



The Research Bureau

# PUBLIC PAR(KING)

Worcester's Past, Present, and Future of  
Parking

REPORT 24-08

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## EXECUTIVE SUMMARY

**PARKING MINIMUMS** in Worcester are the result of decades of parking development in the City, though they are by no means unique to it. This report, **Part 2 of a two part Bureau series on parking**, examines the historical development of parking in Worcester, analyzes parking minimums within zoning, and discusses the visible and invisible costs of parking.

**Public Par(king): Worcester’s Past, Present, and Future of Parking** finds that since the 1920s, Worcester’s planners and residents have clamored for parking, often in pursuit of economic development. However, building

more parking has trade-offs. It uses space that could be used for other purposes and it has enormous monetary costs for developers, owners, renters, and residents. Many of these costs are often invisible to the drivers using that space. Parking can also perpetuate itself; more parking may increase car dependency which may lead to calls for more parking.

**Public Par(king)** should be read along with **Feeding the Meter: Public Parking Usage in Worcester** to get a full picture of the parking situation in Worcester and what could be done about it going forward.

### PAGES 3-6 | PRESENT A HISTORY OF PARKING DEVELOPMENT IN WORCESTER

- Since before the 1924 City Plan, **Worcester has grappled with the personal automobile and where to place them.**
- Parking is a major issue in planning documents from the 1950s through the 2000s; and attitudes towards parking have often vacillated between “there is too much” to “there is too little.” This is especially true Downtown.
- At one point, Worcester **had the largest parking garage in the world**, but even that was not enough to save its mall, or reduce the clamor for more spaces.

### PAGES 6-8 | DISCUSS ZONING FOR PARKING

- Zoning for parking is the idea that development should account for spaces for personal vehicles. This is known as “parking minimums.” **Many municipalities in the United States have parking minimums.** In recent years, many have been reforming or foregoing minimums as well.
- Parking minimums dictate, using a formula, how many spaces should be created. For example, **according to Worcester’s zoning ordinance, a single family dwelling needs two spaces.**
- **Worcester does not have one standard set of parking minimums.** Downtown (BG-6.0) has no parking minimum requirement. The Commercial Corridors Overlay District (mostly the Canal District and Shrewsbury St) have reduced minimums.

### PAGES 9-14 | REVIEW THE COST OF PARKING MINIMUMS

- Parking minimums often have visible and invisible costs. Some of these include the use of space for parking that could be used for other productive purposes and the enormous monetary cost of building parking.
- Parking spaces in garages can cost tens of thousands of dollars per space to build.
- **“Free” parking often hides its true costs for drivers;** and in some ways subsidizes the costs of driving by doing so.
- **Parking minimums can lead to unused spaces in residential developments;** about 3.8% of owner occupied units and 24.7% of renter occupied units, according to the 2022 American Community Survey.
- Ending parking minimums may lower costs, **and therefore allow more housing development to take place.** This has been the case in Everett, which changed the way parking is approved.

### PAGES 15-17 | POSE QUESTIONS TO CONSIDER AND CONCLUSIONS

- **Eliminating parking minimums** may increase new housing development and lower costs.
- Eliminating parking minimums **should be done in the context of increasing and encouraging** other mobility options.
- The City should **better promote municipal garage usage**, as it is a valuable public service.
- The City **should encourage creative reuse** of existing parking.
- Eliminating parking minimums can help the City **reach its sustainability and Green Worcester Plan goals.**



## INTRODUCTION

**Parking is king.** For as long as there have been cars, it has been a subject of conversation in Worcester. Planners have had to balance the needs of commuters, shoppers, local residents, and alleviating the resulting traffic congestion. Those same groups need parking to get where they are going in the car-oriented city. Parking – through the phenomenon known as “cruising,” but also simply through the actions required to enter or leave a parking space – can lead to traffic. But traffic isn’t the only, or even the most significant, thing. Parking takes up space; and **every square foot left for parking is a square foot less for other productive land uses.** A history of parking in Worcester sees these tensions come to light: on-street parking creating traffic; looking for parking to save economic development downtown; and minimum-parking requirements making it expensive to build new housing.

## A SHORT HISTORY OF PARKING IN WORCESTER

Some of the earliest studies of vehicles in Worcester’s Downtown tried to directly address the tensions present between all the competing forces related to parking. For example, Worcester’s 1924 City Plan attempted to address the confluence of parking, the increase in personal automobile traffic, and the needs of Worcester’s extensive series of streetcar lines. On automobile parking downtown, the Plan writes: “One thousand parked vehicles occupy over 100,000 square feet of street space which was not originally designed for such use. The advisability and even the legality of permitting long parking to the detriment of traffic is a grave question” (1924 City Plan, 46). Indeed, such un-planned for parking seemed to be wreaking some havoc, as the streets were now congested with cars being parked, and therefore leaving less space for vehicle movement of any kind.

Moreover, publicly controlled off-street parking was not generally considered in the plan as a way to prevent traffic; instead, widening streets to allow for a trolley car, two heavy traffic lanes, two car lanes for leisurely drives, and a row of parking on each side seemed to be the solution on some of the more heavily trafficked streets (53). The responsibility for off-street parking seemed to be relegated to private businesses choosing to provide it: “In other cities, some theatres, department stores, clubs and business buildings are providing parking spaces for patrons upon private property” (46). On-street parking, though, was the responsibility of the City, and the plan argued that “it should be assumed that parking is going to

This is **Part 2 of the Bureau’s 2024 Parking Series. Read Part 1, Feeding the Meter: Public Parking Usage in Worcester** to see an analysis of municipally-owned garages, lots, and on-street parking in Worcester. This report will cover the history of parking in Worcester, followed by a discussion of minimum parking requirements in the City’s zoning, as well as information about car ownership in Worcester, and an analysis of the ways that parking may impose visible and invisible costs on residents and commuters.

Parking is a key part of modern life; understanding and re-thinking how parking impacts that life is a worthwhile exercise, and becomes an increasingly important one if Worcester wants to reach its housing, sustainability, and other future goals.

be allowed on both sides of every street regardless of its importance or location” with some exceptions (57). Interestingly, much like today, the Plan also argued that the City should do what it can to get the street car companies to improve service, to encourage people not to drive themselves and therefore cause congestion through the whole system.

By the 1950s, the City had seemingly done an about-face on on- and off-street parking. On-street parking caused traffic, just as it had in 1924, but rather than advocate building wider streets to accommodate more of it, a potential solution was to ban it entirely and to build off-street parking. **By the 1950s, personal automobiles were such a part of daily life, however, that eliminating on-street parking was seen as untenable.** Worcester’s Off-Street Parking Board in 1953 described this as it identified potential sites to use for off-street parking in the Central Business District:

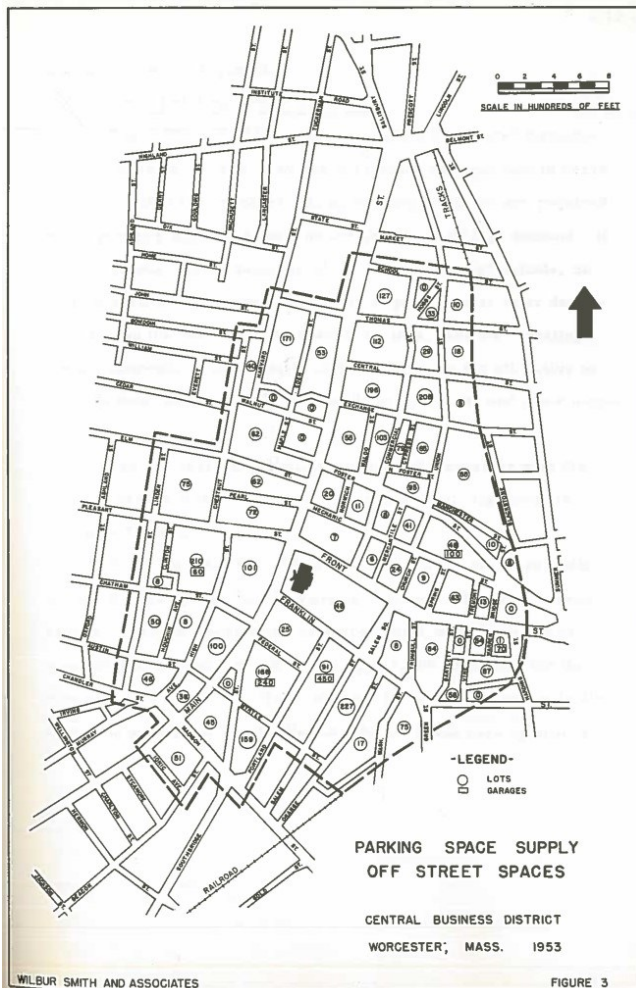
The problem in Worcester is to make it easier for people to transact business in the central Downtown area. ... The reason for this problem in Worcester and other cities is that there are more vehicles than can be accommodated by the street and parking system under present conditions and regulations, thus creating excessive traffic congestion. If no street parking were permitted in the Downtown area, traffic congestion would be reduced very substantially. ... On the other hand, Downtown property owners, including many merchants, would be concerned by this total elimination of street or curb parking (Off-Street Parking, 1953).

