

Performance Measure Summary – New Haven, CT

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 New Haven CT

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	560	560	560	555	550	545
Rank	69	69	69	69	68	68
Urban Area (square miles)	350	350	350	350	350	350
Population Density (persons/sq mile)	1,600	1,600	1,600	1,586	1,571	1,557
Peak Travelers (1000s)	308	306	304	300	295	289
Freeway						
Daily Vehicle-Miles of Travel (1000s)	7,565	7,480	7,465	7,310	7,450	7,505
Lane-Miles	525	525	520	520	520	520
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	4,240	4,295	4,310	4,310	4,270	4,145
Lane-Miles	1,020	1,020	1,015	1,015	1,005	995
Public Transportation						
Annual Psgr-Miles of Travel (millions)	26.2	27.0	24.9	28.4	29.4	43.4
Annual Unlinked Psgr Trips (millions)	8.5	8.8	8.1	8.0	8.3	12.6
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)	3.23	2.83	2.35	2.08	1.60	1.46
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	38	38	38	35	38	36
Congested System (% of lane-miles)	33	32	32	30	32	32
Congested Time (number of "Rush Hours")	6.0	6.0	6.0	5.8	6.0	6.0
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	4	24	36	44	70	90
Transit Riders or Carpoolers (millions)	1	6	10	12	18	24
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	4,225	4,216	4,227	3,789	4,299	4,327
Rank	65	66	64	65	60	61
Fuel per Peak Traveler (gallons)	14	14	14	13	15	15
Rank	56	56	52	57	48	50
Annual Delay						
Total Delay (1000s of person-hours)	5,728	5,737	5,706	5,312	5,944	6,015
Rank	69	68	67	67	67	65
Delay per Peak Traveler (person-hours)	19	19	19	18	20	21
Rank	64	63	61	65	58	56
Delay due to Incidents (percent)	55	55	55	55	54	54
Travel Time Index	1.11	1.11	1.11	1.10	1.11	1.11
Rank	63	60	58	63	59	58
Congestion Cost						
Total Cost (\$ millions)	117	113	107	94	101	100
Rank	70	68	67	67	67	65
Cost per Peak Traveler (\$)	379	368	352	314	343	344
Rank	67	65	62	65	60	57

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 New Haven CT, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	540	525	520	515	505
Rank	68	68	67	65	65
Urban Area (square miles)	345	325	310	300	285
Population Density (persons/sq mile)	1,565	1,615	1,677	1,717	1,772
Peak Travelers (1000s)	283	271	266	260	251
Freeway					
Daily Vehicle-Miles of Travel (1000s)	7,200	6,800	6,400	6,000	5,500
Lane-Miles	510	500	485	470	450
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	3,705	3,695	3,685	3,390	3,240
Lane-Miles	965	945	920	910	880
Public Transportation					
Annual Psgr-Miles of Travel (millions)	42.1	42.2	42.3	28.2	31.6
Annual Unlinked Psgr Trips (millions)	12.2	12.1	12.0	10.9	12.5
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)	1.77	1.70	1.24	1.22	1.39
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	35	31	31	31	29
Congested System (% of lane-miles)	30	28	32	35	35
Congested Time (number of "Rush Hours")	5.8	5.6	5.2	4.8	4.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	90	86	81	67	55
Transit Riders or Carpoolers (millions)	23	22	20	16	13
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	4,202	3,686	3,538	3,085	2,514
Rank	59	64	64	64	64
Fuel per Peak Traveler (gallons)	15	14	13	12	10
Rank	47	50	57	57	64
Annual Delay					
Total Delay (1000s of person-hours)	5,864	5,357	5,179	4,520	3,647
Rank	65	65	64	64	64
Delay per Peak Traveler (person-hours)	21	20	19	17	15
Rank	55	60	62	64	65
Delay due to Incidents (percent)	55	55	54	54	53
Travel Time Index	1.12	1.11	1.11	1.10	1.09
Rank	55	59	59	61	62
Congestion Cost					
Total Cost (\$ millions)	97	86	78	67	54
Rank	65	66	64	64	65
Cost per Peak Traveler (\$)	344	318	295	256	213
Rank	56	62	62	64	69

