

Performance Measure Summary – Charlotte, NC-SC

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 Charlotte NC-SC

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	1,070	1,050	1,030	1,010	960	930
Rank	38	38	39	40	41	41
Urban Area (square miles)	675	670	665	630	605	575
Population Density (persons/sq mile)	1,585	1,567	1,549	1,603	1,587	1,617
Peak Travelers (1000s)	599	584	569	554	524	500
Freeway						
Daily Vehicle-Miles of Travel (1000s)	11,775	11,500	10,985	10,000	9,200	8,700
Lane-Miles	790	760	730	680	630	590
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	9,420	9,115	9,015	8,700	8,300	7,990
Lane-Miles	1,475	1,470	1,450	1,390	1,345	1,295
Public Transportation						
Annual Psgr-Miles of Travel (millions)	106	107	90	90	90	88
Annual Unlinked Psgr Trips (millions)	20	21	18	19	19	17
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)	2.95	2.62	2.27	1.89	1.46	1.33
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	60	60	58	58	60	61
Congested System (% of lane-miles)	50	52	52	48	50	50
Congested Time (number of "Rush Hours")	7.2	7.2	7.2	7.0	7.0	7.0
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	111	129	140	139	141	140
Transit Riders or Carpoolers (millions)	36	41	45	44	44	43
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	16,046	15,467	14,547	14,453	13,204	12,484
Rank	31	31	33	33	34	34
Fuel per Peak Traveler (gallons)	27	26	26	26	25	25
Rank	23	29	29	27	25	24
Annual Delay						
Total Delay (1000s of person-hours)	24,237	22,992	21,567	21,647	19,375	18,334
Rank	29	31	34	32	34	34
Delay per Peak Traveler (person-hours)	40	39	38	39	37	37
Rank	23	28	32	29	29	23
Delay due to Incidents (percent)	53	53	53	53	52	51
Travel Time Index	1.25	1.24	1.24	1.25	1.24	1.24
Rank	26	29	27	26	26	26
Congestion Cost						
Total Cost (\$ millions)	525	483	433	407	349	323
Rank	28	31	31	31	32	31
Cost per Peak Traveler (\$)	876	827	761	734	665	645
Rank	23	25	30	26	26	23

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 Charlotte NC-SC, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	865	830	785	755	720
Rank	44	45	46	48	49
Urban Area (square miles)	545	515	485	460	430
Population Density (persons/sq mile)	1,587	1,612	1,619	1,641	1,674
Peak Travelers (1000s)	458	432	402	381	357
Freeway					
Daily Vehicle-Miles of Travel (1000s)	8,100	7,640	7,000	6,380	6,200
Lane-Miles	550	520	490	460	435
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	7,480	7,000	6,510	6,000	5,455
Lane-Miles	1,280	1,245	1,225	1,205	1,170
Public Transportation					
Annual Psgr-Miles of Travel (millions)	86	70	71	56	46
Annual Unlinked Psgr Trips (millions)	16	13	13	12	12
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)	1.43	1.46	1.05	1.02	1.14
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	59	58	54	49	46
Congested System (% of lane-miles)	50	50	46	45	40
Congested Time (number of "Rush Hours")	7.0	6.8	6.4	6.0	6.0
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	157	162	147	130	125
Transit Riders or Carpoolers (millions)	46	47	40	34	32
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	10,767	9,905	8,072	6,828	5,959
Rank	35	36	42	45	45
Fuel per Peak Traveler (gallons)	24	23	20	18	17
Rank	25	25	36	39	39
Annual Delay					
Total Delay (1000s of person-hours)	15,674	14,540	11,904	10,477	9,101
Rank	36	39	42	44	47
Delay per Peak Traveler (person-hours)	34	34	30	28	25
Rank	27	26	34	39	42
Delay due to Incidents (percent)	52	52	52	52	52
Travel Time Index	1.22	1.22	1.19	1.17	1.16
Rank	27	25	31	35	38
Congestion Cost					
Total Cost (\$ millions)	273	247	189	162	140
Rank	34	35	41	44	47
Cost per Peak Traveler (\$)	597	572	471	427	393
Rank	26	28	38	41	41