At the time, Worcester's Off-Street Parking Board, which was first established by ordinance on July 10, 1951, was trying to determine how to eliminate traffic Downtown while accommodating the growing number of personal vehicles making their way into the central business district every day. It had two principal responsibilities: to manage the (1) construction, operation, and maintenance of off-street parking facilities acquired by the city and (2) study and make recommendations for the acquisition of additional off-street parking facilities. Notably, the Off-Street Parking Board still meets today; its duties include "Oversight of municipal open-air parking lots and municipal parking garages," and its member responsibilities include setting "rates and policies for off-street facilities" and working "with businesses to improve customer and employee parking conditions."

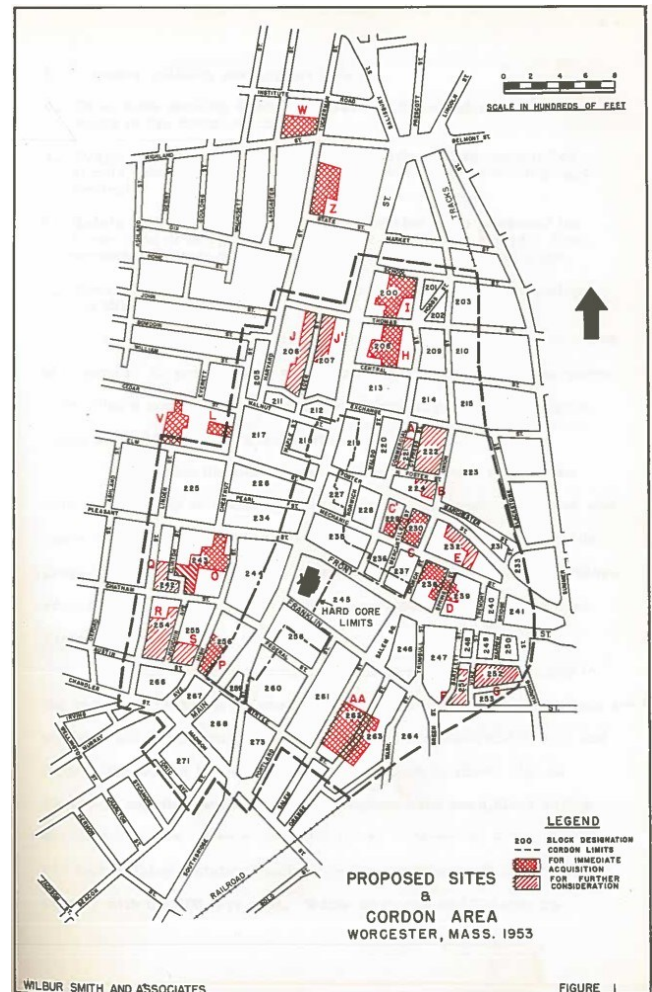
A study later in 1953 conducted by Wilbur Smith and Associates, *Parking Needs of Worcester, Massachusetts*, comes to similar conclusions as it looked at the feasibility of sites identified by the Off-Street Parking Board for

potential off-street parking. In its study of the Downtown area, the firm found that there were 5,586 parking spaces in 67 blocks (see **map 1**). **The problem was not that there were not enough spaces – but, rather, that “many of the existing spaces are improperly located and are otherwise undesirable in relation to reasonable demands, so that a critical deficiency actually exists”** (Wilbur Smith 1953, 1). Later in the study, the authors argued that in the Downtown area, specifically, a “need for additional spaces predominates, so that parkers may have the convenience of parking near their destinations” and that, since those parkers would not have to walk so far, “the duration of stay would be less, thereby creating higher turnover” (12). The main solution proposed was to build off-street parking (see **map 2**) and to remove most curb-parking. In addition, the study suggested zoning for parking; otherwise, the authors suggested, “with increases in building ... spaces in the central business district of cities can be quickly lost for parking” (60).

**Map 1: Off-Street Parking Supply, 1953**



**Map 2: Proposed Downtown Off-Street Parking, 1953**



Source: *Parking Needs of Worcester, Massachusetts*, Wilbur Smith and Associates (1953), Pages 6 and 12



Other groups saw similar problems and clamored for similar solutions. The Citizens' Plan E Association,<sup>1</sup> for example, argued that the increased dependence on personal vehicles had widespread problems in cities not originally designed for them:

First, there are the delays and irritations caused by chronic traffic congestion. This is expensive for everyone because it adds to the cost of truck operation and bus transportation, and leads to irritation and expense for the owner of an automobile used for business or shopping. Secondly, poor traffic flow discourages shopping in the Downtown areas. This results in a decline in business, which will eventually result in a decrease of Downtown property values.

It is obvious that traffic flow and off-street parking are aspects of the same problem. For example, **the cheapest way to widen Worcester's streets is to forbid curb parking**. This step cannot be taken, however, **until ample and convenient off-street spaces are provided**" (Citizens' Plan E Association, 1954; emphasis our own).

These 1950s studies and reports on parking and traffic in Worcester all point to similar problems: there is too much traffic, part of the reason for this is on-street parking, and therefore more off-street parking should be provided to alleviate these problems. Of course, talk about parking does not end in the 1950s. Parking has been the subject of several studies and plenty of news in the decades since.<sup>2</sup>

One significant development in parking in Worcester came from the construction and development of the Worcester Center Galleria, which opened at the end of July 1971. **With it came a 4,300-car parking garage**; at the time, this garage was the largest in the world (Woolhouse, 2006). One Worcester planning study from 1972 found **that the parking area in Downtown grew from 1,334,678 sq. ft. in 1952 to 3,509,984 sq. ft in 1972**; the report argued that by 1990 land use for parking in the area should grow to **4.5 million sq. ft** (Doxiadis, 1972, 101; 112).<sup>3</sup> In any case, the Galleria's sizeable garage was not enough to save it. As early as the aforementioned 1972 study—just one year after the Galleria had opened—Worcester's Downtown shopping experience was hurt by competition "of other regional shopping centers which usually offer easier accessibility, quality merchandise, better environment and **free and convenient parking**" (Doxiadis 1972, 92; emphasis ours). When the mall was eventually demolished as a part of the CitySquare project beginning in 2010, about 2,000 of the aforementioned spaces were demolished (Kelleher 2022).

If the Doxiadis report was any indication, parking remained a focus in Downtown Worcester. The 1987 Master Plan, for example, argued that a lack of parking was a major roadblock to further development Downtown: "One factor that contributes to the attractiveness of new development to Downtown Worcester is the availability of sufficient parking at reasonable rates" (Master Plan 1987, 33). In a quoted 1986 parking demand study, it was found that 94% of available supply was being used during daytime (in general, engineers and planners aim for 85% to 95% occupancy rates). **The solutions for this were better parking management – including an increase in parking fines – but also "in the long term the City's zoning requirements for new construction projects must require construction of new parking facilities"** (33).

Striking the balance between too few and too many parking spaces was a concern for many in Worcester. A selection of early 1990s Telegram headlines referring to the Pearl-Elm Garage puts it into perspective: "City Vexed by Downtown Parking Woes Both Sides" (November 16, 1989); "Council Seeks Parking Spaces From Developers" (January 10, 1990); "More Parking Urged for City" (October 11, 1990); "City has Surplus of Parking Spaces" (December 3, 1991).<sup>4</sup> Balancing a perceived lack of parking with creating an excess of parking is a key political pressure point; drivers that see their desired parking areas full or frequently full can be vocal about it. What they may not see is that there is parking available elsewhere. These headlines and stories betray a hope that a surfeit of parking would increase the economic development of the Downtown. This thought—that adequate parking is a key factor in the economic development of Downtown—has been present since the first studies mentioned in the 1950s. Parking offers trade offs when it comes to economic development. On the one hand, it can bring workers and shoppers to destinations that already exist; but on the other, it uses up valuable and limited land that could be used for other, more productive purposes. In other words, parking provides potential energy for economic development but is no guarantee of it.

A number of studies were conducted throughout the mid-2000s and early 2010s on parking. A 2004 study of parking in Worcester's Central Business District by VHB found that in general there was about 61% utilization rate of all parking located in the area. In the 2007 *Downtown Parking Garage Study* by Desman Associates, it was found that Pearl-Elm Garage was often reaching capacity, but Federal Plaza and Major Taylor garages had plenty of availability. *Worcester Parking System Concession/Lease Report*, by IMG in 2010, found that Worcester parking garage rates were



below comparable cities.<sup>5</sup> The City’s 2013 parking system assessment suggested that Worcester needed more proactive management of its public parking assets and services if it wanted to remain competitive with private offerings. Among its suggestions were updating parking technology, equipment, and signage, and hiring a lead parking professional. The City has invested in some of these things: moving to a district-based system for on-street parking managed through an app, and starting a Department of Transportation and Mobility, with a lead parking director, as some examples.

The Research Bureau itself also contributed a parking report in June 2016: [“Parking in Worcester: Left by the Curb.”](#) Acknowledging the role that parking can play in economic development, the Bureau urged the “City to reconsider the role of parking in both the Downtown and the structure of municipal government,” while also arguing for the implementation of a “strategic parking master

plan” (Research Bureau 2016). Ultimately, the report argues that “Parking does not create a vibrant Downtown. It can support one, however. For Worcester to succeed, it must organize its operations so that parking is not just a place to stop, but a tool for moving the city forward” (9).

Parking is a complex story. In the history described here, a few common themes have emerged that, while not unique to Worcester, are important to the “story” of parking. Indeed, parking is a well-studied phenomenon worldwide, and leading scholars, urban planners, and policymakers have been thinking and writing about it for years. For an example of some of these studies, please see the bibliography following this report.

