



MEMORANDUM

Date: August 1, 2019

To: Brian McGuigan, Lyft and Chris Pangilinan, Uber

From: Melissa Balding, Teresa Whinery, Eleanor Leshner and Eric Womeldorff, Fehr & Peers

Subject: Estimated TNC Share of VMT in Six US Metropolitan Regions

SF19-1016

Introduction

Fehr & Peers was engaged by Lyft and Uber to determine their combined Vehicle Miles Traveled (VMT) in six metropolitan regions in September 2018 and compare that value to approximate total VMT in each area for the same period. While a high-level exercise, both the analysis process and the results should help Lyft and Uber better understand how their services contribute to total VMT in each region at a single point in time and help them form appropriate narratives for both internal and external communication. This memorandum documents our methodology and findings.

Specifically, Fehr & Peers analyzed travel by Transportation Network Companies (“TNCs,” used as shorthand for Lyft and Uber exclusively from here on) as well as VMT by all other passenger and freight vehicles (“total VMT” from here on) in the following six metropolitan regions: Boston, MA; Chicago, IL; Los Angeles, CA; San Francisco, CA; Seattle, WA; and Washington, DC. These locations were selected to show results from a range of urban centers throughout the United States. Results are presented at two levels: at the regional level, using primarily Metropolitan Planning Organization boundaries that incorporate both central urban areas and select surrounding counties; and the “core” county in each region, which contains the main city and densest job and population center(s).

Results are presented at the regional level to provide a snapshot of how TNCs contribute to overall vehicular activity in a region, which serves as a proxy for an economic center. While much of the public discussion related to TNCs has focused on the areas where TNC use is most prevalent (i.e.,



denser, economically active areas), regions function as complex centers of economic, social, and government activity. As such, this information provides a look at how TNC travel is affecting VMT for the larger area, rather than simply the most central city or neighborhood(s).

Because this regional scale does not fully capture how TNCs are concentrated in urban areas, we also present data at the scale of the core county for each region. This memorandum acknowledges that TNC activity may be concentrated at certain times and locations, and at smaller geographies than can be reliably analyzed with the available data (such as a neighborhood or district).

Our findings are shown on **Figure 1** on the next page. TNCs account for an estimated range of 1.0 - 2.9 percent of total VMT for the six metropolitan regions, while all other vehicle activity accounts for approximately 97 to 99 percent of total VMT. When looking solely at the core counties, there is greater variation in the share of total VMT generated by TNCs. The rate is highest in San Francisco, in the estimated range of 12.2 – 13.4 percent (i.e., approximately 87 percent of VMT is due to all other vehicle activity), and lowest in Seattle, in the estimated range of 1.7 – 2.0 percent (i.e., approximately 98 percent of VMT is due to all other vehicle activity). Essentially, the further the core county extends beyond the dense urban core, the closer the TNC share of total VMT in the core county is to the share in the overall region. To illustrate where denser neighborhoods are clustered in each region, **Figure A1** (included in the Appendix) shows the densest urban census tracts in relation to regional and county boundaries, as well as the common Census-designated boundary of a “metropolitan statistical area” (MSA).¹

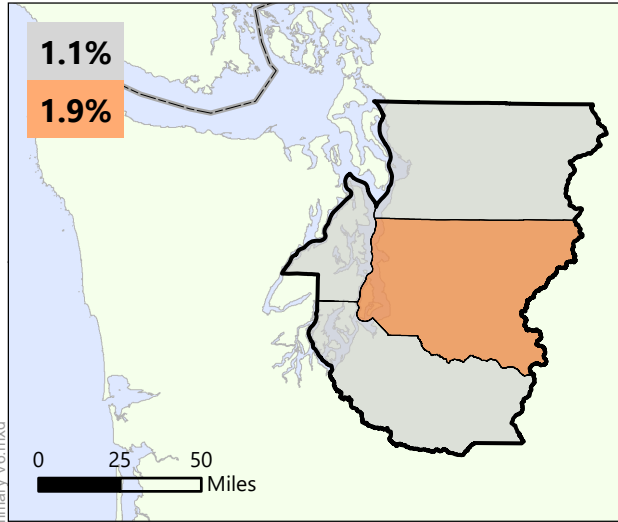
Data Collection

September 2018 was selected as the study month because it is a representative non-summer month with minimal holiday activity. To assess how much Lyft and Uber services contribute to VMT, Fehr & Peers determined approximate total VMT for each metropolitan region for the study month, as well as miles traveled by TNCs while in service. The one-month time period was used for versatility of data, to smooth out any outliers in the data, and to include travel on both weekends and weekdays, where TNC use patterns may be different.

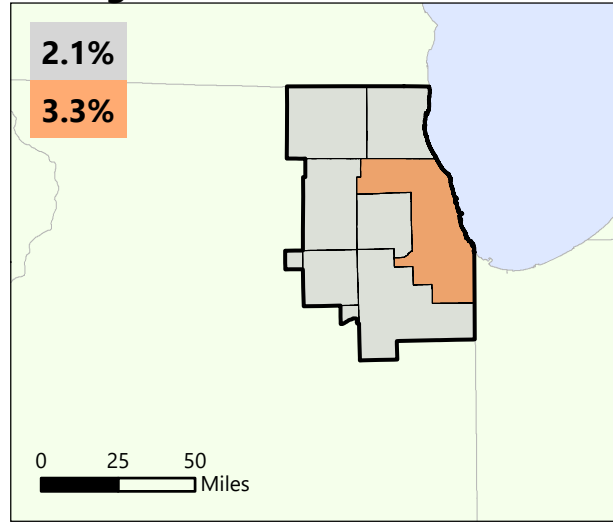
¹ MSA boundaries are included to help with discussion of additional data from the National Household Travel Survey; direct VMT data from roadway monitoring was not analyzed at this geography, but rather at the county and MPO regional level.

