

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 Portland, OR-WA

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	1,730	1,700	1,670	1,615	1,590	1,545
Rank	25	24	25	25	24	24
Urban Area (square miles)	540	535	530	520	515	505
Popn Density (persons/sq mile)	3,204	3,178	3,151	3,106	3,087	3,059
Peak Travelers (1000s)	887	869	850	809	784	749
Freeway						
Daily Vehicle-Miles of Travel (1000s)	13,620	13,085	12,945	12,905	12,670	12,595
Lane Miles	765	750	740	730	720	710
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	13,850	13,555	12,510	11,610	11,440	11,470
Lane Miles	2,480	2,390	2,350	2,310	2,260	2,225
Public Transportation						
Annual Psgr-Miles of Travel (millions)	466	474	453	456	401	393
Annual Unlinked Psgr Trips (millions)	111	106	106	109	97	94
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)	2.48	2.11	1.65	1.52	1.67	1.64
System Performance						
Congested Travel (% of peak VMT)	66	66	65	63	66	66
Congested System (% of lane-miles)	50	50	51	47	47	46
Congested Time (number of "Rush Hours")	7.6	7.4	7.4	7.4	7.4	7.4
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	88	75	57	42	50	63
Transit Riders or Carpoolers (millions)	26	22	16	12	14	18
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	24,007	22,473	21,329	19,914	20,555	19,952
Rank	24	25	25	25	24	24
Fuel per Peak Traveler (gallons)	27	26	25	25	26	27
Rank	27	29	27	26	20	21
Annual Delay						
Total Delay (1000s of person-hours)	33,660	31,840	30,443	28,249	28,729	28,043
Rank	25	25	25	25	23	23
Delay per Peak Traveler (person-hrs)	38	37	36	35	37	37
Rank	33	32	30	28	20	23
Delay due to Incidents (percent)	54	54	54	53	53	53
Travel Time Index						
Rank	1.29	1.27	1.27	1.26	1.28	1.27
Rank	21	22	21	21	12	14
Congestion Cost						
Total Cost (\$ millions)	625	562	514	466	472	448
Rank	25	25	25	25	24	23
Cost per Peak Traveler (\$)	704	647	605	576	602	597
Rank	33	33	32	32	23	22

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 Portland, OR-WA, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	1,510	1,470	1,440	1,355	1,330	1,305
Rank	24	24	24	25	26	27
Urban Area (square miles)	495	490	480	470	445	445
Popn Density (persons/sq mile)	3,051	3,000	3,000	2,883	2,989	2,933
Peak Travelers (1000s)	720	691	665	617	596	574
Freeway						
Daily Vehicle-Miles of Travel (1000s)	12,350	12,020	11,900	11,610	11,105	10,630
Lane Miles	705	695	690	690	685	685
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	11,340	11,230	10,970	10,580	10,505	10,485
Lane Miles	2,195	2,190	2,185	2,170	2,150	2,140
Public Transportation						
Annual Psgr-Miles of Travel (millions)	387	346	291	278	276	259
Annual Unlinked Psgr Trips (millions)	90	87	71	73	70	64
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)	1.47	1.19	1.40	1.37	1.28	1.24
System Performance						
Congested Travel (% of peak VMT)	66	63	61	58	55	50
Congested System (% of lane-miles)	46	46	42	41	41	40
Congested Time (number of "Rush Hours")	7.4	7.4	7.4	7.2	7.2	6.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	67	65	79	87	92	90
Transit Riders or Carpoolers (millions)	19	18	22	23	24	23
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	20,026	18,238	17,569	15,853	13,893	12,083
Rank	24	24	24	25	26	26
Fuel per Peak Traveler (gallons)	28	26	26	26	23	21
Rank	18	16	14	13	17	22
Annual Delay						
Total Delay (1000s of person-hours)	27,984	25,627	24,268	22,352	19,553	17,248
Rank	23	23	24	25	25	25
Delay per Peak Traveler (person-hrs)	39	37	36	36	33	30
Rank	21	20	22	19	25	27
Delay due to Incidents (percent)	53	53	53	53	53	54
Travel Time Index						
Rank	1.28	1.25	1.25	1.23	1.20	1.18
Rank	14	16	14	17	19	25
Congestion Cost						
Total Cost (\$ millions)	428	381	360	323	275	234
Rank	23	24	24	25	25	25
Cost per Peak Traveler (\$)	594	551	542	524	461	408
Rank	21	20	21	19	25	27

