PARKING PARADIGM SHIFT: AN EVALUATION OF LAND USE EFFICIENCY AND PARKING POLICY IN EUGENE, OREGON

by

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A THESIS

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This thesis explores the lasting impacts of minimum parking requirements by measuring the disconnect between minimum parking policy and actual parking utilization rates at a typical American big-box retail store on a commercial strip in a mid-sized city. For decades, parking minimums across the United States have ensured that all drivers could park for free at all destinations, despite any credible research on how to set optimum parking levels. Based on ground-breaking research by Donald Shoup, many city planners and local and state policy makers are beginning to see how poor parking policy has led to detrimental impacts to the environment, household affordability, social equity, buildable land, taxpayer resource efficiency, and economic prosperity. For example, Oregon has recently eliminated parking minimums across most cities and towns to address the historically ubiquitous, but misguided approach to minimum parking provision.

This project centers around a post-occupancy parking study of a Target parking lot on West 11th Avenue in Eugene, Oregon. This parcel of land is within Eugene's urban growth boundary (UGB) and is adjacent to high-frequency bus rapid transit, off-street bicycle infrastructure, and numerous amenities making it prime real estate. After conducting over 26,000 observations of parking utilization at this single big-box retail site, the data revealed that the

parking lot is less than 20% full on a typical day. Even on Black Friday, traditionally the busiest day for in-person shopping despite a recent decline caused by the rise of e-commerce, Target's parking lot was only 35% occupied. *In practice, this means that there are over two acres of buildable land at this single site, currently allocated to parking that is not needed and not used.*

This study is one of the few that has ever conducted a post-occupancy parking analysis to assess how accurately past parking policies reflect actual use. These results suggest that by simply right-sizing existing car parking to match actual utilization, it is likely that hundreds of additional acres of buildable land could be identified within every existing metropolitan footprint. This land holds tremendous potential to be redeveloped for better use. For communities with policies focused on achieving household affordability, social equity, and climate change goals, the potential of reusing wasteful parking is even greater. Therefore, this study, set against the backdrop of recent parking reforms, underscores the urgent need to critically reassess urban land use and apply these insights to develop truly vibrant and livable cities.

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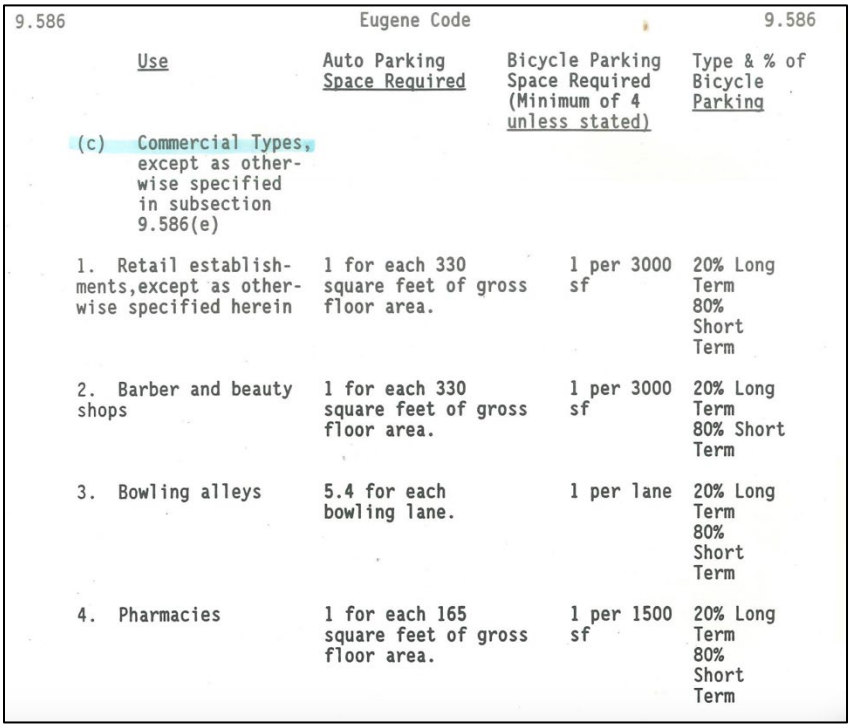
Introduction

At the beginning of the twentieth century, cars were relatively scarce and only owned by the rich. These few motorists easily found parking along the curb in places where they previously tethered their horses and carriages (Shoup, 2011). However, the invention of the Ford Model T drastically reduced the cost of personal vehicles and spurred an accelerated rise in car ownership throughout the 1910s and 1920s (Shoup, 2011). With this rise in vehicle ownership, not all drivers could find parking on the curb, forcing cars to circle helplessly (Shoup, 2011). To solve this parking problem, cities began requiring off-street parking in their zoning codes during the 1930s (Shoup, 2011).

This required off-street parking is enacted through minimum parking requirements (MPRs), which city planners establish to dictate the required number of on-site parking spaces each new development must provide. These requirements are integrated into local zoning codes and used to force developers to provide on-site parking, alleviating parking scarcity problems along the curb (Manville, 2014). However, by coupling parking with new development, parking is characterized solely as an extension of a building, making future development conditional on the parking it provides (Manville & Shoup, 2005). New developments and their parking become intimately intertwined: one cannot exist without the other. As a result, planning professionals rarely separate parking lots from the buildings they serve and, therefore, fail to analyze the costs and benefits of parking lots on their own (Manville & Shoup, 2005). This link between off-street parking and new development forced cities to continuously build parking infrastructure, regardless of its necessity or demand.

Figure 1 highlights minimum parking requirements for four different types of commercial development in Eugene. At first glance, these specific ratios of parking spaces per square footage appear well-thought out. However, no one really knows where minimum parking requirements come from and they appear seemingly random, without a basis in research (Shoup, 2018). For instance, what research led to the conclusion that 5.4 parking spaces is needed for each lane in a bowling alley? Or that one space is needed for every 330 square feet of a beauty shop while a pharmacy needs one space per 165 square feet? The answer is that little to no credible research was conducted while establishing parking minimums across the US (Shoup, 2011). Yet, for years, planners have been asked to set parking requirements for every type of land use despite the lack of research or inclusion of the topic in their training and education.



9.586 Eugene Code 9.586

Use	Auto Parking Space Required	Bicycle Parking Space Required (Minimum of 4 unless stated)	Type & % of Bicycle Parking
(c) Commercial Types, except as otherwise specified in subsection 9.586(e)			
1. Retail establishments, except as otherwise specified herein	1 for each 330 square feet of gross floor area.	1 per 3000 sf	20% Long Term 80% Short Term
2. Barber and beauty shops	1 for each 330 square feet of gross floor area.	1 per 3000 sf	20% Long Term 80% Short Term
3. Bowling alleys	5.4 for each bowling lane.	1 per lane	20% Long Term 80% Short Term
4. Pharmacies	1 for each 165 square feet of gross floor area.	1 per 1500 sf	20% Long Term 80% Short Term

Figure 1: The minimum parking requirements for four different commercial uses, outlined in the Eugene Code (EC 9.586).

Fortunately, in recent decades, planning scholars have scrutinized the development, implementation, and consequences of parking minimums for the first time. It is now widely accepted that years of enforced minimum parking requirements eroded urban landscapes, reduced access to and use of active and public transportation, diminished pedestrian safety, adversely impacted the environment, and decreased the economic viability of many downtown areas across the United States. Many of these consequences stem from large swaths of off-street parking that go unused. Manville and Shoup (2005) explain this oversupply in more detail:

> The surplus arises because parking is an automatic aspect of the planning process. The construction of a new highway is often marked by protest, litigation, fanfare, rent-seeking, public input, and litigation. Parking, more often than not, is just quietly built, and a fair case can be made that in many instances it does more harm than good (244).

Luckily, planners across the US are waking up to the myriad of consequences caused by historic parking policy, thanks to relatively new research. For instance, the State of Oregon is currently undergoing historic, large-scale parking reform that targets minimum parking requirements. Moreover, many cities across the US are removing or reducing their parking minimums in an effort to revitalize their communities, reduce housing costs, and advance climate goals.

This thesis aims to investigate the potential disconnect between the predicted parking demand that dictates parking minimums, and actual parking utilization. Through a meticulously conducted post-occupancy parking study of the Target parking lot on West 11th Avenue in Eugene, Oregon, I will explore this disconnect and the impact of minimum parking requirements locally. This site-specific study is significant as it illuminates areas of overallocated parking and underutilized land, providing crucial insights for future urban planning. On the cusp of historic parking reform, I will explore the lasting effects of parking minimums and offer recommendations to expand the benefit of new parking policies.

Literature Review

Establishing Minimum Parking Requirements

Until recently, planning education failed to provide instructions on how parking requirements should be set (Shoup, 2011). In fact, most textbooks and published articles ignored parking completely (Shoup, 2011). Therefore, planners have historically had very little training and lacked adequate knowledge or site-specific analyses when setting parking requirements. Instead, planners establish parking requirements in one of two ways: (1) by referring to national surveys of observed peak occupancies in suburban areas with ample free parking and without access to public transportation or (2) by copying other cities' requirements (Shoup, 2011). In either case, planners are often deeply uncertain about how much parking should be required, causing them to base their requirements on statistically insignificant estimates published by the Institute of Transportation Engineers (ITE), whose studies are poorly conceived and limited (Shoup, 2011).

In the face of this uncertainty, planners tend to revise these estimates of maximum parking demand *upward* to ensure they do not create a parking shortage (Shoup, 2011). Therefore, minimum parking requirements are set almost arbitrarily and aim to solve parking shortages with more infrastructure rather than through economic means to regulate demand. Problematically, minimum parking requirements are based on the assumption that most people will travel by car, so cities set parking requirements equal to the expected peak demand for *free* parking. Consequently, enough parking is required to ensure that there is no spillover, and the traffic flow along adjacent remains free (Shoup, 2011). At first glance, limited spillover and traffic appear to be beneficial. However, excess free parking produces a myriad of other unaddressed issues that far outweigh these benefits. Since parking demand is defined as "the

peak parking occupancy observed at a site, without taking into account the price that drivers pay for parking," cities require enough parking to satisfy this demand, regardless of the construction costs, while ensuring drivers never pay for parking (Shoup, 2011). As a result, off-street parking requirements create excess parking and offload the cost of parking onto developers and the public by allowing every driver to park for free at the expense of everyone else (Shoup, 2011). These costs do not disappear; instead, they are hidden in the price of other goods and services, skewed travel choices, and level of energy consumption.

Impacts of Parking Requirements

Despite being used for almost 100 years, little to no empirical evidence supports the benefits of minimum parking requirements (Sprei et al., 2020). Most evidence points to the fact that MPRs generate widespread damage to urban form, the economy, and the environment (Shoup, 2011). At the most basic level, these damages stem from the overabundance of parking mandated by these requirements; parking minimums lead to parking satiation, meaning that all potential drivers can park for free even during peak demand (Shoup 2011). Moreover, parking minimums act as automobile subsidies tacked onto new development, reinforcing car dependency and offsetting many benefits of increased density (Manville & Shoup, 2005). These immediate damages translate into widespread impacts on travel behavior, urban development, the economy, and the environment.

Impact on Travel Behavior

The literature on how land use and urban form impact travel is extensive. However, discussions about parking are rarely included. Despite this lack of research, parking requirements, and the availability of parking at the origin and destination of a trip, greatly impact an individual's travel behavior (Manville & Pinski, 2020). The benefit of a personal vehicle

depends on access to storage space, where one can leave their car between trips. As a result, parking accounts for a large share of land area, and has become the largest land use devoted to a single mode of transportation (Manville & Pinski, 2020). Generally, the oversupply of parking generated by minimum parking requirements has pushed Americans into personal vehicles and away from public transportation (Shoup, 2011).

This generous supply of parking makes driving easier because parking is cheap and easy to pay for, reducing the overall cost of driving (Manville & Pinski, 2020). At the same time, parking makes it harder to travel using other modes. Manville (2014) notes that increases in parking requirements force buildings farther apart, reinforcing the necessity of driving and reducing access to other modes of transportation. With an increased number and size of parking lots, walking becomes less enjoyable and unsafe as pedestrians are forced to dodge moving vehicles and walk the elongated distances between sidewalks and storefronts. Personal vehicles, therefore, become necessary for traveling the distances between stores. Establishing free parking at every destination and encouraging the development of car-oriented infrastructure lures people from public transportation and bikes into vehicles (Shoup, 2019). As a result, parking minimums increase car dependency by allocating large portions of land to stationary, unoccupied automobiles instead of housing, community spaces, or commercial uses.

Furthermore, most American housing units come with at least one parking space. When the cost of parking is bundled into the cost of housing, meaning that residents are guaranteed a parking spot, households drive more and use public transit less than if this parking was not guaranteed (Manville & Piniski, 2020). Manville and Piniski (2020) found that households with bundled parking use public transportation less, spend more on gasoline, and are more likely to drive from their homes to transit stops when they do take transit. This is partially contributed to

the fact that bundled parking reduces the time and stress of finding parking near one's home. Moreover, the availability of residential parking increases rates of car ownership (Guo, 2013).

Thus, policies that increase the cost or reduce the supply of residential parking promote alternative modes of transportation and decrease car ownership. However, context matters. In low-density, suburban areas, where driving is essentially the only viable transit mode, the prevalence of bundle parking likely has less influence on travel behavior than in urban places where land is expensive and other modes are suitable (Manville & Piniski, 2020). Regardless, it is clear that widespread, cheap parking created by MPRs sway travel behavior and promote the use of personal vehicles.

Impact on Urban Form

Accelerated rates of vehicle ownership directly impacts land use and urban form. While parking requirements are not solely responsible for accelerated sprawl and reduced demand for public transit, by providing generous, *free* parking at all destinations, MPRs sever the link between the cost of providing parking and the price paid by drivers, exacerbating these issues (Shoup, 2011). Cities respond to this increase in car travel and declining density by requiring even more off-street parking. Furthermore, when the public objects to the increased congestion caused by rises in vehicle ownership and use, cities further restrict density and increase their parking requirements (Shoup, 2011). Figure 2 shows how MPRs perpetuate a dangerous cycle; generous parking supplies restrict human density and accelerate sprawl, incentivizing or necessitating car travel while simultaneously reducing the viability of public transit (Manville, 2014). Thus, it is no surprise that Americans now make 87% of all their trips by personal motor vehicle (Shoup, 2011).

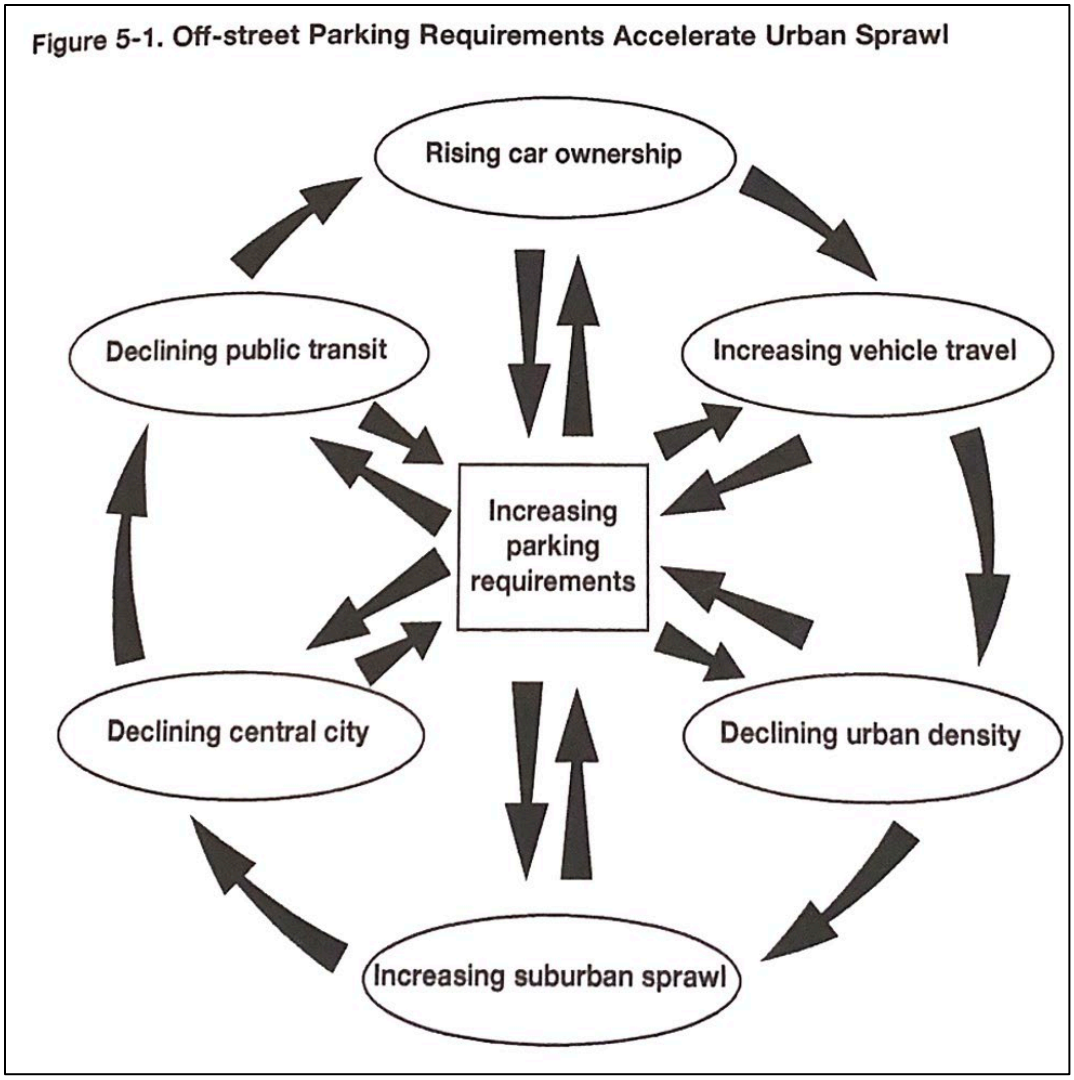


Figure 2: How off-street parking requirements accelerate sprawl (Shoup, 2011).

