

Performance Measure Summary – Washington, DC-VA-MD

There are several inventory and performance measures listed in the pages of this Urban Area Report for the years from 1982 to 2007. 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. 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*).

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 2007 (estimated at \$15.47 per hour of person travel and \$102.12 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.

The Mobility Data for Washington DC-VA-MD

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	4,330	4,300	4,280	4,275	4,250	4,185
Rank	9	8	8	8	8	7
Urban Area (square miles)	1,310	1,310	1,310	1,310	1,305	1,270
Population Density (persons/sq mile)	3,305	3,282	3,267	3,263	3,257	3,295
Peak Travelers (1000s)	2,174	2,154	2,131	2,120	2,100	2,072
Freeway						
Daily Vehicle-Miles of Travel (1000s)	39,045	38,400	38,580	38,200	37,815	36,200
Lane-Miles	2,075	2,060	2,050	2,050	2,040	1,970
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	41,575	40,850	41,195	40,960	40,395	38,385
Lane-Miles	6,175	6,130	6,100	5,945	5,915	5,850
Public Transportation						
Annual Psgr-Miles of Travel (millions)	2,380	2,372	2,195	2,267	2,193	2,156
Annual Unlinked Psgr Trips (millions)	465	461	462	443	434	430
Cost Components						
Value of Time (\$/hour)	15.47	15.06	14.58	14.10	13.73	13.43
Commercial Cost (\$/hour)	102.12	98.77	94.06	86.24	82.38	79.96
Fuel Cost (\$/gallon)	3.15	2.79	2.40	2.04	1.62	1.53
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	81	81	81	81	81	80
Congested System (% of lane-miles)	63	63	63	63	63	63
Congested Time (number of "Rush Hours")	8.0	7.8	8.0	8.0	7.8	7.8
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	130	164	218	219	204	152
Transit Riders or Carpoolers (millions)	44	55	74	75	70	51
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	90,801	86,826	87,951	87,667	86,737	81,841
Rank	8	9	8	8	6	7
Fuel per Peak Traveler (gallons)	42	40	41	41	41	40
Rank	2	5	4	4	3	3
Annual Delay						
Total Delay (1000s of person-hours)	133,862	127,536	129,423	128,390	126,807	119,334
Rank	7	8	8	6	5	6
Delay per Peak Traveler (person-hours)	62	59	61	61	60	58
Rank	2	2	2	2	2	4
Delay due to Incidents (percent)	51	51	51	51	51	51
Travel Time Index	1.39	1.37	1.37	1.38	1.38	1.37
Rank	4	6	7	5	3	3
Congestion Cost						
Total Cost (\$ millions)	2,762	2,509	2,433	2,290	2,170	1,989
Rank	7	8	8	6	6	6
Cost per Peak Traveler (\$)	1,271	1,165	1,141	1,080	1,033	960
Rank	2	3	3	3	3	4

Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.

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

The Mobility Data for Washington DC-VA-MD, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	4,030	3,900	3,885	3,800	3,660
Rank	8	9	9	10	10
Urban Area (square miles)	1,230	1,200	1,160	1,125	1,085
Population Density (persons/sq mile)	3,276	3,250	3,349	3,378	3,373
Peak Travelers (1000s)	1,999	1,938	1,935	1,892	1,826
Freeway					
Daily Vehicle-Miles of Travel (1000s)	35,770	34,535	33,975	33,930	33,340
Lane-Miles	1,970	1,960	1,950	1,935	1,930
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	36,000	35,395	35,165	34,965	34,370
Lane-Miles	5,800	5,740	5,665	5,600	5,550
Public Transportation					
Annual Psgr-Miles of Travel (millions)	2,055	1,854	1,703	1,679	1,499
Annual Unlinked Psgr Trips (millions)	415	381	387	369	323
Cost Components					
Value of Time (\$/hour)	13.22	12.85	12.43	12.17	11.98
Commercial Cost (\$/hour)	80.88	80.75	74.23	72.61	74.32
Fuel Cost (\$/gallon)	1.75	1.61	1.10	1.11	1.21
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	79	74	73	71	73
Congested System (% of lane-miles)	63	59	59	59	59
Congested Time (number of "Rush Hours")	7.8	7.6	7.6	7.6	7.6
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	94	82	79	152	225
Transit Riders or Carpoolers (millions)	30	26	25	48	71
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	76,304	69,611	68,585	63,944	65,311
Rank	7	7	6	6	5
Fuel per Peak Traveler (gallons)	38	36	35	34	36
Rank	5	6	6	6	6
Annual Delay					
Total Delay (1000s of person-hours)	110,952	102,851	99,354	91,516	94,533
Rank	6	7	6	7	5
Delay per Peak Traveler (person-hours)	56	53	51	48	52
Rank	5	6	5	6	5
Delay due to Incidents (percent)	51	51	50	50	50
Travel Time Index	1.36	1.33	1.33	1.31	1.32
Rank	2	6	3	4	3
Congestion Cost					
Total Cost (\$ millions)	1,846	1,664	1,508	1,371	1,410
Rank	7	8	6	7	6
Cost per Peak Traveler (\$)	924	859	779	725	772
Rank	5	6	6	8	6

Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.

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

The Mobility Data for Washington DC-VA-MD, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	3,570	3,510	3,480	3,420	3,300
Rank	10	9	9	9	10
Urban Area (square miles)	1,040	1,000	995	975	925
Population Density (persons/sq mile)	3,433	3,510	3,497	3,508	3,568
Peak Travelers (1000s)	1,785	1,759	1,743	1,717	1,660
Freeway					
Daily Vehicle-Miles of Travel (1000s)	33,045	32,460	31,565	29,320	27,985
Lane-Miles	1,925	1,920	1,915	1,900	1,825
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	34,575	33,880	34,080	33,035	30,420
Lane-Miles	5,440	5,385	5,270	5,250	5,210
Public Transportation					
Annual Psgr-Miles of Travel (millions)	1,435	1,701	1,595	1,447	1,559
Annual Unlinked Psgr Trips (millions)	318	370	343	353	354
Cost Components					
Value of Time (\$/hour)	11.71	11.37	11.06	10.78	10.47
Commercial Cost (\$/hour)	74.17	71.54	69.53	67.77	66.19
Fuel Cost (\$/gallon)	1.32	1.24	1.10	1.12	1.18
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	73	71	70	69	70
Congested System (% of lane-miles)	59	58	61	61	61
Congested Time (number of "Rush Hours")	7.6	7.6	7.4	7.2	7.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	352	414	429	400	335
Transit Riders or Carpoolers (millions)	112	130	136	121	96
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	65,662	60,859	58,835	56,176	53,534
Rank	5	5	5	6	6
Fuel per Peak Traveler (gallons)	37	35	34	33	32
Rank	3	3	4	4	5
Annual Delay					
Total Delay (1000s of person-hours)	94,883	89,110	86,968	83,237	78,812
Rank	4	6	5	6	6
Delay per Peak Traveler (person-hours)	53	51	50	48	47
Rank	4	4	4	6	6
Delay due to Incidents (percent)	50	51	52	52	52
Travel Time Index	1.32	1.30	1.29	1.30	1.30
Rank	4	3	3	3	3
Congestion Cost					
Total Cost (\$ millions)	1,397	1,269	1,196	1,117	1,028
Rank	5	6	5	6	6
Cost per Peak Traveler (\$)	783	721	686	650	619
Rank	5	7	7	7	6

Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.

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

The Mobility Data for Washington DC-VA-MD, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	3,250	3,100	3,080	3,040	2,980
Rank	10	10	10	10	10
Urban Area (square miles)	920	840	835	830	820
Population Density (persons/sq mile)	3,533	3,690	3,689	3,663	3,634
Peak Travelers (1000s)	1,638	1,566	1,540	1,505	1,463
Freeway					
Daily Vehicle-Miles of Travel (1000s)	26,000	25,080	24,590	23,455	22,365
Lane-Miles	1,750	1,675	1,600	1,500	1,425
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	27,525	25,305	24,530	24,045	23,930
Lane-Miles	5,180	5,145	5,125	5,105	5,065
Public Transportation					
Annual Psgr-Miles of Travel (millions)	1,642	1,713	1,640	1,607	1,456
Annual Unlinked Psgr Trips (millions)	383	376	370	354	354
Cost Components					
Value of Time (\$/hour)	10.17	9.75	9.25	8.83	8.48
Commercial Cost (\$/hour)	64.55	62.47	59.16	56.03	54.62
Fuel Cost (\$/gallon)	1.12	1.08	1.10	1.02	1.02
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	67	66	69	67	63
Congested System (% of lane-miles)	61	61	62	61	56
Congested Time (number of "Rush Hours")	6.8	6.6	6.8	6.8	6.8
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	269	300	383	442	473
Transit Riders or Carpoolers (millions)	72	77	97	110	117
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	45,322	40,606	40,560	37,100	33,252
Rank	6	6	6	6	6
Fuel per Peak Traveler (gallons)	28	26	26	25	23
Rank	6	8	7	5	4
Annual Delay					
Total Delay (1000s of person-hours)	66,855	60,117	59,303	54,650	49,873
Rank	6	6	6	6	6
Delay per Peak Traveler (person-hours)	41	38	39	36	34
Rank	7	8	8	7	4
Delay due to Incidents (percent)	52	52	53	53	53
Travel Time Index	1.28	1.26	1.27	1.25	1.23
Rank	4	5	4	5	5
Congestion Cost					
Total Cost (\$ millions)	850	729	686	600	531
Rank	6	6	6	6	6
Cost per Peak Traveler (\$)	519	466	445	399	363
Rank	7	10	9	8	6

