

Performance Measure Summary – Cleveland, OH

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 Cleveland OH

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	1,790	1,790	1,790	1,790	1,785	1,785
Rank	25	24	23	23	22	21
Urban Area (square miles)	895	895	895	895	890	850
Population Density (persons/sq mile)	2,000	2,000	2,000	2,000	2,006	2,100
Peak Travelers (1000s)	995	993	986	983	976	960
Freeway						
Daily Vehicle-Miles of Travel (1000s)	18,120	18,205	18,150	18,375	17,390	16,800
Lane-Miles	1,410	1,410	1,405	1,400	1,375	1,310
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	12,005	12,065	12,185	12,020	11,800	11,490
Lane-Miles	3,080	3,080	3,080	2,950	2,900	2,845
Public Transportation						
Annual Psgr-Miles of Travel (millions)	276	297	293	252	270	256
Annual Unlinked Psgr Trips (millions)	65	70	67	59	61	57
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)	2.88	2.58	2.24	1.81	1.52	1.38
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	28	29	29	32	31	31
Congested System (% of lane-miles)	23	27	27	27	27	27
Congested Time (number of "Rush Hours")	5.0	5.0	5.0	5.2	5.0	5.0
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	57	69	60	71	44	41
Transit Riders or Carpoolers (millions)	13	16	14	17	11	10
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	8,166	8,733	8,840	9,729	8,501	8,665
Rank	48	46	46	43	46	45
Fuel per Peak Traveler (gallons)	8	9	9	10	9	9
Rank	74	72	70	69	70	70
Annual Delay						
Total Delay (1000s of person-hours)	12,037	12,990	13,162	14,162	12,351	12,597
Rank	49	47	47	44	46	46
Delay per Peak Traveler (person-hours)	12	13	13	14	13	13
Rank	76	76	76	73	73	72
Delay due to Incidents (percent)	56	56	56	56	56	56
Travel Time Index	1.08	1.09	1.09	1.10	1.09	1.09
Rank	77	70	66	63	66	69
Congestion Cost						
Total Cost (\$ millions)	241	251	242	247	206	204
Rank	51	48	48	45	46	46
Cost per Peak Traveler (\$)	242	252	246	252	211	213
Rank	78	78	76	73	76	72

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 Cleveland OH, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	1,785	1,780	1,780	1,775	1,775
Rank	21	21	21	21	22
Urban Area (square miles)	840	825	820	820	800
Population Density (persons/sq mile)	2,125	2,158	2,171	2,165	2,219
Peak Travelers (1000s)	946	929	915	898	884
Freeway					
Daily Vehicle-Miles of Travel (1000s)	16,750	17,285	17,260	17,120	16,660
Lane-Miles	1,280	1,280	1,260	1,260	1,250
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	11,310	11,105	10,795	10,605	10,255
Lane-Miles	2,800	2,755	2,710	2,620	2,450
Public Transportation					
Annual Psgr-Miles of Travel (millions)	280	290	296	300	292
Annual Unlinked Psgr Trips (millions)	61	65	69	67	68
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)	1.30	1.55	1.14	1.11	1.13
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	34	39	40	38	37
Congested System (% of lane-miles)	28	33	33	30	30
Congested Time (number of "Rush Hours")	5.2	5.4	5.6	5.6	5.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	61	98	108	124	131
Transit Riders or Carpoolers (millions)	15	24	27	31	33
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	9,350	10,611	10,840	10,277	11,031
Rank	42	35	33	33	30
Fuel per Peak Traveler (gallons)	10	11	12	11	12
Rank	69	64	62	62	57
Annual Delay					
Total Delay (1000s of person-hours)	13,315	15,093	15,461	14,459	16,052
Rank	43	36	35	35	32
Delay per Peak Traveler (person-hours)	14	16	17	16	18
Rank	72	67	67	67	60
Delay due to Incidents (percent)	56	56	55	55	56
Travel Time Index	1.10	1.12	1.12	1.11	1.13
Rank	62	57	55	57	47
Congestion Cost					
Total Cost (\$ millions)	213	239	231	212	235
Rank	46	38	35	35	32
Cost per Peak Traveler (\$)	225	257	253	236	266
Rank	73	67	68	67	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 Cleveland OH, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	1,775	1,770	1,770	1,765	1,765
Rank	21	21	20	20	20
Urban Area (square miles)	780	770	740	700	840
Population Density (persons/sq mile)	2,276	2,299	2,392	2,521	2,101
Peak Travelers (1000s)	872	855	843	826	814
Freeway					
Daily Vehicle-Miles of Travel (1000s)	16,020	15,695	15,310	14,905	14,125
Lane-Miles	1,240	1,230	1,220	1,210	1,200
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	10,020	9,500	9,215	8,785	8,490
Lane-Miles	2,315	2,195	2,110	2,015	1,945
Public Transportation					
Annual Psgr-Miles of Travel (millions)	284	261	275	239	247
Annual Unlinked Psgr Trips (millions)	66	59	61	55	59
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)	1.28	1.12	1.08	1.09	1.11
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	34	33	30	27	24
Congested System (% of lane-miles)	28	32	30	28	26
Congested Time (number of "Rush Hours")	5.2	5.2	5.0	4.8	4.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	123	108	106	102	142
Transit Riders or Carpoolers (millions)	31	28	27	26	36
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	9,542	8,836	7,160	6,281	5,087
Rank	33	32	36	36	38
Fuel per Peak Traveler (gallons)	11	10	8	8	6
Rank	59	58	62	62	68
Annual Delay					
Total Delay (1000s of person-hours)	14,067	13,103	10,477	9,242	7,549
Rank	34	35	38	38	38
Delay per Peak Traveler (person-hours)	16	15	12	11	9
Rank	63	62	64	69	74
Delay due to Incidents (percent)	55	55	55	54	54
Travel Time Index	1.11	1.11	1.09	1.08	1.07
Rank	50	50	55	56	58
Congestion Cost					
Total Cost (\$ millions)	203	182	140	121	96
Rank	34	35	38	38	38
Cost per Peak Traveler (\$)	233	213	167	146	118
Rank	63	62	66	71	76

