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2019 URBAN MOBILITY REPORT

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

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Texas Department of Transportation

August 2019

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Summary

The estimated value of delay time is the average cost of the extra travel time due to congestion. Congestion cost, as presented in the *2019 Urban Mobility Report*, is a function of both the time and fuel used while the motorist is in congested traffic. (Computations for the cost of extra fuel consumed during congestion are shown in the Appendix A methodology). This memo 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 for urban area congestion cost computation.

The 2017 value of delay time estimate for passenger vehicle motorists and truck drivers incorporates several changes from previous estimates.

- The value of delay time for private vehicle drivers and passengers uses the median hourly wage rate for all occupations as produced by the Bureau of Labor Statistics (1) as a base. **Researchers estimate the 2017 value of delay time for personal travel at \$18.12 per person per hour.**
- The commercial value of travel time is now based on an annual survey by the American Transportation Research Institute (2), the leading trade association for the trucking industry. The survey results are modified for the Urban Mobility Report calculations using travel speed, type of vehicle, and vehicle occupancy. **The 2017 hourly value of commercial travel time is estimated to be \$52.14.**
- Neither the value of delay time for personal nor commercial vehicles include the cost of fuel.

What Changed and Why?

In previous reports, the hourly value of delay time first calculated in 1986 (3) was updated by the Consumer Price Index (4) for each Urban Mobility Report. Beginning with the 2019 report, the median hourly wage rate for all occupations as published by the Bureau of Labor Statistics (1) will be used. It is believed this wage rate will prove more representative of the value of personal delay time. This value should be multiplied by the passenger car occupancy rate to determine the value of person-hours of delay time.

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There is one major change in the calculation of the commercial value of delay time. In previous years, the commercial truck value of delay time has fundamentally relied on a value produced by a now dated study and subsequently adjusted by the Consumer Price Index and, in recent years, by the Producer Price Index (5). The *2019 Urban Mobility Report* will use the American Transportation Research Institute's annual study of trucking operational costs as a basis for estimating the commercial truck value of delay time (2). TTI researchers believe the ATRI membership survey is timelier and more representative of the actual operating cost borne by commercial truckers.

Introduction

For passenger car motorists, the 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 panel truck or a tractor-trailer combination vehicle. This memo summarizes the components of each value of delay time cost estimate and the updated values of time used in the *2019 Urban Mobility Report* calculations beginning with 2017 data.

Previous Methodology for Passenger Vehicle Motorist's Value of Delay Time

In earlier iterations of value of delay time calculations, a speed choice model developed by Chui and McFarland (3) of the Texas Transportation Institute (TTI) was used for value of time calculations. The model derived its utility from the notion that speed is regarded as one of the most important factors in any traveler's choice. Travel time is directly related to the choice of speed that one chooses to travel. The first attempts to discern any relationship between speed and the value of travel time were made by Mohring (6). The speed choice model assumes that a rational driver chooses to drive at a speed which minimizes his or her total trip cost (i.e., a speed at which his or her marginal cost is equal to or less than the marginal benefit).

The travel characteristics in Texas during the development of the speed choice model included a relatively small number of toll roads and small percentage of people using mass transit systems in Texas. The model was developed to analyze the nature of traffic in Texas at that time. 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.

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Using this methodology, Column 2 of Exhibit C-1 takes the \$11.98 value of delay time found in 1997 and adjusts it for inflation by the Consumer Price Index (4) back to 1982 as well as forward to 2017. Annual Consumer Price Index values are shown in Column 3 of Exhibit C-1.

With the **previous calculation method**, the hourly value of delay time per person for passenger vehicle travel was estimated to be \$18.29 for 2017.

Exhibit C-1: Value of Passenger Vehicle Motorist’s Time Using Old Methodology

Column 1	Column 2	Column 3
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
2003	\$13.73	184.0
2004	\$14.10	188.9
2005	\$14.58	195.3
2006	\$15.06	201.8
2007	\$15.47	207.3
2008	\$16.07	215.3
2009	\$16.01	214.5
2010	\$16.28	218.1
2011	\$16.79	224.9
2012	\$17.14	229.6
2013	\$17.39	233.0
2014	\$17.67	236.7
2015	\$17.69	237.0
2016	\$17.91	240.0
2017	\$18.29	245.1