## ZONING FOR PARKING

One of the most common ways that cities ensure there is “enough” parking is through “**parking minimums**.” Parking minimums are generally codified through the city’s zoning code, and require that new development and, often, substantial redevelopment, include a certain amount of parking spaces decided by building use. Some cities—and parts of Worcester’s own zoning code as well—have parking “maximums,” i.e., a limit to the amount of parking that can be built.

Worcester has long had parking minimum requirements within its zoning code; as noted, the city’s 1987 Master Plan deemed them necessary, and going back to the 1950s we can see the importance that people have given to getting enough off-street parking in the city. A look at the current zoning code lays out the minimum parking required for the different types of development that might occur in the City. **Additionally, certain zoned areas, like BG-6.0, have no accessory parking requirements**, while certain “overlay districts” have different parking requirements, and there are still other exceptions that can be made to the rules. In other words, experiences may vary depending on where development is occurring. Still, zoning in the city makes the following “general” requirements found on **Table 1** on the next page.

Reading this table is fairly straightforward. The use on the left dictates how many parking spaces there should be per measurement unit. So, a two-family home requires two spaces per dwelling unit – four total. In-Patient Hospitals require one parking space per bed; a 50-bed hospital would

therefore require 50 parking spaces. General retail requires one parking space per 300 square feet of gross floor area.

There are other requirements listed in the city’s zoning ordinance. For example, when a building or land area “is used by two (2) or more categories of uses as defined above, the off-street parking and loading facilities required shall not be less than the sum of the requirements for the individual uses computed separately” (Zoning 2023, 101). In other words, **developments with multiple uses must calculate a combined parking minimum considering both the requirements for all uses**. Parking generally needs to be provided on the same lot as the development; but in business or manufacturing districts, “required parking may be provided through the same ownership and/or through long-term lease agreements ... within one thousand feet of the use it is to serve” (109). Parking lots should allow vehicles to enter and leave in a single motion. Conventional parking spaces should be 9 feet in width and 18 feet long, unless there are more than ten spaces in the lot, and then 25% of the required parking can be designated as compact, whose spaces are then 8 feet wide by 16 feet long. Other requirements include interior and exterior landscaping, and where lots can be placed on a building parcel. In other words, **zoning for parking dictates how many spaces a development should have, as well as where that parking should be built—these two requirements in conjunction therefore affect what is built in the first place**.

Some of these requirements, especially the minimum number of parking spaces, can be waived through special permit from the Zoning Board of Appeals, but even then,



**Table 1: General Zoning Requirements for Parking in Worcester**

Use	Number of Spaces	Measurement Unit
<b>Residential</b>		
Single, two or three family dwelling	2	Dwelling Unit
Multi-Family Dwelling	2	Dwelling Unit
Group Residence	0.25	Bed
Lodging House	0.5	Bed
Housing for Elderly (subsidized)	1	Dwelling Unit
Dormitory	0.33	Dwelling Unit
Continuing Care Retirement Community	1	Dwelling Unit
CCRC Associated Medical Facilities	0.5	Bed
Temporary Shelter	0.1	Bed
All other Residential, including Hotel/Motel	1	Bedroom
Limited Residential Hospice House	0.5	Bed
	1	Employee Living on Premise
<b>General</b>		
Nursing, Convalescent Home/Facility	0.33	Bed
In-Patient Hospital	1	Bed
Out-Patient Hospital	3	Treatment Room/Space
Clinic	4	Treatment Room/Space
Educational Institution	10	Classroom, plus residential
Places of Assembly (non-profit or profit)	0.25	person accommodated
Day Care Center / Adult Day Care Center	1	Teacher or Staff Person
Library, Museum, Recreation/Service Facility	1	350 SF Gross Floor Area
Club, Lodge, Other (non-profit and profit)	2.5	350 SF Gross Floor Area
Health Club (profit)	1	350 SF Gross Floor Area
Heliport	1	350 SF Gross Floor Area
<b>Business</b>		
Office, Professional General	1	300 SF Gross Floor Space
Office, Bank	1	Teller Station (including ATM)
	1	300 SF Gross Floor Space
Radio/TV Studio	1	300 SF Gross Floor Area
Funeral / Undertaking	1	250 SF Gross Floor Area
Research Laboratory (No Manufacturing)	1	300 SF Gross Floor Area
Retail Sales	1	300 SF Gross Floor Area
Services (personal, animal, other)	1	300 SF Gross Floor Area
Food Service/Lounge/Nightclub	0.5	Person rated occupancy
Fast Food / Drive Thru	1	60 SF Gross Floor Area
Bus/Rail Station	1	350 SF Gross Floor Area
Wholesale Sales/Storage/Display	1	1000 SF Gross Floor Area
Retail Storage	1	750 SF Gross Floor Area
Marina, excluding retail space	0.25	Slip
Public Garage, Body, or Paint Shop (auto-truck)	3	Bay/Stall Used for Service/Repair
Drive-Up Service, Lubritorium	1	Bay/Stall Used for Service/Repair
	3	off street Waiting spaces
	1	space beyond service exit
	1	3000 SF Gross Floor Area
Telecommunications Facility	1	Employee
	1	50 Storage Units
<b>Manufacturing</b>		
Manufacturing Area	1	1000 SF Gross Floor
Warehousing/Storage (Enclosed/Open) Area	1	3000 SF Gross Floor
Freight Handling Area	1	1000 SF Gross Floor

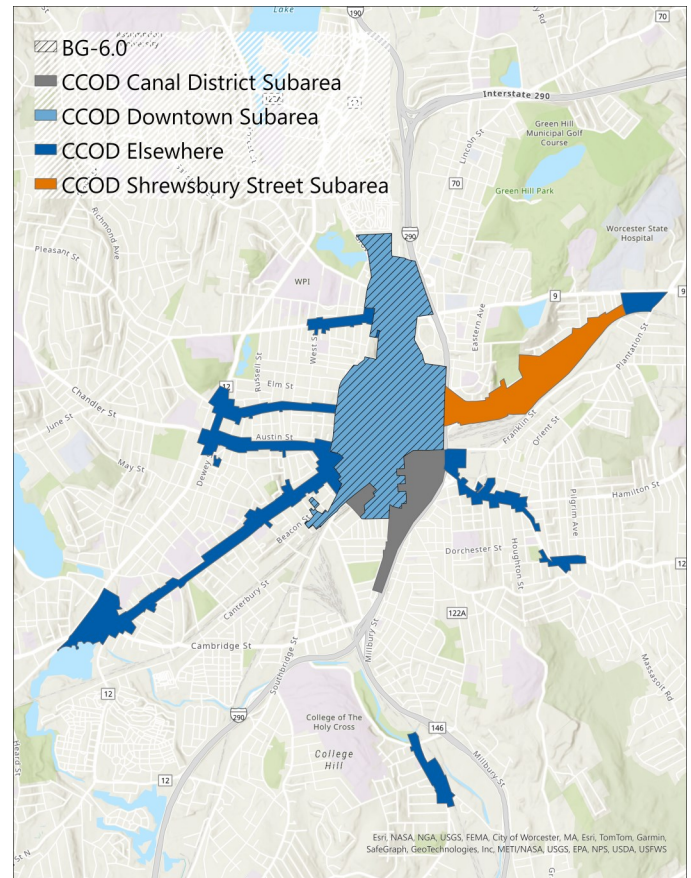
Source: City of Worcester, 2023 Zoning Ordinance; WRRB Recreation



they cannot waive all requirements. Some projects with 16 or more spaces need special approval from the Planning Board.

Not every area of the city is subject to the same parking requirements. In the “Commercial Corridors Overlay District” (CCOD), which includes the Downtown (all of the BG-6.0 areas), Shrewsbury St, the Canal District (the areas that are not BG-6.0), and a few other areas, different rules apply. In the CCOD, if after special permit the number of parking spaces is reduced to five or less, then off-street parking is waived completely. Unlike other areas, the CCOD has maximum parking limits in addition to minimums. Mixed use areas receive additional parking reductions. Providing space for bicycles can reduce parking requirements as well. There are other rules and exceptions—they can be found in Appendix IX of the City’s Zoning Ordinance. **Table 2** shows the minimum parking requirements for each of the areas that make up the CCOD.

