



The Research Bureau

# City On the Move

An Overview and Assessment of Worcester's Transportation Needs

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**Research in the Public Interest**

Worcester Regional Research Bureau, Inc.

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## ***City on the Move: An Overview and Assessment of Worcester's Transportation Needs***

*A transportation center for centuries, Worcester has aggressively developed connections to the outside world. By land, air, and (if only for a few decades via the Blackstone Canal) by sea, Worcester has invested in the infrastructure necessary to move people and goods in and out of the city. Yet traffic continues to build. As industry and technology change, the city needs to reconsider its transportation infrastructure and address the future potential of such opportunities as increased density and innovations like automation and electrification. This report reviews the current state of Worcester's transportation infrastructure and identifies considerations as the city looks to the future.*

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**Introduction**

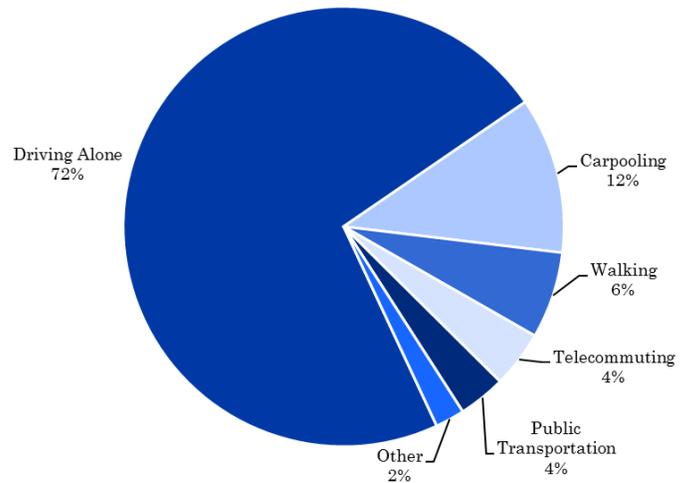
Worcester’s economic success derives from its importance as a transportation nexus. The north-south Blackstone Canal, connecting the city with Providence, Rhode Island, followed by the east-west rail connection to Boston, drove a commercial boom that was responsible for the community’s early expansion and ensured Worcester’s prominence during the Industrial Revolution. Worcester’s accessibility made it a hub of industry, commerce, and people, as it rose to become the second largest city in New England.

While the economic underpinnings of Worcester have changed, transportation remains as critical as ever. Of the nearly 100,000 jobs in the city, two-thirds, almost 65,000, are held by non-residents commuting into Worcester. More than 40,000 Worcester residents commute out of the city for employment. Limited transportation alternatives and time-consuming congestion would restrict Worcester’s ability to draw new residents and businesses. In fact, while the city’s location has not changed, its accessibility via various modes of travel has waxed and waned over time, notably by air and rail. With its growing might in higher education, medicine, and life sciences, Worcester is in an enviable position in the heart of the Commonwealth. Taking stock and staying ahead of the city’s transportation needs and opportunities is critical to the city’s, and the region’s, continued rise.

Today, Worcester has five state and interstate highways, a commuter rail line, passenger rail service, two freight railroads, a regional bus system, interstate bus lines, an airport, taxi and livery companies, ridesharing applications, and a pedicab company—not to mention 516 miles of road and 488 miles of sidewalk used by cars, trucks, buses, bicycles, and pedestrians daily.

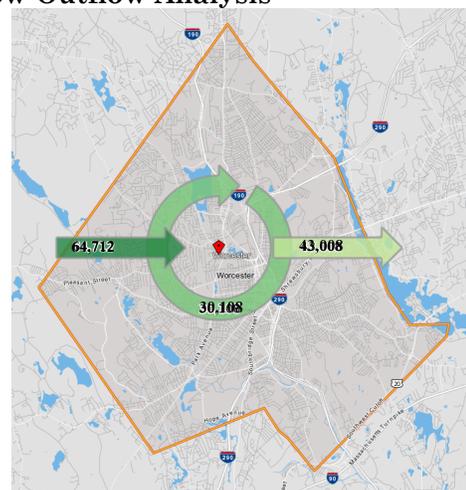
The City and State continue to invest in Worcester’s transportation infrastructure. In just over a decade, construction of the Route 146/I-290 interchange and upgrades to Interstate 290 have improved Worcester’s highway connectivity. Enhancements at Union Station and the adjacent Worcester Regional Transit Authority hub have created a new locus for multi-modal

**Chart 1: Worcester Residents’ Means of Transportation to Work**



Source: U.S. Census Bureau, 2016 5-year American Community Survey

**Map 1: Worcester Employment Inflow-Outflow Analysis**



Source: U.S. Census Bureau, Center for Economic Studies

opportunities. The Category III landing system at Worcester Regional Airport offers expansion in air travel.

Despite these investments, the city must also prepare for new or shifted transportation modes. Advancing technologies offer dramatic change through automated and electric vehicles. Ridesharing is capturing passengers from taxi, livery, and public transit services, and higher-density development will generate new demand for pedestrian-friendly alternatives. This report explores the current state of transportation in Worcester and offers recommendations on planning for a dynamic, multi-modal future.

## Alone on the Road: Privately Owned Vehicles

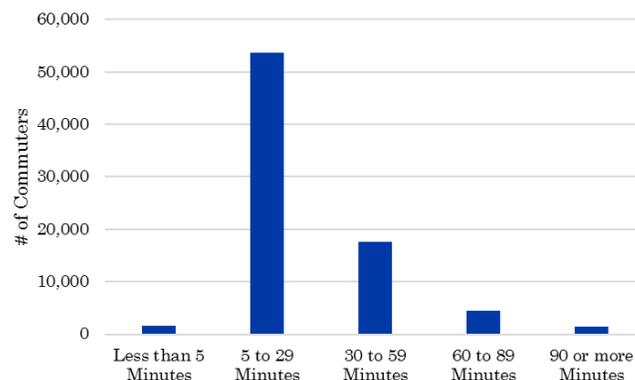
In Worcester, 72 percent of commuters travel to work alone by car, truck, or van, while 12 percent carpool, according to the U.S. Census Bureau. More than 95,000 cars and trucks are registered in Worcester, according to the Massachusetts Department of Revenue, and more enter daily as nearly 65,000 residents from surrounding towns commute to the city for work. Regionally, Worcester is not alone in relying on the automobile. Around 90 percent of Shrewsbury workers, 94 percent of Holden workers, and 95 percent of Auburn workers commute by motor vehicle.

