

Performance Measure Summary – Detroit, MI

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 Detroit MI

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	4,050	4,050	4,045	4,045	4,040	4,035
Rank	11	11	11	11	10	9
Urban Area (square miles)	1,440	1,440	1,440	1,440	1,420	1,400
Population Density (persons/sq mile)	2,813	2,813	2,809	2,809	2,845	2,882
Peak Travelers (1000s)	2,268	2,264	2,245	2,229	2,206	2,163
Freeway						
Daily Vehicle-Miles of Travel (1000s)	32,780	33,065	33,045	33,000	33,000	32,600
Lane-Miles	1,915	1,915	1,915	1,910	1,910	1,890
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	53,680	53,845	53,200	51,465	50,645	49,955
Lane-Miles	8,630	8,620	8,580	8,450	8,355	8,275
Public Transportation						
Annual Psgr-Miles of Travel (millions)	280	299	267	243	259	295
Annual Unlinked Psgr Trips (millions)	50	51	48	45	49	54
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)	3.06	2.64	2.33	1.90	1.51	1.41
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	71	71	71	71	71	71
Congested System (% of lane-miles)	57	57	57	57	57	57
Congested Time (number of "Rush Hours")	7.6	7.6	7.6	7.6	7.6	7.6
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	98	142	219	229	246	229
Transit Riders or Carpoolers (millions)	28	41	62	65	70	64
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	76,425	77,681	76,037	77,190	78,092	75,619
Rank	10	10	10	10	9	9
Fuel per Peak Traveler (gallons)	34	34	34	35	35	35
Rank	11	11	11	8	9	9
Annual Delay						
Total Delay (1000s of person-hours)	116,981	119,130	115,511	118,508	119,540	115,333
Rank	10	10	10	9	7	7
Delay per Peak Traveler (person-hours)	52	53	51	53	54	53
Rank	9	10	10	7	6	6
Delay due to Incidents (percent)	53	53	53	53	54	54
Travel Time Index	1.29	1.29	1.29	1.30	1.31	1.30
Rank	20	20	21	14	10	10
Congestion Cost						
Total Cost (\$ millions)	2,472	2,429	2,250	2,174	2,100	1,970
Rank	10	9	9	9	7	7
Cost per Peak Traveler (\$)	1,090	1,073	1,002	975	952	911
Rank	6	6	9	7	5	6

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 Detroit MI, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	4,030	4,025	4,025	4,020	4,020
Rank	8	7	6	6	6
Urban Area (square miles)	1,380	1,360	1,350	1,335	1,320
Population Density (persons/sq mile)	2,920	2,960	2,981	3,011	3,045
Peak Travelers (1000s)	2,124	2,085	2,049	2,010	1,974
Freeway					
Daily Vehicle-Miles of Travel (1000s)	31,900	31,300	30,800	30,000	29,355
Lane-Miles	1,865	1,845	1,820	1,800	1,790
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	49,405	46,505	44,910	44,295	44,510
Lane-Miles	8,225	8,160	8,110	8,040	8,015
Public Transportation					
Annual Psgr-Miles of Travel (millions)	266	288	269	279	202
Annual Unlinked Psgr Trips (millions)	56	57	53	69	57
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)	1.50	1.63	1.13	1.11	1.12
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	68	67	67	64	63
Congested System (% of lane-miles)	53	52	52	48	48
Congested Time (number of "Rush Hours")	7.4	7.4	7.4	7.2	7.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	199	157	130	89	94
Transit Riders or Carpoolers (millions)	56	42	34	24	25
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	71,330	67,066	66,742	63,467	62,295
Rank	8	8	7	7	7
Fuel per Peak Traveler (gallons)	34	32	33	32	32
Rank	8	9	8	8	8
Annual Delay					
Total Delay (1000s of person-hours)	109,003	101,646	100,412	96,599	95,667
Rank	7	8	5	5	4
Delay per Peak Traveler (person-hours)	51	49	49	48	48
Rank	7	7	6	6	7
Delay due to Incidents (percent)	54	54	54	55	55
Travel Time Index	1.29	1.28	1.29	1.28	1.27
Rank	11	12	9	8	7
Congestion Cost					
Total Cost (\$ millions)	1,849	1,705	1,593	1,507	1,486
Rank	6	7	5	5	4
Cost per Peak Traveler (\$)	871	818	777	750	753
Rank	6	7	7	6	7