**Map 3: BG-6.0 and CCOD Areas in Worcester**



Source: City of Worcester GIS

**Table 2: Minimum Parking Requirements in the Commercial Corridors Overlay District**

Uses	Minimum Parking Requirements			Maximum Parking Limits	
	Shrewsbury Street	Canal District	Elsewhere		
<b>Residential</b>					
Single, two or three family; multi-family dwelling; loft, creative entrepreneur	1 resident space per dwelling unit (Studio, 1 BR Units)	1 resident space per dwelling unit			2 per dwelling unit (total, including residential and guest parking)
	1.5 resident spaces per dwelling unit (2+ BR Units)				
	1 guest (unreserved) space per 10 units for dwellings with 10 or more units				
All other allowed residential uses	75 % of requirements in parking Table 4.4			125% of requirements in Table 4.4	
<b>General Uses</b>					
all allowed general uses	75% of requirements in parking table 4.4			125% of requirements in Table 4.4	
<b>Business Uses</b>					
Office, Professional/General; Retail Sales; Service (personal, animal, other)	1 per 500 sf			1 per 250 SF	
Food Service/Lounge/Nightclub	1 per 4 rated occupancy			1 per 2 rated occupancy	
All Other allowed Business Uses	75% of requirements in parking table 4.4			125% of requirements in Table 4.4	
<b>Manufacturing Uses</b>					
All Allowed Manufacturing Uses	75% of requirements in parking table 4.4			125% of requirements in Table 4.4	

Source: City of Worcester, 2023 Zoning Ordinance; WRRB Recreation





**THE COSTS OF PARKING MINIMUMS**

Zoning for parking, and especially parking minimums, is perhaps among the most controversial topics in discussions around parking. This is especially true when discussing housing and increasing density, as parking minimums spread out what could otherwise be a dense neighborhood. There is also some evidence that parking minimums may dissuade developers from building new or redeveloping properties, though of course parking minimums may not be the only reason why developers choose to build or not.<sup>6</sup>

Why, if many people have cars in the first place, would building parking potentially dissuade developers from building or redeveloping at all? After all, wouldn't developers want to have enough parking for commuters, residents, shoppers, and the like? There are a few aspects of this worth considering, and they largely regard **(1) the opportunity tradeoffs that required parking creates, and (2) the enormous monetary costs of constructing parking.** This is not to mention the environmental impacts, such as increase in impervious surface, that parking can have.

The first major issue concerns opportunity trade-offs. Every parking space requires a certain amount of infrastructure and physical space; **increases in the amount of space required for parking decreases the amount of space available for the development itself.** Rapid increases in parking space change the physical fabric and connectivity of its environment—a string of parking lots, for example, decreases density and lessens walkability.<sup>7</sup> Parking lots increase the amount of city infrastructure necessary to connect to a building; a parking lot in front of a building simply increases the amount of, and therefore cost of, sewer pipe or power line that is needed to effectively service it.

As a thought experiment, consider the following: If a developer wanted to build more residential units, they would be required to provide more parking spaces for each of those units. Doing so would leave less space on the parcel to build those extra units; this might cause the developer to make hard choices in building design, including building smaller units. In the opposite case, the developer might conclude that the space taken up by required parking is not worth it, and so might choose to build *fewer* units overall in order to have a smaller parking burden.

The second issue is with monetary cost. The price of building a parking lot and especially a parking garage is enormous, and growing. According to WGI, a national design and services firm specializing in public infrastructure and real estate, **the median cost of construction for a parking space in an above-ground parking garage in 2023 was \$29,000, or \$86.73 per square foot. In Boston, the cost was \$32,625, or about \$98 per square foot.** Many garage spaces may cost more than this. WGI defines a “median-cost” parking structure to contain the following features, seen on **Table 3.**

The 2023 WGI report on costs indicates that there are other non-standard features of above-ground parking structures that increase their price, including fire sprinkler systems, as well as the increasing requirement to include EV charging in new construction. Building underground garages is even more expensive. **Indeed, the Boston Globe found that in Boston, underground garage spaces cost \$60 to \$70,000 apiece** (Carlock 2023). There are more factors to consider. For example, creating garages with larger parking spaces to accommodate larger cars would increase the cost-per-space as well as decrease the amount of spaces per garage that can be accommodated. This will become an increasingly common need as personal vehicles have tended to grow in size over time. Indeed, according to the U.S. Environmental

<b>Table 3: WGI Median-Cost Parking Structure Inclusions</b>
Spaces 8'6" to 8'9" wide
Precast concrete superstructure
Precast concrete façade with simple architectural treatment
Glass-backed elevators and unenclosed stairs with exterior glass curtain wall
Standard wayfinding and signage
Shallow-spread footing foundations
All above-grade construction
Open parking structure with natural ventilation; without mechanical ventilation or fire sprinklers
Minimal or no grade-level commercial space
Conventional parking access and revenue-control system
Standard energy efficient LED lighting

Source: WGI Engineering Parking Structure Cost Outlook for 2023



Protection agency’s 2023 Automotive Trends report, **vehicle footprint has increased 6% since 2008, from 48.9 to 51.6 square feet** (see the chart below for a breakdown in size; footprint is not the exact size of the vehicle, but as footprint increases so too would total vehicle length and width) (EPA 2023, 31).<sup>8</sup> Additional considerations for the size of garages include heights and clearance size, as vehicles become taller. In any case, parking garages are expensive to build.

Building open-air lots can also be costly, but much less so than building garages. Where land is available, cost per space is a function of the land and paving costs, in addition to the infrastructure costs to and from the building itself as well as other related costs (like interior and exterior landscaping). According to Todd Litman from the Victoria Transport Policy Institute, spaces in a surface lot typically cost \$20,000 less than in structured parking (Litman 2023, 16).

In general, in areas where land is scarce and as construction costs themselves have increased, building parking can be an expensive prospect, that does not have the same opportunities for return on investment that an additional residential unit or more commercial space might have.

**VISIBLE AND INVISIBLE COSTS OF PARKING**

The costs of parking are not just something that developers bear, but something that residents and users bear as well, whether they realize it or not. If users of retail, office, and residential space believe they are receiving “free” parking, it is important to recognize that that is often a mirage of sorts. Parking lots and garages incur regular costs: the cost of construction, operation, and upkeep costs. These costs are passed on to shoppers, workers (in the case of lower pay but with the guarantee

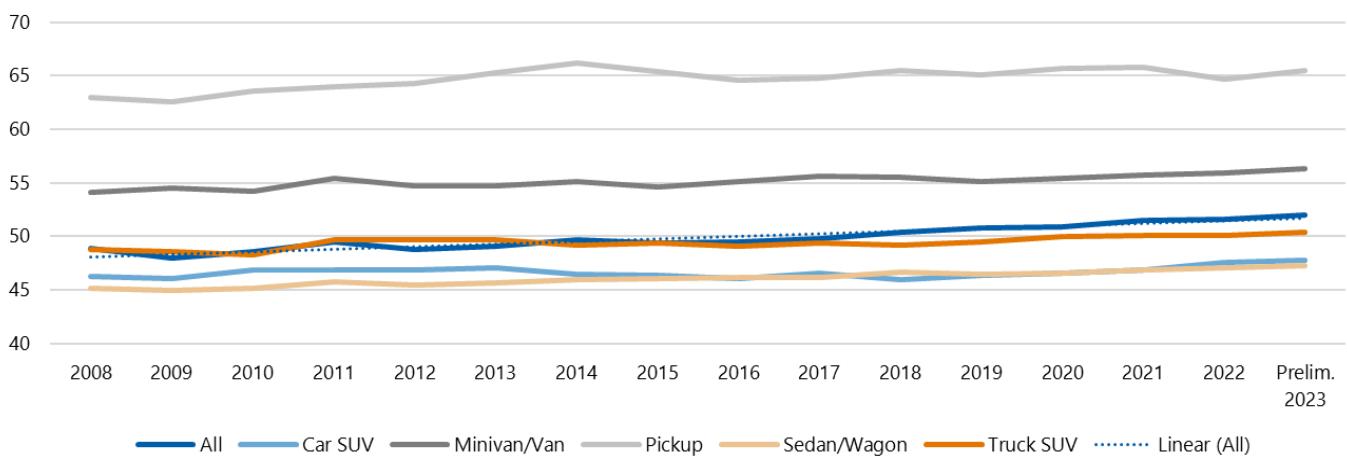
of parking), and to residents (in the form of higher rents or mortgages).

**Many of the costs of parking are “hidden” within housing costs, or workplace benefits.** This may not be as apparent in single-family homes, but in many multi-family dwellings or in rentals, the cost of parking one’s car is often built into, or “bundled,” into the housing cost (and often invisibly). Such bundling not only burdens renters or homeowners who do not own a car but might also serve to encourage vehicle ownership and increase vehicle use (Manville 2016; Manville 2020; Gabbe and Pierce 2016; Weinberger 2012). **Moreover, free parking “subsidizes” and “hides” some of the costs of car ownership**—someone is paying for that parking, including maintenance, upkeep, and staffing—and even if one is paying for parking themselves, its costs can sometimes make up a significant part of the cost of driving.

To put that last line into perspective, consider estimates done by Donald Shoup in 1997 to demonstrate the subsidizing effect of free parking. If a parking space costs \$124 a month for upkeep, and a “commuter works twenty-two days each month, a parking space at work costs \$5.64 a day. A commuter who parks free in this space therefore receives a parking subsidy of \$5.64 a day” (Shoup 1997, 11). Shoup then estimates the cost of daily driving with and without the subsidy, using AAA estimates of daily costs for a vehicle.

Replicating this activity for Worcester could give us a reasonable estimate of “parking subsidy,” provided that parking is provided by an employer to their employee; or, even, the percentage that daily parking makes up of total driving cost. According to the US Census Bureau’s “OnTheMap” tool, in 2021 there were about 32,817 workers in Worcester that commuted 0-10 miles for their

**Chart 1: EPA Growth in Automobile Footprint, in Square Feet, 2008-2023**



Source: U.S. Environmental Protection Agency, 2023 Automotive Trends Report



job (one-way)—this is about half of all residents in Worcester commuting to work covered by this tool. AAA estimates that the total cost of driving a newer vehicle 10,000 miles in a year is about \$1.05 a mile in 2023. Using these figures, the following table estimates the cost that parking contributes to driving for each of the five public garages in Worcester. As with Shoup’s estimates, the daily cost assumes commuting 22-days out of the month.

