculture's (NIFA) contribution to the National Robotics Initiative 2.0.[32] These robotics-centered projects include precision pollination, precision grazing, precision orchard harvesting, precision herbicide application, livestock health monitoring, plant phenotyping, and cooperative human-robotic networks for agricultural applications.

A new generation of automated high clearance tractor is being equipped for crop field-based trait analyses with an array of sensors for use by breeders at the USDA Agricultural Research Service (ARS) Arid Land Agricultural Research Center (ALARC) in Maricopa, AZ. This technology will replace the human piloted sensor platform shown below that is tasked with analyzing wheat for multiple traits simultaneously.

Department of Defense

Autonomy plays a major role in the Department of Defense's (DoD) military missions, and its role in future military missions will likely expand as the technology continues to develop. The DoD's R&D for military purposes contributes to R&D for civilian applications of AVs as well. The role of autonomy within the DoD is not to directly replace humans, but rather to extend and complement human capabilities in a number of ways. The DoD's investments in autonomy focus on developing systems that will facilitate performing complex military missions in dynamic environments with the right balance of warfighter involvement. Increased investment in autonomy will enhance joint warfighter capability in hazardous and degraded environments, heighten speed of action, and provide scalability beyond human capability. Autonomy is not a single-threaded R&D program, but rather a collection of smaller programs and demonstrations.

The DoD is pursuing advanced technology development programs as well as several other efforts to conduct fundamental research. For example, the Automated Ground Resupply program also investigates improved operations of manned platforms through the application of a wide variety of sensing and autonomy technologies developed for unmanned systems. These include maneuver and tactical behavior algorithms, driver assistance techniques, autonomy kits, teleoperation, advanced navigation and planning, vehicle self-protection, local situational awareness, advanced perception, vehicle and pedestrian safety, active safety, and robotic command and control.

The DoD has a wide-ranging effort to improve the sensors and networking technologies for autonomous platforms. This includes efforts in improving relative navigation through improvements in the GPS and inertial navigation systems driven by advances in quantum science. This also covers new approaches to active and passive sensing, such as improved Light Detection and Ranging (LIDAR) and sensor arrays for better situational awareness.

In another example, the Combat Vehicle Robotics (CoVeR) program researches, designs, and develops technologies that enable scalable integration of multi-domain teamed robotic and automated system capabilities supporting Army combat formations. It also investigates, researches, and evaluates ground vehicle technologies for both military and commercial applications in collaboration with industry, universities, and other government agencies. The Research in Vehicle Mobility program is working to develop human cognitive models to represent behavioral dynamics to work side-by-side with control algorithms in a semi-automated robotic system engaged in extreme mobility scenarios, thereby replacing the need for real human-in-the-loop assessments.

The DoD aims to field a Joint Force architecture by 2030 that will fully integrate robotic and automated systems, supplementing and augmenting manned systems and forces in an attempt to counter threats from adversaries across multiple domains. However, humans must remain in the loop and play an oversight role, with the ability to activate or

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32   https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503641

deactivate system functions as necessary. The DoD is developing multiple vehicle demonstration programs in support of its 2030 Joint Force architecture goal and to improve DoD's Non-Tactical Vehicle (NTV) mobility options. Examples include:

- **High Mobility Multipurpose Wheeled Vehicle (HMMWV) Autonomy:** This effort will develop a cost-effective upgrade to the existing HMMWV platform that will enable drive-by-wire control. Converting the vehicle controls from mechanical linkages to electronic actuation will enable connection to computers for autonomous operation, as well as to process, communicate, and store diagnostic/sensor data for use in localization and maintenance functions.
- **Off Road Autonomy:** This effort will look at several new techniques for executing off road autonomy built onto the current Army ground autonomy architecture. This effort focuses on developing new path planning and perception techniques with the intent of increasing reliability and performance for off-road unmanned maneuver systems for Robotics Combat Vehicle (RCV) and other platforms.
- **Situational Awareness in Dynamic Environments:** This research investigates and establishes the components required for embodied intelligent ground robotic systems to achieve understanding of dynamic, highly unstructured environment to support reasoning over time and space given multi-modal sensory input.
- **NTV Automated Shuttle Pilot:** Marine Corps Installations Command (MCICOM) and Army Headquarters are sponsoring a 3-month automated non-tactical shuttle pilot on Joint Base Myer Henderson Hall. This industry-led pilot facilitates an opportunity for the Army's Engineering Research and Development Center (ERDC) to shadow the performers in order to create future automated shuttle programs on other military installations.

Department of Energy

The Energy Efficient Mobility Systems program at the U.S. Department of Energy (DOE) is conducting fundamental research to understand the transportation "system level" impact from connected and automated vehicle technologies. DOE researchers are creating and using large-scale agent-based models to simulate current and future mobility technologies and services, including transportation network companies (TNCs), public transit systems, and other modes for transporting freight and people. These models will allow users to better understand the second and third order impacts from adding a technology like AVs (e.g., induced traffic congestion due to "empty" AV miles or new patterns for land use and development) or to compare the system-wide impacts of different technologies (e.g., traffic flow impacts of SAE Level 4 versus Level 5 ADS-equipped vehicle[33], congestion impacts of personally-owned AVs compared to fleet-owned mobility service AVs).

DOE is also using its unique High Performance Computing[34] (HPC) and AI capabilities at the National Laboratories to develop methods to use AVs or connectivity to anticipate and reduce or prevent congestion. Projects are underway utilizing roadway and vehicle data from the Los Angeles and Chattanooga metropolitan areas. Although in its early stages, as more data from AVs becomes available and HPC capability increases, it will increasingly become possible to optimize traffic flow, and reduce costs.

DOE is also studying how to fundamentally extend computing capability, which will likely be needed to safely operate SAE Level 5 ADS-equipped vehicle in a real-world, consumer-acceptable package. Given the amount of computational capability necessary and the size, weight, and power constraints on a motor vehicle, dramatic improvements in the energy efficiency, performance, and cost of the underlying computer systems will be needed.

Because transportation accounts for nearly one-third of the energy used in the United States, technologies such as AVs, which could reduce energy use associated with driving, play valuable roles in America's energy future. DOE's role with

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33   https://www.sae.org/news/2019/01/sae-updates-j3016-automated-driving-graphic

34   https://www.energy.gov/science/initiatives/high-performance-computing

respect to AVs is to develop technologies, tools, and insights that enhance the affordability, effectiveness, and energy efficiency of the overall transportation system. DOE leads the multi-agency 21st Century Truck Partnership[35] (21CTP). This public/private partnership includes DoD, USDOT, the Environmental Protection Agency (EPA), and DOE, along with industry partners. This non-funded research partnership focuses on pre-competitive information exchange across four technical focus areas: internal combustion engines, electrified powertrains, operational efficiency, and safety. AVs and related mobility technologies are key parts of 21CTP's Freight Operational Efficiency and Safety technical teams. DOE also funds the SuperTruck II initiative[36], a competitive funding opportunity initiated in FY 2016 aimed at developing innovative, cost-effective technologies that can double the freight efficiency of Class 8 trucks. Automation and connectivity are among the technologies being considered by the five teams selected for cost-shared financial assistance awards.

With respect to the development of AVs for personal use, the DOE Vehicle Technologies Office (VTO) and the Advanced Research Projects Agency-Energy[37] (ARPA-E) have made numerous cost-shared financial assistance awards focused on automated and connected vehicles and efficient mobility. VTO also had a recent Funding Opportunity Announcement (FOA) for mobility research (~$7 million) that included AV projects.[38]

ARPA-E's *NEXTCAR* (Next-Generation Energy Technologies for Connected and Automated On-Road Vehicles) Program [39]provided approximately $32 million in FY 2016 for 11 projects to use connected and AV technologies to improve vehicle-level fuel efficiency through improvements in vehicle dynamics and powertrain controls.

A 2019 DOE award will build on the progress of NEXTCAR by adapting a NEXTCAR AV algorithm for use in a SAE Level 4 ADS-equipped vehicle. The project will also implement an infrastructure-based solution that offloads computing from the vehicles to roadside units for centralized perception processing at intersections that can be utilized by any connected vehicle. This project aims to reduce system-level energy consumption by 15%.

A second 2019 DOE financial assistance award will develop deep-learning algorithms for AVs that smooth mixed highway traffic (human-driven and automated vehicles) and reduce system-wide energy consumption by 10% through just 5% AV penetration. In 2018, DOE awarded over $26 million to 18 projects that will bring together key stakeholders in partnerships to provide data on the impact of mobility services and solutions through real-world testing (evaluation/assessment) and validation. The data, analysis, and insights from this work will fill critical information gaps to inform mobility research needs, as well as near- and long-term transportation planning that maximizes energy efficiency and affordability.

In 2018, DOE made $5 million in financial assistance awards to demonstrate the real-world application of Class 8 Truck Platooning to identify remaining roadblocks to practical application of commercial AV technology. The DoD U.S. Army Futures Command is a major participant in one of the projects. This builds on experimental work on which DOE and FHWA have collaborated for a number of years, proving the capability and energy savings from heavy truck platooning.

In 2017, VTO financial assistance awards funding to the Virginia Tech Transportation Institute (VTTI), University of California–Riverside, and Clemson University to conduct research that evaluates energy savings benefits from connected and automated vehicles. The Clemson University project is developing anticipative and predictive AV control algorithms and building a novel vehicle-in-the-loop testbed to demonstrate energy savings of 10% AVs in traffic that includes both automated and human-driven vehicles.

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35   https://www.energy.gov/eere/vehicles/21st-century-truck-partnership

36   https://www.energy.gov/articles/energy-department-announces-137-million-investment-commercial-and-passenger-vehicle

37   https://arpa-e.energy.gov/

38   https://www.energy.gov/articles/doe-announces-59-million-and-43-projects-accelerate-advanced-vehicle-technologies-research
      https://www.energy.gov/eere/vehicles/downloads/fiscal-year-2019-advanced-vehicle-technologies-research-selections

39   https://arpa-e.energy.gov/?q=arpa-e-programs/nextcar

Department of Health and Human Services

NIDILRR's Rehabilitation Engineering Research Center on Physical Access and Transportation at Carnegie Mellon University is researching potential reference designs and vehicle interior concepts intended to promote and facilitate the accessibility of AVs for persons with disabilities. This center is also conducting R&D to generate new knowledge about how AVs can help address transportation barriers that are experienced by persons with disabilities in the first or last mile of a trip.

NIDILRR's Research Project on Optimizing Accessible Public Transportation, at the State University of New York–Buffalo, is generating new knowledge about innovative securement systems for wheelchair users in transit buses and paratransit vehicles. This project includes research into the ramifications of introducing automated securement systems for wheelchair users in automated transit vehicles. In order to provide community input into the R&D process, NIDILRR's Rehabilitation Research and Training Center on Community Living Policy collected data from persons with disabilities and other critical stakeholders to inform recommendations for a future research and standards/architecture development effort for fully accessible and fully automated vehicles.

The National Institute for Occupational Safety and Health (NIOSH) Strategic Plan, FYs 2019–2023, prioritizes research on the health effects of AVs for truck, bus, and taxi drivers. It also prioritizes research on injury risks associated with new jobs that may be created by automation and on potential stress and fatigue consequences of automation.

NIOSH is conducting simulator-based research that will lead to recommendations for the capabilities of automation sensors and driver-vehicle interfaces used in heavy trucks (for example, the minimum time required for sensors to issue a warning in time for the driver to safely re-assume control of the vehicle).

> The U.S. Government has funded various research projects on accessible transportation technologies. Recently, FHWA and NIDILRR has funded a project on ATTRI: Assessment of Relevant Research, which was conducted by The Robotics Institute at Carnegie Mellon University. This report highlights the potential That Automated Vehicles hold for travelers with disabilities.
>
> (For reference: https://www.ri.cmu.edu/wp-content/uploads/2017/04/3_ATTRI_ARR_2017-04.pdf)

Department of Homeland Security

The Department of Homeland Security (DHS) Science and Technology (S&T) Directorate conducts R&D on a range of technologies related to AVs, focusing on understanding their potential utility and vulnerabilities.[40] Examples of DHS AV R&D include operating an AV test bed, spoofing protection for global navigation satellite systems, analytics for evaluating performance of ADAS, and using AI and machine learning for automated systems.

Research examples include:

- DHS's Homeland Security Systems Engineering and Development Institute (HSSEDI) is a Federally Funded Research and Development Center (FFRDC) in the process of developing an open-architecture platform to develop and evaluate AV technology. The purpose is to have an environment to demonstrate multi-agent autonomy, cybersecurity challenges, and communications architectures applicable to potential future networked, unmanned systems. This effort will develop the next generation of AV test bed.
- Since the need for resilient positioning, navigation, and timing will only increase with the advent of AVs, DHS's HSSEDI FFRDC is studying methods of spoofing protection for global navigation satellite systems.
- Active safety and driver assistance systems can potentially save lives and avoid crashes, but usage and safety performance of the systems remains poorly understood. DHS's HSSEDI FFRDC is researching analytics for evaluating performance of ADAS.

Department of Justice

DOJ's National Institute of Justice (NIJ) awarded $50,000 to Purdue University to identify vulnerabilities of AVs' computer systems to cyber threats and to develop measures to counter those threats. NIJ also provided funding to RAND Corporation to host a workshop on AVs in July 2019 with the Police Executive Research Forum (PERF). The workshop highlighted and explored specific public safety scenarios involving AVs that have been or will be faced by law enforcement, ranging from routine police interactions with specific individual vehicles (e.g., traffic stop, accident report) as well as small- or large-scale emergency situations that may require interaction with large numbers of vehicles at once (e.g., detours, evacuations).

Department of Transportation

Several USDOT modal administrations are conducting a wide array of research and demonstration projects related to surface transportation AVs.

- **FHWA is:**
  - Investigating different roadway/automated driving scenarios with a focus on the data and systems that will be needed to enable ADS to exchange data to successfully navigate challenging roadway scenarios.
  - Developing new modeling and simulation capabilities to analyze the impact of connected and automated vehicles (CAVs) on the highway system, including developing new traffic simulation algorithms that incorporate CAVs and conducting case studies to analyze impacts of CAV technologies on traffic flow and operations.
  - Pursuing an update of the Manual on Uniform Traffic Control Devices (MUTCD). The upcoming new edition will propose updated technical provisions to reflect advances in technologies and operational practices; incorporate recent trends and innovations; and set the stage for ADS as those continue to take shape.
  - Funding grants for through the annual $60 million Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program.[41] The Fixing America's Surface Transportation Act (FAST Act) established ATCMTD to make competitive grants for the development of model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment.

CARMA[sm] is a research program designed to develop concepts for cooperative driving automation that address common traffic situations, and test and evaluate resulting applications. **CARMA**[sm] enables ADS to navigate more safely and efficiently with other vehicles and roadway infrastructure though communication and cooperation. **CARMA**[sm] aims to accelerate market readiness and the integration of cooperative automated driving systems, while advancing safety, security, data, and artificial intelligence. FHWA is conducting this work using open source software to encourage national and international collaboration and participation by a community of engineers and researchers in public, private and non-profit sectors. *(Photo credit: FHWA)*

(For reference: https://cms7.fhwa.dot.gov/research/research-programs/operations/carma-overview)

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41   https://www.fhwa.dot.gov/fastact/factsheets/advtranscongmgmtfs.cfm

- **FMCSA is:**
    - Conducting research to increase understanding of the human factors and address specific areas such as driver readiness, the human-machine interface (HMI), adaptation to advanced technologies, and communication with others outside the vehicle.
    - Researching safety performance of critical items such as sensors, brakes, and tires in AV CMV operations, truck platooning, emergency response, and roadside inspections.
    - Conducting research to ensure that the CMV industry is adequately equipped and able to prevent or respond to cyber threats.
- **FTA is:**
    - Conducting research to assess both user acceptance and human factors design considerations for high-priority transit automation use cases involving passengers, bus operators, and other transit users to apply and conduct practical research in demonstrations and to identify and study potential customer acceptance issues associated with fully driverless operations due to perceived security issues or distrust of technology.
    - Developing non-binding guidance, based on earlier research results and demonstration findings, on Federal funding programs that may be relevant to transit automation investments.
    - Working to produce a practical reference guide for transit agencies covering key transition areas, such as vehicle maintenance; human factors, labor, and training issues; customer communications; maintaining consistency in the passenger experience; and transit service planning.
    - Exploring the potential transferability of AV technologies and capabilities from light and commercial vehicles to bus transit.[42]
    - Launching a series of seven demonstrations, organized by use case categories, in real-world transit environments as defined in the FTA *Strategic Transit Automation Research* (STAR) Plan.[43] The demonstrations will create a testbed for study of technical issues, user acceptance, operational and maintenance costs, and institutional issues, and will further assess needs for standards development to ensure interoperability.

- **NHTSA is:**
    - Researching unintended regulatory barriers. Historically, the Federal Motor Vehicle Safety Standards (FMVSS) have been based on the concept of a human operating the vehicle. With the introduction of ADS, the driving tasks are increasingly shifted to the vehicle. The absence of a human driver creates opportunities for vehicle manufacturers to design new vehicle architectures that may remove driving controls, change seating configurations, and establishing new interfaces for occupants.
    - NHTSA has published non-binding guidance to support the automotive industry and other key stakeholders as they consider and design best practices for the testing and safe integration of Automated Driving Systems, along with technical assistance to States and Best Practices for Legislatures.[44]
    - Researching alternative metrics and safety assessment models. This research will identify the methods, metrics, and tools to assess how well the ADS perform at a system level to avoid crashes including system performance and behavior relative to the system's ODD and stated Object and Event Detection and Response (OEDR) capabilities. Research will be conducted to explore the functional performance and safety benefits of ADS implementations. Research also will be performed to study the feasibility and methods to assess normal driving capabilities of an ADS. The dynamic driving tasks (previously undertaken by the human driver) as behavioral competencies

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42   Transferability of Automation Technologies https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118161/transit-bus-automation-project-transferability-automation-technologies-final-report-fta-report-no.pdf

43   https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/114661/strategic-transit-automation-research-report-no-0116_0.pdf

44   https://www.nhtsa.gov/press-releases/us-dot-releases-new-automated-driving-systems-guidance

or maneuvers that can be measured and tested much in the way a human driver is evaluated to ensure driving competency.

— Researching functional safety and ADS subsystems. The safe operation and reliable performance of ADS are critical to public acceptance and successful integration of future ADS. As the dynamic driving tasks are transferred from the human driver to the ADS, human sensing and cognition functions are essentially being relegated to the machine through a collection of integrated hardware and software subsystems. Accordingly, methods and tools are necessary to assess the functional safety of ADS subsystems and their building block components.

— Researching occupant protection[45] in alternative vehicle designs. Vehicle crash mechanics and occupant restraint systems are not directly affected by vehicle automation. However, occupant behavior and the enhanced sensor systems will affect priorities for a vehicle's safety in the event of a crash.

— Researching human factors for ADS Vehicles, for example, vehicles that are designed in a manner where it can be operated by both a driver and an ADS (e.g., dual-mode), involving control handoff between drivers and ADS in certain circumstances. A driver's readiness to resume control in SAE Level 3 ADS-equipped vehicle is critical to safety. Driver engagement with the ADS is influenced by several issues, including the human-machine interface, the driver's experience and training with the system, and other situation-specific factors that affect behavioral responses.

— Researching accessibility considerations in ADS vehicles. ADS vehicles are expected to provide mobility options not previously afforded to persons with disabilities, regardless of cognitive, physical, or even the degree of condition. Research has been initiated to explore the information needs of persons with disabilities and how these needs could be implemented effectively within a HMI.

— Conducting cybersecurity research to promote a layered approach to cybersecurity by focusing on a vehicle's entry points, both wireless and wired, which could be potentially vulnerable to a cyber-attack. A layered approach to vehicle cybersecurity reduces the possibility of a successful vehicle cyber-attack, and mitigates the potential consequences of a successful intrusion. NHTSA has published non-binding guidance to the automotive industry for improving motor vehicle cybersecurity,[46] which it is currently working on updating.

• **Office of the Secretary of Transportation (OST) announced:**
   — $60 million in Federal grant funding for a competitive grant program that awarded 8 recipients for ADS demonstrations.[47]
   — A planned Inclusive Design Challenge[48], which will make up to $5 million in cash prizes available to innovators who design solutions to enable accessible automated vehicles. USDOT aims to increase availability and decrease cost of aftermarket modifiers that improve accessibility of vehicles today and spark development for future automated vehicles.

National Aeronautics and Space Administration

While the National Aeronautics and Space Administration's (NASA) mission relates to space and aviation, in service of that mission NASA is developing and maturing a broad range of technologies that are also relevant to surface AVs. These technologies are primarily described by the "Robotics and Autonomous Systems" Technology Roadmap.[49] NASA's investment in this area includes work in sensing and perception, mobility, manipulation, human-system integration,

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45   https://www.nhtsa.gov/research-data/crashworthiness

46   NHTSA, Cybersecurity Best Practices for Modern Vehicles. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/sae2017chatipoglu_0.pdf

47   https://www.transportation.gov/av/grants

48   https://www.transportation.gov/accessibility

49   For the full text, see https://www.nasa.gov/offices/oct/home/roadmaps

NASA develops and deploys a wide range of operator interfaces to remotely monitor and supervise space robots, including planetary rovers that drive autonomously in uncertain environments. These interfaces, such as the NASA open-source "Visual Environment for Remote and Virtual Exploration (VERVE)", are used to visualize robot sensor data, telemetry, and remote environments as well as to interactively handle contingencies and exceptions. Numerous AV companies are currently developing similar systems to support monitoring and supervision of AV services (delivery, taxi, etc.).

(For reference: https://software.nasa.gov/software/ARC-16457-1A, https://ntrs.nasa.gov/search.jsp?R=20140013445)

system-level autonomy, autonomous rendezvous and docking, and systems engineering. Autonomy (both system- and subsystem-level), cognition, and machine learning are integral parts that span all sub-areas, including object, event, and activity recognition; robot navigation; dexterous manipulation; intent recognition and reaction; and rendezvous and docking.

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NASA's technology investments (including internal projects and external awards) can be tracked and analyzed using TechPort, a web-based, publicly available, software system that serves as NASA's integrated technology data source.[50] Research products are archived in NASA Technical Reports Server (NTRS), which provides access to scientific and technical information (STI) created or funded by NASA including conference papers, journal articles, meeting papers, patents,

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50   For the full text, see https://techport.nasa.gov

research reports, images, movies, and technical videos.[51] Technologies with foreseeable application beyond aviation, space, and planetary exploration include development of higher resolution 3D range imaging sensors allowing an AV to perceive the surrounding landscape, map-based position estimation for navigation by surface vehicles, natural and human-made object recognition algorithms, improved routing and optimization techniques, and adaptive autonomous surface navigation systems.

National Science Foundation

The National Science Foundation (NSF) supports the development of AVs, as well as analysis of the potential benefits and challenges of their introduction into the current transportation system through a variety of programs, primarily in the Computer and Information Science and Engineering (CISE); Engineering (ENG); and Social, Behavioral, and Economic Sciences (SBE) Directorates.

NSF funds basic research in the three broad categories of sensing, reasoning, and acting.

- Basic research in sensing may include improved computer vision, radar, LIDAR, mapping, and other sensing modalities, as well as sensor fusion.
- Basic research in reasoning may include real-time machine learning, perception and localization, safety guarantees for control in uncertain environments, and multi-objective optimization under constraints.
- Basic research in action may include ensuring the safety of the AV occupants as well as other road users—bicyclists and pedestrians, trajectory and path planning, vehicle dynamics, model-predictive control, and blended control.

In addition, NSF funds basic research and workshops to address communication issues between AVs, social issues surrounding the adoption of AVs, and a future transportation system that incorporates surface AVs. As part of NSF's broad portfolio of basic research in communications, infrastructure, and human factors, NSF funds basic research and workshops in:

- Communications including spectrum research for V2V and V2I communication,
- Security of AV systems
- How human responses to sharing roads with AVs can help to foster trust in automated technology.
- The relationship between user privacy and the architecture of AV sharing services.
- How the emergence of automated trucks affects the trucking workforce and the U.S. economy.
- How repurposing time currently taken up by driving can enhance economic productivity and worker wellbeing

U.S. Postal Service

The U.S. Postal Service (USPS) operates the largest civil agency fleet of vehicles in the country with well over 200,000 vehicles. The use of AVs offers an opportunity for USPS to improve operational efficiency and enhance the safety of postal workers and the public. USPS's use of advanced technology to improve efficiency is part of the charter that recreated the organization in the early 1970s. USPS is conducting three AV demonstration programs:

- **Automated Rural Delivery Vehicle (Zippy) Program:**[52] The program created a prototype in conjunction with the University of Michigan to identify current capabilities and value of AVs.
- **Request for Information (RFI) for Autonomous Vehicle Capability:**[53] USPS issued an RFI on an advanced automated delivery vehicle program to produce a mail delivery vehicle for improved productivity and to evaluate current AV capabilities and individual sensor technologies. The USPS received numerous responses and is developing programs

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51   https://ntrs.nasa.gov/

52   https://www.uspsoig.gov/sites/default/files/document-library-files/2017/RARC-WP-18-001.pdf

53   https://www.fbo.gov/spg/USPS/SSP/PhPMSC/RFI-USPS-AVC/listing.html

to pursue targeted research on automated technology for its vehicles. In addition to the research projects, USPS will be exploring partnerships with industry leaders to leverage its vast fleet that drives to every door, every day at typically low speeds to deliver the Nation's mail.

- **Automated Semi-Truck:** This is an automated tractor-trailer proof of concept program operating (with safety engineer and driver present) on defined routes between major distribution centers in the southwest United States. USPS recently completed a pilot program that included five round trips between Dallas, Texas and Phoenix, Arizona. All of the automated trips were either on time or early to the respective facilities.

Security and Cybersecurity

Security and cybersecurity are critical for the development of a transportation system that safely and effectively incorporates AVs. High degrees of connectivity and automation increase the need to protect vehicle control systems and secure sensitive information. In addition, most AV manufacturers have indicated that their vehicles will use electric motors and therefore will need to be plugged into the grid and connected through charging equipment. In consideration of potential increases to the critical technologies for both vehicles and the wider critical infrastructure, the U.S. Government is dedicated to providing a secure AV environment.

Department of Energy

DOE has deep cybersecurity expertise through its national laboratories. Vehicle-related cybersecurity research to date has focused on plug-in electric vehicles and the interconnections between vehicles, charging equipment, buildings, and the grid. However, a more holistic vehicle cyber threat assessment, including AVs, is being undertaken by Sandia National Laboratory to understand whether additional research is needed.

Department of Homeland Security

The DHS's Cybersecurity and Infrastructure Security Agency (CISA) also has deep cybersecurity expertise and leads the national effort to defend critical infrastructure against today's threats, while working with partners across all levels of government and in the private sector to secure against the evolving risks of tomorrow. CISA's integrated operations center provides 24x7 cyber situational awareness, analysis, incident response, and cyber defense capabilities to the Federal Government; State, local, tribal and territorial governments; the private sector, and international partners. CISA provides cybersecurity tools, incident response services, and assessment capabilities to safeguard the networks that support the essential operations of Federal civilian departments and agencies. CISA coordinates security and resilience efforts using trusted partnerships across the private and public sectors and delivers training, technical assistance, and assessments to Federal stakeholders as well as to infrastructure owners and operators nationwide. CISA provides consolidated all-hazards risk analysis for U.S. critical infrastructure through the National Risk Management Center (NRMC).

Department of Justice

DOJ focuses on enforcing Federal law, ensuring public safety, and protecting national security. DOJ's security and cybersecurity interests in AV integration into our transportation system include:

- **Enforcing the Law in Cyberspace:** The computer systems involved in operating and communicating with AVs make the vehicles potential targets of domestic or international criminals. DOJ investigates and prosecutes criminal exploitation of computer systems and works with interagency, State and local, and international partners to mitigate public safety and national security threats in cyberspace. In that regard, it is important to DOJ and its law enforcement partners that AV computer systems employ adequate cybersecurity measures to combat criminal exploitation by cybercriminals. It is also imperative that the data in those systems necessary to investigate crime be accessible to law enforcement officials, upon appropriate authorization.

- **Supply Chain Security:** To mitigate supply chain risks to sensitive technologies, such as AVs, posed by foreign adversaries, DOJ—as well as NHTSA—evaluates proposed foreign acquisitions of U.S. businesses through the Committee on Foreign Investment in the United States (CFIUS).

- **Research and Development of Best Practices for Law Enforcement:** Within DOJ, NIJ is the lead Federal agency in researching the application of technology to and for criminal justice purposes. NIJ not only funds research related to the impact of AVs on law enforcement, but also seeks to evaluate and disseminate best practices for protecting officer safety from any threats posed by AVs. Additionally, NIJ engages with State, local, tribal, and territorial law enforcement partners to identify their operational requirements relating to AVs and interacts with developers, manufacturers, and vendors of law enforcement technology to address those requirements.

- **Federal Law Enforcement Use of Automated Vehicles:** In the future, law enforcement agencies within DOJ may seek to leverage AV technology to increase their law enforcement capabilities while improving officer safety, potentially reducing costs, and ensuring the protection of privacy, civil rights, and civil liberties.

Department of Transportation

The National Traffic and Motor Vehicle Safety Act[54] provides NHTSA with broad authority over motor vehicle and motor vehicle equipment. Congress created this broad authority for the purpose of reducing traffic crashes, deaths, and injuries resulting from traffic crashes.[55] Three key components of NHTSA's authority are its ability to develop and establish safety standards, to enforce the prohibition against covered parties making inoperative aspects of vehicles or motor vehicle equipment installed in compliance with a safety standard, and to take action to protect the public against noncompliance and defects that pose unreasonable risks to motor vehicle safety. NHTSA's broad authority allows the agency to remain nimble and responsive in the face of ever-changing technological advances, including those related to cybersecurity.

While "data security" and "privacy" are important considerations within the context of vehicles and cybersecurity, the specific possibility of software vulnerabilities and other threats or risks potentially causing a crash or safety degradation to motor vehicles or motor vehicle equipment is the primary concern for NHTSA. NHTSA has established a Vehicle Cybersecurity Response Process for Incidents Involving Safety-Critical Systems. During a significant incident, coordination will be handled through DHS's National Cybersecurity & Communications Integration Center (NCCIC), with NHTSA having an information/advisory role and performing its statutory responsibility under the Safety Act.

While cybersecurity is a critical issue for NHTSA, the emphasis for addressing cybersecurity ultimately must be with the industry, which must be the primary mover and leader in this field. The agency has taken several other concrete steps to prepare for the eventuality of an automotive cyber incident that affects safety. In order to encourage industry to face this emerging issue, NHTSA has issued non-binding best practices.[56] Also, in 2015, the Industry formed the Automotive Information Sharing and Analysis Center[57] (Auto-ISAC) as an industry led clearinghouse to share cybersecurity information. The Auto-ISAC is one of the few ISACs formed prior to a sector incident. In July 2016, the Auto ISAC published its own set of best practices to the public.

While general consumer privacy is an important secondary concern for NHTSA, the agency works with Federal Trade Commission (FTC), which has primary jurisdiction over privacy issues not related to motor vehicle safety.

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54   (49 U.S.C. chapter 301) ("Safety Act")

55   49 U.S.C. § 30101

56   NHTSA, Cybersecurity Best Practices for Modern Vehicles. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/sae2017chatipoglu_0.pdf

57   https://www.automotiveisac.com/

National Institute of Standards and Technology

The NIST National Cybersecurity Center of Excellence[58] (NCCoE) conducts research to accelerate the deployment and use of secure, standards-based risk management solutions. NCCoE is a collaborative hub where industry organizations, government agencies, and academic institutions work together to address businesses' most pressing cybersecurity issues. It is the responsibility of AV developers, vehicle manufacturers, parts suppliers, and all stakeholders who support transportation to follow best practices, and industry standards, for managing cyber risks in the design, integration, testing, and deployment of AV. The Federal Government will promote the NIST Cybersecurity Framework—already a de facto common measure for cybersecurity in industry—for AV stakeholders. [59]

NIST's draft publication for *Core Cybersecurity Feature Baseline for Securable Internet of Things (IoT) Devices: A Starting Point for IoT Device Manufacturers*[60] is intended to help IoT device manufacturers understand the cybersecurity risks their customers face. Many IoT devices are the result of the convergence of cloud computing, mobile computing, embedded systems, big data, low-price hardware, and other technological advances. IoT devices can provide computing functionality, data storage, and network connectivity for equipment that previously lacked them, enabling new efficiencies and technological capabilities for the equipment, such as remote access for monitoring, configuration, and troubleshooting.[61] The draft NIST publication defines a core baseline of cybersecurity features that any manufacturers may voluntarily adopt for IoT devices they produce, and also provides information on how they can identify and implement the features most appropriate for their customers. This publication can be used as a resource by AV innovators to better understand cybersecurity risks to their customers and provides a core baseline of cybersecurity features that can be used for potential IoT devices embedded in AVs.

National Security Council

The National Security Council[62] team, with the departments and agencies, enables the President to plan and execute integrated national security strategies to protect American citizens and the homeland while prioritizing national interests and values. These national security strategies are informed by the National Security Strategy (2017)[63] and its four pillars: (1) Protect the American people, the homeland, and the American way of life; (2) Promote American prosperity; (3) Preserve peace through strength; and (4) Advance American influence. The U.S. Government will prioritize the transportation sector as one of seven sectors to prioritize cyber risk-reduction activities. The U.S. Government will prioritize emerging technologies critical to economic growth and security, such as AV technologies. The U.S. Government will also promote and protect its National Security Innovation Base, defined as the American network of knowledge, capabilities, and people that turns ideas into innovations, transforms discoveries into successful commercial products and companies, and protects and enhances the American way of life.

58   National Institute of Standards and Technology. National Cybersecurity Center of Excellence. https://www.nccoe.nist.gov/

59   NIST Cybersecurity Framework. https://www.nist.gov/cyberframework

60   NIST 8259 draft publication for Core Cybersecurity Feature Baseline for Securable Internet of Things (IoT) Devices: A Starting Point for IoT Device Manufacturers. https://nvlpubs.nist.gov/nistpubs/ir/2019/NIST.IR.8259-draft.pdf

61   NISTIR 8228 Considerations for Managing Internet of Things (IoT) Cybersecurity and Privacy Risks. Page IV. https://nvlpubs.nist.gov/nistpubs/ir/2019/NIST.IR.8228.pdf

62   https://www.whitehouse.gov/nsc/

63   National Security Strategy of the United States of America. https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf

Infrastructure

Across the U.S. Government, many agencies are invested in diverse infrastructure R&D that will allow for American entrepreneurship and innovation. This research explores both utilizing current infrastructure and exploring new infrastructure to maximize the potential of AVs.

Department of Energy

DOE's national laboratories have access to the world's fastest HPC facilities, as well as expertise in AI and big data analytics. DOE has developed high-performance computing infrastructure for modeling and simulating AV software for perception, planning, and control. DOE's work in this area related to automation falls into two main areas: (1) efforts to optimize transportation systems to reduce congestion and improve throughput, and (2) developing improved AI or computing needed for AVs.

As an application of this computing infrastructure, Oak Ridge National Lab is working closely with a vehicle manufacturer to use advanced AI software (e.g., Multi-node Evolutionary Neural Networks for Deep Learning—MENNDL)[64] to reduce the development time and improve the performance of AV software for perception, planning, and control.