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 Detroit MI, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	4,015	4,015	4,010	4,010	4,005
Rank	6	6	6	6	6
Urban Area (square miles)	1,305	1,305	1,300	1,295	1,290
Population Density (persons/sq mile)	3,077	3,077	3,085	3,097	3,105
Peak Travelers (1000s)	1,935	1,903	1,869	1,837	1,802
Freeway					
Daily Vehicle-Miles of Travel (1000s)	29,260	28,320	28,440	29,000	28,785
Lane-Miles	1,790	1,770	1,770	1,770	1,770
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	44,475	43,675	42,525	42,000	41,650
Lane-Miles	7,990	7,980	7,960	7,950	7,910
Public Transportation					
Annual Psgr-Miles of Travel (millions)	244	292	350	359	395
Annual Unlinked Psgr Trips (millions)	59	69	70	72	82
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)	1.29	1.12	1.02	1.10	1.08
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	61	59	59	59	56
Congested System (% of lane-miles)	47	46	46	46	42
Congested Time (number of "Rush Hours")	7.2	7.2	7.2	7.2	7.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	169	156	137	186	242
Transit Riders or Carpoolers (millions)	44	40	35	47	61
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	60,252	57,203	57,368	60,016	56,553
Rank	6	6	6	5	5
Fuel per Peak Traveler (gallons)	31	30	31	33	31
Rank	9	9	8	4	7
Annual Delay					
Total Delay (1000s of person-hours)	93,686	90,088	90,650	96,039	89,779
Rank	6	5	4	4	4
Delay per Peak Traveler (person-hours)	48	47	49	52	50
Rank	8	9	6	2	4
Delay due to Incidents (percent)	56	55	56	57	57
Travel Time Index	1.26	1.26	1.26	1.27	1.26
Rank	8	7	6	6	6
Congestion Cost					
Total Cost (\$ millions)	1,445	1,343	1,313	1,365	1,247
Rank	4	4	4	4	4
Cost per Peak Traveler (\$)	747	706	702	743	692
Rank	8	8	5	2	3

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

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The Mobility Data for Detroit MI, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	3,985	3,970	3,915	3,900	3,890
Rank	5	5	5	5	5
Urban Area (square miles)	1,260	1,255	1,250	1,250	1,245
Population Density (persons/sq mile)	3,163	3,163	3,132	3,120	3,124
Peak Travelers (1000s)	1,761	1,723	1,683	1,665	1,645
Freeway					
Daily Vehicle-Miles of Travel (1000s)	27,405	26,645	26,680	25,410	22,650
Lane-Miles	1,770	1,770	1,770	1,730	1,675
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	40,260	39,855	39,500	39,180	39,590
Lane-Miles	7,860	7,825	7,800	7,525	7,285
Public Transportation					
Annual Psgr-Miles of Travel (millions)	421	416	343	325	360
Annual Unlinked Psgr Trips (millions)	96	95	81	75	79
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)	1.13	1.10	1.12	1.03	1.04
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	53	51	50	47	44
Congested System (% of lane-miles)	41	41	41	40	40
Congested Time (number of "Rush Hours")	6.8	6.6	6.6	6.6	6.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	184	283	351	380	322
Transit Riders or Carpoolers (millions)	45	68	84	92	78
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	50,143	46,965	43,354	40,881	33,543
Rank	5	5	5	5	5
Fuel per Peak Traveler (gallons)	28	27	26	25	20
Rank	6	7	7	5	7
Annual Delay					
Total Delay (1000s of person-hours)	81,211	76,927	69,642	67,104	54,459
Rank	5	5	5	5	5
Delay per Peak Traveler (person-hours)	46	45	41	40	33
Rank	5	6	7	4	5
Delay due to Incidents (percent)	57	57	57	57	56
Travel Time Index	1.24	1.23	1.21	1.20	1.17
Rank	9	9	10	11	11
Congestion Cost					
Total Cost (\$ millions)	1,100	1,003	863	789	620
Rank	4	5	5	5	5
Cost per Peak Traveler (\$)	625	582	513	474	377
Rank	6	5	6	4	5

