



Pennsylvania
Department of Transportation

Highly Automated Vehicle Advisory Committee
2025 Annual Report

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Acronyms

Act 117	Act 117 of 2018
Act 130	Act 130 of 2022
ADAS	Advanced Driver Assistance Systems
ADS	Automated Driving System
ATMA	Automated Truck Mounted Attenuator
AV	Automated Vehicle
CMU	Carnegie Mellon University
CV	Connected Vehicle
DVS	Driver and Vehicle Services
HAV	Highly Automated Vehicle
HAVAC	Highly Automated Vehicle Advisory Committee
ITS	Intelligent Transportation Systems
OEM	Original Equipment Manufacturers
PennDOT	Pennsylvania Department of Transportation
PennSTART	Pennsylvania Safety, Transportation, and Research Track
R&D	Research and Development
SDIO	Strategic Development and Implementation Office
SMART Grant	Strengthening Mobility and Revolutionizing Transportation Grant
TTD	Transformational Technology Division
V2I	Vehicle-to-Infrastructure
V2X	Vehicle-to-Everything



Executive Summary

The Pennsylvania Department of Transportation (PennDOT) is facilitating the integration of highly automated vehicle (HAV) technologies into the Commonwealth's transportation network. This 2025 Annual Report highlights PennDOT's significant progress, shaped by the landmark Act 130 of 2022, the collaborative efforts with the HAV Advisory Committee (HAVAC), and expert research partners like Carnegie Mellon University and Penn State University. Building upon the foundational work initiated in the 2019-2020 inaugural report, this report details PennDOT's strategic approach, key project advancements, and the positive impacts of HAVs on Pennsylvania's workforce, economy, accessibility, mobility, and regulatory framework.

The enactment of Act 130 has been a crucial moment, establishing a clear legal pathway for driverless HAV operations and solidifying Pennsylvania's position as a leader in HAV research and development. This legislation, along with PennDOT's ongoing initiatives, ensures a balanced approach that prioritizes public safety, innovation, and economic growth. Meanwhile, industry has made progress in their deployments and position in the Commonwealth.

Through comprehensive focus groups and ongoing evaluations, PennDOT has gained deeper insights into the benefits and challenges of HAVs, particularly in workforce development, economic growth, and enhancing mobility for all Pennsylvanians, including those with disabilities. Key projects, such as the Automated Truck Mounted Attenuator (ATMA) pilot, the Vehicle-to-Everything (V2X) Curve Speed Warning system, the development of the PennSTART testing facility, and the ongoing ADAS/AV Readiness Study exemplify PennDOT's commitment to integrating advanced technologies responsibly.

This report will detail PennDOT's efforts in implementing the recommendations gleaned from stakeholder feedback, outlining the progress made and the strategic direction for future HAV deployment and policy refinement. PennDOT remains dedicated to a transparent and collaborative process, continuously monitoring the impacts of Act 130 and incorporating public and industry insights to shape a safer, more efficient, and equitable transportation future for the Commonwealth.

1 Introduction

The landscape of transportation is undergoing a profound transformation with the rapid advancement of automated vehicle (AV) technology. PennDOT, in its commitment to innovation and public safety, has actively engaged in preparing the Commonwealth for the widespread adoption of highly automated vehicles (HAVs). PennDOT's efforts are anchored by Act 130 of 2022, a legislative amendment to Title 75 (Vehicles), which refines the existing HAV framework established by Act 117 of 2018. This legislation is crucial as it creates the first legal pathway for driverless operations in the Commonwealth, ensuring that Pennsylvania's laws are aligned with the demands of HAV technology while prioritizing safety.

This report serves to outline PennDOT's strategic direction for the 2024-2025 period. It reflects the comprehensive feedback gathered from interviews with the HAV Advisory Committee members and findings from expert focus groups conducted in 2024 in collaboration with Pennsylvania State University. The primary objective is to provide a thorough analysis of Act 130's impact within Pennsylvania's unique context, focusing on workforce development, economic growth, and improvements to accessibility and mobility.

PennDOT's integrated approach involves continuous engagement with stakeholders, including AV companies, automakers, government agencies, and academic researchers. This culmination of efforts is a collaboration between PennDOT's Transformational Technology Division (TTD), Office of Chief Counsel, PennDOT's Policy Office, and Driver and Vehicle Services. This ensures that policy development and project implementation are informed by factual knowledge, existing best practices, and a balanced understanding of regulation and innovation.

PennDOT's approach is led by its Transformational Technology Division which operates under the Strategic Development and Implementation Office (SDIO), ensuring that policy development and project implementation are well thought out and thorough.

2 Act 130: The Cornerstone of HAV Operations in Pennsylvania

Act 130 of 2022 represents a significant milestone in Pennsylvania's regulatory approach to HAVs. Signed into law on November 3, 2022, this comprehensive amendment to Title 75 (Vehicles) builds upon the foundations of Act 117 of 2018, which initially introduced Chapter 85 specifically addressing HAVs. Act 130 provides detailed definitions and guidelines, enhancing Pennsylvania's legal infrastructure to support the complexities of HAV technology and ensuring the state's vehicle laws meet advanced demands.

2.1 Key Aspects of Act 130

- **Definitions:** The Act introduces critical definitions, such as "Automated Driving System (ADS)," which refers to hardware and software capable of performing the entire dynamic driving task (DDT) on a sustained basis, encompassing SAE Level 3, 4, or 5 driving automation systems. "Highly automated vehicle (HAV)" is defined as a motor vehicle equipped with an ADS, excluding personal delivery devices. A "highly automated vehicle driver" can be an authorized employee or contractor of a certificate holder, either onboard or in a remote location capable of monitoring and controlling the HAV. The term "certificate holder" is crucial, identifying eligible entities as firms, co-partnerships, associations, corporations, or educational or research institutions, explicitly excluding individual persons from obtaining HAV certification.



