

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 Very Large Group – over 3 million population urban areas

Urban Area	Delay per Traveler	Travel Time Index	Total Delay	1982 to 2005	
				Delay per Traveler	Total Delay
New York-Newark, NY-NJ-CT	L	0	H+	0	F+
Los Angeles-Long Beach-Santa Ana, CA	H+	H+	H+	S	F+
Chicago, IL-IN	L	H+	H	0	F+
Miami, FL	L	0	L	0	0
Philadelphia, PA-NJ-DE-MD	L-	L-	L-	S-	S-
Dallas-Fort Worth-Arlington, TX	H	L	L	F+	F
Washington, DC-VA-MD	H	0	L	F+	S-
Atlanta, GA	H	L	L	0	S-
San Francisco-Oakland, CA	H	H	L	F	S-
Boston, MA-NH-RI	L	L-	L-	0	S-
Detroit, MI	0	L-	L-	S	S-
Houston, TX	H	0	L-	S	S-
Phoenix, AZ	L	L	L-	S-	S-
Seattle, WA	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 Boston, MA-NH-RI

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	4,075	4,010	3,990	3,970	3,940	3,900
Rank	10	10	10	10	10	9
Urban Area (square miles)	2,240	2,105	2,100	2,040	1,950	1,900
Popn Density (persons/sq mile)	1,819	1,905	1,900	1,946	2,021	2,053
Peak Travelers (1000s)	2,033	1,993	1,979	1,965	1,946	1,919
Freeway						
Daily Vehicle-Miles of Travel (1000s)	40,875	38,585	37,300	36,000	35,200	34,100
Lane Miles	2,550	2,410	2,370	2,300	2,240	2,190
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	35,540	34,600	34,000	32,865	32,500	32,000
Lane Miles	7,200	6,900	6,600	6,240	6,000	5,800
Public Transportation						
Annual Psgr-Miles of Travel (millions)	1,768	1,889	1,902	1,852	1,820	1,680
Annual Unlinked Psgr Trips (millions)	402	396	395	396	365	355
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	2.02	1.53	1.40	1.70	1.58
System Performance						
Congested Travel (% of peak VMT)	59	59	56	59	59	59
Congested System (% of lane-miles)	37	36	35	40	40	40
Congested Time (number of "Rush Hours")	7.2	7.2	7.2	7.2	7.2	7.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	287	235	239	235	254	244
Transit Riders or Carpoolers (millions)	78	64	66	66	72	70
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	62,521	60,080	53,568	53,610	48,161	46,008
Rank	13	13	13	13	13	14
Fuel per Peak Traveler (gallons)	31	30	27	27	25	24
Rank	19	18	24	22	22	25
Annual Delay						
Total Delay (1000s of person-hours)	93,374	89,050	80,460	78,447	71,200	68,476
Rank	12	13	12	13	13	12
Delay per Peak Traveler (person-hrs)	46	45	41	40	37	36
Rank	16	17	19	19	20	24
Delay due to Incidents (percent)	56	56	56	56	55	55
Travel Time Index						
Rank	1.27	1.27	1.24	1.25	1.23	1.22
Rank	25	23	25	23	25	25
Congestion Cost						
Total Cost (\$ millions)	1,820	1,667	1,442	1,372	1,242	1,153
Rank	12	13	12	12	12	12
Cost per Peak Traveler (\$)	895	836	729	698	638	601
Rank	17	15	20	21	20	21

