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Disability Inclusive Transportation: Assessing First Mile Last Mile Conditions in the Richmond Region

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PLAN PREPARED BY REBEKAH CAZARES

DISABILITY INCLUSIVE TRANSPORTATION

Assessing First Mile Last Mile Conditions in the Richmond Region

MASTER OF URBAN AND REGIONAL PLANNING
WILDER SCHOOL OF GOVERNMENT AND PUBLIC AFFAIRS
VIRGINIA COMMONWEALTH UNIVERSITY

Disability Inclusive Transportation
Assessing First Mile Last Mile Conditions in the Richmond Region

Plan Prepared for PlanRVA

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Table of Contents

List of Tables

List of Figures

1.0 | INTRODUCTION

Providing safe, reliable, and accessible public transportation services to individuals with disabilities is critical to ensuring a high quality of life and equal access to opportunities. Mobility, or the ability to get around, has a direct impact on whether an individual participates in society; a lack of personal mobility may lead to social isolation and a decreased quality of life. To increase personal mobility in urban areas, barriers to accessing transit services must be identified and addressed. When the built environment does not accurately reflect the needs of those living with a disability, additional hardships may be created while attempting to access essential resources.

Barriers persistent in the built environment are often referred to by transportation professionals as First Mile Last Mile (FMLM) problems. FMLM problems may be addressed through disability-inclusive development processes, inclusive policies, and increased community partnerships. As cities across the country rapidly urbanize and suburbanize, it is important to address these issues to promote equitable outcomes.

Today roughly 26% of Americans currently live with some form of a disability and as the population ages there is a need for disability-inclusive transportation infrastructure in every city (CDC, 2019). Although the Americans with Disabilities Act (ADA) of 1990 required that all new vehicles used in public transit must be accessible, accessibility issues in transit persist for individuals with disabilities. Disability-inclusive development seeks to address the needs of community members by including individuals across a wide-range of ability levels throughout all decision-making processes.

The greater Richmond region in Virginia is experiencing a great deal of growth and development. According to the Greater Richmond Partnership (2019), the region has averaged 205 new residents every week since 2010. As the region continues to develop, it is critically important that decision makers consider FMLM conditions to promote a high quality of life for all people.

1.1 | PLAN PURPOSE

Accessible public transportation services are vital to promoting a healthy, livable, and thriving region. For people with physical disabilities, the inability to access services and activities can have a harmful impact. A lack of personal mobility to access essential resources and participate in one's community may lead to a decreased quality of life and the inability to advocate for one's rights.

The purpose of this plan is to increase awareness surrounding accessibility issues and to address FMLM concerns in the Richmond region. Additionally, this plan aims to center equity and justice by focusing on the voice, needs, and rights of historically marginalized communities. This analysis is important for the Richmond region as it is experiencing rapid growth and development. The recommendations provided by this plan can be used to inform how the built environment should be integrated concurrently with development to enable more inclusive transportation systems.

1.2 | CLIENT DESCRIPTION

PlanRVA is the Richmond Regional Planning District Commission in the state of Virginia. The agency addresses regional issues by facilitating discussions and providing planning services to its nine localities: Charles City County, Chesterfield County, Goochland County, Hanover County (includes Town of Ashland), Henrico County, New Kent County, Powhatan County, and the City of Richmond. The commission prioritizes efforts in its three main programs: transportation, emergency management, and environment.

Under the transportation program, PlanRVA and the Richmond Regional Transportation Organization (RRTPO) produces the region's the Long-Range Transportation Plan (LRTP). The LRTP guides future planning and project prioritization over a span of 20 years. The most recent LRTP was implemented in 2016 and called Plan2040. Currently, Plan2040 is being updated (required 5-year update) with Connect RVA 2045 to make improvements to transportation systems and better serve the evolving region. The efforts of this professional plan support the LRTP by highlighting the importance of addressing FMLM barriers to increase transit ridership and improve accessibility for people across a wide-range of ability-levels.

Figure 1. PlanRVA Logo; Source: PlanRVA

1.3 | PLAN OUTLINE

SECTION 2.0

Brief introduction to disability, which includes how this plan defines disability, accessibility as it relates to disability, and how various demographics contribute to a lack of access.

SECTION 3.0

First, explains the First Mile Last Mile Approach (FMLM), how barriers in place may impact access to public transportation services for people with disabilities if unaddressed. Next, this section covers transportation facilities and varying design recommendations to improve FMLM conditions. Lastly, the importance of disability-inclusive development processes is recognized.

SECTION 4.0

Overview of the Richmond region's existing conditions including disability data for all nine localities as well as current transportation services and organizations.

SECTION 5.0

Provides a detailed explanation of the plan's methodology and includes two main sections: the regional approach and the local approach. The regional approach includes an overview of how the regional analysis was conducted, which includes data collection and ranked scoring processes. The local approach touches on the case study and how the FMLM infrastructure inventory assessment was completed.

SECTION 6.0

Section six covers the findings from both the sections explained above. At the regional level, map documents and tables reveal the analysis and ranked scoring results. These results provide a better understanding of where a high concentration of people with disabilities and other transportation disadvantaged populations are located. Using these findings, a study area was determined and further examined for FMLM barriers. The final aspect of this section examines the results of the case study, which includes the FMLM infrastructure inventory assessment.

SECTION 7.0

Using the review of existing literature and results from the three-part methodology, this plan provides recommendation in section seven. Following the recommendations is a detailed implementation table that provides a timeline of when all goals, objectives, and actions should be completed. Lastly, potential funding sources are highlighted for consideration.

1.4 | PLAN CONTEXT

Overall, the aim of this plan is to first, inform the reader of the potential barriers people with disabilities face while attempting to utilize public transportation. These barriers often stem from the built environment and can have lasting effects one's ability to move around with ease and overall quality of life. Second, this plan provides a detailed analysis of the Richmond region to provide recommendations for accommodations, modifications, and accessibility measures. Lastly, it provides well-thought-out recommendations to improve mobility and quality of life for those living with a disability.

It is important to note; ***this plan does not aim to portray the disability community as a monolith.*** It recognizes that all people experience barriers in the built environment differently based on a variety of factors (i.e., ability-level, age, race, income, sex, etc.). Disability is complex and severity differs from person to person within the same diagnosis. However, all residents in the Richmond region would benefit from improvements to the built environment as recommended in this plan. When we plan for people with disabilities, we are planning for everybody!

It is important to recognize those in the community that dedicate their life's work towards furthering the rights of people with disabilities. Specifically, we would like to recognize Matthew Shapiro, founder and CEO of 6 Wheels Consulting, LLC. Both Matthew's lived and professional experiences provided a unique set of expertise crucial to the development of this plan document. Furthermore, 6 Wheels Consulting, LLC works tirelessly to advocate for equal access to opportunities for people with disabilities in the Commonwealth.

Figure 2. Matthew Shapiro;
Source: 6 Wheels Consulting, LLC.

2.0 | UNDERSTANDING DISABILITY

Disability is complex and unique to everyone, therefore there is no universal definition. Historically, the medical model dominated how disability was understood. Under this model disability is viewed as a disease that creates a set of issues for an individual and they are responsible for addressing such issues. In recent years, this view shifted with the World Health Organizations (WHO) adoption of the social model, which considers the impact of environmental barriers and their role in creating disability (2011). According to the ADA, a person with a disability is someone "who has a physical or mental impairment that substantially limits one or more major life activity" (National Network, n.d.).

This plan aims to make recommendations for the built environment, which often creates additional barriers for those who have difficulty physically getting around. Therefore, this plan focuses its review of existing knowledge, data collection and analysis, and recommendations to center the voices and needs of those living with a physical disability.

2.1 | ACCESSIBILITY AND TRANSPORTATION

To promote equitable outcomes in urban areas, accessibility is a widely discussed and researched issue in the urban planning field. Providing accessible public transportation for all people regardless of ability level is one of the most pressing issues of the 21st century (Lucas, 2012; Wright et al., 2018). American cities are rapidly evolving and as development continues outside of the city center, personal vehicle dependency and daily commute time increases. This presents a variety of challenges for those who either cannot drive or afford vehicles. As the Virginia Board of People with Disabilities explains, "Access to reliable, physically accessible, affordable transportation is a prerequisite for living a fully integrated life in America's dispersed communities" (VBPD, 2018, p. 9).

While Title II of the ADA requires all fixed-route public transportation services to be accessible and complementary paratransit service is provided, the supporting infrastructure may not be accessibility (Sabella, 2017; NADTC, 2017). Those who experience difficulties accessing transit services are considered transportation disadvantaged, which includes the elderly, poor, and disabled communities (RRTPO, 2015; Jansuwan et al., 2013; Litman, 2020). According to a needs and gaps report on the transportation disadvantaged population in the Richmond region by the RRTPO (2015), "The built environment and physical limitations are more likely to lead to a mobility disability for those who are disabled" (p. 18).

It is widely known that land use decisions directly impact transportation systems, and both are imperative to accessibility (Xu et al., 2018; Evans, 2009). An influx of low-density urban areas and inadequate or inaccessible public transit creates additional barriers to access for individuals with disabilities. Lucas (2012) argues that when transit services are inaccessible, it leads to the inability to access essential resources and to participate in decision-making

processes, which in turn leads to further social exclusion. Addressing inequities in transportation is essential to ensuring full participation in society for those living with a disability. In response to these inequities, increased coordination between local government and community partners, as well as improved pedestrian infrastructure is necessary to ensure safe, reliable, and accessible modes of transportation (DRPT, 2019; VPBD, 2018).

2.2 | DEMOGRAPHICS AND DISABILITY

Issues surrounding transit accessibility include an individual's ability to physically access services, as well a variety of societal factors (RRTPO, 2015). An individual's age is closely tied to their probability of living with a disability, which may impact their ability to easily access public transportation.

According to the U.S. Census Bureau (2012), "the probability of having a severe disability is only one in 20 for those 15 to 24 while it is one in four for those 65 to 69." Similarly, those living with a disability are less likely to be employed and more likely to live in persistent poverty compared to able-bodied individuals (U.S. Census, 2012). For those living with a disability, limited access to employment opportunities, as well as increased medical costs may impact an individual's poverty status. Those in poverty may not have access to the funds necessary for utilizing public transit services, making them more likely to be transportation disadvantaged (RRTPO, 2015; Yavuz, D. & Yigitcanlar, T., 2007).

Another factor impacting accessibility is an individual's race. Minority individuals, specifically Black Americans, are more likely to have a disability compared to their non-minority counterparts. While 11 percent of working-age Non-Hispanic Whites live with some form of a disability, 14 percent of Black individuals do (Goodman et al., n.d.). These societal factors have the potential to create additional barriers to access for those living with a disability; they should be considered when addressing transit accessibility in urban areas.

3.0 | FIRST MILE LAST MILE APPROACH

Addressing FMLM problems in urban areas is critically important to promoting ease of travel for individuals with disabilities. The FMLM approach recognizes that an individual's daily commute is more than getting on and off transit; it is an increased awareness for a rider's entire trip, from origin to destination (Metro, 2014; Metro, 2018; NADTC, 2017). While fixed-route services are required to be accessible, the built environment does not always reflect the needs of those who cannot easily get around. Whether it is walking, rolling, or biking, all modes potentially pose a variety of barriers for the differently abled.

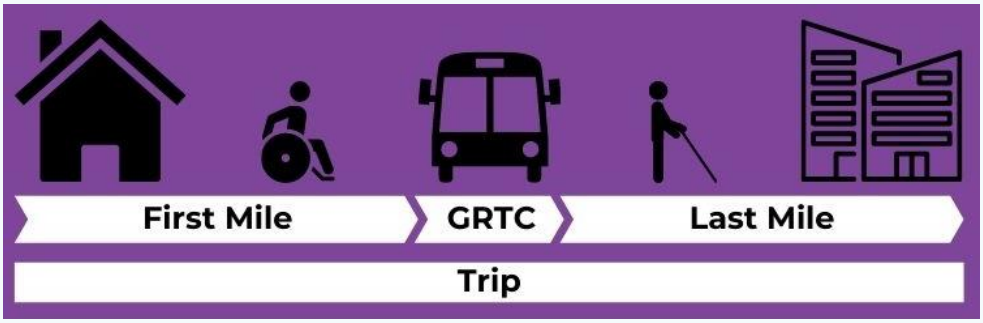

Figure 3. Richmond Region First Mile Last Mile Approach; Source: Rebekah Cazares

3.1 | FIRST MILE LAST MILE BARRIERS

FMLM problems, including but not limited to a lack of sidewalk systems, poorly maintained sidewalks, missing curb ramps, a lack of crosswalks and crossing signals, and inaccessible bus stops all impede equal opportunity for the differently abled (NADTC, 2017; Metro, 2014). Other FMLM problems include a lack of bus stop amenities, such as shelters, benches, and light fixtures. It is important to note that while the built environment is easily observed, attitudinal problems still exist and impede ease of travel; to address such issues, increased community awareness and improved training for transportation providers is suggested (NADTC, 2017). Unaddressed FMLM problems contribute to unsafe travel conditions, which potentially leads to increased travel anxiety and decreased mobility.

Transit studies show that most people are comfortable walking no more than a quarter mile to and from bus stops, or other transit services (El-Geneidy et al., 2009). For able bodied individuals, if additional travel is necessary, they can walk further to get to and from their stop. With barriers still in place a quarter mile poses a variety of challenges for individuals with disabilities and anything further may be impossible.

Many urban areas recognize the importance of addressing FMLM problems to provide reliable transit services and increase ridership (Metro, 2014; Metro, 2018; VBPD, 2017). An increase of transit ridership results in less automobile congestion, which in turn improves pedestrian safety, noise levels, and environmental impacts. To combat barriers to access it is necessary

for cities to provide safe and efficient multimodal (more than one mode) transportation networks.

According to the National Aging and Disability Transportation Center (NADTC) (2017), four opportunities to address FMLM problems, which includes improving pedestrian access to transit and coordination and partnerships between traditional public transportation agencies and private providers (p. 21). When individuals across a wide range of ability levels have increased mobility to independently access essential resources, it positively impacts their lives and the community at large.

These FMLM strategies address the needs of individuals with disabilities through improved pedestrian infrastructure (NADTC, 2017; Metro 2014; UVLSRPC, n.d.; NACTO, n.d.; Toolkit, n.d.). This approach aims to provide communities most in need of disability-inclusive development with safe, reliable, and accessible transportation systems. The location and design of transportation facilities, sidewalks, and crosswalks plays a critical role in the accessibility of public transit for individuals with disabilities.

According the National Association of City Transportation Officials (NACTO) (n.d.), “Universal design features are critical throughout the transportation network, making it possible for any street user to comfortably and conveniently reach every transit stop” (para 1). The following review of existing literature examines both the ADA requirements and universal design for each of these elements. It is important to note that although ADA provides a set of requirements for new and altered projects, it is not enforced

3.2 | EXAMPLES OF FIRST MILE LAST MILE BARRIERS

Figure 4. Example of Sidewalk Obstructions; Source: RTD, 2014

- **Obstructions (i.e., trashcans) in the middle of a sidewalk creates potential barriers for people with disabilities.**
- **Poorly maintained sidewalks impede equal access to public transportation services for people with disabilities.**

Figure 5. Example of Inaccessible Crossing Areas; Source: RTD, 2014

- **Designated ADA accessible crosswalks are crucial to ensuring the safety of individuals with disabilities and all residents while traveling.**

- **The lack of curb cuts, or curb ramps, at this intersection are a FMLM barrier that may cause people with disabilities to feel unsafe while traveling.**

Figure 6. Example of Inaccessible Bus Stop; Source: RTD, 2020

- **A lack of bus stop shelters and other amenities (i.e., benches or light fixtures) potentially make riders feel unsafe while waiting for the bus.**

- **When the bus stop area does not consist of a stable surface (i.e., concrete), it makes accessing the bus more challenging for people with physical disabilities.**

3.3 | TRANSPORTATION FACILITIES

Transportation facilities include bus stop areas, as well as a variety of other amenities (i.e., shelters, signage, benches, and light fixtures) necessary to promote the safety and comfortability of individuals with disabilities (UVLSRPC, n.d.). It is important to provide adequate infrastructure at and around transportation facilities to address FMLM problems and to increase transit ridership.

BUS STOP AREAS:

According the ADA there are four minimum requirements for bus stop areas:

1. A firm stable surface including concrete, asphalt, brick, stone, tile and wood;
2. ADA landing pad – an area that is clear of obstructions and measures eight feet (perpendicular to the curb) by five feet (parallel to the curb, connected to a pedestrian path or accessible walkway, and a firm stable surface). The landing pad can include part of the sidewalk;
3. A cross slope no greater than 2% (1/50);
4. And accessible connections to a street, sidewalk, path etc. Must be at least 3' wide (UVLSRPC, n.d.; Toolkit, n.d.).

Universal best practices also provide suggestions for increased accessibility: bus stops clear of obstructions (i.e., trees, utility poles, planters, etc.); sufficient sidewalk width (at least four feet); tactile surfaces to assist the visually impaired, accessible connections to a street, sidewalk, etc. that has a minimum width of four feet; and sidewalk-level bus stops (UVLSRPC, n.d.; NATCO, n.d.; Toolkit, n.d.).

According to the NADTC (2017), it is important to "consider the application of far-side bus stops – stops that are past the intersection rather than before it, which are safer in terms of pedestrian crossing and easier in terms of bus traffic flow" (p. 43). Other bus stop locations include either near-side and mid-block (**see Appendix A**). When bus stop areas meet these requirements and suggestions, it encourages transit ridership and improves personal mobility.

BUS SHELTERS:

Bus shelters provide riders with coverage from inclement weather and other elements, as well as an increased sense of security while waiting for the bus (UVLSRPC, n.d.). Universal design recommends that bus shelters are "located at the far end of the bus stop to improve visibility and improve walking distance from the shelter to the bus," are in a way that minimizes the impact of inclement weather and is transparent for improved safety and visibility (UVLSRPC, n.d.; Toolkit, n.d.). These best practices aim to provide an overall improved travel experience for the rider.

BENCHES:

Installing benches at bus stops and along sidewalk systems connecting stops is crucial to addressing FMLM problems specific to individuals with disabilities (Metro, 2014; UVLSRPC, n.d. NADTC, 2017). The location of benches also plays a role in the accessibility of transit services. Universal design best practice guidelines suggest that benches are located at “the back of a sidewalk, to allow for pedestrian circulation” (UVLSRPC, n.d., p. 5). When bus stops and sidewalks systems are equipped with benches, it provides the opportunity to rest for those who may have difficulty physically getting around; the opportunity to rest promotes the ease and safety of traveling for all commuters (NADTC, 2017).

SIGNAGE:

Increased and improved signage at and around transportation facilities is key to promoting improved wayfinding and transit ridership (NATCO, n.d.). In their First Mile Last Mile Strategic Plan, the Los Angeles County Metropolitan Transportation Authority (Metro) (2014) suggests that signs should be placed “at or immediately adjacent to bus stops” (p. 7). To assist the visually impaired it is important that information is provided in braille (UVLSRPC, n.d.). Overall, adequate signage allows individuals with disabilities to independently utilize multimodal transit systems in a way that is safe and reliable.

LIGHT FIXTURES:

The light fixtures at and around bus stops are key to improving safety and making all users comfortable while traveling (Metro, 2014). Improved safety is especially important for vulnerable communities, such as the differently abled or elderly populations. Although there are no ADA requirements pertaining to lighting, they are crucial to creating a safe place for people to wait for the bus (Toolkit, n.d.). The use of pedestrian-scale lighting (less than 25 feet high) enhances the safety at and around bus stops (NATCO, n.d.; UVLSRPC, n.d.).

SIDEWALKS:

Inadequate sidewalk systems that contribute to the FMLM problems in the built environment are broken, discontinuous, narrow, cluttered, and poorly maintained (Metro, 2014; NADTC, 2017.). The ADA’s current minimum sidewalk width requirements is 36 inches (three feet), as well as extra space for those using a wheelchair to turn or pass other pedestrians if the sidewalk is less than five feet wide (PedBike, n.d.). Additionally, sidewalks must be clear of obstructions (i.e., street furniture, planters, utility poles, etc.) (PedBike, n.d.). Universal design best practices suggest a width of five or more feet to accommodate space for two wheelchair users traveling in both directions (UVLSRPC, n.d.; Toolkit, n.d.). Another consideration for improved sidewalk infrastructure is connectivity and the use of the most direct path of travel to ensure that “pedestrians are not taking a circuitous route to reach transit” (NADTC, 2017, p. 21).