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- **Operational Requirements:** Act 130 establishes the first legal pathway for driverless operations in Pennsylvania. For driverless operations, the HAV must be capable of complying with applicable traffic and motor vehicle safety provisions, while also being able to execute a minimal risk condition if ADS failure occurs.
- **Accident Reporting:** In the event of an accident involving an HAV with an ADS engaged or without a driver, the certificate holder or a person on their behalf must immediately contact a local police department or Pennsylvania State Police to report the accident and provide registration and financial responsibility information. The HAV must remain at the scene until these requirements are fulfilled.
- **Equipment Standards and Inspection:** HAVs designed to operate exclusively by the ADS or a remote driver are not subject to certain motor vehicle equipment laws or regulations irrelevant to an ADS. However, all HAVs remain subject to periodic vehicle inspection. A rear visibility system on an HAV is considered a mirror and is excluded from the measurement of vehicle width.
- **Local Governance and Preemption:** The Act preempts and supersedes all local ordinances, policies, and rules related to HAVs, ensuring a uniform statewide approach. Local authorities may still exercise police powers but cannot specifically burden or discriminate against HAVs.
- **Commercial Operation:** The Act addresses the operation of HAVs as motor carrier vehicles, including provisions for driverless operation under federal and state law, and the applicability of Public Utility Commission provisions. It prohibits HAVs from being operated as school buses or carrying certain hazardous materials unless specific certification is obtained after regulations are promulgated.
- **Interstate Agreements:** PennDOT is authorized to negotiate interstate agreements with other states for the interstate operation of HAVs and platoons, subject to the Governor's approval and consistency with federal law and requiring adequate insurance coverage. The interstate agreements would allow for reciprocity of HAV approvals.
- **HAV Advisory Committee:** Act 130 outlines the composition and powers of the HAV Advisory Committee, including a broadened membership to incorporate diverse stakeholders such as representatives for Pennsylvanians with disabilities and HAV motor carrier companies. The committee's responsibilities include advising PennDOT, developing technical guidance, evaluating best practices, reviewing laws, and conducting continued research. Importantly, the committee is mandated to submit annual reports, such as this one, evaluating the impact of HAVs on the Commonwealth, covering workforce, economic, accessibility, mobility benefits, and suggested law changes.

3 HAV Advisory Committee Guiding Principles and Their Impacts

To guide PennDOT's efforts over the coming years, the HAV Advisory Committee, through interviews and collaborative work, established key guiding principles for use cases of HAVs. These principles are foundational to developing future AV legislation based on factual knowledge, best practices, and a balance between regulation and innovation. The committee is also tasked under Act 130 with submitting annual reports evaluating the impact of HAVs on the Commonwealth across specific categories. What follows are updates on the progress made on recommendations made in the AV Guiding Principles document, as well as new recommendations based on the focus groups conducted during the development of the [2024 Act 130 Special Reports](#).



3.1 Safety

HAVs hold significant potential to improve the safety of the transportation system, so, Pennsylvania is actively encouraging this technology to ensure the safety of all roadway users.

Progress on Previous Recommendations:

- **Self-Certification:** HAV operators are now required to self-certify to PennDOT that their ADS complies with federal standards and established Commonwealth criteria, ([HAV-04](#)).
- **Metrics:** Certificate holders will be required to routinely provide PennDOT with appropriate metrics and performance information to verify safe operations and accessibility considerations. Stakeholders, including industry and government, are collaborating to identify these appropriate metrics. It is anticipated that the data reporting requirement will be finalized in 2026.
- **Pre-Deployment Testing:** HAV operators are required to certify that they have performed testing within the ODD that they will be operating in and considers its intended users.
- **Insurance and Liability:** Per Act 130, certificate holders must maintain financial responsibility of at least \$1,000,000 per accident for death, bodily injury, and property damage to a third party.
- **Law Enforcement and Emergency Response:** HAV operators must provide necessary information for law enforcement and emergency service responders to identify an HAV and safely address crash events. PennDOT has developed an Automated Vehicle Incident Response Plan (AVIRP) which details the actions taken after a crash and provides an app which contains all necessary response information for HAVs operating in the Commonwealth. The participants in the *2024 Act 130 Special Report* focus groups emphasized the need for detailed emergency response protocols that include procedures for identifying, securing, and disabling vehicles, handling high-voltage areas, and ensuring access to essential documents.

New Recommendations:

- **Adjust Accident Self-Reporting Timeframe:** Some participants in the *2024 Act 130 Special Report* focus groups believe the six-hour window is too short for self-reporting accidents to PennDOT and shared past experiences where reporting within such a limited timeframe was challenging or not feasible.
- **Establish Detailed Emergency Response Protocols:** Some participants in the focus groups recommended to establish a detailed emergency response protocol for HAVs that includes procedures for identifying, securing, and disabling vehicles in emergency situations, covering post-crash events, handling high-voltage areas, and ensuring access to essential documents such as insurance, vehicle identifiers, and keys. The AVIRP addresses this by providing this information to first responders to help them better respond to incidents involving HAVs.
- **Enhance First Responder Training:** It is recommended to establish enhanced training programs for first responders to effectively manage emergency situations involving HAVs, thereby improving safety and preparedness. PennDOT has provided training on the AVIRP app to first responders, and needs to now expand training to computer-aided dispatch operators in how to use the app.
- **Develop Plan for Data Analysis and Publication:** As vendors submit data specified in the "Certificate of Compliance Guidelines," PennDOT should develop a comprehensive plan to analyze, publish, and utilize this information, including ongoing accident reporting, compliance



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reports, and safety reporting data, similar to practices in states like California, to enhance public understanding and foster greater trust in the technology.

3.2 Promote Growth

The Commonwealth, AV developers, and other stakeholders are actively identifying and developing ways to promote and enable industry growth in Pennsylvania.

Progress on Previous Recommendations:

- **Enact Enabling Legislation:** Pennsylvania has enacted legislation, specifically Act 130, that allows for the safe testing of driverless SAE Level 4 and 5 HAVs and provides a pathway to commercial deployment. This legislation reflects national best practices.
- **Technology-Neutral Policies:** Pennsylvania has enacted technology-neutral and platform-agnostic policies to promote a diverse set of HAV use cases and a level playing field across the industry.
- **Flexible Legislation:** Act 130 includes requirements which are flexible for both testing and operations of HAV technology in various forms (driverless, remote operations, etc.) and doesn't restrict the use cases that can be deployed. Pennsylvania has also enacted Act 106 of 2020 allows for Personal Delivery Devices (sidewalk delivery robots) to be deployed on the pedestrian areas and roadways.
- **Public-Private Partnerships:** PennDOT has not yet received proposals or started exploring how public-private partnerships could integrate the needed technology into infrastructure and foster the development of equitable and accessibility-based use cases.

