



## **POLICY BRIEF**

# **Changing Travel Behavior Insights From the 2021 ACS, ATUS, and CE Surveys**

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## ABOUT

The Center for Teaching Old Models New Tricks (**TOMNET**) is a tier-1 University Transportation Center funded by the USDOT, which 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's research is particularly relevant in the context of emerging transportation technologies and mobility paradigms, and the goal is to assist decision-makers in designing and planning transportation infrastructure systems that serve the mobility needs of all. In accordance with its mission, the [TOMNET 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.

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## **Introduction**

Understanding peoples' activity patterns and their need to travel to access those activities is important to inform decisions on transportation investments, policies, and operations. Analysis of several national surveys from 2021 can provide insights into changing travel behaviors. This brief reviews the American Community Survey (ACS), the American Time Use Survey (ATUS), and the Consumer Expenditure Survey (CES) with respect to questions that give insight into travel behaviors. The survey data for 2021 provides information about behaviors during a time period when the country was adapting to COVID conditions but well after the initial COVID disruption. Conditions had stabilized sufficiently that the surveys could be executed in 2021 and provide a sound basis for comparison with 2019 and prior year data.

As time has passed, people increasingly recognize that the impacts of the COVID pandemic have been substantial and are resulting in changes some of which will be persistent even when the threat of COVID has receded in peoples' memories. While virtually every aspect of society and the economy have been impacted by the pandemic, transportation has been among the most obviously impacted. Front and center in that change is the dramatic increase in individuals working at home in lieu of their prior place of employment. Initially motivated by the desire to minimize exposure to the contagion, many workers and employers have found favor in the other benefits that can be obtained by avoiding the work trip commute. Transportation work trips are something of the Holy Grail of travel. Pre-COVID, they comprised an estimated 28% of all household-based vehicle miles of travel and about 20% of all vehicle travel. They constitute an even larger share of transit trips. They disproportionately contribute to congestion and the related consequences, and because they define the peak periods/rush hours they shape significant shares of transportation spending and policy decisions. The referenced surveys provide an additional substantial data set to enhance our understanding of the changes occurring in commuting.

Each survey is discussed briefly with select results and observations.

