

Performance Measure Summary – Milwaukee, WI

There are several inventory and performance measures listed in the pages of this Urban Area Report for the years from 1982 to 2007. 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. 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*).

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 2007 (estimated at \$15.47 per hour of person travel and \$102.12 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.

The Mobility Data for Milwaukee WI

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	1,465	1,465	1,460	1,455	1,450	1,445
Rank	30	30	30	30	30	30
Urban Area (square miles)	590	590	585	585	585	580
Population Density (persons/sq mile)	2,483	2,483	2,496	2,487	2,479	2,491
Peak Travelers (1000s)	804	803	796	789	782	772
Freeway						
Daily Vehicle-Miles of Travel (1000s)	11,055	10,950	10,750	10,940	10,465	10,000
Lane-Miles	750	750	725	725	700	675
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	14,545	14,520	14,400	14,800	14,230	13,380
Lane-Miles	3,980	3,965	3,950	3,870	3,710	3,550
Public Transportation						
Annual Psgr-Miles of Travel (millions)	154	155	158	178	177	188
Annual Unlinked Psgr Trips (millions)	48	51	53	56	60	66
Cost Components						
Value of Time (\$/hour)	15.47	15.06	14.58	14.10	13.73	13.43
Commercial Cost (\$/hour)	102.12	98.77	94.06	86.24	82.38	79.96
Fuel Cost (\$/gallon)	3.08	2.73	2.37	1.98	1.58	1.46
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	39	37	38	39	41	42
Congested System (% of lane-miles)	26	25	25	25	29	30
Congested Time (number of "Rush Hours")	5.6	5.6	5.6	5.8	5.8	5.6
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	87	90	76	115	95	52
Transit Riders or Carpoolers (millions)	16	17	14	23	19	10
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	10,651	10,155	10,990	11,238	10,986	11,058
Rank	41	41	40	38	40	38
Fuel per Peak Traveler (gallons)	13	13	14	14	14	14
Rank	60	59	52	51	52	53
Annual Delay						
Total Delay (1000s of person-hours)	14,860	14,345	15,705	15,840	15,542	15,325
Rank	42	44	41	40	41	40
Delay per Peak Traveler (person-hours)	18	18	20	20	20	20
Rank	67	66	57	57	58	58
Delay due to Incidents (percent)	52	52	52	52	52	52
Travel Time Index	1.13	1.12	1.14	1.14	1.14	1.15
Rank	52	58	51	50	48	46
Congestion Cost						
Total Cost (\$ millions)	307	283	295	282	264	255
Rank	42	44	42	42	42	41
Cost per Peak Traveler (\$)	382	353	371	358	338	330
Rank	65	66	61	58	61	60

Note: System Performance statistics for 2000 through 2007 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

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	1,400	1,365	1,330	1,300	1,285
Rank	30	30	30	30	30
Urban Area (square miles)	580	575	570	565	565
Population Density (persons/sq mile)	2,414	2,374	2,333	2,301	2,274
Peak Travelers (1000s)	742	718	694	672	659
Freeway					
Daily Vehicle-Miles of Travel (1000s)	9,800	9,700	9,325	8,860	8,750
Lane-Miles	650	630	615	610	610
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	13,365	13,515	13,405	13,325	13,225
Lane-Miles	3,450	3,360	3,305	3,280	3,270
Public Transportation					
Annual Psgr-Miles of Travel (millions)	221	218	211	205	199
Annual Unlinked Psgr Trips (millions)	73	74	71	74	72
Cost Components					
Value of Time (\$/hour)	13.22	12.85	12.43	12.17	11.98
Commercial Cost (\$/hour)	80.88	80.75	74.23	72.61	74.32
Fuel Cost (\$/gallon)	1.51	1.64	1.17	1.14	1.19
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	43	44	43	41	39
Congested System (% of lane-miles)	31	31	30	30	30
Congested Time (number of "Rush Hours")	5.8	6.2	6.0	5.6	5.6
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	50	77	82	74	61
Transit Riders or Carpoolers (millions)	10	16	16	15	12
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	10,778	11,153	10,661	9,470	8,935
Rank	34	32	34	35	36
Fuel per Peak Traveler (gallons)	15	16	15	14	14
Rank	47	46	46	50	49
Annual Delay					
Total Delay (1000s of person-hours)	14,854	15,421	14,782	13,497	12,777
Rank	40	34	38	36	38
Delay per Peak Traveler (person-hours)	20	21	21	20	19
Rank	58	55	59	57	57
Delay due to Incidents (percent)	51	51	51	51	51
Travel Time Index	1.15	1.15	1.15	1.13	1.12
Rank	45	44	44	45	49
Congestion Cost					
Total Cost (\$ millions)	245	250	225	201	189
Rank	37	34	37	37	38
Cost per Peak Traveler (\$)	330	348	324	300	287
Rank	59	55	58	56	58

