Portland's 20-Minute Neighborhoods after Ten Years: How a Planning Initiative Impacted Accessibility

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Abstract

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The city of Portland, Oregon set a goal for ninety percent of its residents to live within a twenty-minute neighborhood in 2009. This goal was a part of a broader effort to reduce greenhouse gas emissions and mitigate climate change. This study aimed to find how much of this goal was accomplished over a decade. A twenty-minute neighborhood is a neighborhood which is walkable and has access to several services. Eight built environmental variables are selected: access to grocery stores, convenience stores, parks, elementary schools, frequent transit stops, retail stores, sidewalks, and the street connectivity. Accessibility was calculated by creating walksheds and density clusters. The variables were measured in 2020 and compared to a 2010 baseline. The comparison showed that Portland became more accessible due to an increase in transit service, retail, convenience stores and sidewalks. However, these changes did not lower vehicle miles traveled within the city. More efforts need to be done to reduce car use now that Portland is more accessible for travel without a car.

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Introduction

In 2009, the city of Portland, Oregon initiated a plan called "20-Minute Neighborhoods." The goal of this project was to prepare for expected city growth while reducing climate-harming emissions. The underlying principle was that residents could walk, bike, or take transit to essential services and destinations if they were accessible by a short commute.

As part of the "20-Minute Neighborhoods" plan, Portland city staff conducted an existing conditions report. In 2009, they created a map showing areas of Portland which were already considered accessible. This thesis uses municipal data and similar methods to determine the differences made in the decade since the city started this effort.

"20-Minute Neighborhoods" and similar schemes such as the 15-minute city follow a century-long tradition of planning cities that are accessible by walking. In the 1920s, Clarence Perry championed the neighborhood as the ideal planning unit. This would ensure community between residents of a neighborhood (Perry 1929). Another of Perry's ideas was that public school buildings should be used as community centers outside of school hours. This was published in a 1920 pamphlet entitled "First Steps in Community Center Development." This idea was appropriated as an "innovation" of 15-minute cities.

At the same time Perry was publishing his ideas, Le Corbusier created his vision of a sectioned city that prioritized movement by car between zones (Herbert 2003, 199). In the decades that followed, car-centered cities were being built throughout the American countryside. During the latter part of the twentieth century, new cities and suburbs were built mainly for one mode of transportation, the automobile.

In the 1990s, an alternative design was outlined by the Congress of New Urbanism. New Urbanism favors cities that are mixed-use, dense, and with a range of housing types (Garde 2020). New Urbanism uses the benchmark of a five-minute walk for nodes of commercial activity. The ideal neighborhood has shops and schools within the community allowing for a pedestrian-friendly city. This helps to build a sense of community (Herbert 2003, 195).

The City of Portland, following these ideas of New Urbanism and to reduce car dependency, then launched the "20-Minutes Neighborhoods" plan, as part of an initiative to make the city accessible without a car for 90% of its residents. In its 2009 report, the city of Portland defined a 20-minute neighborhood as having three characteristics. The characteristics are that a neighborhood has "a walkable environment, destinations that support arrange of daily needs and residential density" (City of Portland 2009). The destinations include schools, parks, and grocery stores. Portland residents living in a 20-minute neighborhood help achieve a reduction in harmful emissions According to the City's Climate Action Plan, 90% of Portland residents should live in a 20-minute neighborhood to help achieve climate goals. This 90% benchmark has become the goal for the city to achieve success in making Portland accessible with 20-minute neighborhoods.

No further 20-minute neighborhood planning initiatives took place until the end of the 2010s when Melbourne, Australia started a pilot program to create three 20-minute neighborhoods within its metropolitan area. The Melbourne pilot was explicitly modeled on Portland's plan (Creating a More Liveable Melbourne, 22). Around that time, Professor Carlos Moreno started speaking about the 15-Minute City, a plan to transform cities (Moreno 2020). The plan received international attention when Anne Hidalgo used the plan in her platform when she ran for re-election for mayor of Paris in 2020. The election promise was for neighborhoods

throughout Paris to have daily needs within walking and biking distance. Journalists started writing about the 15-minute city as a transformational change that could come to American cities. Groups such as C40, the global group of cities with a mission to fight climate change, announced the 15-minute city as a goal for its member cities to achieve.

Plans and visions are inspirational, but how well do they affect change in cities? Portland started its plan to increase accessibility within the city through 20-minute neighborhoods more than ten years ago. Did the plans that Portland made improve accessibility in the city?

Literature Review

Walkability and livability are principles that provide the framework to improve cities. Walkability has been a focus of planners and urban scholars since the early twentieth century. Only in the 2000s has livability become a popular focus. The Portland "20-Minute Neighborhood" encompasses both ideas. The 15-Minute City, a more recent planning concept, is also modeled on the ideals of livability and walkability. This, along with its name, suggests that it was influenced by Portland's plan. Walkability and livability are terms whose definition changes depending on the context and the people using them. Even for planners these words have varying definitions. In this section we present several researchers' and practitioners' definitions of livability and walkability.

Livability

Livability, as used by urban planners, is without a specific definition. There is no clear understanding of what the term "livable" means (Congress for the New Urbanism 2019). The aim of initiatives such as New Urbanism and the 15-Minute city is to make cities more "livable." An organization in San Francisco called Livable City mentions five factors that make a city

"livable." The five are complete streets that make streets safe and public spaces attractive and safe for biking and walking, a citywide greenway network, parking reform and improved transit, affordable housing, and highlighting the arts. Yet this is not a definition of livability.

Though the term "livable" regarding the built environment originated in the 1950s, it became popular in 1999 after the promulgation of the Livability Agenda by the Clinton/Gore Administration. The Livability Agenda was an initiative to provide money to preserve green/open spaces, ease traffic congestion by encouraging alternatives to car driving, and develop regional growth strategies (Clinton White House 1999).

In addition, AARP has provided guidance for creating livable communities since 2000. Their website explains that a livable community is "accessible without a car, has enjoyable outdoor spaces, and access to healthy food." A livable community is also "safe and allows residents to participate in activities." AARP's Livability Index includes scoring transportation, housing, and environment. (AARP n.d.).

In 2009, the United States Department of Housing and Urban Development (HUD) collaborated to form the Partnership for Sustainable Communities (PSC) (Hermann and Lewis 2017). Six principles to measure livability were developed and were used by other organizations and municipalities. These six principles were to provide more transportation choices; promote equitable, affordable housing; enhance economic competitiveness; support existing communities; coordinate and leverage investment; and value communities and neighborhoods.

To investigate how these principles were put into action, Hermann and Lewis conducted a literature review to see how the term "livable" was used by cities regarding their built environment. They found that livability was mostly used to refer to "transportation…

development and community features" (2017, 10). In addition, in a report for the National Association of Regional Councils, Young and Hermanson surveyed a variety of journal articles. They found that the term "livability" was used mostly regarding "transportation, quality, and community" (2013, 5). More specifically, they found ten topics that were used as factors for livability. They are "urban planning; cities and towns; policy; housing; urban growth; transportation; social; quality of life; community development; and sustainable development" (5). They also found that livability and sustainability were sometimes used interchangeably. Livability focuses on human experience within the built environment while sustainability focused on goals. There is overlap because complete streets, walkability, and transportation options fulfill both livability and sustainability measures.

While there is not a clear definition of "livability" in an academic sense there are specific features of livability. Both government and non-government entities expect livability to include the ability to live without access to a private vehicle. Livable areas are walkable, mixed-use, have access to healthy food; opportunities for participation with community; and open spaces including parks.

Walkability

Though walkability connotes the ability of community residents to walk to destinations, there is no consensus as to the definition of walkability. One example is provided by Pivo, who defined walkability "as the degree to which an area within walking distance of a property encourages walking trips from the property to other destinations" (Pivo 186). As an alternative to an explicit definition, there have been attempts to identify characteristics of walkable areas.

Studies have been conducted to characterize walkability. Vernez-Moudon et al. (2006) found that areas where destinations were close together, where sidewalks were present, and where blocks were smaller were associated with more walking (Vernez-Moudon 2006, S110). The threshold of residential density in walkable areas was about 15 dwelling units per acre. People walked more where average block sizes were 6.8 acres. This is equal to a block that is less than 500 square feet, when removing street area (S111). Vernez-Moudon's study identified 56,000 linear feet of sidewalks on major roads within a 1 km buffer (about 0.6 miles) to be the threshold for walkability. If considering all streets within 1 kilometer, the threshold would be 200,000 linear feet of sidewalks.

Vernez-Moudon et al. (2006) also found that the presence of grocery stores, restaurants, and banks were important indicators of walkability. They noted that drug stores and coffee shops are probably also an indicator, but these establishments were not included in their analysis. Surprisingly, the study found that parks, open spaces, and trails were not an indicator of walkable neighborhoods. Additionally, schools and community centers were not found to be indicators of a neighborhood's walkability (Vernez-Moudon 2006, S112). This study found that food (retail and restaurants) are the biggest indicators of neighborhood walkability. Therefore, the lack of retail food outlets near residents is the biggest issue limiting walkability.

In addition, the benefits of walkability have been studied. For instance, Nieuwenhuijsen and Khreis (2016) studied how car-free neighborhoods can be healthier for residents through a reduction in local pollutants. They recommended the conversion of space previously reserved for cars to be used as green spaces in cities. This would have a double benefit of reducing car use and the expansion of open space for the neighborhood. Although their paper is about

neighborhoods which restrict cars, their research can be used for any streets or places that restrict private cars.

Pfeiffer et al. (2020) conducted a survey in Phoenix, AZ, and found that people living in areas that were objectively more walkable had a higher life satisfaction. Though people's satisfaction was high the researchers were not able to conclude in what ways walkable neighborhoods increased life satisfaction. Pfeiffer et al. (2020) also found that residents' perception of park access affected their life satisfaction more than actual park access. Since perceptions have a larger impact on life satisfaction it is important for wayfinding systems to advertise how close amenities in a neighborhood are.

Achieving a walkable environment is a multidisciplinary endeavor. According to Hutabarat Lo (2009), this involves architects who design landscaping and other types of visual interest. It involves city government officials who create policies. Most of all it involves urban planners who provide direction about universal access, continuous and well-maintained sidewalks, path directness and street network connectivity, the safety of at-grade crossings, absence of heavy and high-speed traffic, pedestrian separation or buffering from traffic, land-use density, and land-use diversity.

When these measures are implemented, they increase walking and make walking more enjoyable. All the factors must be implemented. For instance, a street that has brand new sidewalks, a diversity of destinations, nice trees, and benches, but is along a six-lane road is not going to see many pedestrians. To make a truly walkable neighborhood people need a completely walkable neighborhood.

15-Minute City

As the 15-minute city concept became more popular there was a need to define it. The 15-minute city started as an academic concept, as opposed to the 20-minute neighborhood which was created by city staff. This meant that it had to be understood as a general concept and not just applicable to a specific city's plans. Professor Moreno and others published a paper in 2021 to outline, define and explain the components of a 15-minute city and why each is important.

Under Professor Moreno's vision of a 15-minute city, there are seven services and amenities included. These are grocery stores, schools, parks, medical clinics, offices, entertainment, and community spaces/centers (Moreno 2020). However, different cities have not included all seven. Entertainment and office space are usually left out and sometimes community spaces. This leaves the four essential ones that all cities have including parks, grocery stores, medical clinics, and schools. In other places, six basic functions of life are outlined as necessary to be available in a 15-minute city. These are living, working, commerce, healthcare, education, and entertainment (Moreno et al. 2021). These are from a paper that Moreno published with others, to explain the 15-minute city five years after he first introduced the idea and to suggest a progression of the concept. There are also four requisite "dimensions" to be used while implementing a 15-minute city. They are density (people per square mile/km), proximity, diversity (both mixed land uses and people/culture), and digitalization (Moreno et al. 2021). It is also essential in Moreno's vision that the 15-minute radius is specifically for walking or biking because this allows for social interaction and participation. Each of the six life functions needs the four dimensions to make them sustainable and equitable in a modern city.

Shelter is the first life function that takes place in a 15-minute city. There is a requirement of a minimum housing density for there to be enough people within the service areas

of the other services and for there to be a high level of social interaction. Digitalization of the housing market is important to allow renters or homebuyers to have equal access to housing. Diversity of housing stock would help increase the diversity of income levels in the neighborhood allowing service workers and higher-income earners to live in the same neighborhood they work in.

The next function in a 15-minute city is working. This is another aspect of Moreno's model which doesn't appear in other cities' plans. However, it might be the most important. The inclusion of work within the neighborhoods is important for equity and social integration. For the working function, it is important to note the diversity aspect of it, having diverse opportunities from white-collar jobs to service jobs and even artistic opportunities is essential for a diverse and vibrant neighborhood.

Commerce is a function of 15-minute cities that fits closely into other initiatives cities have taken such as transit-oriented development and other versions of the 15-minute city. On a basic level commerce includes grocery stores and other retail establishments that people require in their day-to-day lives. In the United States, most of the functions might be in a single supermarket. With an increase in residential density, there is more room for small business owners such as flower shops, bakeries, and hardware stores to exist on their own.

Healthcare is essential for equitable access to essential services. In the United States, this might be hard for a municipality to build out. For a city that is serious about implementing a complete 15-minute city, they can work together with a community provider, providing real estate or other grants to help offset the costs of operating a facility. This category is broad and open to interpretation but at a minimum should include an urgent care clinic. For full coverage, a city can include other healthcare providers to also be located within 15 minutes of residents.

Again, to have this kind of proximity there is required a high density of people living within the service area of these clinics to ensure they can operate successfully. Another aspect of healthcare is pharmacies. Currently, in the US there are areas without access to pharmacies because companies refuse to locate them in lower-income areas (Kingson 2021) An important aspect of implementing a 15-minute city will be to incentivize private companies to locate where the city wants or for the city to build its own facilities.

Education is perhaps the most interesting of services in a 15-minute city, at least in America. It is the only of the six services which are primarily provided by the government. This category is very general and can include elementary, middle, or high schools in addition to libraries, colleges, universities, and other educational institutions. In Seattle, elementary schools serve the smallest number of students per school and are the type of school with the most facilities. With a change in residential density, which would make it affordable for families to live throughout the city, there is potential for a realignment of public schools which allow a school district to have facilities within a 15-minute walk of all residents. This would have far-reaching implications; with schools within walking distance emissions from buses and parents driving their children would drop. An investment in schools and libraries in every community would allow every resident to have access to the most important and most appreciated service that the local government provides. This infrastructure has the potential to fulfill the most important function of Moreno's vision, facilities that have multiple uses throughout the day. School playgrounds can be open to the public after school hours and buildings can be used by community groups.

Lastly, entertainment facilities and opportunities such as community theaters being available within walking distance of all residents overcomes an essential barrier to access.

Proximity on its own does not make entertainment opportunities accessible. However, ensuring that all residents live close to entertainment options makes it easier for them to access recreational opportunities. This service is the one most likely to be dropped from cities' plans because it is not seen as essential by some. If a city is serious about making space for social interactions between neighbors, then entertainment should be a focus of their plans to make a 15-minute city.

There are six essential functions of a city according to Professor Moreno and the presence of all of them within a neighborhood makes it complete. They are housing, work, commerce, education, healthcare, and entertainment. Each of these functions needs to have four dimensions to them. Proximity is the most essential one for a 15-minute city, as well as density, diversity, and digitalization. Having all these six functions in all four dimensions allows residents to enjoy the full benefits of an urban lifestyle.