While Worcester residents commute to work throughout Massachusetts and New England, the majority of residents—84 percent—work in Worcester or Worcester County. Around 2 percent of city residents commute out of state. Around 70 percent of Worcester residents have a commute time of less than 30 minutes. Worcester commuters spend an average of 14 hours, or 5 percent of driving time, in traffic congestion. Commuters headed east will find that number significantly increased; Boston commuters spend nearly 60 hours a year in traffic.

In July 2015, the Central Massachusetts Regional Planning Commission (CMRPC) issued a wide-ranging report, *Mobility2040*, predicting both population (75,000 residents) and job growth (25,000 jobs) for the Greater Worcester region and warning that almost all parts of the four main interstate highways (I-90, I-190, I-290, and I-395) could suffer from significant traffic congestion by 2040. A requirement of Federal transportation funding, the plan will be updated in 2019.

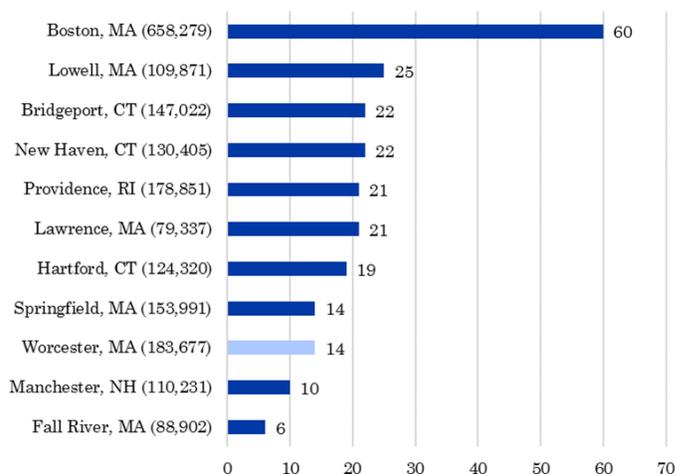
The impact of this growth in traffic will be felt on state and local roadways as well as the highway system. The Kenneth F. Burns Memorial Bridge, which carries Route 9 over Lake Quinsigamond and connects Worcester and Shrewsbury, was recently rebuilt in a \$105 million project to improve bus, bicycle, and pedestrian access. MassDOT has scheduled \$112 million for 15 Worcester projects in its 2018-2022 Capital Investment Plan, part of a \$17 billion plan for the

Chart 2: Worcester Commute Times



Source: U.S. Census Bureau, 2016 5-year American Community Survey

Chart 3: Hours Spent in Traffic per Driver, 2017



Source: INRIX

state. The most prominent project in Worcester has been the Belmont Street Bridge, where a multi-year \$10 million reconstruction beginning in 2014 added a new lane to alleviate traffic.

In FY19, the City will receive just over \$4 million in Chapter 90 funding, the annual State allocation for roadway construction, preservation, and improvement projects, a number equivalent to \$9,400 per mile of local roadway. Other funds are included the City’s Capital Budget—about \$9.5 million in FY19. The City has tried to ease bottlenecks and traffic jams at major intersections and streets by adding left-hand and central turning lanes and turning lights, with the best example being an \$11 million redesign of Main Street that began in 2017 and will feature a reduction in lanes from four to two aided by the inclusion of a central turning lane.

## Sharing the Ride: Regional Transit

Worcester’s public bus system is managed by the Worcester Regional Transit Authority (WRTA), one of 15 regional transit authorities in Massachusetts. The WRTA is a public authority led by an Advisory Board composed of either the Chairman of the Board of Selectman or executive and administrative officers from the 37 communities served. It is publicly funded, supplemented by farebox and advertising revenue. Communities served by a busline are required to pay an assessment between 25 and 50 percent of the cost of service depending on the number of miles within the community. Thirteen communities are served by fixed routes while the remainder are provided qualifying on-call (demand response) transit. RTAs receive a state subsidy at the beginning of the fiscal year, while payments from participating communities can be received up to 24 months after the closing of the fiscal year, creating a challenging fiscal management program—which becomes more challenging as state government resists significant new funding.

The WRTA provides an important service to low-income residents of the city, with nearly 70% of respondents to an agency survey indicating an income of less than \$25,000 per year. The WRTA made nearly 3.8 million passenger trips in 2017, according to the agency’s annual report for that year, and drove nearly 3.2 million miles. It took in around \$3 million in fares on its fixed route service, compared to the nearly \$20 million operational cost of running those routes. Passenger fare revenues decreased by more than 7% from 2016 to 2017, in part due to a decrease in ridership related to an April 2017 fare hike and service reduction. According to a June 26, 2018 *Telegram & Gazette* article, WRTA ridership is down 13% since the beginning of the current year, a larger decline than at any peer agency across the country.

Frustration with public transportation and bus service typically falls into one or more of four categories: schedule, traffic, exposure to inclement weather, and reliability. Weather can

Annual Farebox Revenue	\$3,403,547
Annual Cost of Operations	\$24,899,481
% Fare Box Recovery of Operating Costs	15.54%
Annual Passenger Trips (Fixed Route)	3,599,241
Annual Passenger Trips (Demand Response)	191,681
Operating Cost per Passenger Trip (Fixed Route)	\$5.50
Operating Cost per Passenger Trip (Demand Response)	\$26.66
# of Electric Buses	6
# of Clean Diesel Buses	29
# of Hybrid Diesel-Electric Buses	17

