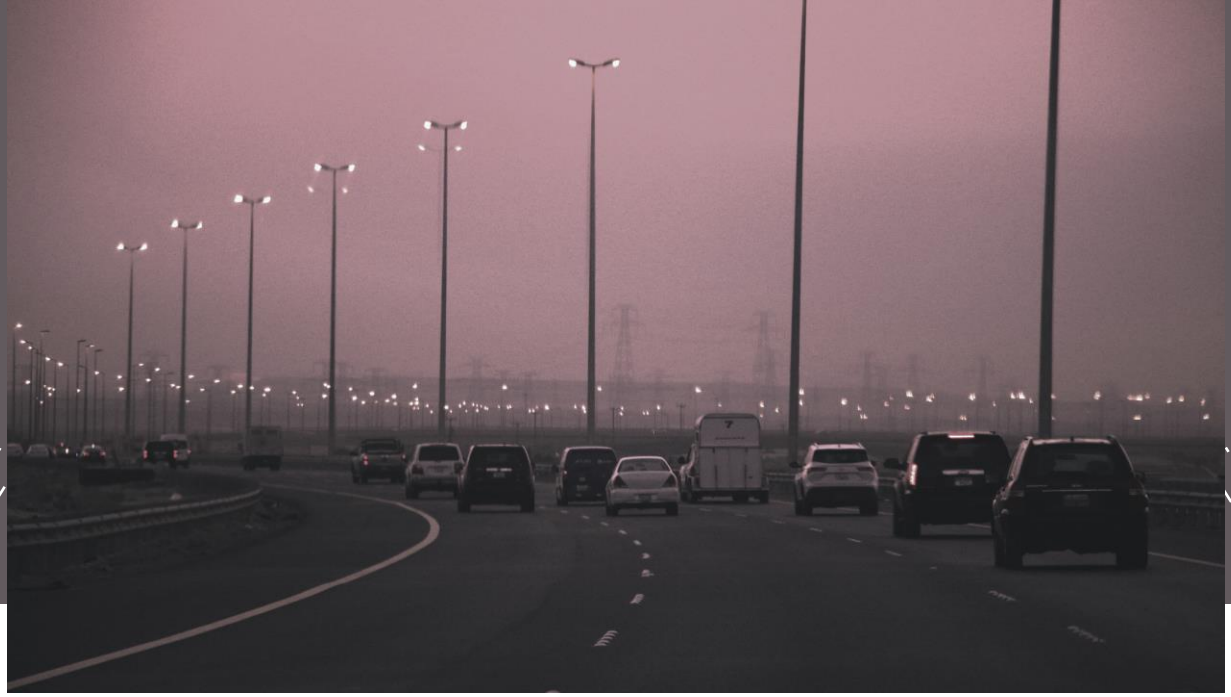

POLICY BRIEF

COVID Recovery? Changing Travel Behaviors? Insights From the 2022 ACS, ATUS, and CE Data Sets

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TOMNET Transportation Center
Teaching Old Models New Tricks

TBD

ABOUT

TOMNET: The Center for Teaching Old Models New Tricks (TOMNET) is a tier-1 University Transportation Center established in 2016 by the U.S. Department of Transportation (USDOT). TOMNET is dedicated to advancing research on traveler behavior and values, the role of attitudes and preferences in shaping mobility choices, and the application of machine learning and data fusion methods to improve transportation demand forecasting models. The Center's unique mission is to provide deep insights into human attitudes and behaviors and their impact on transportation systems, thereby enhancing the accuracy and value of travel demand forecasting models. TOMNET is led by Arizona State University and includes Georgia Tech, University of South Florida, and University of Washington as consortium members.

TBD: The Center for Understanding Future Travel Behavior and Demand (TBD) is a National University Transportation Center established in 2023 by USDOT. TBD's research focuses on understanding evolving travel behaviors driven by technological advances, demographic and cultural shifts, and environmental concerns. TBD is committed to undertake breakthrough research that will fundamentally re-examine and transform the scientific base for measuring, monitoring, modeling, and managing traveler behavior. The Center initiatives aim to support the design, development, and operation of a people-centric, multimodal, intelligent transportation system that meets the needs of people, institutions, and businesses for generations to come. TBD is led by The University of Texas at Austin and includes Arizona State University, Georgia Tech, University of Washington, University of Michigan, Cal Poly Pomona, City College of New York, and Diné College as consortium members.

In accordance with their missions, the TOMNET-TBD Policy Brief Series aims to inform policymakers, practitioners, academics, and the general public about current and emerging traveler behavior trends and their implications for the future of transportation.

CONTENTS

Introduction

The U.S. Census conducts three different annual surveys that provide insight into transportation analysts regarding travel behaviors and travel trends. Each of these surveys has a multi-decade history enabling analysts to discern changes over time. Survey data for the calendar year 2022 is now available with transportation-relevant information presented below. The dramatic transportation impact of the COVID-19 pandemic coupled with ongoing changes in demographics, transportation technologies, and culture and values make it particularly important to review the available data to discern emerging new normal behaviors.

This brief reviews the American Community Survey (ACS), the Consumer Expenditure (CE) Survey, and the American Time Use Survey (ATUS), with respect to questions that give insight into travel behaviors. The survey data for 2022 provides information about behaviors during a time period when the country was still adjusting to COVID recovery conditions but was also dealing with inflation, ongoing demographic shifts, enhanced concerns regarding climate change, troubling urban crime, polarized values, and shifting economic conditions – factors all of which can influence travel.

The passage of time has reaffirmed that some COVID-inspired changes in behaviors appear to be resistant to complete reversion to pre-COVID conditions. Notably, telework or work-from-home (WFH) continued at high levels while travel for socialization and recreation rebounded aggressively. The resurgence in total vehicle miles of travel masks some significant changes in travel behavior, particularly for work-related commuting by both personal vehicles and public transit. Before the pandemic, commuting comprised an estimated 28% of all household-based vehicle miles of travel, about 20% of total vehicle travel, and an even larger share of transit trips. These commutes disproportionately contribute to congestion and the related consequences. Also, since they define the peak/rush hours, they influence a substantial portion of transportation spending and policy decisions.

The subsequent sections provide a brief exploration of each survey, complemented by select results and observations.