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 Boston, MA-NH-RI, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	3,875	3,880	3,760	3,700	3,680	3,655
Rank	10	8	8	8	8	8
Urban Area (square miles)	1,870	1,820	1,790	1,760	1,735	1,730
Popn Density (persons/sq mile)	2,072	2,132	2,101	2,102	2,121	2,113
Peak Travelers (1000s)	1,903	1,897	1,831	1,798	1,781	1,762
Freeway						
Daily Vehicle-Miles of Travel (1000s)	33,000	32,000	30,600	29,875	29,860	29,495
Lane Miles	2,140	2,090	2,040	2,015	2,015	2,015
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	31,600	30,500	29,500	28,300	27,000	25,600
Lane Miles	5,650	5,500	5,300	5,175	5,000	4,800
Public Transportation						
Annual Psgr-Miles of Travel (millions)	1,749	1,553	1,393	1,386	1,388	1,368
Annual Unlinked Psgr Trips (millions)	355	340	324	319	322	333
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)	1.13	1.08	1.28	1.31	1.22	1.07
System Performance						
Congested Travel (% of peak VMT)	59	58	55	54	54	53
Congested System (% of lane-miles)	40	41	39	39	39	39
Congested Time (number of "Rush Hours")	7.2	7.0	7.0	6.8	6.8	6.6
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	252	225	162	137	118	74
Transit Riders or Carpoolers (millions)	73	64	46	38	33	21
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	44,983	44,355	40,294	36,784	35,267	34,936
Rank	14	13	13	13	12	11
Fuel per Peak Traveler (gallons)	24	23	22	20	20	20
Rank	27	25	29	30	30	27
Annual Delay						
Total Delay (1000s of person-hours)	66,889	65,916	60,899	55,668	52,961	52,969
Rank	13	13	13	13	13	12
Delay per Peak Traveler (person-hrs)	35	35	33	31	30	30
Rank	29	27	30	30	31	26
Delay due to Incidents (percent)	55	55	55	55	55	56
Travel Time Index						
	1.22	1.23	1.21	1.20	1.20	1.20
Rank	26	24	23	25	22	17
Congestion Cost						
Total Cost (\$ millions)	1,071	1,033	950	851	791	765
Rank	13	13	13	12	12	11
Cost per Peak Traveler (\$)	563	544	519	473	444	434
Rank	28	23	28	29	27	23

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 Boston, MA-NH-RI, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	3,640	3,630	3,620	3,610	3,600	3,560
Rank	8	8	8	8	8	8
Urban Area (square miles)	1,730	1,705	1,690	1,675	1,655	1,640
Popn Density (persons/sq mile)	2,104	2,129	2,142	2,155	2,175	2,171
Peak Travelers (1000s)	1,751	1,739	1,730	1,718	1,699	1,663
Freeway						
Daily Vehicle-Miles of Travel (1000s)	29,500	29,865	29,340	29,300	29,685	28,000
Lane Miles	2,015	2,010	2,010	2,005	2,005	2,005
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	24,500	24,000	23,600	23,000	22,500	21,750
Lane Miles	4,640	4,550	4,480	4,360	4,280	4,200
Public Transportation						
Annual Psgr-Miles of Travel (millions)	1,288	1,217	1,215	1,191	1,097	900
Annual Unlinked Psgr Trips (millions)	337	324	317	324	303	286
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)	1.15	1.14	1.23	1.04	1.06	0.98
System Performance						
Congested Travel (% of peak VMT)	53	50	49	49	47	42
Congested System (% of lane-miles)	40	38	38	38	38	37
Congested Time (number of "Rush Hours")	6.6	6.6	6.6	6.6	6.6	6.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	110	151	188	196	236	206
Transit Riders or Carpoolers (millions)	31	43	53	56	68	57
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	33,841	32,964	29,684	28,851	29,244	27,055
Rank	11	10	11	11	9	10
Fuel per Peak Traveler (gallons)	19	19	17	17	17	16
Rank	25	22	22	22	19	18
Annual Delay						
Total Delay (1000s of person-hours)	51,124	51,006	43,970	43,019	44,214	42,920
Rank	11	11	13	11	10	10
Delay per Peak Traveler (person-hrs)	29	29	25	25	26	26
Rank	25	20	26	28	19	18
Delay due to Incidents (percent)	56	57	57	57	58	59
Travel Time Index						
Rank	1.20	1.19	1.18	1.17	1.18	1.17
Rank	17	17	19	17	17	14
Congestion Cost						
Total Cost (\$ millions)	726	689	586	553	534	492
Rank	10	10	10	11	9	10
Cost per Peak Traveler (\$)	415	396	339	322	314	296
Rank	21	19	22	23	18	17

