

Performance Measure Summary – Houston, TX

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 Houston TX

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	3,815	3,800	3,790	3,770	3,750	3,720
Rank	12	12	12	12	12	12
Urban Area (square miles)	1,920	1,910	1,905	1,900	1,860	1,830
Population Density (persons/sq mile)	1,987	1,990	1,990	1,984	2,016	2,033
Peak Travelers (1000s)	2,232	2,219	2,198	2,175	2,153	2,120
Freeway						
Daily Vehicle-Miles of Travel (1000s)	48,000	46,700	46,350	45,630	46,665	45,165
Lane-Miles	2,550	2,520	2,480	2,480	2,460	2,400
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	42,350	41,075	39,355	39,330	39,540	39,980
Lane-Miles	7,455	7,440	7,415	7,415	7,405	7,400
Public Transportation						
Annual Psgr-Miles of Travel (millions)	603	605	552	565	549	581
Annual Unlinked Psgr Trips (millions)	101	103	95	96	93	97
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)	2.92	2.55	2.23	1.83	1.45	1.32
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	73	72	73	70	70	68
Congested System (% of lane-miles)	49	48	46	46	46	45
Congested Time (number of "Rush Hours")	7.8	7.6	7.6	7.6	7.8	7.8
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	119	148	233	291	429	482
Transit Riders or Carpoolers (millions)	37	45	70	87	130	145
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	88,239	87,921	86,264	81,250	78,428	76,483
Rank	9	8	9	9	8	8
Fuel per Peak Traveler (gallons)	40	40	39	37	36	36
Rank	3	5	6	6	7	8
Annual Delay						
Total Delay (1000s of person-hours)	123,915	123,975	121,261	115,848	110,985	111,078
Rank	9	9	9	10	10	9
Delay per Peak Traveler (person-hours)	56	56	55	53	52	52
Rank	4	5	6	7	8	9
Delay due to Incidents (percent)	50	50	50	50	50	50
Travel Time Index	1.33	1.34	1.34	1.32	1.30	1.30
Rank	11	10	11	9	13	10
Congestion Cost						
Total Cost (\$ millions)	2,482	2,376	2,220	2,000	1,839	1,787
Rank	9	10	10	10	10	9
Cost per Peak Traveler (\$)	1,112	1,071	1,010	920	854	843
Rank	5	7	8	8	9	10

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 Houston TX, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	3,630	3,500	3,410	3,320	3,225
Rank	12	12	12	12	12
Urban Area (square miles)	1,800	1,770	1,740	1,720	1,710
Population Density (persons/sq mile)	2,017	1,977	1,960	1,930	1,886
Peak Travelers (1000s)	2,058	1,974	1,910	1,849	1,787
Freeway					
Daily Vehicle-Miles of Travel (1000s)	42,320	39,195	37,730	36,000	35,000
Lane-Miles	2,390	2,380	2,265	2,255	2,240
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	39,210	37,085	35,770	33,665	31,965
Lane-Miles	7,400	7,395	7,215	6,935	6,755
Public Transportation					
Annual Psgr-Miles of Travel (millions)	622	596	582	534	455
Annual Unlinked Psgr Trips (millions)	101	101	101	95	87
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)	1.46	1.47	1.07	1.01	1.12
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	66	62	62	59	55
Congested System (% of lane-miles)	45	41	41	41	36
Congested Time (number of "Rush Hours")	7.4	7.2	7.2	7.0	6.8
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	540	488	466	401	407
Transit Riders or Carpoolers (millions)	156	132	126	106	105
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	70,062	60,432	56,549	50,604	47,388
Rank	9	10	10	10	9
Fuel per Peak Traveler (gallons)	34	31	30	27	27
Rank	8	10	12	12	11
Annual Delay					
Total Delay (1000s of person-hours)	102,696	88,655	82,454	73,689	69,146
Rank	9	10	10	10	9
Delay per Peak Traveler (person-hours)	50	45	43	40	39
Rank	8	11	11	11	11
Delay due to Incidents (percent)	50	50	51	51	52
Travel Time Index	1.28	1.26	1.25	1.23	1.23
Rank	13	15	16	17	15
Congestion Cost					
Total Cost (\$ millions)	1,638	1,384	1,218	1,064	994
Rank	9	10	10	11	10
Cost per Peak Traveler (\$)	796	701	638	575	557
Rank	11	14	14	16	18