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 Portland, OR-WA, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	1,275	1,245	1,220	1,190	1,180	1,170
Rank	27	26	27	27	26	26
Urban Area (square miles)	440	425	425	420	410	410
Popn Density (persons/sq mile)	2,898	2,929	2,871	2,833	2,878	2,854
Peak Travelers (1000s)	552	532	512	491	483	475
Freeway						
Daily Vehicle-Miles of Travel (1000s)	10,315	9,760	9,000	8,605	8,385	7,905
Lane Miles	685	660	630	610	600	590
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	10,480	10,225	10,115	9,810	9,690	9,705
Lane Miles	2,125	2,115	2,050	2,010	1,955	1,905
Public Transportation						
Annual Psgr-Miles of Travel (millions)	248	239	238	215	216	212
Annual Unlinked Psgr Trips (millions)	65	65	62	59	56	57
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)	1.26	1.26	1.48	1.16	1.32	1.22
System Performance						
Congested Travel (% of peak VMT)	49	46	42	41	37	34
Congested System (% of lane-miles)	40	35	35	35	30	30
Congested Time (number of "Rush Hours")	6.6	6.4	6.2	6.0	6.0	5.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	95	84	73	72	74	62
Transit Riders or Carpoolers (millions)	24	21	18	17	18	15
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	11,499	10,498	8,448	7,812	6,877	5,845
Rank	26	25	26	27	26	27
Fuel per Peak Traveler (gallons)	21	20	16	16	14	12
Rank	17	19	24	24	26	29
Annual Delay						
Total Delay (1000s of person-hours)	16,700	15,166	12,022	11,219	9,827	8,444
Rank	26	26	28	28	28	28
Delay per Peak Traveler (person-hrs)	30	29	23	23	20	18
Rank	23	24	33	31	31	34
Delay due to Incidents (percent)	54	55	55	55	55	55
Travel Time Index						
Rank	1.17	1.16	1.14	1.13	1.12	1.10
Rank	25	25	30	30	32	36
Congestion Cost						
Total Cost (\$ millions)	222	197	154	137	114	93
Rank	26	26	27	28	28	29
Cost per Peak Traveler (\$)	402	370	301	280	235	195
Rank	24	24	31	31	30	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 Portland, OR-WA, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	1,160	1,155	1,150	1,140	1,130	1,130
Rank	26	26	26	26	25	25
Urban Area (square miles)	410	400	380	350	350	350
Popn Density (persons/sq mile)	2,829	2,888	3,026	3,257	3,229	3,229
Peak Travelers (1000s)	466	460	454	446	438	434
Freeway						
Daily Vehicle-Miles of Travel (1000s)	7,530	7,060	6,470	5,955	5,725	5,500
Lane Miles	590	590	580	580	570	570
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	9,670	9,655	9,635	9,705	9,865	9,760
Lane Miles	1,860	1,835	1,805	1,750	1,705	1,680
Public Transportation						
Annual Psgr-Miles of Travel (millions)	200	190	194	225	225	225
Annual Unlinked Psgr Trips (millions)	54	53	58	52	52	52
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)	1.22	1.19	1.56	1.58	1.61	1.69
System Performance						
Congested Travel (% of peak VMT)	30	27	24	22	21	21
Congested System (% of lane-miles)	27	26	25	24	22	22
Congested Time (number of "Rush Hours")	5.6	5.2	5.0	4.8	4.8	4.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	59	--	--	--	--	--
Transit Riders or Carpoolers (millions)	14	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	5,024	4,438	3,895	3,445	3,465	3,432
Rank	29	28	28	29	26	26
Fuel per Peak Traveler (gallons)	11	10	9	8	8	8
Rank	35	35	35	35	30	28
Annual Delay						
Total Delay (1000s of person-hours)	7,640	6,839	6,130	5,571	5,712	5,724
Rank	28	28	29	29	26	26
Delay per Peak Traveler (person-hrs)	16	15	13	12	13	13
Rank	35	37	36	36	31	26
Delay due to Incidents (percent)	55	55	54	54	54	54
Travel Time Index						
Rank	1.09	1.08	1.07	1.07	1.07	1.07
Rank	39	37	39	40	37	33
Congestion Cost						
Total Cost (\$ millions)	81	70	63	55	54	53
Rank	28	28	28	29	26	26
Cost per Peak Traveler (\$)	173	152	138	124	124	123
Rank	36	37	36	35	31	26

