PennDOT Act 130 Reporting: Evaluating the Impact of Connected and Automated Vehicles to the Commonwealth of Pennsylvania

FINAL REPORT

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16. Abstract

This report presents the findings from focus groups conducted in 2024. The primary objective of the research was to provide a comprehensive analysis of the impact of Act 130 within Pennsylvania's unique context. The study examines the specific benefits and challenges of Highly Automated Vehicles (HAVs), with a focus on workforce development, economic growth, accessibility, and mobility improvements. The findings are intended to support PennDOT in its efforts related to HAVs and offer actionable insights and recommendations to policymakers, helping Pennsylvania maximize the benefits of HAV technology while addressing potential challenges.

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Executive Summary

Pennsylvania's legislative framework for Highly Automated Vehicles (HAVs) has undergone significant evolution with the enactment of Act 130 of 2022, a comprehensive amendment to Title 75 (Vehicles). Building on the foundations established by Act 117 of 2018, which introduced Chapter 85 specifically addressing HAVs, Act 130 refines this framework. It offers detailed definitions and guidelines for the HAV Advisory Committee, enhancing Pennsylvania's legal infrastructure to support the complexities of HAV technology and ensuring the state's vehicle laws meets the advanced demands of HAVs. Act 130 requires the HAV Advisory Committee to complete a set of special reports as detailed in 75 Pa. CS § 8503 (j) to be submitted to the Pennsylvania House and Senate Transportation Committees. The report shall evaluate the following with respect to highly automated vehicles authorized by this chapter:

(1) Benefits and implications to this Commonwealth's workforce.
(2) Economic benefits and implications to this Commonwealth.
(3) Improvements to accessibility and mobility for persons with disabilities.
(4) Improvements to mobility options for the general public.
(5) Suggested changes to the laws of this Commonwealth.

The primary objective of this research was to conduct a thorough analysis of the impact of Act 130 within the unique context of Pennsylvania. This study explores the distinct benefits and challenges of HAVs, focusing on workforce development, economic growth, accessibility, and mobility improvements. Our goal is to provide actionable insights and recommendations for policymakers to help Pennsylvania harness the advantages of HAV technology while mitigating potential challenges. This research aims to contribute to shaping the future of transportation in Pennsylvania, aligning with the commonwealth's specific needs and objectives.

This executive summary outlines the process and findings from expert focus groups conducted in 2024. In collaboration with PennDOT and the HAV Advisory Committee, our research team identified 93 potential participants with relevant expertise across various sectors, including HAV vendors/software developers/automakers, trade associations, non-government organizations (NGOs), government agencies, consulting firms, academic researchers, and transit companies. From this pool, 35 experts agreed to participate in the focus group discussions. These sessions provided a diverse representation of backgrounds and perspectives, essential for a comprehensive discussion on the implications of HAVs in Pennsylvania.

The discussions were held across five focus group sessions on September 3, 4, 5, 12, and 13, supplemented by three shorter individual sessions on September 13, 20, and 26. These discussions were centered on Act 130's implications

and the broader effects of HAVs on Pennsylvania's workforce, accessibility, and mobility. The focus groups explored four key topics:

- Benefits and implications to this Commonwealth's workforce.
- Economic benefits and implications to this Commonwealth.
- Improvements to accessibility and mobility for persons with disabilities.
- Improvements to mobility options for the public.

Below, we provide a summary of the focus group findings, offering insights into how the introduction of HAVs can shape various aspects of public life and policy in Pennsylvania.

Workforce and economic implications

1. Act 130 marks a turning point for Pennsylvania's HAV industry: The enactment of Act 130 has brought legislation to support the testing and deployment of HAVs in Pennsylvania, marking a significant turning point in the state's highly automated vehicle industry. Prior to this legislation, the lack of legal support led some automated driving R&D companies to contemplate relocating or shifting significant portions of their business to other states, where early supportive laws were already in place. The enactment of Act 130 has not only enabled more comprehensive testing and scaling opportunities for AV companies in Pennsylvania but has also created a supportive legal environment that encourages these companies to stay and grow within the state. This legislation has helped protect existing jobs, facilitated the creation of new ones, and paved the way for significant growth in Pennsylvania's highly automated vehicle industry in the coming years.
2. Economic potential of HAVs in freight transportation: Focus group participants discussed the impact of HAVs across various sectors, including transit, passenger vehicles, freight, and more. There were multiple participants who felt strongly that HAVs hold significant economic potential for the freight sector, with benefits likely to materialize more immediately in freight compared to other sectors.
3. Creation of new job opportunities in the era of HAVs: The introduction of HAVs is anticipated to generate many job opportunities across Pennsylvania over the next decade, encompassing a wide range of sectors and skill sets. To succeed in this rapidly evolving landscape, workers will need to combine traditional mechanical skills with advanced expertise in areas such as artificial intelligence, cybersecurity, and data analysis.
4. Talent retention in the HAVs sector: Talent retention was another key topic discussed during the focus group session. Participants shared a concerning trend that individuals, particularly younger generations who earn AV/robotics-related degrees in Pennsylvania, often leave the state to pursue opportunities elsewhere. Participants acknowledged that the passing of Act 130 is a positive development. This legislation enables vendors to test HAVs in Pennsylvania, which could eventually lead to a transition into the manufacturing

phase. It will be interesting to see how these changes influence job opportunities and talent retention in the years ahead.

5. Impact on suburb/rural area economies: Participants discussed and found that HAVs offer significant opportunities to enhance connectivity and economic vitality in rural areas by improving first-mile and last-mile transit solutions. By bridging gaps in transportation services, HAVs can revitalize rural communities through improved job access, stronger links between rural and urban regions, and greater overall regional equity.
6. Post-research and development (R&D) opportunities: Some participants mentioned that, as Pittsburgh and its surrounding regions increase R&D investments in automated driving and HAV testing, a clustering effect of related technology companies may emerge, fostering a robust innovation ecosystem. This ecosystem will attract businesses specializing in crucial automated driving technologies—such as sensors, software development, and integrated systems—further accelerating technological integration and advancement.
7. The need to continuously monitor evaluate impact: Participants note that the economic impact of Act 130 has not yet fully materialized. For example, one participant explicitly noted the economic impact does not exist yet, since the act was only passed recently. They also noted that workforce changes will likely evolve over several years as the situation unfolds. Additionally, it remains unclear which businesses have obtained licenses under the new law since its enactment. Therefore, ongoing and long-term evaluations of workforce, economic, accessibility, and mobility factors are necessary to fully understand Act 130's influence on the development of HAVs in Pennsylvania.
8. Economic potential of HAVs in the Pittsburgh region suggested by participant's previous research: One participant referenced a conservative estimate from research [42] regarding the economic impact of the Pittsburgh region's automated systems industry. According to this study, the industry currently encompasses 71 companies employing over 6,300 individuals, generating significant economic benefits for the area.

Improvements to accessibility and mobility.

1. Impact on people with disabilities and older adults: A general consensus among focus group participants is that 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. However, to fully realize the benefits of HAVs for disabled and older passengers, participants highlighted several critical factors that need to be addressed.
2. Enhancing accessibility through first and last mile connectivity: Participants generally agreed that HAVs could significantly improve accessibility, particularly in regions with limited transportation options, such as

rural areas or underserved urban communities. In these locations, inadequate public transit services often leave residents with few reliable travel options. By offering convenient and flexible transportation solutions, HAVs can help bridge this gap, connecting people to vital services, employment opportunities, and essential resources that would otherwise be difficult to reach.

3. HAVs as a supplement to public transportation systems and freight industry: Many participants concurred that HAVs have the potential to complement—rather than compete with—public transportation systems and the freight industry, improving efficiency, expanding coverage, and enhancing cost-effectiveness.
4. Potential impact on urban and rural areas: Most participants believe that 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. This enhanced connectivity can lead to improved mobility within cities, reduced traffic congestion, and a more integrated urban landscape. Ultimately, the integration of HAVs can result in more efficient and user-friendly transportation systems that benefit all city dwellers.
5. Improving road safety through HAVs technology: HAVs are poised to significantly enhance road safety by strictly adhering to traffic laws and minimizing risks associated with human error. Unlike human drivers, who can be prone to distractions, fatigue, or misjudgments, HAVs operate based on consistent, data-driven decision-making processes. This adherence to traffic rules leads to more predictable and safer behavior on the road, potentially reducing the number of traffic violations and accidents. Participants believe by removing common human-related errors, HAVs can create a safer driving environment and improve overall road safety for everyone.
6. Upgrading infrastructure to support HAVs and public transportation: Infrastructure improvements are crucial for optimizing the performance of HAVs and enhancing the overall public transportation system. Upgrading road markings, protected spaces for vulnerable road users (VRUs), and others were discussed.

Recommendation on policy and legislation updates

1. Some focus group participants, particularly those representing HAV vendors and trade associations, suggested reducing regulatory oversight for Level 3 automated vehicles.
2. Some focus group participants recommended avoiding state-specific testing and reduce regulations.
3. Some focus group participants recommended allowing individual ownership under Act 130.
4. Enhancing public trust in highly automated vehicles is a shared concern.

5. Some focus group participants recommended establishing a detailed emergency response protocol for HAVs that includes procedures for identifying, securing, and disabling vehicles in emergency situations.
6. Some focus group participants recommended establishing enhanced training programs for first responders (e.g., police officers, firefighters, paramedics, hazmat teams) to effectively manage emergency situations involving HAVs, thereby improving safety and preparedness.
7. Some focus group participants recommended prioritizing the repair and maintenance of critical transportation infrastructure, such as road markings, signs, and traffic lights, to support the safe integration of HAVs into Pennsylvania's transportation network.
8. Some focus group participants recommended implementing policies to encourage the deployment of HAVs in rural areas to improve first-mile and last-mile transit solutions, enhance connectivity, and support regional economic growth.

1. Introduction

The rapid advancement in automated vehicle (AV) technology is expected to transform transportation in the coming decade. It is widely predicted that AVs will be in extensive use by around 2040, though estimates of when they will become fully mainstream vary (Litman, 2020). In another research, (Nikitas et al., 2021) suggest that by 2035, 75% of global light-duty vehicle sales will be self-driving vehicles, which would significantly reduce the demand for professional driving jobs. The development of Connected and Automated Vehicles (CAVs) is anticipated to impact numerous industries profoundly. Based on preliminary research into AV-related impacts, the industries expected to experience the most substantial shifts include automotive, technology, freight movement, personal transport, auto repair, medical care, insurance, law, infrastructure, land development, digital media, policing, and oil and gas (Clements & Kockelman, 2017).

As Highly Automated Vehicle (HAV) technology rapidly progresses, various states in the U.S. have introduced legislation to support its development. In Pennsylvania, the legislative framework for HAV is evolving with Act 130, a comprehensive amendment to Title 75 (Vehicles), signed into law in November 2022. This act strengthens Pennsylvania's role as a national leader in HAV research and development by establishing the regulation and operation of HAVs within the state. Building on Act 117, which introduced Chapter 85 to Title 75 specifically for HAVs, Act 130 refines the framework by defining and guiding the HAV Advisory Committee, thus enhancing the legal infrastructure to meet HAV technology’s complex demands and aligning Pennsylvania's vehicle laws with the advanced requirements of HAVs.

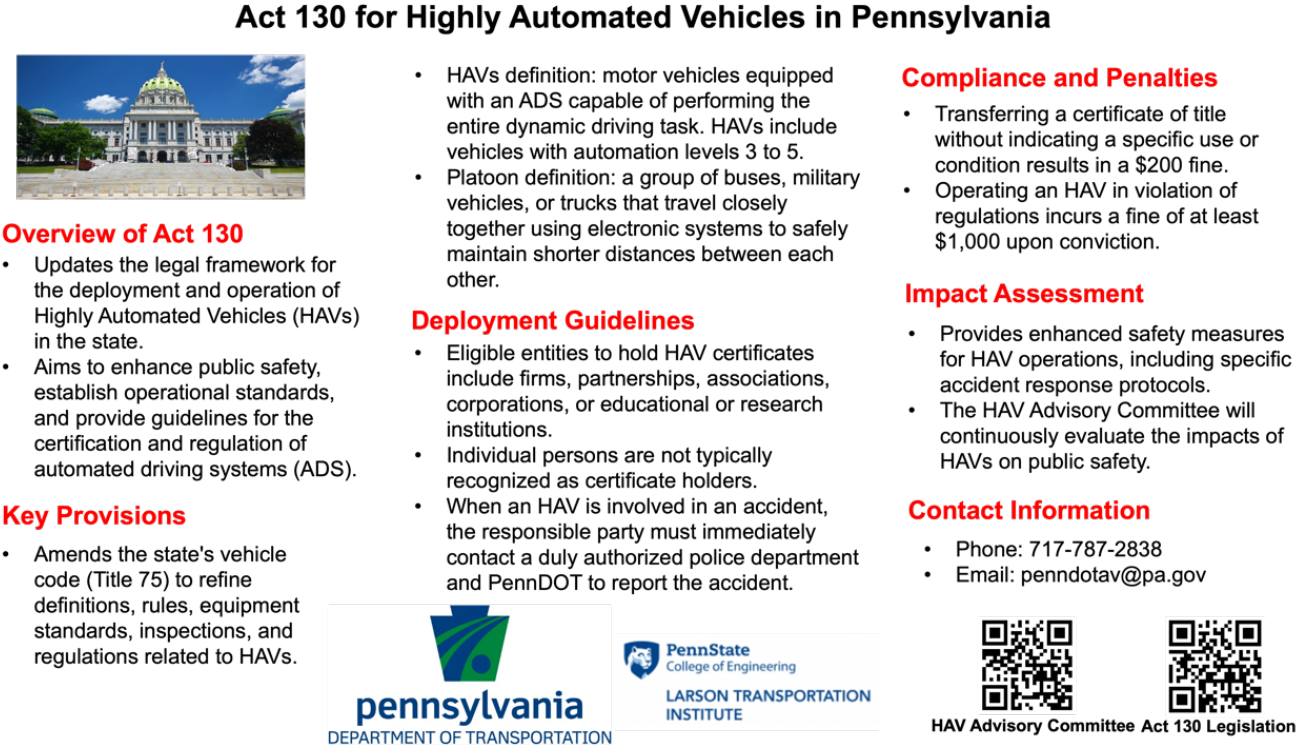


Figure 1 Act 130 Overview

Act 130 marks a major advancement and a milestone in Pennsylvania's regulatory approach to HAVs, particularly as it establishes the first legal pathway toward driverless operations, which were previously prohibited in the state. The act focuses on safety standards, operational protocols, and integrating HAVs into existing transportation systems. It mandates the formation of an advisory committee to steer HAV policy development, ensuring input from diverse stakeholders. Additionally, Act 130 establishes testing and certification procedures for HAVs, balancing public safety concerns with support for innovation. This structured regulatory framework and stakeholder collaboration are key to Pennsylvania's journey toward a modern and safe transportation ecosystem. Together with Title 75 and Act 117, Act 130 forms a comprehensive legal foundation that governs HAV operation and testing while considering the technology's broader societal impacts. By highlighting HAVs, the act emphasizes the importance of exploring how this technology will transform various facets of society.

Analyzing the impact of Act 130 on Pennsylvania is essential as the state navigates the transformative landscape of Highly Automated Vehicles. This legislative act marks a pivotal step for the Commonwealth in adopting HAV technology, making it critical to understand its implications fully. Studying Act 130 allows the Commonwealth to assess its influence on workforce dynamics, economic changes, and improvements in accessibility and mobility, particularly for individuals with disabilities. Additionally, Act 130 positions Pennsylvania as a leader in HAV adoption, underscoring the need for thoughtful policy development and implementation. This study aims to provide

insights and actionable recommendations that contribute to informed policymaking, ultimately positioning Pennsylvania at the forefront of HAV innovation and helping the state maximize benefits while addressing potential challenges and risks.

Penn State has been entrusted with supporting Pennsylvania Department of Transportation in this critical endeavor. The primary goal of this research project is to provide a comprehensive analysis of Act 130's impact within Pennsylvania's unique context. Specifically, the team will examine the implications of Act 130 and the broader effects of HAVs on Pennsylvania across four key areas:

- Benefits and implications to this Commonwealth's workforce.
- Economic benefits and implications to this Commonwealth.
- Improvements to accessibility and mobility for persons with disabilities.
- Improvements to mobility options for the public.

By delivering detailed insights and recommendations, this study will support effective policymaking, reinforcing Pennsylvania's role as a leader in HAV innovation and maximizing benefits for the Commonwealth while proactively addressing potential challenges and risks.

We structure the report as follows:

Section 2 of this report provides an overview of this existing research, aiming to build upon these foundations with a focus specifically tailored to Pennsylvania. In the expansive field of HAVs, our research acknowledges the extensive body of recent studies that have deepened understanding of HAV technology's potential impacts. While these studies are primarily global or national in scope and may not directly address Pennsylvania's unique context, they offer valuable insights in terms of study designs, methodologies, and findings that can inform and strengthen our approach.

Section 3 documents the methodology used to support this project. In collaboration with PennDOT and the HAV Advisory Committee, our research team identified 93 potential participants with relevant expertise across various sectors, including HAV vendors/software developers/automakers, trade associations, non-government organizations (NGOs), government agencies, consulting firms, academic researchers, and transit companies. From this pool, 34 experts agreed to participate in the focus group discussions. These sessions provided a diverse representation of backgrounds and perspectives, essential for a comprehensive discussion on the implications of HAVs in Pennsylvania.

Section 4 details the specific processes and steps of organizing the focus groups. We utilized Google Forms to survey participants' availability and divided them into five focus groups based on theme and availability. Due to scheduling

conflicts, one-on-one sessions were conducted with a few key stakeholders who were unavailable for the group sessions.

Sections 5 and 6 summarize the findings from the focus group and one-on-one sessions, focusing on workforce and economic impacts, and accessibility and mobility impacts, respectively. Section 7 summarizes the recommendations concerning Pennsylvania's HAV legislation and PennDOT policies and procedures, aimed at informing future policy decisions.

The appendix contains multiple task deliverables for reference, providing interested readers with detailed insights into the research methodology and steps. These include Appendix A Q&A Documents for Understanding Act 130 designed to help readers better understand the Act, Appendix B Interviewer Script for Workforce and Economic Impact Analysis, Appendix C Interviewer Script for Accessibility and Mobility Impact Analysis, Appendix D Information of Identified Stakeholders, and Appendix E Information of Final Focus Groups Participants.

2. Review the State of the Art

HAVs are expected to bring systematic impacts to many facets of our society. For example, research in North Carolina demonstrates their potential to enhance safety and efficiency (Bardaka et al., 2019). However, it was also found that personal AVs may induce travel demand, resulting in a 5.4% increase in daily vehicle hours traveled, and a 17.2% increase in daily hours of delay. A study on commercial and shared vehicle operations reveals operational optimizations, promising enhanced efficiency and cost-effectiveness (Part et al., 2021). Meanwhile, HAVs' environmental impact is examined in (Massar et al., 2021), presenting a nuanced view, acknowledging that their effects on greenhouse gas emissions depend on factors like vehicle efficiency and energy sources. These reports collectively portray HAVs as transformative forces, offering benefits in safety, mobility, and sustainability, yet necessitating careful infrastructure and regulatory considerations.

Figure 2 Representative existing studies

Acknowledging the importance of building upon the existing knowledge base rather than reinventing the wheel, we undertake a brief yet systematic review of these pioneering HAV-related studies in this chapter. This review serves as the foundation upon which we will build our research, leveraging the collective insights and experiences of researchers from diverse geographical contexts to tailor our approach effectively to the specific needs and dynamics of Pennsylvania. In the remainder of this chapter, we will elaborate on the benefits and improvement of HAVs from four aspects: workforce, economy, accessibility, and mobility.