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

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The Mobility Data for Cleveland OH, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	1,760	1,760	1,755	1,755	1,750
Rank	20	20	20	20	20
Urban Area (square miles)	835	830	825	815	805
Population Density (persons/sq mile)	2,108	2,120	2,127	2,153	2,174
Peak Travelers (1000s)	799	787	777	770	761
Freeway					
Daily Vehicle-Miles of Travel (1000s)	13,750	13,660	13,175	12,670	11,115
Lane-Miles	1,180	1,180	1,160	1,145	1,135
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	8,210	7,905	7,810	7,590	7,000
Lane-Miles	1,880	1,820	1,760	1,715	1,675
Public Transportation					
Annual Psgr-Miles of Travel (millions)	284	293	285	311	309
Annual Unlinked Psgr Trips (millions)	67	75	75	81	78
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	1.06	1.08	1.00	1.00
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	23	22	18	15	10
Congested System (% of lane-miles)	26	23	18	15	10
Congested Time (number of "Rush Hours")	4.2	4.2	4.0	3.8	3.0
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	143	150	123	108	64
Transit Riders or Carpoolers (millions)	36	38	31	27	14
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	4,751	4,236	3,454	2,650	1,701
Rank	36	39	40	42	53
Fuel per Peak Traveler (gallons)	6	5	4	3	2
Rank	63	67	73	75	81
Annual Delay					
Total Delay (1000s of person-hours)	7,044	6,173	5,086	3,985	2,619
Rank	39	41	42	46	55
Delay per Peak Traveler (person-hours)	9	8	7	5	3
Rank	67	71	73	77	83
Delay due to Incidents (percent)	54	54	54	54	54
Travel Time Index	1.06	1.06	1.05	1.04	1.03
Rank	56	56	63	68	72
Congestion Cost					
Total Cost (\$ millions)	87	73	57	43	27
Rank	38	40	42	47	55
Cost per Peak Traveler (\$)	109	93	74	55	35
Rank	71	73	75	80	85

