Past, Present, and Plans for Transit-Oriented Communities in Worcester, Massachusetts

A thesis submitted by

Emily Thibault

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Thesis Adviser: Christine Cousineau

Thesis Readers: Shan Jiang, Shomon Shamsuddin

Abstract

This thesis examines the potential for expanding transit-oriented community planning in Worcester, Massachusetts. Methods include a literature review of planning research related to transit-oriented development and transit-oriented communities, stakeholder interviews, content analysis of municipal planning documents, and a spatial analysis to determine suitability for transit-oriented community planning beyond the downtown core. Spatial analysis findings suggest that Worcester has the opportunity to build on mixed-use planning and development catalyzed by arts and cultural institutions in the urban core by extending the benefits of Transit-Oriented Communities to key transportation corridors that the city identified in the Now|Next Plan for transformative growth and transit priority. Effective Transit-Oriented Community planning will prioritize pedestrian connectivity and safety, the preservation and development of a mix of housing options and local businesses, and improved transit access and reliability.

Acknowledgments

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Table of Contents

List of Figures

List of Tables

Acronyms

ADU- Accessory Dwelling Unit

AMI- Area Median Income

BID- Business Improvement District

BRT- Bus Rapid Transit

CBD- Central Business District

CCOD- Commercial Corridor Overlay District

EOHLC- Executive Office of Housing and Livable Communities

ETOD- Equitable Transit Oriented Development

ITDP- Institute for Transportation and Development Policy

MAP- Mobility Action Plan

MBTA- Massachusetts Bay Transit Authority

TAD- Transit-Adjacent Development

TDI- Transformative Development Initiative

TDM- Transportation Demand Management

TIF- Tax Increment Financing

TOC- Transit Oriented Community

TOD- Transit-Oriented Development

VMT-Vehicle Miles Traveled

WRTA- Worcester Regional Transit Authority

Chapter 1: Introduction

Background

This thesis will explore the connections between affordable housing, transportation, open space, and arts and culture, and examine opportunities and challenges to promoting transit-oriented communities in Worcester.

Many reports and plans highlight the opportunities for equitable Transit-Oriented Development in Massachusetts' gateway cities, citing case studies of Worcester's recent implementation of TOD in Worcester's Downtown and Canal District (Corley et al 2020; City of Worcester 2024). In Worcester, Union Station provides MBTA Commuter Rail service east to Boston in addition to Amtrak, Peter Pan, and Greyhound service. The Worcester Regional Transit Authority (WRTA) bus hub is located next to Union Station, providing fare-free local and regional bus service.

Worcester's Now|Next plan highlights three major themes for the city's vision, (1) a values-centered framework for growth that benefits all Worcester community members; (2) Equitable and sustained public investment in Worcester's neighborhoods; (3) a more connected and accessible city for all. The comprehensive plan emphasizes increased connectivity, mixed-use neighborhood centers, and equitable transit-oriented development. Implementation of subsequent plans, including the Vision Zero Plan and Housing Production Plan, and anticipated updates to the zoning ordinance, provide opportunities to build on the foundation of mixed-use development in the city's core Downtown and Canal District. This thesis explores the potential of integrating housing,

transportation, and community assets, including arts and culture organizations and public space, to promote transit-oriented community planning in neighborhoods beyond the city's core.

Research Questions

1. How can municipal plans and policies balance the goals of housing affordability, connectivity, and vibrant third spaces without compromising one for another?
2. What locations in Worcester are most suitable for Transit-Oriented Development?

Methods

Methods include a literature review, stakeholder interviews, content analysis of land use, housing, and transportation plans, and a suitability analysis.

The literature review includes planning research on transit-oriented development, transit-oriented communities, and interconnected elements of TOD: compact, mixed-use, dense neighborhoods, promoting active mobility and transit use, and balancing economic development and housing affordability. Stakeholder interviews with an affordable housing developer and the City of Worcester's economic development and planning departments, in addition to content analysis of recent plans, provided context for existing conditions and plans that support elements and long-term goals of TOD.

The suitability analysis includes indicators for transportation and mobility access, community amenities, land use, and demographics. Data includes WRTA bus stops, MBTA Commuter Rail, potential for walkability, density of arts and culture organizations and jobs,

access to parks and libraries, zoning and zoning overlays, vehicle ownership, and opportunity zones. The suitability of each category was computed, then reclassified and weighted 20% for community amenities, land use, and demographics, and 40% for transportation and mobility.

Chapter 2: Literature Review

This literature review examines the evolution of Transit-Oriented Development, from Calthorpe's vision in The New American Metropolis to critiques related to gentrification, ultimately exploring the potential of Transit-Oriented Communities. The literature includes planning research on interconnected elements of TOD: compact, mixed-use, dense neighborhoods, promoting active mobility and transit use, and balancing economic development and housing affordability.

Transit-Oriented Development

Transit-oriented development (TOD) is an urban planning concept aimed at decreasing vehicle miles traveled and a strategy to integrate green space, transportation, and housing solutions through holistic planning with interconnected benefits for residents (Dorsey and Mulder 2013; Shelton and Fulton 2018). The term Transit-Oriented Development was first described in 1993 by Peter Calthrope as "a mixed-use community within an average 2,000-foot (or 10-minute) walking distance of a transit stop and core commercial area mix[ing] residential, retail, office, open space, and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car" (Calthrope 1993; 56). TOD involves a compact, mixed-use, walkable environment within a ½ mile of a transit station (Jamme et al 2019).

TOD resembles the historic integration of land use, public space, and transportation planning and development dating back to the mid-1800s horse-drawn streetcar and surrounding compact neighborhoods, through the evolution of transit with the

electrification of the streetcar in the 1890s and the following rise of the streetcar suburbs (Carlton 2007; Jamme et al 2019). TOD is comparable to several urban planning concepts, including pedestrian pockets, traditional neighborhood development, compact communities, urban villages, and complete communities, but is distinguished by its focus on proximity to transit (Carlton 2007; Jamme et al 2019). With influence from the Linear City, the Garden City, and New Urbanism, Calthrope positioned TOD as a response to environmental issues of auto-centric cities and car-dominated suburbs (Jamme et al 2019; Ibraeva et al 2020). In addition to the environmental impacts of sprawl, Calthrope describes the individual, household, and public costs of auto-dependency and the need for affordable housing and well-connected public and private spaces. Calthrope's vision for TOD requires integrative long-term planning and infrastructure investments (Calthrope 1993; Smart Growth America 2014).

Assuming transit stations serve as the foundational building block for more sustainable transportation, land use planning, and development (Appleyard et al 2019) TOD requires coordinated planning to ensure equitable access to opportunities and associated health outcomes of increased walkability (Dorsey and Mulder 2013; Appleyard et al 2019; Jamme et al 2019).

With a broad vision for sustainability, when applied to diverse communities worldwide, interpretations of TOD have evolved from Calthorpe's description in *The New American Metropolis* (Jamme et al 2019). While affordability, walkability, density, and public space were principal elements in Calthrope's initial vision, succeeding definitions share the focus on transit proximity as foundational to reducing car dependence and

improving quality of life (Jamme et al 2019). The evolution of TOD in the planning literature includes various interpretations of development, including land and real estate development, sustainable development, and community development, each at varying scales with consequent priorities (Jamme et al 2019). In contrast to varying interpretations of development, “transit-oriented” is measurable by a standard distance. The combined prominence in the term’s name and clear measurability discourages wide-ranging interpretations. (Jamme et al 2019; Cottrell 2007).

In response to a gap in evaluation metrics for TOD, the Institute for Transportation and Development Policy (ITDP) developed the TOD Standard with objectives and metrics for TOD principles: “walk, cycle, connect, transit, mix, densify, compact, and shift” (ITDP 2017; Carlton 2007). The TOD Standard provides guidance for integrating community spaces, promoting environmental sustainability, and successfully implementing TOD (ITDP 2017).

Planning research has also developed and utilized TOD typologies, starting with Cervero’s Three-D hypothesis, which suggested three elements (density, diversity, and design) to encourage transit use and reduce car dependence (Ibraeva et al 2020; Jamme et al 2019; Soliz et al 2024). Destination accessibility, demand management, distance to transit, and demographics were later contributed, incorporating equity and transportation considerations into the framework for TOD as a planning tool (Jamme et al 2019). TOD typologies are used to evaluate and compare station areas and developments, including the node-place approach, which assesses the spatial balance of transit accessibility and land use. Other typologies incorporate indexes for TOD potential, VMT impact, and

pedestrian accessibility (Ibraeva et al 2020). Transit-adjacent development (TAD) describes communities or developments lacking pedestrian comfort and connectivity and therefore not meeting environmental sustainability goals related to reduced car ownership and VMTs (Ibraeva et al 2020; Renne et al 2016). The Metropolitan Area Planning Council (MAPC) developed ten TOD typologies for greater Boston MBTA rapid transit and commuter rail station areas, including metro core, town/village, suburban transformation, urban gateway, and others, with regional TOD goals for 2035. MAPC's typologies are defined based on variables including community type, development intensity and mix, land use mix, demographics, redevelopment opportunities, and existing station area plans (Reardon and Dutta 2012).

Land Use

COMPACT, MIXED USES, JOB AND RESIDENTIAL DENSITY

Sprawl is characterized by scattered or dispersed development, commercial strip development, or large, expansive low-density or single-use development (Ewing and Hamidi 2015). The increased use of personal vehicles starting in the mid-20th century as the primary mode of transportation is acknowledged as the primary contributor to increasing urban sprawl. This is especially evident in cities that grew after the rise of the automobile, with negative implications including traffic congestion, energy consumption and environmental issues, local economic, health and quality of life impacts (Rubiera-Morollón and Garrido-Yserte 2020). Since the 1960s, segregated uses dominated, creating

residential neighborhoods, commercial, and industrial districts interconnected by roads, therefore reinforcing car dependence (Ibraeva et al 2020).

In contrast to sprawling communities, compact cities aim to promote sustainability development by reducing travel time and car dependency, lower energy usage and resource consumption, limit loss of green space and natural areas, and encourage choice in employment and services with positive effects on health, social cohesion, and cultural dynamics (Bibri et al 2020). Density, diversity, mixed land uses, sustainable transportation, and green space are core strategies for sustainable, compact cities (ibid). Policy recommendations for encouraging compact communities or mitigating the negative consequences of sprawl include promoting public transport systems and limiting private vehicle use, encouraging social interaction in urban spaces including green spaces and the city center, and introducing construction fees that include the environmental cost of single-family homes or provision of public services in dispersed environments (Rubiera-Morollón and Garrido-Yserte 2020).

Smart Growth America's analysis on sprawl found a strong direct relationship between compactness and upward economic mobility. For every 10% increase in the sprawl index score (a higher score is more compact), there was a 4.1% increase in the probability that a child born in the bottom quintile of national income would reach the top quintile by age 30 (SGA 2014). Additionally, they found the combined cost of housing and transportation decreases as the sprawl index increases (ibid). Compact communities typically have more transportation options and require shorter trips in comparison to sprawling communities (Warner et al 2010; Cervero and Sullivan 2011). The TOD Standard

recommends enabling shortened trip lengths and commutes through mixed and complementary land uses with residential and job densities within an existing urban area. A mix of residential and non-residential uses also supports walkability and safe, connected cycling infrastructure (ITDP 2017).

Compact cities that utilize density and mixed land use encourage efficiency, equity, and livability while responding to environmental, economic, and social challenges (Bibri et al 2020). Cities are increasingly using data-driven technologies to consider environmental and social sustainability to balance the emphasis on economic outcomes and sustainability (ibid). Grant (2023) argues that complete communities are integrative, flexible, and scalable, a political strategy to reframe higher density with economic, environmental, and social benefits.

Denser street networks are associated with increased walking frequency, and higher density residential TOD generates less traffic and lower demand for parking in comparison to conventional residential developments (Noland et al 2014; Dorsey and Mulder 2013). Policymakers, urban planners, and the public generally believe that rail access will mitigate traffic impacts of new development, which may influence developers likeliness to target station areas for development (Chatman 2013). The assumption that rail access will mitigate traffic impacts without consideration of density, mixed uses, and pedestrian connectivity may lead to unfavorable outcomes associated with transit-adjacent development (Dorsey and Mulder 2013). In an analysis of 1,776 transit stations in the U.S., only one-third were classified as TOD based on both a gross density of 8 units per acre and a walk score of 70 or greater. The remaining two-thirds were categorized as hybrid or TAD,

failing to meet one or both thresholds (Renne et al 2016). Improving livability in transit station areas and corridors requires investment in transit systems and coordinated local and regional planning of land use and urban design (Appleyard et al 2019).

Zoning and increased density alone cannot create adequate conditions for TOD. Higher density and mixed-use zoning can promote walkability and encourage cycling. The combination of characteristics—compactness, density, and mixed-use zoning, encourages walkability and is essential to the success of TOD (ITDP 2017; Dorsey and Mulder 2013). Transit-oriented development aims to shift trips from cars to more sustainable modes of transportation. Integrating transit, land use policies, zoning, and investment in transit and pathways together to shorten trips and enable the shift from cars to active transportation or transit (ibid).

Mobility

BIKE, WALK, RIDE

Multimodal mobility refers to the integration of several types of transportation, including walking, biking, rail, bus, and automobiles. Over time, technological innovation has enabled people to travel further and more efficiently. Multimodal mobility effectively accommodates short, medium, and long trips, simultaneously supporting various forms of mobility (Alessandretti et al 2023). Auto-centric planning and preference for automobiles, the least environmentally and financially sustainable transportation option, pose a significant challenge to planning a well-connected network that supports active transportation (ibid). Complete Streets is a multimodal transportation design approach

that accommodates the safety of all street users, including people walking, biking, driving, and riding public transportation. Bas and colleagues studied complete streets design and the effect of mode choice. They found that the level of traffic stress (LTS), which indicates the comfort and safety of a bike ride or walk on a particular road segment in addition to travel times and costs have the strongest impact on demand for alternative transportation (Bas et al 2023).

