

# **Accessible Transportation Technologies Research Initiative (ATTRI) Policy Roadmap for Development Policies to Enable Widespread Deployment**

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**Final Report – March 2020**  
**Publication Number: FHWA-JPO-20-783**



U.S. Department of Transportation

Produced by Booz Allen Hamilton  
U.S. Department of Transportation  
Office of the Assistant Secretary for Research and Technology, Intelligent Transportation  
Systems Joint Program Office

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**Technical Report Documentation Page**

<b>1. Report No.</b> <b>FHWA-JPO-20-783</b>		<b>2. Government Accession No.</b>		<b>3. Recipient's Catalog No.</b>	
<b>4. Title and Subtitle</b> ATTRI Policy Roadmap for Development Policies to Enable Widespread Deployment				<b>5. Report Date</b> March 2020	
				<b>6. Performing Organization Code</b>	
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<b>9. Performing Organization Name and Address</b> Booz Allen Hamilton 8283 Greensboro Drive McLean, VA 22102  Transportation Sustainability Research Center - UC Berkeley 2150 Allston Way #280 Berkeley, CA 94704				<b>10. Work Unit No. (TRAVIS)</b>	
				<b>11. Contract or Grant No.</b> DTFH61-16-D-00035/ 693JJ318F000332	
<b>12. Sponsoring Agency Name and Address</b> U.S. Department of Transportation Federal Transit Administration Office of the Assistant Secretary for Research and Technology, ITS Joint Program Office 1200 New Jersey Avenue, SE Washington, DC 20590				<b>13. Type of Report and Period Covered</b> Policy Roadmap	
				<b>14. Sponsoring Agency Code</b>	
<b>15. Supplementary Notes</b> Robert Sheehan, ITS JPO Task Manager					
<b>16. Abstract</b> The Accessible Transportation Technologies Research Initiative (ATTRI) is an accessibility-oriented research project supported by multiple partners, including the U.S. Department of Transportation (USDOT); the Federal Highway Administration (FHWA); Federal Transit Administration (FTA); Intelligent Transportation Systems Joint Program Office (ITS JPO); and the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR). The goal of ATTRI is to use innovative applications to increase the accessibility of transportation for people with disabilities. This is task three of four in the ATTRI research process, a policy roadmap that builds on findings of previous tasks.					
<b>17. Keywords</b> Accessible, Transportation, Mobility, Options, Policy, Gaps, Prototypes, Pilots, Disability, Roadmap			<b>18. Distribution Statement</b>		
<b>19. Security Classif. (of this report)</b>		<b>20. Security Classif. (of this page)</b>		<b>21. No. of Pages</b> <b>40</b>	<b>22. Price</b>



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# Executive Summary

The goal of the Accessible Transportation Technologies Research Initiative (ATTRI) is to develop applications that help increase accessibility in transportation, particularly for people with disabilities. ATTRI research is a multistep process with each step corresponding with a different task. This paper presents a policy roadmap developed based on the findings of previous steps and project work, which identified existing gaps in transportation accessibility. The paper and policy roadmap were developed by identifying existing policy gaps through a literature review, identifying existing gaps from ATTRI team interviews, identifying potential solutions, and analyzing and prioritizing those potential solutions. The gaps that are identified can be addressed by implementing policies that span a variety of timelines. The roadmap arranges potential policies and their respective gaps by temporal scales of short-term (one to four years), medium-term (five to nine years), and long-term (ten plus years) to create a vision for increasing accessibility in transportation. These policies include developing and implementing new digital accessibility standards, increasing the accessibility of the built environment, and identifying new ways to engage and foster support from stakeholders. This roadmap addresses a variety of challenges including digital accessibility, standards development, and resource identification for accessible technologies.

# Background on the Accessible Transportation Technologies Research Initiative

ATTRI is a joint U.S. Department of Transportation (USDOT) initiative, co-led by the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), and Intelligent Transportation Systems Joint Program Office (ITS JPO), with support from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) and other federal partners.

The ATTRI program is leading efforts to develop and implement transformative applications to improve mobility options for travelers, particularly those with disabilities. Nearly 20 percent of the U.S. population is comprised of individuals with disabilities. Coupled with changing demographics, such as the increasing number of older Americans (research predicts that the percentage of older adults will grow from 15% to 23% of the population by 2035), the USDOT is seeking to expand innovative travel options (Vespa, 2018). ATTRI research focuses on removing barriers to transportation for people with visual, hearing, cognitive, and mobility impairments through the trip-making process. By focusing on the needs of people with disabilities and older adults, emerging technologies and creative service models funded by ATTRI will offer Americans enhanced travel choices and accessibility at higher levels than ever before. The ATTRI program's research focuses on the vision of the "complete trip," which considers accessibility for travelers from origin to destination.

ATTRI research is divided into four tasks: 1) selection of projects to improve transportation options; 2) development of a white paper based on project team interviews to identify existing policy barriers and gaps; 3) creation of a policy roadmap based on the white paper findings; and 4) development of performance metrics to evaluate policy changes. The goal of the policy roadmap is to synthesize the findings of Task 1 and Task 2 and use these findings to inform future policy development.

This paper is divided into five sections. The first section summarizes ATTRI research, including the findings of Task 1 and Task 2. The second section explains the methodology the research team used to develop this policy roadmap. The third section describes existing policy gaps and potential solutions. The fourth section presents the policy roadmap. The paper concludes with the fifth section summarizing ATTRI Task 1 and Task 2 findings and the policy roadmap.

## Summary of Task 2: Policy Assessment, Gaps, and Needs

One of ATTRI's goals is to facilitate the execution of the complete trip by people with disabilities. The complete trip is defined in terms of an individual's ability to plan for and execute a trip from origin to destination without gaps in the travel chain. The inability to get to and from destinations is a persistent issue for travelers with disabilities and older adults.

Professional staff and agencies are often responsible for providing the assistance and resources needed for travelers to accomplish the complete trip. However, one of the ATTRI program’s goals is to move away from this standard and to instead prepare individuals to travel more independently. This goal can be accomplished by providing individuals with the right tools for independent travel, such as the technology that is being developed by the ATTRI funded projects. These tools enable travelers to develop the skills needed to prepare for travel, carry out travel plans, and use any necessary applications or systems. Figure 1 illustrates the complete trip.

**The Complete Trip: If one link in the trip is not accessible, the entire trip is not accessible.**

The accessibility of a complete trip can be defined in terms of an individual’s ability to go from origin to destination without gaps in the travel chain. ATTRI-funded applications in the four technology areas will work together to enable the complete trip. By ensuring a complete trip, ATTRI aims to establish an accessible transportation network that is far more economical, extensive, and convenient than what currently exists.



**Figure 1. The Complete Trip**  
(Source: USDOT)

The projects selected in Task 1 of ATTRI address a variety of accessibility challenges from technology development areas, such as wayfinding and navigation to intersection crossing. Some projects address accessibility for people with specific disabilities (e.g., visual impairments), while others are geared toward increasing accessibility more broadly. Table 1 includes descriptions of each project and their project teams. The table organizes the projects by their respective technology development areas.