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 Boston, MA-NH-RI, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	3,530	3,510	3,500	3,485	3,475	3,450
Rank	7	7	7	7	6	6
Urban Area (square miles)	1,620	1,605	1,585	1,570	1,555	1,540
Popn Density (persons/sq mile)	2,179	2,187	2,208	2,220	2,235	2,240
Peak Travelers (1000s)	1,634	1,611	1,593	1,572	1,553	1,528
Freeway						
Daily Vehicle-Miles of Travel (1000s)	26,845	25,000	23,980	22,750	21,775	20,670
Lane Miles	2,005	2,000	2,000	2,000	2,000	2,000
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	21,220	20,905	20,960	20,640	20,485	20,240
Lane Miles	4,120	4,060	4,050	4,050	4,040	4,040
Public Transportation						
Annual Psgr-Miles of Travel (millions)	900	1,006	997	919	919	919
Annual Unlinked Psgr Trips (millions)	267	278	290	272	272	272
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)	38	32	31	27	24	23
Congested System (% of lane-miles)	35	30	30	28	27	27
Congested Time (number of "Rush Hours")	5.8	5.4	5.0	4.6	4.2	3.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	201	--	--	--	--	--
Transit Riders or Carpoolers (millions)	55	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	21,382	17,202	16,291	13,651	11,755	10,902
Rank	10	11	10	10	10	11
Fuel per Peak Traveler (gallons)	13	11	10	9	8	7
Rank	24	32	31	33	32	30
Annual Delay						
Total Delay (1000s of person-hours)	33,282	27,183	26,005	21,906	18,772	17,899
Rank	10	11	10	10	11	11
Delay per Peak Traveler (person-hrs)	20	17	16	14	12	12
Rank	25	32	32	34	34	32
Delay due to Incidents (percent)	57	58	57	56	56	56
Travel Time Index						
Rank	1.14	1.11	1.11	1.10	1.08	1.08
Rank	16	20	20	24	27	24
Congestion Cost						
Total Cost (\$ millions)	362	285	271	221	183	168
Rank	10	11	10	11	11	11
Cost per Peak Traveler (\$)	221	177	170	141	118	110
Rank	25	30	30	32	33	32

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

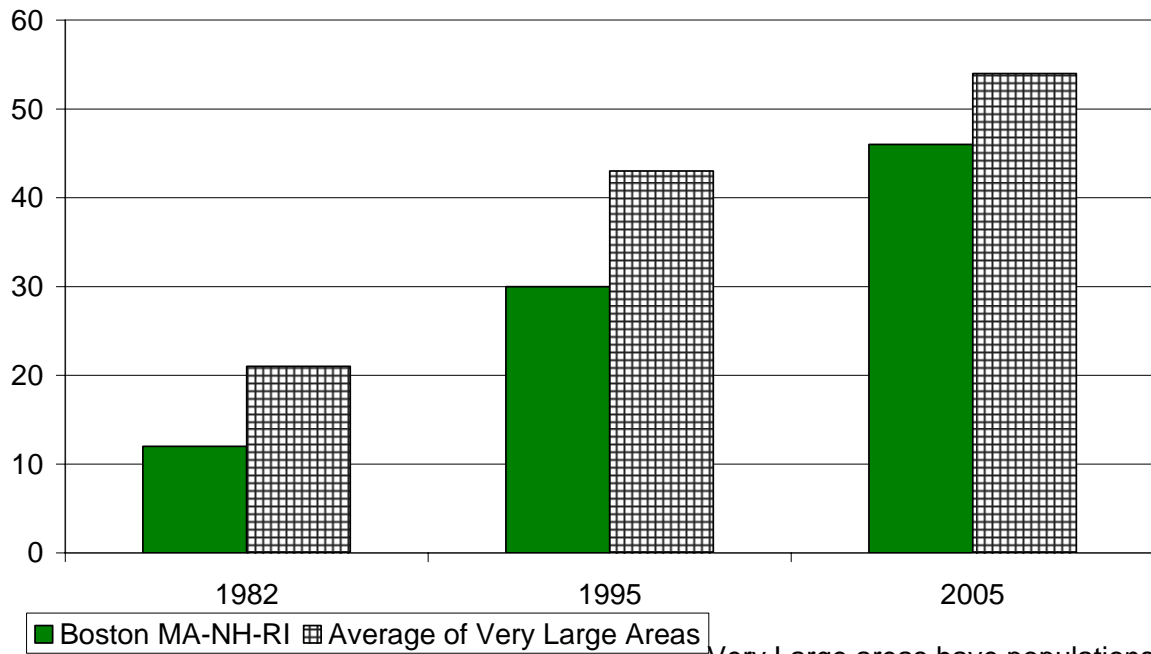
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for Boston, MA-NH-RI