New Recommendations:

- **Reduce Regulatory Oversight for Level 3 HAVs:** Some focus group participants, particularly those representing HAV vendors and trade associations, suggested reducing regulatory oversight for Level 3 AVs, proposing they may not require an HAV certificate as they operate with human oversight and do not fully meet the criteria for higher levels of autonomy that demand additional regulation. There are currently consumer-grade Level 3 HAVs available to the public, so having restrictions on personal ownership of Level 3 vehicles may create a patchwork of different regulations for Level 3 vehicles.
- **Refine Mirror Requirements for Different HAV Levels:** While Act 130 addresses rear visibility systems, a refinement of mirror requirements for different HAV levels is suggested; Levels 4 and 5 HAVs, relying on sensors, may not require traditional mirrors, but Level 3 vehicles still require a driver to take control, making mirrors necessary.
- **Prioritize Infrastructure Repair and Maintenance:** PennDOT should conduct a study to identify the infrastructure maintenance and upgrades required for HAVs to operate in Pennsylvania and understand the costs associated with these activities. The Transformational Technology Division began this study in the summer of 2025.

3.3 Workforce Impacts

Benefits and implications to the workforce are a critical consideration when evaluating current AV legislation.



Progress on Previous Recommendations:

- **Workforce Pipeline Creation:** Pennsylvania does not yet have a workforce development pipeline which makes connections between industry and educational institutions.
- **Automation as Supplement:** PennDOT has no plans to replace staff with automation, only to supplement staff. For example, PennDOT is procuring an Automated Truck Mounted Attenuator (ATMA), which will take a driver out of a traditional TMA and put them in a leader vehicle, which will improve the safety for TMA drivers by taking them out of an inherently dangerous situation.
- **Support for At-Risk Individuals:** Pennsylvania does not yet have a program established to support individuals and industries at risk of losing jobs due to vehicle automation.

New Recommendations:

- **Workforce Transformation and Reskilling:** To succeed in the HAV industry, workers will need to combine traditional mechanical skills with advanced expertise in areas such as artificial intelligence, cybersecurity, and data analysis. Robust training and reskilling programs are crucial to meet the growing demand for skilled labor, particularly in remote management and HAV system maintenance. These programs should focus on real-world applications and specialized roles, with HAV-specific certifications and safety training ensuring expertise for safe operations.
- **Talent Retention:** A key concern is the trend of individuals with AV/robotics-related degrees leaving Pennsylvania for opportunities elsewhere. The passage of Act 130 is a positive development that enables testing and potentially manufacturing, which could influence job opportunities and talent retention. Strategies include strengthening partnerships between industry and educational institutions, creating hands-on learning opportunities, and launching targeted awareness campaigns to attract young professionals to HAV careers.
- **Additional mobility option for the public, specifically older Pennsylvanians, and persons with disabilities:** AVs can provide a mobility option for individuals with disabilities and older adults which would provide a means for transportation to work, groceries, medical appointments, and more. To date, commercial operations and access to the public has not yet been realized in Pennsylvania.

3.4 Equity, Accessibility, and Quality of Life

HAVs can improve mobility, accessibility, and transportation equity, but also carry the risk of disadvantaging or marginalizing populations. HAVs should strive to address community needs and increase access to desirable mobility options and services.

Progress on Previous Recommendations:

- **Accessibility Design:** In the Certificate of Compliance Guidelines, PennDOT requires HAV operators to identify if they have wheelchair access for users if they are offering service to the public. Considerations for visually and hearing-impaired individuals should be considered.
- **Equitable Access:** PennDOT does not currently have requirements around ensuring equitable access to disadvantaged, low-income, disabled, aging, rural or underserved populations as this is not within the scope of the self-certification.
- **Climate and Sustainability** PennDOT does not currently have requirements around climate and sustainability for HAV operators as this is not within the scope of the self-certification.



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- **Vulnerable Road Users:** In the Certificate of Compliance Guidelines, PennDOT requires HAV operators to certify that they can safely operate around vulnerable road users.
- **Data Privacy:** PennDOT does not currently have requirements around data privacy for certificate holders as this is not within the scope of the self-certification.

New Recommendations:

- **Enhance Public Trust through Education:** The participants of the *2024 Act 130 Special Report* focus groups recommended launching public education campaigns and demonstration projects is crucial to build trust in HAV technology, especially among people with disabilities and older adults, to alleviate concerns and highlight benefits.
- **Encourage Rural Deployment Policies:** The focus group participants suggest implementing policies to encourage the deployment of HAVs in rural areas is vital to improve first-mile and last-mile solutions, enhance connectivity, and support regional economic growth.

3.5 Government Responsibilities

Effective governance is essential to the safe and successful deployment of HAVs across Pennsylvania. As federal, state, and local roles continue to evolve, clear responsibilities and proactive policy development will ensure consistency, accountability, and public trust.

Progress on Previous Recommendations:

- **Clear Roles and Responsibilities:** The role of the federal government is still evolving as the feds begin to consider a national framework for HAVs. Currently, the federal government is responsible for overseeing the investigation of incidents through NTSB and approving FMVSS exemptions through NHTSA. The state is responsible for overseeing the HAV operations. The locals are preempted from making HAV-specific restrictions in Pennsylvania.
- **State Policy and Guidelines:** In the absence of federal laws or regulations around HAVs, PennDOT has developed guidelines to outline a self-certification process which allows for both testing with a safety driver and driverless operations.
- **Consistency and Interoperability:** Act 130 allows for PennDOT to enter into interstate agreements to ensure consistency and allow for reciprocity of approvals.
- **PennDOT as Lead Agency:** Per Title 75 Chapter 85, PennDOT continues to be the lead state agency for HAVs.

New Recommendations:

- **Enhance Integration with Driver and Vehicles Services (DVS) Procedures:** Some participants in the *2024 Act 130 Special Report* focus groups recommended to enhance the integration of AV systems with the DVS by updating existing procedures to accommodate AV requirements, supporting efficient coordination during emergencies, and preparing for future technological advancements.
- **Continuous Evaluation of Act 130:** The Special Reports research team recommends that PennDOT continuously monitor and evaluate the impact of Act 130, while periodically reviewing public input and feedback, as the full impact is expected to unfold over the coming years as HAV developers apply for certification and initiate deployment.



3.6 Collaboration and Engagement

With the advancement of ADS, public misunderstanding has become a frequent occurrence. Transparency, especially during testing, is important to inform both communities and policymakers and build trust and awareness.

