



July 24, 2024

Dr. Robert C. Hampshire, PhD
Principal Deputy Assistant Secretary for Research and Technology and Chief Science Officer
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, D.C. 20590

Re: Docket No. DOT-OST-2024-0049 “Opportunities and Challenges of Artificial Intelligence (AI) in Transportation”

Dear Dr. Hampshire,

The Autonomous Vehicle Industry Association (“AVIA”) writes in response to the U.S. Department of Transportation’s (“USDOT”) Advanced Research Projects Agency–Infrastructure’s (“ARPA-I”) Request for Information (“RFI”) on “Opportunities and Challenges of Artificial Intelligence (AI) in Transportation.”¹ As an organization focused on the development and deployment of autonomous vehicles (“AV”), AVIA appreciates the inclusion of questions on autonomous mobility systems within the RFI, and offers these comments to provide further information on the opportunities presented by the continued development and wider deployment of AVs. As ARPA-I begins to provide new transportation research and development funding, directing funding to AV-related projects would help foster continued American leadership in the AV industry and improve roadway safety nationwide.

As an organization, AVIA is committed to bringing the tremendous safety and mobility benefits of AVs—otherwise known as SAE Level 4- and 5-capable vehicles—to consumers in a safe, responsible, and expeditious manner.² AVIA’s membership is comprised of the world’s leading technology, automotive, ridesharing, trucking, and smart transportation companies.³ AVIA members’ vehicles have driven nearly 70 million autonomous miles on U.S. public roads, a distance roughly equivalent to 293 round trips to the Moon or driving across Route 66 over 29,000 times.⁴ Given AVIA’s mission and our members’ significant collective experience developing emerging automotive technologies, AVIA welcomes the chance to work with ARPA-I.

¹ See *Opportunities and Challenges of Artificial Intelligence (AI) in Transportation*, 89 Fed. Reg. 36848, 36850 (May 3, 2024) [hereinafter ARPA-I RFI].

² SAE International has created a taxonomy for vehicle automation technologies that includes six levels of driving automation, rising from “No Driving Automation” (Level 0) to “Full Driving Automation” (Level 5). Level 4 vehicles are defined as having “High Driving Automation.” See SAE INTERNATIONAL, TAXONOMY AND DEFINITIONS FOR TERMS RELATED TO DRIVING AUTOMATION SYSTEMS FOR ON-ROAD MOTOR VEHICLES, J2016_202104 (2021).

³ Our members include Aurora, Bot.Auto, Cavnue, Cruise, Ford, Gatik, J.D. Power, Kodiak, Motional, Nuro, Stack, Uber, UPS, Volkswagen Group of America, Volvo Cars, Volvo Autonomous Solutions, Waabi, Waymo, and Zoox. See *Our Mission and Members*, AUTONOMOUS VEHICLE INDUS. ASS’N, <https://theavindustry.org/> (last visited July 24, 2024).

⁴ *Autonomous Vehicle Industry Association Releases First-Ever “State of AV” Report*, AUTONOMOUS VEHICLE INDUS. ASS’N (Apr. 10, 2024), <https://theavindustry.org/newsroom/press-releases/first-ever-state-of-av-report>.



The RFI identifies autonomous mobility systems as a potential area of future funding for AI research and development,⁵ and asks commenters to provide further information on the opportunities presented by AI and autonomous mobility systems, and how AI can responsibly facilitate autonomous mobility.⁶ As ARPA-I explores the opportunities of AVs, it is important to understand that the technology is not merely conceptual. Today, AVs are increasingly being deployed on America’s roads and highways, using advanced technology to perform all aspects of the driving task. In states as diverse as Arizona, Arkansas, California, Florida, Michigan, Pennsylvania, New Mexico, and Texas, AVs provide valuable transportation services, moving passengers as part of autonomous ride-hailing fleets and goods as part of trucking fleets and middle- and last-mile delivery operations. The U.S. Department of Defense has also embraced autonomous technology, including technology developed by AVIA member Kodiak, to keep America’s soldiers safe.⁷

The history of AV development is a prime example of how partnership and cooperation between government and industry can drive innovation, and AVIA believes the establishment of ARPA-I offers an opportunity to renew that partnership. Many of the leading voices in AV development today participated in Defense Advanced Research Projects Agency-sponsored challenges in the early 2000s. These pioneers used their technical prowess to become entrepreneurs, building dynamic companies across the United States—leading to an explosion in AV development over the last decade. American AV companies have developed the most advanced AVs to date, and billions of dollars have been invested in innovative AV companies, ranging from dogged startups to more established players with experience scaling in the transportation sector. As detailed below, AVs are now poised to address many of the USDOT’s stated priorities, including safety, climate and sustainability, equity, economic strength and global competitiveness, and transformation. Given the diverse benefits AVs can facilitate, cooperation on AV-related research and development represents a significant opportunity not only for ARPA-I or the AV industry, but the country as a whole.

I. AVs as a Vital Tool for Improving Roadway Safety

America’s roads remain a dangerous place for drivers, passengers, and other road users, in large part due to the deficiencies of human drivers. However, the United States should not accept this status quo. The wider deployment of AVs is poised to remove human error from the equation, offering a significant opportunity to improve roadway safety.

⁵ ARPA-I RFI at 36850.

⁶ *Id.* at 36851.