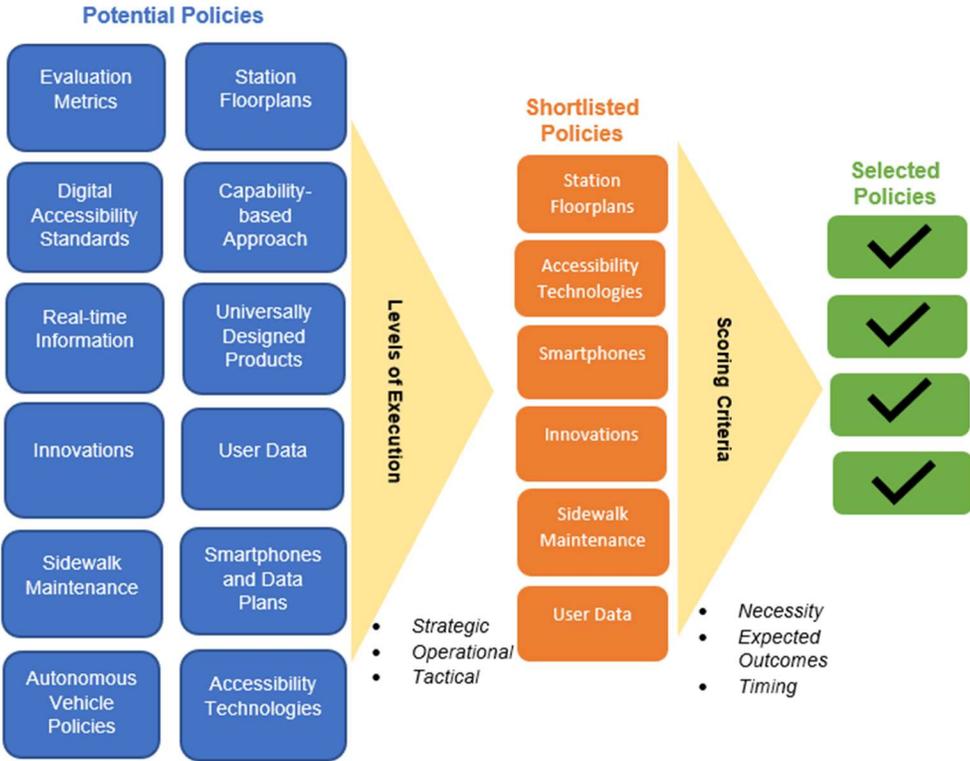
**Table 1. ATTRI Project and Descriptions**

<b>Technology Development Area</b>	<b>Application Development Projects</b>	<b>Description/Expected Products</b>	<b>Partners</b>
<b>Automation and Robotics</b>	Disability and Rehabilitation Research Projects Program on Robotics and Automation for Inclusive Transportation	Cloud-based autonomous and shared robots located in and around transportation hubs	Carnegie Mellon University, NIDILLR
<b>Pre-Trip Concierge and Virtualization</b>	Smart Travel Concierge System	A suite of assessment, self-directed learning, and trip execution technologies to support independent travel for individuals with cognitive disabilities	AbleLink
<b>Safe Intersection Crossing</b>	Safe Intersection Crossing Mobile Application	An application connecting pedestrian travelers with disabilities to the traffic signal systems (and by extension to nearby connected vehicles and infrastructure), developing assistive services for safe intersection crossing, and increasing independent mobility	Carnegie Mellon University
<b>Wayfinding and Navigation</b>	AccessPath	A wayfinding tool for wheelchair users and people with visual impairments that guides users on routes tailored to the user's preferences	Pathways Accessibility Solutions
	Smart Cane	Smart Cane for Assistive Navigation (SCAN), integrated with a smart phone application	City College of New York
	Smart Wayfinding and Navigation (SWaN) with High Accuracy 3D Location Technology	A smart wayfinding and navigation system to obtain real-time location, en-route assistance, and situational awareness	TRX Systems
	SMART Wayfinding Standards	An open wayfinding media standard and related infrastructure to support the creation of geographically-specific, cloud-based libraries of routes that adhere to the SMART accessibility standard for users in different metropolitan or rural areas	AbleLink Smart Living Technologies

The following section provides more information on the roadmap development process.

# Roadmap Development Methodology

The research team developed the policy roadmap using a multi-step process: 1) identifying policy gaps through a literature review; 2) identifying policy gaps through interviews with the ATTRI teams; 3) identifying potential policies to address the gaps identified in the first two steps; 4) analyzing and prioritizing potential policies; and 5) developing the roadmap structure, including selected policies and timelines. Figure 2 summarizes the final three steps of this process, which specifically focus on the policy selection process. The following section describes the research conducted within each of these steps and their findings.



**Figure 2. Policy Selection Process**  
(Source: USDOT)

## Step 1: Identifying Policy Gaps

During Task 2 of the ATTRI research, the research team conducted a literature review to identify existing policy challenges and gaps that decrease accessibility. The literature discussed industry trends (e.g.,

aging U.S. population, increasing growth of urban areas) and focused on the transportation challenges that ATTRI’s target demographic groups (e.g., people with disabilities) face. In addition, the literature review also helped to develop an understanding of how policies can help or hinder the use of technology in transportation.

The research team then organized the policy challenges identified during the literature review into their respective execution levels. The three execution levels are:

- **Strategic** – Long-term goals and plans to become more inclusive of accessibility needs and continually improve service provision
- **Operational** – Structure and functionality of the transportation system that allow for the seamless integration of accessibility technologies
- **Tactical** – Physical changes created within transportation systems to accommodate accessibility-focused plans.

Table 2 summarizes the challenges and gaps identified and organizes these criteria by execution level.

**Table 2. Literature Review Policy Gaps**

Execution Level	Target Issue	Description
<b>Strategic</b>	<b>Built Environment</b>	The physical environment of transportation infrastructure must first be accessible before technology-based innovations can assist in expanding transportation accessibility.
	<b>Changing Demographics</b>	As the population ages, more people will become dependent upon accessible transportation and the technologies that support them.
	<b>Future of Mobility</b>	Innovations in the field of transportation technology, such as automated vehicles, may alter the transportation industry and effect access for different populations.
	<b>Role of Public Transportation</b>	Technological innovations will expand transportation options, affecting the role of public transportation agencies and operators in transportation provision.
	<b>Role of Public-Private Partnerships</b>	The role of technology in transportation often necessitates the development of partnerships for tasks such as data sharing and filling of service gaps (e.g., route operation during off-peak hours). Roles, responsibilities, and best practices for these partnerships need to be detailed to ensure efficiency, equity, and sustainability.
	<b>Universal Design<sup>1</sup></b>	Universal design guidelines need to become more detailed and specific to ensure that transportation is accessible to all people.

<sup>1</sup> The Center for Universal Design defines universal design as the design of an environment that ensures the greatest possible extent of access, understanding, and use in the most natural, independent way possible by the greatest range of people and capabilities possible without the need of adaptation or employment of assistive devices. Universal design has seven principles: 1) equitable use by a variety of people; 2) flexibility in design to accommodate a range of abilities; 3) simple and intuitive use; 4) effective communication to user; 5) minimal negative or harmful

