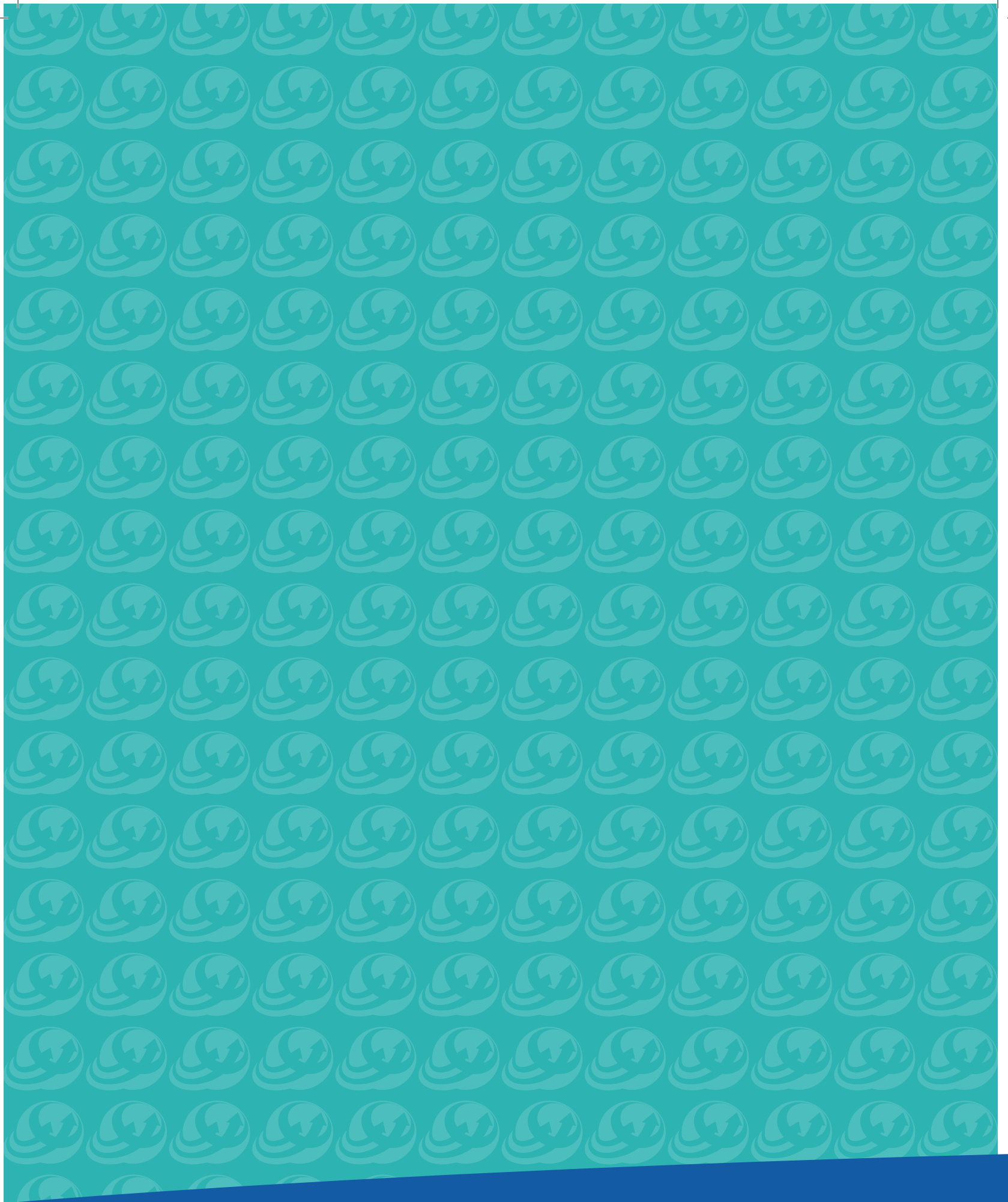


A NATIONAL STRATEGIC FRAMEWORK TO ADVANCE LIFE-SAVING SELF-DRIVING VEHICLES

VERSION 1.0



ATI21
Alliance for
Transportation
Innovation



DEDICATION



Leo Vagias



Sam Cali

This National Strategic Framework is dedicated to the memory of Leo Vagias and Sam Cali along with the more than 30,000 people who die on our nation's highways each year. Sam and Leo lost their lives in a tragic and preventable car crash in Mahwah, New Jersey on June 20, 2016.

They were both 19 years old.

In the United States, we lose almost 100 people in vehicle crashes every day. This framework is intended to inform and assist the incoming presidential administration while urging the new president to lead and help accelerate our journey to self-driving so we may end the unnecessary pain and suffering that too many American families experience as a result of preventable vehicle crashes.

October 18, 2016

Dear Reader,

Last year vehicle crashes killed more than 35,000 of our fellow citizens. We know that 94 percent of these crashes resulted from human error. We are on the cusp of developing and deploying technologies that will allow us to end this tragic loss of life and we believe that America should lead this life-saving effort. To do so will require presidential leadership.

The Alliance for Transportation Innovation (ATI21.org) has studied the potential safety, social, and economic benefits of accelerating our national effort to realize the deployment of these life-saving technologies, as well as the challenges and complexities of doing so. We have outlined what we consider to be the key issues that must be resolved in order to expedite our life-saving journey to a self-driving future, and we are presenting this initial version of our framework to help generate a conversation that we hope will provide additional useful information as our next president prepares the new administration's agenda. We strongly urge the next president to lead us in a bipartisan journey that will leverage presidential leadership and public policy to encourage accelerating our path.