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 Houston TX, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	3,135	3,040	2,975	2,960	2,935
Rank	12	12	12	12	12
Urban Area (square miles)	1,695	1,675	1,660	1,650	1,640
Population Density (persons/sq mile)	1,850	1,815	1,792	1,794	1,790
Peak Travelers (1000s)	1,727	1,666	1,618	1,601	1,579
Freeway					
Daily Vehicle-Miles of Travel (1000s)	34,000	33,000	32,000	31,000	30,095
Lane-Miles	2,220	2,200	2,190	2,175	2,160
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	28,345	26,785	25,805	25,260	23,565
Lane-Miles	6,550	6,450	6,400	6,320	6,150
Public Transportation					
Annual Psgr-Miles of Travel (millions)	401	448	480	488	469
Annual Unlinked Psgr Trips (millions)	81	81	84	88	85
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)	1.21	1.14	1.03	1.10	1.09
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	51	48	46	45	45
Congested System (% of lane-miles)	36	35	35	35	35
Congested Time (number of "Rush Hours")	6.6	6.2	6.0	5.8	5.6
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	291	260	233	245	263
Transit Riders or Carpoolers (millions)	72	63	54	56	59
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	40,049	35,079	33,194	30,050	29,386
Rank	10	11	12	14	14
Fuel per Peak Traveler (gallons)	23	21	21	19	19
Rank	18	21	17	23	18
Annual Delay					
Total Delay (1000s of person-hours)	56,775	50,862	48,630	44,475	42,580
Rank	12	13	13	13	13
Delay per Peak Traveler (person-hours)	33	31	30	28	27
Rank	23	26	23	24	25
Delay due to Incidents (percent)	52	54	54	54	55
Travel Time Index	1.21	1.19	1.18	1.17	1.17
Rank	19	21	20	22	20
Congestion Cost					
Total Cost (\$ millions)	809	701	649	580	542
Rank	13	13	13	13	14
Cost per Peak Traveler (\$)	468	421	401	362	343
Rank	28	31	28	28	29

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

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The Mobility Data for Houston TX, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	2,925	2,900	2,880	2,850	2,820
Rank	11	11	11	11	11
Urban Area (square miles)	1,640	1,640	1,635	1,630	1,610
Population Density (persons/sq mile)	1,784	1,768	1,761	1,748	1,752
Peak Travelers (1000s)	1,565	1,543	1,521	1,491	1,464
Freeway					
Daily Vehicle-Miles of Travel (1000s)	29,280	29,055	28,310	27,280	25,635
Lane-Miles	2,060	1,955	1,925	1,875	1,710
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	23,675	22,480	22,255	21,535	20,285
Lane-Miles	6,005	5,915	5,695	5,515	5,340
Public Transportation					
Annual Psgr-Miles of Travel (millions)	461	419	449	351	376
Annual Unlinked Psgr Trips (millions)	85	88	82	70	77
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)	1.12	1.04	1.07	0.99	0.99
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	48	51	50	48	49
Congested System (% of lane-miles)	36	36	36	36	36
Congested Time (number of "Rush Hours")	5.8	6.0	6.0	6.0	6.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	265	259	215	233	222
Transit Riders or Carpoolers (millions)	60	59	50	53	50
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	31,267	35,079	34,940	33,370	30,978
Rank	9	8	7	7	7
Fuel per Peak Traveler (gallons)	20	23	23	22	21
Rank	14	10	10	9	6
Annual Delay					
Total Delay (1000s of person-hours)	45,028	51,799	52,427	50,270	46,656
Rank	10	8	7	8	7
Delay per Peak Traveler (person-hours)	29	34	34	34	32
Rank	18	11	11	10	6
Delay due to Incidents (percent)	56	58	58	58	59
Travel Time Index	1.19	1.22	1.22	1.22	1.22
Rank	13	11	9	6	6
Congestion Cost					
Total Cost (\$ millions)	560	619	598	547	491
Rank	12	8	8	8	7
Cost per Peak Traveler (\$)	358	402	393	367	336
Rank	19	12	11	11	9

