

Performance Measure Summary – Virginia Beach, VA

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 Virginia Beach VA

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	1,545	1,540	1,540	1,540	1,535	1,530
Rank	28	28	28	28	28	28
Urban Area (square miles)	1,025	1,020	1,020	1,020	1,000	990
Population Density (persons/sq mile)	1,507	1,510	1,510	1,510	1,535	1,545
Peak Travelers (1000s)	865	856	850	845	838	823
Freeway						
Daily Vehicle-Miles of Travel (1000s)	13,115	13,200	13,105	12,995	12,875	12,460
Lane-Miles	945	945	945	940	940	940
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	15,820	15,815	15,900	15,725	15,710	16,000
Lane-Miles	2,995	2,950	2,920	2,890	2,800	2,740
Public Transportation						
Annual Psgr-Miles of Travel (millions)	103	109	108	93	87	82
Annual Unlinked Psgr Trips (millions)	27	24	24	21	18	18
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)	2.88	2.57	2.24	1.85	1.46	1.32
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	51	51	51	51	52	49
Congested System (% of lane-miles)	45	45	45	45	45	44
Congested Time (number of "Rush Hours")	6.2	6.4	6.4	6.2	6.4	6.2
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	13	45	66	74	101	111
Transit Riders or Carpoolers (millions)	3	12	17	19	27	30
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	16,324	16,957	16,818	16,445	16,817	16,677
Rank	29	29	29	30	30	28
Fuel per Peak Traveler (gallons)	19	20	20	19	20	20
Rank	41	41	40	42	40	39
Annual Delay						
Total Delay (1000s of person-hours)	24,665	25,906	25,451	25,091	25,563	26,130
Rank	28	28	28	29	29	27
Delay per Peak Traveler (person-hours)	29	30	30	30	31	32
Rank	41	41	42	40	38	37
Delay due to Incidents (percent)	57	58	57	57	58	57
Travel Time Index	1.18	1.18	1.18	1.18	1.19	1.18
Rank	39	38	39	39	35	37
Congestion Cost						
Total Cost (\$ millions)	501	510	478	446	436	435
Rank	31	29	29	29	30	27
Cost per Peak Traveler (\$)	579	596	562	528	521	529
Rank	42	42	42	43	43	37

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 Virginia Beach VA, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	1,520	1,495	1,475	1,450	1,440
Rank	27	27	26	26	25
Urban Area (square miles)	985	985	980	975	965
Population Density (persons/sq mile)	1,543	1,518	1,505	1,487	1,492
Peak Travelers (1000s)	804	779	755	731	714
Freeway					
Daily Vehicle-Miles of Travel (1000s)	11,635	11,400	11,200	10,755	10,680
Lane-Miles	915	880	865	840	835
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	15,780	15,250	14,900	14,250	13,845
Lane-Miles	2,730	2,720	2,720	2,700	2,690
Public Transportation					
Annual Psgr-Miles of Travel (millions)	94	95	88	82	75
Annual Unlinked Psgr Trips (millions)	17	19	19	18	16
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)	1.47	1.49	1.05	1.02	1.13
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	46	44	47	48	49
Congested System (% of lane-miles)	39	40	41	37	39
Congested Time (number of "Rush Hours")	6.0	6.0	5.8	5.6	5.6
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	116	122	136	136	152
Transit Riders or Carpoolers (millions)	30	31	34	33	37
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	15,733	14,007	15,753	14,833	14,084
Rank	29	30	27	28	28
Fuel per Peak Traveler (gallons)	20	18	21	20	20
Rank	37	43	34	32	32
Annual Delay					
Total Delay (1000s of person-hours)	25,468	22,303	25,196	23,629	21,847
Rank	26	30	24	25	25
Delay per Peak Traveler (person-hours)	32	29	33	32	31
Rank	34	41	28	29	32
Delay due to Incidents (percent)	57	57	57	58	57
Travel Time Index	1.18	1.16	1.19	1.19	1.18
Rank	34	40	31	27	29
Congestion Cost					
Total Cost (\$ millions)	423	364	386	356	329
Rank	27	30	25	25	25
Cost per Peak Traveler (\$)	527	468	511	487	461
Rank	37	44	30	31	35