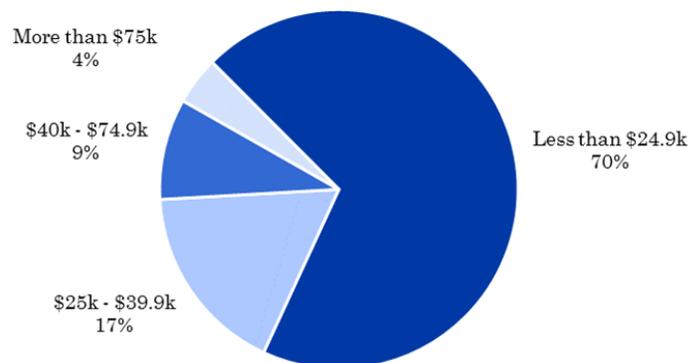
*Source: Worcester Regional Transit Authority*

be partially mitigated through infrastructure such as bus shelters. The other categories require equipment, training, and technology. The Massachusetts Bay Transportation Authority (MBTA) has installed \$50,000 countdown clocks around Boston to provide real-time information about bus arrivals. Worcester uses a less expensive alternative known as “Track by Text” that allows riders to receive text messages about bus arrivals on the route they are using. Mobile applications like “Transit” and “Moovit” offer those with smartphones trip planning assistance. While these measures promote communication, the issues of reliability and service remain critical. Some communities improve reliability by helping buses reduce delays and negotiate traffic with dedicated bus lanes, providing off vehicle fare collection, and offering less frequent stops or express service. A traffic light priority system for buses called “transit signal prioritization,” for example, reduces a bus’s time at traffic signals using technology to hold a green light longer as a bus approaches an intersection or shorten a red light that a bus is stopped at, allowing buses and their riders to navigate quickly through traffic and increase on-time statistics. This technology already exists locally for emergency vehicles like ambulances. The MBTA is currently experimenting with using signal prioritization in Boston for both buses and above-ground trains.

In 2013, to improve customer experience and service, the WRTA opened a new bus terminal next to Union Station. The proximity of the new hub to Union Station connects train service to bus service. The new terminal has amenities such as an enclosed public waiting area, a coffee shop, and an electronic board providing real-time information on bus arrival times. However, the facility is a continuation of the “hub and spoke” system that streamlines point-to-point travel by sending every route through the same location but consequently results in extended travel times for cross-town trips that would not ordinarily pass through downtown. The WRTA also opened a new maintenance and operations facility in 2016 on Quinsigamond Avenue, doubling the size of its previous maintenance garage, with room for 75 buses and a control room that allows the agency to monitor buses in real time.

Riders travelling outside of Central Massachusetts can choose between two private bus companies that operate out of Union

Chart 4: WRTA Riders' Income Levels



Source: Worcester Regional Transit Authority

Station—Peter Pan Bus Lines, a regional carrier with destinations throughout New England and the Mid-Atlantic, and Greyhound, a national carrier. While the two coordinated operations in the past, they began to compete for local business in 2017. For commuters, the two services combine for nearly twenty round trips to Boston daily at a price competitive with MBTA commuter rail.

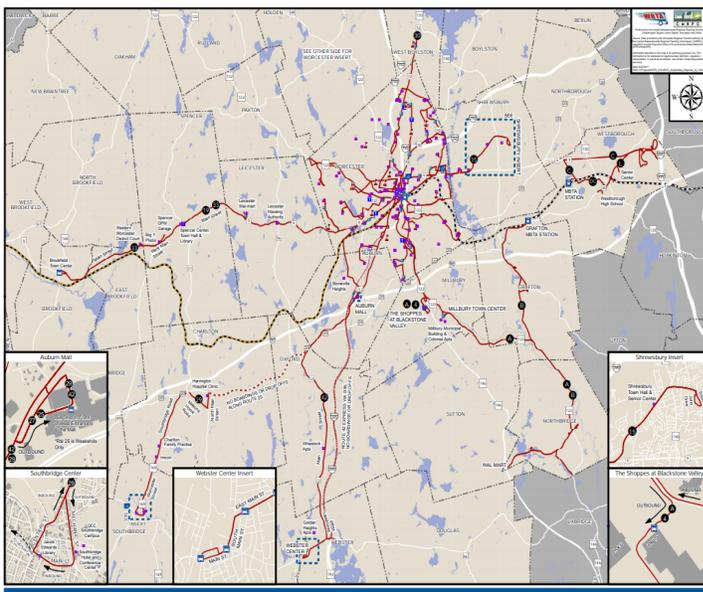
Table 2: Top Routes by Ridership, FY2018	
Route 11: Union Station Hub to The Fair Plaza via Vernon Hill & Greenwood Street	284,255
Route 26: Union Station Hub to Great Brook Valley via Lincoln Street	272,398
Route 27: Union Station Hub to Auburn Mall via Main Street	266,760
Route 19: Union Station Hub to Goddard Memorial Drive/Leicester Walmart via Main Street	261,762
Route 30: Union Station Hub to West Boylston Walmart	209,624

Source: Worcester Regional Transit Authority

Table 3: Top Bus Stops by Ridership, FY2018	
Auburn Mall	44,850
Franklin Street at City Hall	39,651
Main Street at Arena Plaza	39,646
Lincoln Street at Denny's	38,017
South Road at UMass	34,608

Source: Worcester Regional Transit Authority

Map 2: Worcester Regional Transit Authority System Map



Source: Worcester Regional Transit Authority

## Ride Hailing: Taxi, Livery, and Ridesharing

According to the Bureau of Labor Statistics, there were 580 people employed as taxi drivers and chauffeurs in the Worcester Metropolitan Statistical Area in May 2016. There are 110 taxi medallions allocated in Worcester, 72 of which are owned by the Yellow Cab and Red Cab taxi companies. Taxis can be scheduled in advance or can be hailed from the side of the road. The two major livery companies in Worcester are not required to obtain a taxi license but are limited to no more than 14 passengers at one time and are only allowed to take pre-arranged fares.

In addition to taxi and livery services, national ridesharing companies Uber and Lyft operate in the city. Uber entered the Worcester market in October 2014, while Lyft started in February 2017. These companies offer passengers smartphone applications used to hail a ride, similar to a taxi service. The difference is that the request goes out to smartphone application used by freelance drivers, who use their own cars and often drive for the companies on a part-time or intermittent basis.

