Streets for People
Better Integrating Smart Mobility and
Context-Sensitive Street Design in
Transportation Planning

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Prepared for StreetsForPeople.io Lab

Executive Summary

This report is prepared for, and grows out of work by, the StreetsForPeople.io (S4P.io) Lab at the University of Virginia (UVA). The Lab conducts research on the ways trends in smart mobility and context-sensitive street design are shaping city streets.

Through its research, the S4P.io Lab developed an initial conceptual framework for analyzing the ways these trends were shaping, and being shaped by, transportation planning and street management policies and practices. This report builds on that conceptual framework and serves as an initial attempt to create an analytical tool to apply the updated conceptual framework to cities in the US.

The updated conceptual framework posits that Streets for People, versus streets that prioritize cars, can better integrate smart mobility and context-sensitive street design by promoting and balancing three functions of streets: Democratic Streets, Streets for Flows, and Streets for Living.

The report then proposes an Audit Tool that can be used to analyze the extent to which transportation planning and street management regimes in a city are successfully promoting and balancing each of those constructs. The Audit Tool applies a mixed methods approach to analyzing the policies and practices in a given city. The Tool proposed in this report is intended to be an initial attempt at crafting a resource the S4P.io Lab can use in its future research efforts.

Finally, the report applies the Audit Tool to a specific city: Charlottesville, VA. The report contains findings produced via interviews, reviews of government documents, and quantitative analyses of data from a variety of sources.

The Audit produced several findings. First, Charlottesville is falling short in promoting Democratic Streets where all residents' constitutional rights are protected and where a diversity of community needs can be heard and met by local government authorities. Second, while commuting times are relatively low in Charlottesville, residents do not have authentic mobility choices, meaning Charlottesville is not achieving this report's standard of Streets for Flows. Third, Charlottesville streets are relatively safe for all users, though opportunities to promote greater street appropriation for uses other than car travel are currently being missed.

The report provides three recommendations for how to address these gaps or shortcomings. First, it encourages Charlottesville's Bike & Pedestrian Coordinator and Advisory Committee to initiate a Dignity Infused Community Engagement (DICE) program. Second, it recommends that the City create a website that clearly communicates to residents existing opportunities for street appropriation. Third, it highlights the need for improved digital public asset mapping, both to better deliver existing services and to prepare for potential future smart mobility-enabled services.

My hope is that this report is a useful contribution to the rapidly changing transportation planning industry. I am deeply grateful to Dr. Andrew Mondschein, Christopher Neale, the S4P.io Lab team, and all who participated in the production of this report.

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I. Introduction

"Roads aren't just for vehicles - they are for people."
- Pete Buttigieg, US Secretary of Transportation[1]

The prior quote by the current US Secretary of Transportation is at the same time unremarkable and potentially pivotal to the future of transportation planning in the US. Car-centric road design has characterized US transportation planning for most of the 20th and 21st centuries. The Secretary's quote challenges one to consider what it would mean if roads were also designed and managed for people.

The StreetsForPeople.io (S4P.io) Lab at the University of Virginia has been working to consider what such a future might look like since 2018. In particular, the Lab has sought to consider a future of streets for people by analyzing the interactions between two trends in transportation planning and policy: smart mobility and context-sensitive street design.[2] Smart mobility involves "using modes of transportation alongside or even instead of owning a gas-powered vehicle."[3] Context-sensitive street design is defined as "standards and development practices that are flexible and sensitive to community values," including the balancing of economic, social, and environmental objectives.[4]

Smart mobility has emerged as a topic in transportation planning due to the development of digital and physical technologies that have (or stand to) reshape how people move about urban spaces. Ride-sharing applications, like Uber and Lyft, have made it easier for many individuals without access to a car to move about an urban space. Additionally, digitally-enabled bike- and scooter-sharing applications have allowed micromobility options to proliferate in cities across the US.[5] Third, connected, automated vehicles (CAVs), or driverless cars, loom large in the collective imagination as a potentially transformative urban technology.[6]

At the same time, context-sensitive street design has emerged out of changing residential patterns stemming from the back-to-the-city movement. Population growth in the 1990s and 2000s in urban centers, primarily fueled by the return of White residents, has coincided with residents with political influence reinterpreting the purpose of streets and public rights of way.[7] In particular, tactical urbanism has emerged as both an ideal and a practice for appropriating urban spaces to achieve community-directed aims, whether that be through the introduction of a bike lane, a pocket park, or a public art project.[8]

The S4P.io Lab's review of the theory and practice surrounding these trends highlights the role underlying political, economic, and social conditions play in shaping how these technological and social innovations are applied in cities.

This project, then, has three objectives:
1. Extend the S4P.io conceptual framework to account for underlying conditions in cities;
2. Develop an Audit Tool for analyzing underlying conditions across US cities; and
3. Apply the Audit Tool to a city and develop recommendations for how the city may be able to better promote Streets for People

PART 1.
S4P.io Conceptual Framework & Audit Tool

II. Background and Conceptual Framework

Original Conceptual Framework

The S4P.io Lab's initial research into the question of how smart mobility and context-sensitive street design are converging on city streets resulted in several findings that formed the basis for our initial conceptual framework.

First, the introduction of new technological or social innovations in city streets is not a new phenomenon, and conflicts between uses underscore the notion of streets as contested public spaces. The notion of streets as contested public spaces is best articulated by Peter Norton in his book *Fighting Traffic: The Dawn of the Motor Age in the American City.*[9]

In the book, Norton outlines the diverse interests vying for control and space on streets during the early 20th century. Until the 1920s, streets were treated as a public good to be used for public uses – pedestrians, police departments, city officials, business leaders, automobile owners, and street railways all shared the public right of way, despite at times having conflicting interests. Over time, private automobile drivers became increasingly dangerous to other street users, spurring efforts to regulate cars. In response, private automobile interests took systematic steps to "redefine the street" as a consumer commodity that should be governed not by policy makers, but by the free market.[10] Even further, these same interests began popularizing the term 'jaywalking' for someone who does not look both ways before stepping into a street as early as 1924 to blame pedestrians, not drivers, for fatal crashes.[11] These interventions resulted in the fending off of regulations and set the stage for a century of transportation planning and street management that prioritized cars over other modes of mobility

or street use. In the current moment, various interests are vying for use of public spaces. While it is not clear what outcomes may emerge for city streets and residents, Norton's analysis suggests that such outcomes will emerge not out of some form of technological determinism, but rather out of a political process.

Second, our analysis shed light on the disconnect between mobility technologies deployed in streets and community needs. Traffic engineers and transportation planners often consider the impacts of mobility technologies at a system-wide scale, seeing opportunities for balancing traffic loads across streets.[12] These perspectives, however, miss crucial place- and community-based impacts of new mobility technologies.[13] Such was the case in Los Angeles, California and Leonia, New Jersey, when the Waze navigation application began rerouting commuters away from congested highways and through residential neighborhoods.[14] Our expectation is that new mobility technologies, especially connected, automated vehicles, will further exacerbate this phenomenon, with no obvious technical solution having emerged.

Third, while context-sensitive street design interventions can result in improvements to the quality of life for residents, these benefits often do not redound to marginalized communities. For example, Charles Brown of Rutgers University highlights the social, rather than physical, barriers to biking and walking cited by the Black and Latino residents of several cities. While fear of a traffic collision ranked as the largest obstacle to biking and walking, fear of robbery or assault ranked second; fear of being profiled by police was also a notable consideration for these potential cyclists and pedestrians.[15] Traditionally, these facets of public safety do not fall under the jurisdiction of a transportation

or public works agency. Yet, the research indicates that these factors are a real consideration that inform how racial and ethnic minorities in cities opt to use their streets.

Similarly, during the COVID-19 pandemic, many cities initiated open or slow street initiatives to allow additional space for residents to socially distance while moving about a neighborhood.[16] However, as practitioner Destiny Thomas details, these accommodations were primarily delivered without a true public engagement process, and with benefits primarily accruing to wealthier, White residents of cities. Additionally, she argues that open or slow streets can leave communities of color, who are over-policed, exceedingly vulnerable to the threat of state violence.[17]

In summary, our analyses pointed to three findings. First, the converging of smart mobility and context-sensitive street design on city streets is reminiscent of the introduction of another technological innovation, the private automobile, into streets in the 1920s. There are clear lessons to be drawn from that moment in history. Second, smart mobility technologies are not always designed or implemented in cities in ways that are sensitive to place- or community-based considerations. Third, many historically marginalized groups are left out when it comes to context-sensitive street design interventions. With these findings in mind, this report seeks to extend the S4P.io conceptual framework to account for the underlying political, economic, and social considerations that contribute to the outcomes we see in our initial findings.

Figure 1. Original S4P.io Conceptual Framework

Extensions to the Conceptual Framework

Democratic Streets
Given the early history of contemporary American streets outlined above and the outsized influence the automobile industry had in the future of transportation planning and street management, it is essential that any conceptual framework that seeks to understand how interests are balanced in streets begin with a conception of the democratic practice of governing and managing streets.

This report draws on the ideas of political theorist Danielle Allen to produce a conception of Democratic Streets. In her book chapter titled 'A New Theory of Justice: Difference without Domination,' Allen critiques John Rawls' renowned 'difference principle' and develops an updated theory of justice for diverse democracies.[18] Her theory of justice seeks to incorporate two types of liberty: negative liberties and positive liberties. Negative liberties include those liberties that guarantee people freedom from interference from private or state actors. Positive liberties

are those that guarantee people freedom to participate in governing.

Allen argues that Rawls prioritizes negative liberties over positive liberties in his theory of justice, and does so for two reasons: 1) because government overreach can obviously be dangerous; and 2) because, in a relatively homogenous society, who should be allowed to participate in government is largely agreed upon. In a diverse society where values and interests across groups may be contested, though, a prioritization of negative liberties over positive liberties can create the conditions whereby certain groups are excluded from the governing process. The undermining of positive liberties for specific groups can then result in forms of political domination that reinforce existing social and economic inequalities. In her final analysis, Allen claims that, when faced with social or economic inequalities, policymakers should prioritize positive liberties and intervene to ensure groups whose negative liberties are consistently threatened have sufficient opportunities to participate in policy making.

Applying this political framework to the governing and managing of streets, one can define Democratic Streets as streets where:
- Residents' constitutional rights are protected, including protection from state violence or harassment; and
- Residents have a robust say in transportation planning and street management

In the absence of either type of liberty, streets cannot be fully democratic and will inevitably result in forms of domination or the ignoring of a subset of community interests. Even further, as new technological or social innovations in mobility and street management emerge, inequities in political power could result in the inequitable distribution of benefits from these innovations. In fact, this is the precise pattern that we observe in our original findings.

Streets for People are, at their foundation, Democratic Streets. It is through these positive and negative liberties that interests are surfaced, considered, prioritized, and ultimately met. Therefore, an analysis of the underlying political conditions in cities and their impacts on smart mobility and context-sensitive street design interventions should evaluate the extent to which the two criteria of Democratic Streets are met. Proposed measures for such an analysis are included below.

Streets for Flows
In addition to considerations focused on the governing of streets, it is crucial to consider the practical uses of streets. One set of uses are captured in the concept of Streets for Flows.

Streets have always been built to allow for people and goods to flow from place to place. This notion is not necessarily contested, and therefore Streets for People are streets where residents can move efficiently to complete economic and social activities. Streets that produce extremely long travel times, in particular to work, will undermine productivity and quality of life for residents.

At the same time, in order to move from place to place in most localities in the US requires access to a private automobile.[19] Public transit options are quite limited in most American cities and, in general, patterns of development and street design make biking and walking difficult in many places.[20]

Interestingly, many smart mobility applications, including micromobility and ride-sharing applications, seek to make mobility easier for those who cannot afford or otherwise do not have access to a private automobile. Yet, as the "Equity and Smart Mobility" report by the Center for Neighborhood Technology highlights, many of these new technologies are not accessible to communities of color, especially those with fewer means. These same communities are the ones most in need of alternatives to private automobiles for mobility.[21]

Streets for Flows, then, are streets where:
- Residents can move efficiently to complete economic and social activities; and
- Residents have authentic choices for how to move about

Efficient movement on streets and authentic mobility choices are dependent on various forms of physical, economic, and digital infrastructure. An analysis of the underlying economic and social conditions in a city, then, should seek to understand the scale, quality, and distribution of such infrastructure. Again, proposed measures for evaluating mobility options, outcomes, and underlying conditions are proposed below.

Streets for Living
The final facet of Streets for People in this framework attempts to capture the extent to which individuals are able to appropriate streets for uses other than Flows. Underlying conditions that support or undermine these uses are considered under the construct of Streets for Living.

To start, it is worth considering whether residents of a city can feel safe appropriating streets. In general, streets have become increasingly unsafe places for drivers and non-drivers in recent years. In the case of private automobiles, traffic fatalities were their lowest in 2019 since 2014.[22] However, that story changed in 2020 in the midst of the COVID-19 pandemic, when traffic fatalities increased by 8% over the prior year to an annual total of 42,060 deaths despite a reduction in overall vehicle miles traveled. Though counterintuitive at first glance, analysts point to riskier driving behavior on emptier streets as a contributing factor to these pandemic year increases.[23]

Streets are also increasingly unsafe for pedestrians and cyclists. In 2019, pedestrian deaths were up 46% compared with 2010 (for a total of 6,301 deaths), and analyses found a major spike in pedestrian deaths during the first part of 2020.[24] Cyclist deaths have seen a similar trend, with fatality rates having increased by 36% in 2019 since a low point in 2010.[25] Increases in pedestrian and cyclist fatalities are a more persistent trend than driver or passenger deaths. Yet, collectively these figures make clear that driving, walking, or biking in American streets is a dangerous activity. As a result of this real danger, citizens across the country have called for cities to prioritize public safety by initiating Vision Zero programs that aim to eliminate severe or fatal crashes on streets through changes to policy and physical street infrastructure.[26] A consideration of safety is important to achieving Streets for Living because a residents' sense of safety may impact if and how they might seek to appropriate streets for novel uses.

Second, the origins and forms of street appropriation seen in city streets today are worth reviewing. In response to local governments' inability to sufficiently plan and manage streets for local communities, a collection of initiatives that fall broadly

under the categories of Do-it-Yourself (DIY) or tactical urbanism have emerged in recent decades. These initiatives, initially undertaken by activists inspired by critical spatial philosophers Henri Lefebvre and David Harvey, emerged in opposition to formal, neoliberal planning methods. The initiatives involved resident-led, guerilla-like interventions to transform urban spaces to meet community needs, filling the void left by formal planning methods for the built environment.[27] These interventions often involved the use of light-weight and inexpensive materials, so as to be flexible and responsive to individual needs.[28]

While such methods were cultivated as an alternative to traditional planning, the movement has evolved to incorporate interventions that involve collaboration between individuals, community groups, nonprofit groups, and governmental stakeholders. Formal programs, such as San Francisco's Parklet Program, the Quick Build program in Miami-Dade County,

Figure 2. Images of projects from the San Francisco Parklet Program (top left), Miami-Dade Quick Build Program (top right), and Open Streets Projects (bottom).

and Open Streets projects in various cities across North America are examples of such interventions.[29] During the COVID-19 pandemic, there was a significant proliferation of street appropriation to allow for social distancing and outdoor restaurant seating.[30] These developments suggest that many cities are capable of facilitating street appropriation to respond to diverse, context-specific community needs.