This is a first step. The attached framework document should be considered a working draft of a National Strategy to Advance Self-Driving Vehicles. It contains initial recommendations and is designed to generate ideas, approaches and further discussion. We welcome written responses. In the coming weeks, we will be convening a series of discussion groups to further inform each of the key issue areas discussed in the framework and intend to publish a final set of issues and recommendations no later than January 10, 2017.

We welcome input and ideas from any and all interested parties. Should you have any questions, comments or suggestions, please contact me at ATI21.

Sincerely,



Paul Brubaker
President and Chief Executive Officer
The Alliance for Transportation Innovation



THE TIME IS NOW

The Alliance for Transportation Innovation (ATI21.org), a coalition of America's transportation, innovation and technology leaders, is calling on the next president of the United States to lead the National Strategy to Advance Self-Driving Vehicles (NSAS).

Building on the success of the U.S. Department of Defense's DARPA Urban Challenge, the last decade has seen massive innovations in robotics, sensors, communications and artificial intelligence that are now converging to transform mobility. As with the public adoption of the internet and mobile devices, self-driving vehicles will dramatically transform how we live, work, play and learn.

Self-driving vehicles will certainly create new economic opportunities by increasing affordable, accessible and convenient transportation options for people, freight and consumer goods; however, most importantly these technologies can eliminate over 90 percent of the crash-related deaths and injuries in the United States.

Across the nation, motor vehicle crashes:

- Kill more than 90 people every day
- Send more than 2.3 million Americans to the hospital each year
- Are the leading cause of death for people under 30
- Are the leading cause of traffic congestion
- Are caused by human error in 94 percent of all cases

This is nothing less than a national health crisis.

For decades, road deaths and injuries have been accepted as a cost of mobility in a modern society, but for the first time in our history, it is a crisis with a clear solution.

The combination of public and private investment in research and development in robotics, applied computing and artificial intelligence has resulted in innovations that enable autonomous self-driving systems to dramatically reduce crash-related pain, injury and death. Accelerated deployment of these systems must become an urgent national priority.

Beyond the safety implications, self-driving vehicles offer a wealth of other benefits.

Improvements in accessibility will enhance the lives of an aging population, the disabled community and the economically disadvantaged. Convenient, affordable, reliable and accessible transportation is one of the biggest challenges facing these groups and "first mile" challenges in fixed-route public

transportation often deny our most vulnerable citizens access to jobs, healthy meals, social interaction and medical care.

The innovation cycle has never moved at a faster pace and we need to ensure that law, regulation and policy encourages innovators who are creating capabilities that hold the promise of virtually eliminating traffic crashes. As a matter of national policy we must encourage the innovations in sensors, communication, data analytics, cybersecurity and artificial intelligence that are converging to enable a new transportation paradigm. It will save lives, create economic opportunity, reduce congestion and improve the environment.

This issue represents a unique opportunity for the incoming president to accelerate our path to responsibly realize the profound social, economic, environmental and life-saving benefits of self-driving.

The Alliance for Transportation Innovation (ATI21.org) recommends the following:

A Proposal for Creating a National Strategy to Advance Self-Driving (NSAS)

Navigating the road to a self-driving future is complex. While many of the technical pieces are either in place or in development, coordination is not. Successful deployment will require an unprecedented level of cooperation between innovators, transportation stakeholders and government at all levels. It will be a herculean task requiring a holistic view of all the parts that must work together.

Our call for a National Strategy to Advance Self-Driving (NSAS) is not just a good idea from a leadership and public policy perspective, but it is supported by research. ATI21.org and the Consumer Technology Association (CTA) surveyed a group of leaders from industry, government and academia in September 2016. Our research revealed that 93 percent of respondents support the federal government developing a national framework and enforcing it across the country.

ATI21.org envisions that the public, industry and government all represent key pillars that must work in concert to enable our self-driving future. The complexity of the process will require critical involvement from numerous federal departments including the U.S. Department of Transportation (DOT), National Institute of Standards and Technology (NIST) at the U.S. Department of Commerce, Federal Communications Commission (FCC), Federal Trade Commission (FTC) and the Office of Science and Technology Policy (OSTP) within the Executive Office of the President. The state government entities including state executives, departments of transportation, departments of motor vehicles, insurance regulators and legislators also have an important role to play. Lastly, the general public and private industry including innovators in self-driving technologies, will all be crucial in accelerating our journey to self-driving; but this will not happen by itself.

This effort requires presidential leadership.

There is currently no single organization, company or government entity with the depth and breadth of influence to bring together all of the parties necessary to advance self-driving. While small groups are forming around individual ideas, there is little coordination across the stakeholder spectrum. Unless coordination among all stakeholders occurs, major challenges will continue to delay the self-driving economy at the cost of tens of thousands of lives and millions of injuries every year.

The challenges include:

1. Earning public trust
2. Increasing confidence in self-driving technology
3. Ensuring robust cybersecurity
4. Developing standards and regulations that encourage self-driving
5. Creating the legal, liability and insurance framework for accelerating the deployment of self-driving vehicles
6. Adopting reasonable data and privacy policies
7. Accelerating the transition to a fully self-driving fleet
8. Understanding and planning for economic disruption and labor transition

The goal of the NSAS should be clearly stated in an executive order that outlines the critical public benefits and key challenges that must be addressed in order to accelerate the deployment of self-driving. The executive order should call on the public; as well as federal, state and local governments; industry; associations; and all relevant stakeholders to work together to address critical challenges and obstacles to deploying self-driving technologies.

