

Performance Measure Summary – Boulder, CO

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 Boulder CO

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	145	145	140	140	140	135
Rank	90	90	90	90	90	90
Urban Area (square miles)	60	60	55	55	55	50
Population Density (persons/sq mile)	2,417	2,417	2,545	2,545	2,545	2,700
Peak Travelers (1000s)	80	80	76	76	75	72
Freeway						
Daily Vehicle-Miles of Travel (1000s)	700	705	670	685	675	630
Lane-Miles	65	65	65	65	65	60
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	1,125	1,165	1,165	1,160	1,150	1,145
Lane-Miles	205	205	200	200	195	195
Public Transportation						
Annual Psgr-Miles of Travel (millions)	10.8	9.5	8.9	8.0	7.7	7.7
Annual Unlinked Psgr Trips (millions)	1.9	1.7	1.7	1.6	1.6	1.6
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)	3.20	2.60	2.32	1.94	1.51	1.39
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	27	31	27	27	27	27
Congested System (% of lane-miles)	37	37	35	35	35	36
Congested Time (number of "Rush Hours")	5.0	5.2	5.2	5.2	5.2	5.2
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	1	4	4	5	7	5
Transit Riders or Carpoolers (millions)	0	1	1	1	2	1
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	562	655	576	577	561	539
Rank	89	89	89	89	89	88
Fuel per Peak Traveler (gallons)	7	8	8	8	7	8
Rank	77	75	74	74	75	73
Annual Delay						
Total Delay (1000s of person-hours)	953	1,124	996	994	957	925
Rank	89	89	89	89	89	89
Delay per Peak Traveler (person-hours)	12	14	13	13	13	13
Rank	76	75	76	75	73	72
Delay due to Incidents (percent)	54	53	53	53	53	53
Travel Time Index	1.09	1.11	1.10	1.09	1.09	1.09
Rank	70	60	62	67	66	69
Congestion Cost						
Total Cost (\$ millions)	18	21	18	17	16	15
Rank	89	89	89	89	89	89
Cost per Peak Traveler (\$)	229	261	232	222	206	205
Rank	79	76	79	76	77	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 Boulder CO, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	135	135	135	135	135
Rank	90	90	90	90	90
Urban Area (square miles)	50	50	50	50	50
Population Density (persons/sq mile)	2,700	2,700	2,700	2,700	2,700
Peak Travelers (1000s)	71	70	68	68	66
Freeway					
Daily Vehicle-Miles of Travel (1000s)	600	570	530	500	480
Lane-Miles	60	55	55	55	50
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	1,140	1,130	1,125	1,115	1,105
Lane-Miles	195	195	190	190	190
Public Transportation					
Annual Psgr-Miles of Travel (millions)	7.8	7.5	7.3	6.5	6.3
Annual Unlinked Psgr Trips (millions)	1.6	1.5	1.5	1.4	1.4
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)	1.70	1.55	1.16	1.10	1.24
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	29	30	30	29	30
Congested System (% of lane-miles)	39	40	40	40	41
Congested Time (number of "Rush Hours")	5.0	5.2	5.2	4.8	5.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	6	6	5	5	5
Transit Riders or Carpoolers (millions)	2	1	1	1	1
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	569	560	544	521	548
Rank	88	88	88	87	86
Fuel per Peak Traveler (gallons)	8	8	8	8	8
Rank	74	74	73	71	71
Annual Delay					
Total Delay (1000s of person-hours)	976	945	915	881	933
Rank	89	88	88	87	86
Delay per Peak Traveler (person-hours)	14	14	13	13	14
Rank	72	71	72	71	69
Delay due to Incidents (percent)	53	53	53	53	53
Travel Time Index					
	1.10	1.10	1.10	1.10	1.10
Rank	62	63	63	61	57
Congestion Cost					
Total Cost (\$ millions)	15	14	13	13	13
Rank	89	89	88	87	87
Cost per Peak Traveler (\$)	217	209	194	186	198
Rank	74	75	75	73	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 Boulder CO, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	130	130	130	125	125
Rank	90	90	90	90	88
Urban Area (square miles)	45	45	45	40	40
Population Density (persons/sq mile)	2,889	2,889	2,889	3,125	3,125
Peak Travelers (1000s)	63	62	61	58	57
Freeway					
Daily Vehicle-Miles of Travel (1000s)	440	425	405	390	385
Lane-Miles	50	50	50	50	50
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	1,100	1,090	1,080	1,070	1,050
Lane-Miles	190	185	185	185	185
Public Transportation					
Annual Psgr-Miles of Travel (millions)	6.0	5.3	4.7	4.7	4.8
Annual Unlinked Psgr Trips (millions)	1.4	1.3	1.3	1.2	1.2
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)	1.36	1.22	1.16	1.21	1.23
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	27	28	25	24	21
Congested System (% of lane-miles)	37	36	33	33	29
Congested Time (number of "Rush Hours")	4.8	4.8	4.6	4.4	4.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	5	6	8	8	6
Transit Riders or Carpoolers (millions)	1	1	2	2	1
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	465	466	405	393	337
Rank	86	86	86	86	87
Fuel per Peak Traveler (gallons)	7	8	7	7	6
Rank	72	66	67	67	68
Annual Delay					
Total Delay (1000s of person-hours)	792	794	697	675	583
Rank	86	86	86	86	87
Delay per Peak Traveler (person-hours)	13	13	11	12	10
Rank	67	65	71	66	70
Delay due to Incidents (percent)	53	53	53	53	53
Travel Time Index	1.09	1.09	1.08	1.08	1.07
Rank	60	58	57	56	58
Congestion Cost					
Total Cost (\$ millions)	11	11	9	9	7
Rank	85	85	86	86	86
Cost per Peak Traveler (\$)	175	172	149	149	128
Rank	72	68	74	69	71