CROSSWALKS:

To improve connectivity and safety, it is important to consider the condition of crosswalks nearby bus stop locations. Accessible crosswalks include a variety of components: crossing signals (i.e., audible or visual), curb ramps, visibility (i.e., painted stripes or signage), and varying textures to assist those with a visual impairment (PedBike, n.d.; UIIG, n.d.). It is important to provide ADA accessible crosswalks near bus stops to increase mobility and transit ridership for individuals with disabilities.

3.4 | DISABILITY-INCLUSIVE DEVELOPMENT

To accurately identify and address FMLM problems specific to those living with a disability, representation throughout development decision making processes is important. Existing research highlights the lack of representation of individuals with disabilities in urban affairs and provides strategies for disability-inclusive development (Goujan et. al., 2013; DIAUDN, n.d.). Goujan et al. (2013) explains, “Disability inclusive development consists of two main strategies: including the perspectives and rights of people with disabilities in all development activities, while at the same time empowering people with disabilities through disability specific projects.” It is important that decision makers understand the perspective of those who are affected the most by development projects.

As previously mentioned, although the ADA provides a set of requirements for new and altered projects, it is not enforced for existing pedestrian infrastructure. The ADA’s minimum requirements and guidelines are oftentimes not reflective of the needs of community members. Inclusive planning processes are vital to ensure that development goals meet the needs of vulnerable community members.

4.0 | THE RICHMOND REGION

The Richmond region is comprised of nine jurisdictions: Town of Ashland, Charles City County, Chesterfield County, Goochland County, Hanover County, Henrico County, New Kent County, Powhatan County, and the City of Richmond. These nine jurisdictions span 2,165 square miles and home to more than 1,000,000 residents (PlanRVA, 2019a). Each locality offers varying and unique characteristics, with residents living in a mix of urban, suburban and rural settings. Often referred to as the capital region, the region is home to the Virginia State Capitol and other governmental institutions. All in all, the Richmond region's proximity to other major U.S. cities, beautiful natural environment, and diverse population makes it an attractive place to live, work, and visit!

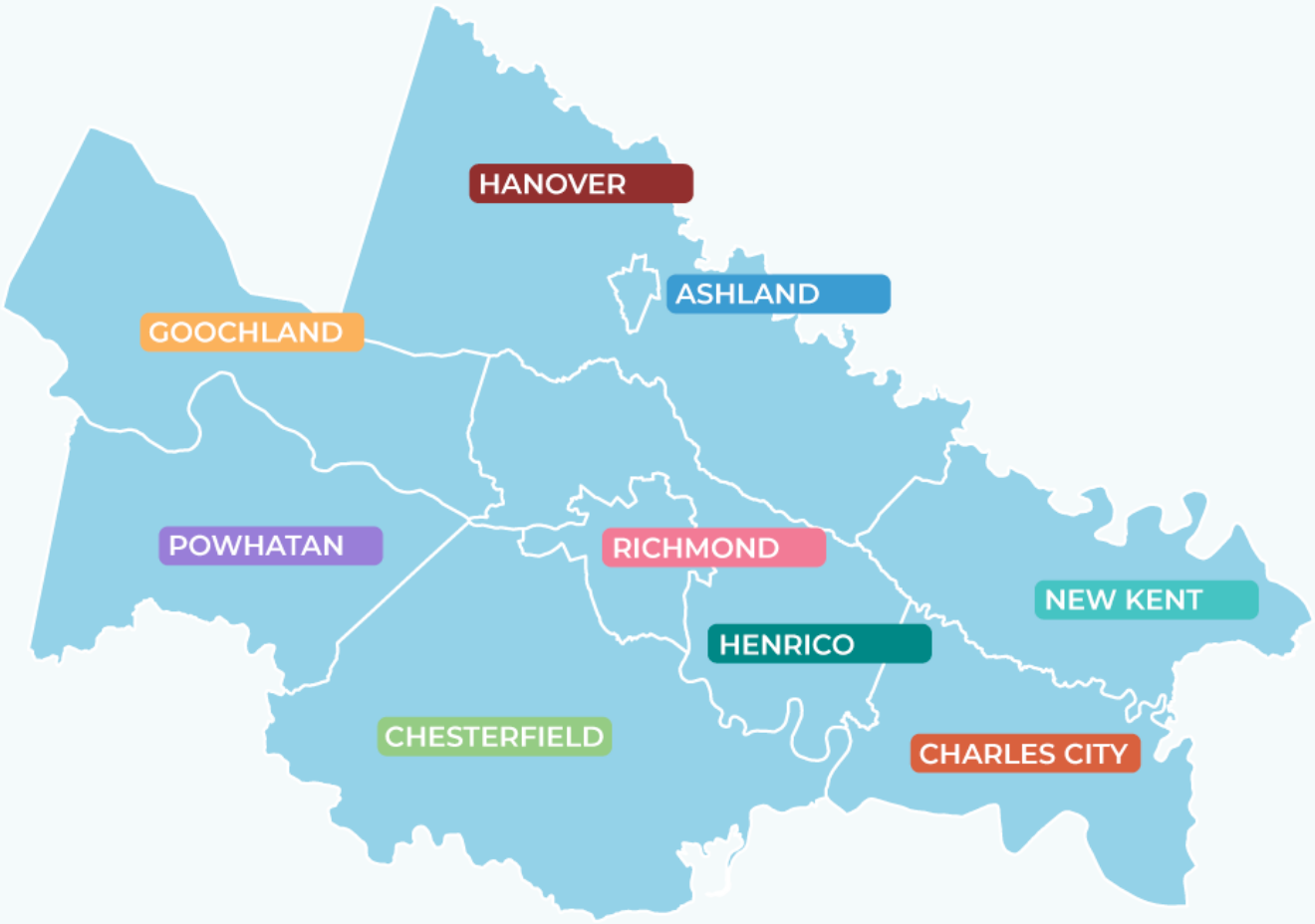

Figure 7. Map of the Richmond Region; Source: PlanRVA

4.1 | RICHMOND DISABILITY DEMOGRAPHICS

The Richmond region is growing and like trends across the nation, the number of individuals living with some form of disability is on the rise. As shown in **Table 1**, about 11.6% (451,956) of the Richmond region is living with some form of disability. Across all nine jurisdictions, the region's largest jurisdictions had the highest total population living with a disability: Henrico (36,881), Richmond City (34,844), and Chesterfield (34,426).

While Charles City had the smallest total population in the region, it had the highest percent of population with a disability (16.50%). Both the City of Richmond and Charles City have percent of population with a disability well above the regional average (11.85%). It is important to understand where in the region the population of people are living with a disability is growing. This plan will explore regional disability data, as well as other criteria in the research section to make well-informed recommendations.

Table 1. Richmond Region Disability Demographics by Jurisdiction

Jurisdiction	Total Population	Total Population with Disability	Percent Population with Disability
Charles City	7,126	1,176	16.50%
Chesterfield	340,848	34,426	10.10%
Goochland	23,536	2,730	11.60%
Hanover*	109,595	10,521	9.60%
Henrico	335,283	36,881	11.00%
New Kent	21,347	2,177	10.20%
Powhatan	29,147	3,002	10.30%
Richmond	224,798	34,844	15.50%
Region	**1,091,680**	**126,635**	**11.60%**

Source: 2017 ACS 5-Year Estimates
**Hanover includes the Town of Ashland*

4.2 | TRANSPORTATION SERVICES AND ORGANIZATIONS

Historically, Richmond led the way in transportation innovation, with public transit available in the region for over 150 years (GRTC, 2020). Since its beginnings, the GRTC aimed to create innovative approaches to better serve community members in a rapidly growing region. Exciting and evolving multimodal transportation options, which include road networks, rail systems, and riverways all contribute to the region's population growth and appeal of living, working, and visiting the area. The following section will highlight some of the existing transportation services and organizations that contribute to transportation-related efforts in the Richmond region.

GREATER RICHMOND TRANSIT COMPANY:

Today, residents and visitors alike rely on the Greater Richmond Transit Company's (GRTC) bus transit network system throughout their daily commute. The GRTC was founded in 1973 and entirely owned by the City of Richmond, until 1989 when Chesterfield assumed 50% ownership (GRTC, 2020). The GRTC primarily serves the City of Richmond and Henrico, but commuter routes reach north to Hanover and the Town of Ashland, and south to Chesterfield (**see Appendix B**).

In recent years, the GRTC made changes to bus services in hopes to improve connectivity, increase efficiency, and compete on a national level. In 2018, the region's first Bus Rapid Transit (BRT) service began services to better connect users to their destinations in a way that is safe, efficient, and reliable (GRTC, 2020). Furthermore, through the creation of the Greater RVA Transit Vision Plan (TVP) in 2017, the Virginia Department of Rail and Public Transportation (DRPT) and the RRTPO aimed to address any needs and gaps in service to improve transit connectivity and accessibility (DRPT, 2017).

MOBILITY COORDINATION:

The passing of the ADA in 1990 expanded accessibility for those living with a disability by requiring all fixed-route transportation services to be accessible. In addition, the ADA requires specialized transportation services (paratransit), which addresses FMLM problems. As the RRTPO (2015) highlights:

> Under the ADA, complementary paratransit service is required for passengers who are: unable to navigate the public bus system, unable to get to a point from which they could access the public bus systems or have a temporary need for these services because of injury or disability (p. 15).

According to the GRTC (2019), "GRTC Transit System's CARE and CARE Plus services provide origin-to-destination service under the guidelines of the Americans with Disabilities Act (ADA) for the citizens of the Richmond Region" (para 1). The GRTC provides specialized

paratransit services through CARE, CARE Plus, and CARE On-Demand. Eligible riders receive curb-to-curb services provided by trained professionals (GRTC, 2019). However, ADA service is limited to a specific distance. While GRTC paratransit is required under the ADA, it is not available for the entire region. For neighborhoods beyond the basic requirements of the ADA, the GRTC offers service through CARE Plus and the remainder of the region relies on various community partnerships to receive reliable transportation services.

Some of the current partnerships and services available in the region not served by the GRTC include Hanover Senior Rides, Shepherd's Centers of Chesterfield and Richmond, Access Chesterfield, and the Rider Connection Program by Senior Connections. To encourage interagency mobility coordination, the Department of Rail and Public Transportation (DRPT) developed a Coordinated Human Service Mobility Plan to increase accessibility for people with disabilities (2019). Additionally, the Virginia Board for People with Disabilities (VBPD) released an assessment of transportation services in Virginia and provided recommendations for improved coordination and planning efforts (2018). Interagency mobility coordination efforts aim to increase transportation options for individuals with disabilities through increased engagement between community members and decision makers. **Appendix C** reveals the existing mobility coordination efforts present in the Richmond region, their hours of operation, and service boundaries.

RICHMOND REGIONAL TRANSPORTATION PLANNING ORGANIZATION (RRTPO):

The Richmond Regional Transportation Planning Organization (RRTPO) is a policy-making organization comprised of agencies and elected officials that develop the region's LRTP (RRTPO, 2017). The organization provides long-range transportation plans (LRTP), transportation improvement programs (TIP), and projects pertaining to congestion management processes and regional transportation funding (PlanRVA, 2019b). In collaboration with community stakeholders and residents, the RRTPO serves/partially serves all nine jurisdictions in the Richmond region. Currently, the RRTPO is updating the region's LRTP with the ConnectRVA 2045 plan to make transportation improvements. Additionally, PlanRVA is undertaking the development of a bicycle and pedestrian plan as part of the ConnectRVA 2045 plan.

In 2020, the General Assembly of Virginia established the **Central Virginia Transportation Authority (CVTA).** The RRTPO provides both planning advice and staff support for CVTA. Both the authority and the RRTPO work together to provide accessible transportation decision-making processes to the public (PlanRVA, n.d.a). The establishment of a regional entity such as the CVTA provides a dedicated source of funding and will impact the delivery of public transportation services. Currently, funds are being channeled to the Authority, GRTC, and the localities for transportation improvements and services.

5.0 | APPROACH

The first step of this plan's three-pronged methodology was a regional analysis and ranked scoring process. To complete these steps, regional census data was collected through the U.S. Census website and reflects American Community Survey (ACS) 5-year estimates.

5.1 | REGIONAL APPROACH

REGIONAL ANALYSIS:

Specific criteria were thoughtfully determined through extensive research and includes six different data points (both total population and percent of the population):

- Individuals with a disability
- Age 65 and up
- Living in poverty
- Households with no car
- Utilize public transportation
- Minority Individuals

These data points aimed to include those who potentially face increased difficulties while attempting to access public transportation services. This specific group of individuals, or the transportation disadvantaged, includes people with disabilities, the elderly, and low-income individuals. Other criteria such as minority individuals, households with no car, and those using public transportation all factor into an area most in need of improved FMLM conditions.

Furthermore, GRTC bus routes and stop locations were identified and analyzed based on the results of the data collections. Being the region's only public transportation bus network system, it is important to understand where in the region needs transportation services, but not currently being served. Additionally, this plan takes into consideration current local or regional plans (i.e., comprehensive plans and long-range transportation plans), as well as existing mobility coordination efforts that aim to improve transportation services for the disability community and other transportation disadvantaged individuals. This information helps to guide the plan's recommendations section and implementation timeline.

RANKED SCORING:

Following the regional analysis, all 240 census tracts were ranked based on the findings (both total population and percent population). This plan's ranked scoring system considers all six criteria and no weight was applied. No weight was applied because no one person is the same. The disability community is not a monolith. While a person may have difficulty physically getting around, they may have the financial or familial support that another may not. All criteria

have varying impacts on an individual level and for that reason, one is not more important than another.

To complete the scoring system, data for the six different criteria was collected for all census tracts within the nine localities that make up the Richmond region. A score was developed by ranking each finding from one to 240. This was completed for both the total population and percent population data. To ensure the findings were comprehensive, it was converted into a percentage (0% - 100%).

The following list provides an overview of the plan's ranked scoring system process (**see Appendix D for further information and scoring formulas**):

1. Collect total population and percent population data for al l six criteria points at the census tract level
2. Organize data by the various criteria points
3. Apply ranked scoring formula with percentage conversion to all census tracts for all six criteria points for both total population and percent population data
4. Find the overall score for total population and percent population census tract data by summing the scores for all criteria points and dividing by the total number of criteria (six)

First, all tracts received a score for the different criteria points (disability, minority, age 65 and up, poverty status, households with no car, and utilizing public transportation). Once individual criteria scores were determined for both total population and percent population data, they were summed to calculate an overall score. Every census tract had an overall score for total population and percent population data. The final percentage for every census tract revealed its overall score, with the highest percentage being those census tracts with the highest scores and the lowest percentage the lowest scores. The scores were then analyzed through the creation of a map document to display the regional findings.

Both total population and percent population data were collected and analyzed to compare findings. This important step highlights any census tracts that may have a lower total number of individuals fitting the criteria, but a higher percentage. Although the percentage may represent a higher score for a tract, this plan aims to serve the largest total number of individuals meeting the criteria. However, it is important to pinpoint those potential pockets of vulnerable communities and analyze the reason behind the higher score.

The results of the scoring provide a snapshot of the region's makeup. It informs the plan's determined study areas to serve the census tracts that have the highest scores based on the total population data. It aims to further analyze those census tracts that are most in need of improved FMLM conditions, and to serve the areas with the largest total population meeting the specified criteria.

5.2 | LOCAL APPROACH

Using the findings from the regional analysis and ranked scoring process, the census tract with the highest total population score was the determined study area for this plan's case study. The case study included an inventory of existing pedestrian infrastructure to understand any barriers in the built environment that make it more challenging for people with disabilities to access public transportation services.

FIRST MILE LAST MILE INFRASTRUCTURE ASSESSMENT:

To assess FMLM conditions and make recommendations for improved disability friendly pedestrian infrastructure, an inventory of existing conditions was completed through online research via Google maps. While on-site visits were not utilized for this plan, the use of online resources allowed the researcher to adequately complete data collection for a larger study area. Additionally, a mix of on-site visits and online research was not conducted for the sake of consistency. It is important to note that while online research does allow for increased data collection, there are some aspects that are better suited for in-person visits. For example, using Google maps for data collection did not allow the researcher to measure specific widths or distances.

The FMLM infrastructure assessment included an inventory of existing pedestrian infrastructure at and surrounding (within about a quarter of a mile) bus stop locations. Specifically, the inventory aimed to assess the area for potential barriers that prevent people with disabilities from accessing public transportation safely and with ease. For example, the bus stop area barriers included landing areas that were either non-existent (i.e., grassy surfaces) or poorly maintained (i.e., uneven surfaces, gravel, etc.), inadequate signage for the visually impaired, a lack of amenities (i.e., benches or light fixtures) or any obstructions (i.e., telephone poles).

Additionally, connectivity issues leading up to the bus stop areas were assessed. Connectivity issues included a lack of sidewalk systems, poorly maintained sidewalks, and inadequate or dangerous crosswalks. To collect data in an effective and organized manner, a field sheet was developed for the inventory process (**see Appendix E**). This sheet acted as a checklist for data collection and allowed the researcher to provide thorough findings and thoughtful recommendations.

5.3 | IDENTIFYING REGIONAL CONCERNS

The following section highlights the findings from the regional analysis and ranked scoring process. This regional approach provided an overview of the region and located specific 'hotspots' that have a large concentration of individuals with disabilities and other transportation disadvantaged populations. The findings from the ranked scoring process determined the top census tract, which was deemed most in need of further FMLM examination. This census tract was examined further in the second part of this plan's approach and the findings will follow this section.

REGIONAL ANALYSIS RESULTS:

The Richmond region consists of nine different localities: Town of Ashland, Charles City, Chesterfield, Goochland, Hanover, Henrico, New Kent, Powhatan, and the City of Richmond. With over one million residents, the localities offer a mix of urban, rural, and suburban settings. They have a variety of population density, demographics, and resources that make them desirable places to live, work, and visit.

The regional analysis aimed to understand where specifically there is a high representation of individuals with disabilities and other transportation disadvantaged populations. This analysis is important to ensure that FMLM are addressed in areas that are most in need. If left unaddressed, these barriers can have serious implications for the health and safety of these populations.

The following tables report the findings from each of the six criteria data points collected. All data was collected from the U.S. Census Bureau website and represents American Community Survey 2017 5-year estimates. The data is displayed in both tables below and map documents located in **Appendix F.**

Table 2. Total and Percent of Population with a Disability

Jurisdiction	Total Population	# Disability	% Disability
Charles City	7,126	1,176	16.50%
Richmond City	224,798	34,844	15.50%
Goochland	23,536	2,730	11.60%
Henrico	335,283	36,881	11.00%
Powhatan	29,147	3,002	10.30%
New Kent	21,347	2,177	10.20%
Chesterfield	340,848	34,426	10.10%
Hanover	109,595	10,521	9.60%
Region	1,091,680	126,635	11.60%

Source: 2017 ACS 5-Year Estimates

Table 3. Total and Percent of Population Age 65 and Up

Jurisdiction	Total Population	# Age 65 +	% Age 65 +
Charles City	7,126	1,568	22.00%
Goochland	23,536	4,707	20.00%
Powhatan	29,147	4,809	16.50%
Hanover	109,595	17,535	16.00%
New Kent	21,347	3,394	15.90%
Henrico	335,283	47,610	14.20%
Chesterfield	340,848	45,674	13.40%
Richmond City	224,798	27,201	12.10%
Region	1,091,680	151,744	13.90%

Source: 2017 ACS 5-Year Estimates

Table 4. Total and Percent of Population Living in Poverty

Jurisdiction	Total Population	# Poverty	% Poverty
Richmond City	224,798	56,627	25.19%
Charles City	7,126	941	13.20%
Henrico	335,283	35,004	10.44%
Chesterfield	340,848	24,405	7.16%
Hanover	109,595	6,313	5.76%
Powhatan	29,147	1,612	5.53%
Goochland	23,536	1,254	5.33%
New Kent	21,347	1,091	5.11%
Region	1,091,680	126,853	11.62%

Source: 2017 ACS 5-Year Estimates

Table 5. Total and Percent of Households with No Car

Jurisdiction	Total Households	# HH No Car	% HH No Car
Richmond City	99,985	16,893	16.90%
Henrico	132,421	7,416	5.60%
Charles City	2,874	129	4.50%
Hanover	40,247	1,248	3.10%
Chesterfield	124,595	3,613	2.90%
New Kent	8,008	184	2.30%
Goochland	8,981	180	2.00%
Powhatan	10,442	115	1.10%
Region	427,526	29,072	6.80%

Source: 2017 ACS 5-Year Estimates

Table 6. Total and Percent of Population Utilizing Public Transportation Services

Jurisdiction	Total Population	# Public Transportation	% Public Transportation
Richmond City	224,798	5,902	2.63%
Charles City	7,126	64	0.90%
Henrico	335,283	1,896	0.57%
Chesterfield	340,848	804	0.24%
Goochland	23,536	45	0.19%
Hanover	109,595	175	0.16%
New Kent	21,347	2	0.01%
Powhatan	29,147	0	0.00%
Region	1,091,680	8,888	0.81%

Source: 2017 ACS 5-Year Estimates
Note: Numbers reflect working aged individuals (16 and up)

Table 7. Total and Percent of Population Minority Individuals

Jurisdiction	Total Population	# Minority	% Minority
Richmond City	224,798	134,879	60.00%
Charles City	7,126	4,169	58.50%
Henrico	335,283	153,560	45.80%
Chesterfield	340,848	126,795	37.20%
Goochland	23,536	5,272	22.40%
New Kent	21,347	4,376	20.50%
Hanover	109,595	17,097	15.60%
Powhatan	29,147	4,489	15.40%
Region	1,091,680	451,956	41.40%

Source: 2017 ACS 5-Year Estimates

SUMMARY OF REGIONAL ANALYSIS RESULTS:

As the regional and local data collection revealed, the nine different localities are made up of different demographics and each present a variety of challenges or advantages. Richmond City, Henrico, and Chesterfield accounted for majority of the criteria point's top three jurisdictions with the largest total populations, which is attributed to their population size when compared to the others. This is important to note as it will help to explain their scoring results. Additionally, these three localities contain majority of the GRTC stops and routes, which explains their high total number of residents utilizing public transportation.