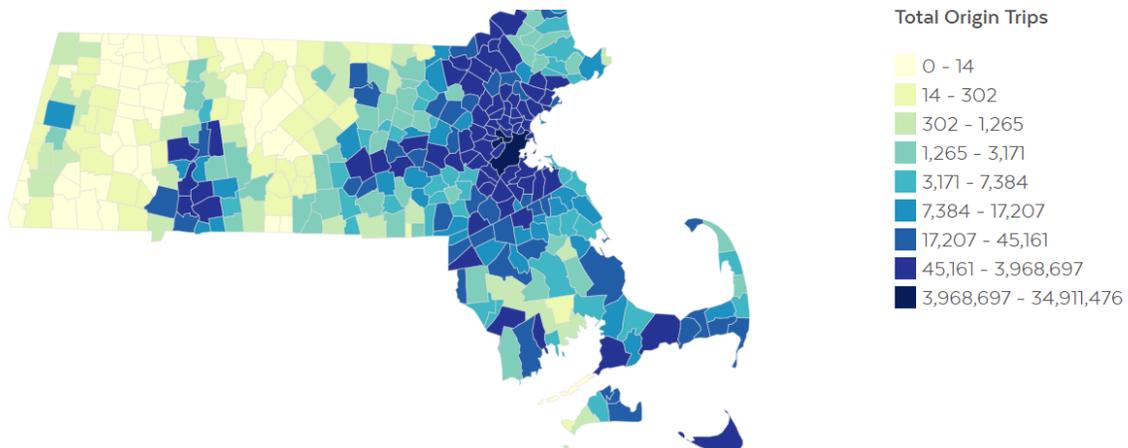
As part of a 2016 law regulating “transportation network companies,” the designation the State applies to ridesharing businesses, ridesharing companies are required to pay a 20 cent fee per trip. Half the fee goes to the city or town in which

Taxi Medallions	110
Taxi Drivers	306
Registered Livery Vehicles	203
Livery Drivers	226

*As of January 2018. Source: Worcester Police Department*

the trip originated, while half goes to various State agencies. Nearly 850,000 ridesharing trips originated in Worcester in 2017, according to data released by the Department of Public Utilities, resulting in a nearly \$85,000 payment to the City. The number of trips ranks Worcester 9th in Massachusetts, with around 1.3 percent of total trips. The rest of the top 10 are all in Greater Boston, with the state capital accounting for 54 percent of total trips, or nearly 35 million rides. While Worcester is the second-largest city in the state, its residents use ridesharing applications at the 35th highest rate, with 4.7 origin trips per person. The statewide median was 0.45 trips per person, illustrating the popularity of the services in densely-populated areas. Worcester also made up the bulk of ridesharing usage in the region—there were 1.2 million total trips originating in Worcester County, for an average of 1.5 trips per person.

**Map 3: Massachusetts Rideshare Trips (by Transportation Network Companies) by Municipality, 2017**



Source: Massachusetts Department of Public Utilities, <https://inc.sites.digital.mass.gov>

## Biking: Weathering Worcester's Street Network

According to the Census Bureau, 0.4 percent of Worcester residents bike to work. Data from CMRPC shows busier bike intersections in Worcester average 2 to 4 cyclists per hour, with the busiest bike intersection at Green and Winter Streets averaging 5 cyclists per hour. Not surprisingly, in the winter months, especially when snow restricts the width of the streets even where there are dedicated bike lanes, very few commuters choose to ride their bikes.

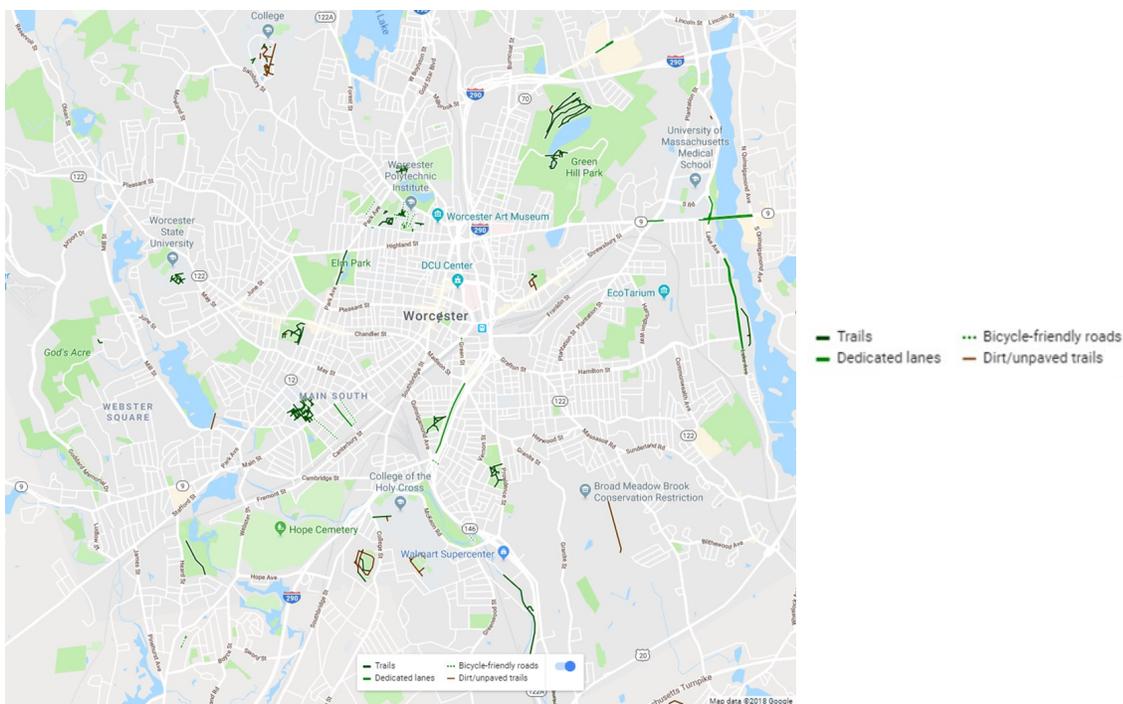
A bike-sharing company, ofo, chose Worcester as a test site in 2017. Users downloaded an app to find and unlock yellow bicycles left strategically in busy areas of the city. For \$1 an hour, a customer could use a bike and leave it at his or her destination for the next user to access, rather than return them to a central dock like other bike-sharing models. In 2017, 80 to 90 percent of ofo's bicycle trips were less than 3 miles in length, and 30-45 percent of its trips took place during the evening rush hour, across all cities. According to a May 24, 2018 *MassLive* article, 25 percent of ofo trips in Worcester in its first three months of operation occurred during morning rush hour, with an average of 352 rides per day. In July of

2018, however, ofo announced its withdrawal from Worcester and a number of smaller cities in Massachusetts, including Quincy and Lynn. Bikeshare remains popular nationwide, however, with major companies like Uber developing or acquiring their own bikesharing operations.