The DOE System Modeling for Accelerated Research in Transportation[65] (SMART Mobility) national laboratory consortium was created in 2016 to produce new knowledge, insights, and understanding about the future of mobility. The consortium is developing modeling and simulation tools that scale from the vehicle/traveler level to the city/regional level, and incorporates new and emerging mobility technologies and services. These modeling efforts include estimates of land use changes and charging infrastructure demand using UrbanSimw and EVI-Pro through an iterative closed-loop simulation with regional agent-based models (POLARIS and BEAM). The agent-based models provide information on travel time, cost, distance, and other factors by travel mode and time-of-day that are then utilized to simulate future population shifts, employment, market penetration of electric vehicles, and electric vehicle charging demand.

The research community, local governments and transportation planners, and other Federal agencies can use the tools to understand the outcomes of future mobility scenarios in terms of energy consumption, affordability, time and convenience, and access to opportunities. The first phase of SMART Mobility will be completed at the end of FY 2019 with a comprehensive set of modeling and simulation tools that, in combination, can fully model current and potential future states of a large metropolitan area. A broad range of new mobility technologies and services, including different levels and effectiveness of automation, will be included.

Department of Transportation

FHWA is responsible for providing stewardship over the construction, maintenance, and preservation of the Nation's highways, bridges, and tunnels. Through research[66] and technical assistance, the FHWA supports its partners in Federal, State, and local agencies to accelerate innovation and improve safety and mobility. FHWA facilitates uniformity in traffic control devices through its MUTCD.

As of early 2019, there are 89 connected vehicle deployments[67] that are either planned or deployed around the country, and the number is growing rapidly. Based in part on the insights afforded by FHWA's National Dialogue, FHWA will

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64   https://www.ornl.gov/division/csmd/projects/multi-node-evolutionary-neural-networks-deep-learning-menndl

65   https://www.energy.gov/eere/vehicles/energy-efficient-mobility-systems

66   https://highways.dot.gov/research/research-and-development/research-programs

67   Map of Connected Vehicle (CV) Deployments in the U.S. https://www.transportation.gov//sites/dot.gov/files/docs/research-and-technology/345996/cv-deployment-locationsusamapnodetails-2.pdf

facilitate the development of a national roadway automation integration readiness strategy. The strategy will define a flexible framework for coordinated planning among State and local transportation agencies, and with ADS developers.

FHWA—in partnership with FMCSA—awarded contracts to three teams to develop detailed proposals for a field test of truck platoons. The field tests will collect technical and operational data related to the vehicles, environment, and drivers to assess safety, efficiency, and mobility impacts of truck platoons on the transportation system. In addition, FHWA is conducting research to better understand the impacts truck platoons may have on roadway infrastructure, e.g., pavement and bridges.

FHWA—in coordination with the ITS JPO—is supporting a Work Zone Data Exchange[68] (WZDx) initiative for AVs. Accurate and up-to-date information about dynamic conditions occurring on the roads—such as work zones—can help AVs navigate safely and efficiently. The WZDx initiative seeks to set the foundation for development of other data set that will facilitate AV integration in to our Nation's roadway systems.

Spectrum and Connectivity

As AVs become more prevalent on American roads, access to spectrum cooperation and connectivity may become increasingly important. Therefore, the U.S. Government will focus on the use and management on this important spectrum.

Department of Energy

DOE-sponsored research has shown that in addition to safety benefits, connectivity can be a significant enabler to reducing congestion on our roadways. Congestion increases fuel consumption and comes at a significant economic cost to businesses, causing delays for consumers, increasing emissions, and contributing to fatalities and injuries. Connectivity also enables vehicles to drive more efficiently in a range of settings—including on freeways, arterial roads, when merging, and at intersections—saving significant amounts of fuel/energy. These benefits require complementary technologies such as vehicle-to-vehicle and vehicle-to-infrastructure connectivity that has very high bandwidth and low latency.

Department of Homeland Security

In July 2019, DHS's CISA released a risk and resilience note providing an overview of risks introduced by 5G adoption in the United States.[69] It highlights a number of risk management mitigations including ensuring robust security capabilities for 5G applications and services.

Department of Transportation

USDOT is collaborating with public and private partners, including State and local governments, vehicle and device manufacturers, and academia, to advance connected vehicle development and implementation. ITS JPO is working with modal administrations within USDOT to coordinate and foster the advancement of connected vehicle technologies. Significant progress has already been made in testing connected vehicle technologies and applications in real-world situations. USDOT's Connected Vehicle Safety Pilot Program[70] provided large amounts of valuable data on how these technologies, applications, and systems perform in the hands of everyday drivers. USDOT strongly supports preserving the ability for transportation safety applications to function in the 5.9GHz Safety Band.[71]

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68   https://github.com/usdot-jpo-ode/jpo-wzdx/blob/master/README.md

69   https://www.dhs.gov/sites/default/files/publications/19_0731_cisa_5th-generation-mobile-networks-overview.pdf

70   https://www.its.dot.gov/pilots/pilots_overview.htm

71   https://www.transportation.gov/content/safety-band

Federal Communications Commission and National Telecommunications and Information Administration

The FCC is the United States' primary authority for communications law, regulation, and technological innovation and is responsible for management of the electromagnetic spectrum (i.e., the radio airwaves) that is vital to nearly all facets of the modern economy.

The FCC works with colleagues in the National Telecommunications and Information Administration (NTIA), a part of the Department of Commerce (DOC), on spectrum matters affecting Federal Government users. NTIA is the executive branch agency that is principally responsible for advising the President on telecommunications and information policy issues. NTIA's programs and policymaking focus largely on expanding broadband internet access and adoption in America, expanding the use of spectrum by all users, and ensuring that the internet remains an engine for continued innovation and economic growth.

Many of the technologies central to enabling vehicle function, added-value features, and driver comfort require spectrum access to function. These include, for example, radars and the transmission of data from cameras used for safety and driver assistance features; GPS for navigation; toll tags, tire pressure monitors, garage door openers, and key fobs that aid and augment the driving experience; stolen vehicle recovery systems that help locate and recover vehicles; and radios (satellite and terrestrial) and Bluetooth/Wi-Fi connections that provide entertainment and in-cabin connectivity.

Today's vehicles incorporate or make use of a wide range and increasing number of spectrum-dependent technologies. They must have the capability to integrate a multitude of services and devices to operate most effectively and provide the functions and features that drivers want. Areas where the FCC has seen particular interest include radar technologies (such as those in the 76-81 GHz band that is reserved for vehicular applications), vehicle-to-vehicle and vehicle-to-infrastructure communications protocols and increasingly widespread network connectivity that will be enabled by ubiquitous terrestrial 5G systems. Through its general spectrum management policies and rules, the FCC creates an environment that permits the development and deployment of communications technologies, including those used in vehicles, while leaving it to innovators to create and integrate those technologies.

The FCC focuses primarily on preventing harmful interference between competing uses while relying on flexible rules that enable innovative devices and services to develop and deploy. This core principle is well suited to the fast-moving world of AV technologies. We expect that developers of technologies and applications will draw increasingly on the different spectrum authorization mechanisms that the FCC offers—whether through use of various frequencies that are assigned to specific users through licensing or for use by the general public without a specific license, or a combination of both. The FCC will continue efforts to ensure that its policies promote the type of modern approach to spectrum management that affords maximum flexibility to all innovators—including those who are working to advance AVs in the United States.

NTIA's Institute for Telecommunication Sciences (ITS) staff monitor C-V2X and 5G communications technology specifications development activities through observation at 3GPP Working Group meetings and plenary sessions at international or domestic settings to identify how each input might affect transportation. This includes the identification of significant shifts to specifications that arise due to technology innovations that come through the working groups. The 5G use cases 3GPP is targeting are focused on remote driving, automated driving, sensing, and platooning.

National Institute of Standards and Technology

NIST, part of the Department of Commerce, advances industrial competitiveness by furthering measurement science, standards, and technology in ways that enhance economic security and improve quality of life. The National Advanced Spectrum and Communications Test Network (NASCTN) is a multi-agency partnership headquartered at and led by NIST that organizes a national network of Federal, academic, and commercial test facilities to provide testing, modeling, and analysis necessary to develop and deploy spectrum-sharing technologies and inform future spectrum policy and

regulations. NASCTN's mission is to provide robust test processes and validated measurement data necessary to increase access to the spectrum by both Federal agencies and non-Federal spectrum users.

NIST also conducts metrology research related to AVs, including the development of measurement techniques, test protocols, calibration services, modeling and simulation techniques that will help with predicting and testing certain connectivity aspects, such as signal propagation, wireless co-existence, and antenna performance as well as minimize radio interference in crowded airwaves. These tools are critical for reliable communications among connected vehicles, roadway infrastructure, and central control centers, and thus generate confidence in the safety of connected vehicles.

Economics and Workforce Research

Complementary to the U.S. Government's role in advancing AV innovation and technology, the DOC, HHS, DOL, and USDOT are collaborating in support of research on the Impact of Automated Vehicle Technologies on (Professional Drivers) Workforce.[72]

DOL's Bureau of Labor Statistics (BLS) is currently conducting a literature review that summarizes and synthesizes economic theory on the interaction between labor and capital in the workplace and how this is affected by new technologies such as automation, digitization, and AI. This review will be the basis for developing a comprehensive list of constructs that need to be measured to allow researchers to determine the effect of these new technologies on the workforce.

FTA is researching economics and workforce considerations associated with AVs, including:

- Analyzing labor and workforce-related considerations with transit bus automation for non-driving tasks of bus operations (e.g., management of bus yard operations).
- Researching the availability and costs of automation-related systems and products with an emphasis on the U.S. domestic bus market.
- Developing methods and tools that transit agencies can use to assess the business case for investing in bus automation.
- Studying the potential impacts of automation-related changes to transit service patterns, such as an increase in point-to-point service using smaller vehicles.

B. U.S. Government Enabling Activities in the Automated Vehicle Sector

The U.S. Government is actively pursuing a range of regulatory and non-regulatory activities that will enable the adoption of AVs, with the overall goal to facilitate the safe and full integration of AV technologies into the national surface transportation system. Integration would help realize the great potential AV technologies have for enhancing public safety, making systems more efficient, and facilitating economic vitality.

Fostering Collaboration with Government

Outreach to Non-Federal Stakeholders

The Federal Government uses the Federal Register[73] to make it easier for citizens and communities to understand the regulatory process and to participate in Government decision-making. Many Federal agencies are also reaching out to stakeholders in State, local, tribal and territorial governments, in industry, and elsewhere as part of the activities described above. These outreach activities are often conducted in collaboration with multiple Federal entities.

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72   https://www.transportation.gov/av/workforce

73   https://www.federalregister.gov/

For example, through a series of listening sessions and online dialogues, most co-hosted with USDOT, the DOL's Office of Disability Employment Policy (ODEP) has engaged Federal agencies, academic researchers, original equipment manufacturers (OEMs), TNCs, State legislators, and disability advocates in a conversation about the role of the Federal Government in ensuring that AVs will be accessible to persons with mobility, sensory, and cognitive disabilities once deployed. The data from these events and meetings will be used in the development of Federal and State policy recommendations.

DOE's SMART Mobility Lab Consortium has convened an external Executive Advisory Board of 12 prominent experts in a broad range of sectors impacting AVs, including manufacturing, transit, delivery, mobility, regulatory, technology, academia, and non-governmental organizations. The board advises the SMART Consortium, providing feedback on the Consortium's research portfolio, advising on industry needs and trends, and making recommendations for improving the quality, relevance, and impact of the SMART Mobility Consortium's research and development.

USDOT has lead numerous public events and published various public notices on the topic of AV to ensure the widest possible outreach to non-Federal stakeholders. These public events[74] and public notices[75] are compiled at an USDOT AV central webpage. [76]

USDOT has supported industry efforts to ensure public access to accurate and clear information about ADAS and ADS can encourage their safe use and adoption. In July 2019, USDOT brought together a diverse group of stakeholders[77] to discuss current issues around communication, terminology, and language regarding AVs and how it influences consumer perception of AV technologies. Additionally, during the Automated Vehicle Symposium, also in July 2019, a panel discussion was held on *Steps Towards Putting the Public Safety Community at Ease with Advanced Vehicle Technologies*.[78]

Cities and local communities manage much of the transportation system within which AVs will operate. They have been asking how they should prepare for this new technology. EPA and DOE have been engaging with these communities to understand their needs and develop tools and information they can use to help consider potential environmental impacts of increasing AV operation.

The FTC and NHTSA co-hosted a public workshop in 2017[79] to explore privacy and security issues related to AVs. FTC staff issued a paper summarizing the important themes from the panelist discussions during the full-day workshop.

NIST hosted a workshop on Consensus Safety Measurement Methodologies for ADS-Equipped Vehicles[80] in June 2019 in collaboration with USDOT. This workshop's objectives was to identify and develop criteria that should be satisfied for any approach to automated vehicle decision-making safety, to review existing or proposed methodologies for the establishing safety requirements and safety measurement approaches, to identify gaps and key challenges, and to explore opportunities for progress, including identifying alternative methodologies that should be considered. The workshop report[81] can be found through NIST Special Publication 1900-320.

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74   https://www.transportation.gov/av/events

75   https://www.transportation.gov/av/publicnotices

76   https://www.transportation.gov/AV

77   www.transportation.gov/av/communications

78   AVS 2019: Steps Toward Putting Public Safety Community at Ease with Advanced Vehicle Technologies, https://youtu.be/oeh6u7JqgrY

79   https://www.ftc.gov/system/files/documents/reports/connected-cars-workshop-federal-trade-commission-staff-perspective/staff_perspective_connected_cars_0.pdf

80   https://www.nist.gov/news-events/events/2019/06/consensus-safety-measurement-methodologies-ads-equipped-vehicles

81   https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1900-320.pdf

Trans–Federal Coordination

In addition to working with non-Federal stakeholders, several agencies lead activities intended to foster interagency coordination and the development of unified Federal approaches to AVs. For example, The General Services Administration's (GSA) Office of Government Policy promotes interagency collaboration through various committees and councils, including the Federal Fleet Policy Council[82] (FEDFLEET). FEDFLEET provides a mechanism for coordinating Federal vehicle management programs and policies, and analyzing the impact of current and proposed regulations, laws, Executive orders, and international agreements. It is composed of representatives of Federal agencies that operate Federal motor vehicle fleets.

Voluntary Consensus Standards and Other Guidance

The U.S. Government will promote voluntary consensus standards as a mechanism to encourage increased investment and bring cost-effective innovation to the market more quickly. Voluntary consensus standards can be validated by testing protocols, are supported by private-sector conformity assessment schemes, and offer flexibility and responsiveness to the rapid pace of innovation. Furthermore, many SDOs utilize existing processes that allow industry participation in the development of voluntary consensus standards.

Department of Health and Human Services

In other voluntary standards-setting efforts, NIOSH served on the subcommittee convened by the American Society of Safety Professionals (ASSP) and National Safety Council, which developed the American National Standards Institute (ANSI)/ASSP Z15.3 technical report, *Management Practices for the Safe Operation of Partially and Fully Automated Motor Vehicles*.[83] The report is intended to help organizations develop policies, procedures, and management processes to control risks associated with the operation of AVs.

Department of Homeland Security

In another Federal collaboration, in March 2019, DHS's U.S. Customs and Border Protection (CBP) authored six vehicle cybersecurity threat scenarios for inclusion in USDOT's Volpe Center's upcoming "Government Fleet Manager's Guide to Medium and Heavy Truck Cybersecurity Best Practices" that have applicability to AVs. CBP also collaborates with USDOT through its participation in the Government Cybersecurity Vehicle Steering Committee and the Commercial Truck Cybersecurity Working Group.

Department of Transportation

In 2017, NHTSA provided voluntary guidance through *Automated Driving Systems 2.0: A Vision for Safety* (ADS 2.0). ADS 2.0[84] revised and streamlined to emphasize the voluntary nature of the guidelines–no compliance requirement or enforcement mechanism. ADS 2.0 focuses on the New Operating Guidance on SAE Level 3 and above Automated Driving Systems. Additionally, ADS 2.0 clarifies that assessments are not subject to Federal approval and that there is no waiting period or delay to begin testing or deployment. Furthermore, it revises priority safety elements, focusing on 12 aspects that are ready for implementation in the near term. Elements involving privacy, ethical considerations, registration, and the sharing of data beyond crash data remain important and are areas for further discussion and research.

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82   https://www.gsa.gov/policy-regulations/policy/vehicle-management-policy/-councils/federal-fleet-policy-council-fedfleet-enrollment

83   https://www.assp.org/news-and-articles/2019/06/25/automated-vehicles-addressing-challenges-and-opportunities

84   https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf

In 2018, USDOT presented further voluntary guidance for AV development across all surface modes through *Preparing for the Future of Transportation: Automated Vehicles 3.0* (AV 3.0).[85] AV 3.0—developed with input from a diverse set of stakeholder engagements throughout the Nation—builds upon ADS 2.0, further expanding the scope to all surface on-road transportation systems. AV 3.0 is structured around three key areas: 1) Advancing multi-modal safety, 2) Reducing policy uncertainty, and 3) Outlining a process for working with USDOT.

USDOT's Volpe National Transportation Systems Center and NCCoE collaborated with three Connected Vehicle (CV) Pilots (Wyoming, New York, and Florida) and the University of Michigan Transportation Research Institute (UMTRI) to develop the CV Pilot Cybersecurity Framework Profile and conduct a privacy risk analysis. This included applying the NIST Privacy Risk Assessment Methodology (PRAM) to UMTRI's Ann Arbor Connected Vehicle Test Environment (AACVTE) research implementation. This research resulted in a Cybersecurity Framework Profile in 2018.[86]

National Institute of Standards and Technology

NIST supports the development and use of measurement science in voluntary consensus standards, conformity assessment, and related tools. This work is enabling the development, deployment and assurance of ADS. NIST's Cyber-Physical Systems Program is developing methods for measuring AV trustworthiness (safety, security, resilience, reliability, and privacy) to support performance measurements for ADS. The goal is to enhance existing methods for validating vehicle trustworthiness—for example to support new modeling and simulation capabilities in ADS-equipped vehicles.

Regulatory Authority and Automated Vehicles

Department of Transportation

USDOT's modal administrations regulate aspects of AVs. For more details, please refer to the *Safety, and Security and Cybersecurity* sections, above.

General Services Administration

The GSA develops Federal motor vehicle management regulations, issues guidance on Federal fleet operations, and provides reports on the Federal fleet, which was estimated as 644,545 non-tactical vehicles in FY2018.[87] Federal regulations on fleet management include requirements regarding agencies' acquisition, use, and disposal of motor vehicles, and cover home-to-work transportation, among other requirements. The GSA Office of Government-wide Policy (OGP) also issues guidance to help agencies manage their motor vehicle fleets effectively. Guidance includes bulletins on various aspects of fleet management, including fleet management information systems, and methodologies for determining the optimal fleet size for agency fleets. GSA OGP will consider guidance for how to integrate AVs into Federal fleets.

Office of Management and Budget

The Office of Information and Regulatory Affairs (OIRA)[88] is a Federal office established by Congress within the Office of Management and Budget (OMB), which is an agency within the Executive Office of the President. OIRA reviews draft proposed and final regulations under Executive Order 12866 from Federal agencies, including USDOT. OIRA also reviews Federal agencies' collections of information from the public under the Paperwork Reduction Act, and develops and

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85   https://www.transportation.gov/av/3

86   https://www.its.dot.gov/presentations/trb2018/TRB_NIST_CSF_Project.pdf

87   https://www.gsa.gov/policy-regulations/policy/vehicle-management-policy/federal-fleet-report

88   https://www.whitehouse.gov/omb/information-regulatory-affairs/

oversees the implementation of government-wide policies in the areas of information policy, privacy, and statistical and science policy.

Taxation, Trade, and Intellectual Property

Tax Incentives for AV Research

To ensure American leadership and growth in AV technology, the U.S. Government offers attractive tax incentives for AV innovators and entrepreneurs to conduct AV R&D in the United States.

Department of the Treasury

The Department of the Treasury and the Internal Revenue Service (IRS) promote innovation in the AV industry through publication of administrative rules and other guidance on current Federal income tax law incentives. Taxpayers can immediately expense the cost of research and developmental activities that are experimental in nature with the purpose of eliminating uncertainty when developing or improving a product. Qualifying activities may include developing a patent and inventing technologies to improve the fuel efficiency of AVs or to enhance driver experiences with AVs. A Federal income tax credit of up to 20% of the eligible spending for research and developmental activities is also available. Taxpayers may also immediately expense the cost of qualified business property purchased after September 27, 2017 and before January 1, 2023. Additionally, AV innovators can immediately expense the cost of purchasing new or used manufacturing equipment, the AVs they operate or lease, and computer hardware and software. Understanding that AV companies may have more operating expenses than revenues in their early years of business, the tax code allows the carryover of net operating losses to offset 80% of taxable income generated in future years. The indefinite carryover of net operating losses to future years ensures the benefit of the operating expenses will be utilized when a company generates profits. Taxpayers may immediately expense start-up and organizational costs of up to $5,000 (for each category) in the year the business begins operations. The $5,000 deduction is reduced by the amount of the start-up or organizational costs that exceeds $50,000; the remainder of the costs may be deducted over a 180-month period. The start-up costs include any amounts paid in connection with creating an active trade or business or investigating the creation or acquisition of an active trade or business. Organizational costs include the cost of creating a corporation or partnership.

Tax incentives are available to promote domestic manufacturing for export, including AVs. U.S. corporations have a reduced U.S. Federal income tax rate through a 37.5% deduction for their directly earned foreign-derived intangible income (FDII) for the 2018 through 2025 tax years (reduced to 21.875% thereafter). The FDII deduction is akin to an *Innovation Box* tax regime designed to incentivize American corporations to maintain U.S.-based operations and intangibles while exporting more goods and services to foreign markets. The FDII deduction is provided for all export-related income in excess of a fixed return on tangible assets to incentivize all U.S. export-based operations. An "interest charge domestic international sales corporation" (IC-DISC) can be utilized to eliminate the Federal corporate income tax on foreign sales of tangible goods that are manufactured or produced in the United States. The earnings from the IC-DISC are taxed only when they are distributed to its shareholders, and usually at a 20% tax rate for qualified dividends. Unlike the FDII deduction, the IC-DISC rules require a substantial amount of U.S. activity in manufacturing or producing the sold good, and thus this regime specifically incentivizes U.S. production for export.

Trade Promotion Related to AVs

The U.S. Government will ensure American AV innovators have fair access to foreign markets. The U.S. Government will seek rules, both at home and abroad, that are as performance-based and non-prescriptive as possible and do not discriminate against U.S. technologies, products, or services.

Department of State

With respect to international trade promotion for AVs, the mission of the Department of State's Bureau of Economic and Business Affairs is to advance America's prosperity and other national interests by supporting American business overseas; fostering good governance through economic transparency, accountability and sustainability; and fostering inclusive economic growth and prosperity. The Bureau of Economic and Business Affairs is the Department's lead bureau on economic engagement, international trade, transportation and telecommunications policy, and commercial advocacy.

Department of Transportation

The USDOT's Office of International Transportation and Trade provides departmental leadership on international multimodal transportation and trade policies and initiatives, including technical assistance and cooperation programs, as well as trade facilitation and advocacy activities. The office provides the Secretary of Transportation with information and analysis to aid in developing international transportation policy and other international responsibilities. These include exchanging technical information with foreign counterparts, facilitating open and liberalized global transportation markets, reducing technical barriers to trade in the transportation sector and resolving market access issues created by other countries' standards and regulations. The office also represents the Department in global transportation organizations and trade fora. It conducts in-depth analysis and provides policy recommendations to address emerging and ongoing international transportation issues, and in consultation with the Department's operating administrations, it also develops the Department's positions on the negotiation or implementation of international trade agreement provisions affecting transport.

International Trade Administration

The International Trade Administration (ITA) within the United States Department of Commerce promotes United States exports of nonagricultural U.S. services and goods. ITA is working with U.S. regulators and industry to collaborate with foreign partners while the technology is still being developed to attain convergent technical specifications and requirements that enable trade and continued U.S. exports because regulatory divergence acts to unnecessarily raise costs while also restricting road vehicle trade. ITA has found that it is much easier to achieve convergent standards and regulations if work begins prior to their initial development to bridge differences prior to investments being made. ITA can also work with smaller technology developers to both find foreign buyers and to help protect intellectual property.

Office of Trade and Manufacturing Policy

The Office of Trade and Manufacturing Policy (OTMP) was created by Executive order within the Executive Office of the President (EOP) in 2017.[89] One of OTMP's primary roles is to support the ability of the United States to manufacture products, particularly technologically advanced products such as AVs, domestically. This can be done through a variety of policy options, including trade policies and government procurement programs (such as "Buy American" preference programs). OTMP has a particular focus on the nexus of economic and national security issues, and works closely with the DoD and other agencies on defense procurement policies, which may include purchase commitments and loan guarantees for production capabilities with critical defense implications.

Office of the U.S. Trade Representative

The Office of the U.S. Trade Representative[90] (USTR) is responsible for developing and coordinating U.S. international trade, commodity, and direct investment policy, and overseeing trade negotiations with other countries. USTR's role

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89   https://www.whitehouse.gov/presidential-actions/presidential-executive-order-establishment-office-trade-manufacturing-policy/

90   https://ustr.gov/

in transportation automation is to engage with trading partners as appropriate to pursue fair and reciprocal market access abroad for U.S.-developed and U.S.-manufactured transportation automation-related technologies, vehicles, and services. This includes protecting U.S. transportation automation-related intellectual property internationally and working with trading partners to shape regulatory environments abroad so that they do not discriminate against U.S. technologies, products, or services.

Intellectual Property Protection

The U.S. Government will continue to promote sensitive emerging technologies through the protection and enforcement of intellectual property rights—patents, trademarks, copyrights, and trade secrets—technical data, and sensitive proprietary communications and will continue to work to prevent other nations from gaining unfair advantage at the expense of American innovators.

Office of the U.S. Intellectual Property Enforcement Coordinator

The Office of the U.S. Intellectual Property Enforcement Coordinator (IPEC)[91] in the Executive Office of the President coordinates and develops policy and strategy to promote innovation and creativity, and ensures effective intellectual property protection and enforcement, domestically and abroad, with respect to all forms of intellectual property. As is the case for other critical technologies, AV technology will rely heavily on intellectual property in the form of patents, trade secrets, copyrighted software, and trademarked goods. For the United States to successfully adopt this technology, the intellectual property of American innovators—and the safety of the American public—will both need to be protected. In this regard, establishing and maintaining secure supply chains for AV technologies will be essential for protecting safety, security, and intellectual property.

Department of Justice

DOJ, through the Computer Crime and Intellectual Property Section (CCIPS) in its Criminal Division, as well as through its National Security Division, executes national strategies in combating intellectual property crimes—including those involving AV technology—worldwide. DOJ attorneys prevent, investigate, and prosecute intellectual crimes by working with other government agencies, the private sector, academic institutions, and foreign counterparts. These attorneys work to improve the domestic and international infrastructure (legal, technological, and operational) to pursue criminals most effectively. They also regularly run complex investigations, resolve unique legal and investigative issues raised by emerging computer and telecommunications technologies; litigate cases; provide litigation support to other prosecutors; train Federal, State, and local law enforcement personnel; comment on and propose legislation; and initiate and participate in international efforts to combat computer and intellectual property crime.

United States Patent and Trademark Office

The United States Patent and Trademark Office (USPTO) is the Federal agency responsible for issuing patents and registering trademarks.[92] The agency's mission is to foster innovation, competitiveness, and economic growth, domestically and abroad. It does this through a three-pronged approach:

- delivering high quality and timely examinations of patent and trademark applications;
- guiding domestic and international intellectual property policy; and
- delivering IP information and education worldwide.

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91   https://www.whitehouse.gov/omb/office-u-s-intellectual-property-enforcement-coordinator-ipec/

92   USPTO provides access to patent and trademark information through its searchable databases, which along with other useful information may be found at: https://www.uspto.gov/learning-and-resources/inventors-entrepreneurs-resources. To facilitate searching patent documents, they are indexed or classified into classes and subclasses. For automated vehicles, the most relevant international classifications are: B60W, B60T, G01S, G05D, and G08G.

Innovators and entrepreneurs in the AV field should be aware of USPTO, as securing a patent, trademark, or both serves not only to afford them important legal rights, but also to help preserve the United States' technological edge, which is key to our current and future competitiveness in AV technologies. In particular, a patent grants a property right to an inventor providing the exclusive right to exclude others from "making, using, offering for sale, or selling" an invention in the United States, or for importing a patent-protected invention into the United States. Generally, patent rights for an invention will last for a term of 20 years from the date on which the application was filed in the United States. A trademark is a word, name, symbol, or device that is used in trade in goods to indicate the source of the goods and to distinguish them from the goods of others. Trademark rights may be used to prevent others from using a confusingly similar mark, but not to prevent others from making the same goods or from selling the same goods or services under a clearly different mark. Trademarks that are used in interstate or foreign commerce may be registered with USPTO. U.S. patents and trademarks are open to applicants around the world, and provide the aforementioned rights within the borders of the United States.

Environmental Quality

The U.S. Government will focus on opportunities to improve transportation system-level efficiency, while avoiding negative transportation system-level environmental impacts from AV technologies.

Council on Environmental Quality

Council on Environment Quality (CEQ)[93] was created by the National Environmental Policy Act (NEPA) and is a Federal agency located within the Executive Office of the President. CEQ oversees NEPA implementation through regulations and guidance. The development and implementation of AV-related technology and infrastructure may require Federal permits or other authorizations that would trigger a NEPA analysis. CEQ would support Federal agencies as they undertake the NEPA process for AV-related projects.

CEQ also houses the Office of Federal Sustainability[94] (OFS), which coordinates policy across the Federal Government to promote energy and environmental sustainability in Federal operations. OFS implements Executive Order 13834 which directs Federal agencies to manage their operations to optimize energy and environmental performance, reduce waste, and cuts costs, which includes vehicles. In order to meet statutory requirements for petroleum reductions and optimize efficiency, some agencies have decided to implement telematics as well as EV infrastructure to manage their fleets. The development and implementation of AV-related technology and infrastructure would require consideration of the existing use of telematics and electric vehicles in the Federal fleet to ensure coordination and interoperability. OFS assists Federal agencies that decide to use AV technology to meet their statutory requirements related to vehicles in a manner that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the environment.

Environmental Protection Agency

As the Federal Government's lead regulator for clean air and other environmental programs, EPA is charged with developing rules and policies to ensure its public health goals are met. All vehicles offered for sale in the U.S., for example, must receive an EPA certificate of conformity before introduction to the market. Automobile manufacturers must demonstrate compliance with environmental regulations over a wide range of operating conditions and test procedures.

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93   https://www.whitehouse.gov/ceq/

94   https://www.sustainability.gov/

The introduction of ADS technologies could modify how these vehicles operate under these test conditions requiring updates in testing to provide a complete environmental profile. EPA's National Vehicle and Fuel Emissions Laboratory has begun to monitor, measure, and assess ADS and ADAS vehicle technology improvements and innovations, so that policy actions targeted toward ADS and ADAS performance that impact fuel economy (as regulated by NHTSA), energy consumption, tailpipe emissions, and vehicle activity profiles account for and have the latest, best technical information available.

EPA provides the Federal Government's official measured testing for tailpipe emission, fuel economy, and consumer information. As AVs come to market those tests must accurately account for ADS and ADAS, which may mean developing and employing special test methods. As appropriate, EPA will update vehicle testing regulations to address unique AV operational considerations that may arise. As data become known, EPA will also incorporate into vehicle performance models and policy tools the benefits (reductions) or dis-benefits (increases) in emissions and energy consumption associated with ADS and ADAS performance on auto-emissions compliance requirements.

Competition, Privacy, and Market Transparency

The U.S. Government will ensure the security of data and the public's privacy as AV technologies are designed and integrated. The U.S. Government will enforce existing laws to ensure entities do not make deceptive claims or mislead the public about AVs technologies or publicly traded AV technology companies.

Department of Justice

The DOJ is the executive branch agency charged with promoting and protecting competition for the benefit of American consumers. DOJ enforces the antitrust laws so that markets for innovative technologies, such as those related to AVs, are dynamic, competitive, and free of collusion. For example, DOJ is charged with prosecuting criminal antitrust conduct, such as price fixing, bid rigging, and market allocation agreements that have no economic benefit and harm competition and innovation in dynamic markets. In addition, DOJ interacts with industry, including as to the role of antitrust enforcement to promote innovation in the standard-setting context, emphasizing open, balanced, and competitive processes. Free market competition enabled by the DOJ's enforcement will support innovation and consumer welfare in emerging markets for automated vehicles.

Federal Trade Commission

The FTC is the Nation's principal consumer protection agency. The FTC enforces Section 5 of the FTC Act, 15 U.S.C. § 45, which prohibits unfair or deceptive acts or practices in or affecting commerce. In the AV context, the FTC could, for example, use its Section 5 authority to take action against a company that makes deceptive claims about the performance capabilities or limitations of AVs or their component systems. The FTC could also use its Section 5 authority to take action against a company that makes deceptive claims with respect to consumer data that is collected, used, or maintained in connection with automated or connected vehicles or that has inadequate privacy or security practices. The FTC uses a variety of measures—such as policy initiatives, including issuing reports or holding workshops, and consumer and business education efforts—to protect consumers.

Securities and Exchange Commission

The U.S. Securities and Exchange Commission's (SEC) mission is to protect investors, maintain fair, orderly, and efficient markets, and facilitate capital formation. The laws and rules that govern the securities industry in the United States derive from a simple and straightforward concept: all investors, whether large institutions or private individuals, should have access to certain basic facts about an investment prior to buying it, and so long as they hold it. To achieve this, the SEC requires public companies (e.g., publicly traded AV technology companies) to disclose meaningful financial and other

information to the public. This provides a common pool of knowledge for all investors to use to judge for themselves whether to buy, sell, or hold a particular security. Only through the steady flow of timely, comprehensive, and accurate information can people make sound investment decisions. The SEC oversees the key participants in the securities world, including securities exchanges, securities brokers and dealers, investment advisors, and mutual funds. Here the SEC is concerned primarily with promoting the disclosure of important market-related information, maintaining fair dealing, and protecting against fraud. Crucial to the SEC's effectiveness in each of these areas is its enforcement authority. Typical infractions SEC may pursue include insider trading, accounting fraud, and providing false or misleading information about securities and the companies that issue them.

C. U.S. Government Resources for Automated Vehicle Sector Innovators

The role of the U.S. Government is to create an environment in which innovators can iterate new technologies to meet market needs. As such, the U.S. Government has resources available to support AV innovators.

