Reallocating Washington, D.C.’s Road Space to Reduce Driving, Improve Safety, and Promote Transportation Equity

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A capstone thesis paper submitted to the Faculty Director of the Urban & Regional Planning Program at Georgetown University’s School of Continuing Studies in fulfillment of the requirements for Masters of Professional Studies in Urban & Regional Planning.

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Abstract

This study evaluates how Washington, D.C. allocates its public right-of-way, or road space, for different uses - travel lanes, parking, bike lanes, and sidewalks. How a city manages its single largest public space asset (its streets and sidewalks), impacts its character and performance, including transportation mode shares, traffic safety, and access for its residents, workers, and visitors. These metrics are critical, as the U.S. transportation system is the largest (and growing) source of greenhouse gas emissions, causes roughly 40,000 deaths a year, and is a key determinant of economic and social mobility. This project utilizes publicly accessible datasets, analyzed in ArcGIS Pro to explore the distribution of road space allocations at the census tract level across D.C.’s geography and by demographic indicators to evaluate how and where road space allocations could be altered to advance existing policy goals for commute mode shares, traffic safety and transportation equity. This project finds that D.C.’s road space allocation could be altered to better support District initiatives to reduce driving commute mode share, reduce fatal and serious injury traffic crashes and the equitable distribution of pedestrian and bike-oriented streets. This study makes the case that to further its stated policy goals, D.C. should use geographically targeted road space reallocation strategies to shift auto-oriented road space toward more active transportation uses.

Keywords

Research Questions

1. How does Washington D.C. allocate its public right-of-way area to each of the following uses: travel lanes, parking, bike lanes, sidewalks, and arterial roads?

2. How, and to what extent, could reallocating the uses of its road space advance progress on the following policy goals of the District of Columbia: 1) To reduce the share of commute trips made by car to 25% by 2032; 2) to eliminate traffic fatalities and serious injuries by 2024; and 3) to advance transportation equity.

3. In which neighborhoods should the District focus its planning efforts on road space reallocation to advance the policy goals stated above?

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1. Introduction

The single largest public space asset in any city is its network of streets. How a city manages this vast public realm speaks volumes about its values. While many U.S. cities have adopted goals to promote sustainable transportation, safety and equity that can only be achieved by prioritizing space for people over cars, most of these same places still devote most of their road space to auto-oriented uses. After decades of car-centric planning and building, the U.S. transportation system became the largest source of greenhouse gas emissions in the country in 2016 and continues to grow. Traffic crashes cause roughly 40,000 deaths a year and are currently on the rise. Access to safe, affordable, and efficient transportation is a key determinant of economic opportunity and access, often overlaid with racial segregation and inequality. Driven by these realities, Washington, D.C. has established policy goals to reduce the share of commute trips made by car, eliminate traffic fatalities and serious injuries, and has committed itself to promoting transportation equity. Yet like most U.S. cities since the mid-20th Century, D.C. has largely oriented its streets toward private automobile travel –to the detriment of its sustainability, safety, and equity goals. This study analyzes the allocation of road space in D.C. through the lens of these three policy initiatives.

This study utilizes publicly accessible datasets, analyzed in ArcGIS Pro to explore the distribution of road space allocations at the census tract level across D.C.’s geography and by demographic indicators to evaluate whether current road space allocations could be altered to advance existing policy goals for commute mode shares, traffic safety and transportation equity. This study finds that D.C.’s road space could be reallocated to better support these initiatives. To this end, D.C. should reallocate road space from auto-oriented uses toward more active transportation and transit uses, revamp planning processes to aim for this outcome, and identify
areas to prioritize for such reallocations. This study also develops suitability models to prioritize where road space reallocation projects should occur to advance specific outcomes.

While this study focuses on census tract-level road space reallocation strategies to advance D.C.’s goals, it acknowledges the vast array of possible interventions currently being utilized or with the potential to be used to advance these same goals. This paper does not suggest that reallocating the overall mix of road space uses is necessarily the best or only strategy but seeks to call attention to its potential and the lack of existing focus on this topic. Given that D.C. (and most cities nationwide) are failing to meet the moment on reinventing our transportation systems to save lives, confront the climate crisis and rectify centuries of racism, more tools must be on the table and used effectively. This project envisions refocusing on this underutilized approach to addressing these solvable, yet persistent problems in Washington, D.C., and cities across the country.

2. Literature Review

Reallocation of road space from one use to another is a common practice in professional transportation planning and public space management. Ultimately, many types of streetscape projects involve reallocating space from one use to another within the right of way, such as converting parking or travel lanes to bike or bus lanes, narrowing the distance between curbs to expand a sidewalk, or creating a pedestrian plaza. Due to the vast literature and examples in planning and practice of projects such as these, this literature review focuses more narrowly on more comprehensive analyses and macro-level allocations within a city or district.

Some cities have undertaken massive and rapid road space reallocation projects that approach the scale envisioned in this project, such as the well-known examples of Barcelona’s
superilla (superblock) program,¹ the expansion of the bike lane network in Paris,² and the pedestrianization of central Oslo.³ However, very few analyses have measured how cities allocate their road space for different uses as this study does. The most prominently cited examples include a 2015 evaluation of four neighborhoods in Freiburg Germany using satellite imagery;⁴ a 2019 study of road space by uses in Amsterdam, based on road classification;⁵ and a 2014 advocacy report which examined 200 roads in Berlin.⁶ The most analogous to this study (in its U.S. setting and methodology) is the 2021 “NYC 25x25” report by the advocacy organization Transportation Alternatives, which used road centerline data to measure allocations of road space by use in New York City.⁷ These few examples expose how little this topic has been studied and beg for more road space allocation analyses in cities around the world.

There is, however, a significant volume of literature that relates to why road space allocations matter, and what can be achieved by reallocating road space from one use to another. First, the geometry of car-oriented space on our roads is inherently inefficient compared to bike lanes and pedestrian oriented spaces.⁸ The National Association of City Transportation Officials (NACTO) estimates that person throughput for a travel lane utilized by private cars is 600-1,600

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⁵ Nello-Deakin, Samuel. ”Is there such a Thing as a ‘fair’ Distribution of Road Space?” Journal of Urban Design 24, no. 5 (September 3, 2019): 698-714.


⁸ Gössling, Stefan. ”Why Cities Need to Take Road Space from Cars - and how this could be Done.” Journal of Urban Design 25, no. 4 (July 3, 2020): 443-448.
people per hour; a two-way protected bike lane can carry 7,500 an hour; a dedicated transit lane 4,000-8,000; a sidewalk 9,000 people per hour.\textsuperscript{9} Reallocating road space from auto-centric uses to ones designed for walking, biking or transit thus increases person throughput capacity.

Reallocating road space from cars to transit-only lanes has been put forward as a tool to alleviate congestion – counter to conventional planning practices that focus on adding roadway capacity for cars to mitigate congestion.\textsuperscript{10}

Allocating road space for active uses provides positive benefits including reducing pollution, increasing safety and has economic benefits.\textsuperscript{11} Measured benefits of targeted road space reallocation projects include the Pavements to Plazas program in New York City, where reallocating car space to pedestrian plazas had positive impacts on walking (measured by increased pedestrian traffic), increased bike traffic, transit performance, traffic safety, increased retail sales, and positive or neutral impacts on traffic flows.\textsuperscript{12} Hagan and Tennøy, in their study of Oslo’s reallocation of central city road space, found increased walking mode share, and increase in commute satisfaction across all modes – even driving.\textsuperscript{13}

Literature suggests that the allocation of road space can have a direct impact on modal choices and vehicle miles travelled. *Induced demand*, the phenomena that increased capacity in


\textsuperscript{10} González-Guzmán, Carlos Alberto and Francesc Robusté. "Road Space Reallocation According to Car Congestion Externality." *Journal of Urban Planning and Development* 137, no. 3 (Sep 1, 2011): 281-290.

\textsuperscript{11} Gössling, Stefan. "Why Cities Need to Take Road Space from Cars - and how this could be Done." *Journal of Urban Design* 25, no. 4 (July 3, 2020): 443-448.

\textsuperscript{12} Bertolini, Luca. "From “streets for Traffic” to “streets for People”: Can Street Experiments Transform Urban Mobility?" *Transport Review* 40, no. 6 (November 1, 2020): 734-753.

travel lanes eventually leads to an increase in vehicle trips, has been observed and studied for decades.\textsuperscript{14,15} More recently, the inverse concept of reduced demand has gained attention, brought to the fore by a study which found that removing travel capacity for cars resulted in overall decreases in traffic and had little impact on congestion.\textsuperscript{16} There is ample literature on the wide range of variables that influence the modal choice of commuters. Factors related to the built environment, such as population and employment density, land use mix,\textsuperscript{17} street grid density and connectivity,\textsuperscript{18} bicycle and pedestrian infrastructure access,\textsuperscript{19,20} quality and safety,\textsuperscript{21} and other built environment factors have all been validated in the literature as impacting mode share, including for commute trips. Volume, availability, and cost of parking – all influenced by how


\textsuperscript{17} Schneider, R.J., L Hu and J Stefanich, “Development of a neighborhood commute mode share model using nationally-available data,” \textit{Transportation} 46, (2019): 909–929

\textsuperscript{18} Vance, Colin and Ralf Hedel. ”The Impact of Urban Form on Automobile Travel: Disentangling Causation from Correlation,” \textit{Transportation} 34, no. 5 (Sept 2007): 575-588


\textsuperscript{20} Le, Huyen TK; Ralph Buehler and Steve Hankey, “Correlates of the Built Environment and Active Travel: Evidence from 20 US Metropolitan Areas,” \textit{Environmental Health Perspectives (Online)}, vol. 126, issue 7, (Jul 2018).

much space is allocated to personal car storage can impact mode choice, as oversupply, and underpricing encourages more driving trips.\textsuperscript{22, 23}

Other variables, such as transportation policies of local governments, employers and institutions, including those dealing with parking,\textsuperscript{24} tolling or congestion charges,\textsuperscript{25} and commuter benefits also impact mode choice.\textsuperscript{26} Demographic factors influence commute and general travel mode share as well, including income,\textsuperscript{27} other social data such as occupation, gender, family characteristics and residence duration,\textsuperscript{28} and attitudes about and satisfaction or enjoyment with different modes.\textsuperscript{29} This study acknowledges the many complex factors that play a role in commute and other trip mode shares, while focusing in on the narrow topic of road space allocation as a potential tool.