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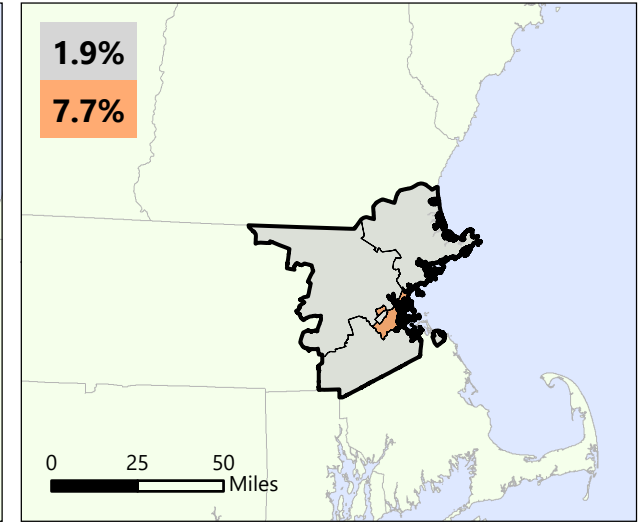
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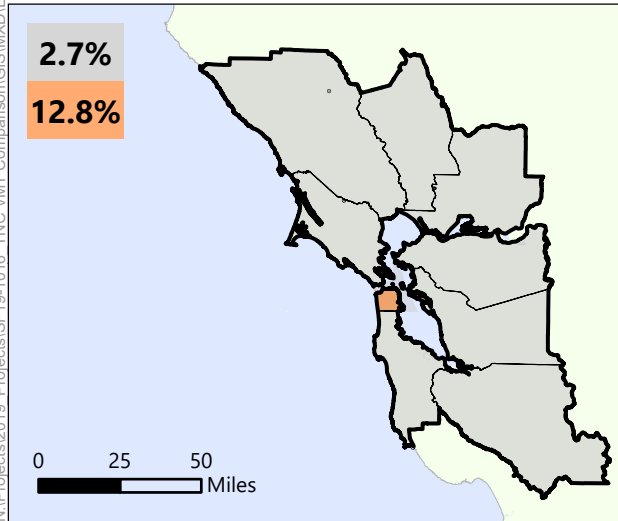
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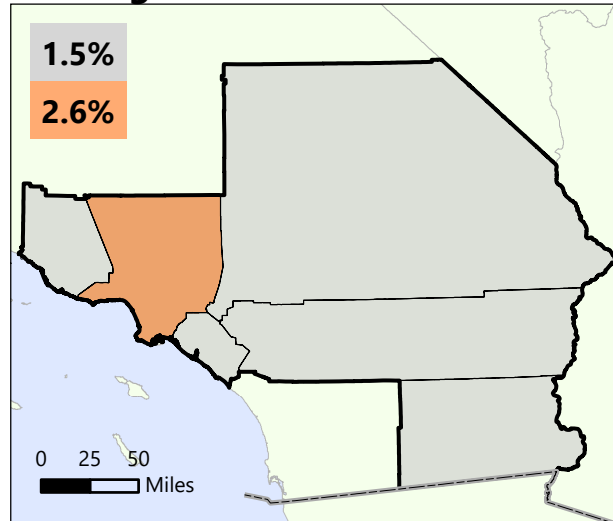
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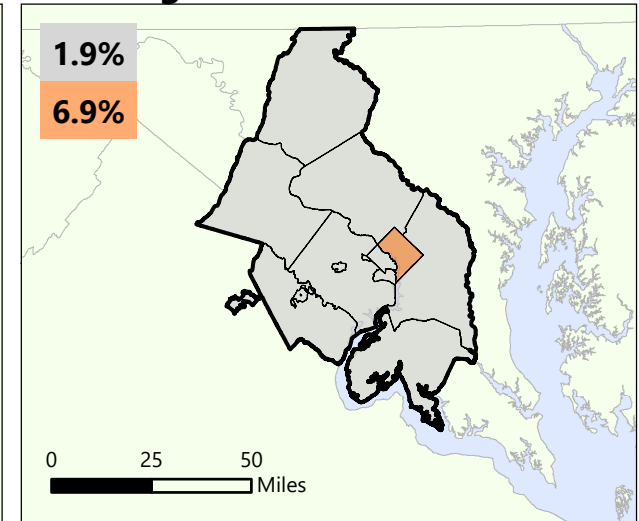
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








Los Angeles, CA



Washington, DC



-  Counties in Region
-  Core County in Region
-  Region Border
-  Land Outside Region
-  International Border

-  X.X% X.X% of VMT from TNCs for Region
-  Y.Y% Y.Y% of VMT from TNCs for Core County

Note: Percentages represent midpoint between low and high estimates from September 2018 TNC VMT data.



Figure 1

Estimated TNC VMT Percentage by Metropolitan Region



Data were compiled from the sources described in **Table 1**. The initial data collection consisted of a mixture of monthly and annual data, based largely on information from the Highway Performance Monitoring System (HPMS) and data from Lyft and Uber. Federal highway data from the HPMS is routinely used in the transportation planning arena to estimate total vehicle travel for states and for metropolitan planning organizations (MPOs), for use in developing travel statistics and apportioning some federal funds. As such, this data represents a well-utilized, standardized source for total VMT in counties both urban and rural, regardless of state. The proportion of statewide VMT occurring in each county and MPO is based on statewide reports cited in **Table 1**, which include annual VMT estimates by county and/or local jurisdiction. The most recent reports for California, Washington, Illinois, and the District of Columbia were 2017 reports, which were deemed sufficient for this purpose.

Table 1: Data and Sources

Data	Source
Lyft Vehicle Miles by Phase ¹ (P1, P2, P3), for six metro regions, September 2018	Lyft staff
September 2018 Uber Vehicle Miles by Phase (P1, P2, P3), for six metro regions, September 2018	Uber staff
2017 California Annual VMT by State and by County	<i>California Public Road Data 2017: Statistical Information</i> ; Derived from the Highway Performance Monitoring System
2017 Washington State Annual VMT by State and by County	<i>Puget Sound Regional Council Report: Vehicle Miles Traveled Trends</i> ; derived from Highway Performance Monitoring System
2018 MAP-C (Boston) Annual VMT by State and by County	Derived from shapefile with associated data, provided to Fehr & Peers by MAP-C
2017 Illinois Annual VMT by State and by County	<i>2017 Illinois Travel Statistics</i> , prepared by Illinois Department of Transportation
2017 District of Columbia / MWCOG Annual VMT by County/Jurisdiction	<i>Regional Transportation Data Clearinghouse</i> , MWCOG
Statewide Monthly VMT by state, September 2018	<i>Traffic Volumes Trend Report: September 2018</i> , FHWA

Notes:

1. TNC vehicle miles are categorized by phase. P1 miles occur when a driver is waiting for a ride request (i.e., logged into the app but hasn't received a ride yet). P2 miles occur when a driver has been assigned a ride and is driving to pick up the passenger(s) and has no other passengers. P3 miles are miles traveled with a passenger(s) in the vehicle. TNC driver commute trips to their market areas are not included if the app is not turned on.



Methodology and QA/QC

Fehr & Peers processed the data provided by Lyft and Uber and collected from FHWA and individual state departments of transportation in the following manner to determine statewide and regional VMT estimates for September 2018:

1. Total Lyft and Uber VMT for the region was totaled across all ride phases (P1, P2, and P3) to generate an aggregate estimate of total TNC VMT for September 2018.
2. A low and high range of total TNC VMT was calculated based on whether double-apping was perfect (i.e., low = all drivers have both the Uber and Lyft apps on at all times when waiting for rides) or completely absent (i.e., high = no drivers ever use both apps at once). This step assumes many TNC driver partners log into both platforms.
3. The most recent published annual VMT data by county/MPO/jurisdiction was presented as a percentage of the statewide total VMT.
4. The regional percentage of annual statewide VMT was applied to the September 2018 monthly state VMT to estimate monthly regional VMT.
5. A similar process was performed for the core counties of each region to determine monthly core county VMT.

The summarized results of this methodology are shown in **Table 2**.

Table 2: Summary of Compiled VMT Data by Metro Region

Metro Region	Annual MPO VMT as % of Annual Statewide VMT	Statewide VMT, September 2018	Estimated MPO VMT, September 2018	Total TNC VMT (Low)	Total TNC VMT (High)	Total TNC VMT (Midpoint)
Boston	51%	5,250,000,000	2,665,911,000	48,320,000	54,210,000	51,265,000
Chicago	56%	8,609,000,000	4,815,920,000	93,380,000	104,480,000	98,930,000
Los Angeles	47%	25,366,000,000	11,856,067,000	160,090,000	184,980,000	172,535,000
San Francisco	18%	25,366,000,000	4,643,111,000	118,580,000	133,680,000	126,130,000
Seattle	52%	5,647,000,000	2,922,624,000	30,130,000	36,030,000	33,080,000
Washington, DC	1206% ¹	360,000,000	4,340,179,000	78,490,000	87,590,000	83,040,000

1. MPO figures for Washington, DC include portions of Maryland, Virginia, and the entirety of the District of Columbia. However, "statewide" numbers are merely those for the District; as such, the regional share is larger than the "state" share.



