

Subject: DES- Driverless Cars/Autonomous Vehicles

**FY 2018 Proposed Budget
Budget Work Session Follow-up**

4/5/2017

The following information is provided in response to a request made by John Vihstadt for the work session on 3/28/2017: Please describe current planning efforts to account for the likelihood of driverless cars/autonomous vehicles and what that could mean for Arlington's future. How is Arlington utilizing recently completed or pending federal DOT and/or VDOT studies in this regard?

There are no planning efforts in the current transportation work plan related to autonomous vehicles; staff is monitoring the topic. The current work supports a wide range of high-priority planning activities including the Lee Highway Corridor Initiative, the Four Mile Run Valley Initiative, implementation planning related to Realize Rosslyn Sector Plan, updates to the Master Transportation Plan, phased development site plans, site plans and capital programming and projects. As such, there is very limited capacity for new Arlington staff-led initiatives.

That being said, staff continues to monitor developments undertaken at the state and federal level on this technology front and will evaluate the feasibility of advancing an Arlington-focused policy recommendation for County Manager and Board consideration at the appropriate time. To address the interests of more urban multimodal environments, the National Association of City Transportation Officials (NACTO), of which Arlington is a member, adopted a policy statement in 2016, which is attached. Also attached is a fact sheet from the US DOT adopted policy on automated vehicles from November 2016.

NACTO POLICY STATEMENT ON AUTOMATED VEHICLES



VISION

NACTO supports a future transportation system that provides a sustainable, accessible, and affordable backbone to the strong cities at the center of our 21st century economy. New technology has the capacity to reduce the footprint of vehicular travel, moving more people in new forms of medium and low density transit, while creating space for safe and inviting walking and cycling infrastructure. Positioning new mobility services to provide access and mobility to all, and to buttress rather than undermine the successful transit lines at the heart of our cities, is vital to realizing the value of fully automated vehicles for mobility. At the same time, policy at every level of government should address head-on the destructive potential for increased traffic, emissions from additional driving, and on-street congestion that could easily result from automated vehicle technology.

SHAPING AUTOMATED VEHICLE POLICY

Fully automated vehicles (often referred to as level 4 automation by NHTSA) are a disruptive technology that will have widespread impacts on safety, mobility, land use, labor, and the built environment. Considering the complexity of urban environments and the many demands placed on city streets, as well as existing city policy goals of reduced greenhouse gas emissions and vehicle miles travelled, NACTO supports automated vehicle policies and regulations designed to:

- » **promote safety** for pedestrians, bicyclists, transit riders, automated vehicle passengers, and all street users within the multi-modal urban context;
- » **incentivize shared, automated, electric vehicles** to reduce the environmental impacts of vehicular travel and refocus planning on the principle of mobility as a service;
- » **support the future vision of communities** as great places to live, work, and play by using technology as a tool to change land use as well as how streets are built;
- » **rebalance the use of the right-of-way** with less space for cars and more space for people walking, cycling, using transit and recreating;
- » **support public transit** by providing first and last mile connections to major transit lines via shared, automated vehicles, and by providing cost-effective, on-demand transit in lieu of low-performing fixed routes; and
- » **improve mobility for all**, contributing to a more equitable transportation system, where benefits reach all demographics and any negative effects are not unjustly concentrated.

To this end, NACTO supports the following principles as the transportation profession explores the future of automated vehicles.

1. **Safety. Plan for fully automated operation (NHTSA Level 4) to support Vision Zero:** In general, protection of humans of all ages and abilities—whether they are walking or cycling in parallel, or stepping off a bus in perpendicular to the path of travel—should be the primary goal of modeling and software development for vehicular movement on city streets.

Regulators and product designers should bar the use of partially automated vehicles (NHTSA Level 3) on any roadway without controlled access, like city streets. Such vehicles have been shown to encourage unsafe driving behavior, with drivers reading more, texting more, and generally being inattentive, while still operating under the expectation that the driver will take over if the vehicle encounters a dangerous situation.

Maximum operating speed in a city street environment should not exceed 25 miles per hour in order to support Vision Zero policies, lessening the likelihood of death upon impact for the human body. Reducing speeds to allow for sufficient stopping distance to avoid or mitigate crashes is critical for safety in a mixed traffic environment, particularly as vehicles approach crosswalks, intersections, driveways, or on-street parking.