Therefore, Streets for Living are streets where:
- Residents can move without fear of injury or death; and
- Residents can appropriate them in ways that allow for the thriving of their communities

For an analysis of Streets for People, it is crucial to understand the safety of a city's streets and the quality of existing programs for allowing residents to appropriate streets for non-mobility uses. Once more, proposed measures for evaluating Streets for Living are included below.

Proposed S4P.io Conceptual Framework

Put together, these contributions generate an updated S4P.io conceptual framework (*Figure 3*) that can be used to analyze underlying political, economic, and social conditions that impact if and how smart mobility and context-sensitive street design interventions might be integrated in transportation planning and street management policies and practices.
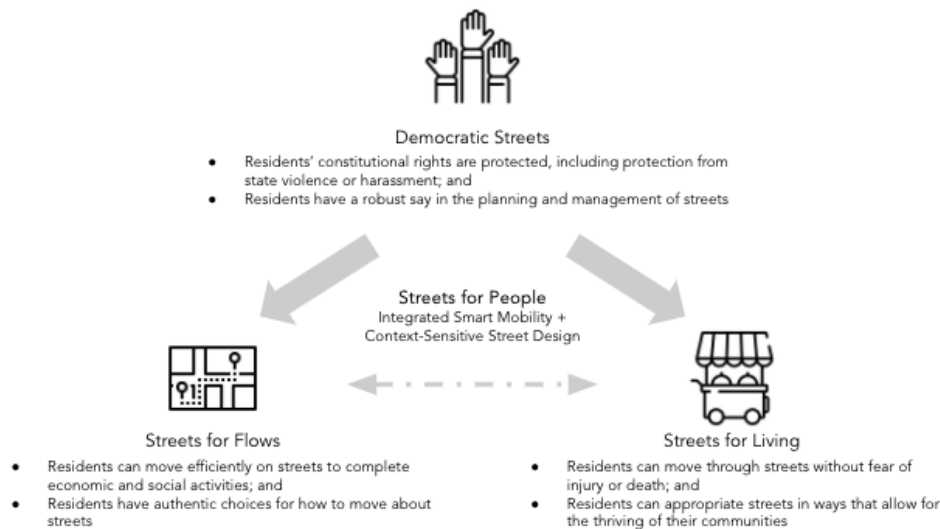
To create Streets for People, the values that produce Democratic Streets must be promoted and nurtured. Again, these democratic processes serve as a mechanism for balancing diverse community interests in streets. Such community interests may relate to Flows,

or efficient and authentic mobility choices, or Living, that is, safe opportunities for street appropriation for uses beyond mobility.

At times, these interests might conflict with each other. Additionally, new technological and social innovations have already entered (and will continue to enter) city streets, potentially reshaping mobility patterns and interests. Yet, the vision of streets produced by the values laid out in the updated S4P.io conceptual framework allow for diverse interests to be adequately considered, equitably balanced, and then served. In short, Streets for People are streets that incorporate new technologies in transportation planning and street management in ways that promote equity, flexibility, and responsiveness to diverse community needs.

Democratic Streets
- Residents' constitutional rights are protected, including protection from state violence or harassment; and
- Residents have a robust say in the planning and management of streets

Streets for People
Integrated Smart Mobility +
Context-Sensitive Street Design

Streets for Flows
- Residents can move efficiently on streets to complete economic and social activities; and
- Residents have authentic choices for how to move about streets

Streets for Living
- Residents can move through streets without fear of injury or death; and
- Residents can appropriate streets in ways that allow for the thriving of their communities

Icons by Freepik and itim2101

Figure 3. Updated S4P.io Conceptual Framework

III. S4P.io Audit Tool

The S4P.io Audit Tool is meant to serve as an analytical tool for the S4P.io Lab. In the past, the Lab has developed case studies of localities across the US and globe for the purpose of better understanding how these localities have attempted to integrate context-sensitive street design and smart mobility into their transportation planning and street management efforts. These case studies were completed primarily by reviewing transportation planning documents and interviewing planners and nonprofit actors.

This Audit attempts to build on that prior work and introduce a mixed methods approach to better understand the underlying conditions in a locality as they relate to transportation planning and street management.

The measures selected draw on existing research examining street use and management patterns. The Tool draws on local data, interviews, and government documents to analyze the extent to which localities are able to promote and balance Democratic Streets, Streets for Flows, and Streets for Living. A locality's relative strength or shortcomings in any of these areas may shed light on points of intervention for promoting Streets for People.

A full list and description of the measures, along with their sources, are included in Appendix A.

Democratic Streets Measures

Police-Pedestrian Interaction Data
Traffic Stop Data
Transportation Planning Ecosystem

Streets for Flows Measures

% of Workers with 60 Minutes or Longer Commute Time
% of Population in Households without a Vehicle
Transportation Mode to Work
% of Population with a Smartphone
% of Population Unbanked
# of Car + Docked Bike Share Locations
# of Dockless Micromobility Programs
Transit Routes Available, High Frequency Routes Available, + % of
  Residents Living Near High Frequency Routes
Transit Stop Quality
Quantity + Quality of Bicycle and Pedestrian Infrastructure
Average Temperatures by Month

Streets for Living Measures

Traffic Fatalities (Drivers, Pedestrians, & Cyclists)
Outdoor Air Quality
Programs for Street Appropriation
Resident Respect + Happiness

PART 2.
S4P.io Audit of Charlottesville, VA

IV. S4P.io Audit of Charlottesville, VA

The second part of this report applies the updated S4P.io conceptual framework and Audit measures to a specific city: Charlottesville, VA. Charlottesville was chosen for this report for two reasons: 1) it is the site of our degree program; and 2) the S4P.io Lab has not completed any detailed analyses of the city. As mentioned previously, the Audit exercise aims to analyze the underlying political, economic, and social conditions that inform transportation planning and street managment practices in a city. These analyses will generate recommendations for how Charlottesvillians - both government actors and private residents - can better promote Streets for People in the city.

A summary of the Audit findings and recommendations are included in the main sections of the report. A full list of the measures and findings can be found in Appendix B.

Methods
For the current Audit, I secured quantitative data from a variety of primary and secondary sources. I also interviewed four stakeholders involved in transportation planning in Charlottesville to gain context about the current planning regime in the city. Additionally, I attended a public meeting of the Bicycle and Pedestrian Advisory Committee in Charlottesville and an Active Mobility Summit organized by the Piedmont Environmental Council, a nonprofit involved in bicycle and pedestrian advocacy in the region. Fourth, part of the analysis draws on past focus groups conducted as part of an earlier study ('Transit Equity in Charlottesville') to which I contributed as a research associate. Last, I reviewed historic and current government policy documents related to transportation planning in the city. All of these resources were used either to produce specific measures or otherwise provide context to the Audit's findings.

Interviewees

Amanda Poncy
Charlottesville Bike & Pedestrian Coordinator

Brennen Duncan
Charlottesville City Traffic Engineer

Jamelle Bouie
Charlottesville Parking Advisory Panel Member

Peter Krebs
Charlottesville Bike & Pedestrian Advisory Committe Member + Community Organizer, Piedmont Enviornmental Council

Meetings Attended

CHARLOTTESVILLE / ALBEMARLE
Active Mobility Summit
02.26.21

BPAC at work in our community

Site Context

Charlottesville was founded in 1762 and is home to the University of Virginia, which was founded in 1814. Much of its early development took place nearby to the University's Academical Village or in the industrial Belmont-Carlton neighborhood. Today, Charlottesville is an independent city that spans 10.3 square miles and is home to 49,181 residents. It is also part of the larger Metropolitan Statistical Area that includes surrounding Albemarle County and other nearby counties.[31]

Before delving into the takeaways from the Audit, it is worth considering some brief historical context as it relates to transportation planning and street management in Charlottesville. There are two primary moments to highlight.

First, between 1957-1977, several steps were taken that shaped the modern development of Charlottesville. In 1957, Harland Bartholomew & Associates (HBA) presented a policy document to Charlottesville's City Council that recommended prioritizing single family housing and slum clearance in the city.[32] The City Council went on to model its zoning and development plans around HBA's recommendations. Three years later, an illegitimate referendum calling for the razing of Vinegar Hill, a bustling Black neighborhood in the city, was passed. In 1964, the buildings and historic street network were destroyed and many residents were moved to public housing at Westhaven.[33] Finally, in 1976, the Downtown Pedestrian Mall was opened, eliminating vehicle access to East Main Street.[34]

Collectively, these series of actions resulted in a few outcomes. First, the focus on single-family housing resulted in less dense development, in particular in segregated wealthier, White

neighborhoods in the city. Second, the razing of Vinegar Hill destroyed much of the historic street fabric in the city and replaced it largely with surface parking lots. Third, the building of the Pedestrian Mall, though seemingly a useful pedestrian intervention, had the effect of creating a walking and commercial destination to which residents would have to drive. Today, residents and business owners are protective of parking Downtown because they believe they would not have access to the Mall without it.

Figure 4. Images of Vinegar Hill prior to its razing[36] (left) and the Downtown Pedestrian Mall[37] (right).

The second major moment in terms of historical context were the events surrounding the Unite the Right rally in 2017. Right-wing protestors looking to protect the Confederate monuments in Charlottesville gathered together in different sites across the city over two days. On Saturday, August 12th, protesters and counter protesters were gathered at 4th Street on the Pedestrian Mall when a right-wing protester intentionally accelerated his car into a crowd of people, killing Heather Heyer. City police were widely cited for ineffective crowd and street management during the incident.[35] The violence of those days and the specific actions of the motorist loom large in the minds of Charlottesvillians, especially in the context of transportation planning and pedestrian safety.

Summary of Findings

Democratic Streets

When applying the Audit measures related to Democratic Streets to Charlottesville, a few important findings emerge.

First, as it relates to whether residents' constitutional rights are protected, there is clear evidence of the over-policing of Black residents moving about in public rights of way in Charlottesville. Data collected and analyzed by the UVA Equity Center point to clear cases of disproportionate targeting of Black residents through the City's stop and frisk program. The analysis found that Black residents were stopped more than twice as often as White residents despite making up a fifth of Charlottesville's population. Additionally, stop rates were 19 times higher in historically Black neighborhoods compared with nearby historically White, segregated neighborhoods, such as Fry's Spring and North Downtown.[38] Such disproportionate targeting might engender

distrust of police in these communities and would clearly impact Black residents' comfort levels moving about in and appropriating streets.

Second, as it relates to robust engagement in transportation planning and street management, research conducted to produce the Transportation Planning Ecosystem point to challenges integrating the various facets of transportation planning into a coherent, inclusive transportation management regime in Charlottesville. To start, the Parking Advisory Panel, a volunteer-based resident-led commission, reports to the City's Economic Development department, meaning that it often prioritizes commercial and business interests interested in expanding parking options and does not consider the impacts of such efforts on the broader transportation system.

Figure 5. Graphics highlighting over-policing of Black residents and neighborhoods in Charlottesville.
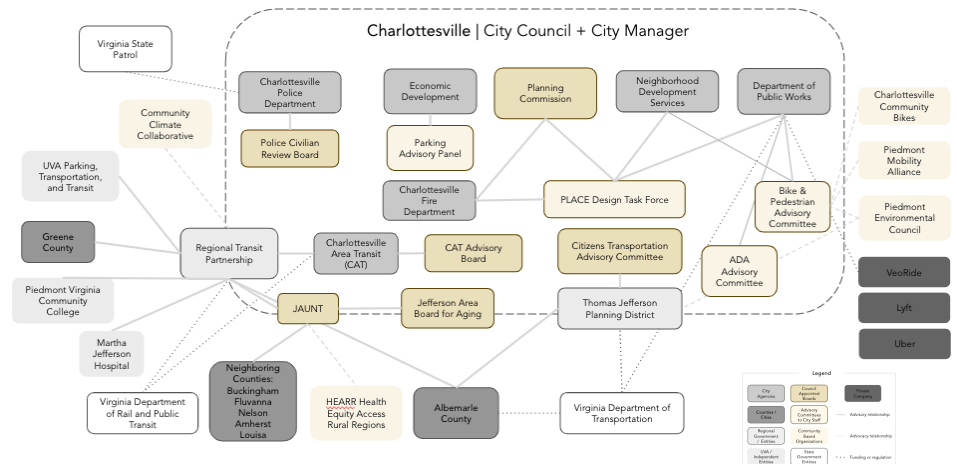

Figure 6. Transportation Planning Ecosystem for Charlottesville

Additionally, the Bike and Pedestrian Advisory Committee (BPAC), another volunteer-based resident-led commission, had made efforts in the past to create diversity and outreach initiatives that secure greater engagement from neighborhoods of color in the city. However, those efforts fell through and have not been re-initiated since the start of the COVID-19 pandemic. Relatedly, there does not appear to be any communication between BPAC and the City's council-appointed Police Civilian Review Board, which is tasked with oversight of police behavior in the city, despite the aforementioned evidence of over-policing of pedestrians on the city streets.

Charlottesville seems to be falling short in many regards as it relates to promoting Democratic Streets. In light of these facts, government actors and private residents ought to consider social innovations that promote greater engagement and a more integrated view of transportation planning in Charlottesville.

Streets for Flows

When considering the measures affecting the flow of people on streets, first it is important to acknowledge that rarely do residents of Charlottesville face commuting times over one hour. In the cases where individuals do face longer commutes, it appears it is primarily higher-income households who may be trading off longer commutes for other benefits.[39] It does not seem that Charlottesville has significant issues moving people to and from work efficiently.

However, when it comes to whether residents have authentic choices for moving about the city, Charlottesville falls short. In terms of outcomes, an overwhelming number of residents rely on cars to get to work, regardless of income level. At the same time, few residents bike to work.[40]

Charlottesville suffers from inadequate physical and digital infrastructure to allow residents to have authentic mobility choices in the city. Details around specific forms of physical and digital infrastructure are included below:
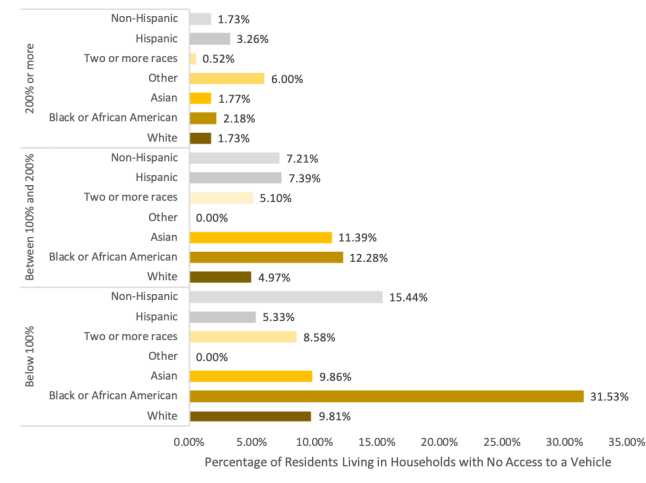

Figure 7. Percentage of residents in the Charlottesville region living in households with access to no vehicles, by race/ethnicity and income as a percentage of the poverty line (2019 5-year ACS, PUMS data).