⁷ See *Accelerating Autonomous Vehicle Technology for the DoD*, DEF. INNOVATION UNIT (Apr. 3, 2024), <https://www.diu.mil/latest/accelerating-autonomous-vehicle-technology-for-the-dod>. AVIA member Kodiak Robotics is currently working with the U.S. Army’s Army Robotic Combat Vehicles program. See *U.S. Army Robotic Combat Vehicle (RCV Program)*, KODIAK ROBOTICS (Nov. 9, 2023), <https://kodiak.ai/news/us-army-robotic-combat-vehicle-program>.



a. *America's Dangerous Roadway Safety Status Quo*

Today, the United States faces an epidemic of fatalities on our nation's roads. In 2023, 40,990 people were killed across the country in motor vehicle traffic incidents.⁸ 2023 was the third year in a row to see traffic deaths rise above 40,000,⁹ a number of fatalities that had not been seen since 2007.¹⁰ Pedestrian deaths have also risen; 2022 was the deadliest year for American pedestrians since 1981, with 7,508 people killed.¹¹ That trend continued into 2023, with an estimated 3,373 pedestrians killed in the first half of the year, a 14% increase over 2019.¹² The increase in roadway fatalities is consistent across vehicle types. In 2022, 5,887 people died in crashes involving large trucks, a 1.8% increase in fatalities from 2021.¹³ This increase is part of a decade-long 49% increase in such crashes.¹⁴ Further, 2022 saw large trucks involved in over 120,200 crashes that resulted in an injury, an 18% increase since 2016.¹⁵ The toll of motor vehicle crashes is not measured in fatalities and injuries alone. According to the National Safety Council, “the total motor vehicle injury costs” in 2022 were estimated at \$481.2 billion.”¹⁶

Research continues to confirm that human behavior is overwhelmingly the most common factor in fatal accidents on our roads. A recent study by the National Highway Traffic Safety Administration (“NHTSA”) found that over 55% of all people injured or killed in a roadway incident (including drivers, pedestrians, and other road users) tested positive for one or more drugs (including alcohol).¹⁷ Drivers are also frequently distracted by electronics; at any given time, almost 3% of all drivers are looking at or using their handheld device.¹⁸ Studies have also found

⁸ NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., DOT HS 813 561, EARLY ESTIMATE OF MOTOR VEHICLE TRAFFIC FATALITIES IN 2023 (APRIL 2023), <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813561>.

⁹ *Id.*

¹⁰ *Fatality Facts 2021: Yearly Snapshot*, INS. INST. FOR HIGHWAY SAFETY (May 2023), <https://www.iihs.org/topics/fatality-statistics/detail/yearly-snapshot>.

¹¹ GOVERNORS HIGHWAY TRAFFIC SAFETY ASS'N, PEDESTRIAN TRAFFIC FATALITIES BY STATE 2022 PRELIMINARY DATA (JAN.-DEC.) (2023), <https://www.ghsa.org/sites/default/files/2023-06/GHSA%20-%20Pedestrian%20Traffic%20Fatalities%20by%20State%2C%202022%20Preliminary%20Data%20%28January-December%29.pdf>.

¹² GOVERNORS HIGHWAY SAFETY ASS'N, PEDESTRIAN TRAFFIC FATALITIES BY STATE JANUARY – JUNE 2023 PRELIMINARY DATA, 3 (2023), <https://www.ghsa.org/resources/Pedestrians24>.

¹³ NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., DOT HS 813 448, EARLY ESTIMATE OF MOTOR VEHICLE TRAFFIC FATALITIES AND FATALITY RATE BY SUB-CATEGORIES IN 2022, 1 (2023), <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813448>.

¹⁴ Nat'l Safety Council, *Large Trucks*, NSC INJURY FACTS, <https://injuryfacts.nsc.org/motor-vehicle/road-users/large-trucks/> (last visited July 24, 2024).

¹⁵ *Id.*

¹⁶ Nat'l Safety Council, *Motor Vehicles: Introduction*, NSC INJURY FACTS, <https://injuryfacts.nsc.org/motor-vehicle/overview/introduction/> (last visited July 24, 2024).

¹⁷ NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., DOT HS 813 399, ALCOHOL AND DRUG PREVALENCE AMONG SERIOUSLY OR FATALLY INJURED ROAD USERS, 2 (2022), https://rosap.nhtsa.gov/view/dot/65623/dot_65623_DS1.pdf.

¹⁸ NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., DOT HS 813 184C, DRIVER ELECTRONIC DEVICE USE IN 2020, 1 (2021), <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813184.pdf>.



that drivers manipulating cell phones are two to six times more at risk for a crash.¹⁹ This behavior remains stubborn, despite 49 states banning texting while driving and 34 states prohibiting the handheld use of cellphones while driving.²⁰ Several categories of behavior-related fatalities have increased in the past few years, including police-reported alcohol-involved crashes and deaths of unrestrained passengers.²¹

Roadway safety impacts each community differently. Roadway crashes, and the resulting injuries and deaths, are not evenly distributed across socioeconomic, racial, or ethnic groups. An analysis published by the Governors Highway Safety Association highlights the disproportionate number of traffic fatalities experienced by Black, Indigenous, and People of Color (“BIPOC”).²² In particular, per capita rates of traffic fatalities among American Indian/Alaskan Natives and Black populations were all higher than the national average,²³ and pedestrian death rates per capita were higher than the national average for American Indian/Alaska Natives, Black, and Hispanic individuals.²⁴ Estimates published by NHTSA indicate that these discrepancies have become exacerbated in recent years, with traffic fatalities of Black people up 23% in 2020 compared to 2019, while American Indian deaths rose 11%.²⁵ Census tracts have recorded pedestrian fatality rates within low-income metropolitan areas approximately twice that of more affluent neighborhoods.²⁶ These patterns are echoed in a City of Chicago report revealing that Black residents and those living in communities with high levels of economic hardship were more at risk of dying in a traffic crash compared to white residents and those living in communities with low and medium levels of economic hardship, respectively.²⁷

Human error, including speeding, unfamiliarity with the roadway, and fatigue, is currently a major contributor to roadway incidents. AVs are designed to remove that error from the equation, as they do not drive distracted, tired, or intoxicated. The improvements to roadway safety that AVs can bring will be especially important to many diverse, economically challenged, and underserved

¹⁹ *Distracted driving*, INS. INST. FOR HIGHWAY SAFETY, <https://www.iihs.org/topics/distracted-driving> (last visited July 24, 2024).

²⁰ *Distracted Driving*, GOVERNORS HIGHWAY TRAFFIC SAFETY ASS’N (July 2023), <https://www.ghsa.org/state-laws/issues/distracted%20driving>.