Road space allocation may also impact traffic safety. Street design is one of many variables in the built environment which can lead to crashes. Notably, whether streets are allocated for higher speed travel as is the case with arterials was identified by Dumbaugh, Li and

\textsuperscript{22} Shoup, Donald C. \textit{The High Cost of Free Parking}. Chicago: Planners Press, American Planning Association, 2005.


\textsuperscript{24} Miller, Gerald K. and Carol T. Everett. “Raising Commuter Parking Prices: An Empirical Study.” \textit{Transportation} 11, no. 2 (06, 1982)


\textsuperscript{29} Ye, Runing, Titheridge, Helena, “Satisfaction with the commute: The role of travel mode choice, built environment and attitudes.” \textit{Transportation Research}, vol. 52 (May 2017): 535-547.
Joh as a major risk factor. Road diets – a corridor level road space reallocation intervention, are a common tool to promote safety for their traffic calming and capacity reducing characteristics. Whether overall road space allocation for different uses at the tract, district or city level impacts traffic safety remains understudied.

Transportation equity or transportation justice is a broad area of study and practice which applies environmental justice (EJ) principles to transportation issues by including variables such as mobility, access and modal opportunity to more traditional EJ indicators such as race, income and pollution exposure. Transportation equity evaluations must combine social and spatial equity considerations – most relevant to this study being the distribution of active transportation resources and infrastructure such as bike lanes, trails and sidewalks. Some prominent analyses of transportation equity focus on access to jobs and other key destinations across race and income levels. For example, Transit Center’s 2021 “Transit Equity Dashboard,” found that in Washington D.C. (and many cities across the country), people of color have less access via transit to jobs, health care, healthy food and more. This study takes on a narrow piece of transportation equity, by solely evaluating the distribution of certain infrastructure characteristics.

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Beyond the measurable performance metrics of transportation infrastructure, streets serve as public space. Streets give cities their character, make them enjoyable or dull, and are one of the defining features of any city. Streets are places of social and environmental justice, meaning that road spaces allocated for human uses rather than cars have intangible benefits around social inclusion, justice, and safety. Road space reallocation and management of streets as public space is often used as a tool to build community, promote liveliness, and spur commerce. Open streets events such as ciclovias have been a popular tool on a temporary basis for decades in some cities, but longer-term interventions in this vein have accelerated during the Covid-19 pandemic in the form of open or slow streets, streateries, and other tactical interventions. While this study does not focus on these approaches, they can play a vital role in the planning and execution of road space reallocation strategies and projects.

Evaluating road space allocations and proposing alternatives can also be a powerful advocacy tool. Transportation Alternatives’ “NYC 25x25” campaign and accompanying report compares current allocations of road space in New York City (54.3% dedicated to travel lanes, 21.1% on-street parking, 23.7% for sidewalks and 0.93% for bike lanes) to a future vision, whereby reallocation 25% of New York’s car-oriented street space, the city could expand its bike lane network, build more parks, make transit more accessible and improve quality of life for New Yorkers in myriad ways. By putting measurable numbers on the current state of New York’s streets, the possibilities for change become tangible.

38 Transportation Alternatives. “NYC 25x25”
With implications for mode share, safety, and equity, it is tempting to determine an ideal road space allocation. However, Nello-Deakin argues that there are no good models for determining a “fair” allocation. Potential methodologies could use modal split or distance travelled by each mode to determine fairness, but these would inherently disadvantage pedestrians in most cases.\(^\text{39}\) For example, in a hypothetical car-oriented city, modal fairness would point to keeping most streets allocated for car-oriented uses since most trips are made by cars, regardless of whether that city wanted to encourage other modes. Nello-Deakin argues that comparative road space allocations is a more appropriate way to evaluate, rather than defining an ideal allocation.\(^\text{40}\) This study adopts the view that there is not an ideal allocation of road space, but rather that comparative changes can be used to advance specific policies or outcomes.

How a city allocates its road space has been documented in the literature to have far reaching impacts from travel mode share to quality of life and equity, yet few cities have undertaken comprehensive evaluations, nor explicitly incorporate this concept into planning processes to achieve their goals. Washington, D.C. – a city with specific goals around commute mode share, safety and transportation equity goals, is one such city where evaluating road space allocations and how and where they could be reallocated could prove fruitful. This project is intended to provide a practical evaluation for the District and its decision-makers, as well as contribute to the limited volume of literature on this topic.

3. **Research Methodology**

This project evaluates D.C.’s road space allocations by uses and explores how these allocations relate to a number of demographic, spatial, and other variables to evaluate if, how,

\(^{39}\) Nello-Deakin, 705

\(^{40}\) Ibid., 708
and where D.C. could reallocate road space to better achieve implement policies and achieve its stated goals. Most of the study methodology is comprised of spatial and statistical analyses utilizing publicly accessible datasets. U.S. Census, American Community Survey and other demographic data is incorporated using ESRI’s enrich layer tool in ArcGIS Pro. The study also uses shapefile layers downloaded from D.C. OpenData, Washington D.C.’s public data portal: “Roadway SubBlock,” “Crashes in D.C.,” “Metro Stations (Regional),” “DDOT Central Business District,” and “Census Tracts in 2010.”

The project evaluates data from these sources through the lenses of three District Department of Transportation (DDOT) policies: D.C.’s commute mode share goals, VisionZero traffic safety goals, and the agency’s Transportation Equity statement. Except when noted, the project uses ArcGIS Pro for all spatial and statistical analyses.

For the geospatial and statistical analysis, the study undertakes the following steps:

1. Builds a census tract layer with attribute fields for all relevant data.
2. Derives the percent of total road area for the following uses using cross section widths in the Roadway SubBlock dataset: car travel lanes, parking lanes, bike

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lanes, sidewalks, and arterial car area. Travel lanes and parking lanes together comprise “Total Car Area” and bike lanes and sidewalks together comprise “Total Active Area.” These values are summarized at the tract level using the “Summarize Nearby” tool. A buffer of 25 feet is used to ensure the attributes of tract boundary roads are included.

3. Using the census tract layer, runs a series of explorations of the relationships between different variables:
   a. First, the “Optimized Hot Spots” tool visualizes statistically significant clustering of variable characteristics.
   b. Second, uses Microsoft Excel to calculate bivariate correlation coefficients between key variables.
   c. Third, the “Local Bivariate Relationship” tool parses out where correlation between variables are significant or not.
   d. Fourth, runs a series of iterative spatial regression analyses in ArcGIS starting with 1) the “Exploratory Regressions” tool, then 2) ordinary least square (OLS) regressions, and finally 3) “Geographically Weighted Regressions” (GWR) for statistically sound OLS regression models.

4. Based on the findings of these data explorations, seven suitability models determine where D.C. should focus its planning efforts to advance its goals around commute mode share, traffic safety and transportation equity.

Data Limitations

There are several limitations in the data and analyses used in this study. The analysis assumes that multiple uses do not overlap in the same road space. While much of our street space is shared to some degree, given the physical dominance of cars on our streets, this project
assumes all shared space with cars is allocated for car-use. For example, a low-stress bike route marked with sharrows is considered car-travel area, not bike area. Similarly, marked crosswalks are not considered pedestrian space as cars freely enter and cross them. The analysis may overvalue bike lanes as most in the District are not protected and therefore are often obstructed by cars.

The “Roadway SubBlock” dataset has several limitations, including:

- Recently constructed streetscape projects, like new bike lanes, and some tactical projects such as flex-post protected curb bump outs, pedestrian zones and slip-lane closures are not included in the data.
- Sidewalk width maxes out at “16+” feet in the data. Sidewalks wider than 16 feet are assumed to be 16 feet for this study.
- The dataset assumes fixed widths for all cross sections. This means that varying width features, such as curb bump outs or variable width cross sections are not captured in the study.
- Areas do not account for parking prohibitions near intersections, at fire hydrants, or pick up drop off zones.
- Areas do not account for on-street micromobility corrals, bike parking or bike share stations that are in a parking lane or on the sidewalk.
- Variation in the quality and use of raised medians is not defined in the dataset. Some raised medians, such as pedestrian islands, could be categorized as sidewalk space. While others, such as narrow dividers separating lanes on a principal arterial serve primarily as a feature to aid in rapid movement of cars.
Due to this ambiguity, this study ignores road space area dedicated to raised medians.

- While bus only lanes are categorized in the dataset, the study ignores them due to their low volume and area, and lack of protection or physical separation from cars.

There may be spatial and/or demographic bias to the crashes used in this projects analysis as recent literature suggests that Metropolitan Police Department’s “Crashes in D.C.” dataset underreports some crashes and be systematically biased.\(^{47}\) It is nevertheless the most complete single dataset for traffic crashes, injuries and fatalities.

Finally, focusing on commute trip modes tell a small portion of the story of how people travel in Washington, DC - most trips made by any individual are not commute trips. On a typical weekday, only 21.4% of all trips in the region are for commuting purposes.\(^{48}\) This data ignores anyone under 16 as commute trips are only captured in the American Community Survey for workers 16 years and older. It also only captures a single mode for each respondent, thereby undercounting modes used as part of multimodal trips and those who use varying modes on different days or to get to different jobs.