Execution Level	Target Issue	Description
Operational	<b>Accessibility Planning</b>	Accessibility planning has been limited to the traditional spheres of paratransit development and the physical accessibility of vehicles, but new technology-based solutions have the capacity to expand the accessibility considerations referred to in planning.
	<b>Automated Vehicle Integration</b>	Researchers predict that automated vehicles will have a variety of effects on the built environment, including changing traffic patterns, altering parking needs, and decreasing car ownership and vehicle miles traveled. These changes need to be planned for accordingly. Additionally, increased automation of vehicles will affect the necessary role and required capabilities of drivers, possibly expanding the number of people who can own and operate a vehicle.
	<b>Data Sharing and Privacy Protection</b>	Use of technology in transit necessitates the collection, storage, and use of data. New measures and protocols that ensure passengers' privacy is protected must be established.
	<b>Limitation of Liability</b>	Innovative technologies have the potential to pose new risks on transit systems, operators, cities, and passengers. Limiting the liability these stakeholders hold is crucial for integrating accessibility technologies into existing operational structures.
	<b>Physical and Digital Integration</b>	New technologies must be integrated into the physical and digital networks of existing transportation systems in order for them to efficiently increase accessibility.
	<b>Pilot Program Funding</b>	Cities often perceive transportation pilot programs as risky endeavors since their return-on-investment is uncertain. Either new funding sources must be identified, or perceptions must be changed to obtain more funding from a variety of stakeholders for these programs.
	<b>Product Awareness and Development</b>	Accessibility technology is limited by its lack of product awareness and limited opportunities for development; these areas must be improved upon to expand accessibility.
	<b>Research and Development Incentives</b>	To get the most comprehensive view of the variety of technologies available, developing ways to incentivize the completion of innovative research and development projects is necessary.
	<b>Subsidy Funding</b>	Subsidies that are distributed need to also include untraditional subject areas, such as technology innovations and platforms.
	<b>Technology Development and Deployment</b>	As new technology becomes a more prevalent component of the transportation industry, funding sources for transportation need to be expanded upon to match the pace of technological developments
Tactical	<b>Barrier Elimination</b>	Physical barriers (e.g., on streets, in vehicles) must be removed or altered to increase the physical accessibility of a space.
	<b>Increasing Awareness of Needs of People with Disabilities</b>	As technology-based solutions function expand the accessibility of transportation, the changing needs of people with disabilities will need to be continually observed and considered through consulting with disability focused organizations, surveys, research, and other methods.
	<b>Infrastructure Retrofitting</b>	Existing infrastructure may need to be altered for accessibility to accommodate new forms of transportation modes, such as transportation network companies, autonomous vehicles, and dockless mobility devices.

consequences for accidental misuse; 6) low physical effort; 7) appropriate size to accommodate a variety of users (National Disability Authority, 2014).

## Step 2: Identifying Existing Gaps

In addition to the literature review, interviews with the ATTRI project teams helped identify additional policy gaps. These gaps included policies that do not yet exist and accessibility challenges produced by existing policies. The team conducted interviews with each of the ATTRI project teams to identify challenges they encountered during the development of their projects. After completing the interviews, the team categorized the information according to the different gaps the projects aim to address. The categories include:

- **Addressing Overlooked Needs** – Some demographic subgroups may have needs that are not addressed by current standards and policies.
- **Data and Privacy** – What information is collected, stored, and transmitted and whether the organization or agency is adequately protecting that data and/or sharing it with third parties
- **Digital Access** – Accessibility of necessary information for developers and digital accessibility for technology users
- **Funding** – Availability and sufficiency of funding for paratransit and accessibility research, development, and deployment
- **Research and Development** – Activities that transit agencies are undertaking to innovate and introduce new products and services
- **The Complete Trip** – Components of travel, from trip planning to arrival at the destination that have the capacity to allow travelers to use transportation independently
- **Transportation Standards** – Guide providing transportation service and transportation projects through the development of defined standards and metrics
- **Working with Vendors** – Market-based challenges, such as product visibility, funding sources, and marketing strategies.

## Step 3: Identifying Potential Policy Solutions

The interviews also asked the ATTRI teams to recommend policies or policy changes that would mitigate the barriers they encountered, support their project, or facilitate greater accessibility in transportation. The report *Accessible Transportation Technologies Research Initiative (ATTRI) Policy and Impacts Assessment Policy Assessment, Gaps & Needs* includes an extensive review of the interview findings. These recommendations helped shape the policies suggested in the policy roadmap. The team developed other potential policies based on the challenges that the agencies identified. Table 3 summarizes identified gaps and policy recommendations.

**Table 3. Existing Policy Gaps and Recommended Strategies**

Category	Existing Gap	Recommended Policy Strategies
Policy and Regulatory Environment	Assumption that people with cognitive impairments will exclusively use paratransit, resulting in a lack of consideration of their needs in fixed-route transit	Require the inclusion of the needs of people with cognitive impairments when assessing the accessibility of a transportation system
	Lack of detailed transportation standards to ensure that all systems are accessible and comparable	Develop nuanced requirements and standardized metrics allowing for transportation systems to be uniformly assessed and compared

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Category	Existing Gap	Recommended Policy Strategies
The Complete Trip	Sidewalks may not be adequately maintained to ensure their accessibility.	Enact policies requiring property owners to maintain the accessibility of their curb space, possibly enforced by means such as fines
	Lack of availability of indoor navigation tools, such as floorplans, making the completion of the last-mile portion of travel challenging	Change policies to allow transit station and transit hub designs to be publicly available, for both application developers and individual users
	A limited amount of real-time information (e.g., route updates, construction delays) may delay trips or challenge their completion	Require information about pre-planned route alterations that effect transportation to be made publicly available
	Current lack of policies supporting the implementation of autonomous vehicles, which may be able to fill the first-mile, last-mile gap	Develop policies encouraging the inclusion of people with disabilities and other vulnerable populations in the development and implementation of accessible, autonomous vehicles
Digital Access	Many people with disabilities do not have access to smartphones and/or reliable broadband due to personal financial constraints.	Expand available funding (e.g., Medicaid) to cover smartphones and broadband plans
	Final end-products and technologies need to be usable by people with disabilities, not just the services these products and technologies provide.	Support the inclusion of a variety of potential users in the design process through design input, user testing, or other methods
	The variety of capabilities people have makes addressing all potential challenges through a single technology-based solution difficult.	Promote the use of a capability-based design approach, developed based on core technologies, to allow for more universally designed products
Working with Vendors	Competing in the marketplace is challenging due to visibility issues, budgetary restraints, marketing limitations, or a compilation of problems.	Encourage the design of products in accordance with universal design guidelines to benefit a wide range of users, thus assisting in expanding funding sources and market position
Filling Paratransit Gaps	Lack of policies requiring the accessibility of technologies for people with cognitive disabilities, which leads them to use other systems, such as paratransit, instead of fixed-route transportation systems	Support the use of “person-centered” technologies to provide people with disabilities independence in travel, allowing them to use fixed-route systems
Funding	Paratransit is an expensive service to maintain, and these costs are unsustainable, particularly due to the aging of the U.S. population and the reduction in state and federal funding.	Agencies could dedicate funding to provide accessible technologies to people with disabilities. This will move paratransit users to the fixed-route transit, thus reducing the demand for and cost of paratransit service
Data and Privacy	Public transit agencies are unwilling to share real-time data on transit vehicle location.	Agencies should consider making data available through means such as secure data depositories.
Research and Development	Many public agencies are unable or unwilling to integrate new technologies or data-driven techniques.	Encourage outreach by specific cities and transportation agencies that are prioritizing research and development initiatives (e.g., Pittsburgh, New York City) and increase the funding for deployment initiatives

## Step 4: Analyzing and Prioritizing Potential Solutions

After reviewing the agency suggestions and compiling other potential policies, the entire team reviewed and prioritized these policies. The team critically reviewed each suggestion for feasibility of implementation and possible impacts on accessibility and the broader transportation network. To assist in this review, the team divided the policies temporally:

- **Short-term** – policies that would require one to five years for implementation
- **Medium-term** – policies that would require five to nine years to execute
- **Long-term** – policies that would need ten plus years for implementation.

