

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 Cleveland, OH

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	1,790	1,790	1,785	1,785	1,785	1,780
Rank	23	22	22	21	21	21
Urban Area (square miles)	895	895	890	850	840	825
Popn Density (persons/sq mile)	2,000	2,000	2,006	2,100	2,125	2,158
Peak Travelers (1000s)	986	983	976	960	946	929
Freeway						
Daily Vehicle-Miles of Travel (1000s)	18,150	18,375	17,390	16,800	16,750	17,285
Lane Miles	1,405	1,400	1,375	1,310	1,280	1,280
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	12,185	12,020	11,800	11,490	11,310	11,105
Lane Miles	3,080	2,950	2,900	2,845	2,800	2,755
Public Transportation						
Annual Psgr-Miles of Travel (millions)	293	252	270	256	280	290
Annual Unlinked Psgr Trips (millions)	67	59	61	57	61	64
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)	2.24	1.81	1.52	1.38	1.30	1.55
System Performance						
Congested Travel (% of peak VMT)	29	32	31	31	34	39
Congested System (% of lane-miles)	27	27	27	27	28	33
Congested Time (number of "Rush Hours")	5.0	5.2	5.0	5.0	5.2	5.4
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	60	71	44	41	61	98
Transit Riders or Carpoolers (millions)	14	17	11	10	15	24
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	8,840	9,729	8,501	8,665	9,350	10,611
Rank	45	43	46	45	42	35
Fuel per Peak Traveler (gallons)	9	10	9	9	10	11
Rank	69	68	67	69	68	63
Annual Delay						
Total Delay (1000s of person-hours)	13,162	14,162	12,351	12,597	13,315	15,093
Rank	46	44	46	46	42	36
Delay per Peak Traveler (person-hrs)	13	14	13	13	14	16
Rank	75	72	72	71	72	68
Delay due to Incidents (percent)	56	56	56	56	56	56
Travel Time Index						
Rank	1.09	1.10	1.09	1.09	1.10	1.12
Rank	64	61	64	67	61	57
Congestion Cost						
Total Cost (\$ millions)	236	243	203	202	210	234
Rank	46	45	46	46	46	36
Cost per Peak Traveler (\$)	240	247	208	210	222	252
Rank	75	72	75	72	72	67

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 Cleveland, OH, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	1,780	1,775	1,775	1,775	1,770	1,770
Rank	21	21	22	21	21	20
Urban Area (square miles)	820	820	800	780	770	740
Popn Density (persons/sq mile)	2,171	2,165	2,219	2,276	2,299	2,392
Peak Travelers (1000s)	915	898	884	872	855	843
Freeway						
Daily Vehicle-Miles of Travel (1000s)	17,260	17,120	16,660	16,020	15,695	15,310
Lane Miles	1,260	1,260	1,250	1,240	1,230	1,220
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	10,795	10,605	10,255	10,020	9,500	9,215
Lane Miles	2,710	2,620	2,450	2,315	2,195	2,110
Public Transportation						
Annual Psgr-Miles of Travel (millions)	296	300	292	284	261	274
Annual Unlinked Psgr Trips (millions)	69	67	67	65	59	61
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)	1.14	1.11	1.13	1.28	1.12	1.08
System Performance						
Congested Travel (% of peak VMT)	40	38	37	34	33	30
Congested System (% of lane-miles)	33	30	30	28	32	30
Congested Time (number of "Rush Hours")	5.6	5.6	5.4	5.2	5.2	5.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	108	124	131	123	108	106
Transit Riders or Carpoolers (millions)	27	31	33	31	28	27
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	11,250	10,622	11,332	9,745	8,976	7,242
Rank	32	33	30	32	31	36
Fuel per Peak Traveler (gallons)	12	12	13	11	10	9
Rank	62	61	53	58	58	60
Annual Delay						
Total Delay (1000s of person-hours)	16,145	15,026	16,619	14,437	13,347	10,591
Rank	34	35	30	34	34	38
Delay per Peak Traveler (person-hrs)	18	17	19	17	16	13
Rank	66	67	60	62	62	63
Delay due to Incidents (percent)	55	55	56	55	55	55
Travel Time Index						
Rank	55	55	46	52	50	54
Congestion Cost						
Total Cost (\$ millions)	237	217	238	203	182	139
Rank	35	34	32	34	35	38
Cost per Peak Traveler (\$)	259	242	270	233	212	165
Rank	66	65	60	62	62	64