In 2017, Worcester saw the introduction of pedicabs—small carts towed by bicycles—as a form of transportation. WooRides, a startup launched in the city in 2017, features multiple drivers and pedicabs that primarily operate in the downtown, Canal District, and Shrewsbury Street area, where bike lanes and nightlife density make a successful business model easier. While these vehicles, sometimes called rickshaws, have been deployed at various festivals and events, they remain a novelty more than an essential part of the average resident's transportation network.

While not yet common in Worcester, electric bicycles and scooters are regularly beginning to appear in larger urban areas around the country and may grow as a local competitor for street space in warmer months.

**Map 4: Bike Trails, Bike Lanes, and Bike Friendly Roads in Worcester Identified by Google Maps**



Source: Google Maps

## Walking the Walk: Pedestrians in Worcester

Worcester has 306 miles of asphalt sidewalks and 182 miles of concrete sidewalks distributed along 436 miles of public streets. Recognizing that an ideal sidewalk system includes sidewalks serving both sides of a street, Worcester's sidewalk capacity addresses just over half its street network.

According to a study by Sweeney Merrigan Law LLP and 1Point21 Interactive, using Massachusetts Department of Transportation data, Worcester has the highest concentration of dangerous intersections in the state for pedestrians. Nine Worcester intersections made it into the "100 Most Dangerous Intersections for Pedestrians" list, and of the nearly 500 intersections with five or more pedestrian-involved collisions from 2001 to 2014, Worcester had 50, more than any other community.

The City's Department of Public Works and Parks (DPW) recently installed new pedestrian crossing signals at certain intersections across the City. When activated by a pedestrian these signals flash to alert drivers that a person is crossing the street using the crosswalk. Like bike riding, however, pedestrians face a tough time on snow-covered sidewalks and steep inclines.

The City has developed a Complete Streets policy that would apply to all future major street redesign efforts in an attempt to make the roadways safer for all users. The policy was announced as part of a package of pedestrian and bicycle safety changes, including a bigger budget for line painting, more crosswalk signals, increased police enforcement, and a Pedestrian Safety Task Force.

To address traffic and accessibility in the downtown area, the City of Worcester is redesigning Main Street to make it safer for drivers, bikers, and pedestrians. The project will feature 11 upgraded traffic signals, 5-foot wide bike lanes on both sides of Main Street, resurfaced pavement, and improved wheelchair ramp accessibility, at the cost of reducing the number of lanes from four to two.

Automobiles are the biggest threat to pedestrian safety, so improving walkability also includes addressing automobile activity. The Worcester Police Department reconstituted its Traffic Division last year, focusing on enforcement campaigns in specific areas of the city. The City Council has also debated the merits of lowering the city-wide speed limit to 25 miles per hour (from 30) to slow down traffic and make intersections and high-density areas safer.

**Table 5: Most Dangerous Intersections for Pedestrians in Worcester, 2001-2014**

Intersection	Rank in State	Crashes	Injuries	Fatalities
Belmont & Edward Streets	7	20	13	0
Wellington & Chandler Streets	38	10	10	0
Main & Myrtle Streets	42	12	9	0
Grafton & Houghton Streets	48	10	9	0
Madison & Southbridge Streets	55	9	9	0
Murray Avenue & Chandler Street	60	11	8	0
Chandler & Piedmont Streets	61	11	8	0
Pleasant & Main Streets	65	10	8	0
Main & Madison Streets	76	8	8	0
Park Avenue & Parker Street	101	7	4	1

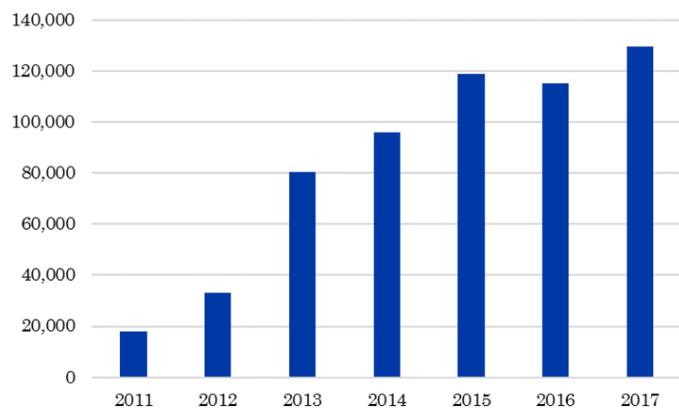
Source: Sweeney Merrigan Law, LLP

## Riding the Rails: Passenger and Freight Service

Worcester residents heading east can take the MBTA commuter rail train service, managed by Keolis Commuter Services, with trains that run from Worcester’s Union Station to Boston’s South Station. In 2016, approximately 1,500 passengers rode commuter rail service daily from Worcester, making Union Station the 8th busiest MBTA station in the commuter rail network. Reliability can be an issue—from December 2015 to May 2016 only 65 percent of trains between Worcester and Boston arrived on time. A second platform is planned for Union Station, which would allow two trains to load and unload passengers at the same time, providing greater flexibility for getting trains in and out of the station. However, the lack of siding or spur capacity which would allow trains to pass one another along the track between Worcester and Boston constricts significant new or faster service.