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 Charlotte NC-SC, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	685	660	635	620	600
Rank	50	50	52	51	53
Urban Area (square miles)	400	375	355	345	330
Population Density (persons/sq mile)	1,713	1,760	1,789	1,797	1,818
Peak Travelers (1000s)	334	317	300	288	275
Freeway					
Daily Vehicle-Miles of Travel (1000s)	5,200	4,485	4,095	3,700	3,300
Lane-Miles	395	375	345	305	260
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	5,120	4,960	4,875	4,795	4,700
Lane-Miles	1,155	1,130	1,100	1,080	1,045
Public Transportation					
Annual Psgr-Miles of Travel (millions)	45	50	51	48	45
Annual Unlinked Psgr Trips (millions)	12	12	12	11	11
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	1.13	1.02	1.07	1.08
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	40	37	37	37	39
Congested System (% of lane-miles)	39	40	40	36	36
Congested Time (number of "Rush Hours")	5.4	4.6	4.6	4.8	5.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	106	86	88	90	76
Transit Riders or Carpoolers (millions)	25	19	19	19	16
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	4,688	3,881	3,752	3,710	3,858
Rank	49	52	50	50	44
Fuel per Peak Traveler (gallons)	14	12	12	13	14
Rank	44	51	48	43	34
Annual Delay					
Total Delay (1000s of person-hours)	7,293	6,196	6,068	6,028	6,418
Rank	49	52	51	50	44
Delay per Peak Traveler (person-hours)	22	20	20	21	23
Rank	47	52	46	41	33
Delay due to Incidents (percent)	52	53	53	54	54
Travel Time Index	1.14	1.13	1.13	1.13	1.15
Rank	42	43	42	34	26
Congestion Cost					
Total Cost (\$ millions)	111	91	86	84	87
Rank	50	52	49	48	43
Cost per Peak Traveler (\$)	332	287	288	291	315
Rank	46	52	48	41	34

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 Charlotte NC-SC, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	560	540	530	520	500
Rank	55	55	55	55	57
Urban Area (square miles)	295	280	275	270	265
Population Density (persons/sq mile)	1,898	1,929	1,927	1,926	1,887
Peak Travelers (1000s)	252	239	233	227	217
Freeway					
Daily Vehicle-Miles of Travel (1000s)	2,800	2,650	2,270	1,915	1,800
Lane-Miles	220	205	175	155	145
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	4,605	4,500	4,390	4,300	4,220
Lane-Miles	1,020	1,000	975	950	920
Public Transportation					
Annual Psgr-Miles of Travel (millions)	44	48	47	44	35
Annual Unlinked Psgr Trips (millions)	11	12	11	10	10
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	1.08	1.08	1.00	1.00
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	40	39	32	31	32
Congested System (% of lane-miles)	37	37	29	29	29
Congested Time (number of "Rush Hours")	5.2	5.2	5.2	5.0	5.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	58	58	54	53	54
Transit Riders or Carpoolers (millions)	12	12	11	10	11
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	3,448	3,209	2,487	2,284	2,145
Rank	45	46	49	48	45
Fuel per Peak Traveler (gallons)	14	13	11	10	10
Rank	31	34	37	36	35
Annual Delay					
Total Delay (1000s of person-hours)	5,626	5,176	4,121	3,917	3,662
Rank	45	47	51	47	44
Delay per Peak Traveler (person-hours)	22	22	18	17	17
Rank	34	32	37	37	32
Delay due to Incidents (percent)	54	54	54	53	53
Travel Time Index	1.14	1.14	1.11	1.11	1.11
Rank	26	24	33	30	27
Congestion Cost					
Total Cost (\$ millions)	74	65	49	44	40
Rank	43	47	49	44	42
Cost per Peak Traveler (\$)	293	273	211	195	185
Rank	35	33	38	38	33

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.

