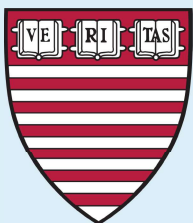




CURB SPACE AND ITS DISCONTENTS

Evaluating and Allocating New York City's Curbs



A Policy Analysis Exercise for the New York City Department of Transportation

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Submitted to the Harvard Kennedy School in partial fulfillment of the requirements for the degree of Master in Public Policy. This PAE reflects the views of the author and should not be viewed as representing the views of the New York City Department of Transportation, nor those of Harvard University or any of its faculty.



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EXECUTIVE SUMMARY

THIS REPORT was completed for the New York City Department of Transportation (NYC DOT), the agency that operates and maintains the public rights-of-way in New York City, including streets, sidewalks, bridges, tunnels, and more. Among its many responsibilities, NYC DOT manages curbs, deciding who can use them, when they can do so, what rules govern that usage, and how much (if anything) it might cost.

THE PROBLEM: DEMAND FOR THE CURB IS DYNAMIC AND GROWING. THE SUPPLY IS FINITE.

NYC DOT's curbs – all 11,468 miles of them – are an incredible asset. It is on the curb that New Yorkers can catch a bus, hail a cab, park a car, lock up a bike, drop off a package, grab a bite to eat, and so much more. The humble curb can enable commerce, movement, recreation, beautification, and access to the infinite opportunities in a city as vast as New York. Yet while the potential uses of the curb are almost infinite, the supply is not.

I explore three facets of that underlying problem in this report.

- I. **Relative to the demand, a disproportionate share of NYC's curb space is free parking.** The two thirds or more of curbs available as free parking provide a significant benefit to the individuals who can take advantage of it. However, free parking also has negative consequences for the rest of the city's residents, including emissions, deaths from vehicle collisions, and inadequate access for the many New Yorkers who rely on other modes like biking, walking, and public transit.
- II. **Curb space in New York City is increasingly contested.** As new transportation modes like ride-hailing have dramatically grown, the demands on the curb have become even greater. The Department must weigh whether to allocate space on the curb to any of the many possible uses, old and new alike.
- III. **Changing the allocation of the curb is difficult.** Because the curb is so valued, people who benefit from the status quo loudly oppose any changes to curb space allocation. Even when officials successfully repurpose free parking into another curb use like bike lanes or loading zones, they face challenges of enforcement, evaluation, and scaling.

METHODOLOGY

This report's qualitative findings are based on twenty interviews with US transportation professionals in New York City and elsewhere, as well as a review of curb management best practices.

Quantitative findings rely on extensive analyses of existing curb allocation inventories, NYC travel patterns, neighborhood-level data from the US Census, and observational data on curb-usage patterns.

RECOMMENDATIONS: NYC DOT CAN REALLOCATE CURBS TO INCREASE PUBLIC VALUE.

I identify three categories of recommendations for NYC DOT.

First, NYC DOT should more systematically evaluate one use of the curb against another. Even with significant gaps in the data, officials can evaluate the impacts different curb uses have on mobility, health, safety, environmental sustainability, and economic vitality. These comparisons provide useful insights and should inform internal agency deliberations over where, and how, to allocate the curb. I propose an illustrative framework, focusing on six uses of the curb, evaluated in neighborhoods across the city's five boroughs. There

***Recommendation 1 in Practice:** NYC DOT should use a systematic framework to inform agency deliberations and messaging. While free parking leads to negative outcomes across neighborhoods, uses such as waste collection are valuable in high-density areas like Morris Heights but not in less dense areas like St. George.*

are crucial differences in these costs and benefits, as well as their distribution, between different parts of the city, with uses like waste collection having greater value in dense contexts but uses like Neighborhood Loading Zones having high value across the city.

Second, NYC DOT should allocate its curbs to maximize the usage of this valuable asset. Using the framework of this report, I identify strategies the Department can use to combine curb uses in ways that maximize benefits. These include locating on-street bike parking at the end of the block to increase visibility in intersections for pedestrians and drivers alike. I also identify curb uses, like pick-up and drop-off zones, that provide high numbers of uses per foot of allocated space, as well as demand management strategies to mitigate against any reductions in parking availability.

Recommendation 2 in Practice: NYC DOT should combine active uses, e.g., by using bike corrals to “daylight” intersections. When re-allocating parking, though, DOT should rely on demand management techniques like pricing and information sharing.

Third, NYC DOT can take actions today that will increase the likelihood of success when reallocating the curb. The Department can make more non-parking uses of the curb into standard operating practices, leveraging the examples of curb-prioritization hierarchies in Seattle and San Francisco. This would minimize the threshold required to implement a new policy, while also providing officials with greater support when making the case for a reallocation opposed by a vocal minority. NYC DOT can also design its curb use practices in ways that increase their enforceability, such as by standardizing policies and minimizing unnecessary complexity. Finally, NYC DOT should strive to collect additional data on existing curb usage. This would enable evaluations of current practices and allow the Department to better understand the impacts of changes when they are made.

Recommendation 3 in Practice: NYC DOT can leverage existing frameworks to inform its own hierarchy of the curb, but additional data collection would help to bolster the case for change. Across its curb uses, the Department should also emphasize enforceability, e.g., by unifying operating hours for the Neighborhood Loading Zones program if expanded citywide.

CONCLUSION: THE REWARDS OF REALLOCATING THE CURB ARE WORTH THE EFFORT.

New York City, like many of its peer cities around the globe, aims to reduce carbon emissions, improve safety, and enable mobility and commerce. NYC DOT has an integral role to play in each of these objectives through its stewardship of the city's curbs. However, managing the curb toward those goals is challenging. The emergence of new transportation modes like ride-hailing and shared bicycles have placed increased strain on an already contested space. The potential deployment of tomorrow's transportation technologies, such as autonomous vehicles, could make that contest even greater.

Without large-scale reforms, free parking will almost certainly continue to be a predominant use of the NYC's curbs in the coming years. Even without making such wholesale changes, though, the Department can and should strive to shift the balance, by reallocating some of the space currently allocated to free parking to other functions. Changing the status quo of the curb is no easy task, but just because it is difficult does not mean it is not worth doing. By re-prioritizing its curbs, away from free parking and toward more active and equitably accessible uses, the Department can make the city a safer, healthier, greener, and more vibrant place for *all* the people who call New York City home.

INTRODUCTION

THE CONTEXT OF THE CURB

PROBLEM: DEMAND FOR THE CURB IS DYNAMIC AND GROWING. THE SUPPLY IS FINITE.

NEW YORK CITY'S CURBS – all 11,468 miles of them^{a,1} – are an incredible asset. The New York City Department of Transportation (NYC DOT) controls these curbs, as well as what New Yorkers can do in the road space running alongside the curb. The Department has an enormous number of options at its disposal, including general travel lanes, dedicated lanes for bikes or buses, bus stops, pick-up and drop-off zones, seating areas, bike racks, electric vehicle charging stations, and so many more.

To many, however, the curb is synonymous only with on-street parking, and free parking most of all. It is by far the most dominant use of the curb. The two thirds or more of curbs available as free parking provide a significant benefit to the individuals who can use it. It even informs how people speak about the curb, such as when they reference the number of “spaces” on a given block, vs. the available number of feet.

In many cases, though, free parking is not the highest and best use of NYC's curbs. This conflict, though longstanding, has been debated more openly in recent months. One of the city's Community Boards,^b representing the Upper West Side, passed a resolution calling for NYC DOT to assess alternate uses of curb space.² This independent study is not a response to that request. However, the willingness of an elected body to broach this topic shows that the terms of the debate may in fact be changing.

As I argue in this report, such a change would be for the better. NYC DOT must make difficult choices every day about how its curbs should be allocated, and to whom. These choices are only becoming more complex as demands on the curb, such as ride-hailing, continue to grow. And while the Department has an enormous supply of curb space at its disposal, it cannot serve every possible use in every possible place.

MOTIVATING QUESTION: HOW CAN NYC DOT EVALUATE THE CURB?

Making these choices requires an understanding of the options available. Thus, in this report I propose an answer to four related sets of questions posed by NYC DOT:

1. What are the public and social costs and benefits of on-street parking? What metrics can be used to evaluate these costs and benefits? How are these costs and benefits distributed?
2. How do the costs and benefits of alternative uses of the curb compare to those of free parking?
3. How would these metrics vary across neighborhoods within New York City?
4. What would the impacts be of reallocating curb space? How could this be done to maximize the relative benefits and minimize any relative costs, keeping in mind the distribution?

a NYC DOT owns 5,734 miles of streets. I assume that each street has an applicable “curb” on both sides.

b Community Boards are a local representative body of New York City government, with members appointed by the Borough President of the respective community. There are 59 Community Boards in total across New York City, each of which are responsible for advising New York City public officials on local concerns and perspectives.

METHODOLOGY: A MIXED-METHODS APPROACH

QUANTITATIVE METHODS

I collected and analyzed data on current curb usage patterns, curb usage intensity, and how both relate to geographic and demographic factors. I relied on a mix of publicly available datasets, information from NYC DOT and Coord,^c and direct observation.

The findings of the report rely on a variety of analyses, including:

- **Understanding the Current State of the Curb:** I analyzed inventories of existing curb use rules, leveraging data from NYC DOT and Coord, to develop profiles of curb usage in select NYC neighborhoods.
- **Developing Metrics to Evaluate the Curb:** I synthesized existing quantitative frameworks to develop proposed metrics on the value of different uses of the curb. I also conducted data collection and analysis of curb usage behaviors for a subset of curb-allocation types to address gaps in prior work. Finally, I analyzed NYC-specific datasets to inform local adjustment factors for the proposed quantitative metrics. These include the NYC’s lot-level land use data and results from citywide mobility surveys.
- **Identifying the Distribution of Costs and Benefits Based on Curb Use:** I evaluated NYC mobility survey data and US Census data to understand existing mobility patterns and how these vary by geography, including through analyses of the American Community Survey 5-year estimates and the Census Bureau’s Public Use Microdata Samples to inform more granular analyses of sub-geographies within New York City.

Quantitative Analyses Relied on a Blend of Curb Use Inventories, New Data Collection, and the Context of NYC

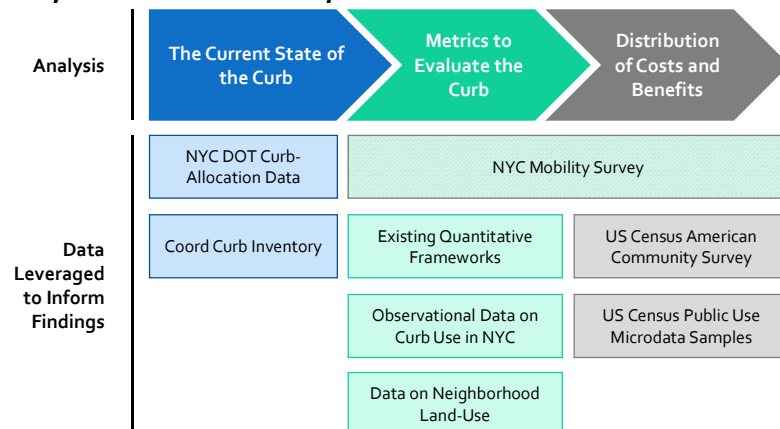


Figure 1: Overview of quantitative analyses and data

Appendices C, D, E, F, G, and H include more details on various components of these analyses.

QUALITATIVE METHODS

I interviewed more than a dozen NYC DOT staff, as well as relevant officials in other peer cities, to understand current curb management practices, identify criteria and metrics currently used to inform curb allocation, and understand gaps this report should seek to fill (see Appendix A). I have included case studies on several of the cities in Appendix B.

I also conducted a review of the available literature on curb-management, including both qualitative evaluation frameworks and best practices (see Appendix I).

^c Coord compiles information on existing curb allocations. It uses that information to provide services to government agencies and private organizations like delivery companies that rely on access to and information about the curb.

THE PROBLEM IN CONTEXT

A DISPROPORTIONATE SHARE OF THE CURB IS FREE PARKING

THE SUPPLY: FREE AND METERED PARKING DOMINATES

THE POSSIBLE USES OF THE CURB are nearly infinite. But the supply of curb space simply is not. For example, on Manhattan's Upper West Side, there are roughly 54 miles of curb space³ to serve all the needs of the neighborhood's 134,000 residents.⁴ If every UWS resident had their own piece of the curb, that would amount to a little over 2 feet per person, barely enough to park a bicycle, and certainly not enough to fit a personal vehicle or a delivery van.

Of course, curb space is *not* allocated individually. Instead, the city divides it into a variety of different usage zones, many of which serve various purposes over the course of any given day (and many of which change based on the day of the week). This includes bus stops, car parking, bike lanes, loading zones, and many more.

As in all American cities, parking dominates New York City's curbs, and free parking most of all.^d Outside of the central business districts (CBDs) of Midtown and Lower Manhattan, free parking is by far the most common use of the curb. Even in CBD zones, paid parking is widespread.

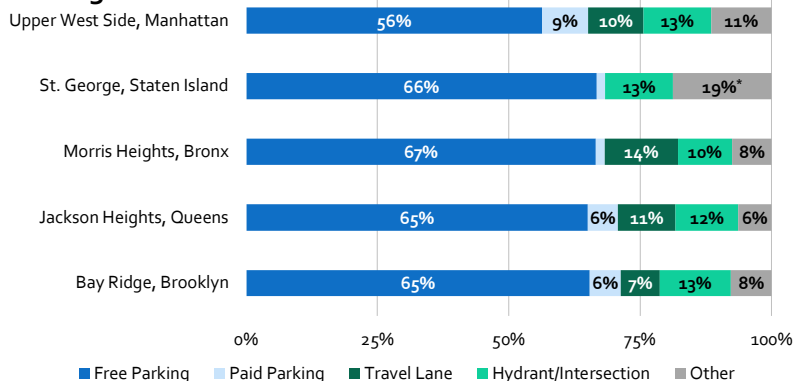
So how much on-street parking is there? The precise number of on-street spaces in the city is unknown, but estimates range from 3 million⁵ to 4.4 million.⁶ Approximately 85,000 of those are metered.⁷

That parking takes up a great deal of NYC's curb space. If NYC's 5,734 miles of roadways⁸ each have curbs on either side, that would give the Department 11,468 miles of curb, or 3.03 million possible 20-foot parking spaces. Even with the more conservative estimate of total parking, that would account for more than 99% of available curbs.

As a share of available curb space, this figure is almost certainly too high – the amount of curb space dedicated to travel lanes alone exceeds 1% of all curb space – but the magnitude of parking in comparison to the available supply is instructive. To generate a more precise estimate, I examined parking rules in five of the City's Neighborhood Tabulation Areas (NTAs),^{e,f} with results in Figure 2.

These neighborhoods, which are also the focus of the curb-evaluation frame-

Most of the Curb Space in New York City Neighborhoods Is Free Parking



* Curb rules in St. George appear to have been formatted differently than in other neighborhoods, with travel lanes categorized indistinguishably from the uses included in "Other". This does not appear to have impacted the overall balance of free parking or paid parking, however.

Figure 2: Allocation of curb space in select New York City NTAs

^d In some cities, although not NYC, residents pay a fee to park their cars on the street, ranging from \$25 to \$100 or more annually.

^e See Appendix H for a summary of my methodology.

^f Neighborhood Tabulation Areas are geographic subareas of New York City defined by the NYC Department of City Planning.

work presented in later sections, are not necessarily representative of NYC as a whole, and may have lower shares of free parking than the aggregate city due to a combination of higher density, greater transit infrastructure, and more.⁹ Even with those caveats, in each of these neighborhoods, free parking takes up at least an absolute majority of all available curb space, with an additional 2-9% dedicated to paid parking that converts to free parking overnight. With travel lanes, fire hydrants, and intersections taking up much of the remaining curb space, all non-parking uses must fit into as little as 6% of total curb space.

After accounting for parking, travel lanes, fire hydrants, and intersections, all non-parking uses must fit into as little as 6% of total curb space.

THE DEMAND: PARKING IS IN HIGH DEMAND, BUT OTHER USES ARE AS WELL

On any given day, almost every resident of New York City will likely use the curb in some way. They might board a bus, pick up a Citi Bike docked on the street, step into a taxi, or park their own car. They might have a package delivered by a truck parked on the curb, or they might visit a business that used the curb to unload its goods earlier that morning.

Although data on every possible demand for the curb are scarce, there are statistics on the share of households that own vehicles. These data show free parking receives a far greater share of curb space than its demand would suggest.

On-Street Parkers Are 30% or Less of Households, but They Take Up 56% or More of All Curb Space

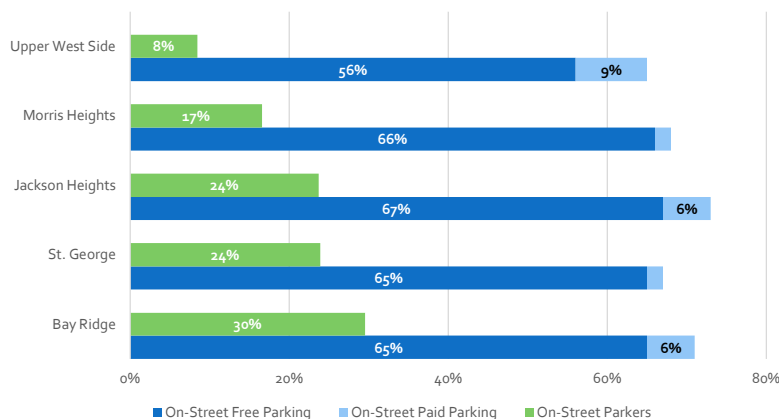


Figure 3: On-street free parking as a share of curb space vs. on-street parking households as a share of total households

Bay Ridge has the highest share of households that are direct beneficiaries of free on-street parking, at 30%. In the remaining neighborhoods, that share is 25% or less.ⁱ

Citywide, approximately 45% of households own vehicles. Returning to the Upper West Side, that share is much smaller – only 27% of households own a vehicle.⁹ Many of those car owners park off-street, such as in a garage, but thirty percent or more park on the street.^{h,10} Keeping in mind the curb allocations identified above, that means that 56% of the curb is dedicated to the use of less than 10% of UWS households. The pattern is similar in the other neighborhoods considered. Bay Ridge has the highest share of households that are direct beneficiaries of free on-street parking, at 30%. In the remaining neighborhoods, that share is 25% or less.ⁱ

As Figures 2 and 3 show, the curb space allocated to non-parking uses does not match up to the share of the population that relies on them. Furthermore, the number of those uses has grown rapidly. That increase in the diversity of usages mirrors an increase in demand for the curb.

Three increases are emblematic of this larger trend.

^g See Appendix F for a profile of these neighborhoods.

^h The Upper West Side falls within the “Manhattan – Core” subsection of the city for purposes of its yearly mobility analysis. However, it is on the outer edge of that zone, and is likely somewhat similar in demographics and composition to the “Northern Manhattan” subzone, which has an on-street parking rate of greater than 60%.

ⁱ As with the analysis of the Upper West Side, I took the household vehicle ownership rate for each of the respective NTAs and multiplied it by the on-street parking rate from New York City’s 2018 Mobility Survey for the broader “Survey Zone” of which the NTA is a part.

First, New York City's population is growing. Since 2000, NYC has grown by 390,000 residents, from 8.01 million in 2000¹¹ to an estimated 8.40 million today.¹² Each of these new residents represents additional demand for the many different uses of the curb. Although the NYC DOT does occasionally make modest increases to its total curb space,^j its road and curb network is essentially complete.

Second, there are now far more pick-ups and drop-offs of both people and goods than even ten years ago. For Hire Vehicle (FHV) trips have increased from 500,000 per day to more than 1,000,000.¹³ There have also been increases in freight traffic due to deliveries, including a significant expansion in deliveries made by personal vehicles, each of which requires a time and a space at the curb (or leads to double parking in a travel lane).¹⁴

For Hire Vehicle Trips in New York City Have More Than Doubled Over the Last Decade

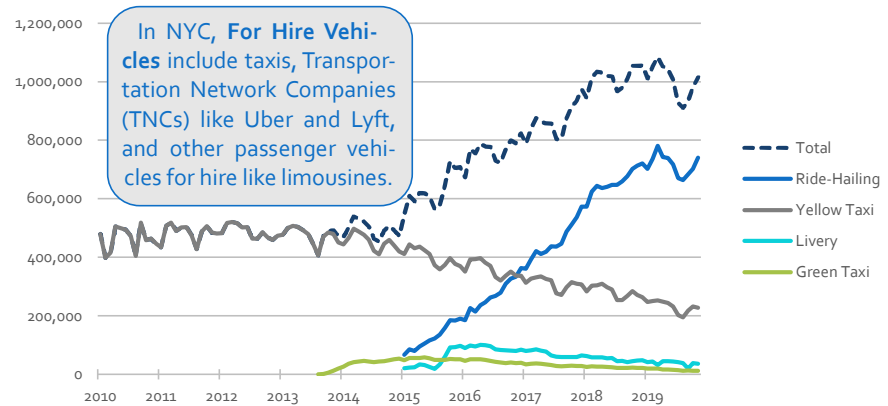


Figure 4: For Hire Vehicles, trips per day

Third, other non-car modes, like bicycling, have also increased dramatically. NYC DOT estimates there are roughly 500,000 daily bicycling trips, up from 150,000 per day in 2000.¹⁵ Riders now take more than 50,000 trips per day on Citi Bike bicycles, many of which start or end at docks located in the curb lane.¹⁶ Further, while cycling has increased in many US cities, the pace of expansion has been higher in NYC than elsewhere – from 2012 to 2017, the share of New Yorkers who cycle to work grew almost twice as fast as it did in other major US cities.¹⁷

Citi Bike is New York City's bike-share program. Users pay to check out a bike for a set period of time, and can return it at any of the system's 800+ docking stations.

THE RESULTS: FREE PARKING IS NOT THE HIGHEST AND BEST USE OF THE CURB

Although these disparities are striking, the disproportionate allocation toward free parking is not necessarily a bad use of scarce resources. After all, it might be the case that parking, and free parking in particular, deserves its disproportionate share based on other factors – the mobility enabled, or the effect on neighborhood attractiveness, or the fact that other uses of the curb are simply not good investments of public assets. But is that the case?

The available literature says otherwise. In his seminal work, *The High Cost of Free Parking*, UCLA scholar Donald Shoup outlines the many negative consequences of providing free (or underpriced) parking, from incentivizing drivers to circle the block in the hopes of finding a free space, to increasing the likelihood that people will commute by car vs. a more sustainable mode. Shoup recommends cities begin to charge for parking at spaces that are currently free, as well as to increase the price for paid parking spots to the point where there is typically at least one open space on a block. This would reduce the “cruising” for parking, which he estimates can account for 30% or more of traffic on a given block.¹⁸

“Cruising for parking” refers to the common practice of driving around the block to find an open space, particularly when on-street parking is free and off-street parking is not.

^j For example, in rare and infrequent developments like Hudson Yards, where land is reclaimed as functional and developable space.

What about comparing parking – free or paid – to other possible uses? In recent reports, the National Association of City Transportation Officials (NACTO),¹⁹ the Institute of Transportation Engineers (ITE),²⁰ and the

The “productivity” of the curb refers to the number of uses it can provide per unit of time, such as the number of people parking in a given 20-foot parking space over the course of a day or the number of trips facilitated per day by a 40-foot pick-up and drop-off zone.

International Transport Forum (ITF)²¹ have each concluded cities can and should use the curb for much more than just parking. These reports, which I discuss in Appendix I, provide municipal transportation officials with guidance on processes and strategies to use when considering reallocations of the curb. These reports also highlight the disparities in the “productivity” of the curb between free parking, which is typically quite low, and higher intensity uses like bus lanes, bike corrals, and pick-up and drop-off zones.

CURB SPACE IS (INCREASINGLY) CONTESTED

THE CURB HAS LONG BEEN A PLACE OF CONFLICT AND CONTESTATION

Today, the contest for the curb is between modes not conceived of 100 years ago – app-based ride-hailing, shared electric scooters, and more, all seeking the same space used by cars. However, the contest itself is not new. In the early 20th century, many cities, including NYC, limited or banned curbside parking.²² City officials thought free curbside parking was not the best use of such limited space. For a few decades, this perspective won out.

Today, the contest for the curb is between modes not conceived of 100 years ago. However, the contest itself is not new.

In 1935, Oklahoma City installed the world’s first parking meter in front of a downtown department store. The goal of the meter was to prevent store employees from parking in front of the store, so that parking would be available for shoppers. The concept, and its goal of increasing “turnover” at the curb, caught on in the following decades.²³ NYC installed its first parking meter in Harlem in 1951.²⁴

In this case, “turnover” refers to the frequency at which different cars use a section of the curb. Higher turnover means that a given car parks for a shorter period. Metered parking incentivizes increased turnover.

Even as metered parking expanded in NYC’s dense urban core, most of its curbs remained open to free daytime street parking. NYC banned overnight parking, with a limit of three hours at a time after midnight.²⁵ In practice, residents ignored these rules, and officials acknowledged enforcement was difficult. For example, in 1953, officials issued ~50,000 tickets for overnight parking violations, compared to the estimated 700,000 vehicles parked overnight any given evening.²⁶

In response, the City Council asked for state authority to impose a \$60 fee for overnight parking,²⁷ but the Board of Estimate^k overrode the fee later that year.²⁸ Instead, in late 1954, NYC legalized fee-free overnight parking.^{29,30} NYC’s modern system of Alternate Side Parking^l emerged around the same time, starting on the Lower East Side.³¹

Although the modes differed from today, the debates surrounding the legalization of overnight on-street parking were remarkably similar to today’s arguments. Some letters to the New York Times expressed the common view that “streets and sidewalks of New York were built by and for the public with public funds... You are applying a discriminatory tax to only one segment of the population,”³² and that “[charging for overnight parking] would be highly discriminatory. It would fall on those car owners who cannot afford garage facilities.”³³

^k The Board of Estimate was a governmental body responsible for numerous aspects of New York City policy, including land use and the budget. Many of the City Council’s actions required Board approval.

^l Free on-street parking in NYC requires car-parkers to observe posted no-parking times for street cleaning, with different days on alternate sides of the street.

