

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 New Haven, CT

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	560	555	550	545	540	525
Rank	67	67	67	67	67	67
Urban Area (square miles)	350	350	350	350	345	325
Popn Density (persons/sq mile)	1,600	1,586	1,571	1,557	1,565	1,615
Peak Travelers (1000s)	304	300	295	289	283	271
Freeway						
Daily Vehicle-Miles of Travel (1000s)	7,465	7,310	7,450	7,505	7,200	6,800
Lane Miles	520	520	520	520	510	500
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	4,310	4,310	4,270	4,145	3,705	3,695
Lane Miles	1,015	1,015	1,005	995	965	945
Public Transportation						
Annual Psgr-Miles of Travel (millions)	25	28	29	43	42	42
Annual Unlinked Psgr Trips (millions)	8	8	8	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)	2.35	2.08	1.60	1.46	1.77	1.70
System Performance						
Congested Travel (% of peak VMT)	38	35	38	36	35	31
Congested System (% of lane-miles)	32	30	32	32	30	28
Congested Time (number of "Rush Hours")	6.0	5.8	6.0	6.0	5.8	5.6
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	36	44	70	90	90	86
Transit Riders or Carpoolers (millions)	10	12	18	24	23	22
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	4,227	3,789	4,299	4,327	4,202	3,687
Rank	64	64	61	62	59	64
Fuel per Peak Traveler (gallons)	14	13	15	15	15	14
Rank	52	58	48	49	46	49
Annual Delay						
Total Delay (1000s of person-hours)	5,706	5,312	5,944	6,016	5,864	5,358
Rank	66	66	66	65	65	65
Delay per Peak Traveler (person-hrs)	19	18	20	21	21	20
Rank	59	63	57	55	54	59
Delay due to Incidents (percent)	55	55	54	54	55	55
Travel Time Index						
Rank	1.11	1.10	1.11	1.11	1.12	1.11
Rank	57	61	57	57	56	58
Congestion Cost						
Total Cost (\$ millions)	104	92	100	98	96	84
Rank	66	66	66	65	65	65
Cost per Peak Traveler (\$)	343	308	337	339	338	310
Rank	62	64	58	56	55	61

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 New Haven, CT, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	520	515	505	495	485	475
Rank	67	65	65	66	68	68
Urban Area (square miles)	310	300	285	270	255	245
Popn Density (persons/sq mile)	1,677	1,717	1,772	1,833	1,902	1,939
Peak Travelers (1000s)	266	260	251	244	236	228
Freeway						
Daily Vehicle-Miles of Travel (1000s)	6,400	6,000	5,500	5,000	4,830	4,700
Lane Miles	485	470	450	435	420	405
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	3,685	3,390	3,240	3,105	3,030	2,920
Lane Miles	920	910	880	845	815	795
Public Transportation						
Annual Psgr-Miles of Travel (millions)	42	28	32	32	36	34
Annual Unlinked Psgr Trips (millions)	12	11	12	13	14	13
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)	1.24	1.22	1.39	1.47	1.34	1.18
System Performance						
Congested Travel (% of peak VMT)	31	31	29	26	26	26
Congested System (% of lane-miles)	32	35	35	32	32	32
Congested Time (number of "Rush Hours")	5.2	4.8	4.4	3.8	3.8	4.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	81	67	55	45	36	29
Transit Riders or Carpoolers (millions)	20	16	13	10	8	6
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	3,621	3,149	2,560	2,060	2,144	1,978
Rank	63	63	63	63	63	64
Fuel per Peak Traveler (gallons)	14	12	10	8	9	9
Rank	55	58	65	66	62	59
Annual Delay						
Total Delay (1000s of person-hours)	5,343	4,641	3,728	3,008	3,130	2,864
Rank	63	63	63	66	64	66
Delay per Peak Traveler (person-hrs)	20	18	15	12	13	13
Rank	61	63	67	68	64	64
Delay due to Incidents (percent)	54	54	53	53	53	53
Travel Time Index						
Rank	59	60	63	65	60	61
Congestion Cost						
Total Cost (\$ millions)	79	67	54	42	43	38
Rank	63	63	63	67	64	67
Cost per Peak Traveler (\$)	298	258	213	174	182	166
Rank	61	63	66	68	64	63