Federal Laboratories Test Beds and Technology Transfer

Leveraging the Federal Government's investments in R&D for societal benefit necessarily involves the transfer of technologies created with Federal money to the open market. The Federal Laboratory Consortium for Technology Transfer (FLC) is a nationwide network of over 300 Federal laboratories, agencies, and research centers that fosters commercialization best practice strategies and opportunities for accelerating Federal technologies from out of the laboratories and into the marketplace.[95] The FLC's mission is to promote, educate, and facilitate Federal technology transfer (T2) among its member laboratories and institutions so they can reach their commercialization goals, and create social and economic impacts with new innovative technologies. One of the FLC's growing service initiatives is the Technology Focus Area (TFA) program. TFA provides an annual spotlight on a specific technology that addresses a public need and supports Federal laboratories' research and technology transfer missions as well as government-wide economic development goals. The TFA for Automated Systems (AS) program is designed to facilitate commercialization activity by cultivating valuable connections between Federal laboratories and innovators. Through the TFA AS program, the FLC provides innovators with a dedicated online platform for identifying relevant AS Federal laboratory technologies, intellectual property, programs, and expertise. The program serves as a pathway of introduction for innovators to access the Federal resources and contacts they need to establish T2 relationships and agreements for accelerating their R&D.

Small Business Administration Resources

The U.S. Small Business Administration (SBA) helps Americans start, build, and grow businesses. It provides access to capital through an array of financing mechanisms, free counseling and low-cost training for both new entrepreneurs and established small businesses, facilitates access to contracts with Federal agencies and departments, and advocates on behalf of small businesses with government policy makers. SBA offers detailed guides for planning, launching, managing, and growing a business[96] as well as District Offices that can provide assistance focused on particular local conditions.[97]

SBA provides policy guidance and leadership for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs,[98] coordinating across 11 Federal agencies and departments to help innovative

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95   https://www.federallabs.org/flcbusiness

96   https://www.sba.gov/business-guide

97   https://www.sba.gov/local-assistance

98   http://www.sbir.gov

small businesses meet Federal R&D needs and commercialize those innovations. SBA assists small businesses interested in pursuing SBIR/STTR opportunities across the Federal Government through outreach, training resources, and by helping entrepreneurs connect to local resources.

SBA offers a wide variety of courses designed to help entrepreneurs research, plan, and turn ideas into businesses.[99] Training includes the Emerging Leaders Initiative, an intensive program that provides free entrepreneurship education and training for executives of small, poised-for-growth companies that are potential job creators in America's underserved cities.[100] The NSF I-Corps™ program prepares scientists and engineers to extend their focus beyond the university laboratory and accelerates the economic and societal benefits of NSF-funded, basic-research projects that are ready to move toward commercialization.

United States Patent and Trademark Office's Inventor and Entrepreneur Resources

USPTO maintains a website[101] linking to resources related to protecting intellectual property (IP) and ensuring innovators understand how and when to register their IP. Information on the IP lifecycle as well as legal resources are available to enable innovators to best protect their efforts.

USAspending.gov

USAspending.gov[102] is the official source for spending data for the U.S. Government. Its mission is to show the American public what the U.S. Government spends every year and how it spends the money. You can follow the money from the congressional appropriations to the Federal agencies and down to local communities and businesses. AV innovators and entrepreneurs could use this as a resource to identify potential U.S. Government funding opportunities.

Additional U.S. Government Resources

A list of all other known U.S. Government AV relevant resources available to AV innovators and entrepreneurs can be found in Appendix A. If AV innovators and entrepreneurs have questions directed at specific components inside the U.S. Government, a contact list can be found in Appendix B.

IV. Conclusion

The White House OSTP encourages a future in which the United States is a global leader in AV technology. The U.S. Government offers AV innovators and entrepreneurs an ideal environment to develop and integrate AV technology while prioritizing safety, security, and privacy for users and communities; promoting efficient markets; and facilitating coordinated research efforts nationwide. In preparation for emerging and innovative AV technology, the U.S. Government will provide policies, guidance, and best practices; conduct appropriate research and pilot programs; and offer necessary assistance to help plan for and invest in a dynamic and flexible future for all Americans.

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99   https://www.sba.gov/learning-center

100   https://www.sba.gov/about-sba/organization/sba-initiatives#section-header-14

101   USPTO Inventor and entrepreneur resources, https://www.uspto.gov/learning-and-resources/inventors-entrepreneurs-resources

102   https://www.usaspending.gov/#/

V.   Appendix A – U.S. Government Resources

Council on Environmental Quality
- **Office of Federal Sustainability:** https://www.sustainability.gov/resources.html

Department of Agriculture
- **National Robotics Initiative 2.0:** Ubiquitous Collaboration Robots (NRI-2.0): https://nifa.usda.gov/funding-opportunity/national-robotics-initiative-realization-co-robots-acting-direct-support

Department of Energy
- **Vehicle Technologies Office:** https://www.energy.gov/eere/vehicles/vehicle-technologies-office
- **Vehicle Technologies Office Annual Merit Review and Peer Evaluations:** https://www.energy.gov/eere/vehicles/annual-merit-review-presentations
- **Vehicle Technologies Office reports and publications:** https://www.energy.gov/eere/vehicles/reports-and-publications?TechArea=Energy+Efficient+Mobility+Systems
- **DOE's Technology Commercialization Fund:** https://www.energy.gov/technologytransitions/services/technology-commercialization-fund
  — Technology Commercialization Fund (TCF) is a nearly $20 million funding opportunity that leverages R&D funding in the Department's applied energy programs to mature promising energy technologies with the potential for high impact. TCF was created by the Energy Policy Act of 2005 and catalyzes the commercial impact of the Department's portfolio of research, development, demonstration, and deployment activities. TCF funds are matched with funds from private partners to promote promising energy technologies for commercial purposes.

Department of Defense
- **Defense Technical Information Center:** https://discover.dtic.mil/products-services/

Department of Health and Human Services
- **NIOSH Center for Motor Vehicle Safety Strategic Plan for Research and Prevention, 2014-2018:** https://www.cdc.gov/niosh/docs/2014-122/pdfs/2014-122.pdf (note: An updated plan is under development and will be posted on the NIOSH docket for public comment.)
- **NIOSH Strategic Plan:** FYs 2019–2023 prioritizes research on the safety impacts of automated and connected vehicles and ADAS for truck, bus, and taxi drivers. In addition, the NIOSH plan prioritizes research on injury risks associated with new jobs that may be created by automation, and on potential stress and fatigue consequences of automation. (See Intermediate Goals 6.14 and 7.8.) https://www.cdc.gov/niosh/about/strategicplan/
- **NIDILRR's Rehabilitation Engineering Research Center on Physical Access and Transportation:** https://acl.gov/sites/default/files/about-acl/2019-01/NIDILRR%20LRP-2018-2023-Final.pdf
- **NIDILRR's research Project on Optimizing Accessible Public Transportation:** https://acl.gov/sites/default/files/about-acl/2019-01/NIDILRR%20LRP-2018-2023-Final.pdf

Department of Homeland Security
- DHS Science and Technology Directorate
  — Critical Infrastructure and Resilience: https://www.dhs.gov/science-and-technology/critical-infrastructure-and-resilience#
  — Cybersecurity: https://www.dhs.gov/science-and-technology/cybersecurity
- **DHS CISA, Cyber Storm:** Securing Cyber Space
  — https://www.dhs.gov/cisa/cyber-storm-securing-cyber-space

Department of Labor
- — Office of Disability Employment Policy: https://www.dol.gov/odep/topics/Transportation.htm

Department of Transportation
- **Access and Mobility for All Summit:** https://www.transportation.gov/accessibility
- **Coordinating Council on Access and Mobility (CCAM) Strategic Plan 2019-2022:** https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/regulations-and-guidance/ccam/about/134436/ccam-strategic-plan-2019-2022.pdf
- **Mobility for All Pilot Program Grants:** https://www.transit.dot.gov/funding/grants/grant-programs/mobility-all-pilot-program-grants
- **USDOT Automated Vehicles Activities:** https://www.transportation.gov/AV
- **USDOT Research HUB 2.0:** https://researchhub.bts.gov/
- **USDOT Repository & Open Science Access Portal:** https://rosap.ntl.bts.gov/welcome
- **USDOT/BTS National Transportation Library:** https://ntl.bts.gov/
- **USDOT/FTA Transit Automation Activities:** https://www.transit.dot.gov/automation-research

Federal Communication Commission
- **FCC Reports & Research:** https://www.fcc.gov/reports-research
- **Office of Engineering and Technology (OET):** https://www.fcc.gov/engineering-technology
- **Wireless Telecommunications Bureau:** https://www.fcc.gov/wireless-telecommunications
- **Dedicated Short Range Communications (DSRC) Service:** https://www.fcc.gov/wireless/bureau-divisions/mobility-division/dedicated-short-range-communications-dsrc-service

Federal Laboratory Consortium for Technology Transfer
- **FLC Business:** https://www.federallabs.org/flcbusiness

National Aeronautics and Space Administration
- **NASA TechPort:** https://techport.nasa.gov/home
- **NTRS:** https://ntrs.nasa.gov/

National Council on Disability
- **Self-Driving Cars:** Mapping Access to a Technology Revolution: https://www.ncd.gov/sites/default/files/NCD_AutomatedVehiclesReport_508-PDF.pdf

National Institute of Standards and Technology
- **Cyber-Physical System:** https://www.nist.gov/el/cyber-physical-systems
- **Mobility Performance of Robotics Systems:** https://www.nist.gov/programs-projects/mobility-performance-robotic-systems
- **Communication Technology research:** https://www.nist.gov/programs-projects/5g-beyond
- **National Advanced Spectrum and Communication Test Network:** https://www.nist.gov/communications-technology-laboratory/nasctn
- **Applied Research – Cybersecurity and Privacy in Connected vehicles:** https://www.nccoe.nist.gov/
- **NIST Cybersecurity Framework:** https://www.nist.gov/cyberframework
- **NIST Privacy Framework:** https://www.nist.gov/privacy-framework
- **U.S. Leadership in AI:** A Plan for Federal Engagement in Developing Technical Standards and Related Tools. https://www.nist.gov/document/report-plan-federal-engagement-developing-technical-standards-and-related-tools

- **An Independent Measurement System for Testing Automotive Crash Warning Systems:** http://ws680.nist.gov/publication/get_pdf.cfm?pub_id=901038
- **Objective Test and Performance Measurement of Automotive Crash Warning Systems:** http://ws680.nist.gov/publication/get_pdf.cfm?pub_id=823603
- **Performance Evaluation of Integrated Vehicle-Based Safety System:** http://ws680.nist.gov/publication/get_pdf.cfm?pub_id=823587
- NIST Work in Support of Army Research Labs and DARPA Autonomous Vehicles for Military Operations (e.g., scouting)
  — 4D/RCS Version 2.0: A Reference Model Architecture for Unmanned Vehicle Systems: http://ws680.nist.gov/publication/get_pdf.cfm?pub_id=821823
  — Intelligent Vehicle Systems: A 4D RCS Approach https://books.google.com/books/about/Intelligent_Vehicle_Systems.html?id=A84mXxcNjlwC
- **NIST Work in Support of DARPA Mobile Autonomous Robots (MARS) and follow-on Programs to develop the foundations for a robotic chauffeur type of capability:**
  — Identifying Sensory Processing Requirements for an On-Road Driving Application of 4D/RCS https://www.nist.gov/node/683826
  — How task analysis can be used to derive and organize the knowledge for the control of AVs https://www.nist.gov/node/705571
  — Achieving Intelligent Performance in Autonomous Driving: https://www.nist.gov/node/705951
  — PRIDE: A Framework for Performance Evaluation of Intelligent Vehicles in Dynamic, On-Road Environments: https://www.nist.gov/node/761331
- **Framework for Defining and Measuring Autonomy Levels (Autonomy Levels for Unmanned Systems):**
  — Autonomy Levels for Unmanned Systems (ALFUS) Framework Volume II: Framework Models Initial Version http://ws680.nist.gov/publication/get_pdf.cfm?pub_id=823618

National Science Foundation
- **NSF Award Search:** https://nsf.gov/awardsearch/advancedSearch.jsp
- **NSF Public Access Repository (NSF-PAR):** https://par.nsf.gov/

National Transportation Safety Board
- **Completed Investigations:**
  — Collision Between a Car Operating with Automated Vehicle Control Systems and a Tractor-Semitrailer Truck Near Williston, Florida - May 7, 2016, https://www.ntsb.gov/investigations/AccidentReports/Pages/HAR1702.aspx
  — Low-Speed Collision Between Truck-Tractor and Autonomous Shuttle, Las Vegas, Nevada, November 8, 2017, https://www.ntsb.gov/investigations/pages/HWY18FH001.aspx
  — Collision Between Vehicle Controlled by Developmental Automated Driving System and Pedestrian , Tempe, Arizona, March 18, 2018, https://www.ntsb.gov/investigations/AccidentReports/Reports/HAR1903.pdf
- **Ongoing Investigations:**
  — Rear-End Collision Between a Passenger Car Operating with Advanced Driver Assistance Systems and a Stationary Fire Truck, Culver City, California, January 22, 2018, https://www.ntsb.gov/investigations/pages/HWY18FH004.aspx
  — Passenger Car Operating with Advanced Driver Assistance Systems Collided with Roadway Barrier, Mountain View, California, March 23, 2018, https://www.ntsb.gov/investigations/pages/HWY18FH011.aspx
  — Collision Between a Passenger Car Operating with Advanced Driver Assistance Systems and Combination Vehicle at an Intersection, Delray Beach, Florida, March 1, 2019, https://www.ntsb.gov/investigations/pages/HWY19FH008.aspx

- **Significant recommendations:**
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-17-037
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-17-038
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-17-039
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-17-040
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-17-041
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-17-042
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-17-043
- **Recommendations for collision avoidance systems:**
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-15-004
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-15-005
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-15-006
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-15-007
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-15-008
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-15-009
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-18-008
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-18-019
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-18-029
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-18-043
  - https://www.ntsb.gov/investigations/AccidentReports/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-18-044

United States Patent and Trademark Office

- **USPTO patent search database:** https://www.uspto.gov/patents-application-process/search-patents
- **USPTO Inventor and entrepreneur resources:** https://uspto.gov/learning-and-resources/inventors-entrepreneurs-resources
- **USPTO Inventors Assistance Center:** 800-786-9199; 517-272-1000; TTY: 800-877-8339

United States Access Board

- **https:**//www.access-board.gov/guidelines-and-standards/transportation

VI. Appendix B – U.S. Government AV Contacts

Organization	Email
DHS	STMCSTasking@hq.dhs.gov
DoD	osd.pentagon.ousd.r-e.mbx.autonomy@mail.mil
DOE	EEMS@ee.doe.gov
DOI	feedback@ios.doi.gov
DOJ	automated.vehicles@usdoj.gov
EPA	OTAQ@epa.gov
FLC	support@FederalLabs.org
GSA	Vehicle.Policy@gsa.gov
NASA	Autonomous-Vehicles@mail.nasa.gov
NCD	ncd@ncd.gov
NIST	inquiry@nist.gov
NSF	info@nsf.gov
NTSB	Correspondence@ntsb.gov
United States Access Board	info@access-board.gov
USDA	askUSDA@usda.gov
USDOT	automation@dot.gov TransitAutomation@dot.gov av_info_nhtsa@dot.gov
USPS	vehicletechnology@usps.gov
USPTO	HelpAAU@uspto.gov

VII. Appendix C – Automated Vehicle Fast Track Action Committee

Chair

Michael Kratsios
United States Chief Technology Officer

Members

Sujeesh Kurup Sudarsana Kurup
EOP/OSTP Liaison

Vishal Amin
EOP/IPEC

Brooks Bentley
EOP/NSC

Michael Berube
DOE

Mark Champoux
DOJ

David Connolly
EOP/OMB

Karin Ferriter
DOC/USPTO

Finch Fulton
USDOT

Chazeman Jackson
HHS

Douglas Kinkoph
DOC/NTIA

Julius Knapp
FCC

Tom McDermott
DHS

Bart Meroney
DOC/ITA

Jon Montgomery
NASA

Wayne Nickols
DoD

James Olthoff
DOC/NIST

Andrew Smith
FTC

VIII. Appendix D – Development and Writing Team

Department of Commerce

National Institutes of Standards and Technology

Heather Evans

Chris Greer

Ajit Jillavenkatesa

Tim McBride

Elena Messina

Al Wavering

National Telecommunications and Information Administration

Charles Cooper

Derek Khlopin

Douglas Kinkoph

United States Patent and Trade Mark Office

Karin Ferriter

Christian Hannon

Molly Stech

International Trade Administration

Elizabeth Clark

Anne Driscoll

Scott Kennedy

Bart Meroney

Dale Tasharski

Andy Parris

Holly Vineyard

Department of Education

Jean Morrow

Department of Energy

David Anderson

Michael Berube

Erin Boyd

Heather Croteau

Prasad Gupte

Rachael Nealer

Department of Defense

Brandon Newell

Wayne Nickols

Department of Health and Human Services

Dawn Castillo

Hongwei Hsiao

Chazeman Jackson

Jennifer E. Lincoln

Stephanie Pratt

William (Karl) Sieber

Department of Homeland Security

Mark Fleming

Christian Van Ginder

Jonathan Murphy

Ted Sobel

Peter W. Tortorell, Jr.

Jeremiah B. Wells

Department of Justice

Mike Buchwald

Mark Champoux

Makan Delrahim

Jennifer Dixton

Brendan Groves

Daniel Haar

Aarash A. Haghighat

Chris Hardee

Joseph Heaps

Lionel Kennedy

David Knight

David Lawrence

David Mudd

Brian H. Pandya

Kimberley Raleigh

Sujit Raman

William Rinner

Colin T. Ross

Steven Schuetz

Anthony M. Shults

Mick Stawasz

Joy Welan

Department of Labor

Kristen Monaco

Michael Reardon

Lindsey Teel

Nathan Uldricks

Kim Vitelli

Department of State

Vanessa Guest

Megan Walklet-Tighe

Department of Transportation

National Highway Traffic Safety Administration

Sara Bennett

Jonathan Morrison

Dorothy Jo (Dee) Williams

Federal Highway Administration

Carl Andersen

Valerie Briggs

Brian Cronin

John Harding

Taylor Lochrane

Heather Rose

Dale Thompson

Federal Transit Administration
Danyell Diggs
Justin John
Steve Mortensen
Gwo-Wei Torng

Federal Motor Carrier Safety Administration
Jeff Loftus
Nicole Michelle
Jonathan Mueller
Kelly Regal

Office of the Secretary of Transportation
Julie Abraham
John Augustine
Nicole Baker
Lily Ballengee
Ted Boll
David Carter
Tony Choi
Trish Fritz
Finch Fulton
Diana Furchtgott-Roth
Ariel Gold
Timothy Mullins
Steve Polzin
Sujeesh Kurup Sudarsana Kurup

Department of the Treasury

Wendy Friese
David Kautter
Krishna Vallabhaneni
James Wang

Environmental Protection Agency

Alexander Dominguez
Matt Brusstar
David Haugen
Karl Simon

Federal Communications Commission

Paul Jackson
Ira Keltz
Julius Knapp
Paul Murray
Aspasia Paroutsas
Jamison Prime
Ronald E. Williams

Federal Laboratory Consortium for Technology Transfer

John Dement
Kevin Barquinero
Denise Wainer

Federal Trade Commission

Mark Eichorn
Peder Magee
Maneesha Mithal
Andrew Smith

General Services Administration

Alexander Kurien
Patrick McConnell
Jim Vogelsinger

National Aeronautics and Space Administration

B. Danette Allen
Terrence Fong

National Council on Disability

Rebecca Cokley
Joan Durocher
Lisa Grubb
Geraldine-Drake Hawkins
Robyn Powell
Neil Romano

Jeff Rosen
Anne Sommers
Clyde Terry

National Science Foundation

Dawn Marie Tilbury
Lloyd Whitman

National Transportation Safety Board

Steve Blackistone
Joseph Schmoll
Christopher Wallace

Small Business Administration

Jennifer Shieh
John R. Williams

Securities and Exchange Commission

Jessica Leonardo
Holli Heiles Pandol

United States Access Board

Juliet Shoultz
Scott Windley

United States Department of Agriculture

Michael Buser
Richard Derksen
Steven Thomson

United States Postal Service

Scott R. Bombaugh
Don E. Crone
Rod Sallay

IX. Appendix E – Acronyms

Acronym	Meaning
21CTP	21st Century Truck Partnership
AACVTE	UMTRI's Ann Arbor Connected Vehicle Test Environment
ACL	Administration for Community Living
ADA	Americans with Disabilities Act
ADAS	Advanced Driver Assistance Systems
ADS	Automated Driving Systems
AI	Artificial Intelligence
ALARC	Arid Land Agricultural Research Center
ANSI	American National Standards Institute
ARPA-E	DOE Advanced Research Projects Agency-Energy
ARS	USDA Agricultural Research Service
AS	Automated System
ASSP	American Society of Safety Professionals
ATCMTD	Advanced Transportation and Congestion Management Technologies Deployment
ATTRI	Accessible Transportation Technologies Research Initiative
AV	Automated Vehicles
AVFTAC	Automated Vehicle Fast Track Action Committee
BLS	United States Bureau of Labor Statistics
CAV	Connected and Automated Vehicle
CBP	Customs and Border Protection
CEQ	Council on Environmental Quality
CFIUS	Committee on Foreign Investment in the United States
CISA	DHS Cybersecurity and Infrastructure Security Agency
CISE	NSF Directorate for Computer and Information Science and Engineering
CMV	Commercial Motor Vehicle
CoVeR	Combat Vehicle Robotics
CV	Connected Vehicle
DHS	Department of Homeland Security
DOC	Department of Commerce
DoD	Department of Defense

Acronym	Meaning
DOE	Department of Energy
DOI	Department of the Interior
DOJ	Department of Justice
DOL	Department of Labor
DOS	U.S. State Department
DSRC	Dedicated Short Range Communication
ED	Department of Education
ENG	NSF Directorate for Engineering
EOP	Executive Office of the President
EPA	Environmental Protection Agency
ERDC	Army's Engineering Research and Development Center
FAST Act	Fixing America's Surface Transportation Act
FCC	Federal Communications Commission
FDII	Foreign-derived intangible income
FEDFLEET	Federal Fleet Policy Council
FFRDC	Federally Funded Research and Development Center
FHWA	Federal Highway Administration
FLC	Federal Laboratory Consortium for Technology Transfer
FMCSA	Federal Motor Carrier Safety Administration
FMVSS	Federal Motor Vehicle Safety Standards
FOA	Funding Opportunity Announcement
FTA	Federal Transit Administration
FTAC	Fast Track Action Committee
FTC	Federal Trade Commission
FY	Fiscal Year
GPS	Global Positioning System
GSA	General Services Administration
HHS	Department of Health and Human Services
HMI	Human-Machine Interface
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HPC	High performance computing
HSSEDI	Homeland Security Systems Engineering and Development Institute
IC-DISC	Interest charge domestic international sales corporation

Acronym	Meaning
IoT	Internet of Things
IP	Intellectual Property
IPEC	Intellectual Property Enforcement Coordinator
IRS	Internal Revenue Service
ITA	International Trade Administration
ITS	NTIA Institute for Telecommunications Sciences
ITS JPO	Intelligent Transportation Systems Joint Program Office
LIDAR	Light Detection and Ranging
MCICOM	Marine Corps Installations Command
MENNDL	Multi-node Evolutionary Neural Networks for Deep Learning
MUTCD	Manual on Uniform Traffic Control Devices
NASA	National Aeronautics and Space Administration
NASCTN	National Advanced Spectrum and Communications Test Network
NCCoE	NIST National Cybersecurity Center of Excellence
NCD	National Council on Disability
NEPA	National Environmental Policy Act
NEXTCAR	Next-Generation Energy Technologies for Connected and Automated On-Road Vehicles
NHTSA	National Highway Traffic Safety Administration
NIDILRR	National Institute on Disability, Independent Living, and Rehabilitation Research
NIFA	National Institute of Food and Agriculture
NIJ	National Institute of Justice
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NPS	National Park Service
NRMC	National Risk Management Center
NSC	National Security Council
NSF	National Science Foundation
NSTC	National Science and Technology Council
NTIA	National Telecommunications and Information Administration
NTRS	NASA Technical Reports Server
NTSB	National Transportation Safety Board
NTV	Non-Tactical Vehicle
ODD	Operational Design Domain

Acronym	Meaning
ODEP	DOL Office of Disability Employment Policy
OEDR	Object and Event Detection and Response
OEM	Original Equipment Manufacturers
OFS	Office of Federal Sustainability
OGP	GSA Office of Government-wide Policy
OIRA	Office of Information and Regulatory Affairs
OMB	Office of Management and Budget
OST	Office of the Secretary of Transportation
OSTP	Office of Science and Technology Policy
OTMP	Office of Trade and Manufacturing Policy
PERF	Police Executive Research Forum
PRAM	NIST Privacy Risk Assessment Methodology
R&D	Research and Development
RCV	Robotics Combat Vehicle
RFI	Request for Information
S&T	Science and Technology
SBA	Small Business Administration
SBE	NSF Directorate for Social, Behavioral, and Economic Sciences
SBIR	Small Business Innovation Research
SDO	Standards Development Organization
SEC	Securities and Exchange Commission
SMART	DOE System Modeling for Accelerated Research in Transportation
STAR	FTA Strategic Transit Automation Research
STEM	Science, Technology, Engineering, and Mathematics
STI	Scientific and Technical Information
STTR	Small Business Technology Transfer
T2	Technology Transfer
TCF	DOE Technology Commercialization Fund
TFA	Technology Focus Area
TNC	Transportation Network Company
UGV	Unmanned Ground Vehicles
UMTRI	University of Michigan Transportation Research Institute
USDA	United States Department of Agriculture

Acronym	Meaning
USDOT	United States Department of Transportation
USPS	United States Postal Service
USPTO	United States Patent and Trademark Office
USTR	United States Trade Representative
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-Everything
VERVE	Visual Environment for Remote and Virtual Exploration
VTO	DOE Vehicle Technologies Office
VTTI	Virginia Tech Transportation Institute
WZDx	Work Zone Data Exchange

About the National Science and Technology Council

The National Science and Technology Council (NSTC) is the principal means by which the Executive Branch coordinates science and technology policy across the diverse entities that make up the Federal research and development enterprise. A primary objective of the NSTC is to ensure science and technology policy decisions and programs are consistent with the President's stated goals. The NSTC prepares research and development strategies that are coordinated across Federal agencies aimed at accomplishing multiple national goals. The work of the NSTC is organized under committees that oversee subcommittees and working groups focused on different aspects of science and technology. More information is available at http://www.whitehouse.gov/ostp/nstc.

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization, and Priorities Act of 1976 to provide the President and others within the Executive Office of the President with advice on the scientific, engineering, and technological aspects of the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources, among other topics. OSTP leads interagency science and technology policy coordination efforts, assists the Office of Management and Budget with an annual review and analysis of Federal research and development budgets, and serves as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government. More information is available at http://www.whitehouse.gov/ostp.

About this Document

This document presents the United States Government's posture for surface transportation automated vehicles (AV) based on a vision in which American innovators are global leaders in AV technology, integrating this technology in the United States and around the world in a safe and secure manner. As Automated Driving Systems (ADS) come into fruition over the coming years and decades, this document is intended to provide AV innovators a single, high-level reference document to navigate the U.S. Government. The scope of this document is limited to surface transportation AVs and does not include maritime, railway, or aviation concerns.

This document is the result of extensive input from relevant stakeholders across 38 Federal departments, independent agencies, commissions, and Executive Offices of The President.

Copyright Information

Proven Safety Countermeasures

FHWA's Proven Safety Countermeasures initiative (PSCi) is a collection of 28 countermeasures and strategies effective in reducing roadway fatalities and serious injuries on our Nation's highways. Transportation agencies are strongly encouraged to consider widespread implementation of PSCs to accelerate the achievement of local, State, and National safety goals. These strategies are designed for all road users and all kinds of roads—from rural to urban, from high-volume freeways to less traveled two-lane State and county roads, from signalized crossings to horizontal curves, and everything in between. Each countermeasure addresses at least one safety focus area – speed management, intersections, roadway departures, or pedestrians/bicyclists – while others are crosscutting strategies that address multiple safety focus areas. Search Proven Safety Countermeasures.

Speed Management

Appropriate Speed Limits for All Road Users

Speed Safety Cameras

Variable Speed Limits

Pedestrian/Bicyclist

Bicycle Lanes

Crosswalk Visibility Enhancements

Leading Pedestrian Interval

Medians and Pedestrian Refuge Islands in Urban and Suburban Areas

Pedestrian Hybrid Beacons

Rectangular Rapid Flashing Beacons (RRFB)

Road Diets (Roadway Reconfiguration)

Walkways

Roadway Departure

Enhanced Delineation for Horizontal Curves

Longitudinal Rumble Strips and Stripes on Two-Lane Roads

Median Barriers

Roadside Design Improvements at Curves

SafetyEdge℠

Wider Edge Lines

Intersections

Backplates with Retroreflective Borders

Corridor Access Management

Dedicated Left- and Right-Turn Lanes at Intersections

Reduced Left-Turn Conflict Intersections

Roundabouts

Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections

Yellow Change Intervals

Crosscutting

Lighting

Local Road Safety Plans

Pavement Friction Management

Road Safety Audit

Safety Benefits:

Two-Way Stop-Controlled Intersection to a Roundabout
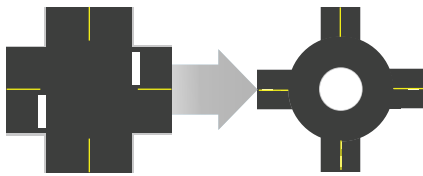
82%

reduction in fatal and injury crashes.[1]

Signalized Intersection to a Roundabout
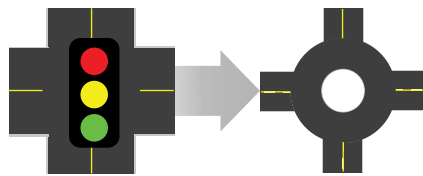
78%

reduction in fatal and injury crashes.[1]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://highways. dot.gov/safety/proven- safety-countermeasures and https://highways.dot.gov/ safety/intersection-safety/ intersection-types/roundabouts.

FHWA-SA-21-042

Roundabouts

The modern roundabout is an intersection with a circular configuration that safely and efficiently moves traffic. Roundabouts feature channelized, curved approaches that reduce vehicle speed, entry yield control that gives right-of-way to circulating traffic, and counterclockwise flow around a central island that minimizes conflict points. The net result of lower speeds and reduced conflicts at roundabouts is an environment where crashes that cause injury or fatality are substantially reduced.

Roundabouts are not only a safer type of intersection; they are also efficient in terms of keeping people moving. Even while calming traffic, they can reduce delay and queuing when compared to other intersection alternatives. Furthermore, the lower vehicular speeds and reduced conflict environment can create a more suitable environment for walking and bicycling.

Illustration of a multilane roundabout. Source: FHWA

Roundabouts can be implemented in both urban and rural areas under a wide range of traffic conditions. They can replace signals, two-way stop controls, and all-way stop controls. Roundabouts are an effective option for managing speed and transitioning traffic from high-speed to low-speed environments, such as freeway interchange ramp terminals, and rural intersections along high-speed roads.

Example of a single-lane roundabout. Source: FHWA

1 (CMF ID: 211,226) AASHTO. The Highway Safety Manual, American Association of State Highway Transportation Professionals, Washington, D.C., (2010).

ZERO IS OUR GOAL
A SAFE SYSTEM IS HOW WE GET THERE

O'ahu Vision Zero
Action Plan

JUNE 2024 | **PUBLIC DRAFT**

Acknowledgements

The Law of the Splintered Paddle	Kānāwai Māmalahoe
"O my people,	E nā kānaka,
Honor thy gods;	E mālama ʻoukou i ke akua
Respect alike (the rights of)	A e mālama hoʻi i kānaka nui
men great and humble;	a me kānaka iki;
See to it that our aged,	E hele ka ʻelemakule,
our women, and our children	ka luahine, a me ke kama
Lie down to sleep by the roadside	A moe i ke ala
Without fear of harm.	ʻaʻohe mea nāna e hoʻopilikia.
Disobey, and die.	Hewa nō, make.

Contents

Acronyms and Abbreviation

The following are acronyms and abbreviations used throughout this Plan.

ACRONYM	DEFINITION
AADT	Average Annual Daily Traffic
AARP	American Association of Retired Persons
ADA	Americans with Disabilities Act
City	City and County of Honolulu
DOH	HawaiʻI Department of Health
DTS	City and County of Honolulu Department of Transportation Services
EJ	Environmental Justice
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
FSI	Fatal or Serious Injury crash
FY	Fiscal Year
HB	House Bill
HBL	Hawaiʻi Bicycling League
HDOT	Hawaiʻi Department of Transportation
HIL	High Injury Location
HPD	City and County of Honolulu Police Department
HRS	Hawaiʻi Revised Statutes
LGBT	Lesbian, Gay, Bisexual, Transgender
MADD	Mothers Against Drunk Driving
MPH	Miles per Hour

ACRONYM	DEFINITION
Plan	Honolulu Vision Zero Action Plan
PSP	Pedestrian Safety Program
ROW	Right-of-Way
RRFB	Rectangular Rapid Flashing Beacons
SHACA	State of Hawaii Advanced Crash Analysis
SHSC	State Highway Safety Council
SRTS	Safe Routes to School
SS4A	Safe Streets and Roads for All
T6/EJ	Title VI/Environmental Justice
Title VI	Title VI of the Civil Rights Act of 1964 (anti-discrimination laws)
US	United States
USC	United States Code
USDOT	United States Department of Transportation
WAO	We Are Oceania

Hawaiian Terms

WORD	MEANING
Kamaʻāina	Residents
Keiki	Youth
Kuleana	Responsibility and privilege
Kūpuna	Elders
Makai	Toward the sea
Mauka	toward the mountains

1
Introduction

On average, we experience one traffic death a week on Oʻahu streets. Every traffic death and serious injury changes the lives of loved ones and people involved in the crash forever. People walking and kūpuna (elders) are among those most impacted by serious injury and fatal crashes.

Our vision is to save lives by eliminating serious injury and fatal crashes.

Truly safe streets are possible. The actions we must undertake to achieve this vision of zero traffic fatalities and injuries on Oʻahu are numerous, and we need everyone that travels our streets to make safer choices. The City and County of Honolulu (City) is committed to ending traffic deaths on our streets and has prepared this Oʻahu Vision Zero Action Plan (Plan) to get us there. The Plan identifies a host of actions to create a truly safe transportation system for kamaʻāina (residents) and visitors who travel in many different ways, using our island's various mobility options.

Traffic deaths and injuries are preventable.

Eliminating future deaths requires all of us to accept our kuleana (responsibility and privilege) to make our streets safer for everyone, including our most vulnerable. The City will continue its partnerships with government agencies, community-based organizations, and the public to make our streets more forgiving to the inevitable mistakes that define being human. We must work together to create a transportation system safety net that prevents these mistakes from having serious and irreversible outcomes by reducing the severity of crashes when they do occur.

Vision Zero is a global initiative committed to developing holistic programs, practices, and projects that prioritize traffic safety to bring us closer to a target of zero serious injury or fatal traffic crashes.

The Oʻahu Vision Zero Action Plan is a roadmap for eliminating traffic-related deaths and serious injuries on Oʻahu.

Existing Conditions

Chapter 2 examines existing conditions, including an overview of relevant previous planning efforts, past and ongoing safety programs, and recent crash patterns including High-Injury Locations.

Safe Streets: Kuleana to Community

Chapter 3 describes the community engagement process that supported development of the Plan.

