

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 Pittsburgh, PA

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	1,800	1,800	1,795	1,760	1,765	1,770
Rank	21	21	21	22	22	22
Urban Area (square miles)	1,210	1,210	1,200	1,160	1,130	1,100
Popn Density (persons/sq mile)	1,488	1,488	1,496	1,517	1,562	1,609
Peak Travelers (1000s)	1,003	999	991	964	944	924
Freeway						
Daily Vehicle-Miles of Travel (1000s)	12,330	12,500	12,210	11,700	11,310	11,130
Lane Miles	1,260	1,255	1,250	1,215	1,190	1,190
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	17,760	17,985	18,070	17,805	17,600	17,350
Lane Miles	3,675	3,675	3,670	3,655	3,650	3,645
Public Transportation						
Annual Psgr-Miles of Travel (millions)	316	311	334	353	399	344
Annual Unlinked Psgr Trips (millions)	70	70	71	78	82	79
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)	2.28	1.94	1.51	1.36	1.54	1.51
System Performance						
Congested Travel (% of peak VMT)	26	27	25	27	26	25
Congested System (% of lane-miles)	32	32	31	35	35	35
Congested Time (number of "Rush Hours")	3.6	3.8	3.8	3.6	3.6	3.4
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	55	67	78	61	37	30
Transit Riders or Carpoolers (millions)	12	14	17	13	8	6
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	9,216	9,573	9,281	9,485	9,205	8,813
Rank	44	44	45	42	43	42
Fuel per Peak Traveler (gallons)	9	10	9	10	10	10
Rank	69	68	67	66	68	67
Annual Delay						
Total Delay (1000s of person-hours)	16,159	16,693	16,217	16,424	16,074	15,300
Rank	41	39	39	38	34	35
Delay per Peak Traveler (person-hrs)	16	17	16	17	17	17
Rank	67	65	65	66	65	64
Delay due to Incidents (percent)	58	57	57	56	56	56
Travel Time Index						
Rank	1.09	1.10	1.09	1.10	1.10	1.09
Rank	64	61	64	60	61	65
Congestion Cost						
Total Cost (\$ millions)	285	283	265	260	252	232
Rank	41	40	41	38	36	39
Cost per Peak Traveler (\$)	285	284	267	269	267	251
Rank	69	69	67	67	68	68

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 Pittsburgh, PA, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	1,770	1,775	1,785	1,780	1,775	1,770
Rank	22	21	21	20	20	20
Urban Area (square miles)	1,060	1,020	1,000	945	940	920
Popn Density (persons/sq mile)	1,670	1,740	1,785	1,884	1,888	1,924
Peak Travelers (1000s)	903	884	868	844	822	800
Freeway						
Daily Vehicle-Miles of Travel (1000s)	11,300	10,910	10,540	10,310	10,105	9,420
Lane Miles	1,195	1,190	1,190	1,190	1,190	1,170
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	17,200	17,080	17,175	17,515	17,505	17,275
Lane Miles	3,630	3,620	3,610	3,605	3,590	3,575
Public Transportation						
Annual Psgr-Miles of Travel (millions)	318	324	305	326	322	331
Annual Unlinked Psgr Trips (millions)	78	77	75	76	77	77
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)	1.11	1.06	1.19	1.26	1.19	1.04
System Performance						
Congested Travel (% of peak VMT)	25	24	25	25	25	22
Congested System (% of lane-miles)	35	34	34	34	34	33
Congested Time (number of "Rush Hours")	3.4	3.2	3.0	3.2	3.0	3.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	64	44	47	53	59	60
Transit Riders or Carpoolers (millions)	13	9	9	11	12	12
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	9,432	8,506	8,852	8,939	8,874	7,503
Rank	38	38	37	35	33	35
Fuel per Peak Traveler (gallons)	10	10	10	11	11	9
Rank	67	68	64	61	55	58
Annual Delay						
Total Delay (1000s of person-hours)	16,704	15,106	15,784	15,948	15,884	13,491
Rank	33	34	34	31	30	32
Delay per Peak Traveler (person-hrs)	19	17	18	19	19	17
Rank	64	65	61	57	52	56
Delay due to Incidents (percent)	57	56	56	56	56	55
Travel Time Index						
Rank	64	64	60	55	55	55
Congestion Cost						
Total Cost (\$ millions)	242	213	221	218	211	172
Rank	34	35	34	32	31	32
Cost per Peak Traveler (\$)	269	241	255	259	257	215
Rank	65	66	62	60	53	57