Portland Climate Action Plans

In 2009 the City of Portland and Multnomah County adopted a Climate Action Plan. The purpose of the plan was to continue efforts to reduce regional carbon emissions (7). This plan was created to respond to a 2007 resolution that called for a reduction in local emissions to 80 percent of 1990 levels by 2050 (9). To help achieve the goals of the 2007 resolution the Climate Action Plan adopted an interim goal to reduce emissions to 40 percent of 1990 levels by 2030 (16).

The plan identifies three other issues that are connected to climate change: "social inequity, rising energy prices, and degraded natural systems" (8). The objectives outlined in the plan were specifically seeking to attain the interim goal by 2030. One of the goals of the plan to

holistically address these issues is to “create vibrant neighborhoods where 90 percent of Portland residents and 80 percent of Multnomah County residents can easily walk or bicycle to meet all basic daily, non-work needs and have safe pedestrian or bicycle access to transit.” (10). The plan goes into detail to describe how this objective will be met by creating 20-minute neighborhoods (39).

Specific destinations are outlined to be included as part of 20-minute neighborhoods. They include grocery stores, restaurants, pubs, drug stores, corner stores, laundromats, transit stops, parks, and schools (40). The plan details that proximity to these destinations should be measured in increments of ¼ mile, ½ mile, and 1 mile. These measurements were to be specifically measured along the street network. Additional factors that contribute to walkability such as sidewalks, intersection density, and steep slopes are also noted. One of the actions related to this objective is to include 20-minute neighborhoods in the Portland Plan.

The 2015 update of the Climate Action Plan includes many of the same objectives as the 2009 plan. The plan still has an objective for eighty percent of Multnomah residents to live in neighborhoods where they can meet their daily needs by walking or biking (21). An update to the 20-minute neighborhood map which is now called complete neighborhoods shows that 60% of Portland residents live in a complete neighborhood. The neighborhoods with the least access are concentrated in the eastern neighborhoods. There are also low levels of accessibility in the southwest part of the city (20). This update of the plan focuses on the fact that lower-income residents have been pushed to the eastern neighborhoods due to housing affordability. The plan notes that these neighborhoods are also less accessible. Frequent transit and sidewalks are specifically noted to be missing from these neighborhoods (47,48). The plan calls for a stable funding source to build sidewalks instead of relying on gas taxes which are insufficient to meet

street maintenance needs (73). The plan notes that the city created a five-year funding plan in 2012 to expand active transportation projects in East Portland. The 2015 Climate Action Plan closely follows the 2009 plan. The plan has new actions to be completed over five years (by 2020). Multiple actions specify new funding sources are needed for active transportation infrastructure and transit improvements (78).

Portland Plan

The Portland Plan was adopted in 2012 with a focus on "prosperity, education, health, and equity (3). Equity was envisioned as being a goal that is present in each of the three strategies. The plan is a strategic one that resembles a comprehensive plan. The plan outlines both short-term and long-term goals to achieve a vision for the year 2035. The plan differs from a typical municipal comprehensive plan in that it is the plan for a partnership of more than 25 "municipal regional and community organizations" (iii). The Portland Plan was created to find a people focused vision for the upcoming comprehensive plan. The plan begins with a focus on enriching the lives of current and future residents as opposed to municipal infrastructure and systems.

One of three strategies included in the Portland Plan is "Healthy Connected City" (27). The goal of this strategy is to create safe and complete neighborhood centers. This goal aims to improve residents' health and the health of the natural environment. In step with the Climate Action Plan, the Portland Plan calls for the creation of complete neighborhoods. The complete neighborhood is broader than the 20-minute neighborhood in the Climate Action Plan. A complete neighborhood includes "a variety of housing options…commercial services, quality public schools, public open spaces, affordable active transportation options, and civic amenities." (76).

The Healthy Connected City has 11 objectives to be completed by 2035. The objective related to complete neighborhoods sets a goal of eighty percent of residents living in a complete neighborhood. There is also an objective for "ninety percent of Portlanders to live within a half-mile" of stores that sell affordable groceries. Another one of the objectives calls for all Portland residents to live within a half-mile safe walking distance of parks (77).

There seem to be slight differences between the complete neighborhoods in the Portland Plan and the 20-minute neighborhoods in the Climate Action Plan. However, in the section of the Portland Plan which addresses how to measure the success of the complete neighborhoods, the criteria are all from the 20-minute neighborhood measures.

To reach the goal of eighty percent of Portlanders living in a 20-minute neighborhood the plan suggests four actions: 1) increase housing in areas that already have high access to services, 2) support economic development, 3) increase services and transit to areas with low accessibility, 4) ensure that grocery stores stay in business and attract new grocery stores to neighborhoods without access to one. (130).

Portland's Comprehensive Plan 2035

The 2035 Comprehensive Plan, adopted in 2020, extends the 2012 Portland Plan, the Climate Action Plan, and Portland's 1980 Comprehensive Plan. The 2035 Comprehensive Plan links land use and transportation decisions to make Portland a walkable, bikeable, and transit-friendly city. The Plan seeks to achieve compact development, with active employment centers, expanded housing choice, and access to parks and open space. These goals are to be achieved in 2035.

The Comprehensive Plan has five guiding principles. They are Economic Prosperity, Human Health, Environmental Health, Equity, and Resilience. Many of the principles are similar or the same as those involved in 20-minute neighborhoods or complete neighborhoods. One of them is "human health" which seeks to minimize negative health impacts and improve Portlanders' ability to lead healthy lives (I-15). The goals of 20-minute neighborhoods or complete neighborhoods are spread through most sections of the comprehensive plan.

In the comprehensive plan chapter titled "Urban Form," there are goals and policies to create "complete healthy connected communities" (GP3-1). Several goals in this chapter support focusing growth in central areas and corridors connecting them. The purpose of this focused growth is to support the vision of 20-minute neighborhoods (GP3-7). The purpose of guiding the urban form of Portland is because the form of the built environment affects the walkability of communities. Urban design also impacts the places for children and adults to gather and play. This chapter is explicitly serving the goal of creating a city where "80 percent [of Portlanders] live in complete neighborhoods by 2035" (GP3-2). The comprehensive plan envisions central areas which act as the anchor for complete neighborhoods. These differ in scale from Central City (downtown) to neighborhood centers. These central areas have frequent transit service, are pedestrian-oriented, include commercial and community services, provide public spaces such as parks, and allow for dense housing (GP3-14). This chapter also addresses the needs of the Eastern Neighborhoods which were only annexed to the city after 1980. These neighborhoods were built post-WWII and are less dense than the rest of the city with fewer commercial uses (GP3-27). The urban form chapter responds to the call for complete neighborhoods in Portland with goals and policies which will increase access to services and goods for most residents of the city by 2035.

The Design and Development chapter suggests four policies to expand Portlanders' access to healthy food. They include strategies to retain and develop stores that sell fresh produce in addition to encouraging corner stores to sell fresh produce. (GP4-16). The Housing chapter sets a goal for new housing to be in complete neighborhoods. This includes strategies such as expanding zoning to allow for greater densities of housing in areas that are already accessible. Several policies are complementary to policies in the previous chapters such as increasing the walkability around new housing and concentrating housing near central areas that have access to transit and services (GP5-6).

The Economic Development chapter focuses on broad economic strategies as well as specific policies to support neighborhood business districts. These policies seek to encourage commercial uses in the neighborhood and town centers. The policies also focus on encouraging small cheaper commercial spaces to allow for a broad range of businesses (GP6-18).

The Public Facilities and Services chapter sets policies to expand trail systems which expand walkability throughout the city (GP8-18). The parks section of this chapter calls for the expansion of public parks. Additionally, some policies encourage the addition of recreational options within public parks and the expansion of those facilities to meet community needs (GP8-23). The plan has several policies related to schools that fit within the goals of complete neighborhoods. They are to plan new facilities with the city to ensure they are being built where there is the most need (GP8-25). Allow for community use of school facilities including buildings and recreational amenities. Ensure that safe walking and biking are options for students when deciding where to build facilities and planning the attendance boundaries of each school (GP8-26).

The Transportation chapter is wide-ranging with goals for the entire transportation system. Many of the goals in this chapter address aspects of complete neighborhoods. Several policies encourage the expansion of the pedestrian and cycling network throughout the city. The chapter encourages policies that make transit the preferred mode of travel when walking or biking is not an option (GP9-11). The plan also calls for partnership with transit providers to increase service to neighborhood centers (GP9-12). This chapter also has policies that call for an increase in street connectivity. It especially calls for an increase in bicycle and pedestrian connectivity with a goal of 330 feet between connections to other roadways where feasible (GP9-16). The transportation chapter sets goals and policies to increase the walkability and bikeability of the transportation system. The chapter also sets policies to increase transit access throughout the city with a particular focus on neighborhood centers.

Methods

The purpose of this study is to determine whether the implementation of Portland's 20-minute neighborhood plan made any meaningful changes in accessibility over the 10 years from 2010 to 2020. To determine whether there have been changes, eight variables are assessed. They are transit, sidewalks, grocery stores, convenience and liquor stores, retail stores, intersections (street connectivity), elementary schools, and parks.

The present study closely follows the analysis performed by Portland city staff in 2009. Because the original data from 2009 is unavailable, a new baseline is measured from 2010 data and compared to data from 2020. One major difference is that the city measured slopes as an attribute of walkability while this study does not.

Below is an explanation of each variable in this study. Each section explains what is measured in the analysis, and how the analysis is conducted. This includes the detailed tools and methods used to conduct the analysis.

Transit

Access to transit is measured by transit line stops which should have at least a 15-minute frequency during peak periods. This measure is important because fast, frequent transit allows residents to switch from driving personal vehicles to riding public transit.

Portland's 20-minute neighborhoods initiative was created primarily as an effort to reduce the city's reliance on fossil fuels. The overarching goal of the Climate Action Plan is "to make transit the logical choice for a greater number of trips" (2). This is done by making transit faster, and more reliable which makes it a better substitute for car trips (4). This goal can only be achieved by making transit fast and reliable.

Sidewalks

Sidewalks are city-built infrastructures and are essential for accessibility. Every transit trip starts and ends with walking to a destination. The most accessible and frequent transit system is not complete without sidewalks for riders to use before getting on and after getting off the bus or train. To promote walking accessibility and decrease emissions, sidewalks must be present on every city street.

Sidewalks are measured for each street centerline. Streets with sidewalks on one side of the street or both sides are measured as similarly accessible. Furthermore, the quality of sidewalks was not considered. Sidewalks that do not have accessible curb ramps or are in poor condition are measured the same as truly accessible sidewalks.

Grocery Stores

Grocery stores, classified by the NAICS code 44511, encompass stores that sell "a general line of food, such as canned and frozen foods; fresh fruits and vegetables; and fresh and prepared meats, fish, and poultry" (NAICS Association). Accessibility to these types of foods is important for residents to maintain a healthy diet. Physical access to grocery stores decreases the possibility of food insecurity.

Research has shown that commercially available data, such as NAICS, for food stores vastly overcounts grocery stores. Researchers found that after reclassifying NAICS data in New Jersey that there were 88 supermarkets compared to the 622 that were listed for the NAICS code. Complimentarily, they found 692 convenience stores compared to the 183 that were listed under the NAICS codes (Ohri-Vachaspati et al. 2011).

Food insecurity has long been an issue in the United States. Recently, due to the Covid-19 pandemic rates of food insecurity have rapidly increased (Niles et al. 2020). Food insecurity has many adverse impacts on health including hypertension, mental health challenges, and increased mortality. Food insecurity does not just mean that people cannot afford healthy food. The UN lists physical access to food as one of the four main dimensions of food security (United Nations Food and Agriculture Organization 2008).

Food insecurity is known to cause adverse health. Additionally, some studies show an association between poor diet quality and higher rates of anxiety and other mental health conditions. (Niles et al. 2020).

Physical access to grocery stores does not solve food insecurity on its own. Another cause of food insecurity is the affordability of food. However, with government programs that

subsidize the price of food, locating grocery stores in proximity to residents can help reduce food insecurity. This is especially true for households that do not own a car.

In 2009, people of color were significantly less likely to commute to work by personal car. Non-white respondents to American Community Survey reported carpooling, taking transit, and walking to work at higher rates than white respondents (McKenzie and Rapino 2009).

Households that don't own a car and don't have a grocery store within walking distance are left with two options to access food. One option is to travel long distances on public transit to access food. Alternatively, they can pay for a taxi or other car service to drive to the store. For lower-income households, this can be a significant cost, which drives up the effective cost of food. The second option is to buy food from whichever stores can be found within their neighborhoods. These options include corner stores and fast-food restaurants which don't sell healthy options.

Grocery stores are generally operated by for-profit companies. These companies decide where they will locate their stores based on several factors which estimate profitability. At present, the local government does not have much power to choose where supermarkets or grocery stores will be built. Local government does have the ability to restrict where these stores can be built through the zoning code. Additionally, the municipal government has the option of offering tax credits and development bonuses for building stores in areas of need.

In the 2010s Multnomah County offered grants to local food establishments to sell healthy food. This effort seems to have ended because the program website is unavailable. Articles about the program indicate that grants up to $4,500 were awarded to stores for improvements that would allow them to display and sell fresh healthy food (Curtis 2011). In the

lead-up to the Portland Plan update the city created an existing conditions report about food systems in the city. As part of it, grant and incentives programs from other cities were surveyed. One of the programs offers a ten-year tax incentive to grocery stores to locate in target areas. Another program is a low-interest loan fund for grocery stores that will locate in food deserts (Food Background Report 2009).

Convenience and Liquor Stores

Convenience stores and liquor stores are classified by NAICS codes 44512 and 4453, respectively. Convenience stores are defined as selling a "limited line of goods that generally includes milk, bread, soda, and snacks" (NAICS Association). Portland's analysis combines convenience and liquor stores into a single category. The accuracy of how convenience stores are defined is low compared to more detailed surveys as explained in the grocery store section.

Convenience stores, also called corner stores, bodegas, or delis, generally sell staples such as bread and milk, frozen meals, prepared sandwiches, and snacks. They generally do not sell fresh produce. They also sell products such as soap, toilet paper, and other personal products. They provide an essential service by selling food in stores that have a smaller footprint and are dispersed throughout cities.

Research has shown that convenience stores promote unhealthy eating habits (McKerchar et al. 2020; Baquero et al. 2021). However, they also serve as a local placeholder for areas without close access to grocery stores, and serve an essential function besides selling food. As a personal example, the convenience store across the street from this author's home sold products such as toothbrushes and toothpaste, toilet paper, lightbulbs, screws, cleaning products, and much more. Even with grocery stores within walking distance, the convenience store provided a

service as described in its name. Convenience stores offer convenience in their proximity for emergencies or to help fill the gaps in between grocery store trips.

Alcohol stores contribute to an unhealthy habit for many Americans. Drinking alcohol can lead to many negative outcomes. However, this habit is popular. According to the National Survey on Drug Use and Health, in 2019 more than 50% of Americans reported drinking alcohol in the past month (NIH 2022). Being that there are so many negative effects of alcohol consumption (vehicle crashes, liver disease, and overdoses to name just a few) it is counterintuitive to include alcohol stores as a measure of accessibility. With that said, since alcohol is so popular in the United States access to alcohol stores provide a higher level of accessibility for people who choose to consume alcohol regularly.