4. D.C. Policy Goals

This project evaluates D.C.’s road space allocation through the lens of three existing policy goals of the District of Columbia: 1) To reduce the share of commute trips made by car to 25% of total; 2) To eliminate traffic fatalities and serious injuries by 2024; and 3) The District


Department of Transportation’s Transportation Equity Statement – specifically, the goal of “ensur[ing] public investments in transportation justly benefit all residents.” 49 This chapter provides more context and details about each of these goals and how they relate to road space allocation.

Commute Mode Share Goals

In 2014, the District of Columbia’s “Multimodal Long-Range Transportation Plan, MoveDC,” established a goal of 75% of all commute trips in the District be made by non-auto modes by 2040.50 In 2019 “Sustainable D.C. 2.0” set three commute mode goals: reducing car trips to 25%, increasing transit to 50%, and increasing the combined walking and biking share to 25% of commute trips – all by 2032.51 DDOT is currently in the process of updating “MoveDC” and may update, modify, or recommit to these goals.

In recent years, D.C. has made lackluster progress toward achieving these modal splits. From 2010 to 2019 (the most recent available data), the share of D.C. residents commuting by car only dropped from 42.4% to 38.7%.52 (See Figure 4.1.) At this pace of driving share reduction, it would take 28 more years (until approximately 2048) to reach the goal of reducing driving to 25% of commute trips. Public transit commute mode share has moved in the wrong direction, dropping from 37.6% to 34.7%. Walking and biking combined has increased from 14.1% (11.9 walking, 2.2 biking) to 17.9% (13.4% walking, 4.5% biking). At current pace, D.C.

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52 All commute mode share data in this study is derived from U.S. Census Bureau, “American Community Survey” 5-year estimates.
would meet its combined walking/biking goal in 17 years, or 2038. Put simply, based on recent trends, D.C. is not on pace to meet its commute mode share goals.

Figure 4.1. Washington, DC Commute Mode Shares 2010-2019. By Author, using data from American Community Survey 5-Year Estimates.

“MoveDC” puts forward several strategies for achieving its commute mode share goals, some explicitly related to road space reallocation. Most directly, the plan recommends a “7% decrease in peak period vehicular facility capacity Districtwide compared to the existing (2013) network as some vehicular space is reallocated for other travel modes. The overall transportation system capacity increases 24% compared to the existing (2013) network.”53 This recommendation is derived by reallocating car travel lanes to more efficient uses, including dedicated transit lanes and bike lanes to increase overall network capacity. While “MoveDC” includes this Districtwide recommendation, the public plan does not include more granularity about how and where this should occur.

53 District Department of Transportation, “MoveDC Section 2,” V-70
“MoveDC” also recommends “Permanent removal of on-street parking on key corridors to and within downtown; reallocation of space to other modes of transportation.” This recommendation envisions reallocating parking lanes – which have zero capacity for moving people to other modes which can increase mobility, while simultaneously reducing the incentive to drive due to plentiful parking availability. “MoveDC” does not specify (beyond “Downtown”) where parking should be converted to other uses.

The supporting materials for the draft update to “MoveDC” includes several strategies that touch on road space allocation, and specifically point to the need for reallocation away from car uses:

- Incorporate Complete Streets principles.
- Identify and implement road diets.
- Create more dedicated bus lanes.
- Adapt curbside uses to fit neighborhood type.
- Improve walkability and amenities with more car-free zones and plazas.

While the commute mode share goal is enshrined in Districtwide policy, most neighborhood studies and plans do not focus explicitly on changing commute or other modal choices of residents. For example, livability studies provide a forum for developing neighborhood level planning priorities to achieve transportation objectives, yet rarely seek to address commute mode shares. Completed in 2017, the “The Far Southeast III Livability Study” lists “Increase non-auto mode split” as one of several objectives buried on the last page of the

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54 District Department of Transportation, “MoveDC,” 49
55 District Department of Transportation. “MoveDC Draft Strategies” February 2021
https://D.C.gis.maps.arcgis.com/sharing/rest/content/items/aa1d651d0f424a4781831b844ff1a3a3/data
However, it does not quantify modal splits for study area residents or workers, nor does it reference the commute mode share goals of the District. The most recently completed livability studies, “Rock Creek Far West,” completed in 2019, and “Rock Creek East One” completed in 2020, do not suggest that reducing the share of commute trips by car is a D.C. goal or a goal of the study. Similarly, small area and other plans conducted by the Office of Planning (OP), corridor studies and other planning documents do not adequately address commute mode share. For example, the 2017 “Buzzard Point Vision Framework + Design Review Guide,” (the most recently completed OP plan available online) makes several mentions of increasing multimodal access for residents and visitors, yet does not put forward a strategy for shifting car trips to other modes in line with D.C.’s goals. Overall, neighborhood level planning in D.C. has not adequately addressed transportation mode goals, yet DDOT’s future livability studies and OP’s small area plans could act as venues for neighborhood level planning to advance D.C.’s mode share goals, potentially by employing road space reallocation strategies.

**VisionZero**

In 2015 Mayor Muriel Bowser established D.C.’s VisionZero program which set the goal that by the year 2024, Washington, D.C. will “reach zero fatalities and serious injuries to travelers of its transportation system through more effective use of data, education, enforcement,

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and engineering.” Since the establishment of this goal, annual traffic fatalities have increased from 26 in 2015 to 37 in 2020. Serious injuries have decreased from 507 in 2016\textsuperscript{60} to 386 in 2020. (See Figure 4.2.)

\textbf{Figure 4.2. Fatalities and Serious Injuries 2011-2020.} By Author, using data from D.C. Open Data.

With engineering as a key component for achieving vision zero goals, road space reallocation is a potential tool. The “VisionZero Action Plan” identifies several strategies which could include reallocating road space, including building new bike lanes, filling gaps in sidewalks, and updating design standards using complete streets principles. However, the “Action Plan” does not identify the overall allocation of road space for different uses as a relevant factor for traffic safety, nor does it discuss reallocating road space from car-oriented uses to more active ones as a potential strategy.\textsuperscript{61} The 2017 “VisionZero Rulemaking Report”

\textsuperscript{60} 2016 was the first year using current methodology for counting serious injuries. Prior to 2016, the definition was more expansive resulting in significantly higher counts.

identifies road diets as a key tool for reducing speed and notes the co-benefit of being able to reallocate road space to other uses. Overall, in publicly available documents for the VisionZero program, road space reallocation is rarely noted as a potential tool for improving safety conditions. This omission could be a missed opportunity to utilize a key tool for achieving VisionZero goals.

Transportation Equity Statement

DDOT has a publicly posted “Transportation Equity Statement,” which, in part states: “…DDOT is committed to elevating and advancing transportation equity by evaluating our policies, planning, community engagement and project delivery, to ensure public investments in transportation justly benefit all residents, visitors and commuters.” This project approaches road space allocation through a transportation equity lens by viewing each road space allocation as a class of transportation infrastructure which can either benefit or harm a community. Given the literature supporting the positive impacts of people-oriented roads over car-oriented ones for local communities, this project assumes road space with high portions dedicated to active uses is a desirable asset for communities. Evaluating this asset through a transportation equity lens requires analyzing the distribution of active use road allocations in relationship to race and income, and potentially other demographic variables such as age and vehicle ownership. DDOT does not have any publicly available information looking at the distribution of road space allocations, so this project seeks to fill a gap in what information is available to evaluate the agency’s progress on equitably distributing infrastructure and investments. The approach taken

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in this study is a very narrow piece of the complex set of issues that contribute to transportation equity. It does not suggest this is the most important measure of transportation equity and the analyses within should not replace place-based planning and public processes to work with communities to deliver benefits or mitigate harms.

**Key Takeaways**

There several planning processes and policies with the potential to incorporate commute mode share and road space reallocation strategies and goals, including MoveDC, VisionZero, DDOT’s Livability Program, the Complete Streets Policy, small area plans, corridor studies and redesigns, and bike/bus lane projects. This project does not evaluate all these possible processes, yet the absence of coordinated road space reallocation strategies in DDOT’s primary planning documents, points to the need for more Districtwide and neighborhood level planning on this topic.

Across the three policy areas evaluated in this study, road space allocation is understudied, and its potential as a tool to achieve measurable results does not appear to be adequately considered in data collection and planning processes. Based on these gaps, this study seeks to contribute to the public understanding of this aspect of infrastructure management and to aid decision-makers as they seek to advance these three specific policy goals, in Washington D.C. and beyond.

5. **Overall and Ward Level Road Space Allocations**

The first step in evaluating how D.C. allocates its road space is to gain districtwide perspective. Using the “Roadway SubBlock” dataset, this study evaluates road areas that are part
of the public street grid, excluding driveways, alleys, walkways etc. All roadways used in this study are shown in Figure 5.1.


This project identifies 10.28 square miles of road space, making up 15.04% of the entire area of the District, broken down by the following uses:

- Total car area (travel lanes and parking lanes) account for 75.32% of total road space at 7.74 square miles, or 11.33% of the total area of D.C. This area is comprised of:
- Travel lanes, which account for 50% of road space at 5.14 square miles, or 7.52% of the total area of D.C., and
- Parking lanes, which are allocated 25.32% of road space at 2.6 square miles or 3.81% of total D.C. area.
- Total car area of roads classified as arterials make up 22.2% of total road space.

- Active uses account for 24.68% of total road space at 2.54 square miles, or 3.71% of D.C. area. This is made up of
  - Sidewalks, which are allocated 24.68% of road space at 2.51 square miles or 3.67% of total area of D.C., and
  - Bike lanes, which are allocated 0.26% of road space, at 0.03 square miles, making up 0.04% of D.C. area.