Acting in Accordance with Our Vision

Chapter 4 outlines goals and actions to get to zero traffic deaths and serious injuries on Oʻahu using five interrelated "Safe System" elements: (1) Safe Speeds, (2) Safe Streets, (3) Safe People, (4) Post-Crash Care, and (5) Safe Vehicles.

Our Work Has Started

Chapter 5 highlights important Vision Zero, Complete Streets, and transportation safety projects already underway.

Our Commitment

Chapter 6 provides an organizational framework and prioritized project list for implementing Vision Zero actions and staying on track to reaching our goal. This chapter includes the City's commitment to achieving zero deaths and serious injuries, including partnerships, updated policies, and immediate changes in the way we do our work.

How will this vision guide the City and County of Honolulu?

The City is committed to making decisions on a daily basis that will:

01 Nurture an organizational culture that breaks down department silos to collaborate on improving roadway safety.

02 Inform our personal and professional decisions based on the concept of saving lives, so we can prioritize safety outcomes first.

03 Foster an islandwide culture that accepts kuleana for the well-being of everyone using our streets.

04 Design, operate, enforce, and maintain streets that keiki (youth), kūpuna, and everyone in between can safely use.

Safe System Principles

The Vision Zero approach is based on these Safe System principles:

Traffic deaths are unacceptable. Death and serious injury are unacceptable outcomes of using the roadway system. Vision Zero advocates for a system-wide approach to reduce the frequency and severity of collisions.

People make mistakes. Humans make mistakes, so we need to design roads and modify how people operate so our mistakes don't lead to serious injury or death.

Bodies are vulnerable. Humans are vulnerable, so Vision Zero actions need to reduce the transfer of energy from cars onto people in crashes by using lighter vehicles and slower speeds.

We're in this together. Safety is a societal responsibility that involves many different participants including the people planning, designing, building, operating our roads; vehicle manufacturers; law enforcement, emergency responders; post-crash personnel; and people using the roads.

Safety is about being proactive. We can take action in places where crashes are not yet documented by systematically applying countermeasures to vulnerable locations.
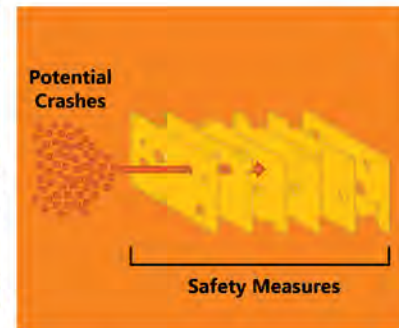
Redundancy is essential. Safety measures must be designed so that if one part of the system fails, people will still be safe.

Why Vision Zero now?

City, state, and federal officials are responding to the public's demand for actions that protect our island's people.

In 2018, the Honolulu City Council adopted a resolution (18-219) urging the Department of Transportation Services to adopt a Vision Zero policy. In 2019, Hawai'i State Law Act 134 adopted Vision Zero as the policy of the State of Hawai'i and required the counties to adopt Vision Zero policies. At the federal level too, there is a laser focus on safety. For instance, federal law (23 U.S.C. Section 148(g)(3)) requires the State of Hawai'i to obligate not less than 15% of its Highway Safety Improvement Program funds to address our most vulnerable populations – people walking, people biking, and our keiki and kūpuna - because they make up more than 15% of the State's total fatalities in roadway crashes.

Finally, this Plan makes the City eligible and well-positioned to apply for and accept a variety of new funding sources from the USDOT, including through the Safe Streets and Roads for All (SS4A) Grant Program.

Vision Zero Action Plan Process

The Oʻahu Vision Zero Action Plan is data-driven at its core, responding to the actual safety experience and priorities of Oʻahu with proven safety interventions. The Plan development process was guided by input from the public, stakeholders, and a project steering committee. The diagram below provides a high-level overview of this process, which began in late 2021.

2021

Project Kickoff

Define project vision and purpose.

2022

Analyze Existing Conditions

Review the high crash network, existing educational campaigns, and relevant legislation.

Ongoing community & stakeholder input

- Steering Committee Meeting #1
- Islandwide Workshop
- Steering Committee Meeting #2
- Round 1 Affinity Group Interviews and Pop-up Events
- Community Safety Stories
- Round 2 Affinity Group Interviews and Pop-up Events
- Honolulu Police Department Meeting
- DTS Staff Workshop
- Community Safety Stories

2023

Advance Safer Streets Work

Develop educational campaigns for safer driving and support Complete Streets projects that benefit Vision Zero goals. Define Vision Zero focus areas based on crash data.

Ongoing community & stakeholder input

- Public Survey
- Round 3 Affinity Group Interviews and Pop-up Events
- Steering Committee Meeting #3
- Honolulu Police Department Meetings
- Community Safety Stories
- DTS Staff Workshop

2024 & BEYOND

Develop Vision Zero Strategies

Provide recommendations for safer street guidelines, projects, and legislation.

2

Existing Conditions

This Vision Zero Action Plan builds on existing policies, plans, and programs. It responds to the past six years of reported crash data reviewed in detail during the planning process.

Plan and Policy Review

This section provides brief descriptions of related plans. A policy review revealed opportunities to build on or strengthen existing plans and policies by incorporating actions that prioritize safety in decision-making and foster kuleana for safe streets. These opportunities are documented as actions in Chapter 4.

Complete Streets Design Manual, 2016
City and County of Honolulu

The Honolulu Complete Streets Design Manual (Manual) sets forth design standards specific to Honolulu and provides guidance to planners, designers, and engineers to incorporate Complete Streets principles and features into projects within the City and County of Honolulu (City) right-of-way. The Manual recommends multi-modal design solutions to increase mobility, improve road safety, and create sustainable communities.
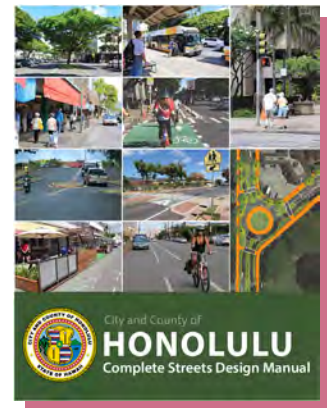
Oʻahu Pedestrian Plan, 2022

City and County of Honolulu

The Oʻahu Pedestrian Plan includes ten objectives to help achieve Oʻahu's goal of creating sustainable, safe, and context sensitive streets that inspire pedestrian activity. The Oʻahu Pedestrian Plan mapped the 393-mile Pedestrian Priority Network as the crucial network to make walking safe and convenient and included a prioritized list of projects to implement walkways in key areas with total project cost estimated at $547 million. The Oʻahu Pedestrian Plan included a Vision Zero approach with proposed actions to improve pedestrian safety, the inclusion of best practice guidelines to better address pedestrian needs, and the identification of High Pedestrian Injury corridors and intersections. The High-Injury corridors and intersections methodology and specific locations were considered as part of the Oʻahu Vision Zero Action Plan (Plan) development.
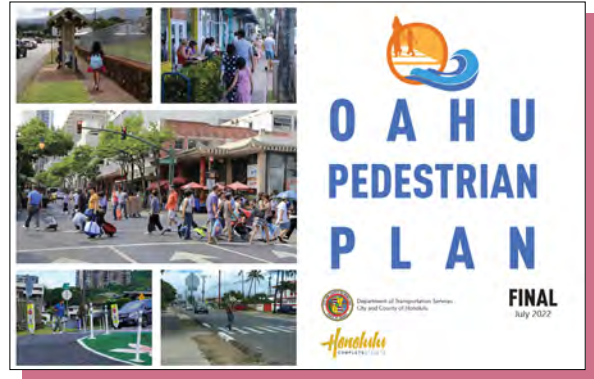
Final Report to Legislature on ACT 134, 2020

Hawaiʻi Department of Transportation

ACT 134 requires the Hawaiʻi Department of Transportation (HDOT) and county transportation departments to adopt a Vision Zero policy. Act 134 also required the State Highway Safety Council (SHSC) to consult with the counties and review policies and recommendations to report to the State Legislature and develop an action plan to reduce traffic fatalities to zero. The SHSC action plan was completed in December 2020 and included policies on how to reduce speeds on state and county roads, engineering recommendations on how to increase vehicular, pedestrian and bicycle safety, data-driven enforcement recommendations to reduce speeding and driving under the influence, additional steps to eliminate fatalities, an implementation plan, and tracking measures. The SHSC action plan included a total of 48 recommendations in areas of enforcement, engineering, education, equity, policy, partnerships, and evaluation.

O'ahu Bike Plan, 2019

City and County of Honolulu

The O'ahu Bike Plan aims to guide the continued growth of bicycling as a safe, convenient, accessible, affordable, healthy, and fun transportation option. The focus of this 2019 O'ahu Bike Plan Update is to identify specific projects, policies, and programs that will expand bicycle ridership and provide a network of safe, low-stress bikeways attractive to users of all ages and abilities. The O'ahu Bike Plan proposed a prioritized list of bikeway projects totaling 567 new miles of bikeways, including 88 miles of priority 1 proposed bikeways on City right-of-way.

Hawai'i Vulnerable Road User Safety Assessment, 2023

Hawai'i Department of Transportation

HDOT's assessment reviewed fatal and serious injury crashes for people bicycling or walking and defined short corridor segments as High Crash Corridors. The corridors defined in this process will be a resource for the City moving forward. Other differentiated findings from the report include a 2022 observation that houseless people make up 43% of the 28 pedestrian fatalities, and 71% of the seven bicycle fatalities across the state.

Honolulu Transportation Demand Management Plan, 2023

City and County of Honolulu

The Honolulu Transportation Demand Management (TDM) Plan includes a list of strategies and actions to inform and encourage travelers to maximize the efficiency of O'ahu's transportation systems. The TDM Plan included the development of the HNL Connect program with key elements including an annual travel challenge and targeted marketing to encourage use of sustainable transportation modes, a vanpool subsidy program, a developer TDM reporting program, and a restricted parking zone program. The TDM program is to be implemented by the City Department of Transportation Services (DTS) and will increase walking, bicycling, transit, and carpooling use and reduce driving.

Safety Programs and Information Campaigns

This section describes the local and statewide programmatic efforts to address traffic safety.

Walk Wise Hawaiʻi

Hawaiʻi Department of Transportation

Walk Wise Hawaiʻi is a program managed by HDOT as part of a larger set of Safe Communities Programs and encourages safe road practices for pedestrians and drivers. The program includes outreach at local events and a Pedestrian Safety Month in August with daily outreach activities. The Walk Wise Hawaiʻi program also partners with the Honolulu Police Department (HPD) and schools to promote safety and provide workshops to students. The program has an active online presence and has partnered with local music artists, The Angry Locals, to produce music videos advocating for safe road use. The program also produces pamphlets that outline pedestrian and driving actions to increase safety, which are available across languages including Ōlelo Hawaiʻi, Tagalog, Spanish, and more.

"No Excuses" Campaign

Hawaiʻi Department of Transportation

In 2021, HDOT partnered with the Hawaiʻi Department of Health, the four county law enforcement agencies, Mothers Against Drunk Driving (MADD) Hawaiʻi, and other community members to remind drivers to drive safely. The campaign was guided by state data, which indicated that nearly half of the fatalities were related to speeding and nearly half of drivers in fatal crashes in the state tested positive for drugs and alcohol. Messaging largely focused on safe speeds, impaired driving, and proper safety protocol such as seatbelts.

The campaign consisted of enforcement of traffic safety laws and education through public engagement and sign waving. Family members and friends of victims were present at select sign waving sites to share their stories. Police departments also coordinated sobriety checkpoints to reinforce the consequences and impacts of impaired driving. Other campaign activities included a public service announcement that aired on television and social media and a "Red Ribbon Challenge" where community members submitted photos of themselves with the MADD Red Ribbon to show their commitment to road safety.

Organizational Safety Champions

Several organizations already integrate safety communication into their daily activities.

Pedestrian Safety Program

City Department of Transportation Services

The DTS is home to the Pedestrian Safety Program (PSP), which encourages road safety on the island of Oʻahu. The PSP largely consists of outreach efforts with youth and adults and operates in partnership with HDOT and Walk Wise Hawaiʻi. The program distributes safety educational materials, including a Halloween activity book, and Walk Wise Hawaiʻi pamphlets, as well as free safety gear for community members. The goal of this program is to educate drivers and pedestrians on road safety and reduce the overall number of crashes involving people walking. Community engagement and education take place in various venues: schools, senior centers, community meetings, and fairs. The program is a mix of in-person and virtual activities. The PSP is currently developing animated characters that represent archetypal road users; a concept that can be tested through surveys and focus groups.

Bicycle Program

City Department of Transportation Services

The DTS is home to the Bicycle Program, which is dedicated to creating a more bike-friendly Oʻahu. The program connects people to information regarding bicycle resources, infrastructure, and projects. The Bicycle Program webpage contains a number of resources to encourage bicycling and bicycle safety including: the 2022 Official Bike Guide, information on bicycle-related traffic laws, an educational pamphlet for drivers, links to bicycle education workshops, and an interactive map of existing bikeway facilities. The Bicycle Program works with and administers grants that fund Hawaii Bicycling League run youth, adult, and senior bicycle education programs.

Safe Routes to School

City Department of Transportation Services

The Safe Routes to School (SRTS) program is aimed at increasing the number of children who walk and bike to school and is housed in the DTS. SRTS uses a 5E's Framework of Education, Encouragement, Evaluation, Enforcement, and Engineering. The SRTS program has active, ongoing engagement with youth that includes a poster contest, workshops, walking school buses, and much more. SRTS also has a mini-grant program to fund non-infrastructure projects and is actively involved in incorporating school-based infrastructure improvements in DTS projects.

Bikes, Pedestrians & Safe Routes to Schools

Complete Streets

City and County of Honolulu

The City Complete Streets team is committed to planning, designing, and operating Complete Streets Projects and programming on Oʻahu. Complete Streets are streets that work for all of us. Many of our streets were planned and designed to move vehicles quickly and efficiently but lack adequate sidewalks, comfortable crossings, low-stress bike facilities, or accessible bus stops. The 2012 Complete Streets Ordinance (Revised Ordinances of Honolulu Chapter 14-18) charted a path towards planning for improved safety for all roadway users, including design changes that are proven to improve safety in all roadway and transportation projects, including routine maintenance, repaving, and roadway rehabilitation. Safety features installed by the Complete Streets team include quick-build design solutions, pedestrian safety improvements, transit enhancements, traffic calming, and new bicycle facilities that enhance the safety of all roadway users, including people driving cars and riding the bus.

Hawaiʻi Bicycling League

The Hawaiʻi Bicycling League (HBL) is an island-wide nonprofit promoting bicycle use, providing education, and advocating for safety. HBL has received City grants to deliver programs to educate youth and adults of all ages on how to cycle safely. The BikeEd program teaches fourth graders around Oʻahu how to ride a bicycle, basic cycling safety, and laws of the road. The BikeEd program reached over 8,000 students in 2018. The Adult BikeEd program educates adults and seniors on safe cycling through a variety of methods including workshops and with education materials. The Adult BikeEd program directly reached over 3,000 participants in 2018.

Traffic Division

Honolulu Police Department

The HPD Traffic Division oversees enforcement of traffic safety. Their webpage also provides access to resources regarding traffic safety laws for pedestrians, cyclists, and drivers. HPD uses National Highway Transportation Safety Agency grant funding from the Office of Traffic Safety to help carry-out its traffic safety programing, including Click It or Ticket, stops to educate drivers and cyclists in violation of bicycle-related laws, and participate in community talks and safety activities.

Learning from Other Vision Zero Cities

In comparing our work with other cities, we learned that safety programs are most effective when they are part of a multipronged approach that includes design professionals, educators, and enforcement personnel.

Our future information campaigns will build from our awareness of the common safety violations and crash factors. When new safety features are installed, communication will tie back to those issues. Finally, in considering empathy campaigns, City staff will conduct outreach that acknowledges the trauma of losing loved ones due to this preventable public health crisis.

In the future, our safety programs will be developed in alignment with safety goals and will be guided by crash analysis data. Primary crash factors will be used to determine campaign messaging. Programs will be developed in partnerships with community-based organizations and those most vulnerable to traffic violence. Another avenue for amplifying the impact of programs is to increase capacity for engagement through formalized volunteer programs that allow youth and other residents to give back to their community while exploring transportation safety.

Because it is difficult to tie the direct impact of safety programs to change in fatal and serious injury crashes, there are opportunities to build new metrics for evaluation. Such metrics include audience reach, media impressions, campaign awareness, number of participants in a program, and driver stop for pedestrian or speed compliance rates.

Crash Patterns

This Vision Zero Action Plan (Plan) is informed by crash report data covering the years of 2015 through 2020. During this time, Oʻahu witnessed an alarming number of fatal and serious injury (FSI) crashes - 1,697. Vision Zero crashes are defined as any injury crash involving a person walking or bicycling and any severe injury or fatal crash involving a motorcycle, a motorist, or a passenger.

1,697
Fatal and serious injury crashes

It is crucial to recognize that each loss of life, or significant injury, not only impacts the individuals involved, but also reverberates through the lives of their families and others connected to the incident. As more data becomes available, existing conditions will be measured and monitored to understand whether we are moving towards our Vision Zero target. As shown in the figure below, the number of fatalities across Oʻahu has remained relatively constant over the 6-year period. Serious injury crashes decreased steadily between 2015 and 2018 but spiked in 2019 and decreased again in 2020.

Fatal and Serious Injury Crashes on Oʻahu 2015-2020

Year	Serious Injury	Fatal Injury
2015	245	49
2016	217	58
2017	197	49
2018	167	63
2019	315	49
2020	237	51

SERIOUS INJURY   **FATAL INJURY**
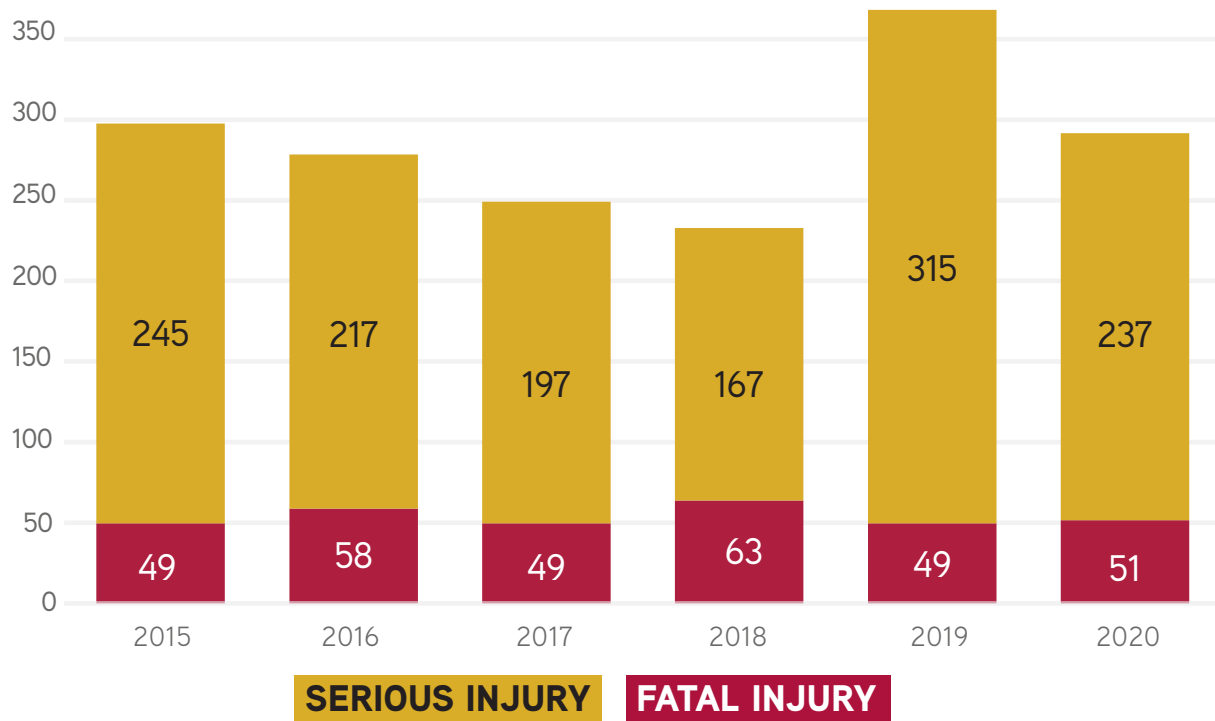
Data Source: Hawaiʻi Department of Transportation SHACA. The State of Hawaii, Department of Transportation, has provided this crash information under the protection of 23 USC 407. This information may not be used in any Federal or State court proceeding in any action for damages arising from any occurrence at a location mentioned or addressed in the information provided.

This Plan focuses on surface roads (excludes interstates). There was a total of 1,504 FSI crashes, including 277 fatalities, on surface roads during the six-year period.

The analysis presented in this section delves into various aspects of these crashes, including the modes of transportation involved, demographics of individuals involved, types of crashes, locations, and infrastructure characteristics.

About the Data

To understand crash patterns (e.g., crash location, conditions, people involved, street characteristics) and given that no single source provides all this information in one place, our crash pattern analysis draws upon several datasets, which are outlined below.

HDOT's State of Hawaiʻi Advanced Crash Analysis (SHACA) includes details reported by the officer who responds to the crash incident, such as the location of the crash, the travel modes involved, the type of vehicle, etc. Details and accuracy about street and other infrastructure characteristics are limited and dependent on what is reported at the moment of the crash.

Vision Zero Crashes combines crash data with the City's multimodal data that incorporates information about the street and land use context. The crashes in this data set are limited to any injury crash involving a person walking or bicycling and any severe injury or fatal crash involving a motorcycle, a motorist, or a passenger.

The Fatality Analysis Reporting (FARS) System reports on details associated with serious suspected injury crashes that have a fatal outcome.

Hawaiʻi Department of Health (DOH) provides insights to assess people killed and hospitalized as a result of being involved in a crash incident.

Impact of Crashes

Crash Severity by Mode

Most traffic crashes involve only vehicles, but the protective features of motor vehicles afforded to drivers tend to mitigate the severity of these incidents and most result in no injury to the drivers involved. On the other hand, people walking, using mobility devices such as wheelchairs, or riding bicycles are far more likely to be killed or seriously injured in crashes. From 2015-2020, people walking and bicycling accounted for 22% of hospitalizations for non-fatal injuries and 41% of fatal crashes. This translates to 118 pedestrian deaths and 13 cyclist deaths during this period. Pedestrian fatalities are the largest portion at 37%; considering this in relation to walking rates (5% of commuters), pedestrian fatalities are heavily disproportionate. Similarly, people bicycling are disproportionately represented at 4% of all fatalities while only accounting for 1% of commuters. Motor vehicle occupants make up 34% of the fatal crashes. It's important to recognize that this Plan is primarily focused on surface roads and as such will largely not address the 15% of motor vehicle occupant and 19% of motorcycle/moped fatal crashes that occurred on interstate facilities.

People Killed Compared to People Hospitalized for Non-Fatal Injuries, by Mode, 2015-2020

	42% Motor Vehicle	36% Motorcycle/moped	22% Bicycle & Pedestrian	
Hospitalizations for non-fatal injuries	1158	997	160	456
Fatalities	117	76	12	115
	36% Motor Vehicle	24% Motorcycle/moped	40% Bicycle & Pedestrian	
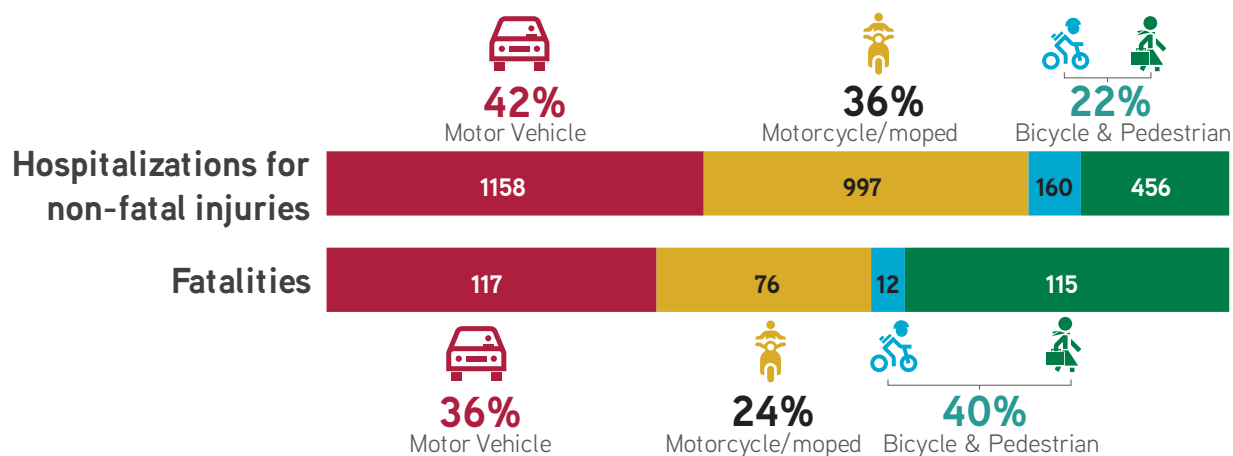
Data Source: Hospitalizations figures from Hawai'i DOH. Fatalities figures from HDOT SHACA.

Crash Details by Mode by Year

The data on fatal crashes by year during 2015-2020 show that fatalities reached a peak in 2018 with 63 deaths. Notably, despite a significant decrease in traffic volumes in 2020 there was no corresponding reduction in the traffic fatalities. Fatalities by mode varied significantly from year-to-year with the most pedestrian and motorcycle/moped fatalities in 2018 and the most bicycle and motor vehicle fatalities in 2020. When looking at fatal crashes combined with serious injury crashes, 2019 had the most with over 360 FSI crashes. During this year, FSI crashes for pedestrians, motor vehicle occupants, and motorcycle/mopeds peaked. FSI crashes for bicycles were highest in 2020.

People Killed by Mode on Oʻahu, 2015-2020
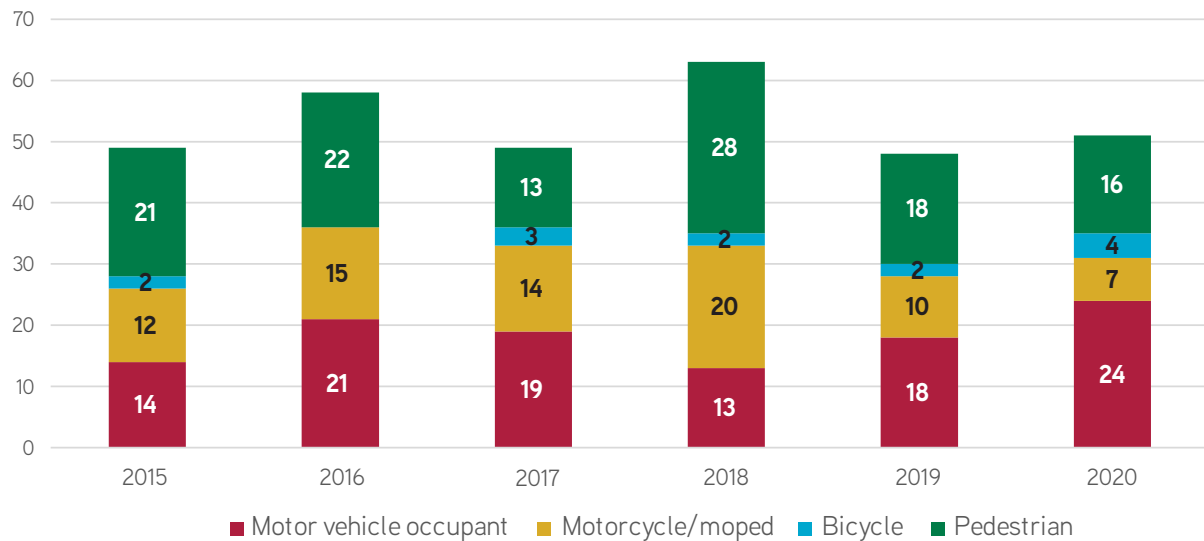
Data Source: HDOT SHACA

Fatal and Serious Injury Crashes by Mode on Oʻahu, 2015-2020

	Bicycle	Pedestrian	Motor vehicle occupant	Motorcycle/ moped	Total FSI
2015	14	75	116	89	294
2016	15	74	100	86	275
2017	13	64	86	83	246
2018	7	68	76	79	230
2019	19	95	132	118	364
2020	21	65	113	89	288

Data Source: HDOT SHACA

Demographics

Age and Gender of Affected Persons

Older adults and young people are some of the most vulnerable road users. Kūpuna aged 65 and older make up 28% of people killed in crashes while walking but represent only 17% of the population. Overall, drivers aged 15-34 are overrepresented in crashes compared to older age groups. The highest proportion of drivers involved in fatal crashes are 25-34 years old, accounting for 23% of all driver-involved incidents. This is followed by those aged 45-54.

Kūpuna aged 65 and older represent only 17% of the County population...

17%

... but make up 28% of people killed in crashes while walking

28%

People aged 15-34 represent 28% of the County population...

28%

... but make up 52% of drivers killed in fatal crashes

52%

People aged 25-34 represent 15% of the County population...

15%

... but make up 23% of drivers involved in fatal crashes

23%
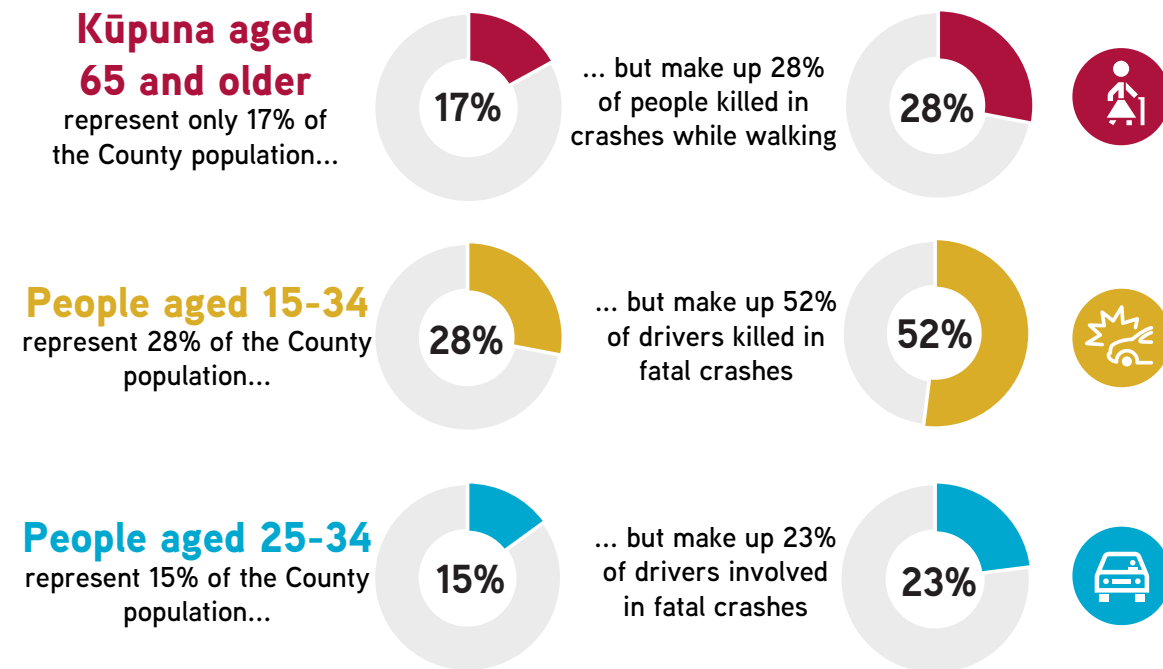
Data Source: National Highway Traffic Safety Administration's FARS

Gender plays a role in road safety, as males are far more likely to be killed in crashes than females. Men make up roughly half of Oʻahu's population but account for 75% of people killed in crashes.

49%
Male

51%
Female

Oʻahu Population

Fatalities

75%
Male

25%
Female
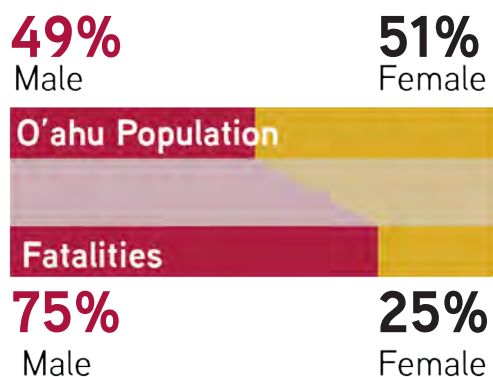
Data Source: FARS, 2019 City and County of Honolulu

Race of Affected Persons

To understand the multifaceted landscape of traffic safety, it is imperative to explore the intersection of race and crash data when compared to overall population demographics. Comparing United States (U.S.) Census and FARS race data is imperfect, as the categories don't match perfectly; most notably for O'ahu is that FARS does not include a category for more than one race, whereas the U.S. Census finds nearly 20% of O'ahu's population is more than one race. With acknowledgement to these limitations, the data suggests that Native Hawaiian and Other Pacific Islanders are disproportionately impacted by traffic deaths.

People Killed by Race/Ethnicity and Mode, 2015-2020
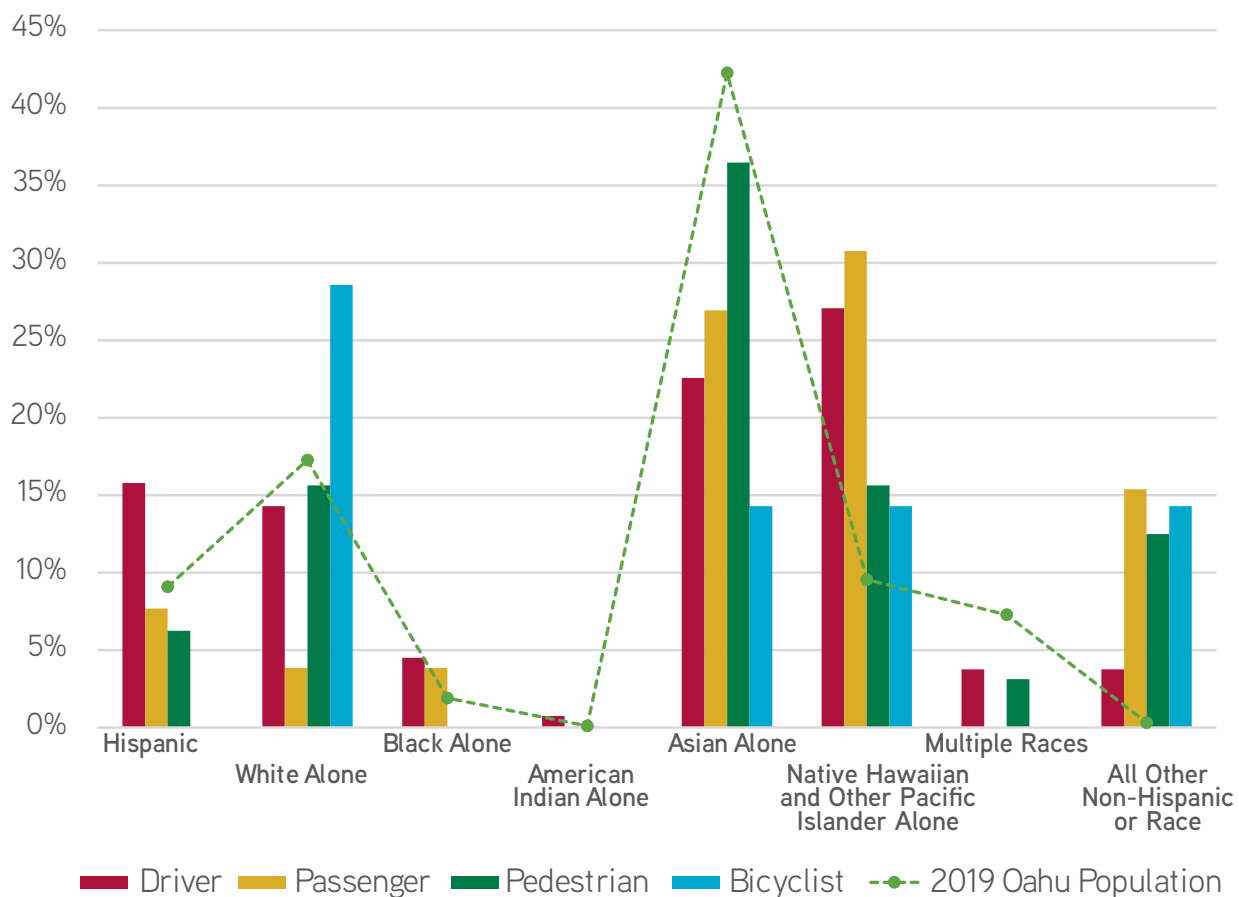
Data Source: FARS; 25 fatal crash victims with unknown race and ethnicity are not shown in this chart.