## **American Community Survey**

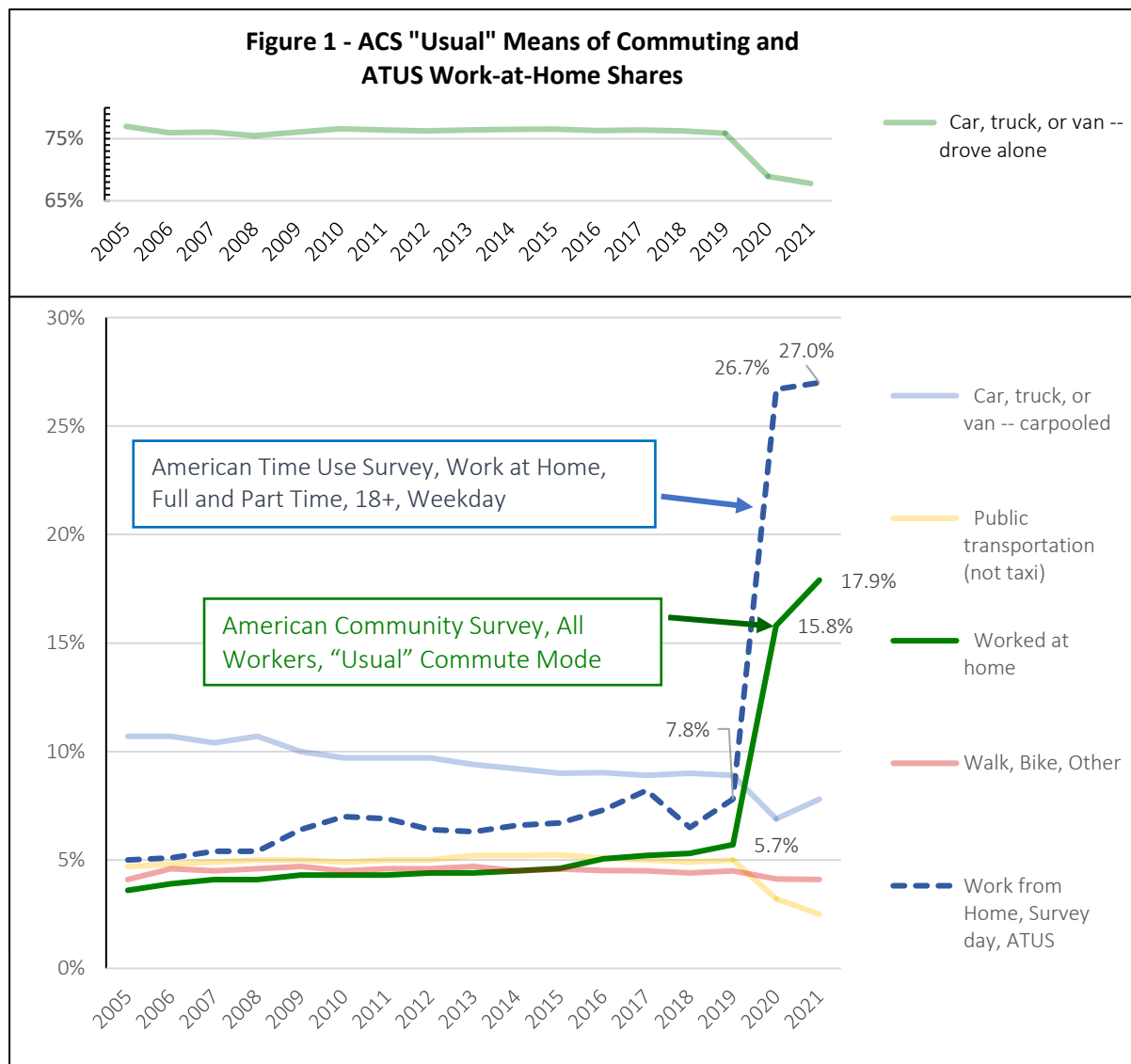
The ACS is an annual Census Bureau survey that collects data about U.S. residents regarding numerous demographic and other household characteristics including a few questions regarding commuting. Its relatively large sample and annual conduct enable it to be used to monitor trends across various geographies. Table 1 itemizes the key questions most relevant to transportation. The survey asks the respondent about the "usual" commute trip last week. The survey does not collect transportation data for any other trip purposes. Due to the pandemic disruptions, data collection was impacted in 2020 and experimental data was released but did not meet the statistical standards the census traditionally applies; hence its inclusion (in red) should be interpreted with caution. Generally, historical trends indicate that behaviors with respect to commute mode have

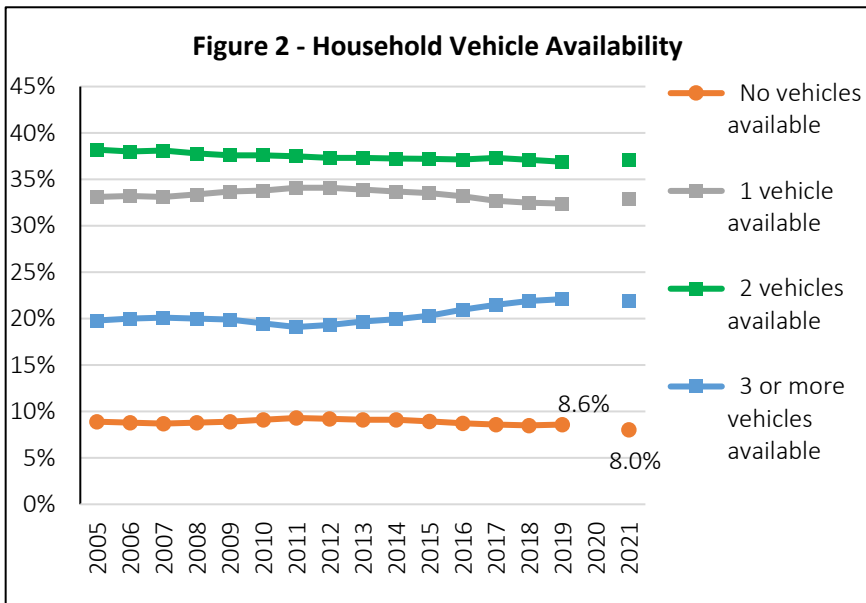
**Table 1 - U.S. ACS Trends**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>VEHICLES AVAILABLE – U.S.</b>																	
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%
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%
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%
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%
<b>COMMUTING TO WORK – U.S.</b>																	
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%
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%
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%
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%	4.1%	2.2%
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%		1.9%
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%		
<i>Walk, Bike, Other</i>	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%
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%
<b>ZERO-WORKER HOUSEHOLDS</b>																	
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%
<b>MEAN TRAVEL TIME TO WORK</b>																	
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