American Community Survey

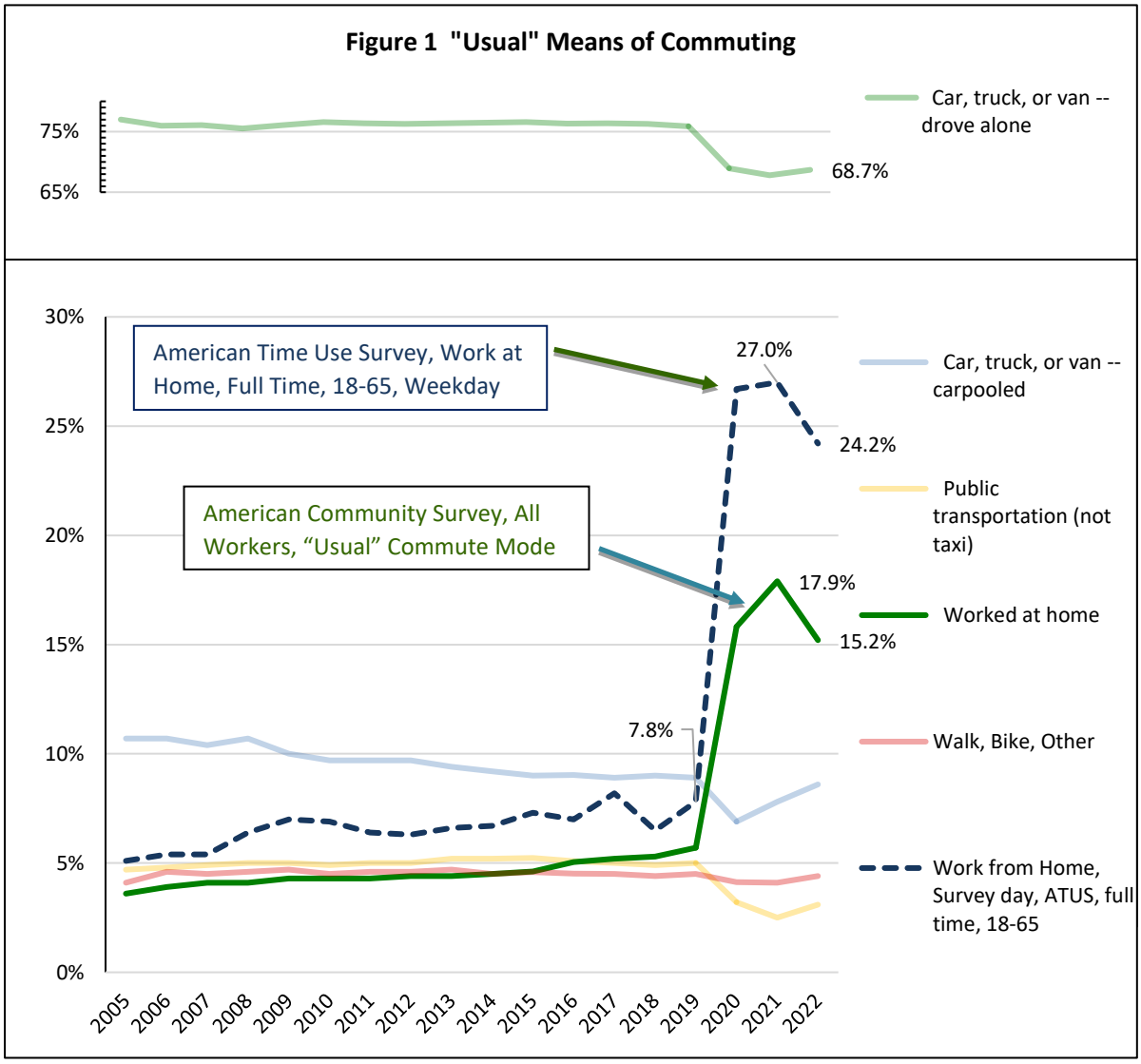
The ACS is an annual Census survey that collects data about U.S. residents. It covers a range of demographic and household characteristics, including commute travel. Due to its large sample size and annual conduct, the ACS is instrumental in monitoring trends across different geographies. Table 1 itemizes the key questions most relevant to transportation. The survey asks the respondent about their "usual" commute trip in the preceding week, without gathering data on other travel purposes. The pandemic impacted data collection in 2020; experimental data was released but did not meet the statistical standards the census traditionally applies. Hence, its inclusion (shown in red) should be interpreted with caution. Historical trends indicate that behaviors with respect