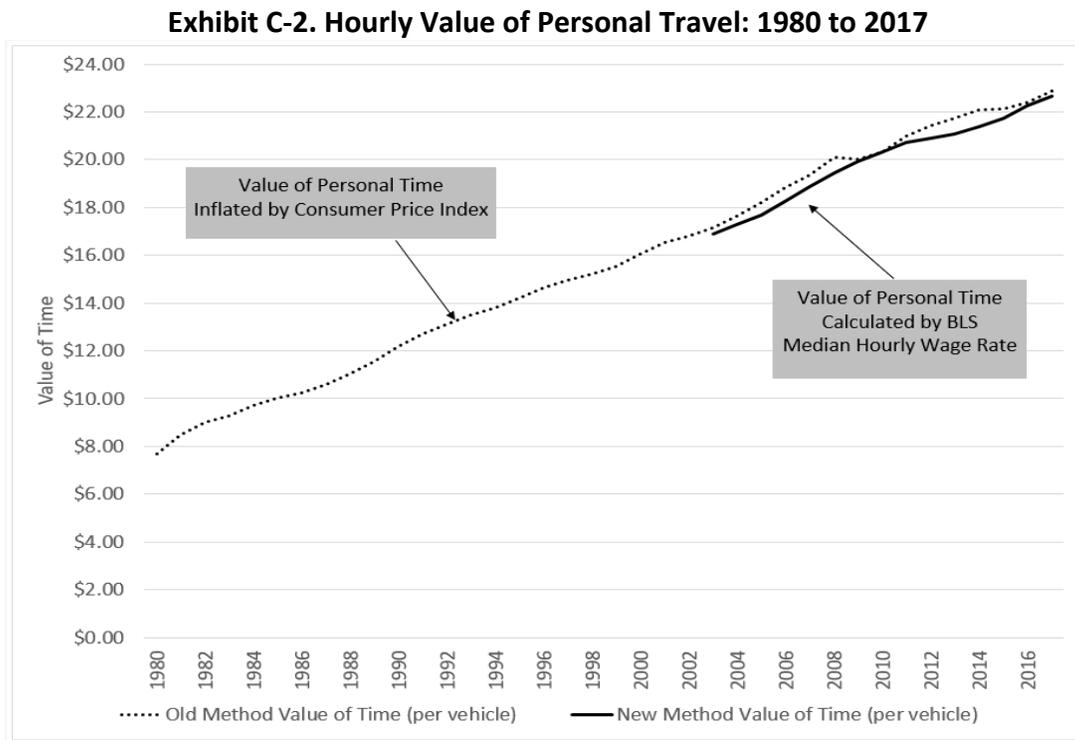
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New Methodology for Passenger Vehicle Motorist’s Value of Delay Time

There has long been a concern that using the perceived value of delay time from an earlier study and adjusting it with the Consumer Price Index for many years might prove to be problematic. 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.

An alternative is to use data published in the Occupational Employment Statistics series by the Bureau of Labor Statistics (1) that provide both a mean and median hourly wage for all job classifications. 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.

As shown in Exhibit C-2, the two time values have been similar for many years. The **median hourly wage for all occupations from the Bureau of Labor Statistics** will be used in future Urban Mobility Reports as a surrogate for the value of delay time for passenger vehicle motorists because it is measured independently and annually and does not rely on adjustments by the CPI inflation measure.



Using the **new methodology** for passenger vehicles, the 2017 value of delay time is \$18.12 per person (Exhibit C-3).

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Exhibit C-3: Value of Passenger Vehicle Motorist’s Time Using New Methodology

Column 1	Column 2	Column 3	Column 4
Year	Personal Value of Time	Consumer Price Index (1982-1984 base year)	Bureau of Labor Statistics Median Hourly Wage
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	
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	\$18.29	245.1	\$18.12

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Previous Methodology for Commercial Truck Value of Delay Time

Historically, commercial truck costs used in the *Urban Mobility Report* were calculated on a cost-per-mile basis. The original base-year cost-per-mile value of \$1.65 per mile used by TTI was obtained from the American Trucking Association in 1986. The per mile value included costs for depreciation, interest, general maintenance, tires, repairs, and other similar costs, but did not include the cost of fuel. The amount of fuel used per mile and the cost of fuel was used to determine the fuel cost-per-mile. In subsequent years, like in the case of personal travel, the value was adjusted by an approximation of the general rate of inflation as measured by the Consumer Price Index (4).

Later, researchers made adjustments to the value of delay time calculation for truck drivers. Three primary sources of data were identified for determining true road user costs for trucks and for use as a check against values used in the *Urban Mobility Report*:

- Operating Costs for Trucks 2000 published by Transport Canada (7).
- Expenses for the For-Hire Motor Carrier Industry: 1976 through 1999 published by Federal Highway Administration (8).
- Expenses per Mile for the Motor Carrier Industry: 1990 through 2000 and Forecasts through 2005 published by Federal Highway Administration (9).