Progress on Previous Recommendations:

- **Community Engagement:** Per Act 130, HAV Operators are required to inform municipalities 10 days prior to deployment.
- **Consistent Statewide Messaging:** The Advisory Committee is required to submit an annual report that will be public on the PennDOT website evaluating the impact of HAVs on the Commonwealth, covering workforce, economic benefits, accessibility, mobility improvements, and suggested law changes.

New Recommendations:

- **Public Trust and Education:** Enhancing public trust in HAVs is a shared concern. Focus group participants recommend launching public education campaigns and demonstration projects to build trust, alleviate concerns, and highlight benefits, especially among people with disabilities and older adults.

4 Key Projects and Initiatives

PennDOT is actively engaged in several pivotal projects and initiatives that underpin the state’s readiness for HAV technologies.

4.1 ADAS/AV Infrastructure Readiness and Design Guidelines Study

This project will investigate the necessary physical and digital infrastructure upgrades that are required to support HAVs and ADAS on PennDOT’s roadways. Some identified challenges include inconsistent road markings, digital infrastructure gaps (e.g., broadband coverage), legacy traffic signal systems, complex workzones and construction areas, and the impact of weather on sensor performance. PennDOT aims to update policies, design standards, and investment strategies to accommodate these evolving needs.

- **Purpose:** This study assesses the infrastructure requirements of Advanced Driver Assistance Systems (ADAS) and Automated Driving Systems (ADS) technologies to support their safe integration into our daily lives.
- **Progress:** The project is currently underway. The literature review has been conducted and the initial framework draft is currently being written. The project is anticipated to be complete in 2026.

4.2 PennSTART Testing Track Development

The development of the Pennsylvania Safety, Training, and Research Track (PennSTART) is a critical initiative to establish a dedicated environment for HAV research and testing; it also aims to function as a traffic incident management training center. In Phase 1, PennSTART will include a high-speed track and vehicle dynamics area. Phases 2 and 3 will build out the remainder of the track.

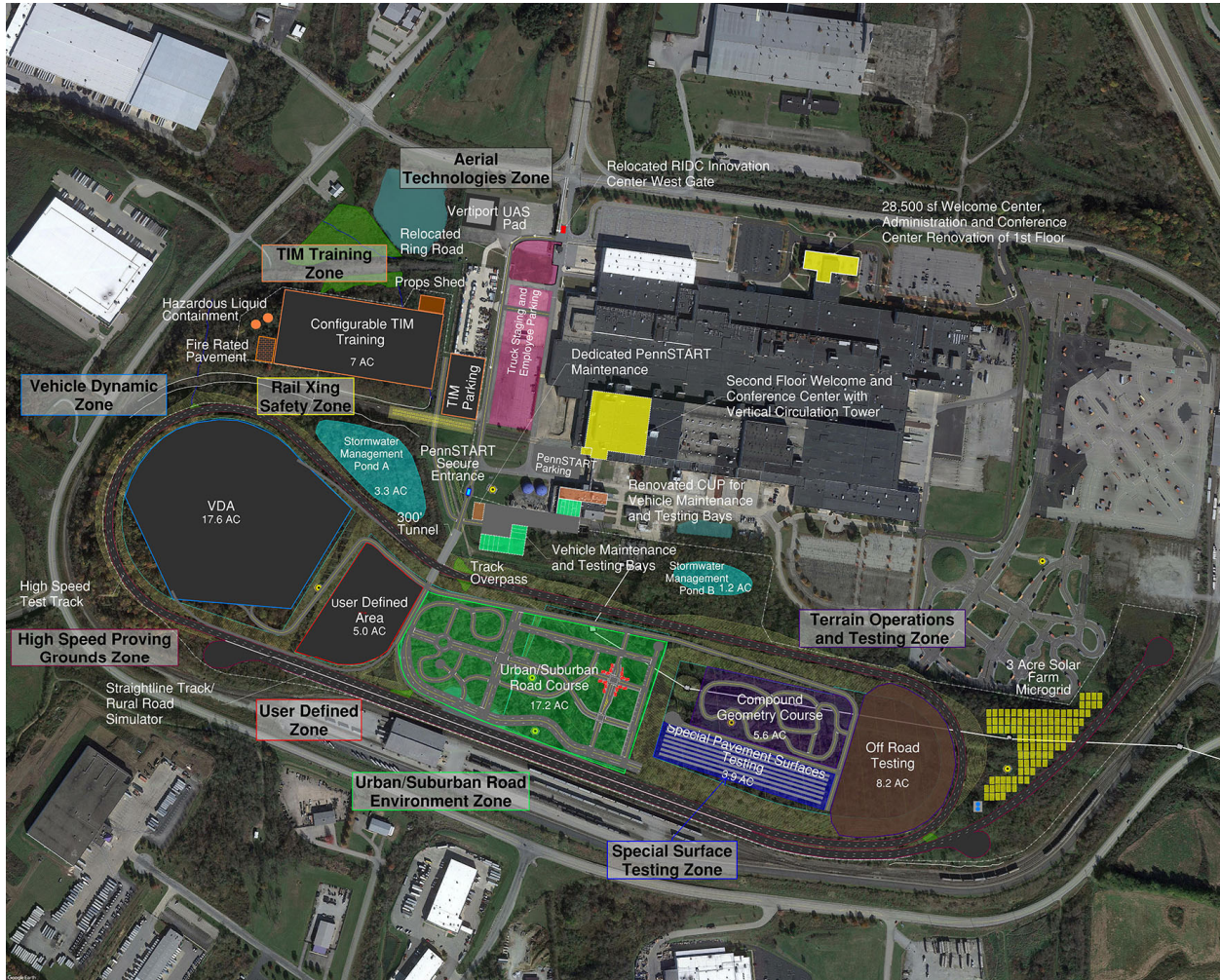
- **Purpose:** PennSTART aims to provide a controlled, real-world environment for testing HAVs, accelerating their development and deployment in Pennsylvania. This facility is expected to



attract numerous companies for research and testing, further strengthening Pennsylvania's automated driving sector and benefiting the state's economy and job market.

- **Progress:** Preliminary site design plans for Phase 1 have been reviewed, with ongoing efforts to address operational challenges, such as the simultaneous use of flat areas and track, optimizing guiderail placement, and clarifying access road designs. The facility will integrate advanced infrastructure to support HAV capabilities. The construction of Phase 1 has begun in Fall of 2025 and is anticipated to be substantially complete by the end of 2026.