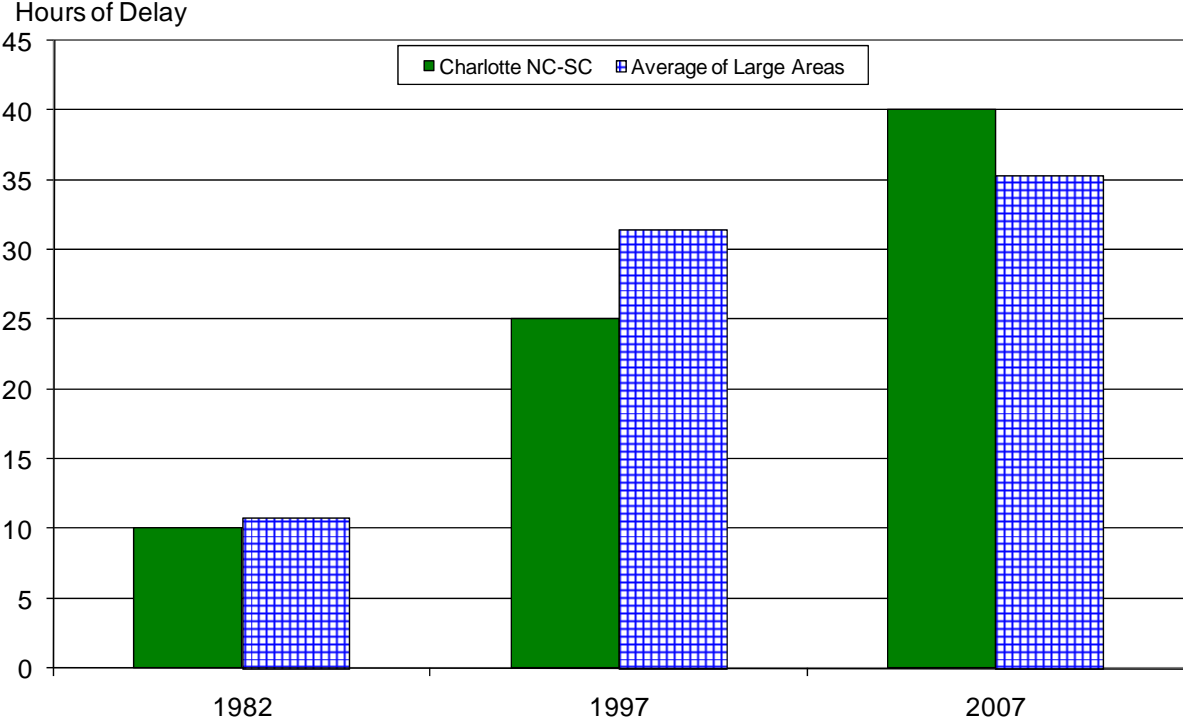
The Mobility Data for Charlotte NC-SC, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	485	445	425	420	415
Rank	58	63	64	64	64
Urban Area (square miles)	260	255	250	240	230
Population Density (persons/sq mile)	1,865	1,745	1,700	1,750	1,804
Peak Travelers (1000s)	208	190	180	176	172
Freeway					
Daily Vehicle-Miles of Travel (1000s)	1,780	1,650	1,600	1,510	1,410
Lane-Miles	135	135	135	135	135
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	4,100	4,000	3,700	3,400	3,290
Lane-Miles	900	880	855	825	800
Public Transportation					
Annual Psgr-Miles of Travel (millions)	28	28	30	30	30
Annual Unlinked Psgr Trips (millions)	9	9	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	1.28	1.29	1.32	1.38
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	33	30	25	22	20
Congested System (% of lane-miles)	29	29	24	23	23
Congested Time (number of "Rush Hours")	5.4	5.0	4.6	4.0	3.6
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	2,201	1,894	1,453	1,135	1,044
Rank	41	41	45	50	48
Fuel per Peak Traveler (gallons)	11	10	8	6	6
Rank	27	30	34	41	36
Annual Delay					
Total Delay (1000s of person-hours)	3,798	3,225	2,472	1,948	1,796
Rank	40	41	45	50	49
Delay per Peak Traveler (person-hours)	18	17	14	11	10
Rank	28	28	31	38	38
Delay due to Incidents (percent)	53	53	53	53	53
Travel Time Index	1.11	1.10	1.08	1.07	1.07
Rank	20	23	30	32	26
Congestion Cost					
Total Cost (\$ millions)	40	35	26	20	18
Rank	39	41	44	49	45
Cost per Peak Traveler (\$)	193	182	143	111	103
Rank	27	29	33	38	37