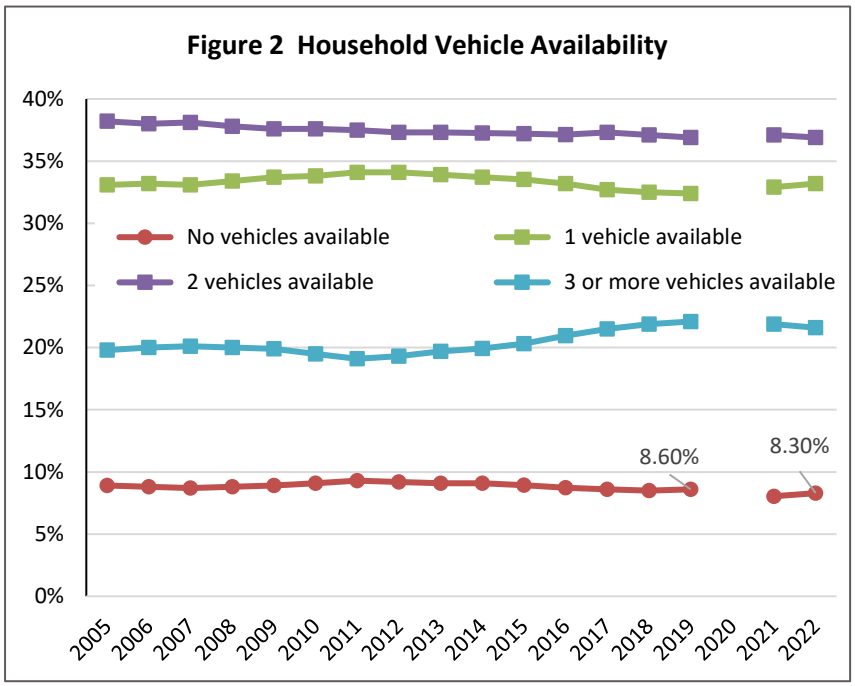
Table 1 - U.S. American Community Survey Trends																		
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
VEHICLES AVAILABLE – U.S.																		
No vehicles available	8.9%	8.8%	8.7%	8.8%	8.9%	9.1%	9.3%	9.2%	9.1%	9.1%	8.9%	8.7%	8.6%	8.5%	8.6%	--	8.0%	8.3%
1 vehicle available	33.1%	33.2%	33.1%	33.4%	33.7%	33.8%	34.1%	34.1%	33.9%	33.7%	33.5%	33.2%	32.7%	32.5%	32.4%	--	32.9%	33.2%
2 vehicles available	38.2%	38.0%	38.1%	37.8%	37.6%	37.6%	37.5%	37.3%	37.3%	37.3%	37.2%	37.1%	37.3%	37.1%	36.9%	--	37.1%	36.9%
3 or more vehicles available	19.8%	20.0%	20.1%	20.0%	19.9%	19.5%	19.1%	19.3%	19.7%	19.9%	20.3%	21.0%	21.5%	21.9%	22.1%	--	21.9%	21.6%
COMMUTING TO WORK – U.S.																		
Car, truck, or van -- drove alone	77.0%	76.0%	76.1%	75.5%	76.1%	76.6%	76.4%	76.3%	76.4%	76.5%	76.6%	76.3%	76.4%	76.3%	75.9%	69.0%	67.8%	68.7%
Car, truck, or van -- carpooled	10.7%	10.7%	10.4%	10.7%	10.0%	9.7%	9.7%	9.7%	9.4%	9.2%	9.0%	9.0%	8.9%	9.0%	8.9%	6.9%	7.8%	8.6%
Public transportation (not taxi)	4.7%	4.8%	4.9%	5.0%	5.0%	4.9%	5.0%	5.0%	5.2%	5.2%	5.2%	5.1%	5.0%	4.9%	5.0%	3.2%	2.5%	3.1%
Walked	2.5%	2.9%	2.8%	2.8%	2.9%	2.8%	2.8%	2.8%	2.8%	2.7%	2.8%	2.7%	2.7%	2.6%	2.6%		2.2%	2.4%
Bicycle	0.4%	0.5%	0.5%	0.5%	0.6%	0.5%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.5%	0.5%	0.5%	4.1%	1.9%	2.0%
Other means	1.2%	1.2%	1.2%	1.3%	1.2%	1.2%	1.2%	1.2%	1.3%	1.2%	1.2%	1.2%	1.3%	1.3%	1.4%			
Walk, Bike, Other	*4.1%*	*4.6%*	*4.5%*	*4.6%*	*4.7%*	*4.5%*	*4.6%*	*4.6%*	*4.7%*	*4.5%*	*4.6%*	*4.5%*	*4.5%*	*4.4%*	*4.5%*	*4.1%*	*4.1%*	*4.4%*
Worked at home	3.6%	3.9%	4.1%	4.1%	4.3%	4.3%	4.3%	4.4%	4.4%	4.5%	4.6%	5.0%	5.2%	5.3%	5.7%	15.8%	17.9%	15.2%
ZERO-WORKER HOUSEHOLDS																		
U.S.	27.0%	25.8%	25.8%	24.5%	26.3%	27.2%	27.5%	27.3%	27.0%	26.9%	26.8%	26.6%	26.5%	26.5%	26.3%	--	27.4%	27.4%
MEAN TRAVEL TIME TO WORK																		
U.S. (mins)	25.1	25	25.3	25.5	25.1	25.3	25.5	25.7	25.8	26.0	26.4	26.6	26.9	27.1	27.6	--	25.6	26.4

to commuting mode have been changing slowly since the survey was initiated. However, COVID dramatically altered commute behaviors. Prior to COVID, the most significant trends observed were the longstanding decline in carpooling and the growth in WFH in the more recent years.

Figure 1 reveals the magnitude of the disruption attributable to the impacts of COVID. The ACS data indicated a decline in the usual WFH workers, but their share still ranks the second most common mode and is at a level many times higher than bike, walk, and transit and nearly twice the share of shared-ride commuters. Due to its wording, the ACS question, which relies on respondents discerning the "usual" commute mode, has become less meaningful in an era of hybrid work patterns and increasingly variable work schedules. Figure 1 also includes a trend line showing the share of respondents in the ATUS who worked exclusively at home on the survey day. This much higher number captures the hybrid and occasional telework participants. The line shown reflects behaviors of 18- to 65-year-old full time workers.

Figure 1 "Usual" Means of Commuting





The second most significant revelation in the post-COVID ACS is the significant change in the share of zero-vehicle households. The share of households with no vehicles ticked up from 2021 but remained below pre-COVID levels. This change is shown in Figure 2. This data hints that some share of households that added vehicles to deal with mobility during COVID have relinquished some vehicles. Higher fuel and insurance prices and improved transit services may have played a role.

Figure 3 presents the share of zero-worker households. The graph has the same data in an inset to show the influence in perception attributable to using different scales. This is an indication of the share of households that do not have workers and hence whose travel demands, and residential location decisions are not necessarily shaped by commuting. This share in conjunction with the households that have work at home members, suggests that nearly half of households had no one commuting on a given workday.

