

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 Large Group – 1 million to 3 million population urban areas

Urban Area	Delay per Traveler	Travel Time Index	Total Delay	1982 to 2005	
				Delay per Traveler	Total Delay
San Diego, CA	H+	H+	H+	F+	F+
Minneapolis-St. Paul, MN	H	0	H+	F+	F+
Baltimore, MD	H	H	H+	F	F+
Tampa-St. Petersburg, FL	H+	H	H+	S	F+
St. Louis, MO-IL	L	L-	0	S	0
Denver-Aurora, CO	H+	H+	H+	F+	F+
Pittsburgh, PA	L-	L-	L-	S-	S-
Riverside-San Bernardino, CA	H+	H+	H+	F+	F+
Cleveland, OH	L-	L-	L-	S-	S-
Sacramento, CA	H	H+	H	0	F+
Portland, OR-WA	0	H	0	0	0
San Jose, CA	H+	H+	H+	F	F+
Cincinnati, OH-KY-IN	L-	L	L	S	S-
Virginia Beach, VA	L	L	L	S-	S-
Kansas City, MO-KS	L-	L-	L-	S-	S-
Milwaukee, WI	L-	L-	L-	S-	S-
Las Vegas, NV	0	H	L	F	0
Orlando, FL	H+	H	H	F+	F+
San Antonio, TX	0	0	L	F	S
Providence, RI-MA	L-	L-	L-	0	S-
Columbus, OH	L	L	L	F	S-
Buffalo, NY	L-	L-	L-	S-	S-
New Orleans, LA	L-	L-	L-	S-	S-
Indianapolis, IN	H	0	L	0	S-
Memphis, TN-MS-AR	L	L-	L-	0	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 Baltimore, MD

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	2,315	2,315	2,310	2,295	2,210	2,175
Rank	17	17	17	17	17	17
Urban Area (square miles)	770	770	770	765	755	750
Popn Density (persons/sq mile)	3,006	3,006	3,000	3,000	2,927	2,900
Peak Travelers (1000s)	1,278	1,271	1,261	1,235	1,169	1,133
Freeway						
Daily Vehicle-Miles of Travel (1000s)	26,455	26,335	26,050	25,430	23,555	22,660
Lane Miles	1,540	1,540	1,530	1,520	1,480	1,475
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	18,720	18,440	18,430	17,830	16,640	16,490
Lane Miles	3,285	3,275	3,270	3,230	3,200	3,170
Public Transportation						
Annual Psgr-Miles of Travel (millions)	659	659	643	635	617	606
Annual Unlinked Psgr Trips (millions)	105	114	113	117	112	115
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)	2.32	1.95	1.52	1.42	1.63	1.57
System Performance						
Congested Travel (% of peak VMT)	66	66	66	66	60	56
Congested System (% of lane-miles)	50	50	50	50	45	43
Congested Time (number of "Rush Hours")	7.4	7.4	7.4	7.4	7.2	7.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	140	157	157	149	83	75
Transit Riders or Carpoolers (millions)	46	51	51	47	25	22
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	40,814	39,952	38,996	36,620	29,705	26,419
Rank	18	16	16	17	19	20
Fuel per Peak Traveler (gallons)	32	31	31	30	25	23
Rank	12	14	13	12	22	27
Annual Delay						
Total Delay (1000s of person-hours)	56,769	55,184	54,088	50,827	41,314	37,322
Rank	18	18	17	18	21	22
Delay per Peak Traveler (person-hrs)	44	43	43	41	35	33
Rank	22	21	16	18	25	31
Delay due to Incidents (percent)	55	55	55	55	55	55
Travel Time Index						
Rank	1.30	1.29	1.29	1.28	1.24	1.22
Rank	18	18	17	14	23	25
Congestion Cost						
Total Cost (\$ millions)	1,126	1,044	984	905	727	637
Rank	17	16	16	16	19	20
Cost per Peak Traveler (\$)	881	821	780	733	622	562
Rank	19	16	12	14	21	28