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 New Haven, CT, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	465	460	455	455	450	445
Rank	68	68	67	66	65	65
Urban Area (square miles)	235	230	230	230	225	225
Popn Density (persons/sq mile)	1,979	2,000	1,978	1,978	2,000	1,978
Peak Travelers (1000s)	220	215	210	207	203	200
Freeway						
Daily Vehicle-Miles of Travel (1000s)	4,605	4,460	4,285	4,320	4,300	4,185
Lane Miles	390	375	375	375	375	375
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	2,810	2,680	2,520	2,495	2,480	2,480
Lane Miles	755	740	735	735	725	720
Public Transportation						
Annual Psgr-Miles of Travel (millions)	37	34	34	29	31	30
Annual Unlinked Psgr Trips (millions)	14	13	12	9	9	10
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)	1.23	1.26	1.23	1.12	1.21	1.12
System Performance						
Congested Travel (% of peak VMT)	26	26	23	21	21	20
Congested System (% of lane-miles)	28	28	23	20	20	17
Congested Time (number of "Rush Hours")	4.2	4.2	3.6	3.8	3.8	3.4
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	24	21	20	29	49	52
Transit Riders or Carpoolers (millions)	6	5	4	6	10	11
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	1,896	1,644	1,263	1,224	1,195	1,105
Rank	63	63	65	65	65	65
Fuel per Peak Traveler (gallons)	9	8	6	6	6	6
Rank	59	59	63	61	61	63
Annual Delay						
Total Delay (1000s of person-hours)	2,754	2,437	1,934	1,916	1,888	1,759
Rank	64	64	65	65	65	65
Delay per Peak Traveler (person-hrs)	12	11	9	9	9	9
Rank	64	63	65	64	64	63
Delay due to Incidents (percent)	53	53	52	52	52	52
Travel Time Index						
Rank	57	57	64	64	62	63
Congestion Cost						
Total Cost (\$ millions)	36	31	24	23	21	18
Rank	64	66	66	65	65	65
Cost per Peak Traveler (\$)	161	143	112	109	103	92
Rank	64	64	65	65	64	63

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

The Mobility Data for New Haven, CT, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	445	440	440	435	435	430
Rank	65	63	63	63	62	62
Urban Area (square miles)	225	225	220	220	215	215
Popn Density (persons/sq mile)	1,978	1,956	2,000	1,977	2,023	2,000
Peak Travelers (1000s)	198	194	193	189	188	184
Freeway						
Daily Vehicle-Miles of Travel (1000s)	4,030	3,750	3,515	3,265	3,100	3,250
Lane Miles	370	370	370	370	365	365
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	2,470	2,470	2,470	2,200	2,195	2,155
Lane Miles	720	715	715	710	710	705
Public Transportation						
Annual Psgr-Miles of Travel (millions)	32	33	38	42	42	42
Annual Unlinked Psgr Trips (millions)	10	10	12	12	12	12
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)	1.12	1.09	1.43	1.44	1.48	1.55
System Performance						
Congested Travel (% of peak VMT)	19	17	16	14	13	13
Congested System (% of lane-miles)	20	22	22	22	18	15
Congested Time (number of "Rush Hours")	3.2	2.9	2.8	2.6	2.6	2.7
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	41	--	--	--	--	--
Transit Riders or Carpoolers (millions)	8	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	986	940	834	634	545	541
Rank	63	64	65	65	65	63
Fuel per Peak Traveler (gallons)	5	5	4	3	3	3
Rank	61	59	60	64	65	63
Annual Delay						
Total Delay (1000s of person-hours)	1,555	1,535	1,377	1,043	885	858
Rank	64	64	65	66	66	65
Delay per Peak Traveler (person-hrs)	8	8	7	6	5	5
Rank	64	58	61	66	65	63
Delay due to Incidents (percent)	52	52	52	52	52	52
Travel Time Index						
Rank	61	61	59	64	64	62
Congestion Cost						
Total Cost (\$ millions)	16	15	13	10	8	8
Rank	64	64	65	66	66	65
Cost per Peak Traveler (\$)	80	77	70	52	43	42
Rank	64	59	61	67	67	63