Figure 1: PennSTART Preliminary Master Plan



4.3 Automated Truck Mounted Attenuator (ATMA) Deployments

The ATMA project focuses on enhancing worker safety in active work zones by removing the human from the crash attenuator follower vehicle. The ATMA is a standard truck mounted attenuator outfitted with hardware and software additions, meeting Federal Motor Vehicle Safety Standards, and operates under PennDOT's safe operating guidelines. The ATMA functions as a leader/follower system where a human-driven lead vehicle transmits position, speed, and heading information for the ATMA (follower) to match while maintaining a set gap distance.

The ATMA will be primarily used for protection of work zone employees who are line-painting and striping. In the future, it may be utilized for various other types of maintenance activities like pothole patching, mowing, and crack sealing.

- **Purpose:** The ATMA project aims to enhance worker safety in active work zones by eliminating operator injuries when the rear protective attenuator vehicle is impacted, achieved by removing the human operator from the vehicle.
- **Progress:** PennDOT has procured a vendor to deploy the ATMA with anticipated pilot testing planned for Spring of 2026.

4.4 ADS Demonstration Grant

The ADS Demonstration Grant, titled "Safe Integration of Automated Vehicles into Work Zones," was awarded to PennDOT to help understand how to improve HAV operations in work zones. PennDOT secured \$8,409,444 in funding from the United States Department of Transportation (USDOT) ADS Demonstration Grants Program for this initiative.

- **Purpose:** The main reason for this project was to safely integrate HAVs into most work zones by exploring the impact of improved connectivity, enhanced computer vision, and High-Definition (HD) mapping. The project aimed to develop a consistent approach to enable HAVs to operate safely in these complex environments.
- **Progress:** The project concluded in January of 2025 with the completion of the [final report](#), which detailed all of the lessons learned and recommendations from the project. During the deployment phase, the project undertook extensive research and testing in various environments, including simulations and closed-track testing at Pennsylvania State University (PSU) for 17 work zone scenarios and live on-road demonstrations for three work zone scenarios. This involved collecting mapping, vehicle, connectivity, operational, and safety performance data for analysis and evaluation.

4.5 CAV Business Plan

PennDOT's Connected and Automated Vehicle (CAV) Business Plan builds upon the 2018 Pennsylvania Joint Statewide CAV Strategic Plan. This plan establishes an actionable framework for implementing CAV technologies across the Commonwealth, aiming to create measurable goals for CAV technology readiness and adoption while providing a detailed roadmap for PennDOT and its partners. CAV technology encompasses both connected vehicles, which use technology to communicate with other vehicles (V2V) and infrastructure (V2I), and HAVs.

- **Purpose:** The goal of the PennDOT CAV Business Plan is to advance Pennsylvania's readiness for CAV technology and build upon the goals of the 2018 CAV Strategic Plan. It seeks to provide strategic recommendations to support infrastructure, policy, and regulatory needs, and to foster collaboration with stakeholders to enhance safety, mobility, and economic opportunities. The plan is designed around three foundational tenets to ensure it is actionable, accountable, and measurable, while also addressing the key challenges inherent in current program efforts.
- **Progress:** An extensive stakeholder engagement process was conducted during the summer of 2023. This involved in-depth interviews with fifteen key stakeholder groups, representing various PennDOT bureaus, engineering districts, regional planning organizations, and Commonwealth departments, to understand the readiness, challenges, and opportunities for CAV technology



implementation across Pennsylvania. Several foundational initiatives commenced recently with the plan's implementation, including the V2X Roadmap and the AV Infrastructure Readiness projects.

4.6 AV Guidebook for Municipalities

The Automated Vehicle Guidebook for Municipalities is a document created by the Pennsylvania Department of Transportation (PennDOT) to help local governments navigate the emerging landscape of HAVs. It was developed following the enactment of Act 130 of 2022, which significantly updated the legislative framework for HAV operations in Pennsylvania and designated PennDOT as the sole regulatory authority, preempting local laws. This guidebook serves as a foundational resource to aid in the use of quickly advancing HAV technology and the anticipated growth of its adoption across the Commonwealth.

- **Purpose:** The AV Guidebook is intended to educate and prepare municipalities for the safe and effective integration of HAVs. It aims to provide strategic guidance and training, clarify how municipal responsibilities may evolve, facilitate informed policy discussions, and offer comprehensive support and resources. PennDOT's overarching goal is to ensure consistency across the Commonwealth in preparing for HAVs, while also aligning with federal standards for vehicle safety.
- **Progress:** The Guidebook was released in 2024, providing local governments with foundational guidance on various topics including safety, traffic management, emergency response, risk management, and potential fiscal impacts of HAVs. Also in 2024, the HAV Advisory Committee, in collaboration with Penn State University, conducted comprehensive focus groups and evaluations. These efforts showed the many impacts of Act 130 on Pennsylvania's workforce, economy, accessibility, and mobility, which are used to inform and refine resources such as the municipal guidebook. As AV operations grow in the state, whether industry driven or new public operations such as transit, the Municipal Guidebook will be updated.

4.7 PennDOT Automated Vehicle Incident Response Plan (AVIRP)

The PennDOT Automated Vehicle Incident Response Plan (AVIRP) has been developed to establish a structured response for incidents involving HAVs on Pennsylvania roadways. This plan is specifically for vehicles equipped with HAV Levels 3, 4, and 5, not including consumer vehicles, providing prepared guidance to assist agencies and responders from detection through recovery.

- **Purpose:** The purpose of the AVIRP is to provide comprehensive guidance for incidents involving HAVs, promoting agency awareness, strengthening communications, and enhancing safety protocols among all responders. Its primary goals include ensuring awareness of all reportable AV incidents, facilitating effective interagency coordination, and equipping responders with critical incident response considerations through an easily accessible mobile application. The plan establishes a framework for safe and efficient management of HAV incidents, outlining clear roles and responsibilities from detection to post-incident actions and supporting law enforcement and emergency services in addressing crash events.
- **Progress:** PennDOT has developed the AVIRP document as foundational guidance. A significant ongoing effort is the active development of the Pennsylvania AV Incident Response Field Guide app, which serves as an incident management and notification resource. This app provides responders with guidance on securing vehicles, locating documentation, and considerations for extrication, towing, and firefighting specific to HAVs. PennDOT has also established a responder-



specific training program to bridge the gap between conventional response tactics and HAV technologies. Interagency coordination guidelines are defined, with the Transformational Technology Division (TTD) leading coordination among city, state, and federal agencies. Protocols for interacting with AVs have been developed, and annual exercises are planned to assess and evaluate training and understanding among stakeholders.