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 Baltimore, MD, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	2,160	2,155	2,150	2,145	2,140	2,130
Rank	17	17	17	17	17	16
Urban Area (square miles)	745	745	740	740	735	725
Popn Density (persons/sq mile)	2,899	2,893	2,905	2,899	2,912	2,938
Peak Travelers (1000s)	1,106	1,086	1,066	1,047	1,027	1,007
Freeway						
Daily Vehicle-Miles of Travel (1000s)	21,755	21,290	20,775	20,435	19,770	18,945
Lane Miles	1,470	1,460	1,440	1,435	1,395	1,385
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	16,370	16,560	16,290	16,370	16,380	16,370
Lane Miles	3,150	3,140	3,135	3,130	3,115	3,115
Public Transportation						
Annual Psgr-Miles of Travel (millions)	563	548	532	504	522	531
Annual Unlinked Psgr Trips (millions)	107	107	104	101	109	107
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)	1.10	1.08	1.19	1.29	1.23	1.08
System Performance						
Congested Travel (% of peak VMT)	54	51	50	49	49	46
Congested System (% of lane-miles)	43	42	42	42	42	40
Congested Time (number of "Rush Hours")	6.6	6.6	6.4	6.4	6.4	6.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	72	88	90	137	129	152
Transit Riders or Carpoolers (millions)	20	25	25	38	36	41
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	24,981	23,866	24,027	23,131	22,700	20,660
Rank	20	20	20	20	18	18
Fuel per Peak Traveler (gallons)	23	22	23	22	22	21
Rank	31	28	27	26	23	26
Annual Delay						
Total Delay (1000s of person-hours)	35,706	34,976	35,867	34,621	34,003	31,793
Rank	22	22	20	21	19	19
Delay per Peak Traveler (person-hrs)	32	32	34	33	33	32
Rank	35	33	29	27	22	24
Delay due to Incidents (percent)	55	55	56	57	57	58
Travel Time Index						
Rank	1.21	1.20	1.21	1.20	1.20	1.18
Rank	28	28	25	26	21	22
Congestion Cost						
Total Cost (\$ millions)	576	549	560	530	506	455
Rank	20	20	19	19	18	16
Cost per Peak Traveler (\$)	521	506	525	506	493	452
Rank	31	30	25	22	18	18

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 Baltimore, MD, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	2,110	2,040	2,020	1,990	1,915	1,905
Rank	16	16	16	16	17	16
Urban Area (square miles)	715	650	600	575	540	530
Popn Density (persons/sq mile)	2,951	3,138	3,367	3,461	3,546	3,594
Peak Travelers (1000s)	981	934	909	882	843	831
Freeway						
Daily Vehicle-Miles of Travel (1000s)	18,030	17,625	16,045	15,800	15,000	13,920
Lane Miles	1,375	1,350	1,250	1,240	1,230	1,205
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	16,400	16,000	15,690	15,580	14,930	14,700
Lane Miles	3,115	3,075	2,940	2,920	2,895	2,820
Public Transportation						
Annual Psgr-Miles of Travel (millions)	533	492	487	386	391	394
Annual Unlinked Psgr Trips (millions)	106	106	111	113	108	119
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)	1.14	1.18	1.13	1.08	1.11	1.02
System Performance						
Congested Travel (% of peak VMT)	46	43	43	43	41	38
Congested System (% of lane-miles)	43	42	42	39	39	37
Congested Time (number of "Rush Hours")	5.8	5.6	5.6	5.6	5.2	4.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	169	162	139	170	187	227
Transit Riders or Carpoolers (millions)	45	43	37	44	47	56
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	19,913	18,564	18,603	18,438	16,395	13,136
Rank	17	17	17	16	17	18
Fuel per Peak Traveler (gallons)	20	20	20	21	19	16
Rank	20	18	15	15	16	19
Annual Delay						
Total Delay (1000s of person-hours)	30,715	29,080	30,106	29,750	26,370	20,956
Rank	18	18	16	16	17	18
Delay per Peak Traveler (person-hrs)	31	31	33	34	31	25
Rank	19	16	13	13	16	20
Delay due to Incidents (percent)	58	58	58	59	59	57
Travel Time Index						
Rank	21	21	17	16	18	20
Congestion Cost						
Total Cost (\$ millions)	426	394	398	382	316	236
Rank	16	17	17	17	17	18
Cost per Peak Traveler (\$)	434	422	438	433	375	284
Rank	16	17	13	12	13	18

