2021 URBAN MOBILITY REPORT

APPENDIX C - Value of Delay Time for Use in Mobility Monitoring Efforts

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Summary

The value of delay time for passenger vehicle motorists uses the median hourly wage rate for all occupations as produced by the Bureau of Labor Statistics (BLS) as a base**. Researchers estimate the 2020 value of delay time for personal travel at $19.64 per person. The commercial value of travel time is now based on the American Transportation Research Institute (ATRI) annual survey modified by speed, type of vehicle, and vehicle occupancy and is estimated to be $55.24 per vehicle per hour for 2020. Neither the value of delay time for personal nor commercial vehicles include the cost of fuel.**

Introduction

The value of delay time is an estimate of the average differential cost of the extra travel time resulting from congestion. As it relates to the *Urban Mobility Report* (*UMR*) methodology, this congestion cost is a function of both the time and fuel used while the motorist is in congested traffic. The cost of extra fuel consumed during congestion is computed separately from the time spent (wasted) in congestion – fuel cost is not a subject of this report. This report focuses on the computation of an updated value of delay time for passenger cars and trucks. This value of delay time serves as an input to compute urban area congestion cost from urban area delay.

For passenger car motorists, this value of delay time is based upon hourly wage rates. For truck drivers, the value of delay time is expressed as the wage rate of the driver multiplied by truck occupancy plus the various operating cost components associated with a straight truck or tractor-trailer. This report summarizes the components of each value of delay time cost estimate and the updated values of time used in the *UMR* calculations beginning with 2017 data.

Methodology for Passenger Vehicle Motorist's Value of Delay Time

The value of vehicle occupant time is based on median BLS wage estimates for all occupations. The median hourly wage for 2020 is $20.17 on a per person basis and yield an estimated value of delay time of $30.26 per personal vehicle using a vehicle occupancy rate of 1.5 persons per vehicle.

In earlier iterations of value of delay time calculations, a speed choice model developed by Chui and McFarland (1986) of the Texas Transportation Institute (TTI) was used by the Texas Department of Transportation. The research indicated the value of delay time was $11.98 in 1997 in Texas and was consistent at the time with estimates produced by other states. Using this methodology, Exhibit C-1 takes the $11.98 value of delay time found in 1997 and adjusts it for inflation by the Consumer Price Index (CPI) back to 1982 as well as forward to 2016.

There has long been a concern that simply taking the perceived value of delay time from an earlier study and adjusting it forward and backward by the CPI might prove to be problematic over time in that the CPI (a rate of change based on a market basket of goods

for all urban consumers) may not be reflective of the actual value of passenger vehicle travel.

Beginning in 2016, the decision was made to use data published in the Occupational Employment Statistics series by the Bureau of Labor Statistics that provide both a mean and median hourly wage for all job classifications taken together. The median hourly wage was chosen for use in this study because the median value eliminates the effect of extremes at either end of the wage range. National median hourly wage values are used for value of time in the Urban Mobility report, so that it is consistent with the national values used for truck value of time. In addition, there is a potential for localized value of time numbers not to be as up to date as national numbers due to local delays in reporting.

Exhbit C-1. Value of Passenger Vehicle Motorist's Time

Year	Personal Value of Time	Consumer Price Index (1982-1984 base year)
1980	$6.15	82.4
1981	$6.78	90.9
1982	$7.20	96.5
1983	$7.43	99.6
1984	$7.75	103.9
1985	$8.03	107.6
1986	$8.18	109.6
1987	$8.48	113.6
1988	$8.83	118.3
1989	$9.25	124.0
1990	$9.75	130.7
1991	$10.17	136.2
1992	$10.47	140.3
1993	$10.78	144.5
1994	$11.06	148.2
1995	$11.37	152.4
1996	$11.71	156.9
1997	$11.98	160.5
1998	$12.17	163.0
1999	$12.43	166.6
2000	$12.85	172.2
2001	$13.22	177.1
2002	$13.43	179.9