²¹ NAT’L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP’T OF TRANSP., DOT HS 813 298, EARLY ESTIMATES OF MOTOR VEHICLE TRAFFIC FATALITIES AND FATALITY RATE BY SUB-CATEGORIES IN 2021, 1 (2022), <https://www.nhtsa.gov/press-releases/early-estimate-2021-traffic-fatalities>.

²² GOVERNORS HIGHWAY SAFETY ASS’N, AN ANALYSIS OF TRAFFIC FATALITIES BY RACE AND ETHNICITY 18 (2021), <https://www.ghsa.org/sites/default/files/2021-06/An%20Analysis%20of%20Traffic%20Fatalities%20by%20Race%20and%20Ethnicity.pdf>.

²³ *Id.* at 8.

²⁴ *Id.* at 13.

²⁵ *Id.* at 18; NAT’L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP’T OF TRANSP., DOT HS 813 118, EARLY ESTIMATES OF MOTOR VEHICLE TRAFFIC FATALITIES AND FATALITY RATE BY SUB-CATEGORIES IN 2020 8 (2021), <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813118>.

²⁶ GOVERNING, AMERICA’S POOR NEIGHBORHOODS PLAGUED BY PEDESTRIAN DEATHS 1 (2014), http://media.navigatore.com/documents/Governing_Pedestrian_Fatalities_Report.pdf.

²⁷ VISION ZERO CHICAGO, ACTION PLAN 2017-2019 17, https://visionzerochicago.org/wp-content/uploads/2016/05/17_0612-VZ-Action-Plan_FOR-WEB.pdf.



communities that continue to face increased risk from the traffic flowing through their neighborhoods.

b. The Safety Benefits of AVs Technology

Improving road safety is a primary goal of the AV industry. Automated driving systems (“ADS”), the heart and brain of an AV, are equipped with suites of sensor systems (including lidar, radar, and cameras) with sensitivities, capabilities, and reaction times well beyond those of a human driver. These sensors grant an ADS a 360-degree field of vision which can detect, track, and react to objects and people even when hidden from human perception due to vehicles, buildings, and other obstructions. For example, AVs are developed to specifically detect vulnerable road users—such as motorcycles, pedestrians, and cyclists—and then predict and safely respond to their unique behavior (e.g., motorcycle lane splitting).

AVs have built a significant safety record through more than a decade of development, testing, and deployment, and ADS-equipped vehicles have now driven millions of miles autonomously, with vehicles operated by AVIA members driving nearly 70 million autonomous miles on public roads in the U.S. alone.²⁸ Reinsurer Swiss Re recently published an analysis of 3.8 million autonomous miles driven by passenger AVs operated by AVIA member Waymo. The analysis found that when compared to baseline human drivers, Waymo AVs reduced bodily injury claims by 100 percent, and reduced property damage claims by 76 percent.²⁹ As a result, Swiss Re concluded that Waymo’s AVs are “significantly safer towards other road users than human drivers are.”³⁰ Waymo’s own review of over 7 million rider-only autonomous miles found that the company’s AVs demonstrated a 85% reduction in crashes involving any injury, and a 57% reduction in police-reported crashes, when compared to human drivers.³¹ A recent Chamber of Progress study looking at California alone found that replacing even 1.3% of drivers with an AV could have prevented 411 fatalities between 2020 and 2022, while replacing 13% of drivers could have prevented 1,342 lives in that same three year period.³² Another study by the Virginia Tech Transportation Institute found that the full scale deployment of occupantless AVs for delivery services could reduce roadway deaths by 58.2%.³³

²⁸ AUTONOMOUS VEHICLE INDUS. ASS’N, *supra* note 4.

²⁹ LUIGI DI LILLO ET AL., COMPARATIVE SAFETY PERFORMANCE OF AUTONOMOUS- AND HUMAN DRIVERS: A REAL-WORLD CASE STUDY OF THE WAYMO ONE SERVICE (2023), <https://arxiv.org/ftp/arxiv/papers/2309/2309.01206.pdf>.

³⁰ *Id.*

³¹ *Waymo Significantly Outperforms Comparable Human Benchmarks Over 7 Million Miles of Rider-Only Driving*, WAYMO (Dec. 20, 2023), <https://waymo.com/blog/2023/12/waymo-significantly-outperforms-comparable-human-benchmarks-over-7-million/>.

³² KAITLYN HARGER, ANALYSIS: AVS IN CALIFORNIA COULD HAVE SAVED UP TO 1,300 LIVES, PREVENTED UP TO 5,000 MAJOR INJURIES OVER PAST THREE YEARS (2024), <https://progresschamber.org/wp-content/uploads/2024/03/AV-Safety-Research-California-Traffic-Fatality-Analysis-03-24.pdf>.

³³ CHRISTINA WITCHER ET AL., ESTIMATING CRASH CONSEQUENCES FOR OCCUPANTLESS AUTOMATED VEHICLES (Feb. 2021), <https://vtechworks.lib.vt.edu/server/api/core/bitstreams/a28aa936-8f89-4302-8859-ee54d34358e2/content>.



In addition, autonomous trucks have demonstrated a remarkable safety record, without a single fatality in more than seven years of operations and millions of miles driven on public roads. This safety record is supported by data collected by NHTSA. For three years, NHTSA has required AV companies to report every incident—no matter how minor or who is at fault—that occurs while an ADS is engaged as part of Standing General Order 2021-01 (“SGO”).³⁴ During this period, only one reported incident involving an autonomous truck resulted in injuries, and the cause of that incident was a human-driven vehicle that collided with an autonomous truck. Autonomous trucks will help address the spate of fatalities caused by truck crashes. Reacting to newly released crash data from NHTSA, the Institute of Safer Trucking and Road Safe America said:

This data highlights a critical problem within the United States: a 76% increase in truck crash fatalities since 2009, with the total reaching a devastating 5,936 lives lost in 2022 alone. . . All of this occurred against a 15 percent increase in truck vehicle miles traveled, which means that trucking continues to get more dangerous in the United States.³⁵

As the autonomous trucking industry continues to grow, so will the roadway safety improvements the technology provides.