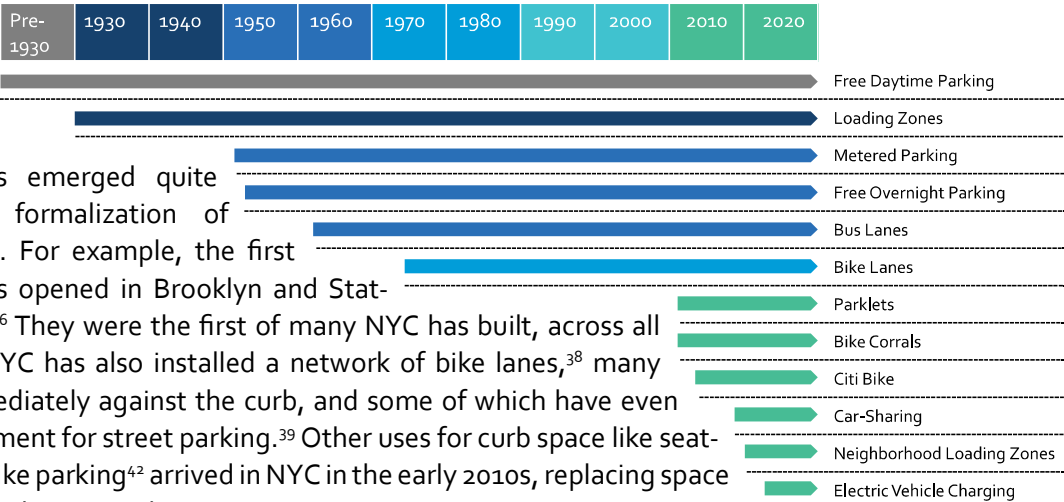
However, not everyone opposed the charge. In response, one New Yorker wrote, “the expensive motor car, too, frequently lacks a place of shelter...in many instances the individual’s failure to provide housing for his automobile is based upon choice instead of necessity...there are more than a few who prefer to expose their property to the elements rather than meet storage fees.”³⁴ These same debates play out today in Community Board meetings, online comment sections, and anywhere else those who currently benefit from curb usage allocations find themselves disagreeing with those who do not.

NON-PARKING USES OF THE CURB ARE INCREASINGLY COMING INTO CONFLICT

Even as free parking came to dominate the curbs of New York, a variety of alternative curb uses began to emerge. The sheer number of different uses of the curb today reflects that diversity, not only for motor vehicles but also for pedestrians, bikes, scooters, seating, food trucks, emergency access, and more.

In the 1930s, officials began to designate specific portions of the curb as “experimental ‘loading zones’” to “facilitate the loading and unloading of trucks,” with the first on 35th Street in Manhattan.³⁵ Although this approach was experimental, it succeeded and expanded in subsequent years.

New York City Has Far More Curb Uses Today Than Even Ten Years Ago



Some other uses emerged quite soon after the formalization of overnight parking. For example, the first curbside bus lanes opened in Brooklyn and Staten Island in 1963.³⁶ They were the first of many NYC has built, across all five boroughs.³⁷ NYC has also installed a network of bike lanes,³⁸ many of which are immediately against the curb, and some of which have even come as a replacement for street parking.³⁹ Other uses for curb space like seating areas^{40,41} and bike parking⁴² arrived in NYC in the early 2010s, replacing space previously dedicated to car parking.

Figure 5: Curb uses by decade of emergence in New York City

In interviews, NYC officials noted these uses are increasingly in conflict with one another. When these uses were more nascent, the primary argument was whether to replace parking – in a city with thousands of miles of streets, the Department could spread alternative curb uses around. However, nascent uses have matured. For example, NYC has committed to build 250 miles of protected bike lanes⁴³ and will likely expand the network of protected bus lanes. Some of these investments will replace travel lanes, but many of them will require reallocating curb space.⁴⁴

As these networks mature and grow, new demands have prompted other new uses, such as curbside pickups and drop-offs and the explosion in package deliveries. NYC DOT has experimented with small-scale pilots to accommodate these uses. However, rolling them out citywide will inevitably create conflicts, not only with parking but also with investments like bus and bike lanes. This conflict is not unique to NYC. Seattle officials made the tradeoff an explicit one, noting, “you can’t have a city without commerce,” as they often face conflicting demands between through movement, like bus and bike lanes, vs. access for businesses, such as loading zones.⁴⁵

Seattle officials recounted conflicts between demands for through movement and access to the curb: “You can’t have a city without commerce.”

CHANGING THE ALLOCATION OF THE CURB IS DIFFICULT

Across the US (and in many other places abroad), reallocating curb space is often challenging. Reasons for this difficulty include a strong status quo bias, a case-by-case approach to reallocations in the absence of any overarching curb priorities, problems with enforcement, and scarce and incomplete data.

THERE IS A STRONG STATUS QUO BIAS FOR (FREE) PARKING

In interviews with officials in NYC and elsewhere, I found a strong status quo bias for maintaining free parking's current dominance.⁴⁶

First, officials highlighted the common political difficulties in reducing the amount of the curb dedicated to parking in general, and particularly free parking. Constituents who currently rely on free parking are often vocal opponents of changes that reduce the available amount of on-street parking. They show up at public meetings and voice their opposition to elected officials. Even if, as is true in NYC, they represent a minority of overall residents, their opposition carries weight. Elected officials might themselves rely on free parking,⁴⁷ making the case for change that much more difficult.

Second, officials who wanted to replace free parking with another use repeatedly rooted their arguments in the benefits that such a change would have for current car-parkers. For example, when discussing the introduction of on-street parking for car-sharing services, officials noted the service was likely to reduce car ownership among its users. They leveraged this fact to argue that the remaining on-street car parkers would have reduced competition for scarce on-street parking spaces. Other officials highlighted that activities like car-share parking and electric vehicle charging were still parking, just for specific vehicles.

*Officials who wanted to replace free parking with another use repeatedly rooted their arguments in the **benefits** such a change would have for current car-parkers.*

As a political argument, this approach to advocating for new curb use seems eminently reasonable. Officials noted it had been largely successful at achieving incremental improvements. However, framing the debate in this way takes the dominance of parking largely as a given. This framing even plays out on the purely semantic level. Media accounts of curb usage changes typically reference the number of parking spaces "being taken away" or even "stolen"⁴⁸ vs. emphasizing the new usage. Parking remains the default, and other uses need a special effort to be put into place.

Third, this bias for parking is strongest in residential areas. Most, although not all, curb use reallocation efforts across the US have focused on commercial corridors and central business districts. There is still opposition to reallocating parking in those areas, but it is often balanced by support from local businesses for uses like loading zones (these zones can be free or pay-per-use; the latter are also known as "commercial parking"). Local businesses or other community actors even fund some uses, like parklets and bike corrals. In contrast, in residential zones, the most vocal actors are current on-street parkers. Even modest reallocations, such as those that might impact 20-40 feet of the curb on a given block, prompt significant complaints.

This tendency to focus away from residential areas is reasonable, both for political and practical reasons. The curb is more valuable and useful in commercial areas, where the potential demands on it are greater. There are more potential supporters, some of whom might even contribute financially to a reallocation. However, residential curbs are still tremendously valuable, and although they are not the norm, efforts in NYC and elsewhere have shown that curb reallocations can succeed in residential areas.^m

^m For example, the installation of on-street parking spaces for car-sharing services.

NEWYORK CITY'S APPROACH

NYC DOT (LEGALLY) CONTROLS THE CURB

The Department has wide legal discretion to allocate curb space. For most small projects (those that affect less than 1,000 feet of curb space and fewer than four consecutive blocks), Department officials can unilaterally reallocate the curb, although they often consult with affected residents regardless.

For the rest of its projects, DOT must consult with local officials, including Community Board and affected City Council officials, and consider their feedback before proceeding.^{49,50,51} The Department has no legal obligation to implement any feedback gathered through this consultative process. However, officials indicated that such feedback plays a large role in determining whether a project will proceed.⁵² They also pointed to specific examples where community opposition led to a project's adjustment or cancellation. For example, in 2019 the Department announced a new "Neighborhood Loading Zone" (NLZ) program to reallocate existing daytime parking to pick-up and drop-off zones for people and goods. Some communities were broadly supportive of the initiative, but others strongly advocated against it. The NLZs proceeded, but only in receptive neighborhoods.⁵³

RESPONSIBILITY FOR THE CURB IS OFTEN DISPERSED

Within NYC DOT, specific curb uses are the responsibility of specific individuals or groups. Many of these teams belong to different units of the Department, spread across multiple offices throughout NYC.

This structure influences the way the Department allocates the curb. Most commonly, a particular curb use team will propose a reallocation from parking (either paid or metered) to their respective use. This might be informed by a Departmental decision to proceed on a new initiative for that allocation. For example, after the City Council passed a law requiring the Department to implement an on-street car-sharing project, the responsible officials conducted an analysis of neighborhoods where such a program might see high utilization. In other cases, a constituent (like a local business owner) prompts a project by requesting a new use, such as a loading zone or a bike corral.

NYC DOT does sometimes take a more systematic look at a stretch of curb or right-of-way, identifying problems and then proposing new uses to solve those problems. For example, officials might consult with local stakeholders to identify needs and desires before embarking on a large-scale street reconstruction or resurfacing project. However, such projects are exceptions, rather than the norm.⁵⁴

QUALITATIVE, AD HOC ASSESSMENTS PLAY A LARGE ROLE IN DECISION-MAKING

When deciding whether and how to proceed, NYC DOT relies on a mix of quantitative and qualitative analyses. Although the specific balance varies project to project, qualitative and ad hoc assessments appear to play a significant, and often dominant, role.

The most commonly cited qualitative consideration was local support from either community members or elected officials. The Department's Borough Engineersⁿ also provide opinions based on their "local knowledge" of the street or corridor in question. Both groups, as well as other officials, routinely suggest alterations or improvements to programs, and sometimes oppose projects outright.

ⁿ Department staff responsible for a borough of NYC.

Relying on these qualitative factors is a reasonable approach – the success or failure of many curb use projects will depend on the very specific context of the neighborhood and even street in question. However, some staff noted this reliance on ad hoc assessments provides more opportunities for good and even broadly supported projects to encounter enough resistance to fail.⁵⁵

Quantitative assessments also play an important role in some instances. For example, Department officials selected neighborhoods for the on-street car-sharing pilot based on a systematic analysis of neighborhoods where existing car-sharing options were limited and where car ownership was relatively low. This analysis also revealed lower-income neighborhoods where shared mobility options were otherwise limited, allowing the Department to add capacity while also addressing equity concerns.

However, the lack of available data limits the broad usage of these analyses. Some uses are particularly data-rich, such as metered parking and bike-share. This enables officials to make better-informed assessments of the relative value of these uses. For other uses, like free parking or unmetered loading zones, there are little to no systematic data on usage. Officials must rely instead on expensive, time-consuming, and one-off data collection efforts to understand their impacts. As a result, when quantitative metrics are considered, they vary significantly across modes (see Appendix J).

Across cities, many curb use decisions are made on a case-by-case basis.

Importantly, the Department's reliance on qualitative, ad hoc assessments is not unique. Across interviews and cities, curb management officials indicated they make many curb use decisions on an unsystematic and case-by-case basis. One peer city official referenced the process as one of "muddling through" the management of stakeholder desires, revenue implications, and policy goals. In every city considered, curb management officials discussed the difficulties of navigating such complex challenges. Officials also routinely identified times in which they prioritized one use of the curb over another based on political opposition, the specific context of a local street, or other one-off factors.⁵⁶

PRIORITIZATION FRAMEWORKS ARE HELPFUL WHEN REALLOCATING CURB SPACE

In recent years, two cities – Seattle and San Francisco – have advanced national curb-management practices by developing and releasing frameworks on their curb usage priorities.^{57,58} These frameworks formalize each city's respective approach to managing its curbs. They also provide guidance on which uses city officials think are relatively more important and how that varies by land use.

Both cities prioritize movement – including travel lanes, bike lanes, bus lanes, etc. – above all other uses, in all land-use categories. This formalization is consistent with the more informal approach recounted by officials elsewhere. In many interviews, officials noted they only make curb allocation decisions *after* the relevant officials decide the right-of-way is not needed for a travel lane.

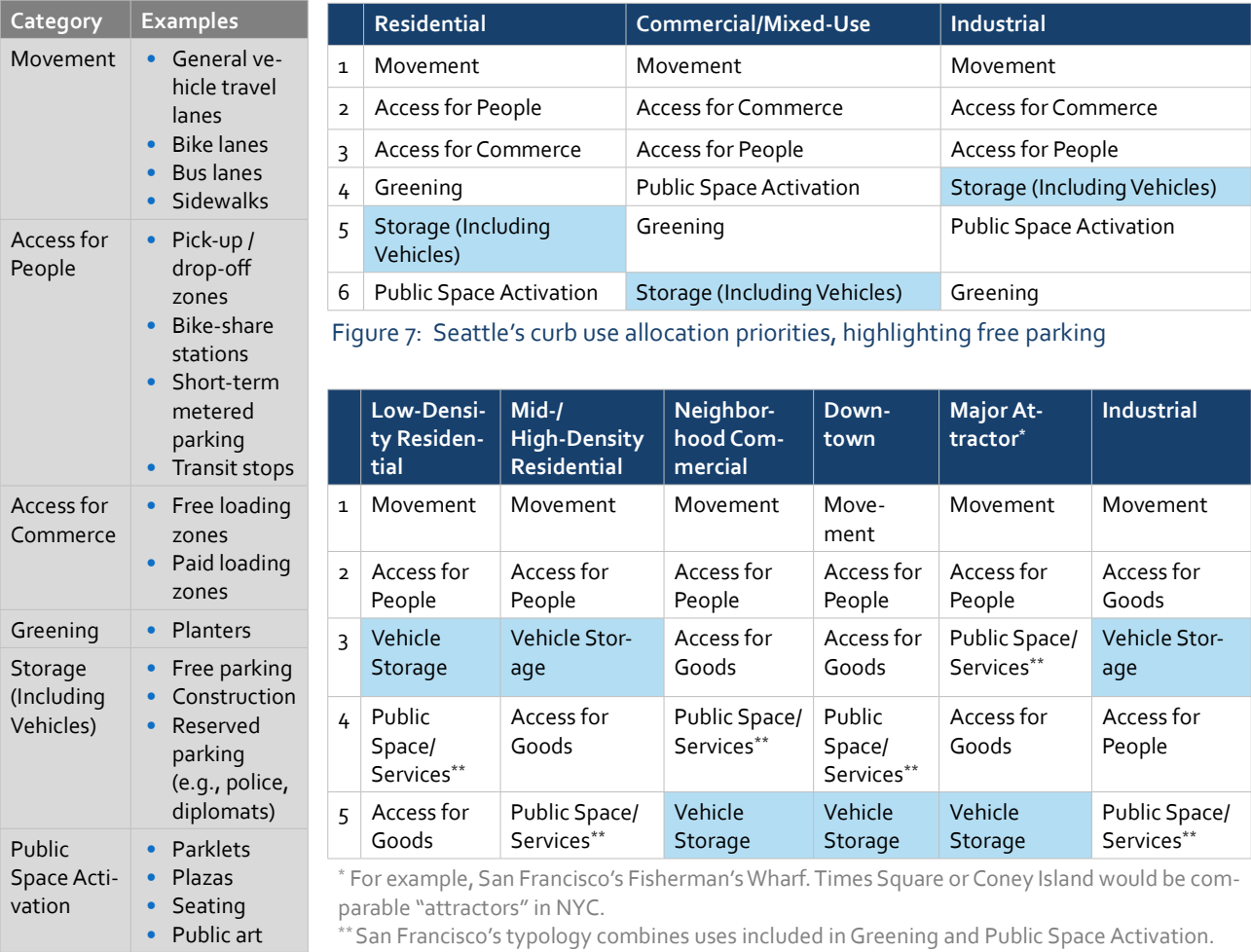
Both San Francisco and Seattle also highly prioritize access for people, such as transit stops, pick-up and drop-off zones, and bike share parking. They also prioritize access for goods or commerce, which includes commercial loading and unloading, deliveries, and more.

Vehicle storage is never of primary importance in either framework. San Francisco has it as at most a third priority in some zones, after movement and access for people or goods. It is the least important use in three land-use types: neighborhood commercial, downtown, and major attractors. In Seattle, it is at most fourth (in industrial areas) and ranked last in commercial zones.

Both cities stressed that this framework does not mean they ignore lower-ranked uses like vehicle storage. Free parking is and remains a dominant use of the curb in both cities. Instead, officials use the frameworks

to guide decisions on the relative amounts of each type. Furthermore, many of the higher-ranked uses, like access for people or goods, are very space-efficient. For example, while many neighborhood commercial streets need a loading zone, very few need one that spans the entire block. This means officials can often satisfy the demands for those uses while still maintaining some curb space for lower-ranked ones.

Seattle and San Francisco Prioritize Movement and Access, While Free Parking Is a Low Priority



	Low-Density Residential	Mid-/High-Density Residential	Neighborhood Commercial	Downtown	Major Attractor*	Industrial
1	Movement	Movement	Movement	Movement	Movement	Movement
2	Access for People	Access for People	Access for People	Access for People	Access for People	Access for Goods
3	Vehicle Storage	Vehicle Storage	Access for Goods	Access for Goods	Public Space/ Services**	Vehicle Storage
4	Public Space/ Services**	Access for Goods	Public Space/ Services**	Public Space/ Services**	Access for Goods	Access for People
5	Access for Goods	Public Space/ Services**	Vehicle Storage	Vehicle Storage	Vehicle Storage	Public Space/ Services**

* For example, San Francisco’s Fisherman’s Wharf. Times Square or Coney Island would be comparable “attractors” in NYC.
** San Francisco’s typology combines uses included in Greening and Public Space Activation.

Figure 6: Curb use categories and examples

Figure 8: San Francisco’s curb use allocation priorities, highlighting free parking

Officials highlighted several ways in which these frameworks increase the likelihood of successful curb reallocations.

First, the frameworks provide a less parking-dominated starting point for any discussions on curb reallocations. This is relevant to both internal deliberations and external advocacy. Without such a framework, the status quo is more likely to remain the default. The existence and public endorsement of such a framework by city leadership also provide transportation officials in Seattle and San Francisco with a useful tool in making the case for a proposed reallocation.

Second, the frameworks enable more comprehensive considerations of the curb. Today, many curb management projects are prompted by one-off requests from constituents or elected officials, with decisions made that may (or may not) align with a city’s mobility goals. Interviewees around the country noted that such a reactive approach is currently quite common and acknowledged it can lead to inequitable outcomes.

Having a framework like Seattle's or San Francisco's enables cities to better evaluate such requests, including by providing a stronger reason to say "no" if circumstances do not warrant the requested change.

Third, officials highlighted that the development of the framework can build internal agency consensus. Many of the priorities included in these frameworks are codifications of existing city and agency principles. However, the experience of making the framework allows those principles to be more widely shared and better understood by all agency staff, across modes and practice areas.

Frameworks can 1) provide a less parking-dominated starting point, 2) enable more comprehensive considerations, and 3) build agency consensus through their development.

Despite the advantages, officials in both San Francisco and Seattle did acknowledge that such a framework alone is not enough to enable change. Public officials still need to engage with stakeholders, understand local contexts, and be flexible enough to accommodate as many demands as the curb can feasibly meet. No matter how sophisticated the framework, there will continue to be a need for case-by-case adjustments. However, the frameworks do appear to help. Further, the success of Seattle and San Francisco in developing theirs may lead other cities to follow. Officials in two other cities I spoke with referenced ongoing efforts to develop curb prioritization hierarchies for their own agencies.⁵⁹

ENFORCEMENT OF CURB USAGE POLICIES IS CRUCIAL AND DIFFICULT

No matter how successful officials are at reallocating curb space, such efforts do not matter if users ignore the rules. A curbside bus lane might no longer reduce travel times if even one parked car obstructs it, and a loading zone can only reduce double parking if it is empty and available for short-term deliveries. Enforcement of these policies matters; without it, parking often reasserts itself.

Officials across cities noted that, despite its importance, successful and cost-effective enforcement remains a challenge.

First, enforcement is often the responsibility of other agencies, such as police departments. These agencies have a variety of priorities, and parking or curb use violations are often not the most important consideration. Violations are often unaddressed. Sometimes, the enforcement agencies themselves violate the rules, such as the cases of police officers parking in bike lanes in NYC and elsewhere.⁶⁰

Second, violations are often difficult to identify and enforce. For example, without automated enforcement, a driver that parks for 30 seconds in a bus or bike lane likely will escape any consequences. However, if such short-term violations become common practice, they can still have significant impacts, such as delays to bus riders in buses forced to divert into regular traffic.

Third, complex curb use allocations can be more difficult to follow and enforce. Many cities have implemented "flex zones" which change allocation based on the time of day, with some curb space serving as many as four or five distinct functions in each 24-hour period. As curb use rules and regulations become more complex, some users may be legitimately confused as to what they can do on a given section of the curb. These complexities can also make it more difficult for enforcement officers to easily identify violations.

There are new technology platforms that propose a variety of ways to maximize the value of the curb by deploying and enforcing complex curb use allocations. However, none has yet been deployed at scale. Furthermore, relying on such a private (and potentially proprietary) platform to enforce curb use policies poses its own challenges, both in terms of operational integration and ensuring that the public interest remains the driving force in any policy decisions.⁶¹

DATA ON CURB USAGE AND ITS EFFECTS ARE SCARCE AND INCOMPLETE

A recurring theme in interviews was the lack of available data on many aspects of the curb, not only its usage but also more fundamentally how much of the curb is available for different uses today. Both municipal officials and outside organizations cited this as a significant challenge.⁶²

Many cities, including NYC, do not have a formal inventory of the amount or deployment of available curb space. When San Francisco completed an inventory of its parking in 2010, it was noteworthy for being the first major city to do so.⁶³ While there are specific uses, such as paid parking, that are more easily (and thus more commonly) inventoried,⁶⁴ those are the exception. The most comprehensive approaches today are those taken by outside organizations like Coord⁶⁴ and SharedStreets,⁶⁵ although these and other similar efforts are still nascent and not in everyday use by most public officials and agencies.

There is a lack of available data on many aspects of the curb, not only its usage but also more fundamentally how much of the curb is available for different uses today.

Coord Provides an Initial Understanding of Curb Allocation Today in NYC

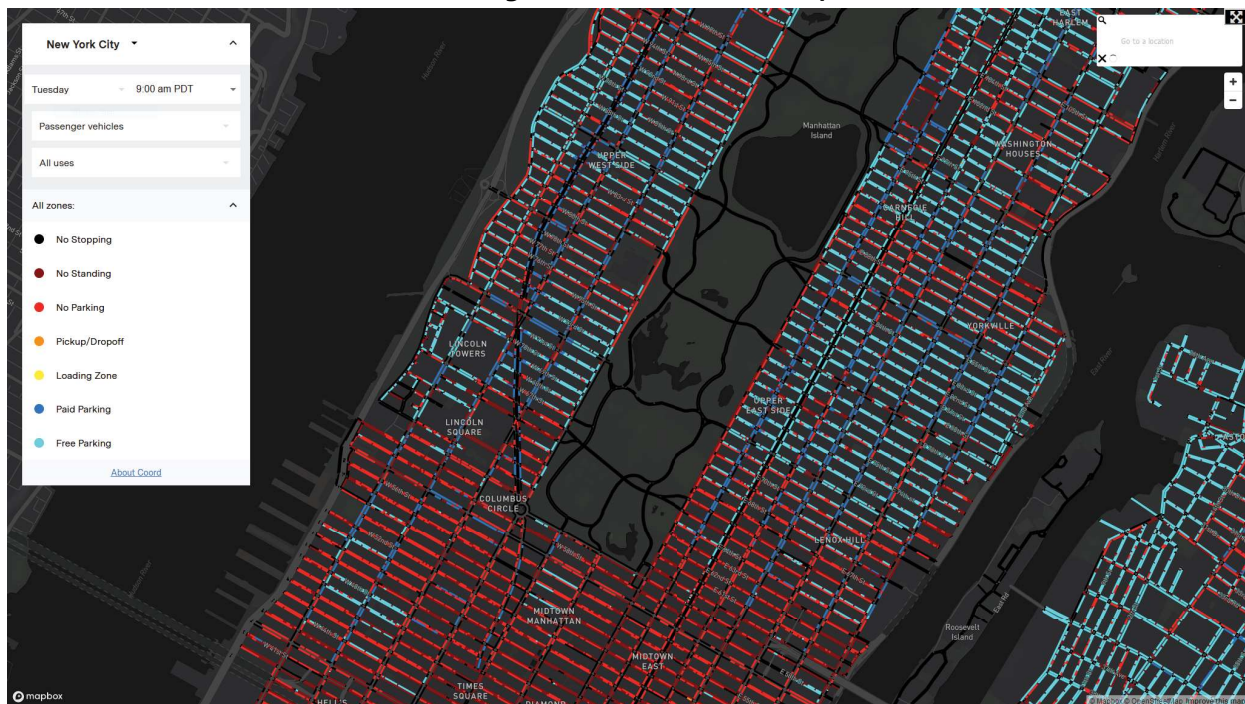


Figure 9: Coord's "Explorer" tool: passenger car uses allowed mid-day weekdays in Manhattan⁹¹

Data on curb *usage* are even scarcer. Again, the most easily tracked are uses that involve payment, such as paid parking. However, even those data are only as good as compliance with existing policy. Furthermore, studies of unpaid uses like free parking are labor-intensive, time-consuming, costly, and infrequent. Cities generally conduct these as one-off studies in support of larger projects or initiatives. The most comprehensive approach to identifying demand for free parking I observed was Seattle's. There, officials conduct yearly parking demand studies on the curbs surrounding paid parking zones to determine whether SDOT should expand paid parking in terms of time or streets covered.

⁶² Due to the associated revenue collection and tracking.

Other unpaid curb uses, such as bike lanes, bike corrals, and unpaid loading zones, are similarly data-poor. To the degree that any data are available, they are often from one-off assessments, which might gather data on occupancy or usage at a point in time while missing crucial data on how long a given user occupies the curb.

This lack of data on the curb poses two challenges for public officials.