2.1 Impacts of HAV on Workforce

HAVs technologies are poised to bring significant changes to the workforce. In the US, the Department of Commerce estimates that 15.5 million U.S. workers were employed in occupations that could be affected (to varying degrees) by the introduction of AVs (Beede & Powers, 2017). They divide these occupations into "motor vehicle operators" and "other on-the-job drivers." Motor vehicle operators are occupations for which driving vehicles to transport persons and goods is a primary activity, are more likely to be displaced by AVs than other driving-related occupations.

Groshen et al. (2018) estimate that 60 to 65 percent of heavy and tractor-trailer driver jobs could be eliminated with full adoption of Level 4 or 5 driving automation. Although current data are somewhat outdated, approximately 300,000 to 500,000 long-haul trucking jobs exist within a total of two million heavy truck and tractor-trailer positions nationwide (USDOT, 2021). Millions more hold roles where driving is a secondary duty, such as construction workers, utility workers, real estate agents, appraisers, and tradespeople who drive between job sites. Additionally, over five million jobs in automotive repair and highway maintenance support these driving roles. Overall, driving automation may offer other on-the-job drivers improved productivity and working conditions, though motor vehicle operators face greater risk of displacement.

Automated trucks offer unique opportunities to generate significant economic growth and create well-paying new jobs in California. A new study released by the Silicon Valley Leadership Group Foundation found that the impact of automated trucking in California would increase the state's economy by upwards of $6.5 billion or more, as well as grow wages and employment for workers without prompting mass driver layoffs (Waschik, 2021). They found that 45,475 jobs at national level are increased by 2050, equivalent to an increase of 0.023 percent. In California, there are 2,394 jobs created under this scenario--an increase of 0.010 percent. New hiring reaches a minimum of about--11,600 in 2033, about 1.6 percent of baseline employment of long-haul truckers in 2033. But by the time the whole fleet has been converted to accommodate automation, net hiring ultimately trends to about +20,000, particularly in areas such as managing high-value goods, hazardous materials, or cross-border movements.

Michigan's heritage as driving force behind America's auto industry is well known and highly regarded. The 20% of Michigan workers directly participating in the automotive industry. The decreased demand for drivers will inevitably stem directly from the commercialization of automated technologies (Brogan, 2018). The new job opportunities are mainly concentrated in the following areas: automated vehicle testing, research and development, vehicle maintenance and management. These jobs can be made up for on the state through new mobility jobs related to technology, but this pivot will require a certain degree of retraining. On the other hand, a Texas Department of Transportation study on Level 2 commercial truck platooning concluded that the technology is ready for commercialization under certain road, fleet, and operational conditions (Yankelevich et al., 2018). Focus groups with industry leaders and officials in Texas, California, and Michigan (N=33) suggested that workers in roles impacted by automation could transition to emerging positions, such as remotely supporting AV passengers, monitoring AV operations, and providing customer service. Participants also stressed the importance of public awareness campaigns to build trust in AVs, highlighting a demand for marketing, public relations, and communication professionals.

The report by Securing America's Future Energy (SAFE) assesses the regional unemployment impact of AV deployment, noting the highest effect in the Northeast, where unemployment could increase by 0.06–0.14 percentage points, and a slightly lower impact in the Midwest, with a peak increase of 0.06–0.13 points. The report also

highlights expected increases in accessible job positions in specific cities due to AV deployment: Benton Harbor, MI (+228%), Gary, IN (+215%), Elmira, NY (+111%), and Wilmington, DE (+201%), largely due to reduced commuting times.

A recent Chamber of Progress report estimates that each 1,000 AVs produced and deployed annually will generate about 190 manufacturing and servicing jobs (Chamber of Progress, 2024). Key findings include: (1) a moderate economic scenario projecting the deployment of 9 million AVs over the next 15 years, creating 114,000 jobs, and (2) an optimistic scenario with 36 million AVs deployed, adding 455,000 jobs. Additionally, jobs in the AV industry are well-paying, with 82% offering wages above the U.S. median. AVs could strengthen the U.S. auto industry's resilience and foster new job centers in tech-rich regions. To capitalize on these economic opportunities, further technology development is essential.

In summary, the adoption of HAV technologies represents both a disruptive shift and an opportunity within the U.S. workforce. While certain sectors, particularly those with driving as a primary duty, may face significant changes or risks of displacement, the broader implications for the economy indicate potential growth and job creation across various fields.

2.2 Impacts of HAV on Economic

HAVs are expected to have profound economic implications. The U.S. Chamber of Commerce forecasts substantial economic growth potential, driven by enhanced productivity and efficiency, and an annual savings of $94 billion from fewer accidents (Shapiro & Yoder, 2023). A University of Texas study echoes this, projecting significant economic benefits through reduced transportation costs and optimized logistics (Clements & Kockelman, 2017). Another study discusses the potential of AVs to stimulate economic growth through technological innovation and improved transportation systems (Winston & Karpilow, 2020). Similar studies can also be found in Europe (Raposo et al., 2022; Alonso et al., 2020).

The automotive industry, a key sector in the U.S. economy employing 1.7 million people and contributing $500 billion in annual wages (about 3–3.5% of GDP), is the most directly impacted by AVs (Clements & Kockelman, 2017). AVs are expected to reshape vehicle use, design, and business strategies across industries. Americans currently spend 84 billion hours annually driving (about 373 hours per person), time that could be redirected toward productive activities if vehicles were self-driving. Research by Securing America's Future Energy (SAFE, 2018) estimates that by 2050, AVs could reduce direct economic losses by $118 billion per year and improve quality of life by $385 billion annually, with total benefits ranging from $3.2 to $6.3 trillion.

McKinsey estimated that the economic gains of driverless vehicles in the trucking industry could range from $100 billion to $500 billion/year by 2025. The bulk of these savings would come from the elimination of the wages of

truck drivers. Morgan Stanley estimated software costs rising from 10% of current car values to 40% in a CAV environment. IHS Technology estimated that U.S. self-driving software and its corresponding updates will grow from $680 million in 2025 to $15.8 billion in 2040.

Introducing automated vehicles will also bring economic benefits to the government, such as reduced healthcare costs due to fewer road accidents. Research by (Shapiro & Yoder, 2023) has found that accident rates would fall sharply (compared with accident rates in 2021) if AVs represented 25 percent of U.S. motor vehicles. With Basic AVs, they estimate 571,000 fewer accidents, 5,000 fewer fatalities, and economic savings of $38 billion. With Standard AVs, they estimate 1,145,000 fewer accidents, 9,000 fewer fatalities, and economic savings of $75 billion. With Highly AVs, they estimate 1,442,000 fewer accidents, 12,000 fewer fatalities, and $94 billion in savings.

In 2019, the National Highway Traffic Safety Administration (NHTSA) estimated the motor vehicle crashes cost American society $340 billion and examines the costs of one year of crashes that killed an estimated 36,500 people, injured 4.5 million, and damaged 23 million vehicles. More recent data indicate that the annual social cost of accidents has exceeded $1 trillion. A conservative estimate suggests that if automated vehicles only address accidents caused by severe driver errors (such as distraction, drunk driving, and speeding), they will bring over $500 billion in benefits annually. Automated vehicles could also bring $58 billion in benefits to society by reducing oil consumption and significantly lowering congestion costs by improving road capacity and reducing bottlenecks.

Visich (2019) estimates that widespread adoption of AVs could generate nearly $800 billion annually in social and economic benefits by 2050. These benefits primarily stem from reducing vehicle crashes, returning productive time to commuters, enhancing energy security by lowering oil dependence, and providing environmental gains. Key components include $71 billion from congestion mitigation, $118 billion from economic impact of accident reduction, $385 billion in quality-of-life improvements, $58 billion from reduced oil consumption, $153 billion in time savings, and $10 billion from reduced taxi service costs.

A new study released by the Silicon Valley Leadership Group Foundation (Waschik, 2021) found that the impact of automated trucking in California would increase the state's economy by upwards of $6.5 billion or more, as well as grow wages and employment for workers without prompting mass driver layoffs.

In conclusion, the economic potential of HAVs spans a wide array of sectors, with the promise of substantial productivity gains, reduced accident costs, and significant quality-of-life improvements. The automotive industry stands at the forefront of this transformation, likely reshaping employment, design, and usage patterns. Additionally, AVs could yield major societal benefits by mitigating accidents, improving quality of life and access, reducing congestion, and lowering oil consumption, collectively contributing to an estimated economic benefit of up to $6.3

trillion by mid-century. As deployment progresses, these technologies offer a transformative pathway toward a more efficient, safe, and economically robust future.

2.3 Impacts of HAV on Accessibility

HAV studies also emphasize their transformative potential for individuals with disabilities. How AVs can significantly enhance transportation services for people with disabilities is systematically reviewed in (Dicianno et al., 2021). Michigan State University's report on AVs for special needs individuals points to increased mobility independence (Kassens-Noor et al., 2021). Another study presents an interesting view of AVs as both a potential boon and a challenge for people with disabilities (Bhuiya et al., 2022). Similar studies were also conducted by ITS America, National Highway Traffic Safety Administration, and others (Bayless & Davidson, 2019; Claypool et al., 2017).

People with disabilities form a unique but substantial group. According to U.S. Census data, nearly one in five people in the United States has a disability. There are over 57 million people with disabilities in the United States, and more than 40% of them rely on others for transportation, while over 70% are completely restricted in their travel. It is estimated that due to physical or economic limitations, age, or vehicle malfunctions, 10% to 20% of the adult population in the U.S. cannot or should not drive (Kassens-Noor et al., 2021). Because reliance on cars is a common feature of typical American cities, non-drivers often face limited transportation options while bearing the economic, social, and environmental costs caused by drivers. The large population of people with disabilities also represents a significant potential demand for transportation services.

AVs present a promising solution for addressing the travel needs of people with disabilities, potentially enhancing their mobility and access to essential services. AVs could significantly increase employment opportunities and independence for people with disabilities and seniors alike. According to studies by the U.S. Chamber of Commerce and the AARP Policy Institute, widespread AV adoption could lead to over a 14% rise in annual miles traveled by non-drivers, with substantial gains in mileage for seniors and those with special needs: standard AVs are projected to increase seniors' mileage by 2.5 billion miles and non-drivers' by 1.3 billion miles, while highly automated AVs could boost travel for people with disabilities by 4.6 billion miles, seniors by 4.9 billion, and non-drivers by 2.4 billion (Dunmoyer, 2024; Bayless & Davidson, 2019). Compared to the usual 1% annual increase in Vehicle Miles Traveled (VMT), AVs have the potential to substantially expand travel accessibility, driving a notable increase in overall travel volume.

Moreover, a study by the National Institute on Disability indicates that eliminating transportation barriers to employment for people with disabilities through the adoption of AVs could bring 9.2 million new labor force participants, generate $867.7 billion in GDP, $1.6 trillion in economic output, and $417 billion in new income. Additionally, it is estimated that accessible AVs could increase employment opportunities for up to 2 million people

with disabilities. Currently, there are 18 to 25.5 million people with travel restrictions in the U.S., including 13.4 million aged 18 to 64 and 11.2 million aged 65 or older. All these groups will benefit from AVs.

However, the impact of AVs and how they will be implemented are still subject to numerous planning, political, technical, and ethical debates. People with disabilities face travel barriers due to the lack of accessible transportation options, lack of awareness and information about available services, scheduling issues, high transportation costs, and insufficient funding in insurance models. Recent findings suggest that people with disabilities may face discrimination when trying to purchase or operate AVs, whether through laws targeting them or the vehicle systems themselves (Dicianno et al., 2021). Furthermore, awareness and willingness to accommodate people with special needs, as well as understanding what their needs might be, have not been well studied.

To enable people with disabilities to practically and independently use AVs, issues related to door-to-door navigation, signage, and curbside pick-up/drop-off must be addressed. For those facing physical barriers, such as mobility-impaired or visually impaired individuals, navigating through obstacles in the built environment to meet vehicles or reach bus/taxi stops will still be a challenge. Mobile device-based assistive applications that tag (or otherwise identify and report on) obstacles in the built environment can be valuable tools to help mitigate this challenge (Sivakanthan et al., 2023). AVs may also need street-level data to successfully locate, navigate, and park at accessible pick-up and drop-off points along sidewalk corridors.

In conclusion, the widespread adoption of automated vehicles holds the potential to significantly enhance mobility and independence for people with disabilities. By offering more flexible travel options, AV technology can not only improve their quality of life but also create new employment opportunities and economic benefits.

2.4 Impacts of HAV on Mobility

The advent of HAVs is also set to revolutionize public mobility. For example, a “Mobility 2030” report predicts a transformation in the mobility landscape, emphasizing more efficient and accessible transportation systems (Simpson et al., 2019). The USDOT’s “Preparing for the Future of Transportation” document highlights the integration of AVs into existing transport networks, promising enhanced safety and reduced congestion (USDOT).

According to previous studies, AVs can improve traffic flow. In uninterrupted traffic, automated vehicles can increase road capacity by 50%. A simulation study on a four-lane highway found that traffic flow improved when the penetration rate of automated vehicles exceeded 30%. When the penetration rate exceeded 40%, the impact of automated vehicles was significant (Park et al., 2021). Additionally, other studies have found that when the penetration rate of automated vehicles reaches 100%, road capacity in urban areas increases by 40%, while highway capacity increases by 80%.

In terms of travel time, research has shown that AVs are more effective on congested roads, significantly reducing travel time when the adoption rate is 20% (Llorca et al., 2022). Automated driving reduces the burden of commuting, which may encourage people to move farther from their workplaces, leading to urban sprawl. The average commuting distance is expected to double, and VMT will increase by one-third. Therefore, the large-scale adoption of automated vehicles is expected to influence residential choices, prompting households to choose suburban or rural areas farther from their workplaces. In scenarios of high market penetration for automated vehicles, particularly connected and automated vehicles, the proportion of the population in suburban and rural areas will increase.

Furthermore, automated driving technology is expected to enhance freight efficiency and reduce freight costs. Automated vehicles are anticipated to lower energy consumption and vehicle emissions, provided the technology is effectively implemented and widely adopted. In the Triangle Region of North Carolina (Bardaka et al., 2021), it is predicted that by 2045, with a 75% market penetration rate of personal automated vehicles, the daily VMT will increase by 3.6%, and traffic congestion will also significantly increase.

A recent report from the Center for Sustainable Systems at the University of Michigan summarizes the potential energy impacts of AV mobility. The report notes that AVs are expected to reduce congestion, leading to a 0-4% decrease in fuel consumption, though this benefit may be offset by increased VMT. Additionally, AVs may promote eco-driving practices that reduce energy use by up to 20%; however, if AV algorithms do not prioritize efficiency, actual fuel savings could be negligible. Platooning, where vehicles travel closely together, is expected to lower energy consumption by 3-25%, depending on factors like vehicle numbers, spacing, and type.

The emphasis on comfort and productivity in AVs could de-emphasize performance features like rapid acceleration, potentially reducing fuel consumption by 5-23%. Increased AV safety may also reduce the likelihood of crashes, which could allow for lighter vehicles, further lowering fuel use by 5-23%. Right-sizing vehicles according to specific trip needs could decrease energy use by 21-45%, particularly when combined with a ride-sharing model.

However, higher highway speeds enabled by AV safety improvements may increase fuel consumption by 7-30%. Travel costs are also expected to drop with AVs due to lower insurance and time costs, likely boosting travel demand and potentially increasing energy use by 4-60%. New user groups, such as elderly and disabled individuals, are expected to increase VMT, adding 2-10% to fuel consumption. Finally, ride-sharing models that leverage AVs could cut energy use by 0-20% due to reduced labor costs. Overall, these factors suggest that AV adoption may lead to both substantial energy savings and increased demand.

In summary, the widespread adoption of HAVs has the potential to transform public mobility, enhancing the efficiency, accessibility, and sustainability of transportation systems. Studies and reports forecast that AV integration can significantly improve traffic flow and road capacity, particularly when penetration rates are high, while reducing

travel time on congested roads. However, increased ease of commuting could lead to urban sprawl as people move farther from their workplaces, potentially increasing VMT. Freight efficiency is also expected to improve, contributing to reduced transportation costs and energy use.

3. Research Methodology

This section documents the methodology developed for this project. Our aim was to analyze the impact of workforce, economic, accessibility, and mobility considerations under Act 130 in Pennsylvania. We organized focus groups to collect data, and the overall research framework supporting our approach is illustrated in Figure 3.

Phase 1–Focus Group Preparation: The initial phase involved preparing for the focus groups to ensure their effectiveness and relevance. This included clarifying the discussion themes and objectives, designing appropriate questions, and guiding participants to share relevant perspectives and experiences. Preparation also involved a thorough understanding of Act 130 and the development of related questionnaires to facilitate targeted discussions.

Phase 2–Conducting Focus Groups: In this phase, we established and conducted the focus groups to complete data collection and gather experts' opinions on the development of HAVs in Pennsylvania. This process enabled us to capture both qualitative and quantitative data, providing insights into the opportunities, challenges, and potential impacts of HAV deployment. The diverse perspectives collected—from technical to regulatory and societal—will be crucial for informing future research directions and policy recommendations.

Phase 3–Individual Interviews: To enhance the results of our project, we conducted individual interviews as a supplementary measure to refine our research. These interviews allowed us to delve deeper into specific topics that emerged during the focus group discussions, enabling a more comprehensive understanding of expert insights on HAVs and Act 130. Gathering detailed and personalized responses helped us address any gaps in the data, validate key findings, and enhance the overall robustness of our conclusions.

Phase 4–Review and Summary of Results: The final phase involved reviewing and summarizing the results, which enabled us to draw meaningful conclusions from the collected data. We recorded the responses from the focus group experts and converted them into qualitative and quantitative data, providing a balanced perspective on the insights gained. This step allowed us to analyze patterns, identify key themes, and quantify the significance of various viewpoints. By systematically organizing the data, we ensured that the findings accurately reflect the experts' opinions and provide valuable input for decision-making and future research directions in the development of HAVs in Pennsylvania.

For a more detailed description of these processes, please see the subsequent sections in this chapter.