To put these areas in context, the amount of road space dedicated to cars is 2.82 times the area of Rock Creek Park - the single largest contiguous geographic feature in the District at 2.74 square miles. On-street parking alone on D.C.’s roads is allocated nearly the same area as our largest park. The 2.6 square miles of road space allocated to parking is enough space for approximately 503,360 parking spots, or 1.4 spaces for the 358,363 registered vehicles in D.C. Overall, D.C.’s allocations closely mirror those of New York City’s, as calculated in the Transportation Alternatives report which found that 54.3% is dedicated to travel lanes, 21.1% on-street parking, 23.7% for sidewalks and 0.93% for bike lanes.

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64 Based on a 144 square foot parking spot (8’x18’).
65 District of Columbia Department of Motor Vehicles. “Historical Registration Data FY2010-FY2019”
66 Transportation Alternatives, “NYC 25x25”
Road space uses are not evenly allocated across D.C.'s eight wards. This uneven
distribution is not surprising given the varying land uses, population and employment densities
and many other factors which might influence street design. Ward 8 has the most total car area
(80.37%) as a percent of total road space due to having the highest share of travel lane area
(58.45%). Ward 3 has the most parking area (31.69%) as a share of road space, while Ward 2 has
the least (18.95%). Ward 1 has the most total active area (31.83%) as a percent of road space,
with the highest sidewalk (31.25%) and bike area (0.58%) percentages. Ward 8 has the lowest
percentages for total active area (19.63%), sidewalk area (19.58%), and bike lane area (0.06%).
See Table 5.1 for the complete breakdown of uses by Ward. Figure 5.2 shows car area % for
each of D.C.'s eight Wards.

Table 5.1. Road Space Allocations by Ward. Darker red shading indicates higher value. Highest
value for each use is noted in *bold italic*.

<table>
<thead>
<tr>
<th>Ward</th>
<th>Total Car Area %</th>
<th>Travel Lane %</th>
<th>Parking %</th>
<th>Total Active Area %</th>
<th>Sidewalk %</th>
<th>Bike Lane %</th>
<th>Arterial Car Area %</th>
<th>Arterial Travel Lane %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68.17</td>
<td>40.66</td>
<td>27.51</td>
<td>31.83</td>
<td>31.25</td>
<td>0.58</td>
<td>30.05</td>
<td>21.18</td>
</tr>
<tr>
<td>2</td>
<td>69.49</td>
<td>50.54</td>
<td>18.95</td>
<td>30.51</td>
<td>30.13</td>
<td>0.38</td>
<td>37.05</td>
<td>28.87</td>
</tr>
<tr>
<td>3</td>
<td>79.79</td>
<td>48.11</td>
<td>31.69</td>
<td>20.21</td>
<td>20.09</td>
<td>0.12</td>
<td>20.42</td>
<td>15.63</td>
</tr>
<tr>
<td>4</td>
<td>77.26</td>
<td>46.56</td>
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<td>22.74</td>
<td>22.53</td>
<td>0.21</td>
<td>18.12</td>
<td>14.37</td>
</tr>
<tr>
<td>5</td>
<td>77.13</td>
<td>53.55</td>
<td>23.58</td>
<td>22.87</td>
<td>22.67</td>
<td>0.19</td>
<td>24.30</td>
<td>21.26</td>
</tr>
<tr>
<td>6</td>
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<td>48.02</td>
<td>21.73</td>
<td>30.25</td>
<td>29.72</td>
<td>0.53</td>
<td>22.51</td>
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</tr>
<tr>
<td>7</td>
<td>78.04</td>
<td>51.32</td>
<td>26.72</td>
<td>21.96</td>
<td>21.83</td>
<td>0.13</td>
<td>18.96</td>
<td>16.38</td>
</tr>
<tr>
<td>8</td>
<td><strong>80.37</strong></td>
<td><strong>58.45</strong></td>
<td>21.92</td>
<td>19.63</td>
<td>19.58</td>
<td>0.06</td>
<td>12.61</td>
<td>11.06</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of Tot. Road Space</th>
<th>Tot. Sq Miles</th>
<th>% of Tot. D.C. Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tot. Car</td>
<td>75.32%</td>
<td>11.33%</td>
</tr>
<tr>
<td>Travel Lane</td>
<td>50.00%</td>
<td>7.52%</td>
</tr>
<tr>
<td>Parking</td>
<td>25.32%</td>
<td>3.81%</td>
</tr>
<tr>
<td>Total Active</td>
<td>24.68%</td>
<td>3.71%</td>
</tr>
<tr>
<td>Sidewalk</td>
<td>24.42%</td>
<td>3.67%</td>
</tr>
<tr>
<td>Bike Lane</td>
<td>0.26%</td>
<td>0.04%</td>
</tr>
<tr>
<td>Arterial Car</td>
<td>22.20%</td>
<td>3.34%</td>
</tr>
<tr>
<td>Arterial Travel Lane</td>
<td>17.79%</td>
<td>2.68%</td>
</tr>
</tbody>
</table>

Source: By Author, using data from D.C. OpenData
Key Takeaways

Overall, the relatively high percentage of road space dedicated to car uses – travel lanes and parking present both a challenge and an opportunity. First, on their face, the existing allocations favor car travel, as most of D.C.’s road space is allocated to travel lane and parking area, undercutting D.C.’s commute and safety goals. It presents an opportunity in that if D.C. were to pursue a road space reallocation strategy, there is plenty of space to shift from car-oriented uses to active uses. The variation by ward demonstrate that road space allocations are
not evenly distributed across the District and given D.C.’s racial and economic segregation, suggest an inequitable distribution of road space uses.

6. Census Tract Level Allocations and Hot spots

This chapter uses maps, created for this study, to show how road space allocation and other key variables are distributed across D.C. at the census tract level. As a first step in exploring how road space allocations and other variables may be related, the project created two maps for each variable. The first visualizes the relative value at the tract level. The second uses the “Optimized Hot Spot Analysis” tool in ArcGIS Pro to show where there are statistically significant hot spots (relatively high values) and cold spots (relatively low values) for each variable. (See online documentation for explanation of methodology for this tool.) The output hot and cold spot maps provide a coarser view of how road space allocations (and the other project variables) are distributed across the District. This alternate visualization provides a larger scale perspective to observe spatial patterns than the census tract-level graduated color maps. Below, each variable is displayed in these two formats.

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Road Space Allocation Maps

Figure 6.1. Car Area %. By Andrew Grinberg, 2021. Data Source: D.C. Open Data. Using: ArcGIS Pro. Tracts with more car area as a percent of total road space are clustered around the periphery of the District and farther from the CBD. Lower car area % tracts are clustered in the center of the District.

Figure 6.2. Travel Lane Area %. By Author. Data Source: D.C. Open Data. Tracts with higher travel lane area percentages are clustered east of the Anacostia, in the Southeast quadrant. Tracts with less travel lane area % are clustered primarily in Northwest.
Higher parking area tracts have less significant clustering, but those that exist are primarily clustered in Upper Northwest.

Tracts with high active area percentages are clustered in the center of the District, while tracts with less active area are on the outskirts, east of the Anacostia and in Upper Northwest.
Figure 6.5. Sidewalk Area %. By Author. Data Source: D.C. Open Data. Higher sidewalk area percentage tracts are clustered in the center of the city. Low sidewalk percentage tracts are on the periphery, east of the Anacostia, Far Northeast and in Upper Northwest.

Figure 6.6. Bike Lane Area %. By Author. Data Source: D.C. Open Data. Higher bike lane area tracts are clustered in the center, while low bike lane tracts are clustered in east of the Anacostia and in upper Northwest.
For both arterial car area and arterial travel lane area, higher percentage tracts are clustered in the center of the District, reaching into much of Upper Northwest. Lower levels of arterial car area are clustered east of the Anacostia.
Commute Mode Share Maps

Figure 6.9. Drive Commute %. By Author. Data Sources: American Community Survey 5-year estimates 2015-2019. High drive commute mode share tracts are clustered primarily east of the Anacostia and other peripheral areas. Low driving commute mode share tracts are clustered in the center and western part of the city.

Figure 6.10. Public Transit Commute %. By Author. Data Source: Data Sources: American Community Survey 5-year estimates 2015-2019. Public transit commute mode share has minimal clustering. With two small higher transit use clusters – one in NW and one in SE. Low transit use tracts are clustered Northwest along the Potomac.
Figure 6.11. Walk Commute %. By Author. Data Source: American Community Survey 5-year estimates 2015-2019. Higher walk commute mode shares are clustered in central D.C. and to the west along the Potomac, while lower walk commute mode shares are clustered around the periphery.

Figure 6.12. Bike Commute %. By Author. Data Sources: American Community Survey 5-year estimates 2015-2019. Higher bike commute mode shares are clustered in the center of D.C., while lower bike commute mode shares are clustered east of the Anacostia.
Traffic Crash, Injury, and Fatality Maps

Figure 6.13. Fatalities Per Mile of Road. By Author. Data Source: D.C. Open Data. Tracts with high fatalities per mile are clustered east of the Anacostia. Low fatality tracts are clustered in upper Northwest.

Figure 6.14. Fatal or Serious Injuries per Mile of Road. By Author. Data Source: D.C. Open Data. Tracts with high fatalities or serious injuries are clustered in central D.C. and east of the Anacostia. There is a large low fatality or serious injury cluster in Upper Northwest and a small part of Northeast.
Figure 6.15. Crashes per Mile of Road. By Author. Data Source: D.C. Open Data. Tracts with higher crashes per mile are clustered in the center of D.C. with a small cluster east of the Anacostia. Low crash per mile tracts are clustered in Upper NW and NE.

Demographic Maps

Figure 6.16. % African American Population. By Author. Data Source: ESRI. Tracts with a higher share of African American residents are clustered east of the Anacostia. Tracts with a lower share of African American residents are clustered in central D.C. and Upper NW.
Figure 6.17. % Non-Hispanic White Population. By Author. Data Source: ESRI. Non-Hispanic white population is clustered in the western half of the District. Low Non-Hispanic white tracts are clustered in the eastern half.