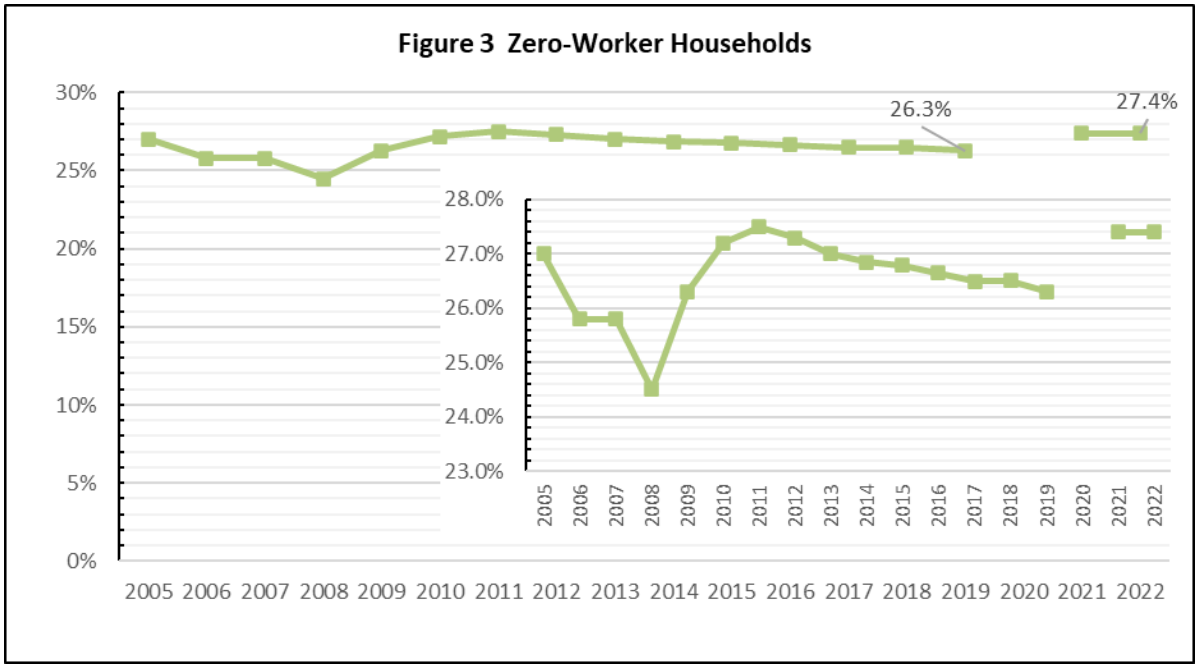
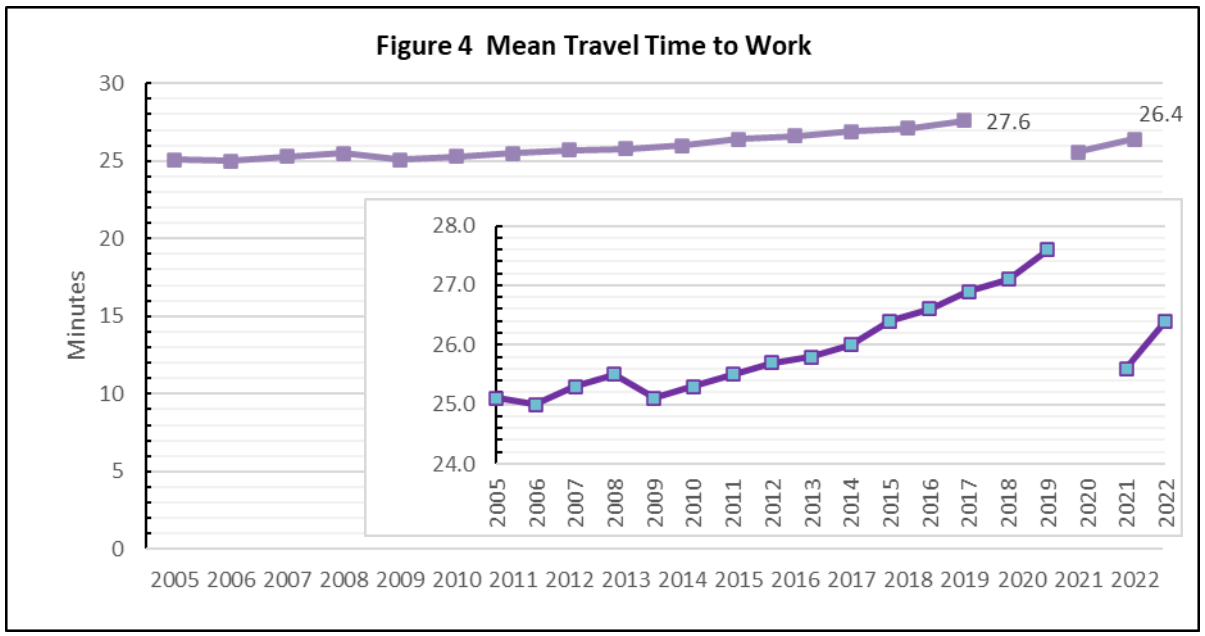


Figure 4 shows the trend in mean one-way travel time to work. The average time declined by 2 minutes in 2021 from 2019, followed by a near one-minute increase in 2022. These fluctuations represent the most significant short-term changes ever observed in ACS's history. It is important to note here that these averages do not include the zero-commute time of teleworkers and reflect a combination of a change in congestion levels, the speed of the commuters' mode choice, and any changes in average trip length that may have occurred. The data aligns with the evidence suggesting that longer trips were more likely to shift to telework, traffic congestion for commuting was lower, and slower modes like transit were less used. The new teleworkers, aside from saving themselves their commute time that might have averaged nearly an hour a day, can also be credited for reducing the round-trip commute time for other commuters by an average of 2-3 minutes.



ACS summary:

- The WFH jump is the most significant change in commuting since ACS began. The shift to WFH is larger than the prior combined share of bike, walk, and public transit.
- Public transit was most impacted by the rise in WFH practices. Its share decreased by around 50% from 2019 to 2021, with a slight rebound in 2022 (5% → 2.5% → 3.1%).
- No-vehicle households remained below pre-COVID level.
- The no-worker household share remained at 27.4%, the highest level since 2011.
- The average commute time has ticked back up but remains below pre-COVID levels.

Consumer Expenditure Survey

The CE offers insights into expenditures, income, and demographic characteristics of consumers in the United States. The CE program data are collected by Census for the Bureau of Labor Statistics in two surveys, the Interview Survey for major and/or recurring items and the Diary Survey for more minor or frequently purchased items. CE data are primarily used to revise the relative importance of goods and services in the market basket of the Consumer Price Index. The CE is the sole federal household survey that provides information on the complete range of consumers' expenditures and incomes. Table 2 presents data on transportation expenditures, delineating the expenditure categories used in the data collection process.

Figure 5 reveals spending levels for major categories of transportation expenditures. Expenditures on transportation increased by over 25% between 2020 and 2022. That substantial increase, $2,552 per consumer unit, is highly reflective of the $1,552 increase in expenditures on fuel and oil. However, as shown in Table 2 and Figure 6, transportation has been a slightly declining share of total household expenditures when reviewed since 2005. Similarly, spending on transportation and housing as a share of total spending as well as transportation and shelter as a share of total spending are both very stable with current levels slightly below those in the 2005-2007 period. Shelter is a narrower definition of housing costs which excludes things like furnishings and utilities.

