

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 Detroit, MI

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	4,055	4,045	4,040	4,035	4,030	4,025
Rank	11	9	9	9	8	7
Urban Area (square miles)	1,440	1,440	1,420	1,400	1,380	1,360
Popn Density (persons/sq mile)	2,816	2,809	2,845	2,882	2,920	2,960
Peak Travelers (1000s)	2,153	2,132	2,109	2,066	2,027	1,988
Freeway						
Daily Vehicle-Miles of Travel (1000s)	33,045	33,000	33,000	32,600	31,900	31,300
Lane Miles	1,915	1,910	1,910	1,890	1,865	1,845
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	53,200	51,465	50,645	49,955	49,405	46,505
Lane Miles	8,580	8,450	8,355	8,275	8,225	8,160
Public Transportation						
Annual Psgr-Miles of Travel (millions)	267	243	259	295	266	288
Annual Unlinked Psgr Trips (millions)	48	45	49	54	56	57
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)	2.33	1.90	1.51	1.41	1.50	1.63
System Performance						
Congested Travel (% of peak VMT)	71	71	71	71	68	67
Congested System (% of lane-miles)	57	57	57	57	53	52
Congested Time (number of "Rush Hours")	7.6	7.6	7.6	7.6	7.4	7.4
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	219	229	246	229	199	157
Transit Riders or Carpoolers (millions)	62	65	70	64	56	42
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	76,062	77,216	78,124	75,647	71,359	67,095
Rank	10	10	10	9	8	8
Fuel per Peak Traveler (gallons)	35	36	37	37	35	34
Rank	10	8	7	7	8	7
Annual Delay						
Total Delay (1000s of person-hours)	115,547	118,550	119,593	115,377	109,049	101,694
Rank	10	9	7	7	7	7
Delay per Peak Traveler (person-hrs)	54	56	57	56	54	51
Rank	8	5	5	5	6	7
Delay due to Incidents (percent)	53	53	54	54	54	54
Travel Time Index						
Rank	1.29	1.30	1.31	1.30	1.29	1.28
Rank	21	15	10	10	11	12
Congestion Cost						
Total Cost (\$ millions)	2,174	2,121	2,058	1,933	1,807	1,654
Rank	10	9	7	6	6	7
Cost per Peak Traveler (\$)	1,010	995	976	936	891	832
Rank	8	5	4	4	6	6

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 Detroit, MI, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	4,020	4,020	4,020	4,015	4,015	4,015
Rank	7	6	6	6	6	6
Urban Area (square miles)	1,350	1,335	1,320	1,305	1,305	1,300
Popn Density (persons/sq mile)	2,978	3,011	3,045	3,077	3,077	3,088
Peak Travelers (1000s)	1,950	1,914	1,877	1,839	1,807	1,775
Freeway						
Daily Vehicle-Miles of Travel (1000s)	30,800	30,000	29,355	29,260	28,320	28,440
Lane Miles	1,820	1,800	1,790	1,790	1,770	1,770
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	44,910	44,295	44,510	44,475	43,675	42,525
Lane Miles	8,110	8,040	8,015	7,990	7,980	7,960
Public Transportation						
Annual Psgr-Miles of Travel (millions)	269	279	202	244	292	350
Annual Unlinked Psgr Trips (millions)	53	69	57	59	69	70
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	1.11	1.12	1.29	1.12	1.02
System Performance						
Congested Travel (% of peak VMT)	67	64	63	61	59	59
Congested System (% of lane-miles)	52	48	48	47	46	46
Congested Time (number of "Rush Hours")	7.4	7.2	7.2	7.2	7.2	7.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	130	89	94	169	156	137
Transit Riders or Carpoolers (millions)	34	24	25	44	40	35
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	68,307	64,865	63,609	61,463	58,292	58,397
Rank	8	7	7	6	6	6
Fuel per Peak Traveler (gallons)	35	34	34	33	32	33
Rank	8	7	8	9	9	7
Annual Delay						
Total Delay (1000s of person-hours)	103,354	99,320	98,227	96,064	92,257	92,724
Rank	7	6	5	6	6	4
Delay per Peak Traveler (person-hrs)	53	52	52	52	51	52
Rank	7	6	7	7	8	5
Delay due to Incidents (percent)	54	55	55	56	55	56
Travel Time Index						
Rank	1.30	1.28	1.28	1.27	1.26	1.27
Rank	12	8	7	8	8	6
Congestion Cost						
Total Cost (\$ millions)	1,600	1,512	1,480	1,427	1,329	1,294
Rank	6	6	4	6	5	4
Cost per Peak Traveler (\$)	821	790	788	776	736	729
Rank	6	6	7	7	8	4