From the table, it is apparent that for short trips within Worcester, parking makes up a significant amount of the cost of driving; it is an even more substantial “hidden” subsidy if one’s employer pays for or provides parking in similar facilities with similar costs. While these numbers reflect the costs of Worcester’s public garages, costs are going to be different depending on the number of miles driven in a year, the cost of a monthly garage pass, and the state of one’s vehicle. Still, parking represents a large cost for driving that may not always be apparent to the driver.

**WHAT CAN BE DONE?**

**Parking minimums impose a one size fits all solution onto every development in a city.** In some sense, urban planners have to “guess” how many spaces a development might need now and in the future. So, how can and should the City approach parking minimums (and parking in general) going forward?

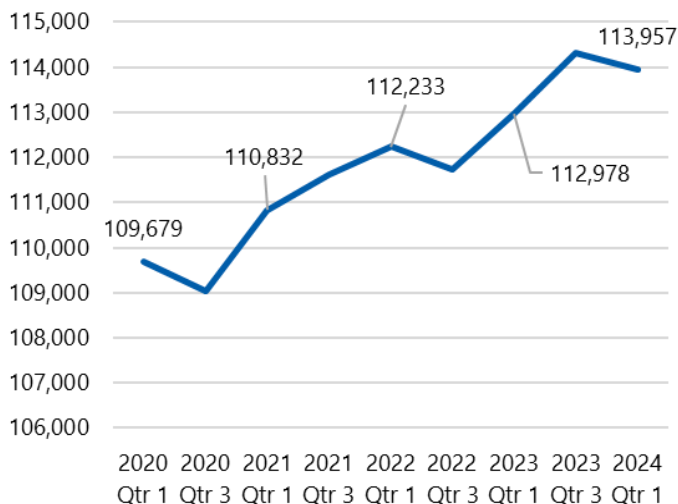
First of all, **it is important to stress that addressing zoning for new development should be done carefully.** Many people do commute to work by personal vehicle. Indeed, in Worcester, according to the Massachusetts

**Table 4: Parking’s Impact on New Car Driving Costs (10,000 yearly miles), Worcester Garages**

Garage	Federal Plaza		Major Taylor, Pearl Elm, and Union Station		Worcester Common		
	Roundtrip Miles to Work	Daily Driving Cost	% of Cost Made Up by Parking	Daily Driving Cost	% of Cost Made Up by Parking	Daily Driving Cost	% of Cost Made Up by Parking
2		\$8.92	76.45%	\$9.96	78.92%	\$11.01	80.92%
4		\$11.02	61.88%	\$12.06	65.18%	\$13.11	67.96%
6		\$13.12	51.98%	\$14.16	55.52%	\$15.21	58.58%
8		\$15.22	44.80%	\$16.26	48.35%	\$17.31	51.47%
10		\$17.32	39.37%	\$18.36	42.82%	\$19.41	45.90%
12		\$19.42	35.11%	\$20.46	38.43%	\$21.51	41.42%
14		\$21.52	31.69%	\$22.56	34.85%	\$23.61	37.74%
16		\$23.62	28.87%	\$24.66	31.88%	\$25.71	34.65%
18		\$25.72	26.51%	\$26.76	29.38%	\$27.81	32.04%
20		\$27.82	24.51%	\$28.86	27.24%	\$29.91	29.79%
Cost to Park Per Weekday (Monthly Cost ÷ by 22)		\$6.82		\$7.86		\$8.91	

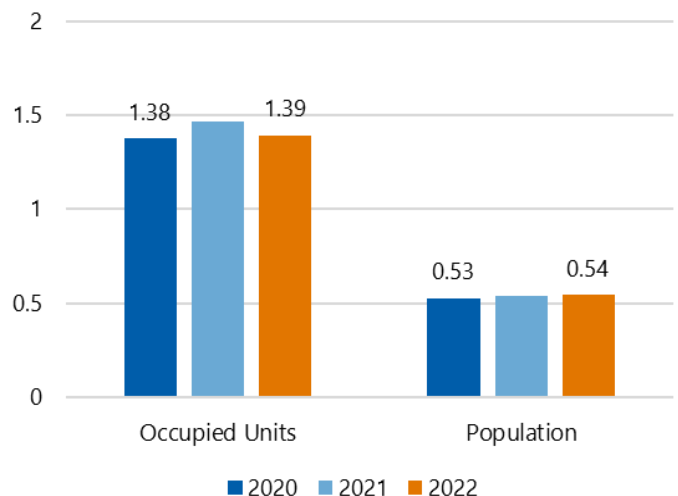
Registry of Motor Vehicles, there are more than 100,000 registered vehicles (of all types), and many households have at least one vehicle. **The maps on the following pages show owner occupied and renter occupied units with at no vehicles, one vehicle, or two or more. Pay special attention to the legends of each map, as maps 6 and 7 do not start below 10%.** In the line chart below, we can see the number of vehicles registered in Worcester on a biannual basis from 2020 to 2024. In other words,

**Chart 2: Total Vehicles, Including Passenger, Municipal, State, and Commercial, Registered in Worcester**



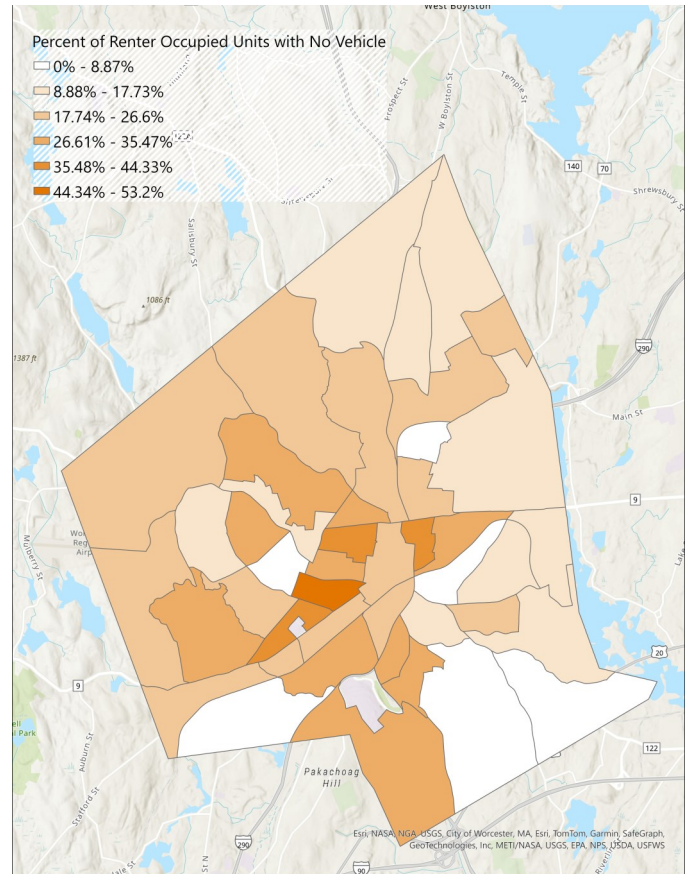
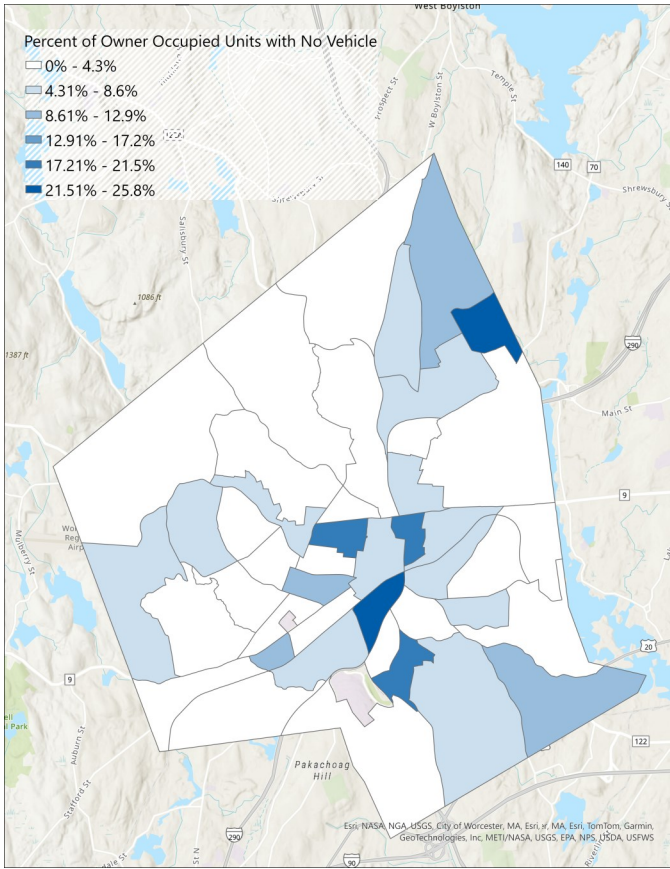
Source: Massachusetts Registry of Motor Vehicles; U.S. Census Bureau, Decennial Census H4 “Tenure,” P1 “Total Population; ACS S2501, 2021 1-YR, 2022 1-YR; ACS DP05 2021 1-YR, 2022 1-YR. Method for Chart 3: Total Registered Vehicles Divided by Number of Total Occupied Units and by Total Population