4.8 National Engagement

The TTD engages in multiple groups at a regional and national level to ensure that PennDOT stays up to date with all the latest industry trends and ensure that PennDOT is in line with best practices for overseeing HAVs. PennDOT is actively involved with the following groups:

- Automated Vehicle Pooled Fund Study
- Transportation Research Board – Connected and Automated Vehicle Subcommittee
- Intelligent Transportation Society of America – Automated Vehicle Committee
- Eastern Transportation Coalition – Connected and Automated Vehicle Group
- Pennsylvania Turnpike Commission – CASE Working Group
- Automated Truck Mounted Attenuator Pooled Fund Study

5 Benefits and Implications to the Commonwealth’s Workforce

The arrival of HAVs will reshape Pennsylvania’s workforce, introducing both challenges and significant opportunities. Strategic investments in education, training, and industry collaboration will be essential to maximize economic benefits and minimize disruption.

5.1 Key Workforce Impacts

- **Job Creation:** The introduction of HAVs is anticipated to generate many new job opportunities across Pennsylvania in the coming decade. These new roles span various sectors and skill sets, including:
 - HAV maintenance and repair
 - Robotics and sensor calibration
 - Infrastructure support and automated inspection
 - Software development and data security
 - AV fleet management and remote operators
 - Specialized roles for first responders and system optimization
 - New opportunities in the insurance and legal sectors due to evolving liability frameworks
 - Accessible AV services and vehicle design
- **Workforce Transformation:** The shift towards HAVs necessitates a transformation of existing job roles rather than outright elimination. Workers will need to combine traditional mechanical skills with advanced expertise in areas such as artificial intelligence, cybersecurity, and data analysis. This dual impact creates new opportunities while potentially phasing out some traditional driving-centric roles, requiring proactive planning and support for the transition.
 - Strengthening partnerships between industry and educational institutions (K-12, career/technical, undergraduate).
 - Creating hands-on learning opportunities and internships to provide practical experience.



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- Launching targeted public awareness campaigns to showcase cutting-edge HAV careers and their long-term prospects.
- Collaboration with aging and disability services organizations.
- **Training and Reskilling Programs:** Robust training and reskilling programs are crucial. These programs must focus on real-world applications, equipping employees with competencies in automated systems operation, software integration, and cybersecurity. Specialized programs are needed for emerging roles like AV test engineers, data analysts, and AI engineers. HAV-specific certifications and safety training will ensure expertise for safe operations. Support from both government and industry is essential, through funding, incentives, and public-private partnerships, to ensure well-targeted and effective workforce development. Continuous learning is vital given the rapid pace of technological advancement.
- **Economic Contribution in Pittsburgh:** RIDC published a [report](#) in 2021 which indicates that the Pittsburgh region's automated systems industry already supports a substantial workforce. The 71 companies in this sector employ over 6,300 individuals directly, which in turn supports more than 8,600 additional jobs through indirect and induced effects, totaling over 14,900 jobs in the region. This industry generates significant labor income (\$1.2 billion total), economic output (nearly \$3 billion total), and tax revenues (nearly \$347 million total), demonstrating its broad economic influence.

5.2 Challenges to Workforce Development

- **Talent Retention and Development:** A significant challenge is the trend of young professionals, particularly those with AV/robotics-related degrees from Pennsylvania's strong educational institutions, leaving the state for opportunities elsewhere. Act 130, by enabling comprehensive testing and potentially fostering manufacturing, is a positive step toward retaining this talent. Strategies to counter this outflow include:

5.3 Industry Impact in 2025

As many companies have roots in Pennsylvania where business operations are headquartered and testing and simulation are taking place, as well as the influence and graduates from universities like Penn State and Carnegie Mellon, workforce and its continual development for AVs is strong in Pennsylvania. Indicators for workforce development can include:

- The number of employees in Pennsylvania involved with HAV development, testing, and operations.
- Number of new jobs created in Pennsylvania as a result of HAV development, testing, and operations.
- Number of workers trained or upskilled through AV-related programs (e.g., safety operators, technicians, developers).
- Partnerships with local workforce development boards or educational institutions, number of internships or apprenticeships offered.

6 Economic Benefits and Implications to the Commonwealth

The integration of HAVs presents a transformative opportunity for Pennsylvania's economy, with the potential to drive innovation, attract investment, and enhance competitiveness. By fostering a supportive regulatory environment and leveraging the state's existing strengths in freight and advanced



manufacturing, the Commonwealth is well-positioned to capitalize on the economic ripple effects of HAV deployment.

6.1 Key Economic Impacts

- **Turning Point for Pennsylvania's HAV Industry:** Act 130 has been critical in solidifying Pennsylvania's position in the HAV industry. Prior to this legislation, the lack of a clear legal framework threatened to drive automated driving R&D companies to other states. With Act 130 in place, companies like Stack AV have chosen to maintain and grow their operations in Pennsylvania, directly preserving and creating local jobs. This legislation fosters a supportive legal environment that encourages companies to stay and expand within the state.
- **Potential in Freight Transportation:** HAVs hold significant economic potential for the freight sector, with benefits expected to materialize more immediately. Given Pennsylvania's high reliance on trucking, automated freight offers opportunities for streamlined logistics, reduced labor costs, and improved efficiency. Automated trucks can operate continuously, minimizing the need for human couriers in urban freight and reducing demand for long-haul drivers and parking facilities for intercity freight.
- **Post-R&D Economic Opportunities:** Pittsburgh's increasing R&D investments in automated driving and HAV testing are fostering a clustering effect of related technology companies. This creates a robust innovation ecosystem, attracting businesses specializing in sensors, software development, simulation, and integrated systems. This growth supports the transition of traditional manufacturing towards intelligent and high-end production processes, leading to new high-skilled job opportunities and boosting local talent competitiveness.