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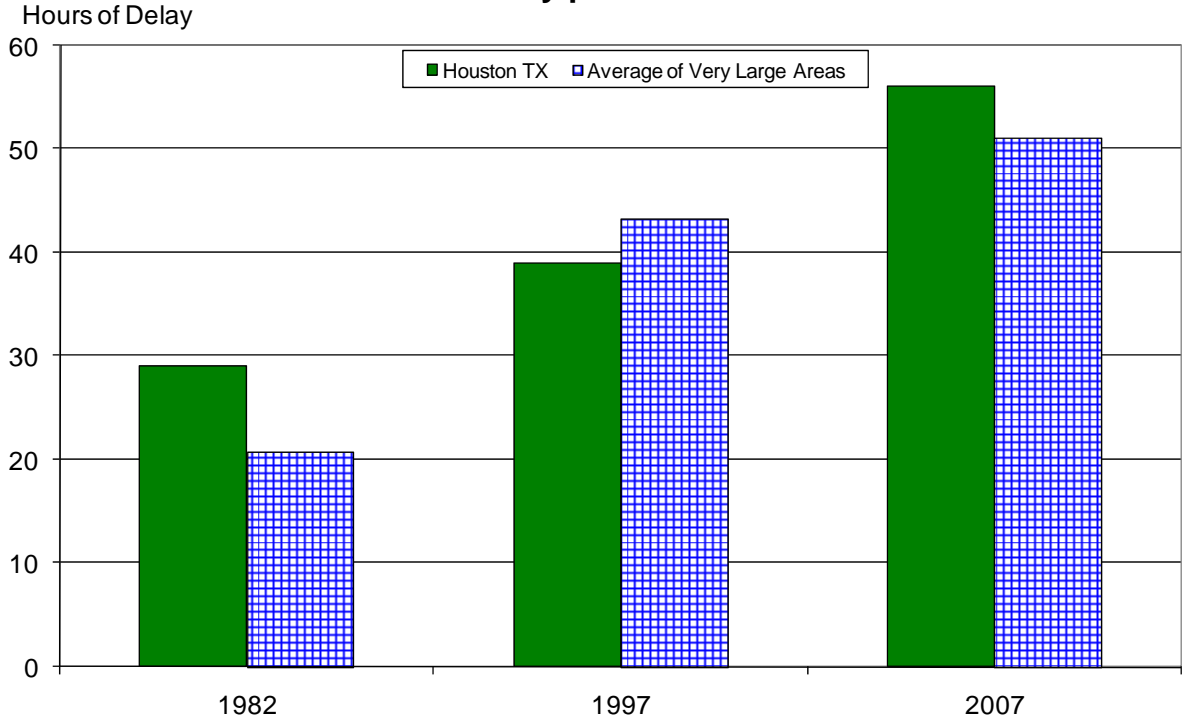
The Mobility Data for Houston TX, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	2,790	2,415	2,410	2,405	2,400
Rank	11	12	12	11	11
Urban Area (square miles)	1,600	1,580	1,550	1,540	1,530
Population Density (persons/sq mile)	1,744	1,528	1,555	1,562	1,569
Peak Travelers (1000s)	1,437	1,234	1,219	1,207	1,195
Freeway					
Daily Vehicle-Miles of Travel (1000s)	24,680	23,135	23,280	21,930	20,000
Lane-Miles	1,600	1,490	1,475	1,455	1,385
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	20,370	20,690	20,705	19,870	19,335
Lane-Miles	5,135	4,720	4,450	4,450	4,450
Public Transportation					
Annual Psgr-Miles of Travel (millions)	350	348	356	356	356
Annual Unlinked Psgr Trips (millions)	69	66	69	69	69
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)	0.97	1.27	1.28	1.31	1.37
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	51	50	51	46	44
Congested System (% of lane-miles)	33	32	32	31	31
Congested Time (number of "Rush Hours")	6.4	6.6	6.8	6.4	6.0
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	34,969	32,441	33,275	27,697	23,141
Rank	5	5	3	3	4
Fuel per Peak Traveler (gallons)	24	26	27	23	19
Rank	4	3	2	2	3
Annual Delay					
Total Delay (1000s of person-hours)	52,603	49,610	50,741	43,629	35,030
Rank	6	5	3	3	5
Delay per Peak Traveler (person-hours)	37	40	42	36	29
Rank	4	3	2	2	3
Delay due to Incidents (percent)	60	59	59	59	58
Travel Time Index	1.26	1.24	1.25	1.21	1.19
Rank	3	3	1	2	3
Congestion Cost					
Total Cost (\$ millions)	536	512	509	421	332
Rank	6	5	4	3	5
Cost per Peak Traveler (\$)	373	415	418	349	277
Rank	5	3	2	3	3