Figure 6.18. Median Household Income. By Author. Data Source: ESRI. Higher median household income tracts are clustered in the western half, and lower incomes are clustered in the eastern half of D.C., primarily east of the Anacostia.
By Author. Data Source: American Community Survey 5-year estimates 2015-2019. Tracts with a higher share of households with zero vehicles are clustered in central D.C., while tracts with low numbers of zero vehicle households are clustered in upper northwest.

By Author. Data Source: ESRI. Tracts with more children as a share of population are clustered east of the Anacostia. Lower percentage of children tracts are clustered over a large portion of the District to the West.
Land Use and Fundamentals Maps

Figure 6.21. Population Density. By Author. Data Source: ESRI. High Population density tracts are clustered in the center of D.C. Less significant clustering of low population density occurs in a few peripheral areas.

Figure 6.22. Employment Density. By Author. Data Source: ESRI. High employment density is tightly clustered in Downtown.
Figure 6.23. Distance to Metro Nearest Metro Station. By Author. Data Source: D.C. Open Data. There are a few small clusters of tracts with higher distances to metro. There is a less significant low distance to metro cluster in central D.C.

Key Takeaways

The maps in this section help to characterize key attributes and how they are distributed across D.C. both at the tract level and with broader geographic patterns, illuminated by the hot spot maps. Many of the hot and cold spots are clustered in distinct parts of the district, such as the central business district/downtown, neighborhoods east of the Anacostia River, and the Upper Northwest. Clustering such as this is not surprising given the variables being mapped, the long history of racial and economic segregation and the simple fact that geography strongly influences many of these variables, such as commute modes.

The maps above show that the central part of D.C. has more actively oriented road space with greater share of bike lane and sidewalk area, and less space dedicated to car-uses. These allocations are overlaid on higher population and employment densities, lower driving commute mode shares and higher biking and walking commute rates. Central D.C. also has higher rates of
fatalities or serious injuries per mile of road space – likely a factor influenced by high volumes of vehicular traffic.

East of the Anacostia, on the other hand, has more car-oriented streets, primarily due to more travel lane area, with less sidewalk and bike lane area. This part of D.C. has high rates of driving, low walking, and low biking. It has generally lower population and employment density and has high rates of fatalities per mile of road. These characteristics overlap with significantly lower median household incomes and higher % African American populations. The clustering of road space allocations combined with the racial and economic segregation east of the Anacostia, indicates a likely inequitable distribution of active road space attributes.

Tracts in Upper Northwest also have more car-oriented road space allocations; however, they are influenced by more parking area and less travel area. This part of D.C. also has lower active area percentages with less bike lane and sidewalk area. Some individual tracts in far and upper NW have high driving commute rates, however there is less significant clustering than east of the Anacostia. This part of D.C. has generally lower traffic crash rates, including fatalities and serious injuries. Upper NW has significantly higher incomes, and higher % non-Hispanic white populations.

Visualizing tract level attributes and clustering can explain the characteristics of specific neighborhoods and sections of D.C. and begin to demonstrate possible associations between road space allocations and other key variables. Given the observed spatial patterns in these parts of D.C., further statistical review is warranted. More rigorous quantitative methods are needed to characterize the relationships between these variables.
7. Tract Level Correlations

The second step in exploring the relationships between road space allocations and the project variables is to calculate bivariate correlation coefficients in Microsoft Excel. This analysis assesses the strength and direction of the association between key variables in the study. This analysis is an important step in understanding whether road space reallocation projects could be used to advance D.C.’s policy goals. The results of this analysis can then be built on to conduct more complex analyses as discussed in subsequent chapters. See Table 7.1 for key results of the bivariate correlation analysis.

*Table 7.1. Bivariate Correlation Coefficients.* More significant positive associations are shaded in darker green. More significant negative associations are shaded in darker red. Correlation strength varies widely, with some relationships having fairly strong relationships, while others have very weak or insignificant relationships.

<table>
<thead>
<tr>
<th></th>
<th>Total Car Area %</th>
<th>Travel Lanes Area %</th>
<th>Parking Area %</th>
<th>Total Active Area %</th>
<th>Sidewalk Area %</th>
<th>Bike Lanes Area %</th>
<th>Population Density</th>
<th>Arterial Car Area %</th>
<th>Principal Arterial Car Area %</th>
<th>Distance to Nearest Metro Station</th>
<th>Distance to Central Business District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median HH Income</td>
<td>-0.28</td>
<td>-0.30</td>
<td>0.17</td>
<td>0.28</td>
<td>0.27</td>
<td>0.30</td>
<td>0.05</td>
<td>0.15</td>
<td>0.31</td>
<td>-0.10</td>
<td>0.23</td>
</tr>
<tr>
<td>% African American</td>
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<td>0.04</td>
<td>-0.42</td>
<td>-0.41</td>
<td>-0.44</td>
<td>-0.30</td>
<td>-0.36</td>
<td>-0.24</td>
<td>0.18</td>
<td>-0.49</td>
</tr>
<tr>
<td>% Non-Hispanic White</td>
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<td>-0.24</td>
<td>-0.04</td>
<td>0.40</td>
<td>0.39</td>
<td>0.41</td>
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<td>0.29</td>
<td>-0.36</td>
<td>-0.16</td>
<td>0.42</td>
</tr>
<tr>
<td>% Population Under 18</td>
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<td>0.17</td>
<td>0.22</td>
<td>-0.45</td>
<td>-0.44</td>
<td>-0.44</td>
<td>-0.27</td>
<td>-0.51</td>
<td>-0.41</td>
<td>0.28</td>
<td>0.63</td>
</tr>
<tr>
<td>% Zero Car Households</td>
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<td>0.37</td>
<td>-0.18</td>
<td>0.43</td>
<td>0.43</td>
<td>0.37</td>
<td>0.32</td>
<td>0.37</td>
<td>-0.39</td>
<td>-0.23</td>
<td>0.37</td>
</tr>
<tr>
<td>Commute - Drive (Alone + Carpool)</td>
<td>0.57</td>
<td>0.13</td>
<td>0.40</td>
<td>-0.57</td>
<td>-0.56</td>
<td>-0.54</td>
<td>-0.42</td>
<td>-0.41</td>
<td>-0.24</td>
<td>0.41</td>
<td>-0.41</td>
</tr>
<tr>
<td>Commute - Drive Alone</td>
<td>0.62</td>
<td>0.32</td>
<td>0.17</td>
<td>-0.62</td>
<td>-0.62</td>
<td>-0.56</td>
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<td>-0.51</td>
<td></td>
</tr>
<tr>
<td>Commute - Carpool</td>
<td>0.39</td>
<td>0.15</td>
<td>0.17</td>
<td>-0.39</td>
<td>-0.38</td>
<td>-0.35</td>
<td>-0.29</td>
<td>-0.35</td>
<td>-0.19</td>
<td>0.29</td>
<td>-0.33</td>
</tr>
<tr>
<td>Commute - Bike</td>
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<td>-0.42</td>
<td>0.10</td>
<td>0.51</td>
<td>0.51</td>
<td>0.48</td>
<td>0.44</td>
<td>0.23</td>
<td>0.32</td>
<td>-0.20</td>
<td>0.41</td>
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<tr>
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<td>0.18</td>
<td>0.02</td>
<td>0.01</td>
<td>0.05</td>
<td>0.19</td>
<td>-0.03</td>
<td>0.13</td>
<td>-0.20</td>
<td>0.01</td>
</tr>
<tr>
<td>Commute - Walk</td>
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<td>-0.15</td>
<td>-0.36</td>
<td>0.57</td>
<td>0.56</td>
<td>0.44</td>
<td>0.44</td>
<td>0.42</td>
<td>-0.26</td>
<td>-0.24</td>
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</tr>
<tr>
<td>Crashes per mile</td>
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<td>-0.09</td>
<td>-0.23</td>
<td>0.36</td>
<td>0.36</td>
<td>0.17</td>
<td>0.47</td>
<td>0.38</td>
<td>0.05</td>
<td>-0.21</td>
<td>0.30</td>
</tr>
<tr>
<td>Fatalities or Serious Injuries per Mile</td>
<td>-0.15</td>
<td>0.02</td>
<td>-0.19</td>
<td>0.15</td>
<td>0.15</td>
<td>0.08</td>
<td>0.18</td>
<td>0.19</td>
<td>-0.08</td>
<td>-0.19</td>
<td>0.09</td>
</tr>
<tr>
<td>Injuries per Mile</td>
<td>-0.16</td>
<td>0.04</td>
<td>-0.23</td>
<td>0.16</td>
<td>0.17</td>
<td>0.02</td>
<td>0.28</td>
<td>0.26</td>
<td>-0.10</td>
<td>-0.16</td>
<td>0.12</td>
</tr>
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<td>Population Density</td>
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<td>-0.54</td>
<td>0.13</td>
<td>0.67</td>
<td>0.66</td>
<td>0.54</td>
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<td>0.33</td>
<td>0.26</td>
<td>-0.15</td>
<td>0.57</td>
</tr>
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<td>Employment Density</td>
<td>-0.32</td>
<td>-0.01</td>
<td>-0.32</td>
<td>0.32</td>
<td>0.31</td>
<td>0.38</td>
<td>0.33</td>
<td>0.43</td>
<td>-0.18</td>
<td>-0.24</td>
<td>0.73</td>
</tr>
<tr>
<td>Distance to Central Business District</td>
<td>-0.59</td>
<td>-0.46</td>
<td>0.08</td>
<td>0.59</td>
<td>0.59</td>
<td>0.53</td>
<td>0.57</td>
<td>-0.44</td>
<td>-0.39</td>
<td>0.36</td>
<td>1.00</td>
</tr>
<tr>
<td>Distance to Nearest Metro Station</td>
<td>0.28</td>
<td>0.05</td>
<td>0.22</td>
<td>-0.28</td>
<td>-0.27</td>
<td>-0.31</td>
<td>-0.15</td>
<td>-0.27</td>
<td>0.21</td>
<td>1.00</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Source: By Author, using data from D.C. OpenData, American Community Survey 5-year estimates, and ESRI.
Discussion of Commute Mode and Road Space Allocation Correlation

There are moderate to strong correlations between road space allocations and commute modes, with the exception of public transit. Driving, walking, and biking are all moderately correlated with road space allocations. High car area % is correlated with more car commuting and less bike and walk commuting. More active area, sidewalk and bike lane area are correlated positively with walking and bike commute. This data tells us that tracts with car commuters are more likely to have more car-oriented road space, while tracts with more bike and walk commuters are more likely to have more active use-oriented streets with more sidewalk area and bike lane area as a share of total road space. These correlations indicate the possibility that road space allocation could be used to influence commute mode share; however further research is needed to determine whether these associations are causal. For example, it is possible that road space allocations influence commuters’ mode choice. On the other hand, it is also possible that residents self-select and choose to live in neighborhoods where the built environment supports their commute preferences, such as a person who bikes choosing to live in a neighborhood with more bike lanes. Determining causality would require disentangling factors such as these.

