

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 Houston, TX

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	3,790	3,770	3,750	3,720	3,630	3,500
Rank	12	12	11	11	11	11
Urban Area (square miles)	1,905	1,900	1,860	1,830	1,800	1,770
Popn Density (persons/sq mile)	1,990	1,984	2,016	2,033	2,017	1,977
Peak Travelers (1000s)	2,198	2,175	2,153	2,120	2,058	1,974
Freeway						
Daily Vehicle-Miles of Travel (1000s)	46,350	45,630	46,665	45,165	42,320	39,195
Lane Miles	2,480	2,480	2,460	2,400	2,390	2,380
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	39,355	39,330	39,540	39,980	39,210	37,085
Lane Miles	7,415	7,415	7,405	7,400	7,400	7,395
Public Transportation						
Annual Psgr-Miles of Travel (millions)	552	565	549	581	622	596
Annual Unlinked Psgr Trips (millions)	95	96	93	97	101	100
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)	2.23	1.83	1.45	1.32	1.46	1.47
System Performance						
Congested Travel (% of peak VMT)	73	70	70	68	66	62
Congested System (% of lane-miles)	46	46	46	45	45	41
Congested Time (number of "Rush Hours")	7.6	7.6	7.8	7.8	7.4	7.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	233	291	429	482	540	488
Transit Riders or Carpoolers (millions)	70	87	130	145	156	132
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	92,559	82,671	80,267	78,061	71,253	61,400
Rank	8	9	8	8	9	10
Fuel per Peak Traveler (gallons)	42	38	37	37	35	31
Rank	6	7	7	7	8	11
Annual Delay						
Total Delay (1000s of person-hours)	124,131	113,989	110,656	110,776	102,409	88,392
Rank	9	10	10	9	9	10
Delay per Peak Traveler (person-hrs)	56	52	51	52	50	45
Rank	7	8	8	9	8	11
Delay due to Incidents (percent)	50	50	50	50	50	50
Travel Time Index						
Rank	8	9	13	10	12	15
Congestion Cost						
Total Cost (\$ millions)	2,225	1,936	1,809	1,760	1,609	1,352
Rank	9	10	10	9	9	10
Cost per Peak Traveler (\$)	1,012	890	841	830	782	685
Rank	7	8	9	9	11	14

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 Houston, TX, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	3,410	3,320	3,225	3,135	3,040	2,975
Rank	11	11	11	11	11	11
Urban Area (square miles)	1,740	1,720	1,710	1,695	1,675	1,660
Popn Density (persons/sq mile)	1,960	1,930	1,886	1,850	1,815	1,792
Peak Travelers (1000s)	1,910	1,849	1,787	1,727	1,666	1,618
Freeway						
Daily Vehicle-Miles of Travel (1000s)	37,730	36,000	35,000	34,000	33,000	32,000
Lane Miles	2,265	2,255	2,240	2,220	2,200	2,190
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	35,770	33,665	31,965	28,345	26,785	25,805
Lane Miles	7,215	6,935	6,755	6,550	6,450	6,400
Public Transportation						
Annual Psgr-Miles of Travel (millions)	582	534	455	401	448	480
Annual Unlinked Psgr Trips (millions)	101	95	87	81	80	84
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)	1.07	1.01	1.12	1.21	1.14	1.03
System Performance						
Congested Travel (% of peak VMT)	62	59	55	51	48	46
Congested System (% of lane-miles)	41	41	36	36	35	35
Congested Time (number of "Rush Hours")	7.2	7.0	6.8	6.6	6.2	6.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	466	401	407	291	260	233
Transit Riders or Carpoolers (millions)	126	106	105	72	63	54
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	59,658	53,273	49,735	41,976	36,654	34,588
Rank	10	9	9	10	11	12
Fuel per Peak Traveler (gallons)	31	29	28	24	22	21
Rank	11	13	12	20	24	18
Annual Delay						
Total Delay (1000s of person-hours)	88,679	78,998	73,943	60,584	54,082	51,552
Rank	10	10	9	11	12	13
Delay per Peak Traveler (person-hrs)	46	43	41	35	32	32
Rank	11	12	11	23	26	22
Delay due to Incidents (percent)	51	51	52	52	54	54
Travel Time Index						
	1.26	1.25	1.24	1.22	1.19	1.19
Rank	17	17	16	19	23	20
Congestion Cost						
Total Cost (\$ millions)	1,288	1,122	1,044	843	730	672
Rank	10	11	9	13	13	13
Cost per Peak Traveler (\$)	675	607	584	488	438	415
Rank	13	14	16	27	29	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.

