

## 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
<b>Providence, RI-MA</b>	<b>L-</b>	<b>L-</b>	<b>L-</b>	<b>0</b>	<b>S-</b>
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
<b>2005 Values</b> 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
<b>1982 to 2005 Trends</b> Delay per Traveler - Total Delay -	5 Hours 5 Hours x Average Population	3 Hours 3 Hours x Average Population

### The Mobility Data for Providence, RI-MA

<b>Inventory Measures</b>	<b>2005</b>	<b>2004</b>	<b>2003</b>	<b>2002</b>	<b>2001</b>	<b>2000</b>
<b>Urban Area Information</b>						
Population (1000s)	1,245	1,245	1,230	1,225	1,210	1,205
Rank	34	34	34	34	34	33
Urban Area (square miles)	800	800	800	795	785	780
Popn Density (persons/sq mile)	1,556	1,556	1,538	1,541	1,541	1,545
Peak Travelers (1000s)	677	675	664	653	636	627
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	11,505	11,415	11,095	10,585	10,430	10,125
Lane Miles	910	905	900	875	855	845
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	11,100	11,110	11,030	10,515	10,110	9,500
Lane Miles	2,150	2,110	2,050	2,005	1,985	1,970
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	99	92	85	78	70	64
Annual Unlinked Psgr Trips (millions)	20	18	18	16	16	18
<b>Cost Components</b>						
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	2.05	1.57	1.44	1.72	1.57
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	39	41	40	37	39	37
<b>Congested System</b> (% of lane-miles)	37	37	37	37	40	40
<b>Congested Time</b> (number of "Rush Hours")	5.4	5.6	5.4	5.2	5.2	4.8
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	88	109	128	151	145	140
Transit Riders or Carpoolers (millions)	23	28	33	38	36	34
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	11,660	11,949	11,528	10,326	9,511	8,604
Rank	38	37	37	40	41	43
Fuel per Peak Traveler (gallons)	17	18	17	16	15	14
Rank	45	45	44	45	46	49
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	19,482	19,368	18,656	17,095	15,406	13,875
Rank	37	37	37	37	37	42
Delay per Peak Traveler (person-hrs)	29	29	28	26	24	22
Rank	44	42	43	44	48	52
Delay due to Incidents (percent)	60	60	59	59	58	58
<b>Travel Time Index</b>						
Rank	1.16	1.17	1.16	1.15	1.14	1.14
Rank	46	42	44	46	50	49
<b>Congestion Cost</b>						
Total Cost (\$ millions)	343	328	302	270	242	211
Rank	38	37	37	37	37	42
Cost per Peak Traveler (\$)	507	486	455	414	380	336
Rank	44	45	46	46	48	54

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 Providence, RI-MA, Continued**