Convenience and alcohol stores serve a necessary function for neighborhoods to be complete. However, they are not necessarily more essential than all other types of retail in the next variable. There is much research explored in the next section about the importance of retail destinations to make neighborhoods more accessible.

Similarly, to grocery stores, convenience and liquor stores are opened by private owners. There is not much influence by the government where these businesses are located aside from restricting where they can be in the zoning code.

Retail

Retail stores are classified by seven NAICS codes and cover stores that provide essential products and services. These retail venues include specialty food stores, health and personal care stores such as pharmacies, restaurants, bars, and laundromats.

Taken together these stores and services are used by most people regularly. Some are more essential than others. Pharmacies are essential to living a healthy life for people with health conditions. Laundromats are essential for residents who don't have laundry machines in their homes. While restaurants and bars are not essential for daily living, they do provide a higher quality of life for people who can afford to use them.

Retail stores are largely controlled by private businesses. Therefore, like grocery and convenience stores the government's role in their distribution is mostly limited to the zoning code. A broad way to encourage retail is to allow mixed-use development throughout the city. Mixed-use zoning recognizes that residents need retail and other commercial uses near their homes to increase accessibility. Doing so wouldn't allow the city to be prescriptive about where these essential retail stores should locate. However, it would allow business owners greater flexibility to meet the demand of their customers.

Street Connectivity

Street connectivity is used to measure the level of walkability of an area. For this study street connectivity was measured by the number of intersections within a given area. It is used as a proxy for street connectivity because the number of intersections correlates with walkability. More intersections result in more pathway options to reach a destination. Additionally, the shorter walking distance results in a more convenient trip.

Many indexes are used to measure walkability including street connectivity, land use mix, and residential density (Shashank and Schuurman 2019). Street connectivity can be measured in different ways. In this study, intersections were used as a proxy for street connectivity. Some other methods include restricting intersections that are measured to ones with

three or more legs. A more complex method is to measure the density of sidewalks, transit stops, and intersections (Shashank and Schuurman 2019, 148).

The assumption for using intersections to measure walkability is that more intersections give pedestrians more options for pathways to reach their destination. Additionally, with shorter blocks trip distances become shorter because pedestrians don't have to walk out of their way to reach destinations.

For a well-developed city such as Portland, there is not much opportunity to build new roads to increase the intersection density. However, a method that can be used is to require large developments to include pedestrian and bike pathways. This essentially adds new roads for pedestrians and bicyclists so they don't need to travel out of their way to get around large developments.

Portland is well known for its short blocks downtown. The 200 feet blocks are much shorter than in other American cities where one can expect to see blocks that are 400 feet long if not longer. Outside of downtown, the grid is rectangular with blocks of 200 x 350-600ft (King 2009). The small block sizes contribute to the walkability of downtown Portland. To replicate this feature throughout the rest of the city, Portland can provide development incentives to encourage sidewalks and bike paths to help break up larger blocks.

Elementary Schools

Elementary school students are young and if not walking to school must be driven by a parent or school bus. Besides increasing children's autonomy, having accessible schools can reduce the number of vehicle miles traveled in the city.

Schools can also be used as community centers and public playgrounds outside of school hours. These public institutions can therefore serve as public commons.

Parks

Parks have been the focus of urban reformists since the 19th century. In dense cities where personal open space is not guaranteed, access to public parks is essential for quality of life. Many studies of neighborhood walkability focus on access to parks with varying results. However, all agree that access to public parks and open spaces is essential when living in a city.

Grocery Stores, Convenience Stores, Parks, Schools, Frequent Transit

Grocery stores, convenience stores, parks, schools, and frequent transit were measured by proximity to services. Areas in Portland that were within ¼ mile of these services were given a numerical score of 3. Areas within a half-mile were scored 2, and within one mile were scored 1.

Distances were measured using Network Analyst in ESRI ArcGIS. The Network Analyst tool is used to measure distances along roads. For the analysis to work, the user must upload a street network. The street network for this analysis was obtained from Metro Oregon. For this analysis roads where pedestrians are not permitted to use such as highways and ramps were excluded from the road network. However, local streets were included whether they had sidewalks or not. Then a file with all of the variable locations was input. Distance breaks of 1320, 2640, and 5280 feet were set. These are equal to ¼ mile, ½ mile, and 1 mile.

Using schools as an example, the results were output into a shapefile with different shapes that have the values of each of the distances. The vector shapefiles were then transformed into raster files with cell sizes of 20 square feet. The values were then reclassified. Cells that were within 1,320 feet were reclassified with the value of 3. Cells within 2,640 feet were

reclassified with a value of 2. Cells within 5,280 feet were reclassified with a value of 1. Any areas within the city that had no data because they were further than a mile from the variable were reclassified to a value of 0.

Retail Stores, Sidewalks, Street Connectivity

Retail stores, sidewalks, and street connectivity (intersections) were measured by the number of instances of the variable within a 2,640 square foot (1/2 mile) cell. First, a blank fishnet was created with 2,640 square foot empty cells over the entire area of Portland. The variable points were then joined to the cell they were intersecting. Each cell was given the value of the amount of each variable that was within its borders. The cells were then separated into three classes by using Jenks Natural Breaks. Jenks Natural Breaks splits data into classes that minimize the distances within each group (ArcGIS). Using this method allows the data to be split into naturally occurring classes as opposed to arbitrary classification methods such as quantile, or equal interval.

Variable	Explanation of Variable	Source
Grocery Stores	Selected by the NAICS code 44511	DataAxle/Infogroup. Access provided by UWDC
Convenience Stores	Selected by NAICS codes 44512 and 4453	DataAxle/Infogroup. Access provided by UWDC
Parks	Includes all publicly accessible open spaces.	Metro Oregon
Schools	Includes public elementary schools including schools that have some elementary grades.	Metro Oregon
Transit	Transit stops which provide access to transit lines with at least 15-minute frequencies during peak hours.	Metro Oregon
Retail	Includes health and personal care, restaurants, bars, breweries, laundromats, and bakeries. NAICS codes 4461, 7225, 7224, 8123, 31212, 311811.	DataAxle/Infogroup. Access provided by UWDC
Street Connectivity	Was measured by using intersection points as a proxy.	Metro Oregon
Sidewalks	Measured for each street centerline. Streets with sidewalks on one side and both sides were measured the same.	Metro Oregon

Table 1: Explanation of Variables

Evaluation

Meaningful changes following the implementation of Portland's 20-minute neighborhood were measured using the methods described below. Each component of the complete neighborhood was assessed. The 2010 performance and the 2020 performance were compared.

Calculation of All Components and Comparison

The class breaks were made using the 2010 data. Those breaks were then used for 2020 data so that there would be an equal comparison. The class with the lowest number of points was

given a score of 1. The middle class was given a score of 2. The cells in the class with the most points were given a score of 3. Any cells with no instances of the variable were scored 0.

After each of the variables was in raster form with scores of 0-4, all the variables were added together. This was done using the raster calculator tool in ArcGIS. Cell values ranged from 0 to 24 in both 2010 and 2020. Twenty-four was the highest possible score as there were eight variables with the highest score of 3 for each. The cells were classified into five classes using Jenks Natural Breaks. Since in this analysis areas on the margins of the city and located in the river were included many cells were in the lowest class with a score of 0-4. This class was included in the final analysis map which shows the difference between 2010 and 2020. However, this class of scores was not included when comparing the percent of land area which was in each class of accessibility.

Class Breaks	
Intersections	0, 66, 195, 468 (514)
Retail Stores	0, 12, 65, 190 (198)
Sidewalks	0.001488954, 0.003708338, 0.007163834, 0.007163834 square feet
Final Difference Map	15, 3, 0, -3, -16

Table 2:Class Breaks for Variables not Measured by Distance

The final map was created using the raster calculator tool again. For this map, the cells with 2010 data were subtracted from the cells with 2020 data. This created an output map with raster cells with values between -16 and 15. The classes were again created using Jenks Natural Breaks. However, after creating the classes the middle of the five classes was edited to only include cells with a value of 0 signifying no change in accessibility. It is important to note that cells labeled as no change in accessibility may have had changes in the accessibility of some of

the variables. However, any change that increased accessibility would have been offset by a reduction in the accessibility of another variable.

Totals of Each Variable				
	2010	2020	Change	Percent Change
Grocery Stores	275	261	-14	-5.09%
Convenience Stores	263	371	+108	+41.06%
Retail Stores	3,193	4,165	+972	+30.44%
Public Parks	412	318	-94	-22.82%
Public Elementary Schools	80	92	+12	+15.00%
Frequent Transit Stops	2,005	2,612	+607	+30.27%
Intersections	72,772	73,434	+662	+0.91%
Sidewalk Segments	23,330	28,696	+5,366	+23.00%

Table 3: Number of Instances of Each Variable

Limitations

Unlike the analysis conducted by the city of Portland, this study did not remove parts of the city from the analysis. This is especially noticeable in the industrial parts of the city along the Columbia River. This part of the city includes a large wetland on the western half and the Portland International Airport near the center. Since these areas are large and single-use there is no benefit to making these parts of the city a 20-minute neighborhood. In this study parts of the city that scored as very low accessibility or not accessible at all were removed from the discussion but are included in the maps.

This study measures change in Portland over ten years. However, it does not discuss how or why this change occurred. The data for public elementary schools was obtained from Metro

Oregon. There is a large discrepancy in the number of elementary schools in 2010 and 2020. In 2010 the dataset has 80 public elementary schools. By 2020 that number grew to 92 which is a fifteen percent increase. This is similar to the total population change which was about 11% over the time period. The city of Portland is served by seven school districts. Therefore, decisions about adding schools cannot be determined in the scope of this study.

The number of parks between 2010 and 2020 also saw a significant change which cannot be attributed to infrastructure changes. The 2010 dataset shows 412 parks in Portland while the 2020 one shows only 318. There are other changes visible in the boundaries in some of the bigger parks such as Forest Park. The reason for this disparity over ten years can be attributed to a change in the way Metro Oregon collected data. Starting in 2012 parks data was included in a dataset called Outdoor Recreation and Conservation Areas (ORCA). The change in the way the park data was organized and classified can be why there is such a disparity in the number of parks between 2010 and 2020.

Additionally, the park data does not account for differences in qualities and characteristics of the parks. Neighborhood parks that include children's play areas or other recreational equipment could be more valuable to residents than open fields. Additional features such as lighting and benches make parks have more usability for visitors.

Results

The results show changes in accessibility throughout the city, described in terms of the neighborhoods outlined in Figure 1. Change was both positive and negative throughout the city but only the North Portland Neighborhood Services coalition saw a decrease in accessibility (Table 4). The changes in accessibility were also not spread evenly throughout the city. It is

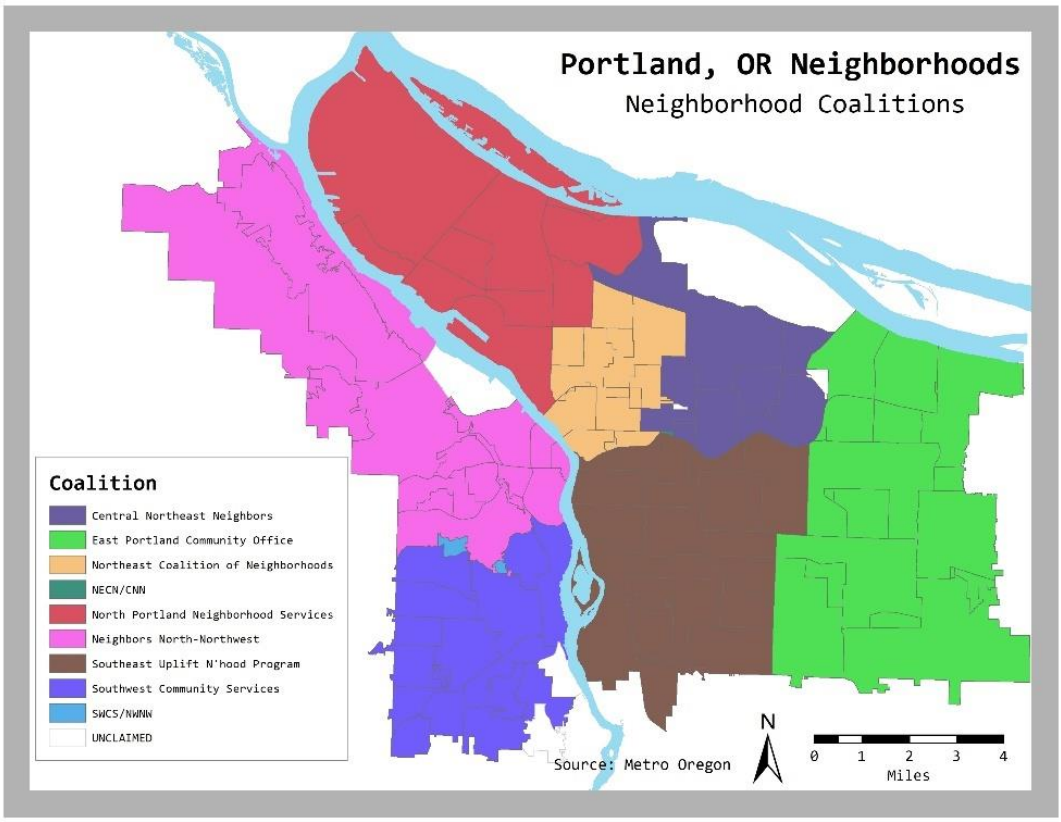

Figure 1:Portland Neighborhood Coalitions

worth mentioning the role of natural areas in calculating accessibility, especially the areas identified in **Error! Reference source not found.**. The map in **Error! Reference source not found.** shows where the changes in accessibility occurred. From a citywide perspective accessibility in Portland grew between 2010 and 2020. The only large concentration of a decrease in accessibility is in Smith and Bybee Wetlands (**Error! Reference source not found.**).

The wetlands are a nature preserve and do not have development. The change in accessibility is probably due to a change in the way data was collected in the two datasets.