6.2 Challenges to Realizing Full Economic Potential

- **Continuous Monitoring Required:** The full economic impact of Act 130 has not yet fully materialized given its recent enactment and the issuance of corresponding certificate of compliance guidelines. Workforce changes are expected to evolve over several years. Therefore, ongoing and long-term evaluations of workforce, economic, accessibility, and mobility factors are essential to fully understand Act 130's influence.
- **Competition and Regulatory Refinements:** Pennsylvania faces competition from states with fewer regulatory hurdles. Focus group participants suggest refining legislation (e.g., reducing regulatory oversight for Level 3 vehicles, revising mirror requirements) and establishing a more open and dynamic testing landscape to attract more HAV companies. Streamlining the self-certification process and potentially involving third-party oversight could reduce bureaucracy and foster a more business-friendly environment.
- **Infrastructure Maintenance:** There is an urgent need to repair and maintain critical infrastructure such as road markings, signs, and traffic lights to support HAV integration. This proactive maintenance is vital for safety and functionality as HAV deployment grows.

6.3 Industry Impact in 2025

To date, commercial operations have not been realized in Pennsylvania as certificate holders are currently in development and testing in PA, therefore there have not been reportable economic benefits and implications from the AV industry. Waymo has announced plans to launch commercial operations in Philadelphia in 2026. Several indirect economic benefits and implications of deploying HAVs across the Commonwealth in 2025 would include:



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- New facilities constructed, purchased, or rented in Pennsylvania as a result of HAV development, testing, and operations.
- Pennsylvania-based suppliers or vendors engaged or indirect benefits to the Pennsylvania supply chain.
- Freight moved by AV trucks throughout the commonwealth.

7 Improvements to Accessibility and Mobility for Persons with Disabilities

HAVs offer transformative potential to enhance accessibility and mobility, particularly for individuals with disabilities and older adults. PennDOT is committed to leveraging this technology to address community needs and increase access to desirable mobility and service options.

7.1 Key Accessibility Impacts

- **Enhanced Accessibility for Disabled and Older Adults:** HAVs have the potential to significantly improve accessibility for individuals with disabilities and older adults by offering a wider range of travel options and more convenient, on-demand services. This is especially impactful for those in areas with limited public transportation, reducing their reliance on others for travel.
- **Integration with Healthcare Systems:** A key suggestion from participants with disabilities is the integration of HAV services with healthcare systems, potentially covering medical trips by medical insurance and allowing clinics or hospitals to validate HAV tickets. This could greatly benefit individuals requiring regular medical transport.
- **First and Last-Mile Connectivity:** HAVs are seen as a key solution for providing effective "first-mile" and "last-mile" connectivity, particularly in rural areas or underserved urban communities where public transit options are limited. By offering flexible and convenient transportation, HAVs can bridge gaps, connecting people to essential services, employment, and community activities that would otherwise be difficult to reach. This expanded range of travel options can significantly improve mobility and independence, leading to a better quality of life.

7.2 Challenges in Accessibility

- **Vehicle Design for Independent Use:** Emphasis needs to be placed on improving vehicle ingress and egress without relying on driver support, including accessible entry points, adjustable seating, and mechanisms for independently operating mobility aids (e.g., wheelchair docking). HAV technology has not fully addressed the needs of individuals with various disabilities, facing issues like seat belt fastening and wheelchair boarding/exiting.
- **Clear Emergency Protocols:** Establishing clear emergency protocols and procedures for HAV malfunctions or stranded passengers is vital, especially for the disabled community who may not have the ability to seek help independently. This builds trust and ensures reliability.
- **Building Trust:** Public education, transparent safety measures, and accessible features (e.g., voice-activated controls for visual impairments) are crucial to alleviating apprehension and promoting broader acceptance of HAVs as a legitimate transit option.
- **Funding and Insurance Models:** Insufficient funding in insurance models and high transportation costs remain barriers for people with disabilities.



7.3 Industry Impact in 2025

The Navy Yard shuttle was wheelchair accessible while operating as a transit service augmentation, providing an additional mobility option to travelers with disabilities to and from Philadelphia's Navy Yard. To date, commercial operations, and availability of AVs for public use have not been realized in Pennsylvania outside of the Navy Yard shuttle, therefore there have not been other reportable improvements to accessibility and mobility for disabled persons with disabilities from the AV industry.

8 Improvements to Mobility Options for the General Public

HAVs have the potential to revolutionize public mobility, enhancing the efficiency, accessibility, and sustainability of transportation systems for the general public across Pennsylvania.

8.1 Key Mobility Option Impacts

- **Supplementing Public Transportation Systems:** Many participants in the *2024 Act 130 Special Report* focus groups agree that HAVs have the potential to complement, rather than compete with, existing public transportation systems. This integration can improve efficiency, expand coverage, and enhance cost-effectiveness. For public transportation, HAVs can provide flexible, on-demand services that connect passengers to transit hubs or destinations not easily accessible through traditional routes, effectively completing the "first and last mile" of travel.
- **Impact on Urban Areas:** In urban environments, HAVs have the potential to significantly extend the reach of existing public transportation systems, such as subways and regional rail networks. By offering efficient first-mile and last-mile solutions, HAVs can make it easier for residents to access transit hubs and reach destinations not directly serviced by traditional transit routes, leading to improved overall mobility within cities.
- **Impact on Rural Areas:** For rural communities, HAVs can play a transformative role by overcoming geographical isolation and improving access to essential services. They can connect residents to healthcare facilities, educational institutions, and commercial centers, reducing travel burdens and fostering regional equity.
- **Improved Road Safety:** Focus group participants believe that HAVs, by reducing human error, can create a safer driving environment and improve overall road safety for everyone. This is attributed to HAVs operating based on consistent, data-driven decision-making, which leads to more predictable and safer behavior on the road.
- **Infrastructure Upgrades:** To optimize HAV performance and enhance the overall public transportation system, infrastructure improvements are crucial. This includes upgrading road markings (ensuring they are clear, durable, and retroreflective), constructing protected spaces for vulnerable road users (e.g., separated bike lanes, accessible sidewalks), and updating traffic signals for V2I communication. These improvements benefit both automated and human-driven vehicles.

8.2 Challenges to Mobility Improvements

- **Public Acceptance and Education:** Building public trust is crucial for widespread adoption. This requires enhanced education and demonstration projects to communicate the benefits and limitations of HAV technology, alleviating skepticism, particularly among older adults, who would be a large beneficiary of improved mobility options.