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 Virginia Beach VA, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	1,430	1,415	1,400	1,390	1,375
Rank	24	25	25	25	25
Urban Area (square miles)	955	945	935	920	905
Population Density (persons/sq mile)	1,497	1,497	1,497	1,511	1,519
Peak Travelers (1000s)	698	679	662	646	630
Freeway					
Daily Vehicle-Miles of Travel (1000s)	10,200	9,750	9,550	9,195	8,900
Lane-Miles	825	815	810	800	780
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	13,255	12,800	12,115	11,500	10,955
Lane-Miles	2,650	2,615	2,600	2,575	2,550
Public Transportation					
Annual Psgr-Miles of Travel (millions)	70	70	68	62	59
Annual Unlinked Psgr Trips (millions)	16	15	14	14	12
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)	1.21	1.15	1.03	1.07	1.08
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	47	42	38	34	33
Congested System (% of lane-miles)	39	37	34	34	32
Congested Time (number of "Rush Hours")	5.4	5.0	4.8	4.4	4.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	135	116	98	86	78
Transit Riders or Carpoolers (millions)	32	26	22	18	16
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	13,226	11,273	9,744	8,060	7,695
Rank	27	28	28	29	29
Fuel per Peak Traveler (gallons)	19	17	15	12	12
Rank	33	36	40	46	44
Annual Delay					
Total Delay (1000s of person-hours)	20,705	18,070	15,636	12,877	12,202
Rank	26	26	27	28	29
Delay per Peak Traveler (person-hours)	30	27	24	20	19
Rank	29	33	38	45	41
Delay due to Incidents (percent)	58	58	58	57	58
Travel Time Index	1.18	1.15	1.14	1.12	1.12
Rank	27	36	37	43	38
Congestion Cost					
Total Cost (\$ millions)	306	259	216	173	160
Rank	26	26	27	29	28
Cost per Peak Traveler (\$)	439	381	327	268	254
Rank	33	36	41	46	43

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

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The Mobility Data for Virginia Beach VA, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	1,355	1,325	1,315	1,275	1,240
Rank	24	24	24	24	24
Urban Area (square miles)	890	885	870	855	845
Population Density (persons/sq mile)	1,522	1,497	1,511	1,491	1,467
Peak Travelers (1000s)	610	587	579	556	537
Freeway					
Daily Vehicle-Miles of Travel (1000s)	8,675	8,475	8,300	7,975	7,560
Lane-Miles	750	720	690	675	650
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	10,700	10,620	10,480	10,265	10,125
Lane-Miles	2,515	2,485	2,445	2,415	2,400
Public Transportation					
Annual Psgr-Miles of Travel (millions)	48	46	45	40	40
Annual Unlinked Psgr Trips (millions)	10	10	11	13	13
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)	1.08	1.06	1.10	1.02	1.02
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	34	33	32	31	28
Congested System (% of lane-miles)	32	32	31	31	27
Congested Time (number of "Rush Hours")	4.2	4.4	4.6	4.4	4.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	79	86	88	90	88
Transit Riders or Carpoolers (millions)	16	18	18	18	18
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	7,739	7,832	7,485	7,319	6,259
Rank	28	26	25	25	24
Fuel per Peak Traveler (gallons)	13	13	13	13	12
Rank	36	34	31	27	26
Annual Delay					
Total Delay (1000s of person-hours)	11,991	12,696	11,932	12,091	10,440
Rank	27	26	25	24	25
Delay per Peak Traveler (person-hours)	20	22	21	22	19
Rank	37	32	28	24	29
Delay due to Incidents (percent)	58	58	59	59	58
Travel Time Index	1.12	1.13	1.12	1.12	1.11
Rank	35	27	25	24	27
Congestion Cost					
Total Cost (\$ millions)	154	156	140	135	112
Rank	28	27	25	24	24
Cost per Peak Traveler (\$)	252	266	243	243	209
Rank	38	34	29	26	28

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.