<b>Inventory Measures</b>	<b>1999</b>	<b>1998</b>	<b>1997</b>	<b>1996</b>	<b>1995</b>	<b>1994</b>
<b>Urban Area Information</b>						
Population (1000s)	1,205	1,190	1,170	1,160	1,145	1,135
Rank	32	32	32	32	32	32
Urban Area (square miles)	775	765	755	750	740	730
Popn Density (persons/sq mile)	1,555	1,556	1,550	1,547	1,547	1,555
Peak Travelers (1000s)	618	603	585	573	559	547
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	9,855	9,505	8,840	8,800	8,525	8,325
Lane Miles	830	810	810	810	810	810
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	9,000	8,405	7,525	7,215	6,855	6,720
Lane Miles	1,940	1,925	1,910	1,880	1,865	1,835
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	69	68	77	75	84	83
Annual Unlinked Psgr Trips (millions)	17	16	17	16	16	16
<b>Cost Components</b>						
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)	1.16	1.11	1.29	1.33	1.25	1.09
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	36	33	27	25	22	21
<b>Congested System</b> (% of lane-miles)	41	37	36	35	35	30
<b>Congested Time</b> (number of "Rush Hours")	4.6	4.4	3.6	3.4	3.0	3.0
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	128	109	83	77	62	61
Transit Riders or Carpoolers (millions)	30	25	17	16	12	12
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	8,033	6,899	5,246	5,066	4,130	3,853
Rank	43	45	49	47	49	48
Fuel per Peak Traveler (gallons)	13	11	9	9	7	7
Rank	59	62	68	65	68	70
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	13,190	11,151	8,817	8,361	6,891	6,388
Rank	40	43	48	46	50	48
Delay per Peak Traveler (person-hrs)	21	18	15	15	12	12
Rank	58	62	66	64	67	68
Delay due to Incidents (percent)	58	58	58	59	59	58
<b>Travel Time Index</b>						
Rank	1.13	1.12	1.10	1.10	1.08	1.08
Rank	51	56	59	57	61	62
<b>Congestion Cost</b>						
Total Cost (\$ millions)	191	158	124	116	93	83
Rank	40	46	48	47	51	50
Cost per Peak Traveler (\$)	309	262	212	202	166	151
Rank	59	62	67	64	68	71

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 Providence, RI-MA, Continued**

<b>Inventory Measures</b>	<b>1993</b>	<b>1992</b>	<b>1991</b>	<b>1990</b>	<b>1989</b>	<b>1988</b>
<b>Urban Area Information</b>						
Population (1000s)	1,120	1,110	1,100	1,095	1,090	1,085
Rank	32	32	32	32	31	30
Urban Area (square miles)	720	710	705	700	695	690
Popn Density (persons/sq mile)	1,556	1,563	1,560	1,564	1,568	1,572
Peak Travelers (1000s)	533	522	510	502	495	488
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	8,055	7,470	7,290	7,200	7,000	6,500
Lane Miles	810	775	765	750	730	700
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	6,675	6,610	6,615	6,525	6,425	6,280
Lane Miles	1,810	1,780	1,750	1,720	1,705	1,685
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	70	61	73	71	71	69
Annual Unlinked Psgr Trips (millions)	15	15	17	17	16	18
<b>Cost Components</b>						
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)	1.08	1.17	1.20	1.10	1.09	1.01
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	21	20	20	19	17	17
<b>Congested System</b> (% of lane-miles)	30	30	30	30	27	22
<b>Congested Time</b> (number of "Rush Hours")	2.9	2.9	2.9	2.9	2.9	2.8
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	75	99	157	164	164	149
Transit Riders or Carpoolers (millions)	15	19	30	31	31	28
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	3,724	3,182	2,876	2,745	2,426	2,313
Rank	50	52	50	50	51	47
Fuel per Peak Traveler (gallons)	7	6	6	5	5	5
Rank	67	67	67	65	68	67
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	6,130	5,184	4,579	4,460	3,902	3,696
Rank	48	51	51	52	52	50
Delay per Peak Traveler (person-hrs)	11	10	9	9	8	8
Rank	66	68	67	67	69	68
Delay due to Incidents (percent)	58	58	56	56	56	56
<b>Travel Time Index</b>						
Rank	58	61	58	57	60	59
<b>Congestion Cost</b>						
Total Cost (\$ millions)	77	64	55	52	43	38
Rank	50	51	51	52	52	51
Cost per Peak Traveler (\$)	145	123	108	104	86	79
Rank	67	69	67	66	69	69

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 Providence, RI-MA, Continued**

