

THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF GEOGRAPHY

Analyzing the Failures of United States Public Transportation and Potential Solutions

NELSON HUFFAKER
SPRING 2022

A thesis
submitted in partial fulfillment
of the requirements
for baccalaureate degrees in Geography and Political Science
with honors in Geography

Reviewed and approved* by the following:

Roger Downs
Professor of Geography
Thesis Supervisor and Honors Advisor

Emily Rosenman
Assistant Professor of Geography
Faculty Reader

* Electronic approvals are on file.

ABSTRACT

American's reliance on private automobiles as the dominant form of transportation has a negative impact on not only the environment, but the livability of American cities. As car-centric urban sprawl continues, traffic congestion, unequal access to job centers, and high transportation costs remain the norm for many people. The reason American cities lag behind their foreign counterparts when it comes to reliable public transportation is due to a multitude of past and present policy failures that have consistently prioritized car-centric infrastructure over much needed public transportation improvements. While public transportation ridership was slowly increasing throughout America in the past decade, the COVID-19 pandemic had a disastrous effect on public transit agencies everywhere. A slow recovery in ridership throughout most of the US along with the growing interest in remote working options has led to concerns that public transportation in the US might be on its last legs. However, with the abrupt change that the pandemic caused in our society comes an opportunity to rethink how we want our cities to function and with the many benefits of prioritizing public transit – as well as other multimodal options – over private automobiles, it is important that we attempt to change. From the implementation of Transit Oriented Developments to reshaping of our residential zoning laws to allow for more density, there remains plenty of policy ideas that can not only improve public transportation access and reliability to urban residents, but also make cities in America more livable to all.

TABLE OF CONTENTS

LIST OF FIGURES	iii
ACKNOWLEDGEMENTS	iv
Chapter 1 Introduction	1
Chapter 2 Why Public/Multimodal Transportation is Better Than Cars	6
Chapter 3 How US Transit Compares to the Rest of the World.....	11
Chapter 4 The Anti-Transit History of the US.....	17
Chapter 5 COVID and Remote Work.....	25
Chapter 6 Remote Work and Public Transit	30
Chapter 7 Transit Specific Changes.....	37
Chapter 8 City Design Changes.....	42

LIST OF FIGURES

Figure 1: Pew Research Poll (2021)	2
Figure 2: Family Transportation Costs (Florida, 2011)	7
Figure 3: Driving Costs (Inrix, 2021)	10
Figure 4: Transit Usage by Country (Greendex, 2009).....	11
Figure 5: Commute Patterns (American Community Survey, 2015).....	12
Figure 6: Reliable Transit Access by City (English, 2018b)	15
Figure 7: Interstate Highway System (DOT).....	17
Figure 8: Cincinnati Demographic Map (Dottle et. al, 2021)	18
Figure 9: Downtown Cincinnati in 1955 (Dottle et. al, 2021)	19
Figure 10: Downtown Cincinnati in 2013 (Dottle et. al, 2021)	19
Figure 11: Government Infrastructure Spending	23
Figure 12: Drop in Ridership Trends (Transit, 2020)	25
Figure 13: NYC Ridership Recovery (NYT, 2021).....	27
Figure 14: Demographics of Transit Ridership (APTA, 2020).....	29
Figure 15: NYC Traffic Patterns (Russell, 2021)	31
Figure 16: LA Traffic Patterns (Russell, 2021)	31
Figure 17: San Francisco Migration (Patino et. al, 2021).....	33
Figure 18: NYC Migration (Patino et. al, 2021).....	34
Figure 19: NYC Population Recovery (Winck, 2021).....	35
Figure 20: Job Access in D.C. by Race (Bliss, 2021)	36
Figure 21: Infrastructure Spending Bill Breakdown (Tomer et. al, 2021).....	38
Figure 22: Atlanta Job Access Before 40% Increase (Transit Center, 2021)	40
Figure 23: Atlanta Job Access After 40% Increase (Transit Center, 2021).....	40
Figure 24: Example of Transit Oriented Development.....	42

ACKNOWLEDGEMENTS

I would like to thank Dr. Downs and Dr. Rosenman for dealing with the many twists and turns this process entailed. Without their guidance and ability to keep me on track and on message, this wouldn't have been possible. As they were both professors of mine at multiple points throughout my time at Penn State, they both served me with invaluable information that helped me write this thesis and even explore a career in transportation planning.

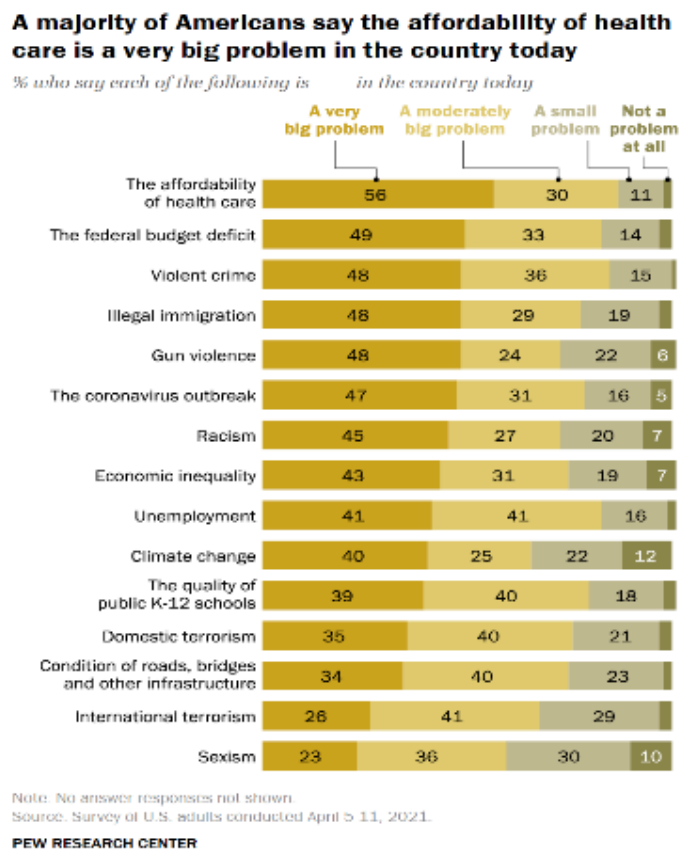
I would also like to thank my dad for exposing me to the powers and importance of public transit through the daily work that he does. My passion for urban and transportation planning stems from his involvement in the public transit world, so this thesis wouldn't exist without him.

Chapter 1

Introduction

Transportation infrastructure is an issue that famously gets very little attention from the national media despite being the issue that arguably affects American's day-to-day lives the most. In polls questioning voters' top priorities in most elections, infrastructure spending is often not even listed as an option for voters to select and if it is, it gets buried under other hot button issues like abortion, the economy, and immigration. When the issue does get the attention it deserves, it is often in the context of "car infrastructure" such as roads, bridges, and highways, and not public transportation. A Pew Research poll measuring how concerned people are about various issues saw "Condition of Roads, Bridges, and other Infrastructure" near the bottom (Pew research, 2021).

Figure 1: Pew Research Poll (2021)



‘Infrastructure week’ in Congress is a term thrown around by political junkies as a joke referencing overall inaction and an issue that rarely gets any attention. Transportation infrastructure spending is admittedly not as politically popular as military spending or big tax cuts. Analysis by political pundits typically downplay the importance transportation infrastructure plays in everyday life by focusing on the size of the infrastructure bill without going into the policies affecting things like highway expansion, transit improvements etc. The lack of attention on the substance of infrastructure bills can lead to complaints of government overspending immediately taking the attention away from the issues that these policies are trying to address. President Biden faced a similar situation in his quest to pass his “big” infrastructure

bill in October of 2021. “3.5 TRILLION INFRASTRUCTURE BILL” flashes on CNN’s chyron and the pundits go back and forth arguing if the government can afford to spend this much. Aside from the fact that the bill was actually 3.5 trillion over 10 years – not one, as could be easily interpreted from the headlines splashed all over the news – little attention was focused on the proposals within the deal. This lack of attention stems from a society that mostly does not understand the real problems our country is faced with when it comes to transportation infrastructure.

In addition to the pervasive attention deficit, the COVID pandemic did no favors to urban planners everywhere trying to raise awareness to various transportation issues. With the quick shutting down of public transit systems in the name of public health and the sharp increase of remote work, public transportation issues took a back seat in the minds of many Americans. Why worry about transit struggles when I don’t need to use it anymore? This would be a sad, but understandable question that a growing number of Americans were thinking. An advocate for the nonprofit organization Investing in Place said “We have lived with subpar (transit) service for so long that it’s hard for people to rally around improving it” (Nelson, 2019). This highlights the key problem that urban planners and advocates must deal with. Public and multimodal transportation movements lack public attention and energy. However, with how much damage car-centric living does to the environment and livability of urban areas, the time has come for Americans to start thinking, and thinking differently about transportation in the US.

My central argument suggests that society needs to act now, despite the hardship brought on by COVID, to address the past failures of our car-centered transportation system, understand the role transportation plays in our lives, and improve the livability of our cities for all residents.

People need to fully grasp the severe problems our transportation infrastructure faces, from lack of funding to a misunderstanding of the impact it has on society. For too long, people have been left in the dark about the problems of our current transportation system and the massive implications they have on a day-to-day basis. Many people think of transportation in terms of highway expansion or fixing potholes, but the reality is that the way the US has handled transportation spending in the past and present has shaped how our urban areas look, where we live, who we live by, and how quickly we are hurting the planet. If more urban-dwelling Americans were able to understand just how much they are paying - both figuratively and literally - for living in a car-centric environment, there would likely be more of a push for more people-centric change in our urban areas. Again, the number one carbon emitter from households is the use of the automobile. Once we can understand how consequential having so many cars in cities is and how many different variables of life it effects, we can hope to change the narrative around transportation spending from a boring joke no one cares about to a solution to multiple problems if policies are enacted the right way.

To accomplish the task of informing and opening minds to the possibility of a better reality, I will start in chapter 2 by discussing the advantages of a car-reduced city living environment and then move into chapter 3, where I will be comparing modes of transport in the US to other urban areas in the world. Chapter 4 will show how the reliance most Americans have on cars as a means of transport is a conscious policy position that our society has consistently chosen since around the 1950s. Chapter 5 and 6 will address the concerns about the affect COVID and remote work had on public transportation systems but will also touch on the multiple policies that can be put in place to begin reversing the damage done by decades of car-centered policy and move forwards towards a more sustainable future for our urban areas.

Before moving on, it is important to define a few terms that will be at the heart of my arguments. Public transit, and its various issues and potential solutions will be at the core of my argument. However, I will also be touching on multimodal, public transportation options – not including cars – which will include busses, rail, biking, and walking. While public transit, such as metro bus systems, subways, and light rail, play a key role in my argument, as they were most affected by the COVID-19 pandemic, broader public transportation options (mentioned above) will still be important to this thesis because they also contribute to my overall goal of creating more sustainable and livable urban areas. I will also strictly be focusing on American urban areas as opposed to rural areas because my focus is on changing the structure of our urban areas specifically.

Chapter 2

Why Public/Multimodal Transportation is Better Than Cars

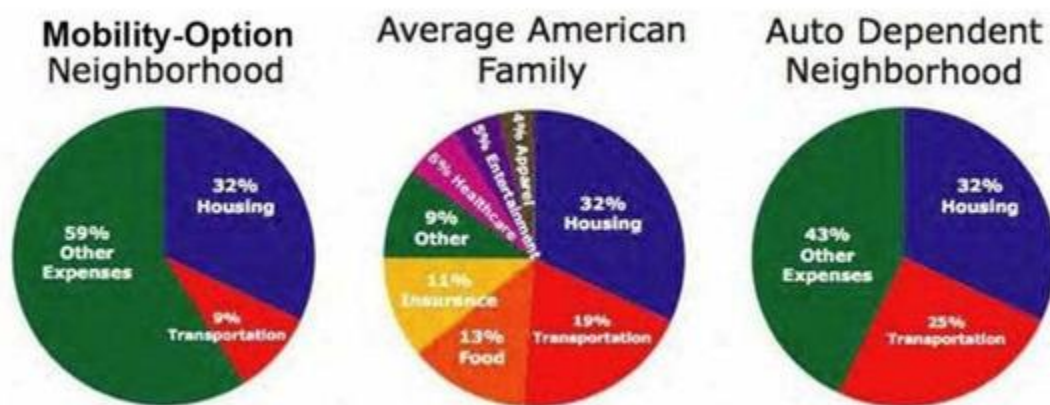
There is a wealth of benefits to be seen from public transportation and other non-car related modes of transportation. Furthermore, the downsides to relying on cars for transportation is real. The Environmental Protection Agency estimates that transportation accounts for approximately 29% of all CO₂ emissions in the US with light-duty vehicles such as cars accounting for over 50% of transportation emissions. Overall, transportation emits more CO₂ than any other sector (EPA, 2019). With climate change already playing a major role in many people's lives around the world, it is essential that the world cuts down on these emissions. From an environmental standpoint, investment in public transportation is essential to the future of not only our cities but our world. According to the American Public Transportation Association (APTA), households could reduce 30% of their overall emissions if they exchanged one of their cars and took public transportation instead (APTA, 2009). Investment in public transportation also has an indirect effect on land use efficiencies. Public transit is most successful in dense cities because it can serve more people without having to cover as much territory (Bertaud et. al, 2004). Instead of the massive sprawl of single-family homes that you find in many American cities such as Los Angeles or Phoenix, transit-successful cities such as New York and Washington DC are denser and more compact, leading to a smaller effect on the environment. However, there are more than just environmental reasons for why public transit needs to be more prioritized in America.

