

Performance Measure Summary – Providence, RI-MA

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 Providence RI-MA

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	1,245	1,245	1,245	1,245	1,230	1,225
Rank	34	34	34	34	34	34
Urban Area (square miles)	800	800	800	800	800	795
Population Density (persons/sq mile)	1,556	1,556	1,556	1,556	1,538	1,541
Peak Travelers (1000s)	682	681	677	675	664	653
Freeway						
Daily Vehicle-Miles of Travel (1000s)	11,735	11,480	11,505	11,415	11,095	10,585
Lane-Miles	915	915	910	905	900	875
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	11,210	11,090	11,100	11,110	11,030	10,515
Lane-Miles	2,165	2,155	2,150	2,110	2,050	2,005
Public Transportation						
Annual Psgr-Miles of Travel (millions)	117	108	99	92	86	78
Annual Unlinked Psgr Trips (millions)	22	21	20	18	18	16
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)	2.98	2.72	2.32	2.05	1.57	1.44
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	39	38	39	41	40	37
Congested System (% of lane-miles)	37	37	37	37	37	37
Congested Time (number of "Rush Hours")	5.6	5.4	5.4	5.6	5.4	5.2
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	52	58	88	109	128	151
Transit Riders or Carpoolers (millions)	13	15	23	28	33	38
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	12,114	10,876	11,658	11,947	11,527	10,325
Rank	39	40	39	37	37	40
Fuel per Peak Traveler (gallons)	18	16	17	18	17	16
Rank	42	48	45	45	46	46
Annual Delay						
Total Delay (1000s of person-hours)	19,937	17,800	19,478	19,365	18,654	17,092
Rank	36	39	37	37	37	37
Delay per Peak Traveler (person-hours)	29	26	29	29	28	26
Rank	41	48	43	45	44	45
Delay due to Incidents (percent)	60	59	60	60	59	59
Travel Time Index	1.17	1.15	1.16	1.17	1.16	1.15
Rank	43	49	45	42	44	46
Congestion Cost						
Total Cost (\$ millions)	386	335	351	333	306	273
Rank	39	39	39	37	37	37
Cost per Peak Traveler (\$)	566	491	519	493	461	419
Rank	43	52	45	46	47	47

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 Providence RI-MA, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	1,210	1,205	1,205	1,190	1,170
Rank	34	33	32	32	32
Urban Area (square miles)	785	780	775	765	755
Population Density (persons/sq mile)	1,541	1,545	1,555	1,556	1,550
Peak Travelers (1000s)	636	627	618	603	585
Freeway					
Daily Vehicle-Miles of Travel (1000s)	10,430	10,125	9,855	9,505	8,840
Lane-Miles	855	845	830	810	810
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	10,110	9,500	9,000	8,405	7,525
Lane-Miles	1,985	1,970	1,940	1,925	1,910
Public Transportation					
Annual Psgr-Miles of Travel (millions)	70	64	69	68	77
Annual Unlinked Psgr Trips (millions)	16	18	17	16	17
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)	1.72	1.57	1.16	1.11	1.29
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	39	37	36	33	27
Congested System (% of lane-miles)	40	40	41	37	36
Congested Time (number of "Rush Hours")	5.2	4.8	4.6	4.4	3.6
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	145	140	128	109	83
Transit Riders or Carpoolers (millions)	36	34	30	25	17
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	9,510	8,604	7,994	6,870	5,225
Rank	41	43	43	44	49
Fuel per Peak Traveler (gallons)	15	14	13	11	9
Rank	47	50	57	62	66
Annual Delay					
Total Delay (1000s of person-hours)	15,404	13,875	13,142	11,115	8,794
Rank	37	42	40	42	48
Delay per Peak Traveler (person-hours)	24	22	21	18	15
Rank	49	53	59	62	65
Delay due to Incidents (percent)	58	58	58	58	58
Travel Time Index	1.14	1.14	1.13	1.12	1.10
Rank	50	49	49	49	57
Congestion Cost					
Total Cost (\$ millions)	245	215	193	160	126
Rank	37	42	40	46	48
Cost per Peak Traveler (\$)	385	343	313	265	216
Rank	50	57	60	63	67