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 Detroit, MI, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	4,010	4,005	3,985	3,980	3,915	3,900
Rank	6	6	5	5	5	5
Urban Area (square miles)	1,295	1,290	1,260	1,255	1,250	1,250
Popn Density (persons/sq mile)	3,097	3,105	3,163	3,171	3,132	3,120
Peak Travelers (1000s)	1,740	1,706	1,666	1,632	1,589	1,572
Freeway						
Daily Vehicle-Miles of Travel (1000s)	29,000	28,785	27,405	26,645	26,680	25,410
Lane Miles	1,770	1,770	1,770	1,770	1,770	1,730
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	42,000	41,650	40,260	39,855	39,500	39,180
Lane Miles	7,950	7,910	7,860	7,825	7,800	7,525
Public Transportation						
Annual Psgr-Miles of Travel (millions)	359	395	421	416	343	325
Annual Unlinked Psgr Trips (millions)	72	82	96	95	81	75
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	1.08	1.13	1.10	1.12	1.03
System Performance						
Congested Travel (% of peak VMT)	59	56	53	51	50	47
Congested System (% of lane-miles)	46	42	41	41	41	40
Congested Time (number of "Rush Hours")	7.2	7.2	6.8	6.6	6.6	6.6
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	186	242	184	283	351	380
Transit Riders or Carpoolers (millions)	47	61	45	68	84	92
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	61,017	57,443	50,884	47,621	43,940	41,396
Rank	5	5	5	5	5	5
Fuel per Peak Traveler (gallons)	35	34	31	29	28	26
Rank	5	4	7	7	8	6
Annual Delay						
Total Delay (1000s of person-hours)	98,122	91,620	82,765	78,294	70,779	68,109
Rank	4	5	5	5	5	5
Delay per Peak Traveler (person-hrs)	56	54	50	48	45	43
Rank	3	3	5	5	5	5
Delay due to Incidents (percent)	57	57	57	57	57	57
Travel Time Index						
Rank	1.28	1.26	1.24	1.23	1.21	1.20
Rank	6	7	9	10	12	11
Congestion Cost						
Total Cost (\$ millions)	1,342	1,227	1,084	998	842	769
Rank	4	4	5	5	5	5
Cost per Peak Traveler (\$)	771	719	651	611	530	489
Rank	3	3	5	4	4	5

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 Detroit, MI, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	3,885	3,885	3,885	3,810	3,810	3,810
Rank	5	5	5	5	5	5
Urban Area (square miles)	1,245	1,245	1,240	1,190	1,140	1,090
Popn Density (persons/sq mile)	3,120	3,120	3,133	3,202	3,342	3,495
Peak Travelers (1000s)	1,550	1,535	1,523	1,478	1,467	1,452
Freeway						
Daily Vehicle-Miles of Travel (1000s)	22,650	21,670	19,500	18,270	17,300	17,925
Lane Miles	1,675	1,630	1,600	1,575	1,575	1,575
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	39,590	39,895	38,000	37,010	35,505	34,250
Lane Miles	7,285	7,105	7,015	6,795	6,650	6,565
Public Transportation						
Annual Psgr-Miles of Travel (millions)	360	349	305	429	429	429
Annual Unlinked Psgr Trips (millions)	79	83	77	99	99	99
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)	1.04	1.01	1.32	1.34	1.37	1.43
System Performance						
Congested Travel (% of peak VMT)	44	43	39	37	35	35
Congested System (% of lane-miles)	40	39	38	37	37	37
Congested Time (number of "Rush Hours")	6.2	6.2	5.6	5.4	5.2	5.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	322	--	--	--	--	--
Transit Riders or Carpoolers (millions)	78	--	--	--	--	--
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	33,964	32,861	26,766	24,447	22,174	21,844
Rank	6	6	6	6	6	6
Fuel per Peak Traveler (gallons)	22	21	18	17	15	15
Rank	7	7	8	7	7	7
Annual Delay						
Total Delay (1000s of person-hours)	55,191	53,739	44,388	40,953	37,145	36,598
Rank	5	6	6	6	5	4
Delay per Peak Traveler (person-hrs)	36	35	29	28	25	25
Rank	5	6	7	7	7	5
Delay due to Incidents (percent)	56	55	55	54	54	55
Travel Time Index						
Rank	11	9	12	11	9	7
Congestion Cost						
Total Cost (\$ millions)	603	566	465	416	364	349
Rank	5	5	6	6	5	4
Cost per Peak Traveler (\$)	389	369	306	281	248	240
Rank	5	7	7	7	7	5