**Chart 3: Total Registered Vehicles, by Occupied Units and Total Population in Worcester**

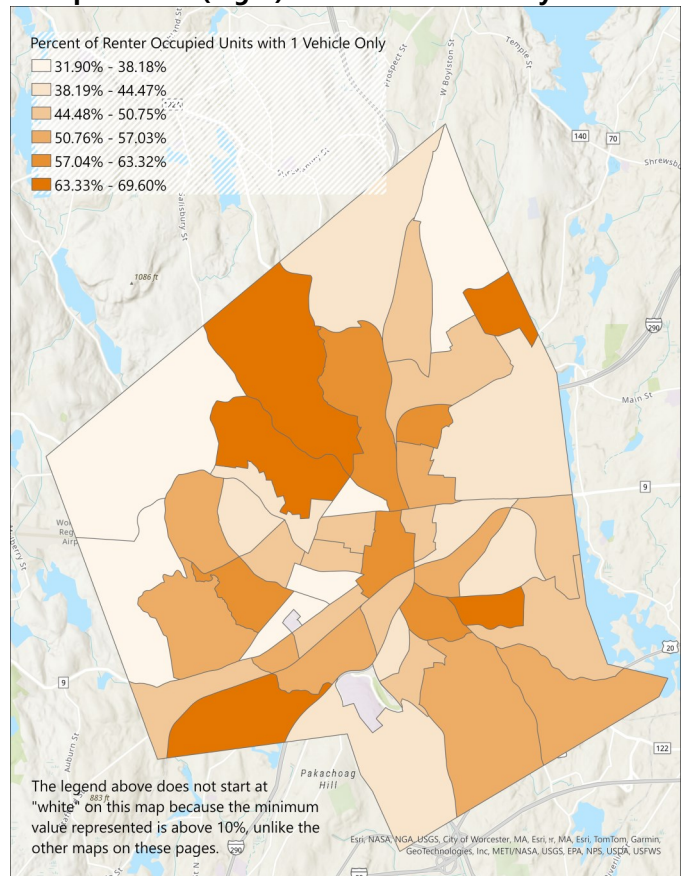
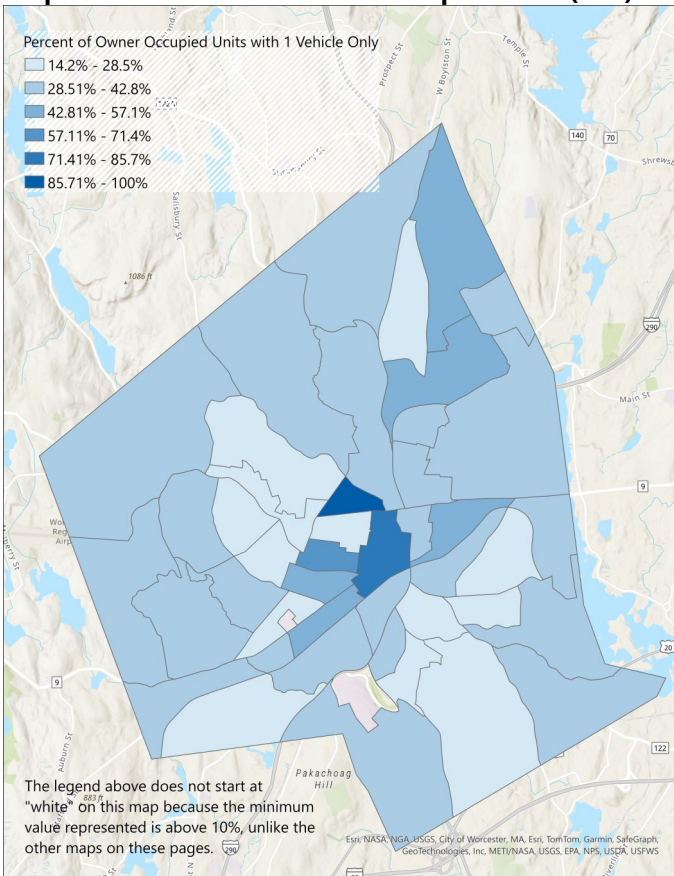




**Map 4 and 5: Percent of Owner Occupied Units (Left) and Renter Occupied Units (Right) with No Vehicles**



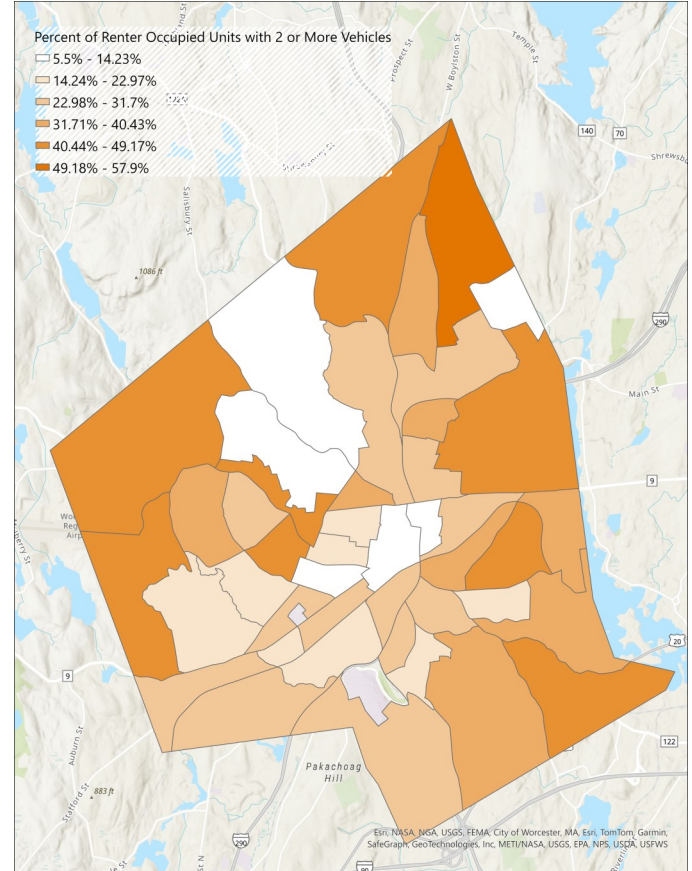
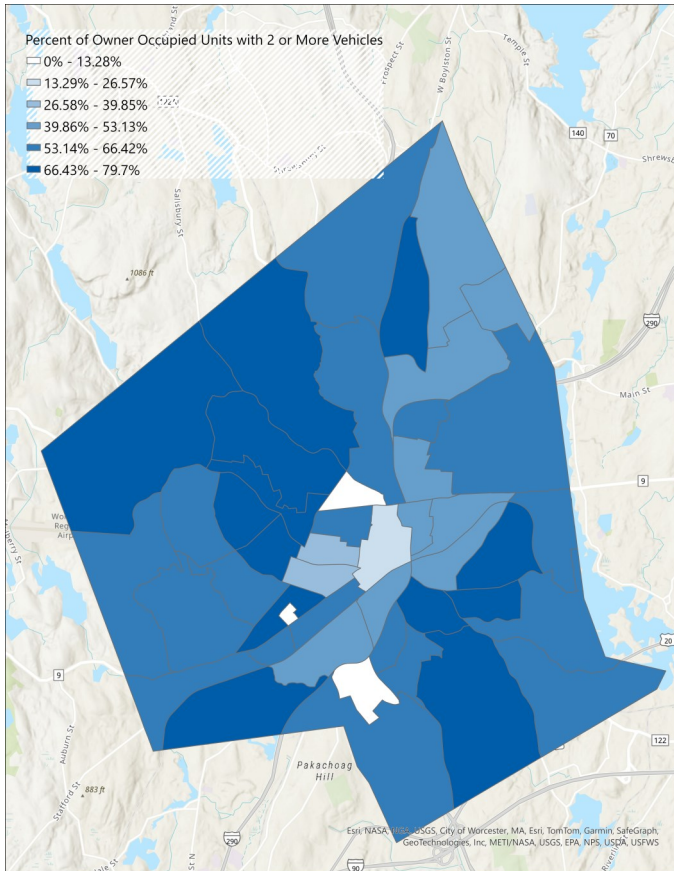
**Map 6 and 7: Percent of Owner Occupied Units (Left) and Renter Occupied Units (Right) with One Vehicle Only**



Source: U.S. Census Bureau, American Community Survey S2504 Physical Housing Characteristics, 2022 5-YR



**Map 8 and 9: Percent of Owner Occupied Units (Left) and Renter Occupied Units (Right) with Two or More Vehicles**



Source: U.S. Census Bureau, American Community Survey S2504 Physical Housing Characteristics, 2022 5-YR

there are a lot of vehicles in Worcester, and planners need to **carefully balance existing parking, existing vehicles, new development growth, growth of new vehicle ownership, and the capacity and service of the WRTA itself.** Where people have fewer vehicles, public transit (along with walkability) plays a larger role. Planners should consider carefully where occupied units have cars; where units are slated to go; where residents do not have cars; and where they most wish density and development to occur.

**Chart 3 on page 11** measures the total number of vehicles registered in Worcester by the number of occupied units and by population. For every occupied unit in the City, there are 1.39 vehicles registered within city limits; for every person, there are about 0.54 vehicles registered.