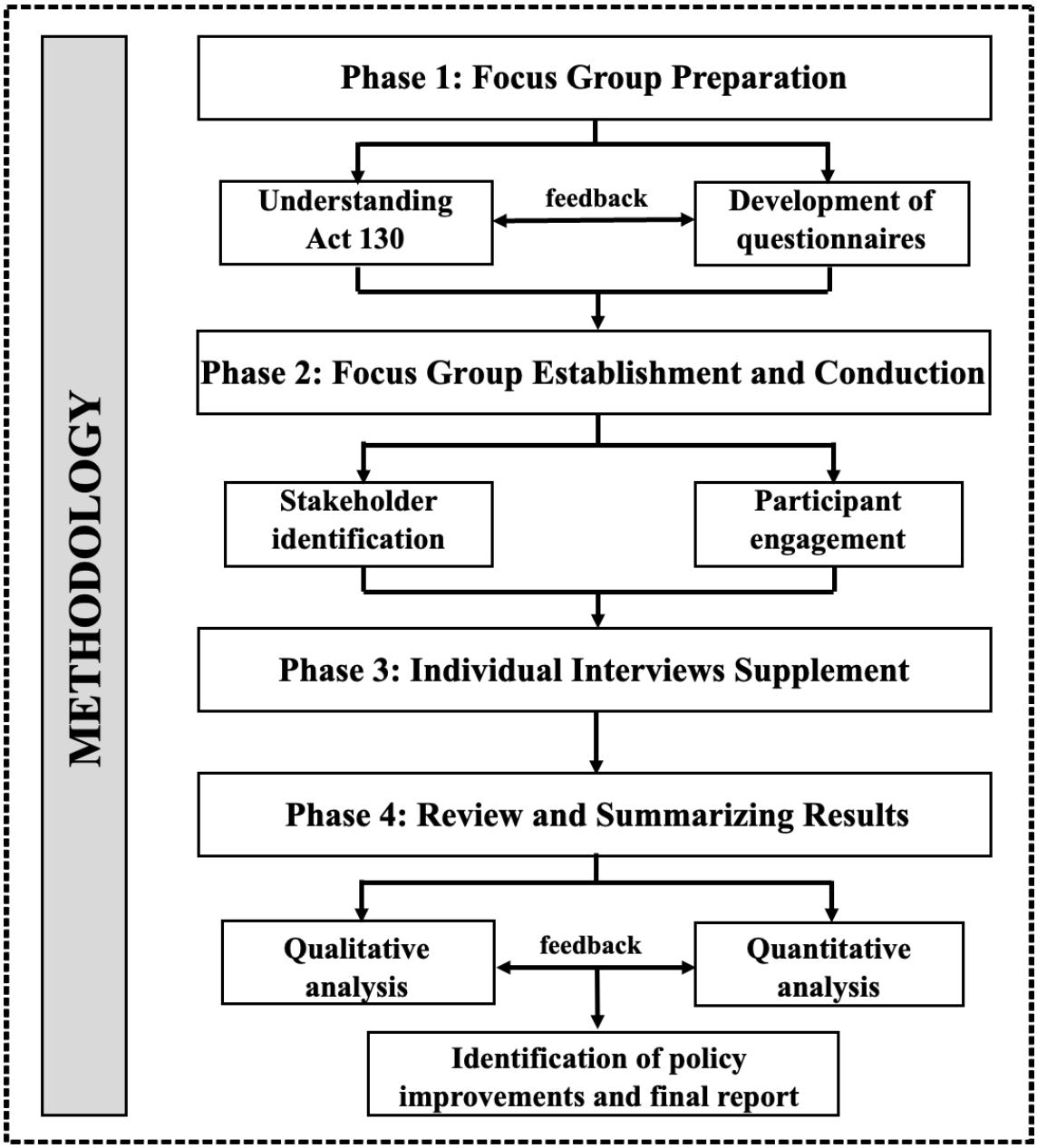


Figure 3 Overview of the research methodology

3.1 Focus Group Preparation

Preparation for the focus group is a foundational step essential to ensuring an effective and relevant discussion on HAVs. This phase includes a series of structured steps to clarify key themes and objectives, enabling a targeted and meaningful exploration of participants' insights.

3.1.1 Understanding Act 130

The initial task in our project involved gaining a comprehensive understanding of Act 130 of 2022. This task was essential, as it established the groundwork for all subsequent activities in the study. Our team examined the specifics of Act 130, analyzing its clauses, objectives, and potential impacts on the current transportation ecosystem. In collaboration with the PennDOT team, we also conducted an in-depth review of related state policies and procedures. This review was crucial for identifying gaps or opportunities for improvement within the existing framework in light of the new legislation.

To support this understanding and prepare for an effective focus group discussion, we developed a series of informational materials. These included (1) an informative brochure outlining the key aspects of Act 130, and (2) a comprehensive Q&A document addressing potential questions that arose during the focus group sessions, ensuring the team was well-prepared for meaningful discussions, as detailed in Appendix A.

These materials were developed through an iterative process, with continuous refinement to ensure clarity and accuracy. Our objective was to create resources that not only enhanced our team's understanding but also served as valuable reference materials for stakeholders involved in subsequent project phases. By the end of this phase, our project team had a thorough understanding of Act 130 and its relationship with existing transportation policies in Pennsylvania. This foundational knowledge was essential for the successful execution of future project tasks, particularly in enabling informed and productive focus group discussions.

3.1.2 Development of Questionnaires

After reviewing Act 130 and multiple HAV-related studies, our focus shifted to constructing effective tools for our study—specifically, questionnaires designed to gather targeted insights from focus groups. We employed a systematic approach to carefully develop each questionnaire, ensuring alignment with our research objectives. This process began with formulating questions that addressed key aspects of Act 130's impact, crafted to be clear, unbiased, and structured to elicit detailed responses.

The questionnaire was designed by drafting questions that addressed specific impact areas of Act 130, balancing open-ended and closed questions to collect both quantitative and qualitative data. The draft then underwent a thorough review by PennDOT to refine questions for relevance, clarity, and effectiveness. Based on feedback, we made necessary revisions and finalized the questionnaire to ensure it captured pertinent data effectively. The final product was a set of precise, well-constructed questionnaires, detailed in Appendices B and C.

By carefully defining the scope of discussion, we crafted questions that were not only relevant but also encouraged participants to share diverse perspectives and personal experiences. This phase also included a comprehensive review of Act 130 to fully understand its implications, along with the development of related questionnaires aimed at

addressing core issues surrounding HAV implementation. This thorough preparation ensured that discussions remained focused and productive, allowing participants to explore specific areas of interest and policy considerations while fostering deeper engagement with the topic at hand.

3.2 Establishment and Conduct of Focus Groups

3.2.1 Stakeholder Identification

In this phase, we focused on identifying key stakeholders and setting up focus groups. In close collaboration with the HAV Advisory Committee, we identified individuals and groups either directly impacted by or with expertise in areas such as Pennsylvania's workforce, economic implications, accessibility, and overall mobility.

During the stakeholder identification process, we worked closely with the HAV Advisory Committee to identify stakeholders based on their impact, influence, or expertise in HAVs implementation. Potential sources for stakeholder identification include:

- Recommendations from the HAV Advisory Committee
- Past attendees of the Transportation Engineering and Safety Conference (TESC)
- Previous participants of the PA AV Summit
- Attendees from past ITS Pennsylvania events
- Connections that Penn State and Larson Transportation Institute (LTI) have built and maintained.

The final list of identified stakeholders is shown in Appendix D.

3.2.2 Focus Group Establishment and Participant Engagements

After identifying the stakeholders, we organized them into two distinct focus group categories. The first group centered on workforce and economic implications, while the second focused on accessibility and mobility enhancements. We carefully planned the logistics for these focus groups, including scheduling, meeting formats, and strategies to address potential challenges, fostering productive and insightful discussions. Detailed information on the focus group stakeholders is provided in Section 4.

The primary objective of these focus groups was to extract meaningful insights that directly informed our research goals, aiming to yield actionable data that significantly deepened our understanding of HAVs' multifaceted impacts. We anticipated gaining a rich, multi-dimensional perspective that would guide subsequent stages of the project, particularly in shaping evaluations and recommendations tailored to Pennsylvania's unique context.

Conducting these focus groups was central to our research project, as it allowed us to capture valuable insights from key stakeholders. Through the careful execution of these sessions, our goal was to gather high-quality qualitative data that substantially contributed to the overall objectives of our project. The focus group structure was illustrated

in Figure 4. Each session was moderated to ensure all voices were heard, encouraging open and honest dialogue aligned with our research objectives. Participants were encouraged to share their perspectives on issues relevant to their expertise. Due to the conversational nature of focus groups, not all participants may have responded to each question, and opposing perspectives may have emerged among participants. We strived to create a supportive environment for active participation, characterized by a welcoming atmosphere, clear discussion topics, and engaging questioning techniques.

Sessions were recorded with participants' consent to facilitate thorough analysis. Recordings were transcribed verbatim, and additional notes were taken to capture non-verbal cues and group dynamics. Confidentiality was strictly maintained to ensure participants felt comfortable sharing openly. After each session, our focus shifted to preparing the collected data for analysis, which included tasks such as transcribing recordings, organizing notes, and structuring the data for efficient and thorough analysis.

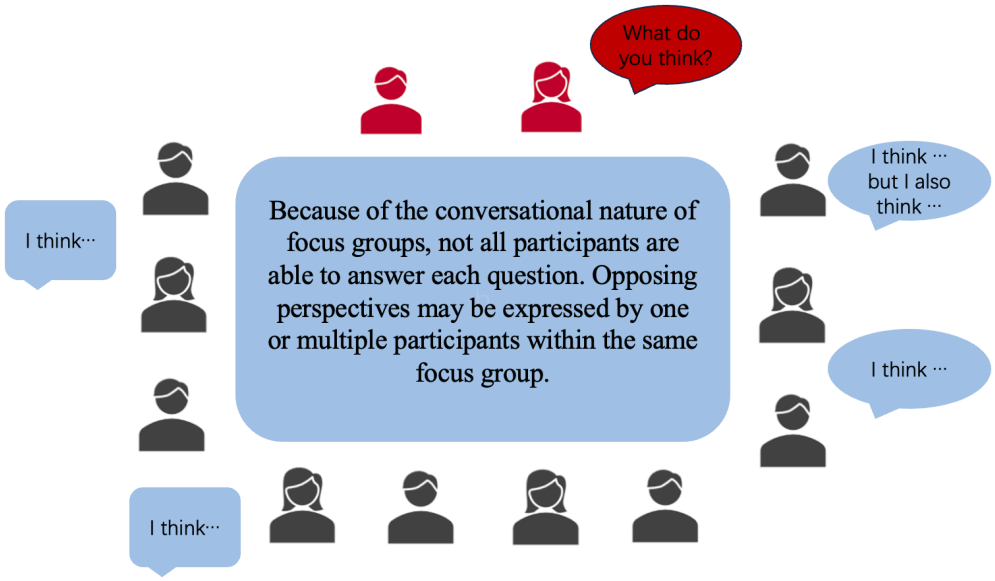


Figure 4 Collecting data through structured focus group conversations

3.3 Individual Interviews

To gain further insights and feedback on HAV development in Pennsylvania, we organized additional one-on-one meetings following the focus group sessions. These meetings provided a unique platform for personalized, in-depth discussions, allowing participants to openly share specific concerns, experiences, and suggestions that may not have surfaced in the group setting. This format enabled us to explore areas of interest more thoroughly, clarify any ambiguities, and deepen our understanding of individual perspectives on HAV implementation and its implications. Using structured guiding questions, we gathered targeted feedback on topics such as traffic safety, privacy, and local

employment impacts. The results from these one-on-one discussions provided valuable data for subsequent project analyses, helping us craft more precise policy recommendations tailored to Pennsylvania.

Figure 5 illustrates the structure of the one-on-one interviews, with the moderator posing HAV-related questions and the participant sharing their insights.

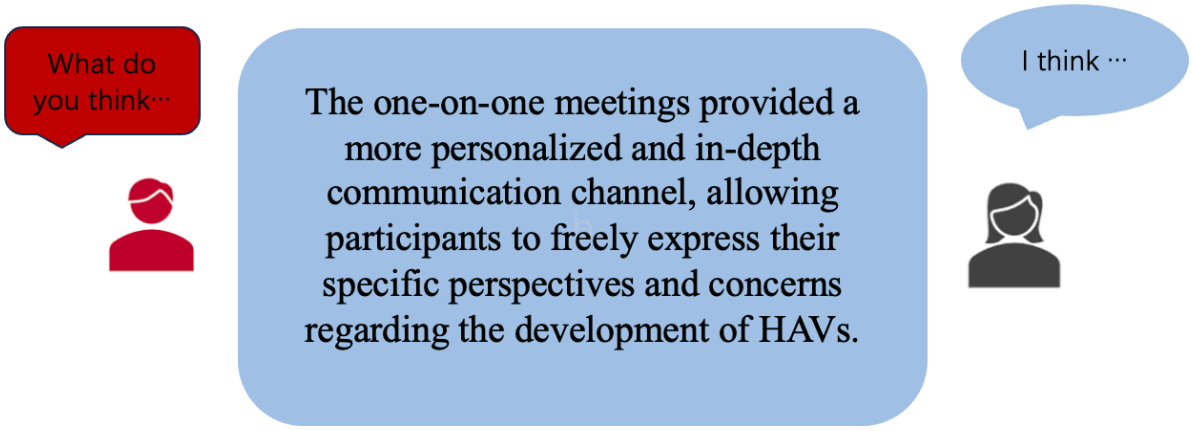


Figure 5 Collecting data through one-to-one meeting conversations

3.4 Review and Summarizing Results

In this phase, we analyzed and synthesized the data obtained from the focus group sessions, serving as a crucial step in converting raw data into coherent, actionable insights. Our aim was to ensure that the rich qualitative and quantitative data collected was effectively harnessed to inform and summarize results.

- **Data Organization**: Initially, all collected data, including transcriptions, notes, and recordings, has undergone systematic organization to ensure efficient analysis.
- **Qualitative Analysis**: By employing qualitative data analysis methods, the team has identified recurring themes, patterns, and discrepancies within the responses. This process has involved coding the data and categorizing it into meaningful groups.
- **Quantitative Analysis**: We have reviewed the quantitative data materials mentioned by experts during the group meetings, carefully reading and extracting key data information. Additionally, we have analyzed information regarding the types of organizations represented by the experts participating in the conference, which has helped ensure the comprehensiveness of our data.
- **Key Findings Synthesis**: Upon completion of the analysis, the team has distilled the extensive data into core insights relevant to the study's objectives.

- **Insight Translation**: The final step has involved translating these key findings into actionable insights, interpreting the data within the context of our research goals. This process has led to practical recommendations and strategies.

Finally, our identification of Policy Improvements was a comprehensive endeavor aimed at enhancing PennDOT's existing policies and procedures about HAVs in response to the insights gained from our research. This task was structured into multiple phases to ensure a thorough and effective approach:

- **Policy Review and Analysis**: In the initial phase, a meticulous review of PennDOT's related policies and procedures has taken place. This review has concentrated on understanding the alignment of these policies with Act 130 and the insights derived from our research. The primary goal has been to pinpoint areas where current policies may require adjustments to address the challenges and opportunities presented by HAVs.
- **Data-Policy Alignment**: In this phase, we have harmonized the findings from our focus groups with the existing policy framework. This has involved mapping specific insights to relevant policy areas and identifying any disparities or gaps.
- **Gap Analysis and Recommendations**: Once gaps have been identified, a comprehensive analysis has been conducted to comprehend the implications of these gaps. Concrete recommendations have been developed, encompassing proposals for new policies or amendments to existing ones to better align with the realities of HAVs in Pennsylvania.

4. Focus Group Formation and Data Collection

To assess the impact of Act 130 on Pennsylvania's economy, workforce, accessibility, and mobility, we organized focus groups and invited experts to discuss HAV-related issues. This chapter outlines the selection of 93 participants, their division into five focus groups, and the follow-up process. The key discussions and insights from the experts are documented in the detailed process below.

4.1 Participant Selection and Invitation

We carefully selected 93 participants based on their expertise and relevance to the focus group themes. The detailed information of those participants is shown in Appendix D. An invitation email was sent to each participant, outlining the study's objectives and requesting their participation in the focus group sessions.

To gather responses efficiently, we designed a questionnaire survey that was distributed via email. We successfully collected 34 responses using Google Forms.

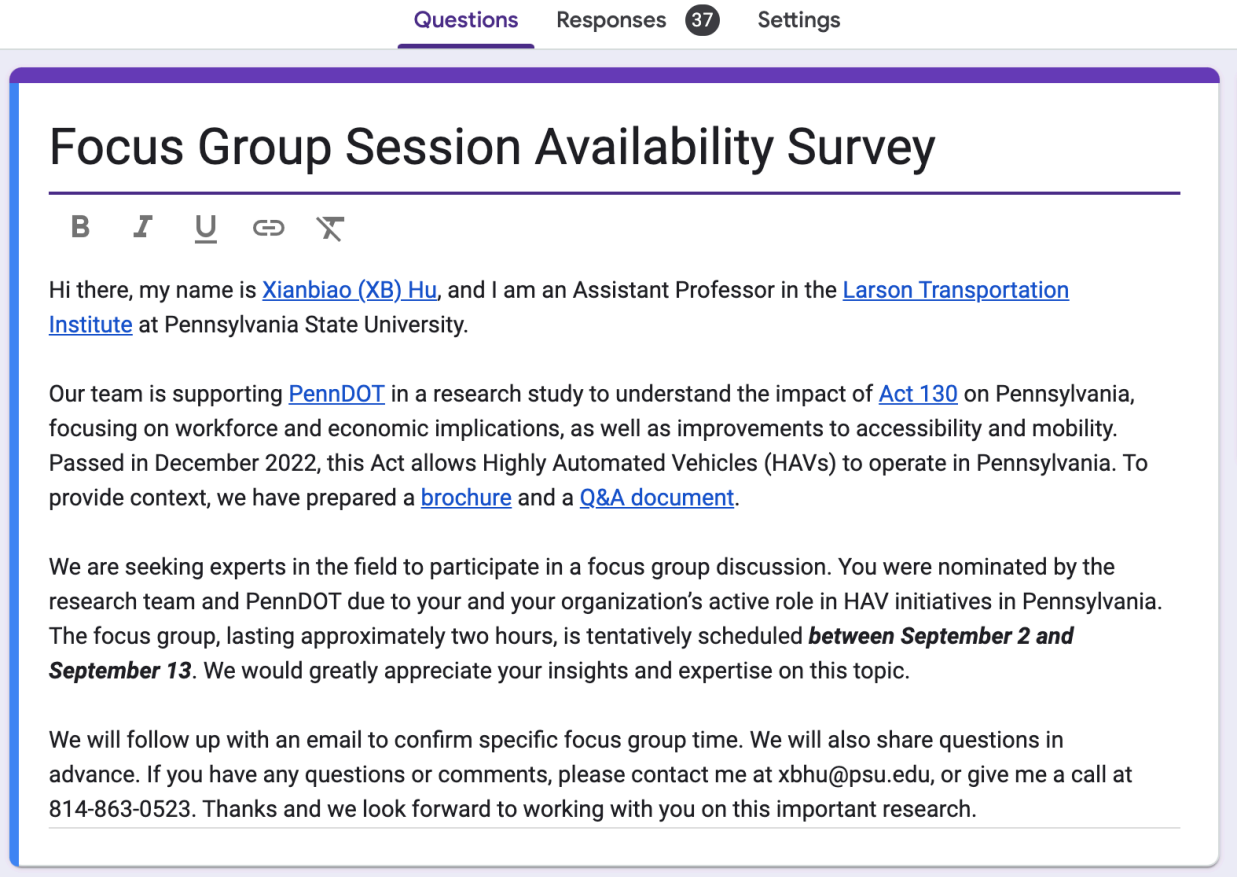


Figure 6 Focus group session availability survey

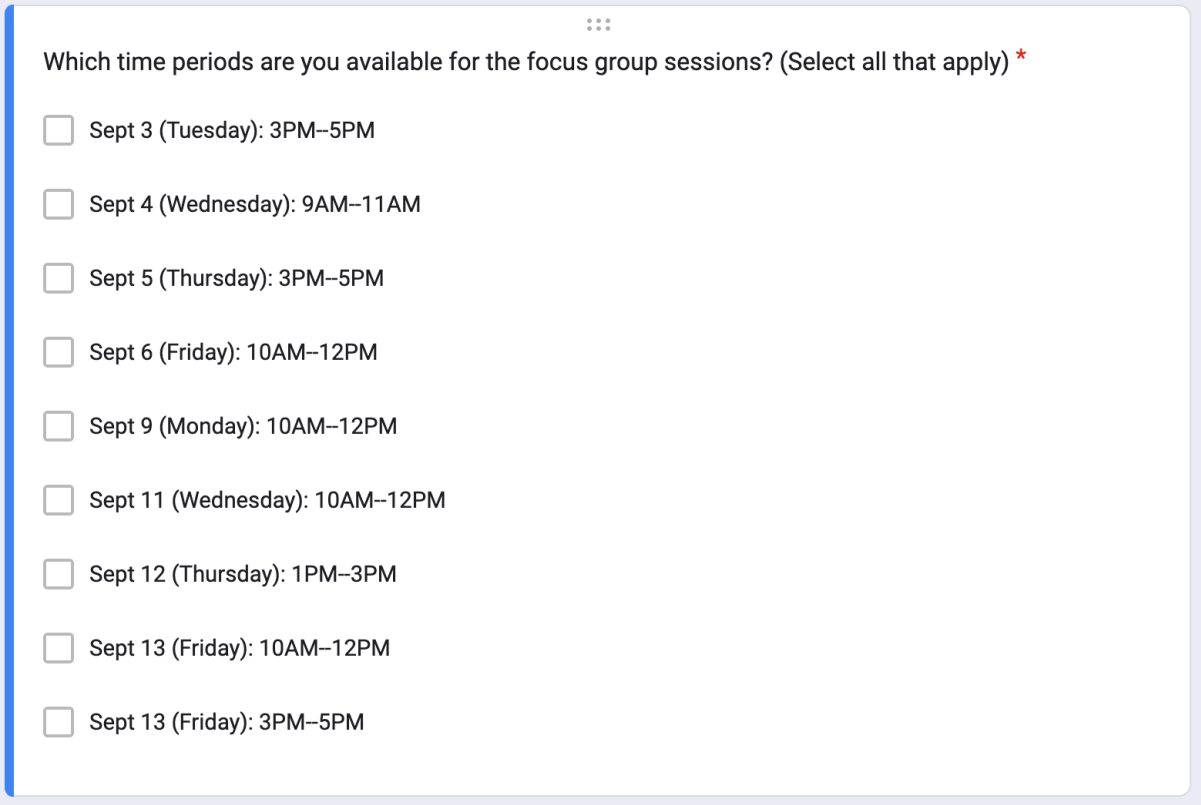


Figure 7 Available time slots

One week after the first email, we sent a reminder email to those who hadn't filled out the Google Form.