One way to visualize the impact of abundant free parking is to examine the total space devoted to idle cars. If there are three parking spaces per vehicle in the U.S., and all cars are packed closely together without room to maneuver, the area needed to park each car is 600 square feet per vehicle (Shoup, 2011). In 2002, the U.S. had a total of 230 million motor vehicles, meaning the total area devoted to parking was 4,950 square miles – about the size of Connecticut (Shoup, 2017).

Aesthetically, large parking lots disrupt an area's sense of place and visual interest. Instead of a bustling retail area, where stores are close together and entrances face the sidewalk,

parking minimums create monotonous expanses of asphalt that isolate individual stores. Since parking (and its associated cost) can act as a barrier to development, developers are incentivized to reduce costs as much as possible while providing the necessary number of parking spots. As a result, surface parking tends to be paved using cheap, impervious substances, such as asphalt, and lacks vegetation or other beautifying additions – contributing to the absence of visual interest (Cotrone, 2022). Furthermore, the increased distance between buildings to accommodate large parking lots makes aesthetically pleasing and continuous street facades impossible (Ibrahim, 2017). Over time, public areas, including squares, fields, and places of social gathering, succumb to the pressure of parking shortages and are converted into parking lots (Ibrahim, 2017). These new surface lots are generally considered the least attractive and most environmentally destructive land use (Ibrahim, 2017). Parking requirements, therefore, ensure that a place will be dull by producing hostile and sterile streetscapes (Shoup, 2011).

Impact on the Urban Economy

Central Business Districts (CBDs) and downtown areas have felt the worst effects of zoning-enforced minimums. Plentiful, free parking conflicts with the very aspect that makes downtown areas vibrant and successful: high density (Manville & Shoup, 2005). Land tends to be most expensive within the CBD, meaning that the cost of providing off-street parking is the highest in these areas (Maville & Shoup, 2005). Therefore, constructing parking lots in the CBD consumes capital that could be invested more productively in other, revenue-generating areas (Maville & Shoup, 2005). The blanket approach to parking facilitated by MPRs (a specified number of parking spots for each land use type regardless of location) incentivizes firms to locate in places where land and thus the burden of providing parking is the lowest, driving businesses out of the CBD (Manville & Shoup, 2005).

Firms in the Central Business Area that must provide large parking lots strip the downtown of its charm, walkability, and economic vitality. Moreover, when customers can park right in front of their destination, they are less likely to spontaneously enter other stores and restaurants because they do not walk by them (Shoup, 2011). Thus, every downtown parking lot has an extremely high and conspicuous opportunity cost; minimum parking requirements facilitate the degradation of downtown areas and adversely impact urban form and vitality. Parking requirements also place heavy restrictions on land use, creating a barrier to urban development and revitalization. An assumption embedded in minimum parking requirements is that the land-use decision occurs first and that a new building is built after. This is particularly problematic for older buildings that predate these requirements. In this case, the assumption is reversed. Older buildings are constrained by their existing space, and they often cannot provide more than their current amount of on-site parking (Shoup, 2011). When this happens, parking requirements limit the number of allowable uses because the building's use must comply with the available parking. In other words, if a store goes out of business or relocates, any new use within the building must have the same or fewer required parking spaces unless the developer can find more land to expand the parking lot. These nonsensical requirements, therefore, drive businesses out of established areas where it is hard to construct new buildings (Shoup, 2011). Shoup further explains this process:

> Parking requirements can freeze older buildings in their existing uses or even prevent any feasible use at all and therefore reduce the economic opportunities these buildings can offer to their neighborhoods. If a building does not satisfy the parking requirement for a new use, zoning will not allow it even if all other planning requirements are met. Parking requirements have become a moral imperative, and in planning disputes they are invoked in nonnegotiable terms, like sacred cows (154).

In older commercial areas built before cities required parking, this problem can severely impact the local economy and cause existing buildings to remain vacant because they lack the necessary

parking. These requirements therefore impede adaptive reuse and often encourage the demolition of older buildings (Shoup, 2011). By strictly enforcing parking minimums, cities kill their ability to revitalize older areas and drive development away to newer locations. Thus, parking minimums are a barrier to urban economic development in several key ways.

Impact on Equity

Furthermore, MPRs disproportionately harm low-income populations. Free parking at a store can attract motorists who buy large quantities at once (Shoup, 2011). However, providing free parking comes at a cost to the store. Since stores often make up for these costs by bundling the cost of parking into the price of their goods and services, they effectively "price discriminate" between customers with and without cars, favoring those who drive (Shoup, 2011). Because drivers are often wealthier than nondrivers, free parking discriminates against low-income shoppers, who are harmed by increased prices (Shoup, 2011).

Parking requirements can also be evoked to strategically block proposed projects. Anyone who objects to a new development can cite the failure to provide all required parking as their reason for objecting, masking their real motive with parking (Shoup, 2011). This type of objection is often used to keep "undesirable communities and activities" out of an area, often manifesting in blocked affordable housing projects (Shoup, 2011). Therefore, parking minimums facilitate the exclusion of certain groups.

Compounding the issue of affordable housing and exclusion, parking minimums also raise housing costs across the board. Gabbe and Pierce (2017) demonstrate this claim that zoning-enforced minimums increase the price of housing. Because the cost of parking provision is quite high, these costs are bundled into rents and passed on to renters. Housing with garage parking is found to have an average of $142 per month higher rents, or a 17% premium, for

urban dwellers (compared to housing without bundled parking) (Gabbe & Pierce, 2017). Renters who do not own cars, including many lower-income individuals, therefore are forced to pay for parking regardless of if they utilize it. In total, this creates a deadweight loss estimated to be about $440 million per year (Gabbe & Pierce, 2017). Additionally, MPRs restrict choices that can be made by buyers and renters by hindering their ability to decide how much parking their household should consume (Gabbe et al., 2020). While a carless household may wish to rent an apartment without parking, they are often restricted to renting a unit with one or more parking spaces because no other options were permitted by local code (Gabbe et al., 2020). These restricted choices force individuals without personal vehicles to pay for parking they will not utilize.

As a result, non-drivers still pay for parking through elevated prices without reaping any of the benefits of free parking. Furthermore, the reduction of public transportation access and quality associated with parking minimums restricts the mobility of those who do not own a car (Shoup, 2011). Through the direct increase in the public supply of parking, which favors drivers over public transit users, cyclists, and pedestrians (who tend to be lower income), MPRs exacerbate social inequities and stunt local economic development.

Impact on the Environment

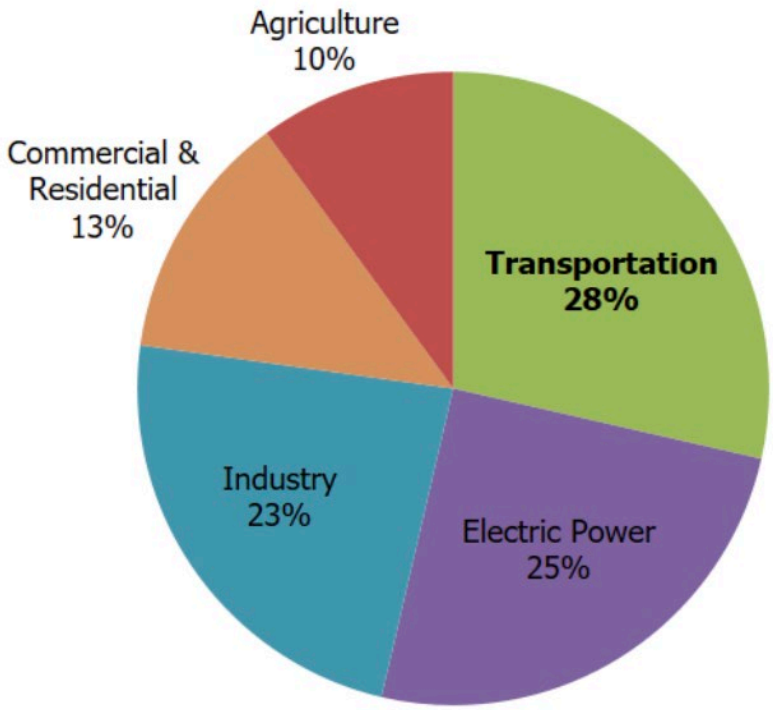


Figure 3: Total US Greenhouse Gas Emissions by Economic Sector in 2021 (US EPA, 2023)

Minimum parking requirements create an array of conditions that perpetuate environmental degradation and contribute to climate change. MPRs systematically block the expansion of public transit and active transportation modes, including walking and biking, and ensure that parking is free for 99% of vehicle trips in the US (Shoup, 2011). In doing so, they establish the car as the most convenient and reliable mode of transportation and prioritize travel by single-occupancy vehicles. Figure 3 highlights that 28% of total greenhouse gas emissions in the US originated from the transportation sector in 2021 (US EPA, 2023). Passenger cars are among the largest sources of greenhouse gas emissions within this sector and account for 87% of all trips in the US, making them a large contributor to global climate change (US EPA, 2023;

Shoup, 2011). Moreover, it is well established that internal combustion engines waste significant amount of energy as heat (Hoehne et al., 2020). Therefore, by reducing density, promoting car-centric infrastructure, and presenting parking as a free right, parking minimums encourage driving, bolster greenhouse gas emissions, and contribute to global climate change.

In addition to increased vehicle travel and dependence, minimum parking requirements promote the construction of large, barren parking lots using resource-intensive, nonporous materials. These materials reinforce the urban heat island effect and compound stormwater runoff (ITDP, 2022). Materials such as asphalt absorb more heat than other substrates and re-radiate it, even after the sun has set (Cotrone, 2022). Research in the late 1990s demonstrates that neighborhoods a quarter of a mile downwind from unshaded parking lots experience elevated temperatures, promoting increased energy consumption through air conditioning and fans (Cotrone, 2022). Additionally, parking lots are sources of polluted stormwater runoff, which carries heavy metals, gasoline, hydrocarbons, and oils into the local waterways (Cotrone, 2022). This polluted stormwater runoff erodes streambanks, adversely impacts aquatic life, and reduces downstream water quality (Cotrone, 2022).

Thus, parking lots contribute to local environmental degradation and exacerbate the problem of climate change by trapping heat and promoting car travel. As climate change escalates, reducing trips completed by single-occupancy vehicles becomes increasingly necessary. However, this reduction is not feasible without large-scale land use changes that disincentivize driving while simultaneously improving access to public transportation and other transit modes – a step that is made impossible by the enforcement of minimum parking requirements.

The Cost of Free Parking

While free parking can increase total sales, this does not always guarantee a higher profit since developers are responsible for the costs associated with building and maintaining their parking lots. Mark Delucchi of the University of California, Davis, estimated the annual capital and operating cost of off-street parking to be between $79 billion and $226 billion a year in the United States (Shoup, 2011). Most of the costs of parking are incorporated into the price of other goods and services, meaning the price is borne by consumers regardless of whether they are drivers or not. Delucchi estimates that motorists only pay $3 billion for parking, or 1 to 3 percent of the total cost of parking; the other 96 to 99 percent is hidden in higher consumer prices (Shoup, 2011).

Thus, it is apparent that a large subsidy for free parking exists. Delucchi estimated the total subsidy for off-street parking between 1990 and 1991. This model was then used by Donald Shoup to estimate the total subsidy for off-street parking in the US in 2002, accounting for inflation. This estimate placed the total parking subsidy between $127 billion and $374 billion (Shoup, 2011). In 2002, the US gross domestic product (GDP) was $10.5 trillion, meaning this subsidy accounted for 1.2 to 3.6 percent of the United States economy (Shoup, 2011). In comparison, the United States government spent $231 billion on Medicare and $349 billion on national defense in 2002, similar to the amount spent on parking ($127 billion to $374 billion) (Shoup, 2011). This revelation is startling; the US seemingly values off-street parking as much as it values healthcare and national security. Is it possible for the subsidy for off-street parking to be this large? Since the 1950s, most American cities have required the provision of ample free on-site parking by each new development. Additionally, most households in the US now have more

cars than drivers, and these cars are parked 95% of the time (Shoup, 2011). Despite spending 95% of their lives parked, drivers rarely pay for their vehicle's parking.

American cars and trucks drove a total of 2.6 trillion vehicle miles in 2002. Thus, the subsidy for off-street parking ranged from 5¢ per mile to 14¢ per mile (Shoup 207). Shoup uses this estimate to assert that removing off-street parking subsidies would have the same effect on travel as increasing the gasoline tax from $1.27 to $3.74 a gallon. In other words, the concealed parking subsidy is both huge, and largely hidden from motorists.

In addition to the annual cost of parking, Shoup also discusses the capital cost of the American parking supply. The cost of all parking spaces in the United States surpasses the value of all vehicles and may even surpass the cost of all roads (Shoup, 2011). Using conservative assumptions, the value of the amount of parking available per car (at home and elsewhere) is priced at $12,000, or two times the average value of a car ($5,507) (Shoup, 2011). Furthermore, the total capital value of all vehicles and roads was $2.5 trillion in 1997 (Shoup, 2011). This translates to about $12,049 per car, which is comparable to the value of parking per vehicle ($12,000). When also accounting for curb parking, in addition to off-street parking, it is possible to assert that more infrastructure may be allocated to stationary vehicles than to moving ones (Shoup, 2011). In 1997, motorists only paid $6.6 billion for public and private parking facilities. Comparatively, drivers paid $90 billion on vehicle taxes, fuel taxes, and tolls. Thus, while parking spaces might be worth more than all roads combined, motorists "paid only 7 percent as much for parking as they did for road-use taxes and tolls" (Shoup, 2011). Thus, Shoup (2011) concludes that:

> [P]arking takes up far more land than the interstate system does, costs far more, and is far more essential to automobile use, but motorists rarely pay anything for parking. Off-street parking requirements, far more than interstate highways, have spurred the dominance of the automobile in urban transportation (210).

Recent Changes in Parking Requirements

Recently, many cities in the US have adopted flexible parking requirements or eliminated parking minimums in response to the growing body of research on their adverse impacts (Herrigies, 2021). In 2018, Hartford, Connecticut, became the first US city to eliminate parking minimums (Herrigies, 2021). Since then, many other cities, including San Francisco and Minneapolis, have followed suit (Herrigies, 2021). Here in Oregon, former governor Kate Brown signed Executive Order No. 20-04 in March 2020, directing state agencies to reduce and regulate greenhouse gas emissions and mitigate the effects of climate change, including roughly 35% of the state's emissions that originate from the transportation sector (Rausch et al., n.d.). Unfortunately, Oregon is off-track to meet these targets and is not expected to reduce how often and how far residents drive to complete daily tasks (Manvel & Meyer, n.d.). These unfavorable findings spurred the Land Conservation and Development Commission to update Oregon's Transportation Planning Rules, engage in two years of extensive community engagement, and ultimately adopt the rules necessary to implement the Climate-Friendly and Equitable Communities (CFEC) program on July 21, 2022 (Manvel & Meyer, n.d.).

The CFEC project targets parking policy as a major tool in meeting climate goals and creating more sustainable cities. It requires parking reforms in the 48 cities in Oregon's metropolitan regions, including Eugene and Springfield (Manvel & Meyer, n.d.). This new project requires the elimination or reduction of minimum parking requirements for certain types of development and for all development within a half-mile walking distance of frequent transit corridors (Rausch et al., n.d.). Figure 4 shows the areas in Eugene within a half-mile of transit corridors, which are subject to parking requirement reform.