- According to American Community Survey data, Black or African American residents in the broader Charlottesville region are least likely to live in a household with access to a vehicle. Rates are especially high for those living below the poverty line, with approximately 31% of Black or African American residents lacking access to a vehicle at home.[41]

- According to AllTransit, there is only one high frequency route that operates during the busiest commuting hours. About 1 in 4 Charlottesvillians live within a half mile of this route.[42] Additionally, given reduced schedules due to the COVID-19 pandemic, it is not clear that the high-frequency routes noted in this measure have continued. Furthermore, a prior study highlights that some transit users feel unsafe using transit due to the lack of lighting near stops and physically isolated stops.[43]
- There are no docked bike share options and one dockless bike and scooter share provider in the city.[44] Furthermore, the City has experienced struggles with dockless vehicles obstructing sidewalks or being left in unsafe places. The City has made attempts to create dedicated spaces for dockless vehicle drop-off through signage. However, there are no data suggesting that the intervention has been effective.

- In terms of digital infrastructure, American Community Survey data show that while smartphone adoption, a requirement for using many micromobility applications, is relatively high in the Charlottesville region, rates are lowest for Black or African American residents at all income levels.[45]
- In terms of bicycle infrastructure, the City's Streets that Work report showed that Charlottesville had 40.5 existing miles of bicycle infrastructure in 2016, with an additional 64.5 miles recommended.[46] Based on data from Charlottesville's Open Data platform it appears that only an additional 2.3 miles of bike lanes have been added since that report, though the data quality made it difficult to discern the location and type of bike infrastructure recently installed.[47]

In the absence of adequate physical and digital infrastructure, Charlottesville will continue to fall short in providing all its residents authentic mobility choices in the city. While commuters may benefit from the dedicated car infrastructure for commuting, such prioritization locks Charlottesville into specific transportation planning and development patterns. Such patterns may undermine other objectives in the city.

Should the City be interested in promoting a comprehensive vision of Streets for Flows, it ought to consider a more comprehensive evaluation of needed infrastructure and detailed plans for building such infrastructure, even if it comes at the expense of car infrastructure in the city.
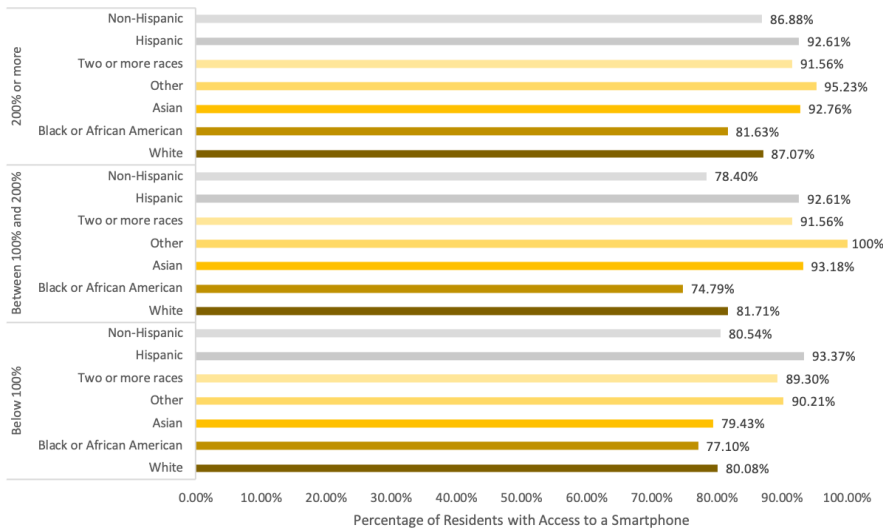

Figure 8. Percentage of residents in the Charlottesville region with access to a smartphone device, across race/ethnicity and income as a percentage of the poverty line (2019 5-year ACS, PUMS data).

Streets for Living

As it relates to measures that afford opportunities to safely and comfortably appropriate streets for diverse community uses, Charlottesville has a mix of positive and negative features. First, generally speaking, the City of Charlottesville has relatively low levels of traffic related deaths. Unfortunately, two deaths are especially relevant for this report. First, as mentioned previously, one individual was killed by a driver during the Unite the Right Rally in Charlottesville in 2017. Heather Heyer was protesting against the right-wing protesters occupying various parts of the city, including the Downtown Pedestrian Mall. Much of the Mall is blocked off from vehicle traffic, but there are two cut-through streets, one of which was the site of the killing.[48] This event, and the failure of police to protect protesters in what is a pedestrian-centric area of the city, is relevant to broader efforts to appropriate streets for activities other than vehicular traffic.

The second incident was the recent killing of a cyclist in Albemarle County on a street just outside the Charlottesville city limits.[49] The incident is still under investigation, but it is sad to see such an event in the midst of drafting a report related to this topic.

Separately, the City of Charlottesville has several programs that provide residents with the opportunity to appropriate streets and other transportation infrastructure for non-mobility or mobility-adjacent activities. Such programs include the Safe Routes to School program, Bike Month, the Bike Rack Giveaway Program, the City as a Canvas Art Bus program, and farmers markets hosted in City-owned spaces some weekends. Despite the various programs, informational resources about the program

are distributed in dispersed pages of the City's website or not included at all. One potential reason for this issue may be that the programs are operated by various agencies in the City (i.e., Economic Development, Public Works, Charlottesville Area Transit).

Figure 9. Graphics related to street and transportation infrastructure appropriation programs, including Bike Month (top), Safe Routes to School (left), and Art Bus with CAT (right).

Finally, it is worth noting that, though only a single study, recent research suggests low-income transit users do not feel much respect or joy when moving about the city or using transit services in Charlottesville. They point to inefficient routes and inadequate transit stop infrastructure as major features that make them feel disrespected. At the same time, they recognized that wealthier, often White residents of the city do not face these similar transportation challenges, as they typically drive in single-occupancy vehicles and find ample parking wherever they drive.[50]

In order to enhance Streets for Living, government actors and residents ought to consider how to ensure residents are aware of, and have the opportunity to take advantage of, programs to appropriate streets in ways that will make them feel more respected by the City and happier when spending time on city streets.

V. S4P.io Audit Recommendations

Based on the findings from the S4P.io Audit, this report provides three recommendations.

Recommendation 1: Initiate Dignity Infused Community Engagement (DICE) Programs

The Audit findings, particularly within the Democratic Streets measures, point to a few potential areas for improvement within Charlottesville's broader transportation planning ecosystem.

- First, the Pedestrian-Police Interaction Data measure highlighted the persistence of over-policing of communities of color in Charlottesville.
- Second, the Parking Advisory Panel, which historically has represented Downtown business interests to the City's Economic Development agency, has been an effective advocate for its agenda, but does not often consider its recommendations in coordination with broader city transportation needs.
- The Bike and Pedestrian Coordinator and Advisory Committee expressed interest in bolstering outreach and diversity to better shape their agenda and push that agenda forward.

Based on the S4P.io Lab's research, these challenges are not unique to Charlottesville. Additionally, given Danielle Allen's framework summarized above, these shortcomings point to the need for interventions to bolster the positive liberties of those seemingly excluded from the street management and transportation planning process.

A model for this work in the transportation planning and street management sector is the Los Angeles Department of Transportation's Dignity Infused Community Engagement (DICE) program. The program grew out of LA's Vision Zero program, a program tasked with eliminating traffic-related deaths in the city.

The DICE program defines itself as:

> "A planning process that intentionally and holistically incorporates the viewpoints, lived experiences, and perspectives of those most impacted by a planning project. It seeks to restore and atone for historic, systemic and institutional injustices."

The work of DICE includes a number of innovative activities, including the formation of Street Teams in specific neighborhoods, the completion of Social Climate Analyses, and the inclusion of the arts as a primary engagement tool. The approach also calls for collaboration between community-based organizations and institutions of higher education.[51]
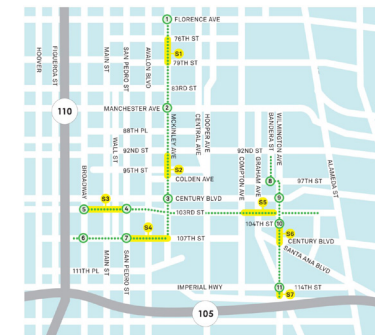

Figure 10. Images from LADOT's Dignity Infused Community Engagement program, including an Eloteros for Streets event (left) and a Planning for Stress Free Connections diagram (right).

The LADOT has mobilized financial and technical resources into DICE programming in select neighborhoods in the city, resulting in innovative engagement methods and projects that are responsive to community needs. Projects organized by the DICE programming can be found at LADOT's dedicated Livable Streets website.[52]

Given Charlottesville's racialized urban planning history, the Bike and Pedestrian Committee should collaborate with grassroots community-based organizations to initiate a DICE program. This program should also engage an institution of higher education to conduct research and evaluation in coordination with the program. One opportunity for a partnership might be with the UVA Equity Center, an entity whose goal is to promote respectful, community-driven research focused on the redress of inequities in the Charlottesville region.[53]

A DICE program in the Charlottesville region could serve as a basis for better understanding existing transportation and street appropriation challenges in the city. Even more, it can bolster political capacity to ensure that City mobility and street appropriation services are more flexible and responsive to diverse community needs.

Recommendation 2: Create a Website Showcasing Charlottesville's Existing Street Appropriation Programs

The second recommendation generated from the Audit findings is a call to create a website showcasing Charlottesville's existing street appropriation programs. As noted earlier, Charlottesville has several street appropriation programs, ranging from bicycle rack giveaways to traffic calming programs. However, information about these programs is distributed across various web pages. Furthermore, in many cases, these programs do not have easy or clear guidance for how to apply for them or take part in their activities.

In the S4P.io Lab's research, we have found several localities that have designed dedicated websites for their street appropriation programs. These websites have a coherent graphic language, a comprehensive account of available programming, and clear directions for how to participate. A few examples include LADOT's Livable Streets website and the San Francisco Public Works Department's Groundplay website.[54] The purpose of these websites is not simply to give residents access to existing programs. Rather, they create a vision of streets and a shared identity around opportunities for street appropriation that meet a diversity of community needs.
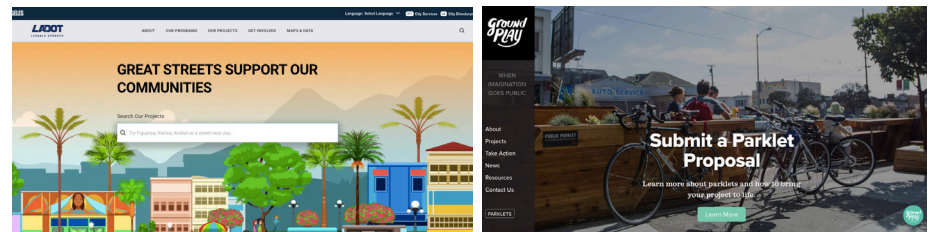

Figure 11. Images from LADOT's Livable Streets website (left; https://ladotlivablestreets.org/) and San Francisco Public Works Department's Groundplay website (right; https://groundplaysf.org/).

In Charlottesville, recent activities shed light on what such a website might look like. First, the Safe Routes to School program recently released a number of graphics that are clear, visually appealing, and tie together a program that serves various parts of the Charlottesville community.[55] Second, for the City's current comprehensive planning process, a website called 'Cville Plans Together' has been used to share information and coordinate engagement activities.[56] These examples may serve as inspiration for efforts to create a shared identity around street appropriation programming.

While the fact that Charlottesville does not have an explicit transportation planning agency might make the creation and management of a website somewhat difficult in the local context, it could also serve as an opportunity for the City to gain alignment on its vision for transportation and street appropriation, as well as identify precise steps it can take with the community to achieve that vision. Additionally, a benefit of a coherent graphic language is that it can be extended out from a digital platform and into the actual built environment for use on signage or public art. The comprehensive planning process mentioned previously, which includes discussions about transportation planning objectives and policies, could serve as a catalyst for moving this recommendation forward.

Figure 12. Graphics from Charlottesville's Safe Routes to School program (top) and the landing page for the Cville Plans Together website (bottom).

Recommendation 3: Consider Opportunities to Bolster and Integrate Digital Public Asset Mapping

The final recommendation coming from the Charlottesville S4P.io Audit calls for bolstering and integrating digital public asset maps.

In completing the Audit, a few themes emerged. First, physical infrastructure for mobility options besides private vehicles is limited. This lack of infrastructure not only limits mobility options, but also is seen as a sign of disrespect by some residents. Second, comprehensive details about the scale and quality of City-owned public infrastructure is difficult to come by. The City's Open Data portal has a good deal of information, but accessing and parsing these data requires a high degree of technical expertise. Also, while some data are maintained regularly, other measures are often taken at the time of report writing or master planning. Third, the City has faced challenges in managing the dockless scooter and bike system, specifically as it relates to scooters and bikes blocking sidewalks or being left in dangerous places for pedestrians, cyclists, or drivers.

In our research, we have come across several entities that are attempting to create what are called 'digital twins' of public assets and private assets being used in public spaces. Digital twins are digital replicas of the physical world, and these initiatives attempt to maintain a real-time record of public assets in a locality.[57] Such efforts include Sharedstreets.io's software platform and the Open Mobility Foundation's Mobility Data Specification (MDS) application.[58] Each of these products attempts to integrate data about public assets and private users of public assets, such as dockless mobility or ride-sharing companies, into a single real-time data source.
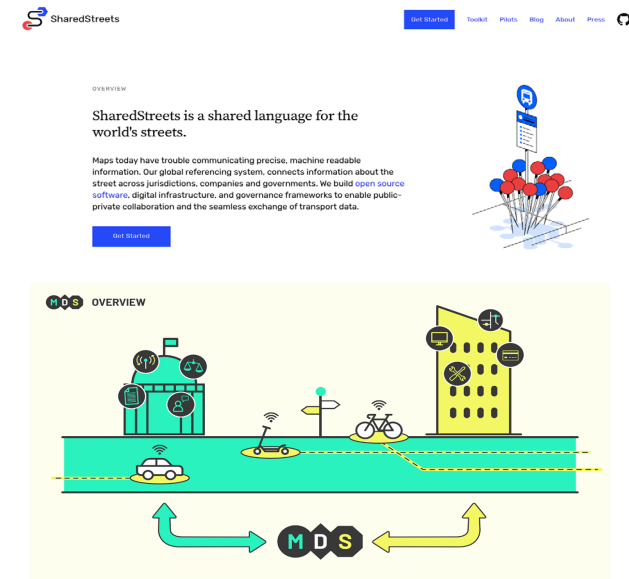

Figure 13. Graphics from SharedStrets.io website (top) and the Open Mobility Foundation's Mobility Data Specification (MDS) platform (bottom), two efforts to improve digital asset mapping in cities.