However, while Charles City has the smallest total population it was within the top three localities with the highest percentage throughout all six criteria points. The data reveals that while Charles City is less dense than all other localities, a high percentage of its population is living with a disability, age 65 and up, minority, utilizing public transportation, has no car, and living in poverty. While this plan aims to serve the tracts with the largest total population scores, it is important to highlight these findings to understand Charles City's scoring results. Another important aspect of the findings was the three localities with the highest percent of residents age 65 and up: Charles City (22.00%), Goochland (20.00%), and Powhatan (16.50%). These localities are a mix of rural and suburban and have the some of the smallest populations across the region. However, many of their residents are elderly and hope to age in place. The CDC (n.d.) explains aging in place as, "The ability to live in one's own home and community safely, independently, and comfortably, regardless of age, income, or ability level." Additionally, both Charles City and Goochland had the highest percentage of residents living with a disability (16.50% and 11.60%, respectively). It is important that as the population continues to age and is more vulnerable to disability the localities are addressing mobility concerns.

Overall, the regional data collection and analysis reveals that while the three largest jurisdictions (Richmond, Henrico, and Chesterfield) consisted of majority of the criteria's largest total population, it is important to note those smaller localities with higher percentages. As previously stated, this plan aims to reach the largest total number of individuals in the region who are more vulnerable to decreased mobility due to FMLM barriers. The following section of the plan will explain the findings from the ranked scoring system. This system will utilize the regional data collected to score each census tract and determine a study area for the FMLM infrastructure assessment.

RANKED SCORING RESULTS:

The development of the regional ranked scoring system provided a detailed overview of the specific census tracts that are most in need of further examination of FMLM conditions. The scores were based on the data collected for the six criteria that potentially impacts an individual's mobility. After performing the ranked scoring process on all 240 census tracts

within the region, those with the highest scores (or percentages) represents those who are most in need of further examination. The following language, tables, and maps will highlight the findings at both the regional and local level. To see all scoring map documents please refer to **Appendix F and Appendix G.** First, the average scores for each jurisdiction and the region are examined. Following the regional scores, an analysis at the local level will highlight findings at the census tract level. Additionally, the top ten tracts are explored in detail to understand how the study areas were determined.

Regional Scores

The region had an overall average total population score of 42.41 (**Table 8**) and an average percent population score of 36.29 (**Table 9**). This means that across all six criteria, the region's 240 census tracts had an average total population score in the 40th percentile and an average percent population score in the 30th percentile. The highest average total population scores for the region were individuals with a disability (51.75), individuals living in poverty (44.09), and minority individuals (42.38). This means that the nine jurisdictions had an average score in the 50th or 40th percentile. Similarly, the top three average percent population scores were individuals living with a disability (49.49), individuals living in poverty (43.18), and minority individuals (42.35).

The City of Richmond had the highest average score for both total population and percent population, with an average score of 63.78 and 57.70, respectively. Additionally, both Henrico and Charles City were within the top three jurisdictions with the highest average scores for both total population and percent population. Although the more rural and less dense jurisdictions (Goochland, Hanover, New Kent, and Powhatan) had the lowest average scores for both, their individual averages for both total and percent population living with a disability raised concerns. While Powhatan had the lowest average total population overall score, it had the second highest score for individuals with disabilities (55.42). Charles City had the highest average score for percent population living with a disability across all nine jurisdictions, with a score of 82.09. Lastly, New Kent had an average total population living with a disability score of 71.11.

Overall, the Richmond region's individual's total population (**see Figure 8**) and percent population living with a disability scores were the highest out of all six criteria, with 51.75 and 49.49, respectively. These high average scores across all jurisdictions shows there is a need for further examination of the built environment for any potential FMLM barriers to ensure that all people, regardless of ability-level have equal access to transportation services and to increase ridership. While the findings for Richmond, Henrico, and Chesterfield were reflective of their higher population density and majority urban and suburban settings. On the other hand, Charles City's average scores revealed the potential need for further examination of FMLM conditions considering these findings.

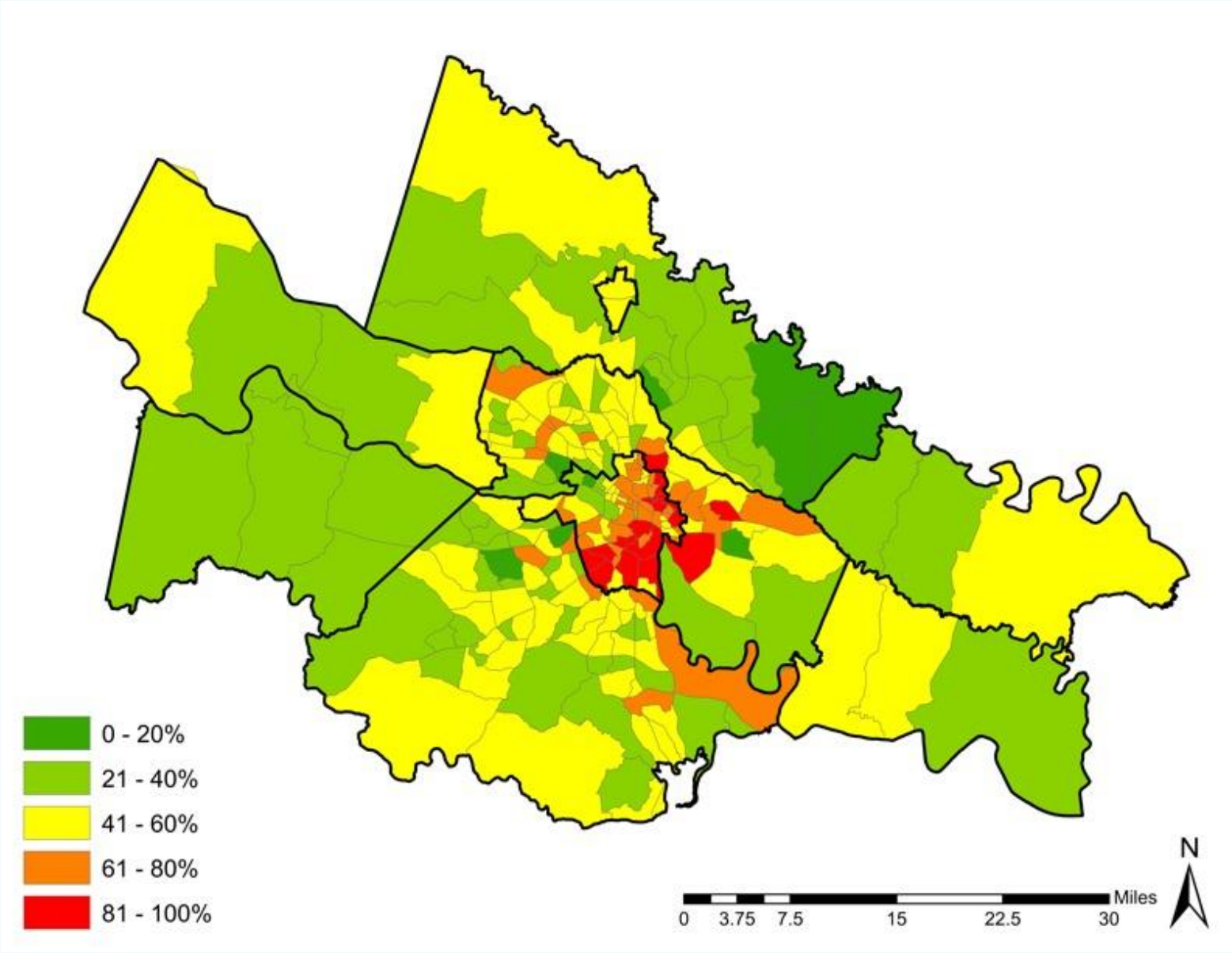

Figure 8. Total Population Overall Scores in the Richmond Region; Source: 2017 ACS 5-Year Estimates

Note: This map displays the region's census tract's overall total population scores, meaning their score based on their scores for all six criteria points (disability, minority, age, income-level, no car, and uses public transportation).

Table 8. Average Total Population Scores for the Richmond Region by Tract

Jurisdiction	Disability	Age 65 +	Minority	Poverty	Households No Car	Utilizing Public Transportation	Totals
Richmond City	47.30	68.65	52.71	65.29	73.52	75.23	63.78
Henrico	56.03	42.11	58.89	52.40	51.58	45.00	51.00
Charles City	38.47	54.44	46.94	43.89	40.69	50.97	45.90
Chesterfield	48.90	47.45	52.47	41.74	34.55	25.35	41.74
New Kent	71.11	15.70	46.66	46.11	49.03	12.36	40.16
Goochland	54.25	34.67	32.92	31.42	27.75	30.92	35.32
Hanover	42.50	39.40	21.45	34.71	37.25	21.14	32.74
Powhatan	55.42	31.58	27.00	37.17	20.08	0.42	28.61
Region	**51.75**	**41.75**	**42.38**	**44.09**	**41.81**	**32.68**	**42.41**

Source: 2017 ACS 5-Year Estimates

Table 9. Average Percent Population Scores for the Richmond Region by Tract

Jurisdiction	Disability	Age 65 +	Minority	Poverty	Households No Car	Utilizing Public Transportation	Totals
Richmond City	64.87	59.05	63.81	73.49	78.40	6.58	57.70
Charles City	82.09	9.44	70.00	65.14	56.11	1.75	47.42
Henrico	48.67	48.84	52.92	47.64	47.63	1.25	41.16
Chesterfield	42.94	52.42	48.93	39.44	34.58	0.49	36.47
Goochland	42.58	32.08	36.67	28.25	33.58	0.33	28.92
New Kent	42.36	36.53	27.50	28.61	36.39	0.02	28.57
Hanover	36.45	35.22	17.05	34.04	36.27	0.32	26.56
Powhatan	36.00	39.33	21.92	28.83	14.84	0.00	23.49
Region	**49.49**	**39.11**	**42.35**	**43.18**	**42.22**	**1.34**	**36.29**

Source: 2017 ACS 5-Year Estimates

Census Tract Scores

When applied to all 240 census tracts in the Richmond region, the ranked scoring system revealed where there is most need for further examination of FMLM conditions. This was determined by the findings from the data collection of the six different criteria that aimed to pinpoint populations that were more vulnerable to mobility issues caused by FMLM barriers. The scoring provided an overview of the entire region and highlighted any pockets of high vulnerability.

Of the top 30 census tracts with the highest total population and percent population scores, the majority (23 and 27, respectively) of the tracts were in the City of Richmond. Additionally, nine of the 10 top census tracts with the highest total and percent population scores were in the City of Richmond. These findings may not come as surprise, given the regional scores that preceded this sections that revealed Richmond as the jurisdiction with the highest average scores. There are six census tracts that scored within the top 10 for both total population and

percent population scores: 202, 204, 301, 607, 608, and 2008.05. All but one of these tracts is within the City of Richmond, the other is in Henrico. Both Charles City and Hanover were the only rural areas to score within the top 50th percentile.

Table 10 and **Table 11** show the top ten census tracts with the highest scores for both total and percent population data. The average total population and percent population living with a disability score across all ten tracts was 86.54 and 91.46, respectively. This shows that all top ten census tracts have a large total and percent of its population living with a disability, as well as other characteristics that make them more vulnerable to accessibility issues.

While it is important to take a high-level approach and understand how the criteria is dispersed geographically across the region, this plan aims to take a deeper dive into the census tracts with the highest total population score. This tract is the determined study area and will help inform recommendations provided by this plan.

Overall, the scoring brought to light the differences between the nine different jurisdictions in the Richmond region and provided a better understanding of who specifically lives in each census tract. While the City of Richmond did receive a majority of the highest top scores throughout, Charles City scores revealed relatively high percent population scores throughout. Given it being a low-density rural locality, these scores are important to investigate. The scoring system highlights the importance of understanding the demographical makeup of the region to better serve the need of residents that are unique to each locality. The Richmond region is rapidly growing and development projects are taking place more frequently. To ensure all people, regardless of ability-level, age, race, or income-level can fully access public transportation services, it is important that the needs unique to each community are understood.

Table 10. Top Ten Census Tracts with the Highest Total Population Scores

#	Census Tracts	Jurisdiction	Disability	Age 65 +	Poverty	Minority	HH 0 Car	Utilizing Public Transportation	Totals
1	202	Richmond City	99.58	66.25	100.00	93.33	100.00	100.00	93.19
2	607	Richmond City	97.92	57.50	97.92	96.25	98.75	93.75	90.35
3	301	Richmond City	80.42	70.00	97.50	80.42	99.58	99.17	87.85
4	204	Richmond City	86.25	63.33	99.17	93.75	99.17	84.58	87.71
5	608	Richmond City	86.67	76.25	90.83	85.83	89.58	91.25	86.74
6	610	Richmond City	66.25	81.25	89.58	86.67	94.17	99.58	86.25
7	604	Richmond City	98.75	41.25	97.08	94.58	98.33	87.50	86.25
8	2008.05	Henrico	65.42	73.75	95.42	88.75	96.67	97.08	86.18
9	108	Richmond City	94.58	52.50	91.67	89.58	90.42	98.33	86.18
10	706.01	Richmond City	89.58	58.75	96.67	97.50	96.25	77.92	86.11

Source: 2017 ACS 5-Year Estimates

Table 11. Top Ten Census Tracts with the Highest Percent Population Scores

#	Census Tract	Jurisdiction	Disability	Age 65 +	Poverty	Minority	HH 0 Car	Utilizing Public Transportation	Totals
1	201	Richmond City	92.50	94.58	98.75	100.00	99.58	32.81	86.37
2	301	Richmond City	99.17	50.42	100.00	99.17	100.00	51.80	83.43
3	202	Richmond City	100.00	77.08	99.58	99.58	99.17	24.25	83.28
4	204	Richmond City	92.92	76.67	98.33	98.75	98.75	7.25	78.78
5	607	Richmond City	93.33	82.50	95.42	94.17	97.92	6.94	78.38
6	608	Richmond City	96.25	78.75	92.50	95.83	95.42	9.22	78.00
7	210	Richmond City	88.33	95.83	94.58	85.42	93.75	6.28	77.37
8	2008.05	Henrico	74.17	77.92	97.50	97.08	97.50	17.18	76.89
9	103	Richmond City	86.67	60.42	95.00	95.00	96.67	27.55	76.89
10	602	Richmond City	91.25	78.33	87.50	92.08	92.08	10.62	75.31

Source: 2017 ACS 5-Year Estimates

Note: Red indicates the determined census tract for the case study

5.4 | IDENTIFYING LOCAL CONCERNS

The following section highlights the findings from the case study. The case study consists of a FMLM infrastructure assessment in the top census tract determined in the regional analysis and ranked scoring process. The study area: census tract 202 was assessed for any FMLM barriers and its results informed this plan's recommendations section. The following section will first give a brief overview of the study area and its demographics. Secondly, it will present the results from the FMLM infrastructure inventory.

FMLM INFRASTRUCTURE ASSESSMENT:

The FMLM infrastructure assessment consisted of an inventory of existing conditions to identify any potential barriers to access. The assessments included an inventory of amenities and conditions at designated bus stop areas and the surrounding conditions within about a quarter mile distance. This parameter was chosen because research suggests that most people are willing to travel no more than a quarter mile to and from transit. However, if additional travel is necessary this can cause serious implications for those who may have difficulty physically getting around.

Additionally, this assessment allowed the researcher to look for any connectivity issues that create additional barriers for people with disabilities (i.e., broken sidewalk systems, non-ADA compliment crosswalks, etc.). The top three census tracts with the highest overall total population scores were the determined study areas for this plan. The total population scores were studied because this plan aimed to assess the tract most in need and serve the largest total number people more vulnerable to mobility issues due to FMLM problems. The determined study area for this plan's case study was census tract 202 in the City of Richmond

The study area was inventoried through online data collection via Google Maps. Given the size of the census tract and the number of bus stops located in each, data collection through Google Maps allowed the researcher to cover more ground. While Google Maps provided adequate findings, there are potential gaps that are important to note. Online research did not allow for reporting of specific physical details like in-person visits could.

The potential gaps, including but not limited to exact measurements (i.e., sidewalk width), traffic flow (i.e., heavy vehicular traffic), up close views of sidewalk conditions (i.e., uneven surfaces), and temporary obstructions (i.e., trashcans, cones, construction, etc.). However, the inventory still provides an understanding of the existing conditions at bus stops locations and any connectivity issues that create barriers to make informed recommendations. The FMLM infrastructure inventory checklist (**see Appendix E**) was used for every bus stop area within the three census tracts.

STUDY AREA OVERVIEW:

Census tract 202 (**see Figure 9**) had the highest total population score when compared to all other tracts. According to the U.S. Census Bureau, the tract spans approximately 0.4 miles and has a total population of 4,517 residents. Tract 202 is situated in northeastern corner of Richmond and on the Henrico border.

Nearly all the residents in census tract 202 reported being a minority individual (98.03%) and more than half (68.55%) are living in poverty. Additionally, 61.20% of its household's reported have no car and 32.81% utilize public transportation services. However, this tract is a relatively younger population with less than 10% of its residents reporting being 65 and older.

This tract was ranked the highest (100 out of 100) for its total population living in poverty, utilizing public transportation, and households with no car. While it had a significantly lower score (66.25) for its total population age 65 and up, its score for individuals living with a disability (99.58) was higher. Additionally, the tract had a significantly high score for total population minority individuals (93.33).

The tract's overall score is reflective of the high scores across all six different criteria points. These scores reveal that the population is extremely vulnerable to mobility issues if any potential FMLM barriers are in place. Therefore, census tract 202 is considered most in need of further examination of FMLM conditions.

Figure 10 is a map of the study area with the 18 designated bus stops and local bus routes servicing the tract. Every bus stop location and their surrounding areas (within about a quarter mile) were assessed for any potential FMLM barriers through a detailed inventory. The FMLM inventory checklist created for this plan was used for each stop and findings can be found in **Appendix H**. The following section will explore the various findings of the inventory by highlighting any major barriers in place to make informed recommendations.

