

Performance Measure Summary – San Francisco-Oakland, CA

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 San Francisco-Oakland CA

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	4,480	4,460	4,400	4,310	4,260	4,185
Rank	6	6	7	7	7	7
Urban Area (square miles)	1,380	1,370	1,345	1,325	1,310	1,300
Population Density (persons/sq mile)	3,246	3,255	3,271	3,253	3,252	3,219
Peak Travelers (1000s)	2,339	2,324	2,288	2,233	2,198	2,130
Freeway						
Daily Vehicle-Miles of Travel (1000s)	49,850	50,155	49,900	49,300	48,985	48,585
Lane-Miles	2,480	2,475	2,470	2,450	2,420	2,415
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	30,725	31,060	31,130	30,900	30,420	30,245
Lane-Miles	5,280	5,260	5,240	5,205	5,165	5,115
Public Transportation						
Annual Psgr-Miles of Travel (millions)	2,460	2,377	2,283	2,233	2,170	2,279
Annual Unlinked Psgr Trips (millions)	423	420	418	415	417	444
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)	3.24	2.88	2.62	2.28	1.78	1.66
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	82	84	81	81	79	77
Congested System (% of lane-miles)	60	60	58	58	58	58
Congested Time (number of "Rush Hours")	8.0	8.0	8.0	8.0	8.0	8.0
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	34	110	93	107	120	142
Transit Riders or Carpoolers (millions)	12	40	34	39	44	52
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	94,295	99,509	94,762	88,275	84,697	82,589
Rank	7	5	7	7	7	6
Fuel per Peak Traveler (gallons)	40	43	41	40	39	39
Rank	3	2	4	5	4	5
Annual Delay						
Total Delay (1000s of person-hours)	129,393	135,834	130,987	120,951	116,187	112,559
Rank	8	6	7	8	8	8
Delay per Peak Traveler (person-hours)	55	58	57	54	53	53
Rank	5	4	4	6	7	6
Delay due to Incidents (percent)	49	49	49	50	49	49
Travel Time Index	1.42	1.44	1.42	1.39	1.37	1.37
Rank	3	3	3	3	5	3
Congestion Cost						
Total Cost (\$ millions)	2,675	2,703	2,496	2,183	1,993	1,880
Rank	8	7	7	8	8	8
Cost per Peak Traveler (\$)	1,144	1,163	1,091	978	906	883
Rank	4	4	4	6	7	8

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 San Francisco-Oakland CA, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	4,090	4,040	4,025	4,015	3,960
Rank	6	6	6	7	7
Urban Area (square miles)	1,280	1,265	1,255	1,250	1,240
Population Density (persons/sq mile)	3,195	3,194	3,207	3,212	3,194
Peak Travelers (1000s)	2,049	1,992	1,956	1,923	1,869
Freeway					
Daily Vehicle-Miles of Travel (1000s)	47,000	46,500	45,710	45,145	43,800
Lane-Miles	2,400	2,335	2,335	2,335	2,280
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	28,690	29,855	29,125	28,260	28,000
Lane-Miles	5,050	5,005	4,980	4,940	4,850
Public Transportation					
Annual Psgr-Miles of Travel (millions)	2,494	2,364	2,205	2,140	2,082
Annual Unlinked Psgr Trips (millions)	465	437	420	414	412
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)	1.93	1.72	1.59	1.27	1.40
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	76	77	76	78	77
Congested System (% of lane-miles)	58	58	58	58	58
Congested Time (number of "Rush Hours")	8.0	8.0	8.0	7.8	7.8
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	86	116	120	85	65
Transit Riders or Carpoolers (millions)	30	42	43	30	22
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	77,212	78,750	71,935	70,659	65,777
Rank	6	5	5	4	4
Fuel per Peak Traveler (gallons)	38	40	37	37	35
Rank	5	3	4	4	7
Annual Delay					
Total Delay (1000s of person-hours)	105,602	107,419	95,379	93,057	86,968
Rank	8	6	8	6	7
Delay per Peak Traveler (person-hours)	52	54	49	48	47
Rank	6	5	6	6	8
Delay due to Incidents (percent)	49	49	50	50	50
Travel Time Index	1.36	1.36	1.32	1.32	1.30
Rank	2	2	4	3	5
Congestion Cost					
Total Cost (\$ millions)	1,761	1,742	1,479	1,398	1,304
Rank	8	6	7	6	7
Cost per Peak Traveler (\$)	859	875	756	727	697
Rank	7	5	9	7	8