The first/last mile describes the experience of traveling from the initial location to a transit stop or from the transit stop to the destination. Several studies emphasize the importance of planning for the first/last mile to increase transit ridership and promote equity (Park et al 2021; Boarnet et al 2017; Mohiuddin 2021). Improving the first/last mile for pedestrians and cyclists can take various forms. Developing well-connected bike and pedestrian networks with bike and micro-mobility parking, continuous sidewalks, crosswalks, and pedestrian-scale lighting are strategies to improve the safety and convenience of active transportation (Mohiuddin 2021). Sidewalk availability and comfort, length of trip, ease of finding information, comfort of waiting areas, and safety were incorporated in the evaluation of the first/last mile walking environments and bus stop infrastructure (Venter 2020). Implementing bike infrastructure and bike shares can address first/last mile issues, especially for destinations beyond a short, easy walk or potentially expand the TOD catchment area for a transit station (Cottrell 2007; Cervero and Sullivan 2011).

A study on land use and transportation characteristics found that the quality of transit service was less important in attracting new ridership if the transport modes to and

from the transit stop were unattractive to potential riders (Venter 2020). In the findings of a study on street life and the built environment, two urban design qualities, imageability and complexity, were positively related to pedestrian counts when controlling for the D variables (Ewing and Cervero 2018). Imageability refers to the qualities of a place that make it memorable or distinct, while complexity is defined as visual richness of a place or the number of noticeable differences a viewer is exposed to within a unit of time (ibid). These findings support Speck's argument in *Walkable City*, the walk should be useful, safe, comfortable, and interesting (Speck 2012).

The TOD Standard recommends accessible, high-quality transit within a 6-to-10-minute walk. According to the TOD Standard, any development built beyond a half mile from a transit station (Metro, Tram, or BRT) is not considered TOD. Chatman's (2013) research on the role of transit in transit-oriented development suggests that the benefits of decreased car ownership and dependence associated with TOD may not be attributed to transit or rail access but instead associated with other variables including parking availability, quality bus service, housing types, stores within walking distance, job, and residential densities may be more influential. While research has prioritized transit access in TOD, Chatman recommends encouraging compact walkable neighborhoods through zoning and demand management to reform parking regulations, height limits, floor area ratios, and planning for (re)development (Chatman 2013).

One of the most significant variables associated with reduced car ownership was the number of bus stops within a mile of a home (Chatman 2013). While rail infrastructure is expensive and nearby land is generally limited, Bus Rapid Transit (BRT) is a potential

alternative or way to expand rail infrastructure, providing flexibility in transit service and cost savings in utilizing existing roadways (ibid). A cost analysis of BRT in the United States found that, on average, BRT can be seven times more affordable than light rail per square mile (Greater Boston BRT 2015). The BRT standard includes five elements aimed at minimizing delays: a dedicated right of way, bus alignment (avoiding conflict with traffic and curb activity), off-board fare collection, intersection treatments (i.e. prohibiting turns across BRT lane, reducing traffic signal phases, transit signal priority), and accessible platform-level boarding (Greater Boston BRT 2015).

BRT is recognized as a cost-effective, sustainable transportation solution. (Cervero and Dai 2014). In 2008, Cleveland, Ohio implemented the HealthLine, a BRT system, transforming a seven-mile corridor into a commercial backbone for the city while reducing emissions and particulate emissions and catalyzing $9.5 billion in economic development (RTA 2018). The Healthline has increased annual ridership by 60%, compared to the previous bus line, and decreased travel time from 46 minutes to 34 minutes (ibid). Cerevo and Dai suggest that BRT is particularly suited for low to moderate residential density, though they acknowledge uncertainty in using BRT to guide growth and promote TOD due to BRT's adaptive potential in comparison to rail transit (Cerevo and Dai 2014).

Many factors influence perceptions of driving and the decision to drive rather than taking an alternative mode of transportation. For older adults, ease of navigation (i.e., avoiding congestion and complicated road networks) factors in the decision, as well as the accessibility of social networks and activities via alternative modes of transportation (Wood et al 2016). Neighborhoods where older adults who may eventually become unable

or disinterested in driving themselves can access everyday errands and activities without a car, as intended in TOD areas, is a potential solution to support aging adults' housing and mobility needs (Wood et al 2016). A study on comparing the likelihood of Gen Z young adults (ages 16-20) holding a valid driver's license in 2017 in comparison to Millennial counterparts in 2009 found that Gen Z teens were about 5% less likely to have a driver's license (Wang 2024). The difference in licensed Gen Z teens versus Millennial teens is even greater on the West Coast (a 24% decrease in the Mountain region and a 17% decrease in the Pacific region). This may be attributed to the promotion of mixed-use, transit-oriented, bike and pedestrian planning on behalf of cities and transit agencies on the West Coast cities (ibid). An evaluation of TOD in three New Jersey communities found the TOD areas had lower vehicle ownership, which is associated with more frequent walking and transit use (Noland et al 2014).

A generalizable assessment of mode choice in association with new development is difficult due to a lack of control groups in studies and the exclusion of on/off-street parking due to limited availability of data. Until recently, the focus of TOD research was devoted to work trips with little consideration of non-work trips (i.e., schools, restaurants, bars, cultural venues, etc.) as the share of these trips is increasingly large (Ibreava et al 2020). Increasing availability of parking data and non-work trips could support efforts to understand land use and transportation policy and planning in relation to mode choice.

Affordability

Critiques of TOD have included association with gentrification and loss of affordable housing. While TOD initially focused on affordable, livable communities with integrated public space and transit, other priorities, including reducing VMTs and increasing property values, are more prominent in the planning literature. Yet the focus on community has recently returned to the forefront, particularly in the context of housing affordability and concerns of gentrification in station areas (Jamme et al 2019; Ibraeva et al 2020; Padeiro et al 2019).

Well-designed, attractive, walkable public spaces with newly constructed housing tend to attract individuals and young professionals, not necessarily due to the presence of transit but to social and built environment – mixed use, services, greenspace, and amenities (Padeiro et al 2019). The dense, mixed-use, pedestrian-friendly design of TOD may increase transit use while potentially increasing property prices (Ibreava et al 2020). The multifaceted and interconnected elements of transit-oriented development further complicate analysis of TOD-induced displacement (Hanrahan 2024). Transit investments are viewed as a way to promote sustainability and increase mobility for low-income residents. These investments can also alter nearby land values and change the accessibility landscape, providing new amenities near transit stations in TOD (Delmelle 2021).

A study comparing housing and transportation costs for Transit-Oriented Development and Transit-Adjacent Development (TAD) station areas suggests that TOD

areas are more affordable overall, accounting for the transportation cost savings that offset the higher housing costs (Renne et al 2016). HUD and the Center for Transit-Oriented Development found that the combined costs of housing and transportation increase with distance from city centers, disproportionately impacting lower-income households seeking affordability outside of an urban center (HUD and CTOD 2014). The cost savings of transit-rich communities depend on the local context, connectivity, and accessibility (Delmelle 2021; Renne et al 2016). Housing and transportation account for households' largest and second-largest expenses (HUD and CTOD 2014). The location and design of affordable housing are critical in determining the ease of meeting daily needs (HUD and CTOD 2014).

Kaniewska and colleagues found that as of July 2021, there were more than 107 TODs in regions with more than one rail line, of which nearly half had no designated or naturally occurring affordable units. 15% of the TODs were 100% affordable. On average, a quarter of the units were affordable to low- and moderate-income households earning between 50-80% AMI (Kaniewska et al 2024). These findings represent wide-ranging approaches to planning and producing housing. Building more market-rate housing affects the affordability landscape but alone is not a sufficient way of addressing housing affordability. Prioritizing preservation and enabling the development of new affordable units are essential to maintaining affordability (Delmelle 2021; HUD and CTOD 2014). Creating a housing system that provides options for residents with a variety of incomes and needs requires an active network of government, developers, nonprofits, and neighborhoods to work together (Howell and Wilson 2018).

Some cities have prioritized Equitable Transit-Oriented Development (ETOD) or Transit-Oriented Communities (TOC), incorporating diverse housing options and enabling people with a range of incomes to experience the benefits of a dense, mixed-use, pedestrian, and transit-oriented neighborhood. ETOD prioritizes production and preservation of affordable housing near transit and access to community services (schools, health clinics, and food) and enhanced connectivity, including bike and pedestrian infrastructure for low-income and transit-dependent populations (Metropolitan Planning Council 2022). Zhao and colleagues propose a Node-Place-People model to support planning for equitable TOD, to identify vulnerability to TOD-induced gentrification (Zhao et al 2024). Yip and colleagues recommend providing suitable and equitable built environments in terms of density, diversity, design, destination accessibility, and distance to transit, with special attention to the needs of disadvantaged groups to promote outcome justice in TOD (Yip et al 2024).

Influx of capital investments in historically marginalized communities is often met with distrust, and the perception that the infrastructure improvements are not for current residents but for newcomers represents a broader issue that needs to be met with plans to prevent displacement and authentic inclusion of residents in the planning process (Delmelle 2021). Calthrope argued that the need for affordable housing itself illustrates the need for integrated solutions in how communities are formed and how home is imagined (Calthrope 1993).

Transit-Oriented Communities

Beyond Complete Streets and Transit-Oriented Development, Transit-Oriented Community (TOC) planning typically expands TOD planning to the neighborhood level, balancing priorities of housing choice and economic opportunity, increasing transit ridership, community building, and infrastructure improvements in communities with public transportation (VTA 2022, MTC 2024; Stein 2019). These broadened efforts to develop dense, mixed-use, low-parking housing beyond the station area are potentially more influential and less expensive than rail-oriented development policy (Chatman 2013).

Several municipalities and transit authorities have adopted TOC policies. The City of New Orleans describes TOC as a more flexible and comprehensive approach "with greater sensitivity to unique neighborhood characteristics and community priorities through smaller projects close to high-frequency transit corridors", an approach better suited for cities served primarily by bus routes (New Orleans City Planning Commission and New Orleans Regional Transit Authority 2023, 6). The Santa Clara Transportation Authority developed Transit-Oriented Communities Playbooks for targeted station areas in the cities of San José and Santa Clara, California. Strategies include updating land use regulations, mobility for everyone, protecting and supporting small businesses and enhancing commercial areas, protecting and producing affordable housing, creating places that strengthen community identity, and prioritizing funding for implementation (VTA 2022). The concept of Transit-Oriented Communities encompasses the intentions of Transit-Oriented Development and Complete Communities, encouraging density, compact, mixed-use,

pedestrian-friendly built environments, enabling economic development without sacrificing affordability and equity.

Chapter 3: Worcester Demographics and Plans

Integrating Housing, Connectivity, and Economic Development Goals

The geographic and historical contexts are essential to understanding the housing and transportation conditions in the City of Worcester. While conditions for Transit-Oriented Development are favorable Downtown, larger-scale multifamily housing is prohibited in much of the city, and the legacy of decades of auto-centric planning and disinvestment has posed significant challenges to neighborhood connectivity and affordable TOD. Recent efforts to increase housing diversity and affordability include the citywide inclusionary zoning ordinance adopted in 2023 and the ADU ordinance adopted in 2024. Additionally, efforts to promote mixed-use development in the Central Business District and in the Canal District, and plans to improve connectivity and prioritize pedestrian safety across the city are important actions in addition to preserving affordable housing and displacement prevention. This chapter assesses Worcester's potential for affordable, connected neighborhoods through stakeholder interviews and content analysis of the city's housing, transportation, and sustainability plans and related policies, following a description of the city's geographic and historic contexts and population demographics.

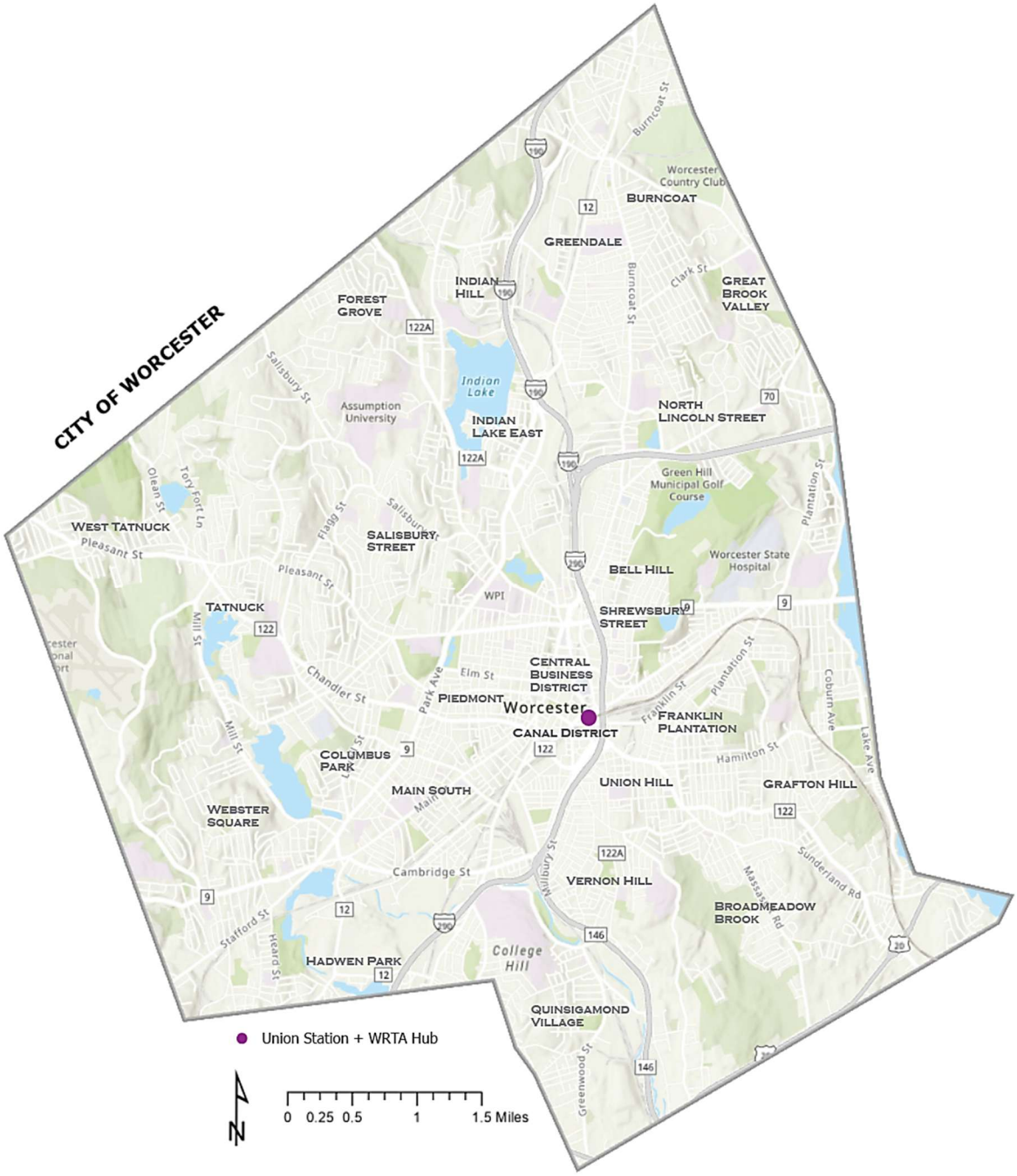

Figure 2: City of Worcester (World Topographical Map)

Local Context

Population Demographics

With a population of 207,620 (2023), Worcester is the second-largest city in New England. Compared to surrounding towns, Worcester has a relatively young population, with a median age of 33.9 (U.S. Census Bureau, 2023). Worcester's population is about 50.5% white alone, not Hispanic or Latino, 24.9% Hispanic or Latino, 12.1% Black alone, 0.6% American Indian and Alaskan Native alone, 6.9% Asian alone, 0.1% Native Hawaiian and other Pacific Islander, and 14.9% two or more races (U.S. Census Bureau 2023).

