

## 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-
<b>Milwaukee, WI</b>	<b>L-</b>	<b>L-</b>	<b>L-</b>	<b>S-</b>	<b>S-</b>
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
<b>2005 Values</b> 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
<b>1982 to 2005 Trends</b> Delay per Traveler - Total Delay -	5 Hours 5 Hours x Average Population	3 Hours 3 Hours x Average Population

### The Mobility Data for Milwaukee, WI

<b>Inventory Measures</b>	<b>2005</b>	<b>2004</b>	<b>2003</b>	<b>2002</b>	<b>2001</b>	<b>2000</b>
<b>Urban Area Information</b>						
Population (1000s)	1,460	1,455	1,450	1,445	1,400	1,365
Rank	30	30	30	30	30	30
Urban Area (square miles)	585	585	585	580	580	575
Popn Density (persons/sq mile)	2,496	2,487	2,479	2,491	2,414	2,374
Peak Travelers (1000s)	796	789	782	772	742	718
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	10,750	10,940	10,465	10,000	9,800	9,700
Lane Miles	725	725	700	675	650	630
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	14,400	14,800	14,230	13,380	13,365	13,515
Lane Miles	3,950	3,870	3,710	3,550	3,450	3,360
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	158	178	177	188	221	218
Annual Unlinked Psgr Trips (millions)	53	56	60	66	73	74
<b>Cost Components</b>						
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)	2.37	1.98	1.58	1.46	1.51	1.64
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	38	39	41	42	43	44
<b>Congested System</b> (% of lane-miles)	25	25	29	30	31	31
<b>Congested Time</b> (number of "Rush Hours")	5.6	5.8	5.8	5.6	5.8	6.2
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	76	115	95	52	50	77
Transit Riders or Carpoolers (millions)	14	23	19	10	10	16
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	10,815	11,057	10,819	10,870	10,785	11,158
Rank	40	38	40	38	34	32
Fuel per Peak Traveler (gallons)	14	14	14	14	15	16
Rank	52	51	51	52	46	45
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	15,402	15,547	15,275	15,033	14,864	15,428
Rank	42	41	42	41	40	34
Delay per Peak Traveler (person-hrs)	19	20	20	19	20	21
Rank	59	57	57	59	57	54
Delay due to Incidents (percent)	51	51	51	51	51	51
<b>Travel Time Index</b>						
Rank	53	53	48	46	44	44
<b>Congestion Cost</b>						
Total Cost (\$ millions)	282	271	256	246	240	244
Rank	42	42	42	41	38	34
Cost per Peak Traveler (\$)	354	344	327	319	324	340
Rank	59	59	59	58	57	53

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 Milwaukee, WI, Continued**

<b>Inventory Measures</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>	<b>1996</b>	<b>1995</b>	<b>1994</b>
<b>Urban Area Information</b>						
Population (1000s)	1,330	1,300	1,285	1,270	1,250	1,240
Rank	30	30	30	29	29	29
Urban Area (square miles)	570	565	565	560	560	555
Popn Density (persons/sq mile)	2,333	2,301	2,274	2,268	2,232	2,234
Peak Travelers (1000s)	694	672	659	646	631	621
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	9,325	8,860	8,750	8,600	8,000	7,600
Lane Miles	615	610	610	610	595	585
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	13,405	13,325	13,225	13,205	13,100	12,910
Lane Miles	3,305	3,280	3,270	3,260	3,220	3,195
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	211	205	199	182	156	180
Annual Unlinked Psgr Trips (millions)	71	73	72	62	58	58
<b>Cost Components</b>						
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)	1.17	1.14	1.19	1.33	1.18	1.09
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	43	41	39	38	36	35
<b>Congested System</b> (% of lane-miles)	30	30	30	30	28	29
<b>Congested Time</b> (number of "Rush Hours")	6.0	5.6	5.6	5.4	5.2	4.8
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	82	74	61	72	63	63
Transit Riders or Carpoolers (millions)	16	15	12	14	12	12
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	11,132	9,836	9,243	9,003	8,840	7,866
Rank	33	34	35	34	34	33
Fuel per Peak Traveler (gallons)	16	15	14	14	14	13
Rank	45	49	49	50	45	48
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	15,535	14,089	13,260	12,959	13,661	12,164
Rank	36	36	38	36	32	33
Delay per Peak Traveler (person-hrs)	22	21	20	20	22	20
Rank	56	54	55	54	47	51
Delay due to Incidents (percent)	51	51	51	51	52	52
<b>Travel Time Index</b>						
Rank	45	46	47	47	45	46
<b>Congestion Cost</b>						
Total Cost (\$ millions)	232	207	192	185	188	161
Rank	37	36	38	35	34	34
Cost per Peak Traveler (\$)	334	307	292	286	297	260
Rank	55	55	58	54	50	50