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

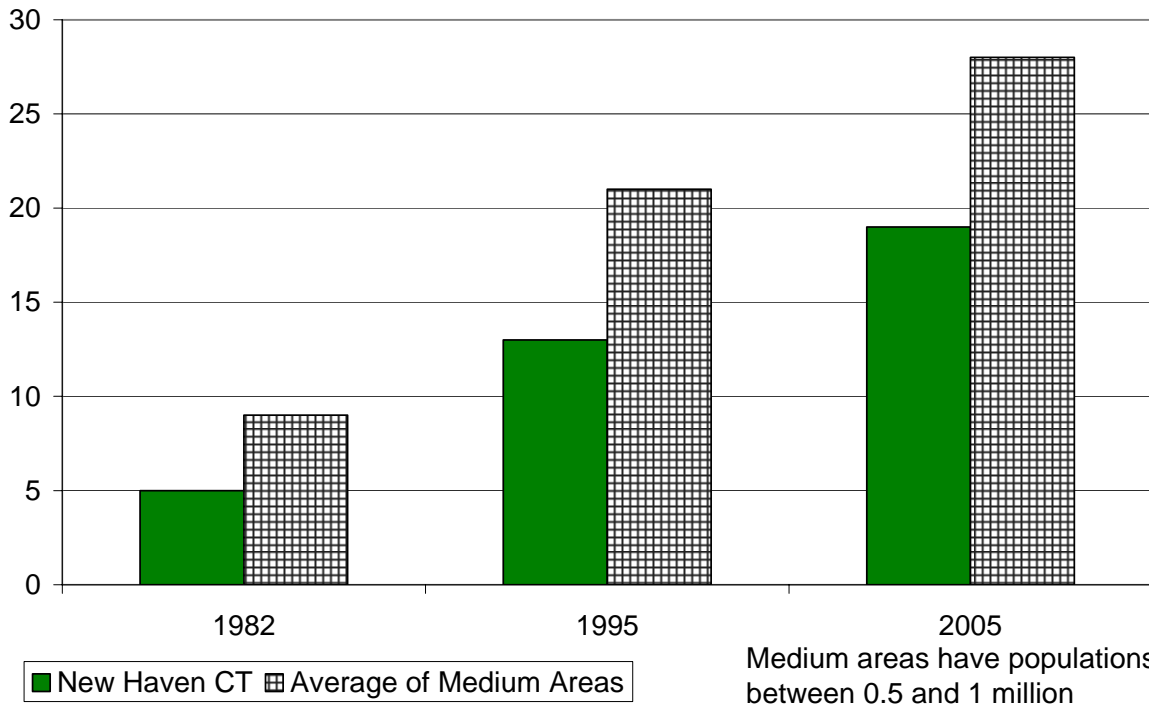
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for New Haven, CT

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	26	26	23	23	24	24
Service Patrols						
Percent of Roadway Miles	42	42	38	38	35	34
Annual Delay Reduction (1000 hours)	101	89	101	111	117	103
Arterial Signal Coordination						
Percent of Roadway Miles	52	52	52	52	54	54
Annual Delay Reduction (1000 hours)	43	47	51	46	44	39
Arterial Access Management						
Percent of Roadway Miles	8	8	8	8	9	9
Annual Delay Reduction (1000 hours)	67	62	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)	211	197	212	219	198	188
Annual Delay Saved per Peak Traveler (hours)	1	1	1	1	1	1
Annual Congestion Cost Savings (\$million)	3.8	3.4	3.5	3.5	3.2	2.9
Travel Time Index with Strategies	1.111	1.100	1.113	1.115	1.120	1.108
Travel Time Index (Base)	1.114	1.103	1.117	1.118	1.123	1.111
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	25	28	29	43	42	42
Unlinked Passenger Trips (million)	8	8	8	13	12	12
Travel Time Index (combined road and transit)	1.110	1.099	1.112	1.113	1.118	1.107
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.116	1.105	1.119	1.123	1.127	1.115
Annual Delay Increase (1000 hours)	158	140	195	316	315	294
Annual Delay Increase per Peak Traveler (hours)	1	0	1	1	1	1
Annual Congestion Cost Increase (\$million)	2.9	2.5	3.3	5.2	5.2	4.6

Growth in Delay per Peak Traveler

Hours of Delay



Annual Hours of Delay (million)

Growth in Total Delay