Discussion of Crash Data and Road Space Allocation Correlation

There are weak correlations between crashes, injuries, and fatalities and road space allocations. There are stronger, yet still weak to moderate correlations between the crash categories and arterial car area percentages. There are several explanations for why crash data is not strongly correlated with road space allocations. First, the crash and injury data used for this project is limited and likely biased (see note in methodology). Second, other factors are likely

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68 This study defines “weak” correlations as 0-.3, “moderate” as .3-.6, and “strong” as .6-1 (absolute values).
more relevant to roadway safety -- for example, the volume of travel, speeds, visibility, and other factors. While road diets (which reallocate travel lane area to other uses) are a common safety intervention, it’s likely that this corridor level treatment does not translate to the macro and tract level analysis of this project.

**Discussion of Demographic and Road Space Allocation Correlation**

There are moderate, yet clear, correlations between demographic variables and road space allocations. African American % is moderately positively correlated with car area %. This means tracts with more Black residents are more likely to have more car-oriented streets, primarily because of the presence of more travel lane area, but not more parking. Non-Hispanic White residents are more likely to live in active-oriented tracts with more bike lanes and sidewalk area.

There are weak to moderate correlations between median household income and road space allocations. Higher income tracts are slightly more likely to have more active area, more bike lanes, and more sidewalk area. Lower income tracts are more likely to have more car area and less sidewalk, and bike lane area. Tracts with more zero car households are less likely to have higher car area and more active area. Population under 18 has a positive correlation with car area, meaning that tracts with a higher share of children (who are unlikely to drive a car) have more road space allocated for car uses and less for active uses, sidewalks, and bike lanes.

These correlations demonstrate an inequitable distribution of active road space. This good, which has numerous positive benefits has been inequitably allocated to whiter, wealthier parts of D.C. where fewer kids live. These trends indicate a needed focus for DDOT in its pursuit of transportation equity.
Discussion of Land Use and Fundamental Variables and Road Space Allocation Correlations

Population density has a significant positive correlation with active street allocations. The densest tracts have less car area and more active, sidewalk and bike lane areas. Employment density has a moderate positive correlation with active road space allocation. Distance to the central business district is positively correlated with more car-oriented allocation – more parking, less bike lanes and sidewalks. Distance to nearest Metro stations has a weak to moderate positive correlation with more car area and negative correlation with active area, sidewalk, and bike lanes. These variables represent some, but not all the additional factors which must be considered when evaluating the efficacy of road space reallocation in advancing commute mode, safety and equity goals.

8. Local Bivariate Relationships

This chapter explains the results of “Local Bivariate Relationship” tool analyses in ArcGIS Pro which evaluate how correlations between key variables vary across the District. While simple tract level correlations tell part of the story, there are variations in those relationships in different parts of the city. The “Local Bivariate Relationship” tool in ArcGIS Pro produces an output map that shows where the relationships between two variables are significant or not, and directionality of significant correlations. Two categories of maps are included below showing relationships between: 1) road space allocations and commute mode share variables, and 2) road space allocations and traffic safety data. Variable combinations with no significant or ambiguous relationships are omitted.
Local Bivariate Relationship Maps

Figure 8.1. Drive Commute and Car Area %: Local Bivariate Relationship. By Author. Data Sources: American Community Survey 5-year estimates and D.C. OpenData. There are large areas of the District where driving has a significant positive correlation with car area %. All convex and concave relationships are in the positive direction. The scatter plot on top right illustrates a positive convex example, showing a generally upward sloping curve. The bottom right is an example of a positive concave relationship.

Figure 8.2. Bike Commute and Active Area %: Local Bivariate Relationship. By Author. Data Sources: American Community Survey 5-year estimates and D.C. OpenData.

Figure 8.3. Bike Commute and Bike Lane Area %: Local Bivariate Relationship. By Author. Data Sources: American Community Survey 5-year estimates and D.C. OpenData.
Figure 8.4. Bike Commute and Sidewalk Area %: Local Bivariate Relationship. By Author. Data Sources: American Community Survey 5-year estimates and D.C. OpenData.

Figure 8.5. Walk Commute and Active Area %: Local Bivariate Relationship. By Author. Data Sources: American Community Survey 5-year estimates and D.C. OpenData.

Figure 8.6. Walk Commute and Sidewalk Area %: Local Bivariate Relationship. By Author. Data Source: D.C. OpenData.

Figure 8.7. Fatal or Major Injury per mile and Car Area %: Local Bivariate Relationship. By Author. Data Source: D.C. OpenData.
Figure 8.8. Fatal or Major Injuries per mile and Arterial Car Area %: Local Bivariate Relationship. By Author. Data Source: D.C. OpenData.

Figure 8.9. Crashes per Mile and Car Area %: Local Bivariate Relationship. By Author. Data Source: D.C. OpenData.

Figure 8.10. Crashes per mile and Travel Area %: Local Bivariate Relationship. By Author. Data Source: D.C. OpenData.

Figure 8.11. Crashes per mile and Arterial Car Area %: Local Bivariate. By Author. Data Source: D.C. OpenData.
Key Takeaways

The map outputs from the “Local Bivariate Relationship” analyses show where, and in which direction, certain road space allocations are significantly correlated with commute mode and safety. Generally, the results of the local bivariate relationship analyses are consistent with the directions and significance of the simple bivariate correlations calculated in Chapter 8. Yet the local bivariate patterns are more informative as they provide a more detailed and nuanced look at where associations are significant, and therefore where reallocation might be more effective. Generally, the patterns of significance are consistent with what one might expect to find. For example, in Figure 8.2, bike commute % and active area % are generally significantly correlated further from the central business district. This makes sense since for short bike trips, the road design characteristics may be less important for influencing modal choice, while for moderate to longer distances, more bike friendly streets could be a pre-requisite or a strong incentive for many potential bike commuters.

9. Multivariate Regressions

Building on the bivariate correlation analyses, the study attempts to use multivariate regressions to further explore the associations between key variables. Multivariate regressions provide a more robust analysis than bivariate correlations in that they disentangle the effects of individual variables from the effects of others. Most real-world behaviors and outcomes are impacted by many factors. Commute mode choice and traffic crashes are no different. Using the variables already incorporated into the project, the study attempts to build statistically significant multivariate ordinary least squares (OLS) regression models to explain dependent variables of commute mode shares (driving, biking, walking, transit) and safety data (crashes per mile, and fatal or serious injuries per mile). For all attempted regressions, the “Exploratory Regression”
tool in ArcGIS was run with all possible variables from the project included. Within the scope of this project’s data and time constraints, only one passing OLS regression was successfully created. The only passing regression in the study models drive commute % with five explanatory variables. This regression model passes all statistically significant tests. Then using the same dependent and independent variables, a geographically weighted regression was also created to show variation in coefficients and r² values across the District.

Table 9.1 summarizes the OLS regression model. Using the same variables, the project created a Geographically Weighted Regression (GWR), summarized in Table 9.2.

**Table 9.1. Drive Commute OLS Regression Summary Table.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.037473</td>
<td>-0.254996</td>
<td>0.799033</td>
</tr>
<tr>
<td>% Non-Hispanic White</td>
<td>-0.002110</td>
<td>-6.809987</td>
<td>0.000000</td>
</tr>
<tr>
<td>Employment Density</td>
<td>-0.000001</td>
<td>-2.254490</td>
<td>0.027333</td>
</tr>
<tr>
<td>Distance to Metro Station</td>
<td>0.000064</td>
<td>4.003845</td>
<td>0.000098</td>
</tr>
<tr>
<td>Crashes Per Mile</td>
<td>-0.000791</td>
<td>-3.269470</td>
<td>0.001310</td>
</tr>
<tr>
<td>Car Area %</td>
<td>0.007701</td>
<td>4.757879</td>
<td>0.000005</td>
</tr>
</tbody>
</table>

Source: By Author

**Table 9.2. Drive Commute GWR Summary Table.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient Min</th>
<th>Coefficient Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.649611</td>
<td>0.632573</td>
</tr>
<tr>
<td>% Non-Hispanic White</td>
<td>-0.003796</td>
<td>-0.000273</td>
</tr>
<tr>
<td>Employment Density</td>
<td>-0.000001</td>
<td>0.000000</td>
</tr>
<tr>
<td>Distance to Metro Station</td>
<td>0.000027</td>
<td>0.000107</td>
</tr>
<tr>
<td>Crashes Per Mile</td>
<td>-0.001368</td>
<td>0.000334</td>
</tr>
<tr>
<td>Car Area %</td>
<td>0.000233</td>
<td>0.013129</td>
</tr>
</tbody>
</table>

Source: By Author.