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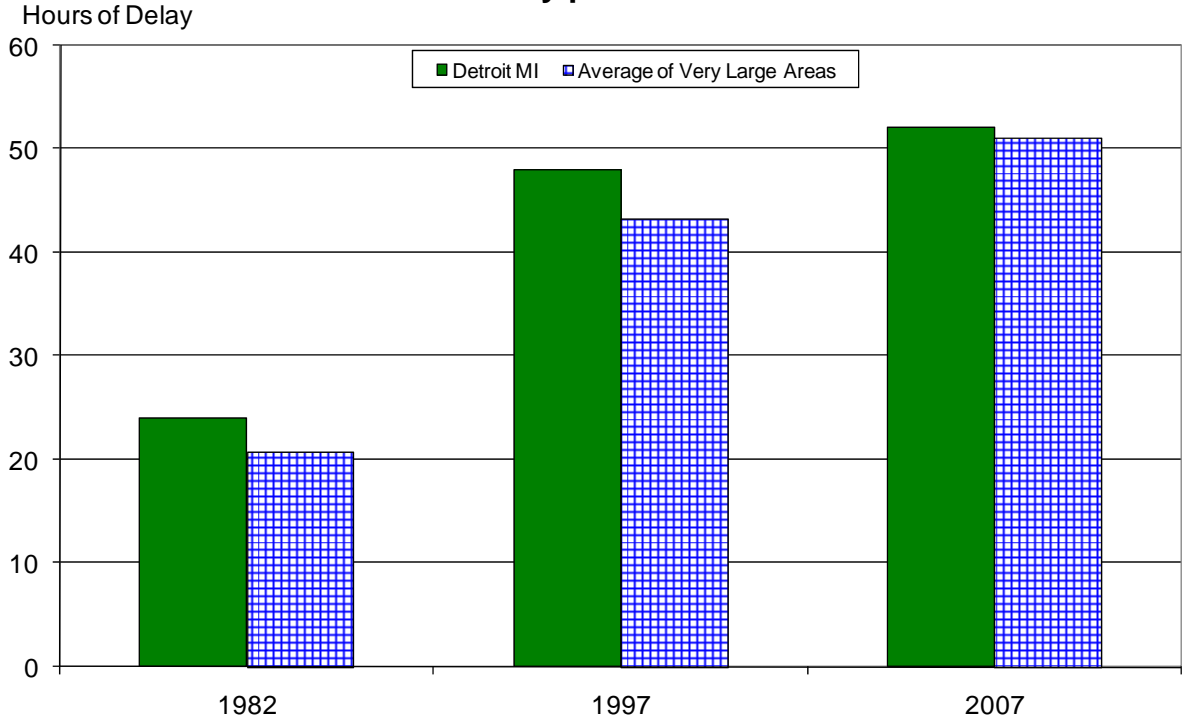
The Mobility Data for Detroit MI, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	3,885	3,880	3,850	3,830	3,810
Rank	5	5	5	5	5
Urban Area (square miles)	1,245	1,240	1,190	1,140	1,090
Population Density (persons/sq mile)	3,120	3,129	3,235	3,360	3,495
Peak Travelers (1000s)	1,628	1,614	1,586	1,566	1,543
Freeway					
Daily Vehicle-Miles of Travel (1000s)	21,670	19,500	18,270	17,300	17,925
Lane-Miles	1,630	1,600	1,575	1,575	1,575
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	39,895	38,000	37,010	35,505	34,250
Lane-Miles	7,105	7,015	6,795	6,650	6,565
Public Transportation					
Annual Psgr-Miles of Travel (millions)	349	305	429	429	429
Annual Unlinked Psgr Trips (millions)	83	77	99	99	99
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)	1.01	1.32	1.34	1.37	1.43
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	43	39	37	35	35
Congested System (% of lane-miles)	39	38	37	37	37
Congested Time (number of "Rush Hours")	6.2	5.6	5.4	5.2	5.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	32,477	26,470	24,196	21,965	21,658
Rank	6	6	6	6	6
Fuel per Peak Traveler (gallons)	20	16	15	14	14
Rank	6	8	7	7	7
Annual Delay					
Total Delay (1000s of person-hours)	53,094	43,911	40,563	36,836	36,337
Rank	5	6	6	5	4
Delay per Peak Traveler (person-hours)	33	27	26	24	24
Rank	5	7	7	7	4
Delay due to Incidents (percent)	55	55	54	54	55
Travel Time Index	1.16	1.14	1.13	1.13	1.13
Rank	8	12	11	8	6
Congestion Cost					
Total Cost (\$ millions)	582	490	438	384	370
Rank	5	6	6	5	4
Cost per Peak Traveler (\$)	357	303	276	245	240
Rank	6	6	6	7	5