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 New Haven CT, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	495	485	475	465	460
Rank	66	68	68	68	68
Urban Area (square miles)	270	255	245	235	230
Population Density (persons/sq mile)	1,833	1,902	1,939	1,979	2,000
Peak Travelers (1000s)	244	236	228	220	215
Freeway					
Daily Vehicle-Miles of Travel (1000s)	5,000	4,830	4,700	4,605	4,460
Lane-Miles	435	420	405	390	375
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	3,105	3,030	2,920	2,810	2,680
Lane-Miles	845	815	795	755	740
Public Transportation					
Annual Psgr-Miles of Travel (millions)	32.4	35.8	34.2	36.6	34.0
Annual Unlinked Psgr Trips (millions)	12.6	14.0	13.4	13.9	13.1
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)	1.47	1.34	1.18	1.23	1.26
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	26	26	26	26	26
Congested System (% of lane-miles)	32	32	32	28	28
Congested Time (number of "Rush Hours")	3.8	3.8	4.0	4.2	4.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	45	36	29	24	21
Transit Riders or Carpoolers (millions)	10	8	6	6	5
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	2,028	2,119	1,962	1,886	1,644
Rank	64	64	65	64	64
Fuel per Peak Traveler (gallons)	8	9	9	9	8
Rank	66	62	58	59	61
Annual Delay					
Total Delay (1000s of person-hours)	2,956	3,090	2,839	2,743	2,437
Rank	67	65	66	65	65
Delay per Peak Traveler (person-hours)	12	13	12	12	11
Rank	70	65	64	66	65
Delay due to Incidents (percent)	53	53	53	53	53
Travel Time Index	1.08	1.08	1.08	1.08	1.07
Rank	64	62	57	56	58
Congestion Cost					
Total Cost (\$ millions)	43	43	39	36	31
Rank	68	65	67	65	67
Cost per Peak Traveler (\$)	175	183	169	165	145
Rank	72	65	65	66	66

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 New Haven CT, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	455	455	450	445	445
Rank	67	67	66	66	66
Urban Area (square miles)	230	230	225	225	225
Population Density (persons/sq mile)	1,978	1,978	2,000	1,978	1,978
Peak Travelers (1000s)	210	207	203	200	198
Freeway					
Daily Vehicle-Miles of Travel (1000s)	4,285	4,320	4,300	4,185	4,030
Lane-Miles	375	375	375	375	370
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	2,520	2,495	2,480	2,480	2,470
Lane-Miles	735	735	725	720	720
Public Transportation					
Annual Psgr-Miles of Travel (millions)	34.4	29.4	31.1	30.0	32.0
Annual Unlinked Psgr Trips (millions)	11.5	9.4	9.4	9.6	10.4
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)	1.23	1.12	1.21	1.12	1.12
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	23	21	21	20	19
Congested System (% of lane-miles)	23	20	20	17	20
Congested Time (number of "Rush Hours")	3.6	3.8	3.8	3.4	3.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	20	29	49	52	41
Transit Riders or Carpoolers (millions)	4	6	10	11	8
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	1,263	1,224	1,195	1,105	986
Rank	66	66	66	66	65
Fuel per Peak Traveler (gallons)	6	6	6	6	5
Rank	63	63	61	59	63
Annual Delay					
Total Delay (1000s of person-hours)	1,934	1,916	1,888	1,759	1,555
Rank	67	67	66	67	66
Delay per Peak Traveler (person-hours)	9	9	9	9	8
Rank	67	66	65	65	65
Delay due to Incidents (percent)	52	52	52	52	52
Travel Time Index	1.06	1.05	1.05	1.05	1.04
Rank	56	65	63	59	65
Congestion Cost					
Total Cost (\$ millions)	24	23	21	19	16
Rank	68	67	67	67	66
Cost per Peak Traveler (\$)	114	109	105	95	82
Rank	68	66	66	67	66

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.