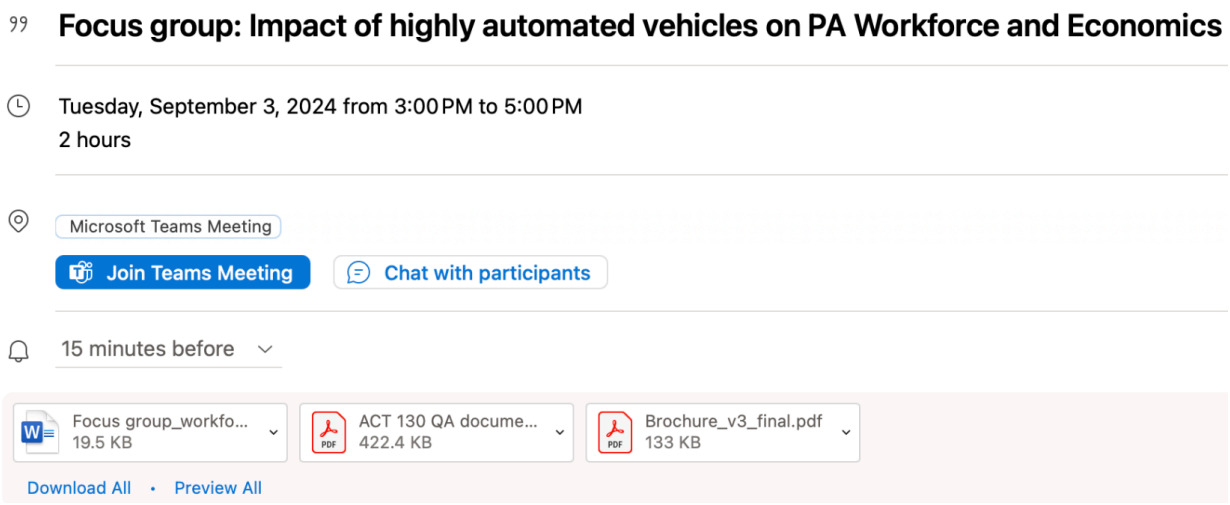
4.2 Focus Group Categorization

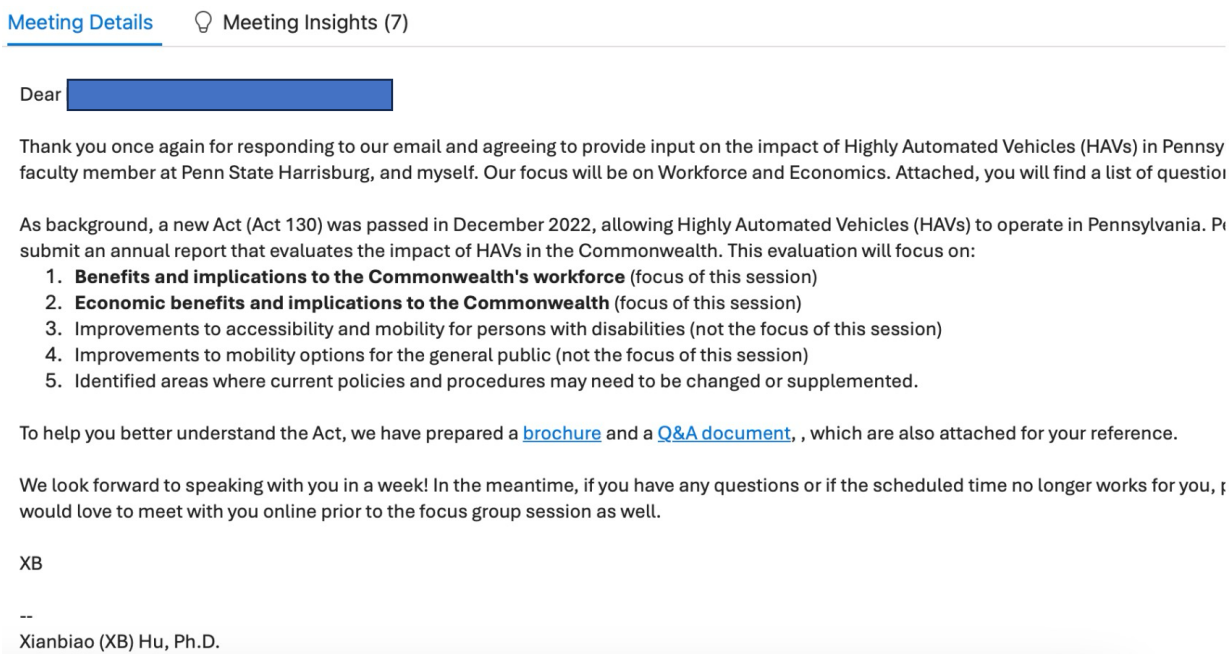
Participants' availability and research interests were analyzed and categorized, leading to the initial formation of five focus groups.

	A	B	E	F	G	H	I	J	K	L	M
1	Organization	Category	Sept 3: 3PM–5PM	Sept 4: 9AM–11AM	Sept 5: 3PM–5PM	Sept 6: 10AM–12PM	Sept 9: 10AM–12PM	Sept 11: 10AM–12PM	Sept 12: 1PM–3PM	Sept 13: 10AM–12PM	Sept 13: 3PM–5PM
2	Motional	Workforce							Workforce		
3	Pennsylvania Department of Education	Workforce		Workforce				Workforce	Workforce	Workforce	
4	Kittelson & Associates, Inc.	Mobility	Mobility	Mobility	Mobility		Mobility	Mobility	Mobility	Mobility	Mobility
5	Michael Baker International	Workforce	Workforce				Workforce			Workforce	Workforce
6	University of Pittsburgh	Accessibility	Accessibility	Accessibility	Accessibility						
7	Southeastern Pennsylvania Transportation Authority (SEPTA)	Mobility				Mobility		Mobility		Mobility	
8	Aurora	Economic								Economic	
9	Motor Carrier Safety Advisory Committee	Workforce	Workforce	Workforce	Workforce		Workforce	Workforce	Workforce		
10	Regional Industrial Development Corporation (RIDC)	Economic	Economic		Economic				Economic		
11	Carnegie Mellon	Workforce	Workforce		Workforce		Workforce			Workforce	Workforce
12	PA Turnpike Commission	Economic			Economic	Economic	Economic	Economic	Economic	Economic	
13	Michael Baker International	Accessibility		Accessibility		Accessibility	Accessibility				Accessibility
14	Executive Deputy Secretary of Policy & Planning,Office of G	Economic							Economic		Economic
15	City of Philadelphia	Workforce		Workforce		Workforce	Workforce			Workforce	
16	University of Pittsburgh	Workforce	Workforce		Workforce				Workforce		
17	Southwestern Pennsylvania Commission	Accessibility		Accessibility			Accessibility				
18	PA Department of Aging	Accessibility	Accessibility	Accessibility		Accessibility		Accessibility	Accessibility	Accessibility	Accessibility
19	Centre Ragional Planning Agency	Mobility	Mobility	Mobility	Mobility	Mobility	Mobility			Mobility	Mobility
20	Southeastern Pennsylvania Transportation Authority (SEPTA)	Mobility	Mobility		Mobility	Mobility	Mobility	Mobility		Mobility	Mobility
21	Drive Engineering	Economic			Economic			Economic			
22	Carnegie Mellon	Mobility					Mobility			Mobility	Mobility
23	Delaware Valley Regional Planning Commission	Accessibility	Accessibility	Accessibility	Accessibility		Accessibility	Accessibility	Accessibility		
24	Autonomous Vehicle Industry Association	Accessibility						Accessibility	Accessibility	Accessibility	Accessibility
25	Centre Area Transportation Authority (CATA)	Mobility	Mobility	Mobility		Mobility	Mobility	Mobility	Mobility		Mobility
26	Conference of Minority Transportation Officials (COMTO)	Workforce	Workforce			Workforce					
27	Pennsylvania Driving Under the Influence Association	Workforce	Workforce	Workforce	Workforce	Workforce	Workforce		Workforce		Workforce
28	PA Motor Truck Association	Workforce	Workforce	Workforce		Workforce				Workforce	Workforce
29	Latitude AI	Workforce					Workforce	Workforce	Workforce	Workforce	
30	TechNet: The Voice of the Innovation Economy	Accessibility				Accessibility				Accessibility	
31	City of Pittsburgh, Department of Mobility and Infrastructure	Mobility	Mobility		Mobility		Mobility	Mobility	Mobility		
32	Rabbit Transit	Workforce			Workforce						
33	SAE International	Economic						Economic	Economic		
34	Southeastern Pennsylvania Transportation Authority (SEPTA)										

Figure 8 Statistics and grouping of participants

We sent an email to participants to inform them about the preliminary group assignments and to reconfirm their availability. During this follow-up, a few participants withdrew due to scheduling or thematic conflicts.




Meeting Details Meeting Insights (7)

Dear [redacted]

Thank you once again for responding to our email and agreeing to provide input on the impact of Highly Automated Vehicles (HAVs) in Pennsy
faculty member at Penn State Harrisburg, and myself. Our focus will be on Workforce and Economics. Attached, you will find a list of questio

As background, a new Act (Act 130) was passed in December 2022, allowing Highly Automated Vehicles (HAVs) to operate in Pennsylvania. P
submit an annual report that evaluates the impact of HAVs in the Commonwealth. This evaluation will focus on:

1. **Benefits and implications to the Commonwealth's workforce** (focus of this session)
2. **Economic benefits and implications to the Commonwealth** (focus of this session)
3. Improvements to accessibility and mobility for persons with disabilities (not the focus of this session)
4. Improvements to mobility options for the general public (not the focus of this session)
5. Identified areas where current policies and procedures may need to be changed or supplemented.

To help you better understand the Act, we have prepared a brochure and a Q&A document, , which are also attached for your reference.

We look forward to speaking with you in a week! In the meantime, if you have any questions or if the scheduled time no longer works for you, p
would love to meet with you online prior to the focus group session as well.

XB

--
Xianbiao (XB) Hu, Ph.D.

Figure 9 Send meeting invitation details

4.3 Execution of Focus Groups

Each focus group was conducted on the scheduled dates, with discussions centered around their respective themes. In the end, we identified 30 participants to participate in 5 focus groups. In each focus group, 2 Penn State team members acted as the moderator and facilitator. The following is the specific information.

(1) Focus Group 1

Time: Sept 3 (Tuesday): 3PM--5PM

Theme: Workforce/Economic

Moderator/ Facilitator: Xianbiao (XB) Hu, Nikhil Menon

Participants: (5)

Table 1 Information on participants of focus group 1

Organization
Michael Baker International
Motor Carrier Safety Advisory Committee
Regional Industrial Development Corporation (RIDC)

PA Motor Truck Association
Conference of Minority Transportation Officials (COMTO)

(2) Focus Group 2

Time: Sept 4 (Wednesday): 9AM--11AM

Theme: Accessibility/Mobility

Moderator/ Facilitator: Xianbiao (XB) Hu, Nikhil Menon

Participants: (7)

Table 2 Information on participants of focus group 2

Organization
Michael Baker International
Kittelson & Associates, Inc.
Centre Area Transportation Authority (CATA)
Delaware Valley Regional Planning Commission
Centre Regional Planning Agency
Southwestern Pennsylvania Commission
University of Pittsburgh

(3) Focus Group 3

Time: Sept 5 (Thursday): 3PM--5PM

Theme: Workforce/Economic

Moderator/ Facilitator: Xianbiao (XB) Hu, Nikhil Menon

Participants: (6)

Table 3 Information on participants of focus group 3

Organization
Pennsylvania Driving Under the Influence Association
Southeastern Pennsylvania Transportation Authority (SEPTA)

Rabbit Transit
Carnegie Mellon
PA Turnpike Commission
University of Pittsburgh

(4) Focus Group 4

Time: Sept 12 (Thursday): 1PM--3PM

Moderator/ Facilitator: Xianbiao (XB) Hu, Nikhil Menon

Theme: Workforce/Economic

Participants: (7)

Table 4 Information on participants of focus group 4

Organization
Motional
Executive Deputy Secretary of Policy & Planning, Office of Governor Josh Shapiro
PA Department of Aging
SAE International
Autonomous Vehicle Industry Association
Latitude AI
City of Pittsburgh, Department of Mobility and Infrastructure

(5) Focus Group 5

Time: Sept 13 (Friday): 10AM—12PM

Theme: Accessibility/Mobility

Moderator/ Facilitator: Xianbiao (XB) Hu, Ilgin Guler

Participants: (5)

Table 5 Information on participants of focus group 5

Organization
Southeastern Pennsylvania Transportation Authority (SEPTA)
Aurora
City of Philadelphia
Carnegie Mellon
TechNet: The Voice of the Innovation Economy

4.4 Holding Short Meetings

In order to gather additional information and feedback on HAV development in Pennsylvania, we organized three brief one-on-one meetings following the focus group sessions. The specific details are as follows.

(1) Short Meeting 1

Time: Sept 13 (Friday): 3PM--3:30PM

Theme: Workforce/Economic/Accessibility/Mobility

Moderator/ Facilitator: Xianbiao (XB) Hu

Participants: (3) from Ford Motor

(2) Short Meeting 2

Time: Sept 20 (Friday): 3PM—3:30PM

Theme: Workforce/Economic/Accessibility/Mobility

Moderator/ Facilitator: Xianbiao (XB) Hu

Participants: (1) from StackAV

(3) Short Meeting 3

Time: Sept 26 (Friday): 3PM--3:30PM

Theme: Workforce/Economic/Accessibility/Mobility

Moderator/ Facilitator: Xianbiao (XB) Hu

Participants: (1) from Drive Engineering

4.5 Analysis of the Composition of Participants

We collected information about the participants and the types of organizations they represented, resulting in the following details.

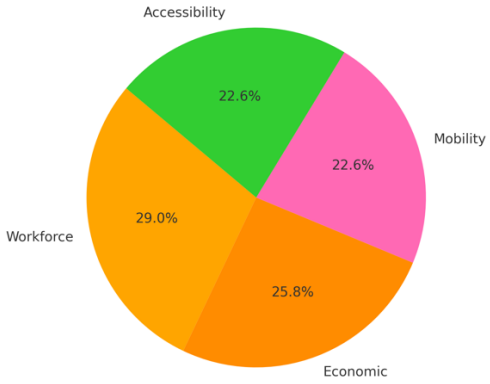


Figure 10 Participants research area distribution

Figure 10 shows the distribution of participants by research area in the dataset. Of these, 9 participants are in the field of Workforce, accounting for 29%; 8 participants are in the field of Economic, accounting for 25.8%; 7 participants are in the field of Mobility; and 7 participants are in the field of Accessibility, which also accounts for 22.6%. This indicates that the participating experts almost cover the four research areas on average, ensuring the comprehensiveness of the data.

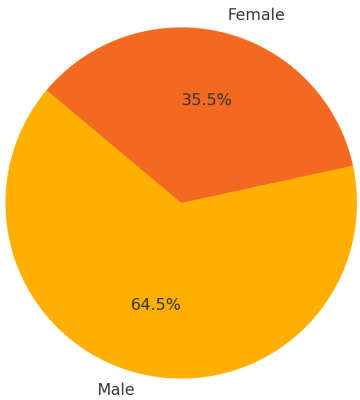


Figure 11 Participants gender distribution

Figure 11, a pie chart, shows the gender distribution in the dataset: males comprise 64.5% (20 participants), while females comprise 35.5% (11 participants). Overall, there were more male participants than female participants, suggesting that we considered not only the advice of male participants but also the insights of female experts.

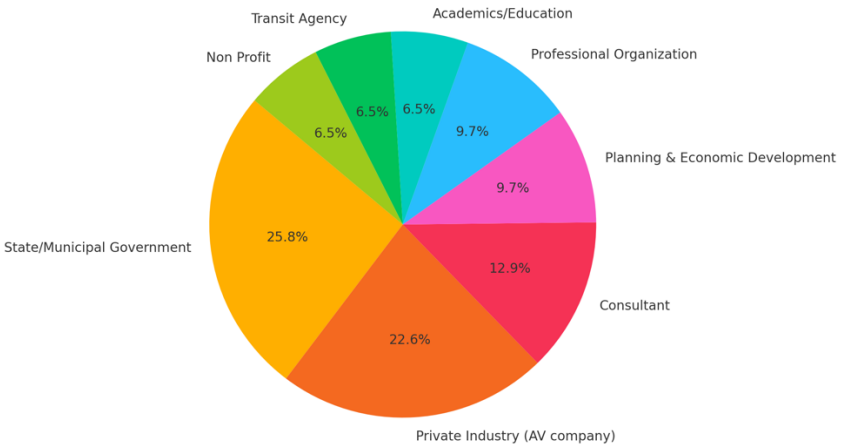


Figure 12 Participants organization category distribution

Figure 12 shows the distribution of sectors or organizations represented by the participants. The largest group is from State/Municipal Government, making up 25.8% (8 participants), followed by Private Industry (AV companies) at 22.6% (7 participants) and Consultants at 12.9% (4 participants). Planning & Economic Development and Professional Organizations each constitute 9.7% (3 participants). The remaining groups—Academia/Education, Transit Agencies, and Non-Profits—each account for 6.5% (2 participants). This distribution demonstrates a diverse representation, with notable contributions from government and private industry sectors.

Overall, the distribution of organization types represented by the participants reflects substantial involvement from government and private industry, along with diverse contributions from academia, consulting firms, non-profit organizations, and professional associations. This broad engagement brings a wide range of perspectives and in-depth insights to the research assessing the impact of HAVs development on workforce, economy, accessibility, and mobility in Pennsylvania, underscoring the fairness of our focus group expert panel composition and the comprehensiveness of the data collected for this project.

5. Impact Analysis of Workforce and Economic Implications

This chapter summarizes the focus group findings and provides a comprehensive analysis of the workforce and economic impacts of Act 130 and Highly Automated Vehicles across various sectors and regions in Pennsylvania. It highlights potential economic benefits, increased freight efficiency, and opportunities for job creation in both urban and rural areas. The chapter also explores the transformative effects HAVs are expected to have on traditional industries, workforce training, and job roles.