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 Providence RI-MA, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	1,160	1,145	1,135	1,120	1,110
Rank	32	32	32	32	32
Urban Area (square miles)	750	740	730	720	710
Population Density (persons/sq mile)	1,547	1,547	1,555	1,556	1,563
Peak Travelers (1000s)	573	559	547	533	522
Freeway					
Daily Vehicle-Miles of Travel (1000s)	8,800	8,525	8,325	8,055	7,470
Lane-Miles	810	810	810	810	775
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	7,215	6,855	6,720	6,675	6,610
Lane-Miles	1,880	1,865	1,835	1,810	1,780
Public Transportation					
Annual Psgr-Miles of Travel (millions)	75	84	83	70	61
Annual Unlinked Psgr Trips (millions)	16	16	16	15	15
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	1.25	1.09	1.08	1.17
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	25	22	21	21	20
Congested System (% of lane-miles)	35	35	30	30	30
Congested Time (number of "Rush Hours")	3.4	3.0	3.0	2.9	2.9
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	77	62	61	75	99
Transit Riders or Carpoolers (millions)	16	12	12	15	19
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	5,049	4,116	3,841	3,715	3,182
Rank	47	49	47	49	52
Fuel per Peak Traveler (gallons)	9	7	7	7	6
Rank	64	68	67	67	68
Annual Delay					
Total Delay (1000s of person-hours)	8,345	6,881	6,381	6,127	5,184
Rank	46	49	47	48	51
Delay per Peak Traveler (person-hours)	15	12	12	11	10
Rank	64	69	64	69	70
Delay due to Incidents (percent)	59	59	58	58	58
Travel Time Index	1.10	1.08	1.08	1.08	1.07
Rank	57	62	57	56	58
Congestion Cost					
Total Cost (\$ millions)	119	94	84	79	66
Rank	46	51	50	50	51
Cost per Peak Traveler (\$)	207	169	154	149	126
Rank	65	70	73	69	73

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 Providence RI-MA, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	1,100	1,095	1,090	1,085	1,080
Rank	32	32	31	31	29
Urban Area (square miles)	705	700	695	690	685
Population Density (persons/sq mile)	1,560	1,564	1,568	1,572	1,577
Peak Travelers (1000s)	510	502	495	488	482
Freeway					
Daily Vehicle-Miles of Travel (1000s)	7,290	7,200	7,000	6,500	5,515
Lane-Miles	765	750	730	700	675
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	6,615	6,525	6,425	6,280	6,115
Lane-Miles	1,750	1,720	1,705	1,685	1,650
Public Transportation					
Annual Psgr-Miles of Travel (millions)	73	71	72	69	67
Annual Unlinked Psgr Trips (millions)	17	17	16	18	19
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)	1.20	1.10	1.09	1.01	1.01
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	20	19	17	17	14
Congested System (% of lane-miles)	30	30	27	22	19
Congested Time (number of "Rush Hours")	2.9	2.9	2.9	2.8	2.6
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	157	164	164	149	102
Transit Riders or Carpoolers (millions)	30	31	31	28	18
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	2,876	2,745	2,426	2,313	1,733
Rank	50	50	51	47	52
Fuel per Peak Traveler (gallons)	6	5	5	5	4
Rank	63	67	68	67	69
Annual Delay					
Total Delay (1000s of person-hours)	4,579	4,460	3,902	3,696	2,850
Rank	51	52	52	49	53
Delay per Peak Traveler (person-hours)	9	9	8	8	6
Rank	67	66	70	68	71
Delay due to Incidents (percent)	56	56	56	56	55
Travel Time Index	1.06	1.06	1.05	1.05	1.04
Rank	56	56	63	59	65
Congestion Cost					
Total Cost (\$ millions)	56	52	44	39	29
Rank	51	52	52	51	52
Cost per Peak Traveler (\$)	110	104	88	81	60
Rank	70	69	72	71	74

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.