<b>Inventory Measures</b>	<b>1987</b>	<b>1986</b>	<b>1985</b>	<b>1984</b>	<b>1983</b>	<b>1982</b>
<b>Urban Area Information</b>						
Population (1000s)	1,080	1,075	1,070	1,060	1,060	1,050
Rank	29	29	29	29	29	30
Urban Area (square miles)	685	680	675	670	665	655
Popn Density (persons/sq mile)	1,577	1,581	1,585	1,582	1,594	1,603
Peak Travelers (1000s)	482	475	469	460	456	447
<b>Freeway</b>						
Daily Vehicle-Miles of Travel (1000s)	5,515	4,345	4,250	4,190	4,050	4,000
Lane Miles	675	670	660	640	620	600
<b>Arterial Streets</b>						
Daily Vehicle-Miles of Travel (1000s)	6,115	5,935	5,720	5,510	5,395	5,390
Lane Miles	1,650	1,620	1,605	1,590	1,575	1,550
<b>Public Transportation</b>						
Annual Psgr-Miles of Travel (millions)	67	78	77	48	48	48
Annual Unlinked Psgr Trips (millions)	19	20	18	10	10	10
<b>Cost Components</b>						
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)	1.01	0.98	1.29	1.30	1.33	1.39
<b>System Performance</b>						
<b>Congested Travel</b> (% of peak VMT)	14	12	11	11	11	10
<b>Congested System</b> (% of lane-miles)	19	19	15	15	15	15
<b>Congested Time</b> (number of "Rush Hours")	2.6	2.4	2.4	2.3	2.3	2.4
<b>Annual Increase Needed To Maintain Constant Congestion Level:</b>						
Lane-Miles	102	--	--	--	--	--
Transit Riders or Carpoolers (millions)	18	--	--	--	--	--
<b>Annual Excess Fuel Consumed</b>						
Total Fuel (1000 gallons)	1,733	1,330	1,124	1,040	1,005	911
Rank	52	57	57	58	56	56
Fuel per Peak Traveler (gallons)	4	3	2	2	2	2
Rank	69	75	76	72	72	72
<b>Annual Delay</b>						
Total Delay (1000s of person-hours)	2,850	2,218	1,839	1,664	1,613	1,452
Rank	53	57	59	60	58	57
Delay per Peak Traveler (person-hrs)	6	5	4	4	4	3
Rank	70	73	76	74	72	74
Delay due to Incidents (percent)	55	55	55	55	55	55
<b>Travel Time Index</b>						
Rank	62	65	65	66	63	64
<b>Congestion Cost</b>						
Total Cost (\$ millions)	28	21	18	16	15	13
Rank	53	58	59	60	58	57
Cost per Peak Traveler (\$)	59	45	38	34	32	29
Rank	70	73	76	76	74	76

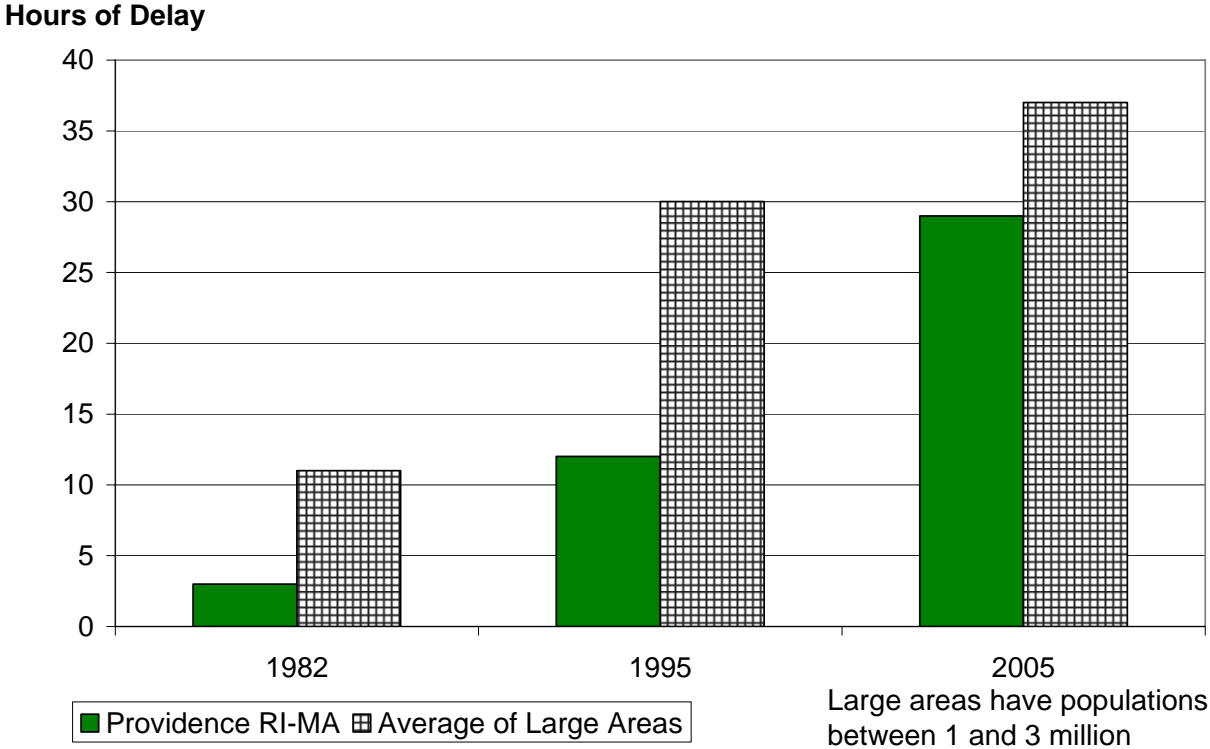
Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