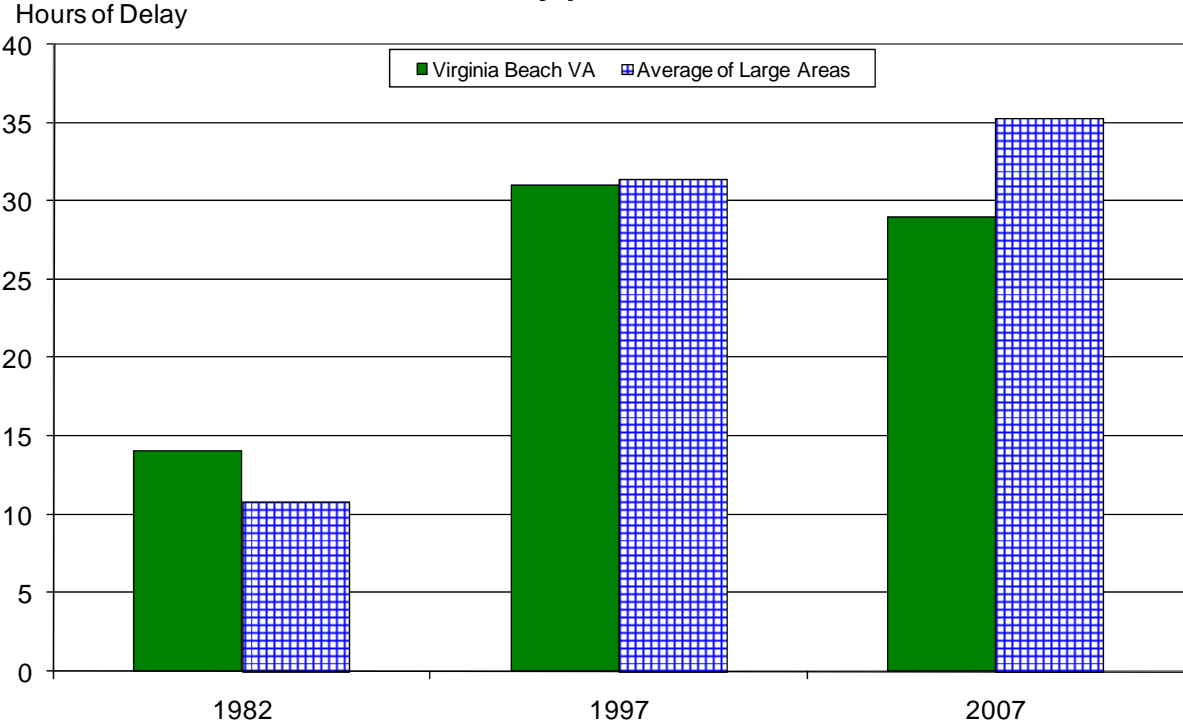
The Mobility Data for Virginia Beach VA, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	1,210	1,190	1,150	1,125	1,100
Rank	25	25	25	27	27
Urban Area (square miles)	830	815	805	790	770
Population Density (persons/sq mile)	1,458	1,460	1,429	1,424	1,429
Peak Travelers (1000s)	519	507	486	473	457
Freeway					
Daily Vehicle-Miles of Travel (1000s)	7,200	6,850	6,600	6,200	5,850
Lane-Miles	620	600	590	575	560
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	10,000	9,870	9,755	9,615	9,500
Lane-Miles	2,370	2,355	2,325	2,295	2,275
Public Transportation					
Annual Psgr-Miles of Travel (millions)	50	83	83	83	83
Annual Unlinked Psgr Trips (millions)	15	16	17	17	17
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)	28	27	25	22	22
Congested System (% of lane-miles)	26	26	26	21	21
Congested Time (number of "Rush Hours")	4.2	4.0	4.0	3.6	3.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	5,802	5,514	4,624	4,105	3,748
Rank	23	22	24	23	24
Fuel per Peak Traveler (gallons)	11	11	10	9	8
Rank	27	22	23	23	24
Annual Delay					
Total Delay (1000s of person-hours)	9,470	9,040	7,517	6,766	6,207
Rank	23	22	23	24	24
Delay per Peak Traveler (person-hours)	18	18	15	14	14
Rank	28	24	28	26	24
Delay due to Incidents (percent)	58	58	58	57	57
Travel Time Index	1.10	1.10	1.08	1.08	1.07
Rank	24	23	30	26	26
Congestion Cost					
Total Cost (\$ millions)	99	96	77	67	60
Rank	23	22	24	24	24
Cost per Peak Traveler (\$)	190	188	159	142	132
Rank	29	26	27	28	24