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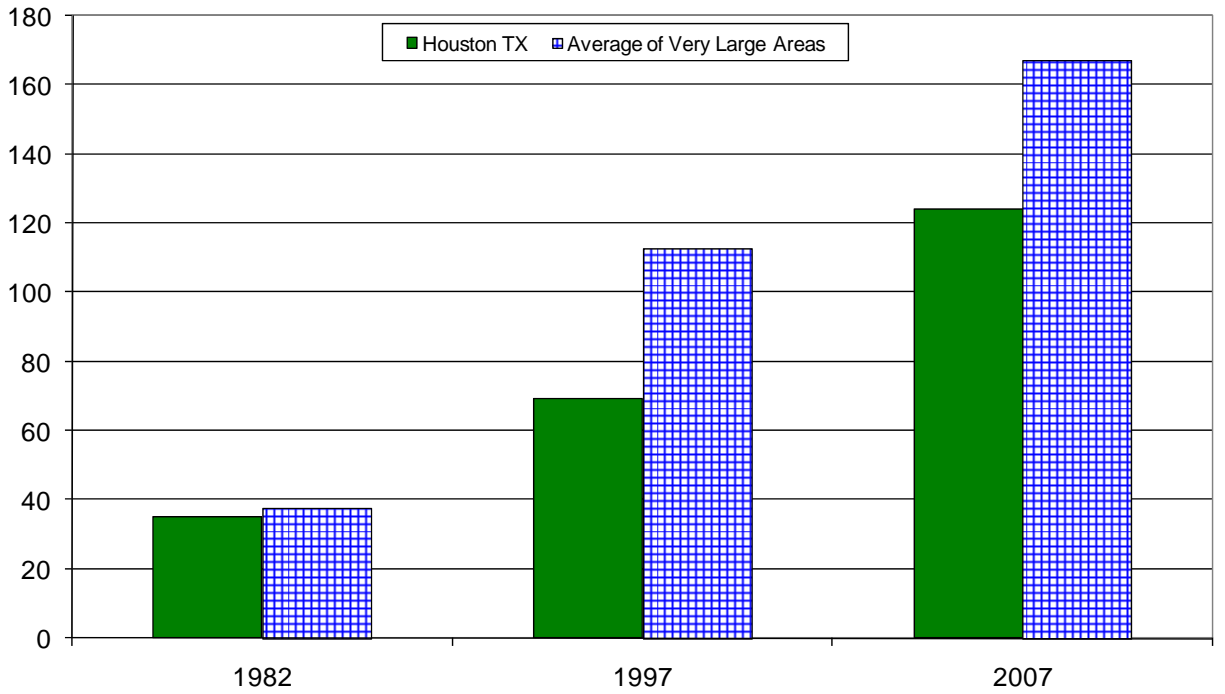
Growth in Delay per Peak Traveler



