The Projected Impact that Autonomous Vehicles Could Have on Vocational Rehabilitation Outcomes

Final Report

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List of Acronyms and Definitions

Acronym	Definition
ACS	American Community Survey
ADA	Americans with Disabilities Act
AFB	American Foundation of the Blind
ATTRI	Accessible Transportation Technologies Research Initiative
AV	Autonomous Vehicle
AVAS	Acoustic Vehicle Alert Systems
CTDOT	Connecticut Department of Transportation
CVTA	Connected Vehicles Trade Association
EV	Electric Vehicle

Acronym	Definition
FHWA	Federal Highway Administration
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MassDOT	Massachusetts Department of Transportation
MBTA	Massachusetts Bay Transit Authority
MCB	Massachusetts Commission for the Blind
NAICS	North American Industry Classification System
NFB	National Federation of the Blind
NIDILRR	National Institute on Disability, Independent Living, and Rehabilitation Research
O&M	Orientation and Mobility
OEM	Original Equipment Manufacturers
RERC-APT	Rehabilitation Engineering Research Center on Accessible Public Transportation
RIDOT	Rhode Island Department of Transportation
RTA	Regional Transit Authorities
SAE	Society of Automotive Engineers
SR	Social Rehabilitation
TMA	Transportation Management Assosciation
TNC	Transportation Networking Companies
VMT	Vehicles Miles Traveled
VR	Vocational Rehabilitation

Executive Summary

The Massachusetts Commission for the Blind (MCB) has invested in this project to learn more about the Autonomous Vehicles (AV) market and framework to date to address mobility and job access challenges. This report provides a "big picture" overview of AVs and the tools that blind or visually impaired persons use today. Analyses on the AV market and vocational needs for the visually impaired are included with recommended next steps. The goal for this project is to provide information to improve employment opportunities for blind or visually impaired persons through an analysis of local employers and how AVs may impact these opportunities. Key findings include:

- According to the American Community Survey (ACS), over half of the working-age people who are blind or visually impaired are not in the labor market, compared with fewer than a quarter of people without disabilities. Only 44.2% of people who are blind or visually impaired are employed, compared with 79 percent of those without disabilities[1] Almost 28% of non-institutionalized persons aged twenty-one to sixty-four years with a visual disability live below the poverty line.[2]The employer's willingness to hire blind / visually impaired persons present an additional hurdle into the workforce, on top of transportation and educational barriers.
- A blind or visually impaired person's biggest challenge, especially with complete loss of vision, is navigating unfamiliar and new places. Familiar travel also poses challenges due to other persons, unexpected obstacles, and construction. The traditional transportation options such as taxi, subway, and transit can be dangerous, costly, and restricted in movement between agencies and municipalities.
- Transportation Management Associations (TMAs) in some communities and Transportation Networking Companies (TNCs) such as Lyft and Uber have changed the transportation landscape. Still, the limited coverage areas, high rate of driver turn over, discrimination, and lack of understanding of Americans with Disabilities Act (ADA) laws and etiquette and vehicle identification, have caused new challenges for blind persons.
- While some new types of services are available and projects are in the works, this is a critical time for collaboration and support between the private sector and public agencies to help advance independence and mobility for all.

The project's objectives focus on impacts:

Social; the recommendations support the use of AV technologies to support the underserved blind population further and positively affect other manned driver decisions and behavior.

Economic; the recommendations support economic growth through new jobs created in the Commonwealth.

Safety; the recommendations enhance safety for blind and visually impaired travelers and pedestrians.

Operational; the recommendations enhance operational efficiencies for transportation agencies to decrease the cost per ride.

[1] U.S. Census Bureau, 2017 American Community Survey 1-Year Estimates, Table B18120: Employment Status by Disability Status and Type
[2] National Federation of the Blind, Blind Statistics, 2016 - https://www.nfb.org/resources/blindness-statistics

The methodology to determine the opportunities provided by autonomous vehicles was as follows:

- Analyzed the location of known MCB VR Service Cases over the past several years and desired job placement;
- Researched and produce a list of potential employers in Massachusetts, their location and job category;
- Assessed the current transit network, TNC, and AV transportation partnerships; and
- Provided eight recommendations moving forward to capitalize on the outcomes of this project, The Projected Impact that Autonomous Vehicles Could Have on Vocational Rehabilitation Outcomes. These are practical recommendations that support safe and enhanced travel for blind and visually impaired persons as the AV market continues to develop.

The project's recommendations extend MCBs impact into AV development, advance VR services in the Commonwealth, and lessen the technological barriers for blind and visually impaired persons in the Commonwealth. While full-scale AV deployment is decades away, the purpose of the recommendations is to help MCB best prepare and serve the blind community in the near term and for the likely future regarding AV to support mobility for all. The recommendations range from shorter-term, to support the blind and visually impaired persons of the Commonwealth now through education, funding and government initiatives to long term, preparing for the market penetration and in support of a more connected world. The belief is that the more collaboration and support from related agencies and industries is a critical step in exploring new projects and deploying more accessible transportation solutions.

Introduction

The Massachusetts Commission for the Blind (MCB) mission is to help legally blind and visually impaired individuals achieve independence and full community participation. The MCB is the point of entry for vocational rehabilitation (VR) and social rehabilitation (SR) services for residents of the Commonwealth who are declared to be legally blind by an eye care professional. According to the National Federation of the Blind, 27.7% of non-institutionalized persons aged twenty-one to sixty-four years with a visual disability live below the poverty line with over 70% not employed full time. Mobility and access to employment are critical.

There are currently limited options for blind person movement, and discrimination and service delivery borders (e.g., Regional Transit Agencies (RTAs) for paratransit work trips) are obstacles for independence and mobility. Current access to ride demand response is limited, including the Massachusetts Bay Transit Authority (MBTA) and RTAs, and private companies such as Lyft and Uber. Autonomous Vehicle (AV) technology may reduce the cost per ride for the MBTA (and other (RTAs)) and passengers, allow blind riders to travel with guide dogs and increase the safety, independence, and experience for blind and visually impaired riders. The "last 50 feet" to a destination or vehicle is typically the most unfamiliar to blind travelers, with ramps, curbs, construction, doorway access, and infrastructure challenges to navigate alone. This is a crucial time in AV development, pilot projects, and policy planning to make the voices of the underserved blind population heard and incorporated into the planning and engineering design to provide mobility for all.

1.1 Scope

The MCB has undertaken this project to investigate how the advent of AV could positively affect the employment outcomes of blind and visually impaired people. People with blindness and visual impairments are not able to drive, which can impact and limit their access and opportunity to employment.

The goal for this project is to provide information and recommendations to improve employment opportunities through data analysis and research for blind and visually impaired persons. The objectives focus on impacts:

- Social; the recommendations support the use of AV technologies to support the underserved blind population further and positively affect other manned driver decisions and behavior.
- $ Economic; the recommendations support economic growth through new jobs created in the Commonwealth.
- Safety; the recommendations enhance safety for blind travelers and pedestrians.
- Operational; the recommendations enhance operational efficiencies for transportation agencies to decrease the cost per ride.

These objectives helped form the direction for recommendations based on market, economic, and transportation analysis. Often the objectives overlap in the recommendations; improvements in economic and safety have social implications, as operations improvements can improve safety, social and economic opportunities. Understanding vocational opportunities and potential AV early adopters such as Bus Rapid Transit Lines, Transportation Network

Companies (TNC)[3], and vehicle Original Equipment Manufacturers (OEM) with AV and fleet services, shall provide the most significant impact to the blind community in Massachusetts.

1.2 Methodology

The methodology to determine VR potential and the impact of autonomous vehicles was as follows:

1. Determined project scope and objectives and interviewed available persons related to visual impairment, involved in AV technology, accessibility research, and development.
2. Reviewed and analyzed MCB available data available to determine the location of known MCB VR Service Cases, their respective location, and desired job placement
3. Reviewed all publicly available MCB material, American Foundation of the Blind (AFB), and national organizations to extract which employers were committed to hiring blind persons to produce a list of potential employers in Massachusetts, their location, and job category.
4. Assessed the current transit network, TNC, and AV transportation partnerships, including a market survey.
5. Developed eight recommendations moving forward to continue this effort, and not to limit the progress of the project to this report.

1.3 Document Overview

The report has been organized to reflect the scope, objectives, and methodology. Each section is described below in Table 1: Document Overview.

Table 1: Document Overview

Section	Description
1. Introduction	Provides an overview of the project scope, objectives, and methodology.
2. Overview	Explanation of the background of the MCB, VR services, references, resource material, a summary of some of the existing travel and navigation tools for blind and visually impaired persons, and existing local transit networks and transportation partnerships with TNCs.
3. Economic and Vocational Analysis	Identification and review of potential employers, locations, and opportunities for employment in growth sectors for blind persons in Massachusetts.
4. Autonomous Vehicle Market Report	Summary of the current AV market for freight, passenger, transit, and shuttle vehicles.
5. Recommendations	Practical recommendations that support safe and enhanced travel for blind and visually impaired persons.
Appendices	A full list of prospective employers for blind persons based on this project's review of material and RTAs in Massachusetts.

[3] 1 Under Massachusetts law, St. 2016, c. 187 "An Act Regulating Transportation Network Companies" (2016), a TNC is defined as "a corporation, partnership, sole proprietorship, or other entity that uses digital network to connect riders to drivers to pre-arrange and provide transportation."

2. Overview

2.1 Background

The MCB was established under Section 129 of Chapter 6 of the Massachusetts General Laws. According to its website, "MCB provides the highest quality rehabilitation and social services to Massachusetts residents who are blind, leading to their independence and full community participation." People who have low vision and have been diagnosed with progressive visual impairments leading to legal blindness are also eligible to receive VR services. MCB partners with local agencies, healthcare providers, employers, and clients' relatives to provide services, including rehabilitation and social services and vocational assistance, to people in Massachusetts who are legally blind.

MCB has offices in four locations supporting its six service regions in the Commonwealth. MCB's main office, located at 600 Washington Street in Boston, serves its Greater Boston, Northeast, and MetroWest Regions; its office at 436 Dwight Street in Springfield serves its Western Region; its office at 390 Main Street in Worcester serves its Central Region, and its office at 888 Purchase Street in New Bedford serves its Southeast Region.[4]

Massachusetts Section 136 of Chapter 6 of the General Laws requires all health providers that diagnosis a person as legally blind to report the person's diagnosis to MCB within 30 days of their diagnoses. Based on conversations with MCB and the data provided, 125,927 persons in Massachusetts have a visual disability (self-identified) per American Community Survey (ACS), or **1.8% of the population of the Commonwealth**. There are approximately 26,000 persons who are registered with MCB as blind and with significant visual impairment (20/200 or less than 10% field of view vision). 82% of clients have some usable vision. Annually, MCB provides vocational rehabilitation services to approximately 600 to 700 persons.

2.2 Vocational Rehabilitation (VR) Services

Nationally, 60% of Americans are in the labor force. By comparison, only 44.2% of blind /visually impaired persons are in the labor force and face an uphill battle to provide for themselves and their families. **Blind and visually impaired persons are 30% less likely to be employed.** An employer's willingness to hire blind / visually impaired persons present an additional hurdle into the workforce, on top of transportation and educational barriers.

VR programs are designed to give people who have disabilities the rehabilitation and social services they need to find and retain employment. VR services are available to eligible candidates; services include VR counseling and guidance, independent living skills education, job exploration, workplace readiness training, self-advocacy education, and assistive-technology training (e.g., training on keyboarding skills, screen-reading software, and computerized speech systems). Other available training services include college or university, occupational/vocational, on-the-job, job readiness, and disability-related skill training, as well as career services such as job-search assistance and on-the-job support. Transportation services and reimbursement of reader and interpreter fees may be provided under certain circumstances.[5]

2.3 Reference and Resources

To understand the current situation further, the project team conducted a series of meetings, interviews, reviewed data sets provided by MCB and other agencies, and reviewed available research and articles related to AV, blind

[4] https://www.mass.gov/info-details/overview-of-the-massachusetts-commission-for-the-blind#overview-
[5] https://www.mass.gov/info-details/overview-of-the-massachusetts-commission-for-the-blind#vr-program-

persons, and guidance. The meetings, interviews, data sets, and articles in this section were reviewed and considered when developing the project recommendations and this report.

2.3.1 Meetings

The meetings below provided the project guidance and reached into the AV and disabled communities. A brief description of each meeting is below to provide context for our discussion and essential takeaways.

- August 6, 2020, Client and Project Team Kick-Off Meeting-Introductions, review of project scope, and review of timeline for deliverables.

- August 13, 2020, Client and Project Team Follow Up Discussion-Approach to develop the report and updated schedule to meet deliverables.

- August 17, 2020, Client and Project Team Interview with Josh Pearson Discussion –Mr. Pearson is blind and works at the University of UMass Amherst, providing training to students, staff, and faculty on assistive technology tools for education and employment across the diverse learning spectrum. The meeting provided a firsthand account of transportation tools used by Mr. Pearson traveling around Massachusetts and developing the PERCEPT application (discussed further in Section 2.4).

2.3.2 Interviews

The interviews below provide insight into AV development in the context of addressing visually impaired challenges.

- August 31, 2020, Interview with Scott McDonald, President Connected Vehicles Trade Association (CVTA)- After serving in the Vietnam War, Mr. McDonald returned home and was blind for nine months. Since then, he has regained his sight, and spent his time advancing technology in automotive and acts as an advisor to Congress of AV and transportation issues. One insight shared was that Mr. McDonald reported interviewing 12 automotive companies approximately three years ago, and only Ford was developing biometrics at the time for an aging consumer. After our discussion with Mr. McDonald, Jacobs developed and circulated a survey to CVTA members (discussed further in Section 4.4).

- September 3, 2020, Interview with Aaron Steinfeld, of Carnegie Mellon University – Since 2008, Carnegie Mellon University and SUNY Buffalo have partnered for Rehabilitation Engineering Research Center on Accessible Public Transportation (RERC-APT) . RERC-APT conducts research to address some timely and critical human factors issues in boarding vehicles and develop essential accessible information technology resources for improving the usability of transit systems for all riders. The RERC-APT was refunded in fall 2013 and brought experts in information technology, ergonomics research, and universal design together to advance the practice of accessible transportation further. It was announced that the 10-year partnership between the two universities had been extended for another five years (2018-2023)[6]. Mr. Steinfeld relayed issues for rendezvous step and vehicle identification, as well as discrimination and certain TNC app developments that incentivize drivers to mark a person as a "no show" for immediate payment without making the trip. While the "no show" incentive may exist for all persons, anecdotal evidence suggests drivers take advantage of this option with blind and disabled travelers more often. Mr. Steinfeld also raised

[6] Rercapt.org

payment issues for TNC and transit partnerships to make sure the right person or agency is paying for a ride when considering subsidized systems and reimbursements.

- September 9, 2020 Interview with Jordana Maisel, SUNY Buffalo University – This meeting provided additional input on RERC-APT, buildings, and infrastructure accessibility standards, Auto Alliance Leadership, and the latest developments in research. Ms. Maisel cited physical limitations more than technological hurdles. The project is currently involving OEMs, usually under a non-disclosure agreement, to participate in developing an approach to make autonomous shuttles more accessible. In addition, seamlessly integrating the user experience while considering privacy concerns, as well as equity issues assuming all persons and disabled persons have smartphones.