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

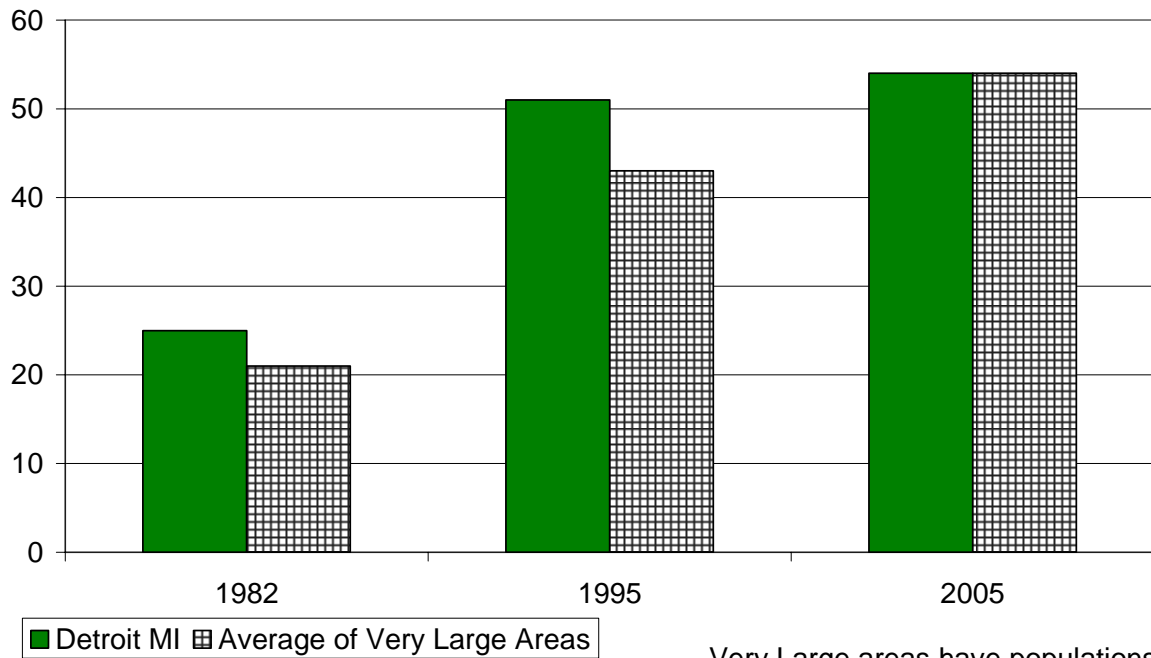
Note: Zeroes in the table reflect values less than 0.5.