This chapter will touch on the many benefits that can be seen from utilizing multimodal transportation options as opposed to just cars. We will look at various cost assessments to determine the economic impact of car transportation as well as the health benefits that

multimodal transportation options produce. Lastly, the traffic congestion problem will be addressed, and we will see how multimodal options could help with the problems that commuters face on a daily basis.

The general livability of a city depends on the physical and mental wellbeing of the inhabitants of that city. Studies (Ahmed et al., 2019) will look at factors such as equal access to public transit, access to affordable housing, public safety, economic development, etc., to determine the livability (Okulicz-Kozaryn, 2013). Cities that are rated to be more livable tend to have better public transportation systems because more residents can move around the city and cities are less dangerous with less cars driving all over downtown (Bassolas et. al, 2019). That study also showed that homeowners would save as much as \$6,000 every year by replacing their car-usage with transit-usage. Figure 2 shows the proportion of expenditures for three different types of households. Specifically, it is clear that a home in a mobility-option neighborhood is able to spend much more on categories outside of housing and transportation.

Figure 2: Family Transportation Costs (Florida, 2011)



Source: Center for TOD Housing + Transportation Affordability Index, 2004 Bureau of Labor Statistics

A 16 percent reduction in transportation costs (between Mobility- Option and Auto-Dependent neighborhoods) is a significant amount when you consider the initial cost of investment (car), gas, and repairs. While switching from using a car to transit may be slightly more inconvenient and an adjustment to a daily routine, it is more financially beneficial to switch to transit (Florida, 2011). Beyond just a financial difference, livable downtown areas become more vibrant all day long rather than just serving as a “9-5 hub” where it is crowded at the beginning and end of the workday, then becoming empty in the nighttime or in the middle of the day (Mouratidis & Poortinga, 2020). With more mixed-use zoning in dense, transit-centered cities, work, home, and activities are all in close proximity. That leads to people being out and about a lot more consistently throughout the day rather than just when going to and from work (Russell, 2021).

Cities that focus on multimodal transport tend to also have healthier lifestyles. A study measuring the correlation between modes of transport and healthy lifestyles was conducted in Atlanta and unsurprisingly, it found that people who took other means of transport than car had much healthier lifestyles than those who simply relied on cars (Lachapelle, 2009). This is one of the more obvious points as people who ride, bike, and walk around all day will be moving their body more daily. This is an often under-discussed factor – due to the seemingly obvious correlation - despite the fact that obesity is a much bigger problem in the US compared to most other places in the world (Ranking % Obesity by Country, 2016). This is not to suggest that a lack of car-less transit options is the sole reason for this, but it undoubtedly is a factor.

Having reliable public transportation options – meaning a train or bus that runs all day every 30 minutes - would also deal with part of the equity problem in the US. Right now, the people who rely on public transportation to get to and from work are more likely to be lower-

income minorities. While people of color only make up about 37% of the US population, they make up about 60% of those who use public transportation (APTA, 2020). This is a massive difference and shows that improving our multimodal transit infrastructure would really make a difference in these communities. On the flip side, due to the fact that communities of color are more likely to use public transit helps explain why public transit investment has not been a top priority in the US because we have a lengthy history of discriminating against these communities. One study (Henderson, 2006) explains how a white “race-based secession from urban space” has led to less investment failures in what is left of many urban communities. Additionally, despite their heavy reliance on public transit, projects that would help underprivileged communities access job centers, and health care facilities consistently fail to break ground (APTA, 2020).

Lastly, what may be the most obvious benefit to prioritizing transit over cars is the massive traffic problem that many cities have. Most major cities in the US have massive traffic issues during rush hours in large part due to our reliance on cars. In Los Angeles, the congestion is so infamous that the yearly MLS match between the LA Galaxy and LAFC is dubbed “El Trafico,” a play on the famous El Clasico between Real Madrid and Barcelona. One study showed that the amount of traffic congestion can shape the way our cities are designed and where people live (Louf et al, 2014). Traffic has become a somewhat accepted fact of life today, but it does not have to be as bad as it is. Thirty people can travel more efficiently all in one bus as opposed to each having their own cars. Fewer cars on the road would inevitably lead to lower levels of traffic which not only saves people time and money, but also their lives. A study done by Inrix, a global traffic analysis firm, shows that less cars on the road because of COVID led to Americans saving up to \$810 per driver every year (Inrix, 2021).

Figure 3: Driving Costs (Inrix, 2021)

We have also already touched on the environmental benefits of multimodal transit, and reducing traffic is one of the most obvious ways that those benefits can be seen. Beyond just reducing congestion on the roads, prioritizing public transit over cars has a plethora of other benefits that are often overlooked. Recognizing the additional health, economic, and “racial” improvements that would manifest from an emphasis on multimodal transit is important for getting people on board and supporting the switch to multimodal transit. Right now, we see public transit as inconvenient and expensive, which is true in some cases, but it is important to understand that these problems exist because of how we have designed these systems and our poor upkeep and maintenance. It does not have to be this way though as many other cities around the world have found ways to live with cars while also prioritizing multimodal transportation options. A closer comparison between transportation trends in the US and in other places around the globe shows that when implemented correctly, public transit and multimodal transportation can be very successful.

Chapter 3

How US Transit Compares to the Rest of the World

The central question we have to ask ourselves here is simple: Why does public transit work always seem to work better outside of the United States? The answer to that question is a bit more complex than simply identifying the difference and involves a multitude of factors. People outside of the US generally use transit more as seen clearly in Figure 4 below.

Figure 4: Transit Usage by Country (Greendex, 2009)

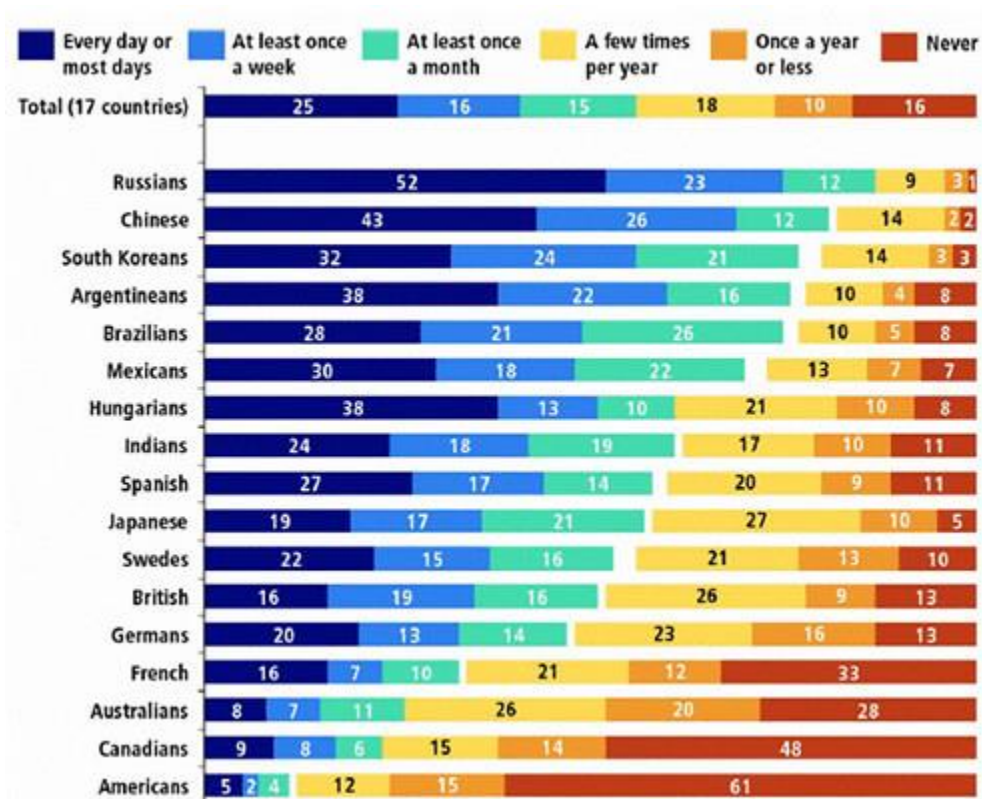
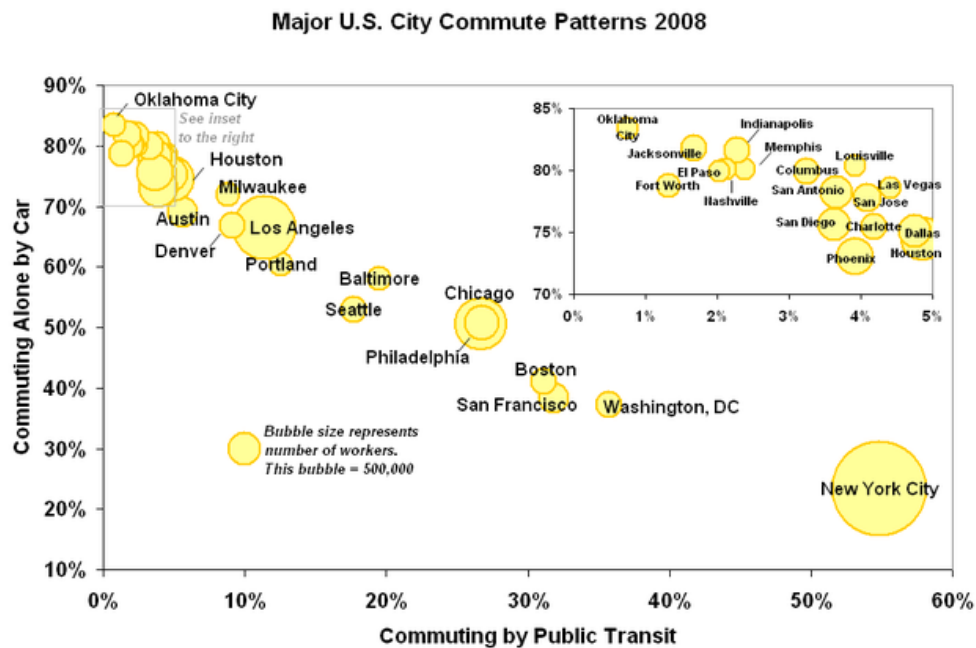


Figure 5 breaks the data down by city in the US and you will find that the vast majority of American cities rely on cars to commute to work.

Figure 5: Commute Patterns (American Community Survey, 2015)



Part of the reason Americans use cars more than European countries is due to higher gas taxes in Europe compared to the US, which points to a potential societal prioritization of public transit over cars (English, 2018a). Diving deeper into the numbers, we can find even more shocking comparisons. A study done by Bloomberg CityLab found that for trips under one mile – meaning trips to grocery stores or to schools - Americans used cars 70% of the time while Europeans used transit 70% of the time (English, 2018a). That same study also found that Americans on average drive 3.5 times the amount that Europeans do in terms of time spent on the road. Part of this could be explained by the fact that the US is a larger country in general, so naturally, Americans would be driving more, but this is a significantly large difference that points to very fundamental differences in how we have designed our cities. Most American cities have been designed in a way that essentially requires the ownership of a car. For many people, there is simply no other way to get around based on where they live. Beyond just looking at

public transit usage, it would come as no surprise that Americans also rank very low when it comes to multimodal forms of transport like walking and biking (Buehler et. al, 2012).

Clearly the fact that Americans rely so much on their cars is not something that was inevitable with the invention of the car. Plenty of other countries all over the globe have been able to maintain high rates of multimodal transit usage (Buehler et. al, 2012). It might seem easy to assume that Americans simply like getting around by car, but that is not necessarily true. YouGov conducted a poll in 2020 which found that 77% of Americans want to have more access to improved transit options (Mangan, 2020). So, what are these fundamental differences that cause this massive difference in transit usage between the US and other places in the world?