2. **Rethink expressways. Modernize plans for expressways, pivoting from expansion to modernization and management** to account for the needs and impacts of automated vehicles. Existing lanes on expressways will be able to accommodate significantly more vehicles if they are able to platoon through connected technology, making new physical capacity unnecessary in the near future.

Transportation planning at all levels should refocus on modernizing existing expressways with instrumentation for new technology. This includes flow management of exiting traffic so that increased volumes on expressways do not overwhelm surface streets with traffic, simply pushing system failure to a new place on the network. Increased throughput on expressways and other limited-access roads will eventually need to be absorbed by local streets. Exiting flows managed by a connected vehicle network should be controlled so that they do not exceed local street capacity. Built-in vehicle routing software should avoid busy local streets for through traffic.

3. **Modernize traffic data. Develop and implement robust data-sharing requirements for new vehicle technology** to improve the quantity and quality of data collected, and to reduce the millions of dollars spent annually on technologically primitive data collection, both from regular traffic operation and from traffic crashes. Traffic management will remain a function managed or regulated by the public sector even in a future dominated by private mobility providers. Public policies should foster open data platforms that enable robust private innovation to better serve transportation customer needs, while reducing aggregate social and environmental costs and inequities through a regulated utility model framework.
4. **Plan with cities. Include transportation professionals from cities** in all planning processes at the national and state levels. To date, many discussions of regulatory action have taken place in state legislatures or at departments of motor vehicles (DMVs), which have limited experience with street operations. Regulators will benefit from discussions with city transportation agencies, which are charged with managing the majority of current traffic technology.

5. **Focus research on technology that works for cities. Federally and state supported research on automated vehicles should focus on city street operations of shared, automated, electric vehicles.** City streets are the locus of the most complex problems for automated vehicles, with mixed traffic environments, many variable-speed activities within the right-of-way, and many possible destinations. By contrast, expressways have few entries and exits, little variation in speed, and little or no other activities in the right-of-way.

Increased Federal and State funding for city operation of automated vehicles that are electrically powered and shared will enable technology developers to work toward a set of clear technical principles that maximize safety, economic development along city streets, and human health through promotion of active transportation. This increase in funding should be based in an understanding of positive and negative externalities in the transportation marketplace.

Research should address any needs for on-street infrastructure in the city environment and how to cover those costs. Research and policy must address standardization of vehicle "behavior" so that everyone—from human drivers to small children—understands how to interact with automated vehicles.

The future of transit vehicles and their unique needs in terms of automation should be investigated to ensure transit can benefit from advances in technology.

6. **Systematize lower travel costs. Adjust and standardize lower travel time costs beginning with model year 2020** based on projections of Level 4 (fully automated vehicles) for regional 4-step travel models, environmental impact statements and other cost-benefit analysis modeling. Researchers in automated vehicle technology widely agree that people will perceive significantly lower travel costs while using automated vehicles, yet modeling continues to use outmoded travel costs as the standard for models that extend into the 2050s in some cases.

Beginning as soon as model year 2020, per-minute travel time costs could be an estimated 80 percent lower.* This revised standard for evaluating the effects of projects will allow planners to more accurately predict future travel demand, weigh the costs and benefits of infrastructure projects, and understand how shared, automated vehicles can complement transit and other modes.

To support this change in modeling, a metropolitan modelling exercise for North America similar to the Lisbon model released by the International Transport Forum in 2015 would be beneficial in understanding how this shift in transportation costs may affect overall travel patterns.

7. **Set the stage for modernized freight and delivery. Support safer, more efficient, environmentally sustainable freight systems** by fostering consolidation of shipments to boost average load factors, non-peak hour deliveries in congested areas, automated truck route enforcement, and use of best available clean truck technologies. Automated freight movement and delivery has the potential to improve energy efficiency and reduce crashes with large trucks.

* Zia Wadud, Don MacKenzie, Paul Leiby, Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles, Transportation Research Part A: Policy and Practice, Volume 86, April 2016, Pages 1-18, ISSN 0965-8564, <http://dx.doi.org/10.1016/j.tra.2015.12.001>.