First, having data on curb usage can inform better decisions about how, and when, to reallocate curb space. Without such data, officials must rely on more ad hoc approaches, potentially leading to inadvertently inequitable or suboptimal decisions. It is true that data are not the only consideration. Several interviewees noted that data alone are not enough to overcome emotional arguments against a proposed change. However, when combined with a more robust engagement of stakeholders on their desires for curb usage, data can be a powerful factor for a public agency to consider.

Without an inventory of current curb uses, it is difficult for public officials to make the case that there is too little, or too much, of a given use of the curb.

Second, without an inventory of current curb uses, it is difficult for public officials to make the case that there is too little, or too much, of a given use of the curb. Officials in several cities noted that, as part of curb reallocation projects, they conducted studies of the amount of parking in each study area. A routine finding was there was enough parking available; it would just require drivers to park on a different block nearby. Several interviewees also brought up the utility of this data regarding loading zones. For example, after inventorying a corridor, officials in one city were able to compare the increase in loading zone capacity (+50%) to the decrease in free parking (-1%) required to achieve it. This is useful not only in communications to the public but also within government to overcome the status quo bias toward parking.⁶⁶

RECOMMENDATIONS

1. SYSTEMATICALLY EVALUATING THE CURB

RECOMMENDATION 1.1: CREATE A FRAMEWORK TO UNDERSTAND DIFFERENT VALUES OF THE CURB

ALTHOUGH IT IS NOT ENOUGH to change curb space allocation on its own, a framework would provide a useful starting point for internal deliberations and provide evidence to support public advocacy for change. I propose an illustrative framework to demonstrate how such a tool would work in practice.

This framework could be useful in both evaluating and communicating change. Based on interviews with agency staff, the near-term focus should be on the former, using it to better calibrate tradeoffs and inform decisions. However, in the medium- to long-term, data can help officials bolster the case for changes.

STRUCTURE

The proposed framework has two components: 1) financial costs and transfers and 2) costs and benefits to users and society based on specific curb use allocations.

NYC DOT Should Consider Costs, Transfers, Impacts, and Their Distribution to Improve Curb Allocations

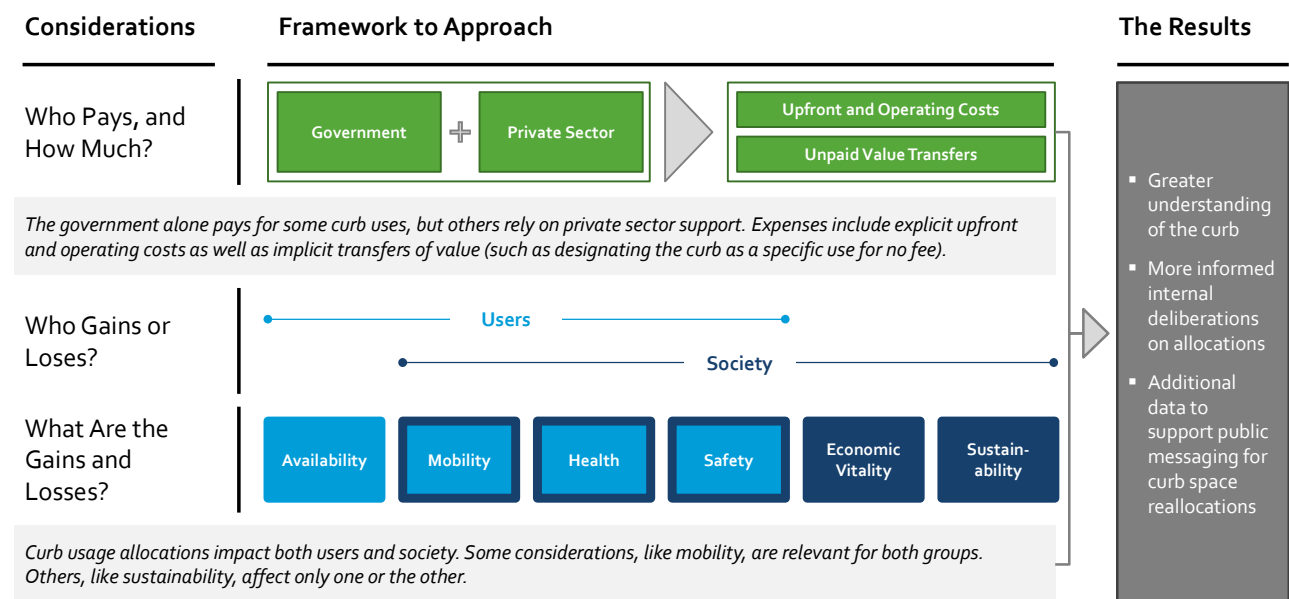
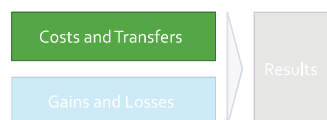


Figure 10: A framework to approach curb usage allocations

FINANCIAL COSTS AND TRANSFERS

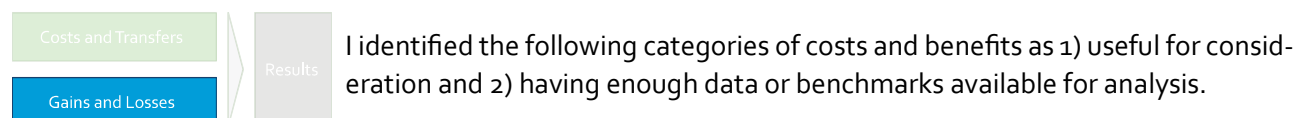


The first aspect for NYC DOT to consider is the cost of implementation, since any use of the curb requires investment, both in upfront construction costs and ongoing operating costs.

Second, NYC DOT should consider who incurs these costs. City government pays for most curb space allocations. However, some uses have private investment support under current policy, such as the ongoing maintenance of bike corrals and parklets.

Finally, NYC DOT should consider any transfers between the government and the private sector. These include explicit transfers, like the charges for paid parking and the permits paid for the use of the curb for on-street car-sharing. These also include implicit transfers, such as the significant value NYC DOT provides to car-owners who park for free on the curb.

COSTS AND BENEFITS TO USERS AND SOCIETY



Selected Metrics Include Usage, Fatalities, and Carbon Emissions

Cost/Benefit Category	Subcategory	Detail
Direct Costs and Benefits (Applicable to Users)	Availability	<ul style="list-style-type: none"> Number of uses per day
	Mobility	<ul style="list-style-type: none"> Number of person trips facilitated per day Number of incremental trips generated
	Health	<ul style="list-style-type: none"> Fatality impacts due to changes in physical activity
	Safety	<ul style="list-style-type: none"> Fatality impacts due to traffic crashes
External Costs and Benefits (Applicable to Society)	Mobility	<ul style="list-style-type: none"> Impact on vehicle miles traveled
	Health	<ul style="list-style-type: none"> PM_{2.5} emissions
	Safety	<ul style="list-style-type: none"> Fatality impacts due to traffic crashes
	Sustainability	<ul style="list-style-type: none"> Impact on CO₂ emissions
	Economic Vitality	<ul style="list-style-type: none"> Qualitative, based on impacts on commerce and property values

Figure 11: Selected cost and benefit metrics for users and society

Some metrics, like the number of uses and number of trips induced per day, allow a straightforward comparison of the “productivity” of a given curb allocation. Almost all the curb uses also have an impact on Vehicle Miles Traveled (VMT). These VMT impacts have downstream impacts on other metrics of concern, such as pollution, traffic fatalities and carbon emissions.^p I have opted not to convert these metrics into a dollar value equivalent based on interviewee and client input.^q

^p I considered several other possible metrics, such as congestion and double parking, but excluded them due to a lack of available data and the reliance of such outcomes on specific street configurations.

^q Several interviewees stressed the importance of considering the non-monetary impacts of the curb, and not just viewing the curb in terms of its pure productivity or abstract impact on financial costs.

METHODOLOGY

SELECTION OF USE CASES

I focused on six demonstrative use cases to illustrate the utility of this framework. I selected these use cases by considering a broader set of possible uses that New York City and other cities have deployed.⁶⁷

The report focuses on six demonstrative use cases varying across key dimensions to illustrate the utility of the framework.

Selected Use Cases Include Both Movement and Access

	Curb Re- quired Per Use (feet)	Category of Use	Span of Con- trol	Precedent in NYC	Description
Free parking	20-200+	Vehicle Storage	Default policy	Yes (de- fault)	Unmetered parking available for all-day free parking (except short-term periods for street cleaning)
Protected bike lanes (at-grade)	200+	Through Movement	Within NYC DOT control	Yes	Bike lanes with physical separation and protection from vehicle travel lanes
Bike corrals	20-40	Vehicle Storage / Access for People	Within NYC DOT control	Yes	On-street sets of bike racks that can be used for personal and dockless bike-share bikes
Neighborhood Loading Zones (NLZs)	40-60	Access for People / Access for Goods	Within NYC DOT control	Pilot pro- gram	Daytime active loading and unloading zones for people and goods
Parklets	20-80	Public Amenity	Within NYC DOT control	Yes ("Street Seats")	Seating areas and gathering places, often installed using a platform deck on top of existing pavement
Waste collection zones	20-40	Public Amenity	Within NYC DOT + DSNY* control	Pending pi- lot program ("Clean Curbs")	Spaces designated for the centralized collection of waste (both garbage and recycling)

*NYC Department of Sanitation

Figure 12: Selected use cases with characteristics considered in selection

I selected use cases that vary across categories and the amount of space required on the curb. For ease of implementation, I focused on uses within the Department's span of control and with a precedent or upcoming pilot in New York City.

SELECTION OF NEIGHBORHOODS

Local context matters when evaluating curb space. Thus, the framework can be adjusted based on demographics, land use, and existing travel patterns.

To enable meaningful comparisons, I chose five neighborhoods across New York City, one in each of the five boroughs of the city. I chose neighborhoods that varied across density, income profiles, age, and existing commute share. I prioritized neighborhoods with NLZs given their inclusion as one of the use cases.

The framework evaluates one neighborhood in each of NYC's five boroughs to demonstrate the impacts of demographic and mobility patterns.

Selected Neighborhoods Span the Five Boroughs

Borough	Neighborhood Tabulation Area (NTA)
Manhattan	Upper West Side
Bronx	University Heights-Morris Heights
Queens	Jackson Heights
Brooklyn	Bay Ridge
Staten Island	West New Brighton-New Brighton-St. George

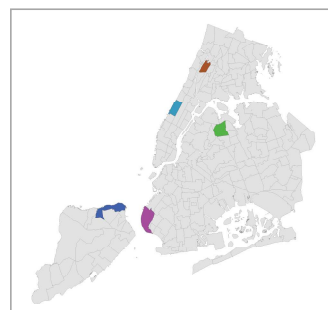


Figure 13: Selected Neighborhood Tabulation Areas in geographic context

See Appendix F for details on the selected neighborhoods.

METRIC DEVELOPMENT

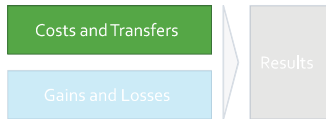
I developed the proposed metrics by:

- Synthesizing existing quantitative analyses on the impacts of various transportation modes
- Leveraging the model of the World Health Organization's "Health Economic Assessment Tool" (HEAT)⁶⁸ for my analyses of curb uses that impact biking and walking
- Reviewing and compiling usage and impact data from project reports on various curb use reallocation projects in NYC and elsewhere
- Gathering data on curb usage patterns for NLZs and free parking in the Upper West Side, Jackson Heights, and St. George
- Integrating these analyses, data, and necessary assumptions into an interactive Excel-based model (available from the author upon request)

See Appendix C for a full overview of the assumptions underlying the proposed metrics.

PROPOSED METRICS

THE INVESTMENT COSTS OF CURB SPACE



I compiled data on upfront and operating costs (e.g., construction, maintenance, enforcement) across uses to inform an assessment of costs and benefits.

Free parking and bike lanes have the lowest overall costs of implementation,^r with bike corrals and NLZs moderately higher due to up-front investments (physical corrals) and increased enforcement requirements (NLZs). The two public amenities – parklets and waste collection – have significantly higher costs than the other use cases considered.

Public Amenities Like Parklets & Waste Collection Have the Highest Costs

	Annualized Installation Costs	Operating Costs	Total
Free Parking	\$40	\$429	\$469
Bike Lanes	\$83	\$429	\$512
Bike Corrals	\$339	\$545	\$884
NLZs	\$47	\$858	\$905
Parklets	\$2,586	\$2,773	\$5,359
Waste Collection	\$209	\$1,296	\$1,506

Parklets require substantial upfront investments (\$10,000 or more), while the waste collection zones could require significant expenses in terms of staff time, installation, or both. Finally, it is important to note that private businesses and organizations contribute part (although not all) of the cost of construction and/or maintenance for bike corrals and parklets, and could also do so in a future waste collection zone program.

Figure 14: Annualized costs of installation and operation per 20' of curb space

See Appendix D for a detailed overview of the benchmarks and assumptions used.

THE VALUE OF CURB SPACE

Although it is difficult to value curb space precisely, the actual value is clearly greater than its current predominant price: \$0. This is the per-user cost not only for free parking but also for most other uses of the curb: bike lanes, bus lanes, parklets, unpaid loading zones, etc.^s I identified the ranges in Figure 15 based on an analysis of parking price benchmarks across the five boroughs (see Appendix E).

20' of Curb Space Could Be Worth \$8,000 or More In Some Contexts

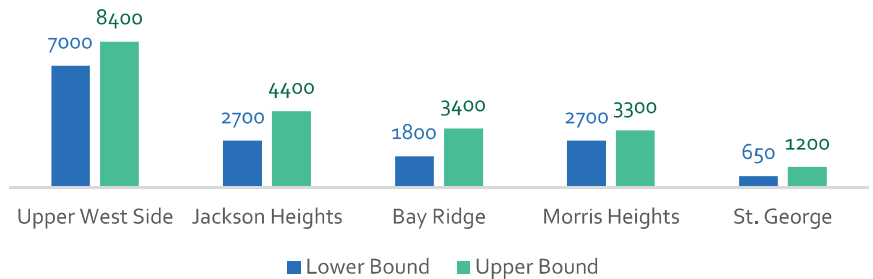
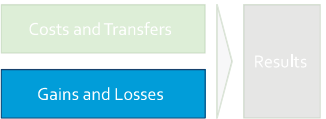


Figure 15: Estimated ranges of annual value of 20' of curb space by neighborhood (annual \$)

THE IMPACTS OF SPECIFIC CURB SPACE ALLOCATIONS



The proposed metrics vary based on local context, such as the share of residents who commute by car, the existing biking mode share, and the relative share of commercial vs. residential property.

^r This assumes a relatively low-cost investment, with bollard or parking-lane protection but not concrete separation.
^s For some uses (e.g., metered parking), the users of the curb *do* pay, although the value of the curb typically exceeds the cost.

Even One Block of the Curb Can Have Significant Impacts, Depending on Its Allocation

	Avail.	Mobility		Health	Safety
	Uses (daily)	Person Trips (daily)	Incremental Trips (daily)	Deaths (annual)	Deaths (annual)
Free Parking	11 <-> 18	18 <-> 30	1.7 <-> 3.4	0.000311 <-> 0.001559	0.000015 <-> 0.000031
Bike Lane	9 <-> 1,416*	9 <-> 1,416	0.1 <-> 15.9	-0.000078 <-> -0.001436	-0.000001 <-> -0.000017
Bike Parking	31 <-> 62	31 <-> 62	0	0	0
NLZs	100 <-> 160	160 <-> 255	0	0	**
Parklets	80 <-> 1,200	0	0	0	0
Waste Collection	30 <-> 240	0	0	0	0

Key: **Benefits** | **Costs** | **Neutral**

*Note that bike lanes allow through movement, so the usage for 20 feet of the curb does not scale linearly; in this framework, 20 feet of bike lanes would have the same utilization as 200 feet of bike lanes on a given block.

**Not quantified. There are possible safety benefits to reduced unsafe pick-up and drop-off behavior.

Figure 16: Range of user costs and benefits from select curb space allocations, 200' of curb space

	Mobility	Health	Safety	Sustainability	Economic Vitality
	VMT (1000s, annual)	PM _{2.5} (grams, annual)	Deaths (annual)	CO ₂ (tons, annual)	Qualitative Assessment*
Free Parking	4.1 <-> 8.5	49 <-> 102	0.000028 <-> 0.000058	0.7 <-> 1.5	Low <-> Med
Bike Lane	-0.2 <-> -4.6	-2 <-> -56	-0.000001 <-> -0.000031	-0.0 <-> -0.8	Low <-> Med
Bike Parking	0	0	0	0	Low
NLZs	-6.4 <-> -11.5	-76 <-> -138	-0.000043 <-> -0.000078	-0.9 <-> -1.7	High
Parklets	0	0	0	0	Low <-> High
Waste Collection	-0.0 <-> -0.2	-6 <-> -49	-0.000045 <-> -0.000375	-0.2 <-> -1.5	Low <-> High

Key: **Benefits** | **Costs** | **Neutral**

*Not quantified. I assessed economic vitality on a scale from Low to High (see Appendix C).

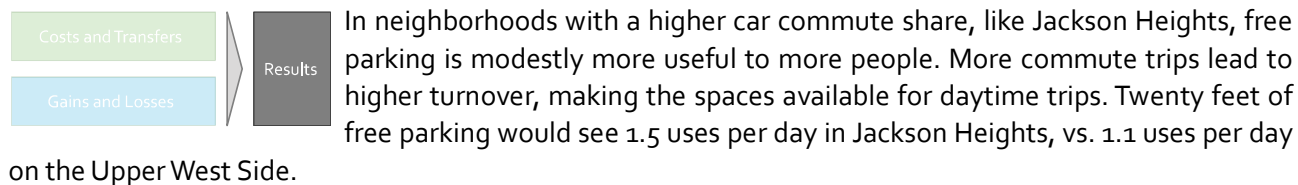
Figure 17: Range of societal costs and benefits from select curb space allocations, 200' of curb space

I discuss my methodology and assumptions in Appendix C. Some metrics distinguish between neighborhood streets that have solely residential vs. a mix of residential and commercial. I have used metrics from the commercial/residential mix in the sample comparisons below.

METRICS IN ACTION

The proposed metrics would allow Department officials to better understand the impacts of different curb use allocations, as well as how those impacts vary by geography.

UNDERSTANDING THE IMPACTS OF FREE PARKING



Users Gain Most of the Benefits and Society Incurs Most of the Losses from Free Parking

	Jackson Heights	UWS	Who Gains or Loses?
Uses/Day/20'	1.5	1.1	Users
Person Trips/Day	+25.3	+18.5	Users
Incremental Trips/Day	+2.5	+1.7	Users
VMT (1000s, annual)	+6.1	+4.1	Society
Deaths (annual)	+0.000610	+0.000354	JH: 93% User / 7% Society UWS: 92% User / 8% Society
PM _{2.5} (grams, annual)	+73	+49	Society
CO ₂ (tons, annual)	+1.1	+0.7	Society
Economic Vitality	Med		Society
Cost (annualized)	\$4,687		Society

Key: **Benefits** | **Costs** | **Neutral** See Appendix C for my methods and assumptions

Figure 18: Costs and benefits from 200' of free parking in selected neighborhoods

should moderately improve economic vitality, such as by enabling some trips to local businesses. Anecdotal reports indicate it might even increase property values.⁶⁹

Finally, although the costs of providing free parking do not markedly change between these neighborhoods (or others), the value transferred is dramatically different, ranging from a lower-bound estimate of \$2,700 in Jackson Heights to \$7,000 in the UWS.

The availability of free parking leads to increased VMT in both neighborhood contexts but has a greater impact in Jackson Heights vs. the UWS because of its higher car commute share. These miles traveled might well provide significant benefits to the passengers of the vehicles that take them. However, with each additional mile traveled, society must bear the cost of increased traffic fatalities, particulate matter pollution, and CO₂ emissions. Even the users bear some health and safety costs, with increased exposure to the risk of a traffic crash and decreased physical activity due to shifts away from active transportation modes.

In both neighborhoods, free parking

The availability of free parking leads to increased Vehicle Miles Traveled in both NTAs, with a greater impact in Jackson Heights.

COMPARING DIFFERENT USES OF THE CURB

The framework also enables comparisons between free parking and other uses. For example, it allows a comparison of ten waste collection zones spread over 2,000 feet vs. the parking it would replace.

Waste Collection Provides Societal Benefits and Increases the Number of Beneficiaries vs. Free Parking

	Morris Heights			St. George			Affected?
	Waste Collection	Free Parking	Difference	Waste Collection	Free Parking	Difference	
Uses/Day/20'	12.4	1.8	10.7	3.0	1.3	1.7	Users
Person Trips/Day	0.0	30.1	-30.1	0.0	22.8	-22.8	Users
Incremental Trips/Day	0.0	2.7	-2.7	0.0	3.4	-3.4	Users
VMT (1000s, annual)	-0.1	6.6	-6.7	-0.0	8.5	-8.5	Society
Deaths (annual)	-0.000192	0.001070	-0.001262	-0.000045	0.001648	-0.001693	Majority Users
PM _{2.5} (grams, annual)	-25	79	-104	-6	102	-107	Society
CO ₂ (tons, annual)	-0.7	1.2	-1.9	-0.2	1.5	-1.7	Society
Economic Vitality	Med	Med	NA	Low	Med	-	Society
Cost (annualized)	\$15,056	\$4,687	\$10,369	\$15,056	\$4,687	\$10,369	Society

Key: **Benefits** | **Costs** | **Neutral**

See Appendix C for my methods and assumptions

Figure 19: Difference between 200' of waste collection and free parking, Morris Heights vs. St. George

Waste collection is a more useful curb allocation in Morris Heights than in St. George. Indeed, at least in some instances, it appears Morris Heights residents are already using parking spaces to leave their waste (see Figure 20). It has an estimated daily usage per 20 feet of 12 in Morris Heights vs. only 3 in St. George. Despite this disparity, waste collection is still more usable than free parking on a per-foot basis in *both* Morris Heights and St. George.

Waste collection is a more useful curb allocation in Morris Heights than in St. George.

When comparing free parking to waste collection on other metrics, the directionality is similar between the two neighborhoods. Free parking leads to greater VMT, with consequent impacts on emissions, fatalities, and pollution. In contrast, on-street waste collection zones lead to reductions in heavy truck VMT, reducing emissions, fatalities, and pollution. With more households relative to the amount of land (and available curb space), the impact of shifting all household waste off-sidewalk is greater in the denser Morris Heights, as the greater streamlining of pickups could more significantly reduce the overall amount of miles traveled by the DSNY's fleet of garbage trucks.

In both contexts, the framework also indicates the negative impacts of providing free parking are more significant than the positive impacts of providing waste collection zones, at least regarding deaths, pollution, and carbon emissions. This pattern emerges across most evaluated use cases.

Despite higher investment costs, waste collection zones could provide significantly greater overall value than free parking. This is especially true in high-density neighborhoods like Morris Heights where the frequent presence of waste on the sidewalk could reduce property values by increasing street clutter and rat populations. The zones might also improve mobility by reducing sidewalk obstructions.



Figure 20: Waste disposal practices, Morris Heights

EVALUATING PROPOSED REALLOCATIONS

The metric framework also enables comparisons of two or more different reallocations of the same curb.

Both Bike Lanes and a Multi-Use Reallocation Provide Benefits vs. Free Parking, But the Benefits of Bike Lanes are More Concentrated

Costs and Benefits of...	Status Quo	Through Movement		A Portfolio of Uses	
	Free Parking: 200'	Bike Lane: 200'		Free Parking: 80' Bike Parking: 20' NLZs: 60' Parklets: 20' Waste Collection: 20'	
	Impact	Impact	Difference from Free Parking	Impact	Difference from Free Parking
Uses/Day	11.7	119.5	107.8	113.4	101.7
Person Trips/Day	19.9	119.5	99.6	69.7	49.8
Incremental Trips/Day	2.3	5.4	3.1	0.2	-2.0
VMT (annual, 1000s)	5.8	-4.6	-10.4	-1.6	-7.4
Deaths (annual)	0.00072	-0.00121	-0.00193	0.00005	-0.00067
PM _{2.5} (grams, annual)	69	-56	-125	-21	-90
CO ₂ (tons, annual)	1.0	-0.8	-1.8	-0.2	-1.3
Economic Vitality	Med	Med	NA	Varies	NA
Cost (annualized)	\$4,687	\$5,117	\$430	\$12,338	\$7,651

Key: **Benefits** | **Costs** | **Neutral** See Appendix C for my methods and assumptions

Figure 21: Impacts of reallocating free parking to different portfolios, Bay Ridge

Both alternate scenarios – through movement and a portfolio of usages – provide significant improvements vs. the status quo of free parking.

In both alternative scenarios, much of the benefit comes from the act of removing free parking. The new uses have their own benefits as well. However, these new benefits are typically less than the benefits accrued to society due to the elimination of free parking.

Both alternatives provide significant improvements vs. the status quo of free parking. Much of the benefits come from removing free parking.

The Through Movement scenario yields the greatest reduction in Vehicle Miles Traveled (and consequent reductions in emissions, deaths, etc.). The Portfolio approach retains higher VMT due to the remaining free parking and overnight parking usage of the NLZs.

However, the Portfolio of Usages is usable by a greater number and variety of people than the Through Movement scenario. Both users and society benefit from bike lanes, but the number of direct beneficiaries is limited

to bike riders. With a combination of free parking, bike parking, parklets, waste collection, and NLZs, the Portfolio approach provides both direct and indirect benefits to a range of Bay Ridge residents and visitors. The Portfolio also mitigates against some of the potential political pitfalls involved in reallocating free parking, since it minimizes but does not eliminate the availability of free parking. It also employs some uses that offer overnight usage for parking while maintaining higher turnover uses during the day.

The Portfolio approach is usable by a greater number and variety of people than the Through Movement scenario.

Of course, such a comparison is inherently an artificial one. Officials can be (and often are) more creative in the placement of different uses, such as by adding bike lanes while maintaining free parking through a parking-protected lane. However, by confronting the tradeoffs between these possible uses, it is apparent that striving for such solutions is worth the effort. It also highlights the utility of combining curb use decisions with those about travel lanes. If the Department decides to allocate the curb-lane to a portfolio of uses, it can also consider allocating space previously dedicated to car travel lanes to other uses, such as bike or bus infrastructure.