42% of Worcester's housing units are owner-occupied. The median value of those units is $339,500 (U.S. Census Bureau 2023). Though lower than the median gross rent in Massachusetts ($1,687), the median gross rent has increased significantly from $935 in 2014 to $1095 in 2019 to $1415 in 2023 (Figure 2). The median household income is $67,544. Nearly 20% of the population is living in poverty. More than half (approximately 53%) of renters are cost-burdened, paying 30% or more of their household income (U.S. Census Bureau 2023).

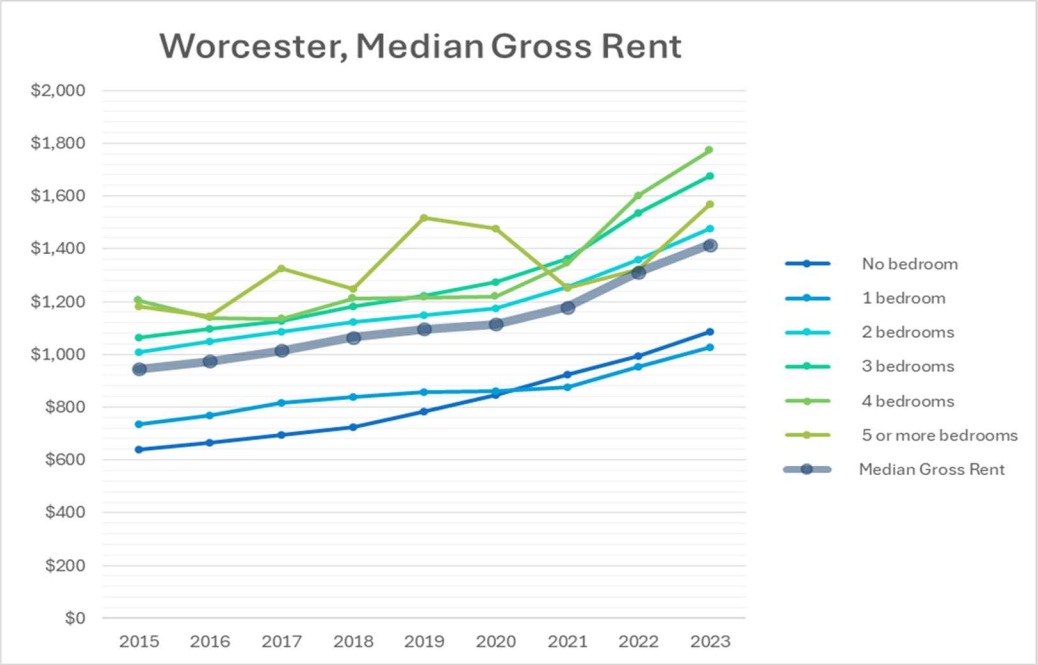

Figure 2: Change in Gross Median Rent (U.S. Census Bureau, 5-year estimates)

The majority of Worcester residents drive alone to work (70%), about 8% carpool, 2.6% take public transportation, 5% walk, 4.6% take a taxi, motorcycle, or other means of transportation, and about 9% work from home. 98.6% of Worcester residents work within the state, and 80% work within Worcester County. The mean travel time to work has steadily increased over the last decade from 23.5 minutes in 2013 to 26.2 minutes in 2023 (U.S. Census Bureau 2023). Figure 3 from the Mobility Action Plan illustrates the comparison of where Worcester workers live in comparison to where Worcester residents work. Workers commuting into Worcester are primarily concentrated in Worcester and nearby towns. The distribution of where Worcester residents live is primarily concentrated within Worcester, Shrewsbury, Northborough, and Westborough, with clusters in the Greater Boston area.

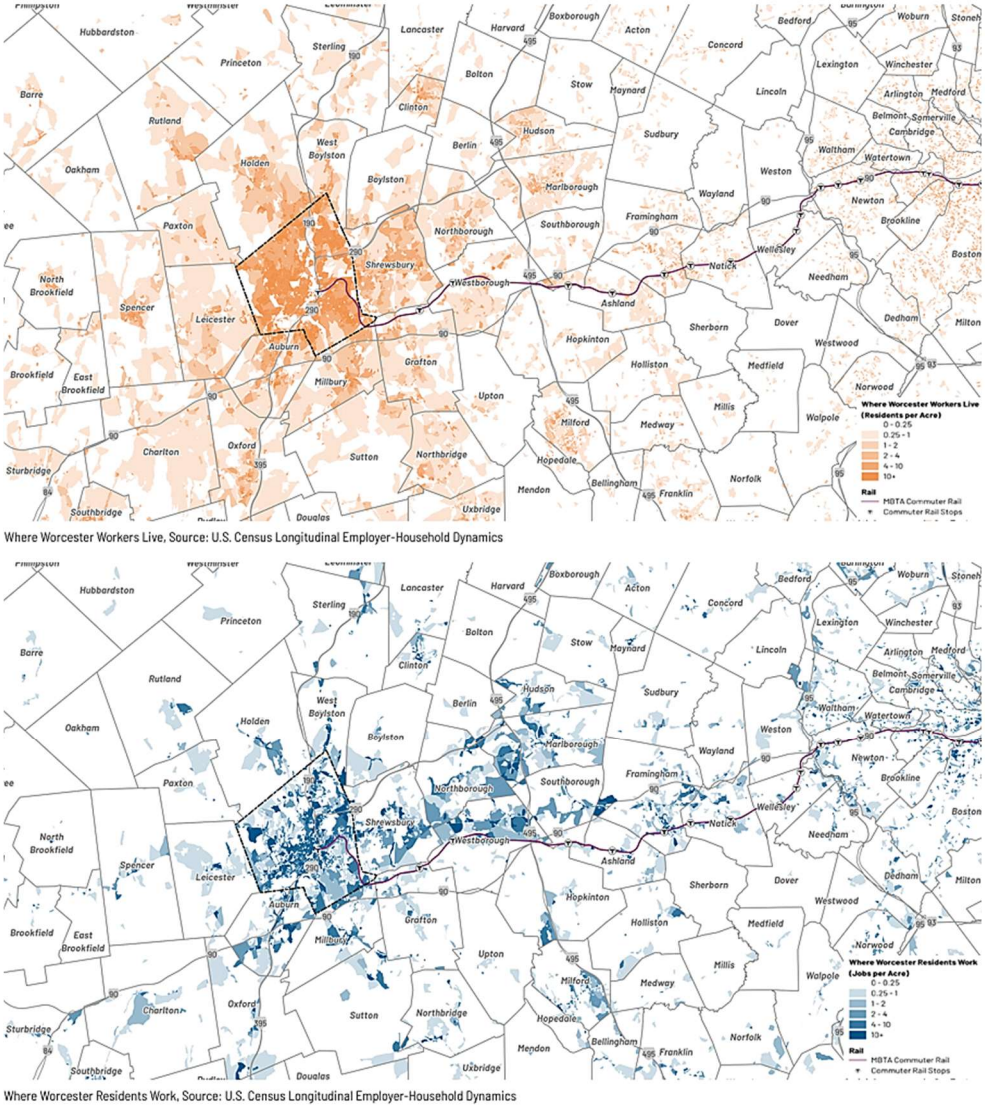

Figure 3: Where Worcester Workers Live vs Where Worcester Residents Work (City of Worcester 2024d).

History and Geography

Worcester, the "heart of the Commonwealth," is located in Central Massachusetts, about 40 miles west of Boston, 50 miles east of Springfield, and 40 miles northwest of Providence, Rhode Island. Worcester was established as a town in 1722 and incorporated as a city in 1848 (City of Worcester 2022). The city grew during the rise of industrialization with the construction of the Blackstone Canal, which connected Worcester to Providence,

enabling port access and trading of goods. The development of railroads connected Boston and Worcester in 1835, followed by the Providence and Worcester Railroad in 1847, establishing Worcester as a regional hub. The city's population steadily increased through the age of industrialization, reaching its previous peak population of 203,486 residents in 1950, followed by decades of population decline until 1990. During this time of industrial decline in the 1950s through the 1980s, Worcester lost about 40,000 residents (City of Worcester 2024e) as many cities experienced with the rise of suburbanization. Figure 4 from the city's Now|Next plan illustrates population change in relation to federal policy, local planning, and economic conditions.

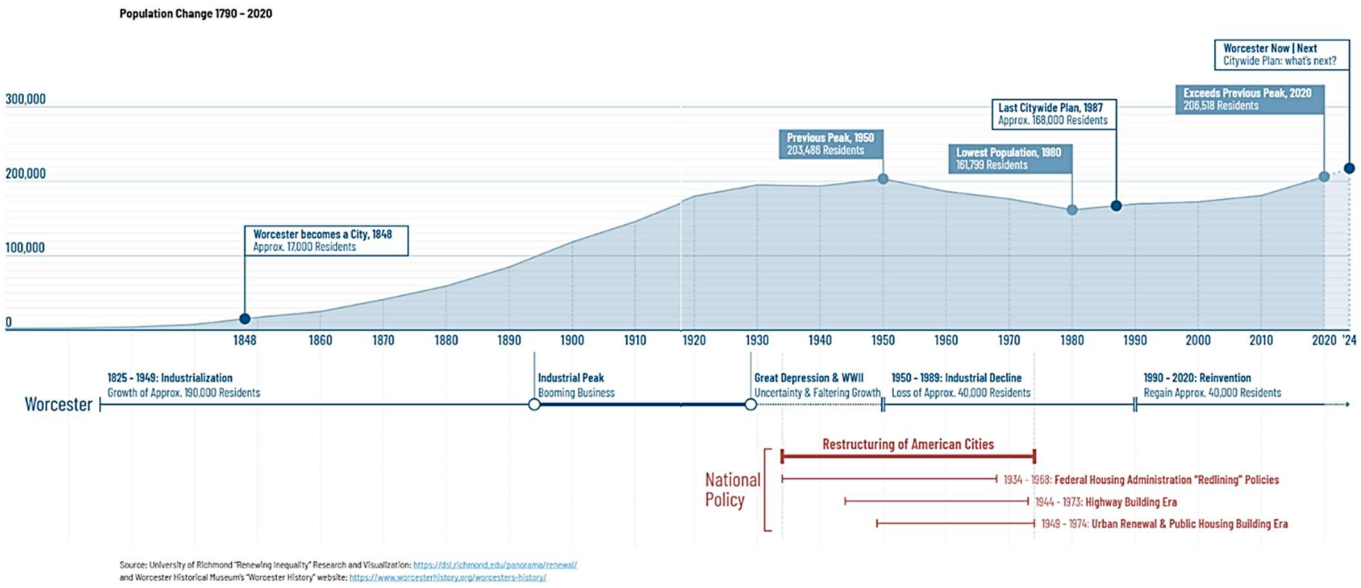

Figure 4: Worcester, Population Change 1790 to 2020 (City of Worcester 2024e; 60-61)

Post-Industrial Reinvention

The Hanover Theatre opened in Downtown Worcester in 2008, serving as a catalyst for investment in the surrounding area and the establishment of Worcester's Cultural

District (Peter Dunn 2025). The 2012 Theatre District Master Plan aimed to activate an 18-hour mixed-use neighborhood, improving pedestrian connectivity along key corridors, Main Street, Federal Street, and Front Street – home to the Hanover Theatre, City Hall, the YWCA, Worcester Public Library (Duckett 2012). The district also included the 20 Franklin St property, the former headquarters of the Telegram & Gazette newspaper, which has since been converted to a mixed-use property that includes Worcester PopUP and the Jean McDonough Arts Center (JMAC) BrickBox theatre in addition to small businesses, media, education, and innovation entities. Other notable locations, including the DCU Center, Mechanics Hall, and Union Station, are just beyond the district boundaries.