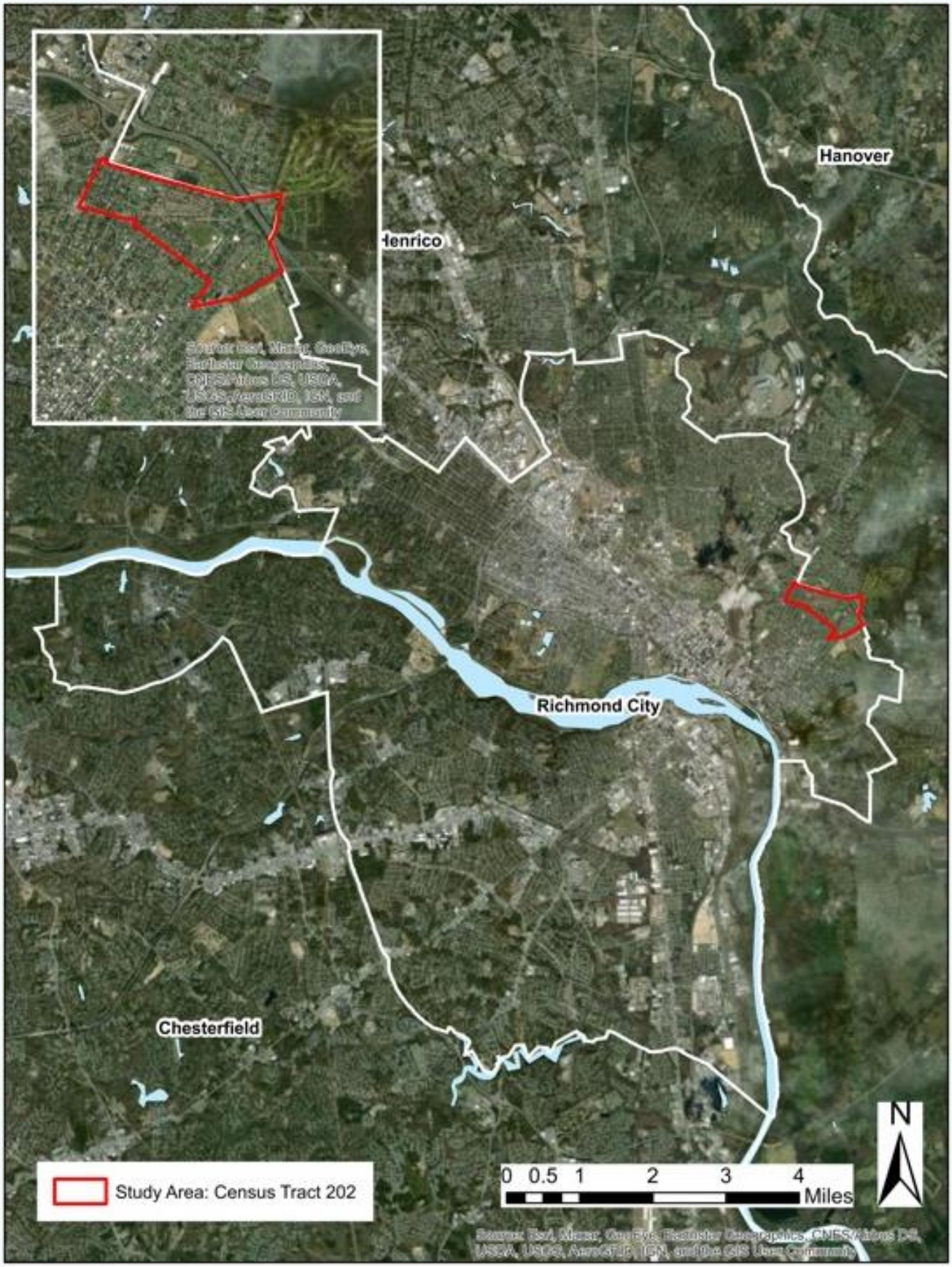

Figure 9. Overview Map of Plan Study Area; Source: U.S. Census

Figure 10. Study Area Boundary with GRTC Stops and Routes; Source: GRTC

INVENTORY RESULTS:

The first step in the inventory was to locate all active designated bus stop locations within the study area boundary. As **Figure 11** shows, all bus stop received a number from one to fourteen to make the reporting of the findings more comprehensive. The existing FMLM conditions at bus stops and surrounding areas were inventoried individually and documented as an entire tract (**see Appendix H**). The inventory revealed that while the area has a high need for more accessible pedestrian infrastructure, there are many barriers in place that make traveling to and from public transportation services more challenging. The following section will highlight specific FMLM barriers determined while conducting the infrastructure inventory. These findings will help to inform the recommendations provided by this plan.

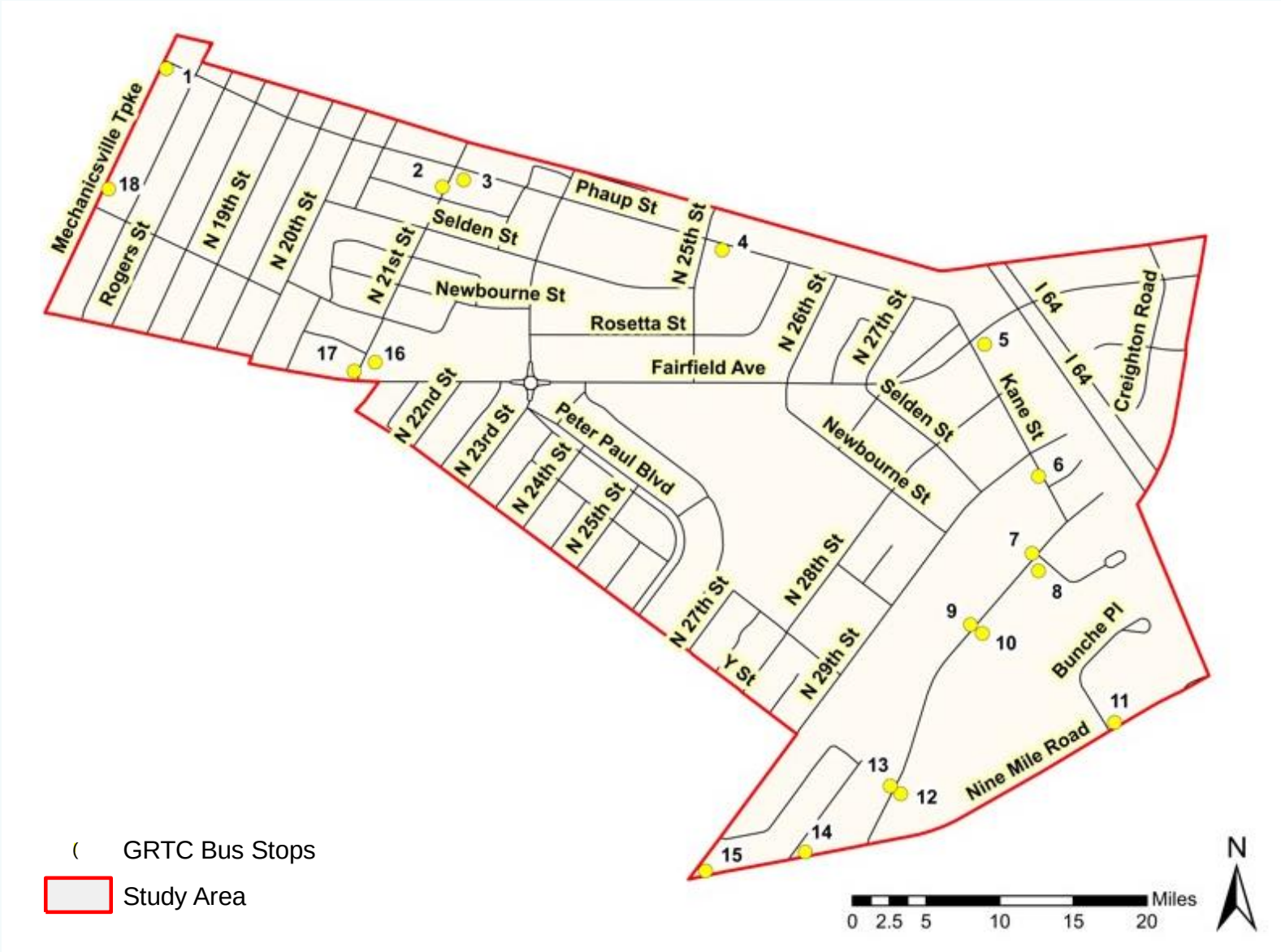

Figure 11. Study Area with Numbered GRTC Bus Stops; Source: GRTC, 2020

Bus Stop Areas:

Of the 18 total bus stops, there were only two that had existing shelters: stop nine and stop eleven. However, both bus shelters need improvements to be accessible for individuals with disabilities. As shown **in Figure 12**, the shelter at stop nine is situated at the back of the designated landing area. This is concerning because now the sidewalk is inaccessible and people who use a wheelchair or who have difficulty physically getting around must pass in front of the shelter. This may be challenging to do during a time when several commuters are waiting for the bus in the landing area. However, all bus shelters had seating either inside or nearby for commuters.

The shelter located at stop eleven shown in **Figure 13** has several barriers to access that must be addressed. While the landing area has enough space, the grassy surface is not stable. The grassy surface may make it more challenging for people with disabilities to access and load the bus. Additionally, the shelter has an open design and does not protect riders from inclement weather. All factors contribute to a commuter's safety and comfortability. It is important to note that the GRTC (n.d.) will be updating this shelter as part of the Bon Secours East End Bus Stop Project to be completed in 2021.

Figure 12. Bus Stop Number Nine; Source: Google Maps, 2019

Figure 13. Bus Stop Number Eleven; Source: Google Maps, 2019

Benches:

Benches provide a commuter an opportunity to rest while waiting for the bus or walking to the bus stop. For individuals who may have difficulty physically getting around, a lack of benches may prevent them from traveling with ease. Half of all 18 bus stops had benches at their bus stop area. However, all surrounding areas received a 'Very Poor' rating for benches leading up to bus stops. There were no benches placed periodically to allow for a resting spot. Overall, the study area needs new and improved benches to ensure the safety and comfortability of all commuters.

As shown in **Figure 14**, stop number two has both a bench and a trash can. While both are placed at the back of a sidewalk, the narrow sidewalk does not allow for adequate space for pedestrians to pass in front. It is important that there is enough space for at least two wheelchair users to pass easily. However, this stop does not allow for this to happen.

Similarly, bus stop number ten in **Figure 15** does not have a landing area and consist of gravel and grass. This may cause riders to have to wait for the bus in unsafe locations, such as the middle of the street. When any commuter, regardless of their ability must wait in the street, it can have serious safety implications. Both conditions may deter individuals with disabilities from attempting to ride the bus all together. This potentially leading to a lack of mobility and decreased quality of life.

Figure 14. Bus Stop Number Ten; Source: Google Maps, 2019

Figure 15. Bus Stop Number Two; Source: Google Maps, 2019

Signage:

All eighteen bus stops inventoried in the study area had adequate signage, with one present at every location. According to the GRTC (n.d.), all bus stops were recently upgraded between 2016 and 2017; additionally, they provide ride information and braille markings for visually impaired riders. **Figure 16** reveals an example of a GRTC bus stop braille marking, but not an image collected from the inventory.

Figure 16. GRTC Bus Stop Braille Marking; Source: GRTC, n.d.

Sidewalks:

The FMLM infrastructure inventory checklist aimed to assess existing sidewalk conditions for the following:

- Sidewalk width
- Clear of obstructions
- Connectivity
- Maintenance
- ADA accessibility (i.e., curb ramps and tactile landings)

All in all, the inventory revealed that throughout the entire study area there is a great need for new and improved sidewalk conditions to improve accessibility. Majority of bus stops had at least a portion of sidewalk at and leading up to the location. However, many had disconnected sidewalks that may cause confusion. For example, **Figure 17** and **Figure 18** show

disconnected sidewalks near busy roads. Several locations did not have ADA accessible curb ramps or tactile landings, making it unsafe or impossible for wheelchair users to access connecting sidewalks (**see Figure 20**). Another barrier present in almost every location was the physical condition of the sidewalk. While Google Maps was utilized, it was clear the disrepair many sidewalks were in. A large portion of sidewalks had severely uneven or dangerous surfaces (i.e., potholes, tree roots coming up, gravel, etc.) (**see Figure 19**). In addition to the poorly maintained sidewalks, it appeared that many were either at the very minimum ADA regulated width (3 feet) or less (**see Figure 20**).

Figure 17. Disconnected Sidewalks at Nine Mile Rd. & N. 31st St.; Source: Google Maps, 2019

Figure 18. Disconnected Sidewalk at N. 21st St. & Selden St.; Source: Google Maps, 2019

Figure 19. Sidewalk Conditions at Nine Mile Rd. & N. 31st St.; Source: Google Maps, 2019

Figure 20. Inaccessible Sidewalks at N. 21st St. & Selden St.; Source: Google Maps, 2019

Crosswalks and Crossing Areas:

There were three major intersections with a designated crosswalk at a traffic light assessed for the inventory: Nine Mile Road and Creighton Court, Mechanicsville Turnpike and Whitcomb Street, and Fairfield Avenue/Way and Mechanicsville Turnpike. All intersections had markings painted in the street to identify the crosswalks. However, these were either nearly completely worn down or beginning to lose visibility (**see Figure 21**). This may cause confusion for both vehicular drivers and pedestrians, which increases safety concerns for more vulnerable people.

Another important aspect to safe crosswalks is the crossing signals. While the Fairfield and Mechanicsville Turnpike, as well as the Mechanicsville Turnpike and Whitcomb Street intersections did have both a crossing signal and visual aide, the Nine Mile Road and Creighton Court location did not. Additionally, curb ramps and tactile landings were present at both locations but were worn down (**see Figure 22**).

Across the entire census tract crossing areas are a major concern and must be addressed to improve accessibility for individuals with disabilities. At many crossing areas there are no curb ramps or tactile landing (**see Figure 23, Figure 24, and Figure 25**), which makes sidewalks inaccessible to those who use a wheelchair or are physically impaired. The crossing areas are often confusing and do not have any marking to make identifying the space easier for both pedestrians and drivers.

Figure 21. Intersection with Faded Crosswalk Paint; Source: Google Maps, 2019

Figure 22. Worn Down Tactile Landing Surface; Source: Google Maps, 2019

Figure 23. Inaccessible and Unsafe Crossing Areas; Source: Google Maps, 2019

Figure 24. Inaccessible Sidewalk and Unsafe Crossing Areas; Source: Google Maps, 2019

Figure 25. Inaccessible and Unsafe Sidewalk; Source: Google Maps, 2019

Other Important Considerations:

Other important factors to promoting the safety and comfortability of all commuters include adequate lighting and both permanent and temporary obstructions. Lighting plays an important role in safety, with many people not feeling comfortable traveling at night if areas are not well-lit. While many of the bus stops had adequate light fixtures, there were many with no lights at all (**see Figure 26**) and areas leading up to stops received a 'Very Poor' rating for lights.

Another factor when considering barriers are both temporary and permanent (**see Figure 27**) sidewalk obstructions. While the study area had very minimal sidewalk obstructions such as trash cans or poles, the most common were stop amenities (i.e., benches or trash cans).

Figure 26. Lack of Lighting at Bus Stop Number One; Source: Google Maps, 2019

Figure 27. Permanent Sidewalk Obstructions; Source: Google Maps, 2019

CONNECTIVITY ASSESSMENT:

To ensure that the study area is currently adequately serving a majority of residential areas a connectivity assessment was completed. The connectivity assessment included a GIS analysis with two main steps: 1) collecting City of Richmond parcel data to determine all residential areas and 2) calculating the total percentage of residential parcels not within a quarter miles distance of GRTC bus stops.

To complete this assessment a quarter mile buffer was created around all GRTC bus stops in the study area. The total percentage of residential parcels outside of the quarter mile buffer was calculated. The calculations revealed that the study area is currently serving nearly all residential areas, with 96.18 percent within a quarter miles distance of a bus stop (**see Figure 28**).

Figure 28. Current Residential Parcels Served by the GRTC; Source: The City of Richmond

6.0 | DISABILITY-INCLUSIVE RECOMMENDATIONS AND IMPLEMENTATION

To improve transportation accessibility for all people, it is crucial that the needs of residents in the Richmond region who have trouble physically getting around are considered. The preceding research and findings of the extensive literature review, as well as the three-part methodology have informed the following list of goals, objectives, and actions. These recommendations aim to first, address any regional level concerns that potentially contribute to barriers to access. Additionally, regional goals seek to further the rights and protections of the disability community to promote equal access to opportunity.

Secondly, a list of FMLM goals will utilize the findings from the case study and FMLM infrastructure inventory to form well-thought-out recommendations for improvements. While every census tract in the region has different distinct characteristics and typology, the inventory approach and checklist can be used to make development decision reflective of the specific needs of community members. However, the goals informed by the case study will mirror the needs of other communities across the region. The hope is that localities will look to this plan's methodology to increase awareness surrounding the importance of disability-inclusive pedestrian infrastructure, as well as inspire them to lobby for local improvements to increase accessibility.

6.1 | GOALS AND OBJECTIVES

GOAL ONE: *Create a built environment free of FMLM barriers*

Goal one focuses on addressing barriers within the built environment to improve accessibility for all people, regardless of ability level. After determining a study area for the case study, a FMLM infrastructure inventory was completed to highlight various barriers in the built environment that might affect an individual with a physical disability's ability to easily move around. While the study area is not reflective of the entire Richmond region, it serves as an example of the potential barriers in the built environment at and leading up to transportation services that are important to address to improve accessibility. The FMLM inventory checklist was developed to first, complete an accurate and thorough assessment of the determined study area. Secondly, for the use of other census tracts in the region to assess FMLM conditions to make improvements to the built environment and improve accessibility. The following objectives and actions are applicable to any census tract in the region and if implemented would benefit not only people with disabilities, but the community at large.

OBJECTIVE 1.1: Address FMLM barriers in the region's high need areas

ACTION 1.1.1: Use the FMLM inventory checklist to evaluate other census tracts in the region most in need to determine any pedestrian infrastructure barriers that need addressed

ACTION 1.1.2: Encourage localities to allocate funding or increase funding to make major improvements to: sidewalks, curb ramps, tactile landings, and crosswalks in census tracts most in need (i.e., high representation of people with disabilities)

ACTION 1.1.3: Localities allocate funding or increase funding for regular sidewalk maintenance in high need areas

ACTION 1.1.4: Prioritize ADA compliance and Universal Design through up to date and frequently updated ADA transition plans

OBJECTIVE 1.3: Increase pedestrian safety throughout the entire region

ACTION 1.3.1: Continue to promote the Vision Zero initiative in the city of Richmond and advocate for similar initiatives in other localities in the region

ACTION 1.3.2: Prioritize the need for increased and improved bus stop amenities, such as benches, shelters, and light fixtures

GOAL TWO: *Promote connected transportation systems to improve mobility for all people*

Goal two is concerned with improving transportation systems to promote increased mobility for all people. The FMLM infrastructure assessment revealed that when sidewalk systems are incomplete or disconnected many barriers for people with disabilities arise. This plan recommendations making improvements in the built environment to increase accessibility to public transportation services. Multi-modal transportation systems address these concerns by expanding transportation options to include more than one method (i.e., walking, rolling, biking, bus services, etc.).

In addition to recommendations for the built environment, this goal recognizes the important role regional mobility coordination plays in connecting people with disabilities to essential services. Mobility coordination is essential to providing people with physical disabilities with safe, reliable, and efficient transportation services. Paratransit services are provided for those who need door to curb service; this meaning they are unable to travel from their current location (i.e., front door at their home) to the vehicle. This service is necessary to ensure that individuals can access essential services such as health care and employment. While these services are important to improving accessibility for people with disabilities, there are potential gaps in service and other barriers that impact their effectiveness. The following objectives and actions aim to improve transportation services and effectiveness to promote a high quality of life for people with disabilities in the Richmond region.

OBJECTIVE 2.1: Plan for multimodal transportation systems

ACTION 2.1.1: Engage with local government officials and provide education on multimodal transportation networks and its importance to improving accessibility

ACTION 2.1.2: Advocate for Complete Streets approach across the region to improve connected multimodal transportation networks that are free of FMLM barriers

ACTION 2.1.3: Prioritize improved walkability and encourage mixed-use and transit-oriented developments

ACTION 2.1.4: Extend GRTC bus services to include those underserved but in need (i.e., rural areas such as Charles City) and ensure residential areas are within 1/4 mile from bus stops

OBJECTIVE 2.2: Invest in mobility coordination services to improve accessibility for people with disabilities

ACTIONS 2.2.1: Expand on partnerships with Senior Connections and other mobility coordinators in the region

ACTIONS 2.2.2: Localities use a portion of Central Virginia Transportation Authority (CVTA) funds to enhance transportation services (i.e., contract demand-response service, additional fixed route services, enhancing volunteer driver programs, etc.)