Note: System Performance statistics for 2000 through 2007 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

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	1,270	1,250	1,240	1,230	1,230
Rank	29	29	29	29	27
Urban Area (square miles)	560	560	555	550	550
Population Density (persons/sq mile)	2,268	2,232	2,234	2,236	2,236
Peak Travelers (1000s)	646	631	621	611	606
Freeway					
Daily Vehicle-Miles of Travel (1000s)	8,600	8,000	7,600	7,500	7,775
Lane-Miles	610	595	585	575	575
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	13,205	13,100	12,910	12,705	12,550
Lane-Miles	3,260	3,220	3,195	3,175	3,145
Public Transportation					
Annual Psgr-Miles of Travel (millions)	182	156	180	161	165
Annual Unlinked Psgr Trips (millions)	62	59	58	56	60
Cost Components					
Value of Time (\$/hour)	11.71	11.37	11.06	10.78	10.47
Commercial Cost (\$/hour)	74.17	71.54	69.53	67.77	66.19
Fuel Cost (\$/gallon)	1.33	1.18	1.09	1.12	1.11
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	38	36	35	37	38
Congested System (% of lane-miles)	30	28	29	30	30
Congested Time (number of "Rush Hours")	5.4	5.2	4.8	4.8	5.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	72	63	63	67	103
Transit Riders or Carpoolers (millions)	14	12	12	13	20
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	8,737	8,639	7,714	8,104	7,896
Rank	35	34	33	28	27
Fuel per Peak Traveler (gallons)	14	14	12	13	13
Rank	44	44	48	43	39
Annual Delay					
Total Delay (1000s of person-hours)	12,550	13,327	11,943	12,541	11,362
Rank	36	32	34	32	30
Delay per Peak Traveler (person-hours)	19	21	19	21	19
Rank	56	47	51	41	41
Delay due to Incidents (percent)	51	52	52	52	53
Travel Time Index	1.12	1.13	1.11	1.12	1.12
Rank	48	43	46	43	38
Congestion Cost					
Total Cost (\$ millions)	184	187	162	168	148
Rank	36	34	34	32	30
Cost per Peak Traveler (\$)	284	297	261	274	245
Rank	55	50	51	45	44

Note: System Performance statistics for 2000 through 2007 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

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	1,225	1,230	1,225	1,225	1,220
Rank	26	26	25	25	25
Urban Area (square miles)	550	550	550	550	550
Population Density (persons/sq mile)	2,227	2,236	2,227	2,227	2,218
Peak Travelers (1000s)	599	597	589	583	576
Freeway					
Daily Vehicle-Miles of Travel (1000s)	7,800	7,615	7,400	7,050	6,775
Lane-Miles	575	570	570	570	565
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	12,075	11,820	11,480	11,435	10,945
Lane-Miles	3,115	3,030	3,000	2,980	2,970
Public Transportation					
Annual Psgr-Miles of Travel (millions)	165	179	199	199	198
Annual Unlinked Psgr Trips (millions)	58	66	74	75	75
Cost Components					
Value of Time (\$/hour)	10.17	9.75	9.25	8.83	8.48
Commercial Cost (\$/hour)	64.55	62.47	59.16	56.03	54.62
Fuel Cost (\$/gallon)	1.15	1.11	1.13	1.04	1.05
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	35	33	30	27	24
Congested System (% of lane-miles)	25	24	23	22	22
Congested Time (number of "Rush Hours")	5.0	5.0	4.6	4.4	4.0
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	108	119	157	178	154
Transit Riders or Carpoolers (millions)	20	22	29	32	27
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	6,783	6,377	5,631	5,048	4,356
Rank	29	29	29	31	31
Fuel per Peak Traveler (gallons)	11	11	10	9	8
Rank	44	43	42	42	44
Annual Delay					
Total Delay (1000s of person-hours)	9,828	9,361	8,404	7,887	7,007
Rank	31	31	30	32	30
Delay per Peak Traveler (person-hours)	16	16	14	14	12
Rank	48	49	48	46	49
Delay due to Incidents (percent)	53	53	54	53	53
Travel Time Index	1.10	1.10	1.09	1.08	1.07
Rank	41	40	41	43	43
Congestion Cost					
Total Cost (\$ millions)	125	114	98	87	74
Rank	31	31	31	31	31
Cost per Peak Traveler (\$)	209	192	166	149	129
Rank	49	50	49	49	48

Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.