### Scoring Criteria

Within these categories, the team prioritized the policies based on the following set of scoring criteria:

- **Necessity.** Based on how great of a barrier has resulted from the current policy or lack of policy, a proposed policy change that will better address a larger barrier will be weighted more than a policy change that addresses a smaller barrier.
- **Expected outcomes** or benefits. While still important, policy changes that address the needs of a select or smaller group of people were weighted less than those that address the needs of a larger number of people.
- **Timing** of implementation and tangible outcomes. The goal of ATTRI is to improve the current transportation landscape. Overarching, strategic policies are important for guiding the accessibility of the future transportation landscape, but there are challenges and barriers that need to be addressed in the short term as well.

Each of these considerations were given equal weight as each of them hold equal importance in policy implementation. The research team identified needs and priorities, which also informed the scoring. The research team's final selections are included in this roadmap.

## Step 5: Roadmap Development

The team produced the policy roadmap to use as a multi-phased implementation plan. The roadmap is structured based on the timeframe for implementing each potential policy. The roadmap also identifies which stakeholders may play a role in implementing the policy and subsequent change. These stakeholders include public agencies at the local, regional, state, and federal levels in addition to non-governmental organizations, such as advocacy groups and nonprofits. The design of the roadmap allows stakeholders to identify which challenges they want to address first and what resources, including time and financial support, they may need to allocate to the development and implementation of these policies. The following section discusses the potential gaps and strategies that informed the development of the roadmap.

# Policy Gaps and Strategies

The policy and regulatory environment shapes the standards that guide transportation system developments. This area is crucial in improving accessibility as the guidelines that policymakers develop, implement, and require have the propensity to drastically increase or decrease accessibility. Existing laws and policies have had some success in making transportation services more accessible, but more work is necessary. For example, in the Task 2 team interviews, AbleLink stated that the pervasiveness of the assumption that people with disabilities will exclusively use paratransit to meet their transportation needs has produced an inaccessible transportation network. Other ATTRI teams also stated that transportation systems may become even less accessible when policies do not require private providers to comply with policies that include people with disabilities. ATTRI teams, including Pathways Accessibility Solutions and Carnegie Mellon University, cited proprietary ownership challenges, which may result in difficulties identifying who is responsible for the maintenance of certain spaces or for the distribution of information. Policy-based strategies may be able to address these challenges. The research team organized potential policy-based strategies into categories, which are discussed in further detail in the following sections.

## Overlooked Needs

Making assumptions about the needs of people with disabilities often causes policymakers and public agencies to overlook or fail to meet these needs. Services specifically oriented toward people with disabilities, including paratransit, may not even meet these needs. Addressing the needs of people with disabilities through new policies, or by altering existing accessibility standards, may expand accessibility.

## Paratransit Use

Paratransit service supplements fixed-route transit by providing qualifying individuals (e.g., people with disabilities) with the opportunity to use a more inclusive means of transportation if they cannot access or use existing fixed-route systems. The prevailing assumption is that people with less visible disabilities (e.g., people with cognitive impairments) will use paratransit as their predominant mode of transportation, resulting in fixed-route transit not considering their needs (e.g., complicated and unintuitive instructions). If left unaddressed, this challenge may perpetuate the need for people with disabilities to use paratransit rather than fixed-route transit, resulting in higher operational costs for the agencies responsible for providing paratransit services. Additionally, this may result in a segregated transportation system where people with disabilities exclusively use paratransit, and people without disabilities exclusively use fixed-route transit.

This challenge may be addressed by using the needs of people with disabilities, particularly those that have been historically overlooked, as an evaluation metric when assessing the accessibility of transportation services and projects. By using needs as a performance metric, local and regional transportation agencies can more accurately identify the aspects of their service that are accessible and improve upon these areas. Addressing this challenge can support the use of transportation by individuals with cognitive disabilities. Local and regional transportation agencies can also address the needs of other

demographic groups, such as non-English speakers, by using needs as a performance metric. Table 4 shows potential strategies for overlooked needs.

**Table 4. Potential Strategies for Overlooked Needs**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline
Paratransit Use	Assumption that people with disabilities will use paratransit as their main transportation mode	Use the needs of people with disabilities (e.g., the need to present information in a simple format) as performance and accessibility metrics	Local transportation agencies	1 to 4 years <ul style="list-style-type: none"> <li>➤ Years 1 to 2: Develop accessibility metrics</li> <li>➤ Year 3: Implement metrics as part of performance and accessibility evaluations</li> <li>➤ Year 4: Assess the use of these metrics and adjust them accordingly</li> </ul>
			Regional transportation agencies	

## Data and Privacy

As transportation services continue to collect and use data to inform decisions, the need for updated and real-time data to be publicly available from these transportation agencies increases. However, the increasing use of data may result in threats to user privacy (e.g., collection of personally identifiable information).

### Real-time Data

Transit agencies and authorities have access to and generate a large amount of transportation data and information. However, agencies may not have the ability to effectively use this information due to limited financial resources, lack of staffing capabilities, or security concerns. Private providers may also be hesitant to share data due to concerns over proprietary ownership. The inability of agencies to use transportation data and information or make information from all providers available for public use may hinder the accessibility of these transportation systems for people with disabilities who are reliant upon this information. These challenges can limit the amount and accuracy of travel information available to travelers which may challenge the completion of trips. In addition, third-party developers may not have access to this information to use it for developments, such as information aggregators and trip planners.

The development of data sharing platforms (e.g., data portals and dashboards) by public and private transportation providers may address the lack of real-time data. Data portals store lists of information, and a data dashboard tracks, analyzes, and displays key information. Data platforms may allow transportation services to aggregate data to improve anonymity and avoid sharing proprietary and personal information. Data sharing platforms may also allow for data to be more readily available in similar formats, making data easier to use for a variety of purposes by different organizations, including third-party aggregators. Public agencies and administrations such as the FTA could require information to be available by making it a stipulation to receive federal aid. Developing and enforcing this stipulation may require input from

partners, associated organizations, and stakeholders potentially including the Department of Homeland Security (DHS) and American Public Transit Association (APTA). Public agencies and administrations can engage stakeholders by hosting webinars, conducting surveys, and holding public comment forums and focus groups.

## User Data and Privacy

The collection of transportation data inherently involves the collection of user data. Transportation services rely upon user data to inform metrics, such as riders per hour, average trip distance, and average trip time. This may challenge the privacy of travelers by revealing their travel patterns and transportation habits.

However, these services may protect travelers' privacy by informing travelers how they will use the travelers' information and data. This can be done through written agreements accessed through downloading apps or through buying fares. When transportation providers inform travelers of what data they are collecting and how they may use it, travelers can be given the option to opt out of the data collection processes. This would provide travelers with the ability to add an additional layer of data protection by not sharing their data with third parties. Table 5 summarizes potential strategies for data and privacy.

**Table 5. Potential Strategies for Data and Privacy**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline
Real-time Data	Real-time transportation data is not available for third parties to use	Require transportation providers to securely share data according to established data standards	Local transit agencies	1 to 3 years
			Regional transit agencies	<ul style="list-style-type: none"> <li>➤ Months 3 to 6: Select data standard (e.g., General Bikeshare Feed Specification)</li> <li>➤ Year 1: Establish data sharing agreements (e.g., vehicle location, frequency of data reporting)</li> <li>➤ Year 2 to 3: Evaluate data sharing agreements and make necessary improvements</li> </ul>
User Privacy and Data	User data and privacy may not be protected	Require agencies and third parties to inform users of how their information and data will be used, providing an option for users to opt out	Public transit agencies Third parties USDOT	1 to 2 years <ul style="list-style-type: none"> <li>➤ Year 1: Require that users are informed of the uses of their data</li> <li>➤ Years 1 to 2: Implement information on the use of users' data and provide the option to opt out</li> </ul>

## Digital Access

Digital access consists of two elements: financial and use access. Financial access refers to the ability for an individual to access digital technologies that increase accessibility, such as smartphones and data plans. This is particularly problematic for people with disabilities in the United States, who typically have higher rates of unemployment and underemployment as well as lower incomes. Use access refers to people with disabilities' capability to use digitally-based devices. People with visual impairments who use screen readers or people with cognitive impairments may be unable to use apps or other digital devices in their current format (Davies, 2003).

