

Performance Measure Summary

There are several inventory and performance measures listed in the pages of this Urban Area Report for the years from 1982 to 2005. There is no single performance measure that experts agree “says it all.” The best comparison of congestion levels and trends is done between regions of similar size, over several years, and with a few measures of congestion aspects. Examining a few measures over many years reduces the chance that data variations or the estimating procedures may have caused a “spike” in any single year. A few key points should be recognized by users of the Urban Mobility Report data.

Use the Trends – The multi-year performance measures are better indicators, in most cases, than any single year. *(5 years is 5 times better than 1 year).*

Use several measures – Each performance measure illustrates a different element of congestion. *(The view is more interesting from the top of a few measures).*

Compare to similar regions – Congestion analyses that compare areas with similar characteristics (for example population, growth rate, road and public transportation system design) are usually more insightful than comparisons of different regions. *(Los Angeles is not Peoria).*

Compare ranking changes and performance measure values – In some performance measures a small change in the value may cause a significant change in rank from one year to the next. This is the case when there are several regions with nearly the same value. *(15 hours is only 1 hour more than 14 hours).*

Consider the scope of improvement options – Any improvement project in a corridor within most of the regions will only have a modest effect on the regional congestion level. *(To have an effect on areawide congestion, there must be significant change in the system or service).*

Comparison of Several Key Mobility Performance Measures Large Group – 1 million to 3 million population urban areas

Urban Area	Delay per Traveler	Travel Time Index	Total Delay	1982 to 2005	
				Delay per Traveler	Total Delay
San Diego, CA	H+	H+	H+	F+	F+
Minneapolis-St. Paul, MN	H	0	H+	F+	F+
Baltimore, MD	H	H	H+	F	F+
Tampa-St. Petersburg, FL	H+	H	H+	S	F+
St. Louis, MO-IL	L	L-	0	S	0
Denver-Aurora, CO	H+	H+	H+	F+	F+
Pittsburgh, PA	L-	L-	L-	S-	S-
Riverside-San Bernardino, CA	H+	H+	H+	F+	F+
Cleveland, OH	L-	L-	L-	S-	S-
Sacramento, CA	H	H+	H	0	F+
Portland, OR-WA	0	H	0	0	0
San Jose, CA	H+	H+	H+	F	F+
Cincinnati, OH-KY-IN	L-	L	L	S	S-
Virginia Beach, VA	L	L	L	S-	S-
Kansas City, MO-KS	L-	L-	L-	S-	S-
Milwaukee, WI	L-	L-	L-	S-	S-
Las Vegas, NV	0	H	L	F	0
Orlando, FL	H+	H	H	F+	F+
San Antonio, TX	0	0	L	F	S
Providence, RI-MA	L-	L-	L-	0	S-
Columbus, OH	L	L	L	F	S-
Buffalo, NY	L-	L-	L-	S-	S-
New Orleans, LA	L-	L-	L-	S-	S-
Indianapolis, IN	H	0	L	0	S-
Memphis, TN-MS-AR	L	L-	L-	0	S-

0 – Average congestion levels or average congestion growth

H Higher congestion; H+ Much higher congestion; F Faster congestion growth; F+ Much faster growth

L Lower congestion; L- Much lower congestion; S Slower congestion growth; S- Much slower growth

Performance Measures and Definition of Terms

Travel Time Index – A measure of congestion that focuses on each trip and each mile of travel. The ratio of travel time in the peak period to travel time in free-flow. A value of 1.30 indicates a 20-minute free-flow trip takes 26 minutes in the peak.

Peak Travelers – Number of travelers (using any travel mode) who begin a trip during the morning or evening peak travel periods (6 to 9 a.m. and 4 to 7 p.m.).

Annual Delay per Traveler – A yearly sum of all the per-trip delays. This measure illustrates the effect of the per-mile congestion as well as the length of each trip. The extra time required to travel in the peak period is divided by the number of travelers who begin a trip during the peak period (6 to 9 a.m. and 4 to 7 p.m.).

Total Delay – The overall size of the congestion problem. Measured by the total travel time above that needed to complete a trip at free-flow speeds. The ranking of total delay usually follows the population ranking (larger regions usually have more delay).