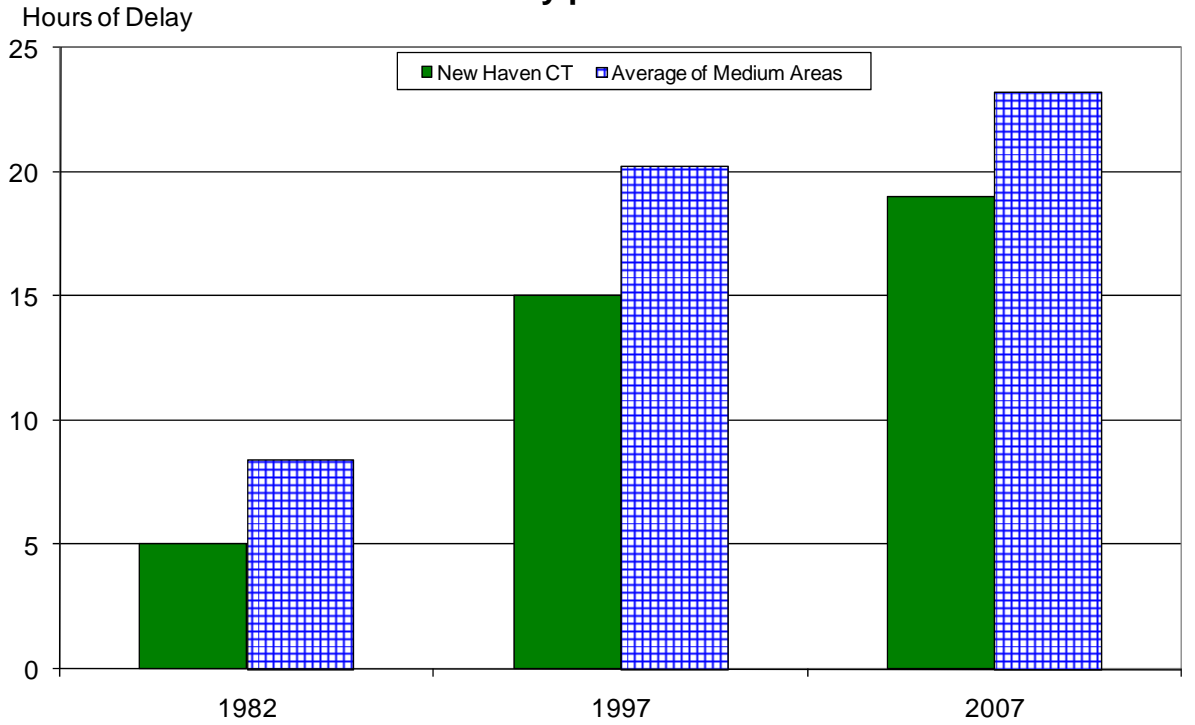
The Mobility Data for New Haven CT, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	440	440	435	435	430
Rank	64	64	63	63	63
Urban Area (square miles)	225	220	220	215	215
Population Density (persons/sq mile)	1,956	2,000	1,977	2,023	2,000
Peak Travelers (1000s)	194	193	189	188	184
Freeway					
Daily Vehicle-Miles of Travel (1000s)	3,750	3,515	3,265	3,100	3,250
Lane-Miles	370	370	370	365	365
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	2,470	2,470	2,200	2,195	2,155
Lane-Miles	715	715	710	710	705
Public Transportation					
Annual Psgr-Miles of Travel (millions)	33.4	38.1	41.5	41.5	41.5
Annual Unlinked Psgr Trips (millions)	10.0	11.8	12.1	12.1	12.1
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)	1.09	1.43	1.44	1.48	1.55
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	17	16	14	13	13
Congested System (% of lane-miles)	22	22	22	18	15
Congested Time (number of "Rush Hours")	2.9	2.8	2.6	2.6	2.7
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	940	834	634	545	541
Rank	65	65	66	68	65
Fuel per Peak Traveler (gallons)	5	4	3	3	3
Rank	61	60	67	64	58
Annual Delay					
Total Delay (1000s of person-hours)	1,535	1,377	1,043	885	858
Rank	66	66	68	69	69
Delay per Peak Traveler (person-hours)	8	7	6	5	5
Rank	62	61	63	66	62
Delay due to Incidents (percent)	52	52	52	52	52
Travel Time Index	1.04	1.04	1.03	1.03	1.03
Rank	65	59	66	63	62
Congestion Cost					
Total Cost (\$ millions)	15	14	10	8	8
Rank	66	67	68	69	68
Cost per Peak Traveler (\$)	79	72	54	45	44
Rank	63	64	69	71	67