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 Boulder CO, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	125	125	120	120	115
Rank	88	88	88	88	88
Urban Area (square miles)	40	40	35	35	35
Population Density (persons/sq mile)	3,125	3,125	3,429	3,429	3,286
Peak Travelers (1000s)	56	55	53	52	50
Freeway					
Daily Vehicle-Miles of Travel (1000s)	375	370	360	330	380
Lane-Miles	50	50	50	50	50
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	1,000	960	920	900	880
Lane-Miles	180	180	180	175	175
Public Transportation					
Annual Psgr-Miles of Travel (millions)	4.6	4.4	4.0	4.3	4.2
Annual Unlinked Psgr Trips (millions)	1.1	1.1	1.0	1.0	1.0
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)	1.19	1.11	1.15	1.06	1.06
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	18	17	15	13	13
Congested System (% of lane-miles)	25	25	25	21	21
Congested Time (number of "Rush Hours")	4.0	3.6	3.2	3.0	3.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	5	4	4	4	8
Transit Riders or Carpoolers (millions)	1	1	1	1	1
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	274	247	216	183	181
Rank	88	87	87	88	88
Fuel per Peak Traveler (gallons)	5	4	4	4	4
Rank	71	74	73	72	69
Annual Delay					
Total Delay (1000s of person-hours)	477	433	378	323	316
Rank	87	87	86	88	88
Delay per Peak Traveler (person-hours)	9	8	7	6	6
Rank	67	71	73	73	71
Delay due to Incidents (percent)	53	53	53	53	53
Travel Time Index	1.06	1.05	1.05	1.04	1.04
Rank	56	65	63	68	65
Congestion Cost					
Total Cost (\$ millions)	6	5	4	3	3
Rank	87	87	86	88	88
Cost per Peak Traveler (\$)	104	92	80	66	65
Rank	74	74	73	74	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.