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 Milwaukee, WI, Continued**

<b>Inventory Measures</b>	<b>1993</b>	<b>1992</b>	<b>1991</b>	<b>1990</b>	<b>1989</b>	<b>1988</b>
<b>Urban Area Information</b>						
Population (1000s)	1,230	1,230	1,225	1,230	1,225	1,225
Rank	29	27	26	25	25	25
Urban Area (square miles)	550	550	550	550	550	550
Popn Density (persons/sq mile)	2,236	2,236	2,227	2,236	2,227	2,227
Peak Travelers (1000s)	611	606	599	597	589	583
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	7,500	7,775	7,800	7,615	7,400	7,050
Lane Miles	575	575	575	570	570	570
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	12,705	12,550	12,075	11,820	11,480	11,435
Lane Miles	3,175	3,145	3,115	3,030	3,000	2,980
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	161	165	165	179	199	199
Annual Unlinked Psgr Trips (millions)	56	60	58	66	74	75
<b>Cost Components</b>						
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)	1.12	1.11	1.15	1.11	1.13	1.04
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	37	38	35	33	30	27
<b>Congested System</b> (% of lane-miles)	30	30	25	24	23	22
<b>Congested Time</b> (number of "Rush Hours")	4.8	5.2	5.0	5.0	4.6	4.4
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	67	103	108	119	157	178
Transit Riders or Carpoolers (millions)	13	20	20	22	29	32
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	8,241	8,014	6,870	6,444	5,677	5,077
Rank	28	27	29	29	29	31
Fuel per Peak Traveler (gallons)	13	13	11	11	10	9
Rank	43	40	43	44	41	43
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	12,731	11,494	9,921	9,429	8,446	7,908
Rank	32	30	31	31	30	32
Delay per Peak Traveler (person-hrs)	21	19	17	16	14	14
Rank	43	45	46	48	46	46
Delay due to Incidents (percent)	52	53	53	53	54	53
<b>Travel Time Index</b>						
Rank	43	38	40	42	42	43
<b>Congestion Cost</b>						
Total Cost (\$ millions)	165	147	124	114	96	85
Rank	32	30	31	31	31	31
Cost per Peak Traveler (\$)	271	242	207	192	162	145
Rank	43	44	47	48	47	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 Milwaukee, WI, Continued**

<b>Inventory Measures</b>	<b>1987</b>	<b>1986</b>	<b>1985</b>	<b>1984</b>	<b>1983</b>	<b>1982</b>
<b>Urban Area Information</b>						
Population (1000s)	1,220	1,215	1,210	1,210	1,210	1,210
Rank	25	24	24	24	24	24
Urban Area (square miles)	550	550	550	550	550	550
Popn Density (persons/sq mile)	2,218	2,209	2,200	2,200	2,200	2,200
Peak Travelers (1000s)	576	569	561	555	551	546
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	6,775	6,315	6,090	5,815	5,385	5,250
Lane Miles	565	560	560	560	560	560
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	10,945	10,905	10,440	9,415	9,090	9,065
Lane Miles	2,970	2,930	2,915	2,915	2,915	2,890
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	198	197	189	213	213	213
Annual Unlinked Psgr Trips (millions)	75	77	77	82	82	82
<b>Cost Components</b>						
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)	1.05	1.02	1.34	1.35	1.38	1.44
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	24	22	19	18	16	16
<b>Congested System</b> (% of lane-miles)	22	21	20	20	19	19
<b>Congested Time</b> (number of "Rush Hours")	4.0	3.6	3.2	2.9	2.8	2.7
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	154	--	--	--	--	--
Transit Riders or Carpoolers (millions)	27	--	--	--	--	--
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	4,374	3,843	3,240	2,695	2,282	2,304
Rank	31	33	32	33	34	33
Fuel per Peak Traveler (gallons)	8	7	6	5	4	4
Rank	46	48	50	51	53	49
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	7,016	6,242	5,385	4,487	3,900	3,959
Rank	31	32	32	33	34	33
Delay per Peak Traveler (person-hrs)	12	11	10	8	7	7
Rank	46	51	50	53	54	49
Delay due to Incidents (percent)	53	53	53	53	53	53
<b>Travel Time Index</b>						
Rank	44	47	47	48	48	46
<b>Congestion Cost</b>						
Total Cost (\$ millions)	73	62	54	43	36	36
Rank	31	32	32	33	34	33
Cost per Peak Traveler (\$)	126	110	95	78	66	66
Rank	45	51	50	53	53	49