The Mobility Data for Houston, TX, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	2,960	2,935	2,925	2,900	2,880	2,850
Rank	11	11	11	11	11	11
Urban Area (square miles)	1,650	1,640	1,640	1,640	1,635	1,630
Popn Density (persons/sq mile)	1,794	1,790	1,784	1,768	1,761	1,748
Peak Travelers (1000s)	1,601	1,579	1,565	1,543	1,521	1,491
Freeway						
Daily Vehicle-Miles of Travel (1000s)	31,000	30,095	29,280	29,055	28,310	27,280
Lane Miles	2,175	2,160	2,060	1,955	1,925	1,875
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	25,260	23,565	23,675	22,480	22,255	21,535
Lane Miles	6,320	6,150	6,005	5,915	5,695	5,515
Public Transportation						
Annual Psgr-Miles of Travel (millions)	488	469	461	419	449	350
Annual Unlinked Psgr Trips (millions)	88	85	85	88	82	70
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)	1.10	1.09	1.12	1.04	1.07	0.99
System Performance						
Congested Travel (% of peak VMT)	45	45	48	51	50	48
Congested System (% of lane-miles)	35	35	36	36	36	36
Congested Time (number of "Rush Hours")	5.8	5.6	5.8	6.0	6.0	6.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	245	263	265	259	215	233
Transit Riders or Carpoolers (millions)	56	59	60	59	50	53
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	31,242	30,498	32,383	36,212	35,971	34,264
Rank	13	14	9	8	7	7
Fuel per Peak Traveler (gallons)	20	19	21	23	24	23
Rank	24	20	14	11	11	10
Annual Delay						
Total Delay (1000s of person-hours)	46,969	44,802	47,230	54,213	54,678	52,291
Rank	13	13	10	8	7	8
Delay per Peak Traveler (person-hrs)	29	28	30	35	36	35
Rank	24	25	17	12	12	10
Delay due to Incidents (percent)	54	55	56	58	58	58
Travel Time Index						
Rank	23	20	15	11	9	6
Congestion Cost						
Total Cost (\$ millions)	598	559	577	645	607	553
Rank	13	14	11	8	8	8
Cost per Peak Traveler (\$)	373	354	369	418	399	371
Rank	27	26	18	13	12	10

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 Houston, TX, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	2,820	2,790	2,415	2,410	2,405	2,400
Rank	11	11	11	11	11	11
Urban Area (square miles)	1,610	1,600	1,580	1,550	1,540	1,530
Popn Density (persons/sq mile)	1,752	1,744	1,528	1,555	1,562	1,569
Peak Travelers (1000s)	1,464	1,437	1,234	1,219	1,207	1,195
Freeway						
Daily Vehicle-Miles of Travel (1000s)	25,635	24,680	23,135	23,280	21,930	20,000
Lane Miles	1,710	1,600	1,490	1,475	1,455	1,385
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	20,285	20,370	20,690	20,705	19,870	19,335
Lane Miles	5,340	5,135	4,720	4,450	4,450	4,450
Public Transportation						
Annual Psgr-Miles of Travel (millions)	376	350	348	356	356	356
Annual Unlinked Psgr Trips (millions)	76	69	66	69	69	69
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)	0.99	0.97	1.27	1.28	1.31	1.37
System Performance						
Congested Travel (% of peak VMT)	49	51	50	51	46	44
Congested System (% of lane-miles)	36	33	32	32	31	31
Congested Time (number of "Rush Hours")	6.2	6.4	6.6	6.8	6.4	6.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	222	--	--	--	--	--
Transit Riders or Carpoolers (millions)	50	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	31,752	35,755	33,092	33,877	28,131	23,470
Rank	7	5	5	3	3	4
Fuel per Peak Traveler (gallons)	22	25	27	28	23	20
Rank	8	5	3	2	2	3
Annual Delay						
Total Delay (1000s of person-hours)	48,369	54,377	51,092	52,079	44,626	35,703
Rank	7	5	5	3	3	5
Delay per Peak Traveler (person-hrs)	33	38	41	43	37	30
Rank	7	5	3	2	2	3
Delay due to Incidents (percent)	59	60	59	59	59	58
Travel Time Index						
Rank	6	3	3	1	2	3
Congestion Cost						
Total Cost (\$ millions)	496	540	505	501	413	323
Rank	7	6	5	3	3	5
Cost per Peak Traveler (\$)	339	376	409	411	342	270
Rank	9	6	3	2	2	3