The summarized data presented in **Table 2** was assessed for potential errors through comparison with:

- 2017 VMT data provided to Fehr & Peers by Lyft as part of assisting them with California Public Utility Commission (CPUC) filings;
- National Household Travel Survey (NHTS) data;
- Publicly available reports about TNC service market share by region and year-over-year growth.

These initial checks indicated the total TNC VMT for September 2018 aligned with expectations based on both growth in trips and seasonal variations of TNC use. Similar checks confirmed the range of miles traveled in each service phase was as expected based on previously analyzed patterns. Market share estimates based on the data provided by Lyft and Uber were compared to publicly available service market share data, and there were minimal variations.

A more detailed breakdown of how TNC VMT is distributed across phases by metro region is shown in **Table 3**. **Table 4** presents VMT data by core counties.

Table 3: TNC VMT by Phase by Metro Region

Metro Region	P1 VMT (Low)	P1 VMT (High)	P1 VMT (Midpoint)	P2 VMT	P3 VMT
Boston	14,700,000	20,590,000	17,645,000	5,340,000	28,280,000
Chicago	29,700,000	40,800,000	35,250,000	9,080,000	54,600,000
Los Angeles	38,300,000	63,190,000	50,745,000	17,660,000	104,130,000
San Francisco	31,500,000	46,600,000	39,050,000	11,930,000	75,150,000
Seattle	9,700,000	15,600,000	12,650,000	2,880,000	17,550,000
Washington, DC	24,400,000	33,500,000	17,645,000	8,100,000	45,990,000
Average as Percent of Total TNC VMT	28%	37%	33%	9 - 10%	54 - 62%



Table 4: Summary of Compiled VMT Data By Core Counties

Core County (Metro Region)	County Share of Statewide VMT	Statewide VMT, September 2018	Estimated Core County VMT, September 2018	Total TNC VMT (Low)	Total TNC VMT (High)	Total TNC VMT (Midpoint)
Suffolk County (Boston)	5.9%	5,250,000,000	312,009,000	22,738,000	25,028,000	23,883,000
Cook County (Chicago)	29.6%	8,609,000,000	2,550,344,000	80,651,000	89,551,000	85,101,000
Los Angeles County (Los Angeles)	23.6%	25,366,000,000	5,986,161,000	145,990,000	162,420,000	154,205,000
San Francisco County (San Francisco)	1.0%	25,366,000,000	259,461,000	31,633,000	34,743,000	33,188,000
King County (Seattle)	28.4%	5,647,000,000	1,606,095,000	27,467,000	32,227,000	29,847,000
District of Columbia (Washington, DC)	100.0%	360,000,000	360,000,000	24,021,000	25,981,000	23,883,000

Findings

The estimated share of each metro region’s total VMT attributable to TNCs is shown in **Table 5** and **Figure 2**. Generally, it is estimated that TNCs account for between one percent and three percent of total regional VMT in the six major regions studied. However, TNC shares in the core and central areas of these regions are higher, ranging from around 2 percent of total VMT to over 13 percent of total VMT.



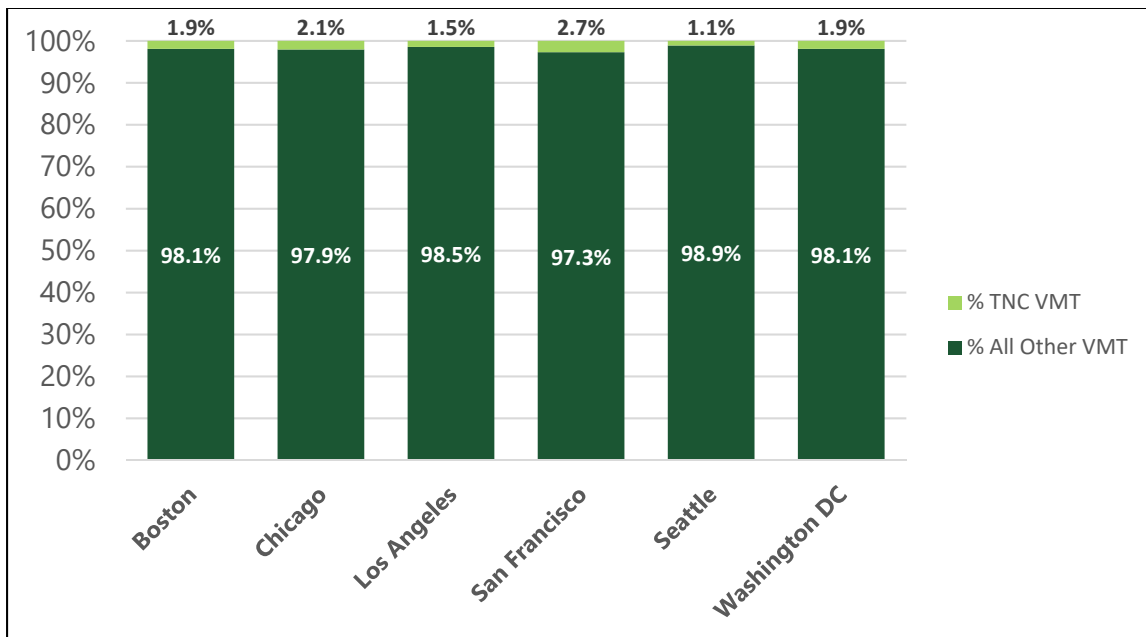
Table 5: Estimated TNC Share of VMT by Metro Region and Core County

Metro Region	TNC Share (%) of Regional VMT (Low)	TNC Share (%) of Regional VMT (High)	TNC Share (%) of Regional VMT (Midpoint) ¹	Core County	TNC Share (%) of Core VMT (Low)	TNC Share (%) of Core VMT (High)	TNC Share (%) of Core VMT (Midpoint) ¹
Boston	1.8%	2.0%	1.9%	Suffolk County	7.3%	8.0%	7.7%
Chicago	1.9%	2.2%	2.1%	Cook County	3.2%	3.5%	3.3%
Los Angeles	1.4%	1.6%	1.5%	Los Angeles County	2.4%	2.7%	2.6%
San Francisco	2.6%	2.9%	2.7%	San Francisco County	12.2%	13.4%	12.8%
Seattle	1.0%	1.2%	1.1%	King County	1.7%	2.0%	1.9%
Washington, DC	1.8%	2.0%	1.9%	District of Columbia	6.7%	7.2%	6.9%

Note:

1. The midpoint estimates are presented in **Figure 1**.

Figure 2: Estimated TNC Share of VMT (Midpoint) by Metro Region





Much of this variation is due to the urban patterns and geographic layout of each individual region and county, with smaller and denser counties having a higher percentage of VMT attributable to TNCs. **Figure A1** in the Appendix presents the location of the densest Census tracts in each region. As such, a brief overview of each region and its estimated VMT is included below.