Below, we present 13 key observations from the focus group sessions, with *italic text* indicating direct statements from participants.

1. Act 130 marks a turning point for Pennsylvania's HAV industry

The enactment of Act 130 has brought legislation to support the testing and deployment of HAVs in Pennsylvania, marking a significant turning point in the state's automated vehicle industry. For example, one participant commented that Act 130 "*paves the way for better things to come. It opens the door for testing, which is crucial for AV companies to achieve scale—one of the most significant aspects of the legislation.*" Another participant noted that "*testing was not allowed legally until Act 130 was in place. The Act enabled AV companies to move beyond the R&D stage*."

Prior to this legislation, the lack of legal support led some automated driving R&D companies to contemplate relocating or shifting significant portions of their business to other states like California, Arizona, and Texas, where early supportive laws were already in place. This potential exodus posed a threat to Pennsylvania's economy and could have reduced local job opportunities. Focus group participants mentioned that on the same day the Act was enacted, Argo AI announced its bankruptcy, leading to the later establishment of Stack AV and Latitude AI. In particular, StackAV chose to retain Argo AI's R&D facilities and 250 employees in Pennsylvania, thereby preserving local jobs. One participant stated that, "*If Act 130 had not been passed, Stack AV would still be formed but not in Pennsylvania. So the 250 employees would not be here. Act 130 … is a big step and allows companies to test in Pennsylvania*".

In summary, the enactment of Act 130 has not only enabled more comprehensive testing and scaling opportunities for AV companies in Pennsylvania but has also created a supportive legal environment that encourages these companies to stay and grow within the state. This legislation has helped protect existing jobs, facilitated the creation of new ones, and paved the way for significant growth in Pennsylvania's automated vehicle industry in the coming years.

2. Economic potential of HAVs in freight transportation

Focus group participants discussed the impact of HAVs across various sectors, including transit, passenger vehicles, freight, and more. There were multiple participants who felt strongly that HAVs hold significant economic potential

for the freight sector, with benefits likely to materialize more immediately in freight compared to other sectors. One participant mentioned that "*Pennsylvania is a highly trucking dependent state. About one in 15 jobs rely on trucking here in Pennsylvania, we have a lot of trucking companies in the Commonwealth*", and another statement that "*We believe that automated trucking has a probably a significant role to play in the future and has a lot of opportunity for the industry*". Another participant seconded and said, "*I think, first and foremost, my personal opinion is and always has been that, if we're going to see the biggest impact of HAVs in Pennsylvania, it's absolutely going to be in freight*". Other statements like "the biggest bucket is in the freight", and "automated truck is where the quickest return is" were also observed.

Participants also discussed that for urban freight, HAVs can autonomously navigate and deliver goods, minimizing the need for human couriers. By streamlining delivery operations and minimizing labor costs, HAVs contribute to overall economic benefits for businesses that rely on urban freight distribution. On the other hand, for intercity freight, the impact of HAVs could be even more pronounced, particularly on long-haul trucking jobs. Automated trucks can operate continuously without breaks, thereby lowering the demand for human drivers in long-distance transportation. This continuous operation also reduces the need for truck parking facilities, as "*HAVs don't require regular rest stops*". Eliminating the necessity for extensive parking infrastructure streamlines logistics processes, reduces infrastructure costs, and further enhances economic efficiency in freight transport.

Moreover, HAVs are expected to transform the trucking industry workforce by reshaping traditional roles and creating new job opportunities. As HAVs become more prevalent, positions will shift towards managing these vehicles, including operators, maintenance staff, and logistics system dispatchers. Skilled workers will be needed to troubleshoot and provide technical support for automated delivery systems. This shift fosters new career opportunities and encourages the workforce to develop more technologically advanced skill sets.

3. Creation of new job opportunities in the era of HAVs

The introduction of HAVs is anticipated to generate many job opportunities across Pennsylvania over the next decade, encompassing a wide range of sectors and skill sets.

Participants identified several areas where new job categories are likely to emerge, including

- HAV maintenance,
- Robotics,
- Sensor calibration,
- Infrastructure support,
- Automated inspection,
- Software development.

- Supporting functions, such as operating & servicing vehicle, cleaning, and customer support
- AV fleet management,
- Remote drivers
- Data security,
- First responder
- System optimization
- Insurance
- Attorney

While HAVs are expected to create new jobs, demand for some traditional roles, like truck and passenger vehicle drivers, may decline. Companies like Uber, for example, may increasingly rely on HAVs for their ride-sharing services, reducing the need for human drivers. This shift underscores the dual impact of HAVs on the labor market: fostering new opportunities in emerging technologies while potentially phasing out certain existing transportation jobs.

One participant remarked, *"The share may change, but the total will increase. More vehicles, more capital expenditure, and hiring will continue to grow."* Another participate noted that "*HAVs are poised to transform the workforce by reshaping existing job roles rather than eliminating them*.". Another participant from transit agencies, when asked of how HAV technology may impact transit drivers, noted that "*As far as it impacting the workforce? maybe it's something like… automated vehicles, could run during the shifts that nobody wants, because it is so hard to hire anyone right now*". However, it is important to note that the true impact of the AV industry remains uncertain, as we are still in the early stages of AV deployment.

The primary challenge will be managing this transition effectively, ensuring that the workforce is adequately prepared and supported as these changes take place. Participants also discussed how AVs might influence overall workforce demand, emphasizing the importance of proactive planning to navigate this evolving landscape.

4. Workforce transformation in the HAVs era

To succeed in this rapidly evolving landscape, workers will need to combine traditional mechanical skills with advanced expertise in areas such as artificial intelligence, cybersecurity, and data analysis. Participants discussed and noted that robust training and reskilling programs will be crucial to meet the growing demand for skilled labor in these emerging areas**.** Workers will need to acquire new competencies, particularly in fields like automated platoon management and HAV system maintenance. Educational institutions, vocational programs, and employers must collaborate to equip the workforce with the necessary skills to operate, maintain, and oversee these sophisticated

systems. Such programs will help workers transition into new roles and maintain overall employment levels despite the shifts brought about by automation.

One area that will see significant change is the insurance industry, particularly for claims adjusters. Traditionally, claims adjusters physically assess vehicle accidents by inspecting the scene and determining the causes based on available evidence. With the introduction of HAVs, this process will shift to a more data-driven approach. Equipped with advanced sensors, cameras, and data recording systems, HAVs can capture comprehensive information about driving conditions, vehicle performance, and events leading up to an accident. As a result, the insurance claims process itself will need to adapt to HAV technology. With the vast amounts of data HAVs provide, insurance companies will be able to automate many aspects of the claims process, from accident reporting to liability determination. Claims adjusters may transition into roles overseeing these automated systems, ensuring that data is accurately analyzed and that claims are processed promptly. New positions focused on data verification, system audits, and customer support could also emerge, helping maintain transparency and trust in an increasingly automated claims process.

The role of vehicle maintenance and inspection will also undergo significant changes as HAV technology becomes mainstream. Traditional vehicle mechanics and inspectors, who are trained to work on conventional internal combustion engine vehicles, will need to develop expertise in advanced software, electronics, and automated driving systems. Skills in areas such as software diagnostics, sensor calibration, and automated system troubleshooting will become essential.

This shift towards HAVs presents numerous opportunities for workforce upskilling and the creation of new job roles. Professionals in various sectors will require training in the operation, maintenance, and oversight of automated systems. This evolution will increase the demand for educational programs and certifications focused on HAV technology, ensuring that workers are equipped with the necessary skills to thrive in this changing landscape.

5. Talent retention in the HAVs sector

Talent retention was another key topic discussed during the focus group session. Participants highlighted a concerning trend: individuals, particularly younger generations, who earn AV/robotics-related degrees in Pennsylvania often leave the state to pursue opportunities elsewhere. For example, one participant mentioned that "*but the biggest thing of all, I think, is that we're losing our, our young people, and people are moving out of Pennsylvania… you know Carnegie Mellon, we have a great system of higher education here. That's a great opportunity, especially in this area, but the kids graduate from this universities and they move out of Pennsylvania. So that is happening. You know it has been happening for years. We keep losing folks to a lot of those other states.*

People have been mentioning to Southern States and that's part of the reason our tax base is declining. Population is aging and we just don't have the workforce to continue to support it. So I think this is an opportunity to build an industry, you know that can we can we can grow in Western Pennsylvania and if we put some resources into it and really help ensure that that it has the resources that it needs in order to grow."

Part of the reason, as one participant noted, is that *while Pennsylvania excels in AV and robotics R&D, it lags in the post-R&D phases, particularly AV testing and manufacturing—areas that potentially offer more significant job opportunities*. Some participants compared Pittsburgh to other mid-sized cities in the Sunbelt, such as Detroit, Milwaukee, Cincinnati, and Columbus, in terms of GDP and job opportunities, expressing concerns that Pennsylvania may be falling behind.

Participants acknowledged that the passing of Act 130 is a positive development. This legislation enables vendors to test HAVs in Pennsylvania, which could eventually lead to a transition into the manufacturing phase. It will be interesting to see how these changes influence job opportunities and talent retention in the years ahead.

To address the challenge of an aging workforce in the trucking and related industries, proactive strategies are essential for attracting younger individuals to the HAV sector. As many current employees approach retirement, the industry must develop a new generation of skilled professionals to fill emerging HAV-related roles. One effective strategy is to partner with technical schools, vocational programs, and higher education institutions to establish a strong talent pipeline. These collaborations can provide young people with the education and training needed to excel in fields such as HAV maintenance, software development, and system optimization.

Building a strong industry presence is also crucial for engaging and inspiring younger individuals. Initiatives such as HAV-focused internships, apprenticeships, and mentorship programs can give students and early-career professionals hands-on experience, making careers in the HAV industry more appealing. Industry leaders should actively participate in career fairs, offer workshops, and highlight the exciting opportunities HAV technology presents. By emphasizing potential growth, innovation, and technological advancement, the HAV sector can create a strong connection with future talent.

Raising awareness about HAV careers through targeted campaigns in schools and communities across Pennsylvania can further attract young professionals. By showcasing the cutting-edge nature of HAV technology, long-term career prospects, and the societal benefits of working in this sector, these campaigns can inspire a new wave of skilled workers. Educating the public about the importance of the HAV industry to the future of transportation will help draw interest from the next generation of professionals.

Collectively, these strategies will help the HAV industry address its aging workforce, ensure sustained growth, and maintain Pennsylvania's leadership in automated vehicle technology. By implementing partnerships with

educational institutions, creating hands-on learning opportunities, and conducting effective awareness campaigns, the industry can cultivate a robust pipeline of skilled workers ready to meet the demands of this evolving field.

6. Preparing the workforce training for the future of HAVs

As the demand for expertise in electric and automated vehicle systems grow, specialized training programs are becoming increasingly essential. This need is particularly evident for technicians working in maintenance shops, manufacturing, and warehousing. With the rise of Level 2 and Level 3 automation, workforce training programs must focus on real-world applications to ensure employees can effectively manage and operate emerging technologies. Comprehensive and diverse training initiatives will be critical as the HAV industry continues to evolve, ensuring that workers are prepared to meet the challenges posed by these technological advancements.

Workforce training is crucial for the successful promotion and expansion of HAV technology. Employees must acquire new skills to manage and operate these advanced systems, highlighting the importance of upskilling, especially as automation begins to change traditional roles in the automotive and transportation industries. Training should cover areas such as automated systems operation, software integration, and cybersecurity. Additionally, specialized programs should be developed for emerging roles, including automated vehicle test engineers, data analysts, machine learning specialists, and artificial intelligence engineers. HAV-specific certifications and safety training will ensure system operators have the expertise and knowledge to maintain safe operations.

Collaboration between industry and educational institutions is vital to develop relevant curricula and provide hands-on training opportunities. By partnering with technical schools, vocational programs, and universities, HAV companies can help shape programs that equip students with the necessary skills. Offering internships and apprenticeships can give future employees practical experience in HAV-related roles. Workers in industries impacted by HAV technology, such as trucking and public transportation, will require reskilling in areas like digital literacy, automation, and fleet management. Additionally, employees must be trained in legal and ethical considerations to ensure compliance with regulations and maintain public trust in automated vehicle technology.

Support from both government and industry is essential to ensure effective workforce development in the HAV sector. Governments can offer funding and incentives for training programs, while public-private partnerships can help ensure that these programs are well-targeted and effective. Given the rapid pace of HAV technology development, continuous learning and professional development are crucial. Regular updates, participation in industry conferences, and attending workshops will help employees stay competitive and adapt to evolving demands.

By implementing comprehensive workforce training programs, regions like Pittsburgh will be better prepared for the future deployment of HAV technology. Ensuring that employees have the skills necessary to operate, maintain, and

oversee automated systems will help promote the growth and success of the HAV industry, ultimately benefiting the economy and the broader community.

7. Impact on suburb/rural area economies

Participants discussed and found that HAVs offer significant opportunities to enhance connectivity and economic vitality in rural areas by improving first-mile and last-mile transit solutions. By bridging gaps in transportation services, HAVs can revitalize rural communities through improved job access, stronger links between rural and urban regions, and greater overall regional equity. In areas where public transportation is limited, HAVs can play a transformative role in expanding transportation options, effectively reducing the accessibility gap for residents and workers.

Increased mobility through HAVs in suburban and rural areas can also help residents access essential services more easily, such as jobs, healthcare, and education. This expanded accessibility has the potential to boost local economies by making rural regions more appealing to both residents and businesses. Furthermore, HAVs could attract more tourists and visitors to these areas by reducing transportation barriers. This influx can lead to increased activity and revenue for local businesses, including restaurants, retail shops, and service providers, thus supporting the economic growth of rural communities.

HAV technology can also have a profound impact on key rural industries, particularly agriculture. Automated vehicles can be employed for tasks like planting, harvesting, and transporting goods, thereby improving efficiency and productivity in agricultural operations. Additionally, automated freight transport can streamline logistics, reduce transportation costs for local producers, and increase the competitiveness of rural businesses in the broader market. This technological advancement in HAVs could lead to more robust economic growth and resilience within rural economies.

8. Post-research and development (R&D) opportunities

Some participants mentioned that, as Pittsburgh and its surrounding regions increase R&D investments in automated driving and HAV testing, a clustering effect of related technology companies may emerge, fostering a robust innovation ecosystem. This ecosystem will attract businesses specializing in crucial automated driving technologies—such as sensors, software development, and integrated systems—further accelerating technological integration and advancement. As a result, Pittsburgh's traditional manufacturing industry can transition towards more intelligent and high-end production processes, including the manufacturing of components like sensors, LiDAR, and

automated control systems. Automation and digitalization will also make these manufacturing processes more efficient and intelligent.

Enhanced R&D capabilities in the region are also poised to draw significant investment and create numerous high-skilled jobs. According to one participant, *this growth will lead to opportunities for automated vehicle developers, test engineers, data scientists, and other high-tech roles*. These developments would boost local talent competitiveness and expand employment opportunities in Pittsburgh's high-tech sector.

To ensure the success of these efforts, supportive government policies and the development of critical infrastructure, such as data centers, will be essential. Collaboration between government agencies and private enterprises will play a key role in accelerating industry transformation and promoting sustained regional growth. By working together, these stakeholders can create an environment that supports technological integration, fosters innovation, and maintains Pittsburgh's position as a leader in automated driving technology.

9. The need to continuously monitor and evaluate impact

With the construction of the PennSTART testing track and the support provided by Pennsylvania's HAV law—Act 130, the state is expected to attract numerous companies for research and testing. This influx is anticipated to strengthen Pennsylvania's automated driving sector and benefit its economy and job market. However, because Act 130 was enacted relatively recently (on November 3, 2022) and the corresponding certificate of compliance guidelines were only issued in October 2024—effectively making this the law's first year in practice—it is challenging to immediately assess the law's direct economic, and workforce impacts or improvements in accessibility and mobility.

Some participants note that the economic impact of Act 130 has not yet fully materialized. For example, one participant explicitly noted the *economic impact does not exist yet, since the act was only passed recently.* They also noted that workforce changes will likely evolve over several years as the situation unfolds. Additionally, it remains unclear which businesses have obtained licenses under the new law since its enactment. Therefore, ongoing and long-term evaluations of workforce, economic, accessibility, and mobility factors are necessary to fully understand Act 130's influence on the development of HAVs in Pennsylvania.

10. Pennsylvania's climate and terrain is a challenge for HAVs testing

Automated driving technology develops incrementally, and many companies initially choose to test their vehicles in regions with simpler, more favorable conditions—such as California, Arizona, and Texas—to minimize early-stage

complexities. However, as the technology matures, Pennsylvania's challenging climate and terrain become invaluable for rigorous testing. In winter, heavy snowfall can make automated vehicle testing significantly more difficult, providing essential data on how these vehicles handle adverse weather conditions. Cities like Pittsburgh, which hosts several automated driving firms, offer some of the most complex terrains in the United States, presenting additional hurdles for testing HAVs.

Participants mentioned that although Pennsylvania's challenging weather and terrain may have seemed like drawbacks in the early stages of automated driving development, they now provide crucial, realistic testing environments. *As the demand for advanced and rigorous testing scenarios grows, Pennsylvania's unique conditions are likely to attract more automated driving companies*. This shift highlights the importance of varied and demanding testing environments for the continued advancement and integration of HAV technology.

11. Emergency responder training for HAVs

Some participants mentioned that *enhanced first responder training is crucial for managing HAV emergencies effectively*. Specialized training should help responders understand how HAV systems operate and react during and after an accident. Unlike conventional vehicles, HAVs are equipped with various sensors, cameras, and onboard computer systems that control their driving functions. After a collision or emergency, these systems may shut down, remain active, or even continue to move automatedly if not properly disabled. First responders must be trained to identify these systems and know how to safely deactivate them to prevent further risks. This knowledge is essential to protect both responders and bystanders from harm.

Another critical aspect of HAV-specific training is learning how to accurately document and report accidents involving automated vehicles. HAVs often have onboard data recording systems, similar to airplane "black boxes," which store information such as vehicle speed, system responses, and sensor data before and during an incident. First responders should be trained on how to access and secure this data without damaging it, as it can be vital for accident investigations and legal purposes. Additionally, responders need to provide detailed reports on the HAV involved, noting any malfunctions, system shutdowns, or unexpected vehicle behaviors.

To ensure first responders are fully prepared for real-world HAV incidents, training programs should include simulated emergency scenarios that mimic potential accidents involving automated vehicles. These simulations might involve scenarios such as collisions in urban environments, rollovers, fires in electric HAVs, or multi-vehicle pileups involving both conventional and automated vehicles. By practicing in controlled environments, first responders can develop the necessary skills and confidence to respond quickly and safely in actual emergencies.

12. Economic potential of HAVs in the U.S. suggested by participant's previous research

A participant cited research [41] indicating that the U.S. economy could generate up to $4.1 trillion in total value between 2025 and 2035 from the deployment of HAVs in delivery services and associated benefits. This total includes an estimated $3.4 trillion from direct economic impacts—such as operational efficiencies and cost savings—and $0.719 trillion from wider benefits like improved road safety, time savings, and reduced transportation emissions.

This research also projects a significant increase in demand for delivery AVs, estimating that by 2035 there could be a need for 3.1 million such vehicles to accommodate 35–40 million daily automated deliveries. As automated vehicle technology advances and consumer acceptance of curbside delivery grows, approximately 23% of relevant vehicle miles traveled (VMT)—amounting to about 191 billion VMT for shopping and errand trips—could be replaced by HAV delivery services by 2035. These findings suggest that the integration of automated delivery vehicles could substantially contribute to economic growth, enhance efficiency in transportation, and provide environmental benefits over the next decade.