Figure 5 Consumer Expenditures on Transportation (Nominal Dollars)

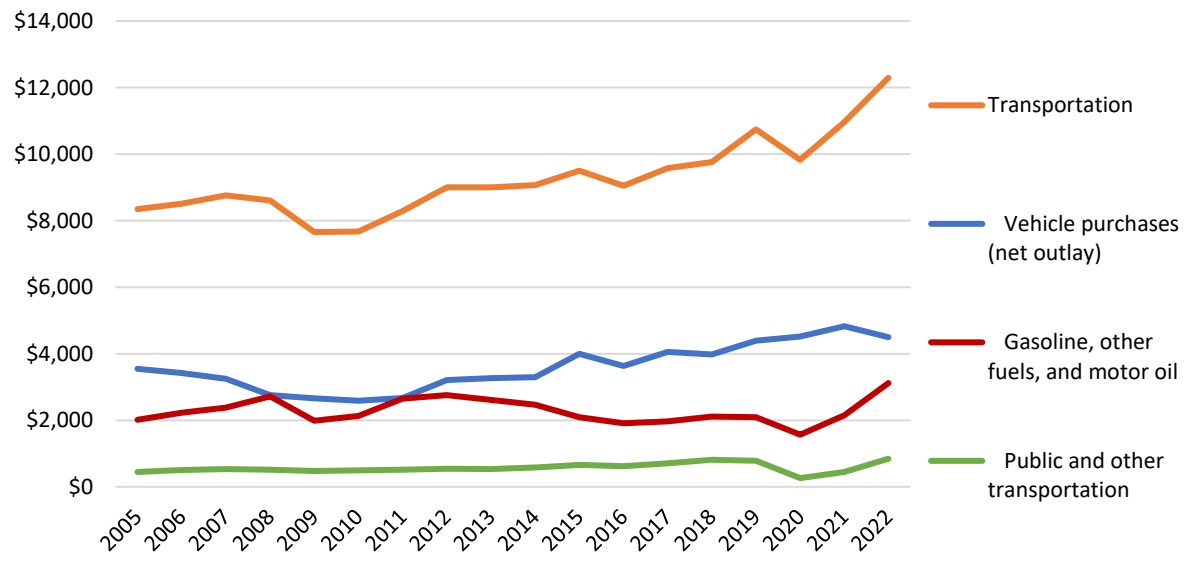
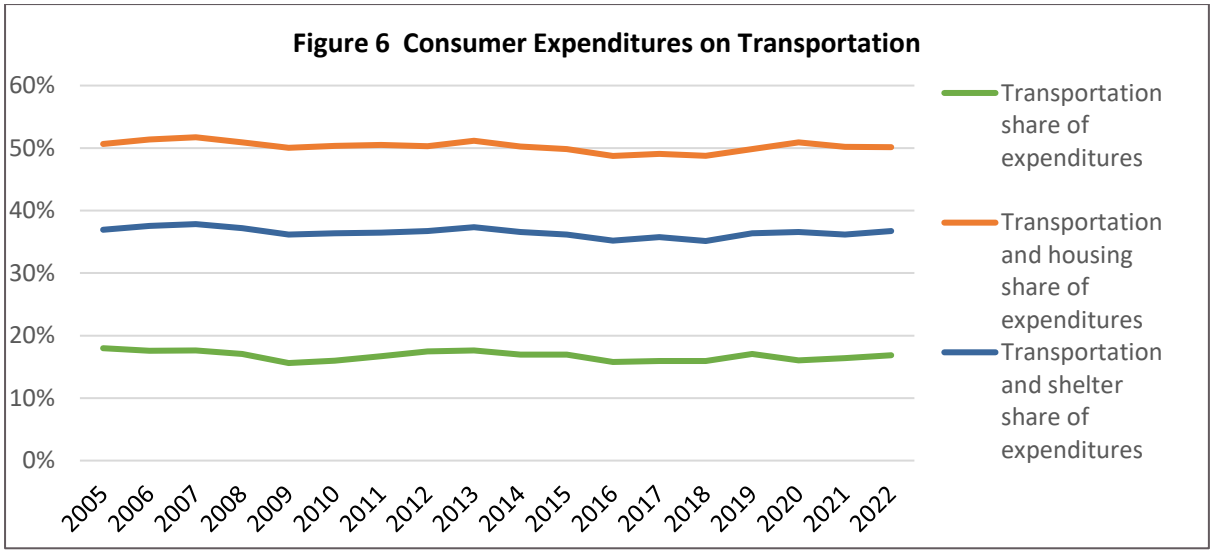


Table 2 - Consumer Expenditure Survey Trends (Nominal Dollars)																		
Item	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Expenditures	$46,409	$48,400	$49,638	$50,486	$49,067	$48,109	$49,705	$51,442	$51,100	$53,495	$55,978	$57,311	$60,060	$61,224	$63,036	$61,334	66,928	$72,967
Housing	$15,167	16,366	16,920	17,109	16,895	16,557	16,803	16,887	17,148	17,798	18,409	18,886	19,884	20,091	20,679	21,409	22,624	24,298
Shelter	$8,805	9,673	10,023	10,183	10,075	9,812	9,825	9,891	10,080	10,491	10,742	11,128	11,895	11,747	12,190	12,604	13,258	14,507
Transportation	$8,344	8,508	8,758	8,604	7,658	7,677	8,293	8,998	9,004	9,073	9,503	9,049	9,576	9,761	10,742	9,826	10,961	12,295
Vehicle purchases (net outlay)	$3,544	3,421	3,244	2,755	2,657	2,588	2,669	3,210	3,271	3,301	3,997	3,634	4,054	3,975	4,394	4,523	4,828	4,496
Cars and trucks, new	$1,931	1,798	1,572	1,305	1,297	1,219	1,265	1,639	1,563	1,562	1,956	1,650	1,900	1,825	1,960	2,089	2,210	2,195
Cars and trucks, used	$1,531	1,568	1,567	1,315	1,304	1,318	1,339	1,516	1,669	1,689	1,982	1,919	2,101	2,084	2,375	2,360	2,555	2,239
Other vehicles	$82	54	105	134	55	51	64	56	39	50	59	66	53	66	59	75	63	62
Gasoline, other fuels, and motor oil	$2,013	2,227	2,384	2,715	1,986	2,132	2,655	2,756	2,611	2,468	2,090	1,909	1,968	2,109	2,094	1,568	2,148	3,120
Other vehicle expenses	$2,339	2,355	2,592	2,621	2,536	2,464	2,454	2,490	2,584	2,723	2,756	2,884	2,842	2,859	3,474	3,471	3,534	3,834
Vehicle finance charges	$297	298	305	312	281	243	233	223	204	208	216	226	220	222	252	258	272	295
Maintenance and repairs	$671	688	738	731	733	787	805	814	835	836	837	849	954	890	887	879	975	1160
Vehicle rental, leases, licenses, and other	$458	482	478	465	447	423	433	434	533	567	624	660	700	772	790	758	760	787
Vehicle insurance	$913	886	1,071	1,113	1,075	1,010	983	1,018	1,013	1,112	1,079	1,149	967	976	1,545	1,575	1,528	1,592
Public and other transportation	$448	505	538	513	479	493	516	542	537	581	661	623	712	818	781	263	452	845
Transportation share of expenditures	18.0%	17.6%	17.6%	17.0%	15.6%	16.0%	16.7%	17.5%	17.6%	17.0%	17.0%	15.8%	15.9%	15.9%	17.0%	16.0%	16.4%	16.9%
Transportation and housing share of expenditures	50.7%	51.4%	51.7%	50.9%	50.0%	50.4%	50.5%	50.3%	51.2%	50.2%	49.9%	48.7%	49.1%	48.8%	49.8%	50.9%	50.2%	50.2%
Transportation and shelter share of expenditures	37.0%	37.6%	37.8%	37.2%	36.1%	36.4%	36.5%	36.7%	37.3%	36.6%	36.2%	35.2%	35.7%	35.1%	36.4%	36.6%	36.2%	36.7%