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 Cleveland, OH, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	1,765	1,765	1,760	1,760	1,755	1,755
Rank	20	20	20	20	20	20
Urban Area (square miles)	700	840	835	830	825	815
Popn Density (persons/sq mile)	2,521	2,101	2,108	2,120	2,127	2,153
Peak Travelers (1000s)	826	814	799	787	777	770
Freeway						
Daily Vehicle-Miles of Travel (1000s)	14,905	14,125	13,750	13,660	13,175	12,670
Lane Miles	1,210	1,200	1,180	1,180	1,160	1,145
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	8,785	8,490	8,210	7,905	7,810	7,590
Lane Miles	2,015	1,945	1,880	1,820	1,760	1,715
Public Transportation						
Annual Psgr-Miles of Travel (millions)	239	247	284	293	285	311
Annual Unlinked Psgr Trips (millions)	54	59	67	75	75	81
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)	1.09	1.11	1.13	1.06	1.08	1.00
System Performance						
Congested Travel (% of peak VMT)	27	24	23	22	18	15
Congested System (% of lane-miles)	28	26	26	23	18	15
Congested Time (number of "Rush Hours")	4.8	4.4	4.2	4.2	4.0	3.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	102	142	143	150	123	108
Transit Riders or Carpoolers (millions)	26	36	36	38	31	27
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	6,323	5,087	4,751	4,236	3,454	2,650
Rank	36	38	36	39	40	43
Fuel per Peak Traveler (gallons)	8	6	6	5	4	3
Rank	63	66	64	68	70	71
Annual Delay						
Total Delay (1000s of person-hours)	9,290	7,549	7,044	6,173	5,086	3,985
Rank	38	38	39	41	42	46
Delay per Peak Traveler (person-hrs)	11	9	9	8	7	5
Rank	67	71	68	70	71	75
Delay due to Incidents (percent)	54	54	54	54	54	54
Travel Time Index						
Rank	55	60	54	59	65	68
Congestion Cost						
Total Cost (\$ millions)	119	94	86	73	56	42
Rank	38	39	39	40	42	47
Cost per Peak Traveler (\$)	144	115	107	93	72	54
Rank	68	72	69	70	71	75

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 Cleveland, OH, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	1,750	1,750	1,750	1,750	1,750	1,750
Rank	20	18	18	17	16	16
Urban Area (square miles)	805	795	790	785	780	775
Popn Density (persons/sq mile)	2,174	2,201	2,215	2,229	2,244	2,258
Peak Travelers (1000s)	761	754	747	740	735	728
Freeway						
Daily Vehicle-Miles of Travel (1000s)	11,115	10,705	10,305	10,600	10,520	10,000
Lane Miles	1,135	1,115	1,115	1,115	1,115	1,020
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	7,000	6,775	6,585	6,460	6,310	6,205
Lane Miles	1,675	1,620	1,585	1,505	1,450	1,400
Public Transportation						
Annual Psgr-Miles of Travel (millions)	309	334	361	417	417	417
Annual Unlinked Psgr Trips (millions)	78	81	91	95	95	95
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)	10	10	10	10	10	10
Congested System (% of lane-miles)	10	10	10	10	10	10
Congested Time (number of "Rush Hours")	3.0	2.9	2.9	2.9	2.9	3.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	64	--	--	--	--	--
Transit Riders or Carpoolers (millions)	14	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	1,701	1,588	1,492	1,532	1,461	1,390
Rank	53	50	50	45	42	39
Fuel per Peak Traveler (gallons)	2	2	2	2	2	2
Rank	79	78	79	75	74	75
Annual Delay						
Total Delay (1000s of person-hours)	2,619	2,488	2,341	2,374	2,205	2,121
Rank	55	54	50	49	45	40
Delay per Peak Traveler (person-hrs)	3	3	3	3	3	3
Rank	81	80	80	78	77	77
Delay due to Incidents (percent)	54	54	54	54	54	54
Travel Time Index						
Rank	76	74	74	72	69	69
Congestion Cost						
Total Cost (\$ millions)	26	24	23	22	20	19
Rank	55	55	52	50	47	42
Cost per Peak Traveler (\$)	35	32	30	30	27	26
Rank	81	80	80	79	78	78