Employment Status of Affected Persons

Employment status was available for 42% of individuals involved in crashes during the study period. Most individuals involved in crashes have an unknown employment status. Among the known categories, employed individuals (classified as "Other Employed") represent the largest proportion of FSI crashes (23%). Unemployed people and students are overrepresented in FSI crashes compared to crashes overall. As noted in a summary of Hawai'i Vulnerable Roadway Users Assessment, HDOT has begun collecting data on houseless status for fatalities; this data is not typically available in crash reports.

Employment Status of People with Fatal and Serious Injuries

| 4.2% | 28.9% | 3.3% | 2.9% 4.4% | 56.3% |

Proportion of People Involved in Crashes

Proportion of FSI

| 3.8% | 22.9% | 3.5% 5.8% | 6.2% | 57.9% |

■Military ■Other Employed ■Retired ■Student ■Unemployed ■Unknown
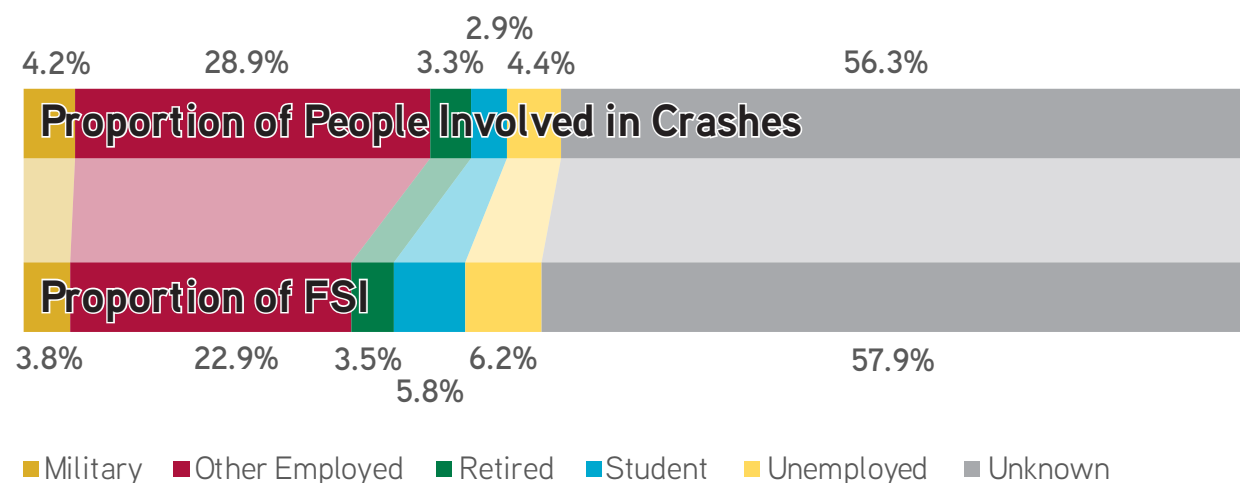
Data Source: HPD

Environmental Justice/Title VI Communities

Title VI of the Civil Rights Act of 1964 prohibits discrimination against anyone in the US based on race, color, or national origin by any agency receiving Federal funds. Moreover, HDOT Title VI programs require environmental justice strategies that ensure fair treatment and meaningful involvement of all people with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. These laws are in place so that all people can participate in and benefit from transportation projects, programs, and policies. The O'ahu Metropolitan Planning Organization uses an analysis of Title VI/Environmental Justice (T6/EJ) areas which include both minority (defined as Black, Hispanic or Latino, Asian American, American Indian and Alaskan Native, and Native Hawaiian or Other Pacific Islander) and low-income populations (median household income is at or below the US Department of Health and Human Services poverty guidelines).

People living in T6/EJ areas are overrepresented in Vision Zero crash data. About 30% of O'ahu's population lives in T6/EJ areas, but 43% of fatalities and 38% of serious injury crashes occurred in T6/EJ areas.

Crashes on State and City Surface Roads within Title VI/Environmental Justice Areas by Injury Level

30%	31%	38%	43%
	n=14,704	n=1,188	n=270
Population lives in T6/EJ areas	Minor injury crashes occurred in T6/EJ areas	Serious injury crashes occurred in T6/EJ areas	Fatal crashes occurred in T6/EJ areas
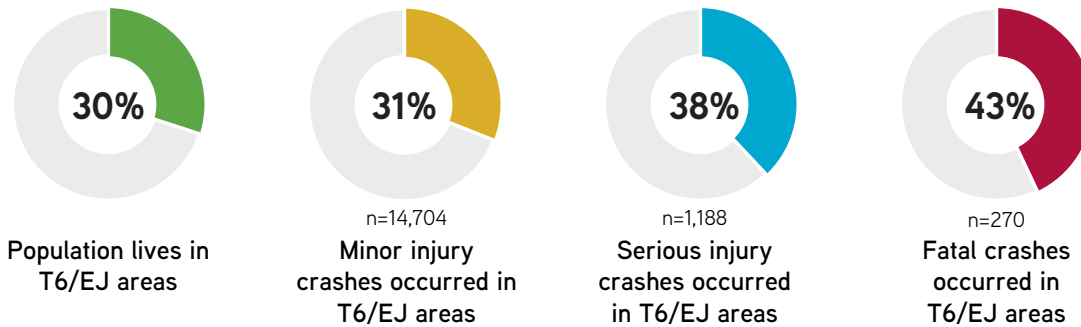
T6/EJ areas are particularly overrepresented in pedestrian FSI crashes modes with crashes where they account for 42% of such crashes. Three out of the top five U.S. Census block groups with the highest rates of FSI crashes per street centerline mile are T6/EJ areas and are the following:

- Kalākaua and King Street (Ala Moana-Kaka'ako)
- Mayor Wright Housing (Kalihi-Pālama)
- Linapuni Elementary School area (Kalihi-Pālama)

Fatal and Serious Injury Crashes on State and City Surface Roads within Title VI/Environmental Justice Areas by Mode

39%	35%	35%	42%
Motor vehicle FSI crashes occurred in T6/EJ areas	Motorcycle/moped FSI crashes occurred in T6/EJ areas	Bicycle FSI crashes occurred in T6/EJ areas	Pedestrian FSI crashes occurred in T6/EJ areas
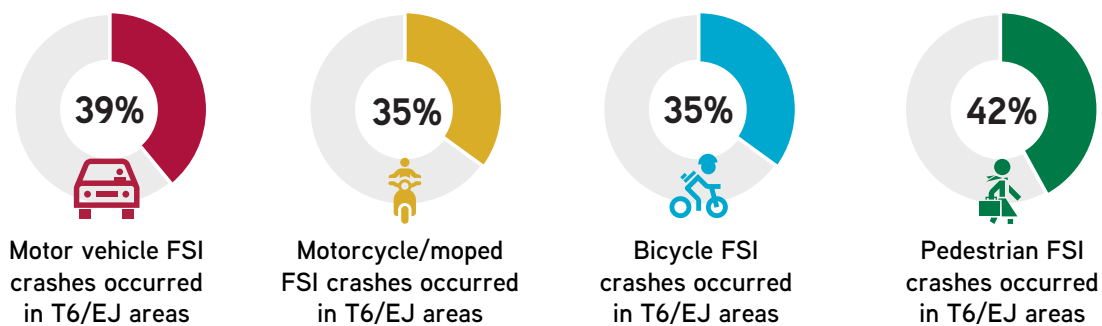
Crash details by Jurisdiction

This Plan is focused primarily on the streets where the City plays a role in design and maintenance, but the analysis also includes State surface roads. On Interstates, engineering design is wholly the responsibility of HDOT.

Of the nearly 5,000 Vision Zero crashes, two-thirds take place on City roads. More than half of the serious injury crashes took place on City roads, but slightly more fatalities occurred on State roads.

Crashes on State and City Surface Roads by Injury Level, 2015-2020

	State	City	Other	
Vision Zero	29%	67%	5%	n = 4,496
Serious Injury	41%	54%	5%	n = 1,213
Fatalities	49%	47%	4%	n = 277
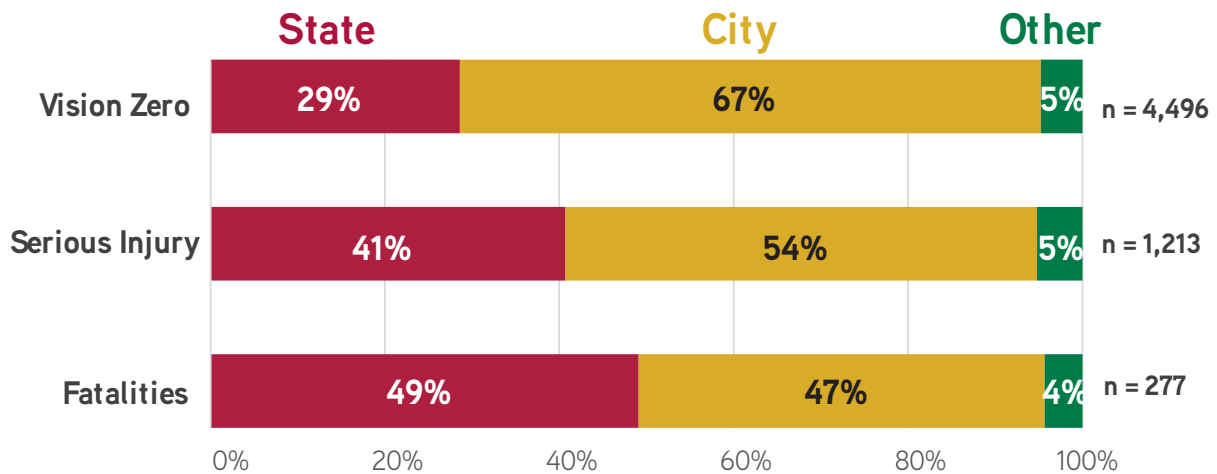
Data Source: HDOT SHACA.

Street jurisdiction in this chart uses a more accurate street multimodal network developed by the City. "Other" includes crashes on private streets and the less than 20 crashes on Department of Defense Federal roads. It does not include grade separated highways.

Common High Risk Roadway Characteristics for All Crash Types

The analysis provides an opportunity to understand the characteristics of the streets with a history of reported crashes, so that safety features can be considered for other streets that may not yet have a history of crashes, but are at risk due to having attributes in common with High-Injury Locations. Corridors with these characteristics will be monitored and maintained to prevent future crashes. Common attributes for streets with a high incidence of crashes include:

- Main Streets and other major streets
- Three or more lanes
- Average daily traffic volumes above 20,000 vehicles
- Speed limits over 30 miles per hour (MPH)
- Unsignalized intersections and those without all-way stop signs or other traffic control.

Functional Classification and Complete Streets Types

There are two types of road categories: functional classification and Complete Streets typology. The functional classification is defined by the Federal Highway Administration, and includes principal arterials, minor arterials, major collectors, minor collectors, and local streets. Complete Streets typologies are defined by the City per the Complete Streets Design Manual, and include main streets, avenues, boulevards, malls, streets, residential streets, lane/alley, rural road, and scenic byways.

- **Functional classification:** 63% of FSI crashes occurred on principal and minor arterials, which make up nearly 17% of our island roadway miles -- a rate of 2.8 (principal arterials) and 2.6 (minor arterials) FSI crashes per centerline mile. Major collectors also saw a disproportionate rate of crashes. While local streets made up almost three-quarters of centerline miles, but less than one quarter of FSI crashes, local streets saw by far the lowest FSI crashes per centerline mile, at 0.2.

- **Complete Streets Types:** Main streets, avenues, and boulevards make up 17.3% of total centerline miles and 63.2% of FSI crashes. Main streets had the greatest rate of FSI crashes per mile at 3.9, followed by avenues which saw 2.6 FSI crashes per mile, and boulevards with 2.3 FSI crashes per mile.

Number of Lanes

Streets with a higher lane count have a higher risk of severe crashes, whereas streets with fewer lanes have a lower likelihood of serious or fatal crashes. Roads with one or two lanes comprise the majority of roads (87.4%), but have a relatively lower proportion of FSI crashes (0.4) per centerline mile Notably, roads with five or more lanes, comprise only 3.6% of centerline miles, but have a significantly higher proportion of FSI crashes per mile at 19.1. The data clearly shows that as the number of lanes increases, so does the FSI crash rate.

Traffic Volumes

The data show a trend between higher crash rates and higher Annual Average Daily Traffic (AADT). Streets with traffic volumes above 5,000 vehicles per day account for approximately 20% of centerline miles but were the site of 73% of FSI crashes. There were over 3 FSI crashes per mile on streets with an ADT volume greater than 15,000. The highest category ("20,001 and above") has the highest crash rate at 3.2 crashes per centerline mile.

Average Annual Daily Traffic (AADT) and Crashes

AADT	Centerline Miles	Percent of All Centerline Miles	Number of FSI Crashes	Percent of All FSI Crashes	FSI Crashes per Centerline Mile
No data*	1513	73.8%	304	21.2%	0.2
5,000 and below	119	5.8%	79	5.5%	0.7
5,001 – 10,000	113	5.5%	203	14.2%	1.8
10,001 – 15,000	110	5.4%	233	16.3%	2.1
15,001 – 20,000	51	2.5%	155	10.8%	3.0
20,001 and above	143	7.0%	459	32.0%	3.2

* Assumed to be local streets with low traffic volumes

Excludes 48 crashes that took place on U.S. interstate ramps within 100 feet of a local street intersection.

Data Source: City and County of Honolulu and HDOT SHACA. HDOT has provided this crash information under the protection of 23 USC 407. This information may not be used in any Federal or State court proceeding in any action for damages arising from any occurrence at a location mentioned or addressed in the information provided.

Posted Speed

Streets with posted speed of 30 MPH or higher experienced a higher rate of FSI crashes than streets with lower speed limits. Streets with posted speeds of 35 MPH account for 27% of FSI crashes but only 8% of centerline miles. The relatively small number of 30 MPH streets (1.6% of centerline miles) had the highest FSI rate per mile at 3.3. At the opposite end, streets with speed limits of 20 MPH or lower had the lowest FSI rate per mile at 0.2.

Posted Speed and Crashes

Posted Speed	Centerline Miles	Percent of All Centerline Miles	Number of FSI Crashes	Percent of All FSI Crashes	FSI Crashes per Centerline Mile
Less than 20 MPH	355	17.3%	65	4.5%	0.2
25 MPH	1436	70.0%	765	53.4%	0.5
30 MPH	33	1.6%	110	7.7%	3.3
35 MPH	160	7.8%	387	27.0%	2.4
40 MPH and above	67	3.3%	106	7.4%	1.6

Excludes 48 crashes that took place on U.S. interstate ramps within 100 feet of a local street intersection and one crash that took place on a street that was missing speed limit data.

Data Source: City and County of Honolulu and HDOT SHACA. HDOT has provided this crash information under the protection of 23 USC 407. This information may not be used in any Federal or State court proceeding in any action for damages arising from any occurrence at a location mentioned or addressed in the information provided.

Intersections

Most crashes resulting in injury on Oʻahu occur at intersections, and crashes that occur between intersections are more likely to result in a fatality or serious injury. Nearly 70% of crashes involving people walking and bicycling take place at intersections compared to 57% of crashes involving motor vehicles only.

The risk of fatal crashes increases at unsignalized intersections and those without all-way stop signs or other traffic controls. Signals and stop signs are the most common traffic control types on Oʻahu. A high number of crashes occurred at signalized intersections but were less likely to result in a fatality or serious injury. The chart below shows crash types at intersections by traffic control type. The "Other" category includes yield signs, flashing red lights, flashing amber lights, and people providing temporary traffic control.

Traffic Control and Injury Severity at Intersections

Data is missing for 898 involved parties (units)

Data Source: HDOT SHACA. HDOT provided this crash information under the protection of 23 USC 407. This information may not be used in any Federal or State court proceeding in any action for damages arising from any occurrence at a location mentioned or addressed in the information provided.

Multimodal Elements

- 80% of FSI crashes involving bicyclists occurred on streets without dedicated bikeway infrastructure. Over 94% of street centerline miles lack dedicated bikeways. This category includes shared roadway bike routes, which include Share the Road signage or sharrows, but still require bicyclists to share a travel lane with motorists. Shared roadway bike routes make up just 3% of centerline miles but account for 18% of FSI crashes involving bicyclists.

- 20% of FSI crashes involving bicyclists occurred on streets or facilities with dedicated bikeways (bike lanes, buffered bike lanes, protected bike lanes, and shared use paths). These dedicated bikeways cover less than 6% of the street network and the bicycle FSI crash rate per mile on these facilities is 0.1. Note that this analysis doesn't consider exposure (bicycle volumes) and streets with bikeway infrastructure facilities typically have much higher rates of bicycle use than those without bikeways. The crash reports also show that the presence of a bikeway facility adjacent to a crash location does not necessarily imply its usage during the crash, as highlighted by instances where cyclists may have been outside designated lanes or crossing the street.

- Nearly one-fifth (19%) of FSI pedestrian crashes occur on roads without sidewalks or other pedestrian facilities, indicating infrastructural deficiencies.

- Though this analysis doesn't consider exposure, higher rates of crashes involving pedestrians and cyclists occurred near high-ridership bus stops (with 200 or more daily ons and offs) as compared to islandwide statistics. These crashes, however, were less likely to result in fatal or serious injury when compared to crashes islandwide.
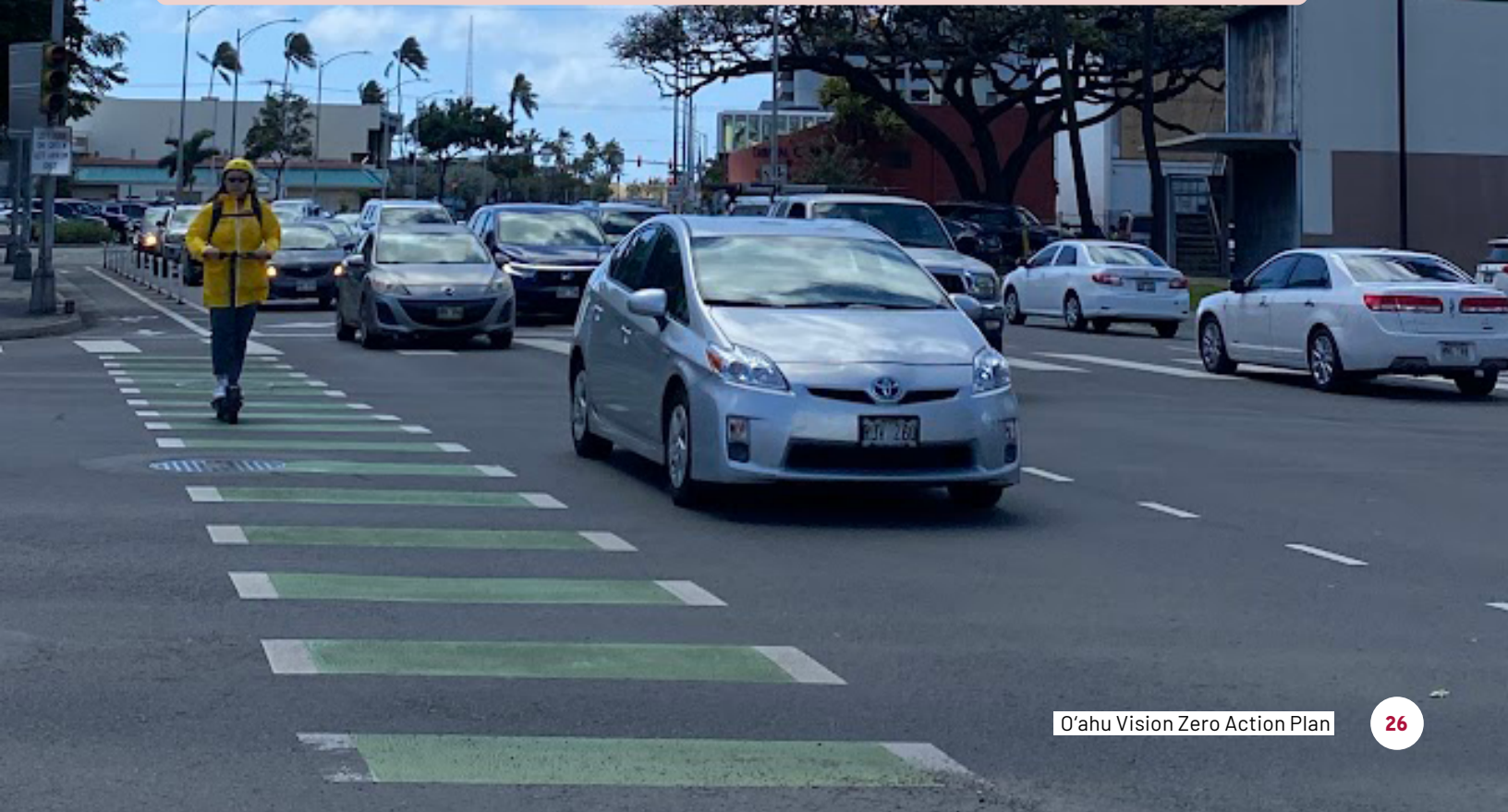
Common Contributing Factors

This section describes the demographic, land use, and infrastructure characteristics associated with increasing crash severity.

Human Factors

Human or other factors, such as inattention, impairment, driving too fast for the conditions, and failure to yield, were contributing factors for 85% of all crashes, and 95% of crashes on a State or City surface road.

Speed

Speed is a determining factor in the severity of injury and fatality when a crash does occur. The crash report data indicates that speed is a primary contributing factor in a significant portion of crashes and the severity of crashes increases with higher speeds.

Vehicle Speed and Pedestrian Injury

20 mph	25 mph	30 mph	50 mph
10% chance of pedestrian fatality or severe injury	**25%** chance of pedestrian fatality or severe injury	**50%** chance of pedestrian fatality or severe injury	**90%** chance of pedestrian fatality or severe injury
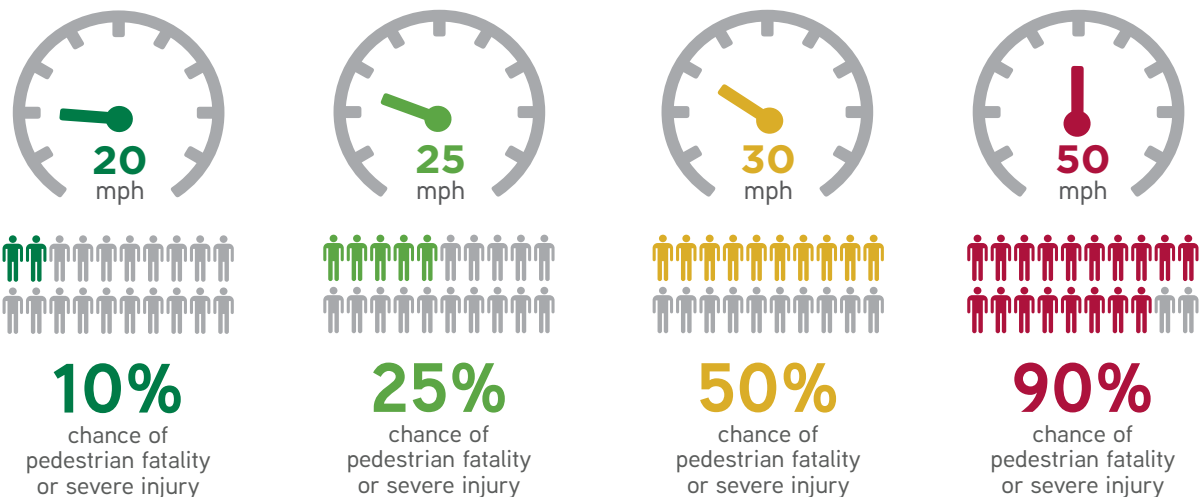
Speed was a contributing factor in 32% of fatal crashes, 17% of serious injury crashes, and 9% of minor injury crashes. While this finding comports with the upward relationship between speed and severity of injury, it should also be acknowledged that speed is likely underreported in less severe crashes.

Speed-Related Crashes by Injury Level on State and City Surface Roads, 2015-2020

	Other Factors	Speed-Related Factors	
Possible or Minor Injury	90.6%	9.4%	n = 14,632
Suspected Serious Injury	82.9%	17.1%	n = 1,213
Fatal Injury	68.4%	31.6%	n = 275
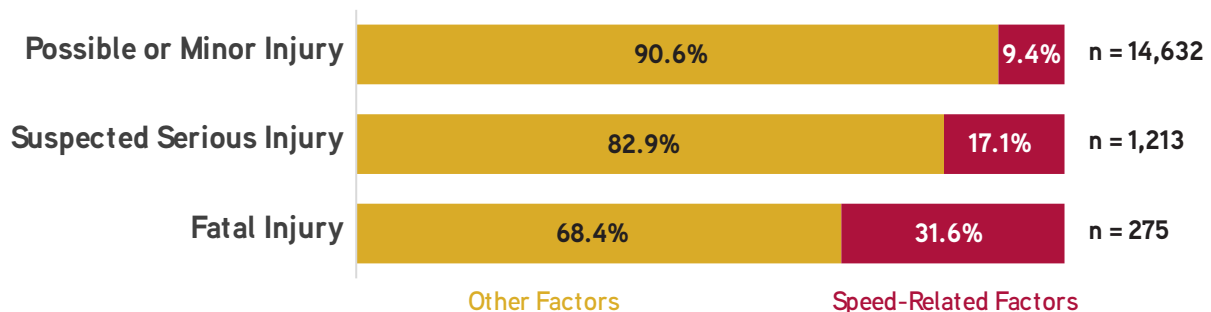
Speed-related crashes include Drove Too Fast for Condition or Exceeded Speed Limit as contributing factors.
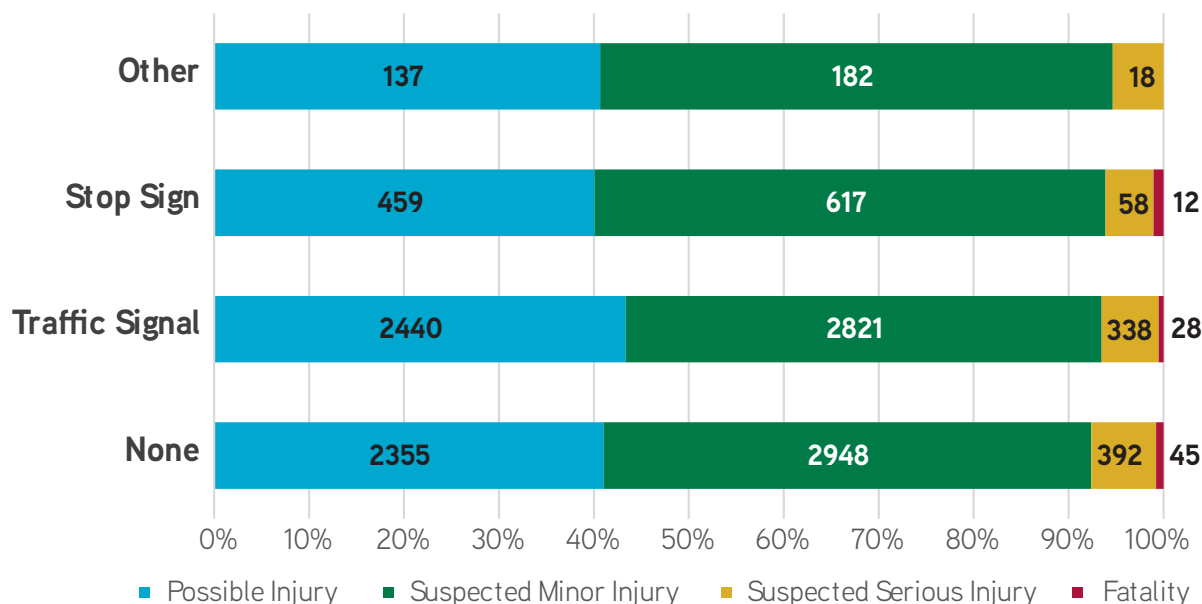
Data Source: HDOT SHACA. HDOT has provided this crash information under the protection of 23 USC 407. This information may not be used in any Federal or State court proceeding in any action for damages arising from any occurrence at a location mentioned or addressed in the information provided.

Impairment and Inattention

Inattention was the most common human factor recorded for crashes. These factors were involved in almost 40% of crashes that resulted in a death or serious injury and a similar number of crashes that resulted in minor injuries.

Impairment, usually from alcohol or other substances, was reported in 8.8% of fatal and 10.4% of serious crashes compared to 3.8% for other injury crashes. However, impairment is relatively underreported in the SHACA data as the data relies on police data from the time of the crash. Police reports document impairment in two ways: impairment or suspected impairment. After the crash, a toxicology report confirms if impairment was present in those involved in the crash, but the crash report is not updated with results from toxicology report. Data from FARS does include toxicology data and indicates that alcohol impairment is a factor in 33% of fatal crashes.

INATTENTION	IMPAIRMENT	SPEED	FAILURE TO YIELD
33%	**33%**	**32%**	**10%**
of fatal crashes	of fatal crashes	of fatal crashes	of fatal crashes
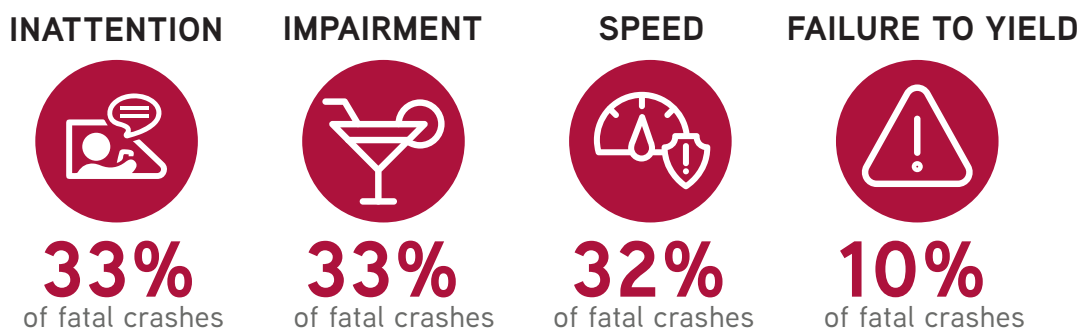
Lighting

Lack of visibility due to time of day and presence of roadway lighting are contributing factors in crashes on Oʻahu. Half of fatal and serious injury crashes take place in daylight. However, crashes that take place in dark conditions, such as at night on unlit streets, are more likely to result in a fatality or serious injury than crashes that take place during the day. In dark conditions with no lighting, 14% of injury crashes result in an FSI. In dark conditions with continuous or spot illumination, the FSI rate is 11%. At dawn or dusk, the FSI rate is 10%. In daylight the rate is 6%.

Dark with no lighting	Dark with lighting	Dusk/Dawn	Daylight
14%	**11%**	**10%**	**6%**
of injury crashes result in an FSI	of injury crashes result in an FSI	of injury crashes result in an FSI	of injury crashes result in an FSI
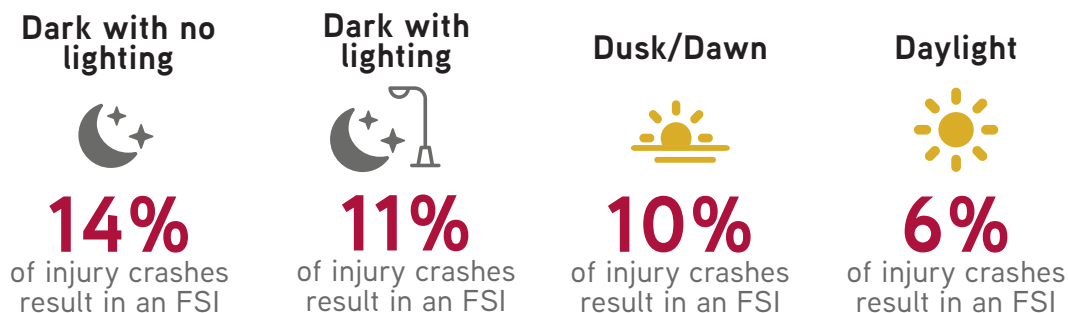
Common Crash Types

Crashes involving motor vehicles

- Of FSI motor vehicle crashes on Oʻahu streets, 43% involve a motor vehicle hitting an object. These objects include utility or light poles, parked cars, bridge railings or supports, fences, traffic signals, traffic barriers, trees, culverts or ditches, and other objects near roadway edges.

- Broadside crashes, when the front of one vehicle collides with the side of another vehicle, account for the second most common type of vehicle crash.

Crashes involving pedestrians

- The most frequent FSI crash scenarios involve pedestrians crossing in a crosswalk and a motor vehicle proceeding straight ahead or making a left turn. Left-turn collisions predominantly occur at traffic signals, while crashes involving vehicles proceeding straight ahead are more prevalent at uncontrolled locations.

- 44% of crashes where a pedestrian is fatally or seriously injured occur when the pedestrian is crossing in a crosswalk.

- 66% of pedestrian crashes in crosswalks took place on roads with four or more lanes.

Crashes involving people on bicycles

- The majority (80%) of FSI to cyclists occurred on a road with no dedicated space for bicyclists.

- The most common types of bicycle-involved crashes include a motor vehicle proceeding straight and colliding with a cyclist riding on a road without a bikeway, or a cyclist crossing a road. Notably, a vehicle proceeding straight ahead, regardless of the bicycle's action, is more likely to result in fatal or serious injuries to the cyclist compared to a turning vehicle.

- Differences exist in the predominant bicycle actions between State surface roads and City streets. Riding outside a designated bikeway is more frequent on State roads, while incidents involving cyclists falling in or on the roadway are more common on City streets.

- While right turn on red maneuvers were not among the top motor vehicle actions, they were implicated in three fatal or serious bicycle crashes and 31 bicycle crashes of all injury levels.