- September 22, 2020 Interview with Dr. Bryan Reimer, Research Scientist at MIT AgeLab, and Associate Director of New England University Transportation Center- Dr. Reimer is renowned in the AV market and accessibility. His concern is that the technology is not there today, in addition to the safety and policy framework, and may never reach fruition. His recommendation is to help some people today, through paratransit partnerships and long term, to allow the technology to mature before imposing ADA requirements. His concern is the additional ADA requirements may dampen the markets ability to develop a full Level 4 vehicle, which may not be achievable without ADA requirements.

At the time of this Final Report, the project team also communicated with other members of the AV and transportation industry. Jacobs has meetings scheduled with

- Monica Tibbits-Nutt, Executive Director of the 128 Business Council and serves on the Massachusetts Department of Transportation (MassDOT) Board of Directors and the Fiscal Management and Control Board that currently oversees the MBTA.

- Laura Brelsford, Assistant General Manager for Systemwide Accessibility for the MBTA.

- Glen Berkowitz, from Better City. Better City advances Boston's and the region's economic health, access, sustainability, and quality of life through applied research, planning, targeted services, and advocacy.

- Alana Olsen Westwater, Vice President of Strategy and Operations for Kendall Square Association. The Kendall Square Association includes leaders in the Kendall community to discuss this innovation ecosystem's unique characteristics. The mission is to build partnerships, host events, and advocate for public policy issues.

In addition, Jacobs reached out to:

- Ryan Chin, Co-Founder and CEO of Optimus Ride, a local AV developer who has worked with Perkins School for the Blind in the past;

- Rory Cooper, Director of the Human Engineering Research Laboratory of the University of Pittsburgh, international leader in accessibility and transportation; and

- Aptiv Technology, a local AV developer and leader in the industry.

If the Project Team can get in contact to interview with these persons, then we will move forward with them to identify opportunities to achieve the project recommendations and share mobility for all strategies.

2.3.3 Data Sets

The MCB provided two data sets that were analyzed to understand the current situation. The information was combined with publicly available transportation network information and prospective employers:

- **Data Set 1:** August 13, 2020, Includes the Occupation for the Civilian Employed Population 16 Years and Over in Massachusetts by Disability Status; and

- **Data Sat 2:** August 27, 2020, Includes existing MCB VR Cases and their county, diagnosis, etiology, and employment goals.

Additional publicly available reports and brochures from the MCB were reviewed for prospective employers with experience hiring persons who are blind and with visual impairments or firms who have expressed a commitment to diversity and inclusion, including blind and visually impaired persons. These materials were critical in developing Section 3. Economic and Vocational Analysis. Names of prospective employers were culled from the websites of the American Foundation for the Blind and the National Federation for the Blind, as well. A full list of prospective employers listed in Appendix A.

2.3.4 Literature Review

Our project team researched and reviewed published and relevant material. While there has been much research and work on AV technology and accessibility, the article "Looking through the Perception of Blinds: Potential Impacts of Connected Autonomous Vehicles on Pedestrians with Visual Impairments," from the Transportation Research Board (TRB) provided the most relevant input. Research in this document was presented on younger and older blind pedestrians and riders, their familiarity and experience, and the increased risks for pedestrians with quieter electric vehicles in the roadways today. Significant takeaways from the research and results of this article stated:

- That the respondents in this survey who experienced being near an accident with an electric vehicle (EV) are less likely to choose connected and autonomous vehicles.

- Respondents who rely on mobile applications and technology-based devices for navigating purposes tend to trust connected and autonomous vehicles.

- Blind people who rely on conventional navigation tools (e.g., white cane, guide dog, etc.) are less likely to trust connected and autonomous vehicles.

- The gender effect is visible, as the female participants tend not to trust connected and autonomous vehicles.

- Concerning policy recommendations, subsidies should be provided to various advocacy groups to offer orientation and mobility (O&M) training services, which are pivotal to educate how to use technology-based navigational services.

- Also, automobile manufacturers should be enforced to add acoustic vehicle alert systems (AVAS) to both EVs and connected and autonomous vehicles. [7]

[7] Looking through the Perceptions of Blinds: Potential Impacts of Connected Autonomous Vehicles on Pedestrians with Visual Impairment

2.4 Current Travel and Navigation Tools

Blind persons traveling independently in rural and urban settings rely on different tools depending on the distance, weather, and location within the Commonwealth. Conventional navigation and aid tools include a minority of blind persons who use white canes, guide dogs, and optical or electronic aids. According to the Perkins School for the Blind, **only 2%-8% of blind persons use a white cane**[8] , and Guiding Eyes for the Blind **estimates 2% of all blind and visually impaired work with guide dogs**[9]. Based on our interview with Mr. Pearson, when possible, blind persons choose walking as a preferred mode of transport. In the winter and for destinations more than a walkable distance, travelers may need to use taxis, transit, or TNCs.

Public transport can be challenging to navigate pick up and drop off locations when buses arrive simultaneously at the same stop and may necessitate the need for a blind person to ask for assistance. This can lead to psychosocial impacts causing anxiety, dependence, lower self-esteem, and unreliable service ending in missed or late work attendance. In Boston or more urban settings, blind persons typically use an app to help navigate the city and receive notifications regarding transit. The MyStop app from Google allows blind users to track and receive announcements for the MBTA. Taxis and TNCs such as Uber and Lyft may be an option but pose challenges; passengers have faced discrimination, ADA etiquette problems, and attitudinal boundaries toward service dogs. While TNCs are required to transport service dogs, high turnover and limited driver training have limited dog acceptance. Blind travelers have responded with a class-action lawsuit against Lyft. Currently, TNC drivers are issued a warning first if they refuse to transport a guide dog, and on the second refusal, the drivers are terminated from the platform. The cost per ride is also high; Uber is typically the lower cost option but has more service interruptions based on anecdotal reports of user experience (source: Josh Pearson).

New systems and devices such as Alexa, Google Home, and Global Positioning System (GPS) applications, such as Seeing Eye, BlindSquare with alerts, and ADA color-coding, have been utilized by the blind and visually impaired to gain independence. IRA is a subscription service smartphone application that connects live humans to blind persons to help them navigate in real-time. IRA links the app to a live agent to guide the user over the phone through audio and video connectivity. IRA can also interface with Uber and Lyft to provide locations in more difficult pick-up and drop off locations.

Locally, UMass Amherst has developed an electronic indoor navigation system called PERCEPT, a seeing-eye directory for the blind and visually impaired, which provides a blind user with verbal directions, electronic signs, and a virtual information booth for finding their way around within buildings and, potentially subway stations in Boston, among other indoor locations.[10] PERCEPT is supported by Microsoft and currently in the development phase to provide an indoor wayfinding application mapping the smartphone picture with blueprints and directions. This tool and approach may be a model for new building design, particularly campuses, both education, and corporate campus, or even senior living campuses of the future. UMass is also working on companion applications to mark hard to navigate physical barriers for the campus.

Sina Azizi Soldouz, Md Sami Hasnine, Mahadeo Sukhai, additional authors. First Published April 9, 2020 Research Article [Volume: 2674 issue: 5, page(s): 183-195,Article first published online: April 9, 2020; Issue published: May 1, 2020] https://doi.org/10.1177/0361198120914299

[8] Perkins School for the Blind. (2015, October 15). "10 Fascinating Facts about the White Cane." Accessed on January 14, 2019, from https://www.perkins.org/stories/10-fascinating-facts-about-the-white-cane.

[9] Guiding Eyes for the Blind. (2019). "FAQs." Accessed January 14, 2019, from https://www.guidingeyes.org/about/faqs/.

[10] https://www.umass.edu/researchnext/video/umass-amherst-percept-technology-assists-visually-impaired-navigation

2.5 Existing Transit Networks and Transportation Options

Under the ADA, transit authorities that offer fixed-route service must also provide complementary paratransit service: origin-to-destination, shared-ride transportation for passengers whose disabilities prevent them from riding the fixed-route and bus routes. It is the policy of the MBTA to provide paratransit services to all persons residing in communities with scheduled bus services or fixed-route (commuter rail or subway) stations. Federal regulations require transit agencies to provide paratransit services to persons within a three-quarter-mile bus route or fixed-route stop. In addition to the MBTA, there are fifteen existing RTAs in the Commonwealth. Amtrak also services locations within the state.

2.5.1 Regional Transit Authorities

The regional RTAs serve communities most of the Commonwealth urban, rural, and suburban areas outside Massachusetts. The RTAs are controlled by the municipalities in which they operate. Each RTA is governed by an Advisory Board composed of member communities' chief elected officials or their designees, as well as one representative of the high need's commuter population and one representative of the local rider community population. [11] RTAs frequently sub-contract paratransit services to third-party vendors.

Table 2: Massachusetts Regional Transit Authorities

Brockton Area Transit (BAT)	Cape Ann Transportation Authority (CATA)	Franklin Regional Transit Authority (FRTA)	Lowell Regional Transit Authority (LRTA)	Merrimack Valley Regional Transit Authority (MVTA)	Montachusett Regional Transit Authority (NRTA)	Southeastern Regional Transit Authority (SRTA)
Berkshire Regional Transit Authority (BRTA)	Cape Cod Regional Transit Authority (CCRTA)	Greater Attleboro-Taunton Regional Transit Authority (GATRA)	Martha's Vineyard Transit Authority (VTA)	MetroWest Regional Transit Authority (MWRTA)	Pioneer Valley Transit Authority (PVTA)	Worcester Regional Transit Authority (WRTA)

[11] https://www.mass.gov/doc/a-vision-for-the-future-of-massachusetts-regional-transit-authorities/download

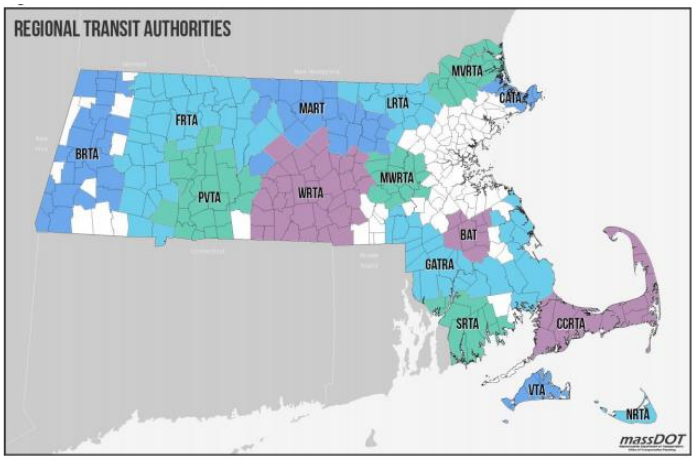

Figure 1: Regional Transit Authorities
Source: MassDOT

Disabled and ADA concerns are included in the MassDOT Vision for the Future of Massachusetts Regional Transit Authorities. Recommendation Number 13 states that RTAs should provide reliable paratransit service in compliance with the ADA requirements and consider the feasibility of offering additional services beyond ADA that meets the needs of their communities. RTAs should also implement an easy-to-use scheduling system using technology that improves the e-customer experience. Typically, paratransit services are only available during the hours of fixed-route bus service. When service is cut, paratransit riders are perhaps the most affected. Disabled riders sometimes have limited mobility choices. For that reason, some RTAs have offered demand response services beyond ADA requirements to persons with high needs and others (particularly the elderly). The Task Force on Regional Transit Authority Performance and Funding Appointed Members does include one disabled commuter population representative. Additional recommendations in the Vision for the Future of Massachusetts Regional Transit Authority Report related to high needs persons include an action item to improve RTAs sidewalk to improve safety and convenience.

The extent of paratransit services offered varies widely by region; some RTAs provide night and weekend services, but others do not.[12] The full-service area may not be covered, for example, like portions of Berkshire County. Many blind persons are located outside of Boston Metro or may need to cross several jurisdictional lines to commute to work.

2.5.2 Massachusetts Bay Transportation Authority

The MBTA is the largest agency by ridership and the agency serving the highest number of blind persons in the Commonwealth. People who are blind or have low vision and an accompanying guide dog ride all MBTA service for free with a Blind Access Charlie Card.

Source: https://www.mbta.com

May 1, 2019, MBTA announced a free six-month accessibility technology pilot called "AccessAI." The pilot used Aira technology to connect blind or low vision users with highly trained sighted agents who provide visual information about the user's surrounding environment—live and on-demand through smartphone video technology. The visual interpreter service was available to free throughout the MBTA's subway, bus, ferry, and commuter rail systems during the six-month pilot through October 31, 2019.

[12] https://www.mass.gov/doc/a-vision-for-the-future-of-massachusetts-regional-transit-authorities/download

Under the ADA, paratransit functions as a "safety net" for people whose disabilities prevent them from using public transit. It is not intended to be a comprehensive system of transportation that meets all the needs of people with disabilities, nor does it function as medical or human service transportation.[13] In addition to the subway, bus routes, commuter rail, and ferry routes, the MBTA offers The RIDE for persons eligible due to temporary or permanent disability. The RIDE paratransit service provides door-to-door, shared-ride transportation in fifty-eight cities and towns in the greater Boston area, with similar operating hours to the MBTA—generally from 5 AM to 1 AM daily. Travel is shared with other customers and travel times are reportedly comparable to the same trip taken on fixed-route (bus, subway, or trolley) **plus an additional** 20 minutes by the MBTA.