One part of the equation is mostly out of the United States' control. Most other cities in the world were founded much earlier than any city in the US which means they were around before cars were invented and massively reduced the time it would take to get around. This means that European cities were already more densely constructed to reduce the time it would take people to get around without cars. Even today, land use regulations encourage density in Europe whereas it encourages sprawl in the US. In places like Germany, residential zoning is typically implemented at the block level and can still include offices, shops, etc. However, in the US, many cities implement large, sprawling single family residential zones that prohibit anything other than houses to be built (English, 2018a). Also, many cities in Europe implement parking maximums which limits the space available for cars which reduces the sprawling parking lots that are seen throughout American cities (Garrick et. al, 2012).

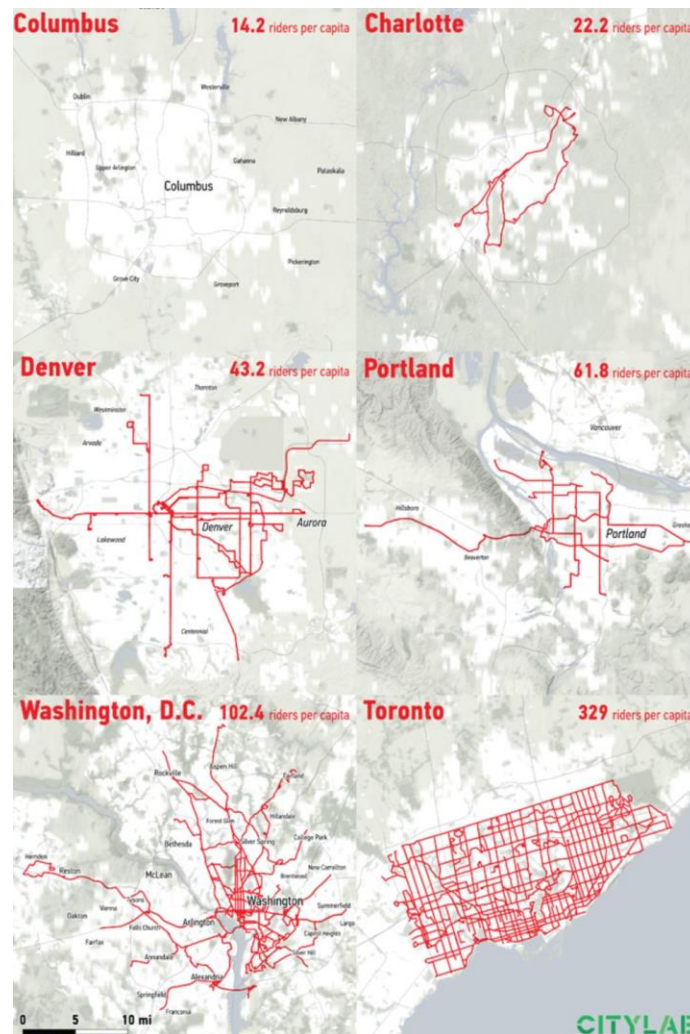
Before the invention of the car, American cities and European cities had very similar rates of transit usage as streetcars were wildly popular in American cities. However, once cars

became invented, the US public transit companies began to slash services to save money and stay competitive which ended up backfiring as public transit became less reliable with routes being cut and others running less frequently. However, Europeans continued to fund public transit projects as well as integrate the car into the transportation system (English, 2018b). A good example of this would be the popularity and effectiveness of commuter rail in Paris. In one year, the RER system, Paris' commuter rail system, handles more passengers than all of commuter rail in the US combined (Levy, 2017). While this may seem surprising, it is because while the US tends to focus on rush hour travel, the RER sustains the frequency of its trips throughout the whole day allowing far more people to rely on it for all sorts of trips besides just going to and from work. Outside of rush hour times, most commuter rail networks in the US only run trains only once an hour which is not frequent enough for most Americans (Levy, 2017).

Another major difference between the strategies employed by the US and Europe is that after the introduction of highway systems, the US simply stopped investing in federal or state level public transit projects, while European cities were able to focus on both. For example, Germany has the autobahn which famously doesn't have any federal speed limit. However, other cities outside the US also invested in transit. With the popularity of car transit rising, the US mostly stopped investing in large public rail projects between the 1940s and 1960s as the Interstate Highway system was being built in favor of cutting services and costs to try to stay afloat as Americans flocked to their new cars. Again, other places in the world still invested in large car infrastructure projects, but they were also able to continue the success of public transit by continuing to fund those projects. For example, China has constructed over 23,500 miles of rail lines just since 2008 (Jones, 2021). The policy of cutting back service for American public transit agencies had lasting effects that are still felt today. Research shows that for transit routes

to be considered reliable by commuters, they must operate at least every 30 minutes, all day to midnight, seven days a week (English, 2018b). Due to historical (and present) cutbacks in frequency in service, many US cities barely have any reliable transit routes – meaning routes that operate at least every 30 minutes all day long - as seen in Figure 6.

Figure 6: Reliable Transit Access by City (English, 2018b)



The difference between Toronto and the rest of the American cities is striking, especially considering that Washington, D.C. has the second highest daily riders per capita in the US behind New York City (APTA, 2020).

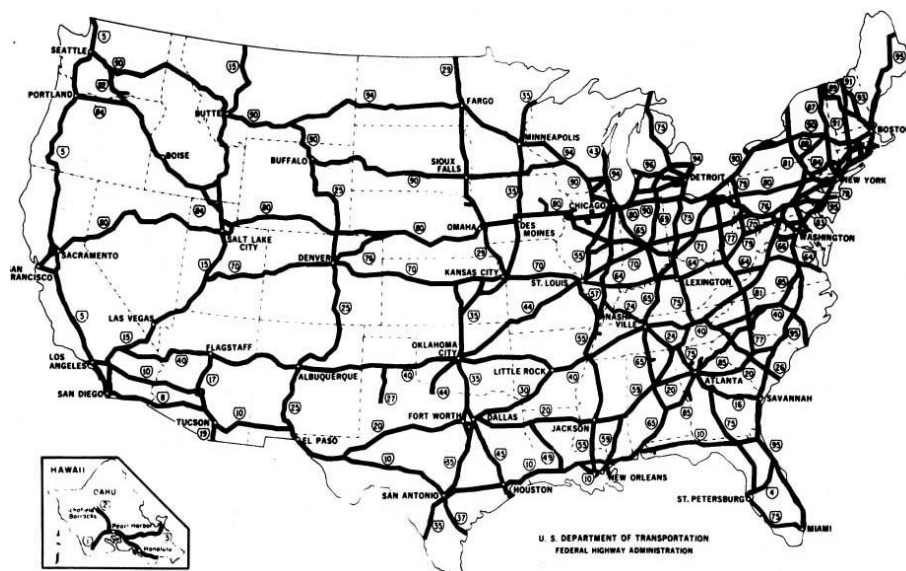
So, while we have established transit success in other places in the world compared to the US, we need to dive deeper into the different historical policy decisions that led to the failing public transit systems we see in the US today. While a simple lack of funding to improve frequency, and efficiency is certainly part of the equation, most of the policy decisions and effects are more complicated.

Chapter 4

The Anti-Transit History of the US

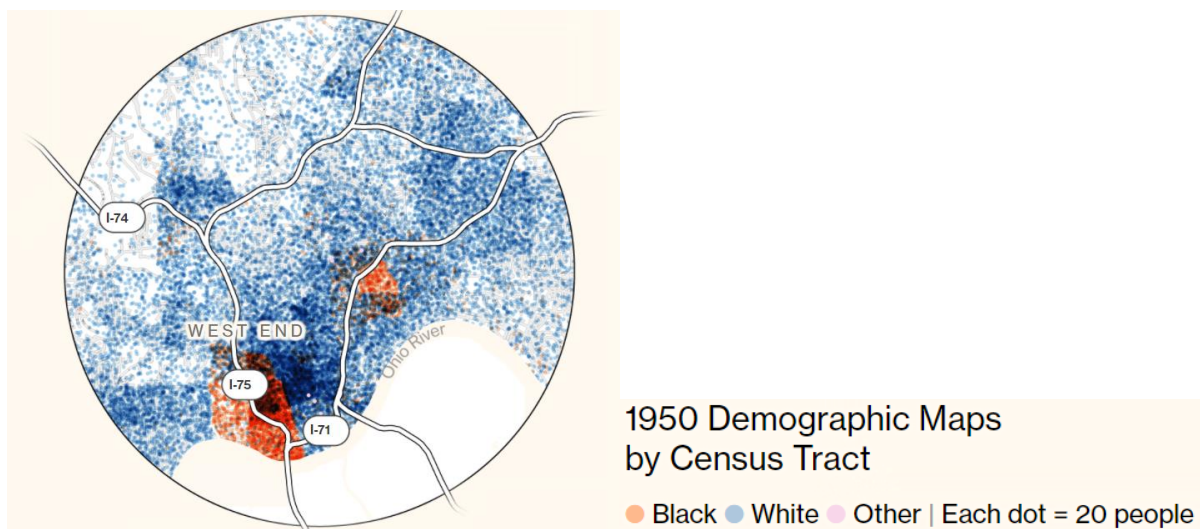
One of the most consequential policies surrounding the design of cities was the Federal Aid Highway Act of 1956. This policy stated that Congress would pay for over 90% of the construction of major auto routes across the country to improve the efficiency of the movement of goods and people across the country. Championed by President Eisenhower after he was impressed with the efficiency of the German autobahns, one of his stated reasons for creating this highway system beyond the simple movement of goods across the country was to allow for swift military movements and rapid evacuations in the event of a nuclear attack (Federal Aid Highway Act, 1956). Figure 7 shows the original design of the highway system, most of which is still used today.

Figure 7: Interstate Highway System (DOT)



It is important to note that while creation of this system was not inherently damaging to the livability of cities and did greatly improve the movement of supplies and goods across the country, many of these highways cut directly through urban areas as opposed to going around them which really had a massive effect on the livability of cities. Even more importantly, these highways did not just randomly cut through urban areas, oftentimes they were purposefully constructed through primarily black neighborhoods forcing them to either relocate or deal with harsh new living conditions (Dottle et. al, 2021). By overlaying demographic information onto interstate highway maps, Figure 8 the purposeful attempts at breaking up black neighborhoods.

Figure 8: Cincinnati Demographic Map (Dottle et. al, 2021)



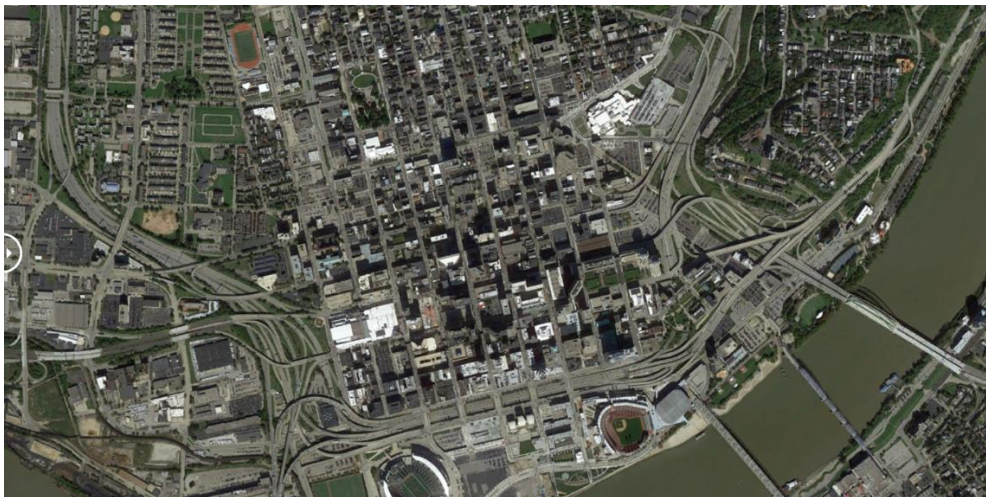
With blue dots representing white areas and red dots representing black areas, we can see how I-75 bulldozed through the West End of Cincinnati and dramatically affected the living space of almost 25,000 black residents. This had various detrimental effects to the black community such as the lowering of land value and property value, and overall quality of life as they were surrounded by more noise and air pollution. Studies show that areas immediately

surrounding highways see higher rates of health problems such as asthma (Maantay, 2007). Just by looking at satellite pictures of affected areas, it is clear how drastic the changes really are to these communities. Figure 9 shows how the interstate completely uprooted a whole downtown, primarily black community between 1955 and in 2013.