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 San Francisco-Oakland CA, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	3,890	3,880	3,870	3,830	3,805
Rank	7	7	7	7	7
Urban Area (square miles)	1,230	1,220	1,210	1,200	1,150
Population Density (persons/sq mile)	3,163	3,180	3,198	3,192	3,309
Peak Travelers (1000s)	1,805	1,773	1,745	1,701	1,663
Freeway					
Daily Vehicle-Miles of Travel (1000s)	42,795	42,330	40,550	41,500	40,695
Lane-Miles	2,270	2,250	2,210	2,230	2,220
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	28,685	28,295	28,445	27,775	27,955
Lane-Miles	4,810	4,770	4,720	4,660	4,595
Public Transportation					
Annual Psgr-Miles of Travel (millions)	2,061	1,991	2,035	2,087	2,080
Annual Unlinked Psgr Trips (millions)	404	401	407	416	432
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	1.27	1.16	1.23	1.28
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	79	77	76	76	76
Congested System (% of lane-miles)	58	56	53	53	57
Congested Time (number of "Rush Hours")	7.8	7.8	7.8	7.8	7.8
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	71	56	22	49	111
Transit Riders or Carpoolers (millions)	25	19	8	17	39
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	70,138	67,936	62,555	66,449	64,993
Rank	4	4	4	3	3
Fuel per Peak Traveler (gallons)	39	38	36	39	39
Rank	2	2	2	2	2
Annual Delay					
Total Delay (1000s of person-hours)	94,379	91,038	83,273	88,629	88,127
Rank	5	4	6	5	5
Delay per Peak Traveler (person-hours)	52	51	48	52	53
Rank	6	4	7	2	2
Delay due to Incidents (percent)	50	50	50	50	50
Travel Time Index	1.33	1.32	1.30	1.32	1.31
Rank	2	2	2	2	2
Congestion Cost					
Total Cost (\$ millions)	1,375	1,291	1,145	1,192	1,152
Rank	6	5	6	5	5
Cost per Peak Traveler (\$)	762	728	656	701	693
Rank	6	6	8	4	2

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 San Francisco-Oakland CA, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	3,725	3,675	3,620	3,610	3,520
Rank	7	7	7	7	8
Urban Area (square miles)	1,120	1,100	1,075	1,050	1,000
Population Density (persons/sq mile)	3,326	3,341	3,367	3,438	3,520
Peak Travelers (1000s)	1,602	1,558	1,520	1,502	1,454
Freeway					
Daily Vehicle-Miles of Travel (1000s)	40,600	40,600	41,015	40,460	38,675
Lane-Miles	2,190	2,180	2,180	2,175	2,150
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	27,400	27,310	26,910	26,400	24,620
Lane-Miles	4,535	4,490	4,410	4,375	4,315
Public Transportation					
Annual Psgr-Miles of Travel (millions)	2,108	2,049	1,914	1,864	1,700
Annual Unlinked Psgr Trips (millions)	427	410	403	401	412
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)	1.11	1.14	1.14	1.05	1.05
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	76	77	75	73	67
Congested System (% of lane-miles)	57	57	57	57	52
Congested Time (number of "Rush Hours")	7.8	7.8	7.8	7.8	7.6
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	178	287	377	404	349
Transit Riders or Carpoolers (millions)	63	101	135	143	118
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	64,040	68,518	71,676	68,790	58,793
Rank	3	3	3	3	2
Fuel per Peak Traveler (gallons)	40	44	47	46	40
Rank	2	2	2	2	2
Annual Delay					
Total Delay (1000s of person-hours)	86,460	94,286	96,410	92,203	79,478
Rank	4	3	3	3	3
Delay per Peak Traveler (person-hours)	54	61	63	61	55
Rank	2	2	2	2	2
Delay due to Incidents (percent)	48	48	48	48	47
Travel Time Index	1.31	1.34	1.36	1.35	1.31
Rank	2	2	2	2	2
Congestion Cost					
Total Cost (\$ millions)	1,087	1,142	1,115	1,019	852
Rank	5	4	3	3	3
Cost per Peak Traveler (\$)	679	733	733	678	586
Rank	2	2	2	2	2