Figure 2:Forest Park, Smith and Bybee Wetlands, and PDX

The neighborhoods with the most gains in accessibility are in the northeast, southeast, and western parts of the city, outside of the center. One of the reasons for this change is that TriMet, the public transportation in the Portland region, expanded its frequent bus service in the 2010s. Currently almost the entire service area is within a quarter mile of a frequent transit stop. This is especially notable because large portions of the eastern neighborhoods were not even within a mile of

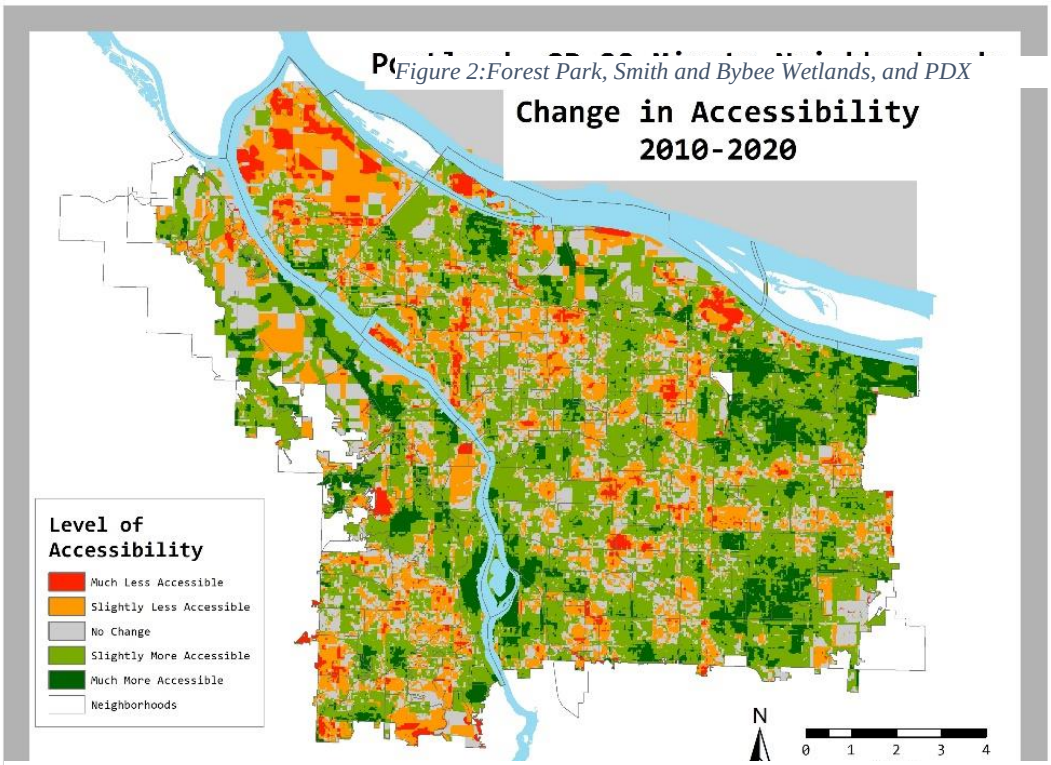

Figure 3:Change in Accessibility 2010-2020

frequent transit stops in 2010. This means that the addition of frequent transit on its own significantly improved accessibility. With a slight improvement in other variables these areas would be in the “much more accessible” class due to a four point accessibiltiy improvement (as seen in Table 6).

Another variable that increased accessibility throughtout the city is the expansion of convenience and liquor stores. The central neighborhoods saw an increase in convenience stores which expanded the area that is within a quarter mile of these stores.

East Portland Community Office Neighborhood Coalition

The eastern neighborhoods of Portland were annexed by the city in the 1980s. These neighborhoods are less dense than the rest of the city (Figure 4 and Figure 5). They also have a lower level of service than orginal parts of the city. This can be seen by the low level of accessibility in these neighborhoods. Block sizes are larger, as would be expected in a suburban area. Sidewalks are underbuilt in this part of the city. Transit service is not as common as it is in the rest of the city, significantly so in 2010. Convenience stores and retail are less prevelant. In genreal, it is clear from the variables measured that the eastern neighborhoods of Portland are

Change in Accessibility by Neighborhood Association			
Neighborhood Association	2010	2020	Change in Accessibility
Central Northeast Neighbors	12.65	13.48	0.84
East Portland Community Office	10.89	12.59	1.82
Northeast Coalition of Neighborhoods	18.64	18.78	0.15
NECN/CNN	20.09	21.27	0.91
North Portland Neighborhoods Services	8.60	8.47	-0.12
Neighbors North-Northwest	6.47	7.05	0.94
Southeast Uplift Neighborhood Program	16.38	17.40	1.00
Southwest Community Services	11.15	11.45	0.49
SWCS/NWNW	6.58	6.69	0.72
Unclaimed	4.03	5.28	1.30

Table 4:Change in Accessibility by Neighborhood Coalition

more suburban than the older parts of Portland. In the decade after 2010 this East Portland Community Office Neighborhood Coalition saw the largest increase in accessibility. As will be shown, this increase is seen in most of the variables measured but it is the most stark in terms of transit access.

Population density

In the ten-year period studied, Portland's population rose dramatically. In 2010, there were 583,776 people living in the city. According to the Census, there were more than 68,000 new Portlanders in 2020, an 11.8% change for a total of 652,503. This change can be seen in the population density maps which show densification occurring throughout the city.

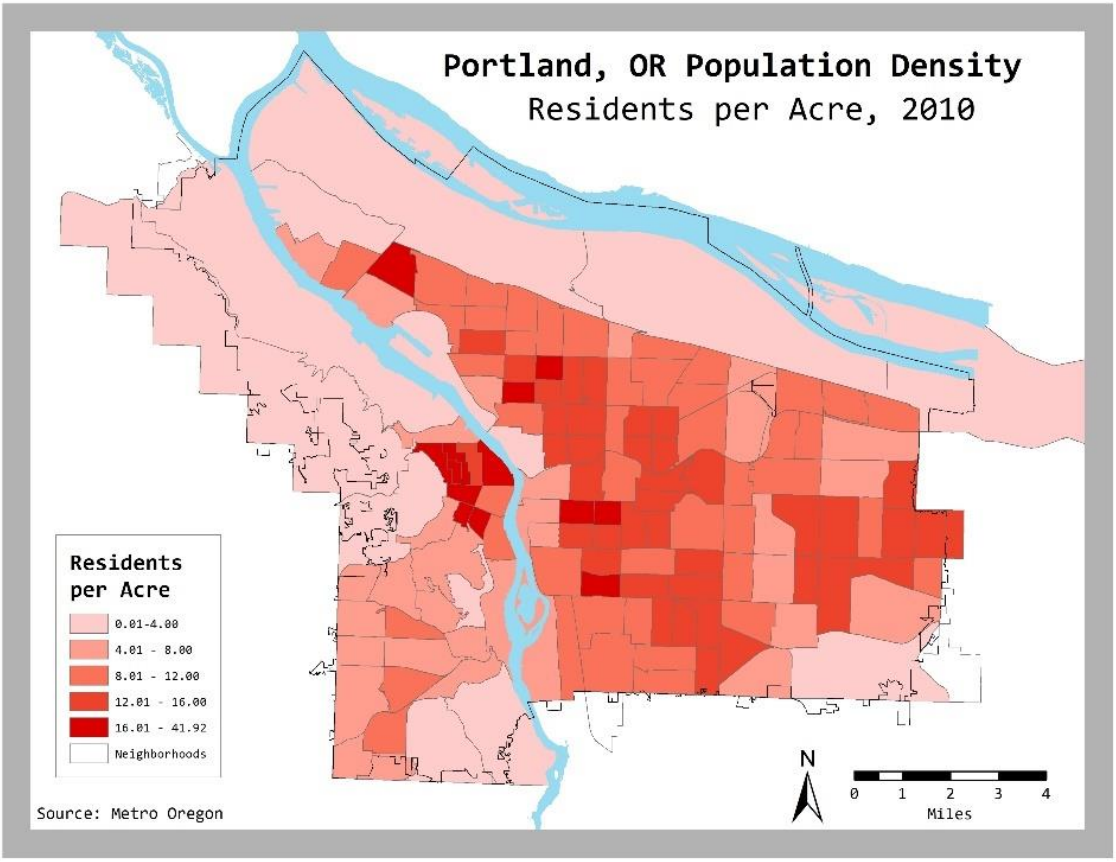

Figure 4:Population Density 2010

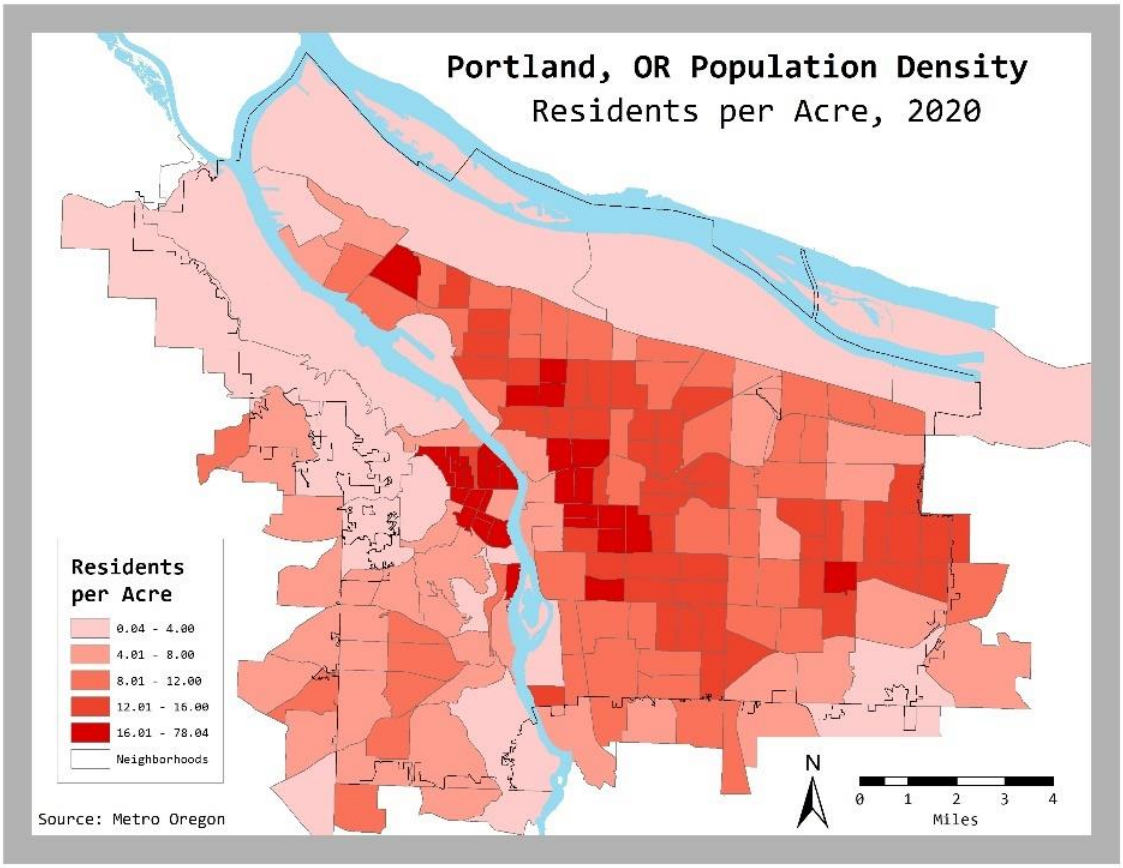

Figure 5:Population Density 2020

The goals set by Portland for accessibility are specifically for eighty percent of residents to live within a twenty-minute neighborhood. That was outside the scope of this paper which just shows the land area that is accessible. Although it was not a part of the analysis it is still important to compare where Portland residents live to the accessibility map. Population growth is concentrated in the Northeast Coalition of Neighbors and East Portland Community Office coalitions. This is important because as Portland's comprehensive plan notes, as the central neighborhoods grow, poorer residents are displaced to the eastern neighborhoods (2035 Comprehensive Plan 2020, I-24). These neighborhoods are less accessible as seen in the maps from this study but also are less served by other city resources than other parts of the city (Table 4). For this reason, it is important that Portland aims for nearly all areas of the city to be

accessible. Together with this there is a need for abundant affordable housing so people can choose which neighborhoods they want to live in.

Accessibility of Portland		
	2010	2020
Least Accessible	27.37%	23.99%
Less Accessible	28.70%	24.88%
More Accessible	26.07%	30.64%
Most Accessible	17.86%	20.49%

Table 5:Accessibility of Portland

When analyzing Portland's accessibility citywide there is a clear increase from 2010 to 2020. **Error! Reference source not found.Error! Reference source not found.** shows the "More Accessible" and "Most Accessible" parts of Portland grew to more than 51% in the ten years.

Most areas that are scored as least accessible surround industrial areas and natural areas such as Portland International Airport, Forest Park, and Smith and Bybee Wetlands as shown in **Error! Reference source not found.**.

Accessibility was measured by adding up the raster cells of each variable. Since there are eight variables with a maximum value of three for each variable, the highest accessibility score possible is 24. The lowest possible score is 0. To make these scores easier to compare they were split into five classes. The classes of accessibility scores are separated using Jenks Natural Breaks. The specific class breaks can be seen in Table 6.

Class	**Score**
Least Accessible	5-9
Less Accessible	10-14
More Accessible	15-18
Most Accessible	19-24

Table 6: Class Breaks for Final Maps

The analysis measured all areas within the borders of Portland. However, after looking at the data it became

obvious that it was weighted towards areas that aren't accessible due to measuring industrial areas and large parks. Therefore, when considering the data, the inaccessible parts (0-4) were not considered.

The number of grocery stores measured by NAICS in Portland dropped by 14 (5%) from 2010 to 2020 (Table 3). This is a relatively small change, and this can be seen in the adjacent maps (Figure 6 and Figure 7) which are like each other despite the time difference.

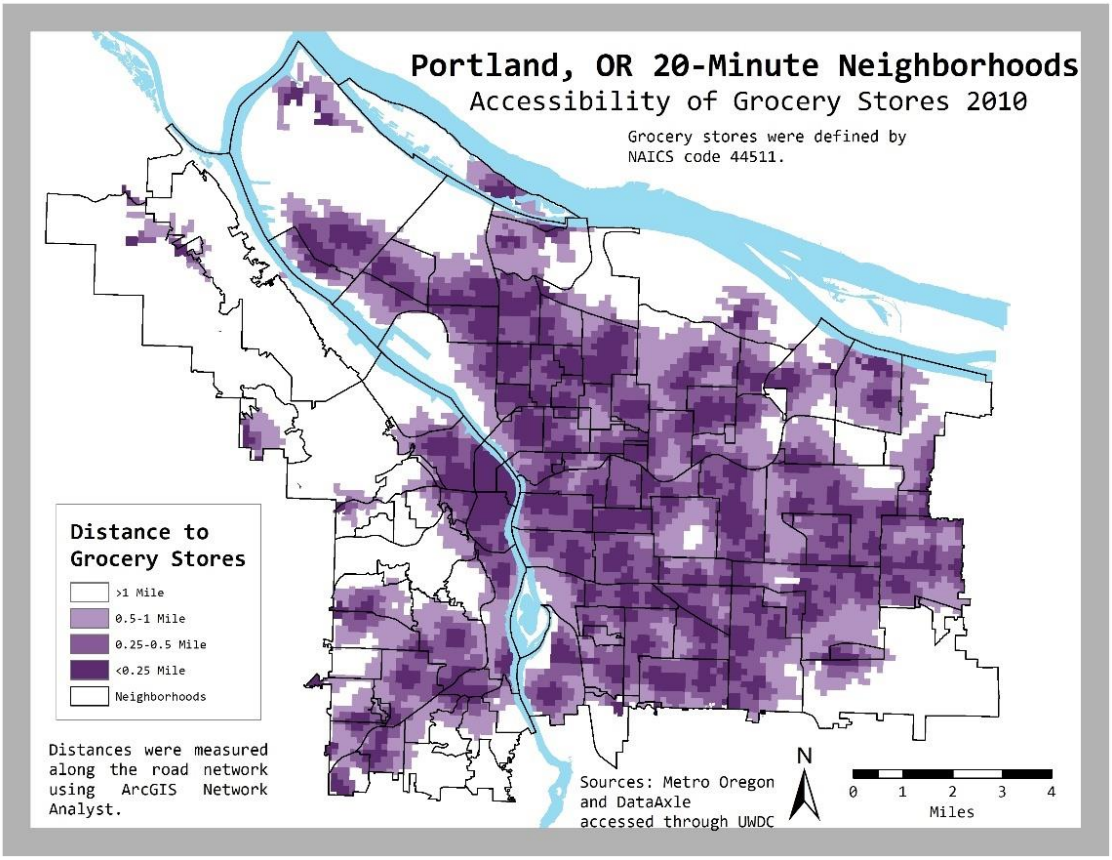

Figure 6:Grocery Stores Accessibility 2010

Grocery stores are notably not present in the northern part of the city in Bybee Lake, Forest Park, and near the Portland International Airport.