In order to operationalize the NSAS and monitor progress within all sectors we recommend that the new administration create a Program Management Office (PMO) for the Advancement of Self-Driving within the Office of Science and Technology Policy (OSTP). The Director of the Office of Management and Budget could potentially fund the office from existing budget authority under the government-wide technology initiatives provision in the Clinger-Cohen Act. We envision the PMO operating under a renewable four-year charter, collaborating with relevant stakeholders and developing outcome-focused and actionable strategies to address each of the core challenge areas. The PMO would be responsible for planning, coordinating and developing appropriate performance metrics, influencing actions and policy, monitoring progress and clearing obstacles on the road toward self-driving.

Make no mistake. We will eventually get to a self-driving future, but every day we delay can be measured in lives lost. This is a global race but one in which the United States can take the lead. If the next president can lead this effort in a manner that encourages the actions of industry, government and the public, we have an unprecedented opportunity to deploy self-driving at scale and demonstrate the dramatic life-saving, economic and social benefits to the rest of the globe.

THE TIME IS NOW.

KEY CHALLENGE AREAS:

1. Earning Public Trust

Objective: Create public trust of self-driving through clear communication.

The Issues:

The case for moving to self-driving has not been effectively communicated to the public. While self-driving will immediately improve and save American lives, recent media attention has focused on sensationalized accounts describing the Florida Tesla fatality, auto-hacking and computers choosing who to kill in accident scenarios. These reports have gratuitously stoked fear and undermined public support for self-driving. Meanwhile, 96 Americans lose their lives every day on the nation's highways.

America's car culture is also at odds with self-driving. As we all know, many Americans equate driving with freedom and personal control and take a particularly harsh view of technology-enabled self-driving. At the same time, we are seeing a growing generational and urban/rural divide when it comes to driving. Millennials and urban dwellers have decidedly different views of private car ownership and driving as evidenced by the sharp decline in personal car ownership among younger Americans and urban dwellers. This may represent a good starting point for making the case for a self-driving future. Additionally, as middle-aged Americans are forced to make decisions about their parents' safety behind the wheel, self-driving offers a solution that could thaw resistance; something ATI21.org has been exploring with the American Association of Retired Persons (AARP).

American drivers have a deeply misplaced confidence in their ability to operate and control a motor vehicle. When asked, most would rather trust in their own skills than those of a computer despite mounting evidence that the technologies enabling self-driving can already outperform humans. There is also a legitimate concern that was highlighted in a recent Kelly Blue Book survey that suggested Americans are quite concerned with the interim phases of self-driving that would require a human to take over in cases where conditions degraded the autonomous driving features. In this study, drivers expressed concern that they may become too reliant on the self-driving features and be unprepared or too distracted to take control of the vehicle when prompted.

The NSAS should include public outreach programs that address the key critical challenges of public trust while incentivizing major public, private and P3 (public-private partnerships) investment in more self-driving pilot projects.

The NSAS must give the public a glimpse of the future to replace fear and uncertainty with facts and personal experience. Creating widespread public demand for the benefits of self-driving will also serve to build support for the public policy responses required as part of the holistic approach to accelerating self-driving.

2. Increasing Confidence in Self-Driving Technology

Objective: Increase confidence in self-driving by ensuring that the underlying technology is safe, secure, reliable and interoperable.

The Issues:

There are a number of technology-related challenges that should be addressed as part of the NSAS.

Many of the technologies exist to enable self-driving in various forms but there are still significant performance issues, system interdependencies and other challenges.

Specific challenges include but are not limited to:

- Weather factors such as heavy rain and fog can significantly degrade system performance
- Current driver assist technologies require clear lane markings for optimal operations
- Enabling hardware and components are still relatively expensive
- The latest advances in artificial intelligence and machine learning are difficult if not impossible to integrate into existing vehicles
- There is no current industry standard to ensure secure transmission of over-the-air software updates

The good news is that progress is being made every day and new innovations are coming to market in sensors, artificial intelligence, machine learning, computer processing, affordable lidar, communications and the effective integration of disparate technologies. As advancements are made toward the Internet of Things (IoT) and these technology gaps are closed, there must be a mechanism to encourage, monitor and assess the testing and deployment of these technologies.

Industry and consumers alike must be confident that the hardware, components and software enabling self-driving capabilities are safe, secure, reliable and interoperable. The NSAS should work closely with industry, researchers and regulators to identify the most pressing issues and develop recommendations focused on best practices such as ensuring supply chain integrity and testing code. The recommendations should encourage 21st century quality control processes as outdated manual audits are simply too cumbersome and time consuming.

To be clear, the purpose of the NSAS is not to create bureaucratic barriers, but to ensure the establishment of a self-driving related innovation clearing house. We must ensure an agile, timely and independent mechanism to constantly and consistently monitor the state of innovation. Because many of the innovations represent competitive advantage, participation must be optional and the clearinghouse must ensure confidentiality. We envision creating an entity similar to the Underwriters Laboratory, but for self-driving technologies. We believe this approach has the potential to increase overall confidence in the underlying technologies that enable self-driving.

3. Ensuring Robust Cybersecurity

Objective: Ensure that self-driving technologies are built with robust cybersecurity.

The Issues:

Cybersecurity is critical to the safe and reliable operation of self-driving vehicles. From data-at-rest within internal vehicle systems to the data flow updating critical safety systems, secure communication throughout the transmission path is a priority.