American Time Use Survey

The ATUS is a particularly useful survey in that it is a federally administered annual time use survey conducted by the Bureau of Labor Statistics (BLS) in the United States since 2003. The survey measures how people spend their time during the sampled day, encompassing activities related to personal care, household maintenance, work, education, shopping, travel, volunteering, errands, telephone calls, and child and elder care. The survey provides detailed information about time spent on all these activities, both in-home and out-of-home. The ATUS does not have a provision for recording multiple activities in the same time slot; thus, it does not capture multitasking when individuals may engage in primary, secondary, and tertiary activities simultaneously. The ATUS provides detailed activity and time use data for a nationally representative sample of about 10,000 individuals annually.

The ATUS confirms numerous other surveys that document the dramatic increase in telework attributable to the pandemic. The ACS which asked individuals their usual means of commuting in the prior week reported telecommuting having a 5.7% share in 2019 and jumping to 17.9% for 2021 and 15.2% for 2022. In comparison, as displayed in Figure 1, the ATUS indicated a 7.8% telework share for full time 18–65-year-old workers who were working on their survey day in 2019, 27.0% in 2021, and 24.2% in 2022, a dramatic increase. Understanding this difference is critically important in that it represents the difference between reported "usual" means of commuting versus reported actual means on the survey day as reported by ATUS. Since telework is still an occasional mode numerous people telework one or two days per week, thus, their answer to the usual mode question would not reference telework but rather their mode used for the majority of the week. This tends to undercount the actual average share of telework participation. This tendency existed before COVID. However, this relationship may shift as the actual extent of telecommuting stabilizes and depends upon how respondents define their usual mode. In 2021 and 2022 the data indicate that telework

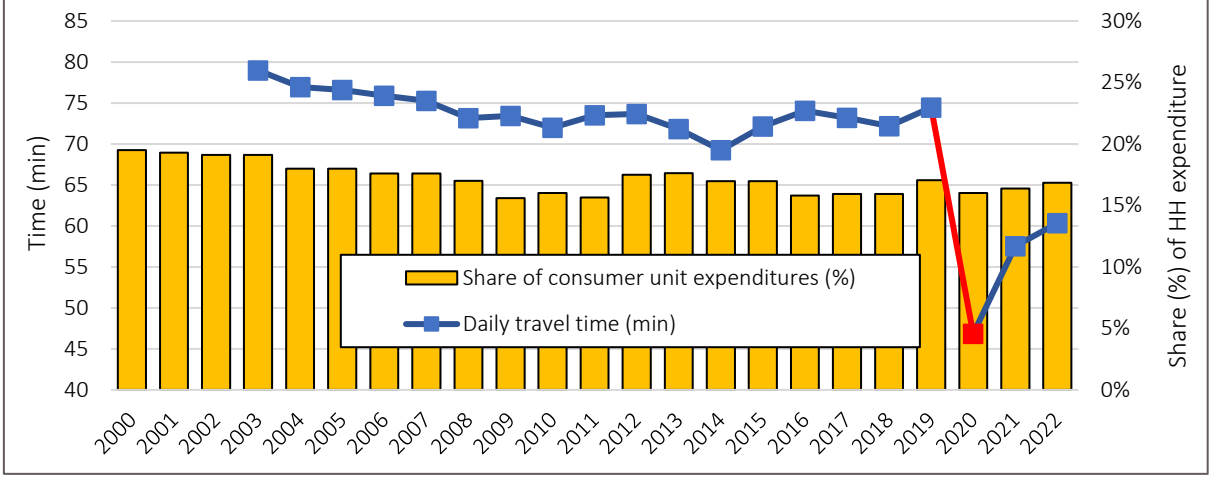
was significantly higher on average than is reported in the American Community Survey. This result is also generally consistent with other surveys carried out by other researchers such as the Survey or Working Arrangements and Attitudes.

Understanding the telework or working-from-home phenomenon is obviously important in understanding future travel demand. The amount of commute trips is critical in defining the peak infrastructure needs for both the roadway system and public transportation. Understanding the trend in post-COVID telework shares is important to the future of travel demand forecasting. The consequence of foregone commutes across the various modes of travel (see Figure 1), the distribution of telework across days of the week, the variations in telework adoption across various metropolitan areas, changes in central city recoveries, changes in peaking characteristics associated with telework and more flexible work habits, and the emerging data that indicates time and money saved via working from home is being redeployed to supplement other travel or carry out activities previously handled as trips chained with the commute, are among the critical questions that will help define the future of travel demand. Understanding the impact of telework at the local level may require insight into factors hypothesized to impact telework participation rates, including the nature of employment, scale/culture/size of firms, metro size/commute length/cost, corporate/community culture, urban crime, and economic conditions.

As waves of COVID were still impacting travel significantly in 2021 and 2022, one would expect some return to normal with respect to travel for many activities. However, the persistence of telework and perhaps other substitution effects such as distance learning, e-commerce, and telemedicine may continue to impact time allocated to travel for various purposes.

Figure 7 combines information from the ATUS and the CE to give an overview of the public's expenditure of both money and time on travel. On one axis, the figure depicts daily travel time expenditures per person for those aged 15 and older, using data from the ATUS. On the other axis, it shows the percent of household expenditures allocated

Figure 7 Time and Money Investments in Travel



to transportation, based on CE survey data for respondents aged 16 and older. As the figure reveals, there was a modest decline in the American public's investment of time and money in travel during the first decade of the 21st century, with a generally stable trend observed thereafter.

Figure 8 shows the trend in daily trips per person for those 15 and older, as derived from ATUS data. This data is consistent with NHTS data and overall VMT trends, suggesting a moderation in person trip making, which is attributable to communication substitution, demographic trends, and other factors.