AVs are poised to improve roadway safety and help combat the glut of roadway deaths facing the United States today. By removing human error, AVs avoid the risks that come from driver distraction, fatigue, and incapacitation. The benefits of AVs extend beyond AV passengers, as the detection capabilities of AVs can better protect VRUs and other road users from harm as well. Through ongoing AV deployments, AVIA members are generating valuable data supporting the safety benefits of AVs. The wider deployment of AVs will bring these benefits to communities across the country and help bring an end to thousands of unnecessary and tragic roadway deaths.

II. AVs and Economic Opportunities

In addition to increasing safety, the continued expansion of AV deployments will also bring social, economic, supply chain, and environmental benefits to American communities. By 2050, the value of public and consumer benefits of AV deployment, including reduced congestion, avoided accidents, and saved time, could amount to \$796 billion annually.³⁶ The wider deployment of AVs can create over three million new jobs by 2035, while driving down the cost of consumer goods, reducing delivery costs, and raising annual earnings for all U.S. workers by between \$203 and \$267 per worker per year.³⁷ By 2026, AVs could represent not only a potential \$1 trillion

³⁴ See NAT’L HIGHWAY TRAFFIC SAFETY ADMIN., SECOND AMENDED STANDING GENERAL ORDER 2021-01 (2023), https://www.nhtsa.gov/sites/nhtsa.gov/files/2023-04/Second-Amended-SGO-2021-01_2023-04-05_2.pdf.

³⁵ *Institute for Safer Trucking and Road Safe America Call for Collaboration in Response to New Data Showing Truck Crash Fatalities Continue to Rise in 2022*, INST. FOR SAFER TRUCKING, <https://www.safertrucking.org/news-blog/ist-statement-on-2022-fars-data-release> (last visited July 24, 2024).

³⁶ SECURING AMERICA’S FUTURE ENERGY, AMERICA’S WORKFORCE AND THE SELF-DRIVING FUTURE 9 (2018), https://avworkforce.secureenergy.org/wp-content/uploads/2018/06/SAFE_AV_Policy_Brief.pdf.

³⁷ *Id.*



market,³⁸ but also a key solution to supply chain troubles, all while decreasing transportation costs, creating jobs, and improving safety. For millions of elderly Americans and individuals with travel-limiting disabilities, AVs can provide greater independence compared to mass transit or paratransit systems, opening the door for new employment opportunities, improved access to medical care, and better connection to their communities. AVs are poised to bring economic benefits at both societal and individual levels, and they can help grow the U.S. economy and support the economic competitiveness of American businesses across many industries, in turn supporting the continued growth of the U.S. economy.³⁹

a. Connecting People and Protecting Communities

By increasing transportation access and improving safety, AVs can serve American communities of all kinds. Today, millions of Americans have their ability to travel limited by mobility challenges or disabilities. The USDOT has estimated that 25.5 million Americans face travel-limiting disabilities,⁴⁰ and roughly 560,000 people with disabilities never leave their homes due to transportation difficulties.⁴¹ Over 7.6 million Americans live with significant vision impairment conditions which can leave them unable to operate a vehicle.⁴² This lack of mobility contributes to a lack of economic opportunity, and only 22.5% of people with disabilities are employed, compared to 65.8% of people without a disability.⁴³ A study by the National Disability Institute found that the wider deployment of AVs could lead to an increase in 4.4 million jobs for people with disabilities, which could create a 3.8% increase in U.S. gross domestic product (nearly \$867 billion).⁴⁴ Whether personally owned, serving as on-demand taxis, or as part of local paratransit services, AVs can provide disabled Americans with greater autonomy, letting them dictate how, where, and when they move through the world.

³⁸ TECONOMY PARTNERS, FOREFRONT: SECURING PITTSBURGH'S BREAK-OUT POSITION IN AUTONOMOUS MOBILE SYSTEMS ES-1-2 (2021), <https://ridc.org/wp-content/uploads/2021/10/PGH-Autonomy-Report-Executive-Summary.pdf>.

³⁹ Jack Caporal, William O'Neil, and Sean Arrieta-Kenna, *Bridging the Divide: Autonomous Vehicles and the Automobile Industry*, CSIS (Apr. 14, 2021), <https://www.csis.org/analysis/bridging-divide-autonomous-vehicles-and-automobile-industry>.

⁴⁰ *ADA at DOT: Accessibility Initiatives*, U.S. DEP'T OF TRANSP. (Feb. 10, 2023) <https://www.transportation.gov/accessibility>.

⁴¹ BUREAU OF TRANSP. STAT., TRANSPORTATION DIFFICULTIES KEEP OVER HALF A MILLION DISABLED AT HOME (2012), https://www.bts.gov/archive/publications/special_reports_and_issue_briefs/issue_briefs/number_03/entire.

⁴² *Blindness Statistics*, NAT'L FED'N OF THE BLIND, <https://nfb.org/resources/blindness-statistics> (last visited July 24, 2024).

⁴³ Economic News Release, U.S. Bureau of Labor Stat., Persons with a Disability: Labor Force Characteristics Summary (Feb. 22, 2024), <https://www.bls.gov/news.release/disabl.nr0.htm>.

⁴⁴ DOMINIC MODICAMORE, ET AL, NATIONAL DISABILITY INSTITUTE, ECONOMIC IMPACTS OF REMOVING TRANSPORTATION BARRIERS TO EMPLOYMENT FOR INDIVIDUALS WITH DISABILITIES THROUGH AUTONOMOUS VEHICLE ADOPTION (Dec. 30, 2022), <https://www.nationaldisabilityinstitute.org/wp-content/uploads/2023/02/ndi-economicimpactsofremovingtransportationbarriers.pdf>.