been changing relatively slowly since this survey was first initiated. However, COVID dramatically altered commute behaviors, with the dramatic adoption of telework as a popular means of work. Prior to COVID, the most meaningful trends of interest were the general decline in carpooling and the growth in working from home or telework in more recent years.

Figure 1 shows the trends in a graphic form which reveals the magnitude of the disruption attributable to the impacts of COVID. The 2021 data covers a period from approximately 9 months through 21 months into the pandemic. The pandemic mandatory shutdowns were generally over but travel behaviors were by no means back to normal. The ACS data indicated a more than tripling of the work-from-home share to almost 18% of total workers who usually worked from home. To give perspective, the increase in work from home's magnitude was approximately 150% of the pre-COVID sum of public transit, bike, and walk – meaning each of these modes would have had to have increased by 150% to have the same impact.





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 decline to its lowest level since the ACS began with a drop from 8.6% to 8.0%, a decline in the share of 7%. This change as

shown in Figure 2, is consistent with anecdotal stories of individuals purchasing additional vehicles to provide individual mobility to minimize COVID exposure risk. Low fuel prices, low interest rates, stimulus checks, and a strong economy facilitated this in the early months after the COVID shutdowns.

Figure 3 presents the share of zero-worker households. The graph is shown with two vertical scales which show the influence of scale. 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 the households had no one commuting on a given workday.