Year	Personal Value of Time	Consumer Price Index (1982-1984 base year)	Bureau of Labor Statistics Median Hourly Wage
2003	$13.73	184.0	$13.53
2004	$14.10	188.9	$13.83
2005	$14.58	195.3	$14.15
2006	$15.06	201.8	$14.61
2007	$15.47	207.3	$15.10
2008	$16.07	215.3	$15.57
2009	$16.01	214.5	$15.95
2010	$16.28	218.1	$16.27
2011	$16.79	224.9	$16.57
2012	$17.14	229.6	$16.71
2013	$17.39	233.0	$16.87
2014	$17.67	236.7	$17.09
2015	$17.69	237.0	$17.40
2016	$17.91	240.0	$17.81
2017			$18.12
2018			$18.71
2019			$19.14
2020			$20.17

The annual *Your Driving Costs* report produced by the American Automobile Association was used as a basis to calculate the marginal cost per mile of travel for passenger vehicles. The individual costs associated with the different classes of vehicles were weighted to produce a fleetwide average that represents the vehicle fleet currently in use in Texas. Those data yielded an operating cost estimate of $0.749 cents per mile as shown in Exhibit C-2 below.

Exhibit C-2. 2020 Passenger Vehicle Operating Costs per Mile

Estimated Cost Per Mile	Average Cost (includes 9 vehicle size/ type categories)
Fuel	0.110
Maintenance, Repair, Tires	0.090
Insurance	0.100
License, Registration, Taxes	0.071
Depreciation	0.310
Finance Charges	0.068
Total	**0.749**

Source: American Automobile Association

Methodology for Truck Driver's Value of Delay Time

The American Transportation Research Institute (ATRI) conducts an annual survey of their membership to determine estimates of operational trucking costs. TTI has closely followed ATRI's survey and has determined it currently provides the most accurate data available for commercial truck operating costs and should serve as the basis for the truck value of delay time estimate used in the UMR.

The ATRI survey disaggregates variable costs into nine categories: fuel, lease/purchase payments, repairs and maintenance, insurance, permits and licenses, tires, tolls, and driver wages and benefits. (For purposes of this report, the Gulf Coast PADD price, as published by the Energy Information Administration, U.S. Department of Energy, were substituted for the fuel costs included in the ATRI survey.) Values are calculated on a per-mile and per-hour basis. Exhibit C-3 provides a summary of the survey results expressed on a per-mile basis for the period 2011 through 2019 published by ATRI, which indicates an estimated average operating cost for commercial trucks of $0.900 per mile for 2020. (Note: Values for 2020 were estimated by TTI based on the methodology described on pages 4 thru 5 of this appendix).

Exhibit C-3. Estimates of Truck Costs per Mile: 2011 through 2019 Calculated by ATRI, 2020 Data Estimated by TTI

Estimated Cost Per Mile	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fuel	0.590	0.641	0.645	0.583	0.403	0.357	0.410	0.422	0.392	0.321
Truck/Trailer Lease or Purchase Payments	0.189	0.174	0.163	0.215	0.230	0.255	0.264	0.265	0.259	0.267
Repair and Maintenance	0.152	0.138	0.148	0.158	0.156	0.166	0.167	0.171	0.143	0.147
Truck Insurance Premiums	0.067	0.063	0.064	0.071	0.074	0.075	0.075	0.084	0.068	0.070
Permits and Licenses	0.038	0.022	0.026	0.019	0.019	0.022	0.023	0.024	0.023	0.024
Tires	0.042	0.044	0.041	0.044	0.043	0.035	0.038	0.038	0.036	0.037
Tolls	0.017	0.019	0.019	0.023	0.020	0.024	0.027	0.030	0.034	0.035
Total	**1.095**	**1.101**	**1.106**	**1.113**	**0.945**	**0.934**	**1.004**	**1.034**	**0.955**	**0.900**

Sources: American Transportation Research Institute (years 2010 to 2019), Texas A&M Transportation Institute (2020).
Note: ATRI data from 2008 through 2019 are used in the calculation. Only data from 2011 forward are shown here due to space limitations.

