

## Performance Measure Summary

There are several inventory and performance measures listed in the pages of this Urban Area Report for the years from 1982 to 2005. 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 aspects. 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*).

### 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 2005	
				Delay per Traveler	Total Delay
Jacksonville, FL	H+	H+	H+	F	F+
Nashville-Davidson, TN	H+	0	H+	0	F+
Salt Lake City, UT	0	H	H	0	F+
Raleigh-Durham, NC	H+	H	H+	F+	F+
Richmond, VA	L-	L-	0	S-	S
Louisville, KY-IN	H+	H+	H+	F+	F+
Hartford, CT	L-	L-	L	S	S-
Bridgeport-Stamford, CT-NY	H	H+	H+	F	F+
Charlotte, NC-SC	H+	H+	H+	F+	F+
Austin, TX	H+	H+	H+	F+	F+
Oklahoma City, OK	L-	L-	L	S	S-
<b>Tulsa, OK</b>	<b>L-</b>	<b>L-</b>	<b>L</b>	<b>S-</b>	<b>S-</b>
Tucson, AZ	H+	H+	H+	0	F+
Dayton, OH	L-	L-	L-	S-	S-
Honolulu, HI	L	H+	L	S-	S-
Birmingham, AL	H+	0	H	F+	F+
El Paso, TX-NM	L	0	L	F	S-
Rochester, NY	L-	L-	L-	S-	S-
Springfield, MA-CT	L-	L-	L-	S-	S-
Omaha, NE-IA	L	0	L	0	S-
Sarasota-Bradenton, FL	L	H	L	S-	S-
Allentown-Bethlehem, PA-NJ	L-	L	L-	S-	S-
Akron, OH	L-	L-	L-	S-	S-
Fresno, CA	L-	L	L-	S-	S-
Grand Rapids, MI	L	L-	L-	0	S-
Oxnard-Ventura, CA	H+	H+	0	F+	F+
Albuquerque, NM	H+	0	0	F	S
New Haven, CT	L-	L-	L-	S-	S-
Albany-Schenectady, NY	L-	L-	L-	S-	S-
Toledo, OH-MI	L-	L-	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

## 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 2005 (estimated at \$14.60 per hour of person travel and \$77.10 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

### 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>2005 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 2005 Trends</b> Delay per Traveler - Total Delay -	5 Hours 5 Hours x Average Population	3 Hours 3 Hours x Average Population

### The Mobility Data for Tulsa, OK

<b>Inventory Measures</b>	<b>2005</b>	<b>2004</b>	<b>2003</b>	<b>2002</b>	<b>2001</b>	<b>2000</b>
<b>Urban Area Information</b>						
Population (1000s)	810	810	810	805	805	805
Rank	51	51	50	50	48	45
Urban Area (square miles)	410	410	410	405	405	405
Popn Density (persons/sq mile)	1,976	1,976	1,976	1,988	1,988	1,988
Peak Travelers (1000s)	440	437	435	427	422	416
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	6,960	6,935	7,025	6,850	6,700	6,500
Lane Miles	745	740	700	680	650	630
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	10,000	9,615	9,335	8,825	8,590	8,365
Lane Miles	1,830	1,810	1,770	1,765	1,760	1,755
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	14	16	16	16	18	19
Annual Unlinked Psgr Trips (millions)	2	3	3	3	3	3
<b>Cost Components</b>						
Value of Time (\$/hour)	14.60	14.10	13.75	13.45	13.25	12.85
Commercial Cost (\$/hour)	77.10	74.60	72.65	71.05	69.95	68.00
Fuel Cost (\$/gallon)	2.19	1.77	1.42	1.27	1.31	1.48
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	24	24	27	27	27	25
<b>Congested System</b> (% of lane-miles)	31	31	33	34	35	31
<b>Congested Time</b> (number of "Rush Hours")	4.0	3.8	4.2	3.8	4.0	3.8
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	69	71	73	64	60	64
Transit Riders or Carpoolers (millions)	16	16	17	14	13	14
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	4,796	4,809	5,370	5,152	4,957	4,611
Rank	59	60	54	53	54	55
Fuel per Peak Traveler (gallons)	11	11	12	12	12	11
Rank	62	64	59	59	60	63
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	8,453	8,392	9,195	8,746	8,446	7,924
Rank	58	57	51	51	52	53
Delay per Peak Traveler (person-hrs)	19	19	21	20	20	19
Rank	59	59	55	57	57	60
Delay due to Incidents (percent)	54	54	55	56	55	56
<b>Travel Time Index</b>						
Rank	1.09	1.09	1.10	1.10	1.10	1.09
Rank	64	65	60	60	61	65
<b>Congestion Cost</b>						
Total Cost (\$ millions)	149	141	150	140	133	123
Rank	58	58	51	51	52	53
Cost per Peak Traveler (\$)	338	323	346	329	316	295
Rank	63	63	57	57	59	62

Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

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

**The Mobility Data for Tulsa, OK, Continued**

<b>Inventory Measures</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>	<b>1996</b>	<b>1995</b>	<b>1994</b>
<b>Urban Area Information</b>						
Population (1000s)	775	760	750	740	730	725
Rank	47	46	46	46	46	45
Urban Area (square miles)	400	390	380	370	360	350
Popn Density (persons/sq mile)	1,938	1,949	1,974	2,000	2,028	2,071
Peak Travelers (1000s)	396	384	374	364	355	348
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	6,300	6,100	5,900	5,800	5,515	5,265
Lane Miles	595	580	550	530	530	525
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	8,135	8,050	7,900	7,700	7,520	7,380
Lane Miles	1,745	1,740	1,730	1,725	1,715	1,715
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	18	17	17	18	18	18
Annual Unlinked Psgr Trips (millions)	3	3	3	3	3	3
<b>Cost Components</b>						
Value of Time (\$/hour)	12.40	12.15	12.00	11.70	11.40	11.05
Commercial Cost (\$/hour)	65.80	64.35	63.40	61.95	60.20	58.50
Fuel Cost (\$/gallon)	1.03	1.00	1.08	1.21	1.06	0.97
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	24	24	24	24	20	18
<b>Congested System</b> (% of lane-miles)	31	31	31	31	26	21
<b>Congested Time</b> (number of "Rush Hours")	4.0	3.8	4.0	4.0	3.6	3.2
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	63	60	66	71	53	34
Transit Riders or Carpoolers (millions)	13	13	14	15	11	7
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	4,290	4,184	4,012	3,799	2,979	2,637
Rank	56	57	57	57	59	61
Fuel per Peak Traveler (gallons)	11	11	11	10	8	8
Rank	66	65	62	62	65	64
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	7,292	7,144	6,750	6,307	4,979	4,517
Rank	56	56	55	56	59	60
Delay per Peak Traveler (person-hrs)	18	19	18	17	14	13
Rank	65	61	62	61	63	61
Delay due to Incidents (percent)	55	56	55	55	55	54
<b>Travel Time Index</b>						
Rank	68	65	64	62	69	69
<b>Congestion Cost</b>						
Total Cost (\$ millions)	107	102	95	87	67	58
Rank	57	56	55	56	59	61
Cost per Peak Traveler (\$)	269	266	256	240	188	167
Rank	64	61	61	61	63	62

Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

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

**The Mobility Data for Tulsa, OK, Continued**

<b>Inventory Measures</b>	<b>1993</b>	<b>1992</b>	<b>1991</b>	<b>1990</b>	<b>1989</b>	<b>1988</b>
<b>Urban Area Information</b>						
Population (1000s)	710	690	675	650	625	605
Rank	46	46	47	48	49	50
Urban Area (square miles)	340	330	320	310	300	290
Popn Density (persons/sq mile)	2,088	2,091	2,109	2,097	2,083	2,086
Peak Travelers (1000s)	337	323	312	296	283	272
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	5,265	4,855	4,430	4,465	4,520	4,485
Lane Miles	525	480	455	460	475	475
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	7,200	7,120	7,150	7,135	7,205	6,915
Lane Miles	1,705	1,700	1,700	1,695	1,690	1,680
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	17	20	19	18	16	17
Annual Unlinked Psgr Trips (millions)	3	3	3	3	3	3
<b>Cost Components</b>						
Value of Time (\$/hour)	10.75	10.50	10.25	10.00	9.25	8.80
Commercial Cost (\$/hour)	57.05	55.40	53.80	51.60	48.95	46.70
Fuel Cost (\$/gallon)	1.05	1.03	1.05	1.11	1.06	0.98
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	18	17	17	17	17	16
<b>Congested System</b> (% of lane-miles)	21	22	22	18	18	18
<b>Congested Time</b> (number of "Rush Hours")	3.2	3.2	3.0	3.0	3.0	3.0
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	40	29	23	27	47	101
Transit Riders or Carpoolers (millions)	8	6	4	5	9	19
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	2,550	2,458	2,421	2,462	2,363	2,258
Rank	61	57	52	52	52	50
Fuel per Peak Traveler (gallons)	8	8	8	8	8	8
Rank	64	60	54	52	49	45
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	4,371	4,342	4,411	4,572	4,311	4,116
Rank	59	55	52	50	48	43
Delay per Peak Traveler (person-hrs)	13	13	14	15	15	15
Rank	62	58	51	49	45	43
Delay due to Incidents (percent)	54	54	54	53	53	54
<b>Travel Time Index</b>						
Rank	67	65	57	54	54	54
<b>Congestion Cost</b>						
Total Cost (\$ millions)	55	53	53	54	47	43
Rank	59	56	52	51	50	44
Cost per Peak Traveler (\$)	164	165	170	182	167	158
Rank	63	58	52	49	45	44

Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

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

**The Mobility Data for Tulsa, OK, Continued**

<b>Inventory Measures</b>	<b>1987</b>	<b>1986</b>	<b>1985</b>	<b>1984</b>	<b>1983</b>	<b>1982</b>
<b>Urban Area Information</b>						
Population (1000s)	580	565	550	530	510	480
Rank	50	50	50	51	53	56
Urban Area (square miles)	280	270	260	250	240	230
Popn Density (persons/sq mile)	2,071	2,093	2,115	2,120	2,125	2,087
Peak Travelers (1000s)	258	250	241	231	220	205
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	4,300	4,200	4,150	3,990	3,545	3,500
Lane Miles	460	450	435	425	410	390
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	6,900	6,800	6,745	6,525	5,520	4,490
Lane Miles	1,660	1,640	1,610	1,585	1,560	1,540
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	14	17	18	15	15	15
Annual Unlinked Psgr Trips (millions)	3	3	3	3	3	3
<b>Cost Components</b>						
Value of Time (\$/hour)	8.50	8.20	8.00	7.75	7.45	7.20
Commercial Cost (\$/hour)	44.85	43.30	42.50	41.05	39.35	38.10
Fuel Cost (\$/gallon)	0.98	0.96	1.25	1.27	1.30	1.35
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	15	15	15	15	12	11
<b>Congested System</b> (% of lane-miles)	18	14	14	14	14	14
<b>Congested Time</b> (number of "Rush Hours")	3.0	3.0	3.0	3.0	2.7	2.6
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	148	--	--	--	--	--
Transit Riders or Carpoolers (millions)	27	--	--	--	--	--
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	1,818	1,772	1,807	1,696	1,194	937
Rank	50	46	44	43	49	54
Fuel per Peak Traveler (gallons)	7	7	7	7	5	5
Rank	48	45	39	37	44	45
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	3,121	3,075	3,139	2,949	2,124	1,637
Rank	50	45	43	42	47	53
Delay per Peak Traveler (person-hrs)	12	12	13	13	10	8
Rank	47	45	38	36	42	45
Delay due to Incidents (percent)	54	54	54	54	54	54
<b>Travel Time Index</b>						
Rank	59	57	53	52	56	58
<b>Congestion Cost</b>						
Total Cost (\$ millions)	32	30	31	28	19	15
Rank	50	46	43	42	49	53
Cost per Peak Traveler (\$)	123	121	127	121	88	71
Rank	47	46	40	38	42	47

Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

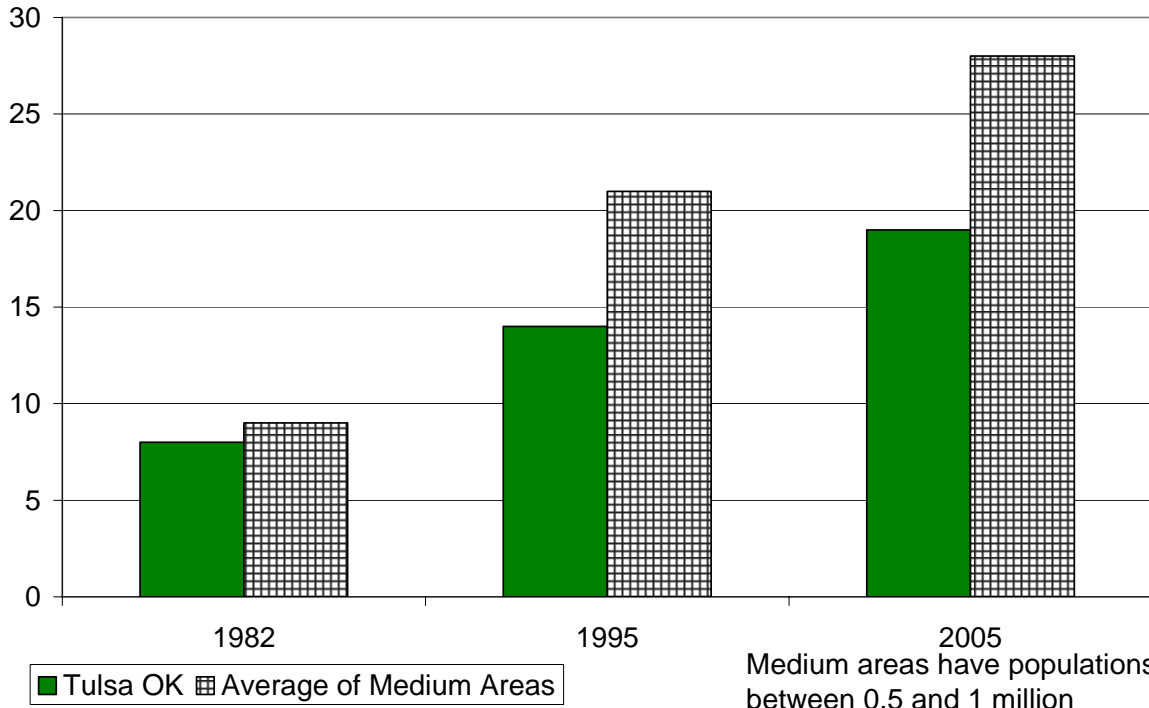
Note: Zeroes in the table reflect values less than 0.5.

### Benefits From Public Transportation Service and Operations Strategies for Tulsa, OK

<b>Operations Strategies</b>	<b>2005</b>	<b>2004</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	26	26	--	--	--	--
<b>Service Patrols</b>						
Percent of Roadway Miles	--	--	--	--	--	--
Annual Delay Reduction (1000 hours)	4	5	--	--	--	--
<b>Arterial Signal Coordination</b>						
Percent of Roadway Miles	3	3	2	2	2	2
Annual Delay Reduction (1000 hours)	9	6	3	8	8	3
<b>Arterial Access Management</b>						
Percent of Roadway Miles	2	2	2	2	2	2
Annual Delay Reduction (1000 hours)	38	30	34	79	78	28
<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)	50	41	38	87	87	31
Annual Delay Saved per Peak Traveler (hours)	0	0	0	0	0	0
Annual Congestion Cost Savings (\$million)	1.0	0.7	0.6	1.4	1.3	0.5
Travel Time Index with Strategies	1.085	1.088	1.099	1.100	1.098	1.094
Travel Time Index (Base)	1.086	1.088	1.100	1.100	1.099	1.094
<b>Public Transportation Service</b>						
<b>Existing Service</b>						
Annual Passenger-miles of Travel (million)	14	16	16	16	18	19
Unlinked Passenger Trips (million)	2	3	3	3	3	3
Travel Time Index (combined road and transit)	1.085	1.087	1.099	1.099	1.098	1.093
<b>Condition if Public Transportation Service were Discontinued</b>						
Travel Time Index	1.085	1.088	1.101	1.101	1.099	1.096
Annual Delay Increase (1000 hours)	-2	49	141	102	32	166
Annual Delay Increase per Peak Traveler (hours)	0	0	0	0	0	0
Annual Congestion Cost Increase (\$million)	0.0	0.8	2.3	1.7	0.5	2.6

### Growth in Delay per Peak Traveler

Hours of Delay



Annual Hours of Delay (million)

### Growth in Total Delay