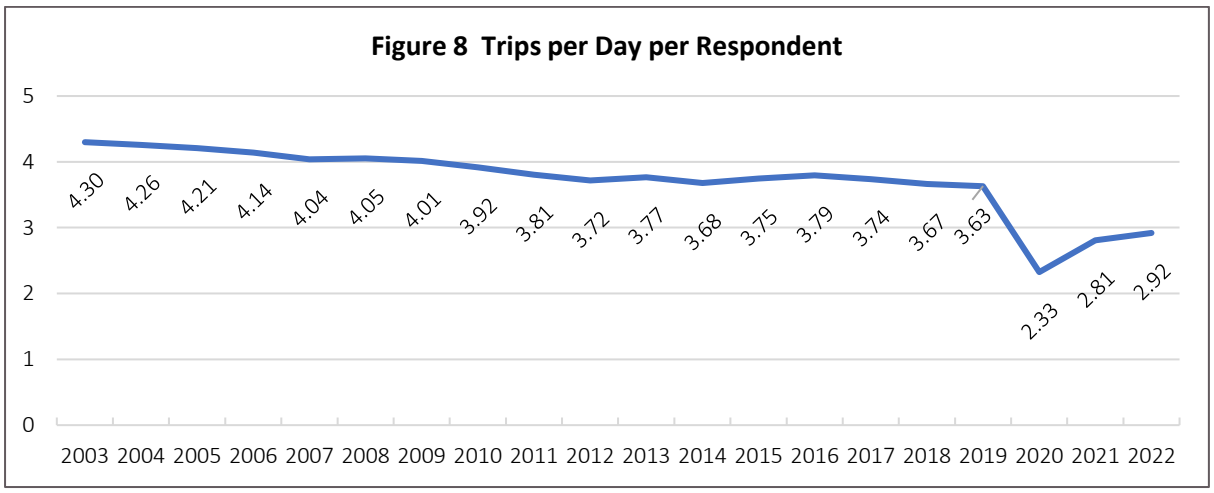


Figure 9 presents the total minutes of daily travel per person as reported by respondents 15 or older. This data similarly shows a slight moderation in travel time expenditures, with both travel time and trip counts for 2022 being approximately 80% of their 2019 levels.

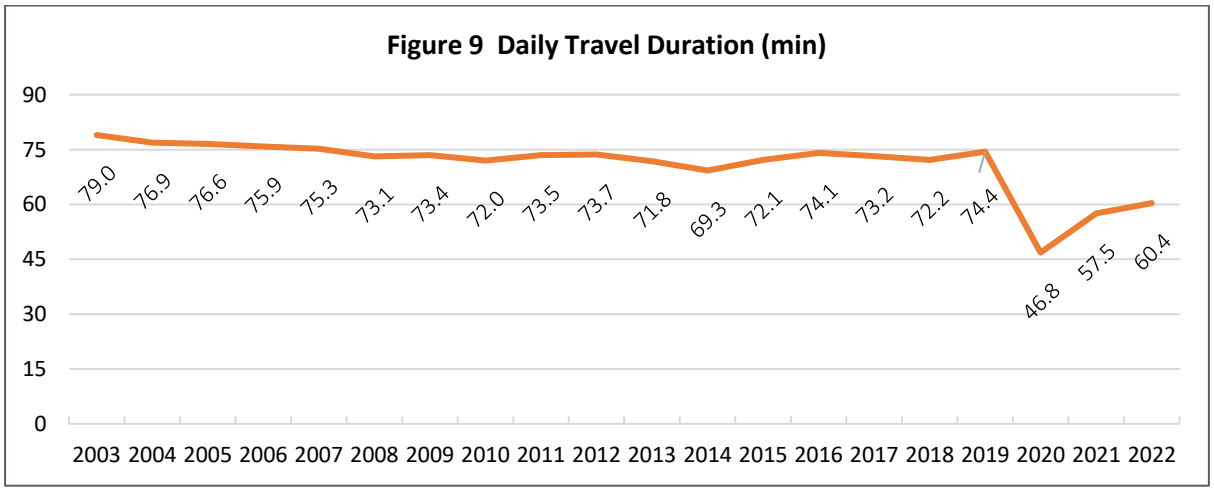
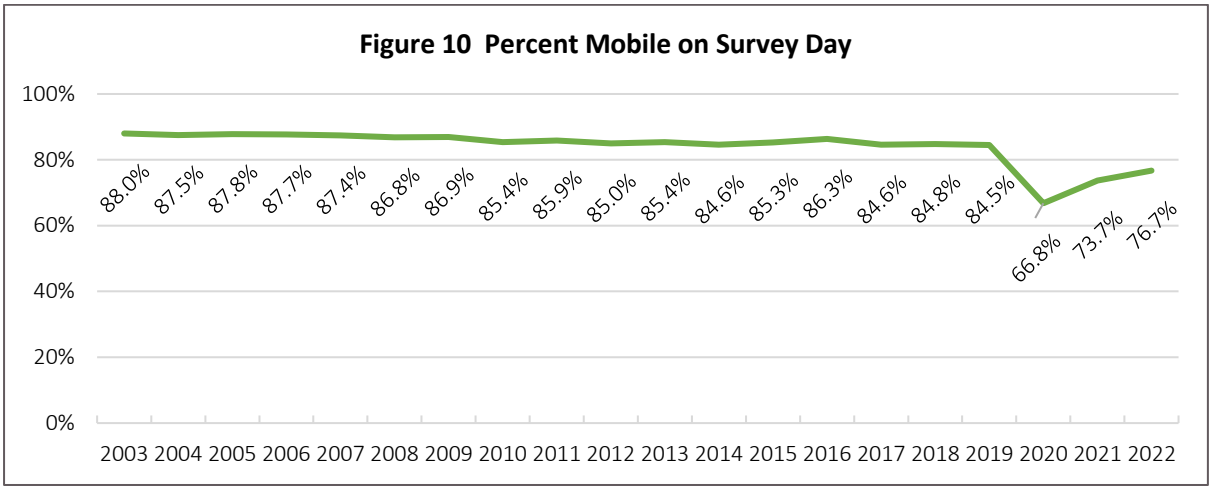


Figure 10 shows the share of the population (15 or older) that was mobile during the survey day where mobility is defined as making a trip away from the home. This share trended down very slightly until the COVID-19 pandemic, during which it plummeted to its lowest point in 2020 due to numerous stay-at-home orders and regulations. Even

though most COVID-related restrictions are now a thing of the past, the percentage of trip-makers on any given day remains significantly below pre-COVID levels (86.6% in 2019 vs. 78.3% in 2022). This sustained decrease may be attributed to the rise in WFH practices, online learning, e-commerce, and other similar trends.

