

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-
Tulsa, OK	L-	L-	L	S-	S-
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
2005 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 2005 Trends Delay per Traveler - Total Delay -	5 Hours 5 Hours x Average Population	3 Hours 3 Hours x Average Population

The Mobility Data for Raleigh-Durham, NC

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	950	910	870	820	790	750
Rank	43	44	46	48	50	50
Urban Area (square miles)	725	705	685	660	630	605
Popn Density (persons/sq mile)	1,310	1,291	1,270	1,242	1,254	1,240
Peak Travelers (1000s)	516	491	467	435	414	388
Freeway						
Daily Vehicle-Miles of Travel (1000s)	9,450	8,910	8,450	8,190	7,715	7,300
Lane Miles	675	650	630	610	590	570
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	11,500	11,200	10,935	10,665	10,320	10,000
Lane Miles	2,235	2,200	2,170	2,110	2,065	1,925
Public Transportation						
Annual Psgr-Miles of Travel (millions)	66	54	52	52	50	44
Annual Unlinked Psgr Trips (millions)	15	14	13	13	12	12
Cost Components						
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)	2.27	1.89	1.46	1.33	1.43	1.46
System Performance						
Congested Travel (% of peak VMT)	47	46	45	43	40	40
Congested System (% of lane-miles)	48	48	48	47	43	43
Congested Time (number of "Rush Hours")	6.2	6.0	5.8	5.8	5.6	5.6
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	113	121	119	119	136	130
Transit Riders or Carpoolers (millions)	28	30	28	29	32	31
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	11,700	10,809	9,917	9,396	8,210	7,556
Rank	37	39	42	43	45	45
Fuel per Peak Traveler (gallons)	23	22	21	22	20	19
Rank	37	37	37	34	37	36
Annual Delay						
Total Delay (1000s of person-hours)	18,234	17,025	15,536	15,053	13,242	12,164
Rank	38	38	40	40	44	45
Delay per Peak Traveler (person-hrs)	35	35	33	35	32	31
Rank	35	34	35	28	34	33
Delay due to Incidents (percent)	55	55	54	54	54	54
Travel Time Index	1.18	1.17	1.16	1.16	1.14	1.13
Rank	39	42	44	43	50	52
Congestion Cost						
Total Cost (\$ millions)	346	309	270	255	221	198
Rank	37	38	40	40	43	45
Cost per Peak Traveler (\$)	671	628	578	585	534	510
Rank	35	34	33	30	34	34

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 Raleigh-Durham, NC, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	710	690	650	630	610	590
Rank	50	52	53	54	55	55
Urban Area (square miles)	575	540	520	510	505	500
Popn Density (persons/sq mile)	1,235	1,278	1,250	1,235	1,208	1,180
Peak Travelers (1000s)	363	348	324	310	296	283
Freeway						
Daily Vehicle-Miles of Travel (1000s)	6,705	6,550	6,395	5,955	5,870	5,530
Lane Miles	550	535	520	500	480	470
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	9,640	9,215	8,840	8,100	7,555	7,190
Lane Miles	1,805	1,725	1,610	1,520	1,500	1,480
Public Transportation						
Annual Psgr-Miles of Travel (millions)	43	43	42	39	32	33
Annual Unlinked Psgr Trips (millions)	12	10	10	10	10	10
Cost Components						
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)	1.05	1.02	1.14	1.21	1.13	1.02
System Performance						
Congested Travel (% of peak VMT)	38	35	36	35	34	32
Congested System (% of lane-miles)	41	41	41	38	38	38
Congested Time (number of "Rush Hours")	5.4	5.4	5.6	5.4	5.2	4.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	121	124	118	109	111	111
Transit Riders or Carpoolers (millions)	29	30	29	26	26	25
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	6,792	6,191	6,176	5,155	4,827	4,411
Rank	46	48	44	46	46	46
Fuel per Peak Traveler (gallons)	19	18	19	17	16	16
Rank	41	42	37	40	39	39
Annual Delay						
Total Delay (1000s of person-hours)	10,944	9,947	9,942	8,405	7,833	7,111
Rank	46	48	43	45	46	45
Delay per Peak Traveler (person-hrs)	30	29	31	27	26	25
Rank	39	40	34	37	38	36
Delay due to Incidents (percent)	54	54	54	54	54	54
Travel Time Index						
Rank	54	54	51	54	51	48
Congestion Cost						
Total Cost (\$ millions)	169	150	149	123	111	98
Rank	47	48	44	44	46	46
Cost per Peak Traveler (\$)	465	431	460	397	376	345
Rank	38	40	36	36	37	36