Figure 3: MBTA The RIDE Service Vehicle
Source: https://www.mbta.com

[13] https://www.mbta.com/accessibility/the-ride

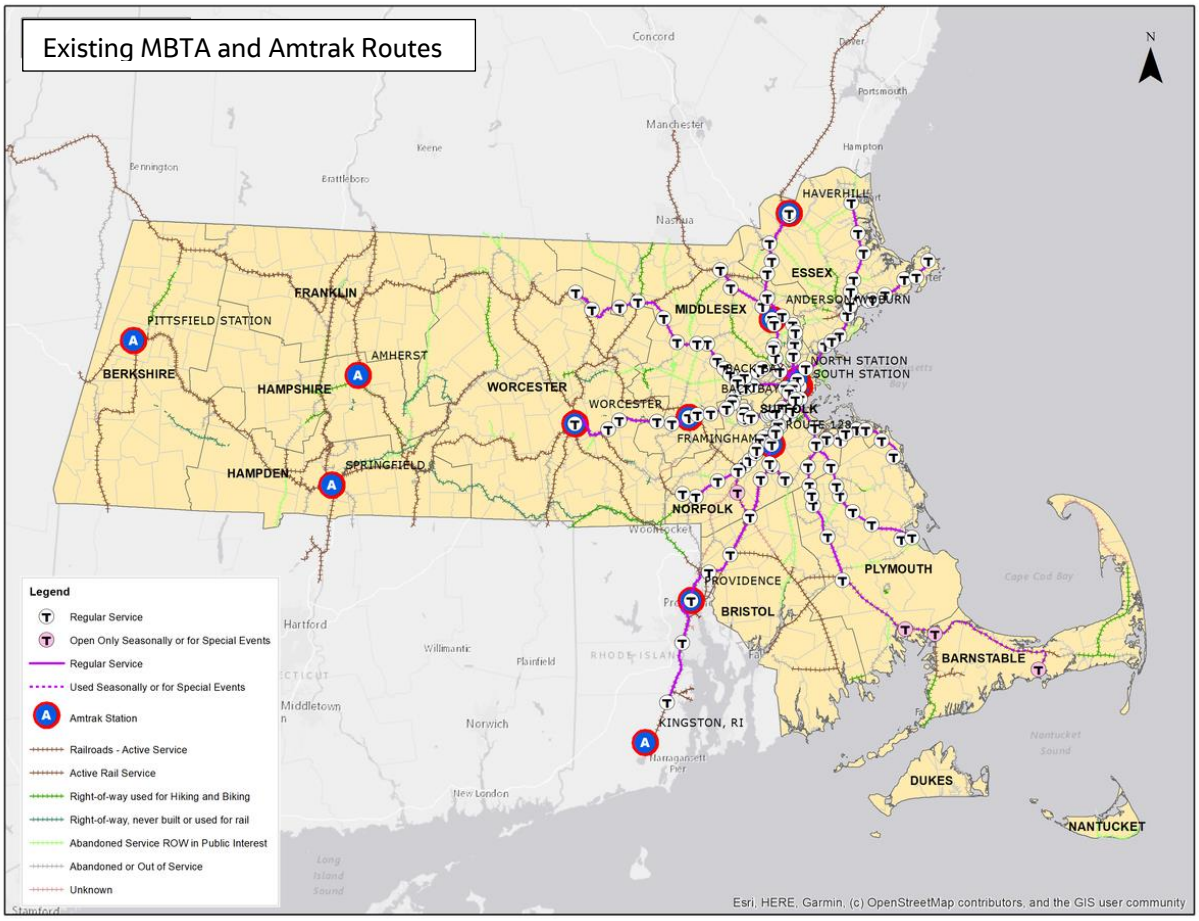

Figure 4: Existing MBTA and Amtrak Routes

2.5.3 Transit Partnerships with TNCs

Recently TNCs have partnered with the public sector to try and solve problems in transit and gaps in service. In 2019, the Massachusetts Mobility Center and MassDOT published a report on five transit partnerships with TNCs. Existing partnerships with TNCs in Massachusetts fall into three broad categories paratransit, general mobility, and first/last mile. [14] In this section, we have also provided a background on TMAs, which also serve a subset of commuter transportation with directed routes. Some of the research uncovered challenges within **ADA accessible vehicles, wait times, and smartphone access for all riders.**

2.5.3.1 Paratransit

The MBTA is piloting a program with ride-hailing companies Uber, Lyft, and Curb Mobility to provide on-demand service to The RIDE customers. The partnership is an effort by the MBTA to decrease the cost per paratransit trip while also enhancing customer service. The RIDE customers who enroll in the pilot receive a monthly allotment of subsidized rides through the partner TNC organization of their choice. The MBTA uses a formula to determine the number of rides allocated to each consumer. Instead of having to request a shared ride in advance, customers can

[14] https://www.mass.gov/doc/partnering-with-transportation-network-companies-to-improve-mobility-for-older-adults-people/download

summon a vehicle on demand, choosing between a shared and private option. This model provides greater flexibility for The RIDE consumers, allowing for spontaneous travel and increased convenience.

2.5.3.2 Mobility Improvements

Organizations have increased access for consumers by providing TNC rides when other services are not available. In Southeastern Massachusetts, the Community Accessing Rides (CAR) program provides Uber rides to consumers of participating organizations when public transit is not an option. The Attleboro-Norton Social Responsibility Alliance, a consortium of organizations that partnered in response to community forums which cited transportation as one of the area's most massive unmet needs, created CAR. Alliance members include the Greater Attleboro Taunton Regional Transit Authority (GATRA), two human service agencies, a faith-based organization, and a behavioral health center. When a consumer of a participating organization needs a ride, the staff of that organization first makes sure that local public transit services are not available before summoning a ride for the consumer. The Brookline Senior Center (BSC), which serves residents of Brookline over the age of 60, supplements its senior van service with both Uber and Lyft. It also extends the subsidy to riders needing last-minute transportation to medical appointments and those interested in trying a TNC for the first time. The Needham Community Council, a nonprofit organization that supports residents of Needham, supplements its volunteer transportation program with TNCs to fill travel needs when no volunteer driver is available.

2.5.3.3 First Mile/ Last Mile

The last category of partnership covers riders of public transit who cannot complete a trip in full due to a gap in service. In northeastern Massachusetts, North Shore Community College (NSCC) uses TNCs to connect student commuters to education opportunities. NSCC's Danvers campus is three miles from the nearest bus stop, and students were having difficulties connecting to campus. To increase access and improve educational outcomes, NSCC partnered with Uber to provide a subsidized rate for student riders traveling between designated areas. The discount is automatically applied when students travel between the eligible geographic zones during select times. A shuttle van previously served these students. Following the two-year pilot program and the connectivity of point-to-point, on-demand transportation, NSCC eliminated the shuttle service and reallocated those funds to the Uber partnership.

2.5.3.4 Transportation Management Associations (TMAs)

Mass Commute, the Massachusetts Coalition of Transportation Management Associations (TMAs) are membership-based, public-private partnerships of businesses, institutions and municipalities joined together under a formal agreement to provide and promote transportation solutions for commuters that reduce traffic congestion, improve air quality and increase access to economic development opportunities. [15] There are sixteen TMAs formed in Massachusetts already; the majority are focused on transport solutions in more urban and populated areas that have other options.

[15] http://www.masscommute.com/tma_directory/

3. Economic and Vocational Analysis

Blind and visually impaired persons live throughout the Commonwealth and need transport and mobility services to gain access to jobs, friends, health care, and services. The data provided by MCB was analyzed to help determine density of vocational cases per county.

3.1 MCB Vocational Rehabilitation Cases by County Over the Past Several Years

Our analysis of the vocational data made available from MCB allowed the research team to understand where VR Service Cases were located and the persons desired employment field. Raw data provided by MCB was organized and plotted by the thirteen counties, including Barnstable, Berkshire, Bristol, Dukes, Essex, Franklin, Hampden, Hampshire, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester. The majority of MCB Service VR cases are in Suffolk and Middlesex county. Data sets showed many VR cases most interested in retail jobs. This may be available for employment to bridge the gap in caring for a family. However, full-time retail professions typically cannot support a household.

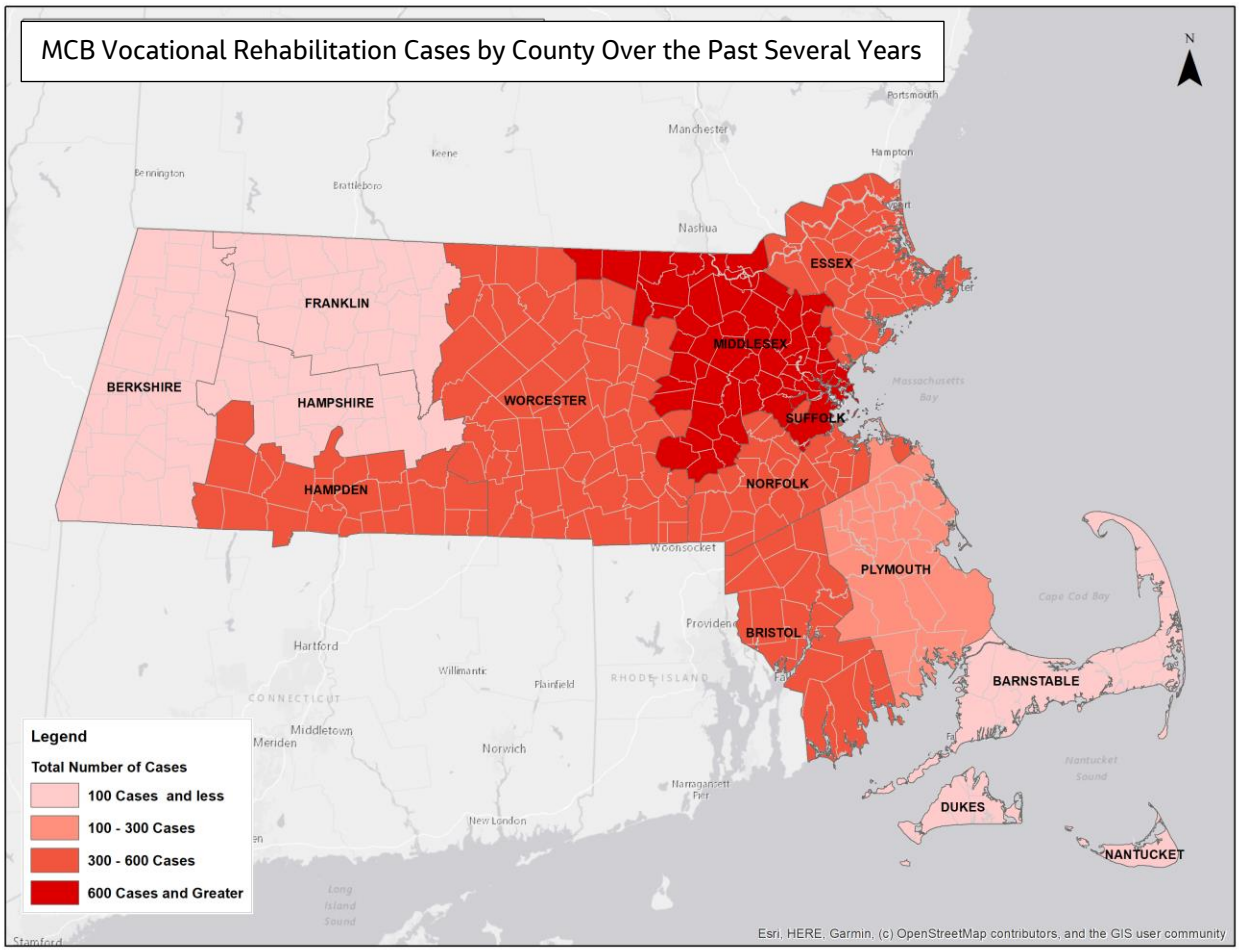

Figure 5: MCB Vocational Rehabilitation Cases by County Over the Past Several Years

3.2 Identifying Potential Employers

The characteristics of employers hiring blind and visually impaired persons were determined to help understand their perspective to help change their willingness to hire and identify obstacles. Visible organizational commitment to hiring persons with disabilities, mainly the blind and visually impaired, is critical. In addition, hiring managers play a significant role in the successful hiring of persons who are blind and visually impaired. An employer has an increased likelihood of successful hiring of blind and visually impaired persons if they have previous experience employing blind person, are in communication with a VR agency specialist, and their level of awareness that blind and visually impaired persons can access print material, use the internet, and use standard industrial equipment.[16]

3.3 Prospective Employers

To identify prospective employers, the project team reviewed MCB, National Federation of the Blind (NFB), and American Foundation for the Blind (AFB) web sites for names of employers with a stated commitment and interest in the employment of blind and visually impaired persons. The list of employers was filtered to determined which firms had operations in Massachusetts. **The analysis resulted in identifying a total of 36 private sector and nonprofit employers and 379 business locations in 130 cities and towns, representing 37% of all state's 351 municipalities.** Business locations in all 13 counties were identified. Table 3 below summarizes the number of business locations in each county. Middlesex County has the largest number of business locations; however, the number of positions in each company or location is unknown. Employment opportunities are dynamic and change over time based on the economy, retirements, job changes, and business growth. More research and working with the companies will present a more rounded assessment of the exact locations of offices hiring blind persons.

Table 3: Prospective Employers of Blind and Visually Impaired Persons by County

County	Number of Business Locations	Percentage
Barnstable	18	5%
Berkshire	5	1%
Bristol	27	7%
Dukes	1	0%
Essex	35	9%
Franklin	2	1%
Hampden	17	4%
Hampshire	7	2%
Middlesex	108	28%
Nantucket	2	1%
Norfolk	51	13%
Plymouth	25	7%
Suffolk	49	13%
Worcester	32	8%

[16] McDonnal, et al.

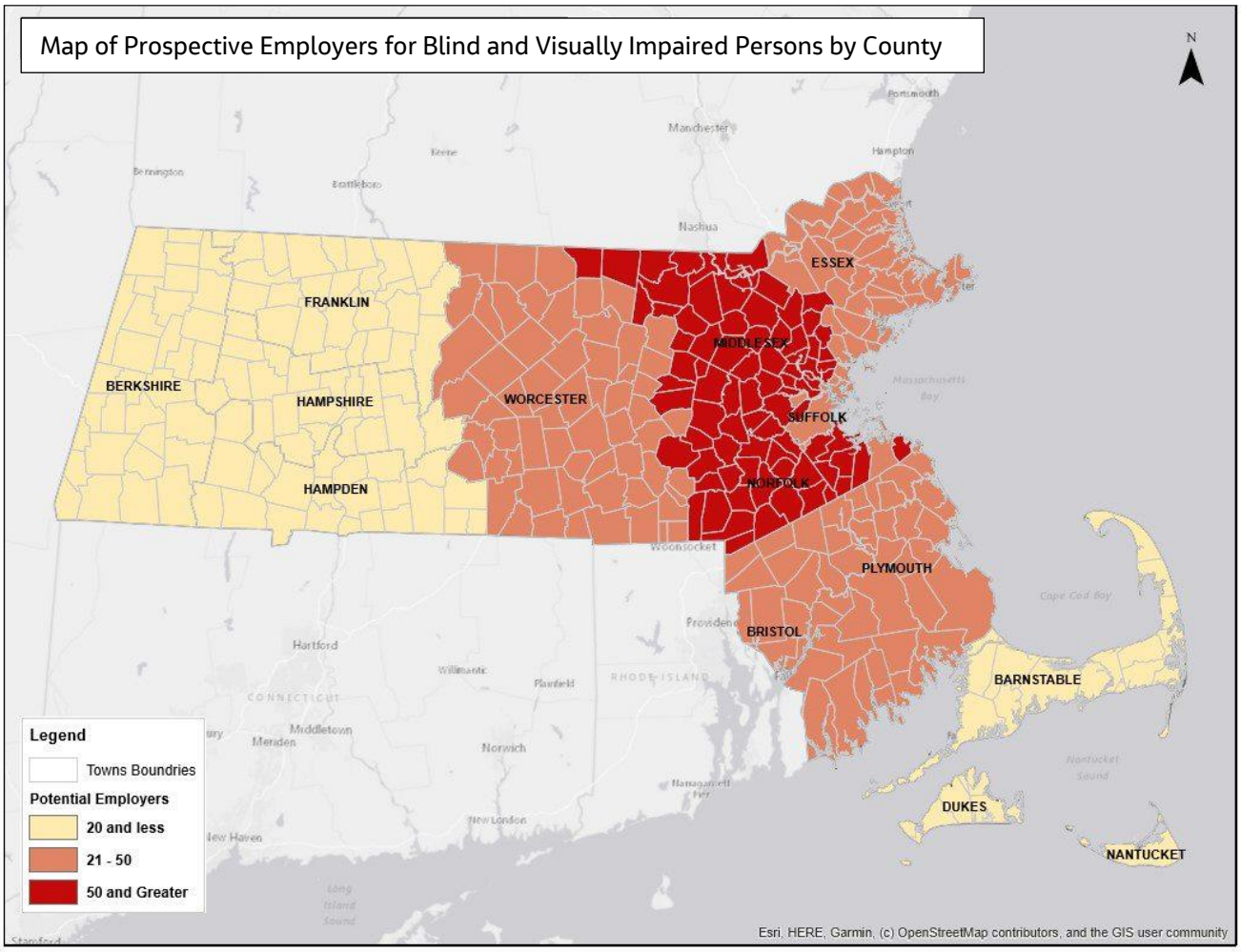

Figure 6: Map of Prospective Employers for Blind and Visually Impaired Persons by County

The employers were organized by the North American Industry Classification System (NAICS), a standard used by the Federal statistical agencies in classifying business establishments to collect, analyze, and publishing statistical data related to the U. S. business economy. Table 4 summarizes the industries of the potential hiring business.