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

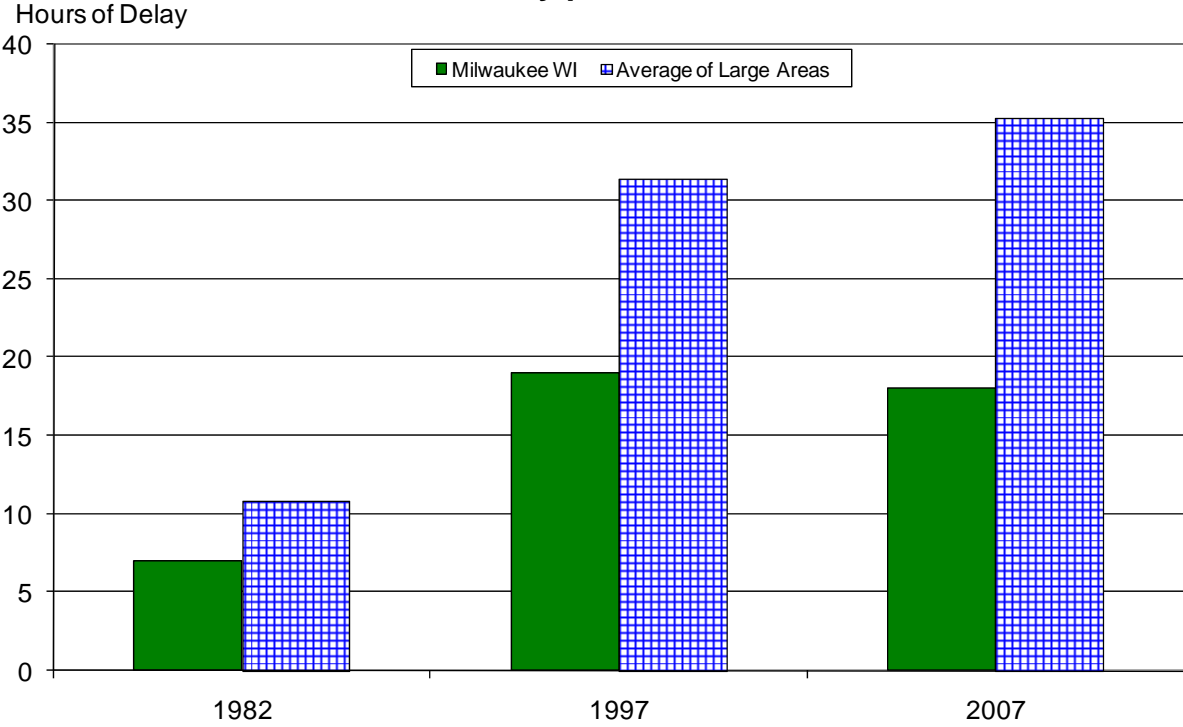
The Mobility Data for Milwaukee WI, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	1,215	1,210	1,210	1,210	1,210
Rank	24	24	24	24	24
Urban Area (square miles)	550	550	550	550	550
Population Density (persons/sq mile)	2,209	2,200	2,200	2,200	2,200
Peak Travelers (1000s)	569	561	555	551	546
Freeway					
Daily Vehicle-Miles of Travel (1000s)	6,315	6,090	5,815	5,385	5,250
Lane-Miles	560	560	560	560	560
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	10,905	10,440	9,415	9,090	9,065
Lane-Miles	2,930	2,915	2,915	2,915	2,890
Public Transportation					
Annual Psgr-Miles of Travel (millions)	197	189	213	213	213
Annual Unlinked Psgr Trips (millions)	77	77	83	83	83
Cost Components					
Value of Time (\$/hour)	8.18	8.03	7.75	7.43	7.20
Commercial Cost (\$/hour)	52.63	55.80	54.65	52.70	52.13
Fuel Cost (\$/gallon)	1.02	1.34	1.35	1.38	1.44
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	22	19	18	16	16
Congested System (% of lane-miles)	21	20	20	19	19
Congested Time (number of "Rush Hours")	3.6	3.2	2.9	2.8	2.7
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	3,843	3,240	2,695	2,282	2,304
Rank	33	32	33	34	33
Fuel per Peak Traveler (gallons)	7	6	5	4	4
Rank	44	49	52	55	53
Annual Delay					
Total Delay (1000s of person-hours)	6,242	5,385	4,487	3,900	3,959
Rank	32	32	33	34	33
Delay per Peak Traveler (person-hours)	11	10	8	7	7
Rank	52	52	54	55	53
Delay due to Incidents (percent)	53	53	53	53	53
Travel Time Index	1.07	1.06	1.05	1.05	1.05
Rank	43	46	47	44	44
Congestion Cost					
Total Cost (\$ millions)	64	56	45	38	38
Rank	31	32	33	33	33
Cost per Peak Traveler (\$)	113	100	81	69	69
Rank	54	54	56	55	53

Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.

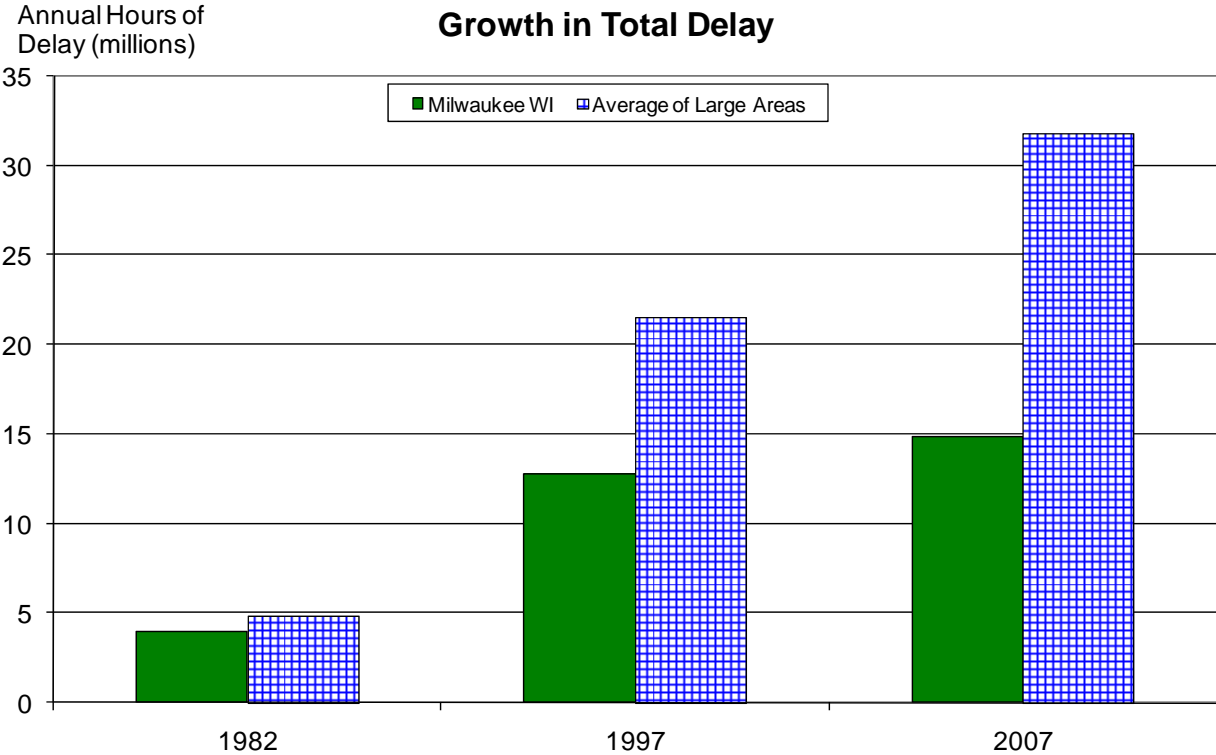
Note: Zeroes in the table reflect values less than 0.5.