## Device Compatibility

Technologies that are developed to increase accessibility for people may not be usable by people with disabilities and/or their assistive devices. For example, apps that providing wayfinding information (e.g., floorplans of transit stations) may not be usable by a screen reader, which would render the apps useless for many individuals with disabilities.

Developing standards to ensure compatibility and uniformity between devices may help address this challenge. Accessibility guidelines already exist (e.g., Americans with Disability Act [ADA]), these guidelines could be altered to include digital accessibility standards (e.g., usability by assistive devices). Standardizing accessibility and development guidelines may assist with ensuring usability between existing and emerging accessibility technologies. Additionally, accessibility standards may encourage the use of existing resources to increase accessibility. Most cell phones are equipped with haptic (i.e., vibration) capabilities. This can be used to increase usability and accessibility by individuals, such as those with cognitive disabilities.

## Digital Accessibility

People have a range of visual, mobility, auditory, and cognitive capabilities. This makes addressing people's potential needs through a single device or platform challenging. Addressing one individual's needs (e.g., adding auditory instructions for people with visual impairments) may challenge another individuals' use (e.g., a person with cognitive impairments may find visual and auditory instructions overwhelming, making a device more difficult to use).

A capability-based design approach may address individuals' ranges of capabilities and needs. Capability-based design is similar to the universal design paradigm which focuses on creating an accessible built environment for users. However, capability-based design differs from universal design as it focuses on the capability of users and encourages design to address the needs of a variety of users for a specific device, rather than the built environment as a whole. Using a capability-based approach may help to make devices usable by individuals with a variety of capabilities.

## Financial Accessibility

Historically, people with disabilities have high rates of unemployment and/or underemployment relative to the general population, which may result in lower incomes (Davies, 2003). These challenges may result in people with disabilities lacking the financial resources necessary to obtain digital devices that would increase accessibility (e.g., smartphones, data plans). For example, if an app is developed to provide

wayfinding information, but is only accessible on a smartphone with an internet plan, low-income individuals may not be able to access this resource.

Publicly funded assistance programs exist to provide people (e.g., low-income households) with access to needed resources. These programs include Medicaid (healthcare coverage to low-income individuals, people with disabilities, older adults, and other vulnerable populations) and Supplemental Security Income (SSI) (provides cash to low-income older adults, individuals with disabilities, and households). The programs fall under state jurisdictions, and many of the programs classify smartphones and data plans as non-health related or necessary expenses. Many programs exclude these devices and plans from program assistance, although some programs have waivers for these resources (U.S. Centers for Medicare and Medicaid Services, 2019). Expanding these programs to include access to smartphones and data plans may require the changing of standards (e.g., reclassifying what constitutes a health expense) to redistribute existing funds. Altering the classifications and definitions of necessary supports in these programs can provide people with disabilities with a resource to increase transportation accessibility. Table 6 summarizes potential strategies for digital access.

**Table 6. Potential Strategies for Digital Access**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline
Device Compatibility	Technologies may not be digitally compatible with assistive devices	Alter accessibility standards to include digital compatibility standards	Local agencies Regional agencies State agencies Federal agencies	1 to 4 years ➤ Years 1 to 2: Review existing standards to identify areas where digital compatibility may be included ➤ Years 2 to 3: Alter existing accessibility standards to include compatibility with assistive devices ➤ Years 3 to 4: Develop new standards that specifically address digital compatibility
Digital Accessibility	Addressing a range of capabilities through a single device can be challenging	Require a capability-based or universal design can make products accessible by a wide range of people	Public transit agencies Private mobility providers	1 to 6 years ➤ Years 1 to 2: Require capability-based and/or universal design requirements ➤ Years 2 to 4: Developers begin to adhere to these standards ➤ Years 4 to 6: Standards reviewed to ensure their helping to expand accessibility
Financial Accessibility	Financial barriers may impede access to financial devices to increase accessibility	Expand publicly-funded assistance programs to include funding for digital resources, such as smartphones	State agencies Federal agencies	1 to 6 years ➤ Years 1 to 2: Identify areas where funding can be reallocated ➤ Years 2 to 4: Change existing programs to include smartphones and data plans ➤ Years 4 to 6: Changes approved by legislation go into action for current and future projects

## Paratransit

Resources that are dedicated exclusively to accessibility-focused services (e.g., paratransit) can drain finite agency resources (Davies, 2003). Limited funding for transportation services can also result in inefficient and lower-quality services for both paratransit and fixed-route transit.

## Paratransit Costs

The ADA requires public transit agencies that operate a fixed-route system to provide paratransit or another similar service to individuals who may face challenges accessing fixed-route transit (Government Accountability Office, 2012). The laws requires these services to be comparable to the level of service (e.g., same hours of service, similar service level) of fixed-route system provides. However, providing paratransit at a high-quality service level has historically been financially challenging for agencies (Government Accountability Office, 2012). Experts anticipate these cost challenges to continue, if not grow, due to an increasingly aging U.S. population which may increase the demand for paratransit and costs of providing this service (Government Accountability Office, 2012).

This financial challenge may be addressed through the reallocation of funding. Rather than directing funding exclusively toward expanding paratransit services, public agencies can allocate funding toward developing and providing technological assistance to improve accessibility for people with disabilities. Using technology to make transportation more accessible may allow a portion of current paratransit users to become fixed-route transit users. Even with new accessible technologies, some paratransit users may still be unable to use fixed-route systems. This may reduce the demand for paratransit and subsequently decrease operational costs for transit agencies. While reallocating funding may decrease paratransit service funds in the short run, in the long run it can help to provide more accessible fixed-route service and higher-quality paratransit service. Table 7 summarizes potential funding strategies.

**Table 7. Potential Funding Strategies**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline
Paratransit Costs	Paratransit is expensive to provide, and costs are expected to increase	Allocate funding toward developing and providing technologies to improve accessibility of fixed-route transit	Local transit agencies Regional transit agencies State transit agencies USDOT	1 to 5 years
				<ul style="list-style-type: none"> <li>➤ Years 1 to 2: Identify areas funding can be reallocated from</li> <li>➤ Years 2 to 3: Redevelop standards to reallocate funds to developing accessibility technologies</li> <li>➤ Years 3 to 5: Implement standards changes</li> </ul>

## Research and Development

Recent innovations in technology and new transportation modes have spurred the development of a variety of transportation options that can help facilitate a complete, multimodal trip. However, there are barriers to using these technologies, which we discuss in more detail in the following subsections.

## Innovation Adoption

As technology evolves and innovations continue to occur, public agencies may be unwilling or unable to integrate new transportation modes or data-driven technologies into their existing networks. This unwillingness or inability may stem from the perception of high risks or instability of these developments. Technologies that have not been extensively tested may appear to be risky because it is difficult to confidently predict their effects. Additionally, these technological developments may be costly, and public agencies may lack the financial resources to obtain and implement them. Patents, such as licensed software, may be prohibitively costly.