Today there is no agreed upon or holistic approach to cybersecurity across the vehicle eco-system. In fact, each vehicle manufacturer has a different approach with varying levels of cyber-maturity. While this approach is not unusual for most industries, the safety-of-life requirements of self-driving vehicle systems calls for consistency and the highest levels of cybersecurity and information assurance.

Cultural practices rooted in the complexity of the design and manufacturing processes of traditional auto manufacturers are also contributing to the cybersecurity challenge. While industry is taking steps to mitigate risks after a number of high profile hacking demonstrations, many of these approaches still conflict with the effective application of proven cybersecurity practices. The Government Accountability Office report on Vehicle Cybersecurity released in March 2016 highlights specific vulnerabilities resulting from industry practices, design features, communication architectures, software complexity and supply chain management.

To be fair, the past year has seen vehicle manufacturers increasingly emphasizing the need to enhance cybersecurity practices and supporting the establishment of the Auto Information Sharing and Analysis Center (ISAC) as part of the Department of Homeland Security's critical infrastructure protection program. At the same time, it is critically important that industry, including aftermarket device providers, look to outside experts from other sectors—most notably aerospace, defense and the intelligence communities—with experience in securing mobile communications and embedded systems for applicable lessons and strategies. ATI21.org recently held an off-the-record roundtable to facilitate such a discussion and we anticipate hosting more in the coming months to bring these communities together.

While the National Highway Traffic Safety Administration (NHTSA) is charged with overseeing automobile safety, the agency simply does not have the level of cybersecurity expertise to effectively oversee or prescribe effective guidance to the industry. Moreover, there is considerable risk in attempting to regulate cybersecurity requirements in a fast changing world. Meanwhile, there is relevant expertise across government (e.g., National Institute of Standards and Technology, Department of Defense, National Security Agency, Department of Homeland Security) and its support contractors that could be effectively applied to help address many vehicle cybersecurity challenges.

As vehicles become increasingly cyber-connected, the American public must be fully confident that manufacturers are ensuring the integrity of systems through the application of sound cybersecurity practices in vehicle production and operation. This will be particularly important as over-the-air software updates to safety critical systems become increasingly common. The adoption of common security protocols, standards and practices—particularly relating to authentication, encryption, and

redundancy common in other industries—requiring the highest levels of information assurance can mitigate these risks.

To that end, the National Institute of Standards and Technology is currently developing a set of cybersecurity guidelines based on existing international standards to guide vehicle manufacturers in achieving the desirable outcomes. These guidelines are expected to be published in December 2016.

We recommend that the NSAS establish a vehicle cybersecurity working group to include relevant cybersecurity experts from government, industry, laboratories, research groups and associations to inform and develop specific actionable recommendations, guidelines and necessary standards to advance the state of cybersecurity in the self-driving eco-system.

4. Developing Standards and Regulations that Encourage Self-Driving

Objective: Ensure that the regulatory environment can keep pace with the innovation cycle and ensure consistency across all jurisdictions.

The Issues:

Innovation is rapidly outpacing regulation. The existing regulatory and standards development process is ill-suited to the rapid pace of innovation in autonomous vehicle technology, communications, artificial intelligence and the Internet of Things (IoT) and needs to be reformed in order to become more agile by developing 21st century approaches to address 21st century needs.

Perhaps more than any other challenge, the need to guarantee that regulation does not act as a barrier to deploying life-saving innovations is critical. At the same time, ATI21.org recognizes the legitimate role that regulators play to ensure the safe deployment of these innovations, although the application of the existing processes, measures, methodologies and rules that are rooted in fifty-year-old guidance, impose an absurd Catch-22 operational data standard, and are no longer applicable or appropriate for the 21st century. These processes and regulations punish innovation and reward the status quo at the expense of safety. They need to change; lives depend on it.

The good news is that DOT leadership is working hard to change. In September, U.S. Secretary of Transportation Anthony Foxx and National Highway Traffic Safety Administrator Dr. Mark Rosekind took a big step forward by announcing the publication of DOT's much-anticipated "Autonomous Vehicle Policy," clearly signaling the department's desire to accelerate the advance of safe deployment of self-driving vehicles.

The DOT's "Autonomous Vehicle Policy" (AV Policy) is organized into four sections and includes a number of excellent provisions. The first section outlines a 15-point safety assessment to guide auto manufacturers on key considerations to deploying safer autonomous vehicles. The second section provides welcome clarification of the roles and responsibilities of federal and state authorities relative to regulating self-driving and including a recommended state policy designed to ensure that state regulations are consistent so that motor vehicle manufacturers can produce vehicles on a national scale without having to accommodate individual jurisdictional requirements.

While the first two sections were welcome, the third section reaffirms DOT's current regulatory tools and gave ATI21.org pause. Specifically, the department reiterated, at least for the time being, its commitment to using what is effectively the existing process and guidelines for approving the sale of motor vehicles in the United States.

The department's current regulatory process that has evolved from the 1966 National Traffic and Motor Vehicle Safety Act is antiquated, cumbersome and too slow to accommodate the rapid pace of 21st century innovation. Worse, the existing federal guidelines governing the approval and safe operation of motor vehicles are inconsistent for the self-driving future. Currently, the Federal Motor Vehicle Safety Standards (FMVSS), for example, make 286 references to human drivers, and self-driving violates at

least one-third of all of the standards and about half of the Series 100 crash avoidance requirements. Using the existing regulatory processes, temporary exceptions to these policies can take a year and permanent policy changes will take even longer. There must be a better way.