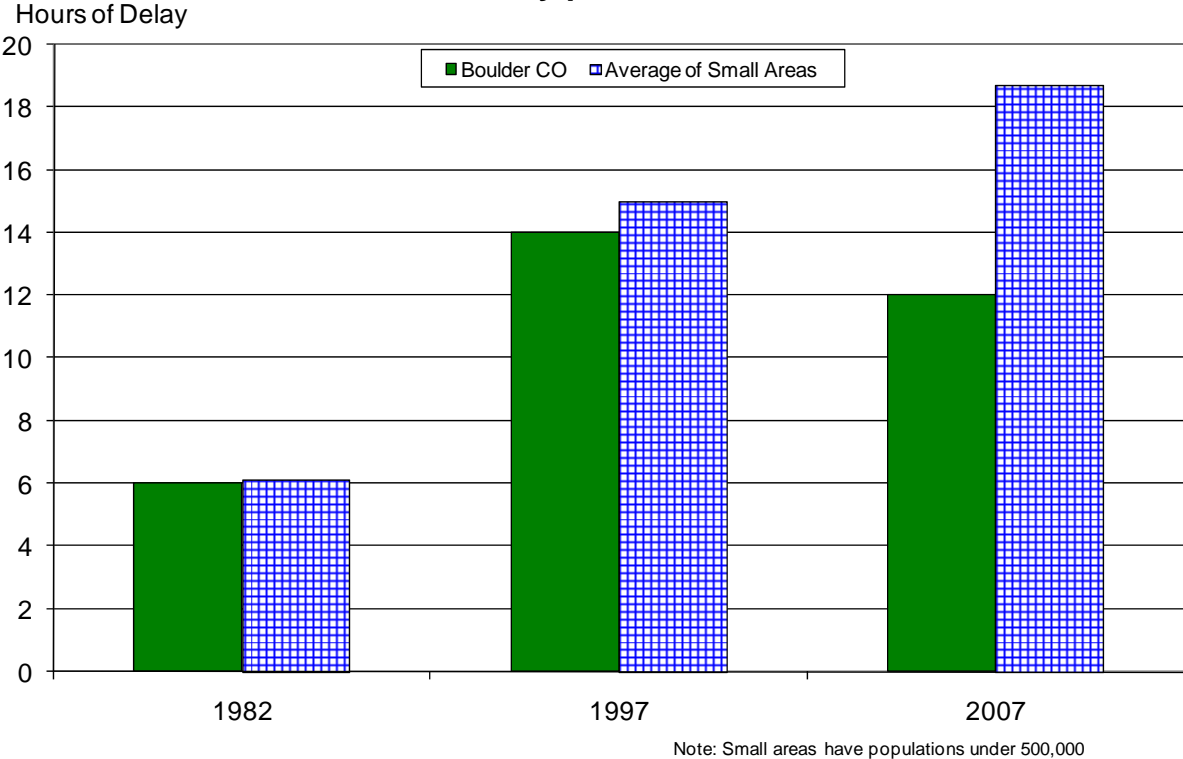
The Mobility Data for Boulder CO, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	115	105	105	100	100
Rank	88	88	88	88	88
Urban Area (square miles)	35	30	30	25	25
Population Density (persons/sq mile)	3,286	3,500	3,500	4,000	4,000
Peak Travelers (1000s)	49	45	44	42	41
Freeway					
Daily Vehicle-Miles of Travel (1000s)	360	350	310	275	250
Lane-Miles	50	50	50	45	40
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	875	870	860	855	825
Lane-Miles	175	170	170	170	170
Public Transportation					
Annual Psgr-Miles of Travel (millions)	4.5	4.9	4.8	4.8	4.8
Annual Unlinked Psgr Trips (millions)	1.1	1.2	1.0	1.0	1.0
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)	1.04	1.36	1.37	1.41	1.47
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	13	13	11	12	12
Congested System (% of lane-miles)	21	20	17	17	17
Congested Time (number of "Rush Hours")	3.0	3.0	3.0	3.0	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)	170	173	139	143	134
Rank	86	86	86	86	86
Fuel per Peak Traveler (gallons)	3	4	3	3	3
Rank	72	60	67	64	58
Annual Delay					
Total Delay (1000s of person-hours)	295	300	240	250	232
Rank	86	86	86	86	86
Delay per Peak Traveler (person-hours)	6	7	5	6	6
Rank	69	61	70	59	55
Delay due to Incidents (percent)	53	53	53	53	53
Travel Time Index	1.04	1.04	1.03	1.04	1.04
Rank	65	59	66	53	50
Congestion Cost					
Total Cost (\$ millions)	3	3	2	2	2
Rank	86	86	86	86	85
Cost per Peak Traveler (\$)	59	67	53	56	52
Rank	73	67	70	64	61