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.

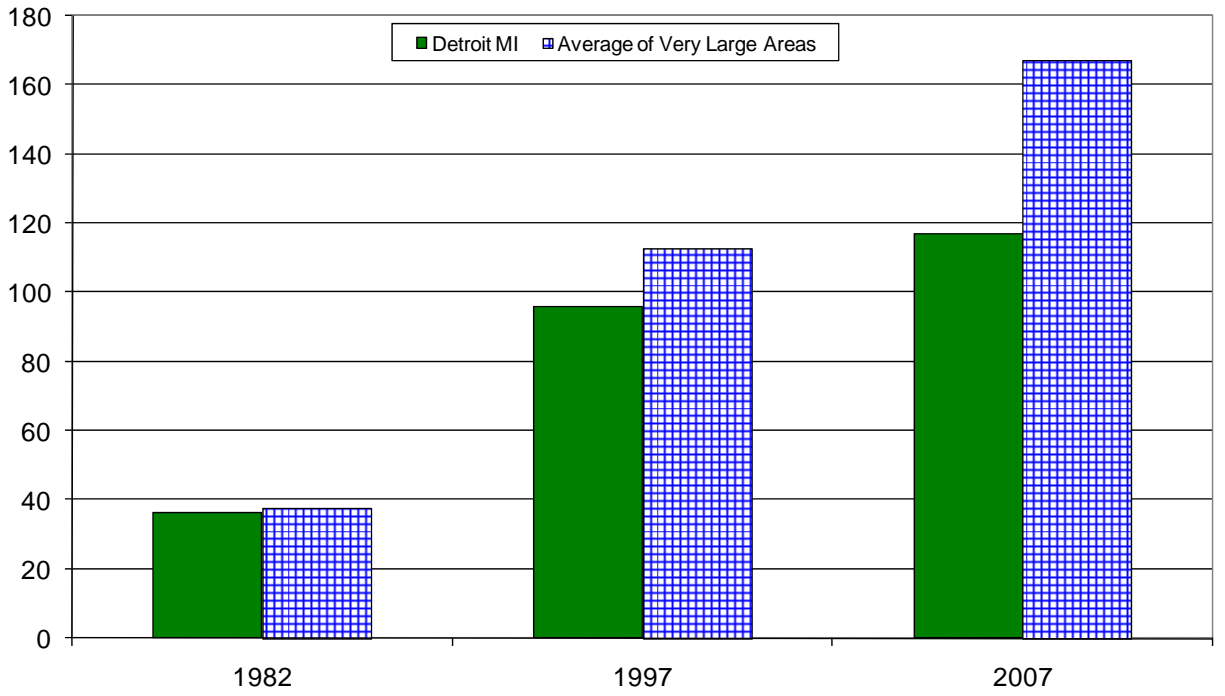
Growth in Delay per Peak Traveler



Note: Very Large areas have populations over 3 million

Annual Hours of Delay (millions)