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 Pittsburgh, PA, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	1,770	1,770	1,775	1,780	1,785	1,785
Rank	19	19	19	19	19	19
Urban Area (square miles)	900	820	770	750	730	725
Popn Density (persons/sq mile)	1,967	2,159	2,305	2,373	2,445	2,462
Peak Travelers (1000s)	782	763	747	732	726	721
Freeway						
Daily Vehicle-Miles of Travel (1000s)	9,350	9,135	8,600	8,195	7,800	7,500
Lane Miles	1,170	1,120	1,070	1,020	950	900
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	17,385	17,265	17,730	17,775	17,265	16,895
Lane Miles	3,570	3,565	3,560	3,560	3,550	3,540
Public Transportation						
Annual Psgr-Miles of Travel (millions)	391	307	408	411	396	383
Annual Unlinked Psgr Trips (millions)	81	79	88	87	88	90
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	1.14	1.16	1.30	1.06	0.98
System Performance						
Congested Travel (% of peak VMT)	22	23	24	24	22	22
Congested System (% of lane-miles)	33	33	33	29	29	25
Congested Time (number of "Rush Hours")	3.0	3.0	3.2	3.2	3.2	3.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	88	116	130	148	139	145
Transit Riders or Carpoolers (millions)	17	23	26	29	27	28
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	7,524	7,574	7,975	8,143	6,826	6,628
Rank	33	31	27	25	27	26
Fuel per Peak Traveler (gallons)	10	10	11	11	9	9
Rank	56	50	46	42	46	41
Annual Delay						
Total Delay (1000s of person-hours)	13,496	13,640	14,394	14,586	12,246	11,868
Rank	27	27	24	23	25	25
Delay per Peak Traveler (person-hrs)	17	18	19	20	17	16
Rank	51	48	40	38	40	39
Delay due to Incidents (percent)	55	55	55	55	54	54
Travel Time Index						
Rank	54	50	47	47	47	44
Congestion Cost						
Total Cost (\$ millions)	168	166	172	171	132	121
Rank	30	27	26	25	26	25
Cost per Peak Traveler (\$)	215	218	230	234	182	168
Rank	56	48	41	38	42	40

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 Pittsburgh, PA, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	1,790	1,790	1,790	1,795	1,800	1,810
Rank	18	17	17	16	14	14
Urban Area (square miles)	715	710	710	710	680	680
Popn Density (persons/sq mile)	2,503	2,521	2,521	2,528	2,647	2,662
Peak Travelers (1000s)	716	709	703	698	695	691
Freeway						
Daily Vehicle-Miles of Travel (1000s)	7,190	6,900	6,655	6,460	6,110	5,635
Lane Miles	900	900	880	865	850	800
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	16,170	16,030	15,500	15,065	14,655	14,825
Lane Miles	3,535	3,525	3,525	3,515	3,510	3,510
Public Transportation						
Annual Psgr-Miles of Travel (millions)	403	396	397	360	360	360
Annual Unlinked Psgr Trips (millions)	88	92	90	91	91	91
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)	0.98	0.96	1.25	1.27	1.30	1.35
System Performance						
Congested Travel (% of peak VMT)	21	20	18	18	18	18
Congested System (% of lane-miles)	25	25	25	25	25	25
Congested Time (number of "Rush Hours")	3.0	2.9	2.9	2.8	2.8	2.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	119	--	--	--	--	--
Transit Riders or Carpoolers (millions)	22	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	5,892	5,935	4,929	4,723	4,394	4,390
Rank	25	22	24	22	22	21
Fuel per Peak Traveler (gallons)	8	8	7	7	6	6
Rank	43	41	43	39	41	38
Annual Delay						
Total Delay (1000s of person-hours)	10,508	10,812	8,811	8,545	7,912	7,916
Rank	24	22	23	22	22	21
Delay per Peak Traveler (person-hrs)	15	15	13	12	11	11
Rank	41	35	42	40	38	35
Delay due to Incidents (percent)	54	54	54	54	54	53
Travel Time Index						
Rank	42	39	44	42	41	36
Congestion Cost						
Total Cost (\$ millions)	104	103	84	79	70	68
Rank	25	22	24	22	22	21
Cost per Peak Traveler (\$)	145	146	119	113	101	99
Rank	41	38	42	40	39	37