Table 4: Prospective Employer by NAICS Code Sector

NAICS	Sector	Business Locations	
		No.	Percent
33	Manufacturing	2	1%
44-45	Retail	186	48%
51	Information	11	3%

NAICS	Sector	Business Locations	
		No.	Percent
52	Financial & Insurance	112	29%
54	Professional, Scientific & Technical	8	2%
55	Management of Companies	1	0%
56	Administrative Support & Waste Mgmt.	1	0%
61	Educational Services	8	2%
62	Health & Social Assistance	56	15%

Overall, there are many retail sector employers for potential employment opportunities. This matched the employment goals of the blind persons provided by MCB. In the Appendix, there are several retail firms listed to connect employers to MCB. This may be available for employment to bridge the gap in caring for a family. However, many retail positions typically cannot support a household, unless it includes commission sales.

In the financial market, Bank of America was a potential large employer with locations throughout the Commonwealth. There are some respondents from the MCB list of cases interested in financial and managerial roles, which can be challenging to find. For Managerial roles, Dunkin Donuts headquarters is in Canton with a commitment to hiring blind persons. Other firms may also have managerial and supervisory positions.

The largest growing sector in most regions of the Commonwealth, and potentially most exciting to make connections with moving forward, is health care and social services. There is an extensive range of potential positions and advancements in social services through technology; there is potential for partnerships and growth. Table 5 highlights the three priority industries for each region, summarized in Table 5 below. Priority industries are identified by each local region drawing on both state and local criteria. The Commonwealth's criteria for priority industries are high employment, presence of a talent gap; high demand/high wage industry; and career pathways. Local, regional criteria varied but often included strengthening regional economic competitiveness and creating opportunities for persons experiencing barriers.

Table 5: Work Force Regions in Massachusetts and Priority Industries

Region	Priority Industry 1	Priority Industry 2	Priority Industry 3
Berkshire (western)	Health Care & Social Assistance	Hospitality	Advanced Manufacturing
Pioneer Valley (Franklin, Hampshire, Hampden)	Health Care & Social Assistance	Education	Advanced Manufacturing
Central (Worcester Co)	Health Care & Social Assistance	Manufacturing	Transportation, Warehousing, Logistics
Northeast (Essex & portions of Middlesex)	Advanced Manufacturing	Professional & Technical Services	Health Care & Social Assistance

Region	Priority Industry 1	Priority Industry 2	Priority Industry 3
Greater Boston (Suffolk, Middlesex, Norfolk)	Health Care & Social Assistance	Professional & Technical Services (IT)	
Southeast (Norfolk, Plymouth, Bristol)	Health Care & Social Assistance	Finance	Professional & Technical Services
Cape Cod & the Islands (Barnstable, Duke & Nantucket)	Hospitality	Health Care & Social Assistance	Construction

Table 6 describes the priority occupations each workforce region has identified. The priority industries and priority occupations in each region guide key and growing industries with job openings that could provide employment opportunities for the blind and visually impaired. Typically, regional workforce boards, community colleges, and the MassHire Career Centers provide additional career training and assistance for persons seeking employment and careers in priority occupations and industries.

The regional employment and workforce boards across the state establish regional priority industries and identify priority occupations. There is a need in each region for people to train and fill these occupations today and within the next three-to-five years. Some of the occupations are entry-level. Priority occupations have career pathways where individuals can advance and earn higher wages. These are not the only available jobs and occupations. But instead, there are a more significant number of openings in priority occupations and growing priority industries.

The priority occupations identified in Table 6 includes only two occupations that require drivers' licenses, which would be a barrier to the blind and visually impaired community. All other occupations could potentially be fulfilled by a blind person with the appropriate skills, interest, and assisted technology with a willing employer. Although some occupations do not require driving a motorized vehicle, an employer's job requirements may add that task to a job description.

The Coronavirus pandemic is undoubtedly impacting the economy, employment, and job opportunities. The hospitality sector– restaurants, hotels, and resorts – has been one of the most adversely impacted sectors. The hospitality sector is a priority industry in the Berkshires and Cape Cod and the Islands regions. Other sectors remain strong, and some are growing, such as health care and life sciences. Health care and social assistance are a priority industry for every region in the Commonwealth. The Life Sciences cluster has jobs in Central and Eastern Massachusetts, including more entry-level jobs such as laboratory assistants.

The list of employers found in the Appendix who have had experience employing a blind person or who have made a significant commitment to the blind and visually impaired community includes employers in the priority industry sectors. It will be important for MCB vocational rehabilitation specialists to reach out to employers in the priority industries to pave the way for the employment of blind persons. Testimonials from existing employers of blind persons in the various sectors should be obtained to increase awareness of employers and hiring managers of the benefits of employing blind and visually impaired persons.

Table 6: Priority Occupations by Region in the Commonwealth

Work Force Region	Priority Industry	Priority Occupations
Berkshire	Health Care & Social Assistance	• Nurses (29-1140) • Nurses' Aides (31-1130) • Emergency Medical Technicians and Paramedics (28-2041) • Dental Hygienists (29-2021) • Medical Records and Health Information Technicians (29-2071) • Social and Community Service Managers (11-9151) • Clinical Counseling and School Psychologists (19-3031)
	Hospitality, Culinary & Management	• Chefs (35-1011) • Management (Food Services 11-950; Lodging 11-980)
	Advanced Manufacturing	• Machinists (51-4040) • Engineers (17-2000) • Management (11-3050)
	Cross-Over Occupations (Hospitality & Health)	• Construction Laborers (47-2061) • HVAC, Refrigeration Mechanics, and Installers (49-9021) • Carpenters (47-2031) • Electricians (47-2111) • Plumbers, Pipefitters and Steamfitters (47-2152 • Heavy & Tractor Trailer Truck Drivers (53-3032) *

Pioneer Valley	Health Care & Social Assistance	• Social & Human Service Assistants (21-1093)
		• Direct Care Workers
		  ○ Registered Nurses (29-1140)
		  ○ Nursing & Medical Assistants (31-1130)
		  ○ Personal Care Aides (31-1132)
		• Technical/Clinical Workers
		  ○ Dental Hygienists (29-2071)
		  ○ Pharmacy Technicians (29-2052)
		  ○ LPNs/LVNs (29-2061)
		  ○ Medical Records/ Health Information Technicians (29-2071)
		  ○ Physician Assistants (29-1071)
		  ○ Occupational Therapists (29-1122)
		• Physical Therapists (29-1123)

	Education	• Educators at all levels and all fields, including vocational-technical, STEM and trades educators (25-0000) • Teaching Assistants (25-9040)

	Advanced Manufacturing	• Supervisors (51-1000)
		• Production Workers
		  ○ CNC Operators (51-9160)
		  ○ Machinists (51-4040)
		• Inspectors, Testers & Quality Control Workers (51-9060)

	Cross-Industry Occupations	• IT-related (15-1200) • Professional Services • Back-Office Administrative Support and Logistical Supports (43-0000)

Work Force Region	Priority Industry	Priority Occupations

Central	Health Care & Social Assistance	• Health Care Practitioners (29-0000)
		  ○ Certified Nurse Assistants (31-1130)
		  ○ LPNs – Licensed Practical Nurse (29-2061)
		  ○ RNs – Registered Nurse (29-1140)
		  ○ Pharmacy Technicians (29-2052)
		• Direct Care Staff (31-0000)

	Manufacturing	• Production Occupations (51-0000) • CNC Machinists (51-9160)
	Transportation, Warehousing, & Logistics	Commercial drivers (53-3030) *
	Cross-Industry Occupations	• Computer & Mathematics Occupations (15-0000) • Software developers (15-1250)
Northeast	Advanced Manufacturing	• Supervisor (51-1000) • Assemblers (51-2000) • Production Workers (51-0000) • Machinists (51-4040) • Inspectors/ Testers/ Quality Control (51-9060)
	Professional & Technical Services	• Computer Related and IT Support (15-1200) • Engineering (17-2000) • Engineering Technician (17-3020)
	Health Care & Social Assistance	• Health Care Practitioners and Technical (29-0000) • Direct Care and Support (29-0000 and 31-0000) • Health Care Administration (11-9110)
Greater Boston	Health Care & Social Assistance	• Health Technologists and Technicians (29-2000) • Nursing, Psychiatric and Home Health Aides (31-1000) • Other Health Care Support Occupations (31-9000)
	Professional & Technical Services	• Computer and Information Analysts (15-1120) • Software Developers and Programmers (15-1130) • Database Administrators and Network Architects (15-1140) • Computer Support Specialists (15-1150)

Southeast	Health Care & Social Assistance	• Health Care Practitioners & Technical Occupations (29-0000)
		  ○ Dental Hygienists/ Assistants (29-2021)
		  ○ Radiologic Technologists (29-2034)
		  ○ Nursing Assistants (31-1014)
		• Physical Therapy Assistants (31-2021)

	Professional & Technical Services	• Web Developers (15-1254) • Computer User Support Specialists (15-1151) • Computer Network Support Specialist (15-1231) • Computer Systems Analyst (15-1210) • Computer Programmer (15-1251) • Computer Information Systems Manager (11-3020)

Work Force Region	Priority Industry	Priority Occupations
	Financial & Insurance	• Tellers (43-3070) • Customer Service Representatives (43-4051) • Loan Interviewers/ Clerks (43-4110) • Loan Officers (13-2070) • Financial Analysts (13-2050) • Financial Managers (11-3030) • Financial Services Sales Agents (41-3030)
Cape Cod & the Islands	Hospitality	Chefs and Head Cooks (35-1011)
	Health Care & Social Assistance	• Health Care Practitioners & Technical Occupations (29-0000) • Health Care Support Occupations (31-0000) • Licensed Practical Nurses and Licensed Vocational Nurses (29-2061) • Nursing Assistants (31-1014)
	Construction	• Construction Laborers (47-2061) • Electricians (47-2111) • Plumbers (47-2152) • Construction & Building Inspectors (47-4010) • Front-line supervisors of Construction Trades (47-1010)

NOTE: Number in parentheses are Standard Occupational Codes or SOCs.
*Occupation requires driving a motor vehicle, which precludes employment of legally blind individuals

MCB provided the project team data on the employment goals of registered vocational rehab clients. The employment goals were analyzed by county and as to alignment with priority industries. Approximately one-third to one-half of the cases did not have a stated employment goal, or the indicated goal was a homemaker or outside Occupational Employment Statistics. Alignment of employment goals with local, regional priority industries ranged from a low of 6.0% in Worcester County to a high of 31.9% in Franklin County. Statewide, on average one in six MCB clients' (18.9%) employment goals were aligned with priority industries in the local region.

Another segment of clients ranging from a low of 28.1% in Hampshire County to over half (56.1%) in Berkshire County had employment goals from a broader range of occupations beyond jobs concentrated in their respective region's priority industries.

The analysis highlighted the need for mobility options for the blind and visually impaired. Often, there were residents in nearby areas with employment aspirations that matched priority industry goals in adjacent counties. The need for easy, convenient, and safe travel options to work that extend beyond county and regional transit agency boundaries is underscored. The review of employment goals also indicated that there are potentially transferable skills that could easily be applied to employment in a priority industry. For example, several MCB clients indicated a desire to be a manager. Management positions are available in all priority industries. However, these aspirations were not specific to one industry and thus were not counted as an aligned aspiration. Other illustrations were administrative support or office positions. Again, many priority industries include these cross-sector jobs. Also, someone with existing skills in administrative or office support may have or could readily learn database skills and begin a career pathway in the professional and technical services industry.

Table 7: Analysis of Employment Goals Based on MCB Cases

County	Number of MCB Cases	Goals Aligned with Priority Industries Percent	Goals: Homemaker, Outside OES, or Unspecified Percent	Balance
Barnstable	88	10.2%	54.5%	35.2%
Berkshire	62	9.7%	33.9%	56.5%
Bristol	314	31.8%	32.2%	36.0%
Essex	539	19.5%	36.2%	44.3%
Franklin	47	31.9%	31.9%	36.2%
Hampden	334	20.7%	37.4%	41.9%
Hampshire	96	29.2%	42.7%	28.1%
Middlesex	1,002	17.9%	35.8%	46.3%
Norfolk	378	21.7%	37.0%	41.3%
Plymouth	246	19.1%	34.6%	46.3%
Suffolk	631	20.3%	33.6%	46.1%
Worcester	487	6.0%	56.3%	37.8%
TOTAL*	4,224	18.9%	38.3%	42.9%

Data Source: MCB.
*Some cases did not include location data as to county.

4. Autonomous Vehicle Market Report

Components that make a vehicle automated consist of a combination of on-board, real-time sensing instruments, and highly complex computational processing. According to the Toyota Research Institute[17], driving automation consists of many interactive systems like localization and mapping, perception, and prediction. AVs are currently classified into six levels, illustrated below in Figure 7, Society of Automotive Engineers (SAE) Automation Levels.

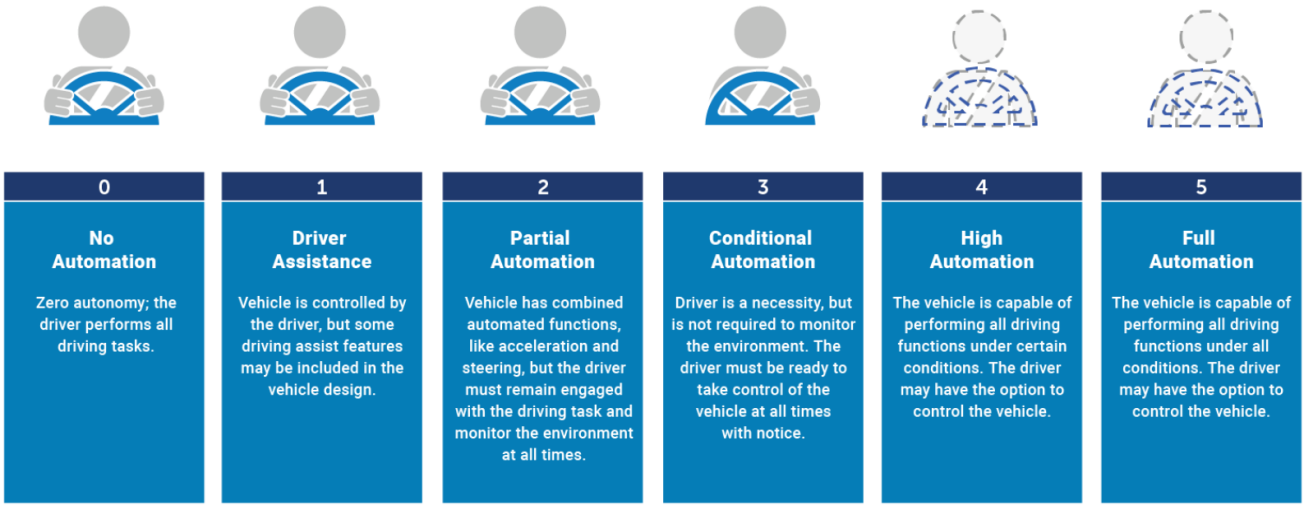

Figure 7: Society of Automotive Engineers – Automation Levels

The development of AVs has surged in the past decade, particularly in the past few years. Ever since the success of the Defense Advanced Research Projects Agency (DARPA) Grand Challenge in 2004, nearly every major automotive manufacturer has invested in advancing their research and development into an AV concept or commercialized AV solution. From the onset, automotive manufacturers were bullish and predicted quick commercialization on specific versions of AVs. The commercialization race of AVs has pushed these dates sooner and sooner.