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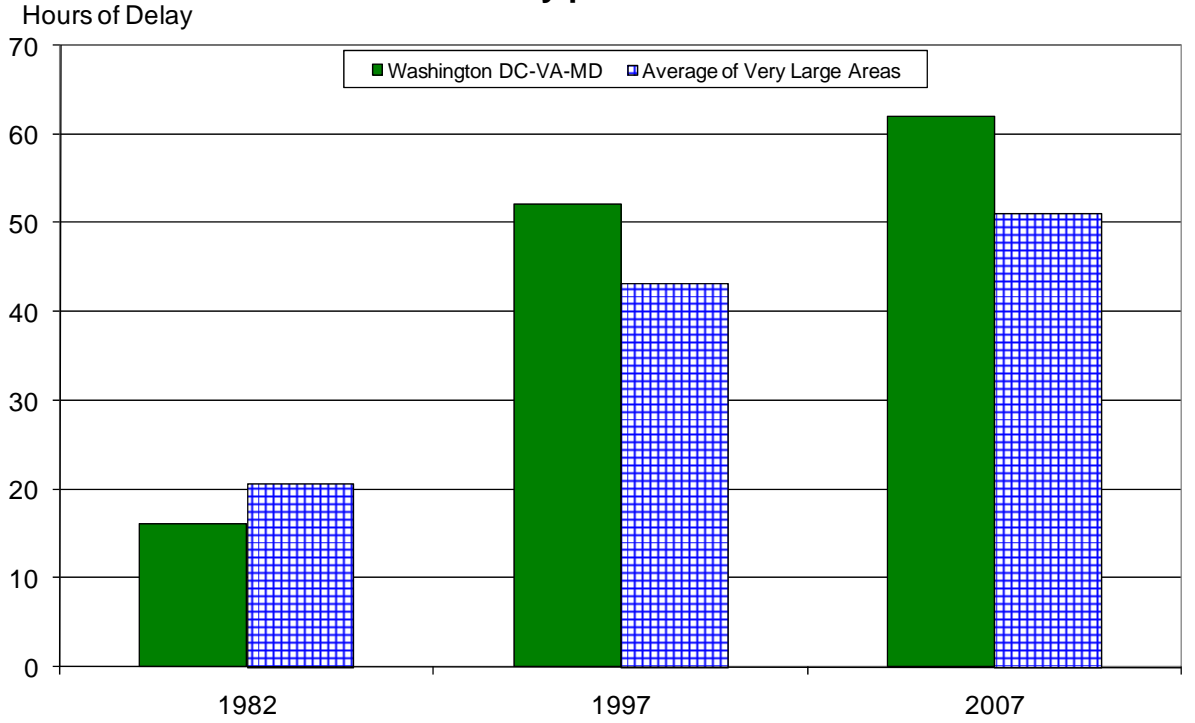
The Mobility Data for Washington DC-VA-MD, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	2,920	2,860	2,810	2,780	2,700
Rank	9	9	9	9	9
Urban Area (square miles)	815	810	805	800	795
Population Density (persons/sq mile)	3,583	3,531	3,491	3,475	3,396
Peak Travelers (1000s)	1,422	1,379	1,343	1,318	1,266
Freeway					
Daily Vehicle-Miles of Travel (1000s)	21,345	19,460	18,015	16,255	15,200
Lane-Miles	1,345	1,290	1,285	1,260	1,230
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	22,885	21,165	19,230	18,105	17,375
Lane-Miles	5,015	4,960	4,940	4,900	4,850
Public Transportation					
Annual Psgr-Miles of Travel (millions)	1,360	1,258	1,163	1,163	1,163
Annual Unlinked Psgr Trips (millions)	329	311	309	309	309
Cost Components					
Value of Time (\$/hour)	8.18	8.03	7.75	7.43	7.20
Commercial Cost (\$/hour)	52.63	55.80	54.65	52.70	52.13
Fuel Cost (\$/gallon)	0.99	1.30	1.31	1.34	1.41
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	63	55	48	40	36
Congested System (% of lane-miles)	56	55	50	45	44
Congested Time (number of "Rush Hours")	6.8	6.2	5.4	4.6	4.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	30,252	24,317	19,137	14,078	12,209
Rank	7	7	7	8	9
Fuel per Peak Traveler (gallons)	21	18	14	11	10
Rank	5	6	10	15	14
Annual Delay					
Total Delay (1000s of person-hours)	45,320	37,870	30,124	22,710	19,761
Rank	7	7	7	8	9
Delay per Peak Traveler (person-hours)	32	27	22	17	16
Rank	7	7	12	17	17
Delay due to Incidents (percent)	53	53	53	54	54
Travel Time Index	1.22	1.19	1.16	1.13	1.11
Rank	5	6	6	8	9
Congestion Cost					
Total Cost (\$ millions)	466	394	304	221	188
Rank	7	7	7	9	10
Cost per Peak Traveler (\$)	327	286	227	167	149
Rank	7	9	13	17	20

Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.

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

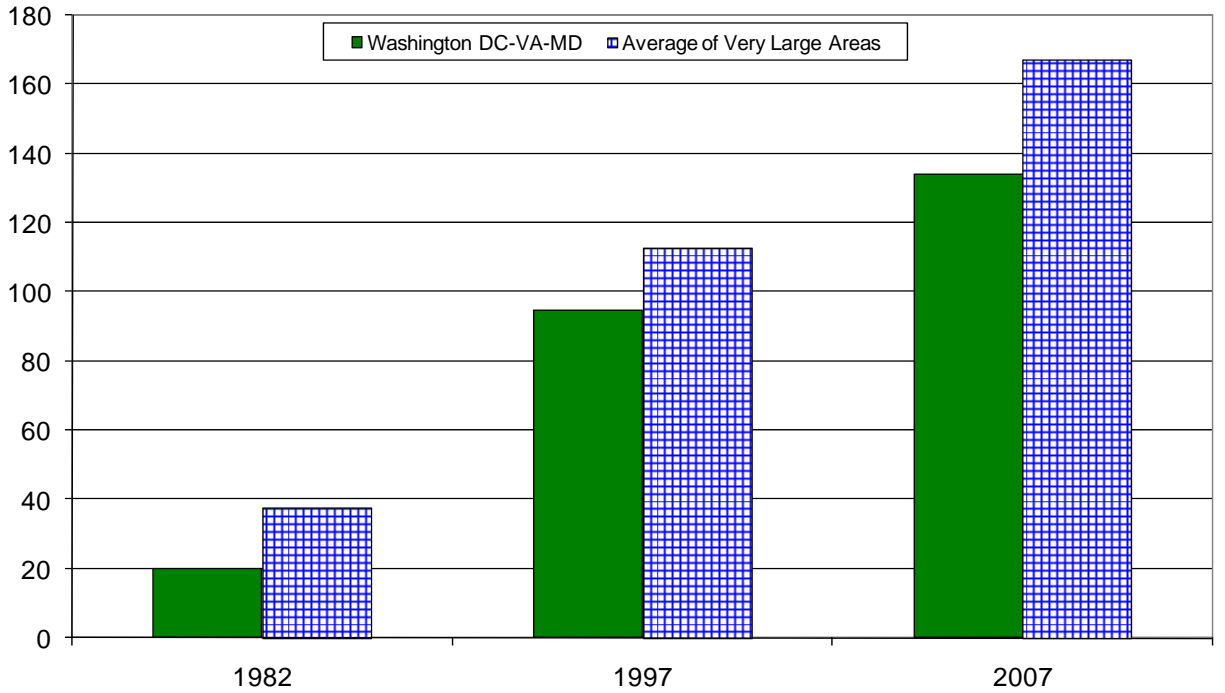
Growth in Delay per Peak Traveler



Note: Very Large areas have populations over 3 million

Annual Hours of Delay (millions)