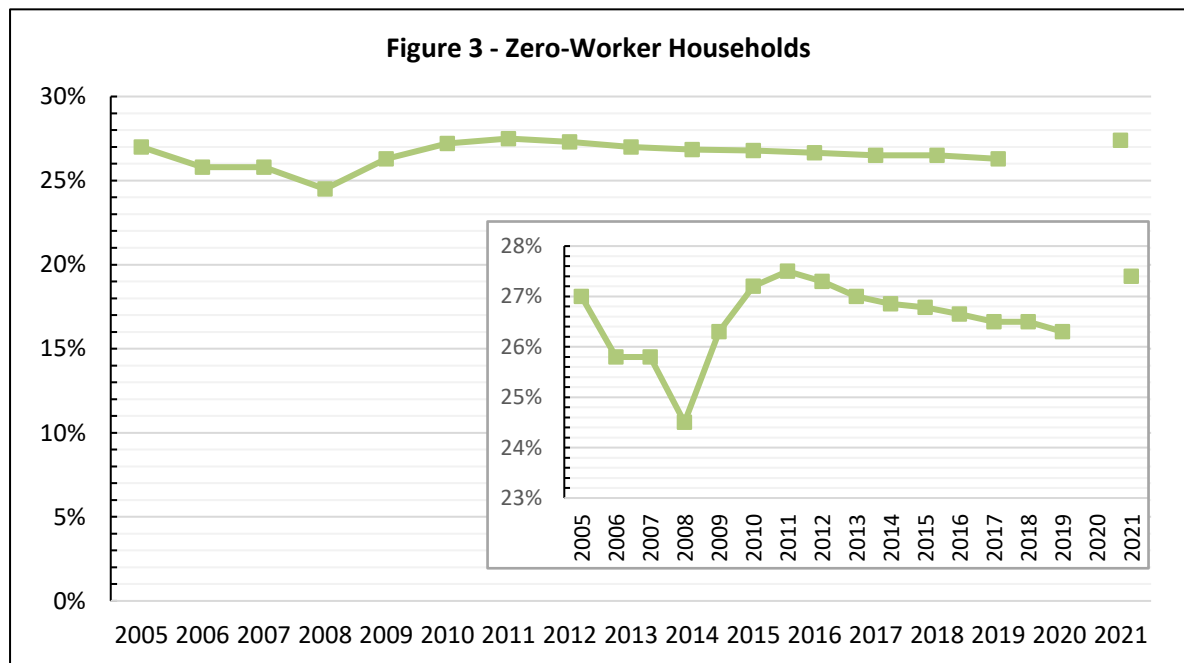
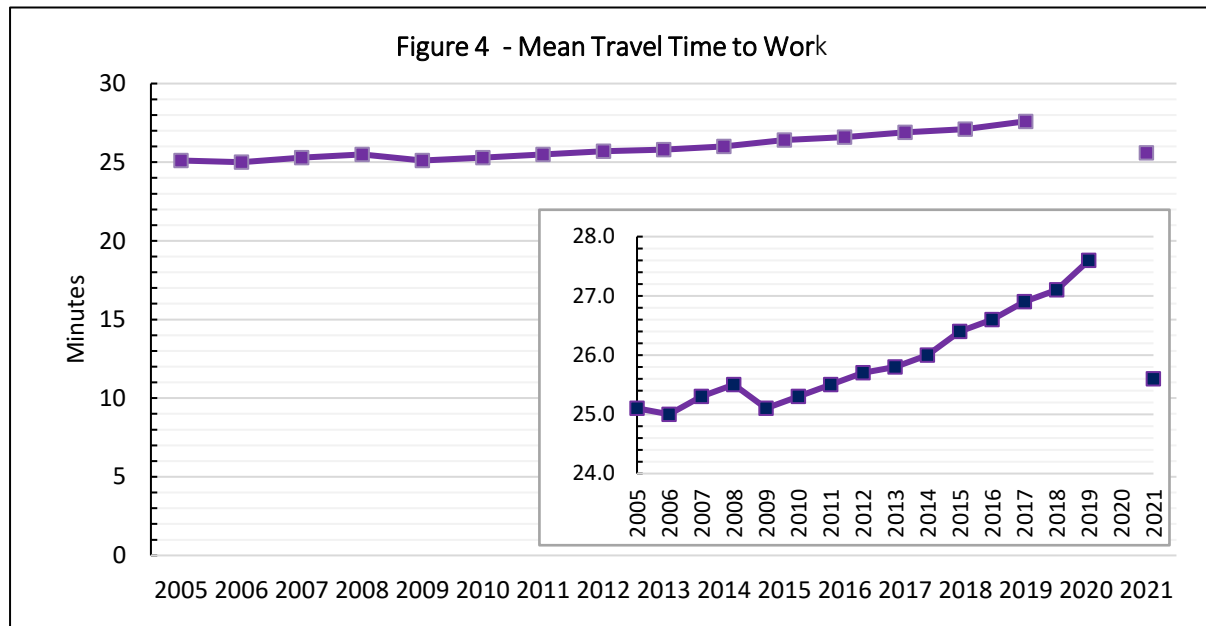


Figure 4 shows the trend in mean one-way travel time to work. The average time declined by 2 minutes to the level that existed in approximately 2011. This is the largest short-term change in the history of the ACS (and it does not average in the zero-commute time of teleworkers) and reflects a combination of a change in congestion levels, the speed of the commuters' mode choice, and any changes in average trip length that may have occurred. This change is consistent with the evidence that longer trips were more likely to shift to telework, traffic congestion for commuting was lower, and slower modes like transit were less used.