High-Injury Locations

While traffic safety is a community-wide issue, safety issues are not evenly distributed around the street network. Identifying High-Injury Locations, or street segments and intersections that experience the highest number of Vision Zero crashes, is one of the pillars of a Vision Zero program. High-Injury Locations will be developed into projects to address safety. They also help inform proposed changes to policy, investments, and non-infrastructure changes.

Our approach for identifying these High-Injury Locations was informed by a review of cities across the US that have successfully moved towards zero FSI crashes through their Vision Zero programs. The analysis is based on major crash reports from the HPD for the period 2015 to 2020, and covers both State and City streets on the island, but excludes interstate facilities.

High-Injury Locations are composed of High-Injury Corridors and High-Injury Intersections.

High-Injury Location: Street segments and intersections that experience the highest number of Vision Zero crashes.

High-Injury Corridor: A street segment that experiences three or more Vision Zero crashes per mile per year.

High-Injury Intersection: An intersection of two streets where one or more Vision Zero crashes occur per year.

High Injury Corridors

39 miles of streets, representing
27.5% of the Vision Zero crashes

27.5%
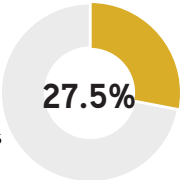
High Injury Intersections

93 intersections, representing
17.4% of the Vision Zero crashes

17.4%
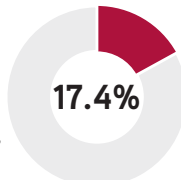
The largest concentration of High-Injury Locations is in urban Honolulu. 90% of the High-Injury Corridors are in the Primary Urban Center development plan area (Kahala to Pearl City). High-Injury Intersections are slightly more geographically distributed across the island.

Note: The crash information in this section is under the protection of 23 USC 407. This information may not be used in any Federal or State court proceeding in any action for damages arising from any occurrence at a location mentioned or addressed in the information provided.

High-Injury Locations in Waiʻanae & Māʻili, Wahiawā, Waipahu & Pearl City, and Kapolei & ʻEwa
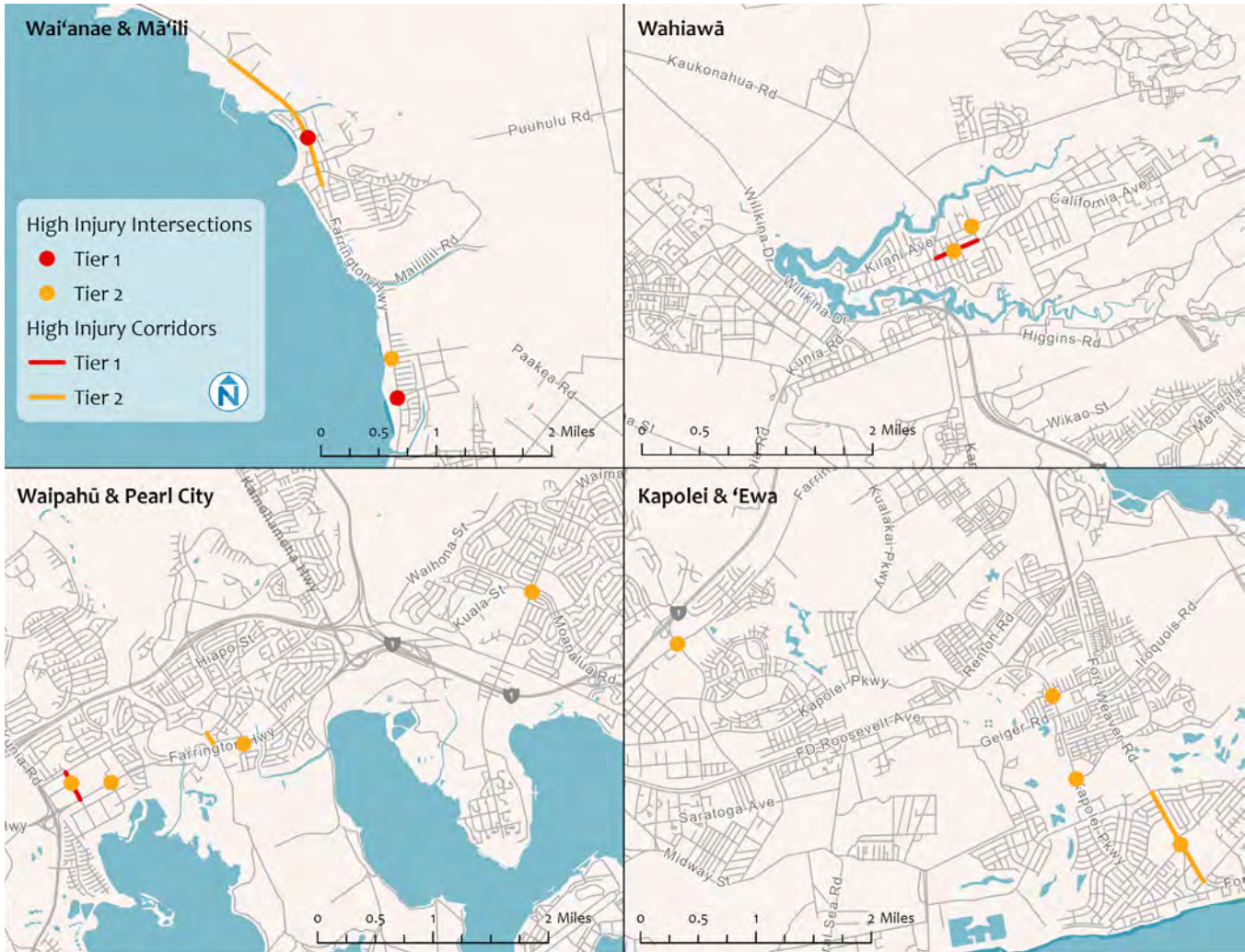
High-Injury Corridors

Area	Tier	Location	From	To	Total Vision Zero (VZ) Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes/ mile/year
Waiʻanae & Māʻili	Tier 2	Farrington Hwy	Ala Akau St	Glenmonger St	26	3.1	12	1.5
Wahiawā	Tier 1	California Ave	Kamehameha Hwy	N Cane St	8	6.2	1	0.8
Waipahu & Pearl City	Tier 1	Leoku St	Farrington Hwy	Waipahu St	10	6.4	1	0.6
Waipahu & Pearl City	Tier 2	Waipahu Depot St	Farrington Hwy	Waipahu St	5	5.2	1	1.0
Kapolei & ʻEwa	Tier 2	Fort Weaver Rd	North Rd	Keoneula Blvd	18	3.2	7	1.2

High-Injury Intersections

Area	Tier	Location	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes / mile/year
Waiʻanae & Māʻili	Tier 1	Farrington Hwy & Old Government Rd	10	1.7	6	1.0
Waiʻanae & Māʻili	Tier 1	Farrington Hwy & Saint Johns Rd	9	1.5	8	1.3
Waiʻanae & Māʻili	Tier 2	Farrington Hwy & Maliona St	7	1.2	4	0.7
Wahiawā	Tier 2	California Ave & Westervelt St	6	1.0	2	0.3
Wahiawā	Tier 2	Kilani Ave & N Cane St	9	1.5	1	0.2
Waipahu & Pearl City	Tier 2	Farrington Hwy & Leokane St	11	1.8	2	0.3
Waipahu & Pearl City	Tier 2	Farrington Hwy & Mokuola St	9	1.5	1	0.2
Waipahu & Pearl City	Tier 2	Kuala St & Noelani St	6	1.0	3	0.5
Waipahu & Pearl City	Tier 2	Leoku St & Leolua St	7	1.2	1	0.2
Kapolei & ʻEwa	Tier 2	Farrington Hwy & Makakilo Dr	7	1.2	3	0.5
Kapolei & ʻEwa	Tier 2	Fort Weaver Rd & Papipi Rd	6	1.0	1	0.2
Kapolei & ʻEwa	Tier 2	Kapolei Pkwy & Kahiuka St	7	1.2	2	0.3
Kapolei & ʻEwa	Tier 2	Kapolei Pkwy & Keaunui Dr	6	1.0	4	0.7

Table is ordered by Area, Tier, then alphabetized by Location.

High-Injury Locations in Kāneʻohe and East Honolulu & Waimānalo
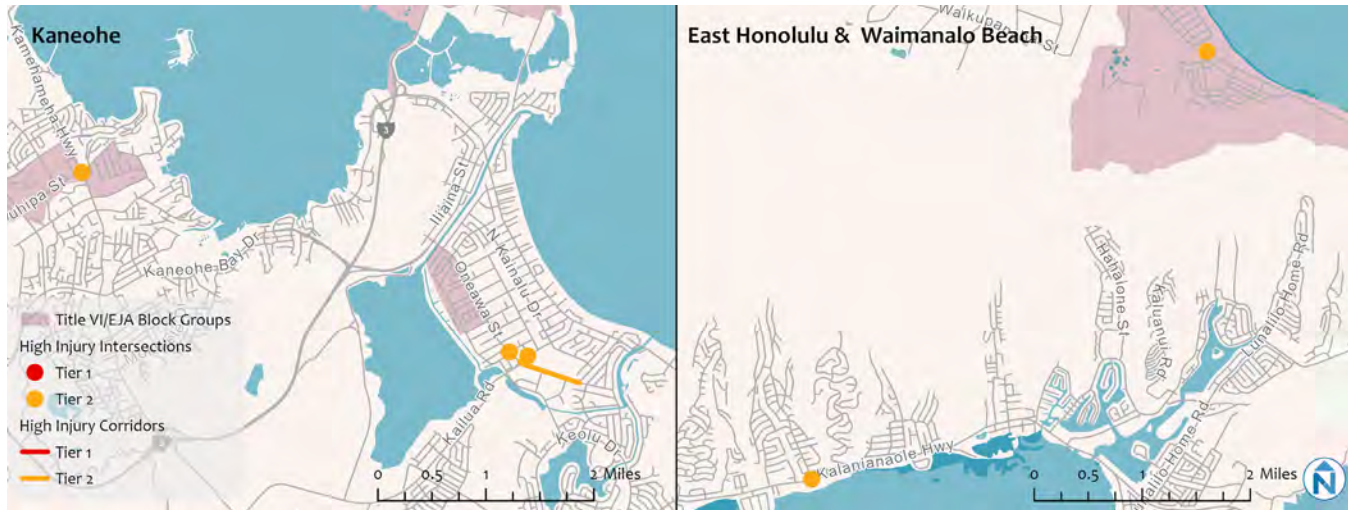
High-Injury Corridors

Area	Tier	Location	From	To	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes/ mile/year
Kāneʻohe	Tier 2	Kailua Rd	Kuʻulei Rd	Wanaao Rd	13	4.3	1	0.3

High-Injury Intersections

Area	Tier	Location	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes / mile/year
Kāneʻohe	Tier 2	Kamehameha Hwy & Kahuhipa St	6	1.0	2	0.3
Kāneʻohe	Tier 2	Kuʻulei St & Aulike St	8	1.3	0	0.0
Kāneʻohe	Tier 2	Oneawa St & Kihapai St	6	1.0	0	0.0
East Honolulu & Waimānalo	Tier 2	Kalanianaʻole Hwy & East Hind Dr	7	1.2	4	0.7
East Honolulu & Waimānalo	Tier 2	Kalanianaʻole Hwy & Nakini St	9	1.5	3	0.5

Table is ordered by Area, Tier, then alphabetized by Location.

High-Injury Locations in Urban Honolulu

High-Injury Corridors

Area	Tier	Location	From	To	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes/ mile/year
Urban Honolulu	Tier 1	Aala St	N Beretania St	N School St	18	7.1	1	0.4
Urban Honolulu	Tier 1	Ala Wai Blvd	Kalakaua Ave	Kapahulu Ave	67	6.5	11	1.1
Urban Honolulu	Tier 1	Bethel St	Nimitz Hwy	S Beretania St	17	8.7	2	1.0
Urban Honolulu	Tier 1	Liliha St	N King St	N School St	13	5.7	6	2.6
Urban Honolulu	Tier 1	Makaloa St	Sheridan St	Kalakaua Ave	25	7.4	5	1.5
Urban Honolulu	Tier 1	Kaheka St	Kapiolani Blvd	S King St	21	8.3	2	0.8
Urban Honolulu	Tier 1	Kapahulu Ave	Kalakaua Ave	Date St	33	6.1	9	1.7

Area	Tier	Location	From	To	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes/ mile/year
Urban Honolulu	Tier 1	Kapiolani Blvd	Kamakeʻe St	McCully St	63	8.5	11	1.5
Urban Honolulu	Tier 1	Keʻeaumoku St	Kapiolani Blvd	Wilder Ave	34	6.3	7	1.3
Urban Honolulu	Tier 1	N King St	Kohou St	Dillingham Blvd / Liliha St	20	6.1	3	0.9
Urban Honolulu	Tier 1	S King St	Alapai St	Punahou St	92	11.3	10	1.2
Urban Honolulu	Tier 1	S King St	Punahou St	University Ave	56	9.5	10	1.7
Urban Honolulu	Tier 1	Pālama St	N King St	N School St	14	5.7	5	2.0
Urban Honolulu	Tier 1	Piʻikoi St	Waimanu St	Wilder Ave	39	6.5	5	0.8
Urban Honolulu	Tier 1	Wilder Ave	Pensacola St	Punahou St	26	6.8	3	0.8
Urban Honolulu	Tier 2	Beretania St	Alapai St	Punahou St	39	5.4	7	1.0
Urban Honolulu	Tier 2	Beretania St	N King St	Alapai St	35	5.6	4	0.6
Urban Honolulu	Tier 2	Beretania St	Punahou St	University Ave	20	3.2	2	0.3
Urban Honolulu	Tier 2	Date St	Isenberg St	Kapahulu Ave	28	4.1	7	1.0
Urban Honolulu	Tier 2	Dillingham Blvd	Waiakamilo Rd	N King St	22	4.1	2	0.4
Urban Honolulu	Tier 2	Hobron Ln	Holomoana St	Ena Rd	9	3.9	1	0.4
Urban Honolulu	Tier 2	Kalakaua Ave	Beretania St	McCully St	32	4.0	7	0.9
Urban Honolulu	Tier 2	Kalihi St	Nimitz Hwy	N King St	14	3.8	2	0.5
Urban Honolulu	Tier 2	Kamakeʻe St	Ala Moana Blvd	Kapiolani Blvd	9	4.3	3	1.4
Urban Honolulu	Tier 2	Kanunu St	Keʻeaumoku St	Kalakaua Ave	6	3.1	1	0.5
Urban Honolulu	Tier 2	Kapahulu Ave	Mooheau Ave / Date St	Harding Ave	17	5.0	1	0.3

Area	Tier	Location	From	To	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes/ mile/year
Urban Honolulu	Tier 2	Kapiolani Blvd	McCully St	Waiʻalae Ave	30	3.7	8	1.0
Urban Honolulu	Tier 2	Kapiolani Blvd	South St	Kamakeʻe St	15	3.8	5	1.3
Urban Honolulu	Tier 2	Kinau St	Ward Ave	Keʻeaumoku St	19	4.6	8	1.9
Urban Honolulu	Tier 2	N King St	Dillingham Blvd / Liliha St	Iwilei Rd	6	4.1	0	0.0
Urban Honolulu	Tier 2	N King St	Middle St	Kalihi St	21	4.5	7	1.5
Urban Honolulu	Tier 2	S King St	University Ave	Kapiolani Blvd	13	3.3	7	1.8
Urban Honolulu	Tier 2	Nuʻuanu Ave	Merchant St	N Kuakini St/S Kuakini St	18	3.1	2	0.3
Urban Honolulu	Tier 2	Paoakalani Ave	Kalakaua Ave	Ala Wai Blvd	8	3.8	1	0.5
Urban Honolulu	Tier 2	Pensacola St	Lunalilo St	Nehoa St	10	3.2	0	0.0
Urban Honolulu	Tier 2	Punahou St	Nehoa St	Phillip St	16	3.3	2	0.4
Urban Honolulu	Tier 2	Punchbowl St	Ala Moana Blvd	S Beretania St	13	3.6	3	0.8
Urban Honolulu	Tier 2	Punchbowl St	S Beretania St	Lusitana St	7	3.3	0	0.0
Urban Honolulu	Tier 2	River St	Nimitz Hwy	S Vineyard Blvd	6	3.1	0	0.0
Urban Honolulu	Tier 2	Royal Hawaiian Ave	Kalakaua Ave	Aloha Dr	7	5.4	1	0.8
Urban Honolulu	Tier 2	Rycroft St	Pensacola St	Kaheka St	17	5.2	1	0.3
Urban Honolulu	Tier 2	School St	Houghtailing St	Liliha St	19	3.8	5	1.0
Urban Honolulu	Tier 2	School St	Kamehameha Iv Rd	Houghtailing St	19	3.3	4	0.7
Urban Honolulu	Tier 2	Seaside Ave	Kalakaua Ave	Ala Wai Blvd	9	5.6	0	0.0

Area	Tier	Location	From	To	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes/ mile/year
Urban Honolulu	Tier 2	Sheridan St	Kapiolani Blvd	Kalakaua Ave	8	3.0	1	0.4
Urban Honolulu	Tier 2	Waiʻalae Ave	Koko Head Ave	17th Ave	8	3.3	1	0.4
Urban Honolulu	Tier 2	Waiʻalae Ave	St Louis	Koko Head Ave	26	4.5	9	1.6
Urban Honolulu	Tier 2	Ward Ave	Ala Moana Blvd	Kapiolani Blvd	10	3.9	1	0.4
Urban Honolulu	Tier 2	Ward Ave	S King St	Prospect St	16	5.7	3	1.1
Urban Honolulu	Tier 2	Young St	Victoria St	Punahou St	34	6.0	7	1.2

High-Injury Intersections

Area	Tier	Location	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes / mile/year
Urban Honolulu	Tier 1	S Beretania St & Piʻikoi St	12	2.0	2	0.3
Urban Honolulu	Tier 1	Kapiolani Blvd & Mahukona St	13	2.2	2	0.3
Urban Honolulu	Tier 1	Keʻeaumoku St & Wilder Ave	13	2.2	5	0.8
Urban Honolulu	Tier 1	King St & McCully St	14	2.3	3	0.5
Urban Honolulu	Tier 1	King St & Ward Ave	16	2.7	2	0.3
Urban Honolulu	Tier 1	S King St & Keʻeaumoku St	18	3.0	4	0.7
Urban Honolulu	Tier 1	S King St & Piʻikoi St	23	3.8	0	0.0
Urban Honolulu	Tier 1	Pālama St & Halona St	10	1.7	6	1.0
Urban Honolulu	Tier 1	N School St & Stillman Lane	12	2.0	1	0.2
Urban Honolulu	Tier 1	Wilder Ave & Makiki St	13	2.2	1	0.2
Urban Honolulu	Tier 2	Ala Moana Blvd & Ena Rd	6	1.0	0	0.0
Urban Honolulu	Tier 2	Ala Moana Blvd & Piʻikoi St	7	1.2	2	0.3
Urban Honolulu	Tier 2	Ala Wai Blvd & Kaiolu St	7	1.2	0	0.0
Urban Honolulu	Tier 2	Ala Wai Blvd & McCully St	11	1.8	3	0.5

Area	Tier	Location	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes / mile/year
Urban Honolulu	Tier 2	S Beretania St & Punahou St	8	1.3	0	0.0
Urban Honolulu	Tier 2	S Beretania St & Punchbowl St	10	1.7	1	0.2
Urban Honolulu	Tier 2	Bethel St & S Pauahi St	8	1.3	1	0.2
Urban Honolulu	Tier 2	Date St & Mahiai St	7	1.2	2	0.3
Urban Honolulu	Tier 2	Dillingham Blvd & Mc Neill St	9	1.5	0	0.0
Urban Honolulu	Tier 2	Dillingham Blvd & Mokauea St	6	1.0	1	0.2
Urban Honolulu	Tier 2	Fern St & McCully St	7	1.2	3	0.5
Urban Honolulu	Tier 2	Hobron Ln & Ala Moana Blvd	10	1.7	0	0.0
Urban Honolulu	Tier 2	Hobron Ln & Lipeepee St	6	1.0	1	0.2
Urban Honolulu	Tier 2	Kalakaua Ave & Ala Wai Blvd	10	1.7	0	0.0
Urban Honolulu	Tier 2	Kalakaua Ave & Makaloa St	6	1.0	1	0.2
Urban Honolulu	Tier 2	Kalakaua Ave & Pa'ū St	6	1.0	0	0.0
Urban Honolulu	Tier 2	Kalihi St & Kahanu St	7	1.2	1	0.2
Urban Honolulu	Tier 2	Kamake'e St & Ala Moana Blvd	7	1.2	3	0.5
Urban Honolulu	Tier 2	Kamoku St & Date St	7	1.2	0	0.0
Urban Honolulu	Tier 2	Kapahulu Ave & Castle St	7	1.2	0	0.0
Urban Honolulu	Tier 2	Kapahulu Ave & Lemon Rd	6	1.0	3	0.5
Urban Honolulu	Tier 2	Kapahulu Ave & Winam Ave	6	1.0	0	0.0
Urban Honolulu	Tier 2	Kapiolani Blvd & Isenberg St	7	1.2	1	0.2
Urban Honolulu	Tier 2	Kapiolani Blvd & Kalakaua Ave	11	1.8	3	0.5
Urban Honolulu	Tier 2	Kapiolani Blvd & Kamake'e St	10	1.7	1	0.2
Urban Honolulu	Tier 2	Kapiolani Blvd & Paani St	6	1.0	2	0.3
Urban Honolulu	Tier 2	Kapiolani Blvd & Pi'ikoi St	9	1.5	0	0.0

Area	Tier	Location	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes / mile/year
Urban Honolulu	Tier 2	Keʻeaumoku St & Kapiolani Blvd	8	1.3	2	0.3
Urban Honolulu	Tier 2	Keʻeaumoku St & Kinau St	7	1.2	0	0.0
Urban Honolulu	Tier 2	Keʻeaumoku St & Makaloa St	8	1.3	2	0.3
Urban Honolulu	Tier 2	N King St & Liliha St	10	1.7	2	0.3
Urban Honolulu	Tier 2	N King St & Mokauea St	8	1.3	3	0.5
Urban Honolulu	Tier 2	N King St & Richards Ln	7	1.2	3	0.5
Urban Honolulu	Tier 2	N School St & Ahonui St	7	1.2	2	0.3
Urban Honolulu	Tier 2	N School St & Alaneo St	9	1.5	1	0.2
Urban Honolulu	Tier 2	N School St & Kamehameha IV Rd	6	1.0	1	0.2
Urban Honolulu	Tier 2	N School St & Lanakila St	6	1.0	0	0.0
Urban Honolulu	Tier 2	S King St & Artesian St	7	1.2	0	0.0
Urban Honolulu	Tier 2	S King St & Makahiki Way	8	1.3	2	0.3
Urban Honolulu	Tier 2	S King St & Nuʻuanu Ave	6	1.0	1	0.2
Urban Honolulu	Tier 2	S King St & Punahou St	10	1.7	2	0.3
Urban Honolulu	Tier 2	S King St & Punchbowl St	10	1.7	3	0.5
Urban Honolulu	Tier 2	S King St & Victoria St	11	1.8	1	0.2
Urban Honolulu	Tier 2	Kona Iki St & Kona St	6	1.0	0	0.0
Urban Honolulu	Tier 2	Kūhiō Ave & Seaside Ave	7	1.2	0	0.0
Urban Honolulu	Tier 2	Liliha St & Holokahana Ln	6	1.0	0	0.0
Urban Honolulu	Tier 2	Liliha St & N Kuakini St	9	1.5	2	0.3
Urban Honolulu	Tier 2	Makaloa St & Kaheka St	9	1.5	2	0.3
Urban Honolulu	Tier 2	Monsarrat Ave & Paki Ave	6	1.0	1	0.2
Urban Honolulu	Tier 2	Pensacola St & Young St	6	1.0	0	0.0
Urban Honolulu	Tier 2	Queen Emma St & Iolani Ave	7	1.2	2	0.3

Area	Tier	Location	Total VZ Crashes	Total Crashes/ mile/year	Total FSI Crashes	Total FSI Crashes / mile/year
Urban Honolulu	Tier 2	Rycroft St & Sheridan St	7	1.2	1	0.2
Urban Honolulu	Tier 2	University Ave & Date St	8	1.3	2	0.3
Urban Honolulu	Tier 2	University Ave & Kuilei St	7	1.2	1	0.2
Urban Honolulu	Tier 2	S Vineyard Blvd & Aala St	10	1.7	0	0.0
Urban Honolulu	Tier 2	S Vineyard Blvd & Liliha St	8	1.3	3	0.5
Urban Honolulu	Tier 2	S Vineyard Blvd & Nuʻuanu Ave	6	1.0	1	0.2
Urban Honolulu	Tier 2	S Vineyard Blvd & Queen Emma St	7	1.2	1	0.2
Urban Honolulu	Tier 2	Waiʻalae Ave & 16th Ave	8	1.3	1	0.2
Urban Honolulu	Tier 2	Waiʻalae Ave & 2nd Ave	11	1.8	2	0.3
Urban Honolulu	Tier 2	Ward Ave & Kinau St	6	1.0	1	0.2
Urban Honolulu	Tier 2	Ward Ave & Lunalilo St	6	1.0	1	0.2
Urban Honolulu	Tier 2	Wilder Ave & Metcalf St	7	1.2	0	0.0
Urban Honolulu	Tier 2	Wilder Ave & Piʻikoi St	9	1.5	0	0.0
Urban Honolulu	Tier 2	Young St & Keʻeaumoku St	10	1.7	2	0.3

Table is ordered by Area, Tier, then alphabetized by Location.

Title VI/Environmental Justice Communities

Of the High-Injury Locations, 34 High-Injury Corridors and 36 High-Injury Intersections are in Title VI/ Environmental Justice Communities. These communities are disproportionately home to these High-Injury streets and intersections, with 30% of O'ahu's population but 46% of the High-Injury Locations.

T6/EJ Census Block Groups and High-Injury Locations

Kaneohe

Title VI/EJA Block Groups
High Injury Intersections
● Tier 1
● Tier 2
High Injury Corridors
— Tier 1
— Tier 2

East Honolulu & Waimanalo Beach

Urban Honolulu

Title VI/EJA Block Groups
High Injury Intersections
● Tier 1
● Tier 2
High Injury Corridors
— Tier 1
— Tier 2
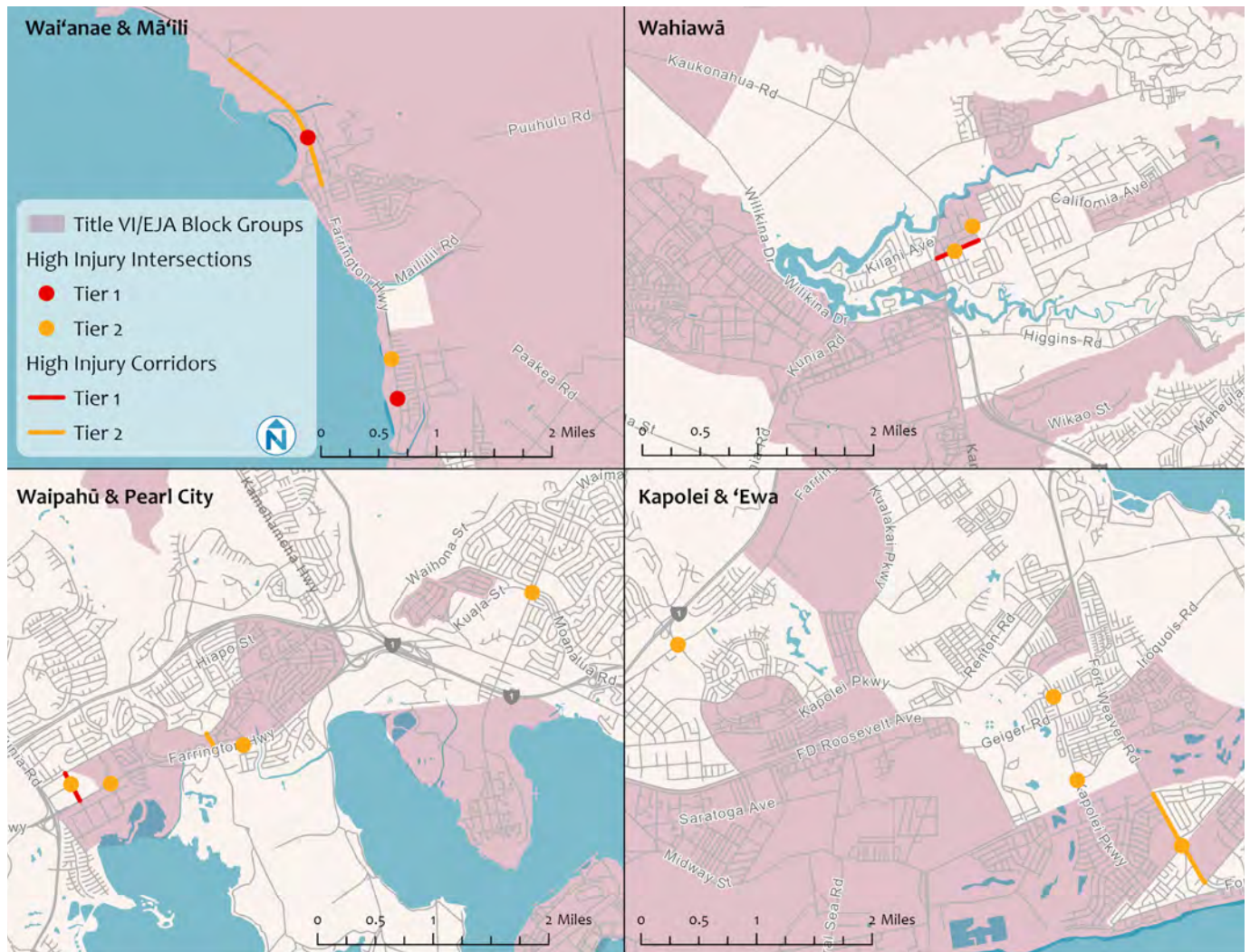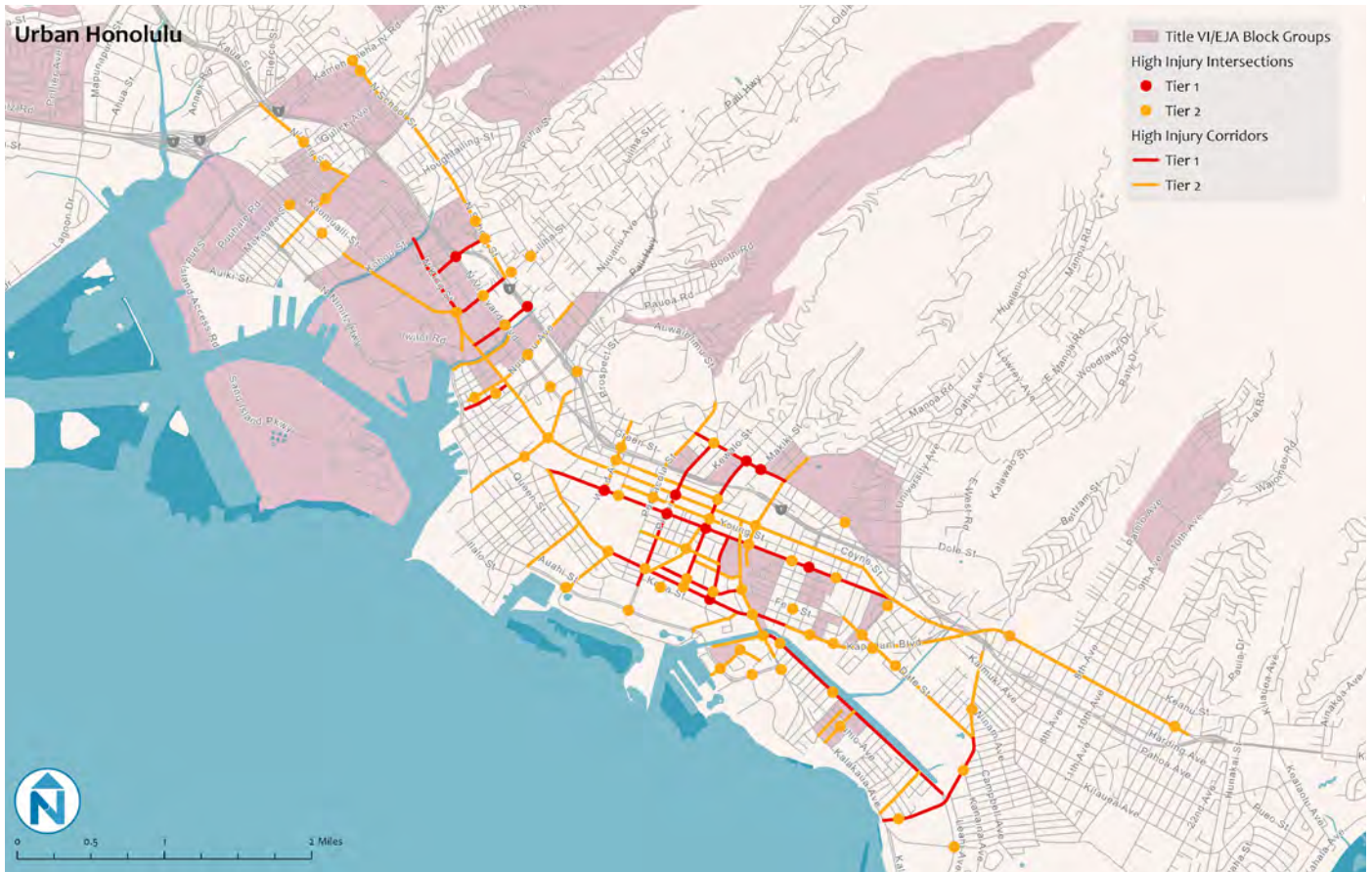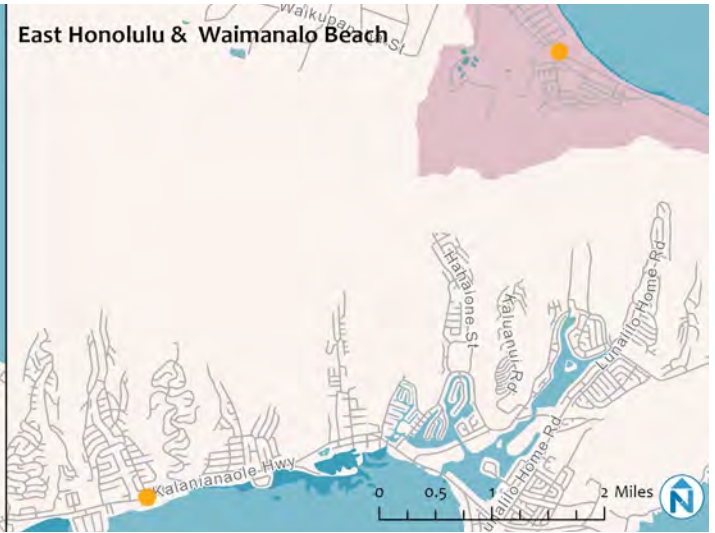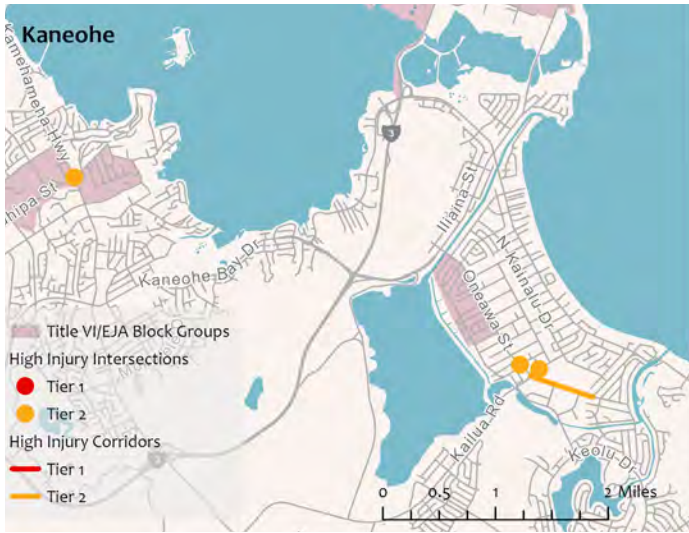
Project Prioritization – Safety and Equity

The High-Injury Locations help the City prioritize its focus and resources. Addressing safety at corridors and intersections with the most extensive history of crashes is critical to reverse the trend of ongoing FSI crashes.