Figure 3 illustrates the distribution of TNC vehicle miles across the three service phases. For most metropolitan regions, approximately one third of TNC vehicle miles are attributed to a driver waiting for a ride request (P1), approximately 10 percent to a driver heading to pick up a passenger (P2), and approximately half to when a passenger is in the vehicle (P3). These general patterns differ most in Los Angeles and Seattle. In Los Angeles, a much higher percent of vehicle miles occur with a passenger in the vehicle. In Seattle, two thirds of miles traveled are when a driver is waiting for a ride request.

Figure 3: Breakdown of TNC VMT by Phase for each Metro Region

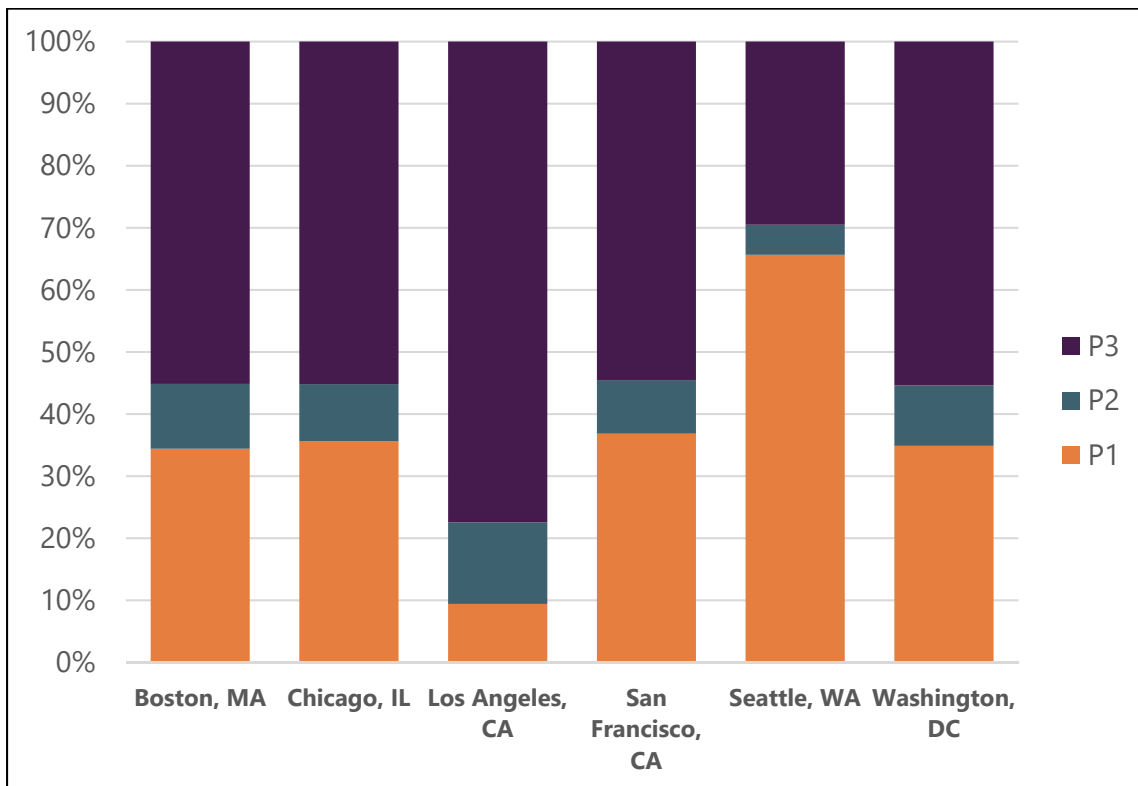


Figure 4 shows the share of VMT associated with P3 mileage *only* for both the metro regions and core counties studied, which represents TNC vehicle miles traveled with a passenger in the vehicle. Some similar trends are evident across regions when looking at both P3 mileage only and total TNC



mileage. For example, passengers make more of their vehicle trips using TNCs in the core counties of each region. Similar to the trends presented in **Table 5**, the core counties in the Boston, San Francisco, and Washington, DC regions have a higher share of VMT from TNCs compared to the other regions. These three core counties are denser and more compact and contain less suburban, rural, and exurban land area compared to the core counties in the Chicago, Seattle, and Los Angeles regions. All these factors contribute to an increased prevalence of TNC use in the core of each region compared to region-wide usage and VMT. The patterns reflected in the core counties are discussed in further detail below. **Table 6** compares key metrics for each region's core county including share of regional population, land area, and VMT.