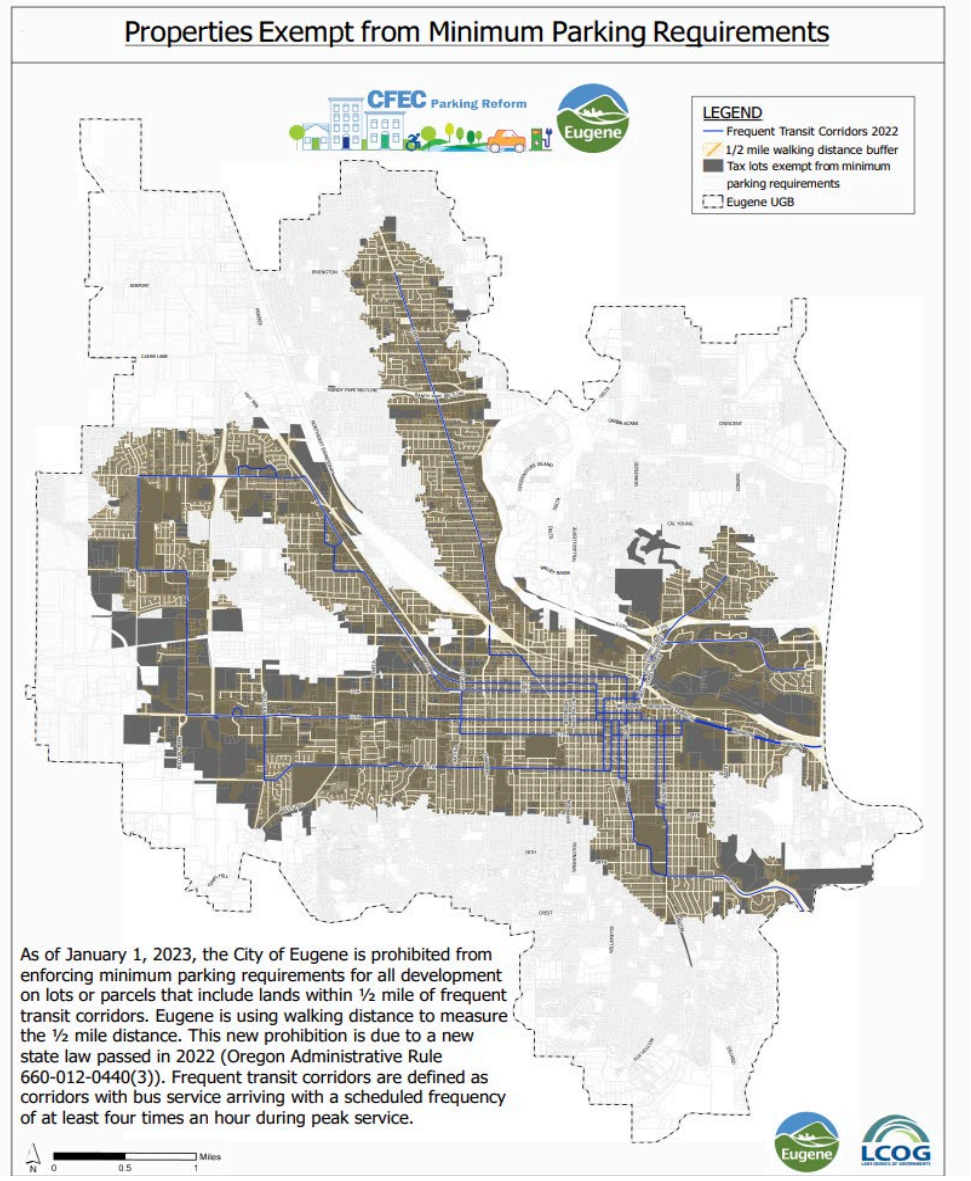


Figure 4: Map of Eugene indicating the areas where new CEFC rules prohibit minimum parking requirements. The dark yellow indicates areas within ½ mile of frequent transit corridors and, thus, where parking minimums are eliminated (Manvel & Meyer, n.d.).

These policy changes were implemented on January 1, 2023. However, cities affected by CFEC must also adopt additional land-use code changes by implementing one of three policy packages (summarized by Table 1, taken from a City of Eugene document): (1) remove off-street parking requirements city-wide, (2A) select more parking reforms and management programs, or (2B) remove minimums for certain uses and locations (City of Eugene, n.d.).

	Option 1 Remove Off-Street Parking Minimums Citywide	Option 2A	Option 2B
		Introduce Specific Parking Reforms & Regulations	
		Select More Parking Reforms & Management Programs	Remove Minimums for Certain Uses & Locations
Pros/Cons	Most straightforward	Increased complexity and cost to implement	
	Same rules for the entire city	Regulations depend on use and location	
	Increased flexibility for development	Requires new regulations and compliance monitoring	
	New development only	Existing development potentially impacted	

Table 1: CFEC Policy Package Options (City of Eugene, n.d.)

Eugene has already eliminated parking minimums in the downtown and university districts, reduced parking requirements in many overlay zones, and defined parking maximums for residential developments (Herrigies, 2021). However, the new CFEC program required that Eugene planners make additional parking decisions and reforms. On November 13, 2023, the Eugene City Council chose option one to eliminate off-street parking requirements citywide (Rausch et al., n.d.). This decision was effective December 31, 2023. In addition to being the most straightforward to implement, the decision aligns with the recommendation from the Eugene Planning Commission and stakeholder preferences (Rausch et al., n.d.). Moreover, the adopted changes to the Eugene land use code also include other parking regulation improvements, including allowing the development of any portion of a parking lot for bike or transit uses, encouraging the redevelopment of underused parking, facilitating shared parking, and establishing parking maximums (Rausch et al., n.d.).

Gaps in Parking Research

While a plethora of research exploring the broad impacts of minimum parking requirements emerged in recent decades, few site-specific parking studies have occurred. Moreover, few, if any, academic papers that investigate the local, development-specific impacts of parking minimums exist. However, a recent report by Barrett et al. (2021) does examine the effects of minimum parking requirements in Minneapolis, providing new insight into the

linkages between local parking policy and urban form, equity, pollution, and development costs at the city level. The authors reviewed development applications over six months and calculated the number of approved parking spaces, ultimately translating these numbers into tangible impacts (Barrett et al., 2021). The findings indicate that parking minimums have contributed to a reliance on automobiles and a plethora of adverse side effects, consistent with other studies (Barrett et al., 2021). The conclusion calls for eliminating or reducing minimum parking requirements in cities across the US, therefore advocating for local impact studies to assess the areas in which parking policy misrepresents demand (Barrett et al., 2021).

How can cities effectively implement new parking policies and alleviate the adverse effects of parking minimums without conducting site-specific parking studies to better understand and quantify the amount of parking actually demanded by drivers? Put another way, without information on parking demand and utilization patterns for different types of developments, how can planners avoid repeating past mistakes and set non-arbitrary parking requirements? Planners need to conduct parking studies to better understand how new parking requirements should be set, if they should exist at all. This thesis fills this large gap in knowledge by answering the questions: How well does predicted parking utilization, which is enforced through mandated parking minimums, reflect actual utilization? And how much land is trapped in underutilized parking infrastructure at the Target in Eugene, Oregon?

Methodology

City planners implement minimum parking requirements to ensure enough parking for all users at times of peak demand. However, a growing body of research affirms that this strategy creates excessive underutilized paved spaces that degrade our cities (e.g., Gabbe et al., 2018). In this thesis, I examine this hypothesis by investigating parking utilization in the Target parking lot at 4575 West 11th Avenue, Eugene, Oregon.

Parking requirements underscore all types of development, providing ample investigative possibilities ranging from apartment buildings to hospitals. Therefore, my first step involved identifying a specific study site. To narrow my focus, I chose to explore on the effects of parking minimums in a uniquely American commercial context: suburban sprawl associated with the large parking lots of big-box retailers. With this in mind, I explored developments within the C-2 Community Commercial zone in Eugene, Oregon. The C-2 Community Commercial Zone is intended to include a range of purchaser goods and entertainment, office, and service needs (City of Eugene, 2023). This zone is of interest because it includes many big-box retailers, which are often accompanied by expansive parking lots and located on car-centric streets.

After identifying the C-2 zone as my zone of interest, I chose to focus on West 11th Avenue. The commercial developments along West 11th Avenue are dotted with large, often vacant, parking lots – a ubiquitous feature of American superstores and, thus, a good starting point for investigating the accuracy of mandated parking requirements and their effect on urban form. As a wide four-lane road with fast-moving cars and infrequent crosswalks, West 11th Avenue is unmistakably car-oriented. Furthermore, the commercial buildings are set back from the street to make space for vast parking lots, effectively segregating the sidewalk from storefronts and favoring vehicle access over pedestrian convenience and safety. These

characteristics (wide streets, fast-moving cars, building setbacks, large parking lots, etc.) are all too familiar in the U.S., presenting West 11th Avenue as a particularly interesting case study that can help cities better understand the connection between parking and urban form. While there are many other locations and types of development I could have chosen, including strip malls, local convenience stores, downtown areas, and more, West 11th Avenue, as a symbol of classic American suburban sprawl, represents a unique opportunity to document the local-level disconnect between parking policy predictions and actual use in a way that can aid future policy decisions.

To identify a specific site within the C-2 zone, I used Google Earth to review satellite images of the developments along West 11th Avenue. Additionally, I visited the street to observe the parking lots in person. I focused my search on retail stores, excluding any developments that shared a parking lot with other businesses or places where the parking lots could not easily be distinguished. By limiting my investigation to isolated parking lots, I could more clearly understand the site's history and established parking requirements. This allowed me to better analyze the difference between parking minimums and actual utilization at a specific site. I, therefore, selected Target because of its large, isolated, and car-centric parking lot. Furthermore, Target's general suburban footprint is indicative of many similar types of stores across the US, including Walmart, Home Depot, and more, providing interesting opportunities for analysis beyond this specific site. Figure 5 shows an aerial image of Target and its parking lot, Figure 6 presents a view of the parking lot from the South side of the lot, and Figure 7 shows an aerial view of Target from the Eugene Zoning Map.

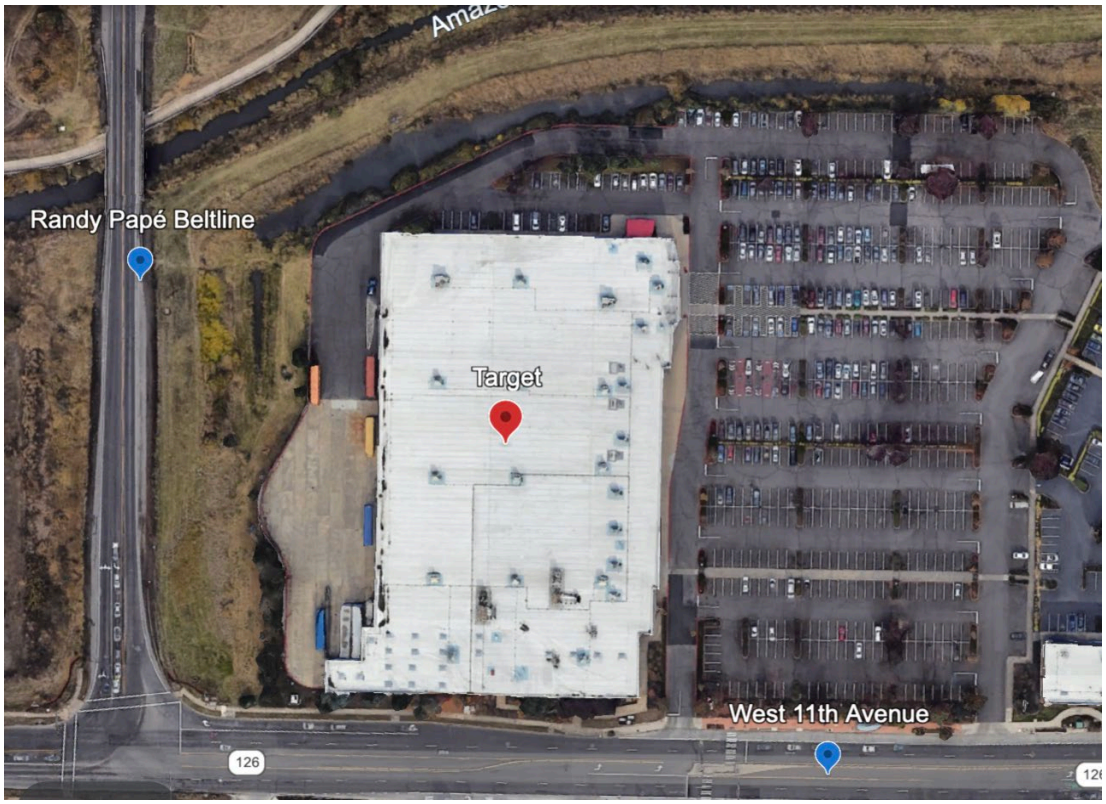


Figure 5: Ariel photo of the Target parking lot (Google Earth).

Figure 6: Image of the Target Parking lot from the Southside of the lot.

Figure 7: Image of the study site from the Eugene Zoning Map. The light pink indicates the C-2 Community Commercial zone (Eugene Zoning Map).

Next, I reviewed the parking requirements associated with this site, both at the time of development and at present, to identify the estimated parking demand. To do this, I searched the planning archives and analyzed documents relevant to the site's approval and development. Initially, the site was slated to become a Home Depot (City File #MDA 01-3, 3). However, in March 2001, the city of Eugene approved a Modification of a Site Review authorizing the construction of a Target instead (City File #MDA 01-3, 3). Per the Conditions of Approval, one vehicle parking spot was required for every 330 square feet of retail space for a minimum of 382 parking spaces (EC 9.586). Additionally, the code dictated a 534-space maximum on the development (City File #MDA 01-3, 3). The applicant originally proposed 589 spots, exceeding the maximum (City File #MDA 01-3, 34-35). The applicant was then required to revise the site plans to ensure compliance with the parking maximum (City File #MDA 01-3, 34-35). After revision, the applicant proposed 534 parking spaces with an additional 10 ADA-accessible spots (MDA 01-3, 42). Thus, the Target parking lot on West 11th contains the maximum number of

parking spaces allowed for a development of its size. The minimum parking requirement for this land use, one parking space per 330 square feet, has remained unchanged since the development of the Target in 2001 (excluding the upcoming changes associated with the Climate Friendly & Equitable Communities program set to change the parking maximum to 1.25 spaces per 330 square feet of retail space or 477 spaces) (EC 9.6410).

The next step of my methods included the development of the data collection procedure to analyze actual parking demand. First, I created a simplified map of the parking lot, shown in Figure 8, to collect and organize the data. This map was created by tracing an aerial image of the parking lot in PowerPoint. To ensure the accuracy of my map, I visited the site and verified that each parking spot was accounted for. Once the map was finalized, each parking spot was assigned a number, starting with zero on the lower left side and ending on the far right of the parking lot (shown in Figure 9). I identified 530 parking spots during this count, less than the 544-maximum agreed to in the development proposal. There is a row of unmarked parking spaces along the back of the parking lot, which I believe accounts for this disparity (this unmarked parking is shown in Figure 10). These parking spaces were omitted from the count as they are hard to differentiate from one another and from the parking lots of neighboring businesses.

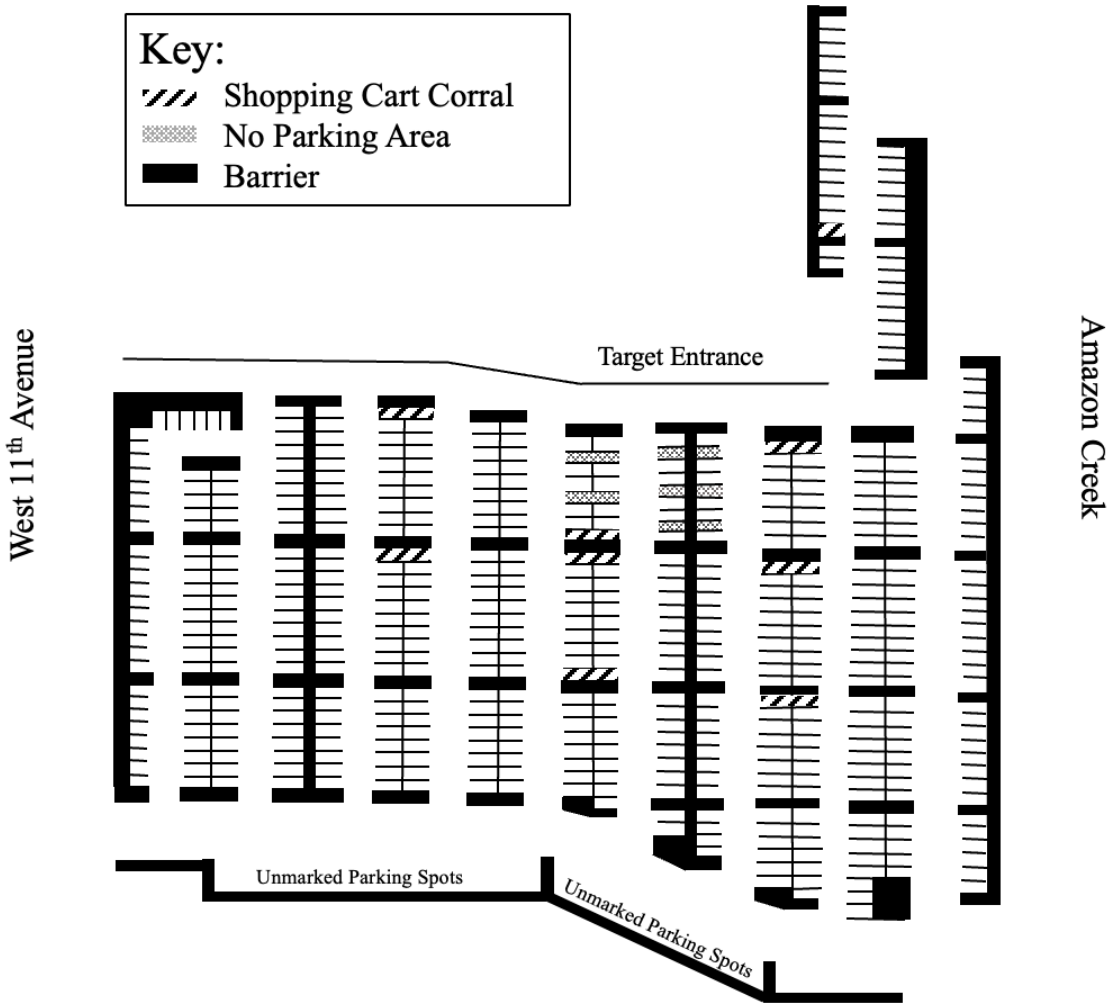


Figure 8: Diagram of the Target parking lot.