Benefits From Public Transportation Service and Operations Strategies for Detroit, MI

Operations Strategies	2005	2004	2003	2002	2001	2000
Freeway Ramp Metering						
Percent of Roadway Miles	15	15	13	14	14	14
Annual Delay Reduction (1000 hours)	182	245	273	233	216	274
Freeway Incident Management						
Cameras						
Percent of Roadway Miles	58	58	59	59	61	61
Service Patrols						
Percent of Roadway Miles	58	58	58	61	34	14
Annual Delay Reduction (1000 hours)	1,482	1,777	2,124	1,879	1,336	734
Arterial Signal Coordination						
Percent of Roadway Miles	24	24	25	19	17	15
Annual Delay Reduction (1000 hours)	453	405	343	236	197	350
Arterial Access Management						
Percent of Roadway Miles	20	20	20	20	20	21
Annual Delay Reduction (1000 hours)	1,707	1,796	1,685	1,606	1,382	1,598
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	--	--	--	--	--	--
HOV User Delay Savings	--	--	--	--	--	--
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	3,824	4,223	4,426	3,954	3,131	2,956
Annual Delay Saved per Peak Traveler (hours)	2	2	2	2	2	1
Annual Congestion Cost Savings (\$million)	73.0	76.1	76.7	67.0	52.4	48.3
Travel Time Index with Strategies	1.290	1.302	1.310	1.303	1.288	1.283
Travel Time Index (Base)	1.300	1.313	1.321	1.313	1.296	1.290
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	267	243	259	295	266	288
Unlinked Passenger Trips (million)	48	45	49	54	56	57
Travel Time Index (combined road and transit)	1.286	1.298	1.305	1.297	1.284	1.278
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.306	1.317	1.327	1.320	1.303	1.297
Annual Delay Increase (1000 hours)	3,276	2,886	3,441	3,763	3,235	3,631
Annual Delay Increase per Peak Traveler (hours)	2	1	2	2	2	2
Annual Congestion Cost Increase (\$million)	61.3	51.5	59.1	63.1	53.7	58.7

Growth in Delay per Peak Traveler

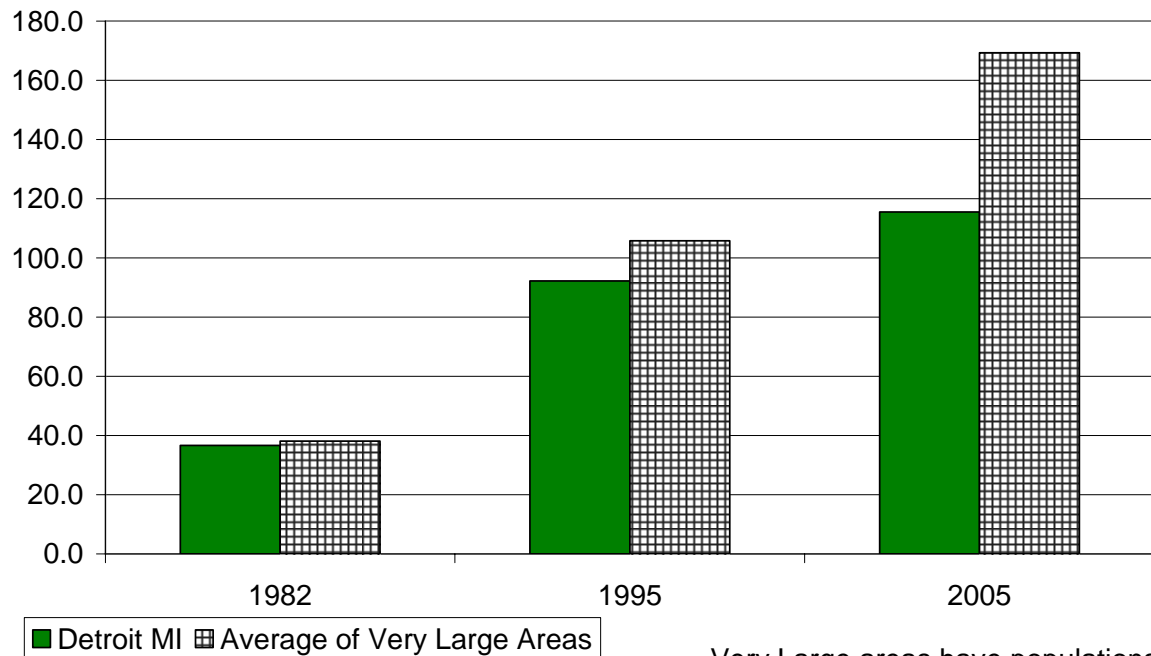
Hours of Delay



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