

2021 URBAN MOBILITY REPORT

Appendix B - Change in Vehicle Occupancy Used in Mobility Monitoring Efforts

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Summary

This appendix reflects an overhaul of the average vehicle occupancy methodology that was incorporated into the *2019 Urban Mobility Report*. The occupancy values described in this methodology were also used in the *2021 Urban Mobility Report*. Even though it could be hypothesized that some occupancy levels during peak periods were likely lower (due to reduced carpooling with non-related travelers) or possibly even higher during the midday, there is not a consistent, updated occupancy data source for conditions during the pandemic; therefore, the authors used the pre-pandemic occupancy approach described in this appendix. Keeping the vehicle occupancy consistent also allowed for a comparison from 2019 to 2020 with “all else equal.”

Virtually all measures of travel delay incorporate some form of average vehicle occupancy estimate – the number of people in a vehicle. TTI’s researchers reexamined and updated this factor to incorporate changes since the 2008/2009 economic recession. Researchers estimate the average vehicle occupancy increased from 1.25 persons per vehicle to 1.50 persons per vehicle, based on data from the National Household Travel Surveys. This change will be reflected in TTI’s congestion and mobility statistics.

What Changed and Why?

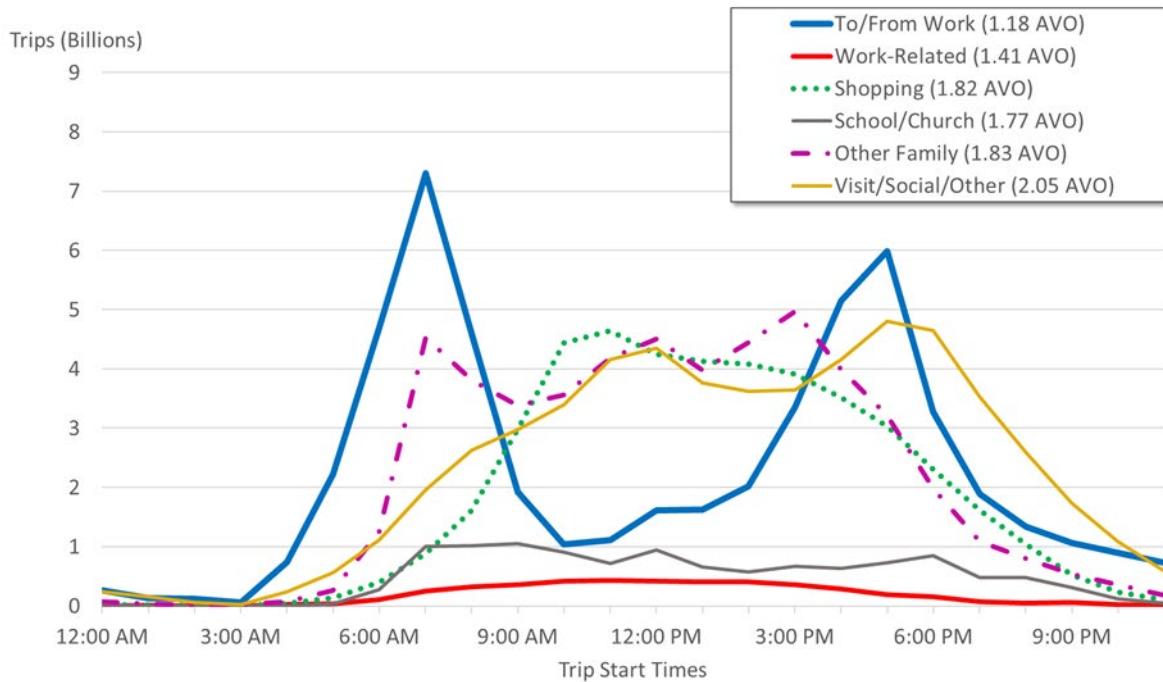
TTI researchers have traditionally used a conservative average vehicle occupancy of 1.25 persons per vehicle for mobility monitoring efforts, including the Urban Mobility Report (UMR) (1), since the mid-1980s. Researchers based this original number on data from the U.S. Census Bureau (2) and the Nationwide Personal Transportation Study (NPTS) (3), focusing on work trips, generally found to be the primary trip purpose during the peak-congested hours. In 1983, the NPTS reported an average vehicle occupancy of 1.29 persons per vehicle.