69 “Passing OLS Regression” is defined by using ArcGIS Pro’s “Explanatory Regression” tool’s default settings. Minimum acceptable adjusted r² value: 0.5. Maximum coefficient p value: 0.05. Maximum VIF value: 7.5. Minimum acceptable Jarque Bera p value: 0.1. Minimum acceptable spatial autocorrelation p value: 0.1.
Figure 9.1 shows the geographic distribution of local $r^2$ values. This map shows where this regression model best predicts driving commute mode share. Higher $r^2$ values mean that the dependent variables explain a higher proportion of the dependent variable. Figure 9.2 shows the distribution of local car area % coefficients. Higher coefficient values mean that a change in car area % has a larger impact on drive commute mode share. For example, in the tract with the highest coefficient (.013129), a one percent decrease in car area percent, would lead to a 1.3% decrease in driving. In the lowest coefficient tract (.000233), a one percent decrease in car area would only lead to a .0233% decrease in driving.

*Figure 9.1. Drive Commute Geographically Weighted Regression Local $r^2$ Values. By Author.*

*Figure 9.2. Drive Commute GWR Car Area % Local Coefficients. By Author.*
Discussion of Regression Analyses

The results of the regression analyses show to what extent and where reallocating road space could impact driving commute mode share. The OLS regression shows that at a citywide level, car area % is a significant explanatory variable which has a positive correlation with driving commute mode share, even when disentangled from the four other variables in the model (% Non-Hispanic White %, employment density, distance to metro station, and crashes per mile of road). The GWR analysis provides further insight as to where road space allocation could have a bigger impact on driving commute mode share as indicated by a higher car area % coefficient (indicating the model is more responsive in those locations), and a higher $r^2$ value (indicating the model is more reliable and explains a larger portion of the dependent variable).

For the dependent variables that could not be used to create a successful regression, it is likely that data outside the scope of this study play significant explanatory roles. This does not indicate reallocating road space would not have an impact on shifting these dependent variables, but it does leave unanswered the question as to what extent. Future research could attempt to fill this gap by incorporating other data to create valid regression models for other key dependent variables. For example, a successful regression modeling bike commute % may need to incorporate a measure of network connectivity (i.e., how bike lanes connect people to jobs) and quality (whether they are physically separated from car traffic) of bike infrastructure. Additionally, a regression that models traffic crash data may need to utilize data on specific design features (such as those that impact visibility), vehicle volumes, and/or vehicle speeds.
10. Discussion of Research Findings

This chapter discusses the findings of the research exploring relationships between allocations and other variables to help inform whether and where road space reallocation projects could advance D.C. policy goals for commute mode share, safety, and equity.

*Commute Mode Share Discussion*

With D.C. lagging on reaching its established goals of reducing car commute trips and increasing walking, biking and transit, this research suggests that census tract-targeted road space reallocation projects – converting car-oriented space to active space – could be a potent tool for advancing this goal. Road space allocation and commute mode shares have moderate to strong correlations, and the regression model indicates that car area % is a significant variable associated with driving commute mode share. The results of the geographically weighted regression model can inform where reallocation interventions would be most effective at reducing car commute trips. Tracts with higher $r^2$ values are more reliably modeled by the regression, and tracts with higher car area % coefficients should yield larger decreases in driving for each unit of road space reallocated from car to active uses.

Road space reallocation could also be a viable strategy for increasing bike commute mode share as bike commute % and road space allocation variables are significantly correlated. The results of the local bivariate relationship analysis can further help target where correlations are significant. For example, locations where biking commute % has a significant positive relationship with bike lane area % should be considered high priority areas for reallocating car area to bike area.
Walking may be influenced by road space reallocation, however given the limits of how far one might be willing to walk for their commute, reallocating road space may have limited impact compared to strategies such as changing land use mixes, increasing employment and housing density in targeted areas, filling gaps in the pedestrian network, or other road design or built environment interventions.

The research in this study suggests that reallocating road space, as defined in this project, would not be the most effective intervention for increasing public transit commute mode share. Until transit priority lanes are more prevalent in the District, data does not capture any correlation between road space allocation and transit ridership at the tract level. It is possible that once more bus only lanes are constructed, this could change. These results are not surprising, as other factors figure to be more significant influencers of transit ridership, such as transit frequency and reliability, transit network coverage and connectivity, stop and station siting and design, fare structures and more.

Traffic Safety Discussion

Weak correlations between road space use allocations and crash data (crashes, injuries, and fatalities and serious injuries) indicate that at the tract level road space reallocation may not statistically impact safety metrics. Other safety interventions like reducing speeds, improving visibility for drivers and road diets – all targeted at dangerous streets, intersections or other more granular locations may be more effective strategies than tract-level targeting. While road diets are a corridor level road space reallocation intervention that is commonly used to promote safety, at the tract level they may not be applicable. Dangerous road conditions are a granular phenomenon, so tract level road space allocation analysis may be too coarse of an analysis. The
share of road space dedicated to arterial car area is more significantly correlated with crash data, indicating that a tract level road space reallocation safety strategy should focus on reducing arterial road space, which has a more significant correlation with safety metrics, rather than car area or travel lane area allocations writ large.

There are some geographic variations in correlation with road space allocation and safety data that could inform where to focus. For example, targeting where crashes per mile and/or fatal and serious injuries per mile are significantly correlated with arterial road space %.

As noted in the methodology section, crash data used for this project has some significant limitations, including undercounting of crash incidents, and potential geographic and demographic biases. Furthermore, crash data itself is an imperfect tool for measuring safety, as near-misses or avoidance of unsafe locations are not captured in the data. For example, if an intersection feels particularly dangerous, it is possible that pedestrians would avoid walking routes that use that intersection – and therefore reduce the chances of pedestrian interaction with vehicles and drive down crash data.

Given the limitations of the data for safety interventions, other factors could be integrated such as targeting interventions to protect particularly vulnerable road users, such as children.

Transportation Equity Discussion

The road space allocations in D.C. are not equitably distributed by race and ethnicity, median household income, or for children. The data show clear racial disparities in how road space is allocated. Whiter tracts have more active road space allocations. Tracts with higher African American populations are correlated with more road space area dedicated to car uses.
This disparity is driven by more travel lane area in Blacker tracts; there is essentially no correlation with parking area and race. There are moderate income disparities in road space allocation. Higher income tracts are more likely to have higher active area % and more parking area. Lower income tracts have more car-oriented area – the result of more travel lane area, but less parking. Additionally, tracts with more children are more likely to have more car area road space, less active area, including less sidewalk and bike lane area.

For these demographic indicators, several factors may be impacting these patterns, which merit further study. These include whether investments in active transportation infrastructure have been targeted to whiter, wealthier tracts, or whether housing costs or other economic factors or other forces for segregation, have excluded certain groups from accessing more sidewalk and bike lane area due to their scarcity and the concentration of these features in the central part of D.C. – a spatial outcome that could be driven by population and employment density rather than racial and economic factors. Regardless of the cause, however, the data indicates an inequitable distribution of road space area that is inconsistent with DDOT’s equity statement.

If active area in our road space is viewed as a beneficial asset for the community, then this project demonstrates that the road space allocations in D.C. undercut DDOT’s transportation equity goals as sidewalk area, and bike lane area are both disproportionately allocated to whiter, higher income census tracts with fewer children. Road space reallocation projects could be targeted to remedy this inequitable distribution.

While this analysis treats active area road space as a desirable asset, project planning with the goal of improving transportation equity should not assume which allocations are desirable for any given neighborhood or community. The equity analysis in this project takes a very narrow and data driven approach to evaluating equity by one metric, chosen by the author. This
approach should not replace place-based planning that incorporates a robust and accessible public process – another key pillar of just and equitable planning and project delivery.

11. Where to Reallocate Road Space

Across all three policy goals, the data can inform how and where to target road space reallocation projects. For each specific desired outcome or policy goal, the analysis conducted for this study can provide criteria for targeting tracts for road space reallocation projects. One approach for deciding where to focus reallocation projects could be to build geospatial suitability models which combine data to select the “most suitable” areas for an intervention. Depending on the desired outcome, each model utilizes selected relevant and useful criteria. This study creates seven suitability models that utilize data already incorporated into the project. Other goals, criteria and approaches could be used, and these are only presented as possible examples of how to target census tracts for reallocation.

For each suitability model, tract level data is converted into raster data, reclassified on a 1-10 scale, and incorporated into a weighted sum to develop a suitability score for each model. In each model, all criteria are given equal weight, however, future models could be tweaked to weight certain criteria above others or use other criteria entirely. For the scope and purposes of this study, these criteria and weights are chosen for simplicity, and are supported by the research. Each model produces a map showing the suitability score by tract as well as an optimized hot spot analysis map to view clustering of areas with high and low suitability scores. Hot spot maps provide a wider-angle view of areas that are more or less suitable for each intervention rather than just focusing on individual tracts. Focusing on larger scale than census tract could be a valuable planning scale in some circumstances.
**Suitability Model 1: Reduce Driving Commute %**

This model aims to reduce driving commute % by targeting census tracts with the following criteria: 1) high drive commute %, 2) high car area %, 3) high car area % coefficients derived from geographically weighted regression (GWR), and 4) high r² value from GWR. The suitability model produces the map on the left in Figure 11.1, showing “Drive Suitability Score” at the tract level on a scale of 0-40. A cluster of four tracts (highlighted in blue) in NW along the Potomac River have the highest scores of 35 and above, indicating they are the most suitable for reallocation of car area for the purpose of reducing driving commute mode share. The hot spot map on the right in Figure 11.1 identifies a vast cluster in Northwest and stretching into Northeast.