There is a small increase in accessibility in the Southeast Uplift Neighborhood Program near the Willamette River. There is also an increase in accessibility on the northern part of the East Portland Community Office coalition.

Overall, there is small change in accessibility of grocery stores due to a relatively high original accessibility in 2010.

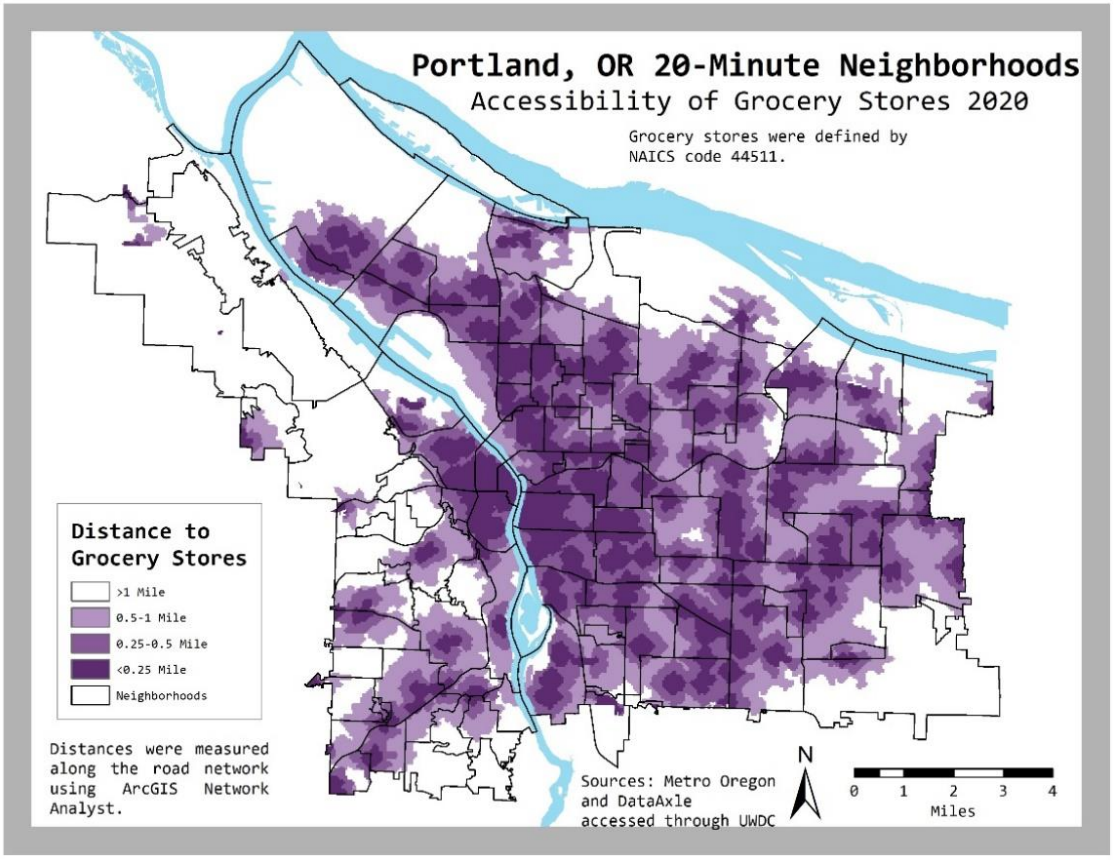

Figure 7:Grocery Stores Accessibility 2020

Convenience stores and liquor stores were measured together in Portland. These stores saw one of the biggest increases of all the variables measured. In 2020 there were 108 more stores than in 2010, a 41 percent increase (Table 3). This change increased accessibility throughout the city. In 2020 a large portion of the city was within a quarter mile or half mile walk of these stores (Figure 9). In 2010 almost the entire city of Portland was within a mile walking distance of a convenience or liquor store (Figure 8).

As mentioned above, the three large areas that show no accessibility are Forest Park, Bybee Wetlands, and Portland International Airport. These areas are large without residential or commercial development.

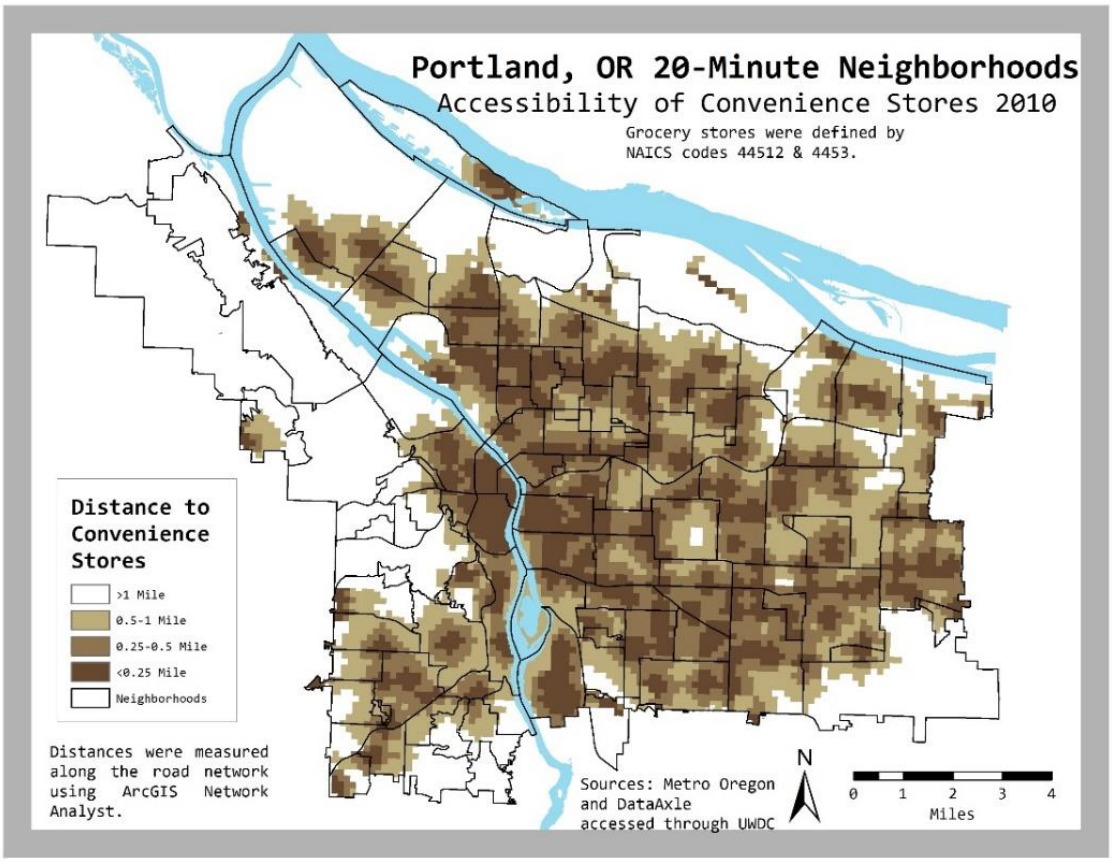

Figure 8:Convenience/Liquor Store Accessibility 2010

The downtown area is the most served by these stores, which is to be expected. Convenience stores are privately owned and tend to locate near areas that have higher population counts. As Portland densifies in the coming years there will likely be continued growth for these stores.

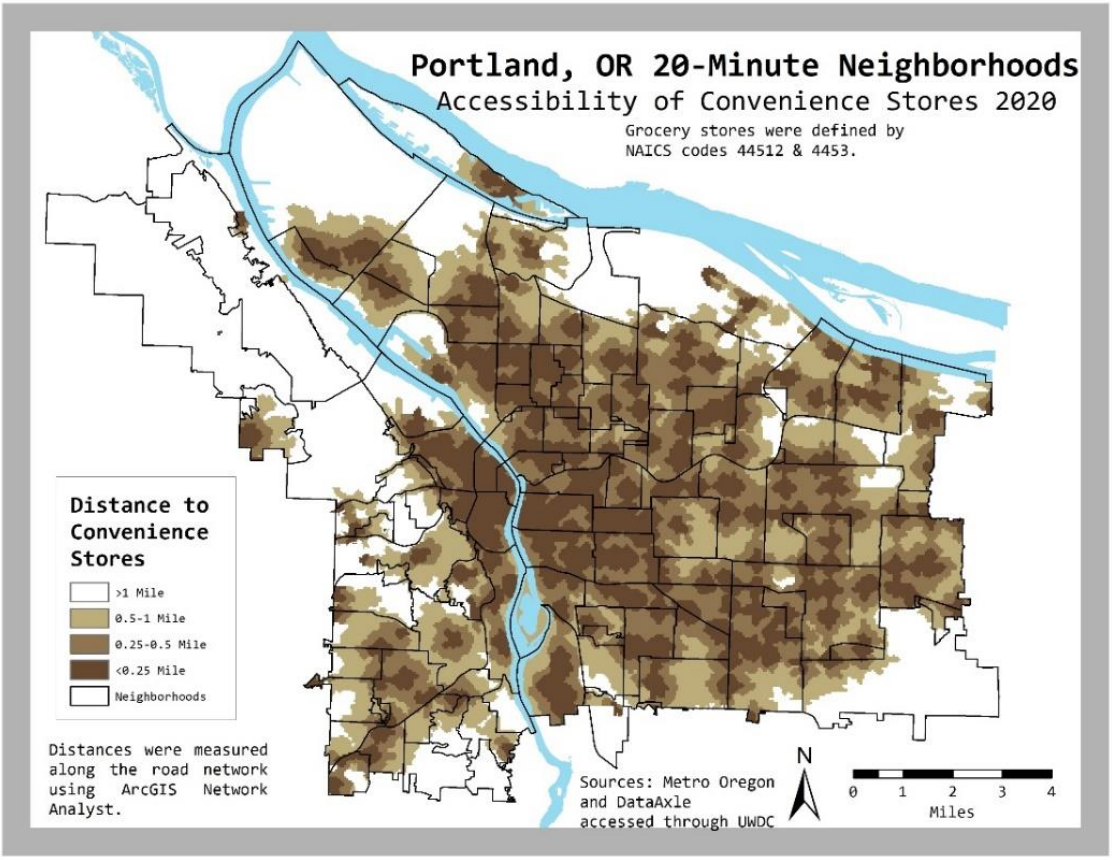

Figure 9:Convenience/Liquor Store Accessibility 2020

Retail stores were measured by the number of stores within a 2,640 square foot (half mile) area. In the ten-year study period there was an increase of 972 of these stores, a 30 percent increase (Table 3).

The growth mostly occurred within downtown Portland with some growth in the “Southeast Uplift Neighborhood Program” coalition near downtown. However, there is change and growth throughout the city.

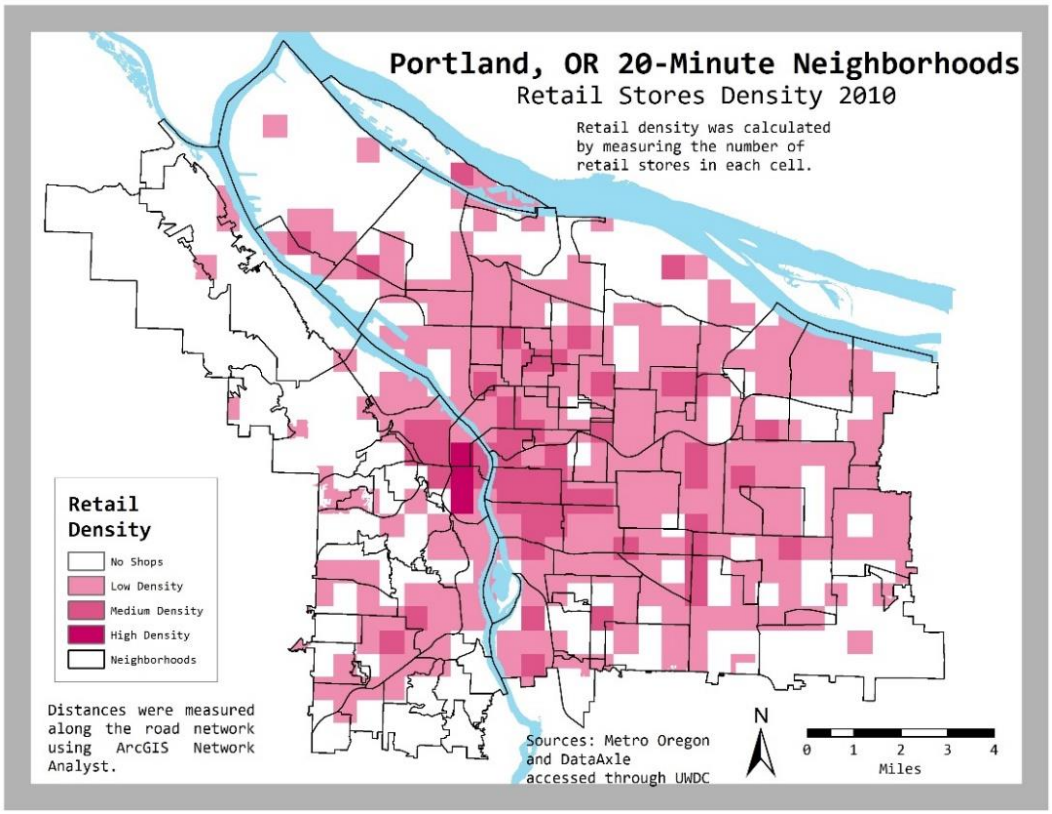

Figure 10:Retail Store Density 2010

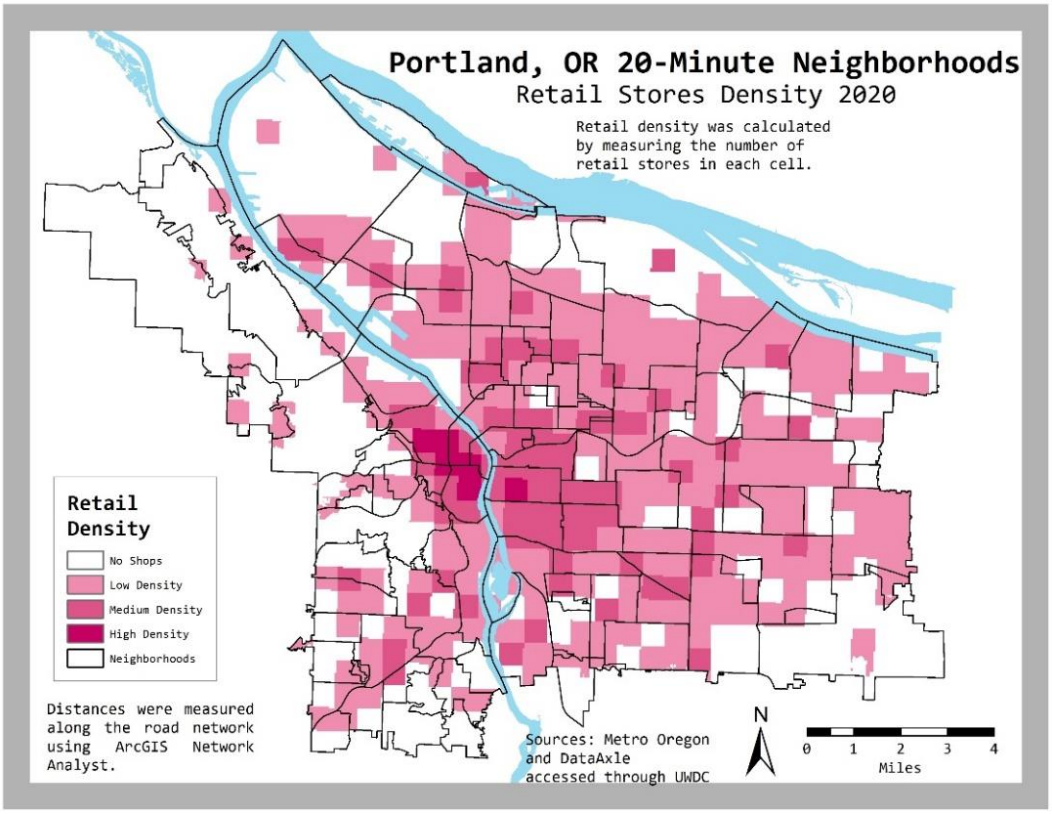

Figure 11:Retail Store Density 2020

As the population of Portland grew there became a larger market for consumer goods. As retail stores are developed by private citizens, they are more elastic to demand. However, even with the large increase in the number of stores there is not such a large impact on the accessibility scores in the adjacent maps (Figure 11 and Figure 10). This may be because there are only three possible ordinal scores which makes moving up a score difficult. It can also be that new retail stores were located in areas that already had other stores.