However, federal and state agencies may address this challenge by supporting research and development incentives. They can support the use of transportation innovations by:

- Offering financial support (e.g., grants) to agencies willing to experiment with transportation innovations
- Disseminating information on case studies where using new transportation technologies or modes has proven to enhance the transportation network (e.g., effective partnerships with transportation network companies to fill first-and last-mile gaps)
- Facilitating partnerships between agencies and transportation innovations and innovators (e.g., mobility on-demand providers) by developing guidelines, best practices, and other structural partnership elements
- Developing and releasing requests for proposals or other information-seeking programs (e.g., unsolicited proposal processes) to gather ideas on how to innovatively enhance the accessibility of existing fixed-route systems.

These supportive measures may allow public agencies to test innovations prior to large-scale deployment to gain an understanding of the opportunities and challenges associated with different developments. Table 8 summarizes potential strategies for research and development.

**Table 8. Potential Strategies for Research and Development**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline
Innovation Adoption	Unwillingness to integrate new transportation modes or data-driven technologies due to perceptions of instability or risk	Encourage integration through research and development incentives and financial support from federal agencies	Public transit agencies  Federal transportation agencies (e.g., Federal Transit Administration)	1 to 10 years  ➤ Years 1 to 3: Develop research areas and programs ➤ Years 3 to 5: Provide resources to test new technologies (e.g., staff support, peer-to-peer information dissemination)
	Inability to integrate new transportation modes or data-driven technologies due to high costs	Provide financial resources to assist with piloting these technologies	State transportation agencies  Federal transportation agencies	1 to 5 years  ➤ Years 1 to 2: Identify areas where funding may be needed ➤ Years 2 to 4: Identify funding sources ➤ Years 4 to 5: Distribute funding

## The Complete Trip

The complete trip is comprised of a variety of components that, ideally, allow people to seamlessly move from their origin to their destination. A variety of barriers exist to facilitating the complete trip.

### Indoor Mapping and Navigation

One area of accessibility that lacks information is indoor mapping and navigation. Indoor mapping and navigation tools are limited by a lack of tools and resources needed to develop them. This lack of resources may be a product of concerns, such as security concerns. Public agencies may be unwilling to distribute information (e.g., station floorplans) due to concerns that this information could increase security concerns (e.g., reveal where security cameras are located).

Releasing general information may help address this challenge, but releasing security information (e.g., video surveillance camera locations, classified documents) will not. For example, releasing edited floorplans that only denote barriers (e.g., stairways, pillars) would allow public and private developers to use this information to develop indoor navigation tools while addressing security concerns.

## Sidewalk Maintenance

Responsible parties may not adequately maintain sidewalks at a level to allow for accessibility. Sidewalks may be uneven or have barriers in the travel path (e.g., parked bicycles, uneven sidewalks, magazine stands) that block access. These maintenance challenges may pose challenges for sidewalk users with disabilities. In addition, the responsibility for sidewalk maintenance may be unclear. Sidewalk maintenance involves many stakeholders outside of the FTA (e.g., private individuals, businesses, public agencies, city officials), and this may result in differences of opinion regarding who is responsible for maintenance (e.g., private or public agencies).

Developing municipal wide standards may address sidewalk maintenance. Property owners are typically responsible for ensuring maintenance. Clarifying this through standards may provide property owners with a better understanding of their responsibilities. Partnerships between public agencies and private companies and/or non-governmental organizations (NGOs) can be used to develop standards. NGOs that are focused on accessibility may be particularly helpful partners. The standards development phase may require user input or testing by people with disabilities or other target demographics. These standards may clarify what maintenance is required (e.g., removal of obstructions). Standards may be enforced through means such as fines levied by police officers. Table 9 summarizes potential strategies for the complete trip.

**Table 9. Potential Strategies for the Complete Trip**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline
Indoor Mapping and Navigation	Lack of information, tools, and resources for indoor mapping and navigation due to regulatory concerns	Provide floorplans that denote barriers (e.g., stairways) and other necessary information but does not include information that may be negatively used	Public agencies	1 to 3 years
			Security agencies	<ul style="list-style-type: none"> <li>➤ Years 1 to 2: Review existing floorplans and remove sensitive information</li> <li>➤ Years 2 to 3: Distribute information</li> </ul>
Sidewalk Maintenance	Lack of adequate sidewalk maintenance and unclear maintenance responsibilities	Develop policies to clarify maintenance responsibilities and standards, enforce policies through penalties (e.g., fines)	Local regulatory agencies (e.g., police departments)	1 to 3 years
			State agencies	<ul style="list-style-type: none"> <li>➤ Years 1 to 2: Develop standards and enforcement standards (e.g., penalties)</li> <li>➤ Years 2 to 3: Implement new standards</li> </ul>

## Transportation Standards

Transportation standards guide the development of new technologies within the industry and the deployment and use of these technologies. The development of transportation standards needs to keep pace with transportation innovation, if not precede them, and ensure accessibility for all.

### Accessibility Standards

While accessibility guidelines (e.g., the ADA) exist, standards used to evaluate transportation systems (e.g., internal infrastructure, vehicles in the fleet) and ensure their accessibility do not exist. Developing standards to evaluate the infrastructure and vehicle fleets of transportation systems can enhance existing guidelines. The lack of evaluation standards results in the inability for transportation agencies and other public agencies to uniformly assess, compare, and evaluate existing transportation systems. This lack of uniform comparison may result in accessibility challenges across a network of transportation systems.

Similar to other industries that have specific standards for evaluation and comparison, policymakers can develop nuanced standards and metrics to uniformly assess, compare, and evaluate transportation systems. These standards may include a range of scores based on the level of accessibility (i.e., similar to restaurant health codes), or scores may consist of a pass/fail per area of accessibility (e.g., information provided in a variety of ways). Standards may be developed through partnerships (e.g., with the National Council on Disability, National Federation of the Blind) to help identify what needs need to be met. Standards could also emulate standards developed by other organizations including:

- Web Content Accessibility Guidelines from the Web Accessibility Initiative of the World Wide Web Consortium
- International Accessibility Standards from the International Commission on Technology and Accessibility
- Training guides from the United Nations Human Rights Commission.

Accessibility standards could include:

- Ensuring that all system-based communications (e.g., text alerts, apps) are usable by assistive devices, such as screen readers
- Requiring staff trainings to ensure that employees know how to effectively assist people with disabilities
- Offering a variety of platforms and methods to communicate with riders (e.g., in station on screens, in station through public address system, on mobile apps)
- Offering a variety of accessible transportation modes at transit stops and stations (e.g., loading zones for wheelchair accessible vehicles, accessibly designed microtransit)
- Implementing user-based evaluations or testing to identify accessibility challenges of the transportation system
- Developing set metrics (e.g., average time for a passenger to enter the stop or station then board their transportation mode) to evaluate the system.

Standards and metrics would allow transportation systems to be uniformly assessed and compared as peers, helping to develop more accessible transportation nationwide.

## Autonomous Vehicles

The transportation industry is witnessing the development and deployment of autonomous vehicles (AVs). These vehicles offer the potential to increase accessibility by providing individuals with disabilities an on-demand transportation option. AVs may also be able to fill service gaps, including first- and last-mile station access gaps. However, AVs may decrease accessibility if their usability by people with disabilities is not ensured. The regulations that guide the development of AVs do not address their accessibility requirements or their operation in the public right-of-way (e.g., in front of curb cuts that people with disabilities may need to use to gain sidewalk access).