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

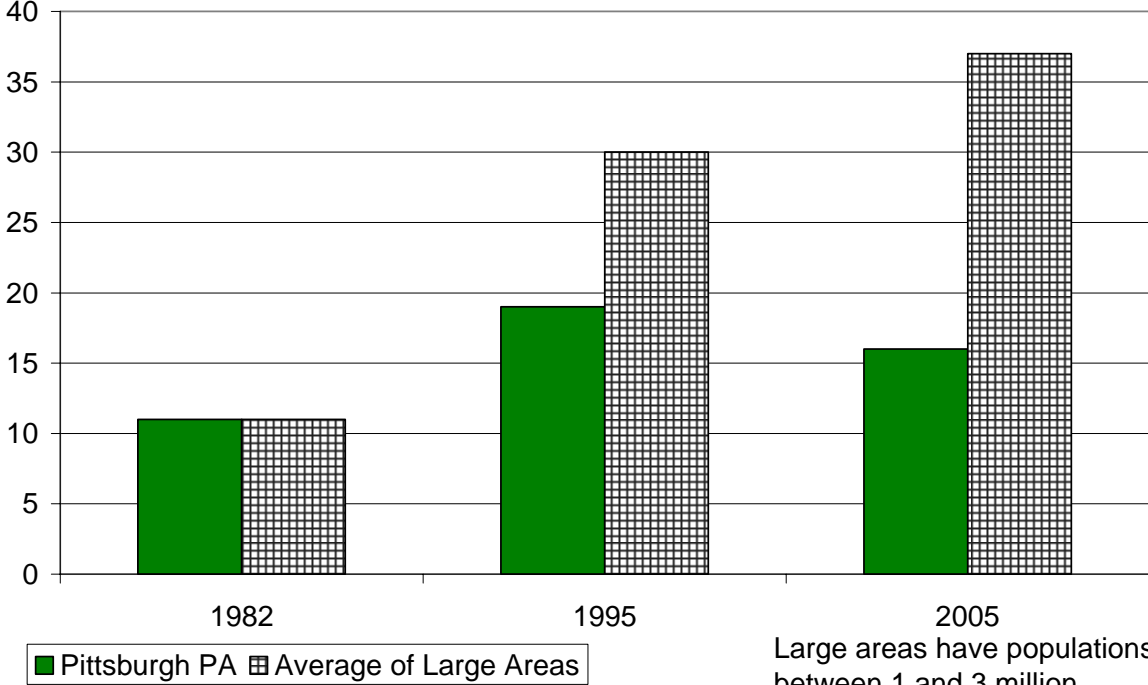
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for Pittsburgh, PA

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	24	24	15	15	15	15
Service Patrols						
Percent of Roadway Miles	17	17	17	17	18	18
Annual Delay Reduction (1000 hours)	164	164	128	110	111	104
Arterial Signal Coordination						
Percent of Roadway Miles	11	11	10	8	7	7
Annual Delay Reduction (1000 hours)	27	29	20	18	5	0
Arterial Access Management						
Percent of Roadway Miles	17	17	16	16	15	15
Annual Delay Reduction (1000 hours)	199	292	330	280	210	232
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	390	485	478	407	325	336
Annual Delay Saved per Peak Traveler (hours)	0	0	0	0	0	0
Annual Congestion Cost Savings (\$million)	7.0	8.3	7.8	6.5	5.2	5.2
Travel Time Index with Strategies	1.093	1.095	1.093	1.097	1.096	1.094
Travel Time Index (Base)	1.094	1.097	1.095	1.099	1.098	1.095
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	316	311	334	353	399	344
Unlinked Passenger Trips (million)	70	70	71	78	82	79
Travel Time Index (combined road and transit)	1.089	1.091	1.089	1.093	1.091	1.089
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.102	1.107	1.103	1.111	1.109	1.107
Annual Delay Increase (1000 hours)	1,882	2,245	2,119	2,770	2,798	2,589
Annual Delay Increase per Peak Traveler (hours)	2	2	2	3	3	3
Annual Congestion Cost Increase (\$million)	33.8	38.6	35.2	44.7	44.8	40.1

Growth in Delay per Peak Traveler

Hours of Delay



Annual Hours of Delay (million)

Growth in Total Delay