However, as new data emerged and the National Household Travel Survey (NHTS) (4) – the successor to the NPTS – produced several iterations, more data, an improved sampling rate and a more robust analysis package, more accurate vehicle occupancy data emerged. In the 2017 NHTS—the latest survey to date—the total average vehicle occupancy for all trip types and times increased to 1.67 (5). The 2017 NHTS also provided more robust information about the trip purpose during the peak travel periods (6:00 a.m. to 10:00 a.m. and 3:00 p.m. to 7:00 p.m.). Exhibit B-1 shows how the distribution of trip types, and therefore the average vehicle occupancy changes during the day (5).

While work trips make up the largest portion of peak period trips, they are not the majority. Therefore, it would be unwise to have an average vehicle occupancy value that **only** uses trips to and from work. It would also be inappropriate to use the average vehicle occupancy number for the entire day (1.67). The number of trips changes dramatically for several trip purposes across the day. The ‘visit friends’ trips, for example, are much lower in the morning peak than

trips to/from work but increase during the day and are almost as numerous as work trips in the evening peak. The ‘other family’ trips tend to peak in a pattern like work trips but are a much larger part of midday trip making.

Exhibit B-1. 2017 National Household Travel Survey Trip Purpose During the Day



Note: AVO – Average vehicle occupancy (in persons per vehicle)

Source: 2017 National Household Travel Survey, (5)

Trips made during the peak period (the most congested times of the day) are the most concerning to policy makers, practitioners, and planners. There are many trips in the social, shopping and other family categories outside of peak hours; those have significantly higher than average vehicle occupancy rates of 2.05, 1.82 and 1.83 persons per vehicle, respectively (5).

TTI researchers believe it would be most appropriate to use the average vehicle occupancy of **all peak period trip types** (commute and non-commute trips) for congestion and mobility analyses. Researchers calculated this new average occupancy using the hourly vehicle occupancy ratios weighted with the hourly areawide traffic volume estimate used in the Urban Mobility Report methodology (6). Exhibit B-2 displays the average vehicle occupancy for each hour with the peak period highlighted. The peak-period weighted average vehicle occupancy was calculated as 1.61 for 2017. To maintain a conservative estimate of person-hours of travel

delay, and to ensure that changes in the occupancy values are not obscuring congestion trends, the Urban Mobility Report will use an occupancy factor of 1.50 persons per vehicle (1).

Exhibit B-2. Average Vehicle Occupancy by Hour

Trip Start Time	% of Daily Volume	Mean Vehicle Occupancy
Hour of 00:00	0.95%	1.50
Hour of 01:00	0.62%	1.84
Hour of 02:00	0.48%	1.26
Hour of 03:00	0.47%	1.34
Hour of 04:00	0.82%	1.64
Hour of 05:00	2.10%	1.43
Hour of 06:00	4.58%	1.34
Hour of 07:00	5.91%	1.48
Hour of 08:00	5.17%	1.58
Hour of 09:00	4.62%	1.71
Hour of 10:00	4.88%	1.83
Hour of 11:00	5.33%	1.81
Hour of 12:00	5.55%	1.89
Hour of 13:00	5.90%	1.78
Hour of 14:00	6.87%	1.66
Hour of 15:00	8.22%	1.65
Hour of 16:00	8.91%	1.65
Hour of 17:00	7.92%	1.72
Hour of 18:00	5.69%	1.67
Hour of 19:00	4.14%	1.78
Hour of 20:00	3.51%	1.78
Hour of 21:00	3.15%	1.69
Hour of 22:00	2.51%	1.78
Hour of 23:00	1.70%	1.51
Total: All Day	100%	1.67
Peak Periods	51%	1.61

Source: TTI estimate using NHTS data (5).

References

1. D. Schrank, L. Albert, B. Eisele, and T. Lomax. *2021 Urban Mobility Report*. Texas A&M Transportation Institute, College Station, June 2021.
<https://mobility.tamu.edu/umr/report/#methodology>.
2. Bureau of the Census, U.S. Department of Commerce. <https://factfinder.census.gov/>. Accessed July, 2019.
3. U.S. Department of Transportation. Nationwide Personal Transportation Study, 1983 to 1998. Ann Arbor, MI: Inter-University Consortium for Political and Social Research, 2006-01-18. <https://doi.org/10.3886/ICPSR08661.v1>
4. U.S. Department of Transportation. *National Household Travel Survey*, <https://www.fhwa.dot.gov/policyinformation/nhts.cfm>
5. FHWA, U.S. Department of Transportation. *2017 National Household Travel Survey*. <http://nhts.ornl.gov>. Accessed July, 2019.
6. D. Schrank, L. Albert, B. Eisele, and T. Lomax. *Appendix A: Methodology for 2021 Urban Mobility Report*. Texas A&M Transportation Institute, College Station, June 2021.
<https://mobility.tamu.edu/umr/report/#appx-c>