Free-Flow Speeds (60 mph on freeways and 35 mph on arterials) – These values are used as the national comparison thresholds. Other speed values may be appropriate for urban areas or sub-regions.

Excess Fuel Consumed – Increased fuel consumption due to travel in congested conditions rather than free-flow conditions.

Public Transportation – Regular route service from all public transportation providers in an urban area.

Operations Treatments – Freeway incident management, freeway ramp metering, arterial street signal coordination and arterial street access management.

Congestion Cost – Value of travel delay for 2005 (estimated at \$14.60 per hour of person travel and \$77.10 per hour of truck time) and excess fuel consumption (estimated using state average cost per gallon).

Annual Increase Needed to Maintain Constant Congestion Level – Number of lane-miles that must be added to the road system each year – or – the number of new transit riders or carpoolers that must be added to keep congestion levels the same as the previous year.

Urban Area – The developed area (population density more than 1,000 persons per square mile) within a metropolitan region. The urban area boundaries change frequently (every year for most growing areas). The annual change in miles traveled, therefore, includes both new travel due to growth and travel that previously occurred in areas designated as rural.

Number of Rush Hours – Time when system might have congestion

Key Mobility Performance Measure Labels

Note: Designation of an urban area congestion problem as “Much higher”, “Much faster growth”, etc. is determined using a general indicator of the accuracy of the congestion estimates. For regions with the same indicator label, there may be no difference in congestion levels. Different values are used for the indicators in regions over 1 million population and below 1 million population.

Measures	Differences Within These Values May Not Indicate a Difference in Congestion Level	
	Above 1M Population	Below 1M Population
2005 Values Delay per Traveler - Travel Time Index - Total Delay -	5 Hours 5 Index Points 5 Hours x Average Population	3 Hours 3 Index Points 3 Hours x Average Population
1982 to 2005 Trends Delay per Traveler - Total Delay -	5 Hours 5 Hours x Average Population	3 Hours 3 Hours x Average Population

The Mobility Data for Memphis, TN-MS-AR

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	1,020	1,010	1,000	990	980	975
Rank	39	39	39	39	39	39
Urban Area (square miles)	555	555	550	515	490	470
Popn Density (persons/sq mile)	1,838	1,820	1,818	1,922	2,000	2,074
Peak Travelers (1000s)	563	554	546	533	518	508
Freeway						
Daily Vehicle-Miles of Travel (1000s)	8,800	8,470	7,815	7,500	7,300	6,900
Lane Miles	635	600	555	540	530	520
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	13,690	13,760	13,260	12,135	12,085	12,000
Lane Miles	3,100	3,030	2,900	2,715	2,710	2,700
Public Transportation						
Annual Psgr-Miles of Travel (millions)	65	72	66	68	68	64
Annual Unlinked Psgr Trips (millions)	12	13	13	13	13	12
Cost Components						
Value of Time (\$/hour)	14.60	14.10	13.75	13.45	13.25	12.85
Commercial Cost (\$/hour)	77.10	74.60	72.65	71.05	69.95	68.00
Fuel Cost (\$/gallon)	2.24	1.86	1.46	1.32	1.45	1.47
System Performance						
Congested Travel (% of peak VMT)	37	39	39	38	37	35
Congested System (% of lane-miles)	32	32	32	32	32	32
Congested Time (number of "Rush Hours")	5.6	5.8	5.8	5.6	5.6	5.4
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	132	131	103	74	69	66
Transit Riders or Carpoolers (millions)	28	28	22	15	14	13
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	9,234	10,116	9,535	8,682	8,372	7,862
Rank	43	41	43	44	44	44
Fuel per Peak Traveler (gallons)	16	18	17	16	16	15
Rank	46	45	44	45	45	46
Annual Delay						
Total Delay (1000s of person-hours)	17,129	15,842	14,973	13,557	13,262	12,560
Rank	39	40	43	44	43	43
Delay per Peak Traveler (person-hrs)	30	29	27	25	26	25
Rank	42	42	45	47	45	45
Delay due to Incidents (percent)	57	56	56	56	56	56
Travel Time Index						
Rank	53	51	48	50	53	52
Congestion Cost						
Total Cost (\$ millions)	317	282	256	225	216	199
Rank	40	41	42	45	44	44
Cost per Peak Traveler (\$)	564	508	468	422	417	392
Rank	42	43	45	45	45	46

Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

Note: Zeroes in the table reflect values less than 0.5.