While a nascent industry and one riddled with technical and ethical complexity (especially around data privacy), having integrated, up-to-date data on public assets is considered to be a critical feature for more responsive, actively managed streets.[59] Emerging technologies will rely on physical and digital interactions with public assets, and therefore can be more effectively deployed and managed if cities have a comprehensive view of their public assets. This report recommends that Charlottesville consider steps it can take to begin digitally mapping public assets and integrating these assets into a comprehensive, accessible data format.

Work in this area has already been initiated by private citizens. First, the City currently provides residents with access to data from the dockless mobility provider in the city, VeoRide.[60] Additionally, a recent project focused on crowdsourcing data on sidewalk quality was initiated out of the UVA School of Architecture.[61] Last, a private resident has created a website analyzing Downtown parking utilization in the city.[62] Charlottesville City government agencies should look to collaborate with these groups and begin efforts to map and integrate data on location, quantity, and quality of public assets, as well identify opportunities for using this data to actively manage mobility providers to provide more equitable, more flexible, and more responsive services in the city.
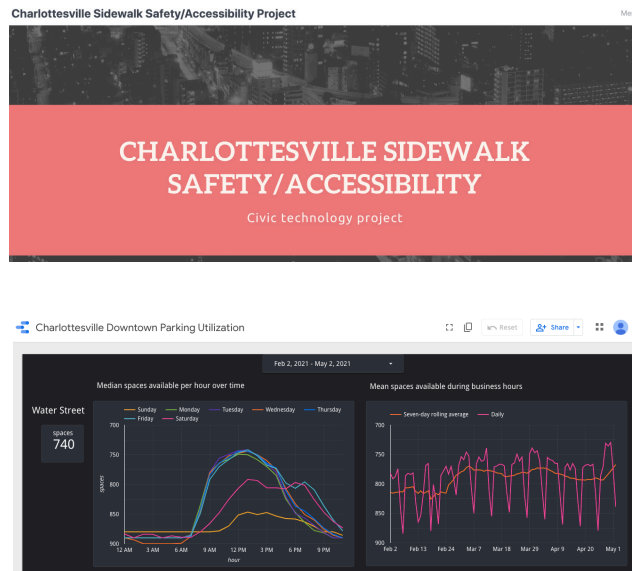
Figure 14. Graphics from a student crowdsource mapping project at UVA (top) and a parking mapping application produced by a private citizen in Charlottesville (bottom).

VI. CONCLUSION

This report set out to achieve three objectives:
1. Extend the S4P.io conceptual framework to account for underlying conditions in cities;
2. Develop an Audit Tool for analyzing underlying conditions across US cities; and
3. Apply the Audit Tool to a city and develop recommendations for how the city may be able to better promote Streets for People

The S4P.io conceptual framework was extended to account for underlying conditions by developing three constructs: Democratic Streets, Streets for Flows, and Streets for Living. Democratic Streets captures the idea that streets are public, contested spaces, and institutions must be in place to ensure equitable treatment and adequate responsiveness to community needs. Streets for Flows includes the idea that people must be able to move about efficiently in city streets, but also introduces the idea of ensuring residents have authentic choices for how to move about a city. Streets for Living highlights the importance of public safety, providing opportunities for street appropriation in cities, and understanding whether residents feel respected and happy while using city streets.

After building out the conceptual framework, the report provides a detailed list of potential measures to evaluate underlying conditions within each of the three constructs. By no means definitive, the measures provided are intended to start broader discussions about how to analyze underlying conditions. Even more, the measures are meant to shed light on potential areas of intervention for city governments or residents to create more equitable, flexible, and responsive streets.

The third part of the report involved completing the Audit for Charlottesville, VA and producing recommendations. The Audit highlighted a few important themes about transportation planning and street management in the city:
- Charlottesville's transportation planning and street management regime is undermining the rights of the area's communities of color, and struggles to be responsive to a diversity of community needs.
- While commuters can move about the city efficiently, the city lacks adequate physical and digital infrastructure to provide residents with authentic mobility choices.
- Charlottesville has a number of programs that provide residents the opportunity to appropriate streets, but these programs can be difficult to identify and adopt.

The report provided three recommendations that aim to enhance community engagement in transportation planning, improve the legibility of street appropriation programs, and encourage digital mapping of public assets in the city. These recommendations will not solve all of the city's transportation planning issues. However, they may serve to reorient transportation planning and street management in the city away from a focus on car infrastructure and toward a vision of Streets for People.

The report began with a quote from the US Transportation Secretary claiming roads were for people too. This report seeks to contribute to the conversation, identifying specific values and potential interventions that might make such a reality possible. The author is optimistic that this Framework and Audit Tool will help residents and governments develop and adopt innovations that make future streets more equitable, flexible, and responsive, and, in the end, more enjoyable places to spend one's time.

APPENDICES

VII. APPENDIX A - S4P.io Audit Tool Measures

Democratic Streets Audit Measures

Audit Measure	Measure Description	Source(s)
Police-Pedestrian Interactions Data	One measure by which the S4P.io Lab can gain a sense of the degree to which residents feel comfortable on streets is to review local stop and frisk data. Stop and frisk is a policy that allows police to perform a "brief non-intrusive" stop should the officer have "a reasonable suspicion that a crime has been, is being, or is about to be committed by the suspect."[63] This policy targets residents who are not in motor vehicles, and it has been controversial due to emerging evidence in various contexts that individuals of color are disproportionately the target of such stops.[64] Where possible, the S4P.io Lab should request and review data on stop and frisk policies in a city or locality.	Data is not often readily available and must be requested of local police departments via the Freedom of Information Act. Such an activity is time-intensive. However, private citizens or groups have sometimes already collected such data. Therefore, it is worth corresponding with local community-based organizations focused on policing to determine if any of these groups already have access to such data.
Traffic Stop Data	Another forum whereby residents might come into contact with law enforcement is during traffic stops. Here too there have been studies underscoring the increased rate at which black residents in the US are stopped and have their motor vehicles searched, despite driving less than other groups.[65]	The Stanford Open Policing Project has select city, state, or regional data on traffic stops for areas across the US. Each of the datasets differs in terms of precise fields collected. Local police departments also sometimes report traffic summons by racial group.
Local Transportation Planning Ecosystem	A transportation planning ecosystem attempts to comprehensively understand the specific agencies, commissions, nonprofit groups, and private companies participating in transportation planning in a city. Qualitative methods can be used to better understand power dynamics amongst the relevant groups when debating transportation planning initiatives in contested spaces.	A city's website typically has a comprehensive list of departments and staff responsibilities. Qualitative methods (i.e., interviews, ethnographic research) should also be used to collect information on the relative influence of different groups or activities by community-based organizations. Such efforts may also shed light on relevant historical context for the city.

Streets for Flows Audit Measures

Audit Measure	Measure Description	Source(s)
% of Workers with 60 Minutes or Longer Commute Time	As noted earlier, streets must be places for people to move efficiently to get to work. This first measure analyzes the percent of workers with commutes of an hour or longer in a locality. The average commuting time in 2017 nationally was 26.4 minutes, and a reasonable commute is judged to be about half an hour.[66] If a specific race or class of worker spends more than an hour getting to work, this suggests a point of failure in the existing commuting infrastructure for that group.	Public Use Microdata Sample data based on five year American Community Survey (specific fields: JWMNP, POVPIP, RAC1P, HISP). Must select relevant Public Use Microdata Area (PUMA).
% of Population in Households without a Vehicle	Again, as noted earlier, car dependence is a part of transportation infrastructure in most US cities. This measure seeks to understand to what extent any racial or class group has disparate access to a vehicle. Lack of access to a vehicle may mean individuals must rely on other forms of transportation to complete economic or social activities. The 'Equity and Smart Mobility' report highlights that in ten of the US's largest counties, African Americans are least likely to have access to a car, regardless of income level.[67] This measure sheds light on such dynamics in a given city or region.	Public Use Microdata Sample data based on five year American Community Survey (specific fields: VEH, POVPIP, RAC1P, HISP). Must select relevant Public Use Microdata Area (PUMA).
Transportation Mode to Work	This measure provides insight into how residents choose to get to work in a given locality. Higher levels of driving suggest increased car dependence in an area, whereas higher rates of other modes suggest existing infrastructure for other modes, such as transit, biking or walking. Nationally, about 75% of workers drive alone to work, while about 5% of workers take public transportation.[68] This measure will shed light on whether and to what extent a locality deviates from this national figure.	Public Use Microdata Sample data based on five year American Community Survey (specific fields: JWTRNS, POVPIP, RAC1P, HISP). Must select relevant Public Use Microdata Area (PUMA).

Streets for Flows Audit Measures cont.

Audit Measure	Measure Description	Source(s)
% of Population with a Smartphone	Many micromobility and ride-sharing applications either require a smartphone or are much easier to access via a smartphone. However, smartphone access is not universal or equally distributed throughout the population. Unsurprisingly, the 'Equity and Smart Mobility' report found that lower-income households were less likely to own a smartphone.[69] Disparate access to smartphones may result in disparate use of ride-sharing or micromobility services. This measure sheds light on access to smartphones in a city or region.	Public Use Microdata Sample data based on five year American Community Survey (specific fields: SMARTPHONE, POVPIP, RAC1P, HISP). Must select relevant Public Use Microdata Area (PUMA).
% of Population Unbanked	Often, micromobility or ride-sharing services require a credit card to sign up for services. Yet, there were 7.1 million unbanked households in the US in 2019. Lower income households and households of color are more likely to be unbanked, again suggesting disparate access to smart mobility services.[70] This measure, therefore, sheds light on the unbanked population in a given locality.	This data can be secured using Federal Deposit Insurance Corporation (FDIC) data at https://economicinclusion.gov/.
# of Car + Docked Bike Share Locations	Car share services are a shared asset service where customers, with a membership, are able to access a vehicle on demand for a set amount of time.[71] Car share services allow individuals to live without or with fewer owned vehicles, only accessing a vehicle under specific circumstances. Cars must be accessed in a specific location and returned to that location. Access to car share services offer individuals more choices for how to move about their city. Docked bike shares are a service provided in urban areas where, again with a membership, customers have access to bikes for hours-long rentals. Bike share locations are distributed throughout a city, and bikes can be returned to any of the bike share locations at the end of a rental.[72] Again, bike share services give residents greater alternatives for how to move about a locality. However, too few bike share locations may mean larger evidence of inadequate infrastructure for biking.	This data can be secured using AllTransit data, produced by the Center for Neighborhood Technology, at https://alltransit.cnt.org/.

Audit Measure	Measure Description	Source(s)
# of Dockless Micromobility Programs	Relatedly, localities have also begun allowing dockless mobility companies to operate in cities. Dockless mobility programs are a service whereby customers can access scooters or bikes left throughout a city using a smartphone. Once accessing the scooter or bike, the customer can then use the vehicle to travel wherever they like in the city, dropping off the vehicle at the end of their trip.[73] The presence of a dockless mobility program affords residents yet another option for moving about a city.	This data can be secured by speaking with the Bicycle / Pedestrian Coordinator or other transportation planner in a locality.
Transit Routes Available, High Frequency Routes Available, + % of Residents Living Near High Frequency Routes	This measure provides a sense of the existing transit infrastructure in a locality. In particular, the number of transit routes provides an overall sense of the scale of local transit infrastructure. Next, the number of high frequency routes is included because high-frequency routes have been associated with sustained increases in ridership.[74] High frequency routes are those that provide service every 15 minutes or less. Finally, the percent of households living near high frequency routes provides a sense of how many residents live within a half mile of transit stops on these routes, by race. These details shed light on how equitably these services are distributed.	This data can be secured using AllTransit data, produced by the Center for Neighborhood Technology, at https://alltransit.cnt.org/.
Transit Stop Quality	Relatedly, in the case where individuals must wait for a transit vehicle at a stop, the quality of stops can influence the ridership experience and likelihood of continued riderhsip.[75] Transit stops can range from an entire facility with amenities to a single pole. Better understanding the quality of transit stops can shed light on the extent to which groups can or wish to use transit.	There are few resources with comprehensive data on transit stop quality. Such data is likely best secured through physical site visits or discussions with transit users.

Audit Measure	Measure Description	Source(s)
Quantity + Quality of Bicycle and Pedestrian Infrastructure	As noted earlier, streets can be extremely dangerous for pedestrians and cyclists. Walking and biking is also much easier with dedicated infrastructure, such as sidewalks and protected bike lanes. This measure seeks to understand the scale and quality of that existing infrastructure. Additionally, the measure seeks to identify existing Standards and Design manuals and Bike/Ped Master Plans in a given locality to better understand existing strategies and commitments to bicycle and pedestrian infrastructure.	For quantity, many cities have Open Data sites with details on the physical length of bicycle and pedestrian infrastructure. Quality data is best collected through interviews, focus groups, and physical site visits. Existing guidelines can be found in local Standards and Design manuals produced by the local government.
Average Temperatures by Month	Extreme temperatures without the appropriate infrastructure can make biking, walking, or waiting for extended periods at a transit stop difficult. Additionally, many ride-sharing applications initiate surges in prices during poor weather.[76] Having a sense of the average temperature by month in a city can provide a sense of when residents might face dangerous conditions when not traveling in a vehicle.	This data can be secured using National Oceanic and Atmospheric Administration (NOAA) data at https://www.ncdc.noaa.gov/cag/city/mapping.

Streets for Living Audit Measures

Audit Measure	Measure Description	Source(s)
Traffic Fatalities (Drivers, Pedestrians, & Cyclists)	Again, streets have become increasingly dangerous places, especially for pedestrians and cyclists, in recent years. The Audit calls for collecting data on traffic fatalities in a region over five years. These data provide a sense of how safe or unsafe streets are for all people using them.	Local or statewide transportation agencies typically collect and report data on an annual basis.
Outdoor Air Quality	Air quality matters for a few reasons. First, exceptionally poor air quality can have harmful health impacts.[77] Second, poor air quality conditions are often concentrated in low-income communities or communities of color and can contribute to or exacerbate higher rates of asthma and other negative health outcomes.[78] Finally, pedestrians, cyclists, and other appropriating streets are differentially impacted by poor air quality, as they spend more time outdoors. Air quality is measured in the particulate matter (PM2.5) rates in a locality. Rates of PM2.5 above 35 µg/m3 are considered unhealthy.[79] This measure evaluates air quality conditions in a locality against this standard.	A single point source of air quality data can be secured on the EPA website at https://www.epa.gov/outdoor-air-quality-data/download-daily-data. This measure can be further enhanced by securing multiple point sources in a city.

Streets for Living Audit Measures cont.