![Drive Suitability Score](image1)

![Hot Spot Map](image2)

*Figure 11.1. Suitability Model 1: Reduce Drive Commute %. By Author.*

**Suitability Model 2: Increase Bike Commute %**

This model seeks to increase bike commute mode share by targeting census tracts with: 1) low total active area %, 2) low bike lane area %, 3) low bike commute %, and 4) significant
positive relationship between bike commute % and bike lane area %, as derived from the local bivariate relationship analysis. The suitability model produces Figure 11.2 below showing “Bike Commute Suitability Score” at the tract level on a scale of 0-40. Thirteen tracts (highlighted), 12 of which are east of the Anacostia, have high scores of 35-37. These are the tracts most suitable for reallocation of car area to bike lane area, in order to increase bike commute mode share. The hot spot map identifies a large cluster east of the Anacostia and a small cluster in the northernmost part of D.C. that are most suitable.

![Figure 11.2. Suitability Model 2: Increase Bike Commute %. By Author.](image)

**Suitability Model 3: Reduce Fatalities and Serious Injuries**

This suitability model focuses on reducing fatalities and serious injuries with an emphasis on protecting children. It targets census tracts with 1) a high percent of population under 18, 2) high rates of fatal or serious injuries per mile of road, 3) high arterial car area %, and 4) where the relationship between fatal or serious injuries and arterial car area % are significant and positive, as derived from the local bivariate relationship analysis. This suitability model produces
the map in Figure 11.3 below showing “Safety Suitability Score – Fatal or Serious Injuries” on a scale of 0-40. Six tracts have high scores of 28-32 (highlighted), primarily located in Northeast. These top scoring tracts are the best candidates for road space reallocation projects that reallocate arterial car area to other uses in order to reduce fatal and serious injury crashes. The hot spot map identifies a cluster in Northeast that is most suitable which largely overlaps with the highest scoring individual tracts.

Figure 11.3. Suitability Model 3: Reduce Fatal or Serious Injuries. By Author.

Suitability Model 4: Reduce Crashes

This suitability model focuses on reducing all crashes by targeting tracts with 1) high arterial car %, 2) high crashes per mile, 3) high population density, and 4) where crashes per mile and arterial car area % have a significant and positive relationship as derived from the local bivariate relationship analysis. This model produces the map in Figure 11.4 showing “Safety Suitability Score – Crashes” on a scale of 0-40. The top three tracts, scoring 34 and up (selected in blue) are clustered on both sides of North Capitol Street between Massachusetts and Florida.
Avenues. These tracts are the best candidates for reallocating road space away from arterial car area to other uses with the goal of reducing crashes per mile of roadway. The hot spot map identifies a large cluster in the center of the District which is most suitable.

![Safety Suitability Score - Crashes](image1)
![Sidewalk Equity Suitability Score](image2)

**Figure 11.4. Suitability Model 4: Reduce Crashes. By Author.**

**Suitability Model 5: Improve Sidewalk Equity**

This suitability model focuses on improving the equitable distribution of sidewalk area. It targets tracts with 1) high car area, 2) low sidewalk area, 3) high zero vehicle household %, 4) low median household income, and 5) high African American population %. The model produces the map in Figure 11.5 showing “Sidewalk Equity Suitability Score” on a scale of 0-50. The top six tracts, which score 40 to 44 are all east of the Anacostia. Of the top 20 scoring tracts, 17 are east of the Anacostia. These highest scoring tracts are most suitable for reallocating car area to sidewalks to improve the equitable distribution sidewalk area based on race, income, and lack of access to a vehicle. The hot spot map identifies the entirety of the area east of the Anacostia, and some tracts along the west bank of the Anacostia as part of a large cluster.
Suitability Model 5: Sidewalk Equity Suitability

Suitability Model 6: Improve Bike Lane Equity

This suitability model focuses on improving the equitable distribution of bike lane area. It targets tracts with 1) high car area, 2) low bike lane area, 3) high zero vehicle household %, 4) low median household income, and 5) high African American population %. The model produces the map in Figure 11.6 showing “Bike Lane Equity Suitability Score” on a scale of 0-50. The top six tracts which score 41 to 44 are all east of the Anacostia. Of the top 31 tracts scoring, 29 are east of the Anacostia. These high scoring tracts are most suitable for reallocating car area to bike lanes to improve the equitable distribution of this use based on race, income and lack of access to a vehicle. The most suitable sidewalk and bike lane equity tracts are largely overlapping. The hot spot analysis identifies almost an identical cluster as the sidewalk equity model east of, and along the west bank of the Anacostia.
Suitability Model 7: Aggregate Model

The final suitability model overlays the outputs of all the previous models to derive an aggregate suitability score using: 1) drive suitability, 2) bike suitability, 3) fatal or serious injuries suitability, 4) crashes suitability, 5) sidewalk equity suitability, 6) bike lane equity suitability. The model produces the map in Figure 11.7 which shows aggregate suitability scores on a scale of 0-60. The top nine tracts score 44-49 (highlighted in blue). They are scattered across the eastern half of the District. The top scoring tracts are the best candidates for road space reallocation from arterial and car area generally to active uses based on safety, equity, and commute mode share considerations together. The hot spot analysis identifies a large area, primarily east of the Anacostia as a cluster of high aggregate suitability scores.
Discussion of Suitability Models

The suitability models this study creates demonstrate a possible methodology for selecting tracts, or clusters of tracts for targeted road space reallocation projects. Prioritizing area for focus may be a necessary tool, given limited resources or budget constraints for such projects. The suitability models seek to help ensure the best return on investment for tract-level road space reallocation strategies. The criteria, the weights of each criterion, and goals of each model can all be adjusted. The outputs of these models are meant to show examples of how DDOT or other agencies could use data to select tracts or clusters of tracts.

12. Recommendations

Based on the findings of this study, D.C. should use road space reallocation strategies to advance its existing policies for commute mode share, safety, and transportation equity. This project recommends specific outcomes which DDOT should pursue, as well as changes to its planning processes to advance these outcomes.
**Recommended Outcomes**

DDOT should pursue the following outcomes in road space allocation:

- An overall reallocation from auto-oriented uses to active uses to reduce driving commute mode share and promote walking and biking.
- An overall increase in transit priority lanes to enable road space allocation strategies to address transit commute mode share goals.
- A more equitable distribution, based on race, income, and access to vehicles, of sidewalks and bike lane areas to further DDOT’s transportation equity commitment.
- Reallocation of arterial car road space to more local, low speed, and active uses to reduce dangerous traffic conditions and support VisionZero efforts.

**Planning Process Recommendations**

DDOT should amend its planning, oversight, and management processes to advance road space reallocation in support of its existing goals on commute mode share, traffic safety and transportation equity.

- Improve data collection and management to measure road space allocations more accurately and effectively. Data collection should also quantify alternative road space uses beyond the narrow framing in this study, such as for streateries, micro mobility parking, bikeshare stations, parklets etc.
- Develop methodology for measuring non-commute trips and incorporating total trip mode share measurements and goals into planning processes.
• Update “MoveDC” to include measurements of road space allocations and establish road space reallocation goals.

• Update future livability studies in the following ways:
  o More directly seek to advance commute mode share goals through the livability study process and reporting.
  o Incorporate road space reallocation measurements and goals into livability studies.

• DDOT should develop methodologies to prioritize targeted areas for road space reallocation projects to support its existing policies. Suitability models are a potential methodology as demonstrated in this project, however other data and community driven processes should be considered.

Other agencies and entities in D.C. could contribute to road space reallocation strategies, goal setting and planning. For example:

• The District Council’s Committee on Transportation and the Environment, and the Council writ large, should consider using its oversight and budget authority of DDOT to spur more aggressive pursuit of existing policy goals, including by encouraging the use of road space reallocation strategies.

• The Office of Planning should utilize the Comprehensive Plan, small area plans and other planning processes to explore issues around road space allocation.

• Advocacy organizations should consider launching a D.C. road space reallocation campaign to push for more aggressive action to reorient streets from auto-centric uses to more active, healthy, sustainable, and equitable ones.
13. Conclusion

This study is meant to fill data gaps on the understudied topic of road space allocation, as well as provide planners, legislators and advocates additional tools for helping D.C. meet its most important transportation goals. Washington D.C. is failing to meet its established policy goals on commute mode share, traffic safety, and transportation equity. This study finds that reallocating space away from auto-oriented uses could help the District make progress on these goals. The current allocation of road space in D.C. continues to be oriented for the movement and storage of cars, despite the urgent need to favor safer, more sustainable, and equitable uses of that space. Driving commute mode share has fallen, but not fast enough to meet D.C. goal of only 25% commute trips by car by 2032. Despite a goal of eliminating them by 2024, traffic deaths and serious injuries continue to persist. And active use road space (bike lane and sidewalk area) is inequitably distributed by race and income.

Yet, there are opportunities to make progress as the analyses in this study demonstrate. At the census tract level, the allocation of road space for car vs active uses is strongly correlated with the share of commuters who drive. Converting arterial roads to more local and less car-oriented ones, along with other safety measures, provide a pathway to safer streets. And converting travel lanes to sidewalks and bike lanes in lower income and more African American tracts would more equitably distribute those valuable community assets. Finally, by developing suitability models, this study provides data driven examples of how the District could select tracts and clusters of tracts for targeted road space reallocation interventions. To advance these recommended outcomes, the District must incorporate road space allocation measurements and strategies into its planning and goal setting processes.
Future Research

The analysis in this study is based on data that predates the Covid-19 pandemic, and as such, does not factor in changes in conditions that have emerged over the last two years, such as higher work from home rates, lower transit ridership, and temporal shifts in travel behavior. Further research is needed to quantify these and other changes on the conclusions of this study. Additional areas of future research could also include an exploration of alternative uses and models for road space allocation beyond the scope of this study, such as utilizing road space for streateries or other commercial uses, recreational uses, and shared road space uses. Additional research should also explore the impacts of road space reallocation projects over time. Given that D.C. has completed several new bike lanes and road diet projects and may soon be significantly increasing the amount of bus lanes, the road space allocations in the District are a moving target. This presents an opportunity to test the conclusions in this study as road space shifts from one use to another.
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