Even with more than 100,000 cars registered in the City, there are many occupied units without any vehicles at all, as evidenced by **Table 5** on this page (the numbers are within the 90% margin of error in the American Community Survey). **About 3.8% of owner occupied units and 24.7% of renter occupied units are estimated not to have any vehicle available.** 35.9% of owner occupied units have one vehicle available, compared to

46.2% of renter occupied units. However, 60.3% of owner occupied units have 2 or more vehicles available, while 29.1% of renter occupied units can say the same.

Second, Worcester has addressed minimum parking in some of its zones. In the BG-6.0 zone, there is no requirement. In the CCOD, which includes Shrewsbury Street and the Canal District, the minimum parking requirement is reduced and there are parking maximums. Elsewhere, the City's inclusionary zoning requirement (Article VII of the Zoning Ordinance) allows for up to 50% reduction in parking in affordable developments that meet its requirements. **In other words, the City has already implemented reduction or elimination of parking minimums in some areas – so it is not an unprecedented step to expand those reductions.**

Table 5: Occupied Units with Vehicles			
	Occupied	Owner	Renter
None	13,388	1,164	12,224
1 Vehicle	33,869	11,034	22,835
2 Vehicles	22,180	11,248	10,932
3 or More	10,740	7,308	3,432
Total Units	80,177	30,754	49,423

Source: U.S. Census Bureau, American Community Survey S2504 "Physical Housing Characteristics," 2022 5-YR



Indeed, the City's first long-range comprehensive plan in nearly 40 years, Worcester Now|Next, itself advocates for a reduction in parking minimums, making similar arguments to what has already been said above: excessive parking requirements can lower density and decrease walkability. In its section on zoning, Now|Next says:

Current parking minimums for a wide variety of residential and commercial land uses are higher than urban needs and market norms. Such requirements reinforce development patterns that directly conflict with Worcester's sustainability goals and encourage use of personal vehicles, and undermine development that would otherwise be desirable and viable. ...

Worcester needs a citywide reduction of parking requirements, more consistent parking requirements across land uses (to allow for change of use flexibility), and tools to encourage complementary mixes of uses that can share parking resources. Off-street parking minimums may not be needed at all for some locations and users, [...] and the practice of providing off-street parking on every individual lot is generally counterproductive to good, sustainable urban design for walkable neighborhood corridors and centers. To that end, targeted elimination of parking minimums and potential introduction of parking maximums [...] in existing and potential mixed use walkable areas would also be beneficial to the city (Now|Next 2024, 71).

More and more cities have been finding ways to reform their parking requirements. For example, recently Colorado adopted legislation banning the requirement of parking minimums in developments near transit in certain cities (Eason 2024). **Everett, MA is another example. It reformed parking minimums, changing the oversight process to allow exemptions to them, and while not the only cause, has seen housing production explode in comparison with other cities in the Boston-Area.** (Chesto 2024). The Parking Reform Network has found 2,778 cities world-wide (most of its data is from the United States) that have either reduced or eliminated parking minimums within at least part of their boundaries (see the map here: <https://parkingreform.org/resources/mandates-map/>). Worcester itself is included in this map for its elimination of parking minimums in BG-6.0 and reduction of minimums within the CCOD.

The elimination of parking minimums does not mean that developers will not build parking with new developments,

but rather that they will build what they believe is necessary based on market conditions. Indeed, if there is demand for housing units with space for cars, then it is likely that developers will build those units. There is evidence that this has occurred in cities that have eliminated parking minimums. For example, Hess and Rehler found that in the two years following the 2017 repeal of parking minimums in Buffalo, developers built 21% fewer off-street parking spaces (nearly 502 spaces) than they would have been required under the previous rules (Hess and Rehler 2021, 407). Of new developments, 47% provided far fewer spaces, while 53% provided the same or more as was required, leading to a net reduction of 502 spaces than would have otherwise been required under previous zoning (404). Additionally, they found that mixed use developments consistently provided fewer parking spaces than previously required, while single use developments (regardless of type) generally provided more (403).

**Another example is Seattle. Seattle reduced some eliminated other parking requirements in 2012. In one study from 2020, the authors found that between 2012 and 2017, about 70% of residential developments with no requirements provided parking anyway, but, overall, developers built 40% less parking than previously required** (Gabbe, Pierce, and Clowers 2020).

Of course, we cannot predict exactly what developers would do given reduced parking minimums. Still, given the costs of constructing parking, and the potential return on investment in building more units (rather than parking), they might choose to build more units. It seems unlikely that developers would forego building parking altogether if they believe that tenants or users would be looking for it; still, this could be an opportunity for developers to build more units and to "unbundle" parking from housing costs for those who don't have vehicles to store—as nearly 25% of renters in Worcester report having no vehicle at all.<sup>9</sup> Eliminating parking minimums may also enable "creative" solutions to parking that requiring parking spaces unfortunately does not allow for, such as allowing existing parking spaces to be reused for new housing or other kinds of development.



## QUESTIONS TO CONSIDER

The following are questions, considerations, and recommendations from the Bureau, uncovered as a part of researching **Feeding the Meter: Public Parking Usage in Worcester** and this report, **Public Par(King): Worcester's Past, Present, and Future of Parking**.

### WHAT IS THE RELATIONSHIP BETWEEN MINIMUM PARKING, HOUSING, AND THE FUTURE OF THE CITY?

The bulk of the preceding section was focused on zoning for parking, and, specifically, the potential drawbacks of minimum parking requirements. This should be a main focus of any parking reforms going forward. The reasons for this are two-fold. If the City is dedicated to (1) sustainability (as the Green Worcester Plan would suggest) and to (2) increased housing development, **one of the main reforms the City could undertake is to eliminate or substantially reduce parking minimums**. Building parking is expensive, and serves to increase developer costs as well as the costs of renters and buyers who have to pay for parking they may or may not even use. In addition, parking increases impervious surface which can increase flood risk and exacerbate the urban heat island effect. Reducing or eliminating parking minimums does not by any means prohibit new parking from being built, but does allow for more control over time, costs, and what "sells." Some cities have implemented parking maximums. The City should only consider parking maximums if the development of parking seriously conflicts with the City's goals.

In addition, **the City might consider promoting other forms of parking mitigation, such as shared parking agreements between developments with different uses**, in order to better utilize the parking that already exists or that might exist in the future. As evidenced by Worcester Now|Next, the City wants to move towards more mixed-use and transit-oriented development; reducing, eliminating, and even sharing parking could help the City reach its goals.

### WHAT IS THE INTERACTION BETWEEN REDUCING PARKING MINIMUMS AND INCREASING THE USE OF OTHER TRANSIT AND MOBILITY ALTERNATIVES?

One of the criticisms of reducing or eliminating parking minimums is that many people, including many people from outside the city, rely on cars to get them where they need to go. In addition, businesses may feel that they are reliant on ample parking supply to attract and maintain business. **If the City were to follow through on reducing or eliminating parking minimums, it would need to make a few other changes, including increased investment in public transit; the creation of new bike**

**lanes and walk zones that make it easier for people to use alternatives to driving; and a focus on dense and mixed-use development**, so that people can live close to the things that they need. In addition, the City could encourage private businesses and other developments to work with the WRTA to find a transit solution that works with them, and which could open up more parking opportunities further afield; or, even, encourage more use of the Commuter Rail and easy access to job-dense locations. In any case, it should be remembered, as mentioned in the previous point, that reducing or eliminating parking minimums is not the same thing as a prohibition on parking construction, and if a new development believes that parking is necessary for its success, then it should be free to do that.

### WHAT CAN WE DO ABOUT GARAGES THAT HAVE, OVERALL, FEWER PEOPLE GOING INTO THEM?

Within the parking usage section of this report, the Bureau found that the usage of public parking has been, in general, trending up *since 2021*. However, there is some evidence that this usage is lower than it was pre-pandemic. If some garages, such as Pearl-Elm, are not receiving the same sort of traffic that they once had, what can or should be done?

First, this is not a call for the City to eliminate its garages – **it provides a valuable public service, and often at a lower rate than any private garage**. Indeed, the garages are not a "revenue generator" – money collected from the City's parking program is put directly back into that program. If, of course, the cost of maintaining a garage becomes a drain on the City's finances, it should consider what it can do with it to stop that loss—including redevelopment in the public's interest. But, in the meantime, the City should consider all the ways it can direct traffic to them, and, especially, out of on-street zones.

**A larger push to promote garage use should be considered**. As discussed previously, some research has shown that many drivers' first inclination is to search for on-street parking, and that the more they do so the more likely they are to continue to do so, seeing such a search as a sunk cost. Many times, this may be due to the belief that on-street parking is substantially cheaper than garage parking (in many cities, on-street parking is usually cheaper than garage parking, but rates vary). While true that within Worcester public garage parking is slightly more expensive than on-street parking, it is not substantially so. For example, parking in a garage costs \$4 for the first hour, and \$1 an hour every hour after that until 5 PM. Two hours of parking is therefore \$5 – compared to



\$3 for two hours of street parking (when each half-hour block costs \$0.75, and when using the kiosks to pay, as the app has a \$0.20 convenience fee per transaction). Drivers may not be aware of how close the prices actually are when they are considering longer term trips Downtown. More modernized or prominent pricing signage may help.

Some drivers may not even realize where public parking garages are located. **Appropriate signage and maps might help to direct drivers (especially those getting off the highway) to generally underutilized garages, like Worcester Common or Pearl Elm.** Relatedly, the City should implement maps and mapping systems near the pedestrian entrances and exits to their garages, to ensure that as drivers exit the buildings they can easily find common landmarks or destinations nearby.