Growth in Delay per Peak Traveler



Note: Large areas have populations between 1 and 3 million

Growth in Total Delay



Note: Large areas have populations between 1 and 3 million

**Benefits from Public Transportation Service and Operations Strategies in
Milwaukee WI**

Operations Strategies	2007	2006	2005	2004
Freeway Ramp Metering				
Percent of Roadway Miles	63	63	65	65
Annual Delay Reduction (1000 hours)	437	332	409	383
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	86	86	89	89
Service Patrols				
Percent of Roadway Miles	89	89	90	90
Annual Delay Reduction (1000 hours)	618	586	692	654
Arterial Signal Coordination				
Percent of Roadway Miles	17	17	14	13
Annual Delay Reduction (1000 hours)	54	45	21	29
Arterial Access Management				
Percent of Roadway Miles	37	37	37	36
Annual Delay Reduction (1000 hours)	186	228	191	207
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	1,296	1,191	1,312	1,274
Annual Delay Saved per Peak Traveler (hours)	2	1	2	2
Annual Congestion Cost Savings (\$million)	26.7	23.5	24.6	22.7
Travel Time Index with Strategies	1.130	1.124	1.137	1.137
Travel Time Index (Base)	1.140	1.133	1.147	1.146
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	154	155	158	178
Unlinked Passenger Trips (million)	48	51	53	56
Travel Time Index (combined road and transit)	1.137	1.131	1.144	1.143
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.147	1.139	1.153	1.153
Annual Increase				
Delay (1000 hours)	1,071	940	1,063	1,112
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	22.1	18.5	20.0	19.8

**Benefits from Public Transportation Service and Operations Strategies in
Milwaukee WI, Continued**

Operations Strategies	2003	2002	2001	2000
Freeway Ramp Metering				
Percent of Roadway Miles	67	32	31	29
Annual Delay Reduction (1000 hours)	356	138	121	117
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	80	83	70	55
Service Patrols				
Percent of Roadway Miles	92	90	90	92
Annual Delay Reduction (1000 hours)	597	577	478	477
Arterial Signal Coordination				
Percent of Roadway Miles	14	14	14	11
Annual Delay Reduction (1000 hours)	44	45	46	14
Arterial Access Management				
Percent of Roadway Miles	35	35	35	36
Annual Delay Reduction (1000 hours)	201	187	198	210
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	1,197	947	843	818
Annual Delay Saved per Peak Traveler (hours)	2	1	1	1
Annual Congestion Cost Savings (\$million)	20.5	15.8	13.9	13.3
Travel Time Index with Strategies	1.139	1.149	1.146	1.151
Travel Time Index (Base)	1.149	1.157	1.154	1.159
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	177	188	221	218
Unlinked Passenger Trips (million)	60	66	73	74
Travel Time Index (combined road and transit)	1.145	1.153	1.149	1.154
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.156	1.166	1.164	1.170
Annual Increase				
Delay (1000 hours)	1,244	1,303	1,445	1,609
Delay per Peak Traveler (hours)	2	2	2	2
Congestion Cost (\$million)	21.2	21.7	23.8	26.1

**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 2007	
				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+	0	F+
St. Louis, MO-IL	L-	L-	0	S-	S
Denver-Aurora, CO	H+	H+	H+	F	F+
Riverside-San Bernardino, CA	H+	H+	H+	F+	F+
Sacramento, CA	H	H+	H	0	F+
Pittsburgh, PA	L-	L-	L-	S-	S-
Portland, OR-WA	0	H	0	0	F
Cleveland, OH	L-	L-	L-	S-	S-
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-
San Antonio, TX	H	0	0	F+	F
Las Vegas, NV	H+	H	0	F+	F+
Orlando, FL	H+	H	H	F+	F+
Providence, RI-MA	L	L	L	0	S-
Columbus, OH	L	L	L	0	S-
Buffalo, NY	L-	L-	L-	S-	S-
New Orleans, LA	L-	L	L-	S-	S-
Charlotte, NC-SC	H	0	L	F	S-
Indianapolis, IN	H	0	L	S	S-
Jacksonville, FL	H	0	L	0	S-
Austin, TX	H	H	L	F	S-
Memphis, TN-MS-AR	L-	L-	L-	S	S-
Raleigh-Durham, NC	0	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

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
2007 Values Delay per Traveler - Travel Time Index - Total Delay -	Above 1M Population 5 Hours 5 Index Points 5 Hours x Average Population	Below 1M Population 3 Hours 3 Index Points 3 Hours x Average Population
1982 to 2007 Trends Delay per Traveler - Total Delay -	5 Hours 5 Hours x Average Population	3 Hours 3 Hours x Average Population