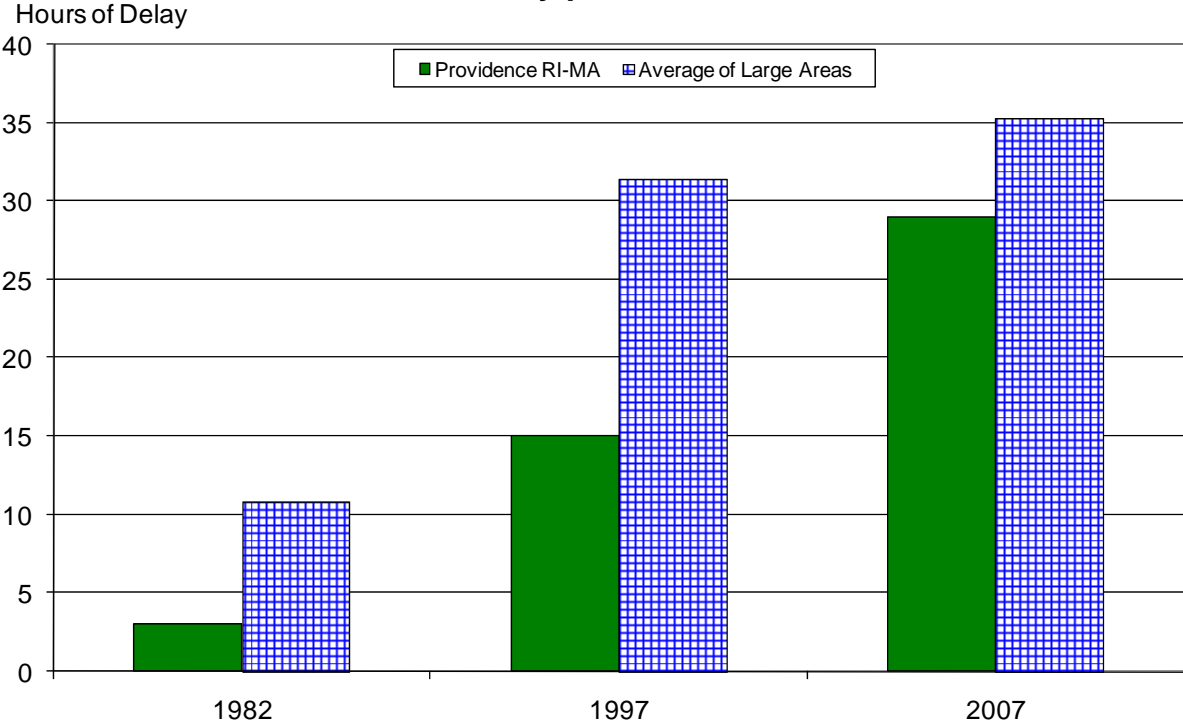
The Mobility Data for Providence RI-MA, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	1,075	1,070	1,060	1,060	1,050
Rank	29	29	29	29	30
Urban Area (square miles)	680	675	670	665	655
Population Density (persons/sq mile)	1,581	1,585	1,582	1,594	1,603
Peak Travelers (1000s)	475	469	460	456	447
Freeway					
Daily Vehicle-Miles of Travel (1000s)	4,345	4,250	4,190	4,050	4,000
Lane-Miles	670	660	640	620	600
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	5,935	5,720	5,510	5,395	5,390
Lane-Miles	1,620	1,605	1,590	1,575	1,550
Public Transportation					
Annual Psgr-Miles of Travel (millions)	78	77	48	48	48
Annual Unlinked Psgr Trips (millions)	20	18	10	10	10
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)	0.98	1.29	1.30	1.33	1.39
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	12	11	11	11	10
Congested System (% of lane-miles)	19	15	15	15	15
Congested Time (number of "Rush Hours")	2.4	2.4	2.3	2.3	2.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	1,330	1,124	1,040	1,005	911
Rank	57	57	57	56	56
Fuel per Peak Traveler (gallons)	3	2	2	2	2
Rank	72	78	73	73	72
Annual Delay					
Total Delay (1000s of person-hours)	2,218	1,839	1,664	1,613	1,452
Rank	57	59	59	58	57
Delay per Peak Traveler (person-hours)	5	4	4	4	3
Rank	75	76	72	71	76
Delay due to Incidents (percent)	55	55	55	55	55
Travel Time Index	1.04	1.03	1.03	1.03	1.03
Rank	65	69	66	63	62
Congestion Cost					
Total Cost (\$ millions)	22	18	16	15	13
Rank	57	59	58	58	57
Cost per Peak Traveler (\$)	46	39	35	33	30
Rank	76	80	79	79	80