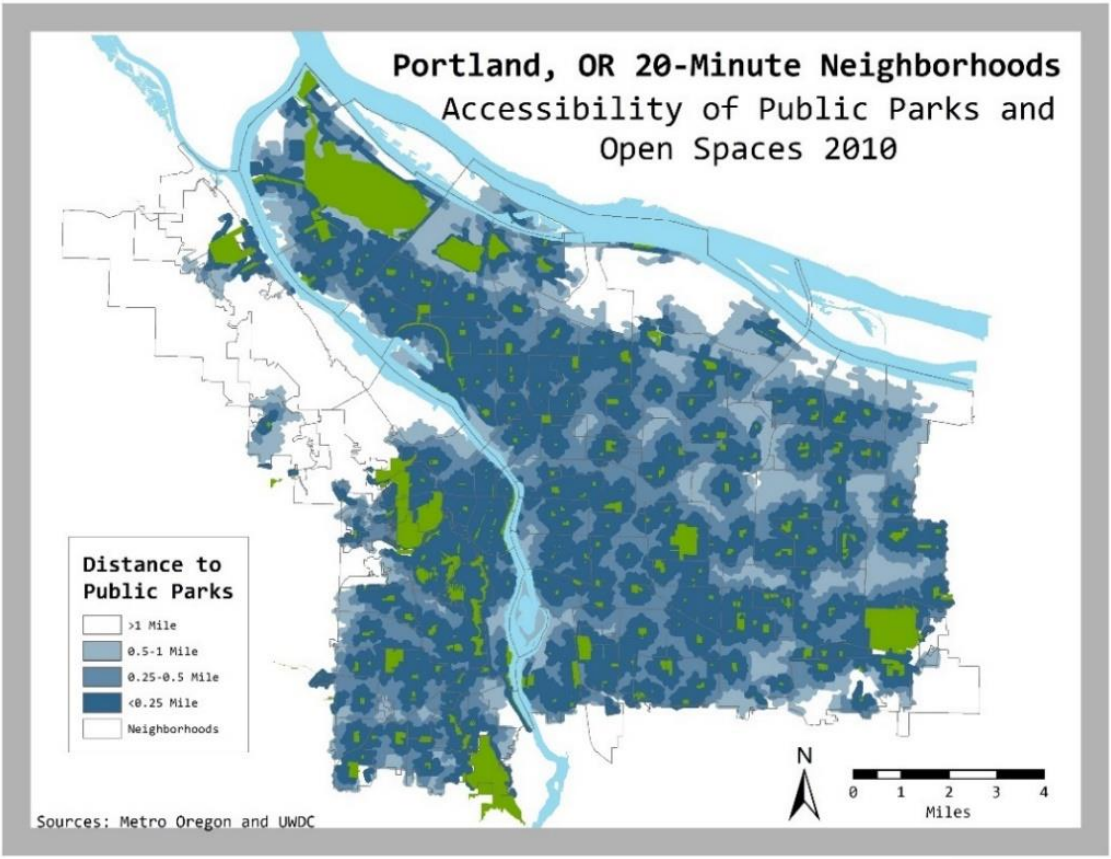

Figure 12:Parks/Open Spaces Accessibility 2010

In the datasets used there were 94 fewer parks in 2020 than in 2010, a 23 percent reduction. As explained in the “Limitations” section this is likely not do to an actual reduction of that many parks in the city. Instead, it is due to the change in ways that parks and open space data were collected.

However, since this was the data that was available it is what was used. The change mostly removed smaller parks/open spaces throughout the city but especially in the north Portland Neighborhood Services coalition and the Southeast Uplift Neighborhood Program coalition.

Due to this, the accessibility scores for the above neighborhood coalitions are probably a bit lower than they otherwise would be. Notwithstanding these issues with the data in both 2010 and 2020 Portland is well served by parks (Figure 13 and Figure 12). Parks are relatively evenly spread across the city. As Portland moves away from reliance on cars, linear parks can replace roadways to increase residents' access to parks and open spaces.

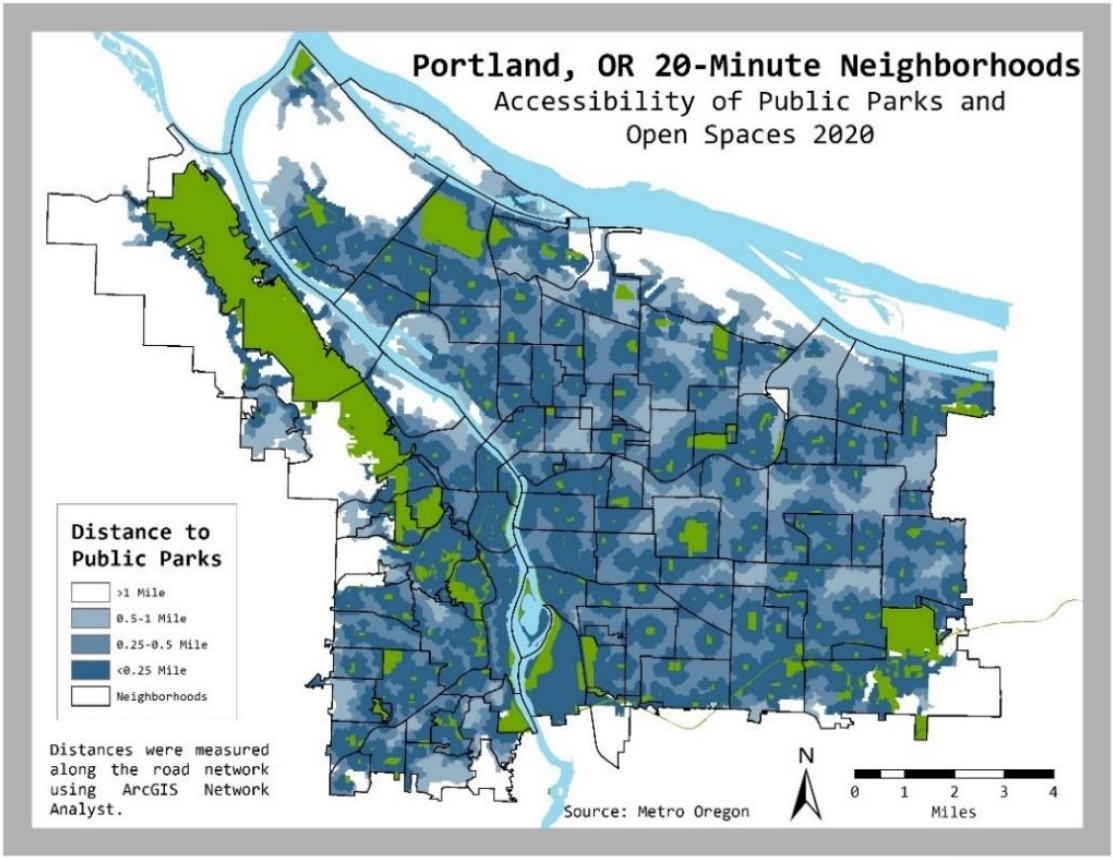

Figure 13:Parks/Open Spaces Accessibility 2020

There was an increase of 12 public elementary schools in 2020. This is equal to a 15 percent increase (Table 3). There are eight different school districts that serve the residents of Portland. The schools selected teach at least one elementary grade. This study only focuses on public school which are available to all residents as. Private schools also provide education to children but do not provide the same service to city residents.

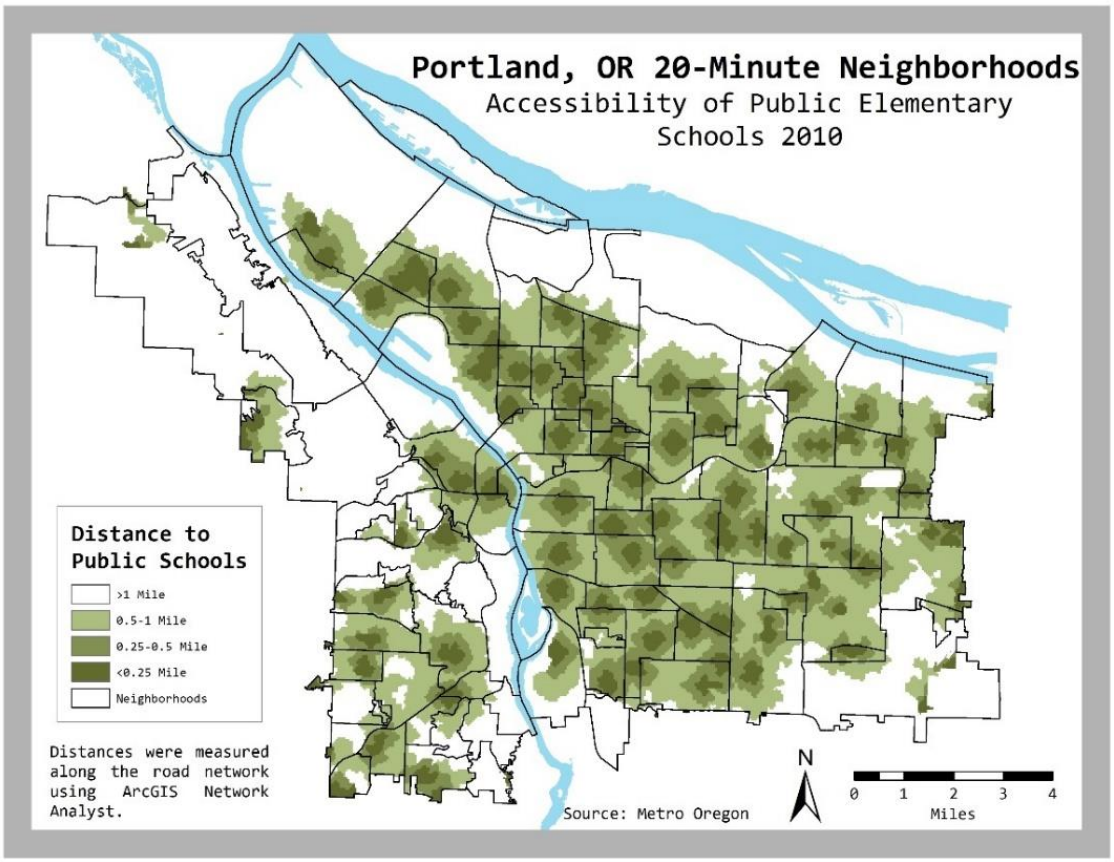

Figure 14:Public Elementary Schools Accessibility 2010

Although there was a significant change in the number of schools in each year there was a much smaller change in the amount of area that was accessible (Figure 14 and Figure 15). In 2010 there were 8,715 raster cells within a quarter mile of a school, 16,940 within a half mile and 29,337 within a mile. In 2020 there were 9,010 cells within a quarter mile (3.34% increase), 17,478 within a half mile (3.18% increase) and 29,464 within a mile (0.04% increase). There was a small increase over the ten years but not what would be expected by a 15 percent increase in

the number of schools. It is likely that most of the new schools were within walking distance of the existing schools from 2010.

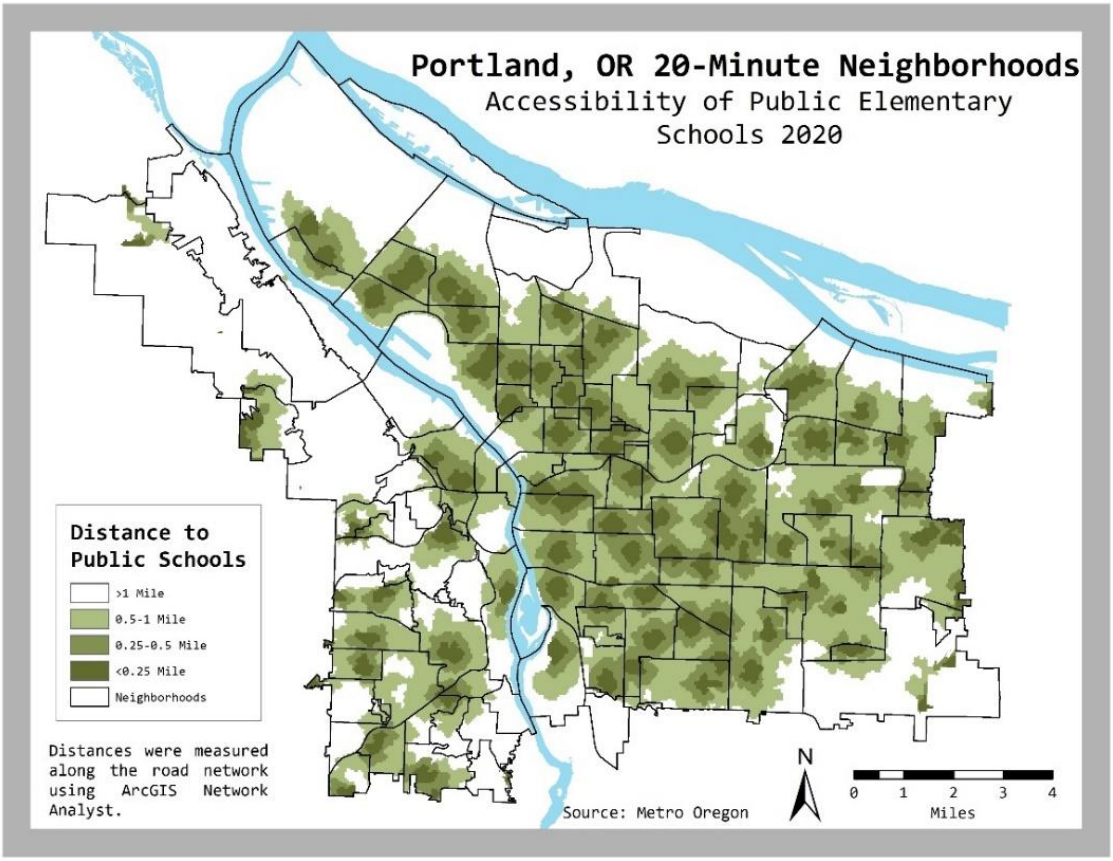

Figure 15:Public Elementary Schools Accessibility 2020

Street connectivity had the smallest change of all the variables measured (Figure 16 and Figure 17). There were 662 new intersections in 2020, less than one percent increase from 2010. This lack of change makes sense for a city that has developed its infrastructure. This variable does show an interesting pattern in the density of intersections throughout the city.