Regrettably, this list is very long, but all High-Injury Locations will be systematically addressed through ongoing work. Within this list of focused locations are two categories based on crash frequency:

- **Tier 1** locations are very high-injury areas and are the highest priority for capital and repaving projects. These locations experience six or more Vision Zero crashes per year per mile or two or more fatal injury crashes.

- **Tier 2** locations are high-injury areas but experience half the rate of Tier 1 locations.

The City will transform its daily decision-making to make safety the priority, as specified in the State's Vision Zero Law. Safety treatments will be integrated into repaving, land use, and operations decisions. In addition, safety features in the Safety Features Toolkit, recommended by this plan will be considered for any work conducted on High-Injury Locations.

3

Safe Streets: Kuleana to Community

Oʻahu Vision Zero Action Plan (Plan) public engagement activities gathered input from the public, community-based organizations, representatives from vulnerable communities, and government agencies to ensure that a broad cross section of our community contributed to the Plan. This effort included outreach and engagement events that centered known and potentially vulnerable populations such as keiki (youth), kupuna (elders), immigrants, Environmental Justice/Title VI populations, and houseless individuals.

Through a suite of online and in-person forums, stakeholders shared their concerns on traffic safety. These engagement opportunities included a virtual islandwide workshop, a project steering committee, interviews with leaders from community-based organizations, and stakeholder meetings about priority topics and communities most impacted by crashes. The engagement team also distributed educational materials and collected comments at pop up events. Digital engagement tools, including an online survey, were also used to solicit input and personal stories related to traffic safety from the public.
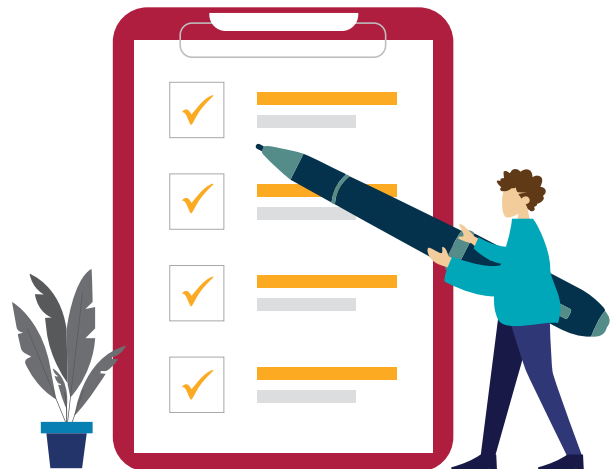
Engagement Activities

Vision Zero Survey Respondents: **412**

Islandwide Workshop Participants: **48**

Pop Up Community Engagement Events: **4**

Traffic Safety Personal Stories Shared: **47**

Project Steering Committee Members: **34**

Stakeholder Meetings with Representatives for Vulnerable Groups: **7**

Islandwide Workshop

The Islandwide Workshop, held on December 12, 2022, gathered nearly 50 O'ahu residents to discuss and collect feedback on the Plan. The Vision Zero team presented the Plan's goals, data on serious injury and fatal traffic crashes, the Safe Systems approach, and actions that have proven effective at improving safety outcomes. Participants were given opportunities to respond to the presentation through polling and open-ended discussion. Breakout rooms encouraged attendees to speak in smaller groups about safety actions including tools to support people using crosswalks, to protect kūpuna, to reduce speeds, to make biking safer, and curb impaired/distracted driving.

The Islandwide Workshop revealed the following themes:

- Nearly all participants (95%) support the goal of zero traffic deaths, and 82% support 2030 as the target date to achieve this goal.

- When asked about what they perceive as the leading cause of traffic fatalities and serious injuries, 61% said speed and 32% said inattention.

- People wanted more information about the relationship between fatal crashes and infrastructure change, and safety features that protect pedestrians and cyclists.

The Islandwide Workshop was promoted through various City and County of Honolulu (City) communication channels, by local media, and with the support of project nonprofit partners.

Public Survey

In June 2023, an online survey gathered 412 responses from all regions of Oʻahu. The top five safety concerns among respondents (with the percentage of the respondents that said it was a major concern noted) were people driving too fast (83%), people driving while impaired (81%), people texting while driving (80%), drivers not yielding to pedestrians (77%), and the lack of sidewalks/walkways (65%). These top five major safety concerns are shown below with the percentage of fatal crashes where the concern was a contributing factor. Only 30% of respondents agreed with the statement that they feel safe traveling on Oʻahu streets, and just over 10% agreed with the statement that they feel it is safe for school-age children to walk and bike. The top five major safety concerns were consistent with residents from different areas of the island:

Top Five Major Safety Concerns

1. People Driving Too Fast

83%

Contributes to 32% of fatal crashes

2. People Driving While Impaired

81%

Contributes to 33% of fatal crashes

3. People Driving While Texting or Looking at Phone

80%

Contributes to 33% of fatal crashes

4. Drivers Not Yielding to People to People Using Crosswalk

77%

Contributes to 10% of fatal crashes

5. Lack of Sidewalks/Walkways

65%

The survey also solicited input on 17 different safety tools, such as roundabouts and red-light cameras. All safety tools were supported by most respondents, with the least popular tool still receiving support from 68% of respondents. Some respondents expressed a need for more education on new roadway safety features and their safety benefits, such as protected bike lanes or roundabouts, so people have a better understanding of why we use them and how to use them.

Top 5 Most Supported Safety Tools

Sidewalks: **99%**
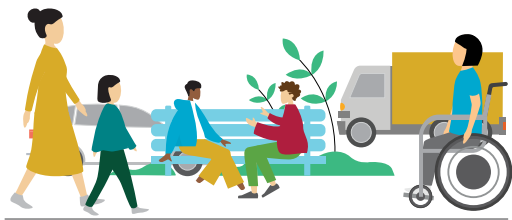
Protected Left Turns: **95%**
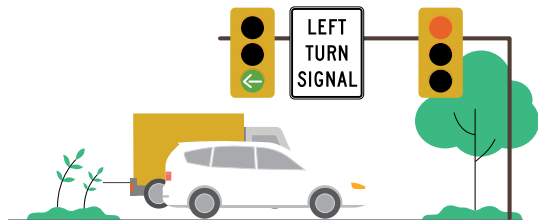
Pedestrian Refuge Islands: **95%**

20 MPH School and Neighborhood Zones: **94%**

Rectangular Rapid-Flashing Beacon: **95%**

Outreach at Community Events

AARP Caregiver Event (November 2022)

As part of the continued engagement with kūpuna and to promote awareness of the Vision Zero Action Plan campaign, the project team attended American Association of Retired Persons' (AARP's) resource fair and event to celebrate family caregivers. The Vision Zero project team hosted an informational table at the event to understand the specific transportation needs and mobility issues that kūpuna and their families face on Oʻahu and to promote the islandwide workshop. The event was attended by 264 caregivers, kūpuna, and family members. Key takeaways from participants were concerns around speeding, the need for traffic calming improvements on neighborhood streets, limited visibility from parked vehicles, and the need for pedestrian walkway improvements.

Hawaiʻi Bicycling League Pau Hana (May 2023)

Hawaiʻi Bicycling League (HBL) invited the Vision Zero project team to host a booth at their annual membership event with the intention of promoting awareness of the Plan and garnering participation in the public survey. HBL members were interested in strategies for safer roadway conditions for people on bikes, engineering solutions for better protecting cyclists from drivers, and active transportation policy.

Better Tomorrow Speaker Series – Reclaim Our Streets (July 2023)

The Better Tomorrow Speaker series hosted a traffic safety movie screening and talk story with local traffic safety leaders, including a Department of Transportation Services representative, and community members. This event featured the Hawaiʻi premiere of "Reclaim our Streets" which offers perspectives on how to make Hawaiʻi's roads safer and more sustainable. Attendees shared their concerns about the safety of our island's transportation system with project staff. Topics raised by concerned members of the public included the dangers pedestrians encounter at intersections with uncontrolled left turns, at uncontrolled crosswalks, along multi-lane roads without medians, and at busy intersections.

Hawaiʻi LGBT Legacy Foundation Kūpuna Rainbow Town Hall (September 2023)

The Rainbow Town Hall is a periodic event to provide a space for older people identifying as lesbian, gay, bisexual, transgender, queer/questioning, intersex, asexual/aromantic, or some other diverse gender identity or sexuality to gather, talk story, and speak on specific issues that impact the lives of this community. The Vision Zero project team promoted the project at this event, solicited feedback, and supported a discussion about policy and engineering approaches for safer streets. Rainbow Town Hall participants mentioned their desires to see more transportation-based educational programs for kūpuna that focus on best practices when using the bus and crossing roads. There were also suggestions to have transportation studies better consider kūpuna and their needs. Requested infrastructure improvements included longer crossing times at large signalized intersections, rectangular rapid-flashing beacons, speed humps, better street lighting, and more visible street signs.

Project Steering Committee

The Steering Committee met during key project milestones to offer important feedback and suggestions on how to address various aspects of the project. The Steering Committee consisted of representatives from federal, state, and local government agencies, nonprofit and community-based organizations, and family members of people killed or injured by traffic violence. The unique and collective contributions of each committee member helped shape the Plan. The Steering Committee was focused on three main goals:

1. Create a culture of creativity and problem solving to create Oʻahu-focused solutions.
2. Support educational and public campaigns through collective networks.
3. Provide insights and perspectives on community needs, vulnerabilities and challenges, project, program and policy development, and resources for implementation.

The Steering Committee was organized by the Vision Zero project team and composed of representatives from the following entities:

- AARP Hawaiʻi
- Aloha Care
- City and County of Honolulu Department of Facility Maintenance
- City and County of Honolulu Department of Design and Construction
- City and County of Honolulu Department of Transportation Services
- Citizens for a Fair ADA Ride
- USDOT Federal Highway Administration
- Hawaiʻi Department of Health
- Hawaiʻi Department of Transportation
- Hawaiʻi Bicycling League
- Honolulu City Council
- Honolulu Community Action Program
- Honolulu Police Department
- Kōkua Kalihi Valley
- Mothers Against Drunk Driving
- Oʻahu Metropolitan Planning Organization
- Papa Ola Lōkahi
- Ulupono Initiative
- Walk Wise Hawaiʻi

Complete Streets Core Team

The City's Complete Streets ordinance assigned implementation responsibility to the City Departments of Design and Construction, Facility Maintenance, Planning and Permitting, and Transportation Services. The Complete Streets Core Team is an internal, interdepartmental group that has been convening twice a month since 2016 to provide a collaborative structure for coordination among the multiple City departments with shared responsibility for various aspects of the street right-of-way, from planning and design to construction and maintenance. Given the connection between Complete Streets and Vision Zero, the Complete Streets Core Team played a prominent role in the development of the Plan through regular review of analysis, recommendations, and project documents. These City stakeholders will ultimately implement many elements of the Plan.

Nonprofit Leader Conversations

Conversations with community leaders and nonprofit organizations revealed specific needs for groups that are more vulnerable to traffic safety issues, including immigrants, unhoused people, youth, and kūpuna.

Micronesian Communities in Kalihi (November 2022)

A conversation with staff from We Are Oceania (WAO) highlighted how Kalihi residents, and particularly the Micronesian community, are impacted by Oʻahu's current transportation system:

- Kalihi, an area with higher concentration of immigrants from Micronesia, is disproportionately impacted by traffic violence. Residents in the area have a high dependence on public transportation and are more likely to work intergenerationally and as a community to meet their transportation needs (e.g., ridesharing coordinated through church groups).

- Cultural differences impact how people understand norms and rules of the road. For example, streetlights and crosswalk signals are not always intuitive to people from other countries. To be inclusive of all community members, we must continue to engage these newer residents.

Houseless Advocacy Organizations (February 2023)

Representatives of agencies that serve unhoused people offered insights into the impacts of our transportation system on houseless individuals and families:

- Transportation can be a major barrier for houseless individuals trying to access medical and social services. TheBus is a heavily utilized public service for houseless individuals, however, the frequency of service in areas with supportive facilities and the cost of fares can be a barrier for some. In rural areas where bus service is less available, and where walking is infeasible, the cost of transit fare to access essential appointments can become burdensome.

- Because of public perception toward unhoused people, pedestrians may jaywalk or walk in the road to avoid encampments or people living on sidewalks.

- Some houseless individuals, who disproportionately experience mental and behavioral health challenges, may be at risk of walking into traffic.

- Some houseless individuals are vulnerable to traffic safety due to walking and bicycling to atypical areas without established sidewalks, pedestrian crossings, or bike facilities.

Safe Routes to School and Youth Groups (April and May 2023)

Representatives from Kokua Kalihi Valley, Kalihi Valley Instructional Bike Exchange, the City's SRTS Program, and the Oʻahu Safe Routes to School (SRTS) Coalition partners revealed unique issues that youth face and ways to support active transportation for Oʻahu youth:

- Many young people use bicycles to get to school, for after school mobility, and to run errands for their families. Safer bike infrastructure that separates bike lanes from vehicle traffic would better protect young people on bicycles.

- Roads shared with vehicles or narrow streets with parked cars put people on bikes at great risk. Drivers may feel more comfortable with separated bicycle lanes as well.

- Speed humps and protected or signalized pedestrian crossings, especially near schools, can better protect children walking and using bikes, especially important in Kalihi where driving rates are lower than the island as a whole.

- Though Hawaiʻi State Law requires drivers to stop for people crossing the street at a crosswalk, many drivers falsely believe that pedestrians should yield to cars and are unaware of their responsibility to stop at unmarked crosswalks.

- Parents, community groups, and nonprofits can share responsibility in building support for SRTS programs. Due to limited resources, SRTS programs are often only implemented if parents are vocal and advocate for safer roads around schools.

Kūpuna Advocacy Groups (August 2023)

Participants from kūpuna advocacy groups, including Honolulu Parks Senior Citizen Program and the Hawaiʻi LGBT Legacy Foundation, shared some unique transportation safety challenges for older adults:

- Many kūpuna are vulnerable road users because they take longer to cross streets or have mobility challenges.

- The most common safety concerns included speeding vehicles, drivers running red lights, and sharing sidewalks with people on bikes or skateboards.

- Many participants offered ideas to make streets safer for kūpuna, including additional four-way stop-controlled intersections, curb extensions, rectangular rapid-flashing beacons, or red flags for kūpuna to wave while crossing the street.

Key Takeaways from Public Engagement

Based on the collective engagement efforts for the Oʻahu Vision Zero Action Plan, the following themes have emerged:

- **The City's goal of zero traffic deaths on Oʻahu is the appropriate target for traffic safety.**

- **Implement safety measures for the most vulnerable community members:** those with disabilities, keiki, and kūpuna. Participants clearly expressed that our transportation system should be improved to better accommodate those who are most vulnerable. Participants shared about the challenges that vulnerable users face and the need to design improvements to accommodate them, through measures such protected pedestrian crossings and sufficiently wide sidewalks. Respondents recognized that transportation system that served the most vulnerable would consequentially serve all roadway users.

- **I**mprove transportation facilities for pedestrians and bicyclists.** More and better pedestrian improvements such as sidewalks, pedestrian crossing refuge islands, and rapid flashing beacons are safety countermeasures highly supported by the public. Protected bike lanes were recognized as an effective safety measure for bicyclists. A more connected system of bike lanes, pedestrian facilities particularly to transit is also desired. Increasing the connectivity of bike lanes, sidewalks, and bus routes were brought up by multiple participants.

- **Take proactive measures to reduce speeding.** Most participants identified speeding as the main contributor to traffic fatalities and injuries. Slowing the speed of vehicles would improve the safety and comfort of people walking, riding on bikes, and everyone using the roadways.

Internal City Agency Meetings

Police Department Meetings

The Department of Transportation Services (DTS) and the Honolulu Police Department committed to working together toward Vision Zero by kicking off a series of three meetings to better understand each other's work and brainstorm solutions. Officers highlighted key findings from their experience in enforcement:

- Police officers found that older adults and unhoused people are disproportionately involved in severe crashes.

- Crashes involving impairment and inattention (e.g., distracted by a cell phone) are often under-reported.

- Interpretation of speed laws varies; although traveling at any speed above the speed limit is technically illegal, criminal prosecution of legal cases need to show a driver was traveling grossly over the speed limit.

- A key challenge for motorcycle safety is that people riding at high speeds need much longer to slow down, which is especially tricky at freeway on- and off-ramps. People in the military and young men are the target audience for safer motorcycle behavior.

Transportation Staff Workshops

During three collaborative working sessions, team members from DTS identified what they consider to be the varied root causes of traffic deaths. Participants included staff from across the agency responsible for transportation planning, engineering, and operations. They expressed the profound sadness they experience in learning about the lives lost, brainstormed barriers to creating safer streets, and prioritized concrete actions to improve safety. Some key takeaways of the working sessions include:

- The agency needs more data to support the use of unproven or innovative roadway safety treatments.

- Traffic signals that manage the movement of vehicles, pedestrians, and cyclists are difficult to change because of the age of our infrastructure and the complexities and costs associated with new construction.

- Long and complex project delivery processes are staff-resource intensive and limit the number of projects that can be delivered.

- A tremendous amount of staff time is focused on responding to public and elected official complaints, which often do not align with documented safety issues. This model limits the staff and funding resources available to implement projects where they are needed most.

These sessions concluded with development of the Vision Zero actions within DTS's control, which have been included in the Plan. The agency will be redoubling its efforts in collecting and analyzing safety data, building community relationships, adjusting the complaint process, integrating safety into the project delivery process, and building staff capacity – both in terms of training and total staff dedicated to Vision Zero.

Road Safety Stories

"**Kalihi needs better sidewalks for seniors and people using walkers and wheelchairs.** When cars double park and encroach on sidewalks, they force people walk on the roads which causes a safety issue for both pedestrians and drivers.

"My wife bikes to work every day on city streets and is **always on high alert** due to drivers that don't look, don't signal for turns, and speed on streets."

"Wheelchair bound residents **have to move out of our community** due to the lack of basic public infrastructure; potholes and puddles are what our residents and visitors must avoid by walking on the busy Kamehameha Hwy in Hale'iwa.

I personally feel it is not safe to ride a bike because [I'm] afraid of being hit by a car...When I ride my bike, cars zip past and it feels like there's little to nothing stopping them from crashing into me."

"[Safer crosswalks] should be a priority and not an afterthought. **Let's not allow another person to lose their life** in a vehicle or on foot in order to cross a roadway."

"**I had an incident while riding a bike when a van came to a screeching halt behind me while in a left turn lane.** I decided that bike commuting wasn't a risk I was comfortable taking anymore, especially because I was pregnant. My daughter is now 9 months old, and I haven't been on my bike since this incident.

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Acting in Accordance with Our Vision

Achieving the vision of a future without fatal and serious injury outcomes from crashes requires a systemic approach. Vision Zero uses five Safe System elements: Safe Streets, Safe Speeds, Safe Vehicles, Safe People, and Post-Crash Care. These elements are layers of a safety net to prevent crashes and to reduce the probability of a fatal or serious injury outcome when they do happen.

Safe System Elements and Goals

The City and County of Honolulu (City) is taking a multi-pronged approach to achieve transportation safety, by including comprehensive goals within each Safe System element. These goals are general statements of desired outcomes as they relate to Vision Zero.

Safe System Elements				
Safe Speeds	Safe Streets	Safe People	Post-Crash Care	Safe Vehicles
Safe System Goals				
Foster safe speeds through proactive street design	Use a data driven approach	Foster a culture of shared kuleana for traffic safety through education and outreach activities	Improve the quality of crash data	Prioritize safer vehicles
Support changes in the enforcement and adjudication process to reduce dangerous driving behaviors	Fund and use quick-build strategies to install roadway safety features	Support funding and development of Safe Routes to School plans, programs, and infrastructure	Take care of people who have been affected by crashes	Collaborate with other agencies to require safety improvements in vehicles
Revise laws, policies, and procedures to support safe speeds	Invest in walking, bicycling, and transit to grow their mode share	Integrate safety into land use and private development permitting		
	Integrate safety into capital and repaving projects from planning, and scoping through preliminary design and delivery	Strengthen organizational capacity		
	Revise laws, policies, and procedures to support safe streets	Support our diversity of roadway users		

This section documents the actions needed to realize each Safe System goal.

A high-level estimate of timeframe, level of effort, and cost has been indicated for each. The following table shows a key for how to read the actions tables:

Action	Timeframe	Effort	Cost
Description of the action	**ST** – Short-Term (within 5 years) **MT** – Mid-Term (5-15 years)	● Lowest effort ●● Medium effort ●●● Highest effort	$ Lowest cost $$ Medium cost $$$ Highest cost

Funding and resources will be made available to implement change by phasing in the effective actions recommended in this plan:

- Short-Term (ST) actions can be implemented within five years. Examples include targeted enforcement programs, pavement markings, and sign installations.

- Mid-Term (MT) actions can be implemented in five to fifteen years and may require legislative approval or multi-year funding. Examples include constructing all O'ahu Pedestrian Plan Tier 1 proposed walkways and expanding the Vision Zero program staff.

Safe Speed Actions

Slower vehicle speeds reduce the force of crashes, provide additional time for drivers to stop, and improve the ability to see what is around us. Vehicles can be slowed through roadway design, speed limit designations, education, and focused enforcement. Safe Speeds are crucial to achieving Vision Zero and there is a host of actions that must be taken, ranging from physical street improvements, to enforcement, to legislation.

Goal 1: Foster safe speeds through proactive street design

	Action	Time-frame	Effort	Cost
1.1.1	Establish safe target operating speeds as the basis for roadway design decisions.	ST	●	$
1.1.2	Study safety impacts of peak-hour contraflow operations on City streets and prioritize safety in decision making of possible changes.	ST	●	$
1.1.3	Update City traffic calming guideline to current best practices, including updating guidance on raised crossings on major streets.	ST	●●	$
1.1.4	Restructure the City's traffic calming program to better address documented speeding and safety issues and manage public requests.	ST	●●	$
1.1.5	Proactively collect speed data at High-Injury Locations, major streets, and other streets where crash data indicates speeding is a significant contributing factor.	ST	●	$
1.1.6	Partner with Hawaiʻi Department of Transportation (HDOT) to utilize aggregate movement data (e.g., Google data) to better understand speeds across the street network and prioritize areas for additional data collection.	ST	●	$
1.1.7	Implement speed reduction measures as part of roadway maintenance activities at: • High-Injury Locations. • School zones and streets without sidewalks.	ST/MT	●●	$$
1.1.8	Fund and implement speed reduction measures at the following locations: • High-Injury Locations that will not be addressed by 2040 by maintenance projects. • Priority streets identified through the traffic calming program	ST/MT	●●	$$

	Action	Time-frame	Effort	Cost
1.1.9	Implement 25 miles per hour (MPH) speed limits on major streets in urbanized areas and on High-Injury Corridors.	ST	●	$
1.1.10	Use signal progression timing to address speeding at High-Injury Locations and on arterials.	ST/MT	●●●	$$

Goal 2: Support changes in the enforcement and adjudication process to reduce dangerous driving behaviors

	Action	Time-frame	Effort	Cost
1.2.1	Expand the Red-Light Safety Camera Enforcement program as provided by Act 30 (2020) and following the successful completion of the 2-year pilot program with the purpose of creating safety improvements at High-Injury Locations and system-wide.	ST	●●	$$
1.2.2	Establish a Speed Safety Camera Enforcement program when legislation allows, with the purpose of reducing speeding and improving safety at High-Injury Locations and system-wide. See 1.3.3 for more details on SB2443.	ST	●●	$$
1.2.3	Support Honolulu Police Department's (HPD's) enforcement and investigation of and the Prosecutor's work in prosecuting more excessive speeding, reckless driving, and other high-risk traffic crime cases.	ST	●	$
1.2.4	Use education campaigns and enforcement to establish a cultural norm of strict adherence to the speed limit.	ST	●	$
1.2.5	Develop collaborative traffic safety grant applications focused on root causes of crashes.	ST	●	$
1.2.6	Work with the Judiciary to expand access to cell phone and vehicle computer data that can be used to investigate crashes.	MT	●●●	$
1.2.7	Work with the Judiciary to establish a lower threshold for excessive speed (or use bodily injury) in order to prosecute negligent injury and homicide cases.	MT	●●●	$

Goal 3: Revise laws, policies, and procedures to support for safer speeds

	Action	Time-frame	Effort	Cost
1.3.1	Adopt a City ordinance to change the speed limit to 20 MPH on all local streets and in school zones.	ST	●	$$
1.3.2	Support State of Hawai'i (State) legislation that increase fines for speeding.	ST	●	$
1.3.3	Support State legislative changes to support the use of speed camera enforcement and prepare for implementation on High-Injury Locations and emerging areas where speed is a significant contributing factor. SB2443 SD2 HD2 CD1 allowing for the establishment of a Speed Safety Camera program was passed by State Legislature in their 2024 session and is currently awaiting Governor's review and signature.	ST	●	$

In 2023, Sara Yara was struck and killed by a motorist as she and her sister walked in a marked crosswalk across Kapi'olani Boulevard on their way to McKinley High School. The driver was reported to have had over 200 traffic-related citations and violations at the time. Stricter penalties on irresponsible drivers may deter future tragedies.

One way affected school and community members came together to safeguard their community was to work with the State Representative Speaker Scott Saiki, the Honolulu Prosecutor's Office, and others to find ways to better address the problem of habitual offenders of traffic laws by restricting their driving privileges, limiting their access to a vehicle, and providing for higher criminal penalties.

The Hawai'i State Legislature passed HB 2526 HD2 SD1 in their 2024 Legislative Session to increase penalties for habitual driving without a license. "Sara's Law" will authorize the courts to confiscate and impound a vehicle as the maximum penalty for a third conviction of operating a vehicle without a license and increase the penalty to a Class C felony.

Safe Streets Actions

The condition and geometric design of streets and intersections has a documented effect on safety. The number and width of travel lanes, pedestrian crossing treatments, traffic calming features, degree of separation between different travel modes, intersection controls, signal phasing, and level of visibility between users, among other factors, can all influence safety performance outcomes on our streets. Research shows that communities with more transit use, walking, bicycling, and less car-driving are safer for all road users. Streets can and should be designed and operated to prevent crashes and reduce injuries and fatalities when crashes do occur.

Goal 1: Use a data driven approach

	Action	Time-frame	Effort	Cost
2.1.1	Maintain the Vision Zero dashboard for critical traffic safety metrics, including geographic and social disparities, by routinely integrating new crash report data.	ST	●	$
2.1.2	Select proven and promising safety improvements based on specific crash types at High-Injury Locations and other problem areas, such as road diets and intersection treatments that reduce turning vehicle speeds.	ST / MT	●●●	$$$
2.1.3	Conduct before and after studies on projects to understand the impact of the change on crash factors and crash frequency.	ST	●●	$
2.1.4	Integrate High-Injury Locations into the workflow for data collection, funding, planning, design, and construction of rehabilitation of streets projects.	ST	●●	$
2.1.5	Pilot and evaluate innovative design strategies, including: • Low-cost solar-powered rectangular rapid flashing beacons (RRFBs) mounted on conventional sign posts. • Raised crossings on major streets, to build on the promising evaluation conducted as part of this Plan and described in Chapter 5.	MT	●●	$$

Goal 2: Fund and use quick-build strategies to install roadway safety features

	Action	Time-frame	Effort	Cost
2.2.1	Fund and implement a crosswalk upgrade program that implements quick-build improvements, including the following: • RRFBs. • Raised crosswalks. • Speed humps near crosswalks. • Pedestrian crossing islands. • Curb extensions and no parking zones on approach to crosswalks. • Leading Pedestrian Intervals. • No Right Turn on Red. • Centerline hardening/medians. • Turn wedges.	ST	●●	$
2.2.2	Support community-based projects at High-Injury Locations.	ST	●	$
2.2.3	Procure a master agreement to install quick-build improvements through a private contractor.	ST	●	$$
2.2.4	Establish a City quick-build focused construction team within Department of Transportation Services (DTS) to increase the volume and pace of quick-build project delivery.	MT	●●●	$$

Goal 3: Invest in walking, bicycling, and transit to grow their mode share

	Action	Time-frame	Effort	Cost
2.3.1	Implement pedestrian crossing improvements that ensure slower pedestrians can safely cross.	ST	●●	$
2.3.2	Implement pedestrian safety improvements and transit stop siting adjustments to ensure safe and convenient access to transit.	ST	●●	$$
2.3.3	Provide improved transit stop infrastructure such as lighting, shelters, and benches at high-use stop locations.	ST	●●	$$

	Action	Time-frame	Effort	Cost
2.3.4	Conduct analyses of high transfer transit stop locations and implement changes such as increased dwell time, schedule modifications, increased bus frequencies, signal modifications, and new pedestrian crossings. The aim is to reduce the risk of people rushing or behaving dangerously to access stops.	ST	●●	$
2.3.5	Identify lighting deficiencies at High-Injury Locations and develop a plan to implement priority improvements by 2040.	ST	●●	$$
2.3.6	Dedicate additional funding and staff to walkway and bikeway projects to leverage historic levels of available federal transportation funding.	ST/MT	●●	$$
2.3.7	Implement O'ahu Pedestrian Plan Tier 1 proposed walkway facilities by 2040 to create a comprehensive walkway network to connect people to transit, schools, and major destinations. Building out the proposed Tier 1 walkway projects would require approximately $12 million in total annual funding.	MT	●●●	$$$
2.3.8	Implement O'ahu Bike Plan Priority 1 proposed bikeway facilities by 2040 to create a low-stress bikeway network. Building out the proposed Priority 1 bikeway projects would require approximately $5 million in total annual funding.	MT	●●●	$$$
2.3.9	Implement transit priority improvements, including dedicated lanes, signal priority, and intermodal connections, to make transit a more competitive and attractive transportation mode. The DTS's forthcoming Honolulu Transit Comprehensive Operations Analysis plan will provide prioritized actions.	MT	●●●	$$$

Goal 4: Integrate safety into capital and repaving projects

	Action	Time-frame	Effort	Cost
2.4.1	Provide safe and conveniently placed crosswalks, including through installation of new crosswalks, consistent with the Complete Streets Design Manual. Marked crosswalks should be spaced so that people can cross at preferred locations and avoid risks associated with crossing outside of marked crosswalks.	ST/MT	●●	$$

	Action	Time-frame	Effort	Cost
2.4.2	Prioritize safety projects in the capital improvement program.	ST	●●	$$
2.4.3	Prioritize safety over vehicular delay considerations in the project planning and design process.	ST	●●	$
2.4.4	Utilize multi-disciplinary teams throughout the project processes to ensure all safety improvements are considered.	ST	●	$
2.4.5	Increase funding levels for rehabilitation of streets program to ensure that safety elements are implemented with all projects.	ST/MT	●●	$$
2.4.6	Update the Complete Streets Checklist to include High-Injury Locations and include safety considerations and an in-house process for integrating lane reconfiguration as part of multi-lane projects.	ST	●	$

Goal 5: Revise laws, policies, and procedures to support safe streets

	Action	Time-frame	Effort	Cost
2.5.1	Adopt a City ordinance, consistent with the State's Vision Zero law, specifying that safety is the first priority for the City, and will take precedence when determining trade-offs related to parking and travel delay.	ST	●●	$
2.5.2	Update the Complete Streets Design Manual and internal DTS guidance documents to add and provide for expanded use of safety tools, including the following: • Centerline hardening. • Curb extensions. • In-street Pedestrian Crossing signs. • Leading Pedestrian Intervals. • Leading Bicycle Intervals. • No Right Turn on Red. • Protected intersections. • Protected turn phasing. • Raised crosswalks. • Turn wedges. • Speed humps.	ST	●	$

	Action	Time-frame	Effort	Cost
2.5.3	Amend City ordinance to provide more clarity on where people are permitted to ride bicycles on sidewalks and expand where bicyclists can legally ride on sidewalks to include streets where bikeway infrastructure is absent.	ST	●●	$
2.5.4	Consider the safety and delay impacts of traffic signal upgrades and operations changes on all modes.	ST	●	$

Safe People Actions

People must practice safe behaviors and share responsibility for potential outcome of their choices. The transportation system must safely serve all people using the street including people who walk, roll, bike, take transit, drive, or use other modes of travel. Safe People actions will play a key role in achieving Vision Zero. Actions range from fostering safe user behavior to building organizational capacity to implement safe streets and speeds.