Thankfully, the fourth section of the policy acknowledges that the current regulatory structure and guidelines may not be appropriate to speeding deployment of highly automated vehicles or otherwise suited to meet our long-term self-driving objectives. Specifically, this section opens the door for future regulatory tools that might be better suited for aligning the regulatory processes with the rapid pace of technology development.

We believe that DOT should consider an outcome-based redesign of its current regulatory approach as well as resist the temptation to adopt pre-market approval strategies offered in this section. The department should create a new regulatory process designed from the ground up that takes advantage of 21st century data science, artificial intelligence, modern communication and computing capabilities that would produce much more timely and desirable outcomes. That said, while we would encourage the DOT to explore a rapid pre-approval process leveraging the tools we discussed above, we would also strongly urge the DOT not to simply adopt the outdated, cumbersome and widely criticized pre-approval processes that were suggested as options in the policy.

The department deserves credit for encouraging public comments and presenting this policy as an iterative work in progress. This will allow participants in the process to shape a DOT regulatory construct that is more in line with the 21st century. It also allows the NSAS to iterate with the DOT to ensure that the policy supports desired outcomes.

While there are certainly some recognized shortcomings in the DOT AV Policy, the department wisely did not permit perfection to be the enemy of the good. The DOT's willingness to consider entirely new regulatory approaches that are more suited to speeding the deployment of these technologies should be commended. The DOT also deserves credit for acknowledging that it is not alone in this endeavor and clearly understands the complex challenge of bringing together other federal agencies, state government, industry, associations and academia to create a new self-driving future.

It is crucial that all parties, particularly innovators, take advantage of the opportunity to participate in the public comment period to shape a new approach, metrics and regulatory guidelines for DOT to incorporate into the policy. For that reason, ATI21.org will be submitting this framework to the DOT as part of our public comment package.

Building on the DOT's evolving autonomous vehicle policy and consistent with the research findings from ATI21.org and CTA, the NSAS should reinforce the establishment of a consistent national framework for self-driving; support creation of an agile, responsive and timely federal safety regulatory process that leverages 21st century tools; reinforce the regulatory roles as outlined in DOT's AV Policy; and encourage adoption of a simplified model state guideline for self-driving vehicles to ensure that self-driving vehicles can operate across state lines unencumbered and that vehicles purchased for use in one state can be transported and used in another.

Consistent with DOT's recently issued policy, the NSAS should also reinforce that states should retain the right to register and license both personal and commercial operators of self-driving vehicles, as well

as establish appropriate policies and regulations governing the operation of on-demand services that use self-driving vehicles.

Lastly, the NSAS should coordinate with the DOT, states and localities to ensure that regulations encourage more testing, demonstration projects and pilot projects at the state and local level leading to full-scale deployment. Specifically, the NSAS PMO should identify and mitigate regulatory obstacles as well as focus on identifying resources for pilots and demonstration projects. This would include developing models for public-private partnerships; recommending reprogramming of funds from modal research and development accounts; and seeking legislative authority to redirect intelligent transportation funds, cooperative research monies and other funds to include authorizing use of other FHWA highway funding formula monies to fund additional pilots and demonstration projects. The NSAS should also consider developing shared mobility pilots specifically designed to look at alternatives to the gas tax.

It is critical that the NSAS encourage the creation of a new regulatory framework that will oversee innovation while ensuring the safe and timely deployment of self-driving technologies.

5. Creating the Legal, Liability and Insurance Framework for Accelerating the Deployment of Self-Driving Vehicles

Objective: To ensure that legal and liability issues do not discourage the development and deployment of self-driving vehicles.

The Issues:

Issues of manufacturer, owner and operator fault and liability have the potential to derail the path to self-driving, especially in the early adoption phase. If the reaction from the legal community surrounding the recent Tesla fatality is any indication, self-driving pioneers will face numerous and expensive law suits.

Addressing the legal, liability and insurance issues are critical to expediting the testing and deployment of these vehicles. Of particular short term concern is that testing does not introduce insurmountable risk. There is also the longer-term concern of the shifts in liability and the need for new insurance products, particularly as it relates to vehicles operating in modes that require humans to take control.

Moving to the self-driving future will have profound and disruptive impacts on the insurance industry. As a recent KPMG study warns, the industry must anticipate the precipitous decline in premiums and payouts resulting from a substantial decline in vehicle crashes. While fewer crash-related deaths and less property damage are welcome news to all, the long-term economic turmoil that will be experienced by the insurance industry will also need to be understood.

The NSAS PMO should commission a study to gather the necessary data and to inform a set of policy recommendations aimed at creating an indemnification framework for manufacturers. The PMO should work with insurance, legal and other relevant experts to understand the implications across the industry for such a framework, and explore alternatives while incorporating suggestions and recommendations as appropriate. An appropriate precedent might be federal government sponsored death and injury payments to those adversely affected by the polio vaccine. In that case, the government determined that the greater public good rested in creating peace-of-mind surrounding fear of adverse reactions to the vaccine. Similarly, the government might offer federally sponsored payments of death and injury benefits in the event of self-driving crashes to ease public fear and enable accelerated deployment of self-driving. In cases of gross negligence on the part of manufacturers, the government could pursue remedies without delaying basic benefit payments.

6. Developing Reasonable Data and Privacy Policies

Objective:

To strike the balance between reasonable privacy and the need to collect operational and safety data.