To illustrate this point, in 2018, manufacturers were identifying a window between 2019 and 2025 as the introduction of Level 4 (L4) automation on the commercial market (Figure 8). The following year, all manufacturers claimed the commercial introduction of L4 automation in vehicles in the next 2 years (Figure 9). An essential qualifier to all these proclamations is that all manufacturers are stating that the initial introduction of AVs will be vehicles that can operate at SAE L4 on highways only. They all estimate that urban driving will follow approximately 5-10 years after highway-capable L4 vehicles are introduced.

[17] Automated Driving at Toyota: vision, Strategy and Development – Toyota Research Institute

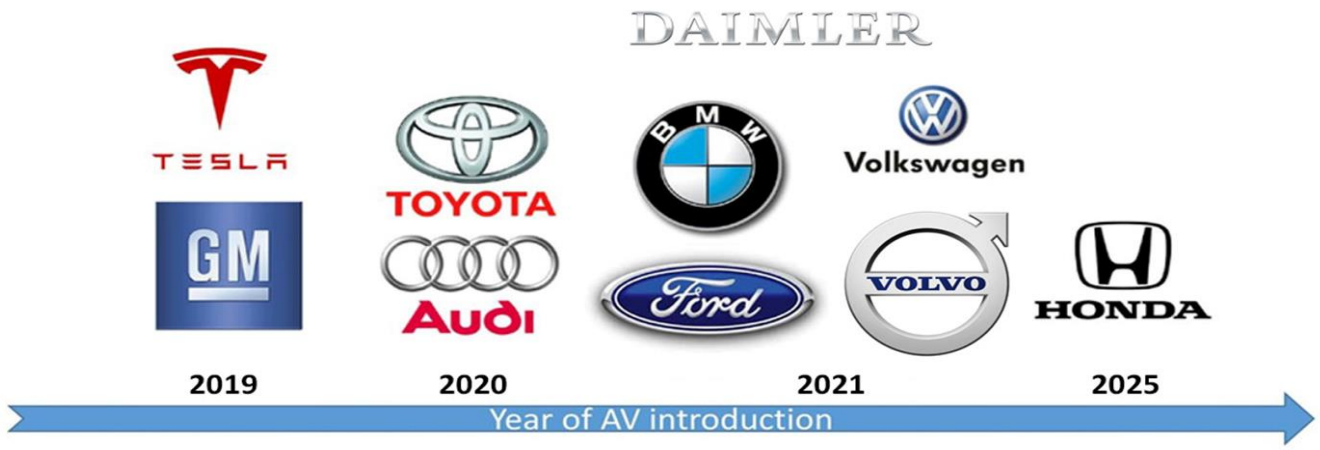

Figure 8: Automotive Manufacturers' Estimates of Commercialization of L4 Automation in 2018

Figure 9: Automotive Manufacturers' Estimates of Commercialization of L4 Automation in 2019

In March 2020, General Motors announced plans on investing $20B into the next generation of electric and automated vehicles. While there is some speculation that automotive manufacturers are bloating their claims of L4 autonomy, the pressure to be the first to market is intense and will continue to push the advancement of AV research, development, and commercialization. This is evident in the development of new AV partnerships and concepts that provide AV as a service.

Today, there are different submarkets within AV, including; freight, passenger, transit, and shuttle vehicles. Some highlights below:

- Freight vehicles are currently being tested on freeways in the south, like in Florida, and can make a trip in half the time across the country (from 4 days to 2 days).

- Passenger- Even with ongoing development, the recent projection of AV sales includes 20% market penetration in the next ten years. **Most recentl OEM estimates a 2045/2050 timeframe for an all-weather, all-road, and traffic capable vehicle meeting AV Level 5 standards.**

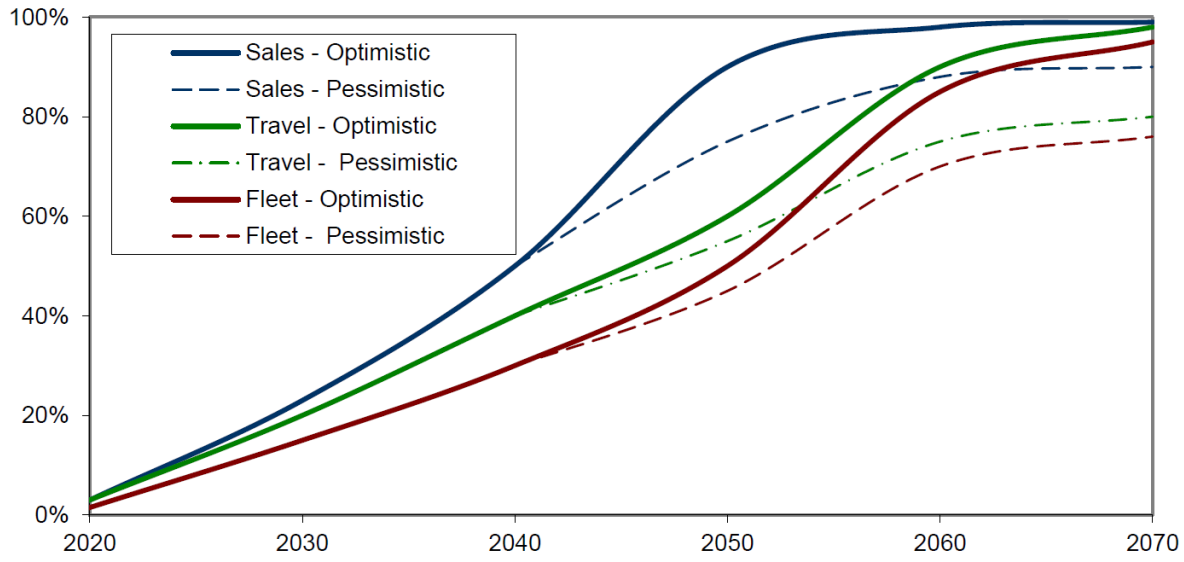

Figure 10: Autonomous Vehicle Implementation Timeline, Source: Victoria Transport Policy Institute

- Transit AV pilots with human drivers : CT DOT was recently awarded a grant for three forty-foot transit vehicles tested on the CTfastrak bus rapid transit corridor, a dedicated nine-mile route between New Britain and Hartford.

- Shuttle pilot with drivers is ongoing: RIDOT recently ended a pilot program reaching an underserved community in Providence through Little Rhody. The program provided riders free of charge for all travelers and introduced the concept in a hands-on, operational environment. Even with its success, more public outreach and communication to the public and underserved communities may have helped the project reach more.

4.1 AV Service Options

In considering the pros and cons of different AV transportation service options, several different variables come into play. Both fleet AVs and ASUVs can be operated using variables for routing, types of stops, and scheduling. **Traditionally, options have been measured by metrics such as vehicle-miles-traveled (VMT) that is generally embraced by the industry – engineers and transit operators/ transportation planners. This report has taken a more comprehensive view to highlight how each AV service option can assist or impact persons who are blind or visually impaired (see Table 8).** For example, the cost of no mobility cannot be measured in VMT; limiting access to employment and independence can be determinantal to a person's life and hurts the entire community.

Flexible Route, Flexible Stop, On-Demand Service - Flexible routes allow vehicles to have free reign but could be geofenced to operate only on certain roadways. Flexible routes allow vehicles to take the most efficient route and can only be used as a service that is on-demand. A rider would call up or schedule an AV using a web-service or smartphone application for a custom pick-up and drop-off anytime. Flexible, on-demand service would not follow a schedule but would only operate to meet demand.

There are complexities to operating a system that aims to optimize shared use, requiring the vehicular intelligence to plan pick-ups and drop-offs as they occur dynamically. This option doesn't suit a shared-use objective as well as others. Instead, this option would best serve many unique trips occurring at irregular times in a day. Single-occupancy or low-occupancy vehicles from fleet AVs like Waymo would be the most applicable option to be applied to this service type.

Flexible Route, Fixed Stop, On-Demand Service – A variant to the flexible stop option for on-demand service would be to use designated stops, or corral points, on the base where riders would go to meet their called ride. This configuration would allow for less complex ridership optimization algorithms but would still better serve many unique trips.

Fixed Route, Flexible Stop, On-Demand Service – This variant would be like the flexible route/stop option but would limit AV routing to a specific directional route. Rideshare optimization would be less complicated. This option would also allow AVs to be called on a route only when needed. ASUV would be most suited for this option.

Fixed Route, Fixed Stop, On-Demand Service – This variant would place an AV on the route, which would stop and pick up at designated pick-up and drop-off points. This option would optimize shared use, and vehicle deployment could fluctuate to address demand as needed.

Fixed Route, Fixed Stop, Scheduled Service – This final option would be the easiest to deploy, operate, and manage. Like scheduled-operated transit, riders would go to designated stops for pick-up and drop-off at set times. AVs would be able to adhere more easily to scheduled stops and would allow for greater reliability and predictability to other options.

Table 8: AV Service Options Comparison for Blind and Visually Impaired Travelers

AV Service Option for Blind and Visually Impaired Travelers	Advantages	Disadvantages
Flexible Route, Flexible Stop, On-Demand Service	• Complete freedom and control for trip planning, time and locations • Blind and visually impaired pick a drop off and pick up location known to be safe and familiar.	• Higher single or low occupancy trips • Higher energy costs • More refueling or recharging required • May not address the last 50 feet or physical challenges between the "stop" and destination
Flexible Route, Fixed Stop, On-Demand Service	• Stops will be pre-planned and **should be** in safe, designated areas	• User has no control on stop point

AV Service Option for Blind and Visually Impaired Travelers	Advantages	Disadvantages
	• Some freedom and control for on demand service	• Shared use may increase obstacles and confusion • Flexible routes or multiple vehicles may increase vehicle identification challenges. • May be better able to address the last 50 feet or physical challenges between the "stop" and destination
Fixed Route, Flexible Stop, On-Demand Service	• Blind and visually impaired pick a drop off and pick up location known to be safe and familiar. • Fixed routes provide predictability • Lower energy costs for shared vehicles and routes	• Shared use may increase obstacles and confusion • Multiple vehicles or flexed stops may increase vehicle identification challenges and challenges identifying their stops if multiple passengers. • May not address the last 50 feet or physical challenges between the "stop" and destination
Fixed Route, Fixed Stop, On-Demand Service	• Stops will be pre-planned and **should be** in safe, designated areas • Fixed routes provide predictability • Lower energy costs for shared vehicles and routes	• User has no control on stop point • Shared use may increase obstacles and confusion • May be better able to address the last 50 feet or physical challenges between the "stop" and destination
Fixed Route, Fixed Stop, Scheduled Service	• Reliability • Predictability • Lower VMT and operations costs for operators	• User has no control on stop point • Shared use may increase obstacles and confusion • May be better able to address the last 50 feet or physical challenges between the "stop" and destination

4.2 Accessible Transportation Technologies Research Initiative (ATTRI)

The USDOT's Accessible Transportation Technologies Research Initiative (ATTRI) is a joint 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. Emerging technologies and creative service models funded by ATTRI will offer all Americans enhanced travel choices and accessibility at levels once imagined. The USDOT is funding six technology innovations in three technology areas under its Accessible Transportation Technology Research Initiative (ATTRI) to make the transportation system easier for people with disabilities.

- **Wayfinding and Navigation** applications guide wheelchair users and people with visual impairments along routes using smartphone applications and other assistive technologies. Four different projects are awarded[18]:
    - City College of New York – Smart Cane for Assistive Navigation (SCAN), integrated with a smart phone application
    - AbleLink Smart Living Technologies – 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 standard for users in different metropolitan or rural areas.
    - Pathways Accessibility Solutions – A wayfinding tool for wheelchair users and people with visual impairment that guides routes tailored to the user's preferences.
    - TRX Systems – A smart wayfinding and navigation system to obtain real-time location, en-route assistance, and situational awareness.
- A **Pre-trip and Concierge** application suite support pre-trip planning for individuals with cognitive disabilities.
- The **Safe Intersection Crossing** application uses connected pedestrian travelers with high needs to the traffic signal systems (and by extension to nearby connected vehicles and infrastructure) and use this connectivity to develop assistive services for safe intersection crossing and increased independent mobility. [19]

The approach considers the complete trip, to take into account pre-trip considerations, safety, automation, and wayfinding. Figure 11 below illustrates the complete trip and role of applications in traveler safety and assistance.

[18] https://www.its.dot.gov/research_archives/attri/wayfinding_nav.htm
[19] https://www.its.dot.gov/research_archives/attri/index.htm

Figure 11: USDOT ATTRI's Complete Trip Example

ATTRI Description and image source is United States Department of Transportation, Office of the Assistnat Secreaty for Research and Technology, Intelligent Transportation Systems, Joint Program Office

https://www.its.dot.gov/research_archives/attri/index.htm

4.3 National Federation for the Blind Resolution 2019-18

In the NFB Resolution 2019-18: Regarding Considerations for Blind Persons in the Development of Autonomous Vehicle Technology, private industry stakeholders such as Cruise, Waymo, and Volkswagen Group, along with others, will work to provide the following features in their designs:

1. A nonvisual vehicle-location system that will direct the blind user to the vehicle and give instructions regarding pick-up and drop-off locations; and
2. Nonvisual accessible navigation and maintenance controls that will allow the blind user to program destinations and make changes during the trip and will alert the user to any maintenance the vehicle may need; and
3. Accessible interior environment controls, including but not limited to climate control, the entertainment system, and the opening and closing of the windows; and
4. Exterior environment alerts inform the blind user when the vehicle experiences sudden and unexpected changes due to heavy traffic, obstacles, or equipment malfunctions.

At the 2019 NFB Conference, **Lyft demonstrated a trial with Aptiv and blind consultants. Throughout the trials, Lyft has been providing riders with Braille maps of the car's route**

and a diagram of the vehicle explaining how all its parts function. The purpose was to demonstrate how tactile maps could share information that's usually conveyed on a screen.

4.4 Perkins School for the Blind Pilot[20]

Locally, Optimus Ride has partnered with the Perkins School for the Blind and invited blind and disabled students hands-on experience with the Optimus Ride AV shuttle vehicles. Optimus Ride reports a desire to partner with institutions to be fully aware of issues, and design and engineer solutions to meet the needs of all travelers. During Optimus Ride's first visit to campus, the AV team held an information session for the Perkins community, where they explained the suite of sensors that help the vehicle "see" its surroundings. The sensors communicate with a central computer, located under the driver's seat, which controls the vehicle's movements. Data gathered at Perkins will help build the vehicle's pattern recognition capabilities, so it can identify obstacles and calculate the safest course of action.

For its inaugural drive at Perkins, the vehicle followed a pre-programmed route around a cleared area. In addition to testing their vehicles on campus, the Optimus team will collaborate with Perkins to learn more about how their technology can best serve riders with visual impairment or other disabilities. Several dozen people participated in an Optimus workshop discussing how the vehicles could be employed as self-driving shuttles on college campuses. Among the participants were Perkins President and CEO Dave Power and Perkins Solutions Vice President Bill Oates, who said the technology could represent a "sea change" in transportation and mobility for people who are blind.