Northeast Coalition of Neighborhoods and Southeast Uplift Neighborhood Program coalitions have the highest density of intersections in the city. This is the area of Portland that includes the central city which is known for its small block sizes.

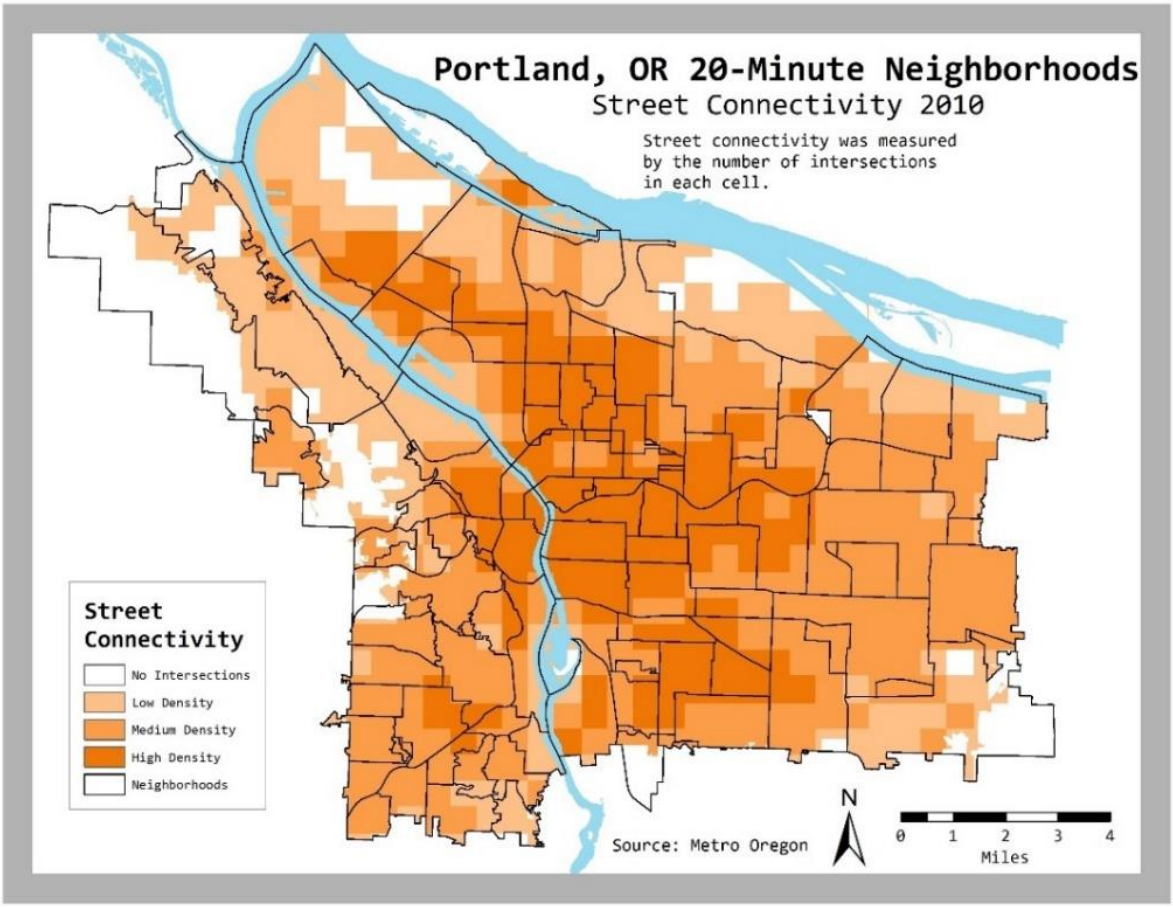

Figure 16:Street Connectivity 2010

This pattern is in sharp contrast to relatively low density of intersection in the East Portland Community Office coalition. This coalition covers the parts of the city that were annexed more recently. This part of Portland was developed as a suburb and did not benefit from the infrastructure building of Portland leaders.

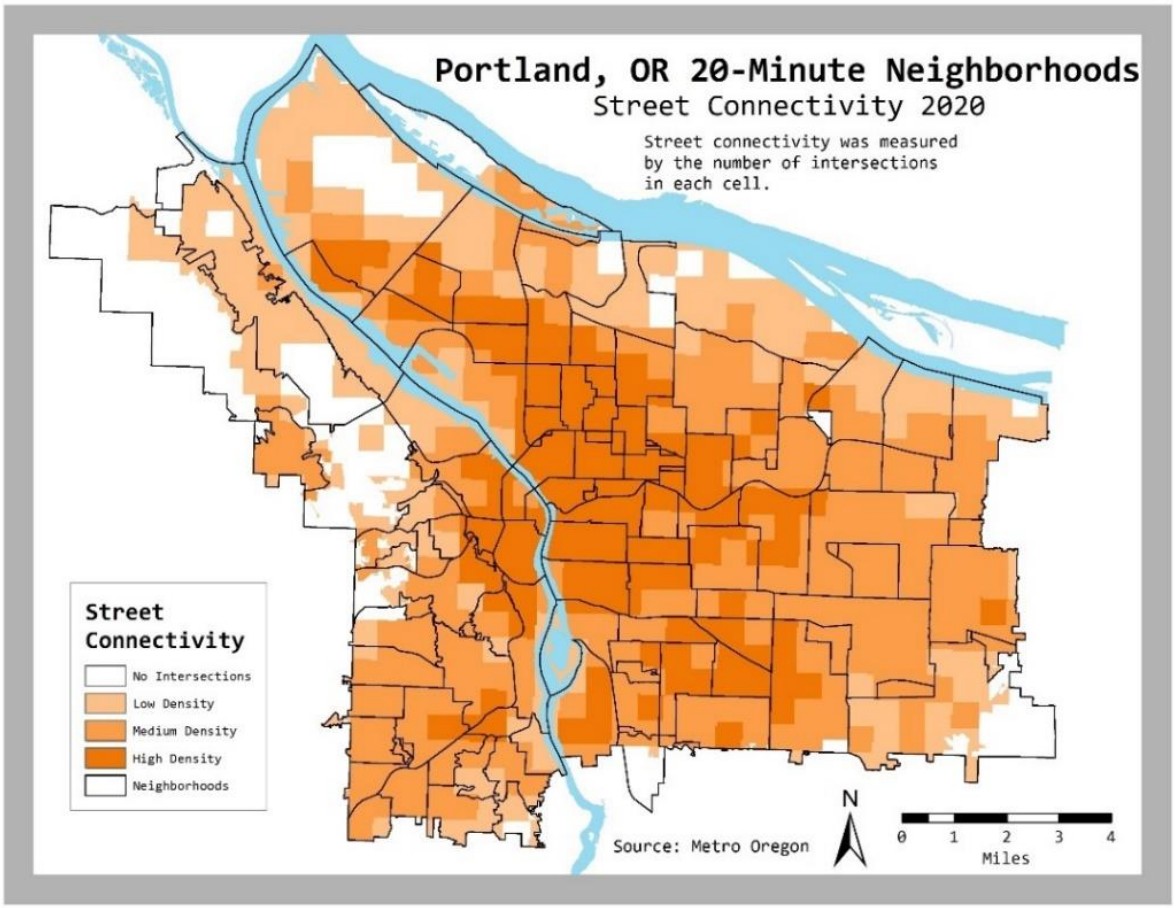

Figure 17:Street Connectivity 2020

In 2020 there were 5, 366 more sidewalk segments than 2010 for a 23 percent increase. The sidewalk accessibility maps are very similar to the previous street connectivity maps (Figure 18 and Figure 19). Older areas of the city have more streets and therefore more opportunities for sidewalks to be. However, sidewalks were expanded across the city especially in the Southwest Community Services coalition and the East Portland Community Office coalition. The growth in sidewalk density shows the city of Portland financing and building one of the few variables of accessibility which they have direct control over. The new sidewalks were built in the two coalitions that had the lowest density in 2010.

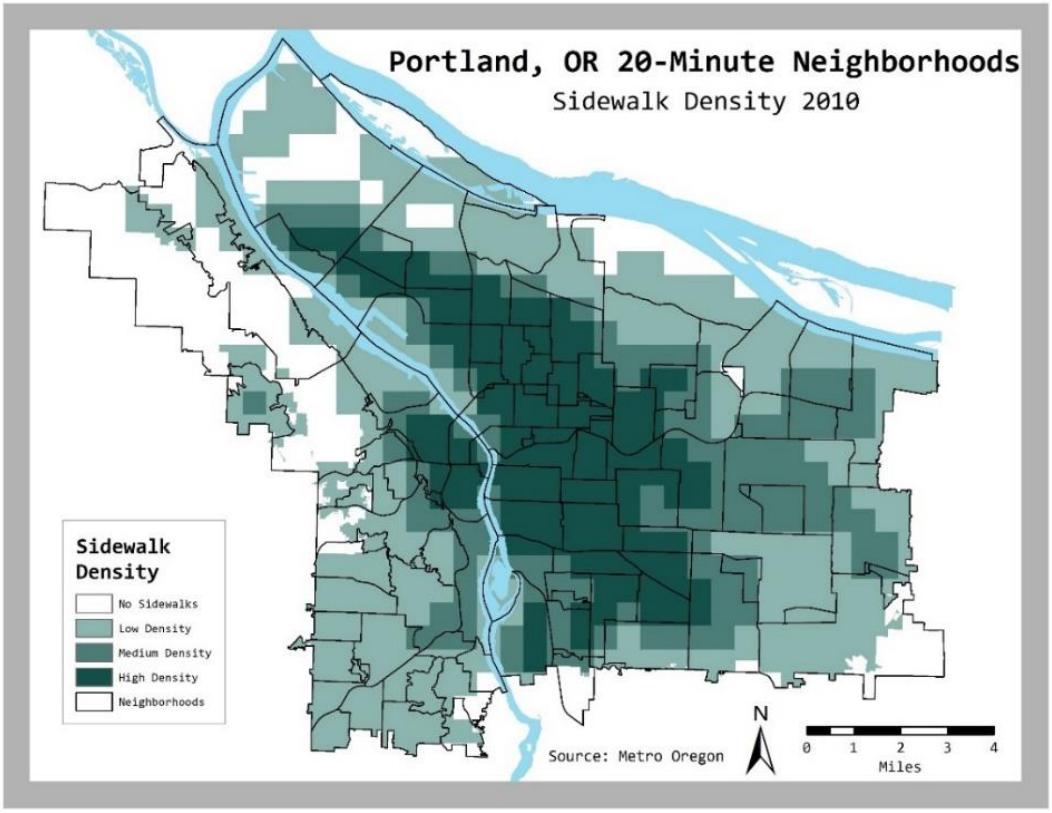

Figure 18:Sidewalk Density 2010

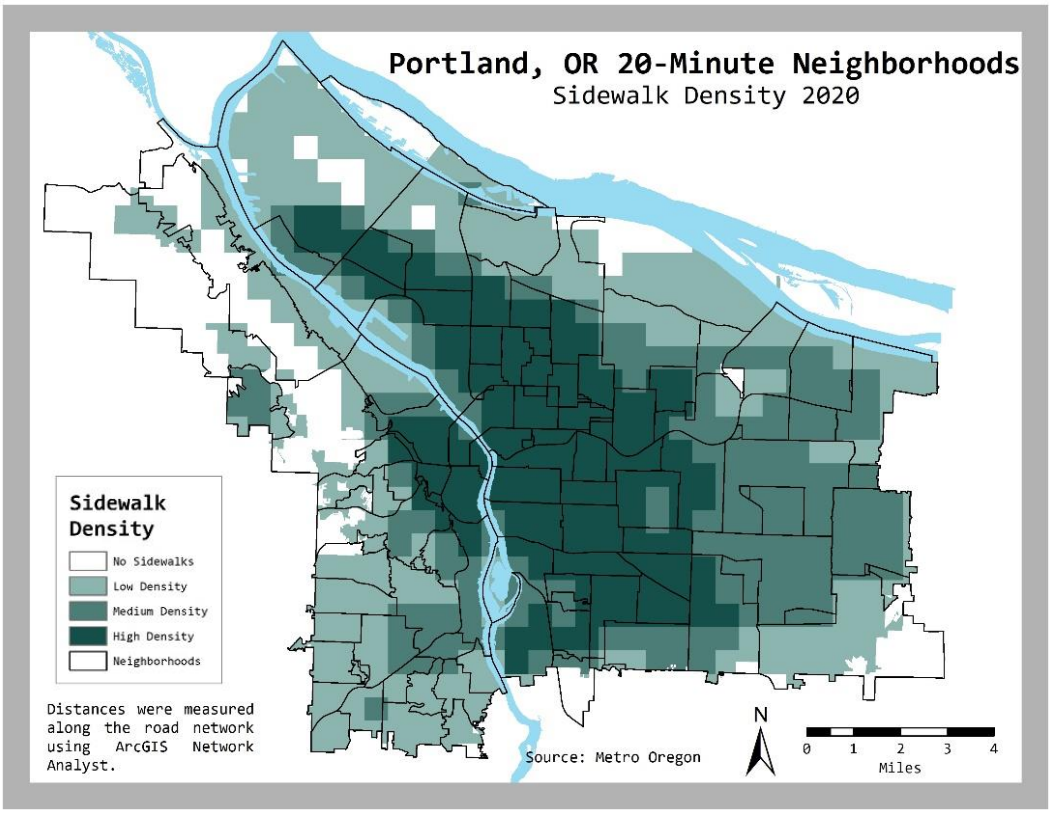

Figure 19:Sidewalk Density 2020

In 2020 the city of Portland had 602 more transit stops with access to frequent service than in 2010. This is equal to a 30 percent increase. These maps show a city and transit agency that greatly expanded their service (Figure 20 and Figure 21). In 2020 almost the entire city is within a quarter mile of a stop with frequent service. The twenty-minute neighborhood plan is supposed to create neighborhoods where all of one's immediate needs can be accessed by walking. However, one important aspect of life is not fully provided: work. Frequent transit access allows people to choose which neighborhood they want to live in while being able to access all the services and that the city offers.

In 2010 many parts of the city had either low or no access to frequent transit stops. The Central Northeast Neighbors coalition, Southeast Uplift Neighborhood Program coalition and the East Portland Community Office coalition all lacked access to transit. In 2020 these neighborhoods saw much greater access. Besides for some small areas in the EPCO coalition they are fully within a quarter mile of frequent transit stops.