In summary:

- Work-at-Home (WAH) jump is the most significant change in commuting since ACS began. The shift to WAH is larger than the prior combined share of the bike, walk, and public transit.
- Public transit was most impacted by work-at-home, dropping its share by approximately 50% since 2019 (5%-2.5%).
- No-vehicle households dropped to the lowest level, declining from 8.6% in 2019 to 8.0% in 2021.
- The no-worker household share at 27.4% is the highest since 2011.
- The 2-minute decline in average commute is the largest recorded change since ACS began.
- The use of “usual” commute mode diminishes the value of the ACS for transportation analysis due to the occasional (hybrid) nature of WAH. For more on the planning implications, see the TOMNET Brief, [Commuting in America in 2020 and Beyond](#).



## Consumer Expenditure Survey

The Consumer Expenditure Survey (CE) provides data on expenditures, income, and demographic characteristics of consumers in the United States. The CE program data are collected by the Census Bureau for BLS 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 only Federal household survey to provide information on the complete range of consumers' expenditures and incomes. The data on transportation expenditures are shown in Table 2. This table enumerates the expenditure categories used in the collected data.

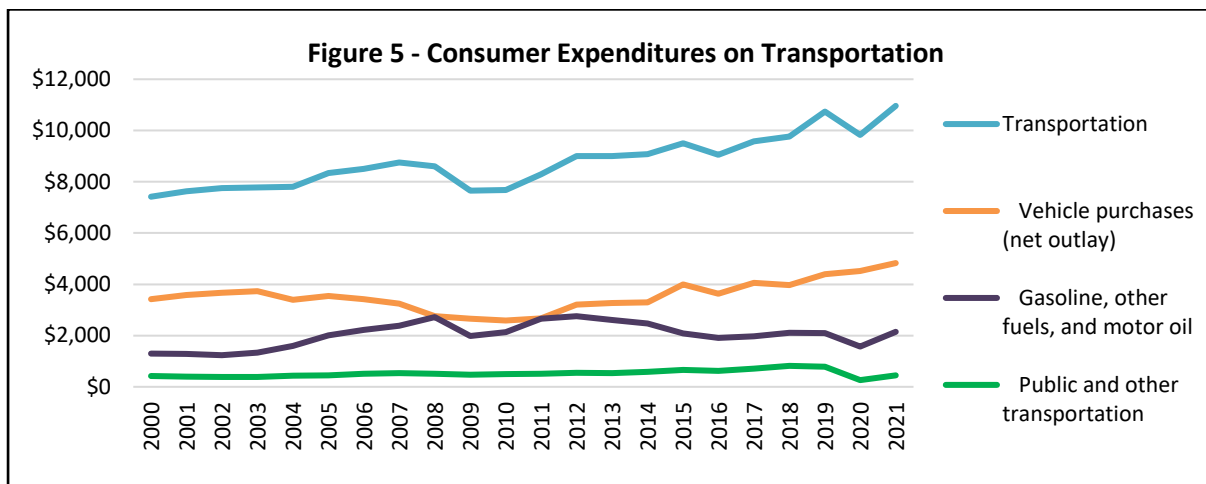
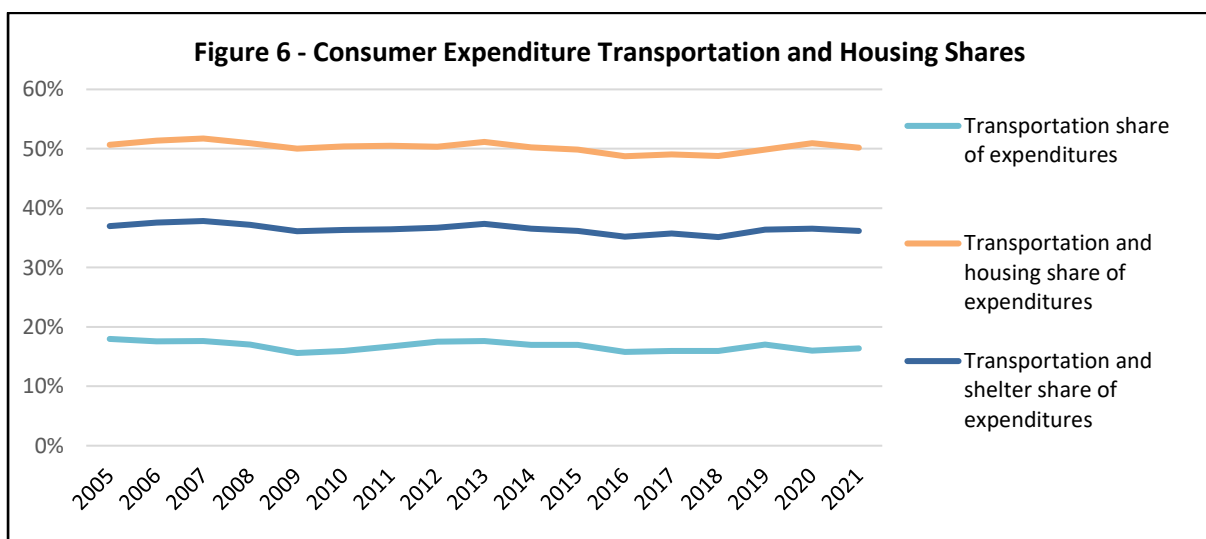