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

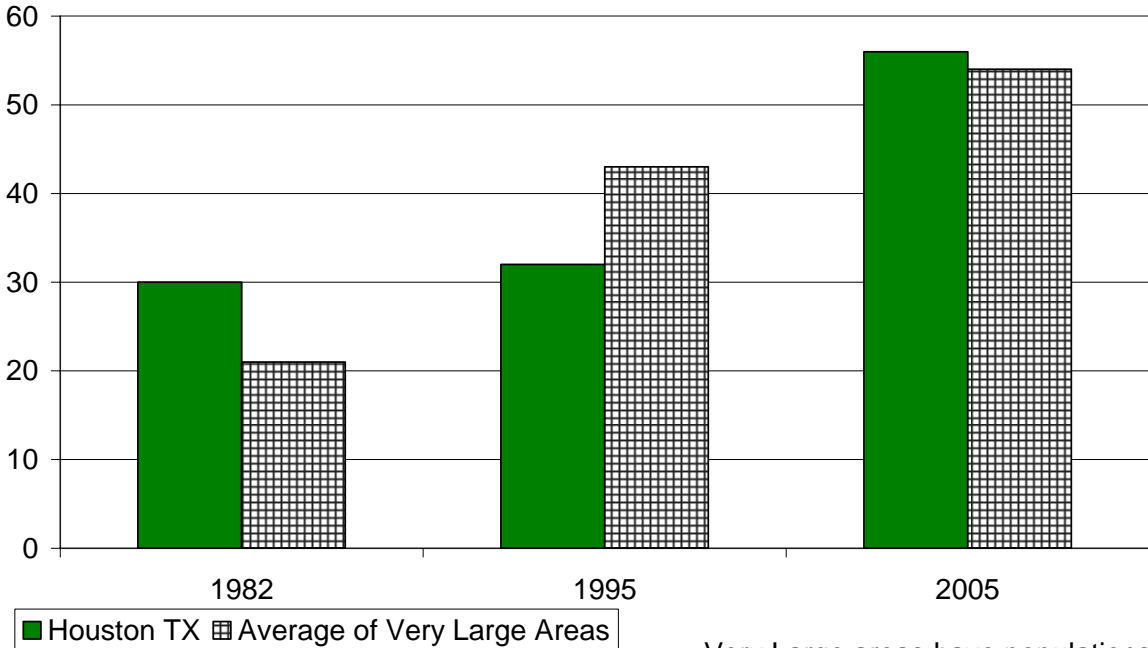
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for Houston, TX