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

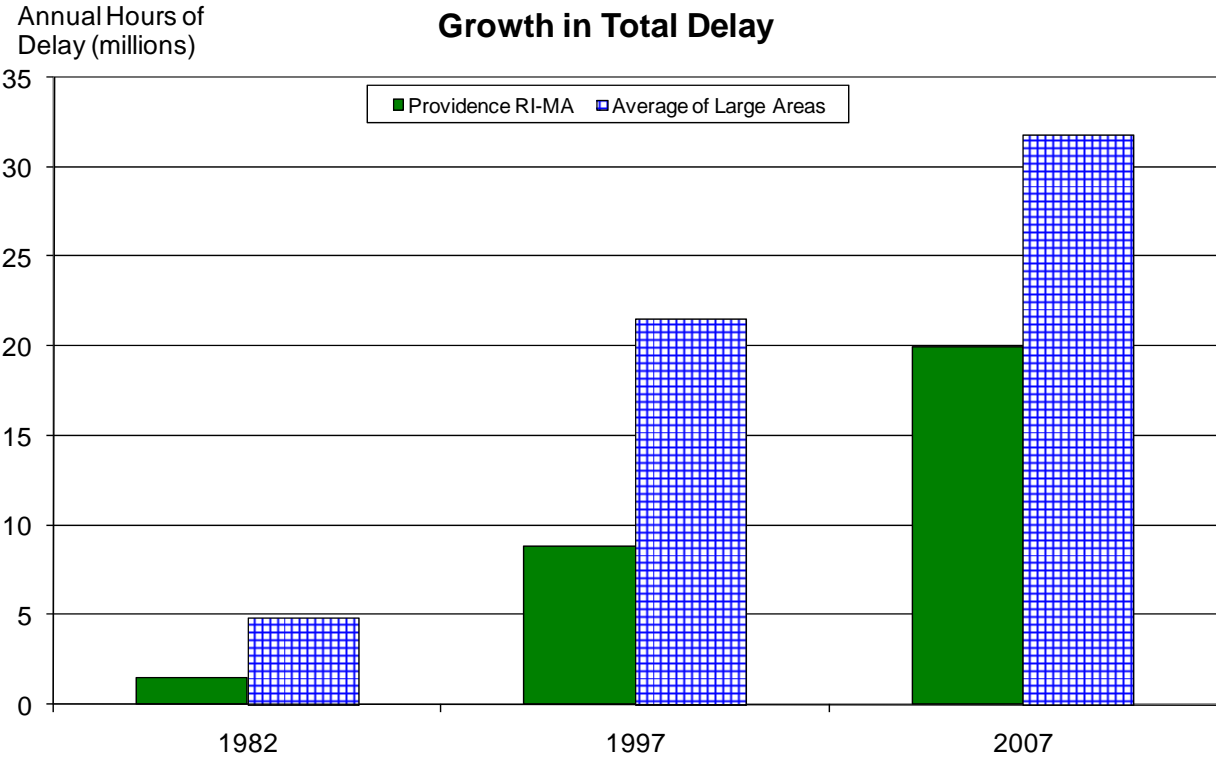
Note: Zeroes in the table reflect values less than 0.5.

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
Providence RI-MA**

Operations Strategies	2007	2006	2005	2004
Freeway Ramp Metering				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	44	41	41	41
Service Patrols				
Percent of Roadway Miles	20	20	20	14
Annual Delay Reduction (1000 hours)	294	222	281	213
Arterial Signal Coordination				
Percent of Roadway Miles	11	11	11	11
Annual Delay Reduction (1000 hours)	6	6	7	10
Arterial Access Management				
Percent of Roadway Miles	7	7	6	6
Annual Delay Reduction (1000 hours)	23	26	11	14
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	324	254	299	238
Annual Delay Saved per Peak Traveler (hours)	0	0	0	0
Annual Congestion Cost Savings (\$million)	6.5	5.0	5.6	4.3
Travel Time Index with Strategies	1.166	1.150	1.161	1.166
Travel Time Index (Base)	1.168	1.152	1.163	1.168
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	117	108	99	92
Unlinked Passenger Trips (million)	22	21	20	18
Travel Time Index (combined road and transit)	1.165	1.150	1.161	1.166
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.173	1.156	1.168	1.172
Annual Increase				
Delay (1000 hours)	989	719	867	744
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	19.1	13.5	15.6	12.8

**Benefits from Public Transportation Service and Operations Strategies in
Providence RI-MA, Continued**

Operations Strategies	2003	2002	2001	2000
Freeway Ramp Metering				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	37	38	18	2
Service Patrols				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	55	48	26	4
Arterial Signal Coordination				
Percent of Roadway Miles	12	12	12	12
Annual Delay Reduction (1000 hours)	25	61	69	49
Arterial Access Management				
Percent of Roadway Miles	5	4	4	4
Annual Delay Reduction (1000 hours)	6	8	4	4
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	86	118	99	56
Annual Delay Saved per Peak Traveler (hours)	0	0	0	0
Annual Congestion Cost Savings (\$million)	1.5	1.9	1.7	0.9
Travel Time Index with Strategies	1.163	1.153	1.144	1.136
Travel Time Index (Base)	1.164	1.154	1.145	1.137
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	85	78	70	64
Unlinked Passenger Trips (million)	18	16	16	18
Travel Time Index (combined road and transit)	1.162	1.152	1.144	1.135
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.167	1.156	1.148	1.140
Annual Increase				
Delay (1000 hours)	653	524	530	468
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	10.7	8.4	8.4	7.3

**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