In an effort to improve commuter rail service between Worcester and Boston, the MBTA initiated the “Heart to Hub” line which runs non-stop between Worcester and Boston. The train leaves Worcester at 8 a.m. and arrives in Boston at 9:06 a.m., shortening the usual length of the trip by approximately 30 minutes. However, the arrival time, after the normal start of the business day, is inconvenient for commuters, especially those who must transfer to a bus, subway, or walk the final distance to work. The return non-stop leaves Boston at 7:35 p.m.—again an inconvenient time for people working a normal

**Chart 5: Total Container Traffic Through the CSX Worcester Freight Terminal, by Year**



Incoming and outgoing containers. Source: City of Worcester

**Table 6: Union Station Rail Counts**

Inbound Trains (Weekday)	20
Outbound Trains (Weekday)	20
Inbound Trains (Weekend & Holiday)	9
Outbound Trains (Weekend & Holiday)	9
Typical Weekday Inbound Boardings	1,500

As of December 2016. Source: MBTA

business day. In its first full month of service, June 2016, the inbound train to Boston averaged 160 passengers while the outbound train averaged 66 passengers. Ridership in April 2017 was about the same, with the inbound train averaging 169 passengers and the outbound train averaging 64 passengers. MassDOT has launched a Commuter Rail Vision study to better leverage the rail system as a tool for economic growth.

While largely conceptual, The Boston Surface Railroad, a private company, has explored the potential of commuter rail service between Worcester and Providence while the *Connecticut State Rail Plan 2012-2016* highlights the potential of new rail service from New Haven to Boston via Hartford, Springfield, and Worcester and New London to Boston via Worcester.

Union Station also serves as a stop on Amtrak’s Lake Shore Limited Route, which runs between Boston and Chicago, and makes stops in Worcester, Springfield, and Pittsfield in Massachusetts. In 2013, 9,552 passengers boarded Amtrak trains from Union Station, while in 2016 only 6,152 boarded, a 36 percent drop.

The largest freight rail company serving Worcester is CSX, a Florida-based transportation giant that serves 21,000 route miles in 23 states, the District of Columbia, and Canada. In 2013, CSX expanded and upgraded its rail yard in Worcester by consolidating functions previously distributed throughout the region. The short line Providence and Worcester Railroad, acquired by Genesee & Wyoming, Inc., in late 2016, connects customers to Gardner, Providence, New London, and, through interchanges, to New York City and points west.

## Worcester Regional Airport: Taking Off

While most Worcester residents fly out of Boston or Providence when travelling nationally or internationally, Worcester Regional Airport (ORH) is positioning itself as a more convenient and cost-effective local option. The airport, which is owned and operated by the Massachusetts Port Authority (Massport), has seen the number of annual passengers out of Worcester rise from 72,000 in 2014 to 121,000 in 2016. The increase comes as more commercial airlines choose to schedule flights at the airport, although private and military flights still dominate the landscape. The airport remains a busy destination, with an average of nearly 77 operations a day in 2017.

The vast majority of ORH commercial passengers currently travel on JetBlue flights to Orlando, Fort Lauderdale, and, most recently, New York. In 2017, 109,911 commercial airline passengers flew out of ORH, resulting in a combined load factor for all commercial flights of 80%.

Passengers also use Rectrix Commercial Aviation to fly to Hyannis and Nantucket, or for chartered flights. In addition to upgrades and improvements made by Massport, Rectrix opened a new 27,000 square foot hangar for private and business charter flights. The new hangar has lounges, concierge services, and a flight planning room. Rectrix will base jets in the hangar.

In the past few years, Massport has invested heavily in infrastructure improvements at the airport. In 2015, the agency broke ground on a “Category III” instrument landing system (“CAT III System”) at ORH that allows planes to land in low visibility conditions, significantly decreasing the number of cancelled flights, diverted landings, and overall flight delays. Funded by \$10 million in federal grants and \$22 million from Massport, the CAT III System is designed to put Worcester on a competitive footing with other regional airports. The system became operational in 2018. In June 2015, Massport opened a renovated Aircraft Rescue and Firefighting Station (ARFF). The airport has also seen more than \$10 million in investments to increase taxiway capacity.

**Table 7: Worcester Regional Airport, 2017**

Aircraft Operations	
Transient General Aviation	16,015
Local General Aviation	8,343
Air Taxi	1,408
Commercial	1,403
Military	798
Daily Commercial Departures	
JetBlue	Orlando, FL Ft. Lauderdale, FL New York, NY
Aircraft Based at Field	
Single Engine Planes	57
Multi-Engine Planes	3

*Source: Massport*

The CAT III System appears to be an important draw for new airlines and destinations. Massport’s original announcement of the CAT III System was paired with Jet Blue’s announcement of renewed commercial service at ORH. Since that time, American Airlines announced daily flights to Philadelphia beginning in October 2018 and Delta Airlines announced new service to Detroit beginning in August 2019. With three airlines serving ORH, Worcester has a one-stop connection to the world. Importantly, New York, Orlando, Philadelphia, and Detroit are “hub” locations that can facilitate flights to many more destinations in the US and six continents. With lower travel and parking costs, Worcester has an opportunity to draw activity from a catchment area of more than one million people, extending from southern Vermont and New Hampshire to northern Connecticut. ORH has an opportunity to dominate, especially, the Central Massachusetts and MetroWest markets due to proximity and ease of access. While ORH is not directly on the interstate highway system, Massport has installed a series of highway and roadway signs leading from all major nearby transportation routes including the MassPike (I-90) and Interstate 290.

## Uncertain Inevitability: Autonomy, Mobility on Demand, and Electrification

As of March 2018, the two leading makers of automated vehicle technology—which allows cars to navigate road networks without assistance from a human driver—had logged a combined 7 million miles in autonomous mode on public roads. In June 2018, the Commonwealth of Massachusetts, together with the City of Worcester and thirteen other communities, signed a Memorandum of Understanding to facilitate the testing of automated vehicles on Massachusetts roadways. While time to commercial market remains uncertain, the advancement of automated technology to a viable state and the fact that it no longer requires significant new infrastructure necessitate that local governments plan for the technology now.