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

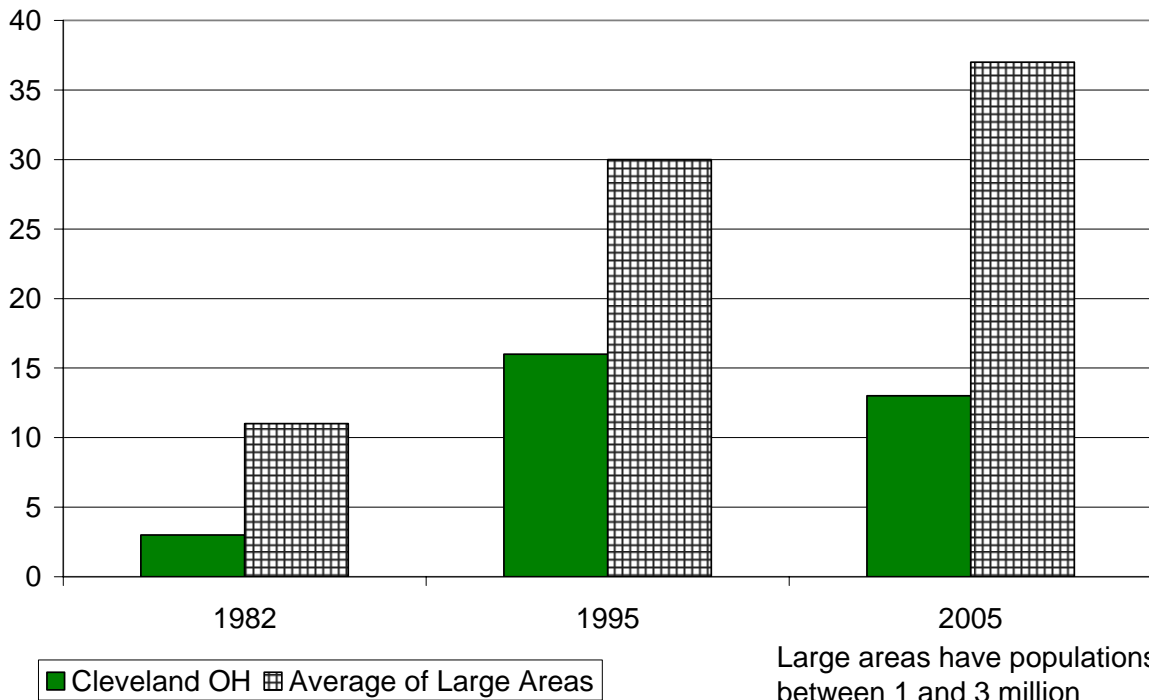
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for Cleveland, OH

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	3	3	2	2	2	2
Service Patrols						
Percent of Roadway Miles	81	81	83	88	89	89
Annual Delay Reduction (1000 hours)	423	480	369	424	487	545
Arterial Signal Coordination						
Percent of Roadway Miles	42	44	38	39	39	36
Annual Delay Reduction (1000 hours)	19	31	27	26	25	66
Arterial Access Management						
Percent of Roadway Miles	9	9	8	8	7	7
Annual Delay Reduction (1000 hours)	46	68	72	58	66	103
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	488	580	467	508	579	714
Annual Delay Saved per Peak Traveler (hours)	0	1	0	1	1	1
Annual Congestion Cost Savings (\$million)	9.0	10.1	7.9	8.3	9.3	11.2
Travel Time Index with Strategies	1.089	1.098	1.089	1.094	1.102	1.115
Travel Time Index (Base)	1.092	1.102	1.092	1.097	1.106	1.120
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	293	252	270	256	280	290
Unlinked Passenger Trips (million)	67	59	61	57	61	64
Travel Time Index (combined road and transit)	1.086	1.095	1.086	1.091	1.099	1.111
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.099	1.110	1.101	1.106	1.118	1.132
Annual Delay Increase (1000 hours)	1,503	1,599	1,583	1,599	1,916	2,060
Annual Delay Increase per Peak Traveler (hours)	2	2	2	2	2	2
Annual Congestion Cost Increase (\$million)	27.4	27.8	26.3	25.9	30.4	32.1

Growth in Delay per Peak Traveler

Hours of Delay



Growth in Total Delay

Annual Hours of Delay (million)