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

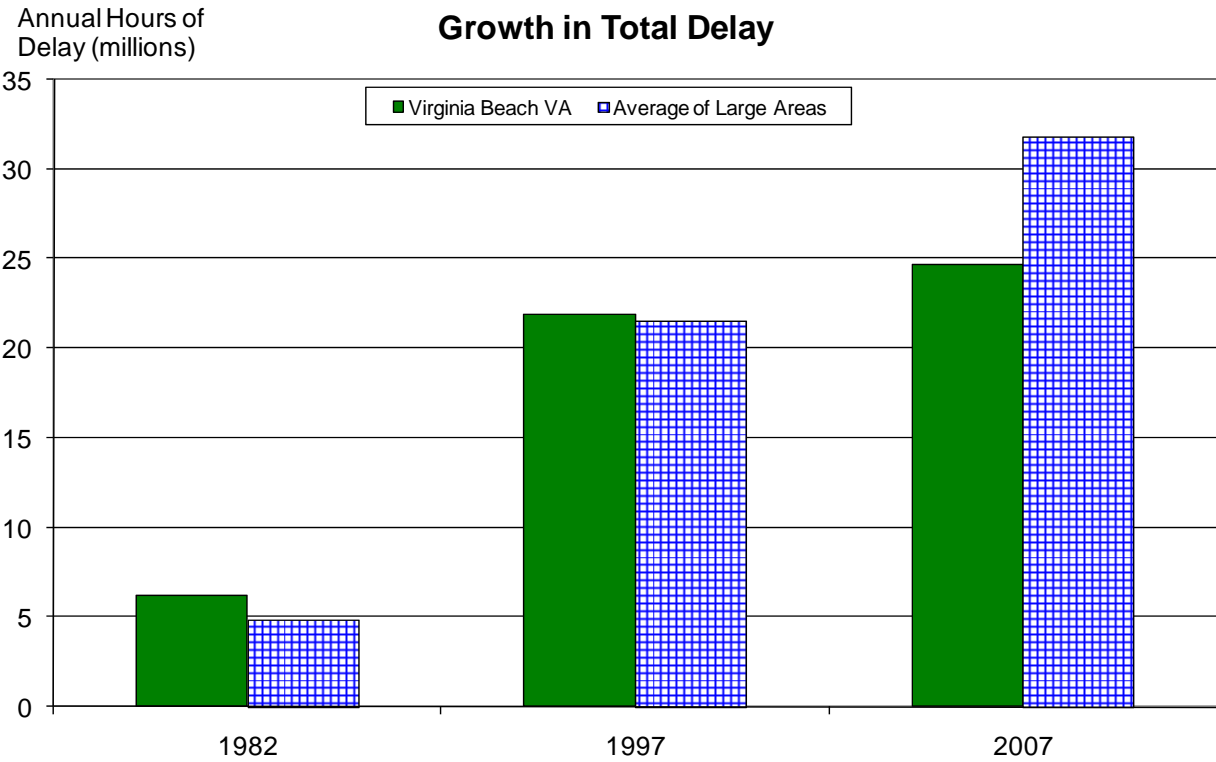
Note: Zeroes in the table reflect values less than 0.5.