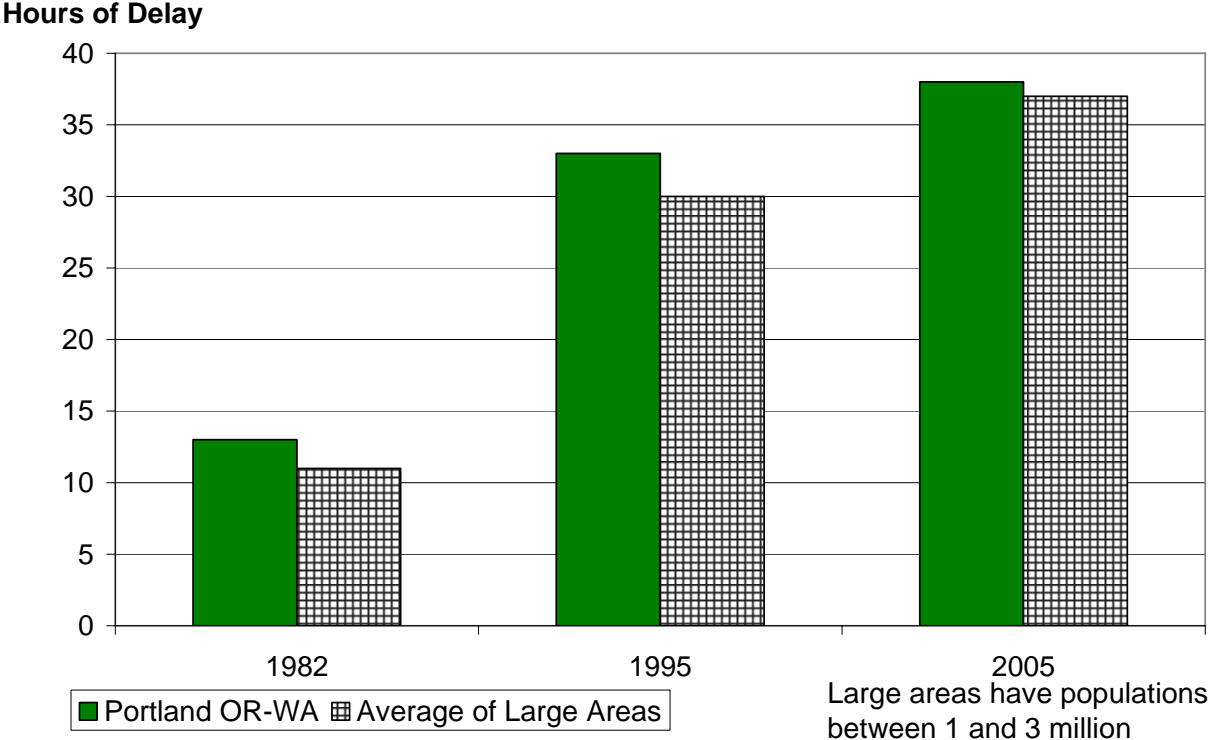
Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

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

Benefits From Public Transportation Service and Operations Strategies for Portland, OR-WA

Operations Strategies	2005	2004	2003	2002	2001	2000
Freeway Ramp Metering						
Percent of Roadway Miles	72	73	55	55	51	46
Annual Delay Reduction (1000 hours)	575	523	526	518	452	357
Freeway Incident Management						
Cameras						
Percent of Roadway Miles	68	56	45	44	39	35
Service Patrols						
Percent of Roadway Miles	80	68	66	67	68	68
Annual Delay Reduction (1000 hours)	1,654	1,197	1,137	1,006	1,052	954
Arterial Signal Coordination						
Percent of Roadway Miles	48	38	32	28	25	26
Annual Delay Reduction (1000 hours)	93	71	83	71	46	40
Arterial Access Management						
Percent of Roadway Miles	15	16	16	17	17	17
Annual Delay Reduction (1000 hours)	228	221	204	288	241	432
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	102	100	98	93	96	90
HOV User Delay Savings	103	88	82	63	77	64
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	2,653	2,100	2,032	1,947	1,868	1,847
Annual Delay Saved per Peak Traveler (hours)	3	2	2	2	2	2
Annual Congestion Cost Savings (\$million)	50.0	37.8	34.8	32.5	31.1	29.7
Travel Time Index with Strategies	1.286	1.275	1.273	1.264	1.278	1.269
Travel Time Index (Base)	1.308	1.293	1.291	1.281	1.296	1.287
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	466	474	453	456	401	393
Unlinked Passenger Trips (million)	111	106	106	109	97	94
Travel Time Index (combined road and transit)	1.268	1.257	1.255	1.245	1.261	1.253
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.349	1.335	1.331	1.324	1.338	1.329
Annual Delay Increase (1000 hours)	6,676	6,430	5,887	6,023	5,708	5,547
Annual Delay Increase per Peak Traveler (hours)	8	7	7	7	7	7
Annual Congestion Cost Increase (\$million)	124.1	114.2	99.9	99.7	93.7	88.9

Growth in Delay per Peak Traveler



Growth in Total Delay