GOAL THREE: ***Ensure that transportation planning processes are inclusive of the disability community***

Goal three aims to promote improve planning processes in the Richmond region to ensure they are inclusive of residents with disabilities. It is important that individuals with disabilities are included in all development decision processes. Specifically, representation of people with disabilities in transportation efforts is extremely important to address potential FMLM barriers present in the built environment. The lived experiences of individuals living with a physical disability must be considered when developing plans such as Long-Range Transportation Plans (LRTP). LRTP's guide regional development decisions over a 20-year horizon. Planning processes and community outreach efforts that are not inclusive of people with disabilities, it is possible that barriers specific to their needs remain unaddressed. The following objectives and actions seek to promote inclusive planning processes to ensure that people with disabilities have equal access to opportunities and a high quality of life.

OBJECTIVE 3.1: Seek out a diverse participation throughout the entire planning process that includes transportation disadvantaged groups

ACTIONS 3.1.1: Develop committee or advisory group to represent the disability community and advocate for their needs

ACTIONS 3.1.2: Engage the committee or group with the Richmond Regional Transportation Organization and the Central Virginia Transportation Authority

ACTIONS 3.1.3: Partner with stakeholders, community-based organizations, and residents that have a connection with the disability community to improve outreach efforts

OBJECTIVE 3.2: Focus aspects of community outreach efforts to prioritize the needs of people with disabilities

ACTIONS 3.2.1: Work with localities to promote increased education and awareness surrounding disability, the ADA, etc.

ACTIONS 3.2.2: Utilize efforts to understand more about ADA compliance, ADA transportation plans, grievances, and needs of community members to address barriers to access in transportation plans

6.2 IMPLEMENTATION PLAN

GOAL ONE Create a built environment free of FMLM barriers		2022				2023				2024				2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
OBJECTIVE 1.1 | ADDRESS FMLM BARRIERS IN THE REGION'S HIGH NEED AREAS																					
ACTION 1.1.1	Use the FMLM inventory checklist to evaluate other census tracts in the region most in need to determine any pedestrian infrastructure barriers that need addressed																				
ACTION 1.1.2	Secure funding sources to make major improvements to: sidewalks, curb ramps, tactile landings, and crosswalks in census tracts most in need (i.e., high representation of people with disabilities)																				
ACTION 1.1.3	Allocate funding for regular sidewalk maintenance in high need areas																				
ACTION 1.1.4	Prioritize ADA compliance and Universal Design through up to date and frequently updated ADA transition plans																				
OBJECTIVE 1.2 | INCREASE PEDESTRIAN SAFETY																					
ACTION 1.2.1	Continue to promote the Vision Zero initiative in the city of Richmond and advocate for similar initiatives in other localities in the region																				
ACTION 1.2.2	Prioritize the need for increased and improved bus stop amenities, such as benches, shelters, and light fixtures																				

GOAL TWO Promote multi-modal and connected transportation networks to improve mobility		2022				2023				2024				2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
OBJECTIVE 2.1 | PLAN FOR MULTI-MODAL TRANSPORTATION NETWORKS																					
ACTION 2.1.1	Engage with local government officials and provide education on multimodal transportation networks and its importance to improving accessibility																				
ACTION 2.1.2	Advocate for Complete Streets approach across the region to improve connected multimodal transportation networks that are free of FMLM barriers																				
ACTION 2.1.3	Prioritize improved walkability and encourage mixed-use and transit-oriented developments																				
ACTION 2.1.4	Extend GRTC bus services to include those underserved but in need (i.e., rural areas such as Charles City) and ensure residential areas are within 1/4 mile from bus stops																				
OBJECTIVE 2.2 | INVEST IN MOBILITY COORDINATION SERVICES TO IMPROVE ACCESSIBILITY FOR PEOPLE WITH DISABILITIES																					
ACTION 2.2.1	Expand on partnerships with Senior Connections and other mobility coordinators in the region																				
ACTION 2.2.2	Localities use a portion of Central Virginia Transportation Authority (CVTA) funds to enhance transportation services (i.e., contract demand-response service, additional fixed route services, enhancing volunteer driver programs, etc.)																				

GOAL THREE Ensure that transportation planning processes are inclusive of the disability community		2022				2023				2024				2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
OBJECTIVE 3.1 | ENSURE REPRESENTATIVE PARTICIPATION WHICH INCLUDES TRANSPORTATION DISADVANTAGED GROUPS																					
ACTION 3.1.1	Develop committee or advisory group to represent the disability community and advocate for their needs																				
ACTION 3.1.2	Engage the committee or group with the Richmond Regional Transportation Organization and the Central Virginia Transportation Authority, GRTC, and other transportation providers																				
ACTION 3.1.3	Partner with stakeholders, community-based organizations, and residents that have a connection with the disability community to improve outreach efforts																				
OBJECTIVE 3.2 | FOCUS ASPECTS OF COMMUNITY OUTREACH TO PRIORITIZE THE NEEDS OF PEOPLE WITH DISABILITIES																					
ACTION 3.2.1	Work with localities to promote increased education and awareness surrounding disability, the ADA, etc.																				
ACTION 3.2.2	Utilize efforts to understand more about ADA compliance, ADA transportation plans, grievances, and needs of community members to address barriers to access in transportation plans																				

6.3 FUNDING SOURCES

In order to achieve the preceding goals, dedicated funding sources and long-term investment is required. Given the current update to the Long-Range Transportation Plan (LRTP), Connect RVA 2045, the region is preparing to tackle transportation related problems to improve accessibility and mobility. The recommendations provided in this plan align with Connect RVA's goals to improve safety, equity/accessibility, and mobility in the region.

This plan aims to compliment the efforts of this update. Specifically, Connect RVA's third goal to "improve equitable access through greater availability of mode choices that are affordable and efficient" (Connect, 2021). The objectives of this goal include reducing trip lengths and increasing access for all residents with a focus on Environmental Justice (EJ) populations: disabled, 65 and up, minority, living in poverty, and households with no cars (Connect, 2021). Similar to this plan, the EJ analysis aims to pinpoint high need areas to ensure accessibility issues for vulnerable populations are addressed.

As shown in the findings of this plan, there are potentially life-threating pedestrian concerns present in the built environment that need immediate attention. In addition to these immediate concerns, there are ways the entire region can collaborate to ensure people with disabilities and other transportation disadvantaged groups are included in planning and development processes. Commitment from government officials and relevant stakeholders, as well as reliable funding sources are necessary to address these pressing concerns. **Table 12** provides a list of potential funding sources to complete recommendations provided in this plan.

Table 12. Potential Funding Sources

Program	Descriptions
The Central Virginia Transit Authority	Established in 2020, the CVTA provides local and regional funding opportunities to address transportation related projects. Projects include improvements through construction and maintenance of roads, streets, and sidewalks (CVTA, n.d.).
Virginia Transportation Alternatives Set-Aside	A reimbursement program that funds non-motorized travel choices by improving transportation infrastructure. The funds go towards community-based projects to improve pedestrian and bicycle facilities (VDOT, n.d.).
Virginia SMART SCALE	Offered by the Virginia Commonwealth Transportation Board and funds transportation improvement projects which includes pedestrian improvements (VCTB, n.d.).
Formula Grants for Rural Areas	The Federal Transit Administration (FTA) offers funding to rural areas (<50,000 total population) to increase access for those who rely on public transportation (FTA, n.d.a).
Community Rides Grant Program	Offered by the National Rural Transit Assistance Program to current recipients and subrecipients of the FTA Formula Grants for Rural Areas with funding for projects related to mobility coordination. These funds are used toward strengthening transportation partnerships to vulnerable rural and tribal communities (National RTAP, n.d.).
Enhanced Mobility of Seniors & Individuals with Disabilities Program	Through this program the FTA provides formula funding to states and aims to assist nonprofit groups to meet transportation needs of older adults and people with disabilities. The goal is to improve mobility for the two groups by removing barriers to services and expand mobility coordination (FTA, n.d.b).
Access and Mobility Partnership Grants	Funding to those recipients and subrecipients of the Enhance Mobility of Seniors & Individuals with Disabilities program. It provides funding to expand access to public transportation; specifically, to improve coordination of both transportation services and non-medical transportation services (FTA, n.d.c).
Regional Surface Transportation Block Grant Program	Awarded to states and regions to use for various highway and transit projects. These funds are suballocated to regional planning organizations and aim to make transportation improvements including pedestrian facilities (PlanRVA, n.d.b)
Congestion Mitigation and Air Quality Program	Federal funding allocated to make transportation improvements that improve air quality and reduce traffic congestion. Funds are provided to locations that previous and/or currently do not meet the National Ambient Air Quality Standards (PlanRVA, n.d.b).
Safe Routes to School	Funds awarded by the Federal Highway Administration to help improve pedestrian safety to encourage children (and people with disabilities) to walk and bike to school. In addition to these goals, the funding aims to help reduce traffic and improve air quality (FHWA, n.d.).

7.0 CONCLUSION

The Disability Inclusive Transportation plan for the Richmond region shined a light on the potential First Mile Last Mile (FMLM) barriers present in the built environment that make accessing public transportation services more challenging for people with disabilities. Overall, the research and findings presented in this plan aim to bring awareness to these challenges to encourage decision makers to prioritize the needs of people with disabilities. The case study, while only representative of one census tract, provided further insight to potentially life-threatening barriers currently in place in the city of Richmond. While census tracts across the region differ in population size, typology, and demographics, the FMLM infrastructure assessment presents the severity of the problem and its impact on vulnerable communities.

Safe, reliable, and accessible public transportation is necessary to provide all people with equal access to opportunities and a high quality of life. This is especially true for vulnerable populations who rely on public transportation services to get to and from employment, health care services, community-based services, and other activities. Specifically, when people with disabilities are unable to participate in their communities, they lack the ability to advocate for their rights and improve their quality of life.

As the Richmond region continues to develop, it is important that people with disabilities are not left behind. Increasing access to public transportation through increased and improved multi-modal transportation networks will ensure that all people regardless of ability-level can benefit from all the economic, social, and recreational assets this region offers. Through the collaboration and commitment of state and local governments, community stakeholders, and residents, these inequities can be addressed to improve quality of life for all Richmond regional residents and visitors.

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APPENDIX A

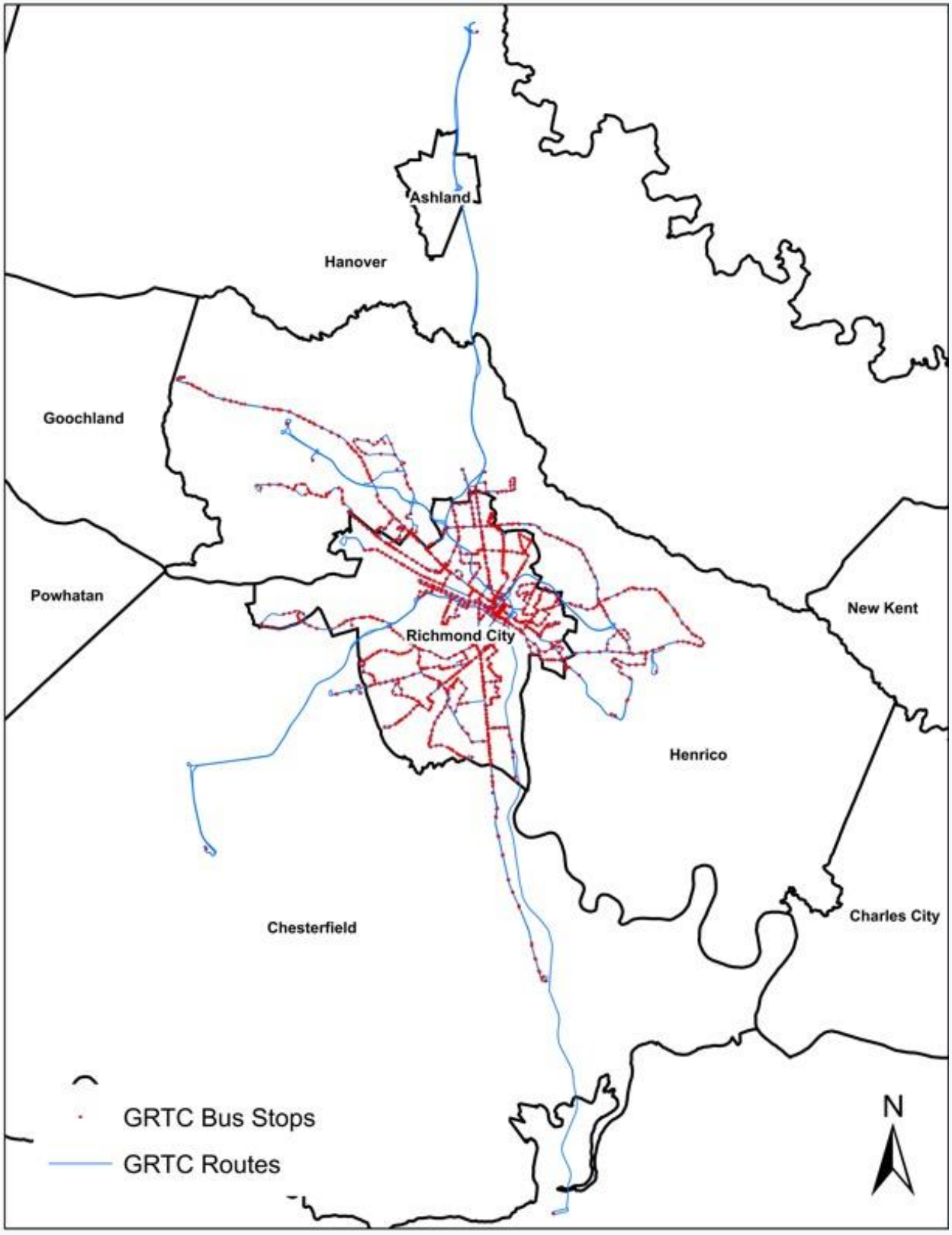
Image of a Table Comparing the Different Types of Bus Stop Locations

	Advantages	Disadvantages	When it's recommended
Far-Side	• Minimizes conflicts between right turning vehicles and bus. • Provides additional right turn capacity. • Minimizes sight distance issues on approach to intersection • Shorter deceleration distance needed since the bus can use the intersection to decelerate. • Encourages pedestrians to cross the street behind the bus. • Driver can take advantage in gaps in traffic created at signalized intersections to reenter traffic.	• If multiple buses are stopped at one time and there is only adequate room for one bus, the cross street may be blocked. • If the bus stops in the travel lane, it may result in queued traffic behind it blocking the intersection. • Could increase the number of rear-end accidents; drivers don't expect the bus to stop again after a red light. • Can obscure sight distance for crossing vehicles. • Can increase sight distance problems for crossing pedestrians.	• Whenever possible as long as it is safe, there is room to put a stop, and the only crosswalk is not on the near-side.
Near-Side	• The bus boarding door is closer to the crosswalk. • Bus has the intersection to merge into traffic. • Bus driver can see oncoming traffic. • Eliminates double stopping potential associated with a red light. • Allows passengers to board and alight while the bus is stopped at a signal. • Minimizes interference when traffic is heavy on the far-side of the intersection.	• Increases conflicts with right turning traffic due to cars cutting in front of the bus. • Could be difficult for bus to reenter traffic. • Can block sight distance for crossing vehicles stopped to the right of the bus. • The stopped bus may block visibility of the stop signs or traffic signals. • Visibility conflicts with pedestrians having to cross in front of a bus.	• It's unsafe to place stop on the far-side. • There is inadequate room for a stop. • A major trip generator is located on the near-side of the intersection, which would result in all passengers crossing the intersection.
Mid-Block	• The stopped bus does not obstruct sight distances at an intersection for other vehicles or pedestrians. • May be closer to major activity centers than the nearest intersection.	• Requires most curb clearance of the three options. • Sometimes results in mid-block jaywalking if there is no crosswalk midblock. • Increases walking distances for passengers crossing the street. • Can be difficult for bus to reenter traffic if the stop is not in the travel lane.	• The major trip generator is located in the middle of a long block. • There are no intersecting roads.

Source: Upper Valley Lake Sunapee Regional Planning Commission. (n.d.). *Bus Stop ADA Guidelines.* https://www.uvlsrpc.org/files/4215/4775/9655/SCT_ADA_Bus_Stop_Guidelines.pdf

APPENDIX B

Map of the Richmond Region and GRTC Bus Services



Source: GRTC, 2020

APPENDIX C

Mobility Coordination Efforts in the Richmond Region

Name	Service Provided	Hours of Operation	Service Boundary
Access Chesterfield	Human Service	Mon – Fri 5:30 a.m. to 7:30 p.m. Sat 5:30 a.m. to 5:30 p.m.	Chesterfield
Acti-Kare in Home Care	Private	Mon – Sun 6 a.m. to 9 p.m.	Chesterfield, Goochland, Hanover, Henrico, Richmond, Petersburg area
Alliance Specialty Transport	Human Service	Transportation provided 24/7	Richmond, Chesterfield, Henrico; additional fees apply in Powhatan, Goochland, and Hanover
American Cancer Society (Road to Recovery)	Human Service	Mon – Fri 8 a.m. to 5 p.m.	Chesterfield, Henrico, and Richmond
Angels for Hire/Angel Ride	Human Service	Mon – Fri 8:30 a.m. to 6 p.m.	Western Richmond, western Henrico, and northern Chesterfield
Bay Transit	Public Transit	PDC15: Mon – Fri 6 a.m. to 6 p.m. PDC 17-18: Demand response service	PDC 15: New Kent and Charles City to Richmond PDC 17-18: New Kent, Charles City, and Richmond
Capital Area Health Network (CAHN)	Human Service	Associated with CAHN medical services	Richmond
Capital Area Partnership Uplifting People (CAP-UP)	Human Service	n/a	Goochland, Hanover, and Powhatan
Chesterfield Community Services Board (CSB)	Human Service	Associated with CSB services	Chesterfield
Comfort Keepers	Human Service	n/a	Chesterfield
Dependacare Transportation	Public Transit	Pre-scheduled and same day appointments	Richmond and surrounding areas
Goochland Free Clinic and Family Services	Human Service	Mon noon to 3 p.m. in Richmond; Tues – Thurs 9 a.m. to 3 p.m. in Goochland; and Fri 9 a.m. to noon in Richmond	Goochland
Greater Richmond Transit Company (GRTC)	Public Transit	Fixed route service available daily from 5 a.m. to 1 a.m.	Richmond, Chesterfield, Hanover, and Henrico
GRTC's CARE	Human Service	Richmond 4:30 a.m. to 12:30 p.m. and Henrico 6 a.m. to 11 p.m.	Richmond, Henrico, and portions of Chesterfield
Heart Havens, Inc.	Human Service	PDC 15: Greater Richmond trips available by appointment PDC 7: Trips for program participants	PDC 15: Greater Richmond PDC 7: Operates 12 homes in Virginia (based in Richmond)

Home Helpers	Human Service	n/a	Hanover, Henrico, Midlothian, and Richmond
Home Instead Senior Care	Human Service	As scheduled	Richmond area
VIP & Associates	Human Service	Mon – Fri 8 a.m. to 4 p.m.	Powhatan, Chesterfield, Hanover, Henrico, Richmond, Goochland, Charles City, and New Kent
Van Go	Human Service	Mon – Fri 5:30 a.m. to 8:30 p.m.; available 24 hours a day with advance notice	Powhatan, Chesterfield, Hanover, Henrico, Richmond, and Goochland
Sunrise Transportation	Private	Mon – Fri 7 a.m. to 7 p.m.	Richmond, Hanover, and Henrico
St. Joseph's Villa	Human Service	As needed to participants in St. Joseph's programs	The greater Richmond area, Hanover, and Powhatan
SOAR365	Human Service	As needed for programs and services	Greater Richmond area
Shepherd's Center of Richmond	Human Service	As needed	Zip codes: 23059, 23060, 23113, 23114, 23219, 23220, 23221, 23222, 23224, 23225, 23226, 23227, 23228, 23229, 23230, 23233, 23235, 23236, 23238, 23294
Shepherd's Center of Chesterfield	Human Service	n/a	Chesterfield and South Richmond
Seniors Helping Seniors	Human Service	As needed	Richmond and eastern Henrico
Senior Express Enterprise	Human Service	Mon – Fri 7 a.m. to 6 p.m.	Greater Richmond area
Senior Connections	Human Service	n/a	Charles City, Chesterfield, Goochland, Hanover, Henrico, New Kent, Powhatan, and Richmond
Save Our Seniors	Human Service	n/a	Richmond area
Ride Rite	Human Service	Self-pay or Medicaid transportation through Logisticare	Statewide
Presbyterian Homes and Family Services and the Family Alliance Ways to Work	Human Service	As needed	Richmond, Chesterfield, and Henrico
New Freedom Transportation, LLC	Human Service	As needed	Richmond area
NeckRide.org	Public Transit	As needed	Richmond
Mobility Transportation, LLC	Human Service	Mon – Fri 6 a.m. to 6 p.m. and Sat 6 a.m. to 1 p.m.	Chesterfield, Henrico, and Richmond
Middle Peninsula Rideshare	Public Transit	n/a	Richmond