Figure 5 reveals that vehicle purchase spending is a major contributor to the total upward increase in spending. However, as shown in Table 2 and Figure 6, transportation has been a slightly declining share of total household expenditures since 2005. Similarly, spending on transportation and housing as a share of total spending as well as transportation and shelter as a share of total spending are both also declining. One should note that shelter is a narrower definition of housing costs which excludes things like furnishings and utilities.



**Table 2 - Consumer Expenditure Survey Trends**

Item	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
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
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
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
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
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
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
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
Other vehicles	\$82	54	105	134	55	51	64	56	39	50	59	66	53	66	59	75	63
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
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
Vehicle finance charges	\$297	298	305	312	281	243	233	223	204	208	216	226	220	222	252	258	272
Maintenance and repairs	\$671	688	738	731	733	787	805	814	835	836	837	849	954	890	887	879	975
Vehicle rental, leases, licenses, and other	\$458	482	478	465	447	423	433	434	533	567	624	660	700	772	790	758	760
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
Public and other transportation	\$448	505	538	513	479	493	516	542	537	581	661	623	712	818	781	263	452
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%
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%
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%

## 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 representative sample of approximately 9000 individuals annually. The analysis subsample used in this brief is limited to those 18 years or older.

The ATUS confirms numerous other surveys that document the dramatic increase in telework attributable to the pandemic. The American Community Survey which asked individuals their usual means of commuting the prior week reported telecommuting having a 5.7% share in 2019 and jumping to 17.9% for 2021. For a discussion of the 2020 ACS, see [Commuting in America in 2020 and Beyond: Observations, Planning Challenges, and Implications for the American Community Survey Transportation Questions](#). In comparison, as displayed in Figure 1, the ATUS indicated a 7.8% telework share for workers who were working on their survey day in 2019 and 27.0% in 2021, a more than threefold increase and a share 9.1 points higher than the ACS number for 2021. 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 as 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 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 various researchers such as [Nicholas Bloom of Stanford](#).

Understanding the telework or work-from-home phenomenon is obviously important in understanding future travel demand. Commute trips are critically important in defining the peak infrastructure needs for both the roadway system and public transportation. Understanding how post-COVID telework shares trend 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 peaking characteristics associated with telework and more flexible work habits, and the prospect