Goal 1: Foster a culture of shared kuleana for traffic safety through education and outreach activities

	Action	Time-frame	Effort	Cost
3.1.1	Create and widely deploy information campaigns, using strategies such as bumper stickers, yard signs, and large vehicle wraps, that raise awareness about high-risk behaviors and every user's role in keeping each other safe, including the following: • Drivers stopping for pedestrians in crosswalks, including unmarked crosswalks. • Driving the speed limit and slowing down around pedestrians and bicyclists.	ST	●	$
3.1.2	Create and widely deploy education campaigns to raise awareness about 20 MPH local streets and school zones, if legislation is adopted establishing such.	ST	●	$
3.1.3	Create and deploy an information campaign that explains the safety benefits of infrastructure changes, for the public, government officials, and other decision-makers to develop better understanding and support for potentially controversial safety projects.	ST	●	$

	Action	Time-frame	Effort	Cost
3.1.4	DTS and HPD partner to integrate enforcement in education campaigns and pursue grant funding to expand the work.	ST	●	$
3.1.5	Create and deploy education campaigns targeted at specific groups and demographics that are key safety offenders (e.g., young male drivers).	ST	●	$

Goal 2: Support funding and development of Safe Routes to School plans, programs and infrastructure

	Action	Time-frame	Effort	Cost
3.2.1	Fund and develop a Safe Routes to School (SRTS) Master Plan for elementary, middle, and high schools that creates Oʻahu-wide and school specific strategies for improving school transportation safety.	ST	●	$
3.2.2	Fund and develop school-specific SRTS Plans, starting with schools with disproportionate crash burden and serving the largest concentrated Title VI/Environmental Justice populations.	ST	●	$$
3.2.3	Use quick-build crosswalk and traffic calming projects on school routes to improve safety and to engage students, parents, school staff, and the broader community on the importance of transportation safety around schools.	ST	●●	$$

Goal 3: Integrate safety into land use and private development permitting

	Action	Time-frame	Effort	Cost
3.3.1	Update the Honolulu Transportation Impact Assessment Guide to include a Vision Zero checklist.	ST	●	$
3.3.2	Require major private development to utilize the updated Transportation Impact Assessment Guide and to implement recommended safety improvements.	ST	●	$
3.3.3	Site City-funded affordable housing investments and temporary shelters in areas with high-quality transit service and multimodal infrastructure.	MT	●●	$$

Goal 4: Strengthen organizational capacity

	Action	Time-frame	Effort	Cost
3.4.1	Establish a Vision Zero Task Force composed of DTS, HDOT, and HPD.	ST	●	$
3.4.2	Add Vision Zero implementation to the Complete Streets Core Team responsibilities.	ST	●	$
3.4.3	Provide routine City and consultant training on current and best practices for Vision Zero and traffic safety improvements.	ST	●	$
3.4.4	Build capacity for staff to pursue federal funding opportunities.	ST	●	$
3.4.5	Expand the Complete Streets/Vision Zero planning branch of DTS to grow the City's dedicated staff.	MT	●●●	$$

Goal 5: Support our diversity of roadway users

	Action	Time-frame	Effort	Cost
3.5.1	Partner with community and advocacy organizations to engage with kūpuna (elders) to understand their safety concerns and needs.	ST	●	$
3.5.2	Work with local organizations to develop strategies to support the safety of unhoused people on our streets.	ST	●●	$
3.5.3	Include immigrant populations during outreach to gain understanding of social norms and community support structures.	ST	●	$
3.5.4	Provide safety information to military installations to support responsible driving on and off base.	ST	●	$
3.5.5	Design and operate streets where people with visual and mobility disabilities are considered the typical user.	ST/MT	●●	$$

Post-Crash Care

When crashes do occur, people involved in crashes must be supported and immediately receive high quality care. Looking ahead, police and road managers must learn from the crash and implement changes to prevent similar crashes from happening again. In addition to sustaining responsive urgent medical care and transport, a comprehensive documentation system that confirms the factors that contributed to the crash creates a better safety landscape and can inform a response by design, program, policy, and justice experts.

Goal 1: Improve the quality of crash data

	Action	Time-frame	Effort	Cost
4.1.1	Establish a multi-disciplinary Crash Response Team to analyze fatal crashes and recommend safety interventions.	ST	●	$
4.1.2	Improve the crash reporting system to ensure consistent and reliable crash data.	ST	●●	$
4.1.3	Create a shared understanding of how difficult it is to understand crash patterns when data are missing (e.g., motor vehicle action preceding crash) and develop a strategy for reducing missing data in crash reports.	ST	●	$
4.1.4	Support State legislation to revise the criteria for Major crash reports to be based on injury, instead of property damage. The use of Minor crash reports for non-injury crashes would reserve Major crash reports and the extensive staff time required to complete them for more serious crashes.	ST	●	$

Goal 2: Take care of people who have been affected by crashes

	Action	Time-frame	Effort	Cost
4.2.1	Explore ways to better acknowledge or remember those whose lives have been lost on our roadways.	ST	●●	$

Safe Vehicle Actions

Safety measures built into vehicles can protect people both inside and outside of a vehicle, with active safety technologies to prevent crashes, and passive equipment or designs that minimize the harm from crashes. Although the regulatory lever of vehicle design lies with federal rule-making and corresponding manufacturing choices, procurement strategies and increased awareness of how vehicles size is related to crash outcomes can be acted upon locally.

Goal 1: Prioritize Safer Vehicles

	Action	Time-frame	Effort	Cost
5.1.1	Explore opportunities for utilizing cameras on board transit vehicles for safety studies.	ST	●	$
5.1.2	Support legislation changes to create a progressive fee structure based on vehicle weight taxes to incentivize lighter vehicles.	ST	●●●	$
5.1.3	Review and revise City policies and practices in procurement of City vehicles, including buses, to incorporate crash prevention technologies such as: autonomous emergency braking, lane change alerts, unobstructed sight lines from vehicle interior, out-of-vehicle cameras, and side guards.	ST/MT	●●	$$
5.1.4	Support City staff use of smaller vehicles and alternatives to driving for daily operations and staff transportation, limiting assignments of heavy vehicles based on job classification.	ST/MT	●●	$$

Goal 2: Collaborate with other agencies to require safety improvements in vehicles

	Action	Time-frame	Effort	Cost
5.2.1	Support legislation to integrate ignition locks in fleet manufacturing that lock engine or limit speeds of impaired drivers.	ST	●●	$
5.2.2	Conduct an assessment of O'ahu needs in preparation for autonomous and connected vehicles and infrastructure.	MT	●●	$

Actions to Create a Safety Net

The actions included within this Plan will work together to create a safety net composed of the Safe System elements that will prevent crashes from happening and keeps those that do from having serious or fatal outcomes.
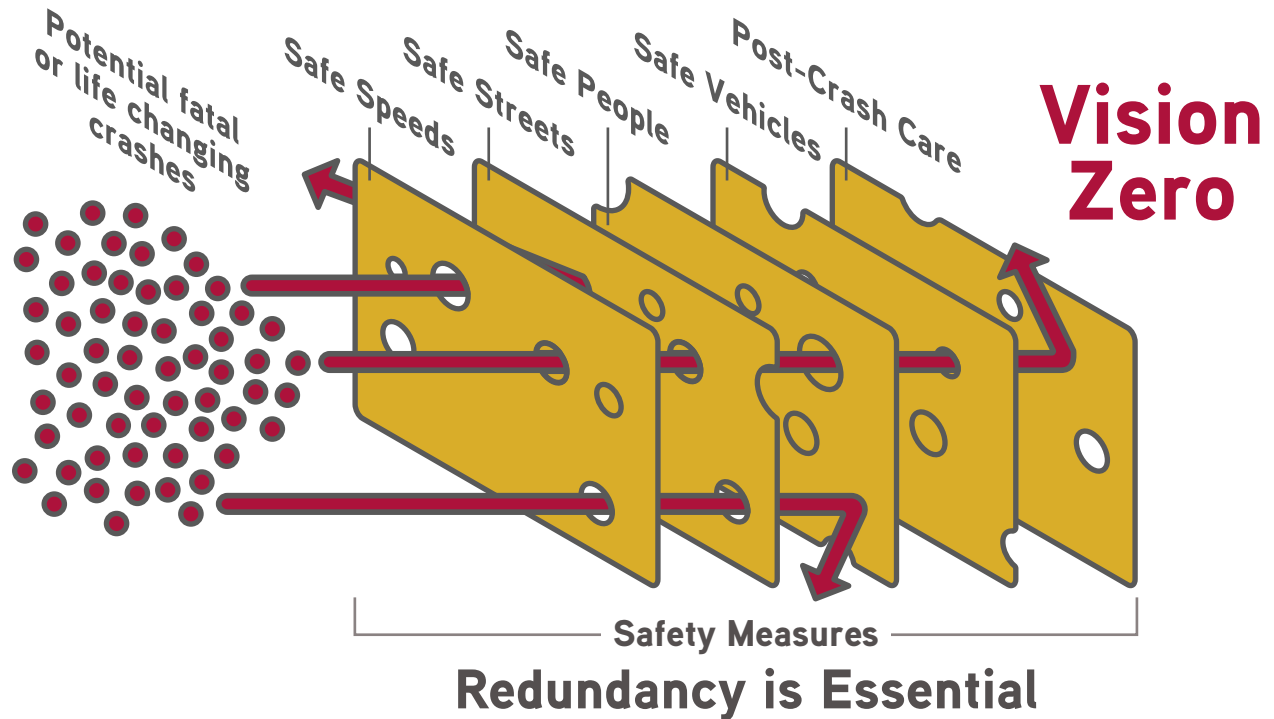
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Our Work Has Started

Through this planning process, we have already started incorporating Safe Systems decision-making into City and County of Honolulu projects and processes, learning along the way from our data and from other cities doing similar work.

Safety Projects

As we have uncovered the underlying causes of O'ahu's traffic safety crisis through detailed analysis and multi-faceted engagement, we have already started advancing new safety strategies. This work has advanced as part of the City and County of Honolulu's (City's) Complete Streets Core Team's commitment to safety and multimodal transportation. Complete Streets is a combined effort of the Departments of Design and Construction, Facility Maintenance, Planning and Permitting, and Transportation Services.

This section describes work that has been underway during the development of this plan. It has been informed by the Fiscal Year 2023 (FY23) Complete Streets Annual Progress Report, required by the City's Complete Streets ordinance (ROH 14-18).

Stop for Pedestrians Awareness Signs and Information Campaign

Hawai'i State Law requires drivers to stop for people crossing the street at a crosswalk, regardless of whether it is marked. As driver failure to stop is a main factor in crashes involving pedestrians, eliminating that behavior is essential to improving safety. In 2023, the Department of Transportation Services (DTS) collected data at nine uncontrolled crosswalk locations across the island and found that, on average, only 53% of drivers stop for people who have signaled their intent to cross the street by stepping off the curb and into the crosswalk.

The DTS installed signs that document the percentage of drivers stopping for pedestrians at these unsignalized crosswalks. In coordination with sign installation, DTS deployed an informational campaign through local news media, social media, and bumper stickers to raise driver awareness of the legal responsibility and safety importance of stopping for pedestrians. The DTS conducted two rounds of additional data collection at the nine locations and the overall rate of drivers stopping for pedestrians increased to 62% and 60%, respectively. The modest increase in the percentage of drivers stopping for pedestrians suggests a positive impact from the awareness campaign, but also makes clear on the need for additional improvements.

Vehicles Stopping for Pedestrians Pre- and Post-Installation

Location	Pre-Installation (% Stopping)	Round 1 Post-Installation (% Stopping)	Round 2 Post-Installation (% Stopping)
California Ave at Makani Ave	68%	78%	81%
Kailua Rd at Hoolai St	64%	50%	60%
Kapolei Parkway at Kunehi St	44%	69%	61%
Moanalua Rd at Ualo St	60%	48%	46%
N King St at Harvey Lane	55%	76%	70%
Punchbowl St at Miller St	64%	70%	78%
Renton Rd at Pahika St	55%	72%	60%
University Ave at Kuilei St	36%	57%	50%
Lunalilo Home Rd at Kaumakani St	29%	60%	47%
Overall Average	**53%**	**62%**	**60%**

Stop for Pedestrians Awareness sign

Rectangular Rapid Flashing Beacon Pilot Installation

The City has several Complete Streets projects in design that will include rectangular rapid-flashing beacons (RRFBs), a safety feature that increases the visibility and driver awareness of crossing pedestrians. The Oʻahu Vision Zero Action Plan (Plan) has also identified the need for RRFBs at a number of crossings at High-Injury Locations. The RRFB beacons remain "dark" until a pedestrian pushes the "call" button to activate the amber colored flashing lights. The lights flash rapidly in an irregular flash pattern that is similar to emergency flashers on police vehicles. The flashing lights are intended to catch the driver's attention that a pedestrian is crossing or attempting to cross the street and reinforce the driver's duty to stop for pedestrians. These can result in higher compliance with the law and a reduction in crashes up to 50%.

The City recently updated its uncontrolled crosswalk guidelines to include RRFBs as the appropriate safety tool for street crossings with multiple lanes and higher traffic volumes. Based on the updated guidelines, RRFBs will be needed at a significant number of pedestrian crossings on City streets. The City also adopted standard specifications for RRFBs that require

signal-mounted infrastructure and typically hard-wired electricity. In the past, the City has taken five to seven years to deliver existing City standard RRFB projects at costs of approximately $500,000 per location. The duration and cost are due to the complexity of design, project approval processes, and material and construction costs.

To explore options to reduce the time and cost for RRFB implementation, the City initiated a pilot program to install solar-powered RRFBs on standard signposts.   The pilot will enable the City to trial the new equipment type and installation method and collect data for proof of concept and appropriate application. In FY23, the City received a grant of $30,000 from the American Association of Retired Persons (AARP) for the upgrade of uncontrolled crosswalks at North School Street at Ahonui Street in Kalihi and Date Street at Laʻau Street in Moʻiliʻili. Planning and design began in FY23 and construction is expected to be completed by winter 2024.

Stop Compliance Study at Raised Crosswalks

Starting in 2022, the Hawaiʻi Department of Transportation (HDOT) took action to reduce speeds and improve pedestrian safety at many locations across the Oʻahu by installing raised crosswalks at existing unsignalized crosswalks. Raised crosswalks provide a gradual hump to slow vehicles. The raised crosswalks can reduce all pedestrian crashes by 45%* by improving the visibility of pedestrians in crosswalks and providing drivers a physical reminder to reduce vehicle speed. HDOT installed more than 30 raised crossings on Oʻahu's state roadways, including on Kalihi Street in Kalihi, Fort Weaver Road in ʻEwa Beach, and Farrington Highway in Waiʻanae.

HDOT partnered with the City to install raised crossing on Pensacola Street at four crossings fronting McKinley High School. HDOT also partnered with DTS to install speed humps near crosswalks on Pāpipi Road near ʻEwa Beach Elementary School and on Kapiolani Boulevard in Kakaʻako.

The Vision Zero team conducted a study of drivers' compliance with stopping for pedestrians before and after raised crosswalk installations at several locations to assess whether this safety feature is suitable to include in the City's uncontrolled crosswalk guidelines.

The raised crossings resulted in multiple benefits:

- Percent of drivers stopping for pedestrians significantly increased from 66% to 89%.

- Average speed of vehicles across study locations dropped by 4 miles per hour (MPH).

- The percentage of drivers exceeding the speed limit decreased significantly with reductions in top speed and lower prevailing speed.

With the support of the Plan consultant team, DTS developed a standard methodology to collect information about driver stop for pedestrians compliance. During the study, observers watch vehicles to see how they respond to a staged pedestrian stepping into the crosswalk when cars are far enough away to stop for them.

The observer at the location collects the following information for each crossing:

1. Number of cars failing to stop (by lane where the crossing included multiple lanes).

2. Number of cars stopping (by lane where the crossing included multiple lanes).

* Federal Highway Administration. (2013). "Raised Pedestrian Crossings" in PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System.

Pedestrian and Bicycle Counters

The City has been installing active transportation monitors on sidewalks, bikeways, and multi-use paths at locations around O'ahu. The monitors count people biking and walking which is important data for project prioritization and planning. Furthermore, as the City continues to invest in Complete Streets and multimodal transportation facilities, the data will help understand how the facilities are used and their impact on the transportation system. The count monitoring data has the potential to allow for future exposure-based safety analysis (that considers the number of street users in relation to crashes). The installation of pedestrian and bicycle monitoring devices was funded in part by the O'ahu Metropolitan Planning Organization and the United States Federal Highway Administration.

Campaign Materials

Speed is a contributing factor in one-third of traffic fatalities on O'ahu. Speeding is the main concern that the DTS receives from community members. The City's data indicates the speeding problems are most common on major streets. While speeding issues are not as common on residential streets, this is where the majority of the complaints DTS receives are focused on. To increase awareness of the impact of speeding, and to provide a resource that responds to these safety risks and community demands for slow speeds, DTS developed and intends to widely deploy campaign materials and a safe driver pledge. The campaign materials include bumper stickers and lawn signs.

Honolulu City Council Resolution

In January 2024, City Council adopted Resolution 23-271, stating an official call for lower speed limits on residential streets. This resolution urged the State Legislature to amend HRS 291c-107 to remove the requirement for an Engineering Study when setting a maximum speed that lowers the existing speed limits and urged DTS to consider 15 MPH speed limits "throughout the City's residential areas."

Advancing a 20 MPH Default Speed Limit on City and County Streets

There has been a growing community consensus that the 25 MPH speed limit is too fast on many streets. The Vision Zero survey (described further in Chapter 3) of O'ahu residents found that "people driving too fast" was the top safety concern, and the vast majority of complaints DTS receives are for speeding, with most of these concerning local streets. Several existing plans, policies, and codes recognize the importance of proactively creating safe speeds. In particular, the December 2020 Report on ACT 134 explicitly calls for speed enforcement and speed management programs, and the 2022 O'ahu Pedestrian Plan and 2016 Complete Streets Design Manual both emphasize the importance of lower speed limits based on street designs that match lower target speeds. This Plan is recommending legislation to amend the City ordinances to change the default speed limit to 20 MPH and requires justification for a higher maximum speed.

Vehicular speed is a critical factor for survival in crashes – the higher a driver's speed, the lower the probability of a victim's survival. Injuries for vulnerable road users increase in severity as vehicle speeds increase. When a person is struck, the vehicle's kinetic energy is transferred to the human body, and the impact is a function of the square of the vehicle's speed. The human tolerance for being struck by a well-designed car will be exceeded if the vehicle is traveling at over approximately 20 mph. In fact, evidence is mounting that pedestrians may survive the impact of a motor vehicle crash only at speeds of 20 mph or less.

Many US cities have taken a safe systems speed limit setting approach to reduce the frequency and severity of speeds by reducing speed limits on non-arterial streets to 20 MPH. Those cities include Denver, New York City, Portland, Seattle, and many others. Together these cities have demonstrated that slower speeds and reduced crashes can be achieved through speed limit changes alone.

Complete Streets Projects Planned for High-Injury Locations

The City prepares Complete Streets plans for upcoming projects, including street rehabilitation projects. Consistent with the Complete Street ordinance and Complete Streets Design Manual, these plans typically include safety features such as crosswalk improvements, protected bike lanes, traffic calming, road diets, curb extensions, and lighting improvements. The City has developed Complete Streets plans for several corridors identified by this Plan as High-Injury Locations and these are listed below. They are in various stages of design for implementation over the next several years.

- **Ala Wai Blvd** / Speed limit reduction, curb extensions, pedestrian crossing beacons, new crosswalks, two-way protected bike lane

- **Kamehameha Hwy (Kaneohe)** / Sidewalk improvements, pedestrian crossing beacons, bike lanes

- **Keʻeaumoku St** / Pedestrian crossing beacons, pedestrian crossing islands, new pedestrian crossings, protected bike lanes, dedicated turn lanes

- **Kuʻulei Rd at Aulike St** / New traffic signal, curb extensions, protected bike lanes

- **Liliha St** / Pedestrian crossing beacons, road diet along sections, curb extensions

- **Moanalua Rd at Ualo St** / New traffic signal with crosswalks

- **North School St** / Pedestrian crossing beacons, pedestrian crossing islands, curb extensions, bike lanes along sections, traffic calming

- **North King St** / Pedestrian crossing beacons, pedestrian refuge islands, curb extensions, bike lanes, buffered bike lanes

- **Nuʻuanu Ave** / Fill in pedestrian gaps with new sidewalks, pedestrian refuge islands, pedestrian crossing beacons, road diet along sections, new curb ramps, curb extensions, additional street trees, traffic calming

- **Oneawa St at Uluniu St** / Curb ramps, curb extensions

- **Waimano Home Rd at Kuala St** / New pedestrian crossing

- **Kūhiō Avenue Bus Lane** / Dedicated Bus Lane, allows bicycles and trucks

Recently Constructed Projects at High-Injury Locations

As part of its work to this point, the City has regularly added innovative safety features and planned priority multi-modal improvements into street repaving and other projects. This is especially important to progress on multi-lane arterials which are overrepresented in Vision Zero crashes. Project descriptions from some of completed projects at High-Injury Locations are listed below.

- **North King St at Richard Ln** / In November 2022, the City completed installation of its second RRFB to enhance pedestrian safety on North King Street at Richard Lane. In addition to the RRFB, the project constructed a median space to limit pedestrian exposure when crossing the road and allow pedestrians to focus on crossing one direction of traffic at a time.

- **King Street Bus Lane** / Completed in December of 2020, the City installed Bus Only lanes on King Street between Dillingham Boulevard and Punchbowl Street. Bus Only Lanes allowed right turning vehicles and bicycles. The project has improved bus times through this core downtown corridor while improving safety for bus passengers.

- **Ward Ave** / In May 2021, new protected bike lanes along Ward Avenue from South King Street to Ala Moana Boulevard were opened to the public. The new bike lanes run in the mauka (toward the mountain) and makai (toward the sea) directions on each side of the street and provide a direct connection to the King Street protected bike lane. A three-foot buffer lined with delineators defines and protects the bikeway and green painted stripes mark conflict zones at driveways and intersections.

- **Pensacola St** / In September 2020, a two-way protected bike lane on Pensacola Street from Wilder Avenue to Kapiolani Boulevard was opened to the public. The bike lane runs in the mauka and makai directions on the Diamond Head side of the street and connects

LEFT: N King St at Morris Lane Pedestrian Refuge Island. RIGHT: Protected bikeway on Ward Avenue.

to the King Street protected bike lane. A three-foot buffer lined with delineators defines and protects the bikeway with green stripes marking conflict zones at driveways and intersections. In November 2023, HDOT in partnership with DTS installed raised crossings on Pensacola Street at intersections with Elm Street, Rycroft Street, Hoʻolai Street, and Kamaile Street. Combined, the improvements have reduced speeds, improved uncontrolled pedestrian crossings, and created a dedicated space for bicycling.

- **California Ave** / In June 2021, the Department of Facility Maintenance installed an interim pedestrian refuge island along the busy and wide stretch of California Avenue near Makani Street. The interim pedestrian crossing improvement, designed by in-house traffic engineering staff, uses low-cost modular materials to create a median space that limits pedestrian exposure and allows pedestrians to focus on crossing one direction of traffic at a time. Design for permanent improvements and a potential road diet are programmed, pending the availability of funds.

- **Nuʻuanu Ave** / In July 2017, pilot curb extensions were constructed along North Pauahi Street at the Nuʻuanu Avenue, Smith Street, and Maunakea Street intersections. The pilot project allowed for design testing and adjustments, and a safety evaluation found that the features reduced crashes at those intersections by nearly 40%. Curb extensions improve safety by reducing pedestrian crossing distances, enhancing visibility between drivers and pedestrians, and slowing the speed of turning vehicles. In 2021, as part of a roadway repaving project, the curb extensions along North Pauahi Street at the Smith, Nuʻuanu, and Maunakea Streets were upgraded with higher-quality materials. The curb extensions feature brick-colored pavers and decorative green metal bollards to protect the expanded space and tactile warning devices for pedestrians with low vision.

Red-Light Safety Camera Enforcement Program Pilot

Red-light running is a significant cause of crashes, injuries, and deaths at signalized intersections. HDOT, in partnership with Honolulu Police Department and DTS, launched the Red-Light Safety Camera Enforcement program to provide automated enforcement of red light violations. The pilot program was installed at 10 intersections on Oʻahu, including seven intersections identified as High-Injury Locations by this Plan. The pilot has proven highly successful with a pre/post review of crash data for all sites showing an overall 47% reduction in crashes after the red-light cameras were installed. The High-Injury Locations included in the program include:

- Kapiolani Blvd/ Kamakeʻe St

- N School St/Likelike Hwy
- Vineyard Blvd/ Pālama St
- Vineyard Blvd/Liliha St
- Vineyard Blvd/ Nuʻuanu Ave
- S King St/Ward Ave
- Beretania St/ Piʻikoi St

The fines collected can only be used for the establishment, implementation, operation, oversight, repair, and maintenance of the red-light safety camera enforcement system. As the pilot period has now been successfully completed, red-light cameras are a tool for future use at other locations.

High-Injury Locations

The High-Injury Locations described in detail in Chapter 2 are a core focus of this Plan. These are the streets and intersections where safety needs are greatest and where our actions can achieve the most progress towards acheiving Vision Zero goals. Our method for selecting the most suitable treatments for High-Injury Locations takes into consideration location and crash characteristics. Based on these conditions at each High-Injury Location, a short list of proven and promising safety tools are recommended for consideration during project scoping. As the City advances with the implementation of safety projects to address High-Injury Locations, the analyses conducted during this planning process will help streamline the design.

The process for recommending potential project elements and phasing is broken out into three steps:

- **Document High-Injury Location characteristics** by mapping out key attributes about the roadway that are relevant for choosing a safety feature. This includes key factors including: the number of lanes, intersection controls, pedestrian crossing treatments, and how the location is prioitized under other existing plans such as the Oʻahu Pedestrian Plan and the Oʻahu Bike Plan.

- **Study the frequently occuring Vision Zero crashes** at that location and define the most commonly occuring crash types and contributing factors.

- **Identify proven and promising safety features that effectively address safety needs in the context of roadway characteristics** to choose safety features that are both suitable for the roadway context and shown to reduce the types of crashes occurring. Different safety features address different street safety issues and are not suitable for all types of roadways. Three suitable safety features from the ranked list were recommended for each High-Injury Location.

Safety Feature Toolkit

The Safety Feature Toolkit builds on the Complete Streets Design Manual to include safety rationale, decision making guidance, and new safety features. It will be a resource for selecting elements for future projects, based on reported effectiveness to reduce the types of crashes that are happening islandwide and at specific locations.

HONOLULU VISION ZERO ACTION PLAN

SAFETY FEATURES TOOLKIT

JUNE 2024

VⱯSION ZERO
Honolulu COMPLETESTREETS

6

Our Commitment

The City & County of Honolulu Is Changing.

For decades, transportation planning, design, operations, and maintenance has been largely focused on moving cars as quickly as possible. Safety has been a priority that was considered in the context of maintaining traffic flow with hesitation to make safety improvements that could result in longer travel times. Oʻahu has a strong history of transit, walking, and bicycling, and in recent years, the City and County of Honolulu (City) has been focusing on building more transportation options through major transit investments and bicycle and pedestrian improvements. These investments provide better, more sustainable options and make a safer transportation system for all.
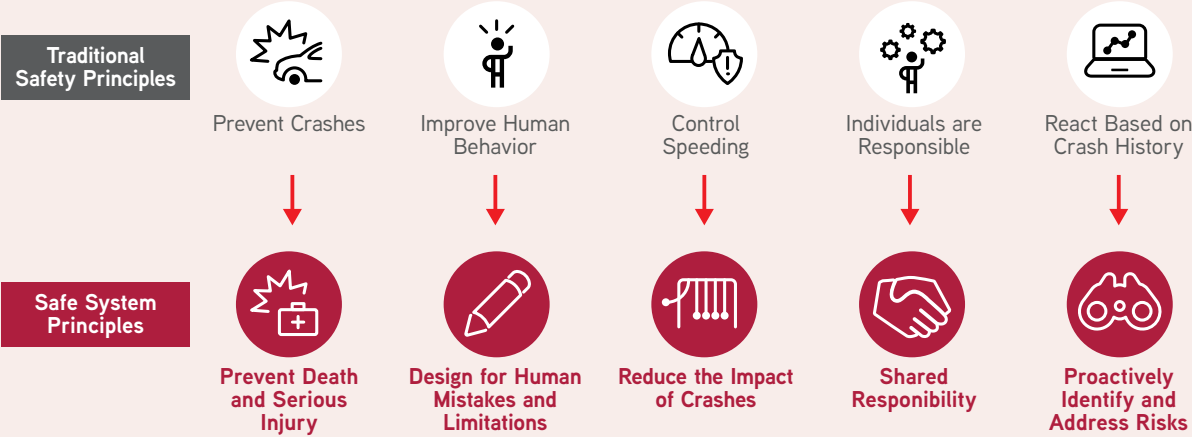
This planning process has illuminated that our people are ready for departments across the City to work together with federal, state, regional, and community-based partners to move away from conventional safety principles, toward Safe System principles that provide a wraparound holistic approach to moving people with safety at the core of the transportation system.

Process

We have shifted how we think about safety. We have moved towards a proactive approach, that acknowledges that people make mistakes. Our Safe System approach uses design, enforcement, post-crash care, and careful decision-making to create a safety net that prevents crashes from having severe or fatal outcomes.

Safe System Principles - A Change in Approach

Traditional Safety Principles	Prevent Crashes	Improve Human Behavior	Control Speeding	Individuals are Responsible	React Based on Crash History
Safe System Principles	Prevent Death and Serious Injury	Design for Human Mistakes and Limitations	Reduce the Impact of Crashes	Shared Responibility	Proactively Identify and Address Risks

Timeline to Zero Deaths

Based on community input, City leadership's readiness to act as stated in its 2018 resolution, the State of Hawai'i's commitment to support City's safety goals, and the United States Department of Transportation's ambitious policy and funding commitment, our target timeline to get to zero traffic deaths is 2040. Our slope is steep, and we acknowledge the closer we get to our target, the harder it will be to reach it. Meeting the target will require $44M-$48M annually and $708M-$755M over the course of the O'ahu Vision Zero Action Plan (Plan).

We began with the immediate adoption of a transportation safety culture and will stay on course with a long-term commitment to accelerate progress, even as we face an uncertain future of transportation, which undoubtedly will include an increasingly older population, and changes in travel patterns with environmental, energy, and development issues.

This target requires strong political resolve to integrate potentially unpopular tradeoffs into every decision, to implement systemic safety actions to protect vulnerable road users, reduce dangerous driving behavior, and to make major safety improvements at High-injury Locations. For every action we take, and every decision we make, we will work with the intention of saving lives. We will monitor our work by collecting the data necessary to understand whether we are staying on target and make changes in either the target year or the actions accordingly if we learn we are not.

The timeframe assumes City leadership will build on its momentum by continuing to integrate safety into decisions about project prioritization, project scoping, and regular maintenance and operations. The share of our work plan's budgets will continue to tip away from capacity enhancements and toward safety and multimodal projects. If funding is not made available to scale up human and budget resources, the turn toward zero traffic fatalities and serious injuries will take longer.

Meeting the target will require $44M-$48M annually and $708M-$755M over the course of the O'ahu Vision Zero Action Plan.

Organization

The City's Vision Zero Coordinator has responsibility to oversee the implementation of this Plan. This civil service position also helps advance the City's multimodal goals as a project manager for preliminary engineering projects, including: Complete Streets, rail access, pedestrian facilities, traffic controls, parking management, multimodal transportation studies, and transportation planning and design. Consistent with the Complete Streets approach outlined in Revised Ordinances of Honolulu Chapter 14, Article 18, the position develops a comprehensive approach to balance competing uses of limited public rights-of-way, curb space, and roadway shoulders in an equitable manner.

The Complete Street Core Team, comprised of the City departments of Design and Construction, Facility Maintenance, Planning and Permitting, Transportation Services, and other partner City departments and overseen by the Complete Streets Administrator (described in detail in Chapter 3), will be responsible for implementation of Vision Zero. The Vision Zero Coordinator will be responsible for providing routine updates to the Complete Streets Core Team on progress on the actions identified in this Plan.

In the future, the Complete Streets Planning/Vision Zero Branch should be grown to better coordinate and advance the many actions needed to achieve Vision Zero.

Finally, the Vision Zero Coordinator will be responsible for providing regular updates (quarterly) on progress to the Vision Zero Task Force, an extension of this Plan's Project Steering Committee.

The Honolulu Complete Streets Program requires close collaboration between five City departments on a wide range of projects and programs.

Critical Projects and Programs

This Plan has outlined an extensive set of actions in Chapter 4. Each action will require investment and this section summarizes and prioritizes some of the most critical projects and programs and the estimated dedication of funds needed. Before describing the priority projects and programs, it's important to note that the High-injury Locations described in Chapter 2 are tiered based on level of safety need and as such the Tier 1 High-injury Locations (HIL) are the highest priority (17 HIL Corridors and 12 HIL Intersections). Tier 2 High-injury Locations (41 HIL Corridors and 81 HIL Intersections) are the second priority.

The following tables show high-level estimates for funds needed for the City to meet its target timeline of reaching Zero by 2040.

Priority 1 Actions

Description			Total Cost to 2040 (000)	Annualized Cost (000)
Quick, High Impact Projects	All HIL Quick-Build Program, including the Oʻahu Pedestrian Plan High Pedestrian Injury Intersections and Corridors	Intersections (93)	$9,300	$620
		Corridors (39 miles)	$39,000	$2,600
	Quick-build high priority walkway and bikeway projects		$30,000	$2,000
	Expand planning, design, and implementation staff to deliver projects (*does not include equipment costs)		$11,250	$750
Longer-Term, High Impact Projects	All HIL Full-Build Program through stand-alone capital and roadway rehabilitation projects – including the Oʻahu Pedestrian Plan High Pedestrian Injury Intersections and Corridors	Intersections (93)	$46,500-$93,000	$3,100-$6,200
		Corridors (39 miles)	$312,000	$20,800
Total			$448,050-$494,550	$27,270 -$30,370

Priority 2 Actions

Description	Total Cost to 2040 (000)	Annualized Cost (000)
Traffic calming program	$15,000	$1,000
Educational information campaigns	$7,500	$500
Oʻahu Pedestrian Plan (2022) Tier 1 Walkways Implementation	$167,000	$11,000
Oʻahu Bike Plan (2017) Priority 1 Bikeway Implementation	$71,000	$5,000
Total	$260,500	$17,366

Holding Ourselves Accountable

The ultimate target of this Plan's implementation is zero fatal or serious injury crashes. The City will track and report on this metric annually.

Additionally, there are opportunities to incorporate more proximal performance measures. By keeping track of proximal measures, we can course correct more nimbly when they are going in the wrong direction.

These measures are both outcome based and output oriented, and they will help us learn from our efforts by keeping track of the behaviors and road design changes that influence the frequency and severity of crashes. The City will share the highlighted findings on its Vision Zero Performance Measures dashboard.

Outcome metrics describe how well our work extinguishes the behaviors that cause serious injury and death, such as awareness of the risks of speeding, support for safety investments, or reduction in driving while impaired.

Output metrics focus on the amount of work completed, including expenditures on safety, number of impressions on social media campaigns, and people participating in safety events.

Metric	Source
Number of traffic-related fatalities • Pedestrian fatalities • Bike fatalities • Motor vehicle fatalities • Motorcycle/moped fatalities	Fatal Analysis Reporting System (FARS)
Number of traffic-related serious injuries • Pedestrian serious injuries • Bike serious injuries • Motor vehicle serious injuries • Motorcycle/moped serious injuries	State of Hawai'i Advanced Crash Analysis (SHACA)
Number of fatal and serious injury crashes involving kūpuna (65 and older)	FARS
Number of fatal and serious injury crashes involving impairment and percent of total	SHACA + Vision Zero dashboard
Number of fatal and serious injury crashes involving speed and percent of total	SHACA + Vision Zero dashboard
Commute mode share for walking, bicycling, and transit	U.S. Census Bureau, American Community Survey
Number of people participating in Vision Zero education campaigns each year	Program specific
Number of High-Injury Locations improved	Project list
Pedestrian crossing improvements implemented	Complete Streets (CS) Annual Report metric
Walkways implemented	CS Annual Report metric
Bikeways implemented	CS Annual Report metric
Traffic calming implemented	CS Annual Report metric
Number of miles of streets with speed limit reduction	Project list
Percent of projects in Title VI/Environmental Justice equity areas	Project list
Automated enforcement red-light and speed installation number of sites	Program specific
Percent of crash reports with preceding action and contributed factor data	Crash report review
Percent of traffic studies conducted on High-Injury Locations	Program specific

Forging Partnerships

A holistic and systemic approach to safety, that protects all residents and visitors using Oʻahu's streets, must reach across agency and professional boundaries. The City Department of Transportation Services will coordinate the work, and bring in new partners as they accept their kuleana to our shared and safe streets.