Source: Virginia Department of Rail and Public Transportation. (2019). *Coordinated Human Service Mobility Plan.* http://www.drpt.virginia.gov/media/2980/2019-final-chsm-plan-2019-12- 1.pdf

APPENDIX D

Ranked Scoring Process Instructions

The following images show the step by step process that went into the scoring of the region based on the following data points: disability, age 65 and up, poverty, minority, households with no car, and individuals (age 16 and up) utilizing public transportation. Both total population and percent population data was collected for all 240 census tracts in the Richmond region. The following figures display the steps taken to determine both total population and percent population scores:

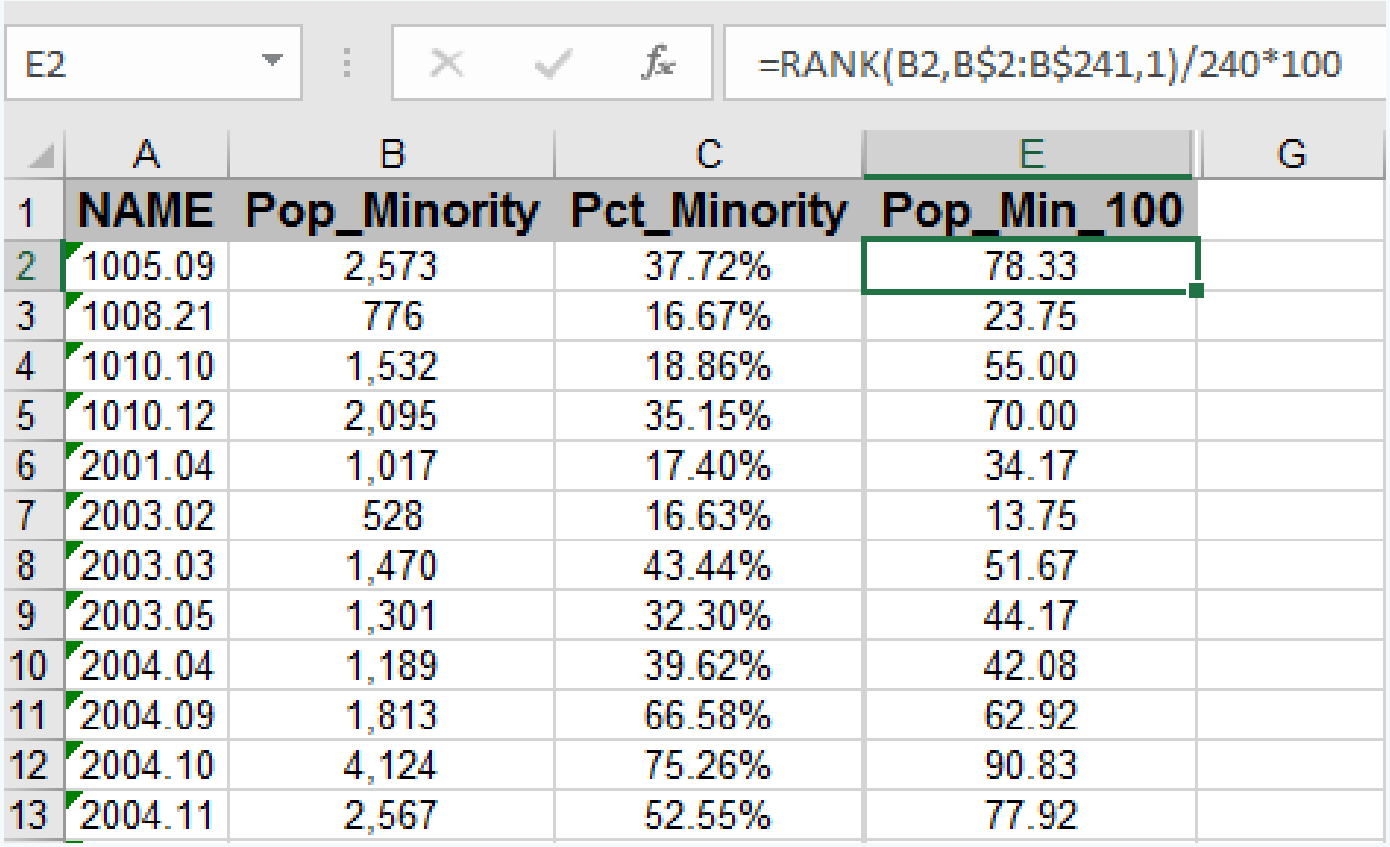
Figure D1. Step One of Scoring Process: Data Organization

Figure D1 displays a snapshot of the first step of the regional scoring process, which includes taking all data collected and organizing it into one spreadsheet.

	A	B	C	D	E	F	G	H
1	**TRACT**	**Jurisdiction**	**Pop_Minori**	**P_Minority**	**Pop_Povert**	**P_Poverty**	**Pop_Disabl**	**P_Disable**
2	102	Richmond City	1319	31.80%	328	8.15%	522	12.97%
3	103	Richmond City	1520	91.24%	625	37.52%	299	18.09%
4	104.01	Richmond City	1228	41.57%	423	14.51%	399	13.53%
5	104.02	Richmond City	1560	43.50%	538	16.91%	407	11.67%
6	105	Richmond City	1337	84.89%	137	8.70%	401	25.46%
7	106	Richmond City	1707	75.66%	298	13.58%	358	16.35%
8	107	Richmond City	2293	94.05%	423	17.35%	602	24.72%
9	108	Richmond City	3833	93.99%	1263	31.03%	981	24.18%
10	109	Richmond City	2998	92.65%	850	26.46%	758	23.42%
11	110	Richmond City	1754	83.29%	601	28.82%	571	27.19%
12	111	Richmond City	2368	75.37%	670	27.32%	487	15.55%
13	201	Richmond City	2067	99.23%	1299	62.36%	435	20.88%

Figure D2. Step Two of Scoring Process: Individual Ranked Scoring for Total Population Data

Figure D2 displays step two of the regional scoring process which included calculating ranked scores for each data point (listed above). As Figure D2 shows, first the calculation =RANK(B2,B$2:B$241,1)/240*100 ranks the data with 1 being the lowest total population and 240 being the highest total population. Additionally, every ranking is then divided by 240 (total number of census tracts) and multipled by 100 to ensure the results are reveled on a 100% scale. This makes it easier for readers to comprehend compared to displaying all 240.



	A	B	C	E	G
1	NAME	Pop_Minority	Pct_Minority	Pop_Min_100	
2	1005.09	2,573	37.72%	78.33	
3	1008.21	776	16.67%	23.75	
4	1010.10	1,532	18.86%	55.00	
5	1010.12	2,095	35.15%	70.00	
6	2001.04	1,017	17.40%	34.17	
7	2003.02	528	16.63%	13.75	
8	2003.03	1,470	43.44%	51.67	
9	2003.05	1,301	32.30%	44.17	
10	2004.04	1,189	39.62%	42.08	
11	2004.09	1,813	66.58%	62.92	
12	2004.10	4,124	75.26%	90.83	
13	2004.11	2,567	52.55%	77.92	

Figure D3. Step Three of Scoring Process: Individual Ranked Scoring for Percent Population Data

Figure D3 displays step three of the regional scoring process which included calculating ranked scores for each data point (listed above). As Figure D3 shows, first the calculation =RANK(B2,B$2:B$241,1)/240*100 ranks the data with 1 being the lowest percent population and 240 being the highest percent population. Additionally, every ranking is then divided by 240 (total number of census tracts) and multipled by 100 to ensure the results are reveled on a 100% scale. This makes it easier for readers to comprehend compared to displaying all 240.

F2 =RANK(C2,C$2:C$241,1)/240*100

	A	B	C	F	G
1	**NAME**	**Pop_Minority**	**Pct_Minority**	**Pct_Min_100**	
2	1005.09	2,573	37.72%	51.67	
3	1008.21	776	16.67%	19.58	
4	1010.10	1,532	18.86%	25.00	
5	1010.12	2,095	35.15%	47.50	
6	2001.04	1,017	17.40%	22.08	
7	2003.02	528	16.63%	18.75	
8	2003.03	1,470	43.44%	57.92	
9	2003.05	1,301	32.30%	44.17	
10	2004.04	1,189	39.62%	53.75	
11	2004.09	1,813	66.58%	76.25	
12	2004.10	4,124	75.26%	82.08	
13	2004.11	2,567	52.55%	65.83	

Figure D4. Step Four of Scoring Process: Calculating Overall Scores by Census Tract for Total Population

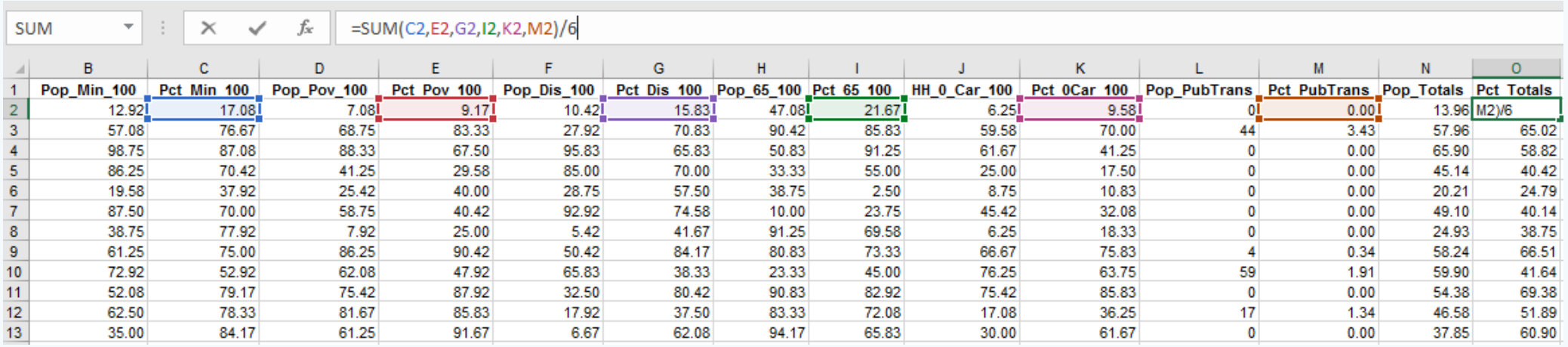
Figure D4 displays the fourth step of the regional scoring process, which includes calculating each census tract's overall score. The overall score consists of adding all six data points (disability, age 65 and up, poverty, minority, households no car, and individuals utilizing public transportation) scores and dividing that by the total number of data points (six). This step is completed across all 240 census tracts in the region.

SUM =SUM(B2,D2,F2,H2,J2,L2)/6

	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Pop_Min_100	Pct_Min_100	Pop_Pov_100	Pct_Pov_100	Pop_Dis_100	Pct_Dis_100	Pop_65_100	Pct_65_100	HH_0_Car_100	Pct_0Car_100	Pop_PubTrans	Pct_PubTrans	Pop_Totals
2	12.92	17.08	7.08	9.17	10.42	15.83	47.08	21.67	6.25	9.58	0	0.00	6
3	57.08	76.67	68.75	83.33	27.92	70.83	90.42	85.83	59.58	70.00	44	3.43	57.96
4	98.75	87.08	88.33	67.50	95.83	65.83	50.83	91.25	61.67	41.25	0	0.00	65.90
5	86.25	70.42	41.25	29.58	85.00	70.00	33.33	55.00	25.00	17.50	0	0.00	45.14
6	19.58	37.92	25.42	40.00	28.75	57.50	38.75	2.50	8.75	10.83	0	0.00	20.21
7	87.50	70.00	58.75	40.42	92.92	74.58	10.00	23.75	45.42	32.08	0	0.00	49.10
8	38.75	77.92	7.92	25.00	5.42	41.67	91.25	69.58	6.25	18.33	0	0.00	24.93
9	61.25	75.00	86.25	90.42	50.42	84.17	80.83	73.33	66.67	75.83	4	0.34	58.24
10	72.92	52.92	62.08	47.92	65.83	38.33	23.33	45.00	76.25	63.75	59	1.91	59.90
11	52.08	79.17	75.42	87.92	32.50	80.42	90.83	82.92	75.42	85.83	0	0.00	54.38
12	62.50	78.33	81.67	85.83	17.92	37.50	83.33	72.08	17.08	36.25	17	1.34	46.58
13	35.00	84.17	61.25	91.67	6.67	62.08	94.17	65.83	30.00	61.67	0	0.00	37.85

Figure D5. Step Five of Scoring Process: Calculating Overall Scores by Census Tract for Percent Population

Figure D5 displays the fifth step of the regional scoring process, which includes calculating each census tract's overall score. The overall score consists of adding all six data points (disability, age 65 and up, poverty, minority, households no car, and individuals utilizing public transportation) scores and dividing that by the total number of data points (six). This step is completed across all 240 census tracts in the region.



	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Pop_Min_100	Pct_Min_100	Pop_Pov_100	Pct_Pov_100	Pop_Dis_100	Pct_Dis_100	Pop_65_100	Pct_65_100	HH_0_Car_100	Pct_0Car_100	Pop_PubTrans	Pct_PubTrans	Pop_Totals	Pct_Totals
2	12.92	17.08	7.08	9.17	10.42	15.83	47.08	21.67	6.25	9.58	0	0.00	13.96	M2)/6
3	57.08	76.67	68.75	83.33	27.92	70.83	90.42	85.83	59.58	70.00	44	3.43	57.96	65.02
4	98.75	87.08	88.33	67.50	95.83	65.83	50.83	91.25	61.67	41.25	0	0.00	65.90	58.82
5	86.25	70.42	41.25	29.58	85.00	70.00	33.33	55.00	25.00	17.50	0	0.00	45.14	40.42
6	19.58	37.92	25.42	40.00	28.75	57.50	38.75	2.50	8.75	10.83	0	0.00	20.21	24.79
7	87.50	70.00	58.75	40.42	92.92	74.58	10.00	23.75	45.42	32.08	0	0.00	49.10	40.14
8	38.75	77.92	7.92	25.00	5.42	41.67	91.25	69.58	6.25	18.33	0	0.00	24.93	38.75
9	61.25	75.00	86.25	90.42	50.42	84.17	80.83	73.33	66.67	75.83	4	0.34	58.24	66.51
10	72.92	52.92	62.08	47.92	65.83	38.33	23.33	45.00	76.25	63.75	59	1.91	59.90	41.64
11	52.08	79.17	75.42	87.92	32.50	80.42	90.83	82.92	75.42	85.83	0	0.00	54.38	69.38
12	62.50	78.33	81.67	85.83	17.92	37.50	83.33	72.08	17.08	36.25	17	1.34	46.58	51.89
13	35.00	84.17	61.25	91.67	6.67	62.08	94.17	65.83	30.00	61.67	0	0.00	37.85	60.90

Figure D6. Step Six of Scoring Process: Ordering Scoring Results Largest to Smallest

The sixth and final step of the regional scoring process is to order scoring for both total and percent population results from largest to smallest. The figure displays only the total population ordering as a reference, but the same approach was taken for the percent population results. For the purposes of this plan, those census tracts with the highest scores (100) are deemed a high need area. A high need area encompasses those census tracts with a high concentration of the six determined criteria and needs further examination of potential First Mile Last Mile barriers that impact accessibility.

	B	O
1	TRACT NAME	Pop_Totals
2	202	93.19
3	607	90.35
4	301	87.85
5	204	87.71
6	608	86.74
7	610	86.25
8	604	86.25
9	2008.05	86.18
10	108	86.18
11	706.01	86.11

APPENDIX E

First Mile Last Mile Infrastructure Inventory Checklist

Stop Area	Location			Route				Stop #			
	Is there a firm stable surface (i.e., concrete, asphalt, brick, stone)?									Yes	No
	If not, please rate the condition of the surface:						Very Poor	Poor	Fair	Good	Excellent
							1	2	3	4	5
	Is the area wide enough (i.e., 8 ft. x 5 ft)?									Yes	No
	Rate the area based on it being clear of obstructions:						Very Poor	Poor	Fair	Good	Excellent
							1	2	3	4	5
	Rate the accessibility of the connecting sidewalk or path:						Very Poor	Poor	Fair	Good	Excellent
							1	2	3	4	5
	Where is the stop located?								Far-Side	Mid-Block	Near-Side
Signage	Is there a bus stop sign?									Yes	No
	Is the signage located directly at the or adjacent to the landing area?									Yes	No
	Rate the signage based on it legibility:						Very Poor	Poor	Fair	Good	Excellent
							1	2	3	4	5
	Is there a tactile (braille) route plaque or information holder?									Yes	No
Shelter	Is there a bus shelter?									Yes	No
	Is there seating inside or nearby?									Yes	No
	Rate the accessibility for wheelchair users:						Very Poor	Poor	Fair	Good	Excellent
							1	2	3	4	5
Benches	Is there a bench at the bus stop?									Yes	No
	Are they located at the back of the sidewalk?									Yes	No
	Rate the accessibility of benches leading up to the bus stop:						Very Poor	Poor	Fair	Good	Excellent
							1	2	3	4	5
	Are they located at the back of the sidewalk?									Yes	No
Lighting	Rate the lighting at/or around the bust stop:						Very Poor	Poor	Fair	Good	Excellent
							1	2	3	4	5
	Rate the lighting leading up to the bus stop:						Very Poor	Poor	Fair	Good	Excellent
							1	2	3	4	5

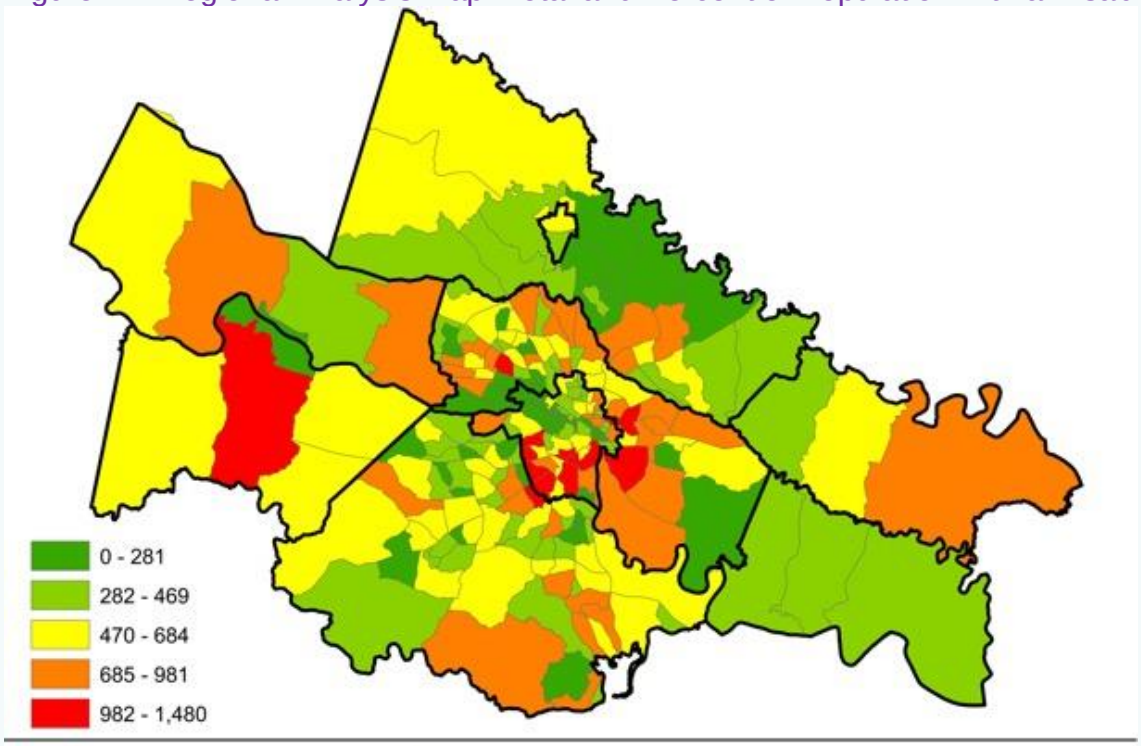
Sidewalks	Is there a sidewalk or path at the bus stop?				Yes	No
	Is there a sidewalk or path leading up to the bus stop?				Yes	No
	Is the sidewalk wide enough (min. of 3 feet)?				Yes	No
	Rate accessibility based on it being clear of obstructions:	Very Poor	Poor	Fair	Good	Excellent
		1	2	3	4	5
	If the stop is near a cross walk, is there a sidewalk connecting the intersection and stop?				Yes	No
	Is the sidewalk system connected?				Yes	No
	If YES, is it properly maintained?				Yes	No
Crosswalks	Is there a crosswalk at an intersection nearby?				Yes	No
	If YES, rate its visibility (i.e., painted stripes, colors):	Very Poor	Poor	Fair	Good	Excellent
		1	2	3	4	5
	Is there a crossing signal?				Yes	No
	Is the crossing signal visual?					
	Is the crossing signal audible?				Yes	No
	Is there a ADA accessible curb ramp?				Yes	No
	If YES, is there a tactile landing?				Yes	No