13. Economic potential of HAVs in the Pittsburgh region suggested by participant's previous research

One participant referenced a conservative estimate from research [42] regarding the economic impact of the Pittsburgh region's automated systems industry. *According to this study, the industry currently encompasses 71 companies employing over 6,300 individuals, generating significant economic benefits for the area*. Key findings from the report include:

- **Job Creation:** The 6,300 direct jobs in this industry support more than 8,600 additional jobs through indirect and induced effects, resulting in a total impact of over 14,900 jobs in the region.
- **Labor Income:** Employees in the automated systems industry contribute approximately $651 million in direct labor income, with total labor income (including indirect and induced effects) reaching $1.2 billion.
- **Economic Output:** The industry generates an estimated $1.5 billion in direct economic output and supports nearly $3 billion in total economic output when considering indirect and induced effects.
- **Tax Revenues:** It contributes over $161 million in direct local, state, and federal tax revenues, with total tax revenues reaching nearly $347 million when including indirect and induced effects.
- **Employment Multiplier:** Each employee in the automated systems industry supports approximately 2.36 additional employees in other industry sectors, illustrating the sector's broad economic influence.

These findings underscore the substantial direct and indirect economic contributions of the automated systems industry in the Pittsburgh region, highlighting its potential for continued growth and regional development.

Challenges discussed during the focus group meetings:

1. **Competition from other states**: Pennsylvania faces competition from states like Texas and Arizona, where regulatory hurdles are fewer and HAVs testing is more advanced. Stakeholders worry that if Pennsylvania doesn't foster a more dynamic and open environment for HAV development, it could miss out on valuable economic opportunities and lose its potential for industry leadership. Furthermore, legal regulations remain inconsistent across different states.
2. **The needs for refinements in legislation**: While Act 130 is a positive step, further refinements might be necessary. For example, as technology advances, ownership allowances for Level 3 vehicles might be expanded, with permits required only for Levels 4 and 5, ensuring the legislation keeps pace with innovation. Additionally, the law might need to revise its detailed requirements for mirrors. Levels 4 and 5 may not require mirrors, as they rely on sensors like cameras, LiDAR, and radar to perceive their surroundings. These sensors can provide a broader field of view than the human eye and can more accurately detect obstacles, as well as the distance and speed of other vehicles, thus reducing or eliminating blind spots. However, for Level 3, the driver is still required to take control in certain situations. In such cases, mirrors remain necessary for the driver to observe the external environment.
3. **Open testing environment**: Some participants mentioned that Pennsylvania should strike a balance between regulation and openness to create a favorable environment for HAVs testing and deployment, while upholding strict safety standards. Establishing a more open and dynamic testing landscape is crucial for attracting companies to set up operations in the state.
4. **Streamlining self-certification**: Streamlining the vehicle self-certification process is essential to reducing bureaucracy and fostering innovation. Industry stakeholders, in particular, expressed a preference for self-regulation, emphasizing the importance of efficiency and transparency in certification procedures.
5. **Possibility for reduced regulation**: To minimize regulatory burdens, some stakeholders suggested that PennDOT may consider involving third-party oversight to help streamline processes and create a more business-friendly environment, enabling HAVs companies to thrive in Pennsylvania.
6. **Infrastructure maintenance**: Some participants suggested that there is an urgent need to repair and maintain infrastructure, such as road markings, signs, and lights, to support the integration of automated vehicles. As HAVs deployment grows, infrastructure wear will intensify, necessitating proactive maintenance to ensure safety and functionality.

7. **Remote driving and CDL drivers**: Concerns remain about the demand for Commercial Driver's License (CDL) holders, especially in the remote operation of HAVs. This raises safety issues, including the significant risks posed if a remote driver were to operate a vehicle under the influence of alcohol or drugs.
8. **Taxation and aging population**: Pennsylvania's relatively high tax rates, compared to states like Texas, may reduce its appeal to HAVs companies. Furthermore, with the state ranking second in the nation for an aging population, this demographic shift could present challenges to industry growth and workforce development.

6. Impact Analysis of Improvements to Accessibility and Mobility

This chapter discusses the focus group findings on the multifaceted impacts of HAVs on accessibility and mobility in Pennsylvania. For people with disabilities and older adults, HAVs provide new travel options that enhance independence but require design improvements to ensure seamless access and safety. In both urban and rural areas, HAVs can strengthen "first and last mile" connections to public transit, improving accessibility where traditional options fall short. As a supplement to public transportation, HAVs offer potential cost savings and flexibility, though they may also compete with existing systems and raise equity concerns in underserved areas. Deploying HAVs will necessitate infrastructure upgrades, such as enhanced road markings and improved sidewalks, to maximize safety for all road users, including vulnerable groups like cyclists. However, challenges—such as regulatory uncertainty, public trust, Americans with Disabilities Act (ADA) compliance, data privacy, and equitable resource distribution—must be addressed to fully realize the benefits of HAVs across diverse communities and create a balanced transportation ecosystem.

Below, we present 6 key observations from the focus group sessions, with *italic text* indicating direct statements from participants.

1. Impact on people with disabilities and older adults

A general consensus among focus group participants is that 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. For those living in areas with limited public transportation, such as rural or underserved urban communities, HAVs can fill the gap by providing door-to-door transportation solutions. This enhanced accessibility is crucial for individuals who depend on consistent and dependable means to reach essential destinations like medical appointments, workplaces, and educational institutions. Moreover, by offering flexible and affordable travel options—comparable in cost to riding a bus—HAVs can cater to a broader demographic, ensuring that these services remain both economically feasible and scalable.

To fully realize the benefits of HAVs for disabled and older passengers, participants highlighted several critical factors that need to be addressed. One participant with a disability emphasized, based on personal experience, the importance of *improving vehicle ingress and egress without relying on driver support*. This includes designing accessible entry points, adjustable seating, and other modifications to accommodate individuals using mobility aids, such as wheelchairs. For instance, HAVs should enable individuals to independently operate the docking mechanism, allowing them to board the vehicle without assistance. Second, there must be "*a clear emergency protocol and procedure for cases when an HAV malfunctions or leaves passengers stranded on the road*"—especially vital for the disabled community who may not have the ability to seek help independently. Establishing these protocols builds

trust and ensures that passengers can rely on HAVs even in unexpected situations. Additionally, building trust in the safety and reliability of HAV technology is paramount, as many potential users may feel apprehensive about relying on automated systems. Public education, transparent safety measures, and accessible features (such as voice-activated controls for people with visual impairments) can help alleviate concerns and promote broader acceptance of HAVs as a legitimate transit option.

Despite the promising potential of HAVs, one participant mentioned that "*adapting these vehicles to meet the needs of various groups, including those with visual or cognitive impairments, or specific medical requirements, presents significant challenges*." The necessary modifications—such as installing ramps, specialized seating, or assistive technologies—can come at a high cost, potentially limiting widespread implementation of fully accessible HAVs. Addressing infrastructure shortcomings, such as poorly maintained sidewalks for wheelchair users, is also essential to ensure HAVs can successfully provide door-to-door service. For instance, improving sidewalks and providing on-demand scheduling can be crucial for individuals who rely on HAVs to reach their destinations on time, such as for medical appointments. Furthermore, integrating HAV services with healthcare systems was emphasized as a priority. A participant with a disability specifically suggested that "*medical trips should be covered by medical insurance*" and posed the question, "*Can clinics or hospitals validate parking tickets or AV tickets?*" Such integration could greatly benefit individuals who require regular medical transport and depend on insurance to cover travel costs. To achieve true inclusivity, policymakers, transportation planners, and HAV developers should collaborate to overcome both the technical and economic hurdles. Encouraging a cultural shift in transportation habits will also be challenging, as people adapt to viewing HAVs as another form of transit. Ensuring affordable pricing, reliable scheduling, and extensive coverage is necessary to build user confidence and integrate HAVs seamlessly into existing transportation ecosystems.

Ultimately, addressing these factors will be crucial for ensuring that HAVs can truly benefit people with disabilities, older adults, and other underserved groups. By offering accessible, trustworthy, and economically viable transportation solutions, HAVs have the potential to improve independence and quality of life for many individuals. As the technology continues to evolve, careful consideration of user needs, alongside supportive infrastructure and policies, will be key to achieving the full promise of HAVs in enhancing mobility and access for all.

2. Enhancing accessibility through first and last mile connectivity

Participants generally agreed that HAVs could significantly improve accessibility, particularly in regions with limited transportation options, such as rural areas or underserved urban communities. In these locations, inadequate public transit services often leave residents with few reliable travel options. By offering convenient and flexible

transportation solutions, HAVs can help bridge this gap, connecting people to vital services, employment opportunities, and essential resources that would otherwise be difficult to reach.

Some participants mentioned that *a key advantage of HAVs is their ability to provide effective "first-mile" and "last-mile" connectivity*. These terms refer to the initial and final segments of a journey where passengers must travel between their starting point or destination and a public transit hub—such as a train station or bus stop. Several participants from transit agencies and operators highlighted the potential value of HAVs in complementing existing public transit systems. They noted that HAVs could enhance seamless connections during critical stages of travel, improving the overall transit experience. This integration effectively extends the reach of public transit, making it more accessible to individuals living in areas not directly served by traditional routes. As a result, HAVs can help fill the transportation gaps that many underserved communities face.

By integrating HAVs into existing transportation networks, the range of travel options available to diverse populations can be significantly expanded. HAVs are uniquely suited to cater to various groups, including individuals with disabilities, older adults, and residents in underserved areas who may struggle with current transportation limitations. With more accessible and reliable transit options provided by HAVs, these populations can experience improved mobility and greater independence. This enhanced accessibility can lead to a better quality of life, as people gain the ability to more easily access essential services, education, job opportunities, and community activities.

3. HAVs as a supplement to public transportation systems and freight industry

Many participants concurred that HAVs have the potential to complement—rather than compete with—public transportation systems and the freight industry, improving efficiency, expanding coverage, and enhancing cost-effectiveness.

In the realm of public transportation, HAVs can fill critical gaps by providing flexible, on-demand services that connect passengers to transit hubs or destinations not easily accessible through traditional routes. This supplementary role can increase the overall efficiency and coverage of public transportation networks, making travel more seamless and convenient for passengers. As one participant mentioned, *"HAVs present a great opportunity to complete that first and last mile of travel from public transportation hubs."* Another participant echoed this sentiment, stating that *"HAVs can be a great supplement to current transportation in urban areas, particularly supporting the existing public transportation system in places like Philadelphia."*

Beyond passenger transportation, the freight industry also stands to benefit significantly from HAV deployment. HAVs can enhance transportation efficiency by enabling continuous operation, especially in long-haul and intercity freight scenarios. This includes the ability to "*operate during nighttime hours when human drivers would typically*

require rest, thereby extending operating hours and keeping goods moving around the clock". The result is not only faster delivery times but also increased operational capacity.

Additionally, HAVs offer the potential to reduce costs in both public transportation and freight sectors. In freight transport, HAVs can lower labor expenses and fuel consumption by optimizing driving patterns and reducing the need for human drivers. Similarly, for public transportation systems, HAVs provide cost-effective solutions on routes where traditional buses or trains may not be economically viable. A participant from transit agencies noted that "*automated vehicles, could run during the shifts that nobody wants, because it is so hard to hire anyone right now*". This makes HAVs a practical supplement to existing transportation services, offering both operational benefits and cost savings across multiple industries.

4. **Potential impact on urban and rural areas**

Most participants believe that 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. This enhanced connectivity can lead to improved mobility within cities, reduced traffic congestion, and a more integrated urban landscape. Ultimately, the integration of HAVs can result in more efficient and user-friendly transportation systems that benefit all city dwellers.

Participants mentioned that "*in rural areas, where public transportation options are often limited or nonexistent, HAVs can play a crucial role in filling these gaps and improving overall mobility*". By providing on-demand and flexible transportation services, HAVs can help residents access essential services such as healthcare, employment, and education more easily. This improved accessibility can help rural populations overcome geographic barriers, creating stronger connections between rural communities and urban centers. Additionally, the deployment of HAVs in rural regions can contribute to the revitalization of local economies by making these areas more accessible and attractive to both visitors and businesses.

Beyond these immediate impacts on urban and rural transportation, HAVs have the potential to reshape commuting patterns and influence business locations, ultimately affecting land use and economic landscapes. As HAVs offer more flexible and efficient transportation options, "*people may become more willing to live farther from their workplaces*", potentially leading to significant changes in residential development and urban sprawl. Businesses might also reconsider their locations, balancing the benefits of central urban areas with the increasing accessibility of suburban and rural regions. These shifts could prompt profound changes in land use planning, transportation infrastructure development, and the overall economic dynamics of both urban and rural areas.

5. Improving road safety through HAVs technology

HAVs are poised to significantly enhance road safety by strictly adhering to traffic laws and minimizing risks associated with human error. Unlike human drivers, who can be prone to distractions, fatigue, or misjudgments, HAVs operate based on consistent, data-driven decision-making processes. This adherence to traffic rules leads to more predictable and safer behavior on the road, potentially reducing the number of traffic violations and accidents. Participants believe by removing common human-related errors, HAVs can create a safer driving environment and improve overall road safety for everyone.

A major factor behind this improvement is that human error is a leading cause of road accidents, and HAV technology is designed to address this issue effectively. Participants agree that HAVs can eliminate many of the mistakes human drivers commonly make, such as abrupt lane changes, speeding, or failing to stop at intersections. Equipped with advanced sensors, cameras, and real-time data analysis capabilities, HAVs react more quickly and accurately to changing road conditions than human drivers. This ability to make precise, split-second decisions can help prevent accidents that often result from delayed or incorrect human responses, thereby reducing the likelihood of collisions and fatalities.

Beyond safeguarding drivers and passengers, HAVs offer enhanced protection for vulnerable road users like pedestrians and cyclists. These vehicles come equipped with sophisticated detection systems capable of identifying and tracking the movements of pedestrians and cyclists. As a result, HAVs can adjust their speed and trajectory to avoid collisions, prioritizing the safety of these more vulnerable groups. This focus on protecting pedestrians and cyclists can contribute to creating safer urban environments where all road users can coexist more confidently. By reducing the number of traffic-related injuries and fatalities, HAVs stand to make a significant positive impact on public safety and wellbeing.

6. Upgrading infrastructure to support HAVs and public transportation

Infrastructure improvements are crucial for optimizing the performance of HAVs and enhancing the overall public transportation system. Upgrading road markings is one significant area of focus. HAVs rely heavily on clear and well-maintained lane markings to navigate accurately. By investing in more durable and visible road markings, cities and regions can ensure that HAVs operate more efficiently and safely, reducing the risk of confusion or accidents. These improvements not only benefit automated vehicles but also create a safer driving environment for human drivers.

The construction of protected spaces for vulnerable road users (VRUs) is also considered a critical factor in supporting the integration of HAVs into transportation networks. When discussing key infrastructure preparations, a participant suggested that he would "*prioritize divided bike lanes and protected bike lanes, which directly benefit their users. Additionally, providing well-maintained and accessible sidewalks improves mobility by enabling people to reach bus stops more easily. This keeps pedestrians out of the streets, minimizing their impact on AVs and addressing other safety concerns*." Protected bike lanes encourage more people to use bicycles as a sustainable mode of transportation, thereby promoting a more balanced, multi-modal transport network. In this way, bike lane infrastructure improvements contribute to a safer and more inclusive transportation system for everyone. Renovating sidewalks is another essential infrastructure improvement that benefits both HAVs and the public. For HAVs, well-maintained and clearly defined sidewalks help enhance pedestrian detection and improve navigation in densely populated areas, allowing automated vehicles to operate more safely and efficiently. For pedestrians, upgraded sidewalks improve accessibility, particularly for individuals with disabilities, older adults, and families with strollers. This leads to a more inclusive transportation environment where pedestrians feel safer and more confident using sidewalks alongside HAV technology. By ensuring that sidewalks are accessible and safe, cities foster an environment where walking becomes a more viable and attractive option for everyone.

Collectively, these infrastructure improvements lead to a more robust and user-friendly public transportation system. Upgrading road markings, constructing protected bike lanes, and renovating sidewalks creates a safer, more efficient, and inclusive environment for all road users. As HAVs become more prevalent, these enhancements to infrastructure not only optimize their performance but also ensure that pedestrians, cyclists, and traditional vehicles can coexist harmoniously. By addressing the needs of various modes of transportation, cities can better support the effective integration of HAVs while enhancing overall mobility, accessibility, and safety for everyone.

Challenges discussed during the focus group meetings:

1. **Improving HAVs ADA compliance for people with disabilities**: HAVs technology has not yet fully addressed the needs of individuals with various disabilities. Issues such as difficulty fastening seat belts, challenges with voice controls, and the inability of wheelchair users to board and exit vehicles independently are still common. These often require assistance from service personnel, adding complexity to operations and limiting accessibility.
2. **Equity issues**: Concerns exist that vulnerable groups—such as ethnic minorities and low-income populations—may be underserved by HAVs services. Companies might prioritize more profitable urban areas, potentially neglecting rural and low-income communities, thereby widening the gap in transportation equity.

3. **Worsening traffic conditions**: Some participants expressed concerns that, if not properly managed, HAV services could reduce transit ridership and worsen urban traffic congestion in cities like Philadelphia. For example, low operating speeds, such as 3 mph in downtown areas to avoid parking, could create moving bottlenecks instead of alleviating congestion. Striking a balance in resource allocation is essential to avoid negative impacts on existing public transportation systems and to prevent further traffic issues.
4. **Infrastructure and technical limitations**: HAVs require supportive infrastructure, including well-maintained pavement markings, reliable GPS and 5G networks, connected traffic signals, and accessible crosswalks. However, these technologies are not yet widely available, particularly in rural areas, where inadequate infrastructure limits the effectiveness and expansion of HAV services.
5. **Liability and regulatory issues**: Determining liability in accidents involving both human and machine errors remains a challenge. Despite legislation like Pennsylvania's Act 130, uncertainties persist regarding how these laws will be applied in practice, creating ambiguity around responsibility in the event of an HAV-related accident. As HAVs technology advances, insurance premiums and coverage terms will likely change significantly, adopting a more dynamic, data-driven approach that uses real-time vehicle data to influence claims processing and reshape the HAVs insurance landscape.
6. **Public acceptance and education**: Building public trust in HAVs is crucial for their widespread adoption. This requires enhanced education and demonstration projects to effectively communicate the benefits and limitations of HAVs technology. Public skepticism, particularly among older adults who may distrust technology, must be alleviated through targeted efforts to build confidence and showcase the advantages of HAVs.
7. **Data security and privacy**: As HAVs collect vast amounts of data, ensuring its secure storage and proper use is a major concern. Protecting this data from breaches or misuse is essential to maintaining public trust and complying with privacy regulations.

7. Recommended Changes to Policies and Legislation

Based on the focus group experts' discussion, the following recommendations summarize potential changes and/or additions needed to current PennDOT policies and procedures.