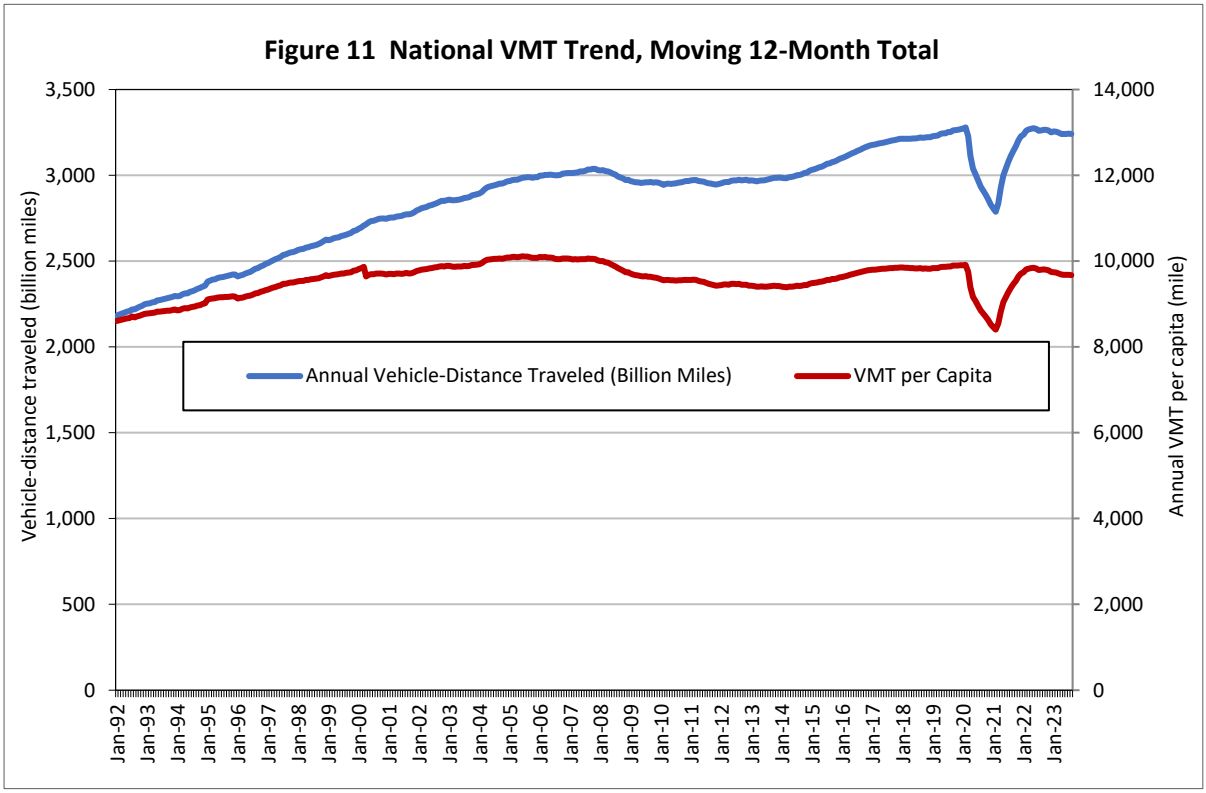


Implications for Future Travel Demand

Figure 11 shows two measures of roadway travel demand. The upper line represents a rolling 12-month average of national VMT, as reported by the Federal Highway Administration data. In contrast, the lower line shows the VMT per capita by simply dividing the total VMT by the population. The data goes through June of 2023. As depicted, VMT has been recovering from the pandemic, with the 12-month total nearly equal to the pre-COVID numbers. Per capita VMT, has similarly recovered; however, it is important to note that per capita VMT remains below its historic peak and shows no pronounced directional trend. The year-to-date 2023 data suggests a softening of travel, hypothesized to be a result of "catch-up" travel abating, the shift of some long-distance travel back to a recovered domestic air travel system, fuel prices, or other undiscerned factors. The unique and significant impacts of the COVID-19 pandemic are clearly apparent in this data.

The magnitude of telework and other situations where communication is substituted for travel remain the biggest uncertainty in the immediate future regarding travel demand trends. Given that commuting, which constitutes about 20% of total VMT, remains diminished by 10 to 20%, it would have the effect of reducing overall VMT by 2 to 4%. This does not consider secondary impacts such as the potential of telework to shift or redeploy the time and money resources for other activity/travel purposes, accomplish the activities previously linked to commute trips and/or replace the social interaction foregone by telework. While these changes might seem modest in total, they are extremely significant when compared to historical changes in travel. In addition, since commuting defines peak periods and peak infrastructure capacity and service levels, understanding these trends becomes even more crucial. Similarly, the emerging

evidence that indicates very different behaviors with respect to telework adoption across geography (in terms of both the home and work end of commute trips) and socio-demographic groups has significant implications for travel demand. As is becoming increasingly evident, the impact of telework on public transportation – particularly modes and services targeted toward longer-distance commute trips to office destinations –carries profound long-term implications on transportation policy and investment.



Both the private sector and public agencies have directed significant resources to monitoring and understanding the transportation impacts of COVID. While this information is being assembled and disseminated, much remains to be done to establish a sound understanding of the path forward. Post-COVID travel behaviors have not yet stabilized, with in office work participation levels continuing to change and other adaptations occurring simultaneously. Confounding factors that muddies the waters include rising fuel prices, the remaining extent of “catch-up” or “revenge" travel to make up for foregone travel during COVID, increasing crime rates impacting certain travel modes and locations, evidence of shifting residential location patterns, among other considerations. These complexities make it even more challenging to fully understand emerging travel behaviors with sufficient confidence to offer confident longer-term forecasts.

What is most clear is that the pace of change in travel behaviors has been unprecedented and uncertain. A host of other issues such as the pace of electrification, the magnitude of onshoring of manufacturing, the pace of immigration, the pace of

continued substitution of virtual connections in lieu of in person activities, the magnitude of reliance on and the logistic efficiency of delivery services and mobility-as-a-service (MaaS) options, the magnitude of adoption of micromobility travel options such as e-bikes, e-scooters, and inevitably pod sized mini vehicles, and finally, the pace and magnitude of meaningful deployment of autonomous services, all suggest a very dynamic future for travel behavior. And, of course, the state of the economy that has avoided a recession for an extended period and may struggle to accommodate high accumulated deficits going forward, can inevitably impact travel levels.

There is no compelling basis to expect a resurgence in per capita VMT growth. This suggests that any future growth will likely mirror shifts in population unless notable changes occur in economic conditions.