

## Performance Measure Summary – Knoxville, TN

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 Knoxville TN

Inventory Measures	2007	2006	2005	2004	2003	2002
<b>Urban Area Information</b>						
Population (1000s)	490	485	465	450	440	430
Rank	75	75	76	76	74	75
Urban Area (square miles)	460	460	460	455	430	420
Population Density (persons/sq mile)	1,065	1,054	1,011	989	1,023	1,024
Peak Travelers (1000s)	270	266	253	244	237	228
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	5,170	5,095	5,130	5,030	4,830	4,650
Lane-Miles	350	350	350	345	340	325
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	6,150	6,200	6,385	6,370	6,160	5,975
Lane-Miles	1,080	1,080	1,080	1,070	1,050	1,005
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	12.7	12.7	11.5	9.0	7.2	7.1
Annual Unlinked Psgr Trips (millions)	3.5	3.4	3.1	3.2	2.6	2.3
<b>Cost Components</b>						
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)	2.98	2.54	2.24	1.86	1.46	1.32
System Performance	2007	2006	2005	2004	2003	2002
<b>Congested Travel</b> (% of peak VMT)	32	29	30	30	31	32
<b>Congested System</b> (% of lane-miles)	31	30	30	30	31	31
<b>Congested Time</b> (number of "Rush Hours")	7.0	6.8	7.0	7.0	6.8	6.8
<b>Annual Increase Needed to Maintain Constant Congestion Level:</b>						
Lane-miles	18	28	44	46	42	40
Transit Riders or Carpoolers (millions)	5	8	12	13	12	11
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	4,295	3,975	4,169	4,270	4,285	4,149
Rank	64	67	65	63	61	62
Fuel per Peak Traveler (gallons)	16	15	16	18	18	18
Rank	50	53	48	45	44	43
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	7,166	6,686	7,033	7,296	7,257	7,038
Rank	63	66	63	62	59	60
Delay per Peak Traveler (person-hours)	26	25	28	30	31	31
Rank	47	52	44	40	38	39
Delay due to Incidents (percent)	57	56	56	56	57	57
<b>Travel Time Index</b>	1.12	1.11	1.11	1.11	1.12	1.12
Rank	57	60	58	58	55	55
<b>Congestion Cost</b>						
Total Cost (\$ millions)	147	131	133	131	126	119
Rank	63	67	63	62	59	59
Cost per Peak Traveler (\$)	542	493	524	537	531	521
Rank	46	51	44	42	41	40

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

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

## The Mobility Data for Knoxville TN, Continued

Inventory Measures	2001	2000	1999	1998	1997
<b>Urban Area Information</b>					
Population (1000s)	420	410	390	380	365
Rank	75	75	76	77	77
Urban Area (square miles)	410	400	380	375	360
Population Density (persons/sq mile)	1,024	1,025	1,026	1,013	1,014
Peak Travelers (1000s)	220	211	198	190	180
<b>Freeway</b>					
Daily Vehicle-Miles of Travel (1000s)	4,475	4,300	4,210	4,100	4,000
Lane-Miles	310	300	295	285	275
<b>Arterial Streets</b>					
Daily Vehicle-Miles of Travel (1000s)	5,775	5,620	5,500	5,370	5,150
Lane-Miles	970	945	920	890	860
<b>Public Transportation</b>					
Annual Psgr-Miles of Travel (millions)	6.8	5.5	5.4	5.0	5.0
Annual Unlinked Psgr Trips (millions)	2.1	1.9	1.7	1.8	1.8
<b>Cost Components</b>					
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)	1.45	1.47	1.07	1.03	1.13
System Performance	2001	2000	1999	1998	1997
<b>Congested Travel</b> (% of peak VMT)	32	34	34	35	35
<b>Congested System</b> (% of lane-miles)	31	31	31	31	31
<b>Congested Time</b> (number of "Rush Hours")	7.0	6.8	6.8	7.0	7.0
<b>Annual Increase Needed to Maintain Constant Congestion Level:</b>					
Lane-miles	40	49	54	57	56
Transit Riders or Carpoolers (millions)	11	13	15	16	16
<b>Annual Excess Fuel Consumed</b>					
Total Fuel (1000 gallons)	4,106	4,196	4,239	4,129	4,091
Rank	62	61	57	58	56
Fuel per Peak Traveler (gallons)	19	20	21	22	23
Rank	41	34	34	24	21
<b>Annual Delay</b>					
Total Delay (1000s of person-hours)	7,015	7,075	7,211	6,997	6,943
Rank	60	58	57	57	55
Delay per Peak Traveler (person-hours)	32	34	36	37	39
Rank	34	26	21	15	11
Delay due to Incidents (percent)	57	56	56	56	56
<b>Travel Time Index</b>	1.12	1.13	1.13	1.13	1.14
Rank	55	52	49	45	43
<b>Congestion Cost</b>					
Total Cost (\$ millions)	118	116	113	107	106
Rank	58	57	55	54	54
Cost per Peak Traveler (\$)	538	551	570	564	589
Rank	35	33	22	18	14