Audit Measure	Measure Description	Source(s)
Programs for Street Appropriation	There are numerous programs that provide community groups and state actors with opportunities to appropriate streets in new and diverse ways. Such programs are most sustainable when there is dedicated funding and support from the relevant agencies. This measure seeks to identify such programs in a locality.	Information can be found on a city's website, as well as through conversations with individuals at the local transportation or public works agency.
Resident Respect + Happiness	While this measure is qualitative, it is possible to evaluate the extent to which residents are happy or feel respected by existing transportation systems. These experiences will likely vary across the population, so surveys, interviews, and focus groups are likely needed to secure a more comprehensive sense of the experience of residents. Once city, Los Angeles, has sought to develop a Transportation Happiness construct to inform their planning efforts.[80] They have developed resources that can be used in future survey research or agenda setting.	Surveys, focus groups, and interviews with residents.

Democratic Streets

Police-Pedestrian Interactions Data

In Charlottesville, the UVA Equity Center conducted analyses on the city police department's stop and frisk program and found clear cases of disproportionate targeting of Black residents. The data show that police stopped about 12 residents each month and about 65% of stops resulted in searches. The analysis found that Black residents were stopped more than twice as often as White residents despite making up a fifth of Charlottesville's population. Additionally, stop rates were 19 times higher in historically Black neighborhoods compared with nearby historically White, segregated neighborhoods, such as Fry's Spring and North Downtown.[81] Such disproportionate targeting might engender distrust of police in these communities and would clearly impact Black residents' comfort levels moving about in and appropriating streets.

This data was secured through Freedom of Information Act requests by a citizen over the course of several years. The data was collected for the years 2012-2014 and 2016-2017 and analyzed by the Equity Center.
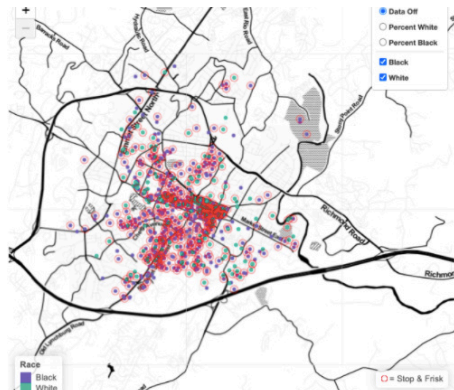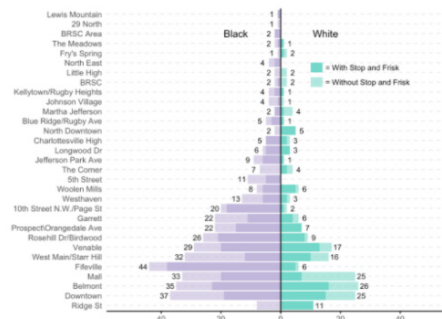

Figure 15. Graphics highlighting over-policing of Black residents and neighborhoods in Charlottesville

Traffic Stop Data

In Charlottesville, there is not one comprehensive dataset on traffic stops. There are two sources of data that provide some sense of traffic stops by racial groups. First, the Open Policing Project has Virginia State Patrol stop and search data from 2006-2016.[82] Figure 16 shows the data for Charlottesville City and Albemarle County, the county surrounding Charlottesville. The data show very few stops in Charlottesville during that period, and overall very few stops of non-white drivers in Charlottesville and Albemarle County. These data are unsurprising given that it is the primary responsibility of the locality's police department, not the Virginia State Patrol, for regular law enforcement activities. Realistically, there is insufficient data to discern any disproportionate treatment of any group based on this data.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total Stops
Asian / Pacific Islander												
Search	0	0	0	1	0	1	0	0	0	0	0	2
No Search	0	0	0	0	0	0	0	0	0	0	0	0
Black												
Search	16	11	10	15	8	21	22	7	4	2	4	120
No Search	0	0	0	0	0	0	0	0	0	0	0	0
Hispanic												
Search	9	2	8	10	5	12	4	1	3	0	1	55
No Search	0	0	0	0	0	0	0	0	0	0	0	0
Other												
Search	1	0	0	0	0	0	0	1	0	0	0	2
No Search	0	0	0	0	0	0	0	0	0	0	0	0
White												
Search	39	56	51	60	747	258	32	17	1218	16	2	2496
No Search	2701	3065	2591	0	0	0	0	0	0	0	0	8357

Figure 16. Traffic stops by Virginia State Patrol, analyzed by race and whether they resulted in a search, 2006-2016

Additionally, the Charlottesville Police Department, in its annual report, released data on traffic summonses issued over the course of the year by racial group.[83] These data do not seem to show any disproportionate treatment across racial groups; in fact, traffic summonses match existing racial demographic data in the city quite closely.

Figure 17. Traffic summonses by race in Charlottesville Police Department 2019 Annual Report

Transportation Planning Ecosystem

The Charlottesville Transportation Planning Ecosystem, shown in the following figure, seeks to provide a sense of the relevant stakeholders involved in transportation planning in the city and region.
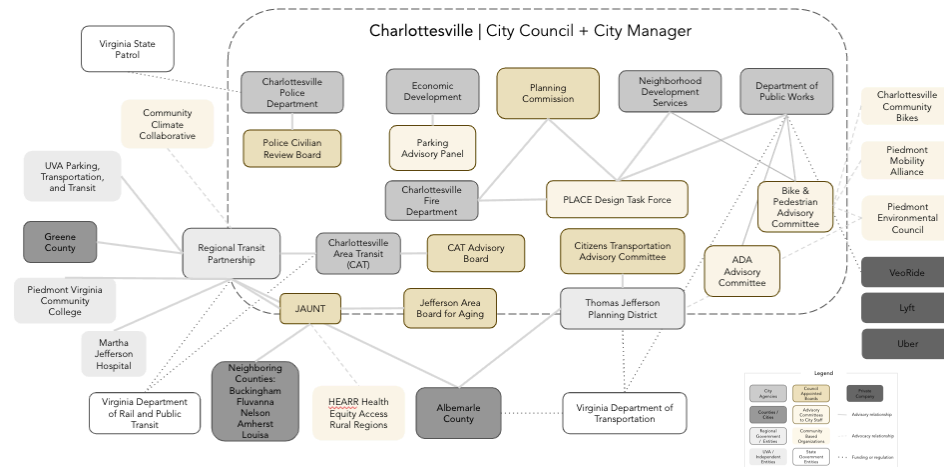

Figure 18. Transportation Planning Ecosystem for Charlottesville

This graphic draws on prior work by Professors Camille Burnett, Andrew Mondschein, and Barbara Brown Wilson in a prior report on Transit Equity in the region.[84] Their graphic primarily focused on the stakeholders involved in regional transit planning in Central Virginia. This graphic expands on the graphic by including stakeholders involved in policing and planning infrastructure investments in streets. It also includes several community-based organizations involved in transportation planning advocacy, including the Piedmont Environmental Council, the Piedmont Mobility Alliance, and Charlottesville Community Bikes, as well as private mobility services operating in Charlottesville, like VeoRide, Uber, and Lyft.

There are two insights worth highlighting related to the graphic. First, there are numerous bodies responsible for regional planning in Charlottesville, including the Regional Transit Partnership and the Thomas Jefferson Planning District. These groups must liaise with numerous stakeholders, adding complexity to the transportation planning process. Second, the City has several citizen-led advisory groups, some council-appointed and others volunteer-based. Four critical groups in transportation planning, the Bike and Pedestrian Advisory Committee (BPAC), the Americans with Disabilities Act Advisory Committee, the PLACE Design Task Force, and the Parking Advisory Panel, are volunteer-based committees. The complexity of planning paired with a volunteer-based advisory regime may be making it difficult for residents to effectively influence transportation planning in Charlottesville.

In the process of producing the graphic, I interviewed individuals involved with several of these entities. They shared insights on the relative power dynamics amongst various groups. One of the primary insights was the relative power of the Parking Advisory Panel compared with BPAC. The Parking Advisory Panel primarily focuses on parking access near the Downtown Pedestrian Mall and provides guidance to the Economic Development agency at the City. Relatedly, because the Panel reports to the Economic Development agency versus the Public

Works agency, its recommendations tend to prioritize the business and commercial interests on the Downtown Mall versus considering parking within a larger transportation planning framework.

Furthermore, while the BPAC is connected with some advocacy organizations, the Committee and the advocacy groups themselves lack racial diversity. There were plans to initiate outreach activities in 2019, but the member in charge of such efforts moved away from Charlottesville and efforts had not been restarted since the pandemic. Notably, there was also no meaningful relationship to speak of between BPAC and the Police Community Review Board, despite the evidence just presented of over-policing of Black residents on city streets.

Finally, the interviewees underscored the idea that micromobility services would likely be most effective in the city if integrated into a broader transit network. Currently, though, transit routes are circuitous, resulting in more direct but less frequent service to neighborhoods. Even further, many bus stops have few amenities and are not American Disability Act (ADA) compliant due to having been grandfathered into the system, discouraging some individuals from opting to take transit. A more frequent, legible transit system, including accessible, functioning transit stops, could provide the foundation for micromobility services in last-mile contexts.

Streets for Flows

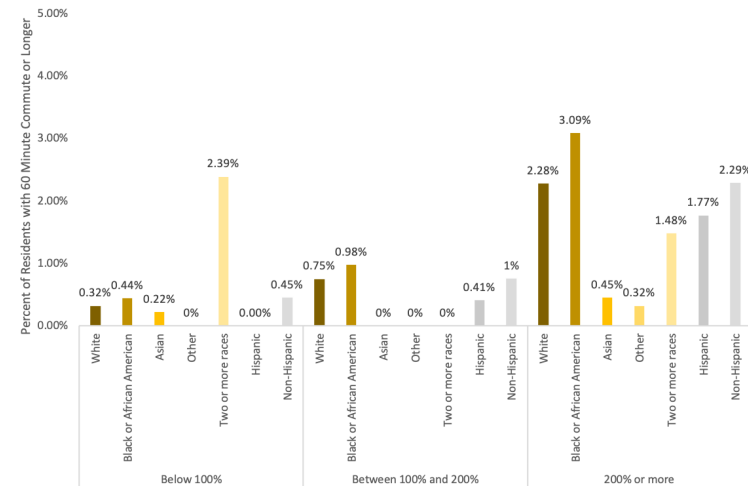**% of Workers with 60 Minutes or Longer Commute Time**

Figure 19. Percent of residents with commutes of 60 minutes or longer, by race/ethnicity and income as a percentage of the poverty line (2019 5-year ACS, PUMS data).

The figure above, as well as the following three figures, draw on Public Use Microdata Sample data based on responses to the American Community Survey. The dataset includes residents living in two Public Use Microdata Areas: Thomas Jefferson Planning District Commission (North) and Thomas Jefferson Planning District Commission (South & East). These areas include the City of Charlottesville, Albemarle County, Greene County, and parts of neighboring counties.

In terms of racial data in these analyses, those placed in the 'Other' category include residents identifying as Alaska Native, American Indian, or Native Hawaiian. For context, these groups make up less than two percent of the region's population. Additionally, analyses include racial groups and ethnic (Hispanic or non-Hispanic) groups.

In terms of commuting times, we find evidence that few residents in the Charlottesville region spend more than one hour commuting. Fewer than five percent of residents in all race/ethnicity or income categories spend more than an hour commuting to work. If any pattern does exist, it suggests that those with higher incomes are more likely to spend an hour or more commuting.[85] These results suggest that Charlottesville meets the first standard of Streets for Flows.
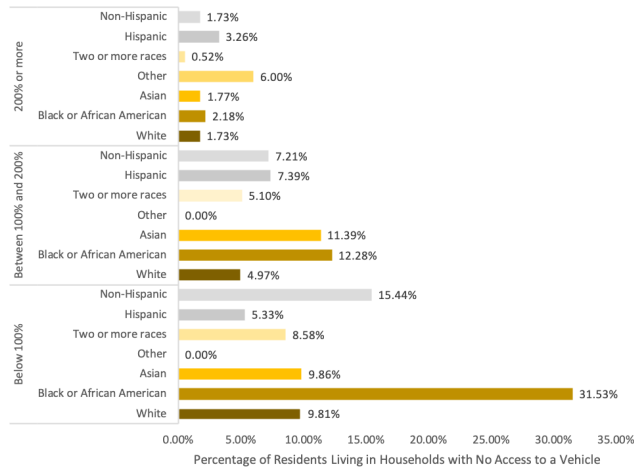
Figure 20. Percentage of residents in the Charlottesville region living in households with access to no vehicles, by race/ethnicity and income as a percentage of the poverty line (2019 5-year ACS, PUMS data).