Figure 9: Downtown Cincinnati in 1955 (Dottle et. al, 2021)



Figure 10: Downtown Cincinnati in 2013 (Dottle et. al, 2021)



In order to change our cities from car-centric environments to more people-centered and livable, it is important to address the fact that Black people, along with Hispanics and other minority groups, have been unequally affected by historic policies that have prioritized car transportation. As a society, we have often prioritized White people's spaces with Black people having to pay the price. Part of the solution to creating healthier, livable, and equal cities must revolve around reinvesting in these communities and understanding the affects that past policies have had.

Beyond just the effect on black communities, the interstate highway system popularized the ever-controversial car-dependent suburb. Highways allowed people greater access to places that used to be out of reach allowing for the urban sprawl that plagues many of America's cities. While being able to travel greater distances in shorter amounts of time may sound like a positive on the surface, it is not as good for the environment, livability, and the inequity problems within cities. The movement of people from city centers to the suburbs meant that to get anywhere, you essentially need to have a car. After World War II, Americans returning home wanted to buy cheap homes away from the ever-diversifying inner cities caused by the Black migration from the south, which led to an exodus from city centers to suburbs often referred to as "White Flight" (Dottle et. al, 2021). Interestingly, between 1950 and 1980, central city populations in the US declined by about 17% despite larger metropolitan areas growing by about 72% leaving downtown areas filled with abandoned office buildings and slums (Baum-Snow 2007). Zoning policies restricting areas to single-family residences and the relative cheapness of buying a home at the time were some of the largest factors for the creation of the suburbs. However, more cynically, part of the attraction of the suburb was the lack of black people in the area. This was

because the Federal Housing Administration (FHA) refused to insure mortgages in areas with heavy Black populations while at the same time subsidizing housing creation in the suburbs under the stipulation that the homes would not be sold to Black people (Rothstein, 2017). With many jobs now also moving to the suburbs, the disinvestment in the inner urban areas had a detrimental effect on city transit agencies. As population in city centers declined, transit agencies were struggling to stay afloat due to their shrinking ridership population, but they did not attempt to reach the growing suburban areas with their service (English, 2018b). Instead, agencies continued to cut back on service in an attempt to save money which only led to less people relying on transit. While the government funded the interstate highway program in a way that created demand for car transportation, they failed to adopt the same philosophy when it came to transit as there were few improvements made to frequency and efficiency of service.

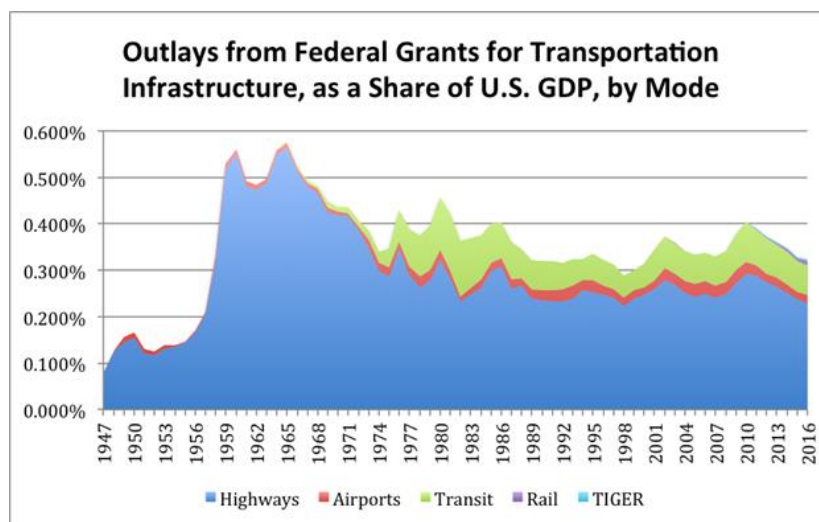
Government policy further hurt transit when it focused its transit funding on big capital projects as opposed to improving frequency. Service is what drives demand and ultimately increases profits for transit agencies, and without reliable service, there is no reason for people to use transit despite new projects. As part of President Johnson's Great Society, the government passed the Urban Mass Transportation Act of 1964 which created massive rail systems in new cities such as Washington D.C (English, 2018b). These new systems penetrated the suburbs allowing greater access to more people. While big projects like these sound like a new beginning for transit in the US, transit's ultimate downfall was the lack of bus routes connecting different population areas. Reaching the new population growth sectors in the suburbs was important, but the low-density model of American suburbs meant that still, few people lived close enough to transit centers to effectively increase ridership. Furthermore, with different public and private agencies controlling different aspects of the urban transit systems, commuters were faced with

double fares and inefficient routes just to get from point A to point B. Yet again, the government's lack of efficient investment at the State and Federal level in improving our nation's public transit infrastructure led to Americans continuing to rely on cars as it remained the most efficient form of transport.

Furthermore, when faced with problems that arose from our car-centric environment such as air pollution and traffic deaths, the Federal Government has focused on technological changes that allow Americans to keep driving as much as they were. These would be changes such as seatbelt requirements, airbags, and even electric cars (English, 2018b). While these changes were successful in reducing car deaths, the government failed to enact policies that would change people's behavior when it comes to deciding on a mode of transport. They continued to subsidize driving in a way that encouraged Americans to drive given that it remained the cheaper, more efficient option compared to transit. A better response to the problems posed by a car-centric environment, would have been to incentivize other forms of transportation that are less dangerous and problematic to the environment and livability of our urban areas.

According to the Bureau of Transportation Statistics (BTS), the US government spends about \$384 billion on transportation if you combine both Federal and State spending (BTS, 2019). While this may sound like a lot, taken as a percentage of the overall budget of almost \$6.6 trillion in FY 2019, this comes out to about 5.8% of the overall budget. Within the \$384 billion that is being spent on transportation, only about 20% is actually being spent on public transit, with the majority of the spending geared towards car-centric needs such as roads, highways, and bridges representing over 60% of the Transportation budget. Figure 11 breaks down federal transportation spending by mode of transit.

Figure 11: Government Infrastructure Spending



You can see the big spike in highway spending in the 1950s which correlates with the passage of the Interstate Highway Act. Since the efforts of President Johnson's Great Society programs that attempted to improve public transit and increased funding at the State and Local level, we have started to increase our spending on transit from about \$10 billion in 1950 to almost \$80 billion today, but it clearly still pales in comparison in how much we spend on car infrastructure (BTS, 2019). So, while our transportation budget represents about 5.8% of our national budget, the money being spent specifically on transit is only a fraction of that percentage. While we've covered many different policy failures by the United States government, it mostly comes down to simply our lack of investment in modes of transportation other than cars. When it comes to public transit, Federal and Local governments as well as public transit agencies have consistently opted for service cuts to try to save money as opposed to investing to make riding transit more attractive to the general population. Going into the year 2020, more than 85% of Americans were using cars as their primary mode of and while transit

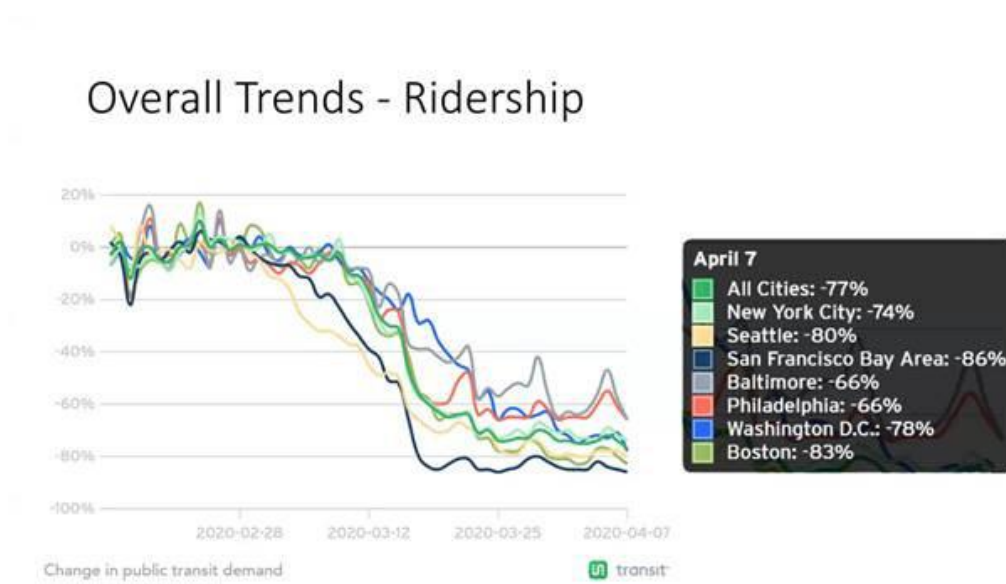
ridership was beginning to improve, public transit agencies were hit incredibly hard by the COVID pandemic.

Chapter 5

COVID and Remote Work

As we all know, life came to a screeching halt seemingly all of a sudden during that middle week of March 2020. Sports seasons were canceled. Schools were closed. Offices were closed. Suddenly, we were literally being told to stay in our homes and not go out unless you absolutely had to. Of all the utilities that were shut down or limited during the early days of Covid, none took the brunt of the hit more than public transit agencies. Across the US, public transit saw huge decreases in ridership which averaged at about 79% of typical ridership levels (Qi et. al, 2021). Even some of the most successful public transit networks based on ridership like those in New York City, Chicago, or Washington D.C. saw huge ridership losses. Figure 12 shows how transit ridership plunged in major cities around the country.

Figure 12: Drop in Ridership Trends (Transit, 2020)

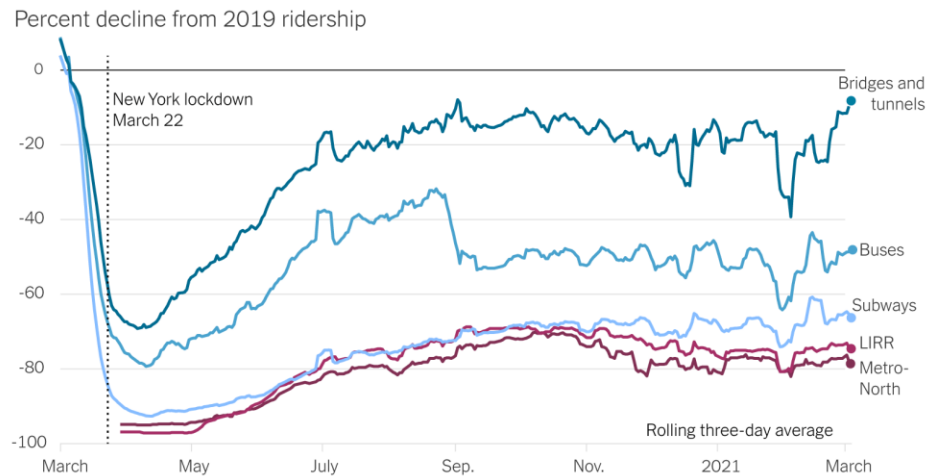


While this was seen as a public health preventative measure that these agencies were even encouraging at the time, the ridership recovery has been much slower for most public transit agencies in the US compared to car trips. People no longer had to go into the office for work, so there was really no need to use public transit because most transit networks outside of New York City, Chicago, and D.C. were designed to get people from outside the city to inside the city where their jobs were and then back home outside of the city. The pandemic shaped people's lives in a way that everyone has begun to question if they really want to go back to what was "normal" to them before the pandemic. While this type of self-reflection should be encouraged as it can lead to improvements in people's lifestyles, it could be very damaging to public transit agencies. With public health becoming a greater concern for many, people no longer wanted to use public transit as it is often very crowded, especially during heavy commute times. Around the world, apart from a few exceptions such as in Singapore which has almost recovered its ridership numbers from before the pandemic hit, most urban public transit networks are struggling to get riders back on their busses, subways, and railways (Sengupta et. al, 2021). People have become accustomed to their new way of life that may not include public transit anymore.

Besides the public health aspect of how the COVID-19 pandemic affected public transit, the ever-growing possibility of remote work has a massive effect as well. According to Pew Research, about 7% of working adults worked all or mostly from home before the start of the pandemic, however, that number had risen to a sky high 71% during the Fall 2020 months of the pandemic (Parker et. al, 2021). While this number is not expected to stay this high as we begin to

come out of the pandemic and return to offices, Global Workplace Analytics estimates that the number of permanent work-from-home adults will rise significantly. Current estimates show that the number could be as high as 30 to 35% representing almost 36.2 million workers (Global Workplace Analytics, 2021). For transit agencies that rely on commuting adults, this would be massively problematic as the demand for transit services would go down. Evidence for this is shown in the slow recovery of ridership data across many transit agencies as we've gone through the pandemic (Sengupta et. al, 2021). Figure 13 shows how while New York City has made some recovery in transit ridership, it is very slow and not nearly recovering as fast as car travel has (NYT, 2021).