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 Knoxville TN, Continued

Inventory Measures	1996	1995	1994	1993	1992
<b>Urban Area Information</b>					
Population (1000s)	350	335	325	320	320
Rank	77	77	76	76	76
Urban Area (square miles)	350	330	320	300	295
Population Density (persons/sq mile)	1,000	1,015	1,016	1,067	1,085
Peak Travelers (1000s)	169	160	153	148	146
<b>Freeway</b>					
Daily Vehicle-Miles of Travel (1000s)	3,900	3,650	3,500	3,400	3,280
Lane-Miles	270	265	260	260	255
<b>Arterial Streets</b>					
Daily Vehicle-Miles of Travel (1000s)	4,900	4,555	4,300	4,090	3,915
Lane-Miles	825	810	775	740	715
<b>Public Transportation</b>					
Annual Psgr-Miles of Travel (millions)	5.9	7.1	7.1	7.1	8.6
Annual Unlinked Psgr Trips (millions)	1.8	2.6	2.6	2.6	3.5
<b>Cost Components</b>					
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)	1.24	1.11	1.03	1.07	1.08
System Performance	1996	1995	1994	1993	1992
<b>Congested Travel</b> (% of peak VMT)	34	30	29	29	28
<b>Congested System</b> (% of lane-miles)	31	30	30	30	30
<b>Congested Time</b> (number of "Rush Hours")	7.0	6.4	6.2	6.0	5.8
<b>Annual Increase Needed to Maintain Constant Congestion Level:</b>					
Lane-miles	56	46	46	49	50
Transit Riders or Carpoolers (millions)	15	12	12	13	13
<b>Annual Excess Fuel Consumed</b>					
Total Fuel (1000 gallons)	3,970	3,158	2,842	2,573	2,419
Rank	55	58	59	59	58
Fuel per Peak Traveler (gallons)	23	20	19	17	17
Rank	18	29	26	26	25
<b>Annual Delay</b>					
Total Delay (1000s of person-hours)	6,812	5,423	4,776	4,310	4,100
Rank	53	56	57	59	57
Delay per Peak Traveler (person-hours)	40	34	31	29	28
Rank	10	16	22	23	20
Delay due to Incidents (percent)	57	56	55	55	54
<b>Travel Time Index</b>	1.14	1.12	1.11	1.10	1.10
Rank	42	47	46	48	45
<b>Congestion Cost</b>					
Total Cost (\$ millions)	103	79	67	59	55
Rank	53	55	56	55	55
Cost per Peak Traveler (\$)	609	496	440	400	377
Rank	10	17	22	24	22