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

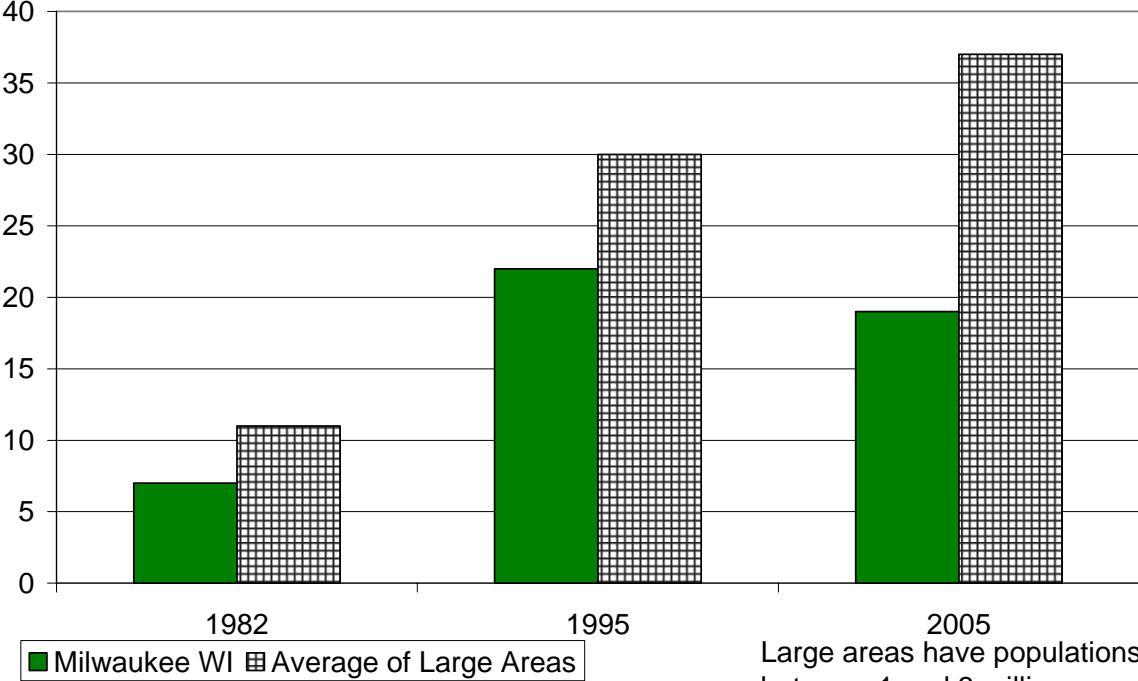
Note: Zeroes in the table reflect values less than 0.5.

## Benefits From Public Transportation Service and Operations Strategies for Milwaukee, WI

<b>Operations Strategies</b>	<b>2005</b>	<b>2004</b>	<b>2003</b>	<b>2002</b>	<b>2001</b>	<b>2000</b>
<b>Freeway Ramp Metering</b>						
Percent of Roadway Miles	65	65	67	32	31	29
Annual Delay Reduction (1000 hours)	380	356	330	128	121	117
<b>Freeway Incident Management</b>						
<b>Cameras</b>						
Percent of Roadway Miles	89	89	80	83	70	55
<b>Service Patrols</b>						
Percent of Roadway Miles	90	90	92	90	90	92
Annual Delay Reduction (1000 hours)	583	552	505	488	467	471
<b>Arterial Signal Coordination</b>						
Percent of Roadway Miles	14	13	14	14	14	11
Annual Delay Reduction (1000 hours)	21	29	44	45	46	14
<b>Arterial Access Management</b>						
Percent of Roadway Miles	37	36	35	35	35	36
Annual Delay Reduction (1000 hours)	191	207	201	187	198	210
<b>HOV Lanes</b>						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
<b>Total Effect of Operations Treatments</b>						
Annual Delay Reduction (1000 hours)	1,174	1,144	1,080	849	833	812
Annual Delay Saved per Peak Traveler (hours)	1	1	1	1	1	1
Annual Congestion Cost Savings (\$million)	21.4	20.0	18.2	13.9	13.5	12.9
Travel Time Index with Strategies	1.135	1.134	1.137	1.146	1.146	1.151
Travel Time Index (Base)	1.143	1.143	1.145	1.153	1.154	1.159
<b>Public Transportation Service</b>						
<b>Existing Service</b>						
Annual Passenger-miles of Travel (million)	158	178	177	188	221	218
Unlinked Passenger Trips (million)	53	56	60	66	73	74
Travel Time Index (combined road and transit)	1.132	1.131	1.133	1.142	1.141	1.146
<b>Condition if Public Transportation Service were Discontinued</b>						
Travel Time Index	1.152	1.155	1.157	1.170	1.173	1.177
Annual Delay Increase (1000 hours)	1,274	1,615	1,526	1,925	2,207	2,150
Annual Delay Increase per Peak Traveler (hours)	2	2	2	2	3	3
Annual Congestion Cost Increase (\$million)	23.4	28.3	25.7	31.7	35.9	34.2

### Growth in Delay per Peak Traveler

Hours of Delay



Annual Hours of Delay (million)

### Growth in Total Delay