AVs can also provide vital connections to areas with high demand but low supply of transportation, otherwise known as “transit deserts.” Access to transportation and average length of commute are connected to upward mobility,⁴⁵ and studies have found links between public transit access, income, and unemployment.⁴⁶ A 2011 study showed that an average person could access only about 30% of all jobs and 25% of low- and middle-skilled jobs in a given metropolitan area via public transit within 90 minutes.⁴⁷ AVs have the potential to reduce or eliminate gaps in transportation access by improving integration with mass transit, whether by providing both first mile and last mile connections to transit, servicing direct trips to workplaces and other endpoints, or by broadly increasing supply that helps free up other conventional and AV transportation options to build those linkages. Projections indicate that the transportation connections facilitated by the adoption of AVs could increase access to jobs within a metropolitan area by 45% by 2040.⁴⁸

Access to food is another area of inequality that AVs can help alleviate. Transit deserts often overlap with food deserts, which are defined as areas with high poverty (20% or greater) and low access to food (at least 33% of people living more than one mile from a grocery store or supermarket).⁴⁹ A 2017 report by the U.S. Department of Agriculture’s Economic Research Service (“ERS”) estimated that 54 million individuals, or 17.1 percent of the total U.S. population, had limited access to a supermarket or grocery store between 0.5 and 10 miles from their home.⁵⁰ Further, a 2009 ERS report found that, at the time, 2.3 million people lived more than one mile from a supermarket and did not have access to a vehicle.⁵¹

AVs can prove particularly useful for improving access to food, both by transporting people to previously inaccessible or difficult to access supermarkets and grocery stores, and by bringing food directly to their doors. With greater widespread deployment, AVs could improve access to fresh food for 14 million low-income households, roughly 70% of the total low-income

⁴⁵ Mikayla Bouchard, *Transportation Emerges as Crucial to Escaping Poverty*, N.Y. TIMES (May 7, 2015), <https://www.nytimes.com/2015/05/07/upshot/transportation-emerges-as-crucial-to-escaping-poverty.html>.

⁴⁶ Gillian D. White, *Stranded: How America’s Failing Public Transportation Increases Inequality*, THE ATLANTIC (May 16, 2015), <https://www.theatlantic.com/business/archive/2015/05/stranded-how-americas-failing-public-transportation-increases-inequality/393419/>.

⁴⁷ Adie Tomer Et Al., *Missed Opportunity: Transit and Jobs in Metropolitan America*, BROOKINGS (May 11, 2011), <https://www.brookings.edu/research/missed-opportunity-transit-and-jobs-in-metropolitan-america/>.

⁴⁸ RICHARD EZIKE ET. AL., UNION OF CONCERNED SCIENTISTS, *WHERE ARE SELF-DRIVING CARS TAKING US?*, 6 (2019), <https://ucsusa.org/sites/default/files/attach/2019/02/Where-Are-Self-Driving-Cars-Taking-Us-web.pdf>.

⁴⁹ Michele Ver Ploeg, Et. Al., *Mapping Food Deserts in the United States*, U.S. DEP’T OF AGRIC.: ECON. RSCH SERV., (Dec. 1, 2011), <https://www.ers.usda.gov/amber-waves/2011/december/data-feature-mapping-food-deserts-in-the-us/>.

⁵⁰ ECONOMIC RESEARCH SERVICE, EIB-165, U.S. DEP’T OF AGRIC. *LOW-INCOME AND LOW-SUPERMARKET-ACCESS CENSUS TRACTS, 2010-2015* 12 (2017), <https://www.ers.usda.gov/webdocs/publications/82101/eib-165.pdf?v=3395.3>.

⁵¹ ECONOMIC RESEARCH SERVICE, *ACCESS TO AFFORDABLE AND NUTRITIOUS FOOD: MEASURING AND UNDERSTANDING FOOD DESERTS AND THEIR CONSEQUENCES* iii (2009) https://www.ers.usda.gov/webdocs/publications/42711/12716_ap036_1_.pdf?v=8423.6.



population, living in food deserts.⁵² AVs can create safe and affordable transportation options for millions of underserved Americans, connecting them with economic opportunities and better access to food and services than ever before.

b. Moving Goods and Growing the American Economy

The integration of AVs into America's commercial fleets will optimize freight transportation nationwide, bringing goods directly to consumers faster and strengthening at-risk supply chains. At present, the United States is not hauling all the freight it could, holding back our nation's farmers, ranchers, and manufacturers. Autonomous trucking offers a means to address supply chain inefficiencies by filling workforce gaps, enhancing fleet flexibility, and reducing travel times.

The growth in autonomous trucking is poised to run in parallel with an ever-growing market for freight trucking, with the Bureau of Transportation Statistics estimating that freight activity in the United States alone will grow fifty percent from 2020 to 2050, reaching a projected value of \$36.2 trillion.⁵³ With trucking representing roughly 72% of all freight transportation tonnage,⁵⁴ the number of trucks on the road, autonomous and human driven, will need to grow as well. As demand for freight hauling continues to grow, AVs can help shippers keep up with that demand, supplementing and augmenting human driven fleets. With AVs hauling more long-haul freight, more opportunities will be created for truck drivers in their own communities. This will also allow companies to strategically place their drivers where they are needed most and ensure America's truck drivers can remain in and near their communities and sleep in their own beds.

For consumers, AVs are positioned to reduce general transportation costs and the cost of goods, and ensure goods are made more readily available and closer to home. Sixty-five percent of U.S. consumable goods are brought to market by trucks, and the implementation of autonomy in the trucking sector stands to decrease operating costs by about 45%—resulting in savings between \$85 billion and \$125 billion, which can be passed on to consumers and transportation workers.⁵⁵ In California alone, the introduction of autonomous trucking could increase that state's

⁵² Sola Lawal, *Serving America's Food Deserts*, MEDIUM (July 15, 2020), <https://medium.com/nuro/serving-americas-food-deserts-a7442e922053>.

⁵³ *Freight Activity in the U.S. Expected to Grow Fifty Percent by 2050*, BUREAU OF TRANSP. STAT. (Nov. 22, 2021), [https://www.bts.gov/newsroom/freight-activity-us-expected-grow-fifty-percent-2050#:~:text=New%20long%2Dterm%20projections%20released,trillion%20\(in%202017%20dollars\)](https://www.bts.gov/newsroom/freight-activity-us-expected-grow-fifty-percent-2050#:~:text=New%20long%2Dterm%20projections%20released,trillion%20(in%202017%20dollars)).