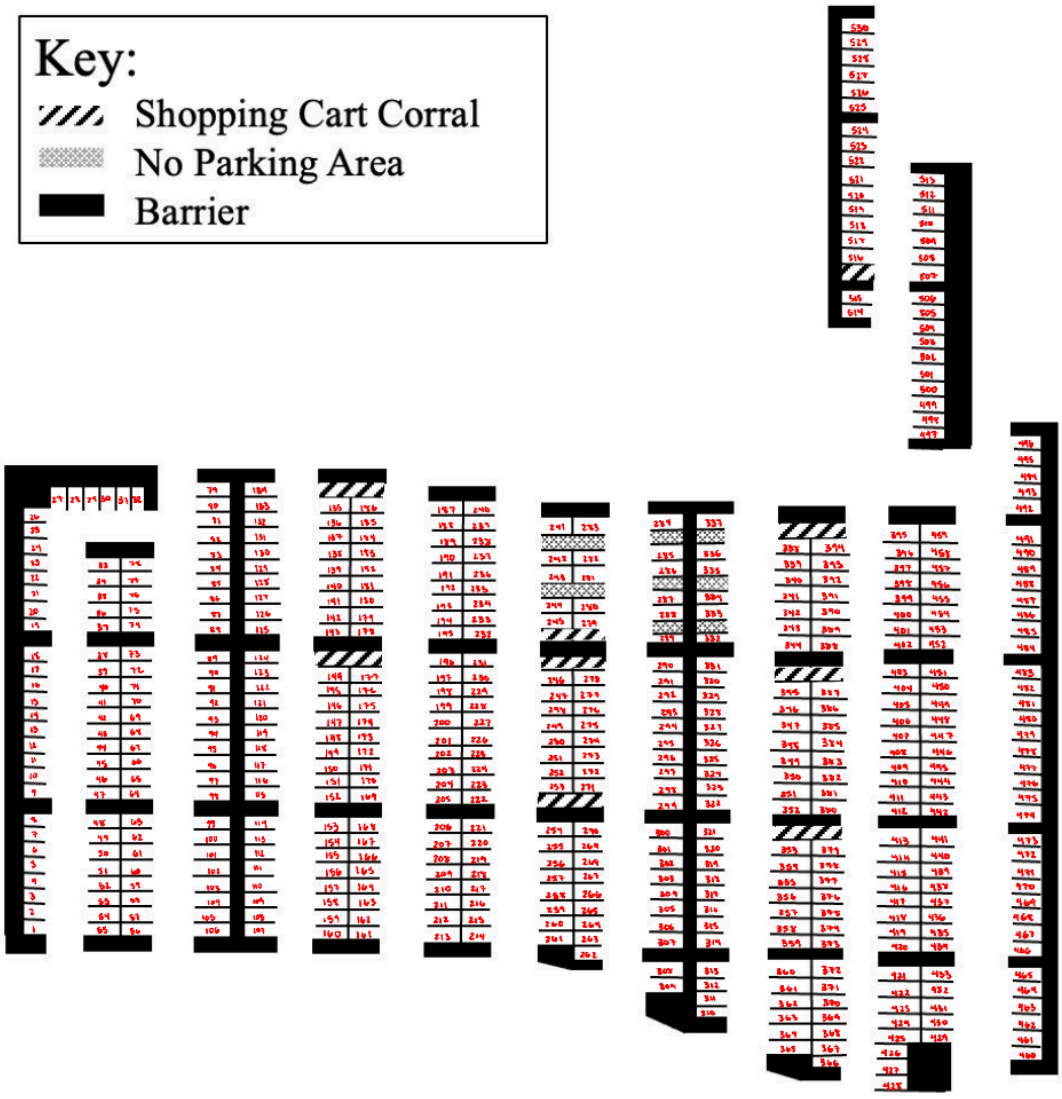


Figure 9: Diagram showing each parking spot with its assigned number.

Figure 10: Image of part of the unmarked parking along the back of the Target parking lot.

It is important that I created and followed a standard procedure for data collection to ensure the reliability of the data. For each site visit, I started at the left (south) side of the parking lot. I walked up and down each aisle, zigzagging across the parking lot and passing each parking spot once (Figure 11 shows the walking route I used). As I passed each occupied space, I marked the associated parking spot with an "X" to indicate the presence of a parked vehicle. Once I passed and recorded a parking spot, any change in occupancy was not documented. Additionally, no moving vehicles were recorded as it would be time-consuming to observe the behavior and destination of each moving car. In the event that a vehicle entered or left a parking space at the same time as I passed it, the parking spot was recorded as occupied. However, once I recorded a spot as vacant or occupied, any additional vehicle movement was not recorded. These occupancy changes and vehicle movements were averaged out after sufficient data was collected.

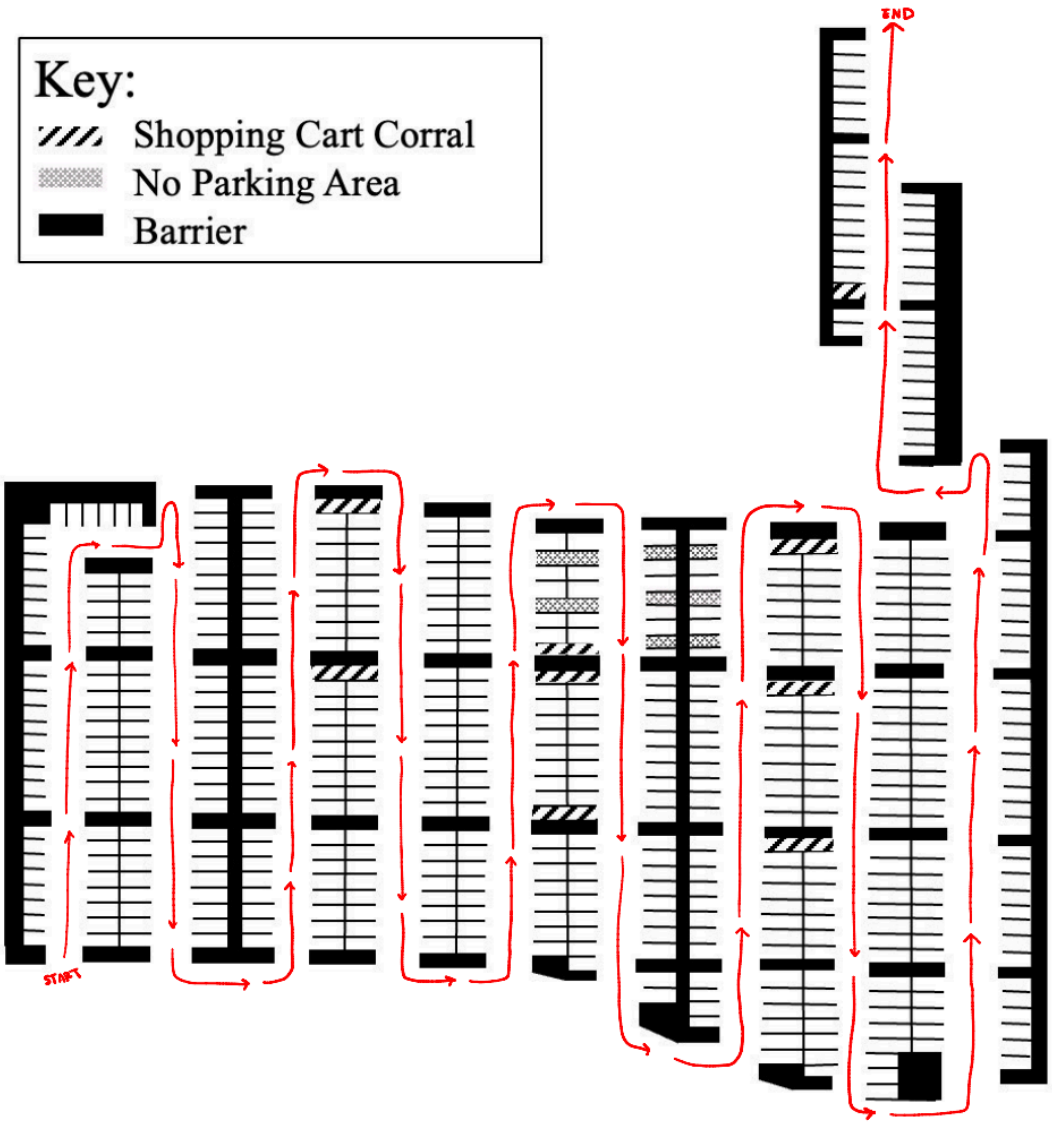


Figure 11: The walking path I took while collecting data.

After establishing a data collection procedure, I identified the times that data collection would occur. I visited and collected data from the site on 50 different days and times to ensure that my data were comprehensive and reflective of actual usage. To determine these days and times, I estimated peak and non-peak demand times for retail shopping at Target based on personal observations, typical workday schedules (9-5 on weekdays), and holidays. Based on these estimated times, I chose three peak time ranges and one range of nonpeak times during which I collected data.

Peak times:

- Anytime on Weekends
- 5-6:30 pm on Weekdays
- 10:30 am on Black Friday

Non-peak times:

- 10 am - 4 pm on Weekdays

It is important to note that other times of peak and nonpeak demand exist, including times outside of the hours in which Target is open (between 10 pm and 8 am). The times listed above merely represent the times during which observation occurred. Data was collected over 50 site visits at various times and on different days of the week. Data collection occurred 37 times during the identified windows of peak demand and thirteen times during non-peak demand. Since minimum parking requirements are traditionally written to ensure parking supply meets demand at peak times, I was particularly interested in the parking occupancy and vacancy rates at these times. If parking requirements accurately reflect demand for peak periods, occupancy rates should be high during these times. Conversely, if the parking requirements do not reflect actual demand, as demonstrated in recent research, I expected to observe excess parking even during periods of peak demand.

After each site visit, I entered the data into an Excel spreadsheet. To organize my data, each parking spot (by number) was assigned a row in the spreadsheet, and each column represented a specific site visit. Furthermore, I created an internal code using ones and zeros to record occupied and vacant parking spots in the spreadsheet. Occupied spots were recorded using a '1,' while vacant spots were assigned a '0.' This allowed me to add up and record the total parking occupancy for each visit (occupancy was recorded both numerically and as a

percentage). Data associated with non-peak times were coded using a red font to track which visits occurred during peak or non-peak times. Additionally, the marked maps allowed me to gain a spatial understanding of where cars tended to congregate. Finally, once I completed all data collection, I calculated the average percent occupancy for both peak and non-peak times and the total average percent occupancy across all site visits. To understand where parked vehicles congregated within the parking lot, I recorded the total number of times each spot was occupied across all site visits and used ArcMap to map parking utilization within the parking lot. I then used these stall occupancy and vacancy calculations to analyze the parking requirements' efficacy.

Average Amount of Land Devoted to Parking

Using Google Earth, the parking spaces in the Target parking lot were measured to be 13 feet long by 9 feet wide. A simple calculation reveals that the area of a single parking spot is 162 square feet. Multiplying the square footage of a single stall by the total number of stalls exposes that a total of 85,860 square feet, or 1.98 acres, are devoted solely to parking spaces. This estimate, while helpful in quantifying total parking space, fails to account for the accessways between the rows of parking spaces. There are two main access routes from West 11th into the parking lot, which are necessary regardless of the number of established parking spaces. The first accessway, which acts as a buffer between the parking lot and the Target store, totals an area of 16,920 square feet. The other main accessway, located at the back of the parking lot, furthest from the building, amounts for an area of 18,510 square feet. Thus, 35,430 square feet of this lot are devoted to the facilitation of necessary car movement, independent of the number of parking spots in the lot. Moreover, each row of parking is accompanied by a car lane to enable access to parking. Using the same calculations as before, the total area of all aisles is estimated to be

roughly 69,779 square feet or 1.6 acres. Dividing this number by 530, the total number of parking spaces, and adding it to the area of one stall, therefore, reveals the average amount of land needed to provide one parking space. Executing this equation results in the finding that each parking space requires an average of 131.66 square feet of aisle space, meaning each stall requires a total of 293.66 square feet of land. Thus, for each additional parking space removed from the lot, an average of 293.66 square feet of land is freed up.

Limitations

It is important to note that this analysis only includes the study of one parking lot in one city. Therefore, findings only directly relate to the Target parking lot in Eugene, Oregon. Other cities within the United States and globally may have different minimum parking requirements, land-use codes, development histories, and built environments, making it difficult to extrapolate these findings to other contexts or apply them broadly. This research also focused only on retail development in a commercial zone, limiting its scope and applicability to other types of developments, including housing, mixed-use developments, and larger, multi-unit shopping complexes. However, there is a fairly consistent pattern of accelerated sprawl, underutilized parking, and parking policy across the US (Shoup, 2011), suggesting findings from this study may apply to other contexts. The findings may, therefore, be used as a starting point for evaluating or understanding parking utilization in other contexts even if they may not be precisely extrapolated.

In addition, while 50 site visits occurred, data collection was concentrated in the winter months. Furthermore, the periods of data collection were largely dictated by my own availability, potentially impacting the results. However, by collecting data on various days and across different times, I sought to reduce the impact of this potential influence. This study, therefore,

offers a snapshot of parking utilization across four months. Moreover, some potential periods of peak demand, such as Christmas Eve, other holiday weekends, or the University of Oregon's move-in weekend, are absent from the results. Thus, it is also important to remember this study's findings represent trends in parking utilization rather than providing an accurate description of parking utilization on any given day.

Results

Results from the case study reveal insights that are consistent with the original hypothesis that predicted parking demand exceeds actual use at the Target on West 11th Avenue in Eugene, Oregon. Both peak and nonpeak times produced low numbers of vehicles and, therefore, low percent occupancies. This results section presents key findings, outlines the underutilized areas of the parking lot, and calculates the amount of space devoted to vacant parking spaces.

Times of Peak vs. Nonpeak Demand

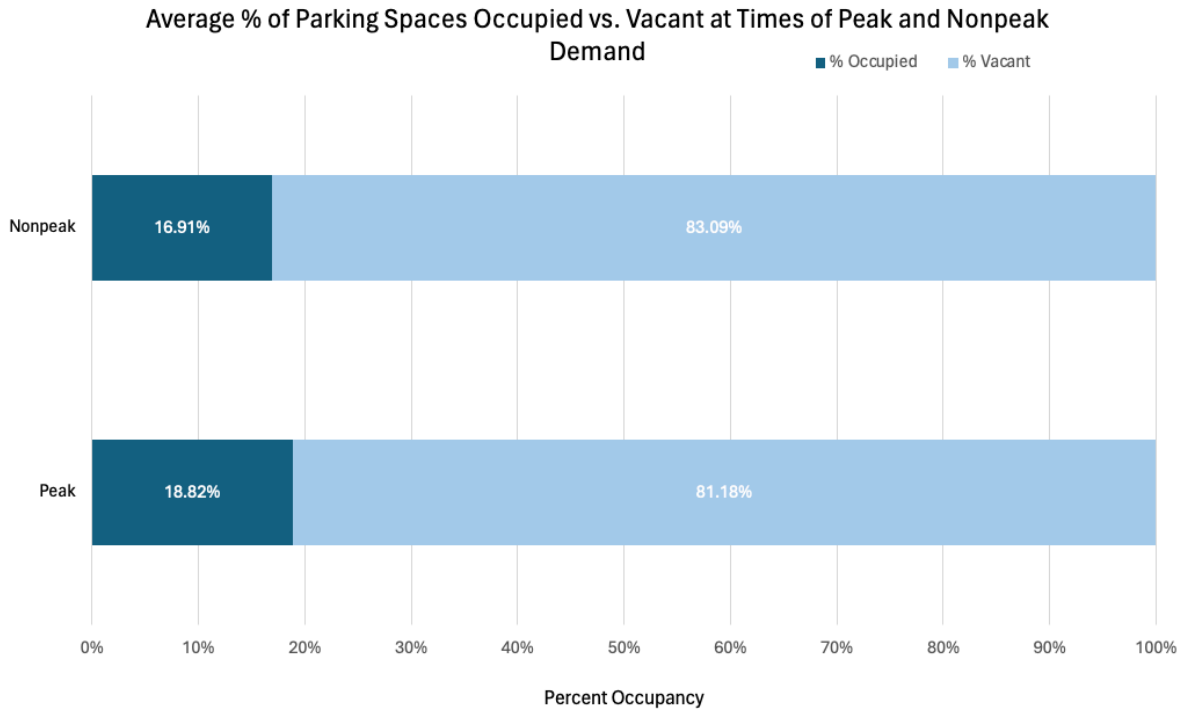


Figure 12: Average percent of occupied and vacant parking spaces during times of peak and nonpeak demand, excluding Black Friday.

Data analysis reveals that most of the parking lot remains vacant even during peak demand. As shown in Figure 12, the average percent occupancy of the lot was 18.82% during times of peak demand. During these times, an average of 99.75 cars occupied the lot's 530 parking stalls. Thus, on average, the parking lot remained 81.29% vacant during peak retail

shopping times. Notably, these statistics exclude the data collected on Black Friday, a distinct outlier, to reflect a more accurate depiction of everyday parking utilization. At 10:30 am on Black Friday, the parking lot saw a high of 185 occupied parking stalls or 34.91% stall occupancy. However, 345 parking spots, or 65.09% of the lot, remained empty. Including Black Friday in these calculations raises the average number of occupied stalls from 99.75 to 102.05 and reduces the percentage of vacant parking spots from 81.09% to 80.75%.