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

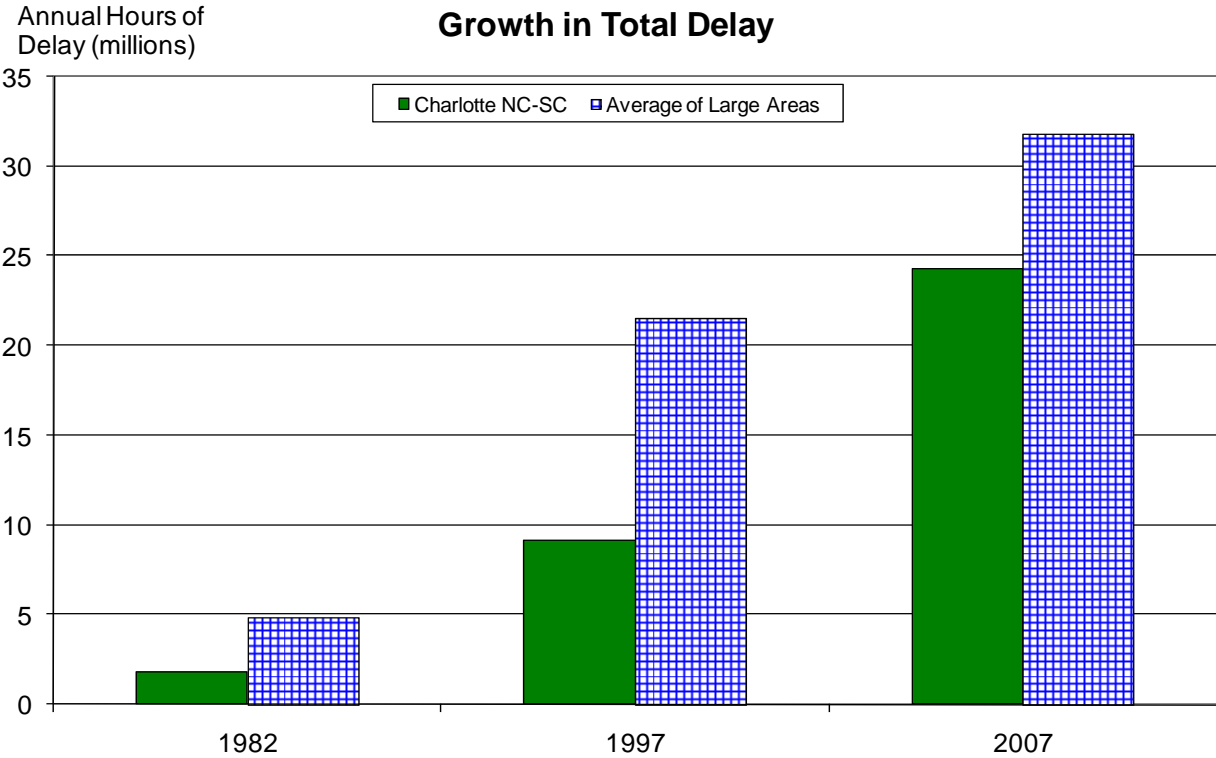
Note: Zeroes in the table reflect values less than 0.5.

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
Charlotte NC-SC**

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	25	26	27	29
Service Patrols				
Percent of Roadway Miles	63	66	68	74
Annual Delay Reduction (1000 hours)	670	716	535	598
Arterial Signal Coordination				
Percent of Roadway Miles	63	62	50	52
Annual Delay Reduction (1000 hours)	112	106	105	112
Arterial Access Management				
Percent of Roadway Miles	10	10	10	9
Annual Delay Reduction (1000 hours)	128	127	120	117
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	910	949	760	826
Annual Delay Saved per Peak Traveler (hours)	2	2	1	1
Annual Congestion Cost Savings (\$million)	19.8	19.9	15.2	15.5
Travel Time Index with Strategies	1.246	1.244	1.235	1.251
Travel Time Index (Base)	1.255	1.252	1.243	1.260
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	106	107	90	90
Unlinked Passenger Trips (million)	20	21	18	19
Travel Time Index (combined road and transit)	1.251	1.249	1.239	1.256
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.260	1.257	1.247	1.264
Annual Increase				
Delay (1000 hours)	946	936	813	822
Delay per Peak Traveler (hours)	2	2	1	1
Congestion Cost (\$million)	20.4	19.4	16.2	15.3

**Benefits from Public Transportation Service and Operations Strategies in
Charlotte NC-SC, 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	16	16	18	19
Service Patrols				
Percent of Roadway Miles	77	82	62	48
Annual Delay Reduction (1000 hours)	476	414	234	160
Arterial Signal Coordination				
Percent of Roadway Miles	52	48	48	50
Annual Delay Reduction (1000 hours)	113	110	106	96
Arterial Access Management				
Percent of Roadway Miles	9	9	9	9
Annual Delay Reduction (1000 hours)	88	80	80	75
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	677	604	420	330
Annual Delay Saved per Peak Traveler (hours)	1	1	1	1
Annual Congestion Cost Savings (\$million)	12.2	10.6	7.4	5.7
Travel Time Index with Strategies	1.244	1.242	1.222	1.217
Travel Time Index (Base)	1.252	1.250	1.228	1.222
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	90	87	86	70
Unlinked Passenger Trips (million)	19	17	15	13
Travel Time Index (combined road and transit)	1.248	1.246	1.224	1.219
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.259	1.255	1.237	1.228
Annual Increase				
Delay (1000 hours)	917	758	932	682
Delay per Peak Traveler (hours)	2	2	2	2
Congestion Cost (\$million)	16.4	13.3	16.2	11.6

**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