Figure 13: NYC Ridership Recovery (NYT, 2021)

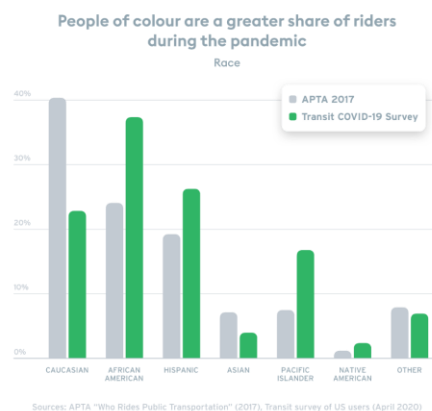


You can see that bus and subway ridership is still more than 40% below normal levels before the pandemic. This correlates with people continuing to work from home which shows the massive negative affect this would have for transit agencies. Admittedly, predicting how much remote work will remain permanent after the pandemic is over is difficult as we are still in the midst of it all, but looking at how popular remote work is can give us clues.

As people have gotten used to their remote work routines, many people have found that they enjoy the freedom it allows as you no longer have to deal with a commute. That same Pew Research study found that over 77% of people would prefer to either continue working from home permanently or at least part time (Parker et. al, 2021). That is a shockingly high number and many large companies have already taken that into account. Companies like Google, Facebook, and Twitter have all given some of their employee's permanent work from home options or some variation of that format (Kelly et. al, 2021). People see this as a positive as they can start to prioritize important matters such as mental health and family. However, the possible future of a remote work environment is not all positive as there would arise some real inequalities between remote workers and workers that still must work in person.

The jobs that are going remote are not perfectly representative of the whole population. Studies show that jobs in technical services, information, and finance are more likely to be done remotely (Bartik et. al, 2020). These jobs are overwhelmingly held by White and Asian people with college degrees with 37% being Asian, 30% being White, 20% being Black, and 16% being Latino. This means that people relying on transit during the pandemic are more likely to be minorities. Figure 14 shows how much the demographics of transit ridership have changed since the beginning of the pandemic.

Figure 14: Demographics of Transit Ridership (APTA, 2020)



Lower income people are also more likely to have essential jobs that are not able to go remote because they help our society to run smoothly. Because they are lower income, they are less likely to have alternative options to transit to commute to their jobs, so they still must use it. However, as transit agencies lose money, they have begun to cut back service which makes it much harder for these people to reliably get to where they need to go. White collar workers who used to ride transit to work in central business districts are not as affected by these cutbacks because they often have other means of transport.

So, while the move to remote work is desirable for a significant portion of the population, it is important to understand the various inequalities that would arise out of this as transit agencies struggle to make money and continue operating. Focus on these inequalities will be key in the discussion of how to move forward with our transit agencies, so that they can best serve as many people as possible. While there are downsides to how remote work is affecting transit ridership overall, a closer analysis of public transit during the time of COVID can provide some clues to how we can successfully implement transit going forward.

Chapter 6

Remote Work and Public Transit

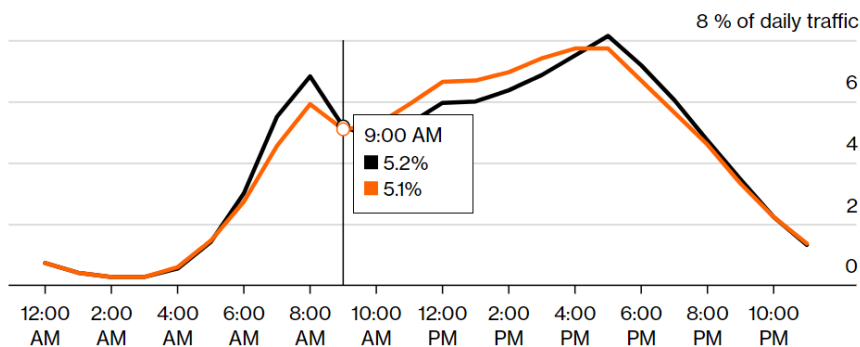
We have well described the challenges that the possibility of a remote work future would mean for ridership numbers for transit. With some estimates not expecting ridership numbers to improve until at least four years if at all, transit agencies are going to be faced with a lengthy period with revenue loss (Quiroz-Gutierrez, 2021). According to the American Public Transportation Association (APTA), despite the multiple rounds of emergency aid from the Federal Government, transit agencies are expected to see a revenue shortfall of almost \$39.3 billion by the end of the 2023 calendar year (APTA, 2021). Throughout American history, when transit agencies have faced budget problems, the go to response has been to cut back on service to save money. However, studies have continued to show that cutting back service only further pushes Americans away from using transit as it becomes no longer reliable (Nguyen, 2020). Recent trends in traffic data point to possibilities for improvement in day-long service among transportation systems. Before COVID, there were two distinct rush hour peaks throughout the day: one in the morning and one in the evening. Analysis by INRIX, a traffic study group, showed that during the pandemic, traffic patterns were a bit smoother throughout the day as opposed to two distinct peaks in the morning and in the night (Inrix, 2021). Below are the traffic patterns in New York City and Los Angeles in 2019 and 2021 throughout the day.

Figure 15: NYC Traffic Patterns (Russell, 2021)

NYC Rush Hour Before and After Covid

The number of daily car trips at midday in July exceeded pre-pandemic rate.

2019 2021



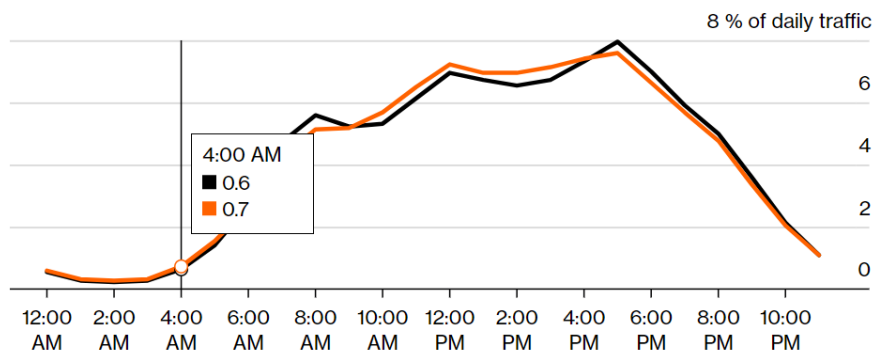
Source: INRIX

Figure 16: LA Traffic Patterns (Russell, 2021)

L.A. Traffic Patterns Before and After Covid

The morning and evening spikes in daily July car trips smoothed out a bit between 2019 and 2021.

2019 2021



Source: INRIX

While these traffic patterns may not look like a big difference, when you consider the sheer number of people on the roads in these two cities on a daily basis, even a small change can make a big difference. Interstate 405 is one of the busiest expressways in the country and sees about 500,000 commuters each day (Smith, 2021). Studies show that transit agencies that were tailored toward the white-collar worker who commutes in the morning and evening but not during the day were hurt more by the pandemic than agencies who provided more consistent

service throughout the day (Russell, 2021). This provides a clue into what would be successful for transit agencies going forward. Providing service throughout the day by lightly decreasing service during peak hours and increasing service at other times rather than just two large peaks of service would be more successful.

Besides the rise of remote work decreasing the number of people that can be served by transit agencies, another concern that transit agencies have is the possibility of people leaving urban areas altogether. Ever since the pandemic began, there has been a theory that many people would leave big, crowded cities that were hit hard early on by the pandemic like New York City, Los Angeles, and San Francisco. While there has been much talk of people leaving California and New York to places like Florida and Texas, data from the U.S Census Bureau shows that 84% of movers during the pandemic stayed in the same metro area, and if they did move to a different area, it was likely in a larger urban center (Patino et. al, 2021). Figures 17 and 18 show were people moved to from San Francisco and New York City, respectfully.

Figure 17: San Francisco Migration (Patino et. al, 2021)

Where San Francisco Residents Moved

A look at moves outward from one Bay Area city center provides a snapshot of relocations to other parts of the state and beyond

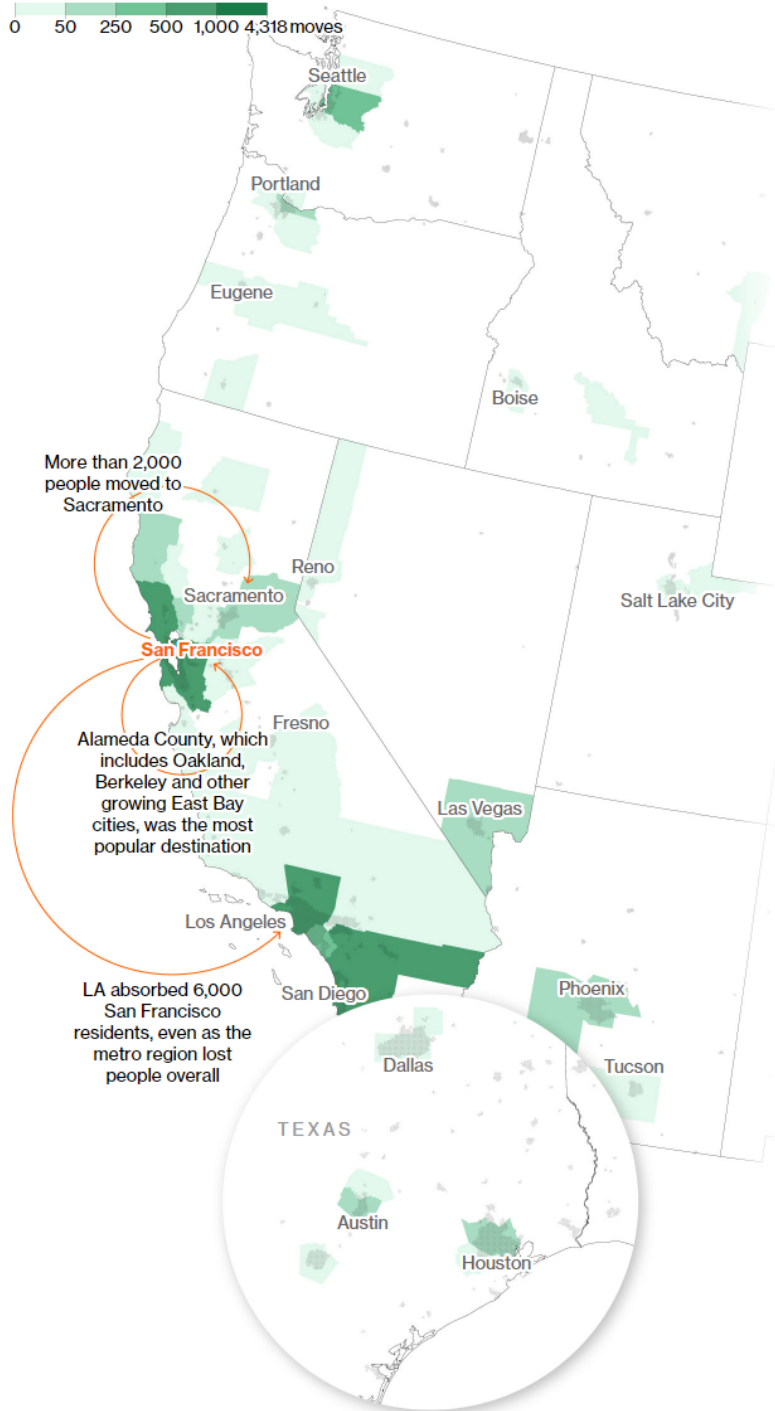
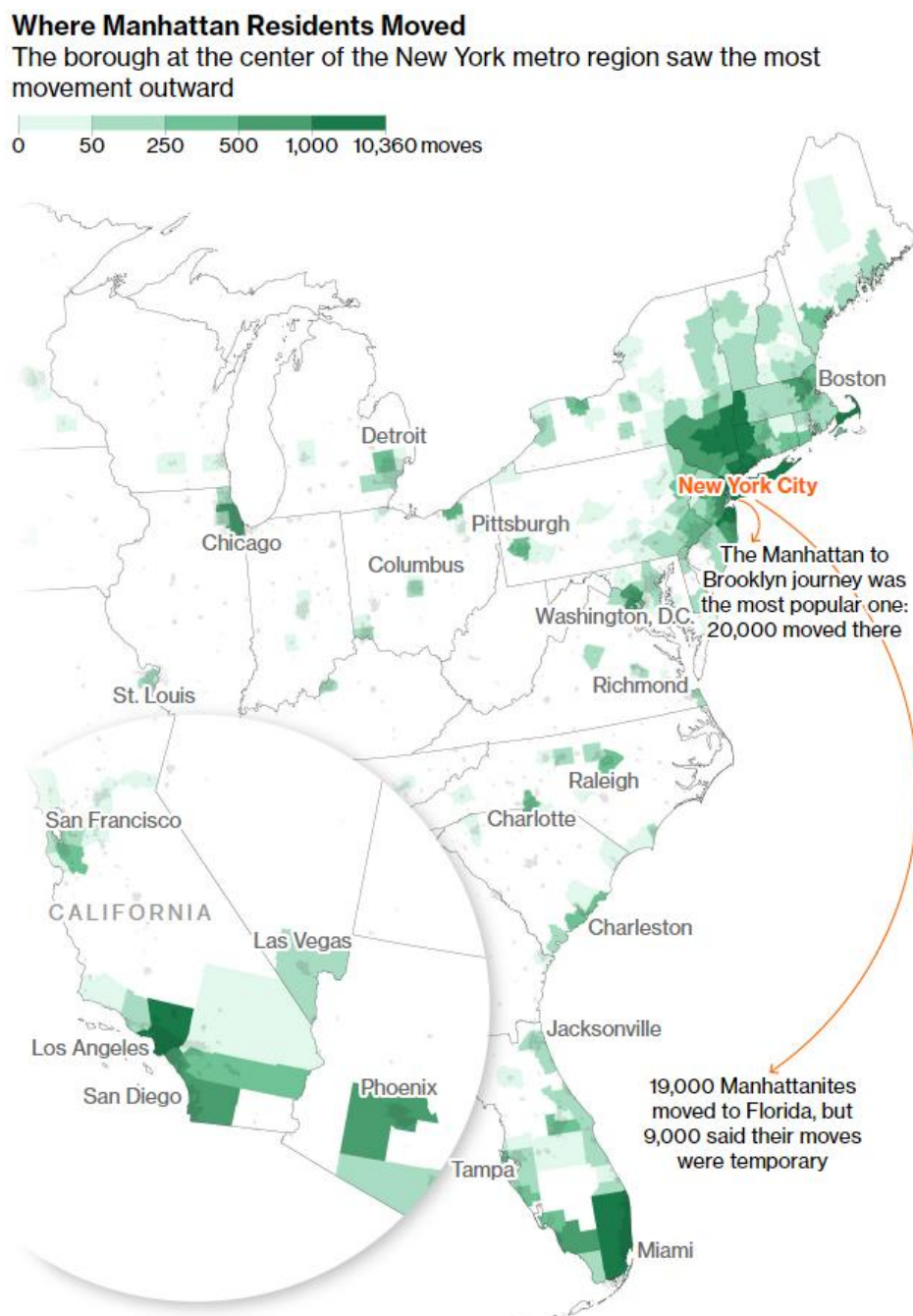