Figure 4: TNC Passenger Miles Only Share of VMT by Metro Region and Core County

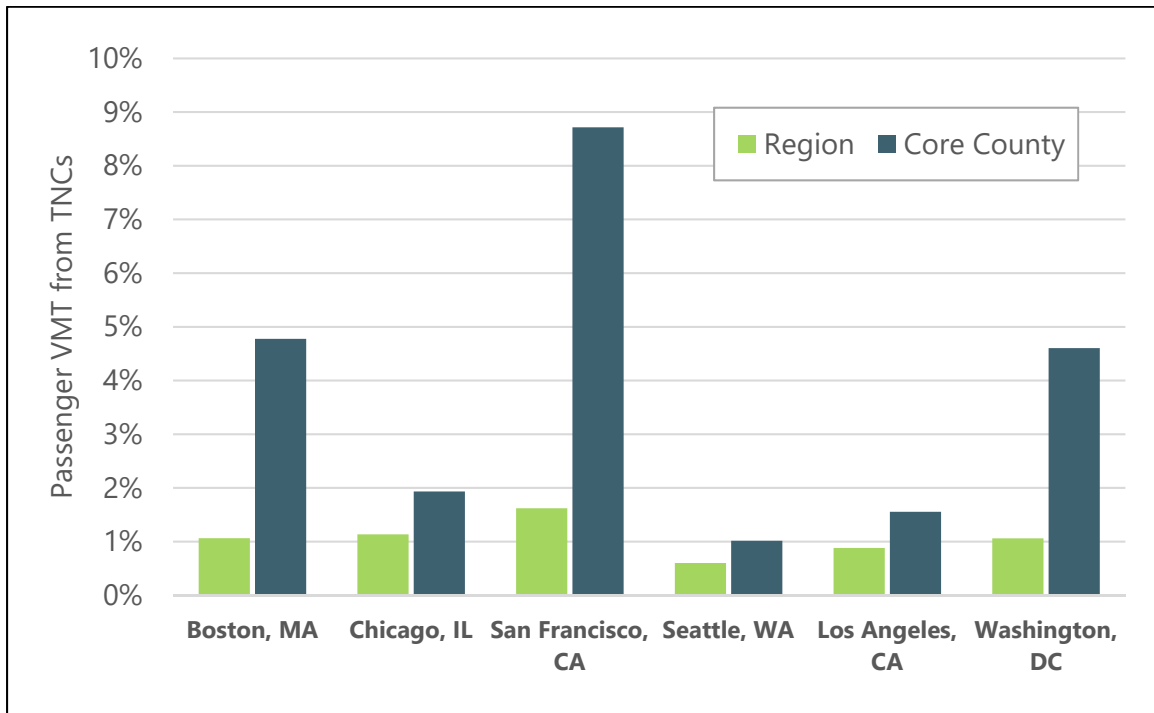




Table 6: Core County Comparison

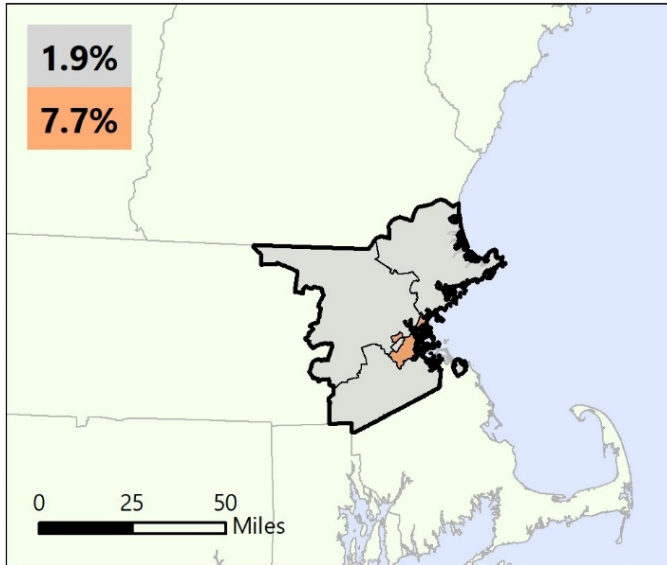
Core County (Metro Region)	Share of Regional Population	Share of Regional Land Area	Share of Regional VMT	TNC Share (%) of Core VMT (Midpoint)	Population Density ¹	Employment Density ²
Suffolk County (Boston)	20%	3%	12%	7.7%	13,400	11,200
Cook County (Chicago)	61%	23%	53%	3.3%	5,500	2,700
Los Angeles County (Los Angeles)	54%	11%	50%	2.6%	2,500	1,100
San Francisco County (San Francisco)	12%	1%	6%	12.8%	18,400	15,000
King County (Seattle)	53%	40%	55%	1.9%	1,000	600
District of Columbia (Washington, DC)	12%	2%	8%	6.9%	11,000	11,000

1. Population density is reported as population per square mile. County population estimates based on 2013-2017 5-year American Community Survey (ACS) data; County land area estimate sourced from 2010 U.S. Census.

2. Employment density is reported as jobs per square mile. County employment estimates are sourced from 2015 Longitudinal Employer-Household Dynamics (LEHD) program; County land area estimate are sourced from 2010 U.S. Census.



Boston



The core county (orange) of each metro region (gray) is indicated. The midpoint estimate of percent of VMT from TNCs (September 2018) is shown for each area.

The Boston Region, as well as the location of Suffolk County, are shown in **Figure A**. Suffolk County is fairly compact, and includes several of Boston's denser neighborhoods, including Boston's downtown core, Back Bay, South Boston, and the Boston Logan International Airport. These dense, central neighborhoods and the Boston airport are all places that generate a comparatively large amount of TNC activity, including activity ultimately bound for areas outside of this core county. Suffolk County contains approximately 20 percent of the regional population,

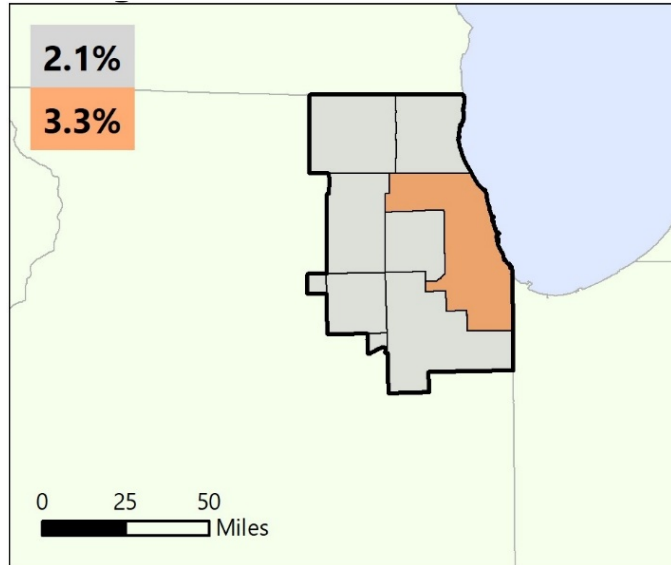
three percent of regional land area, and 12 percent of regional VMT.

In total, approximately seven to eight percent of total VMT in Suffolk County was generated by Lyft and Uber services in September 2018, while all other vehicle activity accounts for 92 to 93 percent of total VMT.



Chicago

The Chicago Region, as well as the location of Cook County, are shown in **Figure B**. Cook County contains most of the urbanized area in the Chicago region, including all of the City of Chicago, as well as suburban communities such as Evanston, Oak Lawn, and Arlington Heights. This includes all of Chicago's downtown core, its densest neighborhoods, Midway Airport, and O'Hare International Airport. While these are all likely generators of TNC activity, most of the generated activity occurs within Cook County, with a much smaller number of trips leaving the county. Cook County contains around 61 percent of the regional population, 23 percent of regional landmass, and 53 percent of regional VMT.

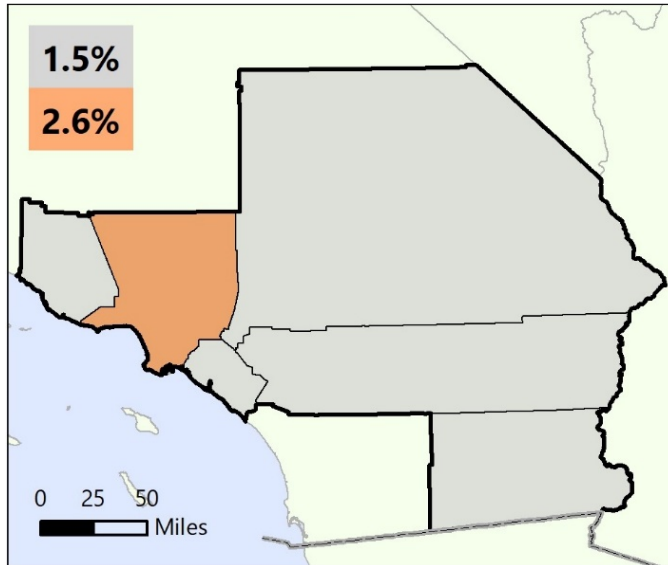


The core county (orange) of each metro region (gray) is indicated. The midpoint estimate of percent of VMT from TNCs (September 2018) is shown for each area.

In total, approximately three to four percent of all VMT in Cook County was generated by TNC services in September 2018, while all other vehicle activity accounts for 96 to 97 percent of total VMT.



Los Angeles



The core county (orange) of each metro region (gray) is indicated. The midpoint estimate of percent of VMT from TNCs (September 2018) is shown for each area.