A significant portion of most U.S. urban centers is dedicated to the vehicle, whether through roadways or parking lots. Yet according to some experts, the average vehicle spends 95 percent of its time empty. Autonomy offers two potentially transformative experiences. First, autonomy allows a vehicle to return to its home garage during non-use hours or continue on to drive other members of the household to different destinations or even complete basic errands (e.g., drive-thru retail and restaurant pick-up). As a result, destination parking—and its cost—will no longer be a constraint on development. Second, autonomy allows multiple households to share automobiles via pooling, eliminating the need for individual vehicle ownership. Shared vehicle services (even transit-like vehicle networks) combined with autonomy could decrease the number of car-owning households in a community while increasing transportation accessibility for currently car-less households, albeit with an as yet undefined, and possibly restrictive, cost.

While offering improved efficiencies and decreased cost, a potential negative outcome of the above scenario is an increase in the total vehicle miles traveled on local streets. Autonomy offers efficiencies in terms of the ability for

vehicles to travel in close formation with no need to accommodate for human error, but an automated vehicle may make four trips to drop off a passenger (drive to destination, return to garage, return to destination, return to garage) where a conventional vehicle would make only two. Similarly, like the current challenge with Uber and Lyft, while shared car services remove some vehicles from the streets, they leave others to circulate awaiting a passenger. Congestion is likely as empty vehicles compete with occupied vehicles for limited road space. In a fossil-fuel dependent universe, the environmental impacts are significant. About 40 percent of Massachusetts greenhouse gas emissions already come from transportation.

In a world with fully-automated traffic, transportation infrastructure could change even more dramatically. Measures to regulate the behavior of human drivers, like signal lights, signage, and road markings, are unnecessary when vehicles communicate via satellite and directly with one another and whose programming makes them incapable of violating traffic regulations. Cars that do not park portend big impacts on downtown parking infrastructure and related public debt. A June 2018 Conservation Law Foundation study cautioned that local revenues related to parking fees, excise taxes, and traffic violations will go down in a shared, automated vehicular future while road maintenance costs will increase due to the rise in vehicle miles. Existing suburban developments, surrounded by soon-to-be vacant parking, may need to be reconsidered to avoid the sensation of isolation.

Automated vehicles do face challenges in gaining a foothold in the transportation market, especially as recent accidents (including one fatality) have stoked fears about relinquishing human control of the road. In a 2018 Gallup poll, nine percent of Americans said they would use a driverless car as soon as it was certified by government regulators, while 38 percent said they would wait, and 52 percent said they would never want to use one. A survey by the World Economic Forum in collaboration with The Boston Consulting Group found that age and income are significant indicators of automated vehicle

adoption. And while the technology has advanced, most of the road miles tested have been in mild weather with unchallenging conditions, and the functionality and cost-effectiveness of the sensors used must manage diverse environments.

A partial solution to the conundrum of automation and the corresponding increase in vehicle miles traveled is electrification. While electrification cannot resolve new congestion, it can help to address the environmental impact. The price of a lithium-ion battery pack has fallen from \$1,000/kilowatt hour in 2010 to just under \$300/kilowatt hour in 2016. It is expected to reach \$100/kilowatt hour by 2026. As batteries become less costly and more effective, electrified vehicles may become a more affordable option than gas-powered vehicles. Electrification could result in a decrease in the market for gas stations, as fewer cars require refueling during the day. With the disappearance of gas stations, gas-powered vehicles become even less competitive as an alternative to electric. The Commonwealth has a legal need to push for expanded electrification. For the state to meet greenhouse gas emission targets set out under the Massachusetts Global Warming Solutions Act, adopted in 2008, reducing the nearly 40 percent of total greenhouse gases that derive from transportation in the state is crucial.

### **The Bureau's View**

Worcester, located in Central Massachusetts and in proximity to many of New England's largest population centers, serves as a regional economic hub for surrounding communities and boasts a transportation network that accommodates nearly every method of travel. These assets, if properly maintained, managed, and leveraged, allow for substantial growth in both population and economic vitality.

Yet Worcester's transportation system is aging. It is primarily focused on an automobile-based system that is likely to change—positively and negatively—to accommodate automation, electrification, and shared vehicles. With a potential impact on infrastructure needs (a decrease in demand for parking, an increase in

vehicle miles travelled, electrification stations competing with gas stations, and a diminished need for traffic control measures as vehicles work together to navigate intersections) and resources (a loss of parking revenues, traffic fines, local vehicle excise taxes, as well as state-collected gas taxes), current investments must consider future conditions. Rapidly changing circumstances demand professional transportation planning. Experts should review existing infrastructure, assess needs, and anticipate investments to accommodate the range of scenarios possible as development continues and technology transitions. These considerations should be outlined and incorporated into a public discussion including both public and private stakeholders. Further, private sector interests should work with City officials to form a Transportation Management Association (TMA) that identifies opportunities to accommodate employer and employee needs while addressing broader transportation implications for the community. Many of Worcester's transportation issues and assets are under the control of outside agencies—state and private. Worcester should employ a professional who can identify and advocate for transportation as part of the City's planning and investment agendas, and work closely with state agencies, private businesses, and neighborhood advocates. In the FY19 Annual Budget, the City funded transportation planner and traffic engineer positions in the City's Planning Division. This is an important step toward creating a holistic, long-term approach to addressing Worcester's transportation challenges and seizing new opportunities.

To continue the momentum of prior infrastructure investments and policy decisions, The Research Bureau recommends a few basic guidelines for improvement.

**Pedestrians & Bicyclists—Pedestrian accommodation (inclusive of those with disabilities) with consideration for travel (e.g., sidewalks, crosswalks, ramps) and experience (e.g., street furniture and urban design), should be prioritized** downtown and connections between the downtown and nearby neighborhoods—Canal District, Main South, Pleasant/Chandler, Elm Park, Lower Lincoln—

should include pedestrian and bicycling opportunities in addition to automobile accommodation. **Bike corridors should be identified** in each of the major directions—north (West Boylston Street), south (Main Street/Park Avenue/Southbridge Street/Millbury Street), east (Shrewsbury Street/Grafton Street/Lincoln Street), and west (Pleasant Street/Salisbury Street/Grove Street/Mill Street) as well as along diagonals, or a ring route, where achievable.