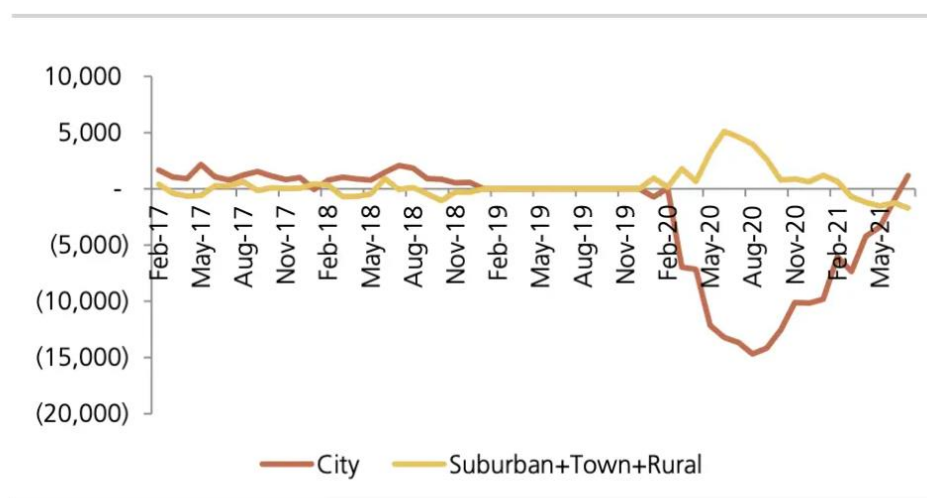
Figure 18: NYC Migration (Patino et. al, 2021)



As you can see, most people moving from these cities were either moving to just outside the city, but still in the metro area, or were leaving the state for other big cities. This means that despite the narrative of an urban exodus, transit agencies should not be concerned about a

sustained drop in urban populations. Now, it is true that many people are leaving city centers and moving out to the suburbs, but now there is even some evidence that people are already returning to the cities. Data from the UBS Evidence Lab shows that migration into New York City has now passed out migration into the suburbs as 2021 comes to a close (Winck, 2021).

Figure 19: NYC Population Recovery (Winck, 2021)



Source : UBS Evidence Lab, ([Access Dataset](#))

All of this is to say that the data is currently pointing to the fact that city populations will recover despite the narrative that everyone is leaving cities. This is positive news for transit agencies located in these cities that need the populations to remain in business. However, just because city populations will recover does not mean that people will necessarily revert back to their pre-pandemic commute strategies. The current shake up in remote work's effect on transit ridership and overall transportation trends actually provides transit agencies an opportunity to rethink how they prioritize their goals.

Historically, transit agencies have focused on large capital projects that may decrease the time it takes to get from point A to point B, but they sometimes fail to consider important

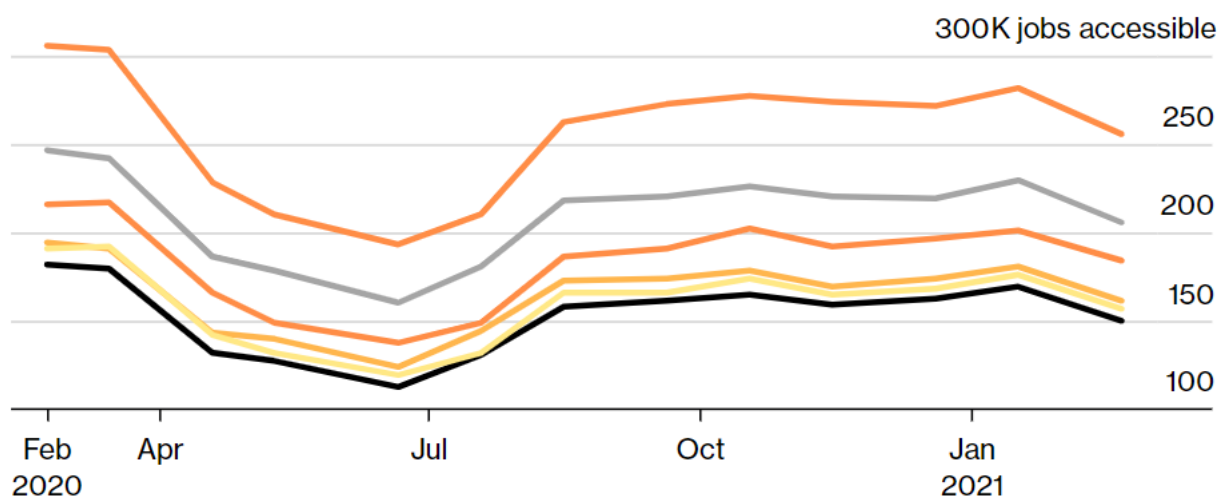
concepts such as access, affordability, equality, and the environment. The largest transit infrastructure projects will be completely ineffective if they do not provide consistent, reliable service to a wide range of people. This is a very important concept because as service cuts have been made around the country, this has affected the number and types of jobs that can be accessed by different groups of people. As is true in many areas of our society, these cuts have hurt minorities first. The graph below shows which demographics have the most access to jobs via transit in 45 minutes in Washington D.C.

Figure 20: Job Access in D.C. by Race (Bliss, 2021)

In D.C., Big Racial Gaps In Job Access

Number of jobs accessible by transit during peak weekday mornings

Single mother Asian Black Hispanic In poverty White



Source: TransitCenter Equity Dashboard
 Note: Jobs accessible in 45 minutes.

By improving reliable service for transportation agencies, a dramatic impact can be made on people’s lives in cities. In the next part, we will discuss various strategies that transit agencies and city governments can implement to improve all aspect of our city societies.

Chapter 7

Transit Specific Changes

Like many problems in our world, we have found that a lack of proper financial investment in public transit infrastructure and agencies is a major barrier to moving towards more livable, public-transit friendly cities. Earlier, we demonstrated how the United States government only spent about 5.5% of their national budget on public transportation with most of that being spent on car-centric needs such as roads and highways (CBO, 2018). With public transportation funding only representing a fraction of that amount, it is clear that we need to spend more, but also smarter, when it comes to transportation. Since car-centric transportation has proved to be very problematic for the livability of our cities in numerous ways, it is time that our government started changing how they spend their transportation money.

In late 2021, Congress passed the Infrastructure Investment and Jobs Act, which was the largest infrastructure bill the US had passed in a long time. While this is overall a good step in the right direction as more public spending will inevitably allow for improvements across many sectors, it was disappointing to see that the plurality of spending in the transportation section of the bill was for roads and highways.

Figure 21: Infrastructure Spending Bill Breakdown (Tomer et. al, 2021)

Figure 1. Topline above-baseline spending in IIJA (billions of USD)

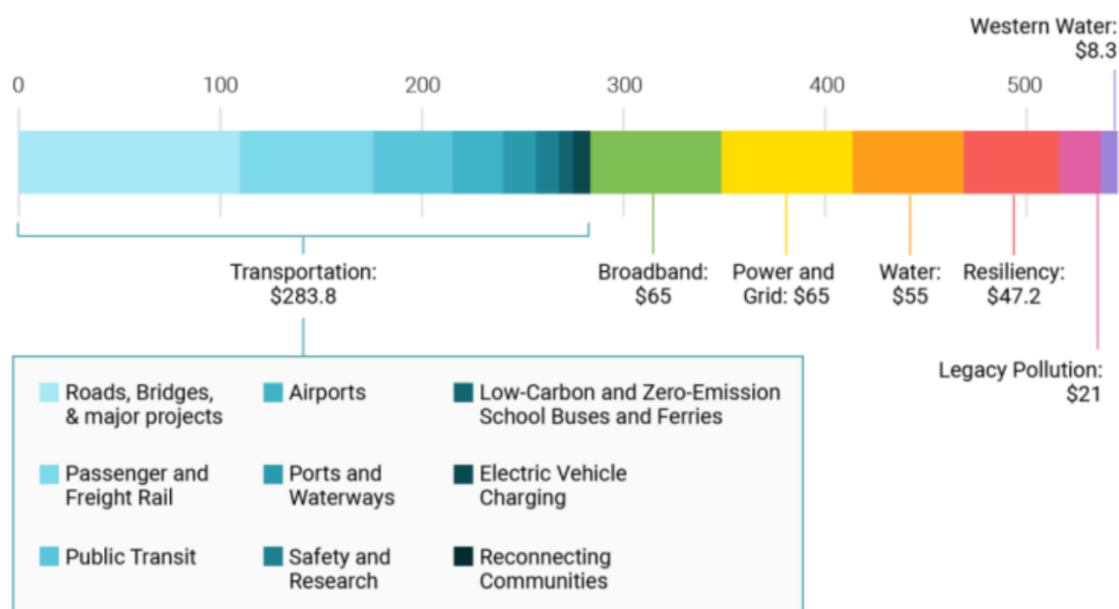
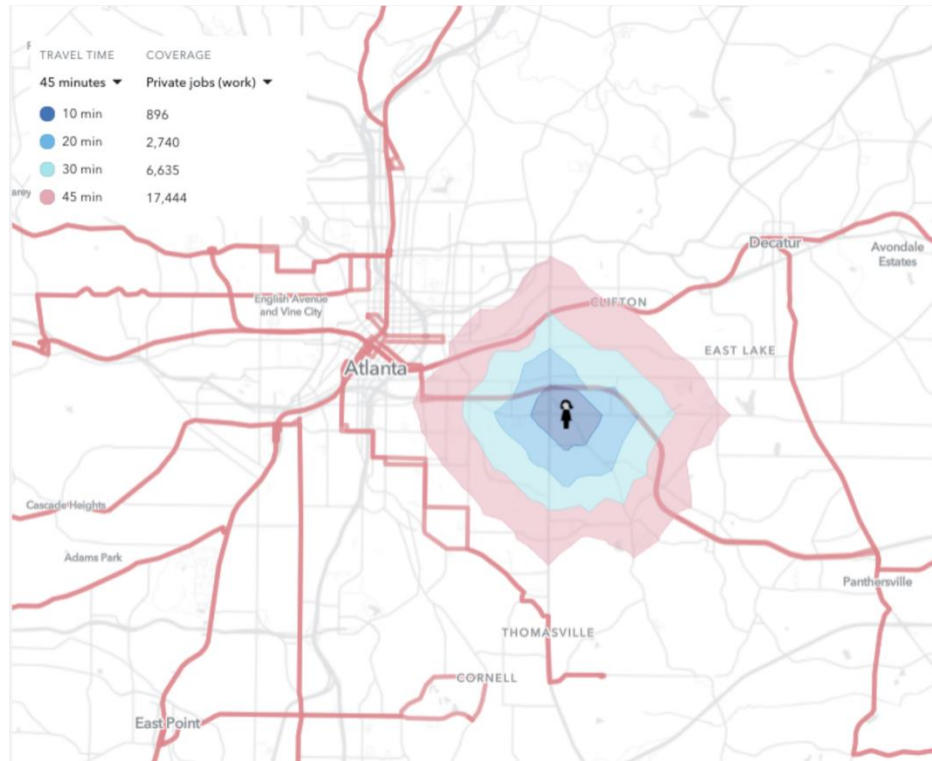