It is important to remember that the minimum parking requirement for this site at the time of development was 383. The vehicles in the Target parking lot on Black Friday, a time of peak demand, would have occupied only 48.30% of this minimum parking requirement, highlighting the disconnect between MPRs and actual utilization. Aside from the data collected on Black Friday, the highest recorded number of parked vehicles was 131. This occurred at 2:15pm on Friday, February 2nd. Conversely, the lowest number of parked cars recorded during peak demand occurred on Saturday, February 24 at 6:30 pm. During this time only 74 cars were parked, meaning that only 13.96% of the total parking spaces were occupied. Therefore, during times of peak demand, the Target parking lot ranged from 13.96% to 24.72% occupied, excluding Black Friday, which was the only time that more than a quarter of parking spaces were occupied simultaneously.

Similarly, low numbers of parked cars were also recorded during times of nonpeak demand. An average of 90.15 vehicles, which occupied 17% of the available parking spaces, were parked during these times. The lowest number of occupied parking stalls, 71, occurred at 10:15 am on Monday, January 29th (a nonpeak time). On this day, the parking lot saw just 13.4% of parking spaces utilized. Therefore, aside from Black Friday, the parking lot ranged from 13.4% to 24.72% full on any given day or time. Across both peak and non-peak times, the

Target parking lot experienced an average of 18.63% stall occupancy or 98.78 vehicles per 530 parking spots. Thus, on average, 81.37% of the 530 parking spaces are vacant.

Consistent with the idea that parking utilization is higher during times of peak demand, the weekend produced higher numbers of parked vehicles on average. During the weekend, the parking lot experienced an average of 99.77 occupied parking spaces or an 18.82% occupancy rate. Thus, on the weekend, an average of 430.23 parking spaces, or 81.18% of the parking lot, remained empty. Moreover, on weekdays, an average of 96.28 vehicles were parked in the parking lot, meaning that 81.88% of parking spaces were not utilized.

Spatial Findings

Through spatial analysis, it is clear that drivers generally prefer to park near the entrance of the store, while the parking spaces further from the entrance and closest to West 11th Avenue go largely unused. Figure 13 presents a map highlighting the areas in the parking lot that are used frequently and areas that are inadequately utilized. Generally, the rows of parking closest to West 11th Ave and furthest from the store's entrance go unused more frequently, while the spots closest to the entrance are utilized quite frequently. Parking utilization is also quite low among the spots furthest from the building. Furthermore, Figure 14 maps the data collected on Black Friday, revealing spatial information about the parking lot utilization at the time of highest demand. These figures emphasize the vast amount of unused land within this parking lot.

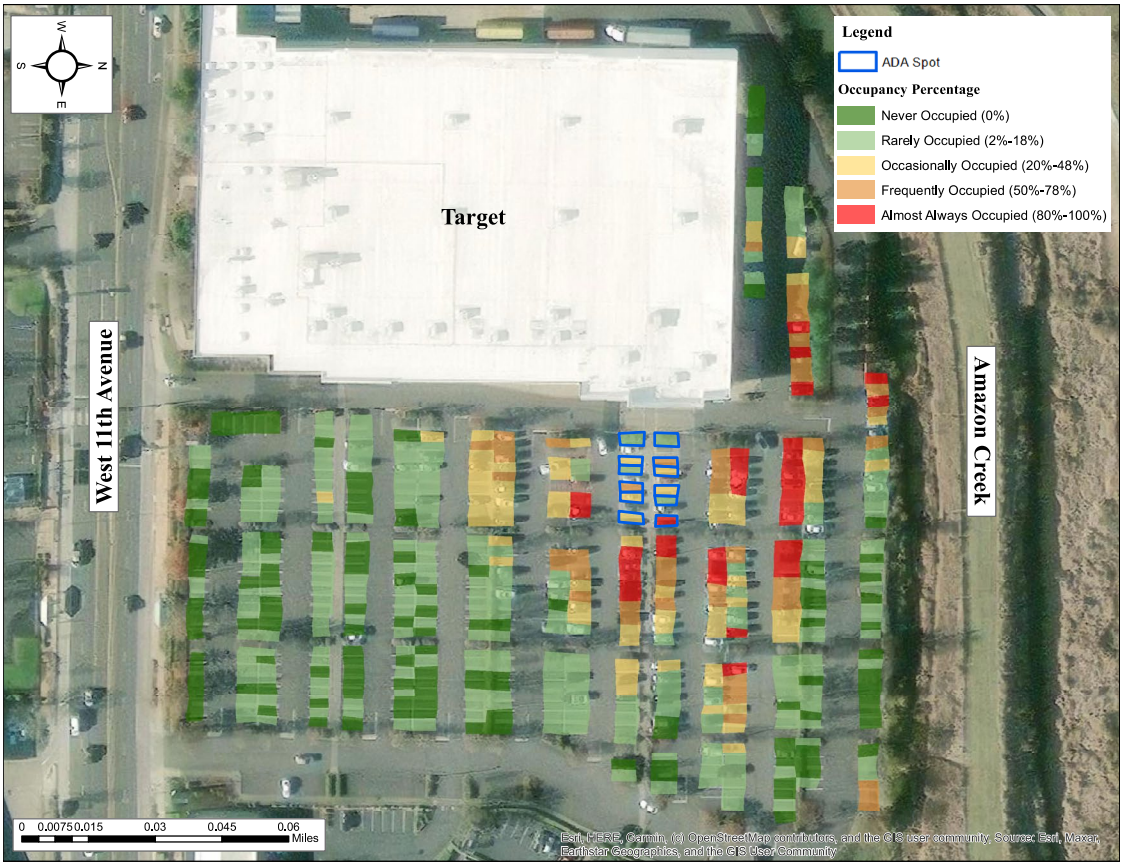


Figure 13: A visual representation of the percentage of times each parking spot was occupied across all site visits. Green represents spots that were never, or almost never, occupied. Yellow and orange represent parking spaces occupied between 20% and 78% of the time, and red indicates spots occupied very frequently.

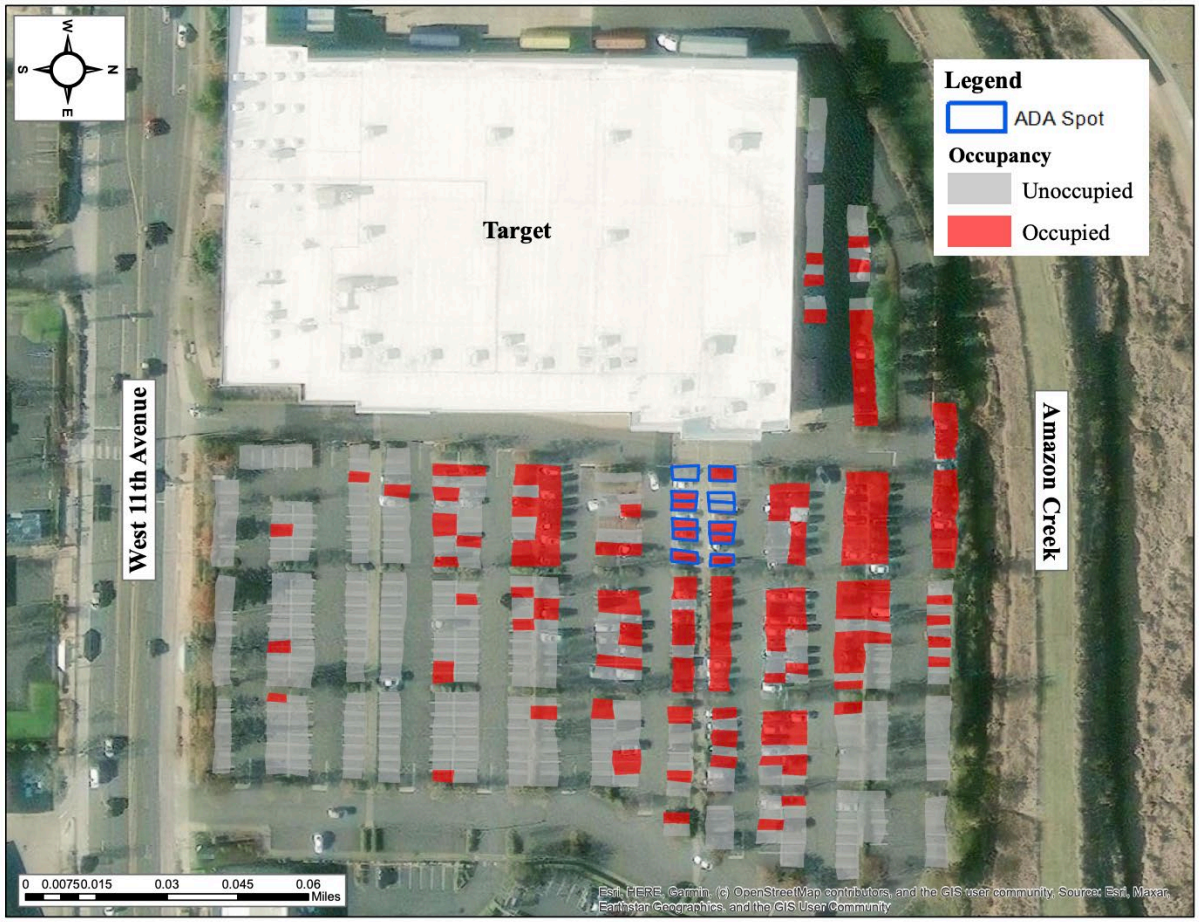


Figure 14: The location of parked cars in the Target parking lot at 10:30 am on Black Friday. Red Spaces indicate occupied parking stalls and grey spaces represent vacant stalls.

Underutilized Parking Spaces

Category	Percentage of Parking Spaces
Never Occupied (0)	26.4%
Rarely Occupied (2%-18%)	45.1%
Occasionally Occupied (20%-48%)	12.6%
Frequently Occupied (50%-78%)	13.6%
Almost Always Occupied (80%-100%)	7.2%

Table 2: Percentage of parking spaces that fall into five data categories based on the percentage of times the parking spot was occupied. This data includes parking occupancy on Black Friday.

To better understand how the parking lot is being used, the data from each parking spot was broken into five categories, as outlined in Table 2. Parking spots that were vacant for all site visits fall into the "never occupied" category, stalls that were occupied between one and nine times are "rarely occupied," stalls occupied during 2% to 18% of site visits are labeled "occasionally occupied," spots observed to be in use during 20% to 48% site visits are "frequently occupied," and parking spaces occupied between 50% and 78% of times are "almost always occupied." This data breakdown highlights that at least 26.4% of parking spaces in this parking lot are entirely unnecessary and never in use. Moreover, 239 spots were occupied between one and nine times over the course of 50 site visits, meaning that 44.8% of parking spaces have an average occupancy rate between 2% and 18%. 12.6% of parking stalls were occupied during 20% to 48% of site visits, and 13.6% were occupied between 50% to 78% of times. Finally, only 7.2% of spaces were occupied between 80% and 100% of site visits, and no stall was in use across all site visits. Thus, it is clear that a large portion of the parking lot is underutilized, and that parking demand is largely concentrated in a small share of parking spaces.

The Amount of Parking Actually Demanded

I performed a few simple calculations to determine the necessary number of parking spaces to meet demand at most, if not all, times. First, the highest rate of parking utilization, 34.9% on Black Friday, was multiplied by the total number of parking spaces. This calculation produced an estimate of the appropriate number of parking spaces, 184.97, that this lot needs while still meeting demand at peak times. Rounding this number to 200 to account for potential fluxes in parking demand provides 7.5% more parking than needed on Black Friday, therefore exposing a conservative estimate for the number of necessary parking spaces. Reducing the parking lot's capacity from 530 to 200, or a 62.26% decrease in the number of parking spaces, still accommodates drivers at all times.

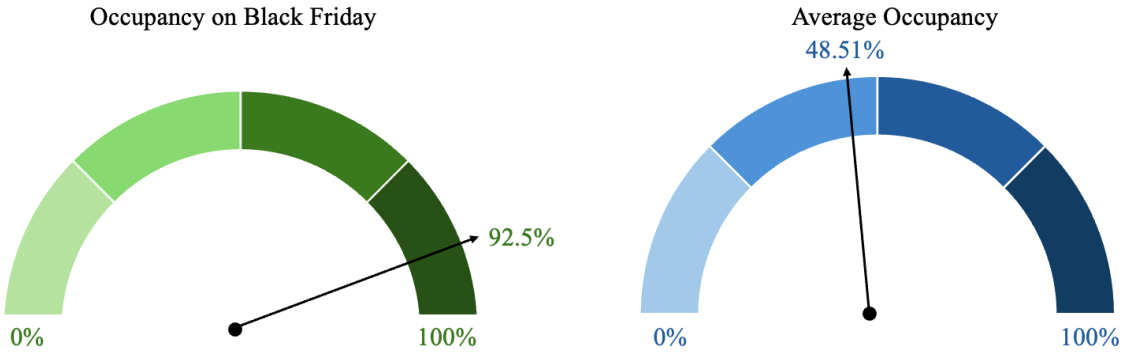


Figure 15: Percent occupancies of the Target parking lot if the number of parking spaces was reduced by 330 (200 total spaces). The figure on the left shows the percent occupancy on Black Friday if there were only 200 parking spaces and the figure on the right highlights the average occupancy across all site visits (excluding Black Friday) if the number of parking spaces was reduced by 330.

Figure 15 uses this calculation of parking demand to highlight the percent occupancy of the parking lot if only 200 parking spaces were provided during data collection. If the parking lot contained 200 parking spaces during each site visit, the average occupancy rate would increase from 18.31% to 48.51% across all times and days. Similarly, the parking occupancy rate on

Black Friday would increase from 34.9% to 92.5%. While 92.5% occupancy at the peak of the peak demand appears sound, it is important to note that this reduction of only 330 parking spaces is very generous. Research often uses 80% (and sometimes up to 90%) as the target occupancy for surface parking lots (Jakob & Menendez, 2020). Since an average of 48.51% occupancy is significantly lower than 80%, it is clear that this reduction would still result in a considerable amount of underutilized space during most of the year.

Analyzing the parking lot using the best practice of 80% occupancy highlights that further reduction is justified. The average number of vehicles in the parking lot across all site visits (excluding Black Friday) was about 99. Using this average and the 80% metric, only 122 parking spaces are required. Thus, removing 408 parking stalls would ensure the average occupancy of the parking lot hovers around 81%. The number of vehicles in the parking lot only exceeded 122 four times across 50 site visits, including Black Friday. The largest number of cars observed in the parking lot aside from Black Friday was 131. Thus, assuming that the lot only had 122 total spaces during data collection, nine vehicles would have been unable to find parking at this time. On two other days, 128 parked vehicles were recorded, or an excess of six cars. It is important to note that these cars would not be entirely stranded and unable to park. As mentioned in the Methods section, there is a row of unmarked parking spaces along the back of the lot that was not included in data collection. However, based on personal observation, these parking spaces are never entirely full. Additionally, during these times of very peak demand, the adjacent parking lot could house these few spillover vehicles. Thus, reducing the parking lot by 408 stalls would only cause a disruption during times of extremely high demand, including Black Friday. However, on all other days the number of parking spaces would be adequate.

Specific Reduction Options

It is clear that a large number of parking spaces in the Target parking lot are underutilized and hold redevelopment potential. However, any redevelopment would occur strategically and by aisle. Each aisle varies in length and width, making it more impactful to calculate the amount of land freed up by different redevelopment options. Furthermore, an odd number of parking spaces would not be removed as this does not maximize the amount of land that can be repurposed. Taking into account all the findings, I offer three different reduction options: (1) a minimal reduction of 330 parking spaces, (2) a moderate reduction of 370 spaces, or (3) a targeted reduction of 408 spaces. The minimal reduction provides 15 more spaces than required on Black Friday, assuring that all drivers can park for free at all times. The targeted reduction ignores Black Friday and reflects the conclusion in literature that the optimal occupancy rate hovers around 80%. Using the average number of parked cars in the Target parking lot across all times (99 vehicles), 122 parking spaces was found to provide an average occupancy of 81.15%, highlighting that a reduction of 408 spaces would achieve this goal occupancy. The moderate reduction offers a middle ground between these two extremes, providing enough parking to meet demand at all times except Black Friday.

Furthermore, the location of this redevelopment, or where parking spaces are removed, can differ. To offer a variety of options, I offer two redevelopment locations. These options include either the redevelopment of the land along the creek or the redevelopment of land near West 11th Avenue. The redevelopment of the perimeter of the parking lot, following the natural patterns of occupancy as shown in Figure 13, was also considered. However, this scenario spreads the amount of land available to be repurposed over more area, making it harder to convert into a different use. In each redevelopment option, I will provide calculations for the

amount of land saved in each reduction option. It is crucial to note that these are merely area estimates and are subject to margins of error. These values should be taken as guides rather than absolute facts.

Option 1: Minimal Reduction

Option one includes removing 330 parking spaces from the Target's parking lot, leaving 200 spots available for customers. Again, this option would include more than enough parking to meet demand at all times, including times of highest demand. Two options for the location of this removal of parking spaces and the total amount of land freed up are outlined below.