LIMITATIONS OF THIS ILLUSTRATIVE FRAMEWORK

Although this framework provides useful insights, it is still illustrative. A more comprehensive framework would cover more curb uses, in more places, and would enable greater comparisons by street-type. For example, what makes sense on a narrow one-way street might not make sense on a wide commercial corridor, even if the two streets are immediately adjacent to one another.

There are also significant gaps in the data. For the purposes of demonstration, I have made conservative assumptions where necessary. Nevertheless, an ideal framework would have additional quantitative backing, including on both the availability and impacts of different curb uses. For a further discussion of the assumptions and methodology used, see Appendix C.

RECOMMENDATION 1.2: CONSIDER IMPACT DISTRIBUTIONS WHEN ALLOCATING CURBS

NYC DOT should also identify the distribution of costs and benefits based on various curb space allocations. Numerous interviewees across the US noted that demands from constituents and elected officials often prompt curb usage allocations. That may be an appropriate course of action when officials prioritize the political likelihood of success. However, if the Department does so without understanding the relative distribution of costs and benefits, it risks perpetuating inequitable outcomes. Below, I include a set of sample analyses on the distribution of costs and benefits and discuss the implications of that analysis.

FINDING: CAR OWNERSHIP SKEWS WEALTHIER AND WHITER

The single most important element to consider in any distribution analysis is car ownership, as car owners are the primary beneficiaries of free parking.

Car-Owners Have Significantly Higher Household Incomes Across All Neighborhoods

Neighborhood*	Median Household Income (2018 \$)		
	All Households	Car-Owners	Non-Car-Owners
Morris Heights, Bronx	26,862	51,276	20,557
Upper West Side, Manhattan	117,774	186,411	97,283
St. George, Staten Island	65,366	87,728	16,411
Bay Ridge, Brooklyn	67,512	93,225	43,057
Jackson Heights, Queens	53,979	73,378	40,714

*This data exists at the Public Use Microdata Area (PUMA) level, the US Census Bureau's most granular level of analysis for American Community Survey Data. NTAs are a more granular breakdown; thus, I have included data from the containing PUMA as representative of the neighborhood in question.

Figure 22: Household income by neighborhood and car ownership

In every neighborhood evaluated, the median household income of car-owners significantly exceeds that of non-car-owners. In some neighborhoods, such as Morris Heights and Jackson Heights, the gap is roughly \$30,000. In other neighborhoods, such as the Upper West Side, the gap is almost \$90,000 annually.

Non-car-owners also have lower incomes than those car-owners who rely on on-street parking. This is not a given, since there are differences between the income profiles of those who park off-street and those who rely on on-street parking. Data from NYC’s 2018 Mobility Survey⁷⁰ show residents who rely only on off-street parking have the highest average incomes citywide.^t Although they have lower incomes than off-street parkers, those residents who have a personal car and park it on the street almost uniformly have higher incomes than non-car-owners – at least 60% greater citywide.^u

Residents who have a personal car and park it on the street almost uniformly have higher incomes than non-car-owners – at least 60% greater citywide.

In addition, when considering the *value* of the free parking, it is important to remember that it is worth the most on the Upper West Side. The Department is transferring a value of \$7,000 or more to UWS residents who park on the street on an annual basis. These residents have incomes that far exceed the citywide median. Even in neighborhoods like St.

Car-Owners Are More Likely to Be Non-Hispanic Whites

Neighborhood	Share Population, White (Not Hispanic)		
	All Residents	Residents in Car-Own- ing Households	Residents in Non-Car- Owning Households
Morris Heights	2%	2%	2%
Upper West Side	73%	78%	72%
St. George	47%	53%	28%
Bay Ridge	65%	68%	62%
Jackson Heights	17%	15%	17%

Figure 23: Racial composition by neighborhood and car ownership

George where the transfer is worth less, perhaps \$650 to \$1,200 annually, NYC is implicitly subsidizing a wealthier sub-population at the expense of its lower-income residents.

There are also disparities in car ownership and parking behavior by race. The disparities are not as significant with respect to race as they are for income, but there are still stark contrasts, especially in St.

George, where car owners are 25 percentage points more likely to be non-Hispanic white than are non-car-owners.

Despite these disparities, it is also important to note that among those New Yorkers with a car, nonwhite residents are relatively more likely to park on the street than are white residents. This is because there are significantly fewer nonwhite New Yorkers who only rely on off-street parking (16%) vs. white New Yorkers who only rely on off-street parking (28%).

White New York City Residents Park On-Street at Higher Rates, but On-Street Parking Is a Higher Share of Overall Parking for Non-White New York City Residents.

	No Car	Park Off-Street	Park On-Street
White (Non-Hispanic)	39%	28%	33%
All Other NYC Residents	54%	16%	30%

Figure 24: Comparison of vehicle ownership and parking behavior by race

t This pattern holds across all borough sub-zones except Inner Brooklyn, where the two are roughly the same.
u I assumed income values at the mid-point of stated income ranges. For incomes above \$200,000 per year, I assumed a value of \$250,000 per year. The actual value could be greater. This pattern holds in all borough subzones except the Manhattan Core, which is plausible given the difficulty of finding on-street parking in much of central and southern Manhattan.

FINDING: NON-PARKING USES OF THE CURB CAN HAVE MORE DISTRIBUTED BENEFITS

Parking, of course, is not the only possible use of the curb. Many of the other uses have benefits that are more widely distributed. One obvious example is waste collection zones. These would benefit essentially every household on a given block by increasing access to the sidewalk, mitigating against rat infestations, and potentially reducing the amount of litter and trash on both the sidewalk and the road.

However, even other uses, which do benefit specific categories of users, have more equitably distributed benefits than free parking. NLZs are a useful demonstration. While many New Yorkers do not have a car, most do sometimes rely on passenger or commercial vehicles. They might take a taxi to get home from work. They might have a package delivered, or order food, or get a ride from a friend or family member. Any of these uses can take advantage of the available curb space from an NLZ.

There are still disparities in usage of services like FHV. However, the gap is smaller. The average income of frequent users^v of ride-hailing services is 35% greater than that of non-frequent users citywide,^w vs. the 60% disparity for non-car owners vs. on-street parkers.

There are still disparities in usage of services like NLZs, but the gap is smaller.

Despite this disparity, the NLZs still provide additional usages that might address the balance. They are not only usable by ride-hail vehicles and other FHV but also by personal vehicles and commercial deliveries. Furthermore, even if a use like an NLZ has direct benefits that are still concentrated, the framework implies that these uses have significantly greater benefits to society, through the reduction of VMT and consequent impacts on crashes, pollution, and emissions.

In contrast, free parking imposes additional costs on society. While the benefits of NLZs could and should be more widely distributed, their implementation will still have positive impacts on currently disadvantaged groups, particularly those who currently bear all the costs of free parking while gaining none of its benefits.

Finally, although not examined closely in this report, there are still other uses of the curb that might even skew in the opposite direction. For example, bus lanes would improve mobility for a sub-population of New York City that tends to be lower-income than the population at large.⁷¹

v A frequent user uses the service at least once a month.

w This pattern holds for all subzones of the city except Staten Island.

2. MAKING THE MOST OF NYC'S CURBS

If followed, the proposed framework has several implications for NYC DOT. Three recommendations relate to how the Department can make the most of its curb space: combining curb uses to maximize benefits, prioritizing high-usage curb allocations, and focusing on demand management when reallocating free parking.

RECOMMENDATION 2.1: COMBINE CURB USES TO MAXIMIZE BENEFITS

The framework’s calculations above assume that each use is mutually exclusive of the others. In practice, this is often true. Most curb space is exclusively free parking, with temporary prohibitions only for street cleaning. Bus stops, dedicated bike lanes, and many other uses preclude the possibility of anything else.

DC’s On-Street Corrals Also Increase Visibility at Intersections.



Figure 25: Micro-mobility corral in Washington, DC⁹⁰

Nevertheless, there are opportunities to combine uses, in ways that allow the Department to “stack” benefits rather than trading off between them.

First, NYC DOT could deploy uses like bike corrals and parklets at the end of the block to “daylight” intersections. This would yield all the benefits of either use while accruing an additional safety benefit to both pedestrians and drivers. This would build on prior daylighting efforts in the city.⁷² It is also the approach taken by other cities, such as Washington, DC.⁷³

Daylighting is the practice of prohibiting parking immediately adjacent to crosswalks and intersections. This increases visibility for both drivers and pedestrians, helping to reduce traffic crashes and fatalities.

Second, NYC DOT can continue to identify strategies to add additional curb uses while minimizing the amount of parking eliminated. For example, some of the Department’s pilot NLZs are located next to hydrants to increase the available length without reallocating an additional twenty feet of the curb. Other cities, like Philadelphia, PA and Grand Rapids, MI, have explored the concept of placing bike corrals next to fire hydrants, providing additional bike parking while maintaining emergency access.^{74,75}

The Department can leverage the framework approach to compare these alternatives. The framework implies that removing parking yields a net benefit in many instances. However, doing so presents significant political challenges. If NYC is to realize any of the theoretical benefits, the Department will need to succeed in its efforts to reallocate its curbs. Thus, Department officials might want to focus in the near term on identifying ways to implement new uses in ways that minimize the amount of parking replaced. Areas like hydrants and (to a lesser extent) ends of blocks could enable exactly such initial deployments.

Third, NYC DOT should expand its deployment of multi-use curb-zones. The NLZs are an example of such zones, enabling pick-ups and drop-offs for both people and goods. As I saw in

The Framework Approach Enables More Systematic Comparisons of Different Implementation Strategies

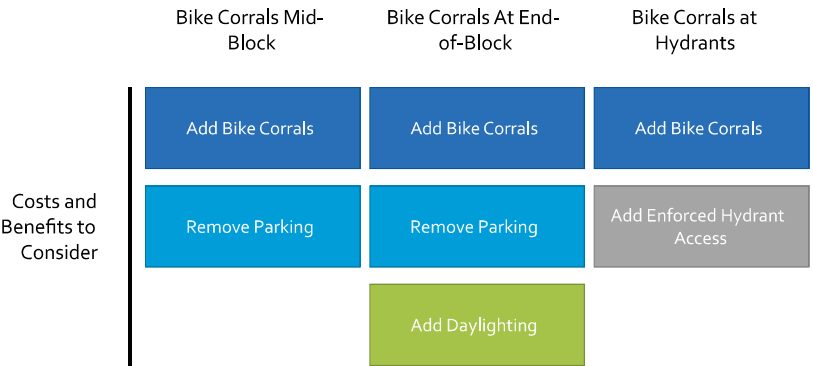


Figure 26: Costs and benefits from various bike corral installation strategies

my observations of the NLZs, the usage profiles vary over the course of the day, with activity for people in the evenings and greater freight and commercial use during the day. These uses complement each other for the 12-hour NLZ period, likely providing greater value than a zone dedicated solely to one use or the other.

NYC DOT has also experimented with the integration of bike corrals into parklets, an idea it should expand upon in the coming years. These provide additional demand for the parklet facilities and could generate additional commercial activity for nearby businesses.

RECOMMENDATION 2.2: PRIORITIZE HIGH-INTENSITY CURB USES

When considering how to allocate curb space, the Department should prioritize uses that enable a higher intensity of usage. Officials should be sensitive to local context, though, and consider where the demand exists to support such usage. As San Francisco and Seattle demonstrate in their curb use hierarchies, the needs for uses can vary between land-use types. They can also vary between geographic contexts.

The Usage of Different Curb Uses Varies Dramatically by Neighborhood

	Upper West Side	St. George	Morris Heights	Jackson Heights	Bay Ridge
Free Parking	1.1	1.3	1.8	1.5	1.2
Bike Lanes*	141.6	0.9	8.1	62.7	11.9
Bike Corrals	6.1	3.1	3.7	6.2	5.5
NLZs	13.0	10.0	13.0	16.0	13.0
Parklets	120.0	30.0	60.0	60.0	60.0
Waste Collection	24.0	3.0	12.4	8.1	7.7

*Note that bike lanes allow through movement, so the usage for 20 feet of the curb does not scale linearly; in this framework, 20 feet of bike lanes would have the same utilization as 200 feet of bike lanes on a given block.

Figure 27: Uses per 20' of curb per day by usage type and neighborhood

remaining block-face available for other uses like car parking. By prioritizing these high-intensity uses, the Department can provide widely shared benefits while still maintaining significant curb real estate for other uses. This might even make the political argument for curb space reallocations easier, although interviewees in NYC and elsewhere acknowledged that repurposing even one parking space has been a significant challenge in some contexts.⁷⁶

As Figure 27 shows, officials should be sensitive to the local context in making these prioritizations. A waste collection zone might be a desirable use of the curb in a high-density neighborhood like the Upper West Side and less useful in a lower-density one like Bay Ridge.

Nevertheless, there are some uses, such as NLZs, that have broadly applicable use and widely distributed benefits. An official in another US city noted they have begun to contemplate deploying passenger pick-up and drop-off zones as a standard practice on each square block throughout the commercial core, potentially combined with “geofencing” restrictions to direct FHV’s toward these consolidated locations.

Interviewees across cities also repeatedly stressed the need to balance high-intensity *access* uses with high-intensity *movement* uses. While a loading zone might only take 40 feet of the curb, a curbside bus or bike lane might preclude all other uses. However, in many instances, cities have arrived at a solution of repurposing

Geofencing is the practice of restricting pick-ups and drop-offs for Transportation Network Companies (TNCs) like Uber and Lyft to specific geographic locations.

vehicle travel lanes for other through movement allocations (e.g., bus and bike lanes). Interviewees often perceived reallocating travel lanes as more politically palatable than eliminating parking. When combined with the framework outlined above, such a reallocation would also allow the Department to add the benefits of new through movement with the benefits of curbside reallocation to other high-intensity uses.

Even while prioritizing productive curb uses, it is important to note that productivity is not the only element that matters in allocating curb space. Several interviewees highlighted the importance of keeping in mind the outcomes curb uses enable, and not just the sheer number of people per hour a specific use might serve. The proposed framework helps to enable such analyses, including the distribution and equity of curb use impacts. Officials should keep these factors in mind when making any curb use allocation decisions.⁷⁷

RECOMMENDATION 2.3: USE DEMAND MANAGEMENT WHEN REALLOCATING PARKING

Under this framework, free parking has significant negative societal impacts. While it has significant value for its users, it also has negative outcomes for them in terms of health and physical activity. NYC DOT should focus its efforts on demand management strategies when reallocating parking, rather than seeking to add new parking to replace it.

Several agencies considered, such as Seattle's SDOT, have been successful in deploying this strategy. They typically do not seek to replace parking when reallocating curb space to other uses. Instead, they focus on managing the demand for that parking, whether through large-scale investments (e.g., new signage that guides drivers to available parking in real-time) or communications to impacted communities about alternatives like bus and rail service. Several interviewees made an

Demand management refers to strategies like pricing and the provision of alternative services to reduce the overall demand for a mode of transportation – in this case, driving and parking a personal vehicle.

NYC DOT should focus its efforts on demand management when reallocating parking, rather than seeking to add new parking to replace it.

explicit contrast between their approaches to managing parking vs. other demands, noting for example that when repurposing loading zones, they try to find an alternative site close by.⁷⁸

NYC DOT already employs several demand management strategies to increase parking availability. One notable example is the Department's staggered parking meter rates, which charge more for the second hour than the first hour of paid parking in select neighborhoods.⁷⁹ However, the Department could expand on these uses and deploy others:

- **Expanding metered parking to increase turnover at the curb.** One model is that of Paris, France, which now charges for almost all its on-street parking.⁸⁰ Paris residents pay a rate of €1.50 per day to park on the street, significantly lower than the rate paid by visitors but still nonzero.⁸¹ Even without expanding metered parking to that degree, more modest increases (such as Seattle's systematic evaluation of paid parking expansions) could provide significant value.
- **Reducing the share of nearby residents and visitors journeying by car.** NYC has the nation's most extensive public transportation network, providing an alternative option for many journeys. The Department has already worked to improve the attractiveness of transit service (e.g., the 14th Street Busway) and should continue to leverage its assets accordingly in future curb-reallocation projects. Interviewees across cities also highlighted the importance of thinking about not only the curb but also the entire transportation network in any curb management initiative.
- **Sharing information about available parking alternatives.** As discussed below, this relies on good and available data on such parking alternatives. However, if the Department can access that information, it could be that the existing parking more than accounts for the existing demand, if only

residents and visitors knew where they could park. NACTO's 2017 report on curb-management best practices highlighted how such data can be used in discussing parking at the "area-wide" level, rather than just on a given block,⁸² a point echoed by interviewees across the country.⁸³

3. INCREASING THE LIKELIHOOD OF SUCCESSFUL CURB USE CHANGES

NYC DOT can take several actions to increase the likelihood of success when trying to reallocate the curb: making alternative curb uses into default policies, designing those policies in ways that maximize their enforceability, and collecting additional data.

RECOMMENDATION 3.1: FORMALIZE NON-PARKING CURB USES AS STANDARD OPERATING PRACTICES

As the Department continues to build its portfolio of alternative curb usage programs, it should make more of them into standard policies rather than one-off initiatives that require special and exceptional consultations. This has already happened to a significant extent with the city's bike lane programs, which the city has integrated into its transportation master plan. The Department should follow suit with uses such as NLZs and bike corrals. As part of this shift, the Department should also expand its reallocation of curb space in residential zones.

RATIONALE: ENABLING MORE BENEFITS, EQUITABLY AND CITYWIDE

This shift would have several benefits for New York City and its residents.

First, if successfully achieved, wide-scale deployment of programs like the NLZs would replicate at scale the localized benefits those programs have brought to their target neighborhoods. Many of these policies, including the NLZs, are relatively cheap to deploy, requiring only a change in signage and incremental enforcement activity. Thus, once the NLZ pilot program has concluded, the Department could expand it across the city with relative (administrative) ease.

As programs like the NLZ pilot have shown, there are also significant benefits to reallocations in residential zones, not just in commercial ones. Furthermore, to date many other programs, such as bike corrals, have focused exclusively on commercial corridors. There could be opportunities for these programs to expand into residential streets, particularly in areas where there is a high demand for a usage like bike parking or car-sharing, or high enough density to warrant the deployment of a waste collection zone.

There are significant benefits to reallocations in residential zones, not just in commercial ones.

Second, making these policies into defaults could make the distribution of non-parking curb uses more equitable. Many Department actions emerge from resident, business, or elected official requests. All of these are reasonable sources for input. However, to rely entirely on them could lead to inequitable outcomes, especially if some areas of the city are more aware of and engaged with the Department's processes than others. Several officials in NYC and elsewhere raised exactly this concern, noting that many programs are reactive, rather than deployed systematically citywide.

Third, such a shift could also increase the likelihood of success by reducing the number of stages at which a vocal minority of opponents might halt a curb reallocation. At the very least, such a shift would increase the number of areas in which curb reallocations are under consideration. Even if the success rate remains the same, the number of successes would increase. Importantly, officials should still consult with

communities affected by curb reallocations. However, several officials indicated the current system, in which parking remains the default, provides opponents with significant opportunities to halt proposed changes, even if the community at large might support the change.⁸⁴

DEFAULT POLICIES IN PRACTICE

The Department could achieve this formalization by adopting a curb prioritization framework, following the model of San Francisco and Seattle. Both cities' frameworks have allowed municipal officials to better articulate and make the case for curb reallocations. Furthermore, both frameworks highlight the importance of non-parking curb uses in all land-use zones, with emphasis placed on enabling movement and access for people and goods.

Even in the absence of such a curb use framework, the Department should codify existing pilots and small programs into citywide initiatives. DC's DDOT provides a model with their bike and scooter corral program, which officials are now in the process of rolling out across the District's eight wards. Furthermore, while DDOT does accept resident suggestions for corral locations, they are also systematically targeting intersections where the placement of corrals would have a positive safety impact due to the daylighting effect.⁸⁵

RECOMMENDATION 3.2: PRIORITIZE ENFORCEABILITY WHEN ALLOCATING CURBS

When designing its curb use policies, NYC DOT should prioritize ones that are both comprehensible to users and enforceable by city personnel. Even the most advantageous curb-reallocation program will not change

Many interviewees highlighted the importance of "flex zones", but shared a concern that time-based changes created problems at the point of transition.

the status quo if users continue to operate as before, either because they are not aware of the changes or because they are willfully disregarding them.

For example, many interviewees highlighted the importance of "flex zones," where usages change by time of day – from a loading zone to free parking, from a bus lane to a regular travel lane, etc. NYC already has several such zones – the NLZs are a prime example. However, many interviewees shared a concern that these changes between usages created problems at the point of transition. A parked car in a bus lane, or an NLZ, might eliminate the benefit that segment of curb space would otherwise provide.⁸⁶

What would a focus on comprehensibility and enforceability look like in practice?

First, the Department should strive for consistency in its curb uses, both geographically and by usage type. For example, the NLZ program currently varies in hours between neighborhoods, with some running until 6:00pm and others ending at 7:00pm. Because the pilot program is only in select neighborhoods, this inconsistency is currently unlikely to cause problems, as both residents and enforcement staff will be familiar with the specific details of their respective areas. However, if the Department implements the program at scale, a unified end-time could make it easier for enforcement staff to identify violations. It could also make it easier for users to rely on the program when traveling across the city.

Second, the Department should minimize the number of wholesale curb use changes by time of day. Beyond standardizing signage and times, some interviewees highlighted the difficulties in successful enforcement of curb uses that change multiple times over the course of the day. In cities that have experimented with more dynamic curb uses, e.g., altering the rules three, four, or even more times daily, there have sometimes been issues with noncompliance and general incomprehension among the target audience. The

success of NLZs shows that two uses – a daytime one and an overnight one, for instance – should be comprehensible enough for effective implementation. In the longer term, there may be technological platforms that will enable more dynamic uses, just as pay-by-phone apps have streamlined dynamic parking pricing. On a sign-based model, simpler, or at the very least more standardized, is better, for now.

Some interviewees noted that once residents are familiar with the rules, complex allocations can succeed.⁸⁷ Although this opinion was not universal, it does indicate that there might be the potential for more complex rules and allocations in places where officials think they might have repeat customers, vs. less complex ones where visitors are more likely. However, given that the most complex allocations tend to be in zones with the most visitors (like CBDs), the Department should carefully weigh the tradeoffs of additional, theoretical, curb use optimization with the realities of actual implementation.

Third, the Department should identify strategies to increase the likelihood of compliance without solely relying on active enforcement. Washington, DC’s pilot project with curbFlow demonstrates one such approach. DDOT leveraged the desire from delivery operators for reliable curb access to incentivize payment and compliance with the terms of these pre-reserved paid loading zones. In the absence of a technology platform, the Department could also consider using physical infrastructure to better ensure compliance. For example, officials could create a buffer for a Neighborhood Loading Zone by siting a bike corral immediately adjacent, reducing the likelihood of parked cars encroaching on the zone.

RECOMMENDATION 3.3: GATHER ADDITIONAL DATA ON CURRENT CURB USAGE

Compared to most American cities, NYC has a remarkable amount of data on its transportation systems and patterns, including on aspects of its curbs and their usage. The city also makes a great deal of that data public through its Open Data portal. Nevertheless, there are significant gaps in that data, including the foundational information on how curbs are allocated *today*, that the Department should address. This would enable better-informed planning and decision-making.

A crucial omission in existing data is information on how the city’s millions of free on-street parking spaces are used. The city cannot and should not expect to know every use of every space. However, the Department should know more than it does today. For example, officials could leverage the same camera-based monitoring system used to evaluate pick-up and drop-off zone pilot projects to more systematically evaluate occupancy and turnover rates of free parking. This would allow department officials to 1) better understand how such spaces are used, 2) identify areas where free parking is under-utilized, as these could be useful targets for reallocation, and 3) make the case to both elected officials and the public for the reallocation of curb space toward non-parking uses.

A crucial omission in existing data is information on how the city’s millions of free on-street parking spaces are used.

As non-parking curb uses become more common across the city, additional data would also allow NYC DOT to better evaluate the impacts those uses have on critical outcomes like sustainable transportation usage, traffic fatalities, and more. The existing FHV data⁸⁸ also demonstrate the ways officials can use such data to improve curb use policies. For example, it is already possible to analyze the amount of FHV pick-ups and drop-offs by geography. When combined with inventory data on existing curbs, these data allow officials to understand which areas of the city have the greatest FHV activity per foot of curb. The Department could use these indicators in siting NLZs.

Municipal officials and others also stressed the importance not only of gathering data but also of having a system in place to keep that data updated.⁸⁹ While one-time data collection projects can be useful, the rate

of change in the transportation sector has increased rapidly in recent years, making studies on usage potentially outdated as soon as they are complete. Thus, when collecting data, NYC DOT should also identify strategies that will keep that data current with minimal public-sector effort.

In any such relationship, though, the Department should be wary of contracts or relationships that require the city to give up long-term control of its curbs. While Chicago's negative experience with its long-term sale of metered revenue shows the perils of such monetary transfers (see Appendix B), the Department should also be careful about giving up long-term control of the allocation and use of its curbs more broadly.

NYC's curbs are an incredible asset. They are also a powerful bargaining chip for NYC DOT to leverage in its management of the citywide mobility system. Private operators want access to the curb. The new curb-management firms want to facilitate that access. However, it is NYC DOT that owns the city's curbs. The Department should use that ownership to incentivize the ongoing provision of data about the curb. For example, in its pilot on-street car-sharing project, NYC DOT required vendors to survey their members about how car-sharing changed their travel and car ownership behaviors. The Department should emulate this approach in future projects.

NYC's curbs are an incredible asset. They are also a powerful bargaining chip for NYC DOT to leverage in its management of the citywide mobility system.