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

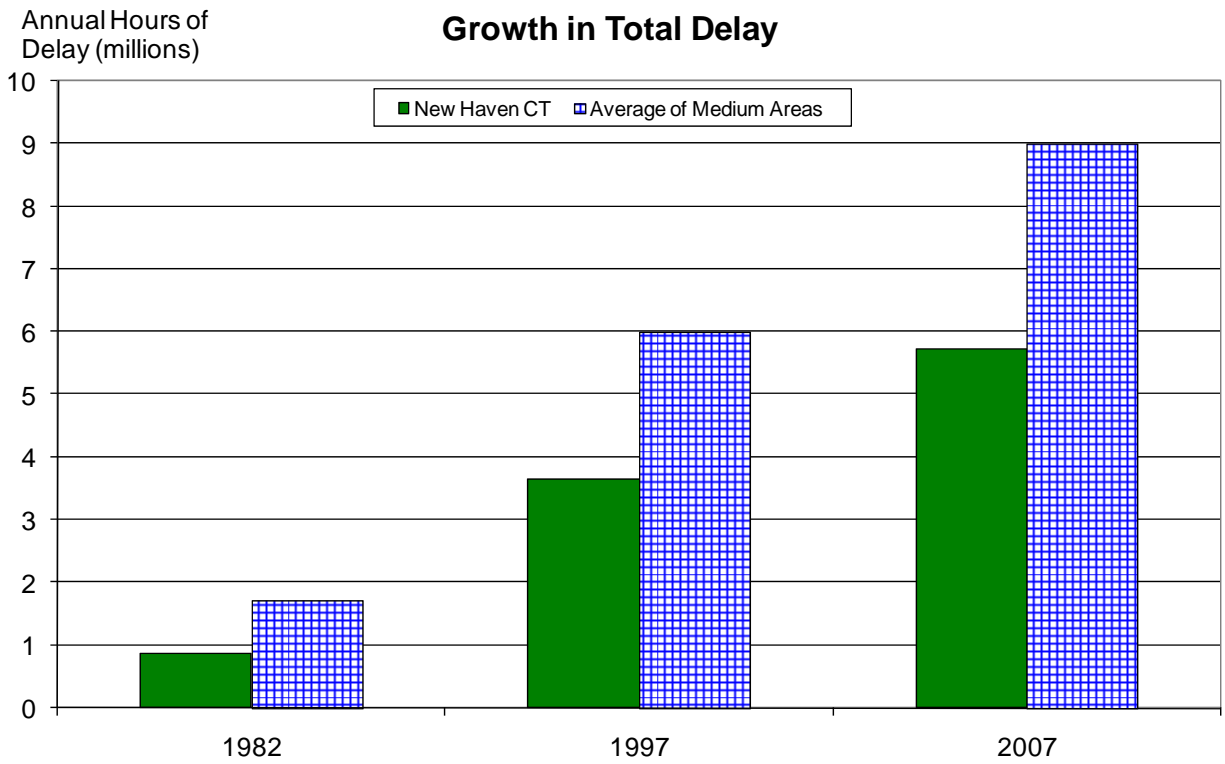
Note: Zeroes in the table reflect values less than 0.5.