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 Knoxville TN, Continued

Inventory Measures	1991	1990	1989	1988	1987
<b>Urban Area Information</b>					
Population (1000s)	320	315	315	315	315
Rank	75	75	74	73	73
Urban Area (square miles)	290	290	285	285	280
Population Density (persons/sq mile)	1,103	1,086	1,105	1,105	1,125
Peak Travelers (1000s)	144	139	138	137	136
<b>Freeway</b>					
Daily Vehicle-Miles of Travel (1000s)	3,150	3,025	2,705	2,520	2,365
Lane-Miles	250	245	240	235	230
<b>Arterial Streets</b>					
Daily Vehicle-Miles of Travel (1000s)	3,730	3,610	3,570	3,380	3,210
Lane-Miles	685	670	650	630	615
<b>Public Transportation</b>					
Annual Psgr-Miles of Travel (millions)	8.6	8.6	9.6	9.1	8.5
Annual Unlinked Psgr Trips (millions)	3.5	3.5	3.6	2.6	2.5
<b>Cost Components</b>					
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)	1.11	1.08	1.12	1.03	1.04
System Performance	1991	1990	1989	1988	1987
<b>Congested Travel</b> (% of peak VMT)	27	27	26	21	20
<b>Congested System</b> (% of lane-miles)	30	30	30	25	25
<b>Congested Time</b> (number of "Rush Hours")	5.6	5.6	5.0	4.6	4.2
<b>Annual Increase Needed to Maintain Constant Congestion Level:</b>					
Lane-miles	54	60	47	40	34
Transit Riders or Carpoolers (millions)	14	15	11	9	8
<b>Annual Excess Fuel Consumed</b>					
Total Fuel (1000 gallons)	2,214	2,071	1,926	1,422	1,237
Rank	55	55	55	61	61
Fuel per Peak Traveler (gallons)	15	15	14	10	9
Rank	26	26	24	36	38
<b>Annual Delay</b>					
Total Delay (1000s of person-hours)	3,720	3,476	3,258	2,444	2,136
Rank	56	55	55	60	61
Delay per Peak Traveler (person-hours)	26	25	24	18	16
Rank	22	24	22	33	35
Delay due to Incidents (percent)	54	54	54	54	54
<b>Travel Time Index</b>	1.10	1.09	1.09	1.07	1.07
Rank	41	47	41	46	43
<b>Congestion Cost</b>					
Total Cost (\$ millions)	49	44	39	28	24
Rank	54	54	54	60	60
Cost per Peak Traveler (\$)	340	316	285	204	174
Rank	23	25	25	33	37