IMPLEMENTATION CONSIDERATIONS

NYC DOT Should Be Strategic About the Order of Implementation

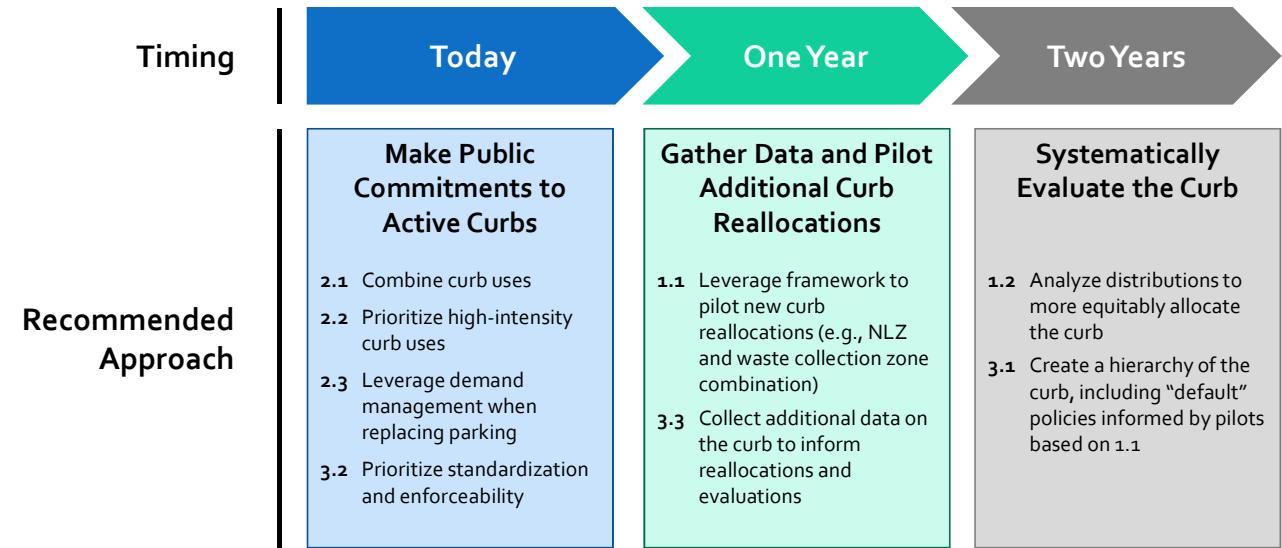


Figure 28: Proposed sequencing of recommendations for NYC DOT

IMMEDIATE ACTIONS: COMMIT TO MORE ACTIVE CURBS

NYC DOT should commit to a more active use of its curbs. The Department could implement four recommendations as standard policies relatively quickly, building on existing agency practices. These recommendations include combining curb uses (2.1), prioritizing high-intensity curb uses (2.2), leveraging demand management when reallocating parking, rather than replacing it (2.3) and prioritizing standardization and enforceability in all curb use policies (3.2). Adopting each of these recommendations would enable the Department to make better use of its curbs, while also making a public commitment to shifting the balance of the curb toward more active uses.

ONE YEAR: GATHER DATA AND PILOT ADDITIONAL CURB REALLOCATIONS

Over the next year, the Department should increase its data collection on the allocation and usage of the curb (3.3). This data will be critical for any efforts to redeploy the curb, not only in making the case to the public but also by enabling the subsequent development of a more systematic approach to the curb.

The Department should also leverage the framework laid out in 1.1 to pilot additional curb reallocation projects, incorporating the above principles. For example, officials could pilot an expanded version of the NLZ program, coupled with one to two additional uses (e.g., waste collection zones and/or bike corrals). Any such pilot must include pre-defined evaluation criteria, such as pre- and post-implementation usage statistics, impacts on double parking, and reduced sidewalk clutter.

TWO YEARS: SYSTEMATICALLY EVALUATE THE CURB

Finally, the Department should incorporate the lessons from these pilot projects (and its existing curb use allocation work) into a more systematic hierarchy of the curb. This should build on the models developed by San Francisco and Seattle but should also incorporate the lessons from the quantitative framework proposed in 1.1 (and any subsequent elaboration of that framework). An important consideration in any such framework should be the equitable distribution of the curb – not only between users, but also across NYC. In existing pilot projects like its on-street car-sharing program, NYC DOT has already demonstrated the impacts of thinking systematically about ways to improve the curb. The Department can and should incorporate this approach into its broader thinking on how best to allocate its valuable curbs.

CONCLUDING REMARKS

CONCLUSION

THE NYC DEPARTMENT OF TRANSPORTATION manages an incredible array of transportation assets: bridges, tunnels, sidewalks, streets, and more. Out of all of those, the Department's 11,468 miles of curbs might be the most contested. It is on the curb that New Yorkers can catch a bus, hail a cab, park a car, lock up a bike, drop off a package, grab a bite to eat, and so much more. The humble curb can enable commerce, movement, recreation, beautification, and access to the infinite opportunities in a city as vast as New York.

The uses of the curb are almost infinite. The curb space available is not.

This contest for limited curb space is not new, but it has changed. While free parking has dominated NYC's curbs since the 1950s or before, the number of alternative uses has grown dramatically in recent years. The emergence of today's new transportation modes like ride-hailing and shared bicycles place increased strain on contested space. The potential deployment of tomorrow's transportation technologies, such as autonomous vehicles, would intensify that contest.

Allocating so much of NYC's curbs to free parking already has significant negative implications, leading to additional pollution, deaths in traffic, and greenhouse gas emissions. Those negative outcomes will worsen in the coming years, as concerns about accessibility, climate, and equity continue to grow.

Despite the costs, free parking will continue as a significant part of NYC's curb use portfolio in the coming years. However, NYC DOT can and should strive to shift the balance, by reallocating some of the space from free parking to other functions. These include bike parking, pick-up/drop-off zones, paid parking, bus lanes, and spaces for car-sharing. Changing the status quo of the curb is no easy task, but despite the difficulty, it is worth the effort. By re-prioritizing its curbs, away from free parking and toward more active, equitably accessible uses, the Department can make the city a safer, healthier, greener, and more vibrant place for *all* the people who call New York City home.

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APPENDIX A: INTERVIEWS

INTERVIEWEES

I conducted interviews and small-group discussions with more than two dozen officials across New York City and other major US cities.

NEW YORK CITY DEPARTMENT OF TRANSPORTATION

I spoke with 16 officials across the following areas of NYC DOT:

- Bike-Sharing Programs
- Borough Commissioner
- Car-Share Policy
- Economic Analysis
- Electric Vehicle Charging Policy
- Freight Policy and Planning
- Parking Policy and Planning
- Public Space Policy
- Revocable Consents
- Traffic Control and Engineering
- Transit Policy and Planning

MUNICIPAL OFFICIALS OUTSIDE OF NEW YORK CITY

I spoke with nine officials across seven US cities:

- Boston, MA
- Chicago, IL
- Columbus, OH
- Minneapolis, MN
- San Francisco, CA
- Seattle, WA
- Washington, DC

The most common role for interviewees was manager of the policy and implementation of curb allocation or access (four of the nine officials). I also spoke with the deputy director of a municipal transportation agency, a curb-management analyst, a loading zones manager, the director of an office responsible for innovation and piloting (including on curb use), and a director of research and evaluation programs.

NON-PROFIT AND FOR-PROFIT SECTOR INTERVIEWS

I spoke with individuals who work on curb allocation issues from the following organizations:

- Coord
- SharedStreets
- Transportation Alternatives

INTERVIEW STRUCTURE

I conducted these 30-60 minute interviews either in-person or over the phone. When speaking with officials from NYC DOT, I asked the following questions (along with follow-ups as prompted by initial responses):

- Could you describe the work you do within NYC DOT, and how that relates to curb management?
- What data, criteria, or metrics do you typically consider when making a change to the curb?
- Do you have a way of quantifying the benefits and costs of the existing use vs. the proposed new use, and/or other possible uses? Can you quantify the distribution of those costs and benefits?
- How do you evaluate the geographic placement of curb space interventions (and if applicable, how do you evaluate the time restrictions of curbside interventions)?
- What data, criteria, or metrics do you use to evaluate a curb space intervention, once it has been deployed? Are there any evaluations that you could share or speak to?
- Could you speak to the realities of implementing a new use of the curb, either operationally or politically? How have you mitigated against negative consequences when changing curb allocations?

My interviews with city officials from other cities followed a similar pattern, allowing for the fact that my interviews were largely with individuals who were broadly responsible for, or at least familiar with, the city's curb management strategy, vs. one particular use. Questions included:

- Who controls the allocation of curb space in your city/region? Does that differ on paper vs. in practice?
- What is your strategy for making curb allocation decisions? Are these made on a case-by-case basis or through a broader framework?
- How do you evaluate possible curb uses against parking? Does that evaluation differ between free or metered parking?
- How do you evaluate possible non-parking curb uses against each other?
- Are there particular criteria, data, or metrics that inform your decisions?
- How have you mitigated against potential negative consequences when changing curb allocations?
- Do you know of other cities with sophisticated approaches to curb management that would be worth investigating?

My interviews with non-governmental organizations were similar in structure to those of my interviews with other US cities, with an additional emphasis on how these organizations make the case to reallocate the curb.

APPENDIX B: CURB MANAGEMENT IN OTHER CITIES

OVERVIEW

I conducted interviews with officials in seven other US cities, initially selecting them based on conversations with NYC DOT officials and existing literature. In each of my initial interviews, I asked which cities interviewees viewed as having the most sophisticated or interesting approaches to curb management. I have included several of the common answers as case studies below: Seattle, DC, and Chicago. I also spoke with officials in Boston, Columbus, Minneapolis, and San Francisco.

Cities Typically Allocate Curb Space on a Case-By-Case Basis, But Some Are More Systematic.

	Curb allocated on a...	Have curb hierarchy?	Quantitative metrics considered ^x	Concerns raised
New York City, NY	Case-by-case basis	No	<ul style="list-style-type: none"> Revenue Project-specific metrics (e.g., double parking rates) Safety 	<ul style="list-style-type: none"> Enforcement Local support
Seattle, WA	Case-by-case basis, informed by curb use hierarchy	Yes	<ul style="list-style-type: none"> Revenue Usage (primarily for parking) Existing supply 	<ul style="list-style-type: none"> Enforcement Demand management Monetization
Washington, DC	Case-by-case basis	No	<ul style="list-style-type: none"> Revenue Usage (where available, e.g., TNCs, scooters, parking) 	<ul style="list-style-type: none"> Enforcement Comprehensibility
Chicago, IL	Case-by-case basis	No	<ul style="list-style-type: none"> Revenue Project-specific (e.g., double parking rates) Safety 	<ul style="list-style-type: none"> Enforcement Role of technology Monetization Local support
San Francisco, CA	Case-by-case basis, informed by curb use hierarchy	Yes	<ul style="list-style-type: none"> Usage Existing supply Trips enabled per foot of curb 	<ul style="list-style-type: none"> Standardization Comprehensibility
Boston, MA	Case-by-case basis	No	<ul style="list-style-type: none"> Revenue Safety Usage (where available) 	<ul style="list-style-type: none"> Enforcement Legibility Local support
Minneapolis, MN	Case-by-case basis	No	<ul style="list-style-type: none"> Project-specific metrics (e.g., scooter ridership) Safety 	<ul style="list-style-type: none"> Enforcement Comprehensibility Role of technology
Columbus, OH	Case-by-case basis	No	<ul style="list-style-type: none"> "Anecdotal" data on impacts Usage (where available) Trips enabled per foot of curb Existing supply 	<ul style="list-style-type: none"> Enforcement Role of technology Monetization

Figure 29: Key findings from interviews with city officials

Except where otherwise noted, these findings (and the case studies below) derive from the interviews discussed in Appendix A.

^x Note that these metrics are those that were mentioned in interview discussions and may not be exhaustive. For example, it is likely that all cities consider safety as part of their curb space evaluations. However, it is instructive to observe which metrics received relatively greater emphasis in discussions, and which less.

SEATTLE, WA

The City of Seattle and its Department of Transportation (SDOT) have a sophisticated approach to managing curb space, including a hierarchy of curb use priorities and a comprehensive approach to allocating that curb through geographic and time-based designations.⁹²

USING A CURB-ALLOCATION HIERARCHY TO INFORM DECISION-MAKING

Seattle defines its curb space as “flex zones,” emphasizing that this scarce resource can serve a variety of roles. The city adopted a formal curb-usage hierarchy in 2016 which differs based on land use: residential vs. commercial / mixed-use vs. industrial. In all areas, Seattle first prioritizes movement (the “modal plan”), which includes projects like bus lanes and bike lanes. Active loading and unloading of people and goods follow, with access for people prioritized more highly in residential zones and vice versa in industrial and mixed-use zones. Other uses, like activation (e.g., seating areas), greening (e.g., planters), and storage (e.g., long-term car parking), are prioritized differently based on the zone as well.

Seattle Has Explicit Curb-Usage Priorities, Varying by Land-Use

Category	Examples		Residential	Commercial/Mixed-Use	Industrial
Movement	<ul style="list-style-type: none"> Car travel lanes Bike lanes Bus lanes Sidewalks 	1	Movement	Movement	Movement
		2	Access for People	Access for Commerce	Access for Commerce
		3	Access for Commerce	Access for People	Access for People
		4	Greening	Public Space Activation	Storage (Including Vehicles)
Access for People	<ul style="list-style-type: none"> Pick-up / drop-off zones Bike-share stations Short-term metered parking Transit stops 	5	Storage (Including Vehicles)	Greening	Public Space Activation
		6	Public Space Activation	Storage (Including Vehicles)	Greening
Access for Commerce	<ul style="list-style-type: none"> Free loading zones Paid loading zones 				
Greening	<ul style="list-style-type: none"> Planters 				
Storage (Including Vehicles)	<ul style="list-style-type: none"> Free parking Construction Reserved parking (e.g., police) 				
Public Space Activation	<ul style="list-style-type: none"> Parklets Plazas Seating Public art 				

Figure 30: Seattle’s curb use allocation priorities by land-use type (highlighting free parking)

In conversations with Seattle officials, they noted that just because modal plan priorities are prioritized first does not mean other uses are not employed as well. Seattle’s modal plan priorities are numerous, but there are many more ways to use the curb than just movement. As one interviewee noted, cities cannot function without movement, but they also cannot function without commerce. Thus, there are times when other priorities, such as access and loading for people and goods, need to be elevated. There are also times where other uses, like activation, make sense given the context of the existing streetscape and surrounding built environment.

Within each category, Seattle officials make decisions about allocations based on a combination of quantitative and qualitative indicators. Some uses, like short-term paid parking, skew more quantitative, with decisions based on comprehensive yearly evaluations of parking usage and turnover. SDOT has specific parking occupancy targets that inform geographic and time-based expansions of their extensive metered parking system. SDOT deploys other uses, like unpaid loading zones and commercial parking, based on requests from local businesses, although officials expressed interest in developing a more systematic approach. Similarly, efforts to increase activation, greening, or storage are generally “one-off” projects, evaluated on a case-by-case basis given local context.

Figure 31: Categories and examples of curb use types

Despite this flexibility, Seattle officials still thought that it was useful to have the priorities as a starting point. This hierarchy serves as a basis for any curb-management discussion and make it more likely that the city will be able to allocate the curb to the true highest and best use, vs. maintaining the status quo.

The priorities are part of a larger systematic decision framework, including an inventory of existing conditions, identification and evaluation of alternatives, decision-making, implementation, and evaluation. A diagram of that framework is included below.

SEATTLE RIGHT-OF-WAY (ROW) ALLOCATION DECISION FRAMEWORK

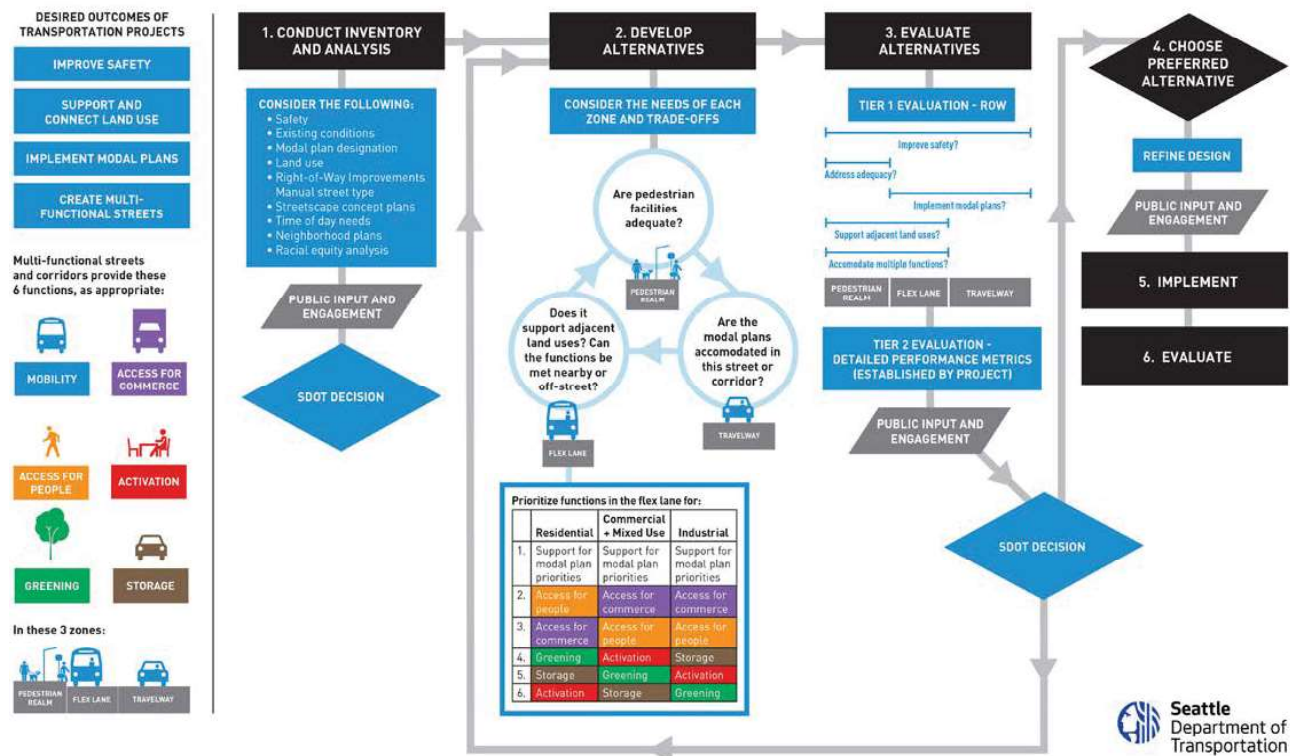


Figure 32: SDOT decision-making framework for curb use allocation⁹³

MAKING THE MOST OF A SCARCE ASSET

SDOT officials acknowledged that even with their framework-based approach, it is not possible to find a solution that provides every possible user of the curb with their desired outcome. As the city's network of bus lanes, bike lanes, and other modal plan priorities are built out, those have begun to come into conflict with other uses, and with each other. This leads to hard conversations and decisions on tradeoffs between possible uses. However, several strategies make success more likely.

First, SDOT deploys combined curb- and right-of-way allocations, such as a freight/transit corridor in downtown Seattle.^y By combining allowed usages and restricting others, the city can improve movement while simultaneously allowing necessary access for commercial loading and unloading.

Second, Seattle changes the allocation and pricing of its curb by time of day. In particular, its metered parking system has variable pricing over the course of a day, with prices set based on observed parking demand and occupancy.

^y This is similar in concept to the 14th Street Busway in New York City.

Third, Seattle officials are concerned with monetization and enforceability. They stressed the importance of designing policies that officials can cost-effectively enforce, and with sufficient mechanisms in place for users to pay when relevant. As with variable pricing, officials felt most confident in the enforcement and usability of paid parking but were not yet comfortable with the same for active loading and unloading, as these activities are difficult to monitor, enforce, or monetize.

Seattle Changes Paid Parking Rates and Locations by Time of Day¹⁹⁴

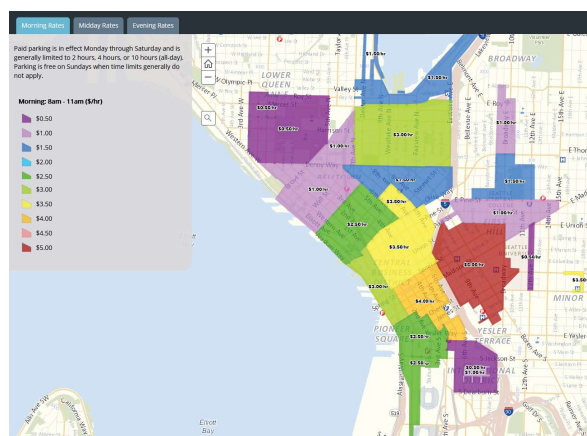


Figure 33: Seattle parking rates, morning

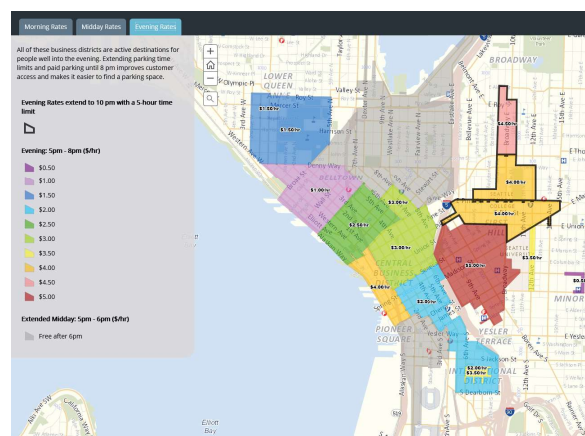


Figure 34: Seattle parking rates, evening

Finally, Seattle officials work to mitigate the negative consequences of changing curb usage in the context of broader transportation priorities. For example, when eliminating parking, SDOT routinely uses demand management strategies rather than adding additional parking. In contrast, when eliminating loading zones, such as for a bike lane, SDOT will find nearby alternatives on intersecting streets. This approach highlights the relative importance Seattle places on active uses of the curb vs. storage.

WASHINGTON, DC

The city of Washington, DC and its Department of Transportation (DDOT) were repeatedly cited by officials from other cities as a useful example to follow.

USING THE CURB TO ADVANCE SUSTAINABLE TRANSPORTATION

Washington, DC allocates its curb space in support of its broader goal of a 75% non-auto mode share among its residents by 2032. DC officials consider curb-usage in three broad categories: through movement, short-term usage, and long-term storage. In commercial areas, they prioritize a balance of through-movement and short-term usage. In residential areas, the demand for through movement is not as significant, allowing for greater allocations toward the other two categories. DDOT completed its own curbside management study in 2014 that discusses many of these issues in detail.⁹⁴

DDOT's curb-management team is responsible for initially adjudicating conflicts between alternative curb uses. These debates involve units from across DDOT and other interested stakeholders, such as the Washington Metropolitan Area Transit Authority (WMATA). In some cases, decisions are elevated to the head of DDOT or even the Mayor and City Council.

As in many other cities, DDOT does consider the revenue implications of eliminating metered parking. Although parking meter revenue does not directly fund DDOT's operations (it funds DC's contribution to WMATA), it still represents revenue the city must make up elsewhere. This informs the city's desire to monetize other aspects of the curb, such as its creation of paid commercial parking for loading and unloading.

MAXIMIZING THE LIKELIHOOD OF SUCCESSFUL ENFORCEMENT

In recent years, DDOT has implemented several innovative approaches to curb management, yielding useful insights for other cities.

First, DDOT has demonstrated the importance of comprehensibility and enforceability in any curb-usage allocations. DDOT experimented with Pick-Up and Drop-Off (PUDO) zones for Transportation Network Companies (TNCs) in high-traffic, high-profile nightlife zones, starting after 10:00pm. Before the implementation of the PUDOs, DC observed increased rates of double parking and unsafe passenger and driver behavior. Officials view the pilots as successful but found that parkers often violated the start time of the zone, leading to continued unsafe behavior on the part of TNC drivers and passengers. In the next iteration of the PUDO program, zones will be 24/7 to reduce the likelihood of parked cars blocking the zones.



Figure 35: A pick-up/drop-off zone in Washington, DC¹⁹⁵

Second, DDOT has begun to increase the monetization of its curb use. It is also interested in expanding that monetization where technology enables it. For example, commercial loading zones already charge per use. Although PUDOs are currently free, there could be opportunities to leverage technological platforms (such as the TNCs' location data) to institute charges for use.

In that vein, DDOT has also collaborated with new technology provider curbFlow to deploy reserved, short-term loading zones. This program addresses two related problems: first, it is difficult to monetize short-term usage (since enforcement must be highly attentive to short trips), and second, delivery operators want reliable access to the curb. DDOT and curbFlow leveraged that desire for reliable curb access to incentivize operator participation, with an app-based system that streamlined payment and enforcement. The nine-zone pilot ran for three months in late 2019, yielding a reported 64% reduction in double parking behavior near the pilot zones.^{95,96}

COMBINING CURB USES TO MAXIMIZE PUBLIC VALUE

DDOT has identified ways to combine alternative curb uses into programs that generate greater impacts vs. individually. Most notably, the District is now installing on-street corrals for bike and dock-less scooter parking.⁹⁷ These zones are at the end of the block, thus also enforcing the District's policy of "daylighting" intersections to improve visibility for all users of the public right-of-way. DDOT even deploys this program in residential ones, further emphasizing the ability for city officials to successfully redeploy curb space across land-use types.



Figure 36: Micro-mobility corral in Washington, DC¹⁹⁶

CHICAGO, IL

Unlike the other cities considered, Chicago no longer has full control of its curbs. In 2008, the City sold the rights to its metered parking revenue to a private operator for 75 years, lasting through 2083.⁹⁸ It is in that context that the City of Chicago, its Department of Transportation (CDOT), and numerous other involved municipal agencies still make routine decisions on reallocating curb space.

A LARGELY REVENUE-BASED APPROACH

Chicago and CDOT must explicitly confront the cost of reallocating curb space. The city must replace any removed metered parking spaces or pay the private operator the difference. It also incentivizes city officials to always be “on the lookout” for opportunities to add more paid parking to alleviate financial pressures on the rest of the system. This might lead to positive externalities, such as adding paid parking to a corridor that will benefit from higher parking turnover. However, it might also lead city officials to prioritize car access to the curb, even when another use might be societally (if not fiscally) optimal. Although this is not entirely different from the situation other cities face – the “bottom line” matters to everyone – having to actively *pay* for any removed revenue does seem to impose a distinct perspective.