As policies are developed to guide the development of AVs, they should ensure that they are accessible and usable by people with disabilities. These policies may require features, such as boarding on ramps that may be used by individuals with wheelchairs or user testing that includes people with disabilities. The technology that guides AVs may also be subject to standards, including compatibility with assistive devices and the digital accessibility of on-board technologies. Policies that ensure that AVs can be integrated into the existing transportation landscape and not impede access also need to be developed. Table 10 summarizes potential strategies for transportation standards.

**Table 10. Potential Strategies for Transportation Standards**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline
Accessibility Standards	Current transportation standards lack the ability to evaluate the accessibility of transportation systems	Develop nuanced standards and metrics to assess, compare, and evaluate transportation systems	Regional transportation agencies	1 to 5 years ➤ Years 1 to 3: Develop standards that can be used for transportation systems in a variety of geographies and in a range of scale ➤ Years 3 to 5: Transition agencies to new standards and evaluation techniques
			State transportation agencies	
Autonomous Vehicles	AVs lack regulation addressing their accessibility or operations	Develop policies that ensure AVs are accessible and can be integrated into the transportation network	Private developers	1 to 10 years ➤ Years 1 to 4: Develop policies to guide AV development at different levels of oversight ➤ Years 4 to 7: Implement policies ➤ Years 7 to 10: Alter standards with the continued development of AVs
			State transportation agencies	
			Federal transportation agencies	

## Working with Vendors

The transportation marketplace reflects changing transportation technology and evolving modal options. Competition in the marketplace may result in products that do not address the needs of accessible populations.

### Marketplace Competition

Accessibility-focused technology and innovations may face challenges competing the marketplace with other, non-accessibility-oriented products. Accessibility-oriented products may face marketplace challenges due to a lack of marketing resources (e.g., staff capability), budgetary limitations, or other challenges.

Marketplace challenges may be addressed through the support of universally designed or people-centered products. Support may be granted through funding, providing staff capability, helping educate consumers, and offering other resources. These products can benefit a variety of users. This broad user base may help developers secure funding from other interested parties or stakeholders and expand products' market positions. Table 11 summarizes potential strategies for working with vendors.

**Table 11. Potential Strategies for Working with Vendors**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline
<b>Marketplace Competition</b>	Accessibility-focused technology and innovations may face marketplace challenges (e.g., lack of marketing resources, budgetary restraints)	Support universally designed or people centered products	Regulatory agencies  Non-governmental agencies oriented toward increasing accessibility	1 to 10 years  ➤ Years 1 to 2: Identify ways stakeholders can support accessibility technology (e.g., funding, areas of research) ➤ Years 2 to 5: Allocate resources toward accessibility projects ➤ Years 5 to 10: Complete accessible technology projects

These policy gaps and proposed strategies address a variety of barriers and challenges in the transportation ecosystem. Many of the challenges addressed are specific, and the policies are targeted toward nuanced issues.

# Policy Roadmap

The previously mentioned policies offer a variety of strategies to address policy gaps and challenges regarding access, information availability, transportation standards, and research and development. However, for these policies to result in effective change, they need to be selected and implemented strategically. Therefore, the suggested policies were evaluated based on the challenge they address, their anticipated outcomes, and the amount of time that is expected to pass before showing results. The potential policies were then organized by their anticipated timelines to allow public agencies and other stakeholders to gain an understanding of timelines of implementation.

## Short-term Potential Policies

Short-term policies are policies that may be implemented in the near term (i.e., one to five years). The short-term policies identified are typically implemented by local and regional agencies and are focused on addressing accessibility challenges that set the foundation for further accessibility increases. These policies consist of four target areas:

- **Device Compatibility:** Digital devices and technologies that may be used to increase accessibility (e.g., offer real-time information) may not be digitally accessible for people with disabilities and/or may not be compatible with other assistive devices (e.g., screen readers).
- **Indoor Mapping and Navigation:** Tools for indoor wayfinding is limited and public agencies may be willing to provide information for wayfinding tools due to concerns, such as security concerns.
- **Paratransit Use:** There is a prevailing false assumption that people with disabilities, particularly individuals with cognitive disabilities, exclusively use paratransit as their form of transportation. This results in a cyclical problem where fixed-route transit is not designed accessibly so people with disabilities must use paratransit.
- **Sidewalk Maintenance:** As part of the broader transportation network, sidewalks are important areas of travel, but they may house accessibility challenges such as uneven pavement panels.

Table 12 summarizes these challenges and potential short-term policies.

**Table 12. Short-term Potential Policies**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Steps	Potential Challenges
Device Compatibility	Technologies may not be compatible with accessibility devices	Alter accessibility standards to include digital compatibility standards	Local agencies Regional agencies State regulatory agencies Federal regulatory agencies	<p>1 to 4 years</p> <ul style="list-style-type: none"> <li>➤ <b>Step 1:</b> Review existing standards to identify areas that already include digital compatibility</li> <li>➤ <b>Step 2:</b> Alter existing accessibility standards to include digital compatibility</li> <li>➤ <b>Step 3:</b> Develop new standards that specifically address digital compatibility</li> </ul>	<p>Accessibility standards will need to keep pace with evolving technologies.</p> <p>Accessibility standards for digital compatibility will need to extend to a variety of devices including technologies that are not readily available, such as autonomous vehicles.</p>
Indoor Mapping and Navigation	Lack of information, tools, and resources for indoor mapping and navigation due to regulatory concerns	Provide floorplans that denote barriers (e.g., stairways), but not sensitive information	Local transportation agencies Regional transportation agencies Security agencies	<p>1 to 3 years</p> <ul style="list-style-type: none"> <li>➤ <b>Step 1:</b> Review existing floorplans and remove sensitive information</li> <li>➤ <b>Step 2:</b> Distribute information through public agencies</li> </ul>	<p>Determining what information classifies as “sensitive” may be challenging with different agencies’ input.</p> <p>The definition of sensitive information may change over time.</p>
Paratransit Use	Assumption that people with disabilities will use paratransit as their main transportation mode	Use the needs of people with disabilities (e.g., need to present information in a simple format) as performance and accessibility metric	Local transportation agencies Regional transportation agencies	<p>1 to 4 years</p> <ul style="list-style-type: none"> <li>➤ <b>Step 1:</b> Develop accessibility metrics</li> <li>➤ <b>Step 2:</b> Implement metrics as part of performance and accessibility evaluations</li> <li>➤ <b>Step 3:</b> Assess the use of these metrics and adjust them accordingly</li> </ul>	<p>As paratransit models evolve to include other modes, such as mobility on demand (MOD), accessibility metrics may need to be altered correspondingly.</p>

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Steps	Potential Challenges
Sidewalk Maintenance	Inadequate sidewalk maintenance and unclear distribution of maintenance responsibilities	Develop policies to clarify maintenance responsibilities and standards, enforce policies through penalties (e.g., fines)	Local regulatory agencies (e.g., police departments)  State regulatory agencies	1 to 3 years	Informing individuals of their responsibilities for sidewalk maintenance may be time consuming for agencies.
				<ul style="list-style-type: none"> <li>➤ <b>Step 1:</b> Develop standards and enforcement standards (e.g., penalties)</li> <li><b>Step 2:</b> Implement new standards in planning and regulatory documents</li> </ul>	Enforcing sidewalk maintenance responsibilities may be a difficult additional task for public agencies to undertake due to the added responsibility on existing personnel. Enforcement also may be complicated in areas where public and private ownership is mixed (e.g., public transit stations located in private office centers).