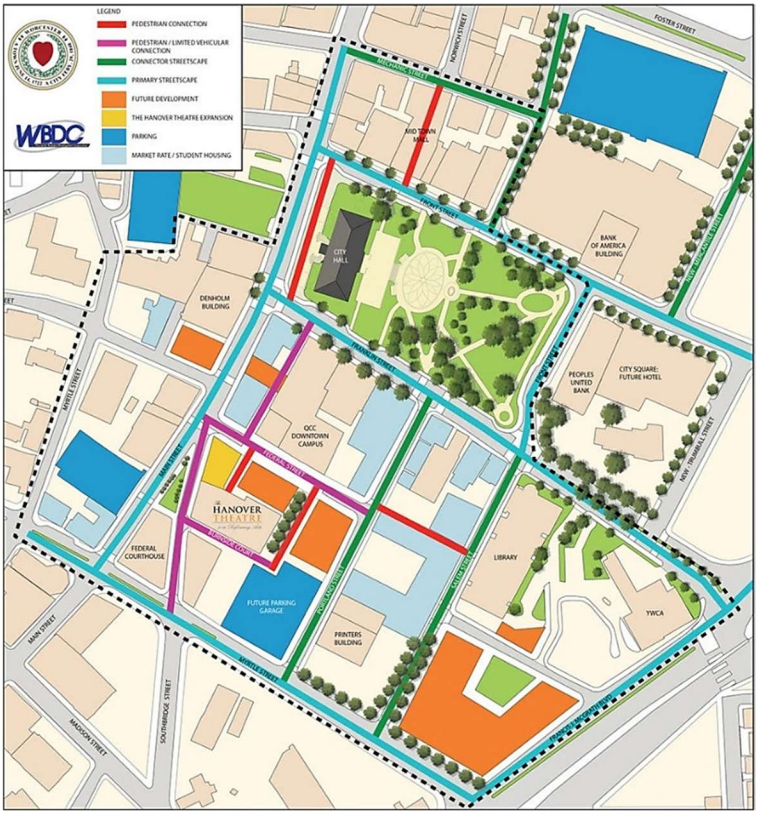

Figure 5 Theatre District Plan (Crosby | Schlessinger | Smallridge LLC 2012)

The Theatre District was selected as one of MassDevelopment's first Transformative Development Initiative (TDI) districts in 2015-2018. The three-year initiative included a designated TDI fellow and eligibility for technical assistance, small business grants, and real estate investments. The Worcester Business Improvement District (BID) was established in 2018 following the completion of the Downtown TDI, continuing placemaking, beautification, ground floor activation, and community building events on the Common.

MassInc and Boston Indicators have highlighted the potential for TOD in Worcester's downtown and Canal District. Grassroots organizing efforts of the Canal District Alliance in the 2000s activated the revitalization of the Canal District, which briefly featured the Blackstone Canal before the construction of the railroads (Calef et al 2021). Bars, restaurants, and clubs opened in the 2000s, and Businesses moved into a renovated mill building in 2013. In 2021, the new baseball stadium, Polar Park, opened, utilizing a vacant brownfield and offering space for residents and visitors to come together and support the Worcester Red Sox (EPA 2021; Calef et al 2021).

Transportation and Mobility

Worcester's transit options include WRTA bus service and the MBTA commuter rail. In 2022, the city created the Department of Transportation and Mobility to coordinate, plan, and implement transportation and mobility programs and projects that promote safety, equity, and sustainability.

The WRTA provides local connectivity through the City of Worcester and the 36 surrounding communities in Central Massachusetts with 54 buses and a mission of providing "convenient, comfortable, safe, reliable, cost-effective mobility services contributing to the economic vitality of the region" (WRTA n.d.). The WRTA was established in 1974 by the Regional Transit Authority Act and has been recognized as the longest-standing fare-free transit system in the U.S. through federal and state funding, starting in 2020. In comparison to other regional transit agencies, the WRTA's ridership recovered and surpassed pre-pandemic ridership (WRRB 2023). The WRTA Central Hub is located at 60 Foster St, adjacent to Union Station.

Worcester's Commuter Rail Station is located at Union Station with service via the Framingham/Worcester line to South Station with trains departing around 45-minute intervals during peak commuting hours and every 2 hours otherwise. Several scheduled trains offer express service from West Natick to Boston Landing, reducing commute time to Boston to 90 minutes while stopping in Grafton, Westborough, Southborough, Ashland, and Framingham. The "heart to hub" train provides express service from Worcester to Boston with a stop in Framingham alone, reducing the trip to 70 minutes from Union Station to South Station (MBTA 2024). As of the spring of 2025, the MBTA is completing upgrades to Worcester Union Station, including platform, track, and accessibility improvements to accommodate additional trains. The project includes a new high-level center platform, infrastructure upgrades, including new elevators, stairways, a pedestrian bridge crossing the tracks, and accessibility improvements to the parking area (MBTA n.d.).

For both the WRTA and Commuter Rail, multimodal mobility is a factor in evaluating connectivity and improving the first/last mile experience. An accessible and walkable built environment is critical to improving the safety of pedestrians and transit riders. In 2024, the city declared a Road Safety and Traffic Violence Crisis in response to the high volume of deaths and severe injuries (City of Worcester 2025). The Vision Zero Action Plan aims to achieve zero fatalities by 2035 through design improvements, systemic programming, policy coordination, and public engagement. The plan includes street and intersection redesigns for priority intersections based on crash data and community input. Recommendations also include pedestrian safety improvements around schools, housing shelters, and resource centers, as well as a safety audit of WRTA bus stops. According to the plan, 62% of pedestrian and 60% of bicycle injury crashes occur within 200 feet of a bus stop, which is only about 8% of the land in Worcester.

Housing

Between 2010 and 2020, the city's population grew by 14.1%, the highest growth rate of New England's 10 most populous cities (Nanos and Logan 2020). In part, this population growth is attributed to the relative affordability of housing in Worcester in comparison to Greater Boston. While 10,000 new units were added to Worcester in the last decade, affordable housing development has lagged in comparison to market-rate housing. Forbes ranked Worcester the third-worst rental market of the 75 most populous cities in the U.S. (Landeck 2024). The vacancy rate of rental units is 1.7% (compared to the average vacancy of 6.7%). The city also had the third-highest increase in rental prices

(average increase of $163) over the last year, according to Forbes' analysis on pricing, availability, and population (ibid).

40% of today's housing units in Worcester were built before 1940, and nearly two-thirds (64%) were built before 1980 (U.S. Census Bureau 2023). The triple-deckers were the prominent housing structure during industrialization and Worcester's period of population growth following the construction of the railroads and local factories. The triple-deckers were built within walking distance of the factories on Chandler Hill, Vernon Hill, and South Worcester, and the majority of them were owner-occupied and rented to immigrants working in the factories. The last building permit for triple-decker construction was granted in 1932. In 1933, 90% of the city's population lived within 3 miles of the city center (Spear 1977). In the 1940s, the triple-deckers accounted for about 50% of Worcester's housing stock (ibid); today, they account for about 25%, while more than one-third (36%) of Worcester's units are single-family structures (U.S. Census Bureau 2023). Worcester's current zoning code, which restricts about 44% of the city's land to single-family units, was created in 1963 with incremental revisions since (City of Worcester 2024e). Current-day single-family zones closely resemble the "best" and "still desirable" neighborhood grades assigned by the Home Owners' Loan Corporation 1936 redlining map while neighborhoods that were "definitely declining" or "hazardous" are correlated with one or more environmental justice factors and were disproportionately impacted by increasing rent costs since 2010 (City of Worcester 2024e).

The city has limited larger-scale density (4 or more units) as zoning prohibits this development in 75% of the municipality (City of Worcester 2024). 8% of the city's housing

stock is 5 to 9-unit structures, 6% is 10 to 19-unit structures, and 14% are 20 or more-unit structures (U.S. Census Bureau 2023). The remaining allocation is single-family, duplexes, and 3 to 4-unit. The antiquated zoning code, aging triple-deckers, and limited new development in Worcester have culminated in current conditions that reinforce auto-centric, segregated land use, missing middle housing, and affordability issues.

Autocentric Policy and Planning

Today, about 35% of Worcester's central city is off-street parking (Parking Reform Network 2024). In the 1950s, Worcester was experiencing congestion due to the increased use of personal vehicles and insufficient parking options in proximity to destinations. The solution was to build off-street parking, remove on-street parking to widen roads, and mandate parking requirements for new construction through parking minimums (Worcester Regional Research Bureau 2024). A study on the utilization of public parking downtown found more than enough parking spaces to meet demand, with over 4000 off-street parking spaces and more event parking available during baseball season at Polar Park and additional parking on-street or privately owned (Worcester Regional Research Bureau 2024). The audit by the Parking Reform Network found that Worcester's percentage of the central city dedicated to parking was among the ten highest of about 100 cities that were analyzed (Parking Reform Network 2023).

Urban renewal and the construction of I-290 through eminent domain effectively disconnected neighborhoods and allocated more space to automobiles at the expense of African American neighborhoods, local businesses, and pedestrian-friendly streets. In

addition to environmental health impacts and generational wealth disparities, I-290 divides the land within walking distance of Union Station, creating a barrier to development and reducing the size of the developable TOD district to 290 acres (City of Worcester 2024; Hodge and Forman 2018). The Union Station area has some large-scale, dense residential developments in a mixed-use district downtown to the west of the Commuter Rail, though I-290 and the rail yard adjacent to the commuter rail line take up a significant portion of the quarter-mile radius, posing challenges to comfortable pedestrian access to the station.

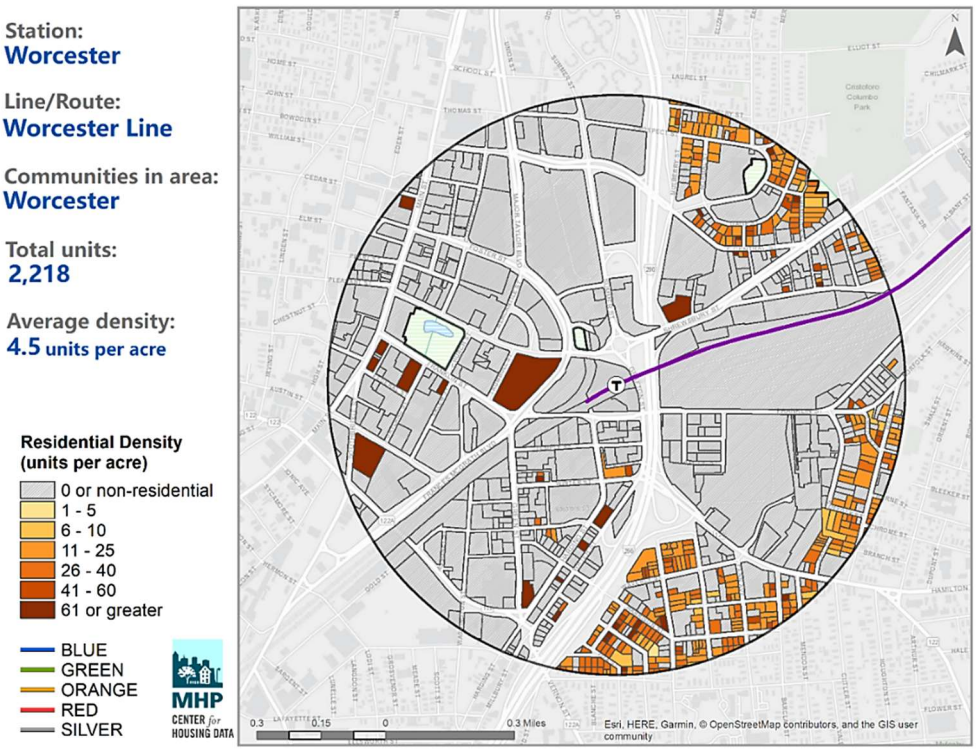

Figure 6: Worcester Union Station Area (MHP TODEX 2019)

Highway on and off ramps are also among priority intersections identified in the Mobility Action Plan and Vision Zero Plan based on crash history, design, and risk to pedestrians and cyclists (City of Worcester 2024d; City of Worcester 2025).

Current Development and Plans

Worcester's Now|Next Plan (2024) describes the shortcomings of the current zoning code, which reinforces segregation and inequities, does not support the growth Worcester has been experiencing, nor guides housing production between 3-family housing and large-scale multifamily developments, exacerbating the "missing middle" housing issue. The Worcester City Council adopted the Commercial Corridors Overlay District (CCOD-D) zoning ordinance in 2015 to encourage mixed-use compact development, eliminate excess parking requirements, and discourage auto-oriented use and single-family low-density housing. The overlay includes a maximum of 125% of normal off-street accessory parking requirements. The city has encouraged ground-floor commercial or communal residential space (such as a lobby or gym) and parking design in the rear when necessary to prioritize the pedestrian experience and promote an active downtown environment (Michelle Smith 2025). Excluding the Central Business District, the segregation of land uses and excessive parking requirements do not support Worcester's sustainability goals and reinforce reliance on cars.

To meet Worcester's vision of *"a creative city of neighbors who value inclusion and celebrate diversity*, the plan recommends equitable investment in communities, connecting neighborhoods to opportunity, and prioritizing sustainable growth (City of Worcester 2024e; 24). Now|Next builds on recent plans, including the Strategic Plan (2020), Green Worcester Plan (2020) and the Cultural Plan (2019) in addition to housing and economic development policy guides and other environmental, health, education, and

neighborhood plans to encourage equitable and sustainable transit-oriented development, more diverse housing opportunities, vibrant mixed-use walkable neighborhood centers and corridors. The plan highlights transformative growth corridors including Shrewsbury St, Grafton St, West Boylston St, Park Ave, Chandler St, Webster Square, and Route 20.

The Now|Next plan projects growth in jobs and population, requiring new homes, offices, and retail spaces, proposing areas within a ¼ mile walk of existing and future transit corridors are identified as managed growth areas which can support a moderate increase in density and limited ground floor retail at appropriate intersections to provide amenities to primarily residential neighborhoods. Infill growth areas with high transit access and walkability can accommodate mixed-use development on vacant or underutilized properties and improved active mobility infrastructure. Transformative growth areas are identified as areas with unmet potential for high walkability and transit access and potential to support substantial job growth and increased density. The plan identifies equitable transit-oriented development as the first strategy to change development norms and better support the vision of the plan. The foundation for ETOD requires displacement mitigation in growth areas, new affordable and mixed-income housing development, support of fair housing principles, ETOD zoning, transportation demand management, and mobility investment plans (City of Worcester 2024e).

The Mobility Action Plan (MAP) identifies complementary strategies to improve safety, connectivity, equity, and sustainability with an evaluation metric scoring system for each strategy. The evaluation metric assigns 0-3 points for alignment and impact to six metrics: (1) vision zero, (2) complete streets, (3) improved connectivity (to schools, parks,

green space, grocery stores, institutions, employment areas, other high demand destinations), (4) transit access and reduced cost or delay of public transportation, (5) community input and co-creation, and (6) reduced VMTs and emissions. Of the top 15 strategies, 3 were also highly ranked by the public. Those strategies are to create a sidewalk and curb ramp implementation plan to improve physical accessibility, develop a First/Last Mile Strategic Plan to improve access to transit, and create and implement a Vision Zero Safety Action Plan. Other top-ranking priorities include developing a bike and mobility network and implementing a bikeshare and/or micro-mobility program. Strategies to improve transit efficiency and reliability include studying the potential for micro transit zones and implementing transit signal priority on key corridors (Figure 7).