Figure 21 shows that public transit represents the third largest section within transportation, sitting at around \$50 billion in additional spending. This will be a little bit helpful, but not nearly enough for transit agencies that are still seeing ridership levels over 40% less than the pre-pandemic levels. This isn't to say that the spending isn't good at all. By allocating additional money for public transit, agencies will be able to catch up on maintenance projects that could cut down on delays (Nguyen, 2020). An easy start to a solution to our failed public transportation system would be to reprioritize our transportation spending. Right now, experts are looking at American commute numbers and noting that about 85% of Americans drive their cars to work. Therefore, it would seem logical to direct the majority of our public spending to the car mode of transport. But, as we have talked about throughout, the way to increase ridership for public transit is to make it more convenient and reliable. This would not be achieved by service cuts taking place during the pandemic. By investing in public transit more than even the

Infrastructure Investment and Jobs Act does, transit agencies will create the ridership demand that is lacking dramatically in urban areas across the country. A study done by the Urban Institute shows that if the government were to spend an extra \$16.5 billion on public transit each year, the US could almost double its transit capacity (Freemark, 2021). While admittedly a significant amount, this would still be \$30 billion less than we spend on car infrastructure every year. To put the number in greater perspective, the US military spends about \$20 billion a year just on air conditioning (NPR, 2011). If the United States could simply start prioritizing spending their money policies that help American's daily lives, public transit would be much better off. Again, the reason many people aren't returning to public transit options isn't necessarily just due to public health concerns, it is because most Americans are forced to rely on cars because many transit options are inaccessible or inefficient.

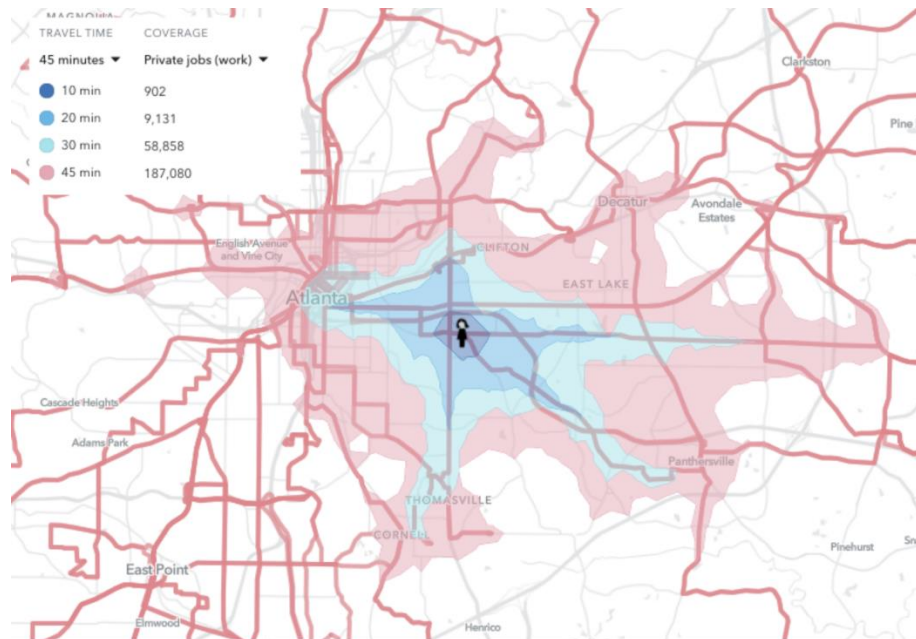
Increasing frequency and service for public transit methods needs to be a number one priority for transit agencies moving forward. Studies are clear that this is one of the main problems facing United States public transportation systems right now. There are huge benefits from prioritizing spending on increasing service including the access of jobs. We have shown that many American transit agencies don't have many bus lines that run reliably and frequently throughout the day. This can hurt people that need to go certain areas for a job. A report done by TransitCenter, a transit activist group, showed that a 40% increase in service could dramatically improve access for city residents to get to jobs (Transit Center, 2021). By using Geographic Information Systems, the agency was able to visualize just how important increasing frequency and service can be. Figure 22 shows a person's access to jobs by reliable transit route before the 40% increase.

Figure 22: Atlanta Job Access Before 40% Increase (Transit Center, 2021)



And then Figure 23 shows after the 40% increase:

Figure 23: Atlanta Job Access After 40% Increase (Transit Center, 2021)



To summarize, the hypothetical person in Figures 22 and 23 went from being able to access just under 7,000 jobs by transit to almost 60,000 with a 40% increase of service. This shows just how big of an impact increasing transit service can have on a person's everyday life. Allowing people to access that many more jobs would be more than enough incentive to begin to ride transit. With a federal government that spends at least equal money between car infrastructure and public transit infrastructure and with transit agencies focused on improving access and frequency of service, the US public transit recovery would be off to a good start. Along with financial and transit specific adjustments that could be made, there are a few city-design changes that could be implemented that would also increase the livability of our urban areas.

Chapter 8

City Design Changes

The big city design change that would help a lot is something called Transit Oriented Developments (TODs). Essentially, these are communities designed around transit stations with a goal of increasing density (minimizing distance to station) and improving livability. While we have touched on the problems of single-family zoning in the US and how that has made cities sprawl in a way that is bad for the environment, these TODs would have mixed use zoning with dense, commercial and residential buildings allowing at most a 15-minute walk to a transit station from any part of the community. The benefits of these communities are significant as they would essentially end the need for cars because your school, job, house, doctor, park would all be within walking or transit distance. A portion of the new residential developments would be established affordable housing in order to help with the inequality problem we see in public transit options. The lack of sprawl would mean a massive reduction of carbon emissions which would lead to a higher quality of life and healthier lifestyle for everyone in the community. A rendering of a planned TOD in China shows just how architecturally beautiful and how people-centric these communities are with ample space for parks.

Figure 24: Example of Transit Oriented Development



Transit Oriented Developments have been implemented in a variety of places across the world with positive, conclusive results. One study compared TOD communities to regular communities from 1970 to 2000 and found that regular communities' share of transit usage dropped from 19% to 7%, while TOD communities' share of transit usage went from 15% to 17% (Renne, 2005). While this isn't as significant of a jump in terms of transit ridership, this is mostly because people are also walking and biking more which still helps improve urban areas. Assuming these trends continued to the present day, this would be a major difference between the two different communities in terms of transit ridership as well as multimodal transportation usage. Beyond just transit usage, regular communities had two-car households at double the rate of TOD communities. The benefits of TODs are clear and have been well studied making it one of the most effective options when it comes to prioritizing transit and making cities more people friendly.

One frequent roadblock that comes up when trying to implement these solutions is the zoning laws that many of our urban areas currently have. With priority given to single-family-zoning, it is hard to get zoning laws to change to allow the kind of dense zoning that is needed for these Transit Oriented Developments. While this may seem like an inevitable roadblock that is impossible to get around, California serves as an example of recent success. Governor Gavin Newsom just signed into law Senate Bill 9 which essentially allows homeowners to turn their single family lots into fourplexes if they want (Dougherty, 2021). This is a big deal for a state that is in desperate need of increased housing supply with homeowner costs skyrocketing. This law would allow for more units on a single lot which would not only increase housing supply, but also bring rent costs down. Now, this bill only means homeowners can choose to make this change (doesn't require them to change), and many lots don't even qualify under this law, so

more laws focused on incentivizing mixed-use zoning need to be passed. However, what it does show is that changes to zoning laws can happen and need to happen when it comes to implementing Transit Oriented Developments.

Beyond just TODs, as a city government, we must start designing our cities around the people in it and not the cars. There are many little policy changes and implementations that can realistically take place and would make a large difference. Some of these changes would focus on encouraging public transit ridership or discouraging car ridership. Cities like Seattle and Houston have seen significant benefits to bus-priority lanes with the idea that transit traffic gets to move faster than car traffic. Seattle's 3rd avenue becomes closed to cars during rush hour allowing for buses to move seamlessly through the city's downtown area where most of their passengers are transferring or getting on. With this change making bus routes more reliable and faster, Seattle had seen a jump in bus ridership before the pandemic (Small, 2017). Another similar idea is congestion pricing where drivers are tolled when entering certain busy areas of a city. This is essentially a tax on driving that might sound like an unpopular solution, but it would be an effective way to start disincentivizing people from driving cars. Now there are many obstacles for any of these solutions to work but beginning the discussion on these solutions is really the first step to making any sort of change. More solutions would be to increase the number of bike lanes around cities and improve their infrastructure, so they have better signage, connectivity to other routes, and safety from cars. An example of these policies working is Paris, France. Mayor Hidalgo recently approved a large \$174 million cycling plan with the hopes of making Paris a "100% cyclable city by 2026." The plan removes more than 70% of the existing on-streetcar parking and is installing almost 50,000 new cycling parking spaces - most located near rail stations - around the city (O'Sullivan, 2021). The city is now quickly competing with

Amsterdam to become the cycling capital of Europe. The point is change is possible even if it may not feel like it at the current time.

The possibilities for what livable, public transit and multimodal transportation focused cities can look our endless, but we must remember one of the core reasons for why we need change in the first place. Climate change has proven to be one of humanities top concerns and transportation plays a huge role in this. Cutting down carbon emissions from cars is one of the best ways that we can try to reduce our impact on the environment. It is important to remember that while there are a number of other benefits economically, socially, and lifestyle wise from switching to multimodal transportation options, this change is also crucial to saving our planet. Chapters 7 and 8 have touched on many different potential solutions and ideas for adjusting to a more transit-centered lifestyle, but it is important that our society continues looking for ways to improve our cities because is something that needs to happen and is not simply a luxury that we dismiss as unnecessary. There is nothing more necessary than adjusting the ways that urban areas have relied on transportation because climate change is not going away.

Public Transit in the United States has faced a lot of adversity in the past 70 years. From governmental policies that prioritized car infrastructure over transit to the COVID-19 pandemic forcing people to stay home and consider their remote option future, public transit here hasn't really caught a break. But, with the pandemic comes an opportunity to rethink how we want our cities to function, and how we want to prioritize them. Do we want to continue to be a society that is a slave to our car, or do we want a community where we can all be healthier, spend less money, and save the environment at the same time? It might seem like an obvious choice when phrased like that, but it is important that we truly understand the devastating impact that cars

have had on our society and the absolute necessity and responsibility we have to make transit work.

BIBLIOGRAPHY

- Ahmed, N. O., El-Halafawy, A. M., & Amin, A. M. (2019). A critical review of urban livability. *European Journal of Sustainable Development*, 8(1), 165-165.
- American Public Transit Association (2009). *The Benefits of Public Transportation*. Retrieved December 3, 2021, from https://www.apta.com/wpcontent/uploads/Resources/resources/reportsandpublications/Documents/greenhouse_brochure.pdf.
- American Public Transportation Association (2020). *Who rides public transportation*. Retrieved November 3, 2021, from <https://www.apta.com/research-technical-resources/research-reports/who-rides-public-transportation/>
- Bartik, A. W., Cullen, Z. B., Glaeser, E. L., Luca, M., & Stanton, C. T (2020). *What jobs are being done at home during the COVID-19 crisis? Evidence from firm-level surveys* (No. w27422). National Bureau of Economic Research.
- Bassolas, A., Barbosa-Filho, H., Dickinson, B., Dotiwalla, X., Eastham, P., Gallotti, R., ... & Ramasco, J. J (2019). Hierarchical organization of urban mobility and its connection with city livability. *Nature communications*, 10(1), 1-10.
- Baum-Snow, N (2007). Did highways cause suburbanization?. *The quarterly journal of economics*, 122(2), 775-805.