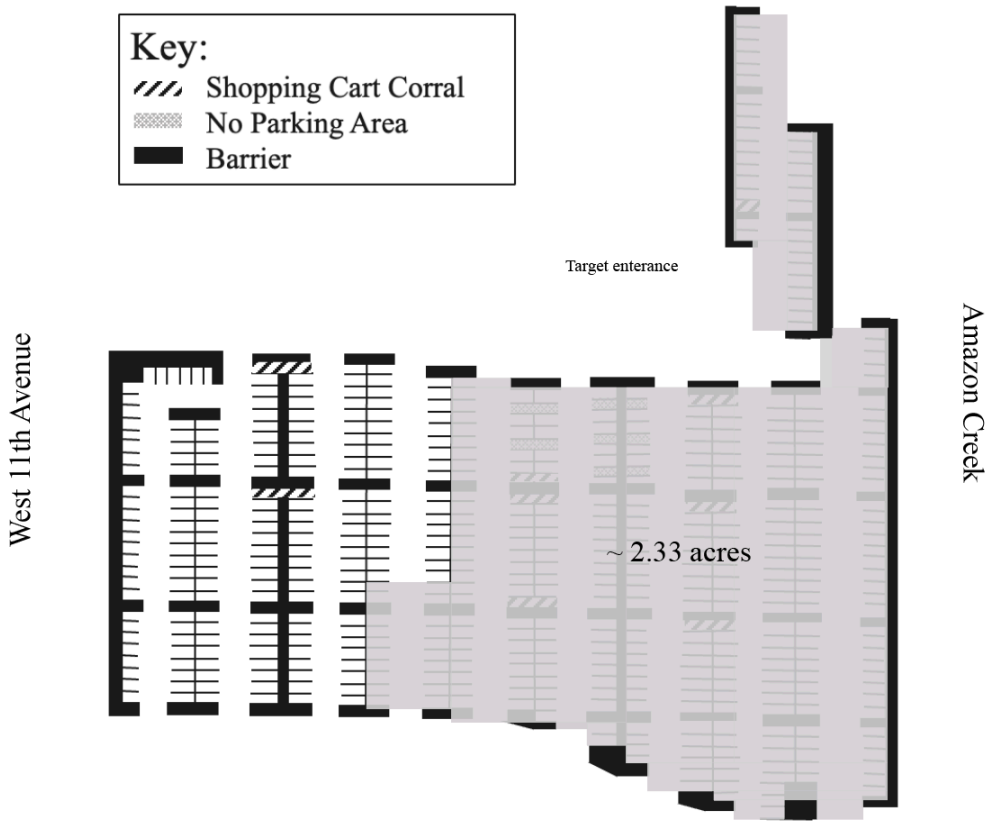


Figure 16: Area of the Target parking lot that would be removed if a minimal reduction was implemented along the North (creek) side of the lot.

Figure 16 shows the area of the parking lot that would be removed along the creekside of the parking lot if a minimal reduction occurred. The total area devoted solely to parking spaces in this area is 53,460 square feet. Factoring in the aisle space (~48,203 square feet), the total amount of land subject to removal increases to 101,663 square feet or about 2.33 acres.

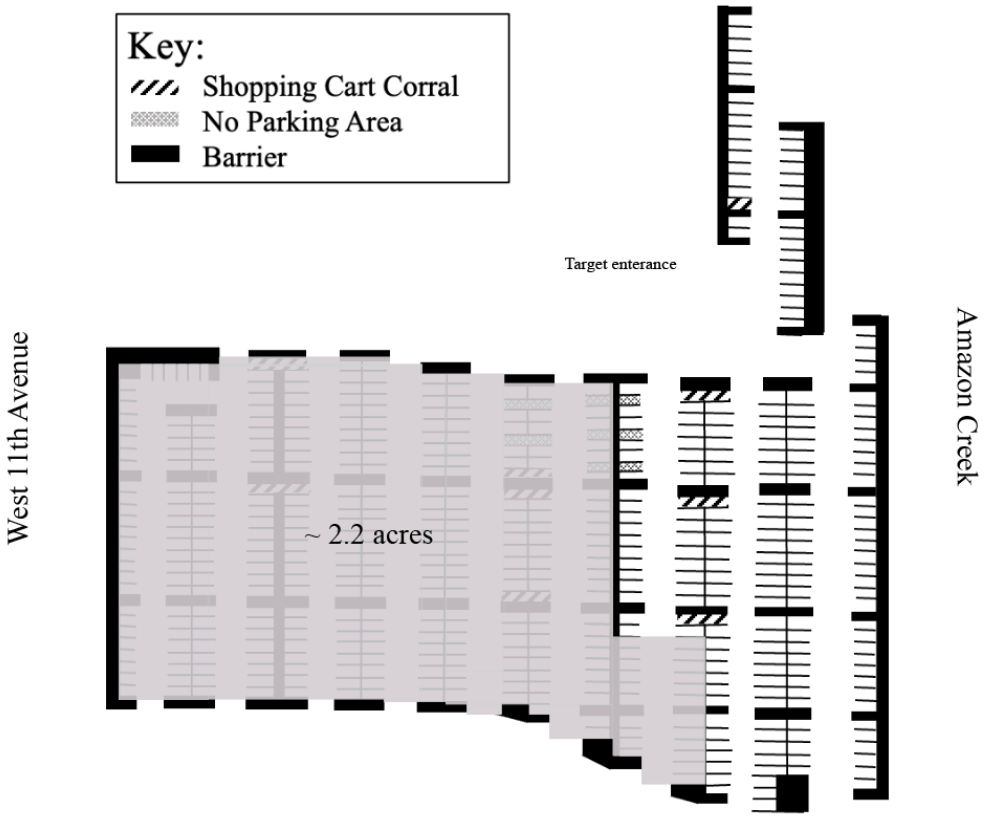


Figure 17: Area of the Target parking lot that would be removed if a minimal reduction was implemented along West 11th Avenue.

Figure 17 highlights what this reduction would look like along the West 11th Avenue side of the parking lot. This option would entail the removal of over six rows of parking. In total, this reduction would free up 95,707 square feet or approximately 2.2 acres of land, including both the area of each parking space and the combined area of each removed aisle. It would also keep the parking spaces closer to the Target's entrance and remove the ones furthest away.

Option 2: Moderate Reduction

Option two, or a moderate reduction, entails the removing 370 parking spaces from the parking lot. This would leave 160 parking spaces. These parking spaces are more than adequate to meet demand at all times except on Black Friday. Thus, all drivers would be able to find parking in this lot on all but the busiest days of the year.

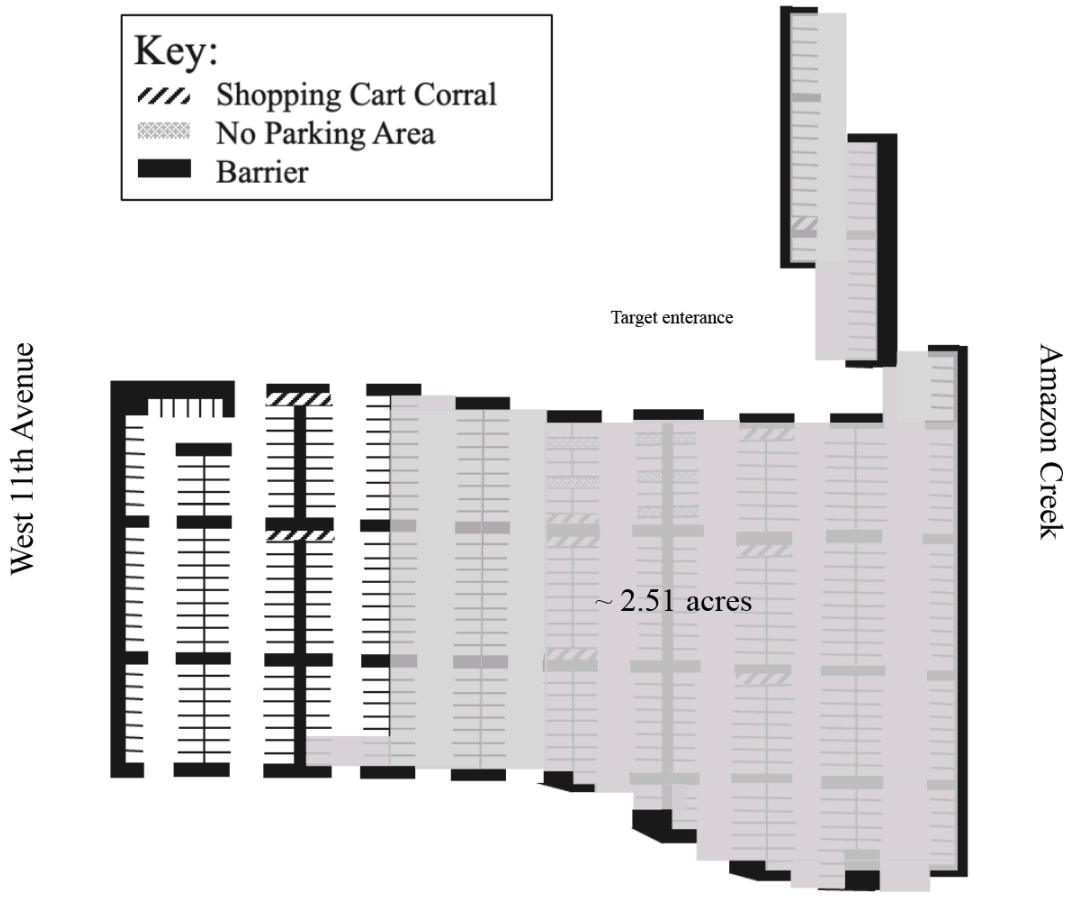


Figure 18: Area of the Target parking lot that would be removed if a moderate reduction was implemented along the creek.

Along the creekside of the parking lot, increasing the number of removed parking spaces from 330 to 370 increases the total area devoted solely to parking spaces to 59,940 square feet.

Again, factoring in the aisle space (~49,378 square feet), the total amount of land subject to removal increases to 109,318 square feet or about 2.51 acres, as shown in Figure 18.

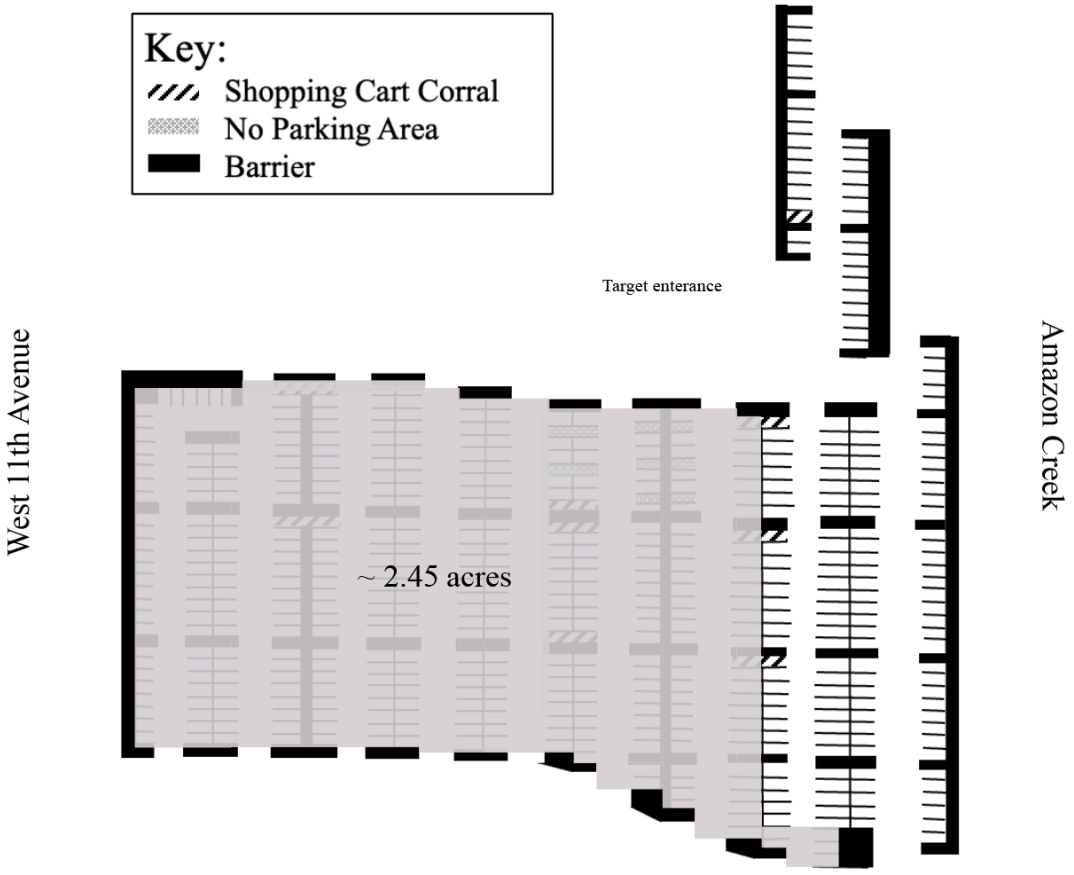


Figure 19: Area of the Target parking that would be removed if a moderate reduction was implemented on the South side of the parking lot.

Moreover, this option would entail the removal of over seven rows of parking from the West 11th side of the parking lot, illustrated in Figure 19. In total, this reduction would free up 106,870 square feet or approximately 2.45 acres of land, including both the area of each parking space and the combined area of each removed aisle.

Option 3: Targeted Reduction

Implementing a targeted reduction would ensure that the average parking occupancy in this parking lot hovers around 80%. This option would ensure that drivers find parking within the lot at most times. However, during times of high demand, some spillover may occur.

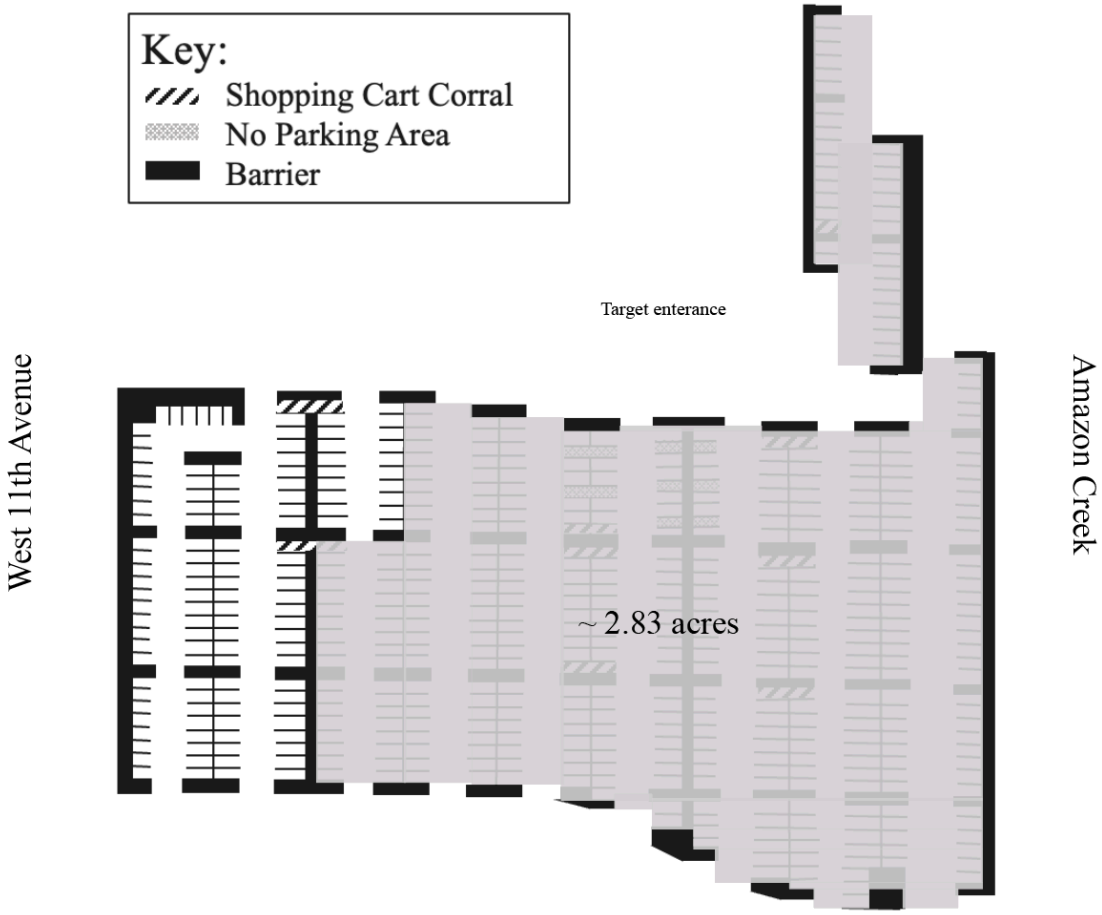


Figure 20: Area of the Target parking lot that would be removed if a targeted reduction was implemented along the creek.

Figure 20 highlights what this option would look like if reduction occurred along the creek. This reduction would remove over seven rows of parking from the North side of the lot, leaving approximately two and a half rows of parking along West 11th Avenue. This option would also increase the area of land that can be repurposed to 123,177 square feet or about 2.83

acres. This area includes the total amount of land devoted to each parking space and the aisles included in the reduction.