Most importantly, because of the sale of metered revenue, Chicago officials now speak about their curbs with an explicit monetary value. That value might still be incorrect – one interviewee described it as “fuzzy” – but it is a starting point for discussions about reallocating the curb, nonetheless. For example, if a given parking meter space generates \$5,000 in revenue, and officials identify a way to repurpose the street that might generate \$6,000 in revenue, the city and its Department of Finance would generally approve the changeover. However, if the new use might only generate \$2,000 or nothing at all, then various officials need to be engaged to discuss whether the policy outcome is worth the cost differential that must be made up.

While conversations about metered parking focus on quantitative revenue implications, the rest of Chicago’s approach to allocating curb space is like that of many other cities: it is done on a case-by-case basis, without an overarching framework. To be clear, some concerns, like safety, must always be satisfied. However, the general approach is more ad hoc, with the outcome dictated by the local context and involvement of stakeholders, such as which of the city’s fifty (and famously hands-on) aldermen^z is responsible for the curb in question.

IMPEDIMENTS TO SUCCESS

Chicago officials find that enforcement is a key issue for curb-usage. Ineffective enforcement hinders their most innovative curb-usage allocations. For example, in a recent paid commercial loading zones project, there have been issues with police cars parking in these loading zones; not only are they not enforcing the zones but also they are making the situation worse.

Officials also highlighted the lack of data on non-revenue metrics as an issue in evaluating program success. Revenue is often the only data available with which officials can evaluate a program. Revenue and other outcomes (e.g., usage, decreased unsafe behavior) are likely correlated. However, there could be times when this relationship breaks down. One piece of the curb might be highly used, but due to low enforcement, it is not generating revenue. Or, it might be the case that even a low-revenue curb allocation is helping to eliminate double parking. In the absence of such other metrics, evaluations default to revenue coupled with anecdotal reports, both of which are helpful but neither of which is enough to understand the true value of a curb space program.

^z The name of city councilors in Chicago.

STRATEGIES TO IMPROVE CURB USAGE EFFECTIVENESS

Chicago officials are also interested in further leveraging the concept of “flex zones,” both in terms of time-based changes in allocations and in combining different usages. Officials highlighted that the curb does not necessarily have to be a binary of parking vs. no parking, and could instead function as a multi-use curb, serving different stakeholders simultaneously.

Officials have been most successful when they have engaged in proactive conversations with interested stakeholders, not only elected officials and community members but also specific users of the curb, such as local business owners or freight operators. These conversations are not always held, but when they do happen, they have informed the design and implementation of curb-usage interventions. However, without a more systematic approach to having and continuing these conversations, there was concern that important insights might be lost.

APPENDIX C: METRIC DEVELOPMENT METHODOLOGY

APPROACH

I developed the proposed metrics through a combination of a literature review of existing quantitative frameworks, direct observations, and project evaluation reports from the New York City context. Where applicable, I calculated specific numbers using an Excel-based model.

CURB ALLOCATION		NEIGHBORHOOD		USES		METRIC OUTPUTS		OVERALL FRAMEWORK		CONSOLIDATED FRAMEWORK	
1	Upper West Side	Neighborhood Tabulation Area									
2	Neighborhood Residential	Type of street									
3	Free Parking	Amount of free parking added / removed									
4	Full Day	If removed, time period parking removed									
5	Bike Lanes	Amount of bike lanes added									
6	Yes	Does it provide a "through route" for bike riders in other neighborhoods?									
7	Yes	Does it fill a gap in the bike lane infrastructure (i.e., is there no similar facility that runs parallel within 1 block on either side)?									
8	Bike Parking	Amount of bike parking added / removed									
9	NLZs	Amount of NLZs added / removed									
10	Parklets	Amount of Parklets added / removed									
11	Waste Collection	Amount of Waste Collection added / removed									
12	Free Parking	0.00									
13	Bike Lane	NA									
14	Bike Parking	0.00									
15	NLZs	0.00									
16	Parklets	0.00									
17	Waste Collection	0.00									
18	Total	0.00									
19	No	Any curb-space assigned?									
20	Free Parking	0.00									
21	Bike Lane	0.00									
22	Bike Parking	0.00									
23	NLZs	0.00									
24	Parklets	0.00									
25	Waste Collection	0.00									
26	Total	0.00									
27	Free Parking	0.00									
28	Bike Lane	0.00									
29	Bike Parking	0.00									
30	NLZs	0.00									
31	Parklets	0.00									
32	Waste Collection	0.00									
33	Total	0.00									
34	Free Parking	0.00									
35	Bike Lane	0.00									
36	Bike Parking	0.00									
37	NLZs	0.00									
38	Parklets	0.00									
39	Waste Collection	0.00									
40	Total	0.00									

Figure 37: Screenshot of curb-allocation impact model

The Excel file for the model is available from the author upon request.

CITYWIDE DATA, ASSUMPTIONS, AND SOURCES

DEMOGRAPHICS

Description	Value	Unit	Source	Notes
Household vehicle ownership rate	45.5%	%	2013-2017 ACS Five Year Estimates compiled by NYC Department of City Planning ⁹⁹	
Total vehicles	1,958,984	Vehicles	Ibid.	Lower bound estimate based on number of reported vehicles per household, with 3+ households assessed as having 3 vehicles
Total workers	3,975,121	People	Ibid.	
Mortality before age 65	184.9	Deaths/100K	NYC Vital Statistics ¹⁰⁰	
Mortality before age 75	265.6	Deaths/100K	NY DOH Reports ¹⁰¹	

TRAVEL BEHAVIOR

Description	Value	Unit	Source	Notes
Commute share, driving alone	22%	Percent	2013-2017 ACS Five Year Estimates compiled by NYC Department of City Planning ¹⁰²	
Commute share, carpooling	4.6%	Percent	Ibid.	
Trips per day, spaces occupied by commuting cars	3	Trips/Day	Author estimate	See model for sample trip assumptions
Trips per day, spaces occupied by other cars (neighborhoods with 2 ASP days per week)	0.45	Trips/Day	Author estimate	See model for sample trip assumptions
Trips per day, spaces occupied by other cars (neighborhoods with 4 ASP days per week)	0.5	Trips/Day	Author estimate	See model for sample trip assumptions
Average number of trips taken per person per day	3.5	Trips/Day/Person	2018 NYC Mobility Survey ¹⁰³	
People per car trip	1.7	People/Car Trip	FHWA ¹⁰⁴	
Average traffic speed	12	Miles per hour	Assumption	Comparable to urban congestion in other cities
Average trip duration	33	Minutes	NYC 2018 mobility survey ¹⁰⁵	
Average trip length	6.6	Miles	Calculation based on speed and duration	
Bike trips as share of all trips	2%	Percent	Calculation based on 2017 and 2018 NYC mobility surveys ^{106,107}	
Walk trips as a share of all trips	0.295	Percent	Ibid.	
Car trips as share of all trips	0.31	Percent	Ibid.	
FHV trips as share of all trips	0.025	Percent	Ibid.	
Transit trips as share of all trips	0.32	Percent	Ibid.	Includes bus, subway, commuter rail, ferry
Other trips as share of all trips	0.025	Percent	Ibid.	

VMT IMPACTS

Description	Value	Unit	Source	Notes
Car passenger fatalities	0.37	Fatalities per 100 million VMT	NYC fatality data ¹⁰⁸ and NY DOT data on citywide VMT ¹⁰⁹	Relies on 2017 VMT and 2018 fatality data
Bicycle fatalities	0.08	Fatalities per 100 million VMT	Ibid.	
Pedestrian fatalities	0.6	Fatalities per 100 million VMT	Ibid.	
Greenhouse gas emissions (passenger car)	404	Grams CO ₂ /VMT	EPA estimate ¹¹⁰	Consistent with other estimates ¹¹¹
Rebound factor for carbon emissions due to increased consumption	60%	Percent	Ottelin, Heinonen, and Junnila ¹¹²	Based on study of car ownership and changes in Finland

Description	Value	Unit	Source	Notes
PM _{2.5} emissions, light-duty vehicles	0.012	Grams/VMT	Bureau of Transportation Statistics ¹¹³	
PM _{2.5} emissions, light trucks	0.014	Grams/VMT	Ibid.	
PM _{2.5} emissions, heavy diesel trucks	0.23	Grams/VMT	Ibid.	
PM _{2.5} levels citywide	9.5	Micrograms/cubic meter	NY Public Health Department ¹¹⁴	
CO ₂ emissions, heavy trucks	2.683	Kilograms/liter	NYC Greenhouse Gas Inventory, 2016 ¹¹⁵	

STREET TYPE

In developing the model, I distinguished between “Neighborhood Residential” and “Neighborhood Commercial” streets. I assume that both contexts have at least some residential property, but the latter has a mix of commercial and residential property. Based on the inclusion of commercial properties (and thus trips), I assume uses like parklets will have higher usage in “Neighborhood Commercial” vs. the same curb-deployment in a more residential context. Neither of these street types are representative of CBD zones.

For the tables included in Recommendation 1.1, I have included comparisons on the “Neighborhood Commercial” metrics.

SUB-CITY-LEVEL DATA, ASSUMPTIONS, AND SOURCES

Except where noted, the data below are at the level of the Neighborhood Tabulation Area containing the respective neighborhood. Throughout, the following abbreviations are used:

- UWS: Upper West Side, Manhattan
- MH: Morris Heights, Bronx
- JH: Jackson Heights, Queens
- BR: Bay Ridge, Brooklyn,
- SG: St. George, Staten Island

DEMOGRAPHICS

Description	UWS	MH	JH	BR	SG	Unit	Source
Population	134,001	57,259	103,414	79,848	32,893	People	2013-2017 ACS Five Year Estimates compiled by NYC Department of City Planning ¹¹⁶
Population (20 – 64)	85,499	34,379	66,247	50,501	19,620	People	Ibid.
Population (20 – 74)	96,118	35,929	72,586	56,340	21,276	People	Ibid.
Workers	73,469	20,828	50,159	38,844	13,213	People	Ibid.
Occupied households	65,005	19,202	36,101	33,320	12,155	Households	Ibid.
Household vehicle ownership	27%	26%	52%	56%	61%	Percent	Ibid.
Households owning a vehicle	17,740	4,975	18,593	18,578	7,449	Households	Calculated
Total vehicles	19,873	5,826	23,400	23,677	10,943	Vehicles	Calculated (see citywide above)

Description	UWS	MH	JH	BR	SG	Unit	Source
Vehicles per house-hold	1.12	1.17	1.26	1.27	1.47	Vehicles/ Household	Calculated

TRAVEL BEHAVIOR

Description	UWS	MH	JH	BR	SG	Unit	Source	Notes
On-street parking rate	31%	64%	46%	53%	39%	Percent	2018 NYC Mobility Survey ¹¹⁷	Based on containing "survey zone" ^{aa}
Vehicles parked on street	6,161	3,729	10,764	12,549	4,268	Vehicles	Calculated	Based on containing "survey zone"
Drive alone to work	5.8%	15.7%	20.6%	23.0%	38.5%	Percent	2013-2017 ACS compiled by NYC DCP ¹¹⁸	
Carpool to work	1.1%	1.4%	2.8%	2.4%	2.8%	Percent	Ibid.	
Walk trips as share of all trips	48.5%	32.0%	36.5%	30.5%	8.5%	Percent	Calculation based on 2017 and 2018 NYC mobility surveys ^{119,120}	Based on containing "survey zone"
Bike trips as a share of all trips	3.5%	0.5%	2.0%	2.0%	0.1%	Percent	Ibid.	Based on containing "survey zone". St. George bike percentage assumed as 0.1% for purposes of comparison (0% in mobility survey across SI but there are some commute trips per ACS).
Car trips as share of all trips	7.0%	21.0%	24.0%	35.0%	71.0%	Percent	Ibid.	Based on containing "survey zone"
FHV trips as share of all trips	5.0%	2.0%	2.0%	3.0%	2.0%	Percent	Ibid.	Based on containing "survey zone"
Transit trips as share of all trips	32.5%	43.0%	31.0%	26.0%	16.0%	Percent	Ibid.	Based on containing "survey zone"
Other trips as share of all trips	2.5%	1.0%	4.5%	3.0%	2.0%	Percent	Ibid.	Based on containing "survey zone"

BUILT ENVIRONMENT

Description	UWS	MH	JH	BR	SG	Unit	Source	Notes
Length of curbs	287,408	169,272	485,599	458,484	429,302	Feet	Author analysis, Coord curb rules ¹²¹	See Appendix H for methodology
Curbs dedicated to free parking	159,895	112,689	315,555	299,647	326,269	Feet	Ibid.	St. George adjusted to account for apparent coding discrepancy
Curbs dedicated to paid parking	24,997	2,830	27,900	27,115	6,569	Feet	Ibid.	

aa The Mobility Surveys break the five boroughs down into subzones. The Upper West Side falls within "Manhattan – Core," Morris Heights falls within "Southern Bronx," Jackson Heights falls within "Inner Queens," and Bay Ridge falls within "Outer Brooklyn." Staten Island is its own survey zone, so St. George data reflects borough-wide statistics.

Description	UWS	MH	JH	BR	SG	Unit	Source	Notes
Curbs used as travel lanes	29,887	23,660	53,295	33,981	26,622	Feet	Ibid.	St. George adjusted to account for apparent coding discrepancy
Curbs restricted due to proximity to intersections	23,288	10,207	36,394	34,662	37,009	Feet	Ibid.	
Share of building square footage dedicated to commercial use	12.8%	17.1%	15.0%	17.2%	36.0%	Percent	Author analysis of PLUTO database ¹²²	
Sidewalk area	34,380	21,255	47,857	67,181	56,030	1,000 Square Feet	Author analysis of sidewalk shapefile ¹²³	
Number of Alternate Side Parking days	4	4	2	2	2	Days/Week	NYC DOT	

USE-SPECIFIC DATA, ASSUMPTIONS, AND SOURCES

FREE PARKING

Description	UWS	MH	JH	BR	SG	Unit	Source	Notes
Rate of decrease for vehicle ownership, off-street parkers, based on on-street parking availability	0.025	0.05	0.05	0.1	0.1	Adjustment factor	Guo ¹²⁴ (with author adjustments)	I assume a weaker effect in areas with higher parking occupancy rates. The NYC Mobility Survey has also found that difficulty finding parking is an important factor for many residents who choose to give up car ownership. ¹²⁵
Rate of decrease for vehicle ownership, on-street parkers, based on on-street parking availability	0.2	0.15	0.15	0.1	0.1	Adjustment factor	Ibid.	Guo study was of off-street car-ownership. However, effect should be at least as pronounced among current on-street parkers. I assume a stronger effect in areas with higher parking occupancy rates.
Share of NTA resident vehicle trips replaced by other vehicle trips (e.g., FHV) after personal car trip is eliminated	0.2	0.2	0.2	0.2	0.2	Adjustment factor	Author estimate	Inner Ring study found that 28% of car trips would not have been made except by car. ¹²⁶ Some trips may also now happen as carpools, which will not increase overall VMT on a one-to-one basis per trip given shared vehicles. I make the assumption that is still valid and applicable to inner ring and nearby neighborhoods (not a certainty given the emergence of TNCs; the model allows adjustments to examine the effects of higher shares on overall impacts) and that some trips will now happen with FHV's or borrowed cars.

Description	UWS	MH	JH	BR	SG	Unit	Source	Notes
Share of non-resident vehicle trips replaced by other vehicle trips (e.g., FHV, carpool) after personal car trip is eliminated	0.4	0.4	0.4	0.4	0.4	Adjustment factor	Author estimate	Same rationale as above. Note that NYC mobility survey finds a lower share of cars among shopping trips, but I raise factor for conservatism (and to account for trips that might be replaced by vehicle trips to other places within NYC).
Car trips per day, residents who commute by car	2.2	1.8	2.1	2.0	1.6	Trips/Day	Author analysis of 2018 mobility survey trip diary data ¹²⁷	Based on containing "survey zone."
Car trips per day, residents who do not commute by car	0.1	0.1	0.3	0.4	0.7	Trips/Day	Ibid.	Based on containing "survey zone." When combined with the estimate for car trips per day for residents who commute by car, this yields an estimate of trips per day that is broadly consistent with that found in prior NYC parking occupancy studies ¹²⁸ and available studies in other jurisdictions. ¹²⁹
Assumed rate of parking occupancy	100%	90%	90%	80%	80%	Percent	Author estimate	Assumptions based on density, car ownership, press reports.

In addition to the data and assumptions referenced above, I also assumed that adding a free parking space would not have any impact on overall VMT from individuals looking for parking, given the high rates of occupancy of on-street parking, the low rates of turnover, and the assumed correspondence between parking availability and trips. This is in contrast to what would be the case for an appropriately priced metered space, which should reduce the overall level of VMT due to "cruising" as it would increase the amount available on a given block at a given time.

BIKE LANES

Description	Value	Unit	Source	Notes
Increase in bike commuters per mile of new bike lane	4%	Percent	Gu et al. estimate based on NYC trends ¹³⁰	
Share of NTA total trips that occur on bike lane infrastructure (i.e., how much of the bike traffic does the lane capture?)	45%	Percent	Based on NYC uptown bike counts ¹³¹ of streets within neighborhood context	Excludes share of trips in Central Park, river greenways.
Daytime usage of protected bike lanes, Upper East and West Sides	118	Users/Hour	Ibid.	Used as a benchmark for the rest of the city, with adjustments for bike trip share and geographic placement.
Net risk of bike fatalities due to increased bicycle activity	0	Rate	Chen et al. ¹³²	Assumption: increased crash risk due to biking offset by increased safety from infrastructure and additional ridership visibility.
Adjustment factor for geographic context: is the neighborhood similar to UWS as a natural "through route" for travelers from other neighborhoods? If not, apply the adjustment factor.	0.25	Adjustment factor	Assumption	Assumed based on the likelihood that "through route" status significantly increases the pool of potential users.

Description	Value	Unit	Source	Notes
Adjustment factor for existing bike infrastructure: is the proposed lane duplicative of existing infrastructure? If so, apply the adjustment factor.	0.25	Adjustment factor	Assumption	Assumed based on the fact that if comparable infrastructure already exists, only moderate diversion to the new infrastructure will occur.

BIKE PARKING

CITYWIDE

Description	Value	Unit	Source	Notes
Annual usage of Citi Bike docks per day	4.41	Uses/Day	Citi Bike usage reports ¹³³	2019 data. Used as a benchmark, not directly leveraged in calculations.
Bikes per foot of corral	0.6	Bikes/Foot	City of Cambridge, MA ¹³⁴	

SUB-CITY-LEVEL

Description	UWS	MH	JH	BR	SG	Unit	Source	Notes
Average occupancy rate of bike corrals, bikes per rack within the corral	1.2	0.4	0.8	0.8	0.4	Bikes/Rack	Author estimate based on Bike Corral Assessment 2019 ¹³⁵	UWS and JH based on bike corral assessment (as they have bike corrals in the current program). Bay Ridge assumed comparable to JH based on bike mode share. MH and SG assumed half of JH based on lower bike mode share.
Share of bikes that are derelict	22%	22%	22%	22%	22%	Percent	Ibid.	
Non-derelict occupancy rates	47%	16%	31%	31%	16%	Percent	Calculated	I assume uniform derelict bike rates.

NEIGHBORHOOD LOADING ZONES

CITYWIDE

Description	Value	Unit	Source	Notes
Passenger trips as a share of NLZ visits	85%	Percent	Author observation	See Appendix G.
Commercial trips as a share of NLZ trips	15%	Percent	Author observation	See Appendix G.

SUB-CITY-LEVEL

Description	UWS	MH	JH	BR	SG	Unit	Source	Notes
NLZ uses per day	13	13	16	13	10	Uses/Day	Author observation	See Appendix G. Morris Heights and Bay Ridge assumed as mid-point of observations.

Description	UWS	MH	JH	BR	SG	Unit	Source	Notes
Reduced VMT from commercial vehicles due to NLZ visit	0.25	0.23	0.23	0.20	0.20	VMT/Trip	Author estimate	Assumed based on reduced cruising, with distance as one circled block in Manhattan. Scaled for assumed parking occupancy rate.
Reduced VMT from passenger vehicles due to NLZ visit	0.13	0.11	0.11	0.10	0.10	VMT/Trip	Author estimate	Assumed based on reduced cruising, with distance as half of one circle of a block in Manhattan (since some will double park to drop off). Scaled for assumed parking occupancy rate.

PARKLETS

CITYWIDE

Description	Value	Unit	Source
Parklet opening hours	12	Hours	Assumption
Parklet opening months	8	Months	Assumption

SUB-CITY-LEVEL

Description	UWS	MH	JH	BR	SG	Unit	Sources and Notes
Parklet usage per hour, commercial zones	15.0	7.5	7.5	7.5	3.8	Uses/20 feet/hour	Author estimates based on UCLA parklet study, ¹³⁶ NYC parklet evaluations, ^{137,138} and assumptions based on reduced density and potential visitors.
Parklet usage per hour, residential zones	4.0	2.0	2.0	2.0	1.0	Uses/20 feet/hour	Ibid. The study includes evaluations of NYC parklets; performance of residential parklets in NYC is comparable to standard parklets in other jurisdictions.

WASTE COLLECTION ZONES

CITYWIDE

Description	Value	Unit	Source
Waste from residential households	1608.5	Pounds/household/year	DSNY Waste Characterization Study ¹³⁹
Recycling from residential households	370.7	Pounds/household/year	Ibid.
Miles driven per ton picked up	1.95	Miles per ton	Miller and Spertus ¹⁴⁰
Gallons of fuel consumed per ton picked up	1.19	Gallons per ton	Ibid.
Size of waste bag	2	Square feet of curb space	Ibid.
Size of recycling bag	2.5	Square feet of curb space	Ibid.
Width of waste drop-off zone on the sidewalk	3	Feet	Ibid.
Bike and pedestrian fatalities from waste trucks	1.75	Fatalities/million miles	Ibid.

Description	Value	Unit	Source
VMT reduction factor if all blocks move to centralized waste collection	0.2	Adjustment factor	Assumption based on reduced time to pick up waste, allowing fewer overall runs
Weight per trash bag	22	Pounds	Zender and Seballo, 2003 ¹⁴¹
Length of block that can be served by one waste pickup zone	200	Feet/Pickup Zone	Assumption based on ChekPeds response to DSNY RFEI ¹⁴²

SUB-CITY-LEVEL

Description	UWS	MH	JH	BR	SG	Unit	Source
Weekly garbage pickups	3	4	2	2	2	Pickups per week	DSNY ¹⁴³
Weekly recycling pickups	1	1	1	1	1	Pickups per week	Ibid.

HEALTH IMPACTS BASED ON WHO'S HEAT MODEL

I leveraged the WHO's HEAT toolkit¹⁴⁴ to generate estimates of the mortality impacts of some of the curb uses under consideration. Although this model was developed for use in European contexts, the model allows modification of most of its input parameters (see Appendix I for additional discussion).

In addition to data and assumptions on mortality, PM_{2.5} levels, and population included above, I used the following assumptions and data as inputs for the model:

Description	Value	Unit	Source and Notes
Typical walking trip distance	0.75	Miles	HEAT model default is 1.3 km or 0.78 miles – rounded to 0.75
Typical biking trip distance	2.5	Miles	HEAT model default is 4.1 km or 2.46 miles – rounded to 2.50
Typical share of biking trips that occur "in traffic" (i.e., in proximity to a roadway)	75%	Percent	Assumption
Typical share of walking trips that occur "in traffic" (i.e., in proximity to a roadway)	75%	Percent	Assumption

With these values and assumptions, the HEAT toolkit generates an estimate of the mortality impacts due to increased physical activity (decreasing mortality) and PM_{2.5} exposure (increasing mortality).

For example, if 1,000 residents who previously did not bike now took one bike trip per day, the model concludes there would be 1.9 fewer deaths over 10 years, deaths, with a reduction of 2 due to increased physical activity and an increase of 0.1 due to PM_{2.5} exposure. For a similar increase in walking, the model concludes there would be a reduction of 2 deaths, with a similar decrease due to physical activity but a smaller offset due to PM_{2.5} exposure. I leveraged these projections to generate an estimate of the impact for smaller numbers of trips, for example, based on the induced mode shift from a new bike lane.

Although these results are based on a framework developed for a European context, the magnitude and direction are consistent with those of other literature on the subject.^{145,146}

QUALITATIVE ASSESSMENTS OF ECONOMIC VITALITY IMPACTS

I evaluated each of the proposed curb uses for their potential impacts on economic vitality. I considered two aspects: the impact on commerce and the impact on property values.

COMMERCE

Use	Residential Rating	Commercial Rating	Rationale
Free Parking	Low	Med	While free parking is unlikely to enable commerce in a residential zone, it does provide benefits to those visiting commercial zones. ¹⁴⁷ It should be noted that metered parking is likelier to enable greater commercial activity due to higher turnover.
Bike Lanes	Low	Med	Bike lanes in residential zones should not be expected to increase commercial activity. Studies of bike lanes in commercial zones tentatively show a relationship between bike lanes and increased commercial activity, at least in some contexts. ^{148,149}
Bike Corrals	Low	Med	Bike corrals in residential zones should not be expected to increase commercial activity. In commercial zones, they should enable more streamlined parking of bikes, with the possibility that they encourage more trips to an area, particularly if the corrals include space for shared mobility options vs. just personal ones. Some studies have found they are associated with more spending on a per-square-foot basis than comparable amounts of free parking. ^{150,151,152}
Neighborhood Loading Zones	High	High	NLZs enable deliveries of goods and food in both residential and commercial zones.
Parklets	Low	Low to High (depending on usage) ^{ab}	Parklets should not lead to increased commercial activity in residential zones. In commercial zones, parklets can be a tremendous asset. However, this depends on usage, with lightly used parklets generating little to no incremental commercial activity.
Waste Collection Zones	Low	Low to Med (depending on usage) ^{ac}	Waste collection should not lead to increased commercial activity in residential zones. In commercial zones, decreased sidewalk obstruction could lead to increased activity and trips, particularly in establishments with open-air components in warmer weather.