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

**Benefits From Public Transportation Service and Operations Strategies for Providence, RI-MA**

<b>Operations Strategies</b>	<b>2005</b>	<b>2004</b>	<b>2003</b>	<b>2002</b>	<b>2001</b>	<b>2000</b>
<b>Freeway Ramp Metering</b>						
Percent of Roadway Miles	--	--	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--	--	--
<b>Freeway Incident Management</b>						
<b>Cameras</b>						
Percent of Roadway Miles	41	41	37	38	18	2
<b>Service Patrols</b>						
Percent of Roadway Miles	20	14	--	--	--	--
Annual Delay Reduction (1000 hours)	277	210	52	45	24	4
<b>Arterial Signal Coordination</b>						
Percent of Roadway Miles	11	11	12	12	12	12
Annual Delay Reduction (1000 hours)	7	10	25	61	69	49
<b>Arterial Access Management</b>						
Percent of Roadway Miles	6	6	5	4	4	4
Annual Delay Reduction (1000 hours)	11	14	6	8	4	4
<b>HOV Lanes</b>						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
<b>Total Effect of Operations Treatments</b>						
Annual Delay Reduction (1000 hours)	295	234	84	115	97	56
Annual Delay Saved per Peak Traveler (hours)	0	0	0	0	0	0
Annual Congestion Cost Savings (\$million)	5.4	4.1	1.5	1.9	1.6	0.9
Travel Time Index with Strategies	1.162	1.166	1.163	1.153	1.144	1.136
Travel Time Index (Base)	1.163	1.168	1.164	1.154	1.145	1.137
<b>Public Transportation Service</b>						
<b>Existing Service</b>						
Annual Passenger-miles of Travel (million)	99	92	85	78	70	64
Unlinked Passenger Trips (million)	20	18	18	16	16	18
Travel Time Index (combined road and transit)	1.159	1.164	1.161	1.151	1.142	1.134
<b>Condition if Public Transportation Service were Discontinued</b>						
Travel Time Index	1.169	1.173	1.169	1.157	1.149	1.140
Annual Delay Increase (1000 hours)	976	857	759	612	579	523
Annual Delay Increase per Peak Traveler (hours)	1	1	1	1	1	1
Annual Congestion Cost Increase (\$million)	17.3	14.6	12.4	9.7	9.2	8.0

### Growth in Delay per Peak Traveler



### Growth in Total Delay