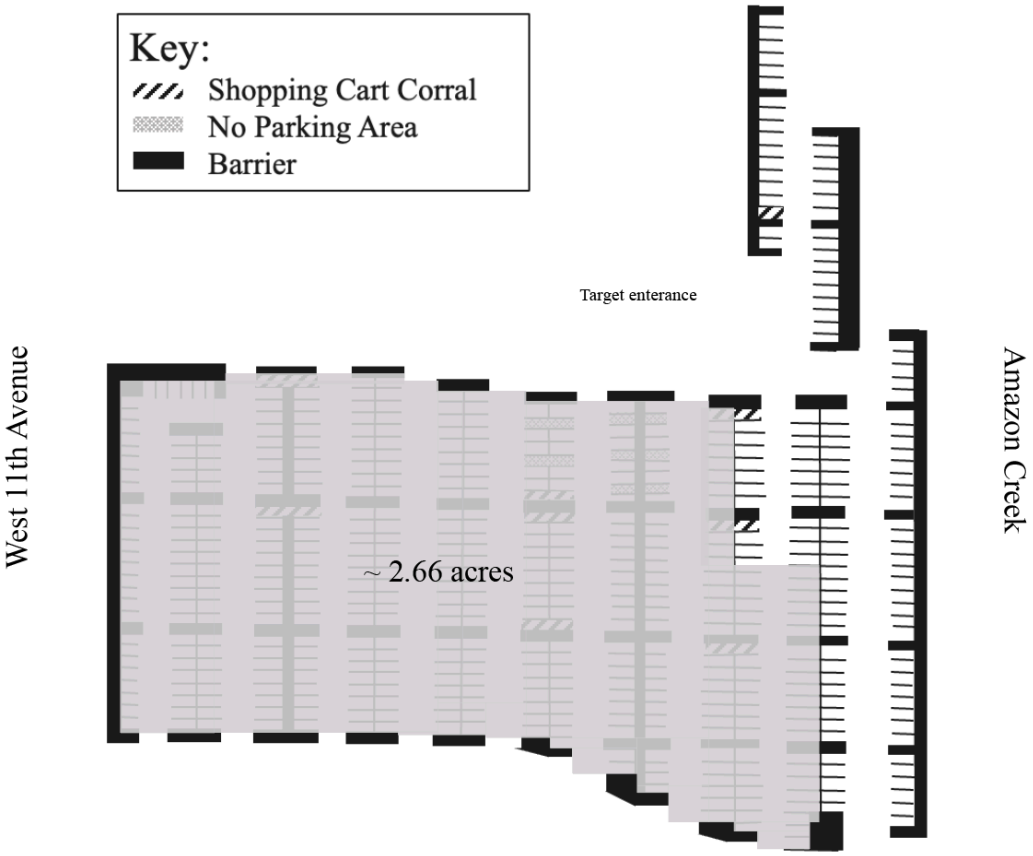


Figure 21: Area of the Target parking that would be removed If a targeted reduction was implemented on the South side of the parking lot.

The removal of 408 parking spaces from the South side of the parking lot would leave only the roughly two and a half rows adjacent to the creek, as shown in Figure 21. While seemingly dramatic, this reduction would meet demand at all but the most extreme of times of peak demand. Furthermore, this option would ensure that the parking occupancy in this lot averaged at 80%. Employing this option would release approximately 115,940 square feet or 2.66 acres of land for other uses.

Discussion

My primary research question investigates how predicted parking utilization, as disclosed in local parking policy, matches actual use at a commercial retail store in Eugene, Oregon. While this question and the research conducted are admittedly very simple, my findings underscore the importance of straightforward parking studies. In administering my methods, I found that most of the Target parking lot goes underutilized every day. Even during the time of highest demand, Black Friday, which minimum parking requirements have historically been based on, the parking lot saw only 34% of spaces occupied. Therefore, it is clear that there is a large disconnect between the amount of parking mandated by policy and the parking demanded by drivers. While my findings only directly apply to the Target parking lot on West 11th Avenue in Eugene, Oregon, a significant amount of research corroborates the claim that this pattern of overallocated parking exists across the United States. Thus, it is likely that similar rates of wasted land exist along West 11th Avenue and across Eugene as a whole. Despite the fact that the analysis in this project honed in on an extremely specific case study and context, the results, therefore, hold broader implications that are rife with potential. Furthermore, this research focuses on the extent to which local planners understood the patterns and quantity of demanded parking when establishing minimum parking requirements. I do not wish to assert that local planners do not execute their jobs well, but rather to explore and quantify the imbalance between the number of parking spaces required or allowed and actual utilization rates.

I found roughly two acres of underutilized land at the Target parking lot alone. This overallocation of parking traps land and potential economic gains into expansive swaths of desolate concrete. Unable to be used for any other purpose, these parking lots sit idle, deteriorating urban form, reducing access to active and public transportation, adversely

impacting the environment, and, above all else, reinforcing the personal vehicle as the dominant mode of transportation. These conclusions are backed by a large body of research on parking minimums that has emerged in the last couple of decades. However, research is scarce on where exactly underutilized land occurs within individual cities and what to do after broad parking policy reform is enacted.

Predicted Demand vs. Actual Utilization

It is clear from the data that the Target parking lot on West 11th Avenue is greatly overbuilt. Furthermore, observational data from developments along West 11th Avenue suggests that other parking lots on this street experience similar usage patterns. Thus, the predicted demand set forth by minimum parking requirements does not come close to matching the actual utilization rates. This mismatch between predicted and actual demand traps significant land in underutilized and desolate paved areas. These paved lots serve no function and sit idle, disrupting urban form, reducing pedestrian safety, and adversely impacting the environment through accelerated sprawl and the prioritization of the personal automobile above all other transportation modes. Analyzing parking utilization rates over 50 days indicates that at least 330 parking spaces within the Target parking lot are unnecessary. Moreover, the largest number of vehicles within the lot at a single time was 185, highlighting that only about 200 parking spots are needed to meet demand at peak times. This finding is consistent with the predominant conclusion found in the existing literature that parking minimums overestimate parking demand.

However, it is important to note that at the time of development, building a parking lot with only 200 parking spaces would not have been in compliance with the minimum parking requirements, further highlighting the disconnect between the predicated demand outlined by parking policy and the actual demand of drivers. However, under the new parking reforms

outlined by the Climate Friendly Community Equitable program, 200 parking spaces would comply with the new 477 spot maximum for this development.

Someone Has to Do It

The observation that parking lots along West 11th Avenue are underutilized is not earth-shattering. In fact, most people who drive, shop, or commute on this street would probably express this idea if asked. However, rarely, if ever, do in-depth studies of local parking utilization, like the one completed in this thesis, occur to quantify the scale of the issue and the opportunity costs. If planners do not understand where underutilized land exists within their cities, how can they begin to correct the decades of overbuilt parking infrastructure mandated by code? It is likely that these planners agree that minimum parking requirements generate adverse impacts generally; however, they rarely examine their local jurisdictions to pinpoint specific areas in need of reform.

Why are these studies important? Ultimately, they provide quantifiable numbers and a step forward in identifying and correcting overbuilt parking infrastructure. Additionally, current parking reform only targets new development, limiting its impact on existing parking lots and highlighting the need for site-specific parking studies. My study found that a whopping two acres of the Target parking lot is underutilized or not used at all. If we extrapolate these findings with observational information about this section of West 11th Avenue in Eugene, Oregon, a similar volume of underutilized parking likely exists in several other parking lots along this street. Thus, post-development parking analyses need to be incorporated into planning practice. It is only through parking studies that city planners can fully understand the impacts of MPRs, quantify the breadth of misused land, and identify developable land that is not currently on the market. This poses a huge opportunity for the City of Eugene, as they seek to meet climate and affordable

housing goals. Eugene's Comprehensive Plan, Envision Eugene (2023), articulates local community values through seven "Envision Eugene pillars":

1. Provide ample economic opportunities for all community members.
2. Provide housing affordable to all income levels.
3. Plan for climate change and energy resiliency.
4. Promote compact urban development and efficient transportation options.
5. Protect, repair and, enhance neighborhood livability.
6. Protect, restore, and enhance natural resources.
7. Provide for adaptable, flexible, and collaborative implementation.

Each pillar is in some way tied to the overabundance of parking within Eugene, which adversely impacts local economic development, increases housing prices, and promotes the use of personal vehicles. Thus, evaluations of parking utilization and targeted policy solutions are crucial as the city pursues these ambitious goals.

Redevelopment Options

As outlined in the results section, I discussed two possible redevelopment locations – the rows of parking along the creek or the aisles on the South side of the lot. Both options included three potential reduction scenarios: (1) a minimal reduction of 330 parking spaces, (2) a moderate reduction of 370 spaces, or (3) a targeted reduction of 408 spaces. The minimal reduction option involves removing 330 parking spaces, creating a new total of 200 available parking stalls. This option would provide 15 more parking spaces than needed on Black Friday, providing a buffer for potential fluxes in parking demand. Additionally, since the largest number of cars in the lot aside from Black Friday was 131, this option would supply 69 more spaces than needed at most times of high demand. This ensures that any new development would likely not

need to build additional parking and could utilize part of this lot. Employing a targeted reduction of 408 parking spaces, leaving only 122 remaining, further expands the amount of land available for redevelopment. This reduction would provide enough spots to meet demand at most times, as the number of vehicles never exceeded 131 across all site visits (except on Black Friday). This targeted approach would mean that some drivers may not find off-street parking in this lot at times of extremely high demand. However, these times would be exceedingly infrequent, and would most likely only occur a few times a year (especially considering that the row of unmarked parking along the back of the lot and the adjacent lot which could accommodate some spillover).

Finally, the moderate reduction option provides a middle ground between these two extremes. Reducing the occupancy of the parking lot by 370 would leave 160 parking spaces. If the parking lot only had 160 spaces, the average percent occupancy across all site visits would be 61.9%. This option provides more than enough parking for all times, except times of extremely high demand (i.e., Black Friday). Thus, each option has pros and cons, and produced a different amount of land that could be repurposed or redeveloped.

Removing Parking Along the Creek vs. Along West 11th

Due to variations in the length and width of each row of parking, removing parking spaces along the creek produces more available land across all reduction options. Reducing the parking lot by 330 parking spaces along the creek frees up roughly 101,663 square feet or about 2.33 acres. However, removing the same number of parking spots from the West 11th side frees up a slightly smaller amount of land, 95,707 square feet or 2.2 acres. Reduction option two (removing 370 parking spaces) releases 109,318 square feet (2.51 acres) along the creek versus 106,870 square feet 2.45 acres) of land on the West 11th side of the lot. Finally, removing 408

parking spaces on the creek side supplies 123,177 square feet or about 2.83 acres to redevelopment, while reduction along West 11th Avenue contributes approximately 115,940 square feet or 2.66 acres of land. Thus, removing parking spaces from the rows furthest from West 11th would make marginally more land available for redevelopment.

However, the amount of land afforded by each reduction scenario is not the only factor in determining the most effective option. It is important to also understand the types of infill development, their parking needs, and the advantages or disadvantages of each redevelopment location when deciding which option is best. For example, the West 11th side of the parking lot provides direct access to the EmX Bus Rapid Transit System stop, marking it as a good site for higher-density, affordable residential housing. On the other hand, the land closer to the creek could provide a better ambiance and perhaps increased safety as it is further from the busy road. However, developing the land along the creek pushes the remaining parking spaces further from the store's entrance. It is also important to note that developing challenges may arise when trying to develop aisles along the creek due to setback requirements within the zoning code. Per Eugene Code 9.4290, buildings within the C-2 zone must adhere to a 15-foot maximum setback (E.C. 9.4290). Thus, many considerations must be made, and consultation of building and zoning codes is necessary to ensure compliance before choosing what type of redevelopment should occur.

Alternative Uses and Infill Development

While discussions about the need to expand the Urban Growth Boundary (UGB) grow in Eugene amidst housing shortage concerns, perhaps planners can instead look inward at the underutilized land within the UGB. Eugene's comprehensive plan, Envision Eugene, calls for an increase in the amount of multifamily housing available within the city:

> Eugene's residential land supply has been established based on analysis that shows Eugene residents will have greater demand for more multifamily housing than they have in the past, as well as trends towards greater density and more diverse housing types that will provide for the needs of households at all income levels (Envision Eugene, 2023).

Thus, it is clear that residents in Eugene desire an increase in the amount of high-density, affordable residential developments.

However, developable land within Eugene's UGB is seemingly sequestered in mostly vacant parking lots, including the Target parking lot. Identifying these areas, therefore, exposes land awaiting redevelopment. Before further expansion of the UGB, which would contribute to accelerated sprawl, planners should examine the land reserves currently trapped within idle parking lots. The redevelopment of this land would offer economic benefits to landowners and produce numerous tangible benefits to the community, including an increased housing supply, higher density developments, and improved urban form. Critically, the Target parking lot and all developments along West 11th Avenue are situated on the Lane Transit District's Bus Rapid Transit Line (BRT), adding to its value and compounding the scale of missed opportunities. Land along BRT services is perfect for new, higher-density housing projects, especially those that target lower-income individuals who rely on public transportation or do not require as many onsite parking spaces. Moreover, Transit Oriented Development (TOD) residents drive less than those living in non-transit supportive locations (Noland et al., 2014). Reductions in vehicle-miles traveled contribute to lower energy demands, which has economic and environmental benefits (Noland et al., 2014).

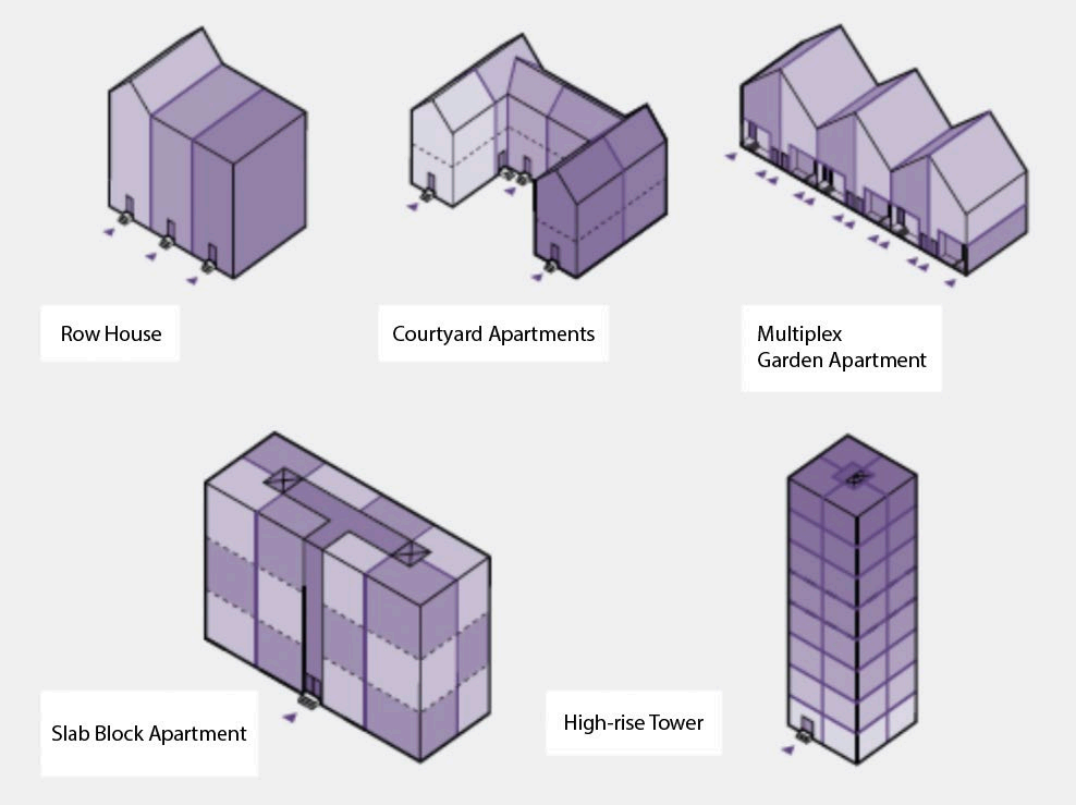


Figure 22: Renderings of typical middle housing types (Larco & Knudson, 2024).

Looking more specifically into how the Target's parking lot can be repurposed, an investigation into the feasibility of new development is warranted. In terms of housing, even the minimal and moderate reduction options generate enough space for high density housing. The Sustainable Urban Design Handbook (2024) presents an overview of housing types targeted at infill development that satisfy demands for missing middle housing. Using the information presented by Larco & Knudson (2024), I calculated the typical lot size for the four highest density housing types: Row House, Multiplex Garden Apartments, Slab Block Apartment, and High-rise Tower. Figure 22 presents renderings of each of these types. Row Houses have a typical net density of 11-25 dwelling unit/acre (du/ac) and a typical lot size of about 3,000 square feet or 0.69 acres. Multiplex Garden Apartments with a density of 12-55 du/ac sit on approximately 0.4 acre lots. Slab Block Apartments that have a net density of 70-100 du/ac, only

need about 0.6 acres. Finally, High-rise Towers with densities of 100-150 du/ac need lots that are approximately 140’ x 240’, or a total of 0.77 acres. The moderate redevelopment option for the target parking lot produced 106,870 square feet (2.45 acres) of land. Thus, it is clear that any of these middle housing types would cover less than half of the underutilized Target parking lot. Even when employing the minimal reduction option, which frees up about 2.2 acres of land, it is evident that this land holds significant housing possibilities. Knowing this, the sheer potential of this land is apparent.