% of Population in Households without a Vehicle

Again, according to American Community Survey data, Black or African American residents in the broader Charlottesville region are least likely to live in a household with access to a vehicle. Rates are especially high for those living below the poverty line, with approximately 31% of Black or African American residents lacking access to a vehicle. Conversely, residents with incomes more than 200% of the poverty line are exceedingly unlikely to live in a household without a vehicle.[86] These results suggest that low-income Black or African American residents are the most likely to be forced to find alternatives for moving about the city.
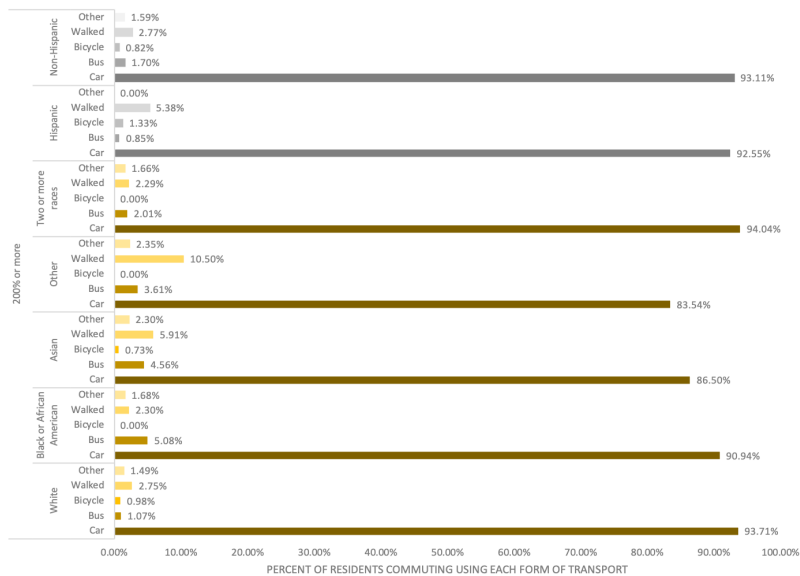
Transportation Mode to Work
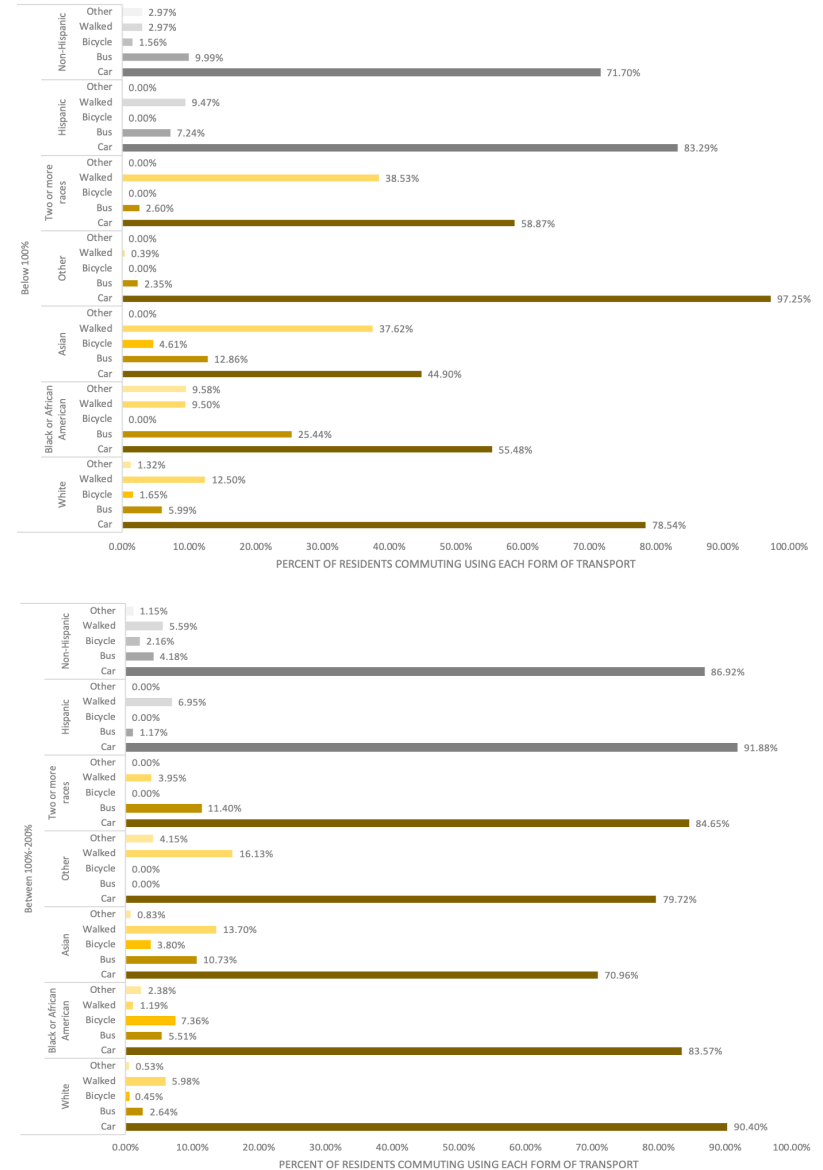
Figure 21. The three figures above show the mode to work for those making below 100% of the poverty line, between 100%-200% of the poverty line, and above 200% of the poverty line, across race /ethnicity (2019 5-year ACS, PUMS data).
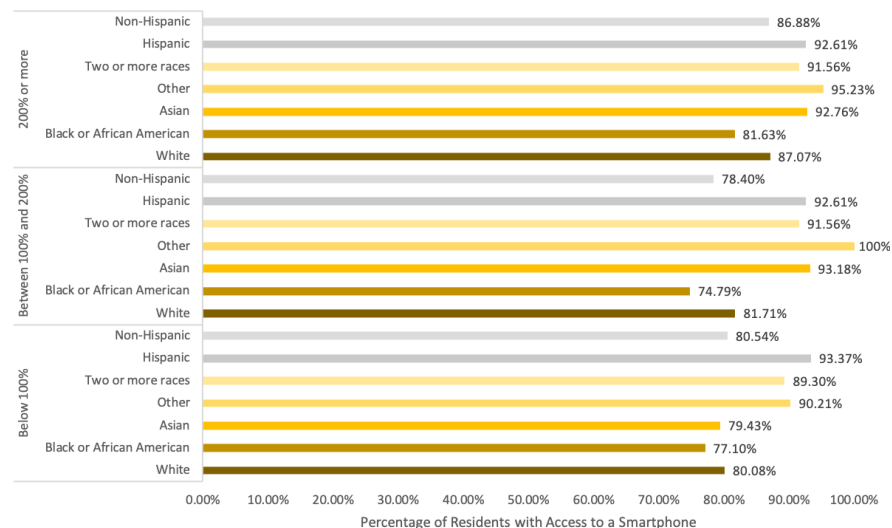
% Population with a Smartphone

Figure 22. Percentage of residents in the Charlottesville region with access to a smartphone device, across race/ethnicity and income as a percentage of the poverty line (2019 5-year ACS, PUMS data).

The three figures above show overwhelmingly that residents in the Charlottesville region rely on cars for their commute. At lower income levels, there are higher rates of bus and walking, especially among Black or African American and Asian residents. Rates of biking are quite low across all races/ethnicities and income levels, interestingly marking their highest levels among Black or African American residents making between 100%-200% of the poverty line (7.36%).[87] These results align quite closely to national averages for commuting.

The low levels of non-car commuting suggest residents do not feel as if, giving existing physical, digital, and economic conditions, they can commute to work without using an automobile. These results suggest shortcomings on the second facet of Streets for Flows.

In terms of digital infrastructure, American Community Survey data show that while smartphone adoption, a requirement for using many micromobility applications, is relatively high in the Charlottesville region, rates are lowest for Black or African American residents at all income levels.[88] These results match findings in the 'Equity and Smart Mobility' report produced by the Center for Neighborhood Technology. Access to a smartphone opens up opportunities for accessing mobility options, including micromobility, ride-sharing, and even tracking delays in the transit system. Lack of access to a smartphone leaves residents reliant on traditional forms of transport and unable to adjust their schedule in response to real-time information.

% of Population Unbanked

The FDIC data source for unbanked populations is not included for Charlottesville. However, statewide data is available and included below.[89] While there does seem to be a pattern of higher rates of unbanked households at lower income levels, there is insufficient data to truly get a sense of the nature of the unbanked population, especially at a local level. A dedicated survey would likely need to be completed to gain a sense of the true unbanked population in Charlottesville and whether lack of access to a bank account is undermining residents; ability to have varied mobility options.

Unbanked for Virginia, 2019 by Selected Household Characteristics
All Households

Row Variables	Number of Households (1000s)	Number of Households (PCT)	Unbanked	Has bank account
All Households	3619	100	4.4	95.6
Race/Ethnicity (PCT)				
Black	NA	100	NA	NA
Hispanic	NA	100	NA	NA
Asian	NA	100	NA	NA
American Indian or Alaska Native	NA	100	NA	NA
Native Hawaiian or Other Pacific Islander	NA	100	NA	NA
White	2267	100	2.3	97.7
Two or More Races	NA	100	NA	NA
Age group (PCT)				
15 to 24 years	NA	100	NA	NA
25 to 34 years	666	100	5.0	95.0
35 to 44 years	562	100	4.3	95.7
45 to 54 years	NA	100	NA	NA
55 to 64 years	575	100	0.8	99.2
65 years or more	987	100	3.3	96.7
Education (PCT)				
No high school diploma	NA	100	NA	NA
High school diploma	768	100	9.0	91.0
Some college	844	100	1.9	98.1
College degree	1684	100	0.2	99.8
Employment status (PCT)				
Employed	2371	100	3.5	96.5
Unemployed	NA	100	NA	NA
Not in labor force	1180	100	5.5	94.5
Family income (PCT)				
Less than $15,000	NA	100	NA	NA
$15,000 to $30,000	NA	100	NA	NA
$30,000 to $50,000	674	100	8.4	91.6
$50,000 to $75,000	570	100	1.6	98.4
At least $75,000	1671	100	0.9	99.1
Disability status (PCT)				
Disabled, aged 25 to 64	NA	100	NA	NA
Not disabled, aged 25 to 64	2203	100	3.7	96.3
Metropolitan status (PCT)				
Metropolitan area - principal city	912	100	7.1	92.9
Metropolitan area - balance	1649	100	2.6	97.4
Not in metropolitan area	NA	100	NA	NA
Not identified	631	100	3.3	96.7

• Source: 2019 FDIC Survey of Household Use of Banking and Financial Services.
• NA indicates that the sample size is too small to produce a precise estimate.
• Race/Ethnicity: A household is classified as Hispanic if the householder identifies as Hispanic or Latino regardless of race. A household is classified as Black if the householder identifies as Black or African American alone and not Hispanic or Latino. A household is

Page 1 of

Figure 23. Levels of unbanked Virginians across demographic groups in 2019.

of Car + Bike Share Locations

According to AllTransit, Charlottesville only has one car share location in the city.[90]

There are zero bike share locations in Charlottesville. The AllTransit website shows that there are three locations, but these locations were discontinued when the University of Virginia discontinued its bike share program in 2019.[91]

These results suggest limits to the number of smart mobility options to which Charlottesville residents have access.

of Dockless Micromobility Programs

The City of Charlottesville has issued permits to three organizations since it began issuing permits. Today, there is only one company currently operating in the city, VeoRide.[92]

Furthermore, the City has experienced struggles with dockless vehicles obstructing sidewalks or being left in unsafe places. The City has made attempts to create dedicated spaces for dockless vehicle drop-off through signage. However, there is no indication that the intervention has been successful.

Transit Routes Available, High Frequency Routes Available, + % of Residents Living Near High Frequency Routes

The Charlottesville Area Transit (CAT) agency operates 13 transit routes. CAT services recently went fare free.[93] The University of Virginia's Transit System (UTS) operates five routes, two specifically for its health system and four academic routes. The UTS system is free to UVA students.[94] Finally, JAUNT, the paratransit agency, offers three separate routes.[95]

According to AllTransit, there is only one high-frequency route (one bus scheduled every 15 minutes) during the busiest commuting hours. About 1 in 4 Charlottesvillians live within a half mile of a bus stop on this route. Low-income households and White residents are especially

well served by these routes.[96]

Given reduced schedules due to COVID-19, it is not clear that the high-frequency routes noted in this statistic have continued. However, CAT has initiated discussions to adjust transit schedules meant to promote greater ridership in the next fiscal year and Albemarle County has initiated a process to create a regional transit vision plan.[97] It appears that changes included as part of these processes may impact the results for this measure on the Audit.
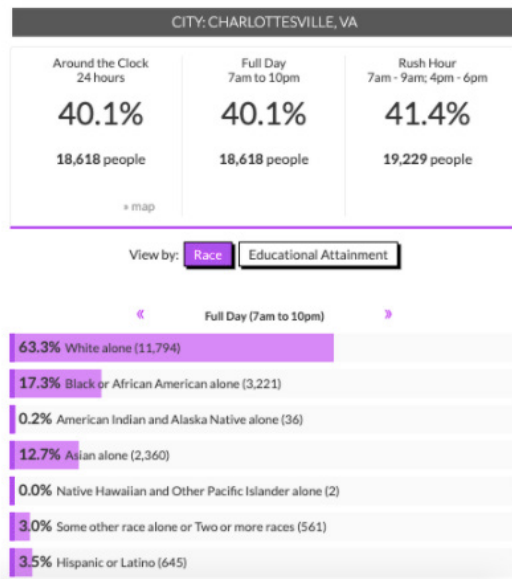
Transit Stop Quality
There is no comprehensive dataset for transit stop quality in Charlottesville. However, a study by researchers at UVA, which involved conducting focus groups with low-income residents in the Charlottesville region, found that transit users felt unsafe using transit due to the lack of lighting near stops and physically isolated stops.[98] Furthermore, many of the City's transit stops do not meet ADA accessibility requirements, as they existed prior to the existence of these regulations and were grandfathered into the transit agency.

Quantity + Quality of Bicycle and Pedestrian Infrastructure
In terms of bicycle infrastructure, the City outlined its current and proposed cycling infrastructure in the Streets That Work report completed in 2016.[99] The details were generated based on the work on the Bicycle and Pedestrian Master Plan update a year earlier.[100] The table in that report is included below and states that Charlottesville has 40.5 existing miles of bicycle infrastructure, with an additional 64.5 miles recommended.

Figure 24. Percentage of population in Charlottesville served by high-frequency transit routes, by race.

Type of Bicycle Facility	Existing Miles⁴	Recommended Miles
Signed Bicycle Routes	13.6	0.1
Shared Lane Markings	3.3	30.2
Wayfinding Sharrows	-	0.8
Bicycle Lanes	13.1	11.2
Climbing Bike Lanes	.5	14.7
Separated Bike Lanes	-	4.1
Contraflow Bicycle Lanes	0.4	0.7
One Way Except Bicycle	-	0.2
Shared Use Paths	9.6	2.5
Total	40.5	64.5

Table 3: Existing and Recommended Bicycle Facility Miles

Figure 25. Existing and recommended bike infrastructure in Charlottesville, from the 2016 Streets that Work report.

Charlottesville City's Open Data portal includes current data on bicycle infrastructure. Based on the data included in the database, it appears that the city now has 42.8 miles of bicycle infrastructure, an addition of 2.3 miles since the measure in 2016. It is not clear from the data which types of infrastructure were added given discrepancies in the data classification. There also now appears to be an additional 11.4 miles of proposed bicycle infrastructure in the database.

In terms of pedestrian infrastructure, the 2016 Streets that Work report noted that Charlottesville had 175 miles of sidewalks.[101] I was not able to secure updated details on the amount of sidewalk currently, though it is unlikely that significant changes have taken place in that time span. However, there is a recently started project that aims to use crowdsourcing to assess the current state of Charlottesville's sidewalks.[102] If not already, the City should seek to coordinate with this project to secure data on the state of the city's sidewalks.

Average Temperatures by Month

The data collected in the below chart is for Albemarle County, the county that surrounds the City of Charlottesville.[103] The temperatures are likely sufficiently close to the average temperatures faced in the city.

Charlottesville faces relatively moderate average temperatures throughout the year. Average temperatures in the region reach about 80 degrees Fahrenheit in the summer and between 30-40 degrees Fahrenheit in the winter.
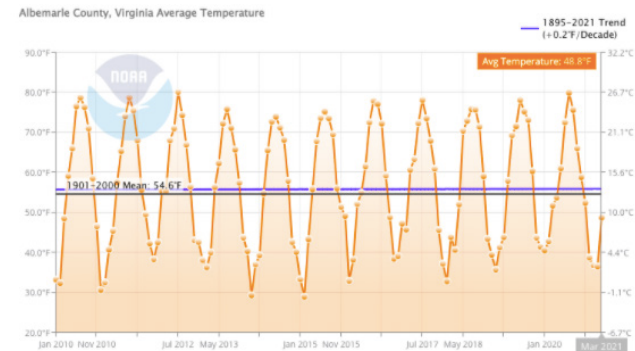

Figure 26. Average monthly temperatures in Albemarle County since 2010 compared with overall average temperature.