4.5 Connected Vehicle Trade Association Survey

The Connected Vehicle Trade Association (CVTA) is a nonprofit business established to facilitate the interaction and advance the interests of the entities involved in the vehicle communication environment. The Connected Vehicle Trade Association enables the collaboration of companies, organizations, and governmental bodies engaged in developing bidirectional vehicle communications. Membership includes car manufactures, Internet of Things (IoT) solution providers, and industry partners. As part of this project, Jacobs provided a survey to the CTA members on AV and the blind community. The results indicated that the members of CVTA that participated in the survey were aware of mobility challenges, smart phone applications and were working to address mobility needs for blind and visually impaired persons. However, they were not open to a pilot or collaboration currently. This may be due to the number of initiatives at the University level or other interests of the respondents at this time.

Since 2011, research work such as the RER-CAPT explores accessibility issues with transportation and the private sector. In the private sector, the Auto Alliance (Alliance of Automobile Manufacturers) is an advocacy group for the auto industry, represents automakers who build 70% of all cars and light trucks sold in the US, including BMW Group, FCA US LLC, Ford Motor Company, General Motors, Jaguar Land Rover, Mazda, Mercedes-Benz USA, Mitsubishi Motors, Porsche, Toyota, Volkswagen Group of America and Volvo Car USA. The Auto Alliance has developed standards and recommendations for accessibility in transportation.

4.6 Blind Driver Challenge

In 2011, the NFB hosted a Blind Driver Challenge. The NFB calls on universities, technology developers, and other interested innovators to build interface technologies that will empower blind people to drive independently. The

[20] https://www.perkins.org/stories/driverless-vehicle-tested-at-perkins

challenge is a car that has enough advanced technology to transport real-time information about the driving conditions to the blind or visually impaired traveler can interpret these data and maneuver a car safely.

The goals of this initiative were:

1. To establish a path of technological advancement for nonvisual access technology and close the gap between access technology and general technology.

2. To increase awareness within the university scientific community about the real problems facing the blind by providing expertise from the perspective of the blind for a difficult engineering challenge.

3. To demonstrate that vision is not a requirement for success and that innovative nonvisual solutions to difficult problems can create new opportunities for hundreds of thousands of people—blind and sighted.

4. To change the public perceptions about the blind by creating opportunities for the public to view the blind as individuals with capacity, ambition, and a drive for greater independence.

The source of information for the Blind Driver Challenge is the NFB. [21]

[21] https://www.nfb.org/sites/www.nfb.org/files/images/nfb/publications/bm/bm09/bm0911/bm091103.htm

5. Recommendations

The project recommendations extend MCBs intent further into AV development and advance VR services and lessen the technological barriers for blind persons in the Commonwealth. While full-scale AV deployment is decades away, the purpose of the recommendations is to help MCB best prepare the blind community for the advent of AVs. The recommendations range from shorter-term, to support the blind and visually impaired persons of the Commonwealth now through education, funding and government initiatives to long term, preparing for the market penetration and in support of a more connected world. The research team intends to involve blind persons and advocacy groups in development to increase accessibility in design as well, leading to a safer and more independent experience. The research team believes more collaboration and support from related agencies and industries is a critical step in exploring pilot projects, learning sessions, and deploying sustainable transportation solutions.

The recommendations have been tied to our project objectives;

- Social; the recommendations support the use of AV technologies to support the underserved blind population further and positively affect other manned driver decisions and behavior.
- Economic; the recommendations support economic growth through new jobs created in the Commonwealth.
- Safety; the recommendations enhance safety for blind travelers and pedestrians.
- Operational; the recommendations enhance operational efficiencies for transportation agencies to decrease the cost per ride.

We also recommend that MCB continue to gather employer testimonials on successful hires and employment experiences of blind and visually impaired persons to use with other employers. MCB should also continue to recruit industry ambassadors from employers with successful histories of employing blind and visually impaired persons to advocate for and share experiences with other employers and their own companies to increase opportunities for the blind and visually impaired.

Table 9: Summary of Recommendations and Impact

No.	Recommendation	Impacts
1	The Commonwealth should consider increasing by two cents the TNC surcharge per ride to create an Equity Fund to provide training to TNC drivers and staff to more ably serve the Blind and Visually Impaired community. In 2018 there were 81.3 million TNC rides in the Commonwealth, and in 2019 there were 91.1 million TNC rides. This could generate $1.6 to $1.8 million annually. The Equity fund could also be used to develop guidelines and undertake pilots with municipalities and employers for best practices regarding the design and location of drop off and pick up areas for blind and visually impaired TNC riders. TNCs are already incorporating AV technology.	Safety Operational Social
2	MCB shall help MBTA leverage Blind Access Charlie Card to save more user data from allowing drivers to respond to their needs in anticipation of the rider and vehicle	Safety

No.	Recommendation	Impacts
	identification or destination drop off location. Also, to save information on trips better to optimize fleet, vehicle movement, and signal timing. This will help the local agency understand the complete trip of the blind and visually impaired travelers to better plan and make improvements in the most impactful places.	Operational Social
3	MCB should advocate for the expansion of Governor Baker's initiative and expand the pilot program with the MBTA and local rideshare (TNCs) statewide to expand paratransit services using TNCs with all regional transit agencies to increase mobility options and connections with jobs for the visually impaired. MCB shall work with local agencies such as MBTA, RTAs, and Mass Mobility to understand their pilot timelines and criteria, to leverage their work to help MCB client base and the larger blind and visually impaired community. MCB shall target an area, for example, a cluster in Western Massachusetts or Middlesex County, with many MCB VR Service Cases to link a health and services firm in to see if they are open to a pilot linking transportation and the blind community with a TNC.	Economic Social Operational Safety
4	MCB should initiate a demonstration program with the use of fleet AVs to serve the mobility needs of blind and visually impaired persons focusing on job access. This recommendation is to help blind persons become familiar and open to AV technology through a hands-on demonstration and allow blind persons to sit and ride in an AV vehicle. Through podcasts, newsletters, and other public communication, engage local blind communities and offer orientation and mobility (O&M) training services to educate how to use technology-based navigational services. A study has shown that blind persons who rely on mobile applications and technology-based devices for navigating purposes tend to trust AVs. Optimus Ride may be willing to partner in a way that they have in the past with Perkins School for the Blind to help locally expose blind persons to AV technology. Aptiv technology is testing in Boston and may be open to a pilot as well.	Safety Social
5	MCB should encourage and work with large property managers where major employers either have a history of employing the blind and visually impaired or are located where priority industries are situated to operate fleets of AVs to augment transit options. This could include organizations such as MASCO in the Longwood Medical Area of Boston, Federal Realty who is redeveloping and managing Assembly Square, Worcester Business Development Corporation (WBDC) in Worcester, who is managing the Gateway Park project, Union Point in Weymouth, MassDevelopment for Devens.	Economic Social Operational Safety
6	MCB should join national technical organizations on mobility for all to connect with persons with similar goals and to continue to learn about developments in Intelligent Transportation Systems (ITS), AV and transit solutions geared toward disabled and blind persons. For example, ITS America, Connected Vehicle Trade Association, American Center for Mobility, and 5G Automotive Association.	Safety Social
7	MCB shouldengage with local universities with biomedical and exciting programs such as Boston University, MIT, Northeastern, Tufts, UMass, Wentworth, Worcester	Social Safety

No.	Recommendation	Impacts
	Polytechnical Institute (WPI), to involve interested students with technology, transportation, and problem-solving for the blind community.	
8	MCB should work with AV manufacturers and developers so that needs of the blind and visually impaired community become embedded in the vehicle and software design of AVs. This shall advocate for automobile manufacturers to be required to add vibration and acoustic vehicle alert systems to both electric and AVs. Coding ADA from the base level provides the most seamless and safe experience for blind travelers as possible. In addition, there have been tools developed for systems accessibility today. For example, JAWS is a long-trusted screen reader that allows users to read and navigate digital content through speech or Braille output and allow blind persons to vote. There are standardizations for accessibility and user familiarity that may be leveraged for AV and transit development. Educate AVs and developers on the existing standards for accessibility in technology that exist today for development.	Safety Social

Appendix A. Full List and Details of Prospective Employers

Prospective Employers

Reports and brochures from the Massachusetts Commission for the Blind were reviewed for prospective employers with experience hiring persons who are blind and with visual impairments or firms who have expressed a commitment to diversity and inclusion, including blind and visually impaired persons. Names of prospective employers were culled from the websites of the American Foundation for the Blind and the National Federation for the Blind, as well. The prospective employer list was filtered for firms with operations in Massachusetts.

Thirty-seven (37) firms have been identified. These firms have 379 different businesses in 130 different cities and towns throughout all thirteen counties in the Commonwealth. Brief profiles of each prospective employer follow.

ADOBE

Web Site:	www.adobe.com
Address:	One Newton Place, 3rd Floor, Newton, MA 02458
Phone:	617-766-2360
Sector & NAICS:	Software/ Information; 5112
Relationship with BVI Community:	Exhibitor at NFB's 2020 Conference Part of the Valuable 500 movement Commitment to Inclusive Design
Description:	Adobe is an international software company with a focus on digital media and publishing.
Locations in MA:	Cambridge Newton

ALWAYS HEALTH PARTNERS

Web Site:	www.allwayshealthpartners.org
Address:	399 Revolution Drive, Somerville, MA 02145
Phone:	866-414-5533, customer service
Sector & NAICS:	Insurance; 5241
Relationship with BVI Community:	Collaborated with MCB
Description:	Health care plan/insurance. Always Health Partners is affiliated with Mass General Brigham health care system.
Locations in MA:	Somerville

AMAZON

Web Site:	www.amazon.com
Address:	410 Terry Avenue North, Seattle, WA 98109
Phone:	206-266-1000

Sector & NAICS:	Electronic Shopping & Mail Order; 4541		
Relationship with BVI Community:	• NFB's 2020 Conference Sponsor • Amazon has 12 internal affinity groups, including Amazon people with Disabilities. • Features a blind employee who has worked at Amazon since 2013 on its corporate web page, https://www.aboutamazon.com/?utm_source=gateway&utm_medium=footer		
Description:	Amazon is an international retailer that sells products of all types, principally online but also has brick and mortar stores in MA. Amazon sells products made by third parties but also manufactures and sells electronic devices, such as Alexa, Kindle. The Amazon Web Services division develops and sells computers, storage, and database services. Amazon's business segments in Massachusetts include Amazon Web Services, Alexa, Amazon Devices, Transportation & Logistics, and subsidiaries. Job types include corporate; fulfillment center and distribution; and customer service.		
Locations in MA:	Bristol County • Fall River • Mansfield • Taunton Essex County • Lynnfield Hampden County • Holyoke Middlesex County • Bedford • Cambridge • Everett • Framingham • Medford • Natick • Newton • North Reading • Somerville • Westford • Wilmington	Norfolk County • Canton • Dedham • Norwood • Stoughton • Weymouth Plymouth County • Middleborough Suffolk County • Boston • Revere Worcester • Milford • Northborough • Westborough	Lynnfield (retail books) Dedham (retail books) Natick (retail books)

APPLE

Web Site:	www.apple.com
Address:	One Broadway, Cambridge, MA One Apple Park Way, Cupertino, CA 95014 -- Corporate HQ
Phone:	408-996-1010 (corporate headquarters)
Sector & NAICS:	Computer System Design and Retail Electronics, 5415 and 4431
Relationship with BVI Community:	• Apple executive serves on AFB board of directors • Apple has an Accessiblity@Apple affinity group

Description:	Apple is a designer and manufacturer of computers, tablets, mobile phones, operating systems, and has an extensive network of retail stores. In addition to Apple Retail, Apple's teams focus on machine learning and artificial intelligence (AI), hardware, software, and services; design, operations and supply chain; marketing; sales and development; support and services; and corporate functions. The Cambridge office of Apple has a specialty in speech technology.		
Locations in MA:	<u>Essex County</u> • Lynnfield <u>Hampden County</u> • Holyoke <u>Middlesex County</u> • Burlington • Cambridge (design) • Cambridge (retail) • Marlborough • Natick • Newton	<u>Norfolk County</u> • Braintree • Dedham <u>Plymouth County</u> • Hingham <u>Suffolk County</u> • Boston	

AT&T

Web Site:	www.att.com		
Address:	208 S. Ackard Street, Dallas, TX 75202 (corporate)		
Phone:	210-821-4105		
Sector & NAICS:	Communications; Electronics Retail; 4431		
Relationship with BVI Community:	• National Federation of the Blind 2020 Convention Sponsor • Corporate commitment to diversity and inclusion, with specifics as to inclusion of persons who are blind or disabled. • Provider of services and products for persons who are blind and visually impaired.		
Description:	AT&T provides telecommunication, media, and technology services. AT&T provides wireless and wireline telecom, video, broadband and internet services, video entertainment services, and audio programming. AT&T brands include Cricket, DIRECTV, and WarnerMedia. AT&T is headquartered in Dallas. AT&T's presence in MA is primarily its network of retail stores, plus a sales and operations office in Framingham.		
Location in MA:	<u>Barnstable County</u> • Falmouth • Hyannis <u>Bristol County</u> • New Bedford <u>Essex County</u> • Lynn • Lynnfield • Peabody <u>Hampden County</u> • Holyoke	<u>Middlesex County</u> • Burlington • Cambridge • Framingham • Lowell • Malden • Newton • Woburn <u>Norfolk County</u> • Braintree • Brookline	<u>Plymouth County</u> • Brockton • Norwell • Plymouth <u>Suffolk County</u> • Boston • Roslindale <u>Worcester County</u> • Millbury • Worcester

	• West Springfield	• Dedham • Quincy	

BANK OF AMERICA

Web Site:	www.bankofamerica.com		
Address:	100 N. Tyron St., Charlotte, NC 28255 – corporate headquarters		
Phone:	704-386-5681, corporate headquarters		
Sector & NAICS:	Bank – Financial Depository; 5211		
Relationship with BVI Community:	Bank of America participated in AFB's Employment Summit Bank of America has received numerous awards for inclusion and diversity.		
Description:	Bank of America is a national and global financial company providing consumer banking services to individuals and small and middle-market businesses, institutional investors, large corporations, and governments. Bank of American also provides wealth management and global banking services.		
Locations in MA:	<u>Barnstable County</u> • Falmouth • Hyannis • Orleans • Yarmouth <u>Bristol County</u> • Attleboro • Dartmouth • Easton • Fairhaven • New Bedford • North Attleborough • Raynham • Seekonk <u>Essex County</u> • Andover • Beverly • Danvers • Haverhill • Lawrence • Methuen • Peabody • Salem • Saugus <u>Hampden County</u> • Chicopee • East Longmeadow • Holyoke • Longmeadow • Springfield • West Springfield	<u>Middlesex County</u> • Arlington • Ashland • Bedford • Belmont • Billerica • Burlington • Cambridge • Chelmsford • Concord • Everett • Framingham • Lexington • Lowell • Malden • Marlborough • Medford • Melrose • Natick • Newton • Reading • Somerville • Sudbury • Waltham • Watertown • Wayland • Wilmington • Woburn <u>Nantucket County</u> • Nantucket <u>Norfolk County</u>	<u>Plymouth County</u> • Abington • Brockton • Hanover • Hingham • Kingston • Marshfield • Plymouth <u>Suffolk County</u> • Boston • Brighton • Dorchester • Hyde Park • Jamaica Plain • Revere • Roslindale • Roxbury • West Roxbury <u>Worcester County</u> • Auburn • Holden • Leominster • Milford • Sturbridge • Sutton • Uxbridge • Westborough • Worcester