8. **Rethink the funding base for transportation. Policies at the Federal and State levels for infrastructure funding must be revised to reflect the restructuring of the transportation system** under automation. Current models of funding, such as fuel and vehicle fees, will see radical changes in revenue streams under potential new automation scenarios. Future funding models should assess investment needs for infrastructure and mitigate the negative externalities in the transportation sector, such as congestion and air pollution. Regulations, technologies, and user interfaces should provide incentives for users of automated vehicles to schedule trips in advance, to fill empty seats in passenger vehicles and empty space in trucks.

9. **Plan for the future of cities. Future visioning for automated vehicles should begin from the inside out, from the centers of our economy, looking at land use as well as transportation.** Theories of automation that focus simply on fitting more vehicles into an expressway lane every hour are beginning from the product of the economy rather than the motor of the economy. Great cities generate traffic; traffic does not generate great cities. Technology has the power to help communities achieve their visions both for transportation and for land use, taking public space back from congestion, traffic and parking. Parking requirements and general curb space usage are particular areas where a decrease in vehicle storage needs could bring about a new era for city streets. Planning should begin with a vision for the future city and put resources into solving for the best methods for providing mobility in low, medium, and high density corridors and environments, from a public investment and a total investment perspective.





FACT SHEET: FEDERAL AUTOMATED VEHICLES POLICY OVERVIEW

The Federal Automated Vehicles Policy sets out a proactive safety approach that will bring lifesaving technologies to the roads safely while providing innovators the space they need to develop new solutions. The Policy is rooted in DOT's view that automated vehicles hold enormous potential benefits for safety, mobility and sustainability.

The primary focus of the policy is on highly automated vehicles (HAVs), or those in which the vehicle can take full control of the driving task in at least some circumstances. Portions of the policy also apply to lower levels of automation, including some of the driver-assistance systems already being deployed by automakers today.

Components of the Policy

- Vehicle Performance Guidance for Automated Vehicles: The guidance for manufacturers, developers and other organizations outlines a 15 point "Safety Assessment" for the safe design, development, testing and deployment of automated vehicles.
- Model State Policy: This section presents a clear distinction between Federal and State responsibilities for regulation of HAVs, and suggests recommended policy areas for states to consider with a goal of generating a consistent national framework for the testing and deployment of highly automated vehicles.
- Current Regulatory Tools: This discussion outlines DOT's current regulatory tools that can be used to accelerate the safe development of HAVs, such as interpreting current rules to allow for greater flexibility in design and providing limited exemptions to allow for testing of nontraditional vehicle designs in a more timely fashion.
- Modern Regulatory Tools: This discussion identifies potential new regulatory tools and statutory authorities that may aid the safe and efficient deployment of new lifesaving technologies.

Policy Development and Public Comment

The Policy is a product of significant public input, including two public meetings and an open public docket. The Policy will be updated annually to ensure it remains relevant and timely, and will continue to be shaped by public comment, industry feedback and real-world experience. DOT is seeking public comment on the entire policy at www.transportation.gov/AV.

Most of the Policy is effective on the date of its publication. However, certain elements involving data and information collection will be effective upon the completion of a Paperwork Reduction Act (PRA) review and process.

The policy outlines a series of next steps that the agency will take to solicit additional public input and to implement the components. The next steps include public workshops, stakeholder engagement, expert review, work plans to implement Policy components, possible rulemakings, and education efforts.



FACT SHEET: AV POLICY SECTION I: VEHICLE PERFORMANCE GUIDANCE FOR AUTOMATED VEHICLES

The Vehicle Performance Guidance for Automated Vehicles (“Guidance”) outlines best practices for the safe design, development and testing of automated vehicles prior to commercial sale or operation on public roads.

The Guidance includes a **15-Point Safety Assessment to set clear expectations for manufacturers developing and deploying automated vehicle technologies.**

For companies, the Guidance describes internal processes and strategies, organizational awareness, record-keeping, testing and validation, engagement with DOT and NHTSA, and improved transparency to support the safe deployment of HAV technology. The industry’s adoption and use of the Guidance, which DOT and NHTSA will review annually and update as necessary, will build public confidence and maintain the U.S. lead on these emerging automotive safety technologies.