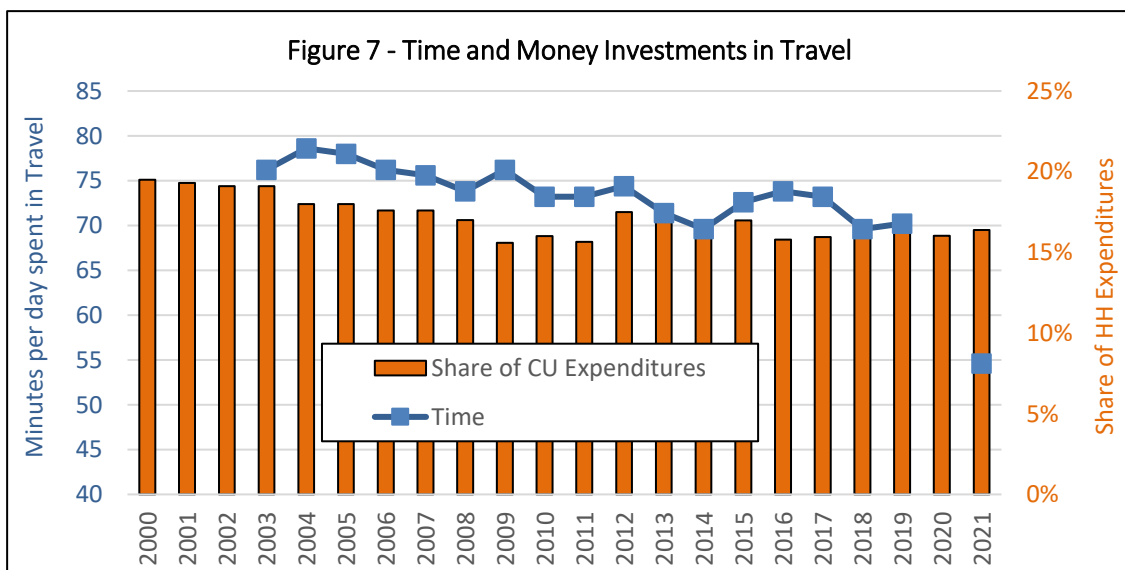
that time and money saved via working from home is being redeployed to supplement other travel, are among the critical questions that will help define the future of travel demand. Understanding the impact of telework at the local level may require insight into factors hypothesized to impact telework participation rates including, the nature of employment, scale/culture/size of firms, metro size/commute length/cost, corporate/community culture, and economic conditions.

Table 3 shows the changes in travel time by trip purpose from pre-COVID to 2021. As waves of COVID were still impacting travel significantly in 2021, 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, telemedicine, etc. may continue to impact time allocated to travel for various purposes.

<b>Table 3 - Changes in Time Use Since Pre-COVID: Change from 2017-2019 Average to 2021</b>		
<i>Travel related to:</i>	<i>Minutes</i>	<i>Percent</i>
Personal care	-0.6	-50.0%
Eating and drinking	-2	-29.4%
Household activities	0.2	7.1%
Purchasing goods and services	-1	-6.0%
Caring for household and nonhousehold members	-2	-25.0%
<b>Work</b>	<b>-4.4</b>	<b>-25.9%</b>
Education	-0.6	-33.3%
Organizational, civic, and religious activities	-1.2	-50.0%
Sports and leisure	-2.6	-21.3%