	Hampshire County • Amherst • Northampton	• Braintree • Brookline • Canton • Cohasset • Dedham • Foxborough • Franklin • Medfield • Needham • Norwood • Quincy • Randolph • Stoughton • Wellesley • Weymouth	

CAMBRIDGE HEALTH ALLIANCE

Web Site:	www.challiance.org	
Address:	1493 Cambridge Street, Cambridge, MA 02139	
Phone:	617-665-1000	
Sector & NAICS:	Health Care – Hospital, Doctor's Offices; Outpatient Services and Other Health Providers; 6221; 6211; 6214;6213	
Relationship with BVI Community:	Participated in MCB Job Fair	
Description:	Cambridge Health Alliance (CHA) serves the Cambridge-Somerville area and the Metro North of Boston area. CHA provides primary care, specialty care, hospital care, emergency services, maternity care, and behavioral health services at neighborhood outpatient clinics and as a teaching hospital. CHA also operates the Cambridge Public Health Department.	
Locations in MA:	Middlesex County • Cambridge • Everett • Malden • Somerville	Suffolk County • Revere

CARROLL CENTER FOR THE BLIND

Web Site:	www.carroll.org
Address:	770 Centre Street, Newton, MA 02458
Phone:	617-969-6200
Sector & NAICS:	Social Assistance – Vocational Rehabilitation; 6243
Relationship with BVI Community:	• Long-time service provider to the BVI community • Collaborator with Mass Commission for the Blind

Description:	Carroll Center for the Blind has been serving persons with vision impairment for over 80 years. The Carroll Center is a vision rehabilitation center providing services to children, teens, adults and seniors. Services include assistive technology, rehabilitation and technology services, low vision services, employment and training services, and braille events.
Locations in MA:	Middlesex County: Newton

CHARTER COMMUNICATIONS

Web Site:	www.corporate.charter.com
Address:	400 Atlantic Ave, Stamford, CT 06901 – corporate headquarters
Phone:	203-905-7801
Sector & NAICS:	Cable television; 5152
Relationship with BVI Community:	• Sponsor of NFB's 2020 Convention
Description:	Charter Communications, also known as Spectrum, provides residential and commercial cable television, broadband, and internet services. Charter operates regional sports networks, local sports, news, and community channels. Charter offers employment in call centers, corporate, sales, technicians, technology, and television, news, and media sections.
Locations in MA:	Berkshire County • Pittsfield Hampden County • Chicopee Worcester County • Millbury • Worcester

COMCAST (XFINITY)

Web Site:	https://jobs.comcast.com/
Address:	One Comcast Center, 1701 JFK Blvd, Philadelphia, PA 19103 – corporate headquarters
Phone:	215-286-1700
Sector & NAICS:	Communications; Media Retail Electronics; 4431
Relationship with BVI Community:	• AFB Donor
Description:	Comcast is a media and technology company with several divisions, which are Cable Communications, Cable Networks, Broadcast Television, Filmed Entertainment, Theme Parks, and Sky. Services including cable TV, high-speed Internet, video, voice, wireless, and security and automation services branded as Xfinity. Comcast owns major news, information, and sports television

	networks, including NBC and Telemundo, and entertainment, including Universal Pictures and DreamWorks Animation.		
Locations in MA:	Barnstable County: • Falmouth • Hyannis • Orleans • Sandwich • Yarmouth Bristol County Fall River • Raynham Dukes County • Edgartown Essex County • Danvers • Methuen	Hamden County: • Holyoke • Springfield Middlesex County • Burlington • Cambridge • Framingham • Lowell • Malden • Somerville • Westford Nantucket County • Nantucket	Norfolk County • Bellingham • Dedham • Weymouth Plymouth County • Brockton • Plymouth Suffolk County • Allston • Dorchester • East Boston • Hyde Park • Roslindale • Roxbury

DUNKIN BRANDS GROUP

Web Site:	www.dunkindonuts.com
Address:	138 Royall Street, Canton, MA 02021
Phone:	781-737-3000
Sector & NAICS:	Corporate Headquarters, 5511
Relationship with BVI Community:	Collaborated with MCB
Description:	Dunkin Brands Group licenses franchises for Dunkin' Donuts and Baskin-Robbins Ice Cream. The company also supplies Dunkin and Basking-Robbins products to retail outlets. Although there are many Dunkin establishments throughout the Commonwealth, most are private franchises. The corporate headquarters is in Canton and is the main employment location of the Dunkin Brands Group.
Locations in MA:	Norfolk County Canton

FANNIE MAE

Web Site:	www.fanniemae.com
Address:	265 Franklin St, 10th Floor, Suite 1003, Boston, MA 02110
Phone:	617-279-0160
Sector & NAICS:	Financial – non-deposit credit intermediary; 5222
Relationship with BVI Community:	• The executive serves on AFB board of directors
Description:	Fannie Mae is the leading source of mortgage financing in the US. The mission of Fannie Mae is to provide liquidity, promote stability, and affordability in the US housing market. Fannie Mae's sections are accounting, business units,

	corporate and administration, economics and analytics, finance, operations, risk management, strategy and business process, and technology.
Locations in MA:	Suffolk County Boston

FEDERAL HOME LOAN BANK – BOSTON

Web Site:	http://www.fhlbboston.com/
Address:	800 Boylston Street, Boston, MA 02199
Phone:	617-292-9600
Sector & NAICS:	Financial, non-deposit credit intermediary; 5222
Relationship with BVI Community:	Participated in MCB Job Fair
Description:	The Federal Home Loan Bank (FHLB) is a bank for banks, credit unions, community development financial institutions, and insurance companies. FHLC is cooperatively owned by more than 440 New England financial institutions and provides credit to member institutions.
Locations in MA:	Suffolk County • Boston

GOOGLE

Web Site:	www.google.com
Address:	365 Main Street, Cambridge, MA
Phone:	650-253-0000, corporate
Sector & NAICS:	Software; 5112
Relationship with BVI Community:	A previous collaboration with MCB
Description:	Google, owned by Alphabet, is one of the world's largest software/ technology companies. In the Cambridge office, Google focuses on engineering and sales. Google products and services include search, YouTube, Chrome, Android, Image Search, Google Play for Education, and Newsstand. Google frequently invests in research and development of technologies and services, including automated vehicles.
Locations in MA:	Middlesex County • Cambridge

HARVARD MEDICAL SCHOOL

Web Site:	https://hms.harvard.edu/
Address:	25 Shattuck Street, Boston, MA 02115
Phone:	617-432-1000
Sector & NAICS:	Education – college/ university; 6113
Relationship with BVI Community:	• Participated in MCB's Job Fairs
Description:	Harvard Medical School is the graduate college focused on medicine at Harvard University. Harvard Medical School educates doctors, undertakes

	research and service to advance health and well-being, and alleviate suffering in the field of biomedicine.
Locations in MA:	Suffolk County • Boston

HP/HEWLET PACKARD ENTERPRISE

Web Site:	www.hp.com
Address:	321 Summer Street, 5th floor, Boston, MA 165 Dascomb Road, Andover, MA 01810 8 Technology Drive, Westborough, MA 01581
Phone:	617-674-0874, Boston 650-687-5817, Andover 888-342-2156, Westborough
Sector & NAICS:	Technology, computer systems & designs; 5415
Relationship with BVI Community:	Executive serves on AFB board
Description:	Hewlett Packard Enterprise Company (HPE) is a technology company focusing on big data, super-computing from the edge to the cloud. It designs and manufactures servers, disk producing, wired and wireless LANs, switches, routers and sensors, software products, cloud-base management, network products and services, and analytics. HPE's divisions include cloud computing, software, IT infrastructure, technology services, and support.
Locations in MA:	Essex County: • Andover Suffolk County: • Boston Worcester County: • Westborough

JP MORGAN CHASE

Web Site:	www.chase.com	
Address:	7 Channing Road, Belmont, MA 02478 776 Beacon Street, Newton, MA 02459	
Phone:	857-626-3296, Belmont 617-663-7200, Newton	
Sector & NAICS:	Financial with branch banks in MA; 5221	
Relationship with BVI Community:	AFB donor	
Description:	JP Morgan Chase is a large global financial institution providing banking and wealth management services to individuals, small and medium-sized businesses, large corporate and institutional customers, and governments throughout the world.	
Locations in MA:	Essex County: • Lynnfield	Norfolk County • Brookline

	• Peabody Middlesex County: • Belmont • Newton • Somerville • Watertown	• Dedham Westwood Plymouth County • Hingham Suffolk County • Boston, • Jamaica Plain • Roxbury

MASSACHUSETTS EYE & EAR

Web Site:	www.masseyeandear.org		
Address:	243 Charles Street, Boston, MA 02124		
Phone:	617-658-3584 617-573-3902, human resources		
Sector & NAICS:	Health – Physicians' Offices and Scientific R&D; 6211; 5417		
Relationship with BVI Community:	• Prior collaboration with MCB and history of hiring blind and visually impaired persons.		
Description:	Massachusetts Eye and Ear is a global center for clinical treatment, home to the world's largest vision and hearing research centers, and a teaching hospital. Mass Eye & Ear has a network of outpatient clinics serving eastern MA.		
Locations in MA:	Barnstable County: • Harwich • Mashpee Middlesex County: • Concord • Malden • Medford • Newton • Stoneham • Waltham • Wellesley	Norfolk County • Braintree • Milton • Quincy • Plainville • Weymouth Plymouth County • Bridgewater • Duxbury	Suffolk County • Boston

MCGRAW-HILL EDUCATION

Web Site:	www.mheducation.com
Address:	281 Summer Street, MA 02210
Phone:	617-859-6100
Sector & NAICS:	Educational Support/ Computer Design; 6117; 5415
Relationship with BVI Community:	• NFB 2020 Convention Sponsor • McGraw Hill Education has received awards for outstanding workplace and Diversity Champion Award.
Description:	McGraw-Hill Education is one of the "big three" educational publishers in the US serving schools from pre-K to higher education. It provides reference and trade publications for the medical, business, and engineering professions, McGraw-Hill Education offers digital learning products and print products.

Locations in MA:	Suffolk County • Boston

MEDIX

Web Site:	www.medixteam.com
Address:	90 Canal Street, Suite 400, Boston, MA 02114
Phone:	(781) 933-4511
Sector & NAICS:	Employment Services; 5613
Relationship with BVI Community:	Participated in AFB's Employment Summit
Description:	Medix provides employment services and workforce solutions to the health care, scientific, information, and technology industries. Medix typically hires people as recruiters or in sales.
Locations in MA:	Suffolk County • Boston

MICROSOFT AND MICROSOFT STORE

Web Site:	www.microsoft.com		
Address:	1 Memorial Drive, Cambridge, MA 02142		
Phone:	857-453-6000, Cambridge		
Sector & NAICS:	Software and retail electronics; 5112; 4431		
Relationship with BVI Community:	• AFB donor • Microsoft works with UMass Amherst on internal building wayfinding for visually impaired persons.		
Description:	Microsoft is a leading software developer and distributor of computer operating systems for individuals and businesses. It also designs and develops computer devices, tablets, Xbox, gaming, and accessories. Microsoft provides a range of cloud-based services for personal and large-scale enterprise computing. Microsoft's New England Research & Development Center is based in Cambridge. It also operates several retail stores in MA.		
Locations in MA:	R&D Center in Middlesex County: • Cambridge	Microsoft Stores Middlesex County • Burlington • Natick Suffolk County • Boston	

NATIONAL BRAILLE PRESS

Web Site:	www.nbp.org
Address:	88 St. Stephen St., Boston, MA 02115
Phone:	888-965-8965

Sector & NAICS:	Publishing; 5111
Relationship with BVI Community:	• Long-time service provider to and employer of blind and visually impaired persons • Employer of the Year – MCB award
Description:	The National Braille Press (NBP) serves the blind and visually impaired with programs, materials, and technology supporting braille literacy and learning through touch. NBP produces many braille materials, including books, tests, textbooks, technology books, children's books, airline safety guides, and more. Known as a leader in producing high-quality braille, NBP also designs and promotes refreshable braille technology tools.
Locations in MA:	Suffolk County • Boston

NEW ENGLAND COLLEGE OF OPTOMETRY (NECO)

Web Site:	www.neco.edu		
Address:	424 Beacon Street, Boston, MA 02115		
Phone:	617-266-2030		
Sector & NAICS:	Professional Education and Other Health Professional Offices; 6113; 6213		
Relationship with BVI Community:	• NECO has served the VBI community and collaborated with MCB.		
Description:	New England College of Optometry educates students to work in eye care delivery, research and education. NECO is the oldest operating school educating optometrists in the US. In addition to its educational facilities, NECO operates two neighborhood eye and vision clinics.		
Locations in MA:	Education: Suffolk County: • Boston	Clinics: Suffolk County: • Boston • Roslindale	

NORTHRUP GRUMMAN

Web Site:	www.northropgrumman.com
Address:	25 Mall Road, Burlington, MA 01803 2980 Fairview Park Drive, Falls Church, VA – NA headquarters
Phone:	781-273-0591, Burlington, MA 703-280-2900, headquarters
Sector & NAICS:	Scientific Research & Development and Aerospace Manufacturing; 5417; 3364
Relationship with BVI Community:	• AFB honoree for employment
Description:	Northrup-Grumman is a defense contractor. It is a large company that designs, develops, builds, and supports advanced aircraft, including airborne systems and sensors, spacecraft, cyber-security, and radar systems. Northrup-Grumman provides logistics and modernization solutions for emergency services. Northrup-Grumman has career opportunities in cyber, engineering,

	information technology, intelligence, manufacturing, and operations & business.		
Locations in MA:	Essex County • Andover	Middlesex County • Burlington • Hopkinton	

NORTHRUP GRUMMAN (AOA XINETICS)

Web Site:	www.northropgrumman.com
Address:	115 Jackson Road, Devens, MA 01432 2980 Fairview Park Drive, Falls Church, VA – NA headquarters
Phone:	978-757-9600, Devens, MA 703-280-2900, headquarters
Sector & NAICS:	Scientific Research & Development; 5417
Relationship with BVI Community:	• AFB honoree for employment
Description:	AOA-Xinetics designs, develop, and manufactures precision advanced optical products and systems, including adaptive optics and image metrology. AOA-Xinetics is wholly-owned division of Northrup Grumman.
Locations in MA:	Middlesex and Worcester Counties • Devens

NU EYES

Web Site:	www.nueyes.com
Address:	120 Newport Center Dr #232, Newport Beach, CA 92660
Phone:	800-605-4033
Sector & NAICS:	Medical device manufacturing; 3391
Relationship with BVI Community:	Working with MCB on the Massachusetts Digital Health Initiative.
Description:	NuEyes is a veteran-owned start-up that has designed and developed products assisting persons with low vision, including Smart Eyes. NuEyes specializes in augmented reality (AR) smart glass solutions to assist persons with severe vision loss.
Locations in MA:	

PEARSON

Web Site:	www.pearson.com
Address:	501 Boylston, Boston, MA 02116 300 Venture Way, Hadley, MA 01035
Phone:	617-848-6000, Boston 413-256-0444, Hadley
Sector & NAICS:	Educational Support Services; 6117
Relationship with BVI Community:	NFB 2020 Convention Sponsor

Description:	Pearson provides courseware services, including curriculum materials in both book form and digital. Products include online learning services, educational technology, assessments, test development, processing, and scoring services for educational institutions, corporations, and professional bodies.		
Locations in MA:	Hampshire County • Hadley	Suffolk County • Boston	