The Issues:

Misunderstanding, fear and legitimate concerns surrounding data ownership, use and privacy issues could easily derail progress on self-driving initiatives. We are already seeing a number of well-meaning but misinformed actions being taken by Congress, state legislatures and regulators in the name of protecting personal privacy that overly restrict the collection and use of data that is critical for ensuring the safe and efficient operation of these vehicles. While there are indeed a number of legitimate concerns relating to the exposure and misuse of personal information, data is at the core of creating the level of situational awareness required to enable all of the benefits of self-driving. Restrictions on data collection, analysis and use can derail progress toward realizing the full potential of self-driving, including shared mobility models.

At the same time, legitimate questions regarding data ownership and permissions related to the collection and dissemination of personally identifiable information (PII) must be addressed, and consistent national policies and practices, should be established. These issues must be fully explored and assumptions revisited. Specifically, the Federal Trade Commission's minimum data collection standard is antiquated and, if left unchanged and enforced, may inadvertently sub-optimize the safe and efficient performance of our transportation system.

The NSAS should specifically suggest that Congress and the states refrain from issuing restrictions on the collection of data from self-driving vehicles. The collection of vehicle data and passenger behavior information alone does not mean that PII is being collected.

It is important that we understand the different types of data that are and can be collected by self-driving vehicles. For example, we should encourage the collection, transmission, dissemination, analysis and use of real-time vehicle telemetry data. This data is important for a variety of reasons and can be used to enhance the situational awareness of surrounding vehicles as well as inform the operator and manufacturer of any operation, maintenance or safety issues that may arise.

Also, as vehicles begin to take on the characteristics of rolling consumer platforms, the preferences and behaviors of riders may also be subjected to collection and analysis. This is where things get interesting, as many firms will seek to monetize this data much in the way they do today with applications. We must be careful not to impose any greater restrictions on the use of this data from a vehicle than we do from any other consumer device unless there are very specific safety or privacy reasons to do so. In the latter case, consumers should always have the opportunity to opt in. Any policy position must encourage the deployment of innovation and, most importantly, there cannot be a double standard for data collected from a vehicle platform application versus any other application.

Personally identifiable information, such as social security numbers, credit card data and other such information should be safeguarded and protected. The collection of PII should as a default, be

avoided unless the individuals involved understand why the information is being used, have agreed to its collection, and specific protections are provided. For example, there are cases where personally identifiable information can have powerful life-saving benefits. In these cases, rules for the use of PII and secure data architectures must be created to make this information available in a manner that is limited to certain situations. Specifically, and in the context of next-generation emergency response (e.g., NG-911), having real-time access to PII in the aftermath of a crash event could be immensely valuable to alerting first responders and medical personnel of pre-existing conditions that would aid in the treatment of individuals involved. At the same time, policy makers and industry should ensure that protections are in place and that this information is safeguarded and only used for its intended purpose.

At a minimum, individuals should be permitted to opt in to providing PII in the event of an emergency. Access should be restricted to authorized users and circumstances, and provided through adequately protected and encrypted data sources. New technologies that can secure, protect and ensure reliability such as blockchain can be applied to such data.

The NSAS PMO should research this issue and develop guidelines, practices and appropriate policy and regulatory recommendations for protecting privacy and PII.

7. Accelerating the Transition to a Fully Self-Driving Fleet

Objective: Ensure that the infrastructure, policy and tax incentives are in place to support and speed the replacement of the driven fleet and, if necessary for safety reasons, significantly reduce the transition period where both self-driving vehicles and driven vehicles co-exist.

The Issues:

As with the introduction of most technologies, the journey to self-driving capabilities will never be complete as innovators and manufacturers engage in a process of continuous improvement. Additionally, we must understand how our infrastructure needs to change in order to accommodate self-driving vehicles. It is not too early for transportation planners to modify their approach to the new environment. This will require some direction on the part of policy makers. At the same time, there are so many unknowns regarding the timeline. However, once we reach critical mass and self-driving vehicles become available at scale, it will become a crucial safety objective that we have the necessary infrastructure to accommodate self-driving and that we take steps to speed the transition of the fleet from human-controlled to fully autonomous.

Frankly, there is a lot of hype regarding the introduction of self-driving vehicles and part of the challenge will be separating fact from fiction. This will set us on a path to develop a plan to responsibly and safely accelerate the deployment of a new mobility paradigm. Similar to the transition from horses and buggies almost exactly a century ago, we will undergo a transition both in terms of scale and dramatic impact on our society and economy.

Accelerating the transition from our existing 20th century model of human-centered driving to a 21st century model of technology-enabled mobility will require thoughtful planning and stakeholder engagement. It will require an acceptance of disruption and perhaps discomfort as some level of government intervention in the transition will be necessary.

If we are to use public policy as a means to accelerate deployment and shorten what many believe will be a dangerous transition period, it would be wise to begin to understand and plan for such a transition that focuses on infrastructure and vehicles.

Infrastructure:

The future of mobility is shared, autonomous and electric which transportation planners must anticipate. The data shows a growing population and an increase in urban dwellers that will contribute to a fundamental shift in modal use. Planners must question traditional and long-standing assumptions and practices regarding use patterns and models, and begin incorporating new possibilities into their process. In this rapidly innovative environment, that need for adaptability and agility is critical and requires a fundamental rethinking of current bureaucratic planning processes in a manner that allows us to incorporate modern analytical tools, decision support models and flexible resourcing and management practices.