Researchers used the ATRI estimates as a basis for calculating the 2020 commercial truck value of delay time. To do so, it was necessary to make several adjustments to the ATRI estimates to update them to 2020. Those methodological adjustments are as follows:

1. Segregated non-fuel and non-labor marginal costs from other costs.
2. Subtracted fuel costs.
3. Calculated the mean and median average percent increase in non-fuel, non-labor marginal costs.
4. Selected the median average percent increase in non-fuel, non-labor marginal cost and apply the increase to the ATRI 2019 non-fuel, non-labor costs to determine cost-per-mile operating costs for 2020.
5. Determined an estimate of fuel efficiency (miles/gallon) for tractor-trailer and straight trucks.
6. Determined an estimate of percent of commercial trucks that are tractor-trailer trucks and straight trucks.
7. Determined a labor cost estimate.
8. Estimated the cost of driver benefits.
9. Estimated an average speed for tractor-trailer trucks and straight trucks.

In the ATRI survey, the mean annual increase from 2008 through 2019 in non-fuel, non-labor costs per mile was calculated at 2.7 percent and the median annual increase calculated to be 2.9 percent. The annual percent change ranged from -12.0 percent to +17.0 percent. Given the wide range in annual percent change, the median value was used to calculate an estimate for non-fuel, non-labor cost-per-mile estimate for 2020 because the median is less impacted by outliers in the data.

The mean annual percentage of the cost of driver benefits as a percent of driver wages was calculated to be 30.3 percent; the median was calculated to be 29.8 percent for the period 2008 to 2019. The annual percent change ranged from 26.2 percent to 36.3 percent. Again, the median value of 29.8 percent was chosen as an estimate of the cost of driver benefits as a percentage of driver wages because it is less affected by outliers in the data.

As noted above, several additional estimates were made based on conversations with industry members and the experience of research professionals to produce a 2020 estimate for value of truck delay time. They are as follows:

Estimate of percent of trucks by type –
- Tractor-trailer trucks: 60 percent
- Straight trucks: 40 percent

Estimate of truck VMT by type –
- Tractor-trailer trucks: 77.5 percent
- Straight trucks: 22.5 percent

Estimate of average truck occupancy –
- Tractor-trailer trucks: 1.1 persons per truck
- Straight trucks: 1.2 persons per truck
- Weighted average: 1.14 persons per truck

Average vehicle speed –
- Tractor-trailer trucks: 45 miles per hour
- Straight trucks: 30 miles per hour
- Weighted average: 39 miles per hour

Using the calculation procedures outlined above, these data yielded an estimated operational truck value of $0.900 cents per mile shown in Exhibit C-3.

Finally, researchers obtained 2019 driver wages from the National Occupational Employment and Wage Estimates for the United States published by the U.S. Department of Labor, Bureau of Labor Statistics (BLS). The median hourly driver wage reported by the BLS for a heavy truck or tractor-trailer truck driver was reported to be $21.76 with the median driver wage for a light or delivery truck drive reported as $16.70 per hour. Weighting the wages by the distribution of trucks by type produces a blended wage rate of $19.74 per hour. However, using previously reported driver wage rates produced by the ATRI surveys, calculating the median annual change in wage rate, and then applying that increase to the 2019 rate produced an estimate for 2020 of $22.06 per hour. Given the disparity between the BLS and ATRI estimates, the ATRI wage rate was selected for use in 2020 calculation. The basis for this decision is two-fold. First, it is believed the ATRI survey more accurately reflects market conditions given the shortage of truck drivers and, second, provides the most recent data available.

Including driver benefits at a rate of 29.8 percent of driver wages (the median value shown in the ATRI data for the period 2008 through 2019) multiplied by an average weighted occupancy of 1.14 persons per vehicle yields an estimate of $32.64 per hour of delay time for commercial trucks.

Taken together, these estimates produced a 2020 value of delay time for truck drivers of $1.42 per mile for use in the *UMR* urban area statistics compared to the 2019 ATRI estimate of $1.27 per mile as seen in Exhibit C-4. Again, these per mile costs do not include fuel.