One asset that the City has is a website that directs people to lots and garages, [Park Worcester](#). The City should substantially market Park Worcester to drivers of all kinds to better direct them to long-term parking when they travel to Downtown and the Canal District. There may also be some hesitancy or uncertainty for some on how to use the parking kiosks or the mobile app; much like some people do not ride the bus because they do not know how to use it, an ongoing public education campaign, in addition to the campaign that originally introduced the new parking system in 2021, that can teach people how to use these resources could be worthwhile.

If the City desires to mitigate new parking development, it should continue to promote the garages under its stewardship and try to ensure that drivers are aware that they are an option for their Downtown and Canal District needs.

### **WHAT CAN OR DO WE DO ABOUT ALL THE PARKING THAT ALREADY EXISTS?**

As evidenced by many of the maps from earlier, some areas of Worcester have a lot of parking. This research is not a call to uproot or eliminate parking. But it is a call to consider how to more creatively use space, and especially space that is underutilized (for example, a parking lot that is often under a certain percentage of occupancy). **The City should work with businesses, residents, and new developers to find new and creative uses of underutilized space** – including, as mentioned in an earlier point, shared parking agreements between new and existing developments.

Land is valuable in a city. Parking lots represent potential – potential for the use of the business or space for which they serve. But it is not a guarantee that people will use

that parking space (i.e., “build it and they will come” is not always true). With all the parking that exists in the City already, how can the City, business owners, and residents better and more creatively use that land, even if much of it remains parking, in more productive ways? And with developable land hard to find, how can we potentially rethink the way that land is utilized in the City? In other words, every square foot in a city is important; innovative reuse should be actively encouraged.

The City can encourage the creative reuse of a business’s parking space, whatever that might look like. **Other cities have encouraged the development of underutilized parking into affordable housing**, for example (Kimmelman, 2014; Peters, 2023). The City has already expressed many of these ideas within Worcester Now|Next, which significantly considers the future of parking in the City. Exploring such possibilities further might be worthwhile in a City trying to build more housing, especially in combination with a reduction or elimination of parking minimums.

On-street parking also represents a large percentage of “existing” parking. In the areas of Worcester where there is paid on-street parking, the City should continue to monitor and evaluate revenue and occupancy patterns. Similarly, the City should more actively monitor the occupancy of “free” on-street parking in non-residential areas, and *could* consider an expansion of paid-parking in certain areas. In areas with high street-parking occupancy, this would ensure regular turnover of customers, shoppers, and diners.

### **HOW CAN WE MITIGATE CURRENT ENVIRONMENTAL IMPACTS FROM NEW AND EXISTING PARKING?**

Impervious surfaces, like parking lots, can exacerbate flood risk and increase the urban heat island effect. To mitigate these deleterious effects, the City could: (1) **include new zoning reforms that require more sustainable landscaping in new parking lots**, if a developer decides to build one; (2) **work with existing developments to create more sustainable parking lots**; and (3) **continue to expand its existing efforts, like its recent Miyawaki Forests, to more public lots** and areas the City has direct control over. This is another area that the City has actively considered already; for example, the Green Worcester Plan, adopted in 2020, contemplates what’s known as “Low Impact Development.” These are standards for new infrastructure and developments to consider stormwater runoff reduction and the use of green infrastructure to mitigate environmental impacts. A larger focus from the City on how parking can help it meet its climate and sustainability goals would be worthwhile.





## CONCLUSIONS

The question of “parking” is one every city must consider, as every square foot of space in a large city must be used effectively. Parking uses valuable, and otherwise productive, land for the storage of cars. When car use became widespread, it made sense to have an abundance of parking, and it is difficult to fault urban planners for trying to accommodate them. Still, in a car-focused society there must be some place for them, and thus a natural tension exists between accommodation and efficient land use when it comes to parking. Urban planners must consider how to provide for car-commuters, shoppers, and residents while also ensuring that the City does not become one giant lot. The solution is not a steady stream of new parking, but smarter land use for the future.

Worcester has grappled with the question of parking since the 1920s. In addressing it, the City tried several things, including creating minimum parking requirements for most new developments in the City, and building garages and lots throughout Downtown and the Canal District, including one garage that was at one point the largest in the world. It has modernized its on-street parking program through pay-by-plate, the adoption of mobile app parking, and through the creation of the Department of Transportation and Mobility (and a Parking Director). The City has indicated there is more work to be done; it

indicated in the Mobility Action Plan a desire to undertake a parking study of key City districts.

If Worcester continues to want to grow, however, it should consider other steps to promote that growth. Eliminating minimum parking requirements entirely could be the way to promote new development, and especially new housing, as building parking is extraordinarily expensive. That same action would serve, also, to promote sustainability and Worcester's Green Plan goals, as parking lots increase flood risk and heat islands. It could go further and encourage new and existing developments to think creatively about their existing lots. Encouraging the growth of public transit, and alternative mobility like walking or cycling, would allow for developments with fewer parking spaces to come into being.

When cars were new and car ownership was growing, it was important to figure out how to adapt. With rising housing costs and a renewed focus on sustainability and environmental consciousness, parking should be adapted yet again.

*Public Par(King): Worcester's Past, Present, and Future of Parking is supported by a grant from the Barr Foundation.*

*The opinions expressed in this report do not necessarily reflect the views of the Barr Foundation.*



## NOTES TO THE TEXT

<sup>1</sup> (page 5) The Citizens' Plan E Association was a group formed in the 1940s to advocate for Worcester to adopt a Plan E form of government. They were active especially in the 1950s, amid several challenges to it.

<sup>2</sup> (page 5) There is evidence that on-street parking does cause traffic. "Cruising" for parking – driving around the block looking for the optimal space – slows down the flow of traffic as one looks. Entering and exiting spots (like, for example, parallel parking) can cause congestion as well. "Cruising" can be caused by many factors, including a lack of knowledge of local parking alternatives to on-street parking, and a perception that off-street parking is more expensive than on-street. There is evidence, too, that looking for parking can be perceived as a "sunk cost" – if one has looked for on-street parking long enough, one will keep looking rather than go for available off-street spaces. See Lee, Agdas, and Baker 2017.

<sup>3</sup> (page 5) The boundaries of the area under study were not defined exactly in this report, at least for the data from 1952. For 1972, the Doxiadis team was able to use "Census Tract 17"; They seem to be referring to Census Tract 7317, which was the Central Business District in the 1970 Census of Population and Housing report (published by the Census Bureau in 1972). Census Tract 7317 remains the CBD in Worcester in the most recent Census, so the boundaries are likely largely the same.

<sup>4</sup> (page 5) At the time, One Chestnut Place was being constructed and there was some question about how many spaces would be leased to the developers and the building tenants. There were some upset by this because the garage was sometimes too full even for monthly parking pass users. In 1991, an addition was finished in the garage adding 200 spaces. As a result of those new spaces, in addition to some other market factors, there were now, at least temporarily, *too many* parking spaces.

<sup>5</sup> (page 6) The previous reports were quoted in "City of Worcester Parking System Assessment" from February 2013, conducted by John M. Burke, Parking, Transit & Downtown Development Consulting.

<sup>6</sup> (page 9) Los Angeles in the 1990s passed an Adaptive Reuse policy for the downtown to encourage the conversion of vacant commercial buildings into housing. Among the policies implemented was an exemption allowing developers not to build new parking on site, so long as existing parking wasn't removed from the parcel. Authors Mannville and Shoup found that, in the decade following the ordinance, developers built less parking than

would have normally been required for their building use. While the developers they interviewed did not indicate that the parking exemption was a sufficient condition for their redevelopment, the absence of it would have prevented it. See Mannville and Shoup 2010, 18-20. Indeed, Mannville and Shoup argue: "For developers, the ARO's exemption was valuable not because it allowed them to forego parking altogether, but because it permitted them to be creative how they supplied parking. The parking exemption also allowed developers to more finely segment the housing market—to target individuals who owned no cars and didn't plan to acquire them; who owned no cars but were considering purchasing them; who owned cars but were willing to store them away from their building, and so forth." (20)

<sup>7</sup> (page 9) This is worse in some places than in others. Still, minimum lot sizes, in addition to required parking lots, can serve to lower density and make it harder for pedestrians to walk or take transit. Parking minimums "create a 'strip mall' effect" which "deter walking and encourage driving" through the creation of landscapes that are visually unappealing and "lengthen the commutes of pedestrians and bicyclists by increasing the distance between streets and destinations." See Michael Lewyn, "How Government Regulation Forces Americans into Their Cars: A Case Study," 2007, 842, 844-845.

<sup>8</sup> (page 10) Footprint measures wheelbase (the distance between the center of the front and rear tires) by track width (the distance between the centers of the passenger and driver side tires). Vehicles are often larger than their footprints if you take into account engines, pickup truck beds, and the vehicle's overall frame.

<sup>9</sup> (page 14) This isn't the end of the story, and what developers may or may not do could be the source of endless debate. It may be well worth considering parking "feedback loops." All policy changes have ripple effects. Will developers see less parking being built, and therefore decide to build less parking themselves as a neighborhood becomes denser? Or will they see less parking as an opportunity to build *more* and to fill a niche? See Lewis Lehe, "Feedback and the Use of Land for Parking," 2017 463-476

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