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	18	20	21	23	23	23
Service Patrols						
Percent of Roadway Miles	77	82	83	85	87	90
Annual Delay Reduction (1000 hours)	3,803	3,757	2,998	2,976	2,447	2,306
Arterial Signal Coordination						
Percent of Roadway Miles	19	20	21	16	17	17
Annual Delay Reduction (1000 hours)	62	46	44	48	83	6
Arterial Access Management						
Percent of Roadway Miles	6	6	6	7	7	7
Annual Delay Reduction (1000 hours)	779	734	723	725	1,092	1,188
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	4,643	4,536	3,765	3,749	3,622	3,500
Annual Delay Saved per Peak Traveler (hours)	2	2	2	2	2	2
Annual Congestion Cost Savings (\$million)	89.5	84.2	67.3	65.5	63.1	59.0
Travel Time Index with Strategies	1.268	1.268	1.243	1.253	1.228	1.223
Travel Time Index (Base)	1.279	1.280	1.253	1.264	1.239	1.234
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	1,768	1,889	1,902	1,852	1,820	1,680
Unlinked Passenger Trips (million)	402	396	395	396	365	355
Travel Time Index (combined road and transit)	1.244	1.242	1.219	1.227	1.206	1.202
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.321	1.328	1.296	1.314	1.285	1.275
Annual Delay Increase (1000 hours)	21,441	23,053	21,735	22,887	18,475	16,551
Annual Delay Increase per Peak Traveler (hours)	11	12	11	12	9	9
Annual Congestion Cost Increase (\$million)	416.1	429.9	388.7	399.4	324.3	280.7

Growth in Delay per Peak Traveler

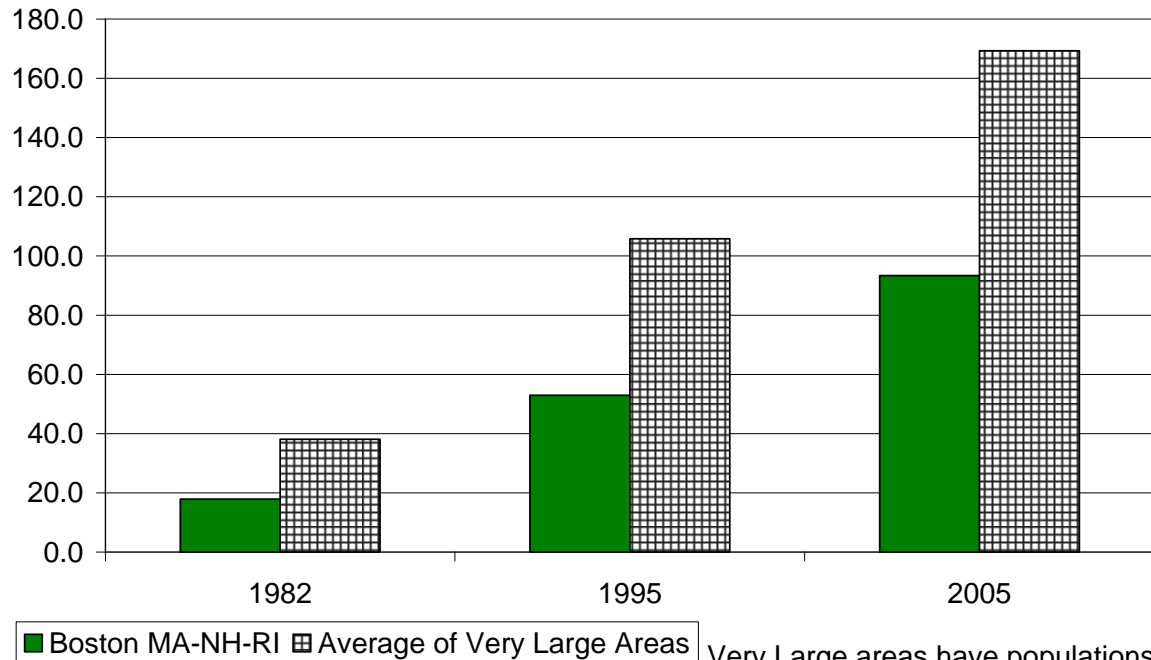
Hours of Delay



Very Large areas have populations over 3 million

Growth in Total Delay

Annual Hours of Delay (million)



Very Large areas have populations over 3 million