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
Houston TX**

Operations Strategies	2007	2006	2005	2004
Freeway Ramp Metering				
Percent of Roadway Miles	45	40	38	38
Annual Delay Reduction (1000 hours)	2,918	1,950	1,605	1,492
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	88	89	91	91
Service Patrols				
Percent of Roadway Miles	61	62	61	41
Annual Delay Reduction (1000 hours)	4,638	4,910	4,079	2,581
Arterial Signal Coordination				
Percent of Roadway Miles	57	50	43	42
Annual Delay Reduction (1000 hours)	248	221	197	214
Arterial Access Management				
Percent of Roadway Miles	61	61	59	59
Annual Delay Reduction (1000 hours)	4,313	3,493	3,602	3,324
HOV Lanes				
Daily Passenger-miles of travel (1000s)	2,100	2,000	1,886	1,700
HOV User Delay Savings	3,084	3,081	2,894	2,238
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	15,201	13,655	12,376	9,849
Annual Delay Saved per Peak Traveler (hours)	7	6	6	5
Annual Congestion Cost Savings (\$million)	300.8	259.2	223.8	168.1
Travel Time Index with Strategies	1.330	1.341	1.343	1.321
Travel Time Index (Base)	1.367	1.375	1.374	1.346
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	603	605	552	565
Unlinked Passenger Trips (million)	101	102	95	96
Travel Time Index (combined road and transit)	1.360	1.367	1.367	1.339
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.377	1.384	1.382	1.355
Annual Increase				
Delay (1000 hours)	5,902	5,465	4,969	5,299
Delay per Peak Traveler (hours)	3	2	2	2
Congestion Cost (\$million)	103.0	90.8	78.3	80.9

**Benefits from Public Transportation Service and Operations Strategies in
Houston TX, Continued**

Operations Strategies	2003	2002	2001	2000
Freeway Ramp Metering				
Percent of Roadway Miles	40	40	38	35
Annual Delay Reduction (1000 hours)	1,446	1,411	1,061	942
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	87	86	79	70
Service Patrols				
Percent of Roadway Miles	40	41	42	42
Annual Delay Reduction (1000 hours)	2,280	2,200	1,938	1,660
Arterial Signal Coordination				
Percent of Roadway Miles	40	39	39	34
Annual Delay Reduction (1000 hours)	236	281	425	319
Arterial Access Management				
Percent of Roadway Miles	58	58	58	58
Annual Delay Reduction (1000 hours)	3,965	4,157	3,695	2,591
HOV Lanes				
Daily Passenger-miles of travel (1000s)	1,532	1,381	1,245	1,122
HOV User Delay Savings	1,674	1,437	1,122	926
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	9,600	9,486	8,240	6,438
Annual Delay Saved per Peak Traveler (hours)	4	4	4	3
Annual Congestion Cost Savings (\$million)	157.2	150.7	129.7	99.4
Travel Time Index with Strategies	1.302	1.297	1.282	1.257
Travel Time Index (Base)	1.325	1.319	1.301	1.274
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	549	581	622	596
Unlinked Passenger Trips (million)	93	97	101	100
Travel Time Index (combined road and transit)	1.318	1.312	1.294	1.267
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.333	1.326	1.309	1.281
Annual Increase				
Delay (1000 hours)	4,916	4,861	5,268	4,777
Delay per Peak Traveler (hours)	2	2	3	2
Congestion Cost (\$million)	71.3	69.2	75.2	66.8

**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