⁵⁴ *ATA Truck Tonnage Index Increased 2.4% in May*, AM. TRUCKING ASS'N (July 20, 2023), <https://www.trucking.org/news-insights/ata-truck-tonnage-index-increased-24-may>.

⁵⁵ Aisha Chottani, Greg Hastings, John Murnane, and Florian Neuhaus, *Distraction or Disruption? Autonomous Trucks Gain Ground in US Logistics*, MCKINSEY & CO., (Dec. 10, 2018), <https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/distraction-or-disruption-autonomous-trucks-gain-ground-in-us-logistics>.



real GDP and welfare by at least \$6 billion a year.⁵⁶ Finally, through the introduction of shared AV fleets, transportation costs—which amount to the second-largest expense for most households—could be reduced by as much as \$5,600 per year.⁵⁷

c. Providing New Jobs

American workers also stand to benefit from the greater adoption of AV technologies. A USDOT-funded study found that autonomous trucking could increase U.S. employment by up to 35,000 jobs per year on average.⁵⁸ AVs will coexist with America’s truck drivers, and the goal of the industry is to create more opportunities for all workers in our country. A growing AV industry will continue to create new job opportunities for workers with a range of educational backgrounds and experiences. Indeed, a USDOT study has found that most autonomous trucking adoption scenarios would not lead to layoffs for existing truckers.⁵⁹

The AV industry has already created new jobs and brought new investment, tax revenue, resources, and human capital to states across the country, including Arkansas, California, Alabama, Arizona, Arkansas, Kansas, Nevada, New Mexico, Oklahoma, Pennsylvania, Michigan, Florida, Washington, Colorado, and Texas. In communities throughout those states, the AV industry is providing opportunities for workers with a wide array of expertise and educational backgrounds, including many jobs that do not require a college degree. These jobs include auto technicians, fleet managers, safety operations specialists, sensor calibrators, transportation planners, and many others to serve the growing needs of AV fleets and AV manufacturers.⁶⁰ As the industry continues to expand, delivery workers and grocery store employees will be involved in selecting, packing, and delivering goods to consumers, among other jobs and roles. The wider deployment of AVs can create over three million new jobs by 2035, all while expanding access to affordable delivery services, according to a study conducted by Steer.⁶¹

The AV industry is also investing in partnerships to create the jobs of tomorrow. These investments not only move AV technology forward, but also prepare the American workforce to

⁵⁶ *Autonomous Long-Haul Trucking Stands to Grow the Golden State’s Economy While Creating Jobs and Raising Wages Without Mass Driver Layoffs*, SILICON VALLEY LEADERSHIP GROUP (Apr. 13, 2022), <https://www.svlg.org/study-shows-autonomous-trucking-will-grow-californias-economy/>.

⁵⁷ SECURING AMERICA’S FUTURE ENERGY, FOSTERING ECONOMIC OPPORTUNITY THROUGH AUTONOMOUS VEHICLE TECHNOLOGY (July 2020), <https://safe2020.wpenginpowered.com/wp-content/uploads/2020/07/Fostering-Economic-Opportunity-through-Autonomous-Vehicle-Technology.pdf>.

⁵⁸ ROBERT WASCHIK ET AL., JOHN A. VOLPE NAT’L TRANSP. SYS. CTR., FHWA-JPO-21-847, MACROECONOMIC IMPACTS OF AUTOMATED DRIVING SYSTEMS IN LONG-HAUL TRUCKING, 1 (2021), <https://rosap.ntl.bts.gov/view/dot/54596>.

⁵⁹ *Id.*

⁶⁰ For more examples of jobs created by AV trucking operations, see *What do self-driving vehicles mean for jobs and the economy?*, Aurora (May 18, 2023), <https://blog.aurora.tech/progress/what-do-self-driving-vehicles-mean-for-jobs-and-the-economy>.

⁶¹ STEER, ECONOMIC IMPACTS OF AUTONOMOUS DELIVERY SERVICES IN THE U.S., XI (2020), https://www.steergroup.com/sites/default/files/2020-09/200910_%20Nuro_Final_Report_Public.pdf.



compete globally. For example, AVIA member Aurora has partnered with Montana State University, Gallatin College's Photonics and Laser Technology Program to support students seeking careers in photonics, including work on AV lidar systems.⁶² Similarly, AVIA member Nuro has developed programs with De Anza Community College in California and San Jacinto Community College in Texas that offer a new career pathway to prepare the next generation of autonomous fleet technicians.⁶³ These initiatives include a free tuition option, access to paid internships and part time work, and preference for full time jobs with and benefits upon graduation.

d. Environmental Benefits of Autonomous Vehicles

The wider deployment of AVs stands to bring important environmental benefits, including by reducing emissions through greater fuel efficiency and reduced congestion. Many AV developers rely on battery electric vehicles ("EVs") or gasoline-electric hybrids for their AV fleets, and further adoption of EVs is increasing. A study by Steer found that autonomous, electric local delivery vehicles could avoid more than 400 million tons of CO₂ from 2025-2035.⁶⁴

Autonomous trucking specifically is poised to provide immense environmental benefits. 29% of U.S. total greenhouse gas emissions are attributed to transportation, with medium- and heavy-duty trucks accounting for 23% of all transportation-related emissions.⁶⁵ In states such as California, that figure is even higher, with transportation representing approximately 50% of all greenhouse gas emissions.⁶⁶ ADS-equipped heavy trucks can reduce fuel consumption by at least 10% as a result of more efficient driving, resulting in a significant reduction of CO₂ emissions.⁶⁷ Additionally, AVIA member Aurora recently released a white paper demonstrating that autonomous trucking has the potential for a 13-32% net energy efficiency improvement per loaded miles relative to human-driven trucks.⁶⁸ These benefits emanate from limiting peak speeds,

⁶² *Aurora Voices with the Gallatin College Photonics Program*, Aurora (Feb. 24, 2022), <https://blog.aurora.tech/people/aurora-voices-the-gallatin-college-photonics-program>.