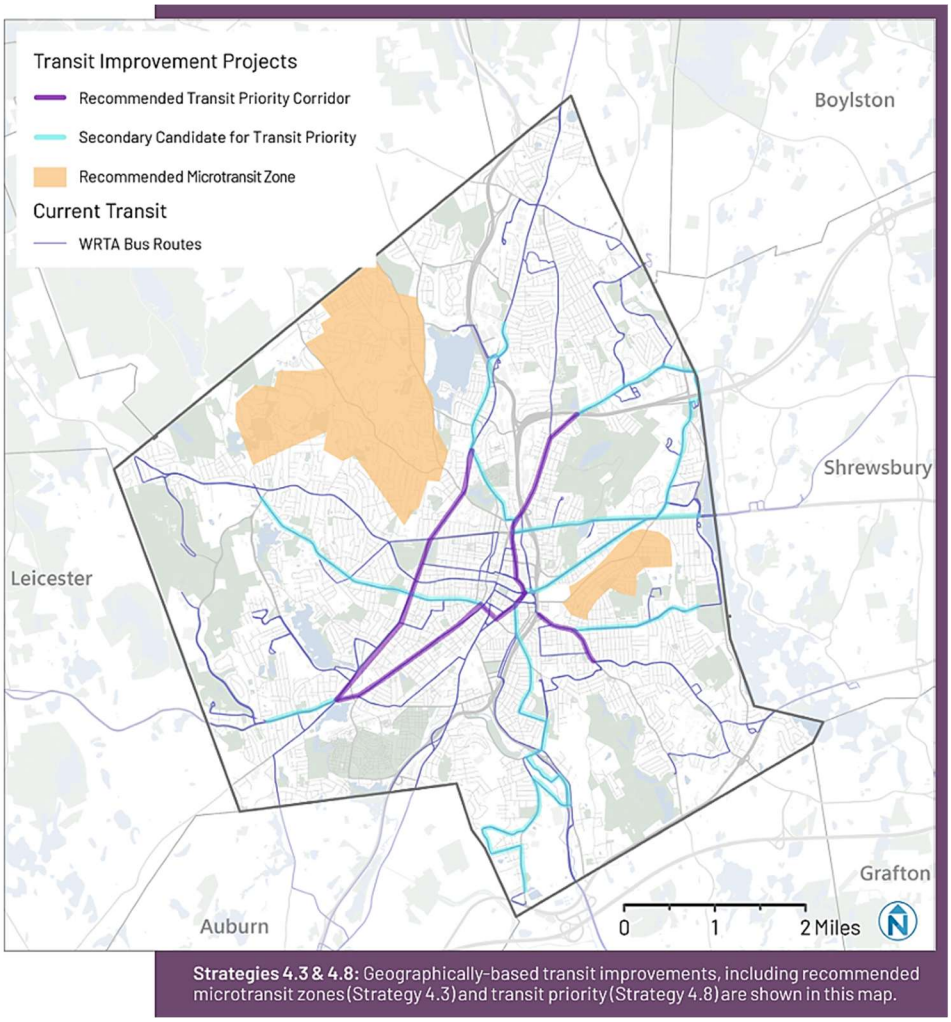

Figure 7: Transit Improvement Projects (City of Worcester 2024d)

The Mobility Action Plan does not explicitly mention transit-oriented development, though improving connectivity, safety, and accessibility for transit and active mobility are essential to effectively implementing ETOD.

Preserving and Developing Affordable Units

In 2023, the city council adopted an Inclusionary Zoning Ordinance, which applies to any development with a net production of 12 or more units. The ordinance provides developers with the option of dedicating at least 15% of units to households at or below

80% AMI, or at least 10% of units affordable to households earning no more than 60% AMI, or a proportional combination of 60% and 80% AMI. Developers also have the option for payment in lieu of 3% of the total construction value, which is allocated to the city's Affordable Housing Trust Fund (City of Worcester 2023). Compliance with the inclusionary zoning includes automatic density bonuses for projects with at least 5% of units at 60% AMI and reduced parking requirements for reduced parking requirements for transportation demand management programs.

The inclusionary zoning ordinance was passed unanimously following political debate of the requirements and increased construction of market-rate units with lower interest rates in 2022 (Peter Dunn 2025). Projects filed or approved before the ordinance are exempt from the requirements for two years. The Massachusetts legislature passed the Mass Leads Act in November 2024, which extended approval for expiring projects between January 2023-2025. Due to the exemptions and automatic extensions, the inclusionary zoning ordinance has applied to limited projects in the short time since it was passed. Rental units may not exceed 30% of annual household income or the fair market rent, whichever is lower. Due to current market conditions, some developers are opting for 5% of units at 60% AMI to meet the requirement for the density bonus and 10% at 80% AMI (Michelle Smith 2025). The inclusionary zoning ordinance will continue to be monitored in the context of market conditions and completed development to ensure affordable units are produced rather than burdening developers and halting development (Peter Dunn 2025).

Potential for Transit-Oriented Worcester

As the literature suggests, TOD is a relatively new term for a historic planning concept. Historically, Worcester's population grew in walkable neighborhoods in proximity to industrial jobs with rail connections to Boston and Providence, enabling trade and economic growth. While auto-centric planning and land use dominated the 20th century, the city's priorities of a more connected and accessible city, equitable and sustained public investment in neighborhoods, and a framework for growth that enables a more equitable, sustainable, resilient, walkable, diverse, affordable, and mixed use communities aligns with the goals and outcomes of equitable transit-oriented development and transit-oriented communities (City of Worcester 2024). The anticipated zoning code overhaul, implementation of transportation and mobility plans, and continued collaborations to produce and preserve affordable housing will likely support the conditions for effective transit-oriented communities and the benefits associated with affordable, connected, sustainable communities.

MassINC highlighted the potential for TOD in Massachusetts' gateway cities with transformative, equitable economic growth benefits, fiscal benefits, and environmental benefits. At optimal buildout capacity, they estimate the TOD area could accommodate a net gain of 6,698 jobs and a population increase of 23,505 (Hodge and Forman 2018). The existing conditions as of 2018 estimate a population of 2,511 and 19,318 jobs within the TOD area (ibid). To effectively deliver the benefits of transformative TOD in gateway cities, MassINC proposes three pillars to equitable TOD: integrative land use, equitable

transportation, and inclusive economic development (Corley et al 2020). This requires linking areas of concentrated activity, a strong mix of land uses with housing, schools, stores, social services, grocery stores, restaurants, and open space. This also requires local and regional planning, travel-demand management, infrastructure that supports transit ridership, and active mobility within and beyond the station area. The City of Worcester has the opportunity to build on the momentum of planning efforts through policy and plan implementation to facilitate sustainable and connected neighborhoods for all. This will require continued coordinated investments and partnerships with nonprofit organizations, CDCs, developers, transit authorities, local businesses, community members, and other stakeholders (Peter Dunn 2025; Larry Curtis 2025; Michelle Smith 2025).

Chapter 4: Spatial Analysis

Introduction

Data incorporated in this analysis was selected based on findings from a multi-criteria prioritization tool intended to catalyze TOD on publicly owned land. The study produced 14 indicators to measure TOD suitability, which include job accessibility, transit network connectivity, land use mix, walk score, sociodemographic characteristics, and other planning and real estate indicators (Cai et al 2023). The City of Chicago's ETOD calculator by the Center for Neighborhood Technology and Metropolitan Planning Council incorporates census data, zoning, amenities, transit, bike lanes, displacement pressure, and qualified development areas such as Opportunity Zones and TIF districts (CNET and MPC 2022). Based on data availability and essential components of TOD, this suitability analysis considers bus and commuter rail access, potential for walkable trips, open space, libraries, job density, arts and culture, zoning, and census data.

Data

Transportation and Mobility

DATA	DESCRIPTION
WRTA Bus Stops (MassDOT 2024)	Point shapefile, each point representing one bus stop
MBTA Commuter Rail (MBTA 2024)	Point shapefile, each point representing one commuter rail station

Potential for Everyday Walk (MassDOT 2022)	The line shapefile displays the latent demand for walking trips. This is calculated by MassDOT using data on transit demand, transit access, and social equity: Potential for Walking/Biking = (.7 * Demand + .2 * Transit Access) + (1 + Social Equity) *High: Top 10% of potential* *Medium: Top 60% of potential* *Low: Remaining 40% of roadways*

Table 1: Data Description—Transportation and Mobility

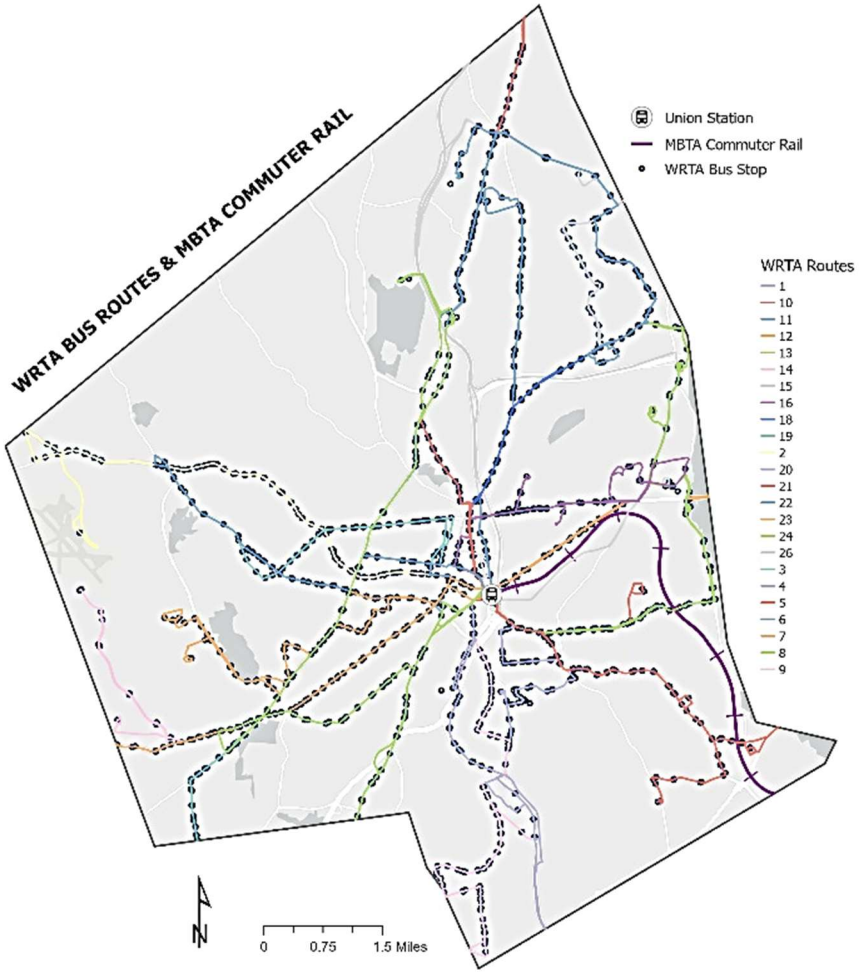

Figure 8: Transportation and Mobility: WRTA Bus Routes and Commuter Rail

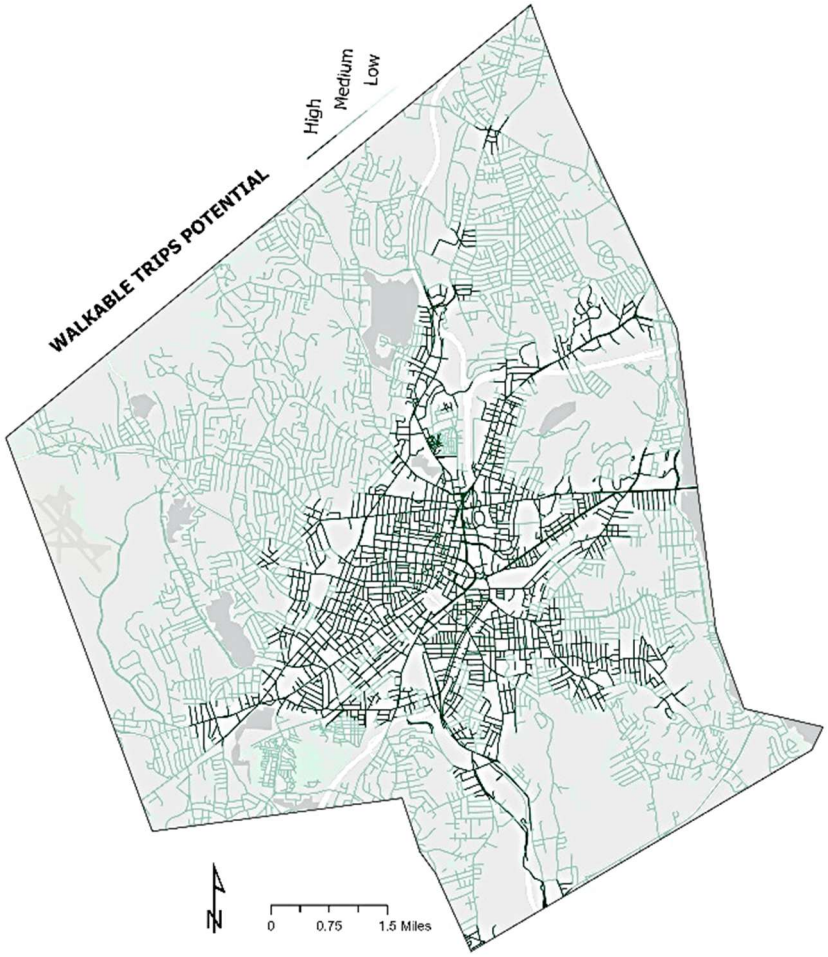

Figure 9: Transportation and Mobility: Walkable Trips Potential (high/medium/low)

COMMUNITY AMENITIES

DATA	DESCRIPTION
Open Space (City of Worcester 2024)	Polygons representing parks and open space
Libraries (MassGIS 2017)	Point shapefile, each point represents a public library
Top 100 Employers, Worcester (MA Dept of Economic Research 2024)	Table with addresses of the top 100 employers in Worcester. Addresses were geocoded to points.
Arts and Culture Organizations (Worcester Cultural Coalition 2024)	Table with addresses of Worcester Cultural Coalition member organizations. Addresses were geocoded to points.