Based on these reports and other data, researchers performed several updates and produced new cost-per-mile estimates beginning with the 2004 *Urban Mobility Report*. The updates included:

- Developing a “new” cost-per-mile figure using the Consumer Price Index (4) for the years 1982 through 2003.
- Using the Producer Price Index (5) for general freight trucking to adjust operating costs.
- Updating diesel fuel prices using data from the Energy Information Administration (10).
- Revising fuel cost-per-mile values using the new fuel price values.

By taking the cost-per-mile calculations and multiplying them by the average peak-period speed (i.e., congested speed) weighted by vehicle-miles of truck travel, a truck operating value of delay time was computed on a per-hour basis. New weighted average speeds were calculated each year as a part of the *Urban Mobility Report* process.

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New Methodology for Truck Driver’s Value of Delay Time

Since the last major revision to the *Urban Mobility Report* commercial travel time methodology, the American Transportation Research Institute (ATRI) began an annual survey of their membership to determine estimates of operational trucking costs. TTI has closely followed ATRI’s survey and has determined it 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 *Urban Mobility Report*.

The ATRI survey (2) disaggregates variable costs into nine categories: fuel, lease/purchase payments, repairs and maintenance, insurance, permits and licenses, tires, tolls, and driver wages and benefits. Values are calculated on a per-mile and per-hour basis.

Exhibits C-4 and C-5 provides a summary of the ATRI truck value of delay (excluding fuel cost) from the survey results for the period 2008 through 2017, which indicates values of \$1.32 per mile or \$52.14 per hour for 2017 (2).

Exhibit C-4: Estimates of Truck Costs per Mile

Year	Truck/Trailer Lease or Purchase Payments	Repair & Maintenance	Truck Insurance Premiums	Permits and Licenses	Tires	Tolls	Driver Wages	Driver Benefits	TOTAL
2009	\$0.26	\$0.12	\$0.05	\$0.03	\$0.03	\$0.02	\$0.40	\$0.13	\$1.05
2010	\$0.18	\$0.12	\$0.06	\$0.04	\$0.04	\$0.01	\$0.45	\$0.16	\$1.06
2011	\$0.19	\$0.15	\$0.07	\$0.04	\$0.04	\$0.02	\$0.46	\$0.15	\$1.12
2012	\$0.17	\$0.14	\$0.06	\$0.02	\$0.04	\$0.02	\$0.42	\$0.12	\$0.99
2013	\$0.16	\$0.15	\$0.06	\$0.03	\$0.04	\$0.02	\$0.44	\$0.13	\$1.03
2014	\$0.22	\$0.16	\$0.07	\$0.02	\$0.04	\$0.02	\$0.46	\$0.13	\$1.12
2015	\$0.23	\$0.16	\$0.07	\$0.02	\$0.04	\$0.02	\$0.50	\$0.13	\$1.17
2016	\$0.26	\$0.17	\$0.08	\$0.02	\$0.04	\$0.02	\$0.52	\$0.16	\$1.26
2017	\$0.26	\$0.17	\$0.08	\$0.02	\$0.04	\$0.03	\$0.56	\$0.17	\$1.32

Source: American Transportation Research Institute (2)

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Exhibit C-5: Estimated Truck Costs per Hour

Year	Truck/Trailer Lease or Purchase Payments	Repair & Maintenance	Truck Insurance Premiums	Permits and Licenses	Tires	Tolls	Driver Wages	Driver Benefits	TOTAL
2009	\$10.28	\$4.90	\$2.15	\$1.15	\$1.14	\$0.98	\$16.12	\$5.11	\$41.83
2010	\$7.37	\$4.97	\$2.35	\$1.60	\$1.42	\$0.49	\$17.83	\$6.47	\$42.50
2011	\$7.55	\$6.07	\$2.67	\$1.53	\$1.67	\$0.69	\$18.39	\$6.05	\$44.62
2012	\$6.94	\$5.52	\$2.51	\$0.88	\$1.76	\$0.74	\$16.67	\$4.64	\$39.66
2013	\$6.52	\$5.92	\$2.57	\$1.04	\$1.65	\$0.77	\$17.60	\$5.16	\$41.23
2014	\$8.59	\$6.31	\$2.89	\$0.76	\$1.76	\$0.90	\$18.46	\$5.15	\$44.82
2015	\$9.20	\$6.23	\$2.98	\$0.78	\$1.72	\$0.79	\$19.95	\$5.22	\$46.87
2016	\$10.20	\$6.65	\$3.00	\$0.88	\$1.41	\$0.97	\$20.91	\$6.18	\$50.20
2017	\$10.39	\$6.58	\$2.95	\$0.92	\$1.50	\$1.05	\$21.97	\$6.78	\$52.14

¹TTI Calculations use an average speed of 40 mph based on *Urban Mobility Report* findings.

Source: Estimated by Texas A&M Transportation Institute Using Data from American Transportation Research Institute (2)

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