⁶³ *Autonomous and Electric Vehicle Technician Pathway*, DE ANZA COLLEGE, <https://www.deanza.edu/autotech/av> (last visited July 24, 2024); Press Release, San Jacinto College and Nuro, San Jacinto College and Nuro Announce First AV Technician Certificate Program in Texas (Feb. 24, 2023), <https://www.newsfilecorp.com/release/156026/San-Jacinto-College-and-Nuro-Announce-First-AV-Technician-Certificate-Program-in-Texas>.

⁶⁴ STEER, *supra* note 61, at XV.

⁶⁵ *Fast Facts on Transportation Greenhouse Gas Emissions*, ENV'T PROT. AGENCY (Oct. 31, 2023), <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>.

⁶⁶ *Transforming Transportation*, CA ENERGY COMM'N, <https://www.energy.ca.gov/about/core-responsibility-fact-sheets/transforming-transportation> (last visited July 24, 2024).

⁶⁷ Ryan Gehm, *Self-driving trucks cut fuel consumption by 10%*, SAE INT'L (Dec. 19, 2019), <https://www.sae.org/news/2019/12/tusimple-autonomous-trucks-cut-fuel>.

⁶⁸ DR. GARRETT BRAY, AURORA, THE SUSTAINABILITY OPPORTUNITY OF AUTONOMOUS TRUCKING 3 (2024), https://downloads.ctfassets.net/8byw6jks7h2/4W2yp42p921nrZXjWgKQRt/278c2eaa0f474a3ae6d75802d0d92a63/The_Sustainability_Opportunity_of_Autonomous_Trucking.pdf; See also Research & Discoveries (R&D): Autonomous Trucks Can Reduce Emissions, AUTONOMOUS VEHICLE INDUS. ASS'N, <https://theavindustry.org/resources/blog/research-discoveries-rd-autonomous-trucks-can-reduce-emissions> (last visited July 24, 2024).



reducing “dead-head” miles, increasing vehicle utilization and off-peak driving, reducing idling, and programmed eco-driving behavior.⁶⁹

In addition, AVs can serve an important role in achieving environmental goals that advance public health.⁷⁰ Emissions from motorized vehicles are a major source of air pollution, which is a leading risk factor for mortality and morbidity.⁷¹ Although the American Lung Association has found that nearly 1 in 4 Americans live in places with unhealthy air, the effects of poor air quality are disproportionately experienced by BIPOC.⁷² Specifically, the American Lung Association’s 2024 “State of the Air” report found that more than 68.9 million BIPOC lived in counties with at least one failing grade in air quality.⁷³

The wider deployment of AVs will bring myriad benefits to communities and individuals across the country. From connecting underserved communities and people with disabilities to new opportunities for employment and independence, to important reductions in transportation sector emissions, to boosting the economy by lowering transportation costs, AVs can help address a diverse set of problems.

III. Challenges of AI in Transportation

In the RFI, ARPA-I also seeks information on current and future challenges of AI in transportation.⁷⁴ One of the primary challenges facing AV manufacturers results from the continued need for a national policy framework to support the further development and deployment of the technology. Despite holding the lead in AV development at the moment, the United States is at risk of falling behind the rest of the world on AV public policy, which would deny Americans the technology’s lifesaving mobility and efficiency benefits and harm the United States’ global economic competitiveness. A national AV policy framework is needed that prioritizes American leadership and has Congress, the USDOT, and the private sector acting in partnership. While federal efforts to establish such a framework have stalled in the last several years, a majority of states have recognized the benefits of AVs by expressly approving AV operations on their roads. AVIA has published a proposed federal policy framework, which details

⁶⁹ *Id.*

⁷⁰ See David Rojas-Rueda, et al., *Autonomous Vehicles and Public Health*, 41 ANN. REV. OF PUB. HEALTH 329 (2020), <https://www.annualreviews.org/doi/10.1146/annurev-publhealth-040119-094035>.

⁷¹ *Id.* at 333 (citing HEALTH EFFECTS INST., STATE OF GLOBAL AIR 2018 1 (2018), <https://www.stateofglobalair.org/sites/default/files/soga-2018-report.pdf>).

⁷² *State of the Air: Key Findings*, AM. LUNG ASS’N, <https://www.lung.org/research/sota/key-findings> (last visited July 24, 2024).

⁷³ *Populations at Risk*, AM. LUNG ASS’N, <https://www.lung.org/research/sota/key-findings/people-at-risk> (last visited July 24, 2024).

⁷⁴ ARPA-I RFI at 36851.



a number of components such a law should include.⁷⁵ Some key steps that the USDOT can take to create an AV federal policy framework include:

- **Move Forward on the AV Deployment Program.** First announced in July 2023, under the ADS-equipped Vehicle Safety, Transparency and Evaluation Program (“AV STEP”) NHTSA “would consider applications for deploying noncompliant ADS vehicles subject to review processes, terms and conditions that the agency would require to ensure public safety and transparency.”⁷⁶ According to then Acting Administrator Ann Carlson, “[b]y allowing the deployment of exempt ADS vehicles under conditions that include requirements to demonstrate safety and provide information about vehicle operation and deployment, we believe AV STEP would open up a wealth of data [and] hasten NHTSA’s progress toward establishing an effective governance structure for ADS performance.”⁷⁷
- **Complete the Rule on Safe Integration of ADS in Commercial Motor Vehicles.** The Federal Motor Carrier Safety Administration (“FMCSA”) should swiftly complete the rulemaking process on the “Safe Integration of Automated Driving Systems (ADS)-Equipped Commercial Motor Vehicles (CMVs).”⁷⁸ This includes enacting regulations that codify FMCSA’s interpretation that the Federal Motor Carrier Safety Regulations do not require a human driver to operate or be present in a commercial motor vehicle operated by a SAE Level 4 or Level 5 ADS.⁷⁹
- **Pursue International Engagement and Ensure Foreign Market Access.** The Administration and the USDOT should preserve foreign market access and U.S. leadership in the AV industry by remaining actively engaged with other governments and international bodies about AV policymaking.
- **Provide a Final Decision on the AV-Industry Backed Emergency Warning Device Exemption Petition.** FMCSA should move expeditiously to grant the still-pending industry exemption request that will allow ADS-equipped vehicles to use alternative warning devices to signal when an ADS-equipped CMV is stopped on the roadside.⁸⁰ This common-sense and data-backed application, filed in January 2023, has been pending for