Table 2: Data Description—Community Amenities

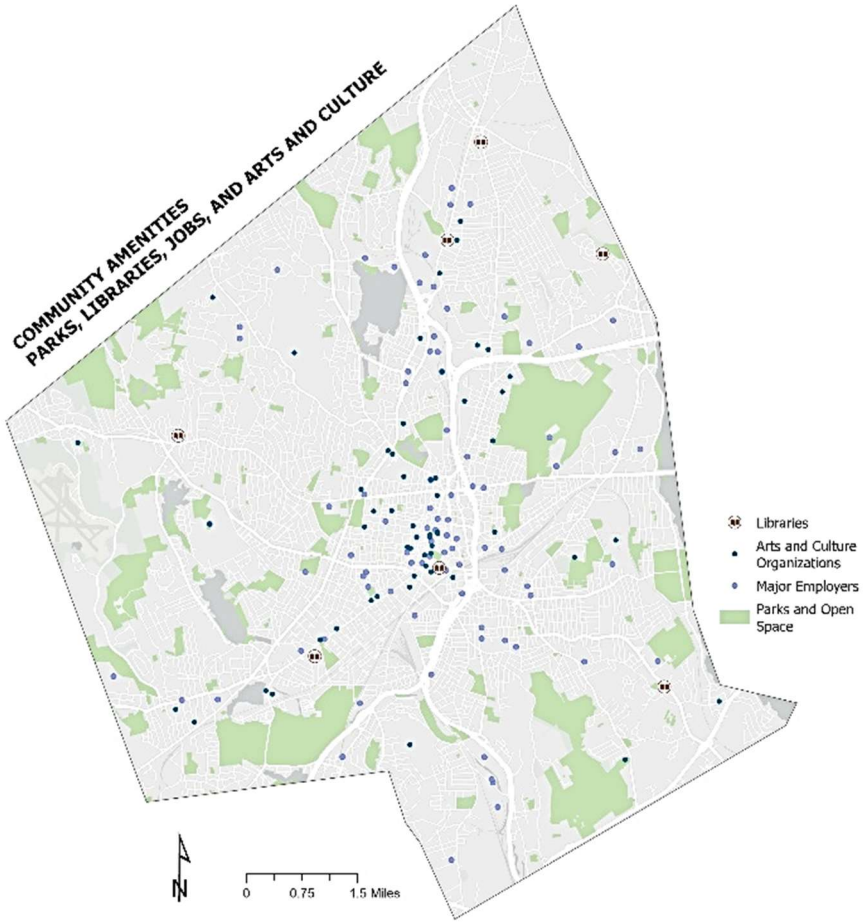

Figure10: Community Amenities (Parks, Libraries, Jobs, and Arts and Culture Organizations)

LAND USE

DATA	DESCRIPTION
Zoning (City of Worcester 2024)	Shapefile- polygon
Zoning Overlays (City of Worcester 2024)	Shapefile- polygons

Table 3: Data Description—Land Use

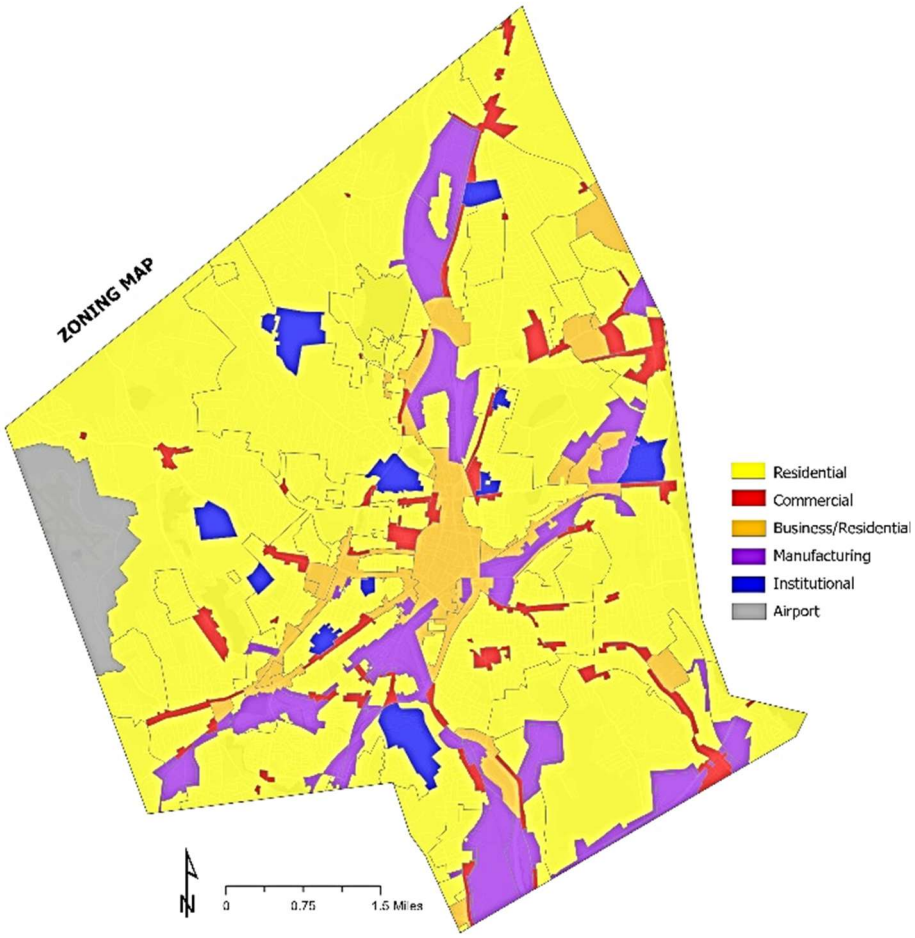

Figure 11: Zoning

VEHICLE ACCESS AND OPPORTUNITY ZONES

DATA	DESCRIPTION
Percent of Occupied Units, No Vehicle (ACS 2023)	Table with ACS 2023 5-year estimates by census tract. Data table was joined to Census Tract polygons, then percent was calculated by dividing the number of occupied units with no vehicle by the total number of occupied units by tract.
Opportunity Zone Census Tracts	6 designated census tracts (7305.00; 7313.00; 7314.00; 7317.00; 7325.00; 7328.00). The City of Worcester describes each tract as follows: **Census Tract 7305.00** *"This tract is generally bounded by Salisbury Street, Grove Street and Indian Lake to the west, Belmont Street (Lincoln*

	Square) to the south, I-290 and the railroad tracks to the east and Shore Drive to the north. It is a portion of North Worcester, including major commercial corridors such as Gold Star Boulevard and much of West Boylston Street." **Census Tract 7313.00** *"This tract is generally bounded by Main Street to the northwest, Crystal Street to the west, the Providence and Worcester railroad tracks to the southeast and Hermon Street to the northeast. It includes a portion of the Main South neighborhood. Part of this area has also been designated as a Transformative Development Initiative (TDI) District by MassDevelopment."* **Census Tract 7314.00** *"This tract is generally bounded by May Street to the southwest, Mayfield Street (across Park Avenue) to the northwest, Chandler Street to the northeast and Main Street to the South East. Much of the area is known locally as the Village of Piedmont."* **Census Tract 7317.00** *"This tract is general bounded by Irving/Lancaster Street to the west, Highland Street (Lincoln Square) to the north, Summer Street/I-290 to the northeast, the Providence and Worcester railroad tracks to the southeast and Hermon Street to the southwest. It is known locally as the Central Business District, or Downtown."* **Census Tract 7325.00** *"This tract is generally bounded by Quinsigamond Avenue to the south and west, I-290 to the east and the Providence & Worcester railroad tracks to the north. Much of the area is known locally as the Canal District and Green Island. A portion of this area is also part of the City's adopted Urban Revitalization Plan."* **Census Tract 7328.00** *"This tract is generally bounded by the Worcester-Millbury town line to the southeast, the Worcester-Shrewsbury town line to the northeast, Sunderland Road to the north and Massasoit Road to the west. It includes a significant part of Route 20, and a portion is known locally as Grafton Hill."* (City of Worcester n.d. b)

Table 4: Data Description—Census Tracts

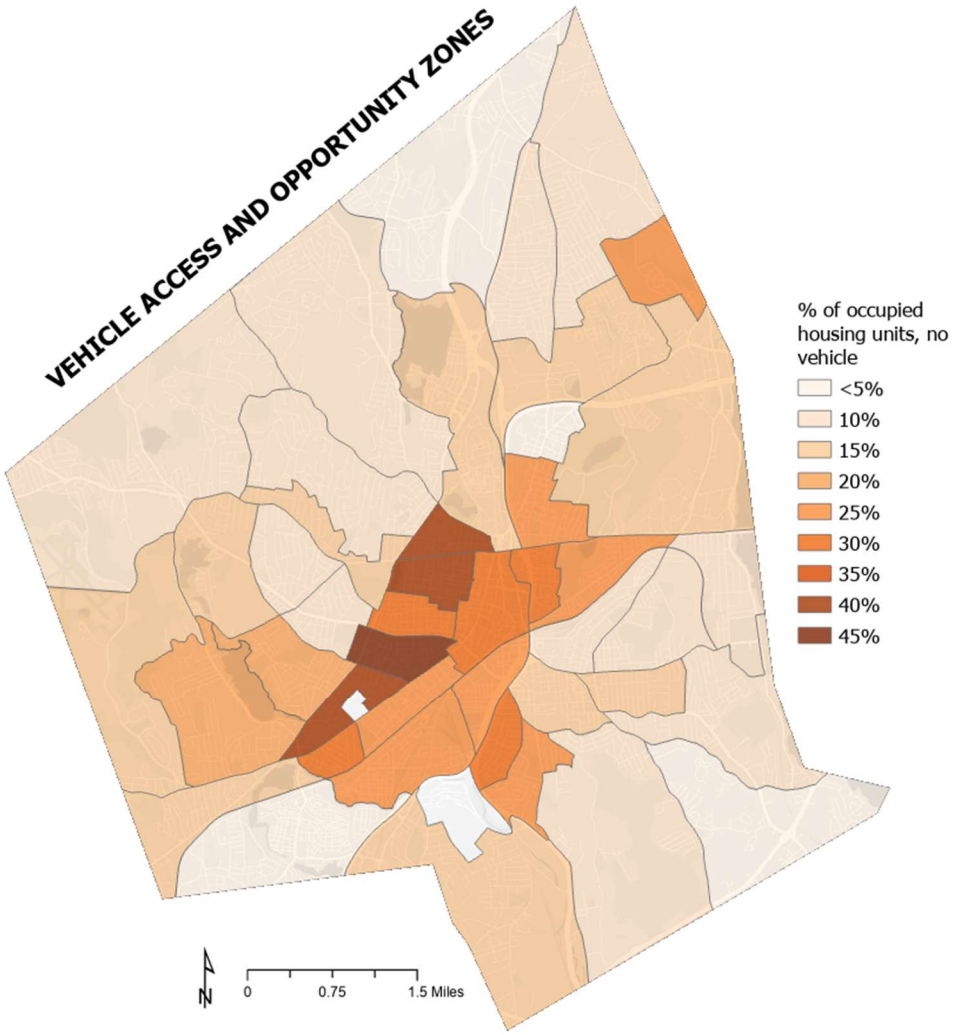

Figure 12: Vehicle Access and Opportunity Zones Census Tracts

Methods

The following steps were taken to prepare spatial data for suitability analysis using the raster calculator.

Transportation and Mobility

Transportation and mobility data includes bus stop density, commuter rail station access, and potential for everyday walkability. The everyday walk data was spatially joined

to census block group polygons. The polygons representing potential walkability were rasterized. Bus stop points were converted to rasters using the kernel density tool. The output represents bus stop density in the City of Worcester. The Commuter Rail service area was developed using a network analysis service area for locations within a 0.25-mile, 0.5-mile, 1-mile, 2-mile, and greater than 2-mile walk to Union Station. All raster data was reclassified 1-5. High density in transit services and high potential walkability were assigned most suitable (5) in the reclassification. Suitability based on transportation access and walkability was calculated with equal weights using the raster calculator.

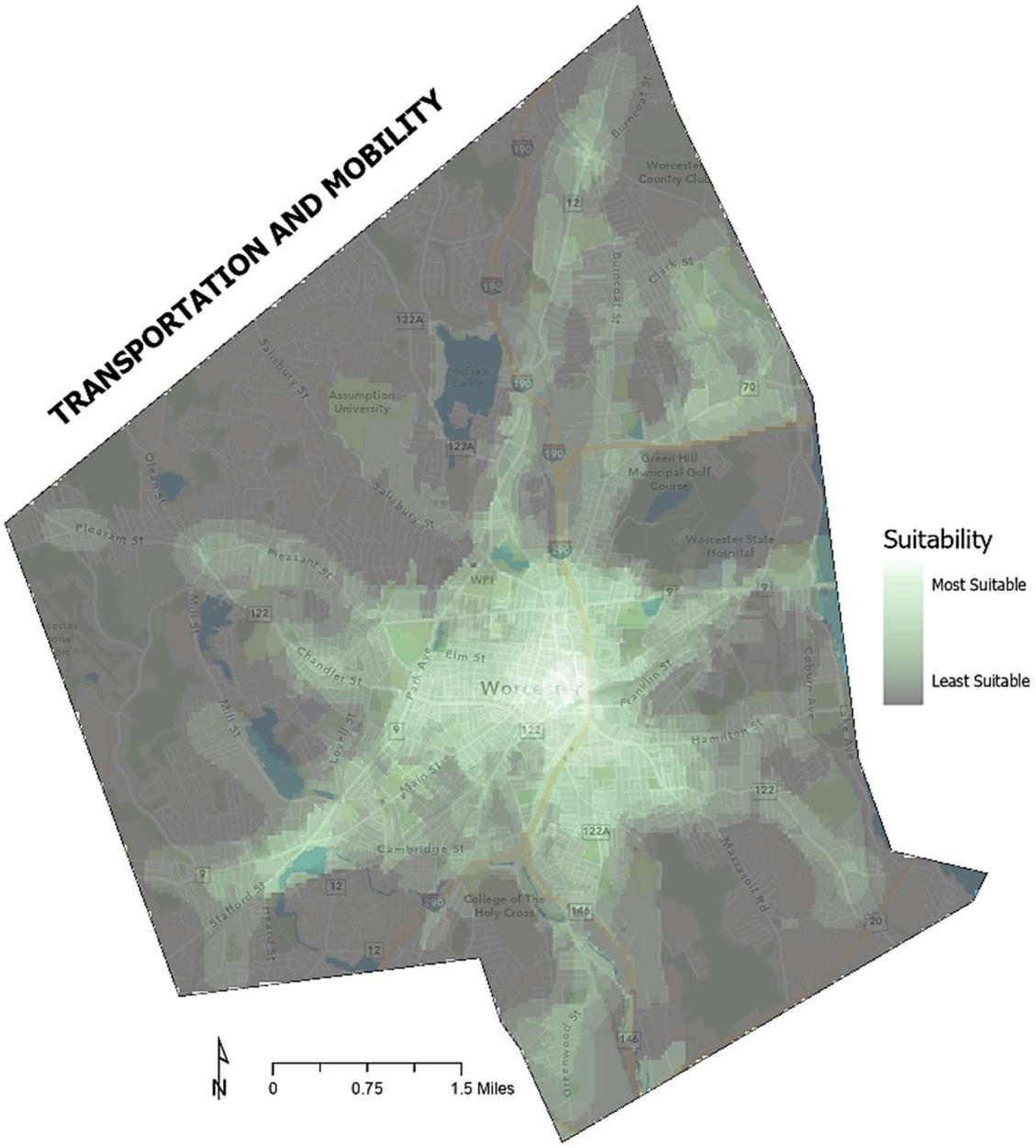

Figure 13: Suitability Map with combined Transportation and Mobility Access

Considering transportation and mobility access, the downtown core is most suitable for Transit-Oriented Development. This area has the highest density of bus stops and the highest potential for walkable trips, and it is also where Union Station is located.