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

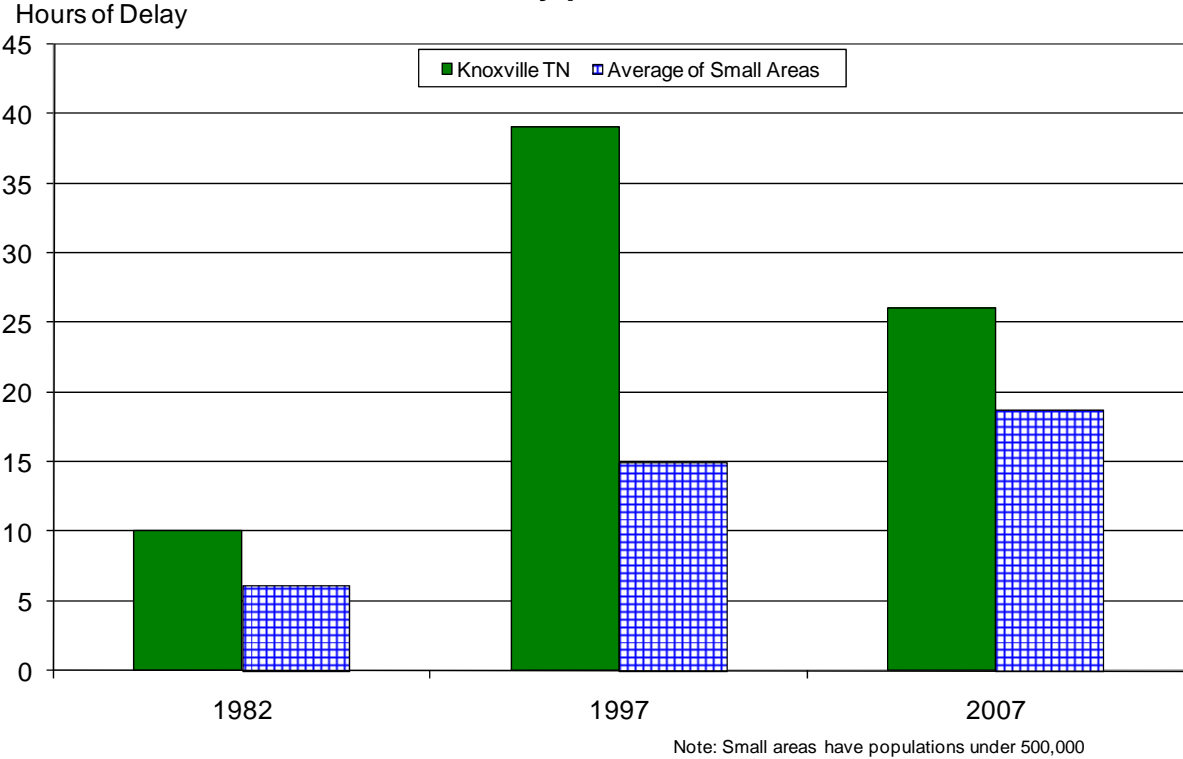
Note: Zeroes in the table reflect values less than 0.5.