Application

- **Systems:** The Guidance applies primarily to technologies where the system can do the entire driving task without reliance on the driver to pay continuous attention to the driving environment. Portions also apply to lower levels of automated driving systems.
- **Vehicles:** The Guidance applies to all classes of motor vehicles, including passenger cars, trucks and buses.
- **Organizations:** The Guidance covers any organization testing, operating, and/or deploying automated vehicles, which includes traditional companies (e.g. auto manufacturers, suppliers) and nontraditional companies (e.g. tech companies, startups, fleet operators).

The information generated from these activities will be shared in a way that allows government, industry, and the public to increase their learning and understanding as technology evolves, while protecting legitimate privacy and competitive interests.

15-point Safety Assessment

The 15-point Safety Assessment outlines objectives on how to achieve a robust design. It allows for varied methodologies as long as the objective is met. The Guidance asks manufacturers and other entities to document how they are meeting each topic area in the guidance. The issues include:

- **Operational Design Domain:** How and where the HAV is supposed to function and operate;
- **Object and Event Detection and Response:** Perception and response functionality of the HAV system;



- Fall Back (Minimal Risk Condition): Response and robustness of the HAV upon system failure;
- Validation Methods: Testing, validation, and verification of an HAV system;
- Registration and Certification: Registration and certification to NHTSA of an HAV system;
- Data Recording and Sharing: HAV system data recording for information sharing, knowledge building and for crash reconstruction purposes;
- Post-Crash Behavior: Process for how an HAV should perform after a crash and how automation functions can be restored;
- Privacy: Privacy considerations and protections for users;
- System Safety: Engineering safety practices to support reasonable system safety;
- Vehicle Cybersecurity: Approaches to guard against vehicle hacking risks;
- Human Machine Interface: Approaches for communicating information to the driver, occupant and other road users;
- Crashworthiness: Protection of occupants in crash situations;
- Consumer Education and Training: Education and training requirements for users of HAVs;
- Ethical Considerations: How vehicles are programmed to address conflict dilemmas on the road; and
- Federal, State and Local Laws: How vehicles are programmed to comply with all applicable traffic laws.

Portions of the Guidance also apply to developers of lower level automated systems that are designed to assist the driver but not take the over the driving task. The Guidance outlines a Safety Assessment for these systems as well.



FACT SHEET: AV POLICY SECTION II: MODEL STATE POLICY

State governments play an important role in facilitating HAVs, ensuring they are safely deployed and promoting their life-saving benefits. The Model State Policy confirms that States retain their traditional responsibilities for vehicle licensing and registration, traffic laws and enforcement, and motor vehicle insurance and liability regimes while outlining the Federal role for HAVs. The Model State Policy supports the establishment of a consistent national framework of laws and policy to govern automated vehicles.

Division of Federal and State Responsibilities

Federal responsibilities include:

- Setting safety standards for new motor vehicles and motor vehicle equipment;
- Enforcing compliance with the safety standards;
- Investigating and managing the recall and remedy of non-compliances and safety-related motor vehicle defects on a nationwide basis;
- Communicating with and educating the public about motor vehicle safety issues; and
- When necessary, issuing guidance to achieve national safety goals

State responsibilities include:

- Licensing (human) drivers and registering motor vehicles in their jurisdictions;
- Enacting and enforcing traffic laws and regulations;
- Conducting safety inspections, when States choose to do so; and
- Regulating motor vehicle insurance and liability.

The Model State Policy

The Model State Policy is intended for States that wish to regulate testing, deployment, and operation of HAVs. The model framework addresses State regulation of the procedures and requirements for granting permission to vehicle manufacturers and owners to test and operate vehicles within a State.

Model framework areas covered include:

- Administrative structure and processes that States can set up to administer requirements regarding the use of public roads for HAV testing and deployment in their States;
- Application by manufacturers or other entities to test HAVs on public roads;
- Jurisdictional permission to test;
- Testing by the manufacturer or other entities;
- Drivers of deployed vehicles;
- Registration and titling of deployed vehicles;
- Law enforcement considerations; and
- Liability and insurance.



FACT SHEET: AV POLICY SECTION III: CURRENT REGULATORY TOOLS

This section summarizes how existing regulatory tools will be used to promote the safe development and deployment of automated vehicles, including interpretations, exemptions, notice-and-comment rulemaking, and defects and enforcement authority. NHTSA (the “Agency”) has streamlined its review process and is committing to expediting simple HAV-related interpretations and exemption requests.