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 Baltimore, MD, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	1,875	1,860	1,840	1,820	1,750	1,700
Rank	16	15	15	15	16	18
Urban Area (square miles)	525	520	520	520	490	450
Popn Density (persons/sq mile)	3,571	3,577	3,538	3,500	3,571	3,778
Peak Travelers (1000s)	812	798	784	770	735	706
Freeway						
Daily Vehicle-Miles of Travel (1000s)	13,735	13,015	12,225	10,870	9,250	8,520
Lane Miles	1,200	1,180	1,180	1,025	900	885
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	14,350	13,940	13,470	13,105	12,500	11,180
Lane Miles	2,770	2,750	2,745	2,740	2,600	2,500
Public Transportation						
Annual Psgr-Miles of Travel (millions)	386	361	354	408	408	408
Annual Unlinked Psgr Trips (millions)	112	113	108	110	110	110
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)	1.03	1.00	1.31	1.33	1.36	1.42
System Performance						
Congested Travel (% of peak VMT)	35	34	29	30	27	23
Congested System (% of lane-miles)	35	35	35	36	31	31
Congested Time (number of "Rush Hours")	4.8	4.4	3.8	4.0	3.8	3.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	292	--	--	--	--	--
Transit Riders or Carpoolers (millions)	72	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	11,909	10,735	8,415	8,140	6,422	4,852
Rank	18	18	18	19	18	20
Fuel per Peak Traveler (gallons)	15	13	11	11	9	7
Rank	19	19	29	22	28	33
Annual Delay						
Total Delay (1000s of person-hours)	19,230	17,432	13,646	13,249	10,778	8,029
Rank	18	18	18	18	17	20
Delay per Peak Traveler (person-hrs)	24	22	17	17	15	11
Rank	18	20	29	23	26	36
Delay due to Incidents (percent)	56	56	56	56	56	55
Travel Time Index						
Rank	21	18	25	22	22	27
Congestion Cost						
Total Cost (\$ millions)	209	181	141	133	105	76
Rank	18	17	18	18	17	20
Cost per Peak Traveler (\$)	257	227	180	173	143	108
Rank	18	18	28	20	27	35

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

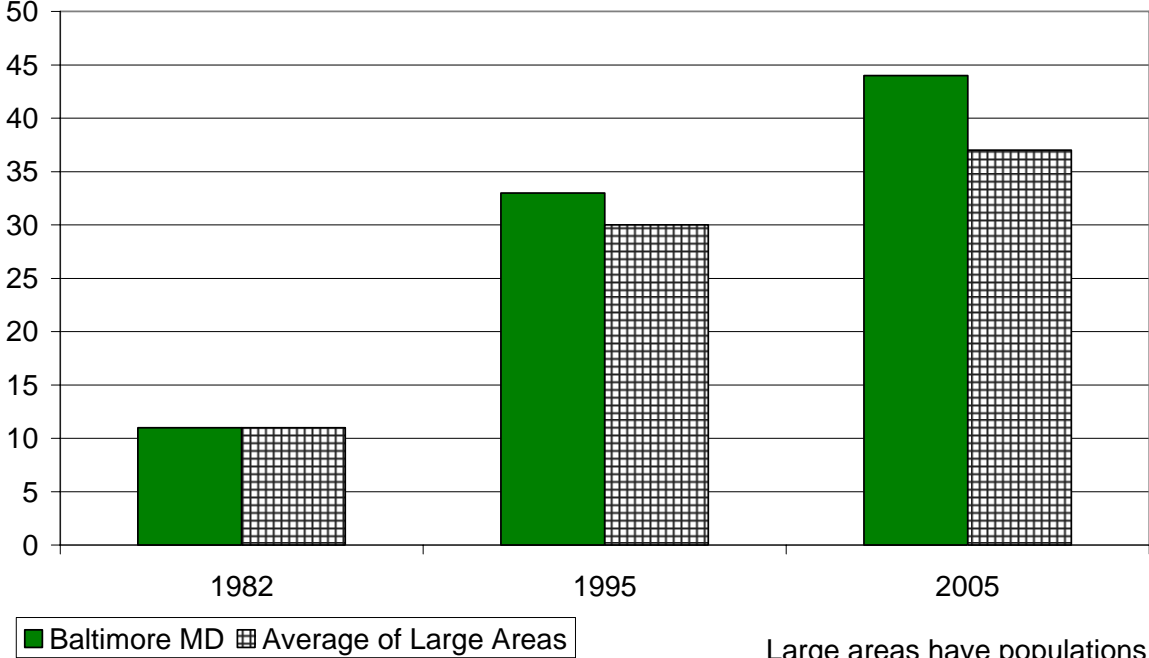
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for Baltimore, MD