Los Angeles County is the most populous county in the United States, and includes the City of Los Angeles, as well as other cities in the Los Angeles Basin and San Gabriel Valley. This includes Los Angeles International Airport, Long Beach Airport, and Bob Hope Airport, as well as the Ports of Los Angeles and Long Beach, which together act as the largest importer of goods in the United States. Los Angeles therefore sees a very high amount of freight traffic and freeway traffic, in addition to bustling local traffic throughout the Los Angeles Basin. Most TNC trips are likely to be

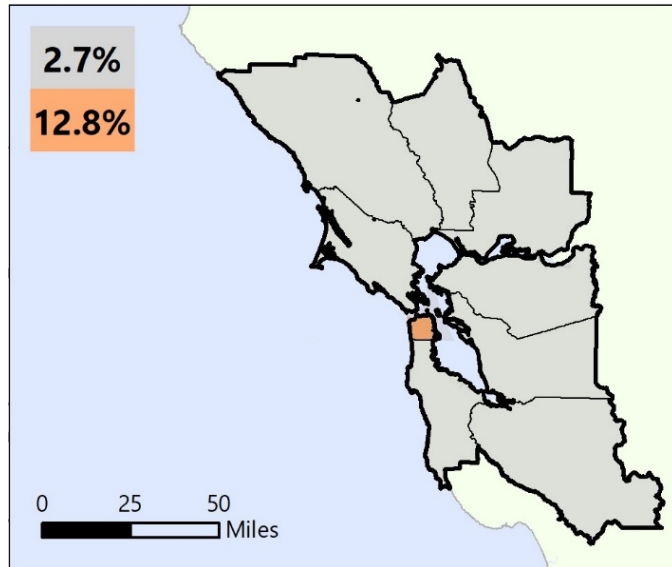
contained within the county, with the potential exception of trips between Orange County and Los Angeles County. Los Angeles County contains around 54 percent of the regional population, 11 percent of regional land area, and 50 percent of regional VMT.

In total, approximately 2 to 3 percent of all VMT generated in Los Angeles County was generated by Lyft and Uber services in September 2018, while all other vehicle activity accounts for 97 to 98 percent of total VMT.



San Francisco

The San Francisco Bay Area region and the location of San Francisco County are shown in **Figure C**. San Francisco County contains the City of San Francisco and represents the densest residential and commercial location in the Bay Area. This also includes the San Francisco International Airport, located to the south of the urban core. San Francisco County is the fourth most populous county in the region, containing around 12 percent of the regional population, less than one percent of regional landmass, and only six percent of regional VMT.



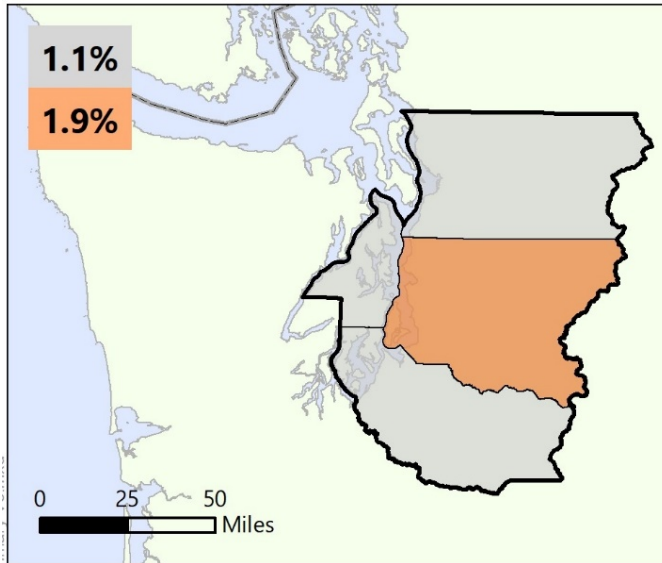
The core county (orange) of each metro region (gray) is indicated. The midpoint estimate of percent of VMT from TNCs (September 2018) is shown for each area.

San Francisco has a lower rate of car ownership compared to the rest of the Bay Area, as well as a robust internal transit system, and the lowest VMT per Capita in the region. As such, the higher share of VMT potentially associated with Lyft and Uber may reflect lower overall rates of driving and higher transit rates, as well as a less centralized location for freight passing through the region.

In total, approximately 12 to 14 percent of all VMT generated in San Francisco was generated by Lyft and Uber services in September 2018, while all other vehicle activity accounts for 86 to 88 percent of total VMT.



Seattle



The core county (orange) of each metro region (gray) is indicated. The midpoint estimate of percent of VMT from TNCs (September 2018) is shown for each area.

King County in Washington includes the City of Seattle, SeaTac International Airport, and substantial rural and wilderness areas east of the Seattle downtown core, including Interstate 90, which supports a fair amount of freight and other through-traffic. King County does not include the City of Tacoma, but otherwise includes much of the densest and most economically active areas in northwestern Washington. King County contains roughly 53 percent of the population in the region, 40 percent of the land area, and 55 percent of regional VMT.

In total, approximately 1.5 to 2 percent of all VMT generated in King County was generated by Lyft and Uber services in September 2018, while all other vehicle activity accounts for 98 to 98.5 percent of total VMT.

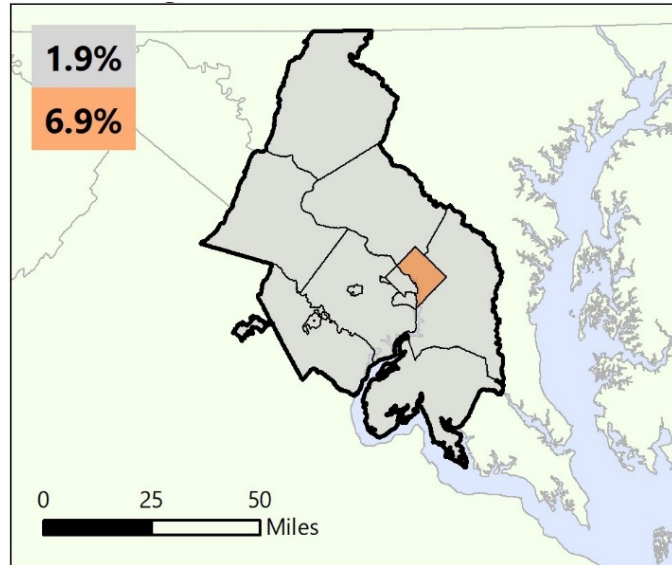


Washington, DC

The District of Columbia is the designated home of the federal government, and as such is neither truly a state nor a county. The District includes the densest portions of the DC metropolitan region east of the Potomac River, but does not include any of the major interstates providing passage through the region (I-95 passes through the District, but has multiple ring routes offering alternatives without passing through DC). As such, it likely sees fewer through trips on the freeway due to freight activity, and generally has a smaller share of total regional VMT

than any other core county except San Francisco. The District contains around 12 percent of the regional population, two percent of regional land area, and eight percent of regional VMT.

In total, Lyft and Uber contributed approximately six to seven percent of total VMT within the District of Columbia in September 2018, while all other vehicle activity accounts for 93 to 94 percent of total VMT.



The core county (orange) of each metro region (gray) is indicated. The midpoint estimate of percent of VMT from TNCs (September 2018) is shown for each area.