1. Some focus group participants, particularly those representing HAV vendors and trade associations, suggested reducing regulatory oversight for Level 3 automated vehicles. Level 3 vehicles may not require a HAVs certificate. It was suggested that these vehicles should not be included in the certificate regulatory framework, as they operate with human oversight and do not fully meet the criteria for higher levels of autonomy that require additional regulation.
2. Some focus group participants recommended avoiding state-specific testing and reduce regulations. One participant mentioned that "*having 50 different regulations, one for each state, would create significant challenges in terms of compliance and consistency across jurisdictions*". Another participant also noted that the Eastern U.S. region poses more challenges due to smaller state sizes, where a single trip can easily cross multiple state borders. Significant regulatory differences between states can make compliance difficult for vendors. A unified regulatory framework is suggested to streamline the process and reduce complexity.
3. 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.
4. Enhancing public trust in highly automated vehicles is a shared concern. Several focus group participants recommended launching public education campaigns and demonstration projects to build trust in HAV technology, especially among people with disabilities and older adults. These outreach initiatives should alleviate public concerns, highlight the benefits of HAVs, and strengthen confidence in the technology.
5. Some focus group participants suggested revising the 10-day notice requirement for municipalities outlined in the act, which states: "A certificate holder shall notify in writing the governing body of the municipality of the intent to operate an HAV within the boundaries of the municipality at least 10 days prior to commencing operations." They argued that requiring a 10-day notice for a municipality that the HAV will merely pass through is unnecessary. Additionally, the absence of an identified point of contact (POC) often leaves municipalities unaware of such notifications and unable to respond effectively within the 10-day time frame.
6. In section 4, "Highly automated vehicles.--If an HAV is operating on highways of this Commonwealth, a rear visibility system comprised of a set of devices or components, that together perform the function of producing the rearview image, shall be considered a mirror or a similar device to a mirror, and shall be

excluded from the measurement of the width of the HAVs consistent with applicable Federal and State laws." Some focus group participants recommended to refine the requirement for mirrors for different level of HAVs. Levels 4 and 5 may not require mirrors, as they rely on sensors such as cameras, LiDAR, and radar to perceive their surroundings. For Level 3, however, the driver must still take control in certain situations, making mirrors necessary for observing the external environment.

7. In Section 9, the act states: "A certificate holder is required to self-report to the department any accident in this Commonwealth involving the certificate holder's HAVs if the accident resulted in bodily injury, serious bodily injury, death, or damage to property. The department shall establish the time frame for self-reporting an accident, provided that the time frame is no less than six hours from the occurrence of the accident." Some focus group participants believe the six-hour window is too short and shared past experiences where reporting within such a limited time frame was challenging or not feasible.

8. Some focus group participants recommended establishing a detailed emergency response protocol for HAVs that includes procedures for identifying, securing, and disabling vehicles in emergency situations. This protocol should cover post-crash events, handling high-voltage areas, and ensuring access to essential documents such as insurance, vehicle identifiers, and keys.
9. Some focus group participants recommended enhancing the integration of automated vehicle systems with the Department of Motor Vehicles (DMV) by updating existing procedures to accommodate automated vehicle requirements. This will support more efficient coordination during emergencies and ensure the system is prepared for future technological advancements in both AVs and EVs.
10. Some focus group participants recommended establishing enhanced training programs for first responders (e.g., police officers, firefighters, paramedics, hazmat teams) to effectively manage emergency situations involving HAVs, thereby improving safety and preparedness.
11. Some focus group participants recommended prioritizing the repair and maintenance of critical transportation infrastructure, such as road markings, signs, and traffic lights, to support the safe integration of HAVs into Pennsylvania's transportation network.
12. Some focus group participants recommended implementing policies to encourage the deployment of HAVs in rural areas to improve first-mile and last-mile transit solutions, enhance connectivity, and support regional economic growth. They expressed concerns that without such measures, AV vendors might prioritize urban areas with higher demand, leaving rural communities underserved.
13. The research team recommends that PennDOT continuously monitor and evaluate the impact of Act 130, while periodically reviewing public input and feedback. Since both Act 130 and its guidelines were only recently issued, the full impact is expected to unfold over the coming years. Furthermore, as vendors begin applying for certification and initiating the deployment process, it is anticipated that additional feedback will

emerge. The HAV committee should remain attentive to this input and address it promptly through timely discussions.

14. The research team suggests that as vendors submit the data specified in the "Certificate of Compliance Guidelines" to PennDOT, the state should develop a comprehensive plan to analyze, publish, and utilize this information. This includes ongoing accident reporting, compliance reports, and safety reporting data. For instance, states like California regularly publish AV collision and disengagement reports. By analyzing AV safety metrics—such as miles per disengagement—and creating visualizations of disengagements, crash frequency, and locations, as well as tracking how these metrics evolve over time, PennDOT could significantly enhance public understanding and, in turn, foster greater trust in the technology.

Appendix A Q&A Documents for Understanding Act 130

General Summary

1. Q: What is Act 130?

A: Act 130 refers to a piece of legislation enacted in Pennsylvania that addresses various aspects related to Highly Automated Vehicles.

2. Q: When do the different sections of Act 130 take effect?

A: The effective dates for the provisions of Act 130 are as follows:

(1) Section 11 of the Act, which outlines the effective dates, takes effect immediately.
(2) The amendment of 75 Pa.C.S. § 1106(b) (Section 2) will take effect in one year from the date of approval, specifically on November 3, 2023.
(3) The addition of 75 Pa.C.S. § 3723 (Section 3.1) is set to take effect in 60 days from the approval date, which is January 2, 2023.
(4) The addition of 75 Pa.C.S. § 8510.2 (Section 9) takes effect immediately upon approval.
(5) The remainder of the Act will take effect in 240 days from the date of approval, i.e., July 1, 2023.

3. Q: Where is Act 130 available?

A: Act 130 is available online and can be freely accessed at:

https://www.legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=2022&sessInd=0&act=130

4. Q: What is Act 130 about?

A: Act 130 includes significant amendments to the State's vehicle code (Title 75) and covers definitions, rules, equipment standards, inspections, and other regulations concerning HAVs. This Act provides a framework for how these vehicles should operate, focusing on areas like safety, licensing, insurance, and operations on public roads. Additionally, Act 130 introduces new offenses, such as the theft of catalytic converters, and establishes guidelines for the reporting and handling of vehicular accidents. It also outlines the responsibilities of different government bodies in regulating and overseeing the use of HAVs in Pennsylvania. Act 130 includes a total of 11 sections.

Section 1: Adding definitions in section 102 of Title 75

5. Q: What is an "Automated Driving System (ADS)" and how does it function?

A: An ADS consists of advanced hardware and software capable of handling the entire driving task independently. It controls functions such as steering, braking, accelerating, and monitoring the vehicle's surroundings and can respond to road conditions without human input.

In terms of driving automation levels as defined by the Society of Automotive Engineers (SAE) and adopted by the US Department of Transportation, as shown in **Fig. 13**, ADS varies in complexity and capability:

1. **Level 0 (No Driving Automation):** The driver performs all driving tasks.

2. Level 1 (Driver Assistance): The vehicle includes systems like cruise control for acceleration or automated steering, but not both simultaneously.

3. Level 2 (Partial Driving Automation): The vehicle can automate both steering and acceleration tasks yet requires the driver's full engagement with the driving process and environment monitoring.

4. Level 3 (Conditional Driving Automation): The ADS executes all driving functions under certain conditions; however, the driver must be ready to intervene if called upon.

5. Level 4 (High Driving Automation): The vehicle can perform all driving operations under specific conditions without any human intervention, but there may be some operational constraints.

6. Level 5 (Full Driving Automation): The vehicle is fully automated, capable of performing all driving operations under all conditions without any human input.

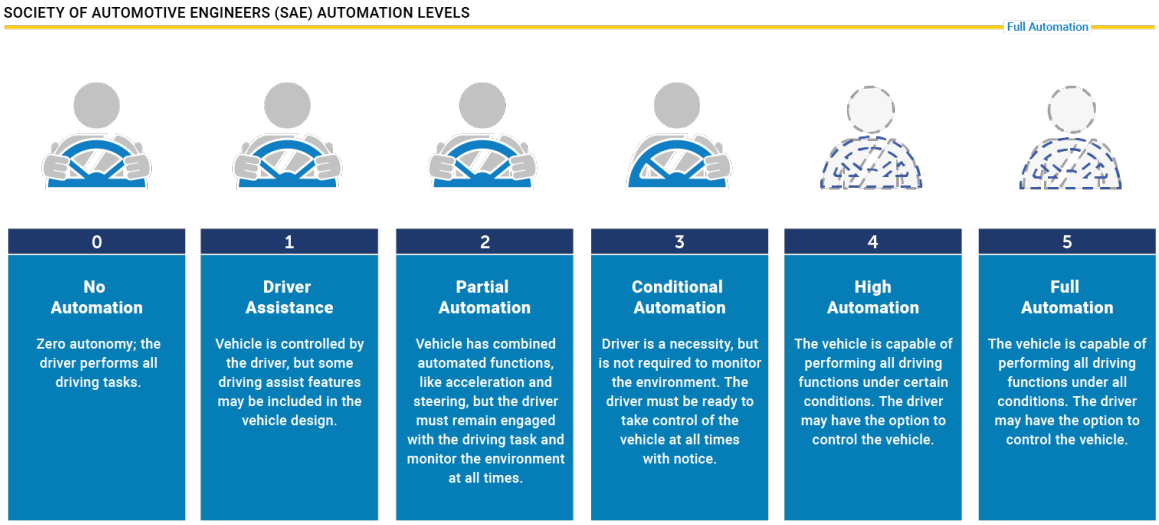


Figure 13 Levels of automated driving

At Levels 3 to 5, vehicles are typically referred to as HAV. Vehicles designed to operate exclusively on Level 4 or Level 5 automation are known as “ADS-dedicated vehicles,” meaning they do not require a human driver.

6. Q: What automation vehicles are HAVs?

A: HAVs refer to the vehicles with automation level 3 to 5.

7. Q: Can an individual obtain an HAVs certificate?

A: According to Act 130, individual persons are not typically recognized as certificate holders for HAVs. Eligible entities to hold such certificates include firms, partnerships, associations, corporations, or educational or research institutions.

8. Q: How to become an HAV driver?

A: To become a driver of an HAV under Act 130, the following criteria must be met:

(1) Certificate Holder Affiliation: The individual must be an authorized employee or contractor of a certificate holder.

(2) Dynamic Driving Task (DDT): The driver is responsible for managing all or part of the dynamic driving task, even if the vehicle is largely automated.

(3) Monitoring Capability: The driver must be capable of monitoring and controlling the HAV either on board the vehicle or remotely from a location within the United States.

9. Q: What is a "platoon"? What kind of vehicles can form a platoon? Can school vehicles form a platoon?

A: A platoon refers to a group of vehicles, specifically buses, military vehicles, or motor carrier vehicles, traveling closely together at electronically coordinated speeds, which allows them to maintain shorter following distances than typically advisable. Platoon configurations do not include school buses or school vehicles.

10. Q: Does a platoon have a maximum vehicle limit?

A: Yes, a maximum of three vehicles shall be in a platoon

11. Must each vehicle in the platoon include a driver?

A: Yes, a driver shall be present in each vehicle of a platoon, except as provided in the following: Consistent with applicable federal or state laws and regulations, the lead vehicle may operate with a driver, and one non-lead vehicle may operate with an Automated Driving System (ADS) engaged, with or without a driver.

12. Q: Should vehicles in a platoon travel only on limited-access highways or interstate highways?

A: Yes, vehicles in a platoon shall travel only on limited access highways or interstate highways, unless otherwise permitted by the department or the Pennsylvania Turnpike Commission, as applicable.

13. Q: Can "Personal Delivery Devices" (PDDs) with an ADS be called HAVs?

A: No, PDDs equipped with ADS are not classified as HAVs under Act 130. While both utilize ADS technology, HAVs are specifically defined as motor vehicles designed for the transportation of persons or goods, whereas PDDs are primarily used for transporting goods on sidewalks and pathways, and are not designed to carry passengers. Act 130 explicitly excludes PDDs, which are considered as pedestrians under Pennsylvania law, from being recognized as HAVs.

Section 2： Amending the content and effect of certificate in section 1106 (b) (10) and (11) of Title 75

14. Q: I want to transfer my vehicle title certificate, but I don't want to disclose that the car is an HAV. Is that okay? What will be the consequences?

A: No, it is not permissible to transfer a vehicle title without disclosing that the vehicle is an HAV. According to Act 130, any transfer of a vehicle title must include clear notification if the vehicle has specific conditions or uses, such as being an HAV. Failing to disclose this information violates the Act, and any person found guilty of such nondisclosure commits a summary offense. Upon conviction, they are subject to a fine of $200.

Section 4: Amending Sections 3742, 3743, 3744, 3745, 3746, 4103, 4702 and 4921 of Title 75

15. Q: What should be done when an HAV is involved in an accident?

A: When an HAV is involved in an accident, the responsible party—either a person on behalf of the certificate holder for the HAV or an operator of the HAV itself—must immediately contact a duly authorized police department to report the accident. They must also provide the registration details and proof of financial responsibility for the HAV to the police department and PennDOT.

16. Q: When an HAV equipped with a rear visibility system, which functions as a traditional mirror, is operating on highways of this Commonwealth, should the rear visibility system be included in the overall width measurement of the vehicle for compliance with state vehicle dimension regulations?

A: No, according to Section 4921(e.3) of Act 130, a rear visibility system that functions as a traditional mirror in an HAV operating on highways of this Commonwealth shall be considered equivalent to a mirror but shall be excluded from the measurement of the width of the vehicle. This exclusion is consistent with applicable Federal and State laws.

Section 5: Amending Section 6109 (a) (13) of Title 75 by specific powers of department and local authorities

17. Q: Does Act 130 affect the reasonable exercise of police powers? Are local authorities allowed to ban or regulate the use of certain classes or types of traffic on particular streets, specifically targeting or discriminating against HAVs? Do HAVs have equal rights with other regular driver-driven vehicles?

A: According to Act 130, local authorities maintain the power to prohibit or regulate the use of specific streets by any class or kind of traffic, ensuring the reasonable exercise of police powers. However, these regulations must not specifically target or discriminate against HAVs, ensuring HAVs are treated equally to traditional, driver-driven vehicles on public roads.

Section 6: Amending Section 8501 of Title 75 by adding definitions

18. Q: What is a highly automated work zone vehicle?

A: A highly automated work zone vehicle is a motor vehicle that is utilized within an active work zone, managed by either the Pennsylvania Department of Transportation or the Pennsylvania Turnpike Commission. It is specifically used for operations related to that active work zone and is characterized by one of the following features:

(1) Equipped with an automated driving system that enables it to operate in automated mode.

(2) Connected via wireless communication or other technologies to another vehicle, which allows for coordinated or controlled movement within the work zone.

19. Q: What is "Dynamic Driving Task fallback"?

A: DDT fallback refers to the actions taken by the ADS of an HAV when there is a system failure related to the DDT or when the vehicle exits its operational design domain. The ADS or the driver, if present, must either continue performing the DDT or transition the vehicle to a minimal-risk condition to ensure safety.

20. Q: Can the "Dynamic Driving Task" select a destination or a waypoint? What can DDT accomplish? Could you give us an example?

A: No, the DDT does not include strategic functions such as trip scheduling or the selection of destinations and waypoints. It focuses on immediate operational tasks required for driving. These include, but are not limited to:

(1) Lateral vehicle motion control via steering.

(2) Longitudinal motion control via acceleration and deceleration.

(3) Monitoring the driving environment through the detection, recognition, classification, and preparation to respond to objects and events.

(4) Execution of responses to objects and events.

(5) Maneuver planning.

(6) Enhancing vehicle conspicuity through lighting, signaling, and gesturing.

(7) These functions are integral to managing the vehicle's movement and ensuring safety but do not encompass navigation to chosen destinations or waypoints.

21. Q: How do HAVs reduce the risk of collisions? What does "minimal risk condition" mean?

A: HAVs incorporate a 'Minimal Risk Condition' to significantly reduce the risk of collisions. This feature is a safety protocol where the HAVs or its ADS brings the vehicle to a stable, stopped condition if continuing the trip becomes unsafe or impractical. This condition is activated following a 'DDT fallback' scenario, where the vehicle must manage a failure or operational issue that threatens the continuation of normal driving operations.

Section 7: Amending Section 8502 of Title 75 by the definition of HAV

22. Q: Which organization has the authority to grant or deploy highly automated work zone vehicles? Will HAVs require driver supervision? In what areas might their work zones be involved?

A: PennDOT and the Pennsylvania Turnpike Commission have the authority to authorize locations on their roadways for the deployment of highly automated work zone vehicles in Pennsylvania. These organizations decide on the specific locations where these vehicles can be used on a periodic basis. Depending on the specific operational requirements and safety considerations, a driver may be required in a highly automated work zone vehicle, especially when used in active work zones. The deployment areas typically involve major roadways or areas undergoing extensive maintenance or construction work.

Section 8: Amending Section 8503 (b) and (h) of Title 75 by adding a subsection about Highly Automated Vehicle Advisory Committee

23. Q: Could Tom, who works as a regular car salesman, and his friend Jack, a teacher, be eligible to serve on the Highly Automated Vehicle Advisory Committee?

A: Tom and Jack would only be eligible if they represent one of the specific groups mentioned in the committee structure. These include members from educational or research institutions, technology companies, vehicle manufacturers, and other specified stakeholders in highly automated vehicle development. Typically, the roles of a car salesman and a teacher do not align with the specialized positions defined for committee membership unless they have additional relevant qualifications or representational roles.

The Advisory Committee shall consist of the following members:

(1) The secretary, who shall serve as the chairperson of the advisory committee.
(2) The Secretary of Community and Economic Development.
(3) The Insurance Commissioner.
(4) The Secretary of Labor and Industry.

(5) The Commissioner of Pennsylvania State Police.
(6) The Chief Executive Officer of the Pennsylvania Turnpike Commission.
(6.1) The chairperson of the Pennsylvania Public Utility Commission.
(7) The chairperson and minority chairperson of the Transportation Committee of the Senate.
(8) The chairperson and minority chairperson of the Transportation Committee of the House of Representatives.
(9) The following members to be appointed by the Governor:
i. One member representing a transit authority located in this Commonwealth.
ii. One member representing [a transportation,] an educational or research institution located in this Commonwealth engaged in developing highly automated vehicles.
iii. One member representing a technology company engaged in developing highly automated vehicles.
iv. One member representing a vehicle manufacturer engaged in developing highly automated vehicles.
v. One member representing bicyclists, pedestrians or motorcyclists in this Commonwealth.
vi. One member representing drivers or consumers in this Commonwealth.
vii. One member representing a municipality of this Commonwealth.
viii. One member representing platoon operations.
ix. One member representing an insurance company, association or exchange who is authorized to transact the business of motor vehicle insurance in this Commonwealth.
x. Two members representing different labor organizations in this Commonwealth.
xi. One member representing Pennsylvanians with disabilities.
xii. One member representing a company engaged in the development of highly automated motor carrier vehicles.

24. Q: The HAV Advisory Committee is required to submit a special annual report that evaluates the impact of HAVs on the state. What will be included in this report?

A: The annual report submitted by the HAV Advisory Committee under Act 130 should include several critical evaluations to assess the impact of HAVs on the state:

(1) Benefits and implications for the workforce.

(2) Economic benefits and implications.

(3) Improvements to accessibility and mobility for persons with disabilities.

(4) Improvements to mobility options for the general public.

(5) Suggested changes to the laws of this Commonwealth to better integrate and regulate HAVs.

25. Q: Does the HAV Advisory Committee have the power to punish HAV drivers?

A: No, the Highly Automated Vehicle Advisory Committee does not have the authority to punish HAV drivers directly. Their powers are limited to evaluating accidents and other aspects related to the operation of HAVs. The committee can provide recommendations and feedback based on their evaluations, but any legal actions or penalties would fall under the jurisdiction of legal and regulatory bodies, not the advisory committee itself.

Section 9: Amending Title 75 by adding Section 8504, 8505, 8506, 8507, 8508, 8509, 8510

26. Q: Can an HAV from California enter Pennsylvania without a certificate if it intends to travel through Pennsylvania?

A: An HAV must have a valid certificate to operate in Pennsylvania, regardless of its state of origin. If an operator holds an HAV certificate in California, it does not automatically permit operation in Pennsylvania unless there is an existing interstate agreement or recognition of out-of-state certificates specifically allowing such an operation. As of current regulations under Act 130, each state maintains its certification process, and there's no automatic reciprocity for HAV operation across state lines without specific authorization.

27. Q: Tom is a driver for the public transit operator (such as SEPTA or CATA), which has a certificate for operating HAVs. Can Tom legally drive an HAV on a highway?