PERKINS SCHOOL FOR THE BLIND

Web Site:	www.perkins.org		
Address:	175 N. Beacon, Watertown, MA 02472		
Phone:	617-924-3434		
Sector & NAICS:	Education -- school; 6111		
Relationship with BVI Community:	Perkins has a long history of serving and employing persons who are blind and visually impaired.		
Description:	Perkins School for the Blind provides educational services to children and young adults with blindness, deaf-blindness, and multiple disabilities. Perkins provides education, global leadership and consulting, and a braille library and shop. Perkins provides advisory services accessibility for the blind, deaf-blindness, and persons with multiple disabilities.		
Locations in MA:	Middlesex County Watertown		

PROCTOR & GAMBLE (GILLETTE)

Web Site:	www.pg.com; www.gillette.com		
Address:	1 P&G Plaza Cincinnati, OH 45202 – P&G headquarters 1 Gillette Park, Boston, MA 02210 – Gillette headquarters		
Phone:	513-983-1100, P&G headquarters 617-463-3000, Gillette headquarters		
Sector & NAICS:	Manufacturing; 33		
Relationship with BVI Community:	AFB awardee (P&G)		
Description:	Proctor & Gamble (P&G) owns a wide range of consumer brand products ranging from personal care and cleaning products. P&G owns Gillette Corporation. Gillette specializes in shaving and razors. Gillette's worldwide headquarters is in Boston with manufacturing facilities in Andover. Gillette's business segments include manufacturing, engineering, and research and development.		
Locations in MA:	Essex County Andover	Suffolk County • Boston	

RADCLIFFE INSTITUTE OF ADVANCED STUDIES

Web Site:	www.radcliffe.harvard.edu
Address:	10 Garden Street, Cambridge, MA 02138
Phone:	617-496-0227
Sector & NAICS:	Education – colleges/university; 6113
Relationship with BVI Community:	History of collaboration with MCB
Description:	Radcliffe Institute for Advanced Study is a laboratory of ideas in the fields of humanities, sciences, social sciences, arts, and professions that demand cross-disciplinary exploration at Harvard University. The Radcliffe Institute operates the Schlesinger Library, a research library on the history of women in America; a fellowship program; and academic ventures which sponsor conferences, exhibitions, and lectures.
Locations in MA:	Middlesex County • Cambridge

SPAULDING REHABILITATION

Web Site:	https://spauldingrehab.org/		
Address:	300 First Avenue, Boston, MA 02129		
Phone:	617-952-2000		
Sector & NAICS:	Rehabilitation Hospital, Nursing Home Care, and Outpatient Clinics; 6223; 6231; 6214		
Relationship with BVI Community:	History of collaboration with MCB		
Description:	Spaulding Rehabilitation provides advanced rehabilitation treatment and undertakes research in physical medicine and rehabilitation. Spaulding Rehab operates 3 inpatient hospitals, a skilled nursing facility and outpatient centers in eastern MA. Spaulding's rehab services and programs address: adaptive sports; arthritis and joints; brain injury; neurological; stroke; spinal cord; pediatrics; musculoskeletal/orthopedic; sports medicine.		
Locations in MA:	Barnstable County • Hyannis • Orleans • Sandwich Essex County • Gloucester • Lynn • Marblehead • Peabody • Salem	Middlesex County • Cambridge • Lexington Norfolk County • Braintree • Foxborough • Quincy • Wellesley	Plymouth County • Hanover • Plymouth Suffolk County • Boston • Brighton Worcester County • Westborough

TARGET

Web Site:	www.target.com
Address:	1000 Nicollet Mall, Minneapolis, MN 55403 (headquarters)
Phone:	612-304 6073 headquarters
Sector & NAICS:	Retail – General Merchandise; 4523

Relationship with BVI Community:	NFB 2020 Convention Sponsor		
Description:	Target is a general merchandise retailer. Target sells groceries, including perishables, dry goods, dairy, and frozen items; apparel, accessories, home decor products, electronics, toys, seasonal offerings; beauty and household essentials		
Locations in MA:	Barnstable County • Hyannis Berkshire County • Lanesborough Bristol County • Dartmouth • Easton • North Attleborough • Seekonk • Swansea • Taunton Essex County • Danvers • Haverhill • Methuen • Salem • Saugus	Hampden County • Holyoke Hampshire County • Hadley Middlesex County • Burlington • Cambridge • Everett • Framingham • Lowell • Marlborough • Medford • Newton • Somerville • Stoneham • Watertown • Wilmington • Woburn	Norfolk County • Braintree • Plainville • Stoughton • Westwood Plymouth County • Abington • Hanover • Kingston • Wareham Suffolk County • Boston • Brighton • Revere • Roslindale Worcester County • Leominster • Milford • Millbury • Westborough • Worcester

TUFTS HEALTH PLAN

Web Site:	https://tuftshealthplan.com/		
Address:	705 Mt. Auburn Street, Watertown, MA 02472		
Phone:	617-972-9400		
Sector & NAICS:	Insurance – health plan; 5241		
Relationship with BVI Community:	• Prior collaboration with MCB; participation in MCB job fair		
Description:	Tufts Health Plan provides health plans/ insurance throughout MA and neighboring states. It offers members and employers health management programs.		
Locations in MA:	Middlesex County • Watertown	Worcester County • Worcester	• Some remote work available

U-MASS AMHERST

Web Site:	www.umass.edu
Address:	Whitmore Administration Building, 181 Presidents Drive, Amherst, MA 01003
Phone:	413-545-0111

Sector & NAICS:	Education – colleges, and universities; 6113		
Relationship with BVI Community:	• Prior collaboration with MCB • History of employing persons who are blind and visually impaired		
Description:	UMass Amherst is the flagship public research university in MA. It offers higher education degrees – bachelor's, master's, and doctorates – in business, education, engineering, humanities, sciences, computers, the arts, nursing, health, and agriculture.		
Locations in MA:	Hampshire County • Amherst	Middlesex County • Newton	

USI INSURANCE SERVICES

Web Site:	https://www.usi.com/		
Address:	100 Summit Lake Drive, Valhalla, NY 10595, headquarters		
Phone:	914-749-8500, headquarters		
Sector & NAICS:	Insurance; 5241; 5251		
Relationship with BVI Community:	Participated in MCB Job Fair		
Description:	USI provides insurance for property & casualty, employee benefit, personal risk, and retirement needs nationwide. USI employs people in accounting, audit, actuarial, administration, affinity programs, analysis, customer service/ client management, employee benefits, finance, human resources, information technology, legal/ compliance, management, marketing, personal risk services, project management, property & casualty, retirement counseling, risk management, sales, training and development, and underwriting.		
Locations in MA:	Barnstable County: • Brewster Hamden County • Chicopee	Middlesex County • Framingham • Woburn Norfolk County • Dedham • Needham	Suffolk County • Boston

VERIZON MEDIA

Web Site:	www.verizonmedia.com
Address:	31 St. James Avenue, Suite A, Boston, MA 02115 770 Broadway, New York, NY 10003, headquarters
Phone:	212-652-6401, headquarters
Sector & NAICS:	Advertising; Video Production; 5418, 5121
Relationship with BVI Community:	NFB 2020 Convention Sponsor
Description:	Verizon Media specializes in advertising, media, technology, and communication. Its brands include AOL, Yahoo, TechCrunch, HuffPost, Yahoo Sports, Yahoo Finance, Yahoo Mail, MAKERS, BUILD, etc. Verizon Media is a division of Verizon.

Locations in MA:	Suffolk County • Boston		

WALMART

Web Site:	www.walmart.com		
Address:	702 SW 8th Street, Bentonville, AR 72716, headquarters		
Phone:	479-273-4000, headquarters		
Sector & NAICS:	Retailer – general merchandise; 4523		
Relationship with BVI Community:	• Executive is AFB Board Chair in 2019		
Description:	Walmart is a general merchandise retailer with wholesale operations. Products and services offered include groceries, health & beauty, baby products, pet supplies, electronics, cameras and photo processing, movies, music, video games, books, automotive, hardware, paint, sporting goods, gardening, apparel, shoes, home furnishings, housewares, small appliances, bedding, home décor, toys, fabrics, crafts, and seasonal goods. Walmart operates supercenters, warehouse clubs, and e-commerce websites, under the name of Walmart or Sam's Club.		
Locations in MA:	Berkshire County • North Adams • Pittsfield Bristol County • Attleboro • Dartmouth • Fairhaven • Fall River • Raynham • Seekonk Essex County • Danvers • Lynn • Methuen • Salem • Saugus	Franklin County • Orange Hampden County • Chicopee • Springfield Hampshire County • Hadley • Northampton Middlesex County • Chelmsford • Framingham • Hudson • North Reading	Norfolk County • Abington • Avon • Bellingham • Quincy Plymouth County • Brockton • Plymouth • Halifax Worcester County • Gardner • Leicester • Leominster • Lunenburg • Northborough • Oxford

WILMER HALE

Web Site:	www.wilmerhale.com
Address:	60 State Street, Boston, MA 02109
Phone:	617-526-6000
Sector & NAICS:	Professional services – law; 5411
Relationship with BVI Community:	• Participated in MCB Job Fair
Description:	International law firm providing legal services to individuals, businesses, and governments. Wilmer Hale employs people to work in

	administrative/operations; document processing; finance; human resources; information services; law, litigation support; paralegal; marketing; practice management; and secretarial.		
Locations in MA:	Suffolk County • Boston		

Appendix B. Regional Transit Authorities in Massachusetts

Regional Transit Authority	RTA Member Cities and Towns
Berkshire Regional Transit Authority (BRTA) berkshirerta.com (413) 499-2782	Adams, Alford, Becket, Cheshire, Clarksburg, Dalton, Egremont, Florida, Great Barrington, Hinsdale, Lanesborough, Lee, Lenox, Monterey, Mount Washington, North Adams, Otis, Pittsfield, Richmond, Sheffield, Stockbridge, Washington, Williamstown, Windsor, all in Berkshire County.
Brockton Area Transit Authority (BAT) www.ridebat.com (508) 588-1000	Abington, Avon, Bridgewater, Brockton, East Bridgewater, Easton, Hanson, Rockland, Stoughton, West Bridgewater, Whitman. Located primarily in Plymouth County, with some service in Norfolk County (Stoughton).
Cape Ann Transportation Authority (CATA) www.canntran.com (978) 283-7916	Essex, Gloucester, Hamilton, Ipswich, Rockport, all in Essex County.
Cape Cod Regional Transit Authority (CCRTA) www.capecodrta.org (800) 352-7155	Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Mashpee, Orleans, Provincetown, Sandwich, Truro, Wellfleet, Yarmouth, all in Barnstable County.
Franklin Regional Transit Authority (FRTA) www.frta.org (413) 773-8090	Ashfield, Bernardston, Blandford, Buckland, Charlemont, Chester, Chesterfield, Colrain, Conway, Cummington, Deerfield, Erving, Gill, Goshen, Greenfield, Hatfield, Hawley, Heath, Huntington, Leyden, Middlefield, Montague, Montgomery, New Salem, Northfield, Orange, Petersham, Phillipston, Plainfield, Rowe, Russell, Shelburne, Shutesbury, Southampton, Southwick, Warwick, Wendell, Westhampton, Whately, Worthington
Greater Attleboro Taunton Regional Transit Authority (GATRA) www.gatra.org (800) 483-2500	Attleboro, Bellingham, Berkley, Carver, Dighton, Duxbury, Foxborough, Franklin, Hanover, Kingston, Lakeville, Mansfield, Marshfield, Medway, Middleborough, Norfolk, North Attleboro, Norton, Pembroke, Plainville, Plymouth, Raynham, Rehoboth, Scituate, Seekonk, Taunton, Wareham, Wrentham
Lowell Regional Transit Authority (LRTA) www.lrta.com bus info: (978) 452-6161 paratransit info: (978) 459-0152	Acton, Billerica, Carlisle, Chelmsford, Dracut, Dunstable, Groton, Lowell, Maynard, Pepperell, Tewksbury, Townsend, Tyngsborough, Westford
Merrimack Valley Regional Transit Authority (MVRTA) www.mvrta.com (978) 469-6878	Amesbury, Andover, Boxford, Georgetown, Groveland, Haverhill, Lawrence, Merrimac, Methuen, Newbury, Newburyport, North Andover, North Reading, Rowley, Salisbury, West Newbury

Regional Transit Authority	RTA Member Cities and Towns
MetroWest Regional Transit Authority (MWRTA) www.mwrta.com (508) 935-2222	Ashland, Dover, Framingham, Holliston, Hopedale, Hopkinton, Hudson, Marlborough, Milford, Natick, Sherborn, Southborough, Sudbury, Wayland, Wellesley, Weston
Montachusett Regional Transit Authority (MART) www.mrta.us (978) 345-7711	Ashburnham, Ashby, Athol, Ayer, Bolton, Boxborough, Fitchburg, Gardner, Hardwick, Harvard, Hubbardston, Lancaster, Leominster, Littleton, Lunenburg, Royalston, Shirley, Sterling, Stow, Templeton, Westminster, Winchendon
Nantucket Regional Transit Authority (NRTA) www.nrtawave.com (508) 228-7025	Nantucket
Pioneer Valley Transit Authority (PVTA) www.pvta.com (413) 781-7882	Agawam, Amherst, Belchertown, Chicopee, East Longmeadow, Easthampton, Granby, Hadley, Hampden, Holyoke, Leverett, Longmeadow, Ludlow, Northampton, Palmer, Pelham, South Hadley, Springfield, Sunderland, Ware, West Springfield, Westfield, Wilbraham, Williamsburg
Southeastern Regional Transit Authority (SRTA) www.srtabus.com (508) 999-5211	Acushnet, Dartmouth, Fairhaven, Fall River, Freetown, Mattapoisett, New Bedford, Somerset, Swansea, Westport
Vineyard Transit Authority (VTA) www.vineyardtransit.com (508) 693-9440	Aquinnah, Chilmark, Edgartown, Oak Bluffs, Tisbury, West Tisbury
Worcester Regional Transit Authority (WRTA) www.therta.com (508) 791-WRTA	Auburn, Barre, Berlin, Boylston, Brimfield, Brookfield, Charlton, Clinton, Douglas, Dudley, East Brookfield, Grafton, Holden, Holland, Leicester, Millbury, New Braintree, North Brookfield, Northborough, Northbridge, Oakham, Oxford, Paxton, Princeton, Rutland, Shrewsbury, Southbridge, Spencer, Sturbridge, Sutton, Wales, Warren, Webster, West Boylston, West Brookfield, Westborough, Worcester
Berkshire Regional Transit Authority (BRTA) berkshirerta.com (413) 499-2782	Adams, Alford, Becket, Cheshire, Clarksburg, Dalton, Egremont, Florida, Great Barrington, Hinsdale, Lanesborough, Lee, Lenox, Monterey, Mount Washington, North Adams, Otis, Pittsfield, Richmond, Sheffield, Stockbridge, Washington, Williamstown, Windsor, all in Berkshire County.
Brockton Area Transit Authority (BAT) www.ridebat.com (508) 588-1000	Abington, Avon, Bridgewater, Brockton, East Bridgewater, Easton, Hanson, Rockland, Stoughton, West Bridgewater, Whitman. Located primarily in Plymouth County, with some service in Norfolk County (Stoughton).
Cape Ann Transportation Authority (CATA)	Essex, Gloucester, Hamilton, Ipswich, Rockport, all in Essex County.

Regional Transit Authority	RTA Member Cities and Towns
www.canntran.com (978) 283-7916	