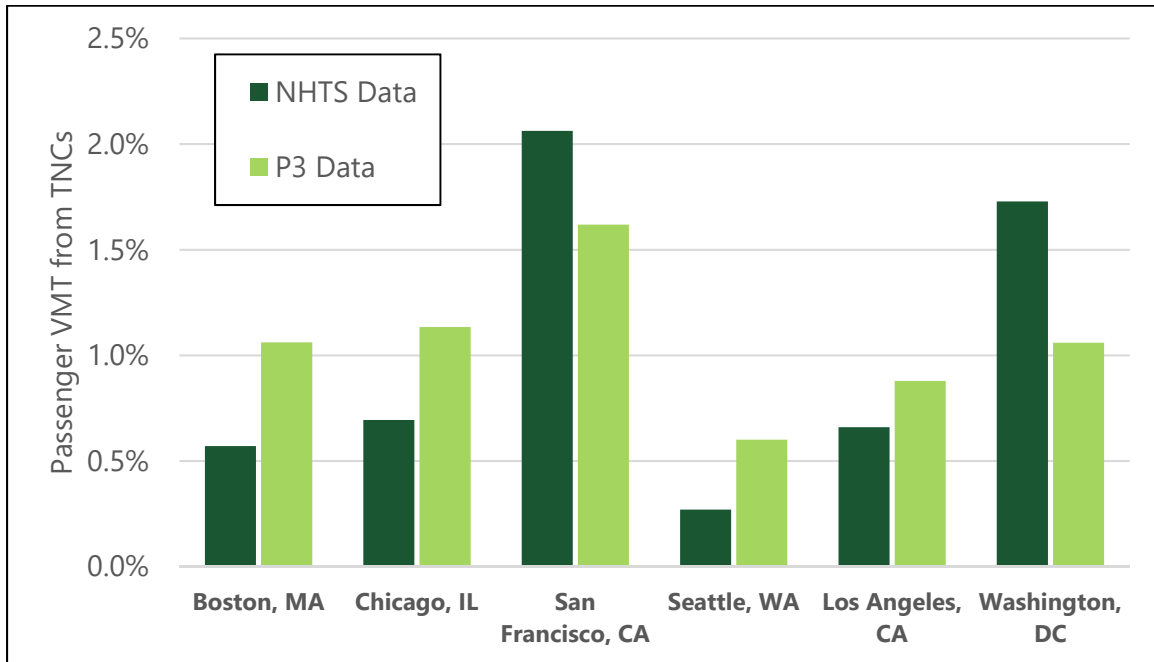
Introducing NHTS to Add Context

The most recent iteration of the National Household Travel Survey (NHTS) conducted in 2017 includes TNC as a travel mode. NHTS data are collected by having a sample of households log all trips made during a given period of time. Data for each trip include the distance traveled, mode of travel, purpose of trip, and number of household members taking the trip. Data are then weighted by household and individual to correct for differences between the sample and the U.S. population due to representation errors like non-response error. The result is a full dataset that is roughly representative of the U.S. population by important demographic variables like age, gender, race, and ethnicity. While this dataset is not directly comparable to the data used in the rest of the analysis, it is presented here to provide a second perspective on how TNC travel contributes to VMT.

NHTS data includes only personal trips by individuals living in a given location; it also only includes the portion of the trip that provided passenger service (i.e., P3 miles in the case of TNCs). As shown in **Figure 5** below, the P3 VMT estimates from the TNC data estimated above are roughly similar to the VMT estimates based on data from NHTS sample households. The NHTS data results in a slightly higher share of VMT in two regions (San Francisco and Washington, DC), and a somewhat lower share of VMT in the other four regions; however, the number of total TNC trips recorded is quite small in some regions, and these data are not directly comparable to TNC records. It should be noted that the region defined in the NHTS is different than the TNC definition of regions; the NHTS uses Metropolitan Statistical Areas (MSAs) for its regions rather than the metropolitan regions and core counties assessed in the TNC analysis. **Figure A1** in the appendix compares these different geographies.



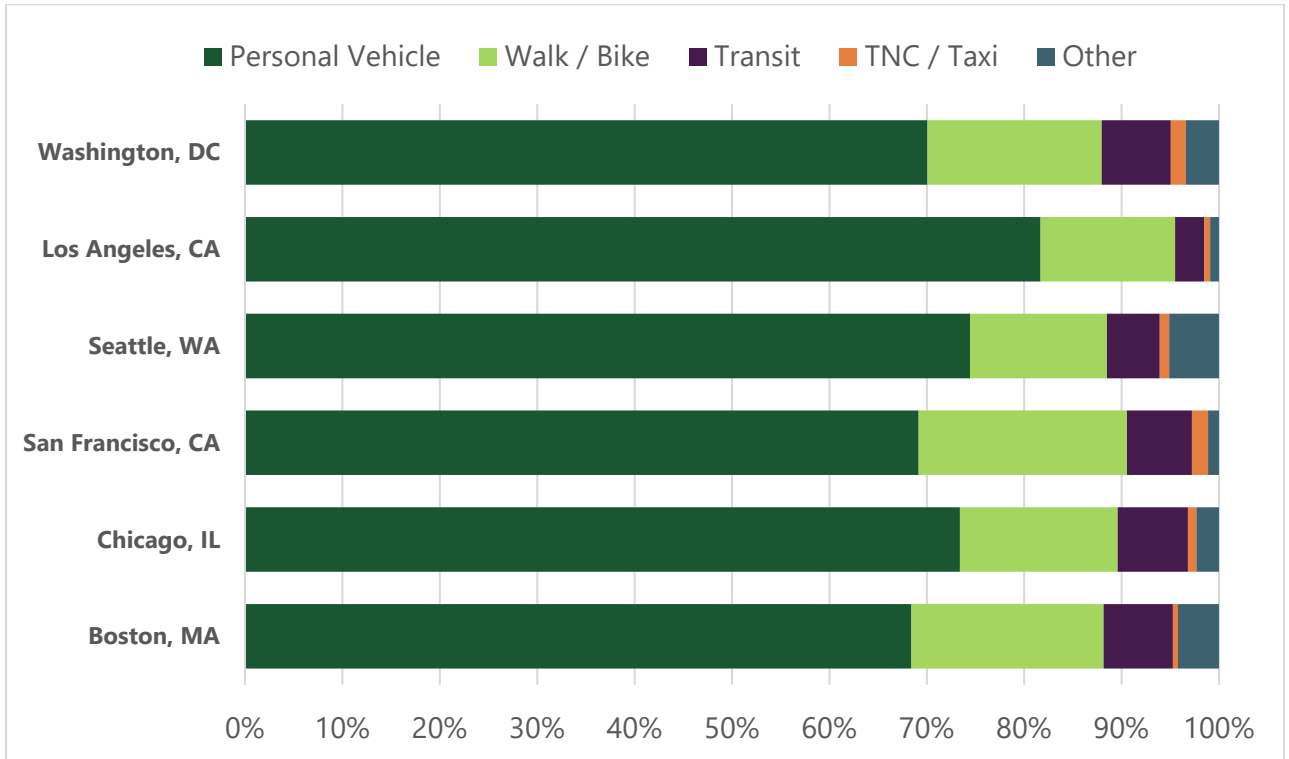
Figure 5: TNC Passenger Miles Only VMT Share - NHTS Data and TNC Reported Passenger Miles (P3) by Metro Region