8.3 Industry Impact in 2025

The Navy Yard shuttle operated as a transit service augmentation, providing an additional mobility option to travelers to and from Philadelphia's Navy Yard. To date, commercial operations, and availability of AVs for public use have not been realized in Pennsylvania outside of the Navy Yard shuttle, therefore there have not been reportable improvements to mobility options for the public from the AV industry. Waymo has announced plans to launch commercial operations in Philadelphia in 2026 which should provide a new mobility option for the public.

9 Suggested Changes to the Laws of this Commonwealth

Based on discussions with the *2024 Act 130 Special Report* focus groups and the ongoing evaluation of Act 130's implementation, several recommendations have emerged for potential changes and additions to Pennsylvania's current policies and legislation regarding HAVs.

Key Recommendations:

- **Regulatory Oversight for Level 3 HAVs:** Some focus group participants, particularly those representing HAV vendors and trade associations, suggested reducing regulatory oversight for Level 3 AVs, proposing they may not require an HAV certificate as they operate with human oversight and do not fully meet the criteria for higher levels of autonomy that demand additional regulation. There are currently consumer-grade Level 3 HAVs available to the public, so having restrictions on personal ownership of Level 3 vehicles may create a patchwork of different regulations for Level 3 vehicles.
- **Allow Individual Ownership under Act 130:** Some focus group participants recommended allowing individual ownership under Act 130. Restricting individual ownership may negatively impact business models of many automakers, who rely on individual vehicle sales. Allowing this ownership would support existing business practices and encourage broader market participation.
- **Revise 10-Day Municipal Notice Requirement:** The current requirement for a 10-day written notice to municipalities for intent to operate an HAV is seen as unnecessary for vehicles merely passing through. Additionally, the lack of an identified point of contact (POC) often renders municipalities unable to respond effectively. Revisions are suggested to make this process more practical.
- **Refine Mirror Requirements for Different HAV Levels:** While Act 130 addresses rear visibility systems, a refinement of mirror requirements for different HAV levels is suggested. Levels 4 and 5 HAVs, relying on sensors like cameras, LiDAR, and radar, may not require traditional mirrors. However, Level 3 vehicles still require a driver to take control in certain situations, making mirrors necessary for external environment observation.
- **Adjust Accident Self-Reporting Timeframe:** The current six-hour window for self-reporting accidents to PennDOT is considered too short by some stakeholders. Past experiences indicate challenges in meeting such a limited timeframe, suggesting a need for revision.



10 Certificate Holders in Pennsylvania

According to Act 130, PennDOT's publicly accessible website should provide a list of the certificate holders, including where they operate and a contact in case of an incident. **Table 1** contains the entities currently holding a valid certificate of compliance.

Table 1: Certificate Holders

Name	Operations Locations	Operations Type
Aurora Operations, Inc.	Pittsburgh; Millvale; Etna; Sharpsburg; O'Hara; Blawnox; Harmar; Springdale; Frazer; East Deer; Tarentum; Ross; Ohio; Franklin Park; Marshall; and Cranberry.	HAV Driver on board
Motional AD Inc.	Pittsburgh, specifically Hazelwood, Southside and Oakland neighborhoods. Unincorporated Allegheny County	HAV Driver on board
Stack AV	Mt. Pleasant, East Huntingdon, Scottsdale, New Stanton, Hempfield, South Huntingdon, Perry, Rostraver, Speers, Fallowfield, Bentleyville, Somerset, North Strabane, Penn, Monroeville, Plum, Penn Hills, Harmar, Indiana, Hampton, Richland, Pine, Marshall, Cranberry, South Strabane, North Franklin, Buffalo, Claysville, Donegal	HAV Driver on board
Carnegie Mellon University	Interstate highways: I-376, I-279, I-579, I-79, I-91, I-80, I-79, I-70. Counties: Adams, Allegheny, Beaver, Bedford, Butler, Chester, Crawford, Cumberland, Dauphin, Erie, Fayette, Franklin, Fulton, Greene, Lancaster, Mercer, Perry, Venango, Washington, Westmoreland, PA Turnpike, I-376, I-279, I-579	HAV Driver on board
Perrone Robotics, Inc.	Philadelphia	HAV Driver on board
Mapless AI, Inc.	City of Pittsburgh, Pittsburgh International Airport (Allegheny County Airport Authority)	HAV Driver on board
Waymo	Philadelphia	HAV Driver on board



11 Pennsylvania HAV Advisory Committee Members

The members of the HAVAC as of the end of 2025 include:

- **Mike Carroll (Chair)** - Secretary, Pennsylvania Department of Transportation
- **Melissa Wright** - Pennsylvania Department of Community and Economic Development
- **Caroline Boehm** - Pennsylvania Insurance Department
- **Stephen DeFrank** - Chairman, Pennsylvania Public Utility Commission
- **James Martini** - Pennsylvania Department of Labor and Industry
- **Lt. Rachel Grant** - Pennsylvania State Police
- **Mark Compton** - Chief Executive Officer, Pennsylvania Turnpike Commission
- **Emily Yates** - Deputy Chief Planning Officer - Innovation, SEPTA
- **Senator Judy Ward** - Pennsylvania Senate Transportation Committee Chairperson
- **Senator Marty Flynn** - Pennsylvania Senate Transportation Committee Minority Chairperson
- **Representative Ed Neilson** - Pennsylvania House Transportation Committee Chairperson
- **Representative Kerry Benninghoff** - Pennsylvania House Transportation Committee Minority Chairperson
- **Dr. Raj Rajkumar** - George Westinghouse Professor of Electrical and Computer Engineering, Carnegie Mellon University
- **Dr. Rory Cooper** - University of Pittsburgh
- **Gerardo Interiano** - Head of Government Relations, Aurora
- **Kelley Yemen, AICP** - Director of Complete Streets, City of Philadelphia
- **Ted Leonard** - Executive Director, Pennsylvania AAA Federation
- **Sara Innamorato** - Allegheny County Executive
- **Liz Fishback** - Director of State and Local Affairs, Stack AV
- **David Vrona** - Teamsters Local 1776
- **Wendell W. Young IV** - President, United Food and Commercial Workers Local 1776 Keystone State
- **Mark Dombrowski** - Insurance Industry Representative
- **Michelle Elder** - Regional Director, State Government Affairs (Northeast), Ford Motor Company