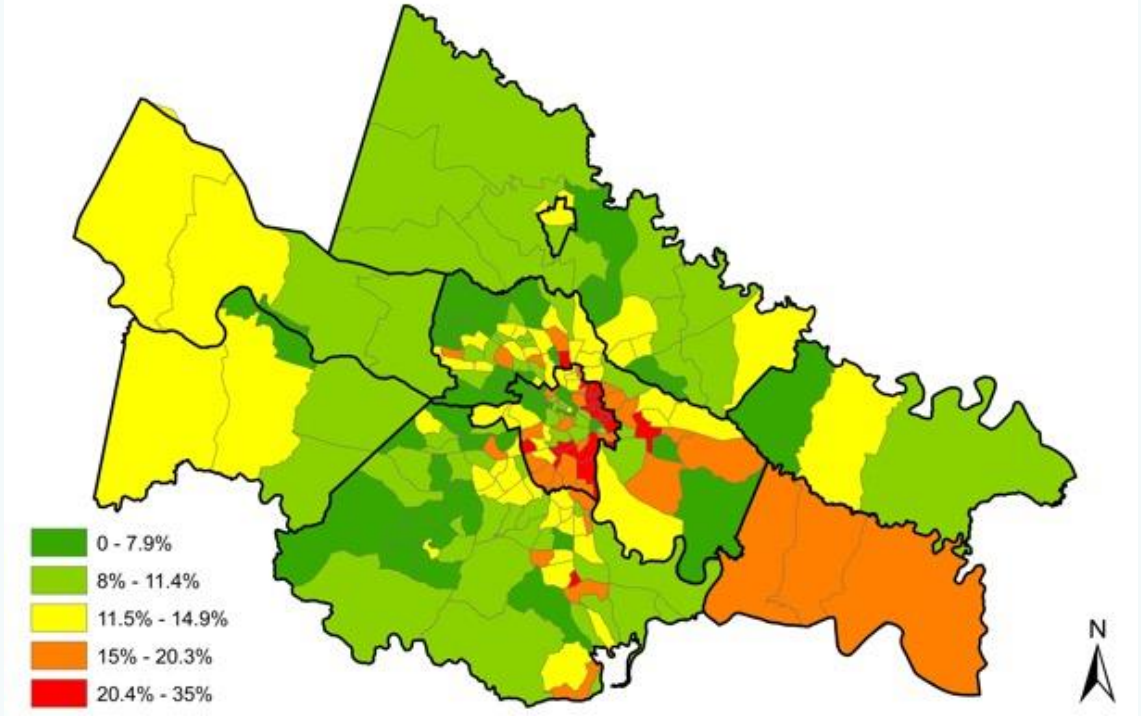
Source: Upper Valley Lake Sunapee Regional Planning Commission. (n.d.). *Bus Stop ADA Guidelines.* https://www.uvlsrpc.org/files/4215/4775/9655/SCT_ADA_Bus_Stop_Guidelines.pdf

APPENDIX F

The following figures displayed in Appendix F include maps of the results from the regional scoring process. Maps are color coordination with red representing the highest and green the lowest.

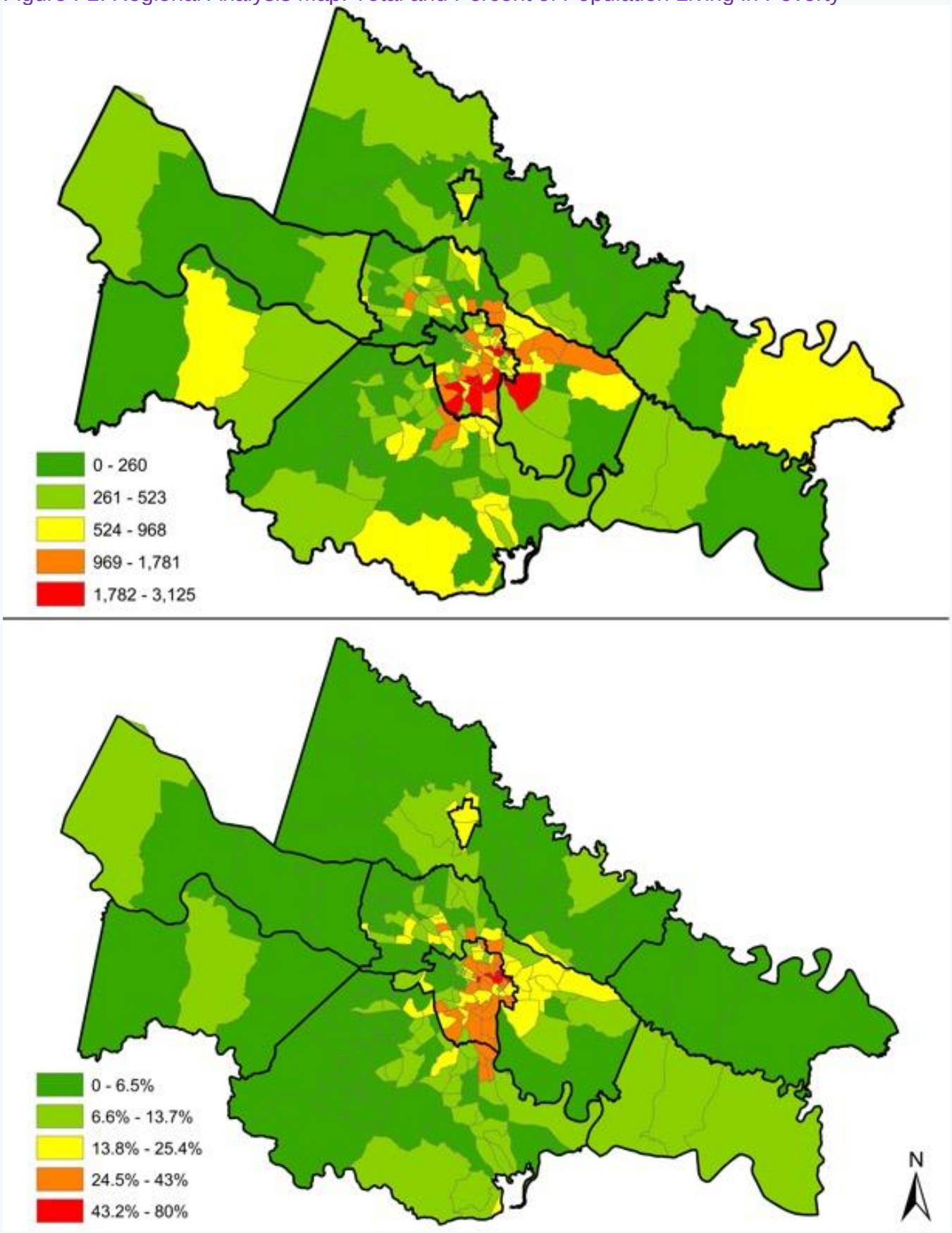
Figure F1. Regional Analysis Map: Total and Percent of Population with a Disability





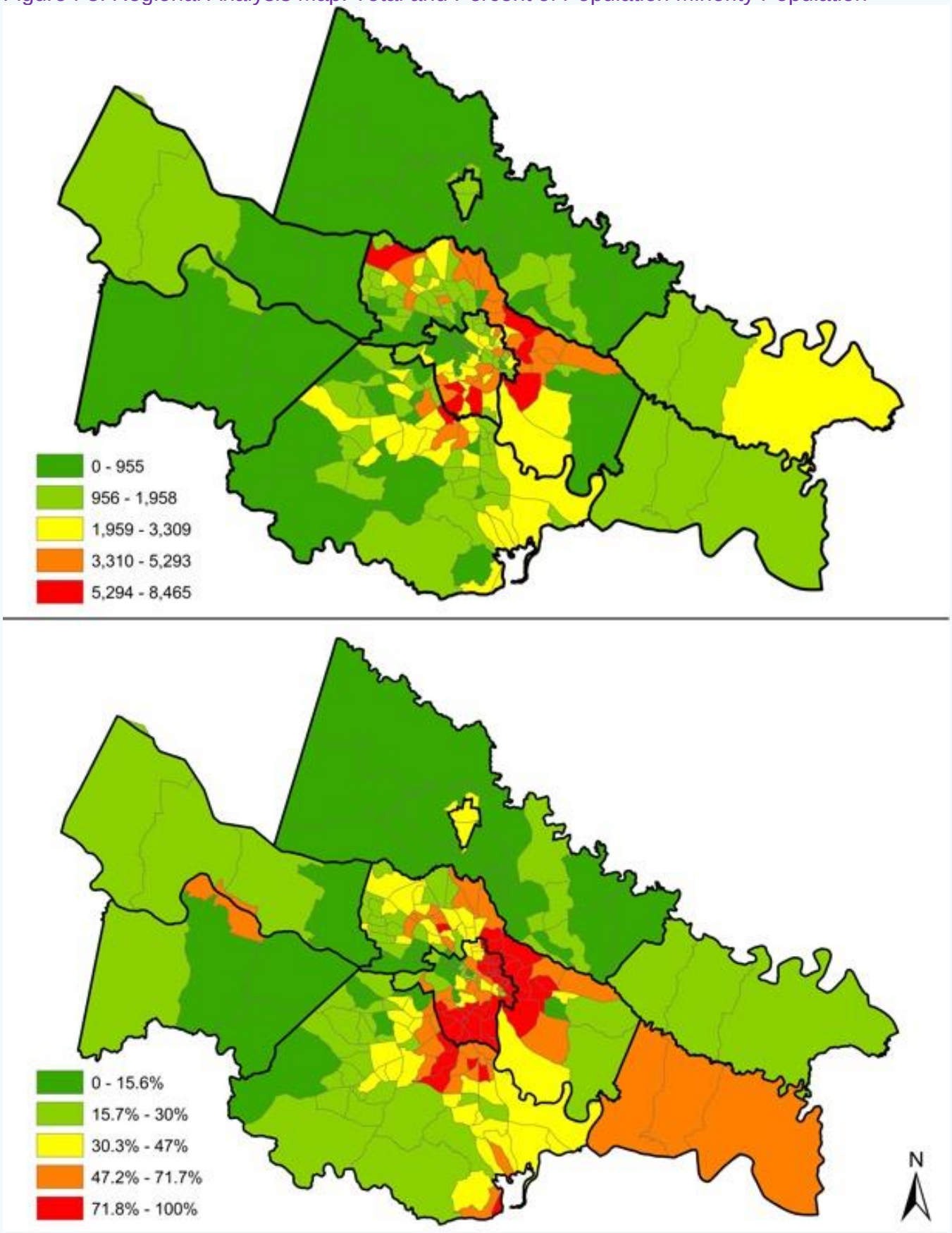
Source: ACS 2017 5-Year Estimates

Figure F2. Regional Analysis Map: Total and Percent of Population Living in Poverty



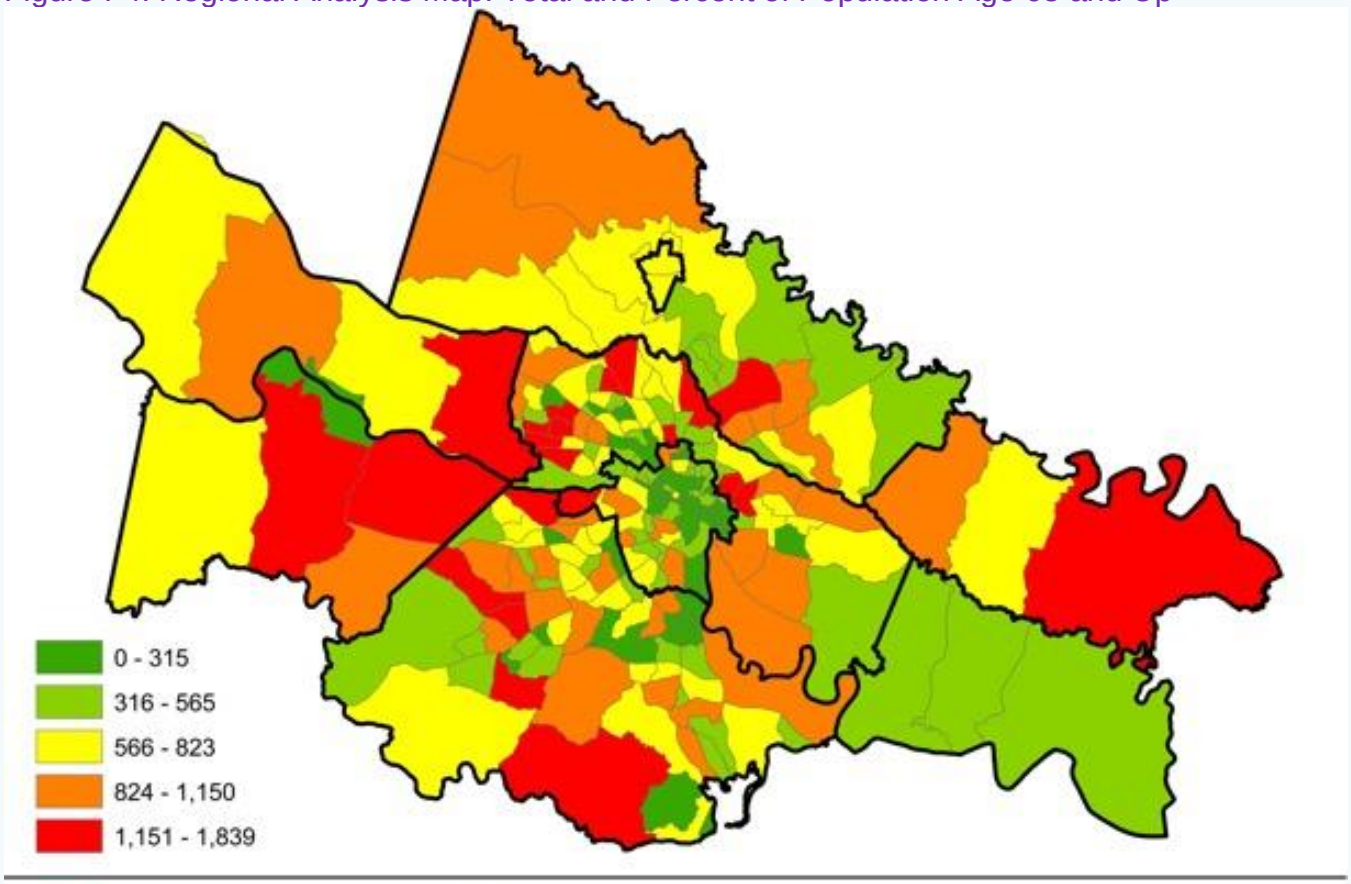
Source: ACS 2017 5-Year Estimates

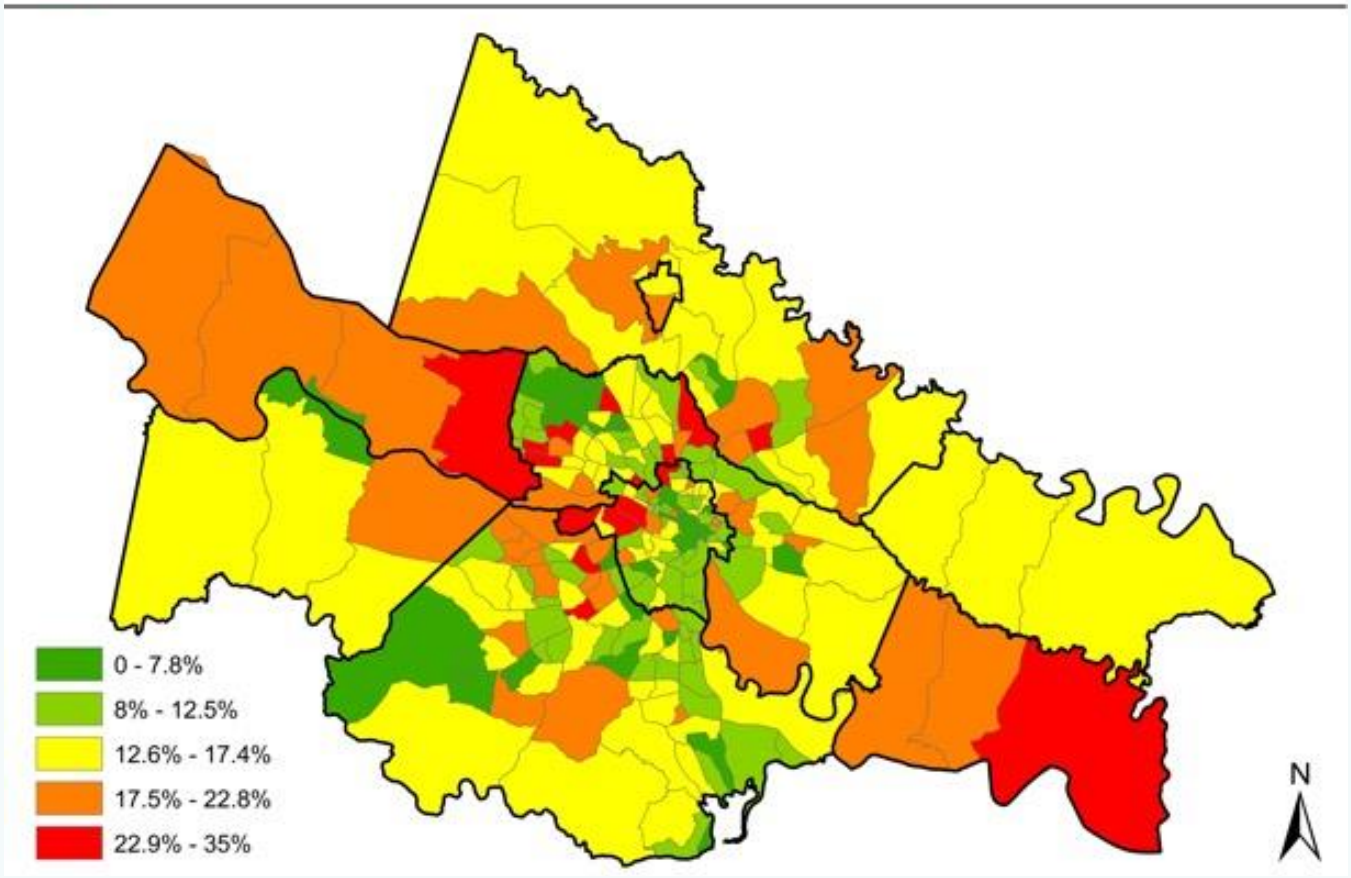
Figure F3. Regional Analysis Map: Total and Percent of Population Minority Population