*Public Transit*—The bus system’s financial and operational challenges have been well-publicized. Schedule adjustments are necessary and reliability is critical. Frequency is a key selling point for public transit of all kinds. **Increasing the number of buses for peak hour services in the morning and evening**, operating on a 15- or 20-minute loop, could capture more peak hour commuters and other travelers. **Transit must be supported and highlighted as a transportation alternative, however, through marketing and coordination with other public and private organizations**, notably through an expansion of the monthly pass program and the expansion of reduced fares. A TMA can promote ridership through employer/employee outreach and incentives. **The WRTA should partner with ride sharing alternatives**, including such entities as Uber and Lyft (see, for example, Lyft’s “Friends with Transit” initiative), taxis, and livery services, especially pooled programs, to address low-revenue routes and formalize after-hours coverage.

As Boston continues to struggle with skyrocketing rental costs, Worcester can serve as a ready-made high-density development site for the Commonwealth. In April 2018, MassINC released *The Promise and Potential of Transformative Transit-Oriented Development in Gateway Cities*, an analysis of transit-related development opportunities in several Gateway Cities including Worcester. Commuter rail service was the crucial element necessary to capture the value of those assets. While the Framingham/Worcester line will experience some growth in demand as local populations increase, **the “Heart to Hub” route must improve departure and arrival times to accommodate a broad “nine to five”**

**commute pattern**. Reliability, as expressed through on-time percentages, must improve. Discussion of a regional rail concept, rather than commuter rail, offers an opportunity to provide statewide solutions to challenges in both economy and equity and strengthen economic growth in Worcester.

*Air Travel*—The path forward to improving Worcester Regional Airport is obvious—more flights, more destinations, and greater reliability. Over the past few years, ORH has been moving forward in all of these areas. Yet for ORH to serve as a key player in the transportation network, the economic opportunities of air travel must also be considered. ORH currently has few amenities to serve travelers or the public. In the past, the airport hosted The Stockholm Restaurant—a popular spot for Worcester diners in search of a meal and a view. **ORH should provide new amenities that could expand ORH’s visibility and improve the customer experience**. While an access road between the highway system and ORH does not appear to be a near-term possibility, **improved signage and signal prioritization of existing access routes at key times** would enhance airport accessibility, similar to a recent initiative around Webster Square. Multimodal accessibility remains important and Massport should explore **improved access between Union Station and ORH via WRTA, Uber, or Lyft as well as a direct bus connection, similar to the Logan Express, between Framingham and ORH that enhances MetroWest connectivity**. **Zoning and land use along access routes should consider the potential economic opportunities while travel impediments (e.g., intersections, curb cuts, on-street parking) should be minimized**. Massport should also **explore the potential of new technologies—limited seating electric planes and automated drones** with applications for both transportation and distribution—as possible expansion arenas for the airport.

*Future Scenarios*—Automation will undoubtedly impact road infrastructure and travel patterns. **Parking should be phased out in new downtown projects**, using the framework in place in the City’s Commercial Corridor Overlay

District. **Parking maximums, rather than minimums, should be standard in zoning.** New buildings should accommodate walking and biking through the provision of shower facilities and bike parking. **The City should consider incentives to induce additional car sharing opportunities** such as free parking for pooled vehicles at public garages and reduced excise taxes for shared vehicles. **The Complete Streets concept should be adapted and incorporated into the variety of Worcester streets,** with recognition that shared vehicles and pooling may require pick-up and drop-off points at convenient sites around the city.

Transportation is a critical component of economic development, yet funding for road transportation in the Commonwealth leans more heavily on some residents than others. Residents west of Boston are required to pay tolls for highway travel on the Masspike, while communities north and south of the city (with the exception of those served by the Tobin Bridge and harbor tunnels) are not. **Worcester should advocate for transportation equity so that economic investment is not driven from the region by the higher cost of transport.** Equity does not necessarily mean elimination; in light of the ongoing need for transportation investment it may mean **the expansion of tolls on highways serving currently non-tolled communities or the replacement of the current toll system with regional congestion pricing.**

## Conclusion

Planning has no ability to affect reality without investment both in the near- and long-term. The transition to automation and electrification, however, and the subtle ways each might influence infrastructure and human activity, offers an opportunity to shift, rather than quickly replace, the current distribution of public resources. Local, state, and federal governments should identify current and future needs and look to maximize the impact of investment.

Transportation investments—intended to last generations—require a comprehensive and

considered effort to anticipate future demand. Preparation, but not prescription, ensures readiness for the broad range of technological, social, and economic opportunities to come. Importantly, public investment must guide new transportation nodes toward equitable accessibility as well as effectiveness. As transportation is a critical tool for economic development, it can also be a critical tool for equitable advancement. With the support of trained professionals, Worcester should start planning now by thinking carefully about the flexibility of public and private investment to accommodate new forms of transportation and new demand. Replacing like with like is no longer acceptable; understanding the trends and accommodating the future will ensure that the city retains its place as a hub of industry, commerce, and people now and into the future.

**One More Thing:** On August 17, the City announced that the Pawtucket Red Sox, the Boston Red Sox's Triple-A affiliate, had agreed to move to Worcester as part of a development initiative to build a Minor League baseball stadium as well as hotel, residential, retail, and parking. Transportation is a critical challenge for this project. While the site is close to I-290 and Route 146, road access requires navigating Kelley Square, the location with the most automobile accidents in the state according to a March 2018 MassDOT report, with a combined ten un-signalized entry and exit points (as well as two adjacent highway ramps). Union Station, with the WRTA hub and MBTA commuter rail, is approximately one-third of a mile away but with poor pedestrian connectivity. The development of this project must consider not only automobile access but provide viable alternative access via walking, bicycling, and public transit through sidewalk reconstruction to Union Station and Downtown, streetscape enhancements, signage, street furniture, bus shelters, lighting, and public art. It should incorporate the potential of electrification and autonomy. A public ballpark is simply a destination; a focus on transportation is necessary to ensure that fans are going to arrive.

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*The Research Bureau serves the public interest of Greater Worcester by conducting independent, non-partisan research and analysis of public policy issues to promote informed public debate and decision-making.*

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