PROPERTY VALUES

Use	Residential Rating	Commercial Rating	Rationale
Free Parking	Med	Med	In both zones, press reports indicate that free parking is viewed as an amenity when individuals make decisions about where and whether to move. General “pleasantness” is likely to be improved, vs. status quo of travel lane, due to slower traffic and reduced volume of traffic. A recent literature review highlighted the various benefits, including slower speeds of 5-20 kilometers/hour and a reduction in collisions of 10% or more on minor streets. These benefits are not necessarily replicated on wider or arterial streets. ¹⁵³
Bike Lanes	Med	Med	Studies show at least neutral, ¹⁵⁴ although it is difficult to draw firm conclusions. Some studies claim some positive value associated with proximity to bike lanes, ¹⁵⁵ which would also be consistent with NYC DOT work on the economic benefits of sustainable streets. ¹⁵⁶

^{ab} I assessed parklets on the UWS as having the greatest commercial value of all considered neighborhoods due to density. St. George is the lowest, with Bay Ridge, Morris Heights, and Jackson Heights rated as “Med.”

^{ac} I assessed the overall amount of curb frontage that waste would take in a given NTA, rating those neighborhoods where it would be expected to take 15% or more as “Med” and others as “Low.”

Use	Residential Rating	Commercial Rating	Rationale
Bike Corrals	Low	Low	Bike parking appears unlikely to materially impact property values (except to the degree it impacts commerce as noted above).
Neighborhood Loading Zones	Med	Med	Although program evaluations are still underway, my observations of NLZs showed their potential to reduce double parking and increase throughput at the curb. This could lead to a more “pleasant” atmosphere, e.g., with reduced honking. It also enables greater access to a variety of services, which could increase the attractiveness of a given property.
Parklets	Low to Med (depending on usage) ^{ad}	Low to High (depending on usage) ^{ae}	In residential zones, parklets are unlikely to yield increased property values unless they are relatively highly utilized. Some interviewees noted that residents sometimes object to under-utilized parklets as a nuisance. However, in commercial zones, parklets could have a significant positive effect, depending on usage.
Waste Collection Zones	Low to High (depending on usage) ^{af}	Low to High (depending on usage) ^{ag}	Waste collection zones would significantly reduce sidewalk clutter in dense neighborhoods and could lead to reduced on-street litter, both of which could contribute to overall property value increases. I distinguished between NTAs based on the percent of available curb frontage likely to be occupied by waste and assume the effect is stronger for property values than commerce.

SYNTHESIZED RATING

I gave point values of 1, 2, and 3 to Low, Med, and High, respectively. After summing the two scores, I assigned uses with a total score of 2 or 3 as Low, uses with a total score of 4 as Med, and uses with a total score of 5 or 6 as High.

Use	Rating in Residential Zones	Rating in Commercial Zones
Free Parking	Low	Med
Bike Lanes	Low	Med
Bike Corrals	Low	Low
Neighborhood Loading Zones	High	High
Parklets	Low	Low to High
Waste Collection Zones	Low to Med	Low to High

SAMPLE MODEL CALCULATIONS AND OUTPUTS

I have included screenshots of the model’s calculations of the impacts of free parking below. Other calculations can be reviewed in the full impacts model, which is available from the author upon request.

^{ad} I assessed parklets on the UWS as “Med” in residential zones as the only group likely to generate positive property value impacts based on the neighborhood’s extremely high density. Others are rated “Low.”

^{ae} I assessed parklets on the UWS as having the greatest property value potential of all considered neighborhoods due to density. St. George is the lowest, with Bay Ridge, Morris Heights, and Jackson Heights rated as “Med.”

^{af} I assessed the overall amount of curb frontage that waste would take in a given NTA, rating those neighborhoods where it would be expected to take 20% or more as “High,” 10% or more as “Med”, and less than 10% as “Low.”

^{ag} I used the same thresholds as residential zones for this metric.

Bay Ridge			
Data Type	Data	Units	Notes
SOURCE DATA AND ASSUMPTIONS			
CURB DETAILS			
Change in Parking		200 Feet	
Change in Parking Spaces (Change / 20)		10 Spaces (20 feet)	
Time of parking change	Full Day	Time of Day	
Type of street	Neighborhood Commercial		
NYC DETAILS			
Demographics			
TotalVehicles		1958984 Vehicles	
TotalWorkers		3975121 People	
Travel Behavior			
CitywideDriveAlone		22% Percent	
CitywideCarpool		5% Percent	
Scaled Car Commute (drive alone + .5*carpool)		24% Percent	
NYC Commuter Vehicles (Total Vehicles * Scaled Car Commute)		965954 Vehicles	
Commuter Vehicles / Total Vehicles		49% Percent	
PeoplePerCarTrip		1.7 People/Trip	
AverageTripLength		6.6 Miles	
TripsPerDayCommuterSpace		3 Trips/Day	
TripsPerDayOtherSpaceASP2		0.45 Trips/Day	
TripsPerDayOtherSpaceASP4		0.5 Trips/Day	
NTA DETAILS			
Demographics			
OccHHs		33320 Households	
20to64Pop		50501 People	
20to74Pop		56340 People	
Workers		38844 People	
Curb Inventory			
FreePark		299647 Feet	
PaidPark		27115 Feet	
CurbLen		458484 Feet	
Changed Free Parking / Available Free Parking		0.07% Percent	
Changed Free Parking / (Available Free + Paid Parking)		0.06% Percent	
Travel Behavior			
VehOwnership		56% Percent	
VehHHs		18578 Households	
VehPerHH		1.27 Vehicles/Household	
Total Vehicles (VehPerHH * VehHHs)		23677 Vehicles	
NTADriveAlone		23% Percent	
NTACarpool		2% Percent	
Scaled Car Commute (drive alone + .5*carpool)		24% Percent	
ASPPerWeek		2 Days/Week	Number of alternate side parking days per week
Commuting Cars (Total Vehicles * Scaled Car Commute)		9408 Cars	
Commuting Cars / Total Cars		40% Percent	
Non-Commuting Cars (1 - Commuting Car Share)		60% Percent	
NTA Commuting cars share / NYC commuting cars share		81% Percent	
AverageWalkTripShare		31% Percent of trips	
AverageBikeTripShare		2% Percent of trips	
AverageCarTripShare		35% Percent of trips	
AverageFHVTripShare		3% Percent of trips	
AverageTransitTripShare		26% Percent of trips	
AverageOtherTripShare		3% Percent of trips	
Walking as share of non-car trips		47.29% Percent	
Biking as share of non-car trips		3.10% Percent	
CarTripsPerDay_Commuters		2.04 Trips/Day	
CarTripsPerDay_NonCommuters		0.37 Trips/Day	
Parking Behavior			
OnStreetParkRate		53% Percent	

Data Type	Data	Units	Notes
Off Street Parking Rate (1 - On Street Parking Rate)	47%	Percent	
OnStreetAdj	0.1	Adjustment factor	Assumed factor for decline in vehicle ownership, on-street parkers
OffStreetAdj	0.1	Adjustment factor	Assumed factor for decline in vehicle ownership, off-street parkers
Res_VehTripReplacementRate	0.2	Adjustment factor	Assumed rate of vehicle trip replacement for resident car trips
NonRes_VehTripReplacementRate	0.4	Adjustment factor	Assumed rate of vehicle trip replacement for visitor car trips
Residential Non-Vehicular Trip Replacement (1 - Resident Rate)	80%	Percent	
Visitor Non-Vehicular Trip Replacement (1 - Visitor Rate)	60%	Percent	
AssumedParkingOccupancy	80%	Percent	
Built Environment			
ComShare	17%	Percent	
MODE-SPECIFIC IMPACTS			
Health			
Biking - Annual premature deaths due to physical activity per 1 new trip/resident	-17.10	Deaths/Trip/Day/Person	
Biking - Annual premature deaths due to PM2.5 consumption	0.85	Deaths/Trip/Day/Person	
Walking - Annual premature deaths due to physical activity per 1 new trip/resident	-19.22	Deaths/Trip/Day/Person	
Walking - Annual premature deaths due to PM2.5 consumption	0.38	Deaths/Trip/Day/Person	
Safety			
Change in Car Passenger Fatalities Per VMT	3.7E-09	Fatalities/VMT	
Change in Bike / Pedestrian Fatalities Per VMT	6.8E-09	Fatalities/VMT	
Pollution			
PM2.5 per VMT	0.012	Grams PM2.5	
GHG			
Light Duty GHG Impact (tons) per VMT	0.00018	CO2 Emissions in Tons/VMT	
IMPACT CALCULATIONS			
VEHICLE OWNERSHIP IMPACTS			
On-Street			
On Street parking rate	53%	Percent	
Total Vehicles	23677	Vehicles	
On Street Vehicles (On Street Rate * Total Vehicles)	12549		
Removed Free Parking as a Share of Total Free + Paid Parking	0.06%	Percent	Assumption is they are willing to park overnight in paid parking spots
Commuting Cars as a Share of Total Cars	40%	Percent	
Adjustment factor for on-street parkers	0.1	Adjustment factor	
Parking Occupancy	80%	Percent	
Change in Vehicles, On-Street Commuters (on-street vehicles * parking * commuting car share * adjustment factor * parking occupancy)	0.24	Vehicles	
Removed Free Parking as a Share of Total Free Parking	0.07%	Percent	
Non-Commuting Cars as a Share of Total Cars	60%	Percent	
Adjustment factor for on-street parkers	0.1	Adjustment factor	
Parking Occupancy	80%	Percent	
Change in Vehicles, On-Street Non-Commuters (on-street vehicles * parking * non-commuting car share * adjustment factor * parking occupancy)	0.40	Vehicles	Assumption is they are not as impacted by paid parking spots since cars are left longer in between use
Off-Street			
OffStreetParkRate	47%	Percent	
Total Vehicles	23677	Vehicles	
Off Street Vehicles	11128	Vehicles	
Removed Free Parking as a Share of Total Free + Paid Parking	0.06%	Percent	Conservative assumption is that the presence of any parking leads to the effect posited by Guo
Adjustment factor for on-street parkers	0.1	Adjustment factor	
Change in Vehicles, Off-Street (on-street vehicles * parking * adjustment factor)	0.68	Vehicles	
Total Vehicles			
Change in On-Street Commuter Vehicles	0.24	Vehicles	
Change in On-Street Non-Commuter Vehicles	0.40	Vehicles	

Data Type	Data	Units	Notes
Change in Off-Street Vehicles	0.68	Vehicles	
Total Change to Vehicles	1.33	Vehicles	
Trips			
Car Trips Per Day, Commuters	2.04	Households	
Change in On-Street Commuter Vehicles	0.24	Vehicles	
Implied changed trips, on-street (commuters)	0.50	Trips/Day	
Car Trips Per Day, Non-Commuters	0.37	Trips/Day	
Change in On-Street Non-Commuter Vehicles	0.40	Percent	
Implied changed trips, on-street (non-commuters)	0.15	Trips/Day	
Car Trips Per Day, Commuters	2.04	Trips/Day	
Car Trips Per Day, Non-Commuters	0.37	Trips/Day	
Commuter Car Share	0.40	Percent	
Average Car Trips Per Day (weighted for commuter share)	1.03	Trips/Day	
Change in Off-Street Vehicles	0.68	Vehicles	
Implied changed trips, off-street	0.70	Trips/Day	
Total changed trips	1.35	Trips/Day	
Non-Vehicle Trips Replacing Prior Vehicle Trips	80%	Percent	
Total vehicle trips changed (on-street commuters)	0.40	Trips/Day	
Total vehicle trips changed (on-street non-commuters)	0.12	Trips/Day	
Total vehicle trips changed (off-street)	0.56	Trips/Day	
Total vehicle trips changed (sum)	1.08	Trips/Day	
VMT IMPACTS			
Per-Space Profile			
TripsPerDayCommuteSpace	3	Trips/Day	
TripsPerDayOtherSpaceASP2	0.45	Trips/Day	
TripsPerDayOtherSpaceASP4	0.5	Trips/Day	
Commuting Cars / Total Cars	40%	Percent	
Commute Space trips (Trips per commute space * commute cars share)	1.19		
Non-Commuting Cars	60%	Percent	
ASP	2	Days/Week	
Relevant ASP	0.45	Days/Week	
Non-Commuting Space trips (Relevant ASP * Non-Commuting Cars)	0.27	Trips/Day	
Total trips/day/space (Commute Space Trips + Non-Commute Space Trips)	1.46		
Parking Occupancy	80%	Percent	
Total trips/day/space (scaled for parking occupancy)	1.17		
Curb parking spaces added (removed)	10	Spaces (20 feet)	
Total trips/day (scaled for parking occupancy)	11.71		
People per car trip	1.700	People/Trip	
Total people trips/day/space (trips/day/space * people per trip)	1.99		
Curb parking spaces added (removed)	10	Spaces (20 feet)	
Total people trips/day	19.90		
From Residents			
Time of parking change	Full Day	Time of Day	
VMT per car trip	6.60	Miles	
Total vehicle trips changed, on-street commuters	0.40	Trips/Day	
Impacts, on-street commuters (no impact if only daytime parking removed)	2.63	VMT/Day	On-street commuter impacts are zeroed out if overnight parking allowed
Total vehicle trips changed, on-street commuters	0.12	Trips/Day	
Impacts, on-street non-commuters	0.79	VMT/Day	
Total vehicle trips changed, on-street commuters	0.56	Trips/Day	
Impacts, off-street	3.72	VMT/Day	
Total Impacts per year (sum of impacts * 365)	2,853.74	VMT/Year	
From Neighborhood Visitors			
Commercial square footage as share of total square footage	17.21%	Percent	
Trips by non-residents per space (assumed as trips per day per space * commercial share)	0.20	Trips/Day	
Non-Vehicle Trips Replacing Prior Vehicle Trips	60.00%	Percent	
Total parking space change	10	Spaces (20 feet)	

Data Type	Data	Units	Notes
Estimated impact on trips/day	1.21	Trips/Day	
Trip Length (miles)	6.6	Miles	
Estimated impact on VMT from visitors / day	7.98	VMT/Day	
Estimated impact on VMT from visitors / year	2,911.29	VMT/Year	
Resident VMT Impact	2,853.74	VMT/Year	
Visitor VMT Impact	2,911.29	VMT/Year	
Total Impact on VMT	5,765.02	VMT/Year	
Overall			
Total impact on vehicle trips, residents	1.08	Trips/Day	
Total impact on vehicle trips, visitors	1.21	Trips/Day	
Total impact on vehicle trips	2.29	Trips/Day	
HEALTH IMPACTS			
To users			
Total impact on vehicle trips	2.29	Trips/Day	
People per car trip	1.70	People/Trip	
Total people trips/day replaced by non-car modes (negative of total impact * people per car trip)	(3.89)	People Trips/Day	
Walking			
Walking as share of non-car trips	47.29%	Percent	
Number of incremental walking trips/day (walking share * total trips per day replaced by non-car modes)	-1.84	Walking trips/day	
Population from 20-74	56340	People	
Number of incremental walking trips/day/population from 20-74 (number of incremental trips divided by total relevant population)	-3.27E-05	Trips/Day/Person	
Walking - Annual premature deaths due to physical activity per 1 new trip/resident	-19.2	Deaths/Trip/Day/Person	
Mortality impacts due to physical activity (deaths/trip/day/person rate * number of trips/day/person)	0.0006	Deaths	
Walking - Annual premature deaths due to PM2.5 consumption	0.38	Deaths/Trip/Day/Person	
Mortality impacts due to PM2.5 (deaths/trip/day/person rate * number of trips/day/person)	-1.3E-05	Deaths	
Mortality impact of additional biking trips/year (sum of physical activity and PM2.5 exposure)	0.0006	Deaths/year	
Biking			
Biking as share of non-car trips	3.10%	Percent	
Number of incremental biking trips/day (biking share * total trips per day replaced by non-car modes)	-0.12	Biking trips/day	
Population from 20-64	50501	People	
Number of incremental biking trips/day/population from 20-64 (number of incremental trips divided by total relevant population)	-2.4E-06	Trips/Day/Person	
Biking - Annual premature deaths due to physical activity per 1 new trip/resident	-17.10	Deaths/Trip/Day/Person	
Mortality impacts due to physical activity (deaths/trip/day/person rate * number of trips/day/person)	4.1E-05	Deaths	
Biking - Annual premature deaths due to PM2.5 consumption	0.85	Deaths/Trip/Day/Person	
Mortality impacts due to PM2.5 (deaths/trip/day/person rate * number of trips/day/person)	-2.0E-06	Deaths	
Mortality impact of additional biking trips/year (sum of physical activity and PM2.5 exposure)	3.9E-05	Deaths/year	
Mortality impact of additional walking trips	0.0006	Deaths/year	
Mortality impact of additional biking trips	3.9E-05	Deaths/year	
Total Impact on Mortality (sum bike + walking impacts)	0.000654	Deaths/year	
To Society			
Total Impact on VMT	5,765	VMT/Year	
PM2.5 per VMT	0.012	Grams PM2.5	
PM2.5 emissions (VMT * impact per VMT)	69.2	Grams PM2.5	
SAFETY IMPACTS			
Total Impact on VMT	5,765	VMT/Year	
Users			
Total Impact on VMT	5,765	VMT/Year	
Change in Car Passenger Fatalities Per VMT	3.7E-09	Fatalities/VMT	
Change in Car Passenger Fatalities (VMT * impact per VMT)	0.000021	Fatalities/Year	
Society			
Total Impact on VMT	5,765	VMT/Year	

Data Type		Data	Units	Notes
		Change in Bike / Pedestrian Fatalities Per VMT	6.8E-09	Fatalities/VMT
		Change in Bike + Pedestrian Fatalities (VMT * impact per VMT)	0.000039	Fatalities/Year
ENVIRONMENTAL SUSTAINABILITY				
		Total Impact on VMT	5,765	VMT/Year
		Light Duty GHG Impact (tons) per VMT	0.0002	CO ₂ Emissions in Tons/VMT
		GHG Impact (VMT * impact per VMT)	1.03	CO ₂ Emissions in Tons/Year
Economic Vitality				
		Street type	Neighborhood Commercial	
		Change in curb allocation	200 Feet	
Commerce				
		Residential ranking	1	
		Commercial ranking	2	
		Applicable ranking	2	
		Ranking (rationale below)	2	
		While free parking is unlikely to enable commerce in a residential zone, it does provide benefit to those visiting commercial zones.[i] It should be noted that metered parking is likelier to enable greater commercial activity due to higher turnover.		[i] Lee, "What Is the Economic Contribution of Cyclists Compared to Car Drivers in Inner Suburban Melbourne's Shopping Strips?"
Property Values				
		Residential ranking	2	
		Commercial ranking	2	
		Applicable ranking	2	
		Ranking (rationale below)	2	
		In both zones, press reports indicate that free parking is viewed as an amenity when individuals make decisions about where and whether to move. General "pleasantness" is likely to be improved, vs. status quo of travel lane, due to slower traffic and reduced volume of traffic. A recent literature review highlighted the various benefits, including slower speeds of 5-20 kilometers/hour and a reduction in collisions of 10% or more on minor streets. These benefits are not necessarily replicated on wider or arterial streets.[i]		[i] Biswas, Chandra, and Ghosh, "Effects of On-Street Parking In Urban Context."
		Overall ranking	2	

APPENDIX D: INVESTMENT COSTS OF THE CURB

I used the following data and assumptions to generate my estimates for investment and operating costs of the selected curb uses.

BASELINE DATA AND ASSUMPTIONS

In each of the calculations, I relied on the following baseline data and assumptions.

Description	Value	Unit	Source	Notes
Interest rate	4%	Percent	Rosenberg ¹⁵⁷	
Length of one "space" on the curb	20	Feet	NYC DOT standard practice	
Width of the curb lane	8	Feet	NYC DOT standard practice	
Cost of pavement	\$3.08	\$/Square foot	NYC DOT	
Expected lifespan, pavement	18	Years	NYC DOT	
Cost of signage	52	\$/Sign	NYC DOT	Includes installation
Expected lifespan, signage	18	Years	Assumption it is the same as pavement	
Distance between signs (on average)	100	Feet	Assumption	

USE-SPECIFIC ASSUMPTIONS AND METHODOLOGY

For all uses, I annualized the construction costs over the expected lifespan into an expected annual payment. I have listed other assumptions and methodology below.

PARKING

Description	Value	Unit	Source	Notes
Ongoing operating costs for free parking	\$429	\$/20 feet/year	Victoria Transport Policy Institute ¹⁵⁸	Estimate is the inflation-adjusted cost of "Urban, On-Street" parking. Includes administrative costs.

To estimate construction costs, I assumed that each parking space represents 160 square feet of pavement (20' by 8'), and that every hundred feet needs at least one sign.

To estimate operating costs, I leveraged the benchmark provided by VTPI.

BIKE LANES

Description	Value	Unit	Source	Notes
Installation cost of bike lanes (at-grade cycle track with bollards but no concrete infrastructure)	\$25	\$/Foot (2013 dollars)	Weigand et al. ¹⁵⁹	Low end of possible costs, based on two-way on-street cycle track installation in Washington, DC.
Adjustment factor for maintenance costs vs. on-street parking	1	Adjustment factor	Assumption it is the same as parking	
Expected lifespan, bike lanes	18	Years	Assumption it is the same as pavement	

To estimate construction costs, I multiplied the length of the proposed facility by the per-foot rate identified in Weigand et al. I assumed comparability between the operating costs of free parking and of bike lanes.

Note that both these categories reflect conservative, low-end assumptions on costs. Bike lanes requiring new concrete infrastructure and/or new signals would likely cost an order of magnitude more, or even greater, depending on the project design and context.

BIKE CORRALS

Description	Value	Unit	Source	Notes
Installation cost of bike corrals	\$3,300	\$	Chicago Department of Transportation cost estimate ¹⁶⁰	Used as first benchmark.
Installation cost of bike corrals	\$3,000	\$ (2013)	Weigand, McNeil, and Dill ¹⁶¹	Used as second benchmark; equals ~\$3,300 in current dollars.
Expected lifespan, bike corrals	18	Years	Assumption same as pavement	
Operation and maintenance costs for bike corrals	\$545	\$	Business owner estimate for parklets ¹⁶²	Adjusted for inflation. Parklets are likely to be more expensive to maintain than bike corrals, but I use this estimate for conservatism. Note this rate is similar to the estimate for administering on-street parking.

To estimate construction costs, I annualized the rate of \$3,300 per corral over an expected 18-year lifespan. I leveraged operating cost estimates from parklets as an upper bound estimate, as the ongoing maintenance and administration requirements from parking are likely to be greater on a daily basis, but the problem of derelict bikes would add some expenses to the overall operating budget.

NEIGHBORHOOD LOADING ZONES

Description	Value	Unit	Source
Number of signs per NLZ	2	Signs	Current NYC DOT practice.
Adjustment factor for maintenance costs vs. on-street parking	2	Adjustment factor	Assumption that enforcement needs are greater than those of parking while other costs remain the same.

Installing an NLZ only requires two additional signs vs. free parking. Thus, I calculated the cost of those signs and added it to the base pavement cost. I assume that operating costs are twice as expensive as those of free parking because of higher enforcement needs. However, this could be lower; it would simply reduce the effectiveness of the zones.

PARKLETS

Description	Value	Unit	Source	Notes
San Francisco estimate for parklets	\$12,000	\$/Parklet	San Francisco People for Parks Director ¹⁶³	Average of stated range, adjusted for inflation. Assumed 20 feet for purposes of calculation.
Philadelphia estimate for parklets	\$21,500	\$/Parklet	Philadelphia Parklet Guide-lines ¹⁶⁴	Assumed 20 feet for purposes of calculation and adjusted for inflation.
Seattle estimate for parklets	\$27,000	\$/20 Feet	Seattle Parklet Handbook ¹⁶⁵	Mid-range estimate, normalized for 20 feet and adjusted for inflation.

Description	Value	Unit	Source	Notes
Current NYC DOT funding for parklets	\$15,000	\$/Parklet	NYC DOT Street Seats Program ¹⁶⁶	Benchmark, not included in costs since it is not a construction figure.
NYC DOT annual funding for parklets	\$5,000	\$	Ibid.	
Operation and maintenance costs for parklets	\$545	\$	Business owner estimate for parklets ¹⁶⁷	Adjusted for inflation.
Expected lifespan, parklet	10	Years	Assumption, based on the increased intensity of usage vs. free parking	

I took the average of the three benchmarked parklet construction rates as the installation cost for 20 feet of parklets. This came to roughly \$20,200 per parklet. For ongoing operation and maintenance costs, I took the average of press reports on the cost of parklet maintenance (\$545) and NYC DOT's annual funding for its partners in its Street Seats program (up to \$5,000).

Note these calculations assume that the costs of parklets scale linearly with the length of the parklet.

WASTE COLLECTION

Description	Value	Unit	Source	Notes
Installation of fence and wheel stops	\$889	\$/Zone	Chekpeds proposal in response to DSNY RFEI ^{168,169}	Low-end cost for this type of proposal; NYC's recently announced "Clean Curbs" ¹⁷⁰ pilot likely more expensive due to greater infrastructure and vehicle investment requirements (although that focuses on commercial, and not residential, waste).
Cost of three visits per week from sanitation workers to pick-up zone	\$3,889	\$/3 visits	Ibid.	
Expected lifespan, waste collection zone	10	Years	Assumption, based on the increased intensity of usage vs. free parking	

To estimate the cost of this still-nascent proposal, I leveraged one approach taken in response to the Department of Sanitation's Containerized Waste RFEI, which proposed installing on-street waste collection zones with relatively inexpensive fencing to centralize the pick-up and drop-off of waste and recycling on the street.¹⁷¹ I adopted the installation costs from that proposal in my estimates. For ongoing maintenance, I assumed the need for one supplemental visit to the pickup zones per week.

The costs I generated are relatively conservative. They are likely significantly lower than the costs of installing new waste collection bins in the curb lane (along with any necessary modifications to waste collection vehicles). That more ambitious approach is the one outlined by NYC DOT in its recently announced pilot project, "Clean Curbs."¹⁷² Thus, these estimates represent a lower bound and could be significantly higher, depending on the deployment model chosen.

APPENDIX E: A VALUE OF THE CURB

Given the disproportionate share of the curb which free parking represents, it is easiest to assess the value of the curb by examining what it could be worth, if it were instead paid parking.