In addition to potential housing uses, many other types of infill developments hold potential. Allowing this land to be used commercially could help revitalize the area and make it more attractive as a commercial center. Currently, most people who shop on West 11th Avenue do not walk between stores or experience the area on foot; instead, they drive from parking lot to parking lot to complete their errands. Allowing other retail stores to take over this underutilized parking space, and therefore raising the area’s density, would promote better urban form, expand pedestrian safety, and generate economic gains for the surrounding retailers. Studies show that increased foot traffic promotes economic gain, as consumers are more likely to spontaneously enter stores or restaurants when not trapped inside their vehicles (Shoup, 2011). Additionally, reducing the size and quantity of parking lots along this street and replacing them with high-density housing or stores would decentralize the personal vehicle as the dominant mode of transportation and encourage the use of public and active transportation. Furthermore, the implementation of mixed-use developments and green space would benefit not only the economic development of this area, but also its urban landscape (Figure 23 provides a rendering of what this parking lot could look like if redeveloped). This would promote a more vibrant and

livable community. Thus, these underutilized parking lots hold a number of potential uses if redeveloped.

Figure 23: A rendering of what the Target parking lot could look like if the South side of the lot was converted into an apartment complex.

Current Parking Reform

As Oregon moves into a new era of parking policy, thanks to the Climate Friendly and Equitable Communities program, newly proposed developments will face a cap on the maximum number of parking spaces they can provide. This fundamental change will hopefully promote smaller parking lots and higher-density development. However, these reforms do nothing to target existing, underutilized parking infrastructure. This is a critical shortcoming of parking reform that must be addressed. Even with the adoption of CFEC in Eugene, discussions about measures to reform the existing desolate parking lots across the city do not occur, stressing the importance of parking studies like this one.

The Leaky Roofs and Patchwork Solutions of Current Parking Reform

When your roof springs a leak, your immediate response is likely to address the root cause. You might temporarily place a bucket under the leak to mitigate the problem until you can patch up the hole. Eventually, you might even replace the entire roof to prevent future leaks. However, if water has already seeped into your home, it will have damaged your furniture, walls, and floors. Consequently, addressing the root problem does not automatically rectify the damage already caused inside the house. While patching up the roof can prevent further leaks, it cannot undo the damage already inflicted by the water. Moreover, there is no way to know if the patchwork you did on your roof will hold the next time it rains.

Broad parking reforms can be likened to the temporary patch applied by urban planners to the issue of excess parking. While effective at curbing the additional waste of land within cities, these reforms do not correct the harm caused by decades of misguided parking policy. Broad parking policy reform, which includes removing or reducing minimum parking requirements, represents a critical first step in tackling this problem. However, to fully remedy the problem, additional actions are needed to effectively repair the internal damage caused by past policies.

To truly correct the consequence of decades of overbuilt parking infrastructure and wasted land, planners must not stop at simply patching up the leak. Instead, they should address the damage by critically examining existing parking lots and by conducting post-occupancy parking studies to identify areas needing reform. Moreover, as new policies are implemented, local parking studies are crucial in analyzing the accuracy of these new parking demand estimates to ensure the cycle of excess parking does not continue. Therefore, it is important that parking reform does not end at the city or even county level. Local impact studies illuminate

what these board policies and studies do not: where underutilized, developable land exists within city boundaries. Once these areas are identified, cities can begin to amend the adverse effects of parking minimums through infill development and the repurposing of land.

Currently, Eugene and other cities across Oregon find themselves at the crossroads of historic parking reform. The Climate Friendly and Equitable Communities Program will revolutionize parking requirements, facilitating a much-awaited reduction in the number of parking spots required for new developments. However, this approach to parking reform exhibits traits associated with patchwork fixes. While certainly a critical first step, CFEC does not address the internal damage that already exists within Oregon cities. Thus, it is important not only to recognize and fix the root cause of excess parking and sprawl but also to understand where it exists and how previously developed lots not targeted by these reforms can be rectified.

Recommendations

With this discussion and the results of my study in mind, I provide three broad recommendations for city planners: (1) conduct post-occupancy parking studies and adjust policy based on the results, (2) redevelop underutilized land, and (3) penalize landowners who possess large, underutilized parking lots. Figure 24 summarizes this process. These recommendations are organized into three categories, weak, moderate, and broad, based on feasibility of implementation and potential impact.

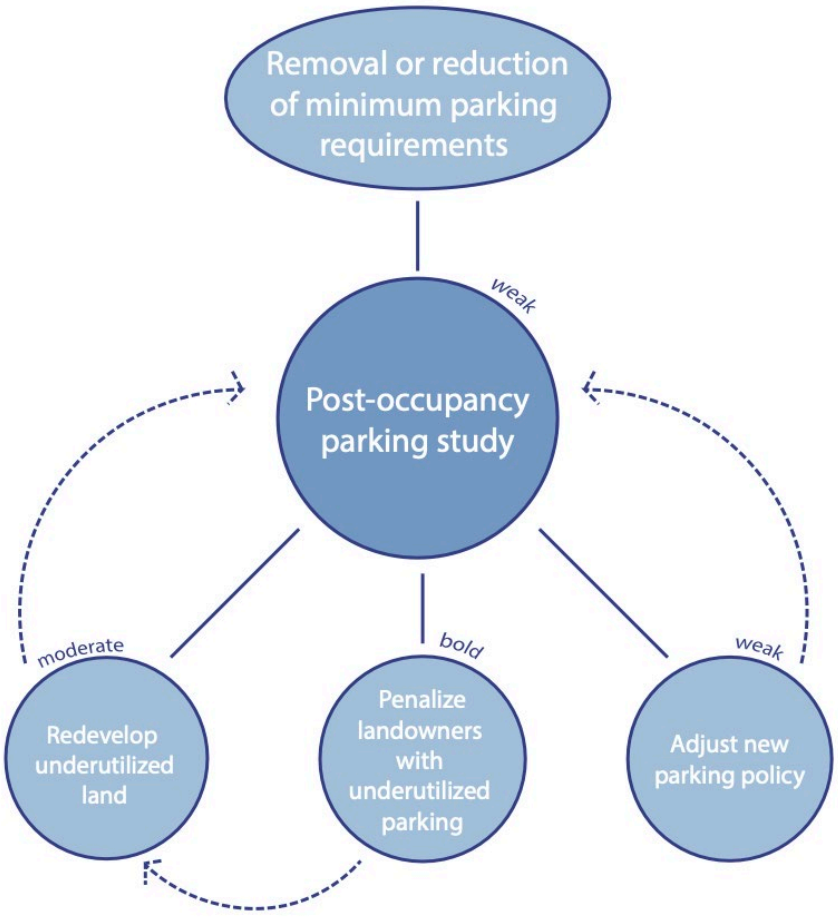


Figure 24: Summary of recommendations and their associated aggression level.

Weak Recommendations

As illustrated in Figure 23, my recommendations are all interconnected. Once broad parking reform occurs, as is the case across the state of Oregon, localized parking studies are necessary. Therefore, at the very least, I recommend that cities conduct post-occupancy parking studies semi-regularly. While extremely simple, most cities and planning departments do not conduct research on existing infrastructure. It is not enough to simply reform parking minimums at the city, county, or state level because the overallocation of parking has already happened. Just this single study identified approximately two acres of underutilized and potentially buildable land within the UGB. If studies like this were commonplace or even required, there is no telling how much buildable, but not on the market, land would be uncovered.

Thus, it is also necessary that planners analyze the utilization of existing parking infrastructure. Traditionally, once a parking lot is built, planners do not re-examine it until a developer files plans to alter the site's use. Even then, parking demand and use are not investigated, and the developer simply updates the parking lot based on the new parking requirements. This historic lack of attention to parking lots compounds the adverse effects of minimum parking requirements. Thus, cities cannot fully reform their parking policy without understanding how these policies impact local development.

Currently, however, parking studies that target specific developments are exceedingly rare, if they even occur. Furthermore, these kinds of studies are not included in anyone's job description, reducing the likelihood that they will occur. Therefore, I recommend that post-occupancy parking studies that investigate the efficacy of current parking policies are mandated. At a minimum, I recommend that these studies are mandated for developments with exceedingly large parking lots that hold the potential to be redeveloped. While it is easy to understand why

these studies are not commonplace, as they are time-consuming and tedious, they are extremely impactful. Considering these challenges, it is possible to outsource these parking studies if necessary. For example, local planning departments can partner with a local university class to have students perform these tasks or they can hire interns to complete these studies to reduce costs.

Importantly, the results of these studies should not be locked away in the back of a filing cabinet. Instead, they should be analyzed, and their information should contribute to an updated parking policy. Rigid parking policy directly contributed to the car-dependency and suburban sprawl cities face today. Thus, to truly break out of this cycle, the parking policy undergo continuous adjustment. Land-use and zoning codes should also be re-examined to ensure that higher density commercial and housing redevelopment is permitted, especially in areas close to high frequency transit and high-quality bicycle infrastructure. While the parking reform outlined in CFEC is a historic first step, planners must not stop there. At the very minimum, parking studies and updated policies to reflect ever-changing community needs should be commonplace or even required.

Moderate Recommendations

The next step in parking reform includes increased education and support for landowners who wish to redevelop their idle parking lots. Once an underutilized lot is identified, I recommend that the results of the post-occupancy parking studies be sent to landowners, along with educational information about the redevelopment process and potential options. As mentioned previously, performing parking studies on all developments within a city is not feasible. Thus, planners should target the largest and seemingly most underutilized parking lots. Ultimately, this recommendation does not provide direct redevelopment incentives but grants

assistance and education and allows the developer to decide what to do with their land. Similarly, another possibility includes providing incentives for financing. By dividing up parcels of land, where underutilized parking occurs, interested developers could buy a portion of these parking lots, rather than necessitating that the current landowner redevelops the land. This would lessen the burden on current landowners who do not wish to redevelop their land and provide financial incentives for the transfer of underutilized lands to new developers.

Furthermore, reducing barriers within the permitting and planning process provides indirect incentives for redevelopment. This includes fast-tracked permitting approval and reduced permitting fees. This recommendation can be viewed as the "carrot" in the carrot and the stick metaphor. By reducing the burden of the site development process, planners can further encourage the revitalization of underutilized parking lots. Moreover, it is important that once new developments are built, post-occupancy parking studies continue to ensure that the new parking policy accurately reflects demand and should be updated accordingly.

Public outreach and education are also exceedingly important as cities remove parking minimums. To prevent developers from simply building parking lots to reflect the new maximum, a fundamental shift in the way the public views parking is vital. The average American has been conditioned to view access to free off-street parking close to their destination as an intrinsic right. Therefore, combatting this narrative, educating the public on the vast amount of underutilized land, and describing the benefits of reduced parking is necessary in changing the way American cities are built in the long run. Public education can take the form of pamphlets, planning meetings, or community engagement events. Moreover, this education will alleviate resistance to further parking reform, allowing planners to implement the necessary "sticks" to alter urban landscapes for good.

Bold Recommendations

Finally, I recommend that landowners be penalized if their development contains a large quantity of underutilized parking. This could take a couple of different forms, and the severity of this penalization is up to the city's discretion. One option includes an underutilized parking tax that is placed on landowners whose parking utilization rates do not exceed a certain threshold (i.e., an average of 50%). This threshold can be altered depending on the level of aggression planners wish to apply within their parking reforms. Placing a tax on empty parking lots would incentivize the redevelopment of surface lots, increasing an area's amenities and density. This idea operates similarly to a land value tax system (LVT). A detailed overview of tax systems is beyond the scope of this thesis. However, I will provide a brief overview. Kepner and Mattoon explain that:

> Pure land value taxes, in comparison, are taxes on the value of land, excluding any improvements to the property (...) Under a pure land value tax system, an empty lot of land would be taxed at the same rate as neighboring, equivalent parcels with homes on them. Removing a tax on improvements removes the disincentive to develop improvements on land (Kepner & Mattoon, 2023).

Land value taxes discourage land speculation and limit urban sprawl because taxes are placed on the land rather than any improvements or developments made on top of the land (Clanton, 2023). Therefore, landowners are not disincentivized to develop their land and instead are provided tax incentives to redevelop underutilized surface lots. It is important to note that this tax system is largely untested in the United States. However, Detroit is set up to become the first major city to implement a land value tax system on a significant level (Clanton, 2023). Thus, cities and planners grappling with how to redevelop idle parking lots should keep an eye on this experiment.

Another option includes some kind of adjusted property tax that assesses the parking rate tax, regardless of occupancy, at a higher rate. Importantly, this tax structure would include two

different tax rates, one that is placed on development and a higher one levied on the development's parking lot. By effectively separating the cost of parking from the cost of development, the so-called "hidden costs" or parking, which are currently imposed upon consumers through the increased price of goods, services, and homes, are instead placed on landowners and developers (Shoup, 2011). This could provide a financial incentive for reducing parking lot sizes and encourage alternative uses, as landowners would incur a higher cost for parking. Furthermore, lower rates could be used on certain uses, including city related uses.

My recommendation to tax underused parking lots aims to provide similar effects as land value taxes and adjusted property taxes. However, either option presents pros and cons. For instance, an underutilized parking tax requires more oversight because parking studies are necessary to enforce the tax and successfully nudge landowners to develop unused land. Conversely, a land value tax can be implemented more broadly and, therefore, requires fewer resources for implementation. In any case, the main goal of this recommendation is not to outline a specific tax system but rather to encourage the penalization of landowners with large, idle parking lots. Any system that disincentivizes developers from sequestering land in empty parking lots and penalizes the ones that do would have the desired effect. It is important to note that while taxes that increase the relative cost of owning land are historically unpopular, taxing land is a progressive move that can help combat the lasting impacts of minimum parking requirements. Thus, planners and policymakers should not shy away from the penalization of underutilized parking lots in the face of resistance, as they are uniquely situated to dictate the future of their urban landscapes and to create more livable, vibrant cities.

Conclusion

The results of this thesis are simple and not entirely surprising. It is widely accepted that huge swaths of paved land sit idle in our cities, yet post-occupancy parking studies almost never occur. Large, empty surface parking lots present a host of negative consequences felt by all within a community, from reduced safety to increased consumer costs. For decades, minimum parking requirements harmed everyone while benefiting no one. Today, as we shift into a new era of parking policy and reckon with the lasting impacts of parking minimums, it is the planners' job to ensure their communities are safe, livable, and vibrant. A vital first step in revitalizing American's urban landscapes and combatting the pressing issues faced by cities in the 21st century, including climate change and amplified socio-economic disparities, is the redevelopment of wasted land and the decentralization of the personal vehicle.

Therefore, I argue it is essential that planners be required to perform parking studies and continuously update parking policies to ensure their accuracy. While this may seem bold, this is merely a starting point in undoing the years of accelerated urban sprawl and the deterioration of urban landscapes at the hands of parking minimums. The results of my study clearly show that vast amounts of developable land exist within Eugene's Urban Growth Boundary, land that can be harnessed to provide affordable housing, increase economic activity, and reduce car-dependency. Without additional parking studies and actions taken after broad parking reform, planners cannot adequately assuage the widespread, detrimental effects of minimum parking requirements that persist within cities. Thus, updated parking policies hold the key to establishing more equitable, sustainable, and lively cities. Each recommendation listed in Table 3 is feasible, as long as planners are committed to aggressive parking reform.

Level of Aggression	Recommendations
Weak	Require post-occupancy parking studies for the largest, most underutilized parking lots.
	Update parking policy based on results of parking studies.
	Ensure land use & zoning codes allow for higher density commercial and housing redevelopment, especially in areas close to high frequency transit and locations of existing or planned high quality bicycle infrastructure.
Moderate	Provide redevelopment support & education for developers through fast-tracked land development permitting.
	Conduct public outreach and education about parking policy.
Bold	Penalize landowners with large, underutilized parking lots through taxes to encourage development.

Table 3: Summary of recommendations discussed in the previous section. Each recommendation is categorized into three different categories based on their level of aggression. The categories are weak, moderate, and bold.

Ultimately, if planners want to revitalize land sequestered in empty parking lots, implementing these recommendations is a necessary first step. Through the implementation of these suggestions, planners can effectively combat the lingering impacts of historic parking policy, even after widespread policy reform. Encouraging the redevelopment of underused paved land offers the opportunity to rebuild American cities to better fit community needs, desires, and wants. However, current car-dependency and automobile-oriented development acts as an insurmountable barrier to equity and vibrance. Thus, I cannot overstate the importance of aggressive parking reform and the incentivization of redevelopment. For instance, how can we be sure broad parking reform, including the statewide Climate Friendly and Equitable Communities program, is effective without consistent parking studies to monitor progress? The answer is we can't. We cannot fully grasp the success of new parking policy, or update it as

needed, without this information. Thus, we cannot ensure that the cycle of overbuilt parking and deteriorated urban form will not continue unless we push planners to do better.

Furthermore, while the removal or reduction of minimum parking requirements represents a great initial improvement, we must not stop here. The consequences of historic parking policy, in the form of empty, unsightly paved parking lots, persist within cities today. These lots will continue to linger, and with them the remnants of decades of misguided parking policy, unless we demand more. Developers must be incentivized to redevelop underutilized parking lots into uses that better serve our communities. Without the restoration of these desolate expanses of concrete, planners cannot create vibrant, equitable, and livable cities. Therefore, as we approach a pivotal juncture marked by the escalating climate crisis and social inequality, planners must exert every effort to reduce reliance on cars and rejuvenate urban landscapes, beginning with simple parking studies.

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