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 Raleigh-Durham, NC, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	565	550	520	500	490	465
Rank	57	57	58	61	61	63
Urban Area (square miles)	495	490	450	425	400	375
Popn Density (persons/sq mile)	1,141	1,122	1,156	1,176	1,225	1,240
Peak Travelers (1000s)	268	257	240	228	221	209
Freeway						
Daily Vehicle-Miles of Travel (1000s)	5,190	5,080	4,600	4,200	3,900	3,400
Lane Miles	455	430	400	370	340	315
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	6,880	6,560	6,200	6,025	5,765	5,385
Lane Miles	1,455	1,415	1,355	1,310	1,220	1,165
Public Transportation						
Annual Psgr-Miles of Travel (millions)	33	31	24	12	19	13
Annual Unlinked Psgr Trips (millions)	9	9	7	4	3	5
Cost Components						
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)	1.07	1.08	1.12	1.08	1.08	1.00
System Performance						
Congested Travel (% of peak VMT)	29	28	26	26	25	22
Congested System (% of lane-miles)	36	33	35	36	32	31
Congested Time (number of "Rush Hours")	4.6	4.8	4.4	4.4	4.6	4.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	125	134	117	126	138	121
Transit Riders or Carpoolers (millions)	28	29	25	27	30	25
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	3,875	3,250	3,172	3,153	2,650	2,101
Rank	47	50	48	47	47	51
Fuel per Peak Traveler (gallons)	14	13	13	14	12	10
Rank	41	41	37	33	36	38
Annual Delay						
Total Delay (1000s of person-hours)	6,402	5,306	5,446	5,299	4,437	3,576
Rank	47	50	47	46	47	51
Delay per Peak Traveler (person-hrs)	24	21	23	23	20	17
Rank	37	37	34	30	33	36
Delay due to Incidents (percent)	54	54	54	54	54	53
Travel Time Index						
Rank	49	51	48	48	46	49
Congestion Cost						
Total Cost (\$ millions)	86	69	69	65	51	39
Rank	47	49	46	46	47	50
Cost per Peak Traveler (\$)	321	269	288	287	231	187
Rank	37	37	34	29	32	36

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 Raleigh-Durham, NC, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	455	430	410	390	380	365
Rank	63	65	65	65	65	66
Urban Area (square miles)	350	325	300	280	260	240
Popn Density (persons/sq mile)	1,300	1,323	1,367	1,393	1,462	1,521
Peak Travelers (1000s)	202	190	180	170	164	156
Freeway						
Daily Vehicle-Miles of Travel (1000s)	3,000	2,700	2,400	2,200	1,900	1,600
Lane Miles	295	285	265	255	245	235
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	5,205	5,135	4,735	4,120	4,040	3,635
Lane Miles	1,110	1,075	1,065	1,015	975	905
Public Transportation						
Annual Psgr-Miles of Travel (millions)	14	14	15	13	13	13
Annual Unlinked Psgr Trips (millions)	5	5	5	4	4	4
Cost Components						
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)	1.00	0.98	1.28	1.29	1.32	1.38
System Performance						
Congested Travel (% of peak VMT)	21	18	17	15	14	13
Congested System (% of lane-miles)	30	26	26	26	22	22
Congested Time (number of "Rush Hours")	3.8	3.6	3.0	2.9	2.8	2.6
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	132	--	--	--	--	--
Transit Riders or Carpoolers (millions)	27	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	1,863	1,528	1,307	1,030	842	697
Rank	49	54	52	59	60	62
Fuel per Peak Traveler (gallons)	9	8	7	6	5	4
Rank	38	42	41	46	46	48
Annual Delay						
Total Delay (1000s of person-hours)	3,234	2,625	2,313	1,799	1,453	1,200
Rank	49	52	51	58	59	61
Delay per Peak Traveler (person-hrs)	16	14	13	11	9	8
Rank	38	41	39	44	46	48
Delay due to Incidents (percent)	53	53	53	53	53	53
Travel Time Index						
Rank	47	52	49	51	53	50
Congestion Cost						
Total Cost (\$ millions)	34	27	23	18	14	11
Rank	48	51	50	57	59	61
Cost per Peak Traveler (\$)	169	141	130	104	84	71
Rank	38	40	39	44	46	46