Growth in Delay per Peak Traveler



Note: Large areas have populations between 1 and 3 million

Growth in Total Delay



Note: Large areas have populations between 1 and 3 million

**Benefits from Public Transportation Service and Operations Strategies in
Virginia Beach VA**

Operations Strategies	2007	2006	2005	2004
Freeway Ramp Metering				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	41	41	41	26
Service Patrols				
Percent of Roadway Miles	58	58	58	58
Annual Delay Reduction (1000 hours)	743	918	653	595
Arterial Signal Coordination				
Percent of Roadway Miles	53	48	48	38
Annual Delay Reduction (1000 hours)	211	271	244	135
Arterial Access Management				
Percent of Roadway Miles	44	44	44	44
Annual Delay Reduction (1000 hours)	839	985	899	951
HOV Lanes				
Daily Passenger-miles of travel (1000s)	220	210	204	200
HOV User Delay Savings	155	162	151	142
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	1,947	2,336	1,946	1,822
Annual Delay Saved per Peak Traveler (hours)	2	3	2	2
Annual Congestion Cost Savings (\$million)	39.5	45.6	36.3	32.2
Travel Time Index with Strategies	1.178	1.185	1.183	1.180
Travel Time Index (Base)	1.191	1.200	1.196	1.193
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	103	109	108	93
Unlinked Passenger Trips (million)	27	24	24	20
Travel Time Index (combined road and transit)	1.189	1.197	1.194	1.191
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.195	1.204	1.200	1.197
Annual Increase				
Delay (1000 hours)	913	1,062	1,006	937
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	18.6	20.9	18.9	16.7

**Benefits from Public Transportation Service and Operations Strategies in
Virginia Beach VA, Continued**

Operations Strategies	2003	2002	2001	2000
Freeway Ramp Metering				
Percent of Roadway Miles	--	--	--	--
Annual Delay Reduction (1000 hours)	--	--	--	--
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	25	25	20	14
Service Patrols				
Percent of Roadway Miles	58	58	50	45
Annual Delay Reduction (1000 hours)	606	596	493	398
Arterial Signal Coordination				
Percent of Roadway Miles	36	37	37	33
Annual Delay Reduction (1000 hours)	120	129	109	63
Arterial Access Management				
Percent of Roadway Miles	44	46	47	47
Annual Delay Reduction (1000 hours)	644	891	959	320
HOV Lanes				
Daily Passenger-miles of travel (1000s)	196	192	188	184
HOV User Delay Savings	145	135	125	116
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	1,515	1,751	1,687	897
Annual Delay Saved per Peak Traveler (hours)	2	2	2	1
Annual Congestion Cost Savings (\$million)	26.0	29.1	27.9	14.9
Travel Time Index with Strategies	1.186	1.185	1.181	1.164
Travel Time Index (Base)	1.197	1.196	1.191	1.171
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	87	82	94	95
Unlinked Passenger Trips (million)	18	18	17	19
Travel Time Index (combined road and transit)	1.195	1.195	1.189	1.169
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.200	1.198	1.195	1.175
Annual Increase				
Delay (1000 hours)	774	620	927	848
Delay per Peak Traveler (hours)	1	1	1	1
Congestion Cost (\$million)	13.3	10.3	15.5	13.9

**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 2007	
				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+	0	F+
St. Louis, MO-IL	L-	L-	0	S-	S
Denver-Aurora, CO	H+	H+	H+	F	F+
Riverside-San Bernardino, CA	H+	H+	H+	F+	F+
Sacramento, CA	H	H+	H	0	F+
Pittsburgh, PA	L-	L-	L-	S-	S-
Portland, OR-WA	0	H	0	0	F
Cleveland, OH	L-	L-	L-	S-	S-
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-
San Antonio, TX	H	0	0	F+	F
Las Vegas, NV	H+	H	0	F+	F+
Orlando, FL	H+	H	H	F+	F+
Providence, RI-MA	L	L	L	0	S-
Columbus, OH	L	L	L	0	S-
Buffalo, NY	L-	L-	L-	S-	S-
New Orleans, LA	L-	L	L-	S-	S-
Charlotte, NC-SC	H	0	L	F	S-
Indianapolis, IN	H	0	L	S	S-
Jacksonville, FL	H	0	L	0	S-
Austin, TX	H	H	L	F	S-
Memphis, TN-MS-AR	L-	L-	L-	S	S-
Raleigh-Durham, NC	0	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