## The Mobility Data for Knoxville TN, Continued

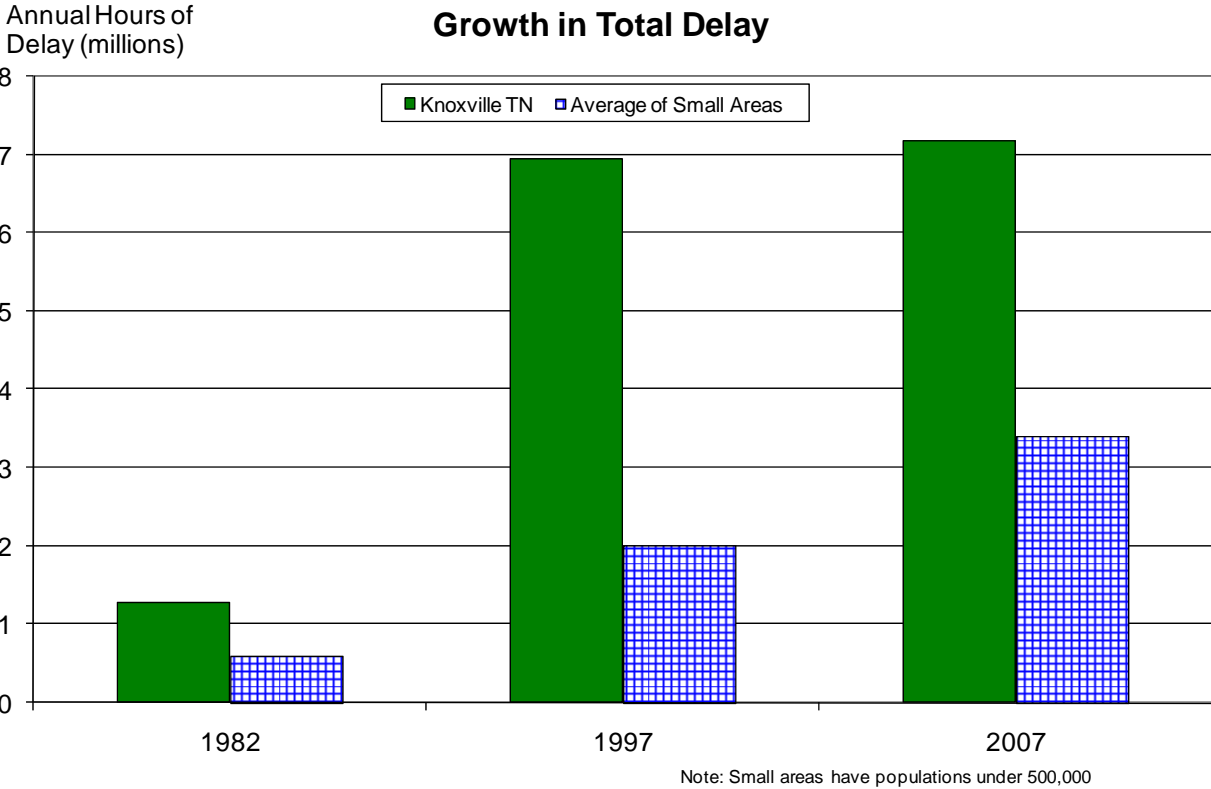
Inventory Measures	1986	1985	1984	1983	1982
<b>Urban Area Information</b>					
Population (1000s)	310	310	305	300	300
Rank	73	73	73	73	73
Urban Area (square miles)	280	280	280	280	280
Population Density (persons/sq mile)	1,107	1,107	1,089	1,071	1,071
Peak Travelers (1000s)	133	132	129	126	124
<b>Freeway</b>					
Daily Vehicle-Miles of Travel (1000s)	2,100	1,920	2,060	2,020	1,980
Lane-Miles	225	220	210	205	200
<b>Arterial Streets</b>					
Daily Vehicle-Miles of Travel (1000s)	3,095	2,900	2,800	2,700	2,575
Lane-Miles	600	580	570	550	530
<b>Public Transportation</b>					
Annual Psgr-Miles of Travel (millions)	11.0	14.2	10.0	10.0	10.0
Annual Unlinked Psgr Trips (millions)	3.1	3.8	2.5	2.5	2.5
<b>Cost Components</b>					
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)	1.01	1.32	1.34	1.37	1.43
System Performance	1986	1985	1984	1983	1982
<b>Congested Travel</b> (% of peak VMT)	17	15	16	15	15
<b>Congested System</b> (% of lane-miles)	25	25	25	21	21
<b>Congested Time</b> (number of "Rush Hours")	3.6	3.2	3.6	3.6	3.6
<b>Annual Increase Needed to Maintain Constant Congestion Level:</b>					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
<b>Annual Excess Fuel Consumed</b>					
Total Fuel (1000 gallons)	934	784	861	753	731
Rank	66	67	62	62	61
Fuel per Peak Traveler (gallons)	7	6	7	6	6
Rank	44	49	37	41	36
<b>Annual Delay</b>					
Total Delay (1000s of person-hours)	1,612	1,365	1,476	1,304	1,275
Rank	65	67	61	61	61
Delay per Peak Traveler (person-hours)	12	10	11	10	10
Rank	46	52	42	43	38
Delay due to Incidents (percent)	53	53	54	54	54
<b>Travel Time Index</b>	1.05	1.05	1.05	1.05	1.05
Rank	55	51	47	44	44
<b>Congestion Cost</b>					
Total Cost (\$ millions)	17	15	16	13	13
Rank	64	65	58	60	57
Cost per Peak Traveler (\$)	131	113	121	105	102
Rank	46	49	40	40	38