Understanding this change will be critical to enabling it. As we move toward more self-driving, we may want to consider segregating infrastructure as these vehicles have the potential to obviate the need for existing traffic signals, loop sensors and roadside signal controllers. At the same time, we will want to

deploy other sensor and communication capabilities to enhance the collective situational awareness of the transportation system. For example, there may be a need for additional roadside cameras, sensors, microcells, data storage and computing capabilities that are closer to the network edge.

Optimizing the infrastructure to fully realize the benefits of self-driving may also require ensuring ubiquitous communications capability to include rural areas and both urban and rural canyons. Communications technologies should anticipate a future enabled by mobile ad-hoc peer-to-peer networks, 5G and satellite broadband. As an aside, we also need to guarantee that self-driving vehicles have the capacity to operate safely in a connected and disconnected state. There may also be implications for road construction materials and perhaps the integration of new technologies such as inductive charging capabilities, embedded passive sensors, smart-lane markings and the solar roadways that are currently being demonstrated in Idaho. Optimizing people movement will also cause us to rethink transit systems and the use of fixed route buses as affordable and convenient shared mobility-on-demand becomes more common.

The move to more electric also has disruptive potential, particularly with the reduction in gas tax revenue and will also increase stress on the electrical grid. We must gain a deep understanding of exactly what our future requirements will be and plan accordingly. This complex system engineering challenge involves a large number of variables and is much broader than transportation alone. It will impact most sectors of the economy and thus is the reason for a broader much more holistic approach to designing our future infrastructure.

Vehicles:

Transitioning to self-driving vehicles will require considerable thought and analysis in order to ensure that we optimize the safe and efficient operation of the transportation system.

Internal and external connectivity requirements must be fully understood, and drawing on lessons from the defense community, we must understand the best strategies for ensuring that vehicles are communicating with each other, with the infrastructure and outside sources in a secure, resilient, and reliable manner that improves situational awareness for all.

As the vehicle of the 21st century becomes a rolling sensor platform, many of the traditional design features including standard vehicle controls will no longer be required. The objective is to achieve capability and depth so that there is a redundancy in sensor systems enabling a level of observation and situational awareness that is far beyond the capacity of a human.

This is a difference with profound implications. In a fully autonomous and potentially “crashless” society, cars of the future may no longer require airbags, heavy steel structures or other expensive safety features. Moreover, we can expect fundamental changes in cabin design including the elimination of control features such as steering wheels and brake pedals associated with human drivers. There are also a host of additional benefits including improved energy efficiency, reduced congestion and a dramatically higher functioning transportation system.

Transition:

The transition period when there is a shared environment between self-driving and traditional human controlled vehicles has the potential to be complex and dangerous. Some of the most significant

challenges facing the developers of self-driving capabilities are those trying to predict the unpredictable behavior of human drivers. If all vehicles on the road were self-driving and operated according to agreed upon standards, we would immediately achieve dramatic reductions in crashes, fatalities and injuries.

At the same time, we must recognize that the United States is a driving culture much like it was a horse culture at the beginning of the last century. Just as we made this transition from the horse culture, with the right planning, incentives and regulatory environment, we will also make the transition to self-driving. But it won't happen by itself nor will it happen if it is simply left to the vagaries of this highly regulated market. A successful transition needs to be planned in a manner that is sensitive to cultural realities and norms. Perhaps it is worth considering the establishment of designated driving areas and roads where human drivers can continue to operate human-controlled motor vehicles.

Speeding transition raises significant questions that can be responsibly addressed if studied and informed as part of an overall national strategy. For example:

- What happens to the existing fleet?
- What role will after-market technology play in enabling capability?
- What will the future infrastructure look like?
- What is the new modal mix especially as it relates to transit?
- Will we restrict certain roads for human-driving or self-driving vehicles?

These are just some of the questions that can be anticipated and there will undoubtedly be more.

As part of the NSAS, the PMO should be tasked with conducting the research, gathering the data and developing a strategy to accelerate the retirement of the driven fleet at the earliest possible time. Incentives such as vehicle buy-backs, direct subsidies and tax credits should be considered and proposed based on the expected and quantified return on investment. The PMO should also be tasked with planning the transition to a ubiquitous self-driving infrastructure and assist transportation planners at all levels as they consider and plan our infrastructure including modal mix for the self-driving future.

8. Understanding and Planning for Economic Disruption and Labor Transition

Objective: Understand and address the economic impacts of the transition to a self-driving future.

The Issues:

While there are dramatic safety and social benefits to be realized by accelerating the advance toward a self-driving future, the economic impacts and dislocation resulting from this new capability must also be fully understood as part of the NSAS. Without proactive consideration, we risk fierce political battles that could delay deployment.

Many driving-related jobs will no doubt face elimination, although at the same time there is the likelihood that as people begin using these services, they will expect attendants to be present to ensure individual safety and comfort. Also, new jobs will be created for the operation and maintenance of self-driving fleets. That said, there will be a level of disruption that cannot be denied.

Dramatic reductions in vehicle crashes will also impact jobs as we transition from the crash economy. First responders, tow truck operators, body shop owners and trauma centers will all experience displacement along with a major disruption to the property and casualty insurance market.

Self-driving impacts government revenue streams. Because we believe the future of mobility is shared, autonomous and electric, we can anticipate a significant reduction in gas tax revenues. Other state and local revenue sources will decline as well. Traffic violations, parking fines and driver's license fees will all become relics of the past. The NSAS must explore these issues and the PMO should endeavor to formulate strategies and tactics to ensure that the necessary funding streams are available to support our national, state and local infrastructure needs.