The Mobility Data for Memphis, TN-MS-AR, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	975	970	960	950	930	905
Rank	39	39	39	39	39	38
Urban Area (square miles)	450	435	420	410	410	410
Popn Density (persons/sq mile)	2,167	2,230	2,286	2,317	2,268	2,207
Peak Travelers (1000s)	499	489	476	464	446	428
Freeway						
Daily Vehicle-Miles of Travel (1000s)	6,600	6,370	5,920	5,725	5,640	5,480
Lane Miles	510	495	465	450	450	450
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	12,015	11,825	11,630	11,715	11,450	11,180
Lane Miles	2,660	2,625	2,600	2,570	2,550	2,500
Public Transportation						
Annual Psgr-Miles of Travel (millions)	64	65	64	65	62	57
Annual Unlinked Psgr Trips (millions)	12	12	13	12	15	13
Cost Components						
Value of Time (\$/hour)	12.40	12.15	12.00	11.70	11.40	11.05
Commercial Cost (\$/hour)	65.80	64.35	63.40	61.95	60.20	58.50
Fuel Cost (\$/gallon)	1.07	1.03	1.13	1.24	1.11	1.03
System Performance						
Congested Travel (% of peak VMT)	33	33	34	34	32	30
Congested System (% of lane-miles)	31	31	32	31	31	30
Congested Time (number of "Rush Hours")	5.2	5.2	5.2	5.2	5.0	4.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	71	81	107	162	179	201
Transit Riders or Carpoolers (millions)	15	16	21	33	35	39
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	7,367	7,352	7,096	6,692	6,338	5,576
Rank	45	42	42	41	43	41
Fuel per Peak Traveler (gallons)	15	15	15	14	14	13
Rank	50	47	47	45	44	45
Annual Delay						
Total Delay (1000s of person-hours)	11,790	11,799	11,383	10,689	10,114	8,927
Rank	45	41	41	41	41	40
Delay per Peak Traveler (person-hrs)	24	24	24	23	23	21
Rank	49	47	46	46	43	46
Delay due to Incidents (percent)	56	56	56	55	55	55
Travel Time Index						
Rank	56	51	52	49	49	51
Congestion Cost						
Total Cost (\$ millions)	178	174	166	152	140	119
Rank	45	41	41	41	41	40
Cost per Peak Traveler (\$)	357	356	349	327	313	277
Rank	49	47	45	46	44	48

Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

Note: Zeroes in the table reflect values less than 0.5.

The Mobility Data for Memphis, TN-MS-AR, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	885	880	865	860	850	830
Rank	38	38	38	37	37	37
Urban Area (square miles)	405	405	405	400	400	400
Popn Density (persons/sq mile)	2,185	2,173	2,136	2,150	2,125	2,075
Peak Travelers (1000s)	412	403	389	381	374	362
Freeway						
Daily Vehicle-Miles of Travel (1000s)	5,150	5,070	4,725	4,575	4,286	3,975
Lane Miles	445	440	420	400	390	380
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	10,850	9,695	8,700	8,210	7,705	7,405
Lane Miles	2,450	2,285	2,105	1,975	1,855	1,705
Public Transportation						
Annual Psgr-Miles of Travel (millions)	58	62	65	67	60	61
Annual Unlinked Psgr Trips (millions)	13	13	14	14	14	14
Cost Components						
Value of Time (\$/hour)	10.75	10.50	10.25	10.00	9.25	8.80
Commercial Cost (\$/hour)	57.05	55.40	53.80	51.60	48.95	46.70
Fuel Cost (\$/gallon)	1.07	1.08	1.11	1.08	1.12	1.03
System Performance						
Congested Travel (% of peak VMT)	27	24	25	25	22	19
Congested System (% of lane-miles)	29	28	33	32	32	26
Congested Time (number of "Rush Hours")	4.4	4.2	4.0	4.0	3.8	3.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	204	173	152	159	99	98
Transit Riders or Carpoolers (millions)	39	33	28	30	18	18
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	4,635	3,886	3,533	3,390	2,900	2,367
Rank	42	45	44	44	45	45
Fuel per Peak Traveler (gallons)	11	10	9	9	8	7
Rank	50	51	49	49	51	55
Annual Delay						
Total Delay (1000s of person-hours)	7,700	6,516	5,925	5,734	4,930	4,072
Rank	41	42	43	42	44	44
Delay per Peak Traveler (person-hrs)	19	16	15	15	13	11
Rank	49	51	49	50	51	54
Delay due to Incidents (percent)	54	54	53	53	53	53
Travel Time Index						
Rank	53	55	52	52	52	53
Congestion Cost						
Total Cost (\$ millions)	99	82	72	68	54	42
Rank	40	45	44	44	44	46
Cost per Peak Traveler (\$)	240	203	186	179	146	117
Rank	49	52	49	50	51	55

Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

Note: Zeroes in the table reflect values less than 0.5.

The Mobility Data for Memphis, TN-MS-AR, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	815	800	775	770	770	760
Rank	37	37	39	39	39	39
Urban Area (square miles)	400	380	360	350	350	350
Popn Density (persons/sq mile)	2,038	2,105	2,153	2,200	2,200	2,171
Peak Travelers (1000s)	353	343	330	326	323	315
Freeway						
Daily Vehicle-Miles of Travel (1000s)	3,750	3,270	3,050	3,035	3,240	3,200
Lane Miles	380	365	365	350	330	315
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	7,095	6,755	6,195	6,630	5,820	5,150
Lane Miles	1,585	1,575	1,505	1,455	1,405	1,355
Public Transportation						
Annual Psgr-Miles of Travel (millions)	65	72	58	42	42	42
Annual Unlinked Psgr Trips (millions)	14	14	15	15	15	15
Cost Components						
Value of Time (\$/hour)	8.50	8.20	8.00	7.75	7.45	7.20
Commercial Cost (\$/hour)	44.85	43.30	42.50	41.05	39.35	38.10
Fuel Cost (\$/gallon)	1.04	1.01	1.32	1.34	1.37	1.43
System Performance						
Congested Travel (% of peak VMT)	17	13	12	14	13	13
Congested System (% of lane-miles)	22	17	17	17	17	17
Congested Time (number of "Rush Hours")	3.6	3.0	2.9	3.0	3.2	3.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	105	--	--	--	--	--
Transit Riders or Carpoolers (millions)	20	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	1,950	1,413	1,223	1,433	1,324	1,091
Rank	48	56	55	47	44	47
Fuel per Peak Traveler (gallons)	6	4	4	4	4	3
Rank	59	65	65	54	54	57
Annual Delay						
Total Delay (1000s of person-hours)	3,353	2,465	2,138	2,534	2,337	1,871
Rank	48	55	54	45	42	46
Delay per Peak Traveler (person-hrs)	10	7	6	8	7	6
Rank	57	63	63	54	53	55
Delay due to Incidents (percent)	53	53	53	53	53	53
Travel Time Index						
Rank	56	63	63	55	51	52
Congestion Cost						
Total Cost (\$ millions)	34	24	21	24	21	17
Rank	49	54	54	46	42	47
Cost per Peak Traveler (\$)	97	70	63	74	66	53
Rank	58	64	64	55	52	57

Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

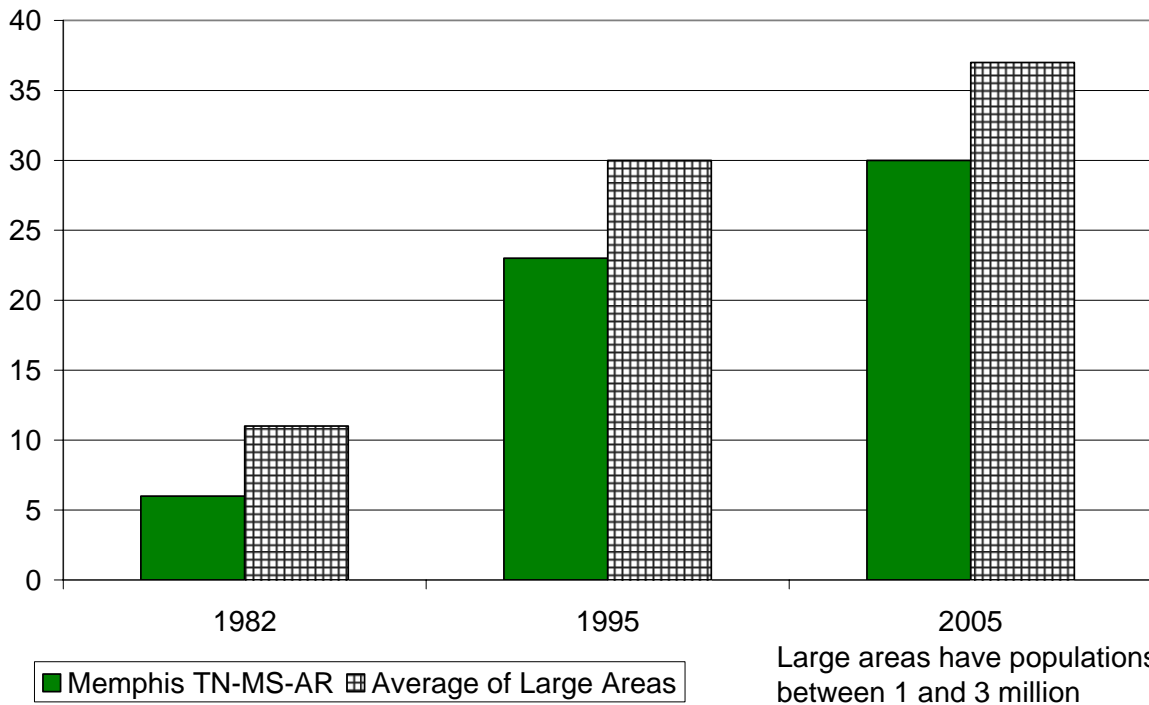
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for Memphis, TN-MS-AR

Operations Strategies	2005	2004	2003	2002	2001	2000
Freeway Ramp Metering						
Percent of Roadway Miles	--	--	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--	--	--
Freeway Incident Management						
Cameras						
Percent of Roadway Miles	--	--	--	--	--	--
Service Patrols						
Percent of Roadway Miles	71	70	66	67	67	68
Annual Delay Reduction (1000 hours)	783	601	499	432	422	412
Arterial Signal Coordination						
Percent of Roadway Miles	36	37	32	28	23	19
Annual Delay Reduction (1000 hours)	71	60	57	50	45	33
Arterial Access Management						
Percent of Roadway Miles	10	10	10	7	7	7
Annual Delay Reduction (1000 hours)	56	37	27	23	15	30
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	910	698	583	505	482	475
Annual Delay Saved per Peak Traveler (hours)	2	1	1	1	1	1
Annual Congestion Cost Savings (\$million)	17.8	13.2	10.6	8.9	8.4	8.1
Travel Time Index with Strategies	1.126	1.141	1.140	1.137	1.133	1.128
Travel Time Index (Base)	1.132	1.147	1.145	1.141	1.138	1.132
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	65	72	66	68	68	64
Unlinked Passenger Trips (million)	12	13	13	13	13	12
Travel Time Index (combined road and transit)	1.125	1.139	1.138	1.135	1.132	1.127
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.136	1.151	1.149	1.147	1.142	1.137
Annual Delay Increase (1000 hours)	634	664	596	709	611	676
Annual Delay Increase per Peak Traveler (hours)	1	1	1	1	1	1
Annual Congestion Cost Increase (\$million)	12.0	12.1	10.5	12.1	10.3	11.0

Growth in Delay per Peak Traveler

Hours of Delay



Growth in Total Delay

Annual Hours of Delay (million)