This data provides a sense of average temperatures generally, but fails to capture highly localized conditions. Recent data has shown significant warming in the month of July in Charlottesville, as well as the potential presence of heat islands, or places where the presence of permeable surfaces and absence of tree cover results in significantly higher temperatures than the surrounding area, in the city.[104] It is worth collecting more localized data on highly trafficked bike or pedestrian ways, as well as transit stops that may be especially exposed to the elements.
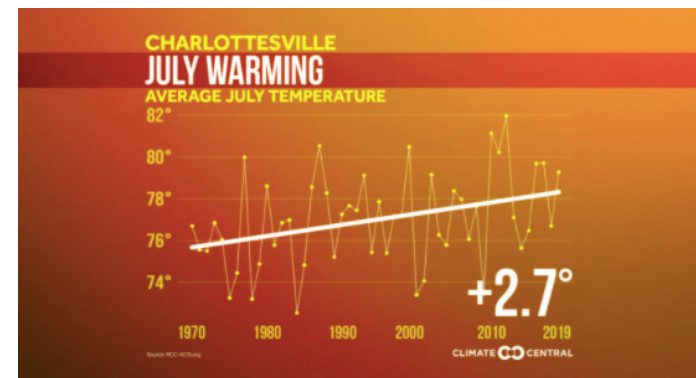

Figure 27. Graphic by Climate Central showing steadily increasing average July temperatures in Charlottesville since 1970.

⛺ Streets for Living

Traffic Fatalities (Drivers, Pedestrians, & Cyclists)
The table below, sourced from Virginia Traffic Crash Facts reports produced by the Virginia Department of Motor Vehicles (DMV) between 2016-2019, shows traffic crash and fatality data for the City of Charlottesville and Albemarle County.[105] The results show lower injury and fatality rates in Charlottesville compared with Albemarle County.

Year	Locality	Crashes	Fatalities	Injuries	Licensed Drivers	Death Rate per 1000 Drivers	Fatal Crashes Involving Bicycles	Fatal Crashes Involving Pedestrians
2019	City of Charlottesville	611	2	368	36,804	0.05	0	1
	Albemarle County	2,238	16	1,108	69,946	0.23	0	1
2018	City of Charlottesville	568	1	315	35,621	0.03	0	0
	Albemarle County	2,163	10	1,049	69,440	0.14	0	0
2017	City of Charlottesville	535	0	0	4,240	0.00	0	0
	Albemarle County	2,108	12	825	70,030	0.17	0	0
2016	City of Charlottesville	587	2	244	34,517	0.06	0	1
	Albemarle County	2,128	9	875	72,289	0.12	0	1

Figure 28. Statistics from the Virginia Department of Motor Vehicles (DMV) showing crash and fatality data in the City of Charlottesville and Albemarle County.

Curiously, the Virginia DMV report does not list any deaths in 2017 in Charlottesville, the year that Heather Heyer was struck and killed by a right-wing protester. It is possible that that fatality was not categorized as a crash, but rather as crime data. Nevertheless, that pedestrian fatality looms largely in Charlottesville's collective memory.

Additionally, and sadly, there has already been one death of a cyclist in Albemarle County this year. The cyclist was killed April 12th on Ivy Road.[106]

Outdoor Air Quality

In general, Charlottesville has quite good air quality. In the last year, rates of particulates have not been close to the 35 μg/m3 deemed dangerous by the Environmental Protection Agency. That said, these measures are from a single location. More precise location data, especially in areas with high vehicular traffic or other sources of emissions, should be used to gain a more comprehensive picture of Charlottesville's air quality. That said, air quality does not seem like a significant issue for those appropriating streets in the Charlottesville.
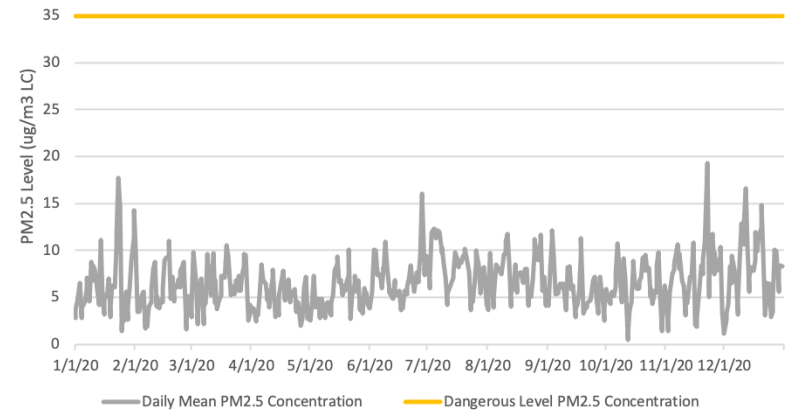

Figure 29. Average daily air quality readings in Albemarle County in 2020, compared with dangerous levels of PM2.5 concentration.

Programs for Street Appropriation

Charlottesville has several programs that allow for appropriation of streets or other transportation assets by community members. These programs, and the entities that operate them, are listed below.

- *Bike Month:* Each year, in May, Charlottesville hosts Bike Month. The month includes the hosting of community-based activities for cyclists, as well as the curation of individual activities that can be completed on a bike. Even further, the website highlights the presence of dockless bikes in the city and encourages residents to take advantage of these assets. Bike Month is planned by the Bike and Pedestrian Coordinator.[107]
- *Safe Routes to School:* This program serves to provide planning and investments to promote greater walking and biking by students to school. The program was initiated in 2016 and is run by a Safe Routes to School coordinator who works with the City and its schools to design and plan safe options for walking or biking to school.[108]
- *Traffic Calming:* Residents of Charlottesville are able to request a traffic calming study of the City's Traffic Engineering department. Traffic calming involves installing infrastructure to reduce speeds on a street or otherwise mitigate the danger of vehicular traffic. Once applied for, engineers complete a study of a specific site and determine if the conditions merit traffic calming measures.[109]
- *Art Bus - City as a Canvas:* Charlottesville Area Transit (CAT) has partnered with the Tom Tom Founders Festival, an annual festival in the city, each year since 2014 to select artists whose work will be placed as wall murals, street art, and bus wraps. The bus wraps use giant, removable stickers to cover select buses within CAT's fleet for a year.[110]
- *Bicycle Rack Giveaway:* The City Bike & Pedestrian Coordinator runs a program allowing residents to request a bike rack to be installed at a given location. The resident must fill out an application and secure buy-in from businesses or residents in the surrounding area, as well as meet specific physical site requirements.[111]
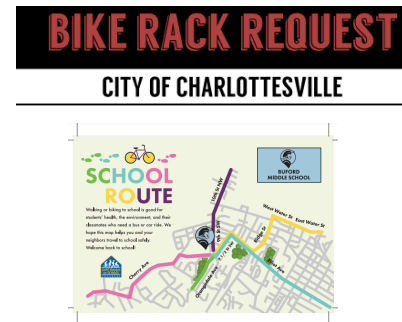

Figure 30. Graphics related to street and transportation infrastructure appropriation programs, including the Bike Rack Request program, Safe Routes to School, and Art Bus with CAT

There are two other initiatives that do not have formal names but that have taken place since the start of the COVID-19 pandemic in Charlottesville.

- First, restaurant owners have had the option to work with the Economic Development office and the City's engineers to reserve curb space for drop-off/pick-up by customers. While there had been some discussion about opening up curb space for tables and other restaurant uses, many restaurants did not take up this option because the City refused to pay for needed barriers to allow for safe curb usage.
- Second, the City's Traffic Engineer, in partnership with the Bike and Pedestrian Coordinator, worked on proposals to create a program called "Safe Streets for Social Distancing." The team created proposals for five street segments to close off or restrict car access to allow for greater access for pedestrians and cyclists during the COVID-19 pandemic. Only one of the proposed projects, the Belmont Bridge Safe Streets Pilot, was funded and executed.

It is worth noting that the details for these respective programs are not organized on a single website or landing page on the City's website. Instead, they are dispersed across different sites. This is likely due to the fact that the programs are operated by different departments within City government. Yet, such disorganization fails to convey any unified vision for street management or appropriation by residents in Charlottesville.

Resident Respect / Happiness

During the course of this study, it was not possible to compile a comprehensive sense of the respect and happiness residents of Charlottesville feel with their streets and transportation infrastructure. However, there are a few existing data points worth reviewing. First is a useful graphic produced as part of the 2015 Bike and Pedestrian Master Plan. The 'Level of Traffic Stress' graphic maps the relative stress pedestrians and cyclists experience traversing specific streets. In the graphic, shown below, a clear pattern emerges - pedestrians
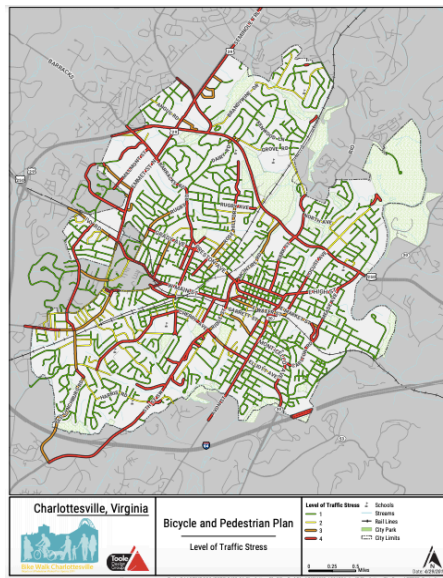

Figure 31. Map from the 2015 Bike and Pedestrian Master Plan showing levels of stress for walkers and bikers along different corridors across the city.

and cyclists feel most stress on major connective corridors in the city.[112] While reasonable to expect given past prioritization of vehicle efficiency and infrastructure in transportation planning, it does underscore the anxiety that stems from insufficient prioritization of these forms of transportation in Charlottesville's main arterial streets. Based on a review of the Master Plan, it seems that this takeaway was understood and efforts have been initiated to improve the experience for pedestrians and cyclists in these corridors.

Second, a local study, which was cited earlier, sought to understand low-income transit riders' experience of public transit in Charlottesville. Over the course of several focus groups, the researchers asked transit riders to answer the following question: "Do the transportation systems I use treat me humanely and give a sense that I am a valued consumer?' Participants consistently responded to the question in the negative. In general, they cited inefficient routes for regular trips and spending much more time than they thought reasonable moving about the city using transit. At the same time, they recognized that wealthier, often White residents of the city did not face these challenges, as they typically drove in single-occupancy vehicles and found ample parking wherever they drove.[113] While this was only one study with one subset of Charlottesville's population, it is clear this subset does not feel respected by the City's public transit services.

More surveys, focus groups, and interviews are surely necessary to paint a more comprehensive, ongoing picture of residents' happiness and perceived sense of respect when spending time on Charlottesville's streets. If people do not feel respected or happy, though, then surely they cannot think the streets are for them. Innovations should be targeted toward addressing these shortcomings and welcoming all residents to enjoy Charlottesville's streets.

ENDNOTES

Endnotes

1   Secretary Pete Buttigieg, Twitter Post, February 8, 2021, 3:23P M, https://twitter.com/SecretaryPete/status/1358874001184030730

2   StreetsForPeople.io, "HOME," Accessed on May 1, 2021, https://www.s4p.io/

3   Geotab, "What is Smart Mobility," Last modified August 21, 2018. https://www.geotab.com/blog/what-is-smart-mobility/

4   Victoria Transport Policy Institute, "Context Sensitive Design: Roadway Design that is Responsive to Local Community Values. Victoria Transport Policy Institute," Last modified April 15, 2015. https://www.vtpi.org/tdm/tdm57.htm#:~:text=Description,economic%2C%20social%20 and%20environmental%20objectives

5   Kersten Heineke, "The future of micromobility: Ridership and revenue after a crisis," McKinsey & Company, Last modified July 16, 2020, https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-future-of-micromobility-ridership-and-revenue-after-a-crisis#

6   Jeff Plungis. "Self-Driving Cars: Driving Into the Future," Consumer Reports. Last modified February 28, 2017, https://www.consumerre-ports.org/autonomous-driving/self-driving-cars-driving-into-the-future/

7   Eugenie L. Birch, "Who lives downtown," Washington,: The Brookings Institution, 2005.

8   Emily Talen, "Do-it-Yourself Urbanism: A History," *Journal of Planning History,* 14, no. 2 (2015): 135–148, https://doi.org/10.1177/1538513214549325; Mike Lydon and Anthony Garcia, *Tactical Urbanism: Short Term Action for Long Term Change*, Washington, DC: Island Press, 2015.

9   Peter Norton, Fighting Traffic: The Dawn of the Motor Age in the American City, Cambridge, MA: MIT Press, 2011.

10 Norton, 2011, 19

11   Clive Thompson, "When Pedestrians Ruled the Streets," Smithsonian Magazine, Last modified December 2014, https://www.smithsonian-mag.com/innovation/when-pedestrians-ruled-streets-180953396/?page=1

12   Sun, Bingrong, and Byungkyu Brian Park. "Route choice modeling with support vector machine," *Transportation research procedia 25* (2017): 1806-1814.

13   Thai, Jerome, Nicolas Laurent-Brouty, and Alexandre M. Bayen, "Negative externalities of GPS-enabled routing applications: A game theo-retical approach," *In 2016 IEEE 19th international conference on intelligent transportation systems (ITSC)*, pp. 595-601, IEEE, 2016.

14   Mark Pampanin, "PRESS RELEASE: Councilmember Ryu Calls on City of Los Angeles to Consider Legal Action Against Waze," Coun-cilmember David Ryu, 2018. http://davidryu.lacity.org/press_release_waze; Lisa W. Foderaro, "Navigation Apps Are Turning Quiet Neighborhoods Into Traffic Nightmares," The New York Times, December 24, 2017.

15   Charles Brown, "Fear: A Silent Barrier to Bicycling in Black and Hispanic Communities," ITE Journal, September 2016, https://nacto.org/wp-content/uploads/2017/03/2016_Brown_Fear-A-Silent-Barrier-to-Bicycling-in-Black-and-Hispanic-Communities.pdf

16   Skip Descant, "COVID-19 Gives Rise to 'Slow Streets,' Curb Creativity," Government Technology, Last modified August 28, 2020, https://www.govtech.com/fs/transportation/pandemic-gives-rise-to-slow-streets-curb-creativity.html

17   Destiny Thomas, "'Safe Streets' Are Not Safe for Black Lives," Bloomberg CityLab, Last modified June 8, 2020, https://www.bloomberg.com/news/articles/2020-06-08/-safe-streets-are-not-safe-for-black-lives.

18   Danielle Allen, "A New Theory of Justice: Difference without Domination," *Difference without Domination: Pursuing Justice in Diverse De-mocracies*, Chicago: University of Chicago Press, 2020, 27-57.

19   John Pucher and Christian Lefèvre, "The United States: The Car-Dependent Society," The urban transport crisis in Europe and North Ameri-ca, London: Palgrave Macmillan, 1996, 175-200.