Source: ACS 2017 5-Year Estimates

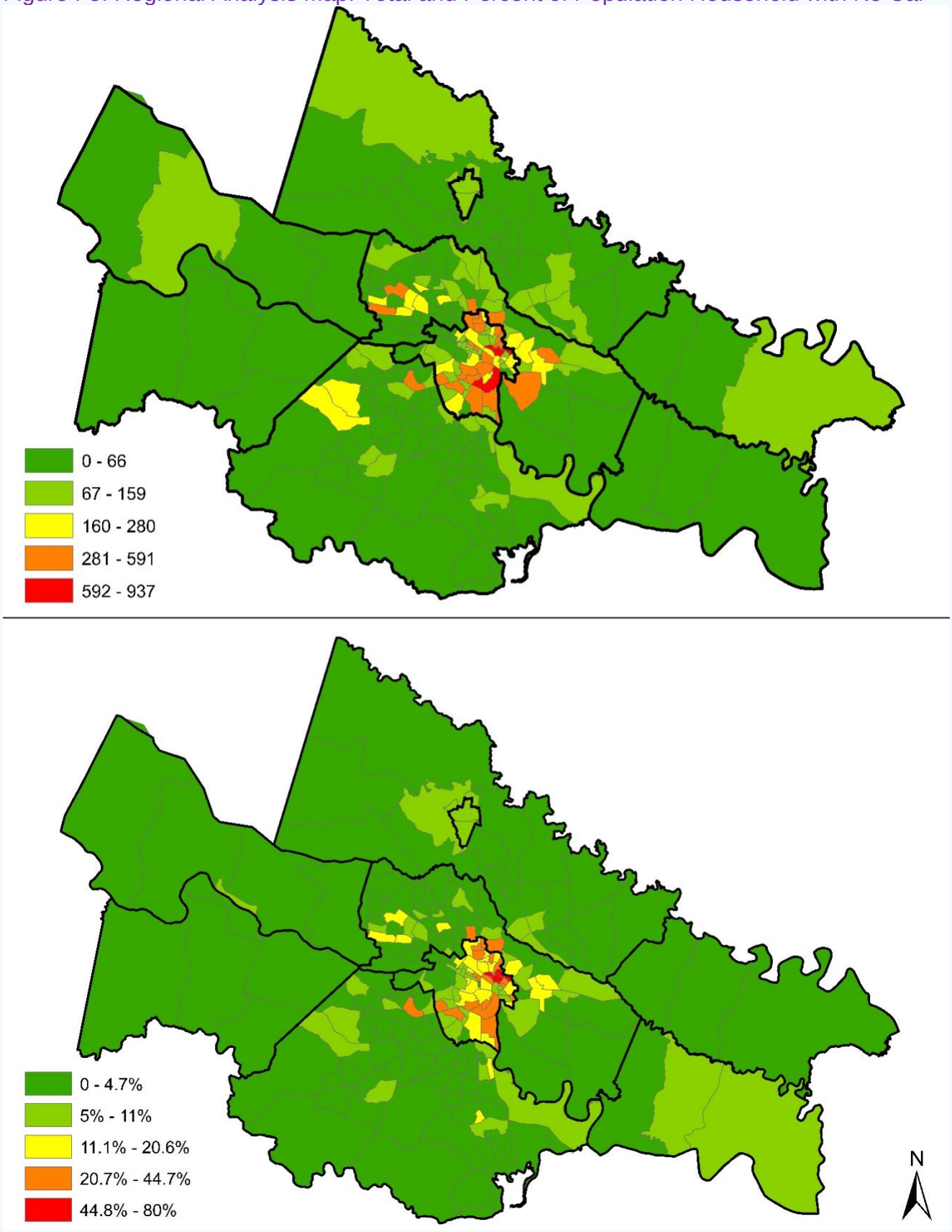
Figure F4. Regional Analysis Map: Total and Percent of Population Age 65 and Up





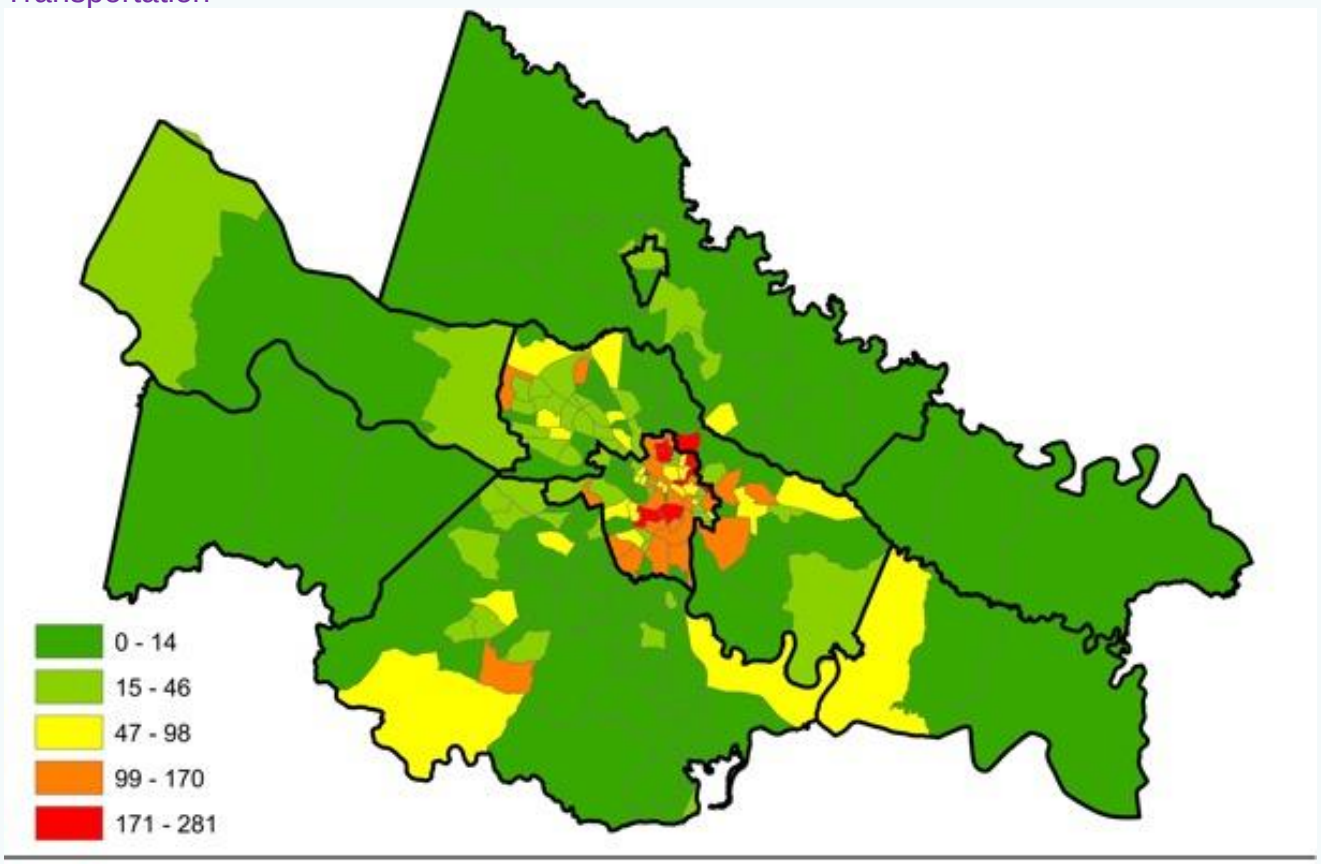
Source: ACS 2017 5-Year Estimates

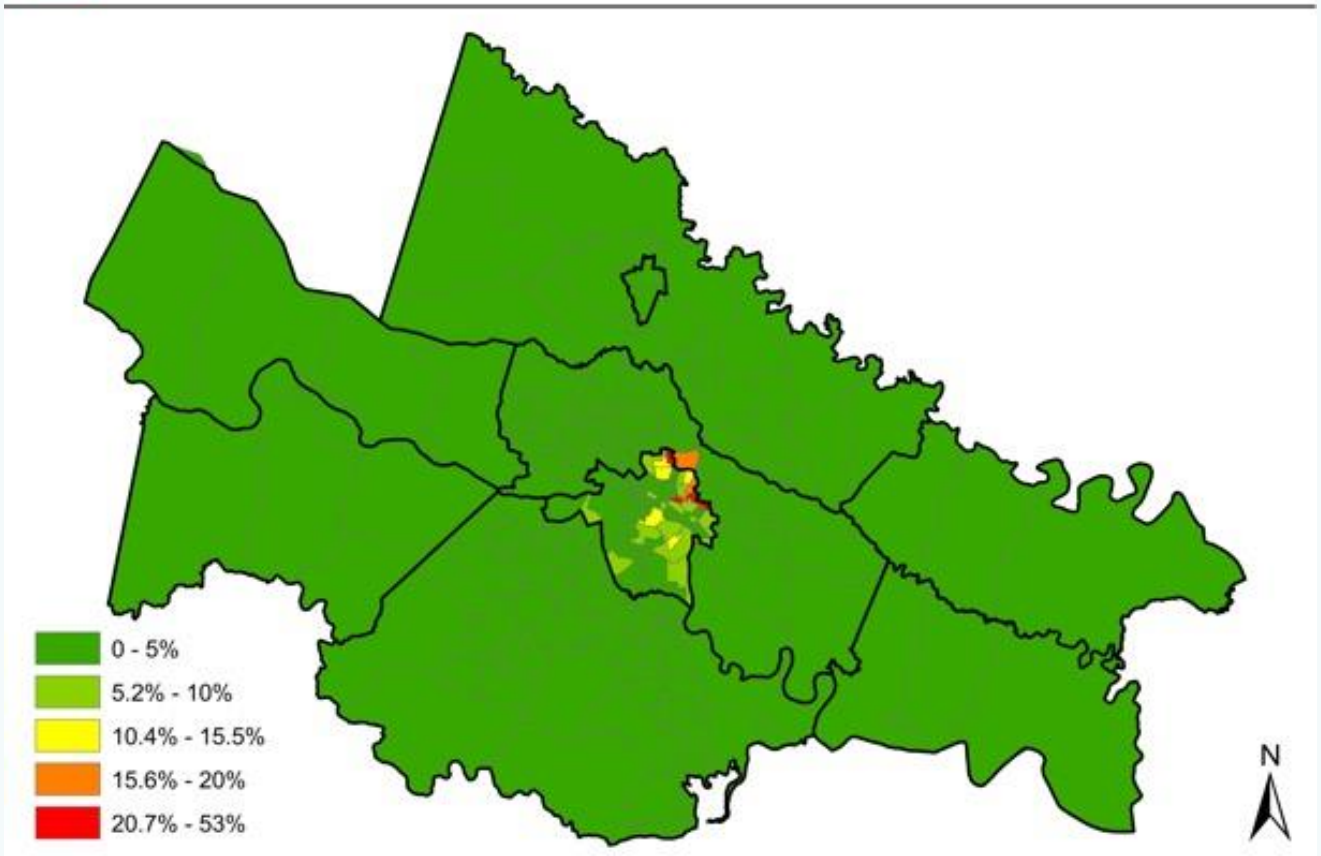
Figure F5. Regional Analysis Map: Total and Percent of Population Household with No Car



Source: ACS 2017 5-Year Estimates

Figure F6. Regional Analysis Map: Total and Percent of Population Utilizing Public Transportation



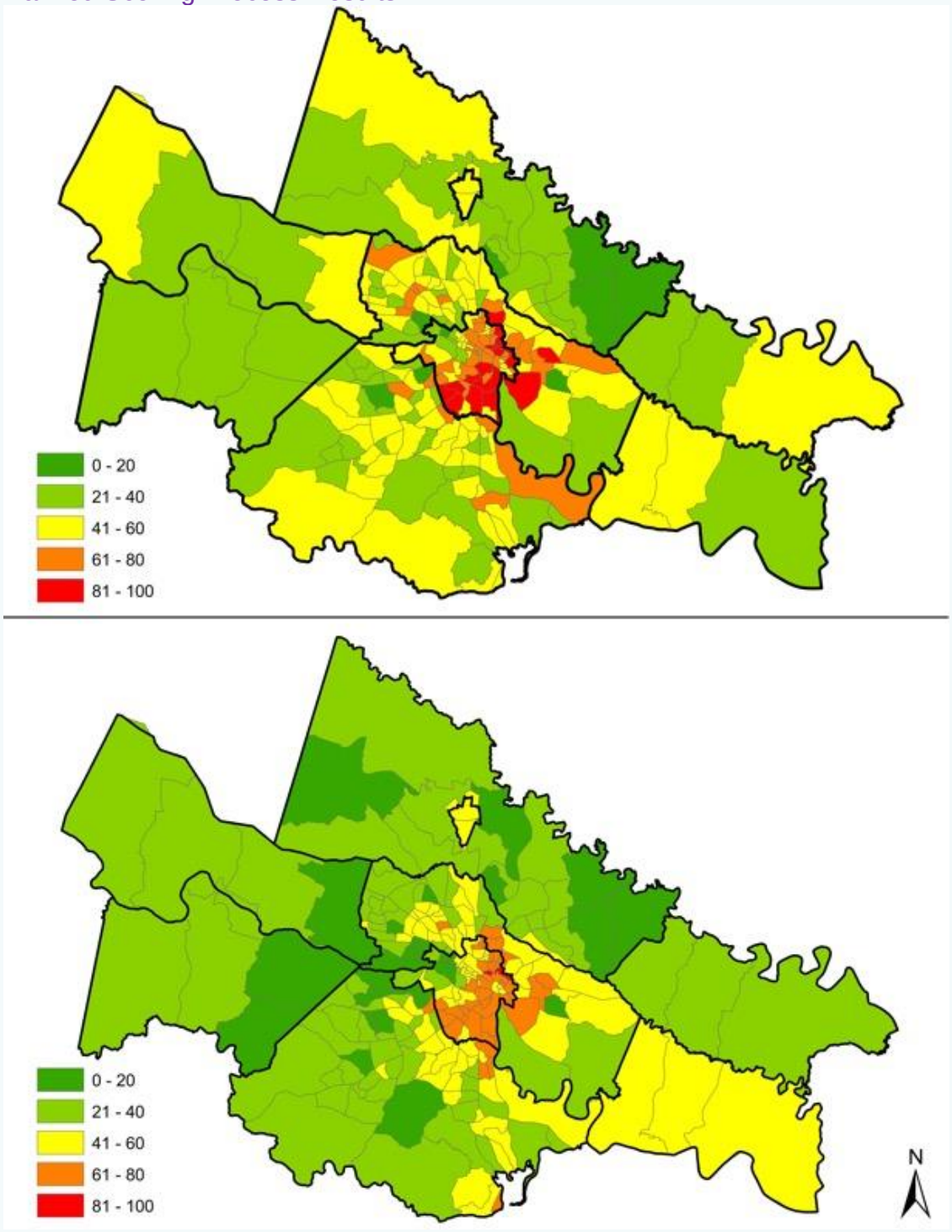


Source: ACS 2017 5-Year Estimates

APPENDIX G

The following figure displays the ranked scoring process results for the Richmond region. The top map represents the total population scores and the bottom represents the percent population scores, with 0 being the lowest score and 100 being the highest score.

Ranked Scoring Process Results



Source: ACS 2017 5-Year Estimates

APPENDIX H

Table H1. First Mile Last Mile Infrastructure Inventory Findings – Stop Area

Stop #		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Stop Area	Is there a firm stable surface (i.e., concrete, asphalt, brick, stone)?	Yes	No	Yes	N/A	No	Yes	Yes	No	Yes	No	No	No	Yes	Yes	No	N/A	No	No
	Rate the condition of the surface.	Good	Poor	Fair	N/A	Poor	Good	Good	Poor	Excellent	Very Poor	Very Poor	Very Poor	Fair	Good	Poor	N/A	Very Poor	Very Poor
	Is the area wide enough (i.e., 8 ft. x 5 ft)?	Yes	No	No	N/A	No	No	No	No	Yes	No	Yes	No	Yes	No	No	N/A	No	No
	Rate the area based on it being clear of permanent obstructions.	Good	Very Poor	Good	N/A	Good	Poor	Fair	Good	Good	Good	Good	Good	Good	Fair	Poor	N/A	Very Poor	Good
	Rate the accessibility of the connecting sidewalk or path.	Good	Good	Fair	N/A	Excellent	Good	Excellent	Good	Good	Poor	Good	Poor	Good	Good	Fair	N/A	Poor	Fair
	Where is the stop located?	Near-side	Far-side	N/A	N/A	N/A	Far-side	Far-side	N/A	Near-side	N/A	Near-side	N/A	Near-side	Mid-Block	Near-side	N/A	N/A	Far-side

Note: Not all data was accessible and “N/A” reflects this

Table H2. First Mile Last Mile Infrastructure Inventory Findings – Signage

Stop #		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Signage	Is there a bus stop sign?	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes
	Is the signage located directly at the or adjacent to the landing area?	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes
	Rate the signage based on it legibility.	Excellent	Excellent	Excellent	N/A	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	N/A	Excellent	Excellent
	Is there a tactile (braille) route plaque or information holder?	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes

Table H3. First Mile Last Mile Infrastructure Inventory Findings – Shelter and Benches

	Stop #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Shelter	Is there a bus shelter?	No	No	No	N/A	No	No	No	No	Yes	No	Yes	No	No	No	No	N/A	No	No
	Is there seating inside or nearby?	N/A	Yes	N/A	N/A	N/A	N/A	N/A	N/A	Yes	N/A	Yes	N/A	Yes	N/A	N/A	N/A	N/A	N/A
	Rate the accessibility for wheelchair users:	N/A	Very Poor	N/A	N/A	N/A	N/A	N/A	N/A	Poor	N/A	Very Poor	N/A	Good	N/A	N/A	N/A	N/A	N/A
Benches	Is there a bench at the bus stop?	Yes	Yes	No	N/A	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	No	N/A	Yes	No
	Are they located at the back of the sidewalk?	Yes	Yes	N/A	N/A	N/A	Yes	No	N/A	No	N/A	Yes	N/A	Yes	Yes	N/A	N/A	No	N/A
	Rate the accessibility of benches leading up to the bus stop.	Very Poor	Very Poor	Very Poor	N/A	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor	Very Poor	N/A	Very Poor	Very Poor
	Are they located at the back of the sidewalk?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table H4. First Mile Last Mile Infrastructure Inventory Findings – Lighting

	Stop #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Lighting	Rate the lighting at/or around the bust stop.	Very Poor	Poor	Good	N/A	Poor	Fair	Good	Poor	Good	Very Poor	Very Poor	Fair	Poor	Poor	Very Poor	N/A	Poor	Very Poor
	Rate the lighting leading up to the bus stop.	Very Poor	Poor	Poor	N/A	Poor	Fair	Good	Poor	Good	Very Poor	Very Poor	Fair	Poor	Poor	Poor	N/A	Poor	Poor

Table H5. First Mile Last Mile Infrastructure Inventory Findings – Sidewalks

	Stop #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Sidewalks	Is there a sidewalk or path at the bus stop?	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes
	Is there a sidewalk or path leading up to the bus stop?	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes
	Is the sidewalk wide enough (min. of 3 feet)?	No	No	No	N/A	No	No	Yes	No	Yes	Unsure	Yes	No	Yes	No	No	N/A	No	No
	Rate accessibility based on it being clear of obstructions.	Good	Good	Good	N/A	Good	Poor	Good	Good	Good	Good	Good	Fair	Good	Fair	Fair	N/A	Poor	Good
	If the stop is near a cross walk, is there a sidewalk connecting the intersection and stop?	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	N/A	Yes	Yes
	Is the sidewalk system connected?	Yes	Yes	No	N/A	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	N/A	No	Yes
	Are sidewalks properly maintained?	No	No	No	N/A	No	No	Yes	Yes	Yes	No	No	Yes	No	No	No	N/A	No	No

Table H6. First Mile Last Mile Infrastructure Inventory Findings – Crosswalks

	Stop #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Crosswalks	Is there a designated crosswalk at an intersection nearby?	Yes	No	Yes	N/A	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes
	Rate the visibility of the crosswalk (i.e., painted stripes, colors).	Good	N/A	Good	N/A	N/A	N/A	Fair	N/A	Fair	Fair	Very Poor	Fair	Poor	Fair	Fair	N/A	Fair	Poor
	Does the crosswalk have a crossing signal?	Yes	N/A	Yes	N/A	N/A	N/A	Yes	N/A	Yes	Yes	No	No	No	Yes	Yes	N/A	Yes	Yes
	Is the crossing signal visual?	Yes	N/A	Yes	N/A	N/A	N/A	Yes	N/A	Yes	Yes	N/A	N/A	N/A	Yes	Yes	N/A	Yes	Yes
	Do all crosswalks and intersections have ADA accessible curb ramps?	No	No	No	N/A	No	No	No	No	No	No	No	No	No	No	No	N/A	No	No
	Do all curb ramps have tactile landings?	No	No	No	N/A	No	No	No	No	No	No	No	No	No	No	No	N/A	No	No