⁷⁵ AUTONOMOUS VEHICLE INDUS. ASS’N, FEDERAL POLICY FRAMEWORK FOR OUR AV FUTURE (MARCH 2023), <https://theavindustry.org/resources/AVIA-Federal-Policy-Framework-for-Our-AV-Future.pdf>.

⁷⁶ Ann Carlson, Acting Adm’r, Nat’l Highway Traffic Safety Admin., Keynote Address at the Automated Road Transportation Symposium (ARTS2023) (July 12, 2023), <https://www.nhtsa.gov/speeches-presentations/automated-road-transportation-symposium-arts23-keynote-address>.

⁷⁷ *Id.*

⁷⁸ Safe Integration of Automated Driving Systems (ADS)-Equipped Commercial Motor Vehicles (CMVs), 88 Fed. Reg. 6691 (Feb. 1, 2023).

⁷⁹ U.S. DEP’T OF TRANSP., PREPARING FOR THE FUTURE OF TRANSPORTATION: AUTOMATED VEHICLES 3.0 (AV 3.0) 9 (Oct. 2018), <https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/320711/preparing-future-transportation-automated-vehicle-30.pdf>; Safe Integration of Automated Driving Systems-Equipped Commercial Motor Vehicles, 84 Fed. Reg. 24449, 24453 (May 28, 2019).

⁸⁰ See AURORA & WAYMO, FMCSA-2023-0071-0011, JOINT WAYMO-AURORA APPLICATION FOR EXEMPTION (Jan. 10, 2023), <https://www.regulations.gov/document/FMCSA-2023-0071-0011>.



16 months when we have seen several equipment and lighting-related petitions over the past several years be acted on, on average, within 8 months.⁸¹

- **Swiftly Update Regulations.** The USDOT should continue work on regulations to support AV deployment, starting with issuing proposed rules for telltales, indicators, and warnings in ADS-equipped vehicles and crash avoidance testing for new ADS vehicle designs, and expanding to new enabling rules that support the deployment of ADS-equipped vehicles, including those with novel designs.

The USDOT should also collaborate with other federal agencies on policies that could impact American leadership on AVs, such as the recent Advance Notice of Proposed Rulemaking from the Bureau of Industry and Security on securing the connected vehicle supply chain.⁸² As the government's issue area experts on AVs, USDOT is well positioned to ensure new rules do not have unintended impacts on the American AV industry. USDOT can likewise work with other agencies, state governments, companies, and communities to promote research into and development of AV manufacturing and manufacturing components integral to AVs, such as lidar sensors, to help grow domestic industries and strengthen the AV industry workforce.

In addition to these actions, the USDOT and ARPA-I can continue to support research and development of AV-related technical standards and provide technical assistance and best practices to help harmonize state AV regulatory frameworks. The current patchwork of state AVs laws complicates interstate AV operations in ways that do not impact traditional vehicles, and federal guidance can help create more consistent rules nationwide. Likewise, further encouragement by the USDOT for roadway maintenance and traffic management practices can ease roadway operations for AVs and human drivers alike. USDOT could incentivize states to follow the Manual on Uniform Traffic Control Devices more closely, and ensure greater consistency in signage and markings nationwide, which will not only be helpful for AVs, but also for human drivers and other road users. States could also be encouraged to proactively share construction forewarning information, to ensure AV developers and other road users have the most up-to-date information on road conditions. This could be effectuated through providing support and funding for states to participate in the existing Work Zone Data Exchange program,⁸³ simplifying the path to building out greater roadway data sharing nationwide. ARPA-I could also fund the research and development of smarter roadway systems that, for example, communicate granular weather data to road users, including AVs, to help vehicle operators to track real-time, location-specific weather conditions.

⁸¹ FMCSA's own regulations state that the agency will attempt to issue a final decision on any exemption application within 180 days of receipt. 49 C.F.R. § 381.320.

⁸² See *Securing the Information and Communications Technology and Services Supply Chain: Connected Vehicles*, 89 Fed. Reg. 15071 (proposed Mar. 1, 2024). AVIA submitted its own comments on the ANPRM. See *Autonomous Vehicle Indus. Ass'n, Comment Letter on Advanced Notice of Proposed Rulemaking on Securing the Information and Communications Technology and Services Supply Chain: Connected Vehicles* (Apr. 30, 2024), <https://www.regulations.gov/comment/BIS-2024-0005-0039>.

⁸³ See *Work Zone Data Exchange*, U.S. DEP'T OF TRANSP. (APR. 30, 2024), <https://www.transportation.gov/av/data/wzdx>.



Through updated regulations, new policies, and targeted funding of research, development, and programing, ARPA-I and the USDOT are well positioned to help the AV industry tackle major challenges and bring lifesaving technologies to communities across the country.

IV. Conclusion

AVIA appreciates the chance to provide these comments on the significant opportunities offered by AV technologies. As ARPA-I begins funding research and development into advanced and emerging AI-enabled transportation and smart infrastructure technologies, the agency should consider the many opportunities and benefits offered by AV technologies, and how to ensure those benefits are felt by Americans across the country.

AVIA looks forward to continued engagement with ARPA-I and the USDOT on AV policy and funding. If there is anything further we can do to assist ARPA-I on these or related matters, please do not hesitate to reach out.

Sincerely,

Jeff Farrah
Chief Executive Officer
Autonomous Vehicle Industry Association