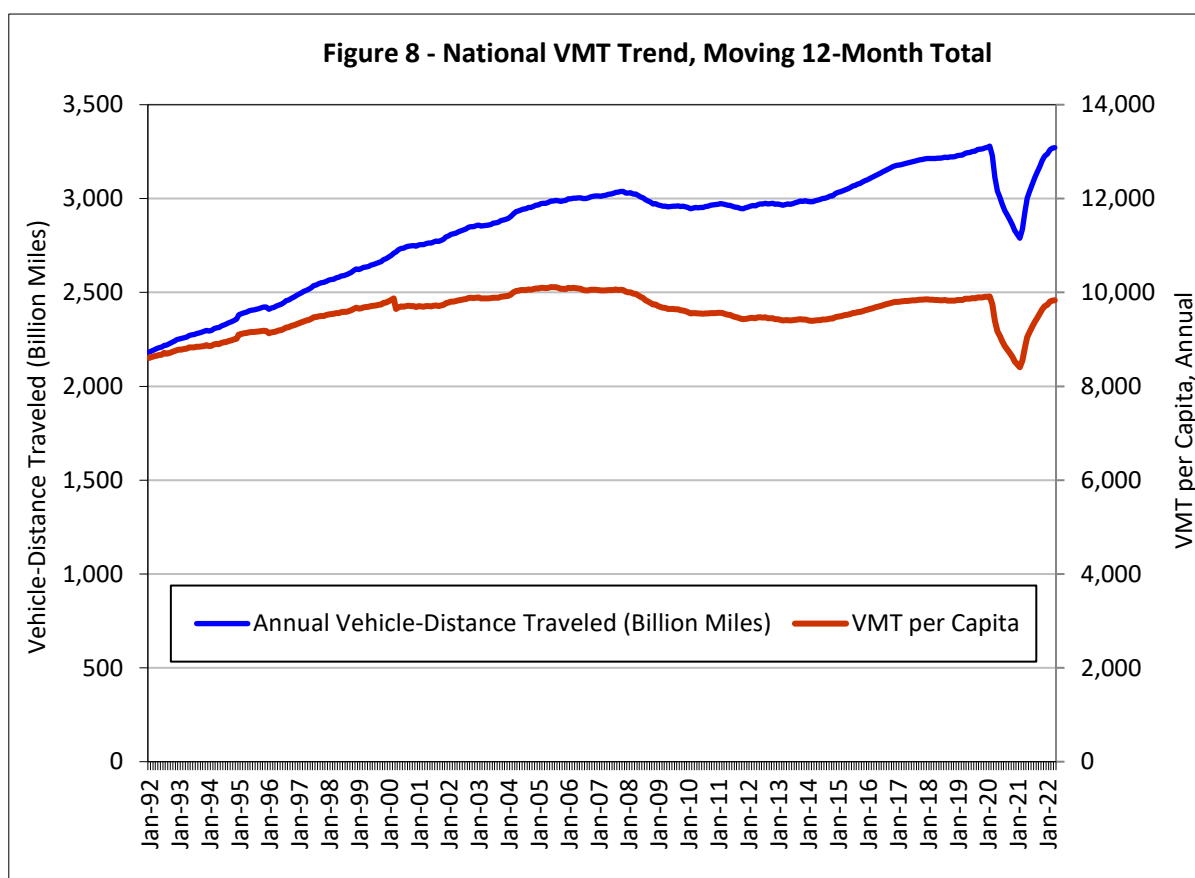
*Note: The changes are muted relative to personal experiences due to the fact that the numbers are averaged over the total 15+ population and not every person participated in each activity*

Figure 7 combines information from the ATUS and the ACS to give an overview of the public's commitment of money and time to travel. As the figure reveals, there has been a general downward trend in the time and money commitments to travel by the American public over the past few decades.



## Implications for Future Travel Demand

Figure 8 shows two measures of roadway travel demand. The top line is a rolling 12-month average national VMT as reported by the Federal Highway Administration data. The lower line simply divides that VMT by population to produce a per capita measure of VMT. The data goes through July 2022. The graph reveals that 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 unprecedented impacts of COVID are clearly apparent, however, significant uncertainty remains regarding trends going forward.



The magnitude of telework and other situations where communication is substituted for travel remains the biggest uncertainty in the immediate future regarding travel demand trends. Given commuting which constitutes about 20% of total VMT remains diminished by 10 to 20%, it would have the effect of reducing overall VMT by two to 4% before any accommodation for secondary impacts such as the shift to telework inducing or enabling other travel to redeploy the time and money resources and or replace the social interaction foregone by telework. While modest in total, this is extremely significant relative to historic travel changes. In addition, the fact that commuting defines peak periods and peak capacity for infrastructure and service levels heightens the importance

of understanding these trends. Similarly, the emerging evidence of very different behaviors with respect to telework adoption across geography (at both the home and work end of commute trips) and socio-demographic groups has significant implications on travel demand. As is increasingly evident, the impact of telework on public transportation and particularly those modes and services targeted toward longer distance work trip commutes to office destinations, has significant long-term implications on transportation policy and investment.

Both the private sector and public agencies have directed significant resources at 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 considerations such as high gas prices, the magnitude of “catch-up” or “revenge” travel to make up for foregone travel during COVID, crime levels impacting travel on some modes and to some locations, evidence of shifting residential location patterns, and other factors will make it 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 is 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 options, the magnitude of adoption of micro-mobility travel options such as e-bikes, 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.