Bertaud, A., & Richardson, H. W (2004). Transit and density: Atlanta, the United States and western Europe. *Urban Sprawl in Western Europe and the United States*. London: Ashgate, 293-310.

Bliss, L (2021). *Pandemic Cuts to Public Transit Persist in Major U.S. Cities*. Bloomberg.com. Retrieved December 30, 2021, from <https://www.bloomberg.com/news/articles/2021-06-17/where-pandemic-cuts-to-subways-and-buses-persist>

Buehler, R., & Pucher, J (2012). Walking and cycling in Western Europe and the United States: trends, policies, and lessons. *Tr News*, (280).

Congress approves the Federal-Aid Highway Act. U.S. Senate: Congress Approves the Federal-Aid Highway Act (2019). Retrieved February 12, 2022, from https://www.senate.gov/artandhistory/history/minute/Federal_Highway_Act.htm

Congressional Budget Office (2018). *Infrastructure and Transportation*. Retrieved February 3, 2022, from <https://www.cbo.gov/topics/infrastructure-and-transportation>

Dottle, R., Bliss, L., & Robles, P (2021). *What It Looks Like to Reconnect Black Communities Torn Apart by Highways*. Bloomberg.com. Retrieved January 7, 2022, from <https://www.bloomberg.com/graphics/2021-urban-highways-infrastructure-racism/>

Dougherty, C (2021). *After years of failure, California lawmakers pave the way for more housing*. The New York Times. Retrieved January 16, 2022, from <https://www.nytimes.com/2021/08/26/business/california-duplex-senate-bill-9.html>

English, J (2018, October 10). *Why Public Transportation Works Better Outside the U.S.*

Bloomberg.com. Retrieved August 27, 2021, from

<https://www.bloomberg.com/news/articles/2018-10-10/why-public-transportation-works-better-outside-the-u-s>

English, J (2018). *Why Did America Give Up on Mass Transit? (Don't Blame Cars.)*.

Bloomberg.com. Retrieved September 9, 2021, from

<https://www.bloomberg.com/news/features/2018-08-31/why-is-american-mass-transit-so-bad-it-s-a-long-story>

Environmental Protection Agency (2019). *Sources of Greenhouse Emissions*. EPA. Retrieved

February 3, 2022, from <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

Federal Aid Highway Act, 16 U.S.C. ch. 2, subch. I § 503

<https://www.congress.gov/bill/94th-congress/house-bill/8430>

Florida, R (2011). *The financial benefits of living in transit-friendly, walkable areas*. The

Atlantic. Retrieved November 18, 2021, from

<https://www.theatlantic.com/business/archive/2011/06/the-financial-benefits-of-living-in-transit-friendly-walkable-areas/240075/>

Freemark, Y (2021). *In Search of Equitable Transit Operations: Examining Public*

transportation funding and service across the United States. Urban Institute. Retrieved

January 8, 2022, from <https://www.urban.org/research/publication/search-equitable->

transit-operations-examining-public-transportation-funding-and-service-across-united-states

Garrick, N., & McCahill, C (2012). *Lessons From Zurich's Parking Revolution*. Bloomberg.com. Retrieved November 3, 2021, from <https://www.bloomberg.com/news/articles/2012-08-08/lessons-from-zurich-s-parking-revolution>

Global Workplace Analytics (2021). *Work-at-home after covid-19 - our forecast*. Retrieved February 3, 2022, from <https://globalworkplaceanalytics.com/work-at-home-after-covid-19-our-forecast>

Henderson, J. (2006). Secessionist automobility: Racism, anti-urbanism, and the politics of automobility in Atlanta, Georgia. *International Journal of Urban and Regional Research*, 30(2), 293-307.

Inrix (2021). *Global Traffic Scorecard*. Inrix. Retrieved January 3, 2022, from <https://inrix.com/scorecard/>

Jones, B (2021, May 20). *Past, present and Future: The evolution of china's incredible high-speed rail network*. CNN. Retrieved March 16, 2022.

Kelly, H., & Lerman, R (2021). *As offices open back up, not all tech companies are sold on a remote future*. The Washington Post. Retrieved October 12, 2021, from <https://www.washingtonpost.com/technology/2021/06/04/big-tech-office-openings/>

Lachapelle, U., Frank, L (2009). Transit and Health: Mode of Transport, Employer-Sponsored Public Transit Pass Programs, and Physical Activity. *J Public Health Pol* 30, S73–S94.
<https://doi.org/10.1057/jphp.2008.52>

Levy, A., Rudick, R., Schmitt, A., Vance, S., & Short, A (2017). *What American commuter rail can learn from Paris*. Streetsblog USA. Retrieved December 2, 2021, from
<https://usa.streetsblog.org/2017/02/13/what-american-commuter-rail-can-learn-from-paris/>

Louf, R., & Barthelemy, M. (2014). How congestion shapes cities: from mobility patterns to scaling. *Scientific reports*, 4(1), 1-9.

Maantay, J (2007). Asthma and air pollution in the Bronx: methodological and data considerations in using GIS for environmental justice and health research. *Health & place*, 13(1), 32-56.

Mangan, E (2020). *Voters want and need more transportation options*. Transportation For America. Retrieved October 15, 2021, from <https://t4america.org/2020/03/17/voters-want-and-need-more-transportation-options/>

Mouratidis, K., & Poortinga, W. (2020). Built environment, urban vitality and social cohesion: Do vibrant neighborhoods foster strong communities?. *Landscape and Urban Planning*, 204, 103951.

- Nguyen, T (2020). *Public transit in the US is already underfunded. the pandemic has made it worse*. Vox. Retrieved August 13, 2021, from <https://www.vox.com/the-goods/22168191/public-transit-funding-future-covid>
- Okulicz-Kozaryn, A. (2013). City life: Rankings (livability) versus perceptions (satisfaction). *Social indicators research*, 110(2), 433-451.
- O'Sullivan, F (2021). *Inside the New Plan to Make Paris '100% Cyclable.'* Bloomberg.com. Retrieved January 15, 2022, from <https://www.bloomberg.com/news/articles/2021-10-22/how-paris-will-become-100-cyclable>
- Parker, K., Horowitz, J. M., & Minkin, R (2021, May 25). *How coronavirus has changed the way Americans work*. Pew Research Center's Social & Demographic Trends Project. Retrieved January 24, 2021, from <https://www.pewresearch.org/social-trends/2020/12/09/how-the-coronavirus-outbreak-has-and-hasnt-changed-the-way-americans-work/>
- Patino, M., Kessler, A., & Holder, S (2021). *More Americans Are Leaving Cities, But Don't Call It an Urban Exodus*. Bloomberg.com. Retrieved July 31, 2021, from <https://www.bloomberg.com/graphics/2021-citylab-how-americans-moved/>
- Qi, Y., Liu, J., Tao, T., & Zhao, Q (2021). Impacts of COVID-19 on public transit ridership. *International Journal of Transportation Science and Technology*.

Quiroz-Gutierrez, M (2021). *Public Transit Systems won't recover for nearly a decade*. Fortune.

Retrieved September 5, 2021, from <https://fortune.com/2021/11/02/covid-public-transportation-pre-pandemic-levels/>

Ranking (% obesity by country). World Obesity Federation Global Obesity Observatory (2016).

Retrieved February 12, 2022, from <https://data.worldobesity.org/rankings/>

Renne, J. L (2005). *Transit-oriented development: measuring benefits, analyzing trends, and evaluating policy*. Rutgers The State University of New Jersey-New Brunswick.

Russell, J (2021). *Can Rush Hour Be Banished?* Bloomberg.com. Retrieved November 20, 2021,

from <https://www.bloomberg.com/news/articles/2021-08-25/despite-remote-work-rush-hour-returned>

Sengupta, S., Abdul, G., Andreoni, M., & Penney, V (2021). *After a year of the pandemic, public*

transit around the world is hanging by a thread. The New York Times. Retrieved

February 12, 2022, from <https://www.nytimes.com/2021/03/27/world/after-a-year-of-the-pandemic-public-transit-around-the-world-is-hanging-by-a-thread.html>

Small, A (2017). *How Seattle Bucked a National Trend and Got More People to Ride the Bus*.

Bloomberg.com. Retrieved August 20, 2021, from

<https://www.bloomberg.com/news/articles/2017-10-16/how-seattle-got-more-people-to-ride-the-bus>

Smith, H (2021, June 18). *L.A. traffic behavior is changing. is post-pandemic gridlock*

inevitable? Los Angeles Times. Retrieved February 13, 2022, from

<https://www.latimes.com/california/story/2021-06-18/post-covid-l-a-traffic-analysis-has-rush-hour-changed>

Staff, N. P. R (2011). *Among the costs of war: Billions a year in A.C.?* NPR. Retrieved January 11, 2022, from <https://www.npr.org/2011/06/25/137414737/among-the-costs-of-war-20b-in-air-conditioning>

Tomer, A., George, C., Kane, J., & Bourne, A (2021). *America has an infrastructure bill. what happens next?* Brookings. Retrieved January 20, 2022, from <https://www.brookings.edu/blog/the-avenue/2021/11/09/america-has-an-infrastructure-bill-what-happens-next/>

Transit (2021). *How coronavirus is disrupting public transit.* Retrieved February 3, 2022, from <https://transitapp.com/coronavirus>

Transit Center (2021). *To tackle the Climate Crisis and racial inequity, we need to run a lot more transit service.* Retrieved November 30, 2021, from <https://transitcenter.org/we-need-federal-to-tackle-the-climate-crisis-we-need-support-for-transit-operations/>

Bureau of Transportation Statistics (2019). *Transportation expenditures by level of government and mode from own funds, fiscal year.* Transportation Expenditures by Level of Government and Mode from Own Funds, Fiscal Year | Retrieved February 12, 2022, from <https://www.bts.gov/content/transportation-expenditures-mode-and-level-government-own-funds-fiscal-year-current-millions>

Winck, B (2021, August 16). *4 charts show how fast everyone is flocking back to big cities.*

Business Insider. Retrieved January 19, 2022, from

<https://www.businessinsider.com/urban-exodus-people-leaving-cities-charts-exurbs-real-estate-moving-2021-8>

Nelson Huffaker

nelsonhuf@gmail.com

OBJECTIVE

I devote myself to building a more efficient and knowledgeable world by using my GIS, research, and political experience to present more intellectually accessible information to policymakers and the public.

EDUCATION

THE PENNSYLVANIA STATE UNIVERSITY, University Park, PA

▲ Schreyer Honors College Students

Bachelor of Art in Geography, May 2022

- *Relevant Coursework:* Image Analysis, GIS, Spatial Analysis, Adv. Spatial Analysis

Bachelor of Art in Political Science, May 2022

- *Relevant Coursework:* Amer. Foreign Policy, Comparative Gov, Int'l Political Economy

RESEARCH EXPERIENCE

Penn State Center for Environmental Informatics, University Park, PA

Undergraduate Research Assistant, Jan 2021 – May 2021

- Analyze and compare coastal wetland images and determine extent of damage caused by Superstorm Sandy.
- Design [StoryMaps](#) to be used as reference for New Jersey coastal wetland damage and location.
- Collaborate with fellow researchers to create user guide for the NJ Coastal Wetland Database.
- Perform policy analysis about wetland reconstruction in the Mid-Atlantic region

WORK EXPERIENCE

NASA Develop Program, Athens, GA

Team Member, June 2021 – August 2021

- Utilized satellite imagery to determine deforestation in Madre De Dios, [Peru](#) and its effects on the spread of zoonotic disease in the surrounding communities.
- Created land use and land change cover maps for the region with the use of remote sensing.

Penn State Department of Geography, University Park, PA

Research Assistant, May 2021 – Sep 2021

- Reliably organized hundreds of files of data making it easy for processing.
- Analyzed current research on effects of algae and dust on snow albedo levels.
- Collaborated with project lead and coworkers daily leading to a successful end project.

SKILLS/ACTIVITIES

- Proficient in ArcGIS Pro, ArcMap, ArcGIS Online, [StoryMap](#)
- Proficient with Microsoft Office (Word, Excel, [Powerpoint](#))
- Experience with R, [ModelBuilder](#), QGIS, Python, GEE, Unix, Stata, Adobe Creative Suite

CAMPUS LEADERSHIP EXPERIENCE

Penn State Marching Band - Trumpet (2018-2021)

- Committed 20 hours/week collaborating different movements in small and large groups.
- Traveled across the country performing in front of millions of people (Orlando, Dallas, Ann Arbor)