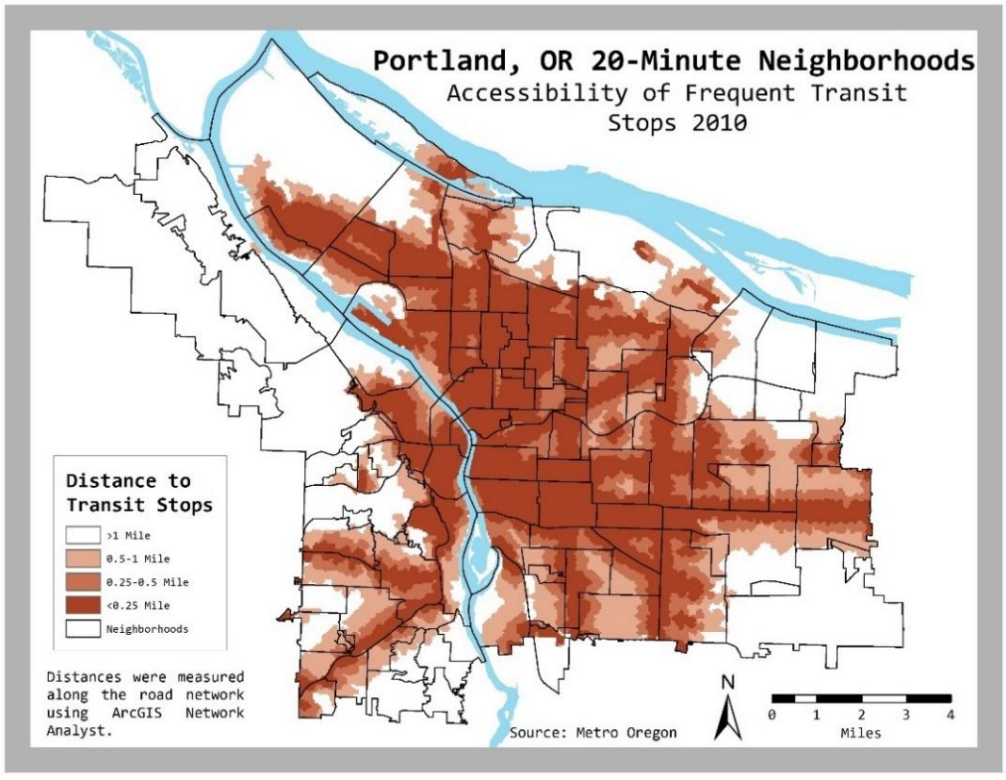

Figure 20:Frequent Transit Accessibility 2010

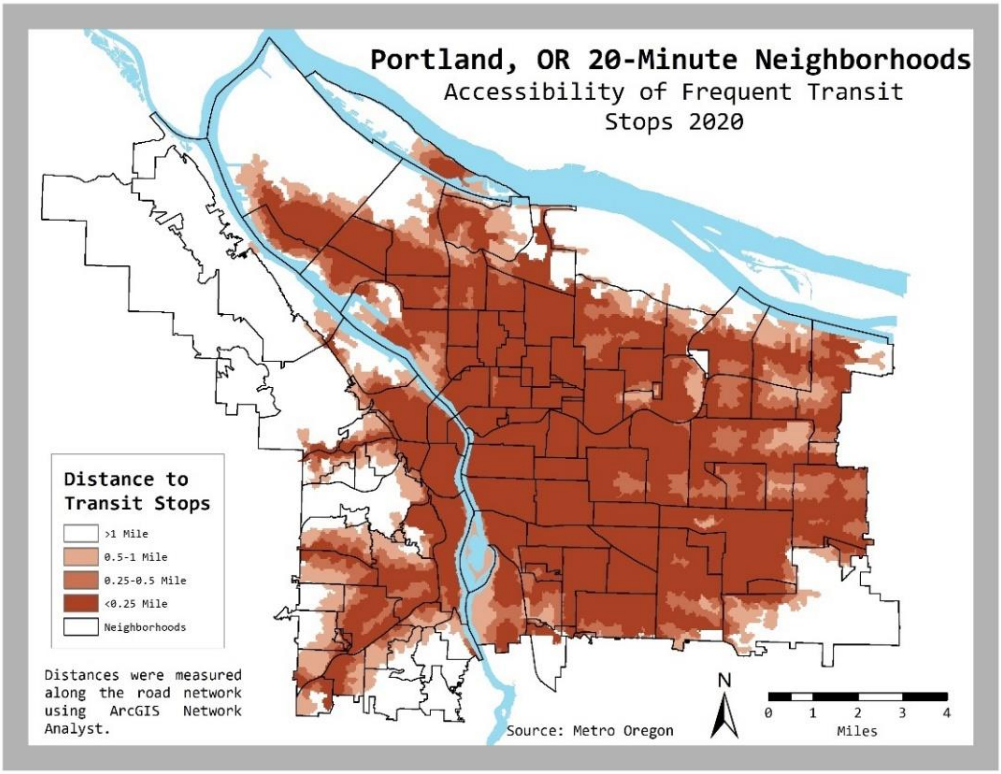

Figure 21:Frequent Transit Accessibility 2020

Discussion

Having destinations in close proximity to residents is important for accessibility. However, for those destinations to truly be accessible by walking or biking there must be safe and friendly routes for people to take to them. This study measures two variables that affect the safety and convenience of walking to the destinations: street connectivity and sidewalk presence. This study merely measures the presence of these two variables. Specifically, this study did not measure the width and quality of sidewalks, nor did it note whether there was a sidewalk on both sides of the street. Street connectivity measured the number of intersections in Portland. This is important to measure if pedestrians can walk the shortest distance to their destination and if they can take multiple paths to their destination. However, other factors such as the width of streets and the speed of drivers were not measured.

Portland's effort to make the city accessible without using a car was initiated in their Climate Action Plan which calls to reduce greenhouse gas emissions to 80% of 1990 levels by 2050. An intermediate goal is to reduce emission levels by 40% by 2030. The plan outlines several goals, one of which is to "Create vibrant neighborhoods where 90 percent of Portland residents … can easily walk or bicycle to meet all basic daily, non-work needs and have safe pedestrian or bicycle access to transit" (9).

Portland did become more accessible during the 2010s. Notably, this study does not measure the number of residents in each of these areas. However, assuming more residents live in the denser, more accessible parts of the city should skew accessibility towards more residents.

Both walkability and livability can be used to describe small improvements. However, walkable, and livable areas are measured at the neighborhood or city level. This is because people experience the entire neighborhood and city throughout their week. Residents who travel to the center city for work and shop in another neighborhood need all their trips to be within walkable and livable areas for them to truly live in a walkable and livable city. If only one street meets the definition of walkable or livable then people do not benefit daily.

When measuring change, it is important to keep in mind that some of the variables being measured are more changeable than others. Schools, parks, and street connectivity have less capacity to change over any ten-year period. Grocery stores, convenience stores, general retail, and sidewalks have the most opportunity for growth. Within those, sidewalks are mainly limited to the existing road network. Therefore, within this study and Portland's analysis, the biggest driver of accessibility is private businesses. Like most American cities, development in Portland is constrained by zoning. Although Oregon has recently eliminated single-family zoning there are still restrictions on where businesses can be located. Therefore, the biggest determinant of

whether Portland will become more accessible is whether they make changes to their zoning code to allow businesses to be in “residential neighborhoods”.

For Portland to reach its goal it would need to work with private providers of the services that make a 20-minute neighborhood. One of the ways Portland can encourage more grocery stores and other shops is by housing density to ensure that these private businesses become economically viable in more neighborhoods (Easton and Owen 2009). In the last few years, the state of Oregon and city of Portland have made monumental changes to land use regulations. Today it is possible to build four units of housing on almost any lot within the city (Britschgi 2022). This added density will allow more private commercial shops throughout the city.

This study suggests how, and to some degree, why accessibility changes over time. The areas that were least accessible had the most room for improvement. Therefore, the areas with the highest growth in accessibility are in the eastern suburbs which were the least accessible in 2010. However, even the central neighborhoods which were very accessible in 2010 became more accessible in the ensuing decade. The areas that become less accessible are concentrated in the northern parts of the city along the Columbia River. Another area that became less accessible is Forest Park and the area surrounding it. Other areas that became less accessible are in the southwestern section of this city. This area has steep slopes which make pedestrian accessibility difficult to plan for. Most of the rest of the areas that became less accessible are smaller and spread throughout the city. Understanding why they became less accessible will require examining each of the inputs that determine accessibility in this study.

This study shows how the suburbs of Portland are affected by the land-use patterns of Portland. The northern area of Portland along the Columbia River is not accessible because industrial uses are concentrated there, including the airport. Positioning industrial uses on the

margins of the city is understandable when trying to separate these uses from other parts of the city. However, from a regional perspective it makes less sense. Besides the Columbia River acting as a barrier to the north of Portland there are also the industrial areas that separate the city from its suburbs. Vancouver, WA which is just north of Portland across the river has no urban continuity connecting it to the larger urban area. This degrades the walkability between the two cities, leaving travelers to either drive or take transit to travel.

Housing in the 20-minute neighborhood

In cities like Portland, there is a need for denser development to support the services and businesses of a 20-minute neighborhood. Planners in Melbourne found that 10 dwelling units per acre is the minimum density to support a mixed-use neighborhood (Creating a More Liveable Melbourne 2019, 13). Therefore, together with any public investments, there needs to be coordinated housing development with private developers. Melbourne found that existing statutes didn't allow developers to build the housing density required. In the United States, this takes the form of single-family zoning which makes up most of the land use in cities. With these development restrictions in place, neighborhoods can't become 20-minute neighborhoods. Recently, the state of Oregon and city of Portland have passed legislation allowing for higher densities. As mentioned above, in 2019 the state legislature passed a law that allows four units on any residential lot in cities (Andersen 2020). Portland followed with their own legislation removing parking requirements for residential development. These laws will permit a density that is high enough to support 20-minute neighborhoods (Easton and Owens 2009).

Transit

Transit is essential to allow for efficient transportation in a dense city. Portland's 20-Minute Neighborhood initiative does not explicitly call for greater density. However, it does expect population growth within the borders of the city which means greater density. Additionally, the variables of accessibility that rely on private investment rely on a higher population density to make the businesses profitable.

TriMet the public transportation agency that serves Portland has been rapidly increasing the number of Frequent Service lines in the region. Frequent Service lines have fifteen-minute frequencies for most of the day every day of the week. TriMet currently operates seventeen bus lines as Frequent Service in addition to the MAX light rail (TriMet 2022).

Portland has made efforts to expand access to frequent transit during peak hours. This has been one of the few changes that have increased 20-minute neighborhood accessibility within Portland. Public transportation is a service that municipalities can use to reduce reliance on cars. Doing so ensures that the cities are sustainable and built to grow. Providing access to frequent transit also has the benefit of reducing the cost of living for people who no longer require the expense of owning a personal vehicle.

It should be noted that due to changes accelerated by the Covid-19 pandemic there is a greater need for all-day frequent transit. More people are working from home and not using the transportation system for a regular commute pattern. Trips are spreading out throughout the day and for transit to truly be accessible it needs frequent service throughout the day. Currently, Tri-Met, Portland's public transit provider considers frequent transit to be in line with at least fifteen-minute frequencies for most of the day, every day of the week.

A robust transit system allows people who don't own cars to access all parts of the city. Being that a reduction in car use is an essential part of walkability. Having transit in place allows cities to reappropriate space for cars to active transportation. This is important since an increase in accessibility on its own does not necessarily decrease car utilization.

Being that 20-minute neighborhood is a climate policy initially, progress should be measured within that framework. The best measure as to whether Portland's climate change fighting initiative had an effect is on the direct variable; vehicle miles traveled. Since 2010 Portland has not seen a noticeable reduction in VMT per capita.

Portland is still better off than the rest of the country regarding VMT per capita. When the rest of the country saw a jump in VMT post-Recession, Portland continued a gradual decrease. However, over the last ten years Portland's VMT per capita has plateaued. Together with population growth this means that total VMT has increased since Portland started 20-minute neighborhoods.

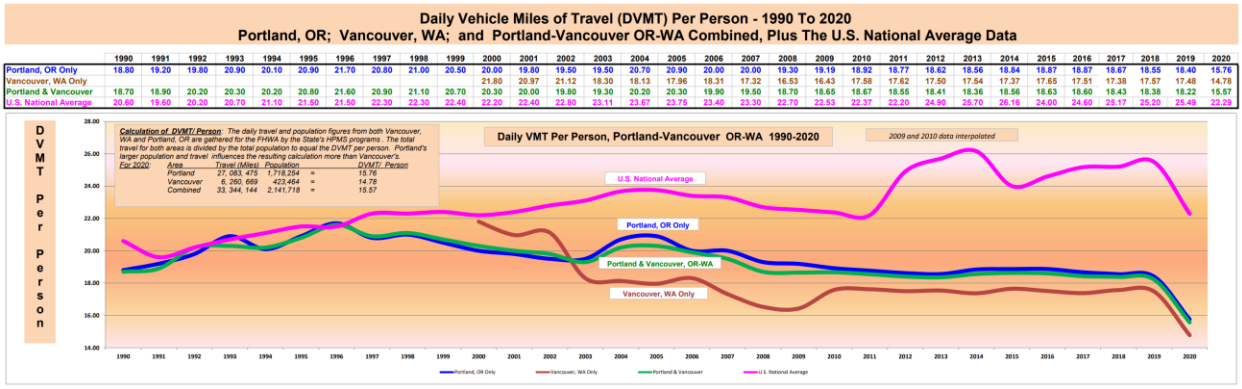

Figure 22: VMT Per Person 1990-2020 Source: Metro (Oregon)

Conclusion

In 2009 the city of Portland created a framework for reducing emissions that was the first of its kind. In the ensuing decade impressive progress has been made towards making Portland more accessible.

Not all of the measured variables are able to be changed easily by city officials. Focus needs to be set on the variables that can have the most impact to residents' accessibility. Grocery stores are not usually developed or operated by municipalities, but examples have shown how it can work.

Going forward the city of Portland should consider how to it would like to further implement 20-minute neighborhoods. Similar to how TriMet boosted its system to provide fifteen-minute service, the city would need to invest in parks, sidewalks, and grocery stores to see the gains similar to those brought by TriMet.

On the other hand, Portland should not be trapped within its own framework for 20-minute neighborhoods. Strategies such as opening streets for pedestrians and bicyclists around schools and parks increase the walkability of a neighborhood.

Further research should focus on people, the residents of Portland. Do people who live in Portland noticing the change in accessibility? Additionally, more research needs to be done to understand how housing affordability changes compared to an increase in accessibility. Also, as Portland eases zoning constraints for housing, in the coming years there will be a need to understand how an increase in density affects the accessibility of Portland. As mentioned earlier, there are variables in this analysis which are services provided by private citizens. Research suggests that they should proliferate in areas with increased populations.

This study suggests that a large increase in accessibility occurred in Portland since the idea of 20-minute neighborhoods was first introduced. Going forward, Portland planners and leaders will need to decide how much money and resources they are willing to use to make Portland a truly accessible city. As seen in this study that will likely mean a turn away from

travel using private vehicles. If space reserved for cars were instead used for other purposes, the City would likely increase the accessibility and further its goals for the 20-minute neighborhood. Will Portland transform streets into park space, learning areas, bus lanes and vendor spaces?

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