One source of benchmarks is rates currently charged by the DOT and the broader NYC government. For example, the lowest annual rate charged by NYC DOT is \$360/year for some of its Staten Island parking lots.¹⁷³ Other DOT lots charge as much as \$6,000 annually, although most range between \$1,000 and \$3,000 annually, with spaces in Manhattan the most expensive. The New York City Housing Authority (NYCHA) also maintains parking facilities, which range from \$650 annually in Staten Island to \$2,200 annually for Manhattan spaces.

Second, there is some scholarship on the stated willingness to pay for on-street parking. In a study to examine the prospects of a residential parking permit system in NYC, NYU scholar Zhan Guo found the stated willingness to pay for an on-street parking permit was on average \$408 per year across all survey respondents who were willing to pay.¹⁷⁴ This far exceeds the rates charged in other US cities for similar programs. For example, Chicago residents must pay \$88/year for a general parking permit, with an additional \$25/year for a neighborhood-specific permit in some areas of the city. Other US cities like San Francisco, Portland, and Washington, DC also have paid parking permit systems, with fees ranging from \$35 in DC to \$127 annually in San Francisco.¹⁷⁵

Third, there are many NYC residents already paying for parking. So, what do they pay? In 2013, the NYC Department of City Planning analyzed parking in the “Inner Ring”^{ah} and established that among those residents who pay for off-street parking, the majority pay more than \$1,200 annually, and only 10% pay nothing at all.¹⁷⁶ A survey of monthly garage prices on SpotHero indicates that residents of the Upper West Side face the steepest parking costs out of all neighborhoods considered, at \$7,000-\$8,400 annually (ranging from the 25th to 75th percentiles).¹⁷⁷

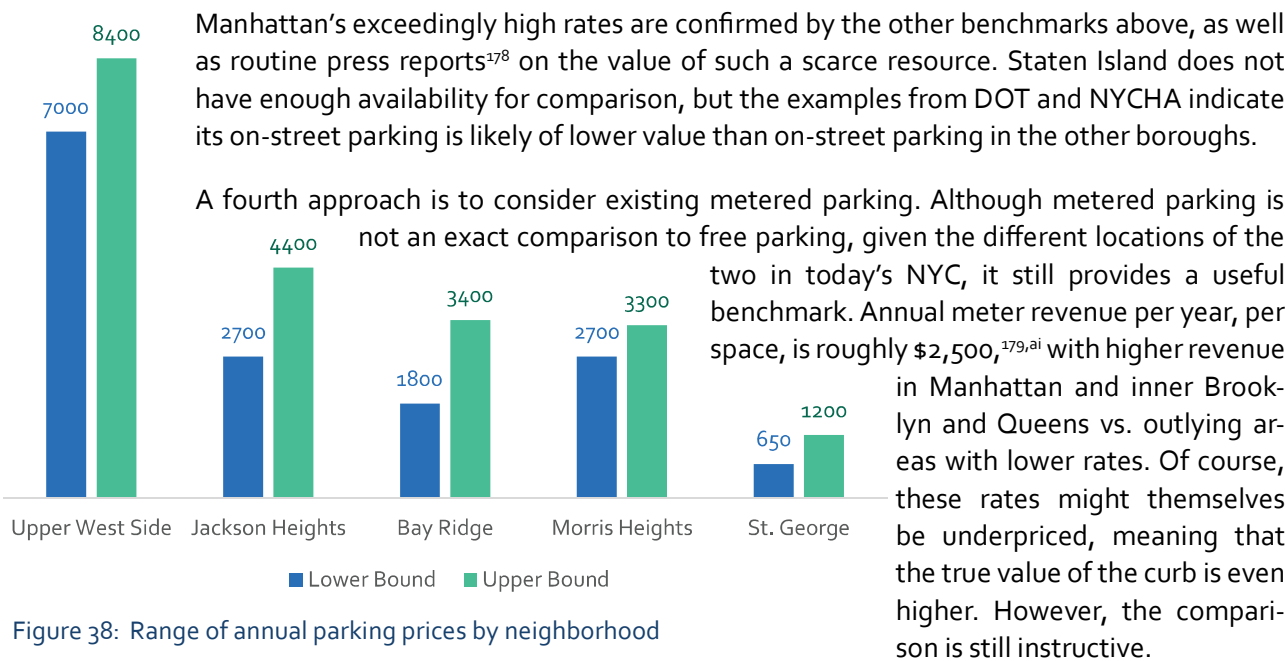


Figure 38: Range of annual parking prices by neighborhood

ah The “Inner Ring” includes neighborhoods surrounding the Manhattan Core, including northern Manhattan, the southeastern Bronx, and much of inner Brooklyn and Queens.
ai Calculated based on parking meter revenue and 85,000 metered spaces.

Even in Staten Island, the Curb Could Be Worth \$650 or More Annually

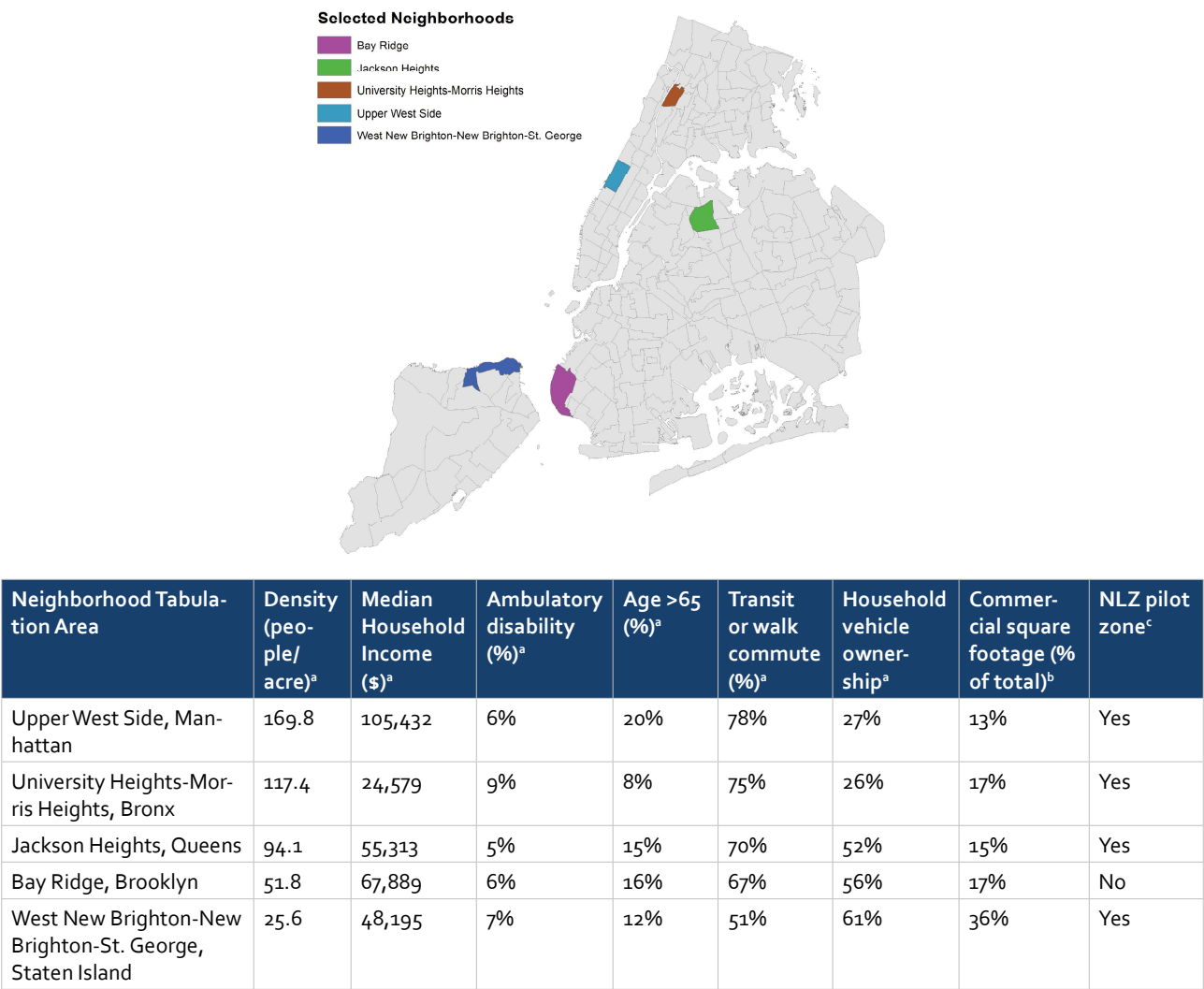
	Range	Source
Upper West Side	\$7,000 - \$8,400	Estimate based on SpotHero
Jackson Heights	\$2,700 - \$4,400	Estimate based on SpotHero
Bay Ridge	\$1,800 - \$3,400	Estimate based on SpotHero
Morris Heights	\$2,700 - \$3,300	Estimate based on SpotHero
St. George	\$650 - \$1,200	NYC DOT and NYCHA Rates

Figure 39: Estimated value of curb space by neighborhood

Finally, while useful, it is also important to remember that monetary value is not the only consideration when allocating the curb – there are many cases in which such a transfer makes sense, based on other policy considerations. This point was raised most explicitly by officials in Chicago, who must make such tradeoffs on a routine basis. However, this concern also emerged in conversations with other city officials, including in NYC.

APPENDIX F: NEIGHBORHOOD PROFILES

I leveraged a variety of demographic data, travel patterns, and other information on the built environment to select the focus neighborhoods for this analysis. I have included the most important information about each below.



Sources:
a: Author analysis of 2013-2017 American Community Survey, compiled by the NYC Department of City Planning¹⁸⁰
b: Author analysis of the NYC Department of City Planning's PLUTO Database¹⁸¹
c: NYC DOT's Neighborhood Loading Zones Program¹⁸²

Figure 40: Neighborhood profiles

APPENDIX G: IN-PERSON DATA COLLECTION

METHODOLOGY

I observed three Neighborhood Loading Zone sites in late January 2020. Those were:

- Upper West Side: West End Ave. between 83rd St. and 84th St.
- Jackson Heights: 74th Ave. between 35th Ave. and 37th Ave.
- St. George: St. Mark's Pl. between Wall St. and Fort Pl.

Neighborhood Loading Zones are active from 7:00am to 6:00pm or 7:00pm, depending on the site. I visited each NLZ two times over three weekdays, once during mid-day (which I defined as between 9:30am and 4:00pm) and once during the evening peak (which I defined as between 4:00pm and 7:00pm).

At each site, I divided the curb into the following categories:

- Free Parking
- Metered Parking (only applicable in Jackson Heights)
- Neighborhood Loading Zone(s)
- No Standing Zones
- Curb Cuts
- Fire Hydrants

I monitored each NLZ for 1.5 to 2 hours at a time, visually tracking curb-usage to identify:

- The number of uses for each curb-usage category
- The duration of each curb use
- The type of vehicle using the curb
- The purpose of the curb usage (if observable)

In addition to monitoring behavior at the curb, I noted double parking incidents and how those incidents related to available curb space.

I entered the data into an online spreadsheet in real-time.

SUMMARY OF DATA COLLECTED

NLZs and other non-parking curb space had significantly higher usage than free parking in both the mid-day and evening periods, across all geographies.

	Mid-Day	Evening
Neighborhood Loading Zone	0.72	1.48
Total Non-Parking Use (includes NLZ)	0.94	1.46
Free Parking	0.22	0.31

Figure 41: Summary of curb turnover per hour per 20' by time of day

	Mid-Day			Evening		
	Upper West Side	St. George	Jackson Heights	Upper West Side	St. George	Jackson Heights
NLZ	0.91	0.51	0.75	1.30	1.16	2.00
Total Non-Parking Use (includes NLZ)	1.08	0.87	0.87	1.70	0.78	1.90
Free Parking	0.08	0.20	0.39	0.31	0.23	0.40
Metered Parking	-	-	0.97	-	-	0.40
Ratio: NLZ to Free Parking	11.25	2.54	1.94	4.17	5.08	4.99
Ratio: Non-Parking Uses to Free Parking	13.38	4.31	2.25	5.45	3.45	4.75

Figure 42: Detailed curb turnover per hour per 20' by time of day and NTA

LIMITATIONS

While consistent with my hypotheses, these data are only from one specific point in time and do not include enough observation periods to represent a statistically significant model of curb-usage. NYC DOT is conducting a more systematic evaluation of NLZ usage but was unable to share preliminary assessments for use in this report.

In general, there is a significant lack of rigorous data on curb usage, particularly in ways that allow cross-comparison between different curb allocations. In the absence of better data, even directional trends are worth considering.

APPENDIX H: CURRENT STATE ANALYSIS METHODOLOGY

APPROACH

I developed estimates on the existing state of the curb by analyzing a curb rules inventory developed by Coord. That inventory, which builds on a variety of data provided by NYC DOT, has foot-by-foot accounts of curb usage rules and regulations across NYC. Coord provided me with a subset of that dataset, sharing all rules in the five selected NTAs. These include curb segment lengths, primary uses by time of day and day of the week, and allowed vehicles. I used R to categorize each meter of the curb into the following categories.

Category	Curbs Included
Free Parking	<p>Confident</p> <ul style="list-style-type: none"> Free parking is listed as the only primary use and all vehicles can use it Coded for free parking and goods loading (with or without passenger loading) Free parking and “none” are the primary uses, with rule patterns that indicate no-parking times are due to Alternate Side Parking^{aj} <p>Likely^{ak}</p> <ul style="list-style-type: none"> Coded for passenger loading (with or without goods loading) and bus access, with a length of 50 meters or more Coded for passenger loading but not bus access or goods loading Coded for passenger and goods loading without bus access but with street cleaning Coded for parking, passenger loading, and bus access, with a length of 50 meters or more Has street cleaning but is not coded as loading and unloading
Paid Parking	<ul style="list-style-type: none"> Coded for paid passenger parking but not commercial (based on rates) Coded for paid parking for both passenger and commercial (based on rates)
Loading	<ul style="list-style-type: none"> Coded for goods loading only Coded for both passenger and goods loading, but not bus access or street cleaning Coded for paid commercial parking but not passenger (based on rates)
Bus Stop	<ul style="list-style-type: none"> Coded for passenger loading (with or without goods loading) and bus access but not parking, with a length of less than 50 meters Coded for parking, passenger loading, and bus access, with a length of less than 50 meters
Other Active Use	<ul style="list-style-type: none"> Free parking is listed as the only primary use but it is restricted to certain categories of vehicles (e.g., diplomats) Free parking and “none” are the primary uses, with rule patterns that indicate no-parking times are not due to Alternate Side Parking Other
No Use Allowed (Hydrant)	<ul style="list-style-type: none"> Coded as “hydrant”
No Use Allowed (Lane)	<ul style="list-style-type: none"> Coded as “lane”
No Use Allowed (Intersection)	<ul style="list-style-type: none"> Coded as “intersection”
No Use Allowed (Other)	<ul style="list-style-type: none"> No uses allowed, not falling into hydrant, lane, or intersection categories

Figure 43: Summary of curb analysis methodology

^{aj} There are fewer than five rules for the curb in question and the duration of the no-parking times is either 30, 60, 90, or 120 minutes. A loading zone would have a longer duration, more rules, or both.

^{ak} Spot checks indicated these categories were typically free parking. I separated curbs into those with <50 meter segments and those with ≥ 50 meter segments when sorting potential bus stops, as some long stretches of curbs (e.g., on the UWS’s Riverside Drive) were coded as having bus access but according to Google Street View actually have extensive free parking available.

LIMITATIONS

This analysis has several limitations that should be considered.

First, the Coord curb rule inventory for NYC does not account for rules on some portions of the curb that lack no-parking signs, such as curb cuts for residential driveways. This is particularly important in neighborhoods with a significant number of residential driveways, such as Bay Ridge and St. George. Such curb cuts are likely predominantly coded as “Free Parking” in the analysis, which is at least consistent with their ultimate purpose (enabling vehicle parking).

Second, the rule set for St. George does not include any curbs marked explicitly as a travel lane. However, my observations and review of Google Maps indicate some curbs serve only as travel lanes. To adjust, I had to make assumptions about the applicability of travel lane shares as a percent of total curbs in the other NTAs to St. George.

Third, this analysis relies on the accuracy of the Coord dataset (and by extension, the data provided to Coord upon which that rule inventory relies). While I believe that both are broadly accurate, there are likely to be localized inconsistencies and errors, as New York City does not have an official foot-by-foot inventory of its curbs. All conclusions should be considered in that context.

APPENDIX I: LITERATURE REVIEW ON MANAGING AND VALUING CURB USAGE

EXISTING FRAMEWORKS

In developing my framework on the impacts of different curb space allocations, I drew on the lessons and examples of several previous frameworks and reports.

First, in 2011, NYCDOT issued a report on new strategies for the 21st-century street, “Measuring the Street.”¹⁸³ The report outlines several metrics for DOT to consider, including:

- Crashes and injuries for motorists, pedestrians, and cyclists
- Volume of vehicles, bus passengers, bicycle riders, and users of public space
- Traffic speed, aiming to move traffic not too slowly, but also not too fast
- Economic vitality, including growth in retail activity
- User satisfaction
- Environmental and public health benefits

A second resource is the Victoria Transport Policy Institute’s report on “Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications.”¹⁸⁴ This comprehensive overview provides estimates of the costs and benefits of eleven different transportation modes, including the costs imposed by on-street parking. Although it does not relate specific curb uses to costs and benefits, the report does provide useful guidance that can inform such a framework. I have leveraged its estimates on the investment and operating costs of on-street parking spaces.

Third, I rely on the framework proposed by Krizek in “Estimating the Economic Benefits of Bicycling and Bicycle Facilities.”¹⁸⁵ Krizek systematically reviews the types of metrics that can inform analyses of bicycling facilities, identifying those with enough data for analysis. He also distinguishes between direct and indirect benefits, identifying the following as useful for analysis:

- Direct benefits to users, including mobility, health, and safety
- Indirect benefits to society, including fiscal impacts, external impacts like congestion and pollution (with consequent impacts on health, safety, and sustainability), and impacts on livability (including access to recreation and open space)

While Krizek focused specifically on bicycling, the philosophy of the analysis is applicable more broadly, and I follow his general approach in this report.

VALUING SPECIFIC IMPACTS OF CURB ALLOCATIONS

In addition to these three frameworks on the broad costs and benefits of transportation investments, there are several toolkits that provide values for specific impacts of the curb, such as economic vitality, health, safety, and the environment.

ECONOMIC VALUE

NYC DOT has previously analyzed “The Economic Benefits of Sustainable Streets.” By leveraging sales tax data, the Department showed correlations between a range of streetscape improvements (including plazas, bike paths, and bus rapid transit) and increased sales tax revenues in comparison to nearby sites. This analysis did not conclusively show that these projects created incremental economic value (vs. displacing investments that might have been made elsewhere in the city). However, it still provides compelling material

for public officials to discuss when making the case for more sustainable (and in many cases more pleasant) street and curb space allocations.¹⁸⁶

HEALTH, SAFETY, AND THE ENVIRONMENT

The World Health Organization provides a comprehensive and interactive tool for transportation policy practitioners to calculate the health, safety, and sustainability impacts of transportation investments and behaviors. The WHO developed this “Health Economic Assessment Tool”¹⁸⁷ (HEAT) through a comprehensive review of the available literature on the impacts that increased biking and walking have on mortality.¹⁸⁸ This includes discrete impacts calculated based on:

- Changes in physical activity
- Changes in air pollution exposure
- Changes in crash risk

The tool also calculates impacts on carbon emissions based on changes in mode shift. Although the WHO developed the tool for European contexts, the interactive web interface allows users to modify key model parameters to account for their local context.

Rabl and de Nazelle elaborated on the approach taken by HEAT’s creators in their 2011 analysis on the “Benefits of shift from car to active transport.”¹⁸⁹ In this analysis, they find that switching from car travel to either biking or walking has significant health impacts, including in terms of decreased mortality based on physical activity (similar to the HEAT conclusions). They also find evidence that such shifts would lead to improved health among the general public due to decreased pollution, a finding that extends the benefits beyond those outlined in the HEAT framework.

Both HEAT’s creators and Rabl and de Nazelle acknowledge that a shift to more active transport can have some negative implications, particularly due to increased crash risk and consumption of particulate matter for the individual travelers (such as new bike riders). However, these are offset by the health benefits from increased physical activity, which are an order of magnitude greater than any negative health impacts.

BEST PRACTICES IN CURB SPACE MANAGEMENT

Because the curb has so many possible uses, an enormous number of reports and studies might be relevant to consider. Indeed, there is far more literature than I could discuss in this report. I discuss a subset of scholarship and research I consider the most relevant below.

ON-STREET PARKING

Much of the literature, particularly that related to parking policy, builds on the work done by Donald Shoup on the “high cost of free parking.” In the seminal book of that name and his additional scholarship, Shoup outlines the significant costs that cities incur by providing on-street parking for free (or for less than the market would bear). These costs include increased congestion due to individuals “cruising” for parking spaces and the consequent negative impacts that has in terms of emissions, pollution, and lost time.

Shoup also rebuts the claim that on-street parking is a “public good”^{al} by observing that although it is provided by the public sector, it meets neither of the conditions for public good status. It is a rival good, as one person parking a car on the curb means that no one else can use the space. It is also an excludable good, as

^{al} In economics, “public goods” are nonrival and nonexclusive, i.e., one person consuming the good does not preclude another from doing so, and charging (or otherwise limiting access to) the good is difficult or even impossible.

the common provision of metered parking shows. Given this status, and the externalities imposed by not charging for parking, Shoup concludes that providing free on-street parking is typically not the correct approach.¹⁹⁰

FRAMEWORKS TO MANAGE THE CURB

I identified three reports that provide a compelling and comprehensive overview of curb space management practices relevant to today's curb space contests.

In late 2018, the Institute for Transportation Engineers (ITE) released its "Curbside Management Practitioner's Guide."¹⁹¹ The report provides local officials with a systematic overview of the different uses of the curb, including those I discuss in this report. It highlights the increased demands for curb space, including from ride-hailing services and online shopping deliveries. The report also recommends how local officials should approach curb space allocation decisions, leveraging the framework of cities like Seattle that have adopted formal hierarchies of the curb. It proposes a process for officials to follow when reallocating the curb, including:

- Inventorying the existing curb use patterns
- Identifying factors that might affect the prioritization of the curb, including land use and broader transportation network needs
- Identifying alternatives to consider
- Systematically assessing those alternatives and presenting them to the public for consultation
- Implementing and refining curb allocation policies

ITE's report builds on the work of the National Association of City Transportation Officials (NACTO). In its 2017 report, "Curb Appeal,"¹⁹² NACTO recommends how cities can deploy their curbs to maximize public value, with a focus on using the curb to improve transit service. The report identifies four broad strategies to make better use of the curb:

- Shifting from Parking Lane to Flex Zone: The report recommends that city officials think about ways that the curb can be used beyond just parking and emphasizes the importance of using data in making the case to local stakeholders that parking is not always the best use of the curb.
- Clearing the Way for Transit: The report identifies specific strategies that city and transit agency officials can use to improve bus service, including short curb-allocation like bus "queue jumps" that can improve transit reliability while only requiring moderate reallocation of the curb away from existing parking.
- Moving Loading and Access Nearby: The report discusses several strategies to maintain and bolster the loading and unloading of people and goods. A primary recommendation is to shift these uses onto side streets just off main commercial streets so that the scarce space on those corridors can be maintained for uses like bus stops that cannot easily be moved. The report also highlights the importance of pricing and enforcement strategies to increase the turnover and availability of these access zones.
- Looking Beyond the Corridor: The report recommends officials consider more than just the affected block-face or corridor when evaluating or communicating about a curb reallocation project. For example, rather than discussing the number of parking spaces replaced on a given block, it is more helpful to put that into the context of all the parking spaces, including off-street parking, located within a five- to ten-minute walk.

The findings of both reports echo those in “Shared Use City: Managing the Curb,” a 2018 report by the International Transportation Forum (ITF) at the OECD.¹⁹³ The ITF’s report reviews the significant increase in demands on the curb. It also finds that data and metrics on curb use allocations are insufficient or nonexistent, a finding echoed in my interviews with officials in NYC and elsewhere.

The report’s authors do find that a significant expansion in pick-up and drop-off zones could have mixed effects in the near term, reducing congestion and on-street conflicts while simultaneously enabling additional VMT (due to a freer-flowing street network). However, the authors conclude that in the long term, a greater diversity of curb uses will allow public officials to create more public value.

Specific recommendations from the ITF report include:

- Designate streets into specific use-types to enable better and more systematic curb use allocations
- Develop a structure that allows officials to make decisions about how to reallocate the curb more systematically, including the addition of space for pick-ups and drop-offs where appropriate
- Proactively prepare for the negative side effects of repurposing parking into pick-up and drop-off zones, potentially including revenue (if replacing metered parking with unmetered PUDOs)
- Standardize and gather additional data on existing curb use allocations and users of the curb, including by leveraging public regulatory powers to require operators to share such data
- Allow curb uses to vary by time of day to better reflect the dynamic nature of demands on today’s curbs

APPENDIX J: SUMMARY OF NYC DOT METRICS CONSIDERED

In interviews with NYC DOT officials, the following metrics were cited as relevant for their respective curb use allocation decisions.

	Number of uses	Number of unique uses	Revenue	Impact on double parking	Economic value	Impact on travel times	Safety
Bike lanes	Where Available	No	No	No	Where Available	Where Available	Where Available
Bike parking	Where Available	No	No	No	No	No	No
Car-share parking	Yes	Yes	Yes	No	No	No	No
Electric vehicle charging	Yes	Where Available	No	No	No	No	No
Neighborhood Loading Zones	Where Available	No	No	Where Available	No	No	No
Metered parking	Yes	Where Available	Yes	No	No	No	No
Bike-share	Yes	No	No	No	No	No	No
Parklets	Where Available	No	No	No	Where Available	No	No
Free parking	Where Available	No	No	No	No	No	No
Bus lanes	Yes	No	No	No	No	Yes	No
Waste collection zones	Where Available	No	No	No	Where Available	No	No
Commercial loading zones	Yes	Yes	Yes	Where Available	Where Available	No	No

Figure 44: Quantitative factors currently considered by NYC DOT in curb space allocations

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