Letters of Interpretation

The Agency can use letters of interpretations to explain how existing law applies to specific motor vehicle equipment. Interpretation letters describe the Agency’s view of the meaning and application of an existing statute or regulation. They can better explain the meaning of a regulation, statute, or overall legal framework and provide clarity for regulated entities and the public.

An interpretation may not make a substantive change to the meaning of a statute or regulation or to their clear provisions and requirements. In particular, an interpretation may not adopt a new position that is irreconcilable with or repudiates existing statutory or regulatory provisions.

Historically, interpretation letters have taken several months to several years for NHTSA to issue, but the Agency has committed to expediting simple interpretation requests regarding HAVs to provide responses in 60 days.

Exemptions from Existing Standards

The Agency has authority to provide limited exemptions from existing standards to accommodate alternate vehicle designs. Manufacturers can apply for exemptions that may allow for the deployment of vehicle test fleets with significantly different vehicle designs that would otherwise not be compliant with standards.

Agency rulings on exemptions have historically taken several months to several years. The Agency has committed to expediting simple exemption requests regarding HAVs to provide responses within six months.

Rulemakings

Notice-and-comment rulemaking is the tool the Agency uses to adopt new standards, modify existing standards, or repeal an existing standard. If a party wishes to avoid compliance with a standard for longer than the allowed time period for exemptions, or for a greater number of vehicles than the allowed number for exemptions, or has a motor vehicle or equipment design substantially different from anything currently on the road that compliance with standards may be very difficult or complicated (or new standards may be needed), a petition for rulemaking may be the best path forward.



Enforcement Authority

NHTSA has broad enforcement authority under existing statutes and regulations to address existing and emerging automotive technologies. Part of the agency's mission is to protect against unreasonable risks of harm that may occur because of the design, construction, or performance of a motor vehicle or motor vehicle equipment, and to mitigate risks of harm. As described in the accompanying Enforcement Bulletin, NHTSA's existing authority and responsibility covers defects that create unreasonable risks to safety that may arise in connection with HAVs.



FACT SHEET: AV POLICY SECTION IV: MODERN REGULATORY TOOLS

This section identifies potential new tools, authorities and resources that could aid the safe deployment of new automated technologies by enabling DOT to be more nimble and flexible. Some of the identified tools could be created under current law while others would require Congressional action.

Today's governing statutes and regulations were developed before HAVs were even a remote notion. Current authorities and tools alone may be insufficient to ensure that HAVs are introduced safely, and to realize the full safety promise of new technologies. This challenge requires DOT and NHTSA to examine whether the ways in which the Agency has addressed safety for the last several decades should be expanded to realize the safety potential of HAVs over the decades to come.

Considered New Authorities

- Safety Assurance: Methods and tools for vehicle manufacturers and other organizations to provide pre-market testing, data and analyses to DOT to demonstrate that organization's design, manufacturing and testing processes apply NHTSA's vehicle performance guidance.
- Pre-Market Approval: Pre-market approval authority, in which the government inspects and affirmatively approves new technologies, would be a departure from NHTSA's current self-certification system. The merits and challenges of implementing some form of a pre-market approval are discussed.
- Cease and Desist: Authority to require manufacturers to take immediate action to mitigate safety risks that are so serious and immediate that they constitute "imminent hazards."
- Expanded Exemptions: Raising the cap on the number of vehicles subject to exemption and/or the length of time of exemptions, to facilitate the safe testing and introduction of HAVs.
- Post-sale Regulation of Software Changes: This authority would clarify the Agency's ability to regulate post-sale software changes in HAVs.

Considered New Tools

- Variable Test Procedures: Expand vehicle testing methods to create test environments more representative of real-world environments.
- Functional and System Safety: Make mandatory the 15-point Safety Assessment envisioned in the Vehicle Performance Guidance for Automated Vehicles.
- Regular Reviews: Regular reviews of standards and testing protocols to keep current with the development of technology.
- Additional Recordkeeping and Reporting: Require additional reporting about HAV testing and deployment.
- Enhanced Data Collection: Enhance data recorders and greater reporting requirements about the performance of HAVs.



Considered New Resources

- Network of Experts: Establish a network of experts to broaden the NHTSA’s existing expertise and knowledge.
- Special Hiring Tools: Special hiring tools—including direct hiring authority, term appointments, and greater compensation flexibility—to hire qualified applicants with specialized skills.