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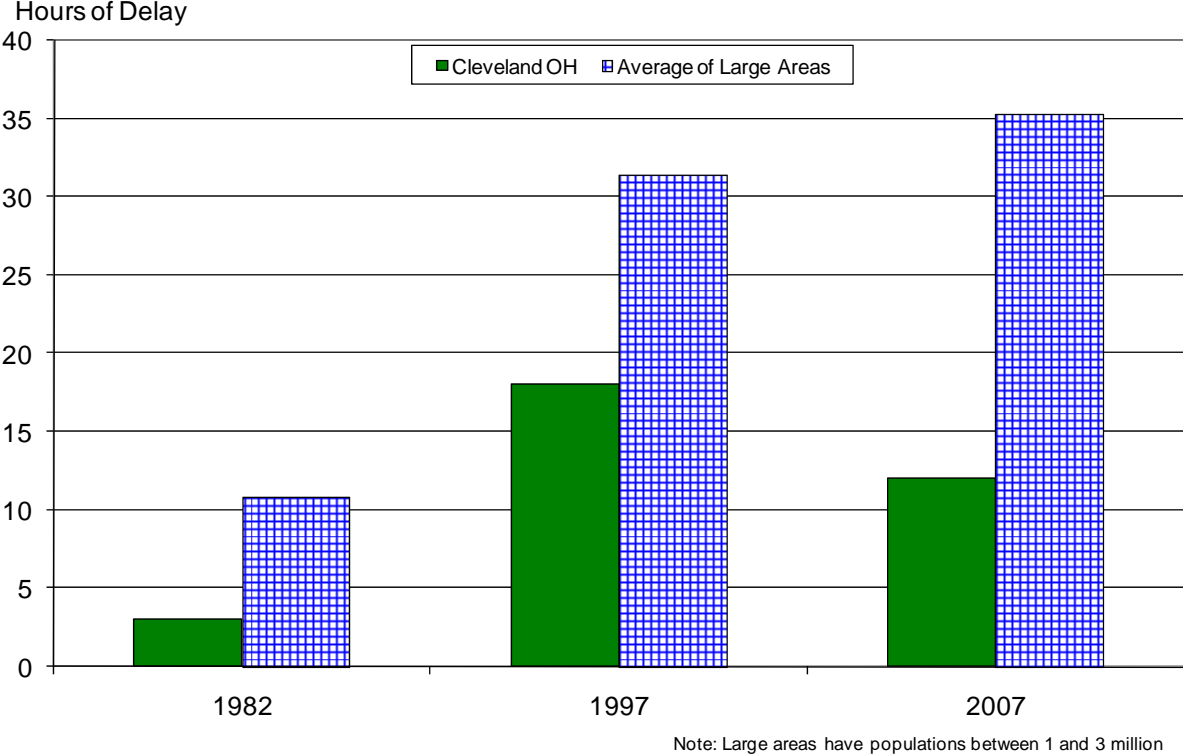
The Mobility Data for Cleveland OH, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	1,750	1,750	1,750	1,750	1,750
Rank	19	19	18	17	17
Urban Area (square miles)	795	790	785	780	775
Population Density (persons/sq mile)	2,201	2,215	2,229	2,244	2,258
Peak Travelers (1000s)	754	747	740	735	728
Freeway					
Daily Vehicle-Miles of Travel (1000s)	10,705	10,305	10,600	10,520	10,000
Lane-Miles	1,115	1,115	1,115	1,115	1,020
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	6,775	6,585	6,460	6,310	6,205
Lane-Miles	1,620	1,585	1,505	1,450	1,400
Public Transportation					
Annual Psgr-Miles of Travel (millions)	334	361	417	417	417
Annual Unlinked Psgr Trips (millions)	81	91	95	95	95
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	1.28	1.29	1.32	1.38
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	10	10	10	10	10
Congested System (% of lane-miles)	10	10	10	10	10
Congested Time (number of "Rush Hours")	2.9	2.9	2.9	2.9	3.0
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	1,588	1,492	1,532	1,461	1,390
Rank	50	50	44	42	39
Fuel per Peak Traveler (gallons)	2	2	2	2	2
Rank	80	78	73	73	72
Annual Delay					
Total Delay (1000s of person-hours)	2,488	2,341	2,374	2,205	2,121
Rank	54	50	48	45	40
Delay per Peak Traveler (person-hours)	3	3	3	3	3
Rank	83	82	79	78	76
Delay due to Incidents (percent)	54	54	54	54	54
Travel Time Index	1.03	1.03	1.03	1.03	1.03
Rank	71	69	66	63	62
Congestion Cost					
Total Cost (\$ millions)	25	23	23	21	19
Rank	54	52	48	46	43
Cost per Peak Traveler (\$)	33	31	31	28	27
Rank	84	84	81	82	82