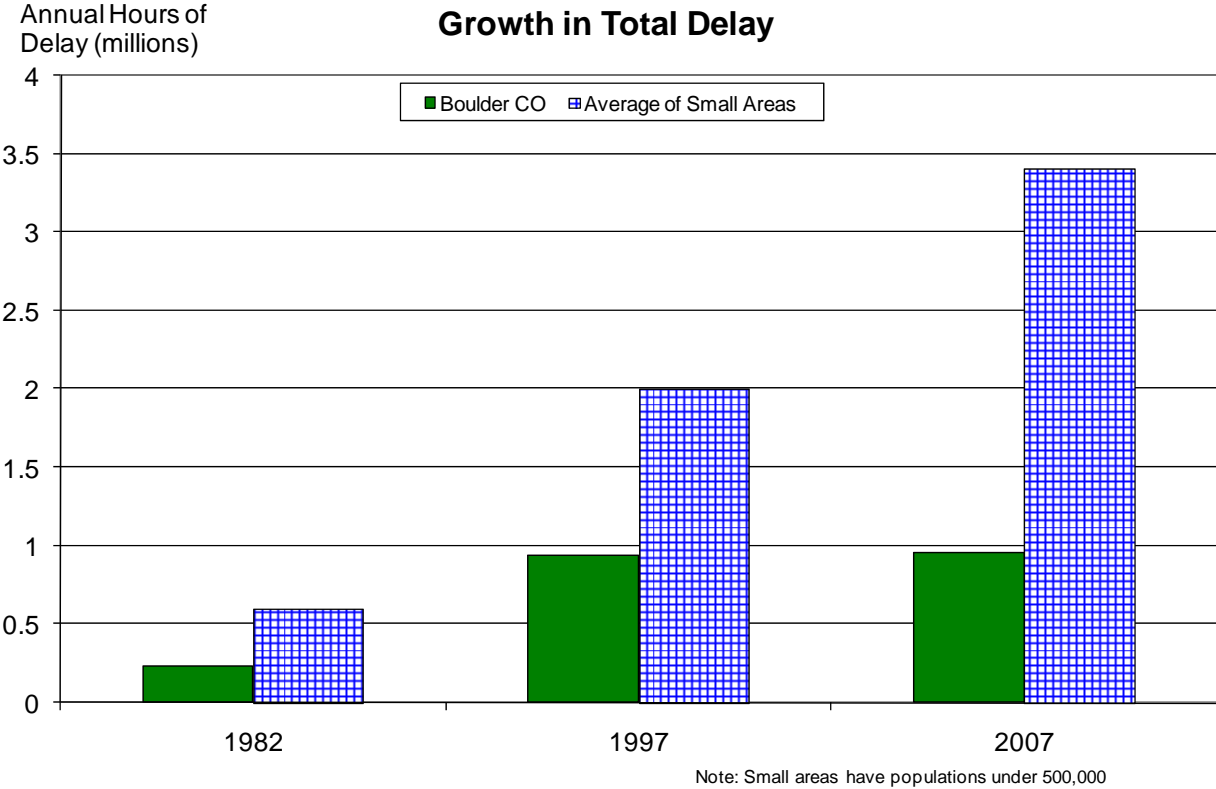
Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.