Operations Strategies	2005	2004	2003	2002	2001	2000
Freeway Ramp Metering						
Percent of Roadway Miles	38	38	40	40	38	35
Annual Delay Reduction (1000 hours)	1,642	1,474	1,446	1,411	1,061	942
Freeway Incident Management						
Cameras						
Percent of Roadway Miles	91	91	87	86	79	70
Service Patrols						
Percent of Roadway Miles	61	41	40	41	42	42
Annual Delay Reduction (1000 hours)	5,050	2,848	2,609	2,503	2,225	1,924
Arterial Signal Coordination						
Percent of Roadway Miles	43	42	40	39	39	34
Annual Delay Reduction (1000 hours)	197	214	236	281	425	319
Arterial Access Management						
Percent of Roadway Miles	59	59	58	58	58	58
Annual Delay Reduction (1000 hours)	3,602	3,324	3,965	4,157	3,695	2,591
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	1,886	1,700	1,532	1,381	1,245	1,122
HOV User Delay Savings	3,126	2,166	1,674	1,437	1,122	926
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	13,617	10,026	9,929	9,788	8,527	6,702
Annual Delay Saved per Peak Traveler (hours)	6	5	5	5	4	3
Annual Congestion Cost Savings (\$million)	240.8	168.4	160.5	153.7	132.3	101.4
Travel Time Index with Strategies	1.355	1.315	1.301	1.296	1.281	1.257
Travel Time Index (Base)	1.390	1.341	1.325	1.319	1.301	1.274
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	552	565	549	581	622	596
Unlinked Passenger Trips (million)	95	96	93	97	101	100
Travel Time Index (combined road and transit)	1.346	1.305	1.292	1.286	1.270	1.248
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.395	1.346	1.331	1.325	1.308	1.281
Annual Delay Increase (1000 hours)	5,959	5,791	5,494	5,621	5,613	5,201
Annual Delay Increase per Peak Traveler (hours)	3	3	3	3	3	3
Annual Congestion Cost Increase (\$million)	96.1	89.2	81.1	81.5	80.6	72.8

Growth in Delay per Peak Traveler

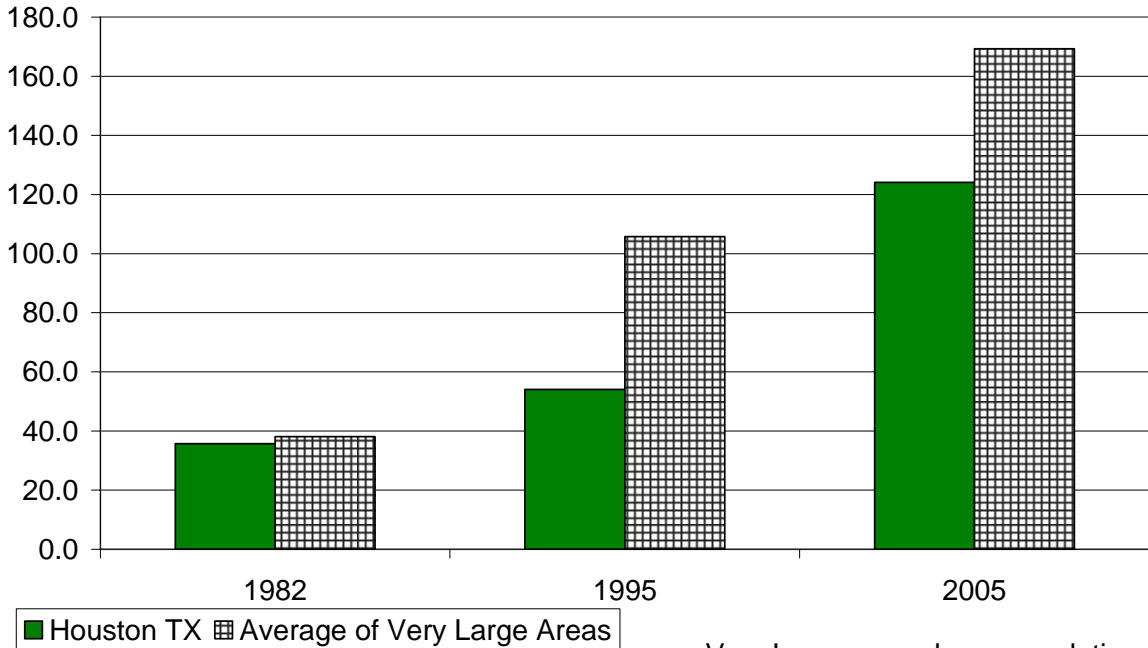
Hours of Delay



Very Large areas have populations over 3 million

Annual Hours of Delay (million)

Growth in Total Delay



Very Large areas have populations over 3 million