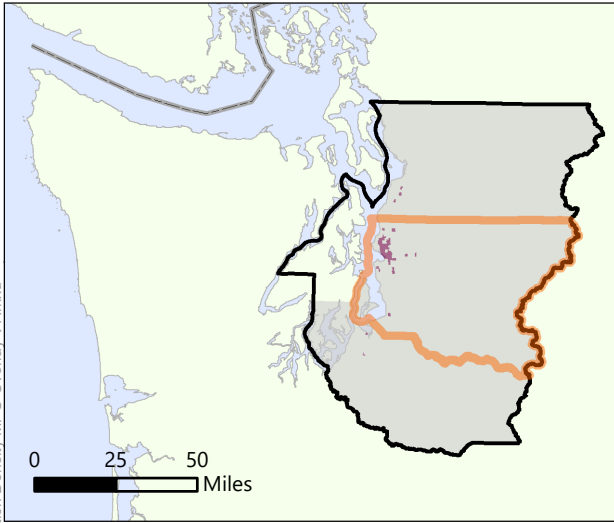
While this memorandum has until now been devoted to summarizing how TNC vehicle miles compare within and across metro regions, it is important to not lose track of the amount of transportation options available and to what extent they are used by the populations of each area. Specifically, **Figure 6** shows a comparison of the average mode split from NHTS data (summarized by metropolitan statistical area, or MSA) to show how TNC use fits in in the broader modal picture for each metro region. While TNC travel plays a larger role in metro regions that include comparatively dense, urban areas such as San Francisco and Washington, DC, TNC use there is estimated to be around 1.7 and 1.5 percent, respectively. In comparison, across all regions, travel by personal vehicle is estimated to be used for 68 to 82 percent of trips, travel by walking and biking is estimated to be between 14 and 21 percent of trips, and travel by transit is estimated to be between 3 and 7 percent of trips.



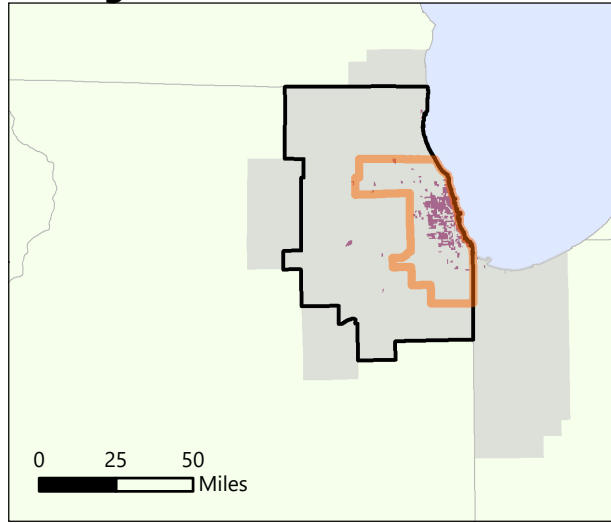
Figure 6: NHTS-Estimated Person Trip Mode by Metro Region (2017)



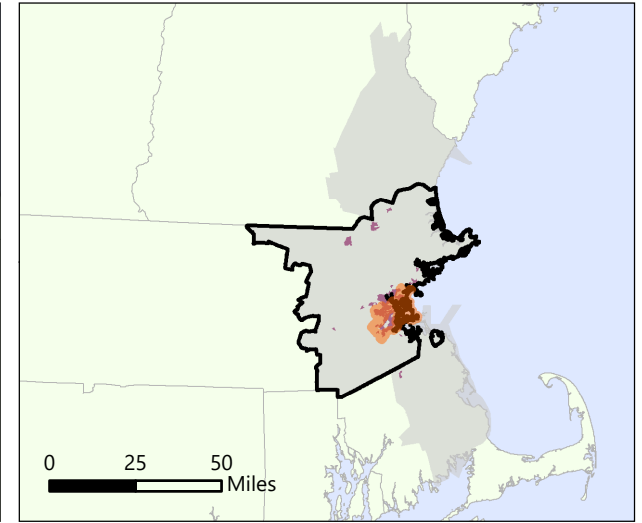
Seattle, WA



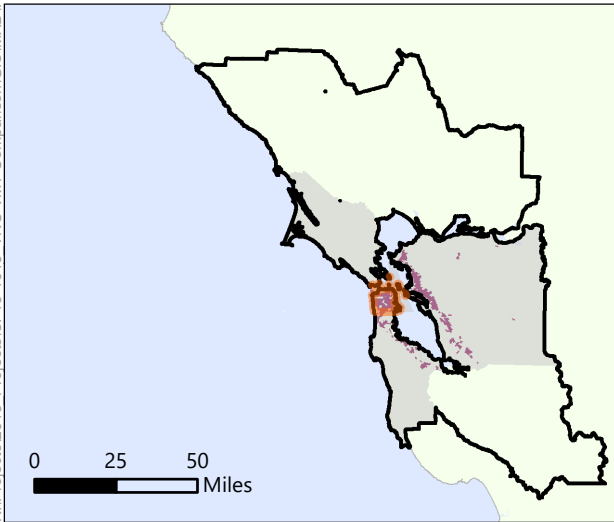
Chicago, IL



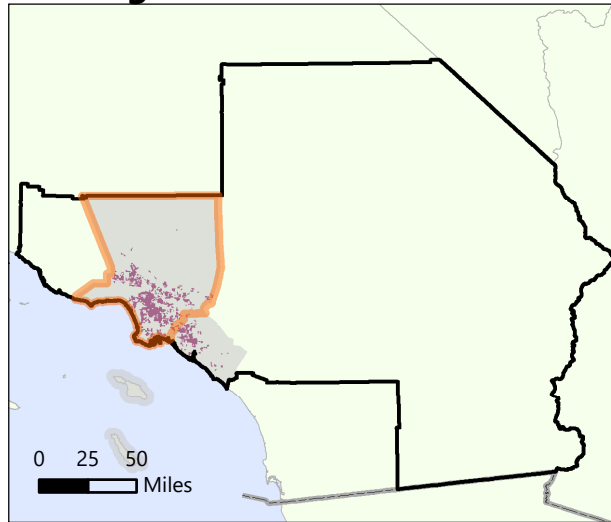
Boston, MA



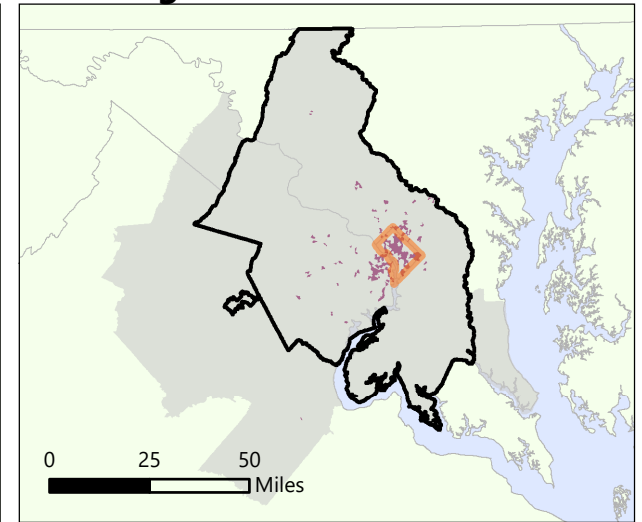
San Francisco, CA



Los Angeles, CA



Washington, DC



- Metropolitan Statistical Area (MSA)
- Densest Census Tracts (Population Density > 10k / sq mi)
- MPO Region Border
- Core County Border
- Land Outside MSA
- International Border



Figure A1
MSA and Densest Census Tracts by Metropolitan Region (NHTS Analysis)