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

Growth in Delay per Peak Traveler



Growth in Total Delay



**Benefits from Public Transportation Service and Operations Strategies in
Boulder CO**

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	--	--	--	--
Service Patrols				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--
Arterial Signal Coordination				
Percent of Roadway Miles	43	44	44	35
Annual Delay Reduction (1000 hours)	9	12	13	10
Arterial Access Management				
Percent of Roadway Miles	36	36	30	30
Annual Delay Reduction (1000 hours)	17	20	21	31
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	26	32	34	41
Annual Delay Saved per Peak Traveler (hours)	0	0	0	1
Annual Congestion Cost Savings (\$million)	0.5	0.6	0.6	0.7
Travel Time Index with Strategies	1.093	1.107	1.095	1.095
Travel Time Index (Base)	1.095	1.110	1.098	1.098
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	10.8	9.5	8.9	8.0
Unlinked Passenger Trips (million)	1.9	1.7	1.7	1.6
Travel Time Index (combined road and transit)	1.094	1.108	1.097	1.097
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.098	1.112	1.100	1.100
Annual Increase				
Delay (1000 hours)	52	48	37	42
Delay per Peak Traveler (hours)	1	1	0	1
Congestion Cost (\$million)	1.0	0.9	0.7	0.7

**Benefits from Public Transportation Service and Operations Strategies in
Boulder CO, 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	--	--	--	--
Service Patrols				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--
Arterial Signal Coordination				
Percent of Roadway Miles	35	35	35	35
Annual Delay Reduction (1000 hours)	11	10	8	14
Arterial Access Management				
Percent of Roadway Miles	31	30	30	30
Annual Delay Reduction (1000 hours)	43	51	58	41
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	54	61	66	55
Annual Delay Saved per Peak Traveler (hours)	1	1	1	1
Annual Congestion Cost Savings (\$million)	0.9	1.0	1.0	0.8
Travel Time Index with Strategies	1.093	1.092	1.099	1.100
Travel Time Index (Base)	1.097	1.097	1.105	1.105
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	7.7	7.7	7.8	7.5
Unlinked Passenger Trips (million)	1.6	1.6	1.6	1.5
Travel Time Index (combined road and transit)	1.096	1.095	1.104	1.104
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.099	1.099	1.107	1.106
Annual Increase				
Delay (1000 hours)	39	39	41	30
Delay per Peak Traveler (hours)	1	1	1	0
Congestion Cost (\$million)	0.6	0.6	0.6	0.5

**Comparison of Several Key Mobility Performance Measures
Small Group – less than 500,000 population urban areas**

Urban Area	Delay per Traveler	Travel Time Index	Total Delay	1982 to 2007	
				Delay per Traveler	Total Delay
Knoxville, TN	H+	H	H+	F	F+
Charleston-North Charleston, SC	H+	H+	H+	F+	F+
Cape Coral, FL	H+	H+	H+	F+	F+
Columbia, SC	H	0	H+	F+	F+
Wichita, KS	L-	L-	L-	S-	S-
Little Rock, AR	H	0	H	F+	F+
Spokane WA	L-	L-	L-	S-	S-
Pensacola, FL-AL	H+	H	H+	F+	F+
Corpus Christi, TX	L-	L-	L-	S-	S-
Anchorage, AK	L-	L	L-	S-	S-
Eugene, OR	L-	L	L-	S-	S-
Salem, OR	L	0	L	0	S-
Beaumont, TX	L-	L-	L-	S-	S-
Laredo, TX	L	H	L-	0	S-
Brownsville, TX	L-	L	L-	S-	S-
Boulder, CO	L-	0	L-	S-	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 -	5 Hours 5 Index Points 5 Hours x Average 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