Exhibit C-4. Estimates of 2020 Truck Value of Delay Time in Dollars per Mile

	ATRI Estimate	TTI Estimate
Cost Per Mile	**2019**	**2020**
Truck/Trailer Lease or Purchase Payments	0.259	0.267
Repairs and Maintenance	0.143	0.147
Truck Insurance Premiums	0.068	0.070
Permits and Licenses	0.023	0.024
Tires	0.036	0.037
Tolls	0.034	0.035
Subtotal	**$0.563**	**$0.580**
Driver Wages	0.533	0.645
Driver Benefits	0.160	0.192
Subtotal	**$0.693**	**$0.837**
Total	**$1.256**	**$1.416**

Note: The 2020 TTI Estimate for driver wages and benefits includes an average vehicle occupancy of 1.14 persons per vehicle.

Exhibit C-5 below uses the per mile calculation multiplied by the weighted speed (39 miles per hour) to produce an hourly estimate of commercial truck value of delay time of $55.24 for 2020 compared to the ATRI estimate of $49.49 per hour for 2019. Note that the 2019 estimate for driver wages and benefits includes an average vehicle occupancy of 1.14 persons per vehicle.

Exhibit C-5. Estimates of 2020 Truck Value of Delay Time in Dollars per Hour

Cost Per Mile	ATRI Estimate 2019	TTI Estimate 2020
Truck/Trailer Lease or Purchase Payments	$10.21	$10.40
Repairs and Maintenance	$5.62	$5.74
Truck Insurance Premiums	$2.68	$2.73
Permits and Licenses	$0.90	$0.92
Tires	$1.42	$1.45
Tolls	$1.34	$1.37
Subtotal	**$22.17**	**$22.60**
Driver Wages	21.01	$25.14
Driver Benefits	6.31	$7.49
Subtotal	**$27.32**	**$32.64**
Total	**$49.49**	**$55.24**

Note: The 2020 TTI Estimate for driver wages and benefits includes an average vehicle occupancy of 1.14 persons per vehicle.

Exhibit C-6 and Exhibit C-7 show the estimated historical truck value of delay time in dollars per hour. ATRI and TTI values for truck value of delay time are available from 2008 to 2020. The average annual growth rate of 2008 to 2018 was calculated and applied to years 2000 through 2007. For years 1980 to 1999, the average annual growth rate was adjusted to account for the effects of deregulation. During that time-period, the average operating cost per mile was estimated to have dropped 35 to 75 percent. This combined with the impacts of inflation, produces a slower rate of growth for those years. Exhibit C-8 depicts the truck value of delay time from 1980 to 2020. The 2020 TTI Estimate includes an average vehicle occupancy of 1.14 persons per vehicle.

Exhibit C-6. Estimated Truck Value of Time in Dollars per Hour (1980 to 1999)