There are also corridors that are somewhat suitable based on active mobility potential and transportation access along the spokes stemming from the WRTA bus hub.

Community Amenities

This category incorporates access to parks, arts and culture organizations, libraries, and job density. Geocoded address data for arts and culture organizations and the top 100 employers were used to calculate job density and density of arts and culture entities using kernel density. Access to parks was determined by converting polygons to points and then using network analysis service area within a 10-minute walk. Library service areas were also defined using the service area tool at 5-minute intervals, from a 5-minute walk to a greater than 20-minute walk.

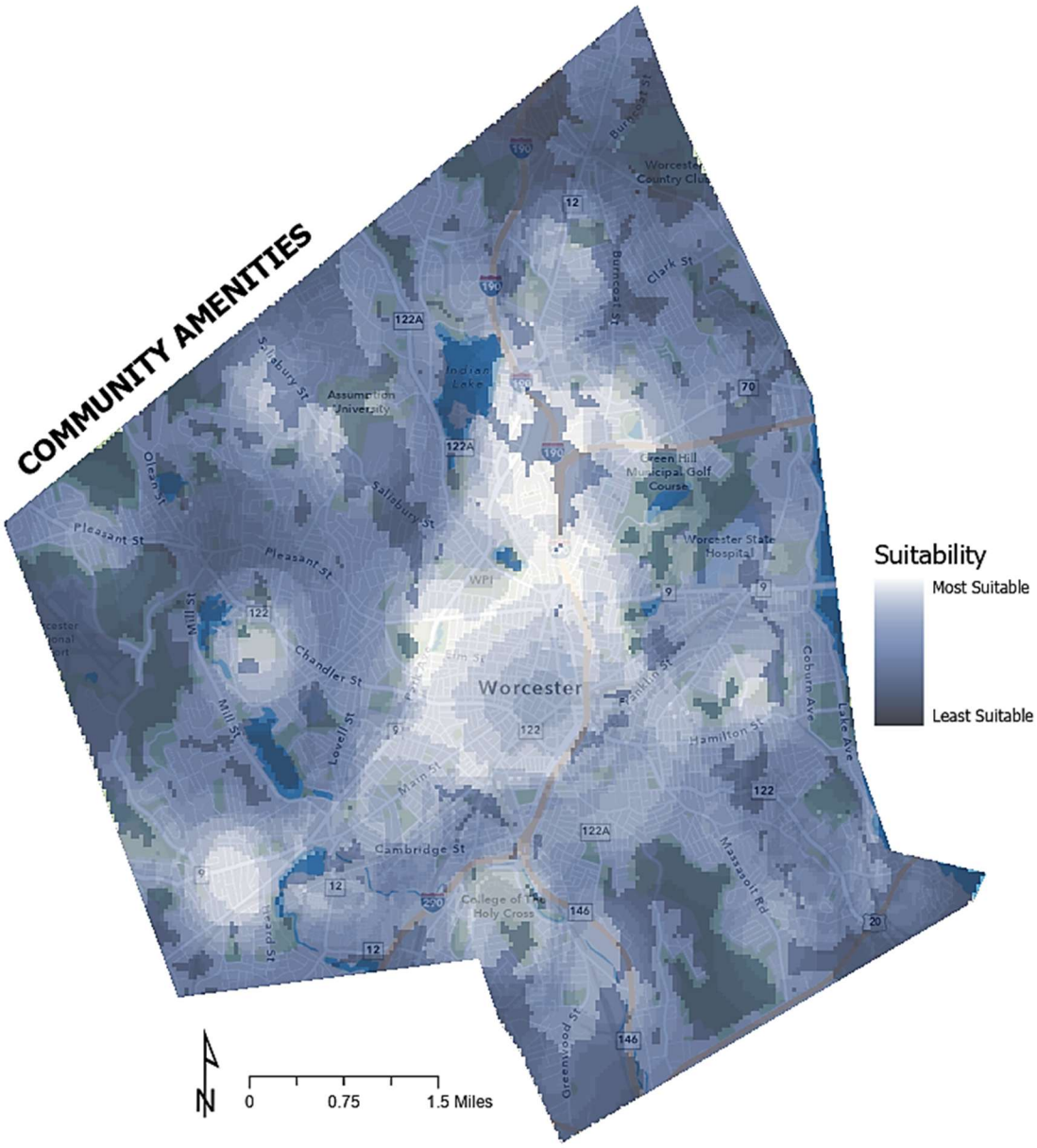

Figure 14: Suitability Map with combined community amenities indicators

Considering community amenities alone, the most suitable locations are north of the station area and in the Webster Square neighborhood in the Southwest corner of the city.

Land Use

Land use suitability incorporated current zoning and zoning overlays. Mixed-use and residential districts were defined as most suitable (5), followed by multifamily residential (4), single-family residential (3), business (2), manufacturing, and special districts, including hospital, university, and airport (1). The water resources protection overlay and airport environs overlay were defined as least suitable (1), commercial corridors overlay districts, sign overlay districts, and adaptive reuse overlay districts were defined as most suitable (5), and remaining areas with no overlay zoning were classified as somewhat suitable (3).

Considering zoning alone, the most suitable areas zoned mixed-use business/residential are primarily located in the Central Business District. The airport and areas with environmental protection are the least suitable.

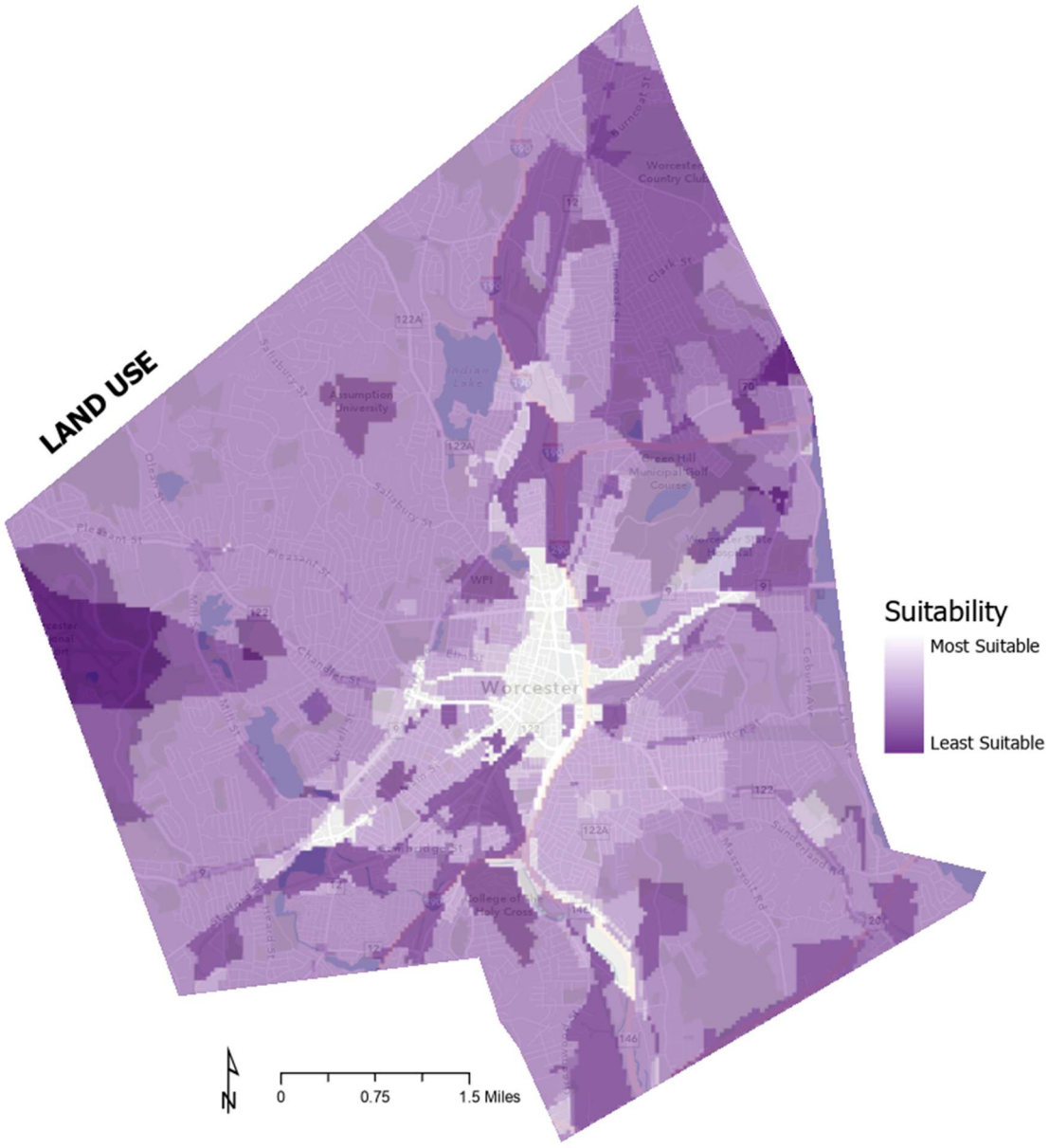

Figure 15: Land Use Suitability Map

Vehicle Access and Opportunity Zones

Demographics indicators consisted of households with no vehicles and Opportunity Zone census tracts. These indicators consider the transit-dependent population and potential tax incentives for investment in low-income communities. Eligible census tracts

were reclassified as most suitable (5). Percent of households with no vehicle was reclassified as follows: less than 10%, (1); 10.1-20%, (2); 20.1-25%, (3); 25.1-35%, (4); 35.1-45%, (5).

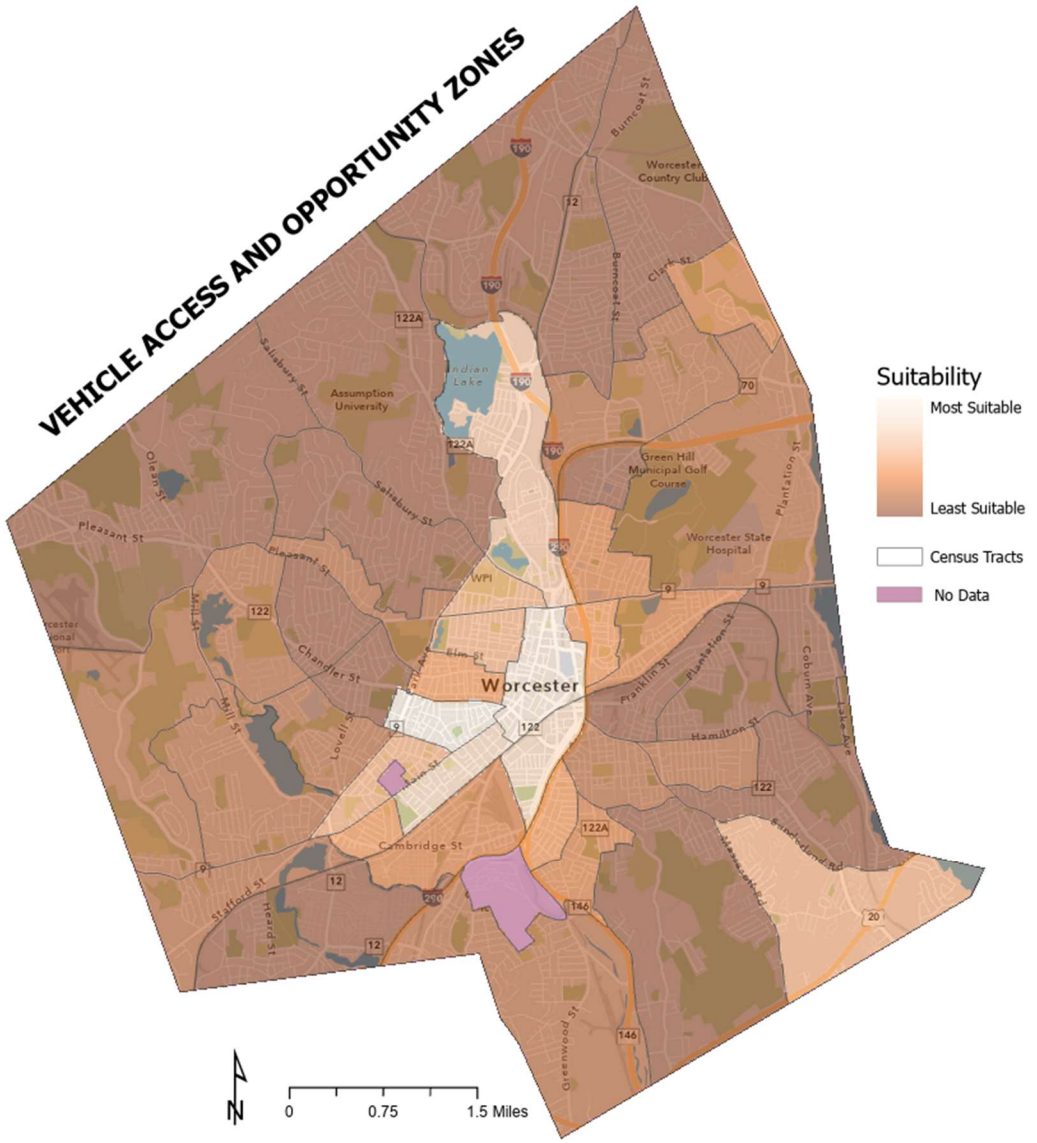

Figure 16: Census Tract Suitability

Considering demographic indicators alone, census tract 7314.00 is most suitable, followed by 7317.00. These tracts are both designated as opportunity zones. The

percentage of households without a vehicle is 43% and 25%, respectively. Two census tracts have no data on vehicle access, where Clark University and the College of Holy Cross are located. These campuses are excluded from the suitability analysis, though they likely have a concentration of students without access to a personal vehicle.