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  
Knoxville TN**

<b>Operations Strategies</b>	<b>2007</b>	<b>2006</b>	<b>2005</b>	<b>2004</b>
<b>Freeway Ramp Metering</b>				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--
<b>Freeway Incident Management</b>				
<b>Cameras</b>				
Percent of Roadway Miles	67	67	67	--
<b>Service Patrols</b>				
Percent of Roadway Miles	92	91	91	93
Annual Delay Reduction (1000 hours)	222	167	172	181
<b>Arterial Signal Coordination</b>				
Percent of Roadway Miles	42	41	40	39
Annual Delay Reduction (1000 hours)	15	18	38	18
<b>Arterial Access Management</b>				
Percent of Roadway Miles	22	22	22	22
Annual Delay Reduction (1000 hours)	137	147	188	139
<b>HOV Lanes</b>				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
<b>Total Effect of Operations Treatments</b>				
Annual Delay Reduction (1000 hours)	373	332	398	337
Annual Delay Saved per Peak Traveler (hours)	1	1	2	1
Annual Congestion Cost Savings (\$million)	8.0	6.8	7.7	6.3
Travel Time Index with Strategies	1.116	1.108	1.111	1.115
Travel Time Index (Base)	1.121	1.112	1.116	1.119
<b>Public Transportation Service</b>	<b>2007</b>	<b>2006</b>	<b>2005</b>	<b>2004</b>
<b>Existing Service</b>				
Annual Passenger-miles of travel (million)	12.7	12.7	11.5	9.0
Unlinked Passenger Trips (million)	3.5	3.4	3.1	3.2
Travel Time Index (combined road and transit)	1.121	1.112	1.116	1.119
<b>Condition if Public Transportation Service were Discontinued</b>				
Travel Time Index	1.121	1.113	1.116	1.119
Annual Increase				
Delay (1000 hours)	48	104	53	53
Delay per Peak Traveler (hours)	0	0	0	0
Congestion Cost (\$million)	1.0	2.0	1.0	0.9

**Benefits from Public Transportation Service and Operations Strategies in  
Knoxville TN, Continued**

<b>Operations Strategies</b>	<b>2003</b>	<b>2002</b>	<b>2001</b>	<b>2000</b>
<b>Freeway Ramp Metering</b>				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--
<b>Freeway Incident Management</b>				
<b>Cameras</b>				
Percent of Roadway Miles	--	--	--	--
<b>Service Patrols</b>				
Percent of Roadway Miles	79	83	84	87
Annual Delay Reduction (1000 hours)	184	171	172	153
<b>Arterial Signal Coordination</b>				
Percent of Roadway Miles	37	37	34	32
Annual Delay Reduction (1000 hours)	21	19	17	17
<b>Arterial Access Management</b>				
Percent of Roadway Miles	16	15	16	16
Annual Delay Reduction (1000 hours)	84	74	51	63
<b>HOV Lanes</b>				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
<b>Total Effect of Operations Treatments</b>				
Annual Delay Reduction (1000 hours)	289	263	240	233
Annual Delay Saved per Peak Traveler (hours)	1	1	1	1
Annual Congestion Cost Savings (\$million)	5.3	4.7	4.3	4.0
Travel Time Index with Strategies	1.120	1.120	1.123	1.131
Travel Time Index (Base)	1.123	1.123	1.127	1.134
<b>Public Transportation Service</b>	<b>2003</b>	<b>2002</b>	<b>2001</b>	<b>2000</b>
<b>Existing Service</b>				
Annual Passenger-miles of travel (million)	7.2	7.1	6.8	5.5
Unlinked Passenger Trips (million)	2.6	2.3	2.1	1.9
Travel Time Index (combined road and transit)	1.123	1.123	1.126	1.134
<b>Condition if Public Transportation Service were Discontinued</b>				
Travel Time Index	1.124	1.124	1.126	1.135
Annual Increase				
Delay (1000 hours)	79	75	17	53
Delay per Peak Traveler (hours)	0	0	0	0
Congestion Cost (\$million)	1.4	1.3	0.3	0.9

**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
<b>2007 Values</b> 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
<b>1982 to 2007 Trends</b> Delay per Traveler - Total Delay -	5 Hours 5 Hours x Average Population	3 Hours 3 Hours x Average Population