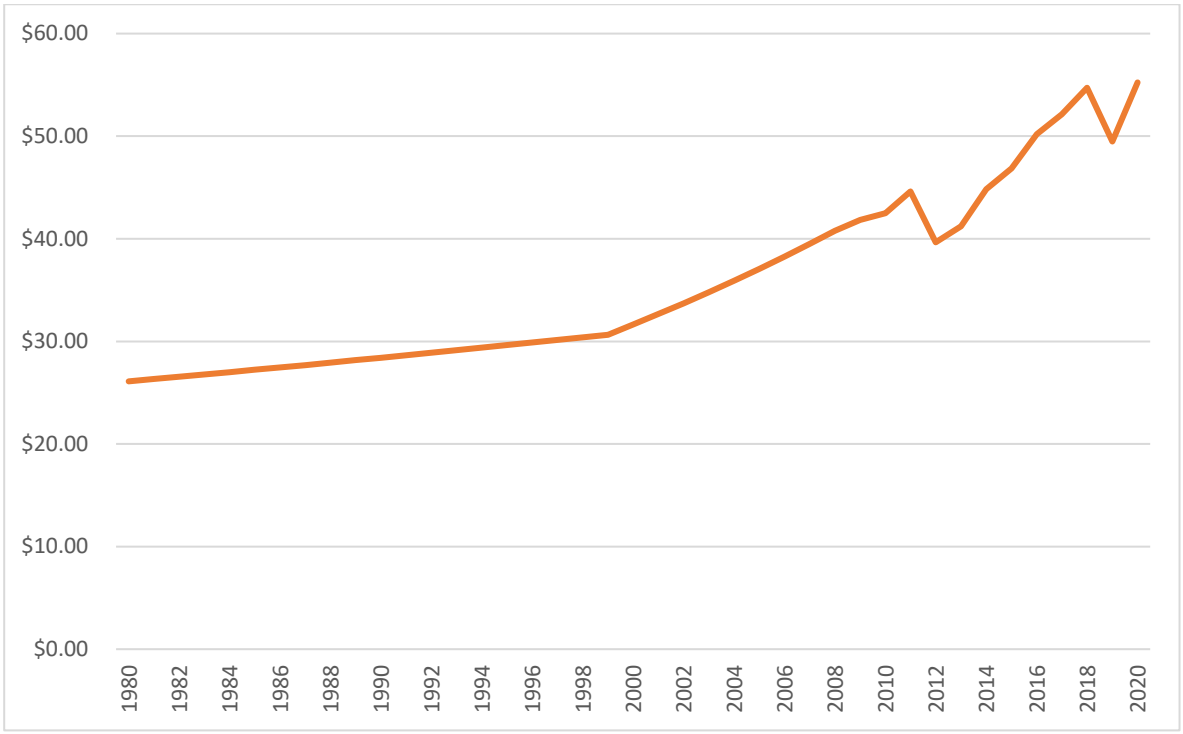
1980	$26.10	Average Annual Growth Rate 2008-2018 Adjusted to Account for Impacts of Deregulation
1981	$26.33	
1982	$26.55	
1983	$26.77	
1984	$27.00	
1985	$27.23	
1986	$27.46	
1987	$27.69	
1988	$27.93	
1989	$28.17	
1990	$28.40	
1991	$28.65	
1992	$28.89	
1993	$29.13	
1994	$29.38	
1995	$29.63	
1996	$29.88	
1997	$30.13	
1998	$30.39	
1999	$30.65	

Exhibit C-7. Estimated Truck Value of Time in Dollars per Hour (2000 to 2020)

2000	$31.64	Average Annual Growth Rate 2008-2018
2001	$32.65	
2002	$33.71	
2003	$34.79	
2004	$35.91	
2005	$37.07	
2006	$38.26	
2007	$39.50	
2008	$40.77	ATRI
2009	$41.83	
2010	$42.50	
2011	$44.62	
2012	$39.66	
2013	$41.23	
2014	$44.82	
2015	$46.87	
2016	$50.20	
2017	$52.14	
2018	$54.71	
2019	$49.49	
2020	$55.24	TTI

*For comparison purposes the 2020 value using a single driver is $51.23.

Exhibit C-8. Estimated Truck Value of Delay Time in Dollars per Hour (1980 to 2020)



Sources

American Automobile Association. Your Driving Costs. How Much are You Really Paying to Drive? https://exchange.aaa.com/wp-content/uploads/2019/09/AAA-Your-Driving-Costs-2019.pdf. 2019.

American Transportation Research Institute. An Analysis of the Operational Costs of Trucking: 2019 Update. (Arlington, VA: American Transportation Research Institute) http://atri-online.org/atri-research/operational-costs-of-trucking/

U. S. Department of Labor, Bureau of Labor Statistics. Occupational Employment Statistics. https://www.bls.gov/oes/current/oes_nat.htm

Bureau of Labor Statistics. Economic News Release. https://www.bls.gov/news.release/eci.t08.htm

Chui, Margaret K. and William F. McFarland. The Value of Travel Time: New Estimates Developed Using a Speed-Choice Model. (College Station, Texas: Texas Transportation Institute) 1986.

Daniels, Virginia, David Ellis, and William R. Stockton. Techniques for Manually Estimating Road User Costs Associated with Construction Projects. (College Station, Texas: Texas Transportation Institute). 1999.

Winston, Clifford. U.S. Industry Adjustment to Economic Deregulation. Journal of Economic Perspectives Vol. 12, Num. 3. 1998. https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.12.3.89, https://www.ftc.gov/system/files/attachments/us-submissions-oecd-2010-present-other-international-competition-fora/ibero-trucking.pdf