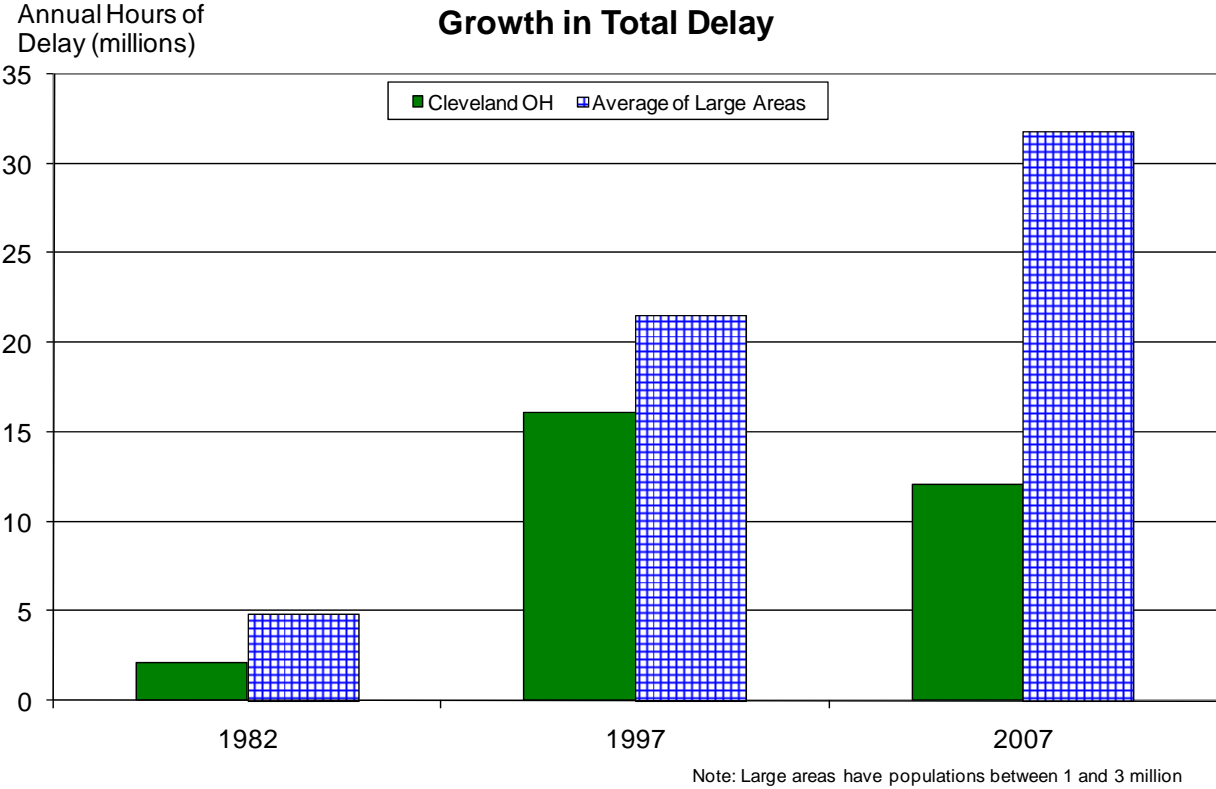
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Growth in Delay per Peak Traveler



Growth in Total Delay



**Benefits from Public Transportation Service and Operations Strategies in
Cleveland OH**

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	3	3	3	3
Service Patrols				
Percent of Roadway Miles	80	80	81	81
Annual Delay Reduction (1000 hours)	410	417	423	480
Arterial Signal Coordination				
Percent of Roadway Miles	45	45	42	44
Annual Delay Reduction (1000 hours)	61	34	19	31
Arterial Access Management				
Percent of Roadway Miles	11	10	9	9
Annual Delay Reduction (1000 hours)	34	41	46	68
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	505	492	488	580
Annual Delay Saved per Peak Traveler (hours)	1	0	0	1
Annual Congestion Cost Savings (\$million)	10.3	9.8	9.3	10.4
Travel Time Index with Strategies	1.082	1.088	1.089	1.098
Travel Time Index (Base)	1.085	1.091	1.092	1.102
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	276	297	293	252
Unlinked Passenger Trips (million)	65	70	67	59
Travel Time Index (combined road and transit)	1.083	1.088	1.089	1.099
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.091	1.097	1.098	1.107
Annual Increase				
Delay (1000 hours)	1,227	1,479	1,425	1,273
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	24.6	28.6	26.4	22.3

**Benefits from Public Transportation Service and Operations Strategies in
Cleveland OH, 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	2	2	2	2
Service Patrols				
Percent of Roadway Miles	83	88	89	89
Annual Delay Reduction (1000 hours)	369	424	487	545
Arterial Signal Coordination				
Percent of Roadway Miles	38	39	39	36
Annual Delay Reduction (1000 hours)	27	26	25	66
Arterial Access Management				
Percent of Roadway Miles	8	8	7	7
Annual Delay Reduction (1000 hours)	72	58	66	103
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	467	508	579	714
Annual Delay Saved per Peak Traveler (hours)	0	1	1	1
Annual Congestion Cost Savings (\$million)	8.0	8.4	9.4	11.4
Travel Time Index with Strategies	1.089	1.094	1.102	1.115
Travel Time Index (Base)	1.092	1.097	1.106	1.120
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	270	256	280	290
Unlinked Passenger Trips (million)	61	57	61	64
Travel Time Index (combined road and transit)	1.089	1.095	1.103	1.117
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.099	1.104	1.114	1.130
Annual Increase				
Delay (1000 hours)	1,502	1,476	1,505	2,015
Delay per Peak Traveler (hours)	2	2	2	2
Congestion Cost (\$million)	25.2	24.1	24.2	31.9

**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