Growth in Total Delay



Note: Very Large areas have populations over 3 million

**Benefits from Public Transportation Service and Operations Strategies in
Detroit MI**

Operations Strategies	2007	2006	2005	2004
Freeway Ramp Metering				
Percent of Roadway Miles	15	15	15	15
Annual Delay Reduction (1000 hours)	194	194	182	245
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	58	58	58	58
Service Patrols				
Percent of Roadway Miles	58	58	58	58
Annual Delay Reduction (1000 hours)	1,910	1,967	1,518	1,819
Arterial Signal Coordination				
Percent of Roadway Miles	24	24	24	24
Annual Delay Reduction (1000 hours)	381	307	453	405
Arterial Access Management				
Percent of Roadway Miles	19	19	20	20
Annual Delay Reduction (1000 hours)	1,828	1,808	1,707	1,796
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	4,313	4,276	3,860	4,265
Annual Delay Saved per Peak Traveler (hours)	2	2	2	2
Annual Congestion Cost Savings (\$million)	92.9	88.4	76.2	78.8
Travel Time Index with Strategies	1.291	1.295	1.290	1.302
Travel Time Index (Base)	1.302	1.306	1.300	1.313
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	280	299	267	243
Unlinked Passenger Trips (million)	50	51	48	45
Travel Time Index (combined road and transit)	1.299	1.302	1.297	1.310
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.305	1.309	1.304	1.316
Annual Increase				
Delay (1000 hours)	2,732	2,993	2,945	2,626
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	57.4	60.6	56.9	47.8

**Benefits from Public Transportation Service and Operations Strategies in
Detroit MI, Continued**

Operations Strategies	2003	2002	2001	2000
Freeway Ramp Metering				
Percent of Roadway Miles	13	14	14	14
Annual Delay Reduction (1000 hours)	273	233	216	274
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	59	59	61	61
Service Patrols				
Percent of Roadway Miles	58	61	34	14
Annual Delay Reduction (1000 hours)	2,177	1,923	1,382	782
Arterial Signal Coordination				
Percent of Roadway Miles	25	19	17	15
Annual Delay Reduction (1000 hours)	343	236	197	350
Arterial Access Management				
Percent of Roadway Miles	20	20	20	21
Annual Delay Reduction (1000 hours)	1,685	1,606	1,382	1,598
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	4,479	3,998	3,177	3,004
Annual Delay Saved per Peak Traveler (hours)	2	2	1	1
Annual Congestion Cost Savings (\$million)	79.3	69.0	54.5	50.6
Travel Time Index with Strategies	1.309	1.303	1.288	1.283
Travel Time Index (Base)	1.321	1.313	1.296	1.290
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	259	295	266	288
Unlinked Passenger Trips (million)	49	54	56	57
Travel Time Index (combined road and transit)	1.317	1.310	1.293	1.287
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.325	1.317	1.301	1.295
Annual Increase				
Delay (1000 hours)	2,974	2,891	2,852	3,127
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	52.1	49.2	48.3	52.1

**Comparison of Several Key Mobility Performance Measures
Very Large Group – over 3 million population urban areas**

Urban Area	Delay per Traveler	Travel Time Index	Total Delay	1982 to 2007	
				Delay per Traveler	Total Delay
New York-Newark, NY-NJ-CT	L	0	H+	0	F+
Los Angeles-Long Beach-Santa Ana, CA	H+	H+	H+	S	F+
Chicago, IL-IN	L-	H	H	S	F+
Miami FL	L	0	L	0	S
Philadelphia, PA-NJ-DE-MD	L-	L-	L-	S-	S-
San Francisco-Oakland, CA	H	H	L	0	S-
Dallas-Fort Worth-Arlington, TX	0	L	L	F+	0
Atlanta, GA	H	0	L	F+	S
Washington, DC-VA-MD	H+	0	L	F+	S-
Boston, MA-NH-RI	L-	L-	L-	0	S-
Detroit, MI	0	L-	L-	0	S-
Houston, TX	H	L	L	S	S-
Phoenix, AZ	L	L	L-	S-	S-
Seattle, WA	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

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