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	27	27	27	27	28	28
Service Patrols						
Percent of Roadway Miles	69	70	69	70	71	97
Annual Delay Reduction (1000 hours)	1,940	1,880	1,814	1,731	1,451	1,664
Arterial Signal Coordination						
Percent of Roadway Miles	37	37	37	37	38	38
Annual Delay Reduction (1000 hours)	210	167	172	191	103	105
Arterial Access Management						
Percent of Roadway Miles	25	24	23	20	19	19
Annual Delay Reduction (1000 hours)	693	676	636	477	591	488
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	2,843	2,722	2,622	2,399	2,145	2,257
Annual Delay Saved per Peak Traveler (hours)	2	2	2	2	2	2
Annual Congestion Cost Savings (\$million)	56.2	51.6	47.9	43.1	37.9	39.1
Travel Time Index with Strategies	1.299	1.295	1.289	1.278	1.239	1.216
Travel Time Index (Base)	1.312	1.308	1.301	1.290	1.250	1.228
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	659	659	643	635	617	606
Unlinked Passenger Trips (million)	105	114	113	117	112	115
Travel Time Index (combined road and transit)	1.281	1.278	1.272	1.262	1.225	1.204
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.351	1.348	1.339	1.326	1.282	1.260
Annual Delay Increase (1000 hours)	9,923	10,221	9,473	9,282	7,981	7,720
Annual Delay Increase per Peak Traveler (hours)	8	8	8	8	7	7
Annual Congestion Cost Increase (\$million)	199.7	196.5	175.2	168.5	143.1	134.6

Growth in Delay per Peak Traveler

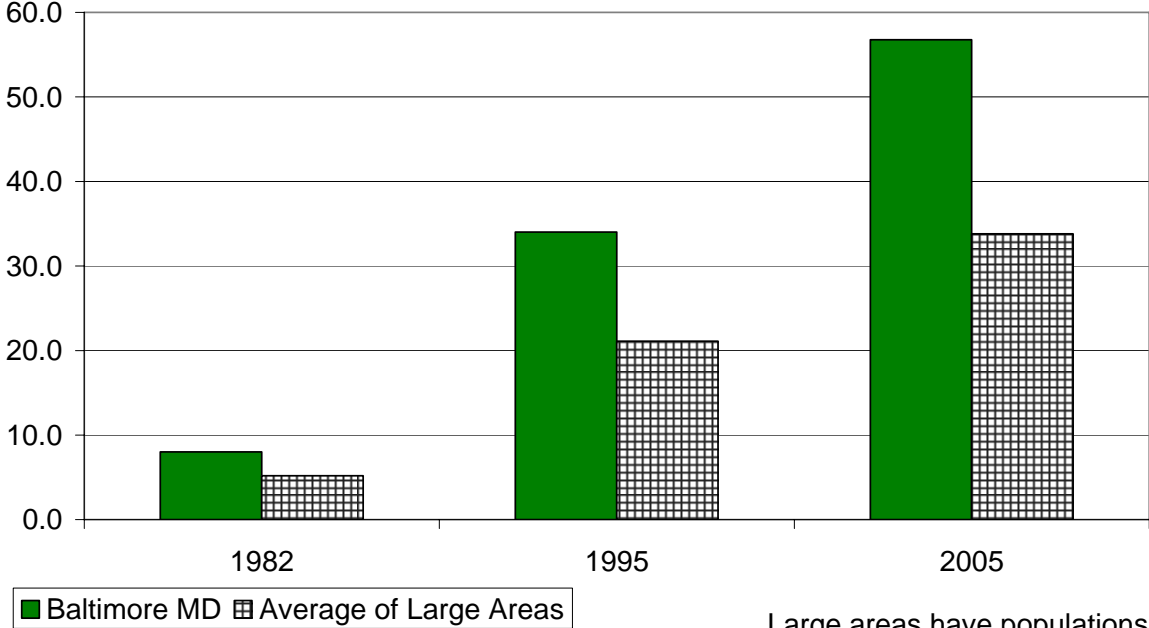
Hours of Delay



Large areas have populations between 1 and 3 million

Growth in Total Delay

Annual Hours of Delay (million)



Large areas have populations between 1 and 3 million