The executive order should specifically address this issue. The order should outline steps that will be taken to understand the potential disruption to the labor market and pledge to proactively address the issue with compassion and humanity. We recommend realistic levels of compensation through job training, apprenticeships and transition assistance to ensure that displaced people are treated with dignity and respect. From organized labor to auto dealers, many of the disrupted groups represent important constituencies that make significant contributions to our economy. They must be included in this discussion and allowed a voice in shaping and transitioning to the future.

The NSAS PMO should undertake a comprehensive analysis to better understand the adverse economic impacts and develop specific policy recommendations to identify retraining needs and provide support to those displaced as a result of the new economy. Moreover, the PMO should also identify proposed sources of funding to finance the financial and job training assistance required for people transitioning from the crash economy.

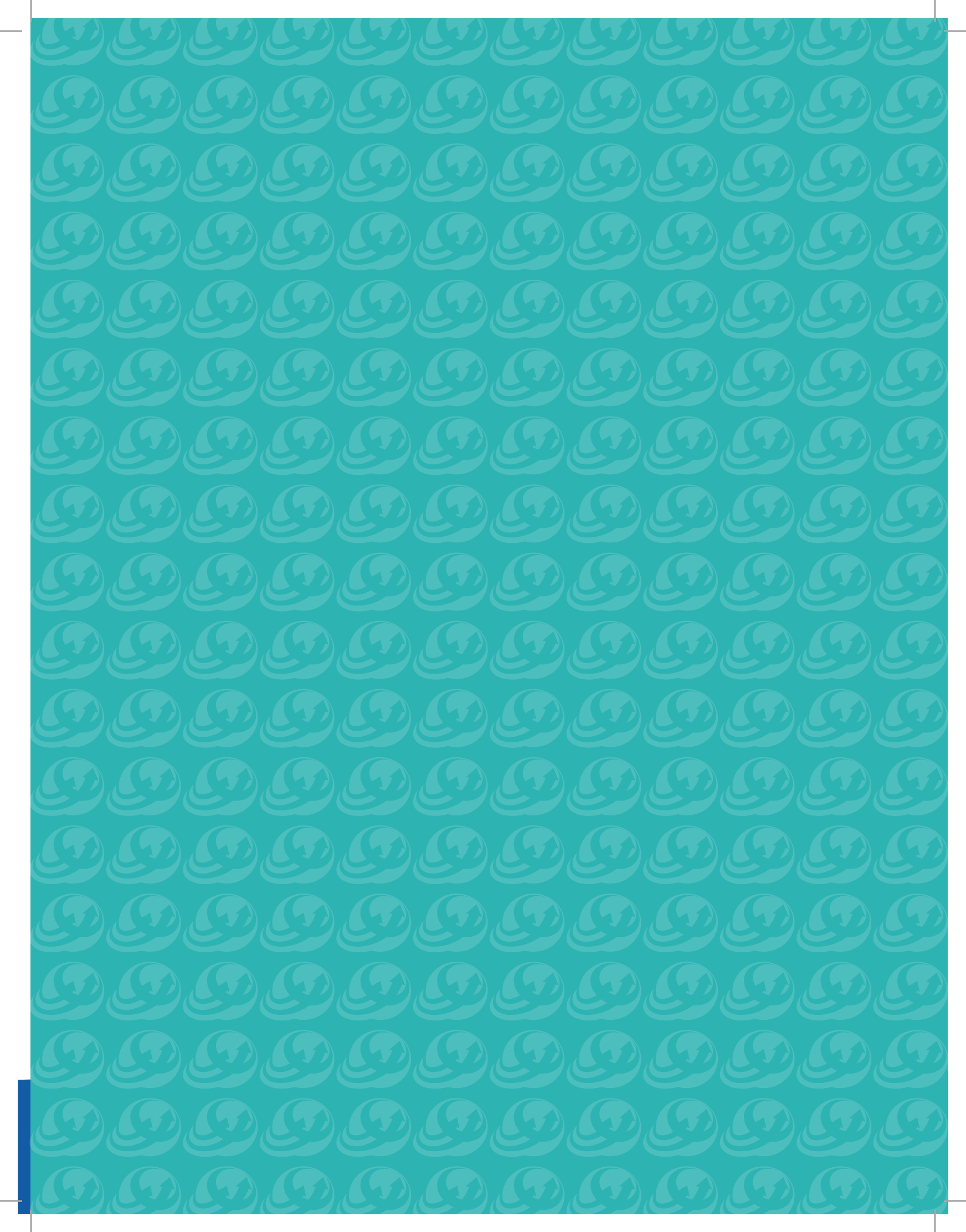
We have to get this right.

Conclusion:

The preamble of the Constitution reminds us that the role of government is to “provide for the common defense and promote the general welfare.” That statement alone makes a powerful case for an accelerated path to self-driving. It is incumbent upon us all to focus our energy and speed the transition to a transportation future with the potential to save tens of thousands of lives and prevent millions of injuries every single year.

Accelerating the path to self-driving will not be easy. By taking this issue on early in the new term, we believe the new president can seize an opportunity to lead in an area where dramatic progress can be made quickly resulting in most Americans embracing the president’s efforts as outlined in the National Strategy to Advance Self-Driving.

This is an unprecedented opportunity for an incoming president to lead the nation in a program that will guarantee safe, accessible and convenient mobility options to all Americans regardless of ability, age, or economic condition; a transportation legacy our new president can be proud to leave for future generations.





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