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

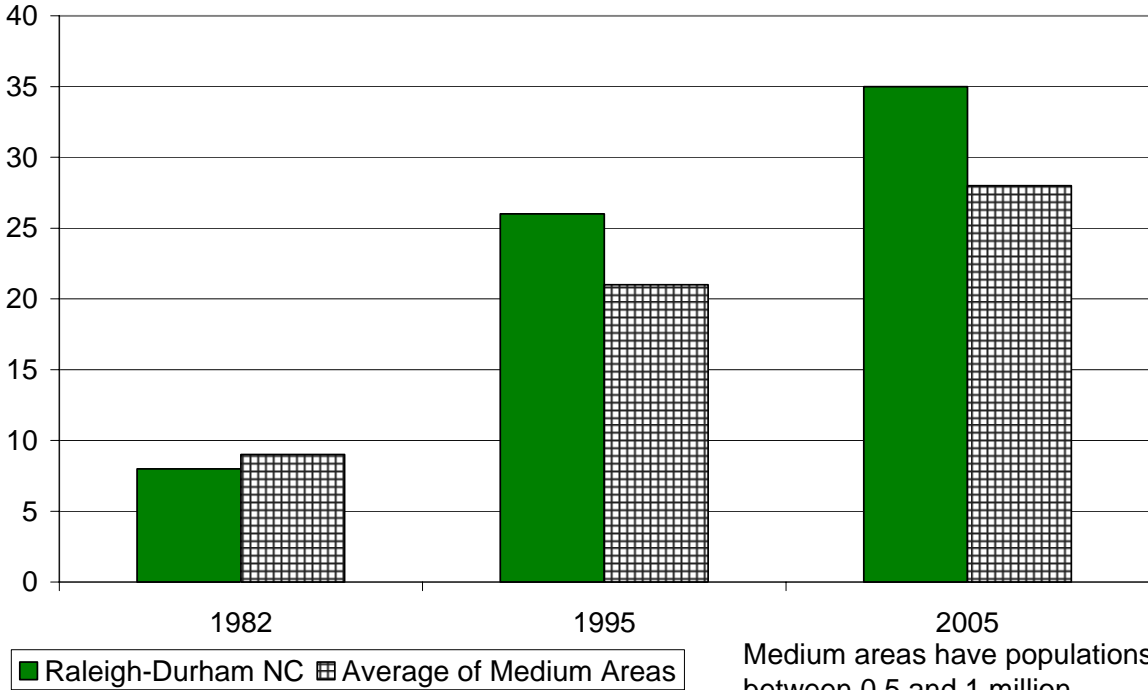
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for Raleigh-Durham, NC

Operations Strategies	2005	2004	2003	2002	2001	2000
Freeway Ramp Metering						
Percent of Roadway Miles	--	--	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--	--	--
Freeway Incident Management						
Cameras						
Percent of Roadway Miles	34	33	32	32	30	26
Service Patrols						
Percent of Roadway Miles	65	71	39	39	34	32
Annual Delay Reduction (1000 hours)	351	319	143	120	96	69
Arterial Signal Coordination						
Percent of Roadway Miles	49	36	37	38	39	42
Annual Delay Reduction (1000 hours)	43	54	52	53	62	45
Arterial Access Management						
Percent of Roadway Miles	11	8	8	7	7	8
Annual Delay Reduction (1000 hours)	43	32	30	39	41	58
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	437	405	224	212	199	172
Annual Delay Saved per Peak Traveler (hours)	1	1	0	0	0	0
Annual Congestion Cost Savings (\$million)	8.5	7.5	4.0	3.7	3.4	2.9
Travel Time Index with Strategies	1.176	1.168	1.160	1.155	1.141	1.135
Travel Time Index (Base)	1.180	1.173	1.162	1.158	1.143	1.137
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	66	54	52	52	50	44
Unlinked Passenger Trips (million)	15	14	13	13	12	12
Travel Time Index (combined road and transit)	1.173	1.167	1.158	1.154	1.139	1.133
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.185	1.177	1.166	1.160	1.145	1.139
Annual Delay Increase (1000 hours)	742	562	443	376	338	276
Annual Delay Increase per Peak Traveler (hours)	1	1	1	1	1	1
Annual Congestion Cost Increase (\$million)	14.1	10.2	7.7	6.4	5.7	4.5

Growth in Delay per Peak Traveler

Hours of Delay



Growth in Total Delay

Annual Hours of Delay (million)