Suitability Analysis

The suitability for each category (transportation and mobility, community amenities, land use, and demographics) was reclassified (1-5) then entered into the raster calculator using the following weights, with the most weight assigned to transportation and mobility, all other categories were weighted equally: Transportation and Mobility 40%; Community Amenities 20%; Land Use 20%; Demographics 20%

Results

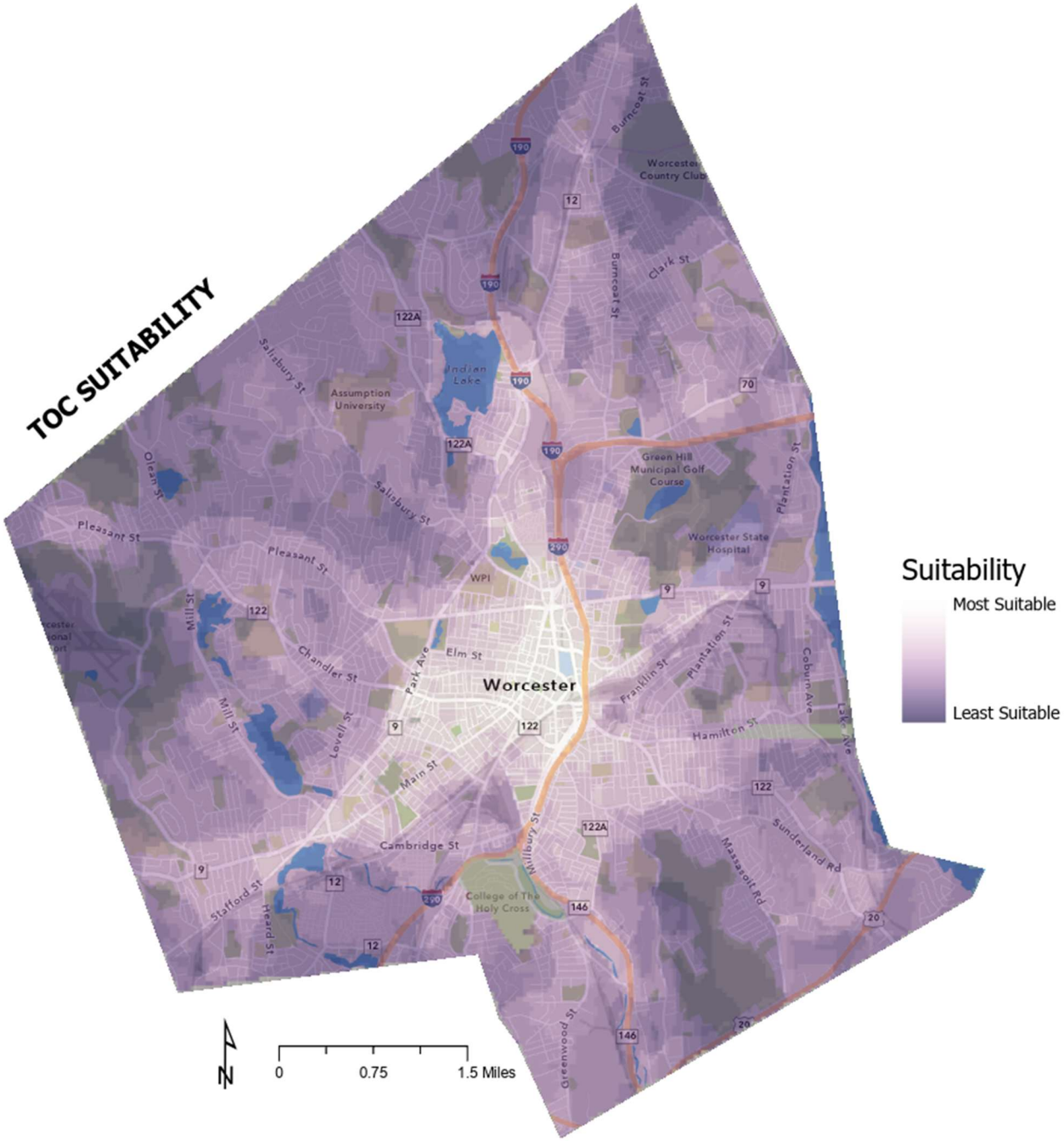

Figure 17: Suitability for Transit-Oriented Communities

Based on transportation access and potential walkability, community amenities, land use, and demographics, the results indicate the greatest suitability in the urban core.

This is not surprising due to the mixed-use, transit-rich downtown with the greatest density of jobs and most compatible zoning, though the calculated suitability goes beyond the Central Business District. There is also suitability along the Main St, Park Ave, and Route 9 corridors in addition to east of I-290 and Route 146. Continued improvements to connectivity and transportation access, as well as changes to zoning to allow for more mixed-use and increased density, would likely increase suitability for Transit-Oriented Communities.

Limitations

The results include a small number of data errors due to the unavailability of census data for vehicle access for the College of the Holy Cross and Clark University, due to a lack of occupied housing units as defined by the U.S. Census Bureau on the college campuses. There is also an area with a spatial data error east of I-290 along Hamilton Street to Lake Avenue. Additionally, this analysis does not incorporate bus service frequency or reliability and utilizes latent demand for walkable trips rather than data on current walking conditions. Improvements to the built environment to support safety, comfort, and ease of navigation for people walking, biking, or rolling, as identified in the city's Mobility Action Plan and Vision Zero Safety Action Plan, would be necessary to leverage the benefits of transit-oriented development. Finally, the weighting assigned is arbitrary. The most weight was assigned to the transportation and mobility indicators, given the critical role of transit access and walkability in transit-oriented communities and decreasing vehicle miles traveled.

Chapter 5: Results and Findings

Transit-Oriented Development is a strategy to decrease VMTs and promote sustainable development through the integration of housing, transportation, work, and recreation. Transit-Oriented Communities consist of a dense, mixed-use, compact, walkable environment with access to transit and diverse housing options. In contrast to transit-adjacent development and transit-oriented development, TOCs are well connected and accessible to a wide range of incomes and households that depend on public transit and active mobility. The impact of TOC is dependent on local context and elements, including density, diversity, design, connectivity, and parking availability. Chatman's findings are particularly promising for communities without rapid transit or rail infrastructure—decreased car dependence associated with TOD may not be attributed to the train, but correlated with density, quality bus service, jobs within walking distance, and other factors.

The City of Worcester has effectively promoted mixed-use development in the downtown area and the canal district within the urban core. These districts offer job density, pedestrian connectivity, bus and commuter rail access, and are rooted in arts and cultural institutions and places to gather. Following decades of auto-centric planning and development, the city's core has the potential to serve as a foundation for Worcester's continued growth and re-integration of housing and transportation planning that supports transit use and active mobility with coordinated efforts and continued investment in connectivity and pedestrian safety.

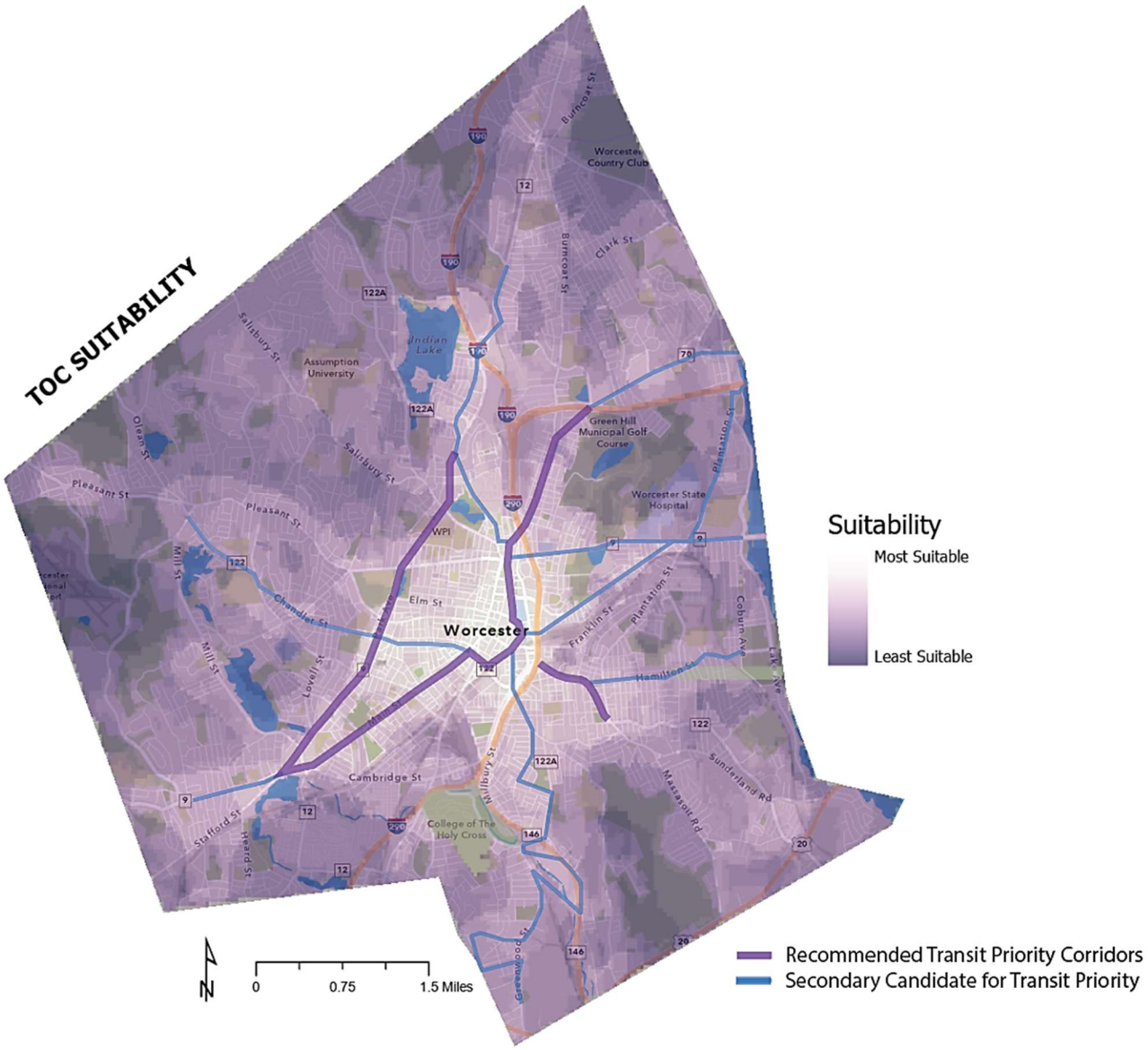

Figure 18: TOC Suitability and Recommended MAP Transit Priority Corridors

The spatial analysis indicated the most suitable locations for TOC in Worcester to the west of I-290 and I-190 from Indian Lake to Stafford Street, including downtown and the canal district. There is also some suitability to the east of I-290 in the area bound by Route 9 (Belmont St and Shrewsbury Street and south of Hamilton Street to Route 146. The corridors that are most suitable for transit-oriented development are also identified as

potential candidates for transit signal priority (City of Worcester 2024) and closely align with the transformative growth areas identified in the Now|Next Plan (City of Worcester 2024). This alignment represents potential for transit-oriented neighborhoods in Worcester, assuming future planning and implementation integrates all components of TOC, including density, diversity, design, housing choice, economic opportunity, transit access, active mobility infrastructure, and balanced parking availability.

Chapter 6: Discussion

Planning for Transit-Oriented Communities is a strategy that municipalities can utilize to integrate housing, transportation, economic development, public space, and other neighborhood priorities. In the context of the City of Worcester, transportation, housing, and economic development have been inextricably linked since the city's initial growth during industrialization. The city has an exciting opportunity to build on the foundation of the mixed-use urban core while prioritizing pedestrian safety, transit accessibility, and housing affordability with recent planning documents that emphasize the opportunity to accommodate population growth and improve connectivity. Incorporating the Transit-Oriented Communities framework can help support and align these efforts with specific attention to the local context and community needs.

Limitations and Recommendations for Future Study

In addition to gaps in spatial data and the arbitrary assigned weighting in the suitability analysis, the spatial analysis does not consider potential displacement risk or sensitivity. Preservation of existing affordable housing and local businesses should be considered in following planning and implementation. Planning and community engagement at the neighborhood level to identify priorities, community assets, barriers to connectivity, and safety concerns should be considered to facilitate transformative growth and effectively prioritize equitable transportation.

Recommendations

1. Consider implementing a Bus Rapid Transit pilot to expand transit access and improve efficiency.
2. Improve Local Connectivity by implementing Mobility Action and Vision Zero Plans
3. Adopt a Transit-Oriented Communities Overlay with eliminated parking minimums.
4. Update the City's Zoning Ordinance to allow increased density and mixed uses in transit accessible corridors.
5. Allocate additional funding to the Affordable Housing Trust Fund
6. Continued collaboration between city departments, developers, nonprofit organizations, transit agencies, and residents.

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