## Medium-term Potential Policies

Medium-term policies are policies that may begin to enact change in the time span of approximately one to nine years. These policies are mostly the responsibility of regional and state agencies and require the disruption of resources and the development of standards. The medium-term policies address the four areas of:

- **Accessibility Standards:** Guidelines to increase accessibility exist, but metrics to evaluate accessibility may need to be developed.
- **Digital Accessibility:** The variety of potential users of accessibility technologies may result addressing all needs through a single device challenging.
- **Innovation Adoption:** High costs of transportation innovations (e.g., software programs) may be too costly for public transit agencies to afford.
- **Paratransit Costs:** Operating paratransit services, particularly with anticipated increased demand, may be costly for public transit agencies.

Table 13 summarizes medium-term challenges and potential policies.

**Table 13. Medium-term Potential Policies**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline	Potential Challenges
Accessibility Standards	Transportation standards cannot always be used to evaluate the accessibility of transportation systems	Develop nuanced standards and metrics to assess, compare, and evaluate transportation systems	Regional transportation agencies	1 to 5 years ➤ <b>Step 1:</b> Develop standards that can be used for transportation systems in a variety of geographies and in a range of scale ➤ <b>Step 2:</b> Transition agencies to new standards and evaluation techniques	Transitioning agencies to new standards may be a difficult and/or long process.  Public agencies may require new resources to help adjust to new standards.
			State transportation agencies		
Digital Accessibility	Addressing a range of capabilities through a single device can be challenging	Require a capability-based or universal design can make products accessible by a wide range of people	Public transit agencies  Private mobility providers	1 to 6 years  ➤ <b>Step 1:</b> Require capability-based and/or universal design requirements ➤ <b>Step 2:</b> Developers begin to adhere to these standards ➤ <b>Step 3:</b> Standards reviewed to ensure their helping to expand accessibility	There may be a limited supply of individuals with experience and knowledge in capability-based and universal design.
Innovation Adoption	Inability to integrate new transportation modes or data-driven technologies due to high costs	Provide financial resources to assist with piloting these technologies	State transportation agencies  Federal transportation agencies	1 to 5 years  ➤ <b>Step 1:</b> Identify areas where funding may be needed ➤ <b>Step 2:</b> Identify funding sources ➤ <b>Step 3:</b> Distribute funding	Even with new funding sources there may not be enough funding to support the use of new technologies.

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline	Potential Challenges
Paratransit Costs	Paratransit is expensive to provide and costs are expected to increase	Allocate funding toward developing and providing technologies to improve accessibility of fixed-route transit	Local transit agencies Regional transit agencies State transit agencies USDOT	1 to 5 years <ul style="list-style-type: none"> <li>➤ <b>Step 1:</b> Identify areas funding can be reallocated from</li> <li>➤ <b>Step 2:</b> Redevelop standards to reallocate funds to developing accessibility technologies</li> <li>➤ <b>Step 3:</b> Implement standards changes and distribute funding for current and future projects</li> </ul>	The integration of new transportation modes (e.g., MOD) may further paratransit financial challenges.  Moving from traditional paratransit funding models may be a difficult process for agencies.

## Long-term Potential Policies

Long-term policies are policies that may be implemented over the duration of ten or more years. These policies require the input of a variety of stakeholders, including federal agencies and departments. The gaps these potential policies address includes:

- **Autonomous Vehicles:** The development of AVs presents the opportunity to potential expand or decrease accessibility and mobility for people with disabilities. The accessibility of AVs may need to be guided by public policies.
- **Innovation Adoption:** The adoption of innovation may be threatened by the perception of these developments as risky or unsafe.

**Marketplace Competition: Accessibility-oriented devices may have a difficult time competing on the marketplace due to a lack of resources.**

Table 14 summarizes long-term gaps and potential challenges.

**Table 14. Long-term Potential Policies**

Topic	Current Gap	Potential Solution	Stakeholder(s)	Predicted Timeline	Potential Challenges
Autonomous Vehicles	AVs lack regulation addressing their accessibility or operations	Develop policies that ensure AVs are accessible and can be integrated into the transportation network	Private developers State transportation agencies Federal transportation agencies	1 to 10 years ➤ <b>Step 1:</b> Develop policies to guide AV development at different levels of oversight ➤ <b>Step 2:</b> Implement policies ➤ <b>Step 3:</b> Alter standards with the development of AVs	Developing policies that preempt the deployment of AVs in the market may be difficult due to time constraints.
Innovation Adoption	Unwillingness to integrate new transportation modes or data-driven technologies due to perceptions of instability or risk	Encourage integration through research and development incentives and financial support from federal agencies	Public transit agencies Federal transportation agencies (e.g., Federal Transit Administration)	1 to 10 years ➤ <b>Step 1:</b> Develop research areas and programs ➤ <b>Step 2:</b> Provide resources to test new technologies (e.g., staff support, peer-to-peer information dissemination)	Public agencies may need to be incentivized to engage in activities to support innovation adoption.
Marketplace Competition	Accessibility-focused technology and innovations may face marketplace challenges (e.g., lack of marketing resources, budgetary restraints)	Support universally designed or people centered products	Regulatory agencies Non-governmental agencies oriented toward increasing accessibility	1 to 10 years ➤ <b>Step 1:</b> Identify ways accessibility technology can be supported (e.g., funding, areas of research) ➤ <b>Step 2:</b> Allocate resources toward accessibility projects ➤ <b>Step 3:</b> Complete accessible technology projects	Accessibility-oriented technologies may need to wait for consumer trends and preferences to change before they are competitive in the broader marketplace.

# Conclusion

The goal of the ATTRI program is to increase the accessibility of transportation, particularly for people with disabilities. Part of ATTRI's focus on accessibility is the complete trip, or the length of the trip from the planning stage to the arrival at the traveler's destination. The ATTRI technologies and projects that were selected during Task 1 attempt to increase the accessibility of transportation and help facilitate the complete trip. During Task 2, ATTRI project teams were interviewed to identify policy gaps and challenges they had encountered during the development of their projects. The findings from these interviews were used to inform Task 3, this policy roadmap.

The roadmap was constructed through the identification of policy gaps, existing gaps, and potential solutions. The research team identified the length of time these strategies may require, then organized possible policies by timeline: short-term (one to four years), medium-term (five to nine years), and long-term (five to ten years).

Local and regional agencies are responsible for carrying out most of the proposed short-term policies. These policies addressed challenges including device compatibility, indoor mapping and navigation, paratransit demand, and sidewalk maintenance. Addressing these challenges may increase the feasibility of and support for longer-term policies, such as supporting the development of new assistive technologies. For example, by developing standards to evaluate device compatibility, standards development organizations will help ensure that future technologies are compatible with existing devices.

Regional and state agencies are responsible for carrying out most of the proposed medium-term policies. These potential policies addressed challenges including accessibility standards, digital accessibility, innovation adoption, and paratransit costs. These gaps focus on the evaluation of current accessibility projects and plans and ways to improve their accessibility going forward.

State and federal agencies may be responsible for creating long-term policies. Interagency cooperation with organizations, such as the Department of Health and Human Services, may be necessary for both medium- and long-term policies. These policies are targeted toward overarching changes to the transportation innovation market including autonomous vehicles, innovation adoption, and marketplace challenges. Addressing these market challenges may increase transportation accessibility as the technology continues to evolve.

While these policies attempt to address current challenges in facilitating the complete trip, the implementation of these policies may be accompanied with their own obstacles and possible shortcomings. The existing gaps, potential solutions, and potential accompanying challenges are preliminary findings based on this stage of ATTRI research. Further research may be necessary to more definitively identify areas of improvement and policies to address them.

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FHWA-JPO-20-783



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