Growth in Delay per Peak Traveler



Note: Medium areas have populations between 0.5 and 1 million

Growth in Total Delay



Note: Medium areas have populations between 0.5 and 1 million

**Benefits from Public Transportation Service and Operations Strategies in
New Haven CT**

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	26	26	26	26
Service Patrols				
Percent of Roadway Miles	42	42	42	42
Annual Delay Reduction (1000 hours)	107	106	101	89
Arterial Signal Coordination				
Percent of Roadway Miles	54	54	52	52
Annual Delay Reduction (1000 hours)	41	36	43	47
Arterial Access Management				
Percent of Roadway Miles	8	8	8	8
Annual Delay Reduction (1000 hours)	49	53	67	62
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	197	196	211	198
Annual Delay Saved per Peak Traveler (hours)	1	1	1	1
Annual Congestion Cost Savings (\$million)	4.0	3.8	3.9	3.5
Travel Time Index with Strategies	1.110	1.110	1.111	1.100
Travel Time Index (Base)	1.114	1.114	1.114	1.103
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	26.2	27.0	24.9	28.4
Unlinked Passenger Trips (million)	8.5	8.8	8.1	8.0
Travel Time Index (combined road and transit)	1.113	1.113	1.113	1.102
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.115	1.115	1.116	1.104
Annual Increase				
Delay (1000 hours)	138	128	139	127
Delay per Peak Traveler (hours)	0	0	0	0
Congestion Cost (\$million)	2.8	2.5	2.6	2.3

**Benefits from Public Transportation Service and Operations Strategies in
New Haven CT, 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	23	23	24	24
Service Patrols				
Percent of Roadway Miles	38	38	35	34
Annual Delay Reduction (1000 hours)	101	112	117	104
Arterial Signal Coordination				
Percent of Roadway Miles	52	52	54	54
Annual Delay Reduction (1000 hours)	51	46	44	39
Arterial Access Management				
Percent of Roadway Miles	8	8	9	9
Annual Delay Reduction (1000 hours)	61	63	37	46
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	213	220	198	189
Annual Delay Saved per Peak Traveler (hours)	1	1	1	1
Annual Congestion Cost Savings (\$million)	3.6	3.6	3.3	3.0
Travel Time Index with Strategies	1.113	1.115	1.120	1.108
Travel Time Index (Base)	1.117	1.118	1.123	1.111
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	29.4	43.4	42.1	42.2
Unlinked Passenger Trips (million)	8.3	12.6	12.2	12.1
Travel Time Index (combined road and transit)	1.116	1.117	1.121	1.110
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.119	1.121	1.126	1.114
Annual Increase				
Delay (1000 hours)	174	261	253	246
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	3.0	4.3	4.2	4.0

**Comparison of Several Key Mobility Performance Measures
Medium Group – 500,000 to 1 million population urban areas**

Urban Area	Delay per Traveler	Travel Time Index	Total Delay	1982 to 2007	
				Delay per Traveler	Total Delay
Nashville-Davidson, TN	H+	0	H+	F	F+
Salt Lake City, UT	H	H+	H+	F	F+
Richmond, VA	L	L-	H	0	F+
Louisville, KY-IN	H+	H+	H+	F+	F+
Hartford, CT	L	L	H	F	F+
Bridgeport-Stamford, CT-NY	H+	H+	H+	F+	F+
Oklahoma City, OK	H	L	H+	F+	F+
Tulsa, OK	0	L	0	0	F
Tucson, AZ	H+	H+	H+	F	F+
Dayton, OH	L-	L-	L-	S-	S-
Rochester, NY	L-	L-	L-	S-	S-
Birmingham, AL	H+	0	H+	F+	F+
Lancaster-Palmdale, CA	L-	L	L-	S-	S-
Honolulu, HI	H	H+	H	S	S
El Paso, TX-NM	L	L	L	0	S
Oxnard-Ventura, CA	H+	H+	H+	F+	F+
Sarasota-Bradenton, FL	H	H+	0	S-	0
Springfield, MA-CT	L-	L-	L-	S-	S-
Omaha, NE-IA	H	H	0	F+	F
Fresno, CA	L	0	L	S-	S-
Allentown-Bethlehem, PA-NJ	0	0	L	S	S-
Akron, OH	L-	L-	L-	S-	S-
Grand Rapids, MI	0	L	L	0	S
Albany-Schenectady, NY	L	L	L	0	S-
Albuquerque, NM	H+	H	H	F+	F+
New Haven, CT	L	L	L-	0	S-
Indio-Cathedral City-Palm Springs, CA	L-	0	L-	S-	S-
Toledo, OH-MI	L-	L-	L-	S	S-
Poughkeepsie-Newburgh, NY	L-	L-	L-	S-	S-
Bakersfield, CA	L-	L-	L-	S-	S-
Colorado Springs, CO	0	0	L	F	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