Growth in Total Delay



Note: Very Large areas have populations over 3 million

**Benefits from Public Transportation Service and Operations Strategies in
Washington DC-VA-MD**

Operations Strategies	2007	2006	2005	2004
Freeway Ramp Metering				
Percent of Roadway Miles	6	6	6	6
Annual Delay Reduction (1000 hours)	143	121	122	127
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	66	66	66	66
Service Patrols				
Percent of Roadway Miles	53	53	54	54
Annual Delay Reduction (1000 hours)	2,647	2,400	2,421	2,413
Arterial Signal Coordination				
Percent of Roadway Miles	55	54	54	56
Annual Delay Reduction (1000 hours)	808	779	785	768
Arterial Access Management				
Percent of Roadway Miles	36	34	34	35
Annual Delay Reduction (1000 hours)	2,470	2,531	2,660	2,801
HOV Lanes				
Daily Passenger-miles of travel (1000s)	3,100	2,900	2,774	2,523
HOV User Delay Savings	4,450	3,782	3,580	3,315
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	10,517	9,613	9,567	9,423
Annual Delay Saved per Peak Traveler (hours)	5	4	4	4
Annual Congestion Cost Savings (\$million)	216.1	188.5	179.2	167.4
Travel Time Index with Strategies	1.386	1.372	1.374	1.376
Travel Time Index (Base)	1.419	1.403	1.405	1.407
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	2,380	2,372	2,195	2,267
Unlinked Passenger Trips (million)	465	461	462	443
Travel Time Index (combined road and transit)	1.383	1.368	1.372	1.372
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.462	1.451	1.446	1.450
Annual Increase				
Delay (1000 hours)	26,285	27,328	24,056	25,388
Delay per Peak Traveler (hours)	12	13	11	12
Congestion Cost (\$million)	521.1	520.2	435.4	438.4

**Benefits from Public Transportation Service and Operations Strategies in
Washington DC-VA-MD, Continued**

Operations Strategies	2003	2002	2001	2000
Freeway Ramp Metering				
Percent of Roadway Miles	6	6	6	6
Annual Delay Reduction (1000 hours)	105	101	153	151
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	67	69	57	44
Service Patrols				
Percent of Roadway Miles	54	56	72	93
Annual Delay Reduction (1000 hours)	2,430	2,295	2,589	3,011
Arterial Signal Coordination				
Percent of Roadway Miles	48	46	46	45
Annual Delay Reduction (1000 hours)	589	619	626	467
Arterial Access Management				
Percent of Roadway Miles	36	34	31	27
Annual Delay Reduction (1000 hours)	2,638	2,188	2,174	1,499
HOV Lanes				
Daily Passenger-miles of travel (1000s)	2,294	2,087	1,898	1,726
HOV User Delay Savings	2,942	2,608	2,129	1,800
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	8,704	7,812	7,671	6,928
Annual Delay Saved per Peak Traveler (hours)	4	4	4	4
Annual Congestion Cost Savings (\$million)	148.6	130.1	127.6	112.7
Travel Time Index with Strategies	1.376	1.371	1.357	1.331
Travel Time Index (Base)	1.404	1.398	1.384	1.354
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	2,193	2,156	2,055	1,854
Unlinked Passenger Trips (million)	434	430	415	381
Travel Time Index (combined road and transit)	1.371	1.365	1.351	1.327
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.446	1.447	1.432	1.391
Annual Increase				
Delay (1000 hours)	23,990	25,187	23,557	19,074
Delay per Peak Traveler (hours)	11	12	12	10
Congestion Cost (\$million)	396.1	408.0	380.5	297.6

**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 2007	
				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	S	F+
Miami FL	L	0	L	0	S
Philadelphia, PA-NJ-DE-MD	L-	L-	L-	S-	S-
San Francisco-Oakland, CA	H	H	L	0	S-
Dallas-Fort Worth-Arlington, TX	0	L	L	F+	0
Atlanta, GA	H	0	L	F+	S
Washington, DC-VA-MD	H+	0	L	F+	S-
Boston, MA-NH-RI	L-	L-	L-	0	S-
Detroit, MI	0	L-	L-	0	S-
Houston, TX	H	L	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

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
2007 Values Delay per Traveler - Travel Time Index - Total Delay -	Above 1M Population 5 Hours 5 Index Points 5 Hours x Average Population	Below 1M Population 3 Hours 3 Index Points 3 Hours x Average Population
1982 to 2007 Trends Delay per Traveler - Total Delay -	5 Hours 5 Hours x Average Population	3 Hours 3 Hours x Average Population