A: Yes, Tom can legally drive an HAV on a highway as long as he is authorized by the public transit operator (such as SEPTA or CATA) to do so. The transit operator, being a certificate holder for HAVs, must designate its drivers who are permitted to operate these vehicles. If Tom is authorized by the transit operator, he can operate the HAV on a highway; if not, he cannot drive the HAV without proper authorization.

28. Q: Which organization has the sole regulatory authority to operate HAVs on highways in Pennsylvania?

A: PennDOT has the sole regulatory authority to operate HAVs on highways within this Commonwealth. This authority is consistent with the provisions of Act 130 and applicable federal laws and regulations.

29. Q: Can someone from the HAV Advisory Committee prohibit the use of an HAV on a highway?

A: No, only the secretary of PennDOT has the right to prohibit the use of an HAV on a highway. The premise is that an HAV operate on a highway may constitute a hazard. The Advisory Committee itself does not have the authority to prohibit the use of HAVs on highways.

30. Q: Suppose there is a serious accident involving an HAV on a highway. As the holder of the HAV certificate, Tom did not report the incident to the department until 24 hours later. Is this, okay?

A: No, reporting the incident 24 hours later does not comply with the requirements set forth in Act 130. According to the Act, PennDOT establishes the timeframe for reporting accidents involving an HAV that resulted in bodily injury, serious bodily injury, death, or significant property damage. The timeframe established by the department is no less than six hours from the occurrence of the accident. Therefore, Tom should have reported the accident within the timeframe specified by PennDOT, which would be no less than six hours after the incident.

31. Q: What information of the certificate holders will be listed on PennDOT's publicly accessible Internet website?

A: According to Act 130, the publicly accessible Internet website should provide comprehensive information about HAV operations, not just the list of certificate holders. This includes:

(1) Location information where the HAV is expected to operate.

(2) The name and contact information for accident claims, including the registered agent for service of process.

32. Q: Tom was penalized for a violation while driving an HAV a year ago. Can he now control all or part of the DDT?

A: Yes, if the penalty specified under Act 130 or related regulations includes a one-year ban from driving an HAV, and this period has elapsed, Tom would no longer be subject to this restriction. After the completion of the one-year penalty, restrictions on controlling the DDT would no longer be imposed, allowing him to resume driving under the terms of his certification.

33. Q: A public transit operation wants to conduct self-certification for HAVs, but the form they submit does not include registered agents for legal process services related to accident claims. Will this self-certification form be approved?

A: No, the self-certification form for HAVs must include specific information to be approved under Act 130. The required contents of the form include the name, address, and contact information of the applicant. Crucially, it must also include details such as a principal point-of-contact for the applicant's accident claims and a registered agent for service of process. If these elements are missing, the form will not meet the statutory requirements and therefore will not be approved.

34. Q: How can we ensure the safety of the HAV driver and the operation of the HAV on a highway?

A: To ensure the safety of the HAV driver and the operation of the HAVs on a highway, the ADS must be properly engaged. If there is a failure in the ADS that renders it unable to perform the entire DDT within the intended Operational Design Domain (ODD), the vehicle or the driver must transition the HAV to a minimal risk condition. This involves taking necessary actions to reduce the risk of accidents, such as safely pulling over or stopping the vehicle.

35. Q: Is it reasonable for a compliance certificate holder of an HAV, to notify the municipal administration in writing within five days before the commencing operation of the HAVs?

A: No, at least 10 days.

36. Q: If there is a motor carrier HAV with a commercial driving license but without an HAV driver, is the vehicle subject to federal and state laws or regulations? Are they subject to the same HAV regulations as vehicles with a driver?

A: Yes, motor carrier HAVs without drivers are subject to both federal and state laws, similar to those with drivers. However, the specific regulations applied may vary, particularly in areas that involve direct human oversight. Federal and state laws ensure that all HAVs meet stringent safety and operational standards, whether they are operated with the ADS engaged or with a human driver. Nevertheless, certain aspects of the regulations that specifically address the human driver's responsibilities might be adjusted or replaced by requirements suited to automated operations.

37. Q: A transit operator owns two HAVs; the company has decided to use one vehicle for public welfare activities, such as serving as a campus bus, and to use the other vehicle to transport hazardous materials to generate revenue. Is this allowed?

A: Using an HAV for public welfare activities like serving as a campus bus is permissible under Act 130, as long as it does not involve operating as a school bus or school vehicle. However, using an HAV to transport hazardous materials is generally restricted under Act 130. The law states that HAVs may not carry hazardous materials that require placarding according to federal regulations unless the certificate holder receives specific certification from the department following the promulgation of regulations. Therefore, the use of an HAV to transport hazardous materials, as described, would not be allowed unless these conditions are met.

38. Q: When an HAV is involved in a traffic accident, should it be subject to the local law or state law? How should decisions be made when there is a discrepancy between local and state laws?

A: In the event of a traffic accident involving an HAV, both local and state laws may apply. Local authorities have the right to exercise their police powers reasonably over HAVs, as long as these powers do not specifically discriminate against HAVs. However, where there is a discrepancy between local and state laws concerning the

operation of HAVs as a type or class of vehicle, state laws will generally take precedence. This is to ensure uniformity in the regulation of HAV operations across the state. Therefore, in cases where local ordinances conflict with state regulations regarding HAVs, the state regulations should be followed.

39. Q: How can a driverless HAV satisfy a police inspection by a police officer?

A: Under Act 130, if a driverless HAV is stopped for a police inspection and there is no human driver on board, the vehicle is required to provide access to its vehicle registration card. This card must be either physically present within the vehicle or electronically accessible to the police officer. This provision ensures that even without a driver, the vehicle can still comply with typical requirements during traffic stops, such as showing a driver's license and registration card to an officer.

40. Q: How can we ensure that the public and stakeholders are able to adequately express their comments and concerns before regulations and guidelines for HAVs are developed?

A: To ensure public and stakeholder engagement in the development of regulations and guidelines for HAVs, the department responsible for these regulations conducts a thorough consultation process. This includes consulting with the advisory committee in a public meeting before promulgating any regulations or publishing guidelines under this subchapter. Additionally, there is a mandatory 10-day public comment period before any temporary regulations or guidelines are finalized. For the final regulations, the department adheres to the public comment period stipulated under the Regulatory Review Act, allowing ample opportunity for all concerned parties to submit their inputs.

41. Q: Would the Department, on behalf of Pennsylvania, establish an interstate agreement with another State to allow its HAVs and platoons to operate in Pennsylvania? Once established, would it take effect immediately?

A: The Department can negotiate an interstate agreement to allow the operation of another State's HAVs and platoons in Pennsylvania. Such an agreement would become effective only after it receives approval from the Governor of Pennsylvania. Additionally, the agreement must comply with all relevant federal laws and regulations. It is also required that each HAV operated under this agreement within Pennsylvania be adequately insured or self-insured in accordance with the minimum amounts stipulated by Act 130. The immediate effect of the agreement upon governor's approval ensures prompt enactment, provided that all legal and regulatory requirements are satisfied.

42. Q: What are the penalties for non-compliance with the regulations governing highly automated vehicles?

A: Under Act 130, any person who operates an HAV on a highway in a manner that is not in accordance with the set regulations is subject to legal penalties. Specifically, if convicted for such non-compliance, the individual is liable to pay a fine of not less than $1,000. This stringent penalty underscores the importance of adhering to regulatory standards to ensure the safety and efficiency of HAV operations on public roads.

Section 10: Amending Chapter 85 of Title 75 by adding a subchapter D named other automated vehicles

43. Q: What kind of vehicle can be the leader of a platoon on Pennsylvania? And can one nonlead vehicle operate without a driver via an ADS?

A: According to Act 130, the lead vehicle in a platoon must be operated with a driver. However, one or more nonlead vehicles in the platoon may operate with an ADS engaged, and these vehicles may operate either with or without a driver, consistent with applicable federal and state laws and regulations. This allows for flexibility in the

configuration of platoons, enhancing the potential benefits of automated driving technology while ensuring safety and regulatory compliance.

44. Q: For the general platoon operations program, what procedures and standards apply to operating a fleet on the highways of this Commonwealth?

A: Under Act 130, the following procedures and standards apply to operating a platoon fleet on the highways of Pennsylvania:

(1) A person or entity may operate a platoon on state highways if they submit a plan for general platoon operations to the Department of Transportation. This submission must be made in consultation with the Pennsylvania State Police and the Pennsylvania Turnpike Commission, as applicable.

(2) The department has 30 days to review the submitted plan. If the plan is neither explicitly approved nor rejected, nor is additional information requested within this period, the plan is deemed approved automatically, allowing the person or entity to commence platoon operations.

45. Q: Where can I find out more about the policies around platooning operations?

A: The vehicle platooning policy could be found here:

https://www.penndot.pa.gov/ProjectAndPrograms/ResearchandTesting/Automated%20_Vehicles/Documents/Vehicle%20Platooning%20Policy.pdf

Section 11: Amended the effective time of this Act 130

Appendix B Interviewer Script for Workforce and Economic Impact Analysis

Specific Questions:

0. **Icebreaker**

    a) Introduce yourself (set the context). Please share your name, your organization, and describe your experience in workforce and economic development within your professional setting.

    b) When did you first encounter the concept of HAV, and how has HAV impacted your work?

    c) What's the first word that comes to mind when you hear "HAV coming to Pennsylvania"?

1. What specific changes in workforce demand have you observed in your industry, organization, or company due to HAV technology? Have these changes increased or decreased workforce demand?
2. Can you identify any new job roles or occupations that have emerged (or will emerge) as a result of HAV technology in Pennsylvania, either currently or in the future? (e.g., mechanical shops, inspection, car washing, remote operators)
3. Have you observed, or do you foresee, any reduction in operational costs in your organization due to HAV technology? If so, how? (Specifically related to levels 3 and above, not automation in general)
4. What new skills or training do you think are necessary to adapt to HAV technology in your field? Which trainings are most important or needed?
5. How do you think Act 130 will impact the workforce in Pennsylvania? You can use your organization as an example or discuss PA in general.
6. How do you think Act 130 will impact economic development in Pennsylvania? You can use your organization as an example or discuss PA in general (e.g., sales, tax, job creation, faster traffic and goods delivery).
7. In your opinion, how might vehicle inspection, repair, and maintenance businesses adapt to the development of HAV technology? Have you heard of any discussions or news on potential changes?
8. How will Act 130 impact economic development in PA? You can use your organization as an example, or in general PA. (sales, tax, job positions, faster traffic and good delivery?)
9. In your opinion, how may the vehicle inspection, repair and maintenance businesses/shops adapt to the development of HAV technology? Have you heard of any discussions/news on some potential changes?
10. What market growth opportunities, such as vehicle purchases, sensors, data analytics, and others, do you foresee as a result of HAV technology?

Closing Questions:

1. What are some opportunities and challenges you foresee for fleet-based HAVs (Levels 3, 4, and 5) in Pennsylvania?

Appendix C Interviewer Script for Accessibility and Mobility Impact Analysis

Specific Questions:

0. Icebreaker

a) Introduce yourself (set the context). Please share your name, your organization, and describe your experience with accessibility and mobility-based analysis in your professional setting.
b) When did you first encounter the concept of Highly Automated Vehicles, and how has HAV impacted your work?
c) What's the first word that comes to mind when you hear "HAVs coming to Pennsylvania"?

1. Do you believe HAVs will enhance accessibility and mobility in Pennsylvania? Please share your thoughts to support your answer.
2. How well does HAVs technology meet the needs of individuals requiring special accommodations? What areas do you think need improvement?
3. What roles should HAVs play in public transportation? Do you see HAVs complementing or replacing existing transit systems? Considering Pennsylvania's rural nature, how do you foresee HAVs impacting transit services?
4. What existing infrastructure do you think needs improvement to better support HAVs technology?
5. What improvements have you seen, or do you foresee, in public transportation services due to HAVs technology in Pennsylvania?
6. Do you believe that HAVs technology has the potential to enhance safety for vulnerable road users, marginalized communities, and disabled travelers? In your experience, have you seen such measures implemented in Pennsylvania?
7. What is your overall experience or opinion on HAVs shared mobility services, such as Waymo's robotaxi? Do you believe these services can enhance accessibility and mobility?
8. How can Pennsylvania DOT better utilize HAVs technology or support its deployment to improve overall accessibility and mobility in Pennsylvania?
9. If you could only choose one, would you prioritize HAVs investment in urban or non-urban (suburban & rural) areas, from the perspective of enhancing accessibility and mobility?

Closing Questions:

1. What are some opportunities and challenges you foresee for fleet-based HAVs (Levels 3, 4, and 5) in Pennsylvania?

Appendix D Information of Identified Stakeholders

(1) Benefits and Implications to the Commonwealth's workforce

TABLE 6 IDENTIFIED STAKEHOLDERS FOR THE WORKFORCE IMPACT ANALYSIS

Organization	Category
SAE International	Professional Organization
PA. Public Utility Commission	State/Municipal Government
Pennsylvania Department of Education	State/Municipal Government
City of Pittsburgh - Department of Mobility & Infrastructure	State/Municipal Government
City of Philadelphia	State/Municipal Government
Pennsylvania Department of Labor and Industry	State/Municipal Government
Carnegie Mellon University	Academics/Education
Michael Baker International	Consultant
Partners for Automated Vehicle Education (PAVE)	Non Profit
Centre Area Transportation Authority (CATA)	Transit Agency
Buchanan Ingersoll & Rooney	Law Firm
Conference of Minority Transportation Officials (COMTO)	Work Force Organization
DOL Women's Bureau	Work Force Organization
Royal Truck & Equipment	Private Industry
Perrone Robotics	Private Industry
RoboTire	Private Industry
FedEx Ground Package System, Inc.	Private Industry
Aurora	Private Industry
PA Motor Truck Association	State/Municipal Government

Motor Carrier Safety Advisory Committee	State/Municipal Government
PA Department of Labor & Industry	State/Municipal Government
PA Department of Agriculture	State/Municipal Government
Southwestern Pennsylvania Commission	State/Municipal Government
Motional	Private Industry
TechNet: The Voice of the Innovation Economy	Non Profit
Waymo	Private Industry

(2) Economic Benefits and Implications to the Commonwealth

Table 7 Identified stakeholders for the economic impact analysis

Organization	**Category**
Carnegie Mellon	Academics/Education
SAE International	Professional Organization
PA Department of Community & Economic Development	Planning & Economic Development
Pittsburgh Regional Alliance	Planning & Economic Development
PA Turnpike Commission	State/Municipal Government
PA Department of Community and Economic Development	State/Municipal Government
Southwestern Pennsylvania Commission	State/Municipal Government
Drive Engineering	Consultant
DCED-Governor's Action Team	Planning & Economic Development
Pittsburgh Regional Alliance	Planning & Economic Development
Regional Industrial Development Corporation (RIDC)	Planning & Economic Development
Skyline Technology Solutions	Private Industry
Royal Truck & Equipment	Private Industry

Royal Truck & Equipment	Private Industry
Perrone Robotics	Private Industry
Allegheny Conference on Community Development	Non Profit
Pittsburgh Downtown Partnership	Non Profit
Aurora	Private Industry
PA Chamber of Business & Industry	State/Municipal Government
PA Department of Community & Economic Development	State/Municipal Government

(3) Improvements to Accessibility for Persons with Disabilities

Table 8 Identified stakeholders for the accessibility impact analysis

Organization	**Category**
University of Pittsburgh School of Medicine	Academics/Education
University of Pittsburgh	Academics/Education
Carnegie Mellon	Academics/Education
SAE International	Professional Organization
Southwestern Pennsylvania Commission	State/Municipal Government
Centre Area Transportation Authority (CATA)	Transit Agency
Rabbit Transit	Transit Agency
Automated Vehicle Industry Association	Law Firm
Aurora	Private Industry
Aurora	Private Industry
Royal Truck & Equipment	Private Industry
Locomation	Private Industry
Cubic Transportation	Private Industry

Koop Technologies	Private Industry
ABATE (motorcyclists)	State/Municipal Government
Statewide Independent Living Council	State/Municipal Government
Pedalcycle and Pedestrian Advisory Committee	State/Municipal Government
Pennsylvania Driving Under the Influence Association	State/Municipal Government
PA Department of Aging	State/Municipal Government
Delaware Valley Regional Planning Commission	Planning & Economic Development

(4) Improvements to Mobility Options for the General Public

Table 9 Identified stakeholders for the mobility impact analysis

Organization	**Category**
Carnegie Mellon	Academics/Education
University of Pittsburgh	Academics/Education
Kittelson & Associates, Inc.	Consultant
Kittelson & Associates, Inc.	Consultant
Imperial Traffic & Data Collection, LLC.	Consultant
Michael Baker International	Consultant
Southwestern Pennsylvania Commission	State/Municipal Government
City of Pittsburgh Dept of Mobility & Infrastructure	State/Municipal Government
City of Pittsburgh Department of Mobility and Infrastructure	State/Municipal Government
Royal Truck & Equipment	Private Industry
Perrone Robotics	Private Industry
Reflex AI	Private Industry
Ford Motor Company	Private Industry

Pittsburgh Regional Transit	State/Municipal Government
Southeastern Pennsylvania Transportation Authority (SEPTA)	State/Municipal Government
Latitude AI	Private Industry
Stack AV	Private Industry
PA Public Transportation Association	State/Municipal Government
PA School Bus Association	State/Municipal Government
Public Utility Commission	State/Municipal Government
Centre Regional Planning Agency	State/Municipal Government

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Appendix E Information of Final Focus Groups Participants

Thirty-five individuals from the 29 listed organizations agreed to participate in the focus group sessions. They were divided into five focus group sessions. Additionally, three shorter one-on-one sessions were organized to accommodate participants with scheduling conflicts.

1. Aurora
2. Motional
3. Latitude AI
4. Ford Motor
5. StackAV
6. PA Motor Truck Association
7. Autonomous Vehicle Industry Association
8. TechNet: The Voice of the Innovation Economy
9. SAE International
10. Regional Industrial Development Corporation (RIDC)
11. Pennsylvania Driving Under the Influence Association
12. Motor Carrier Safety Advisory Committee
13. Conference of Minority Transportation Officials (COMTO)
14. Centre Area Transportation Authority (CATA)
15. Southeastern Pennsylvania Transportation Authority (SEPTA)
16. Rabbit Transit
17. Executive Deputy Secretary of Policy & Planning, Office of Governor Josh Shapiro
18. PA Department of Aging
19. PA Turnpike Commission
20. Delaware Valley Regional Planning Commission
21. Centre Regional Planning Agency
22. Southwestern Pennsylvania Commission
23. City of Pittsburgh, Department of Mobility and Infrastructure
24. City of Philadelphia
25. Carnegie Mellon University
26. University of Pittsburgh
27. Michael Baker International
28. Kittelson & Associates, Inc.

29. Drive Engineering

Table 10 Identified information for the participants

Organization	Name	Email
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PA Motor Truck Association	Rebecca Oyler	royler@pmta.org
Michael Baker International	Jeffrey Kupko	jeffrey.kupko@mbakerintl.com
Kittelson & Associates, Inc.	Glenn Rowe	growe@kittelson.com
Centre Area Transportation Authority (CATA)	Kimberly Fragola	kfragola@catabus.com
Delaware Valley Regional Planning Commission	Fang Yuan	fyuan@dvrpc.org
Centre Ragional Planning Agency	Gregory M. Kausch	gkausch@crcog.net
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Pennsylvania Driving Under the Influence Association	Leo Hegarty	lhegarty@padui.org
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Motional	Sam Wempe	samuel.wempe@motional.com
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Ford Motor	Michelle Elder	melder7@ford.com
StackAV	Elizabeth Fishback	liz@stackav.com
Drive Engineering	Gabby Benson	gabby@driveengineering.com

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