20   Joseph Stromberg, "The real reason American public transportation is such a disaster," Vox, Last modified August 10, 2015, https://www.vox.com/2015/8/10/9118199/public-transportation-subway-buses

21   Young, L., Elizabeth Irvin, and Preei Shankar, "Equity and Smart Mobility," Center for Neighborhood Technology, 2019, https://www.cnt.org/sites/default/files/publications/Equity-and-Smart-Mobility-Report.pdf

22	National Highway Traffic Safety Administration, "2019 Fatality Data Show Continued Annual Decline in Traffic Deaths." Last modified October 1, 2020, https://www.nhtsa.gov/press-releases/2019-fatality-data-traffic-deaths-2020-q2-projections

23	Camila Domonoske, "'Tragic': Driving Was Down In 2020, But Traffic Fatality Rates Surged," National Public Radio, Last modified March 5, 2021, https://www.npr.org/2021/03/05/974006735/tragic-driving-was-down-in-2020-but-traffic-fatality-rates-surged

24	Camila Domonske, "Roads Are Getting Deadlier For Pedestrians; Fatality Rates Are Worse For Minorities," National Public Radio, Last modified March 23, 2021, https://www.npr.org/2021/03/23/980438205/americas-roads-are-getting-deadlier-and-fatality-rates-are-worse-for-minorities

25	Insurance Institute for Highway Safety (IIHS) and Highway Loss Data Institute (HLDI), "Fatality Facts 2019: Bicyclists," Accessed on May 1, 2021, https://www.iihs.org/topics/fatality-statistics/detail/bicyclists#:~:text=Posted%20March%202021.-,Trends,with%20motor%20vehicles%20in%202019.&text=Most%20bicyclist%20deaths%20in%202019,20%20and%20older%20have%20tripled.

26	Vision Zero Network, "What is Vision Zero," Accessed on April 27, 2021, https://visionzeronetwork.org/about/what-is-vision-zero/

27	Talen, 2015

28	Lydon and Garcia, 2015

29	San Francisco Public Works, "Parklets," Accessed on May 3, 2021, https://sfpublicworks.org/services/permits/parklets; Street Plans, "MDT Quick Build Program | Miami, FL", Accessed on May 3, 2021, http://www.street-plans.com/mdt-quick-build-program/; Open Streets Project, "Open Streets Project," Accessed on May 3, 2021, https://openstreetsproject.org/

30	Descant, 2020.

31	Cvillepedia, "Charlottesville," Charlottesville Tomorrow, Accessed on May 2, 2021, https://www.cvillepedia.org/Charlottesville

32	Harland Bartholomew and Associates, A Preliminary Report Upon Housing: Charlottesville, Virginia, May 15,1957.

33	Saunders, James Robert and Renae Nadine Shackelford. Urban renewal and the end of black culture in Charlottesville, Virginia: An oral history of Vinegar Hill. McFarland, 2005.

34	Matthew Gillikin, "Charlottesville Land Use - A Brief History," RealCentralVA.com, Last modified April 27, 2018, https://www.realcentralva.com/2018/04/27/charlottesville-land-use-a-brief-history/

35	Debbie Lord, "What happened at Charlottesville: Looking back on the rally that ended in death," The Atlanta Journal-Constitution, Last modified August 13, 2019, https://www.ajc.com/news/national/what-happened-charlottesville-looking-back-the-anniversary-the-deadly-rally/fPpnLrbAtbxSwNI9BEy93K/

36	The Institute for Advanced Technology in Humanities, "Charlottesville Archive - Historic Photographs," Vinegar Hill, Last modified July 28, 2005, http://www2.iath.virginia.edu/schwartz/vhill/vhill.html.

37	Edwin Roseberry, "Roseberry's Charlottesville," C'ville Images, Last updated 2018, http://www.cvilleimages.com/portfolio/roseberrys-charlottesville/

38	Jordy Yager, "Determined to Be Free," Charlottesville Tomorrow, Last modified June 20, 2020, https://www.cvilletomorrow.org/articles/determined-to-be-free/

39	US Census Bureau, American Community Survey 5-Year Estimates, Public Use Microdata Sample, 2019.

40	US Census Bureau, 2019.

41	US Census Bureau, 2019.

42	AllTransit Metrics, "City: Charlottesville, VA," AllTransit, Accessed on May 3, 2021, https://alltransit.cnt.org/metrics/?addr=charlottesville

43	Burnett, Camille, Andrew Mondschein, and Barbara Brown Wilson, "Transportation Equity and Accessibility in the Charlottesville Region: Summary and Recommendations," October 2020.

44	AllTransit Metrics, 2021.

45   US Census Bureau, 2019.
46   City of Charlottesville, "Streets That Work: Charlottesville Design Guidelines," 2016, https://www.charlottesville.gov/DocumentCenter/View/482/2016-Streets-That-Work-Plan-PDF
47   Charlottesville Open Data, *Bicycle Lane Lines*, Accessed on May 3, 2021, https://opendata.charlottesville.org/datasets/bicycle-lane-lines?-geometry=-78.604%2C38.016%2C-78.376%2C38.063
48   Lord, 2019.
49   Staff Report, "Police identify city man as bicyclist killed in Monday crash," The Daily Progress, Last modified April 13, 2021, https://daily-progress.com/news/police-identify-city-man-as-bicyclist-killed-in-monday-crash/article_040fc6a4-9c9d-11eb-964c-ef250b57d0ee.html
50   Burnett, Mondschein, & Brown, 2020.
51   Vera, Caro and Kevin Ocubillo, "Dignity Infused Community Engagement in Los Angeles," TREC Friday Seminar Series. 195, 2020 https://archives.pdx.edu/ds/psu/33271
52   https://ladotlivablestreets.org/
53   The Equity Center, "Home," Accessed on May 5, 2021, https://virginiaequitycenter.org/
54   https://ladotlivablestreets.org/; https://groundplaysf.org/
55   City of Charlottesville, "Safe Routes to School," Accessed on May 3, 2021, https://www.charlottesville.gov/565/Safe-Routes-to-School
56   https://cvilleplanstogether.com/
57   Laura Bliss, "Why Real-Time Traffic Control Has Mobility Experts Spooked," Bloomberg CityLab, July 19, 2019, https://www.bloomberg.com/news/articles/2019-07-19/why-cities-want-digital-twins-to-manage-traffic
58   SharedStreets, "About SharedStreets," Accessed on May 3, 2021, https://sharedstreets.io/about/; Open Mobility Foundation, "About MDS," Accessed on May 3, 2021, https://www.openmobilityfoundation.org/about-mds/
59   Bliss, 2019.
60   City of Charlottesville, "Dockless Scooters & E-Bikes," Accessed May 3, 2021, https://charlottesville.org/612/Dockless-Scooters-Bike-Share.
61   https://www.canva.com/design/DAEbx_F2scg/kTbku7KjkHMsMdO6zgum-g/view?website#4
62   https://datastudio.google.com/u/0/reporting/7d72f879-914f-4e2c-9f1f-2860b90cffcc/page/5CP8
63   Legal Information Institute, "Stop and Frisk," Cornell Law School, Accessed on April 27, 2021, https://www.law.cornell.edu/wex/stop_and_frisk
64   NCYLU, "Stop-and-Frisk Data," Accessed on April 27, 2021, https://www.nyclu.org/en/stop-and-frisk-data
65   Chris Horn, "Racial disparities revealed in massive traffic stop dataset," University of South Carolina, Last modified June 12, 2020, https://www.sc.edu/uofsc/posts/2020/06/racial_disparities_traffic_stops.php#.YIgRB31Ki3V
66   Young, Irvin, & Shankar, 2019.
67   Young, Irvin, & Shankar, 2019.
68   U.S. Census Bureau, 2006 to 2019 American Community Survey, 1-year estimates, Table S0801; U.S. Census Bureau, 2006 to 2019 American Community Survey, 1-year estimates, Table S0801.
69   Young, Irvin, & Shankar, 2019.
70   Federal Deposit Insurance Corporation, "How America Banks: Household Use of Banking and Financial Services," Last modified October 19, 2020, https://www.fdic.gov/analysis/household-survey/index.html
71   Carsharing Association, "What is carsharing," Accessed on April 27, 2021, https://carsharing.org/what-is-car-sharing/
72   Katy Bryce, "The Many Benefits of Car-Sharing Programs," Commute Options, Accessed on April 27, 2021, https://www.commuteoptions.

org/the-many-benefits-of-bike-sharing-programs/

73   Brienne Eby, "The U.S. Dockless Mobility Experiment," Eno Center for Transportation, Last modified April 27, 2018, https://www.enotrans.org/article/the-u-s-dockless-mobility-experiment/

74   Leah Binkovitz, "What Makes Transit Successful? Survey Says It's Frequency, Reliability and Shorter Travel Times," Government Technology, July 13, 2016, https://www.govtech.com/fs/what-makes-transit-successful-survey-says-its-frequency-reliability-and-shorter-travel-times.html

75   Shi, Xiao, Anne Vernez Moudon, Philip M. Hurvitz, Stephen J. Mooney, Chuan Zhou, and Brian E. Saelens, "Does improving stop amenities help increase Bus Rapid Transit ridership? Findings based on a quasi-experiment," *Transportation Research Interdisciplinary Perspectives* 10, 2021.

76   Young, Irvin, & Shankar, 2019.

77   US Environmental Protection Agency, "Research on Health Effects from Air Pollution," Accessed on April 27, 2021, https://www.epa.gov/air-research/research-health-effects-air-pollution

78   Young, Irvin, & Shankar, 2019.

79   US Environmental Protection Agency, "Revised Air Quality Standards for Particle Pollution and Updates to the Air Quality Index (AQI)," 2012, https://www.epa.gov/sites/production/files/2016-04/documents/2012_aqi_factsheet.pdf

80   Los Angeles Department of Transportation, "Transportation Happiness: A guide to measuring mobility experience in Los Angeles," May 2018, https://ladot.io/wp-content/uploads/2018/12/TransportationHappinessGuide_2018.05.14.pdf

81   Yager, 2020.

82   https://openpolicing.stanford.edu/data/; E. Pierson, C. Simoiu, J. Overgoor, S. Corbett-Davies, D. Jenson, A. Shoemaker, V. Ramachandran, P. Barghouty, C. Phillips, R. Shroff, and S. Goel. "A large-scale analysis of racial disparities in police stops across the United States". *Nature Human Behaviour*, Vol. 4, 2020.

83   Charlottesville Police Department, "2019 Annual Report," 2019, https://charlottesville.org/DocumentCenter/View/4101/2019-Annual-Report?bidId=

84   Burnett, Mondschein, & Wilson, 2020.

85   US Census Bureau, 2019.

86   US Census Bureau, 2019.

87   US Census Bureau, 2019.

88   US Census Bureau, 2019.

89   Federal Deposit Insurance Corporation, "Custom Data Table Tool," 2019, https://economicinclusion.gov/custom-data/

90   AllTransit Metrics, 2021

91   AllTransit Metrics, 2021.; Allison Wrabel, "UVa ending docked bicycle program," The Daily Progress, Last modified February 15, 2020, https://dailyprogress.com/news/local/uva-ending-docked-bicycle-program/article_5b78b637-bd02-5dc6-8b47-e07261d7bdda.html

92   City of Charlottesville, "Dockless Scooters & E-Bikes," Accessed May 3, 2021, https://charlottesville.org/612/Dockless-Scooters-Bike-Share

93   CAT, "CAT Schedules and Map," Accessed on April 27, 2021, https://www.charlottesville.gov/481/CAT-Schedules-Maps

94   Katherine Knott, "CAT planning to stay fare-free for three years," The Daily Progress, Last modified March 25, 2021, https://dailyprogress.com/news/local/govt-and-politics/cat-planning-to-stay-fare-free-for-three-years/article_b963cfae-8dbc-11eb-8d53-6f156753580a.html

95   UVA Parking and Transportation, "University Transit System," Accessed on April 27, 2021, https://parking.virginia.edu/university-transit-service

96   AllTransit Metrics, 2021.

97   Allison Wrabel, "Changes to CAT bus service proposed in hopes of increasing ridership," The Daily Progress, Last modified March 1, 2021, https://dailyprogress.com/news/local/govt-and-politics/changes-to-cat-bus-service-proposed-in-hopes-of-increasing-ridership/article_9484f-

3ba-7af3-11eb-a790-f77e550a7c42.html

98   Burnett, Mondschein, & Wilson, 2020.

99   City of Charlottesville, "Streets That Work: Charlottesville Design Guidelines," 2016.

100   City of Charlottesville, "2015 Bicycle and Pedestrian Master Plan Update," 2015, https://www.charlottesville.gov/DocumentCenter/View/480/2015-Bicycle-and-Pedestrian-Master-Plan-PDF

101   City of Charlottesville, "Streets That Work: Charlottesville Design Guidelines," 2016.

102   https://www.canva.com/design/DAEbx_F2scg/kTbku7KjkHMsMdO6zgum-g/view?website#4

103   NOAA National Centers for Environmental information, Climate at a Glance: County Time Series, published April 2021, retrieved on May 3, 2021 from https://www.ncdc.noaa.gov/cag/

104   Charlotte Rene Woods, "Heat islands to factor into planning process revision," Charlottesville Tomorrow, Last modified July 23, 2020, https://www.cvilletomorrow.org/articles/heat-islands-to-factor-into-planning-process-revision

105   Office of Highway Safety, "2019 Virginia Traffic Crash Facts," Department of Motor Vehicles, 2019, https://www.dmv.virginia.gov/safety/crash_data/crash_facts/crash_facts_19.pdf; Office of Highway Safety, "2018 Virginia Traffic Crash Facts," Department of Motor Vehicles, 2018, https://www.dmv.virginia.gov/safety/crash_data/crash_facts/crash_facts_18.pdf; Office of Highway Safety, "2017 Virginia Traffic Crash Facts," Department of Motor Vehicles, 2017, https://www.dmv.virginia.gov/safety/crash_data/crash_facts/crash_facts_17.pdf; Office of Highway Safety, "2016 Virginia Traffic Crash Facts," Department of Motor Vehicles, 2016, https://www.dmv.virginia.gov/safety/crash_data/crash_facts/crash_facts_16.pdf

106   Staff Report, 2021.

107   City of Charlottesville, "Bike Month," Accessed April 28, 2021, https://www.charlottesville.gov/904/Bike-Month

108   City of Charlottesville, "Safe Routes to School," Accessed on April 28, 2021, https://www.charlottesville.gov/565/Safe-Routes-to-School

109   City of Charlottesville, "Traffic Engineering," Accessed on April 28, 2021, https://www.charlottesville.gov/1386/Traffic-Engineering

110   City of Charlottesville, "Art Bus - City as a Canvas," Accessed on April 28, 2020, https://www.charlottesville.gov/480/Art-Bus---City-as-a-Canvas

111   City of Charlottesville, "Bike Rack Request," Accessed April 28, 2021, https://www.charlottesville.gov/DocumentCenter/View/1204/Bike-Rack-Request-Information-PDF

112   City of Charlottesville, "Bicycle and Pedestrian Plan | Level of Traffic Stress," Last modified April 29, 2015, https://www.charlottesville.gov/DocumentCenter/View/1208/Biking-and-Walking-Level-of-Traffic-Stress-Map-PDF

113   Burnett, Mondschein, & Wilson, 2020.

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