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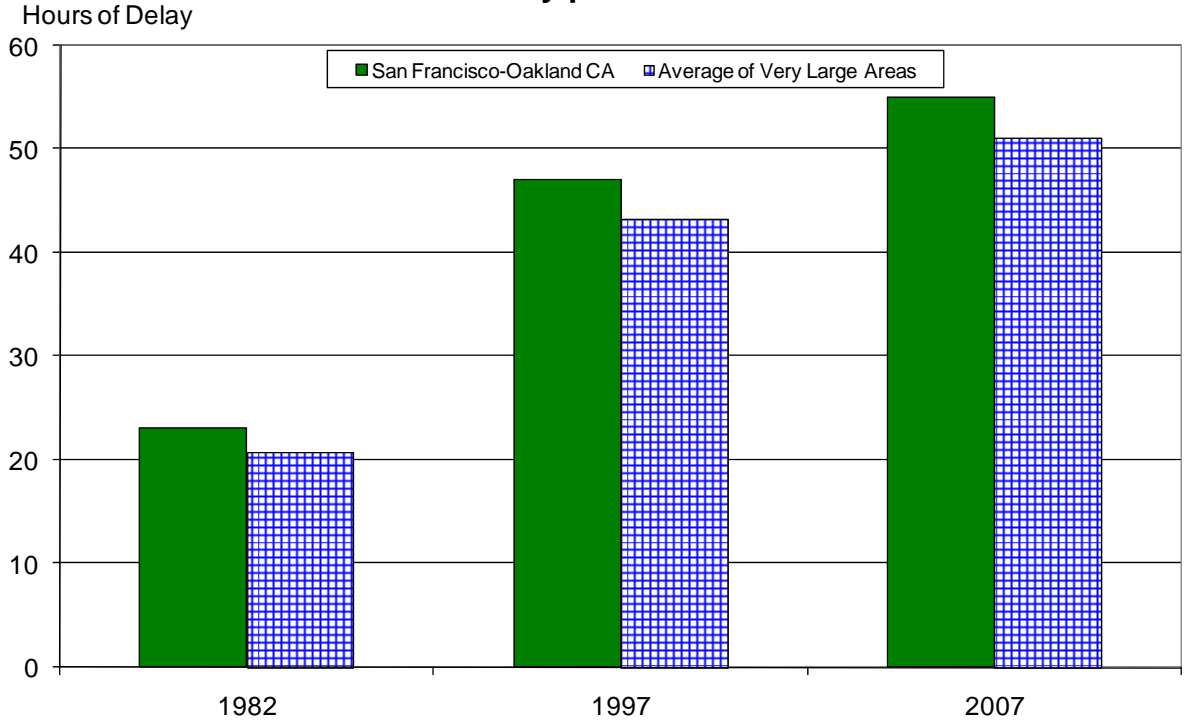
The Mobility Data for San Francisco-Oakland CA, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	3,435	3,350	3,330	3,310	3,290
Rank	8	8	8	8	8
Urban Area (square miles)	960	890	850	830	800
Population Density (persons/sq mile)	3,578	3,764	3,918	3,988	4,113
Peak Travelers (1000s)	1,405	1,357	1,339	1,317	1,296
Freeway					
Daily Vehicle-Miles of Travel (1000s)	36,905	34,575	32,215	30,500	29,790
Lane-Miles	2,140	2,125	2,105	2,080	2,055
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	22,765	20,460	19,225	19,065	18,895
Lane-Miles	4,285	4,230	4,210	4,150	4,120
Public Transportation					
Annual Psgr-Miles of Travel (millions)	1,621	1,650	1,671	1,671	1,671
Annual Unlinked Psgr Trips (millions)	420	435	491	491	491
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)	1.03	1.35	1.36	1.39	1.46
System Performance	1986	1985	1984	1983	1982
Congested Travel (% of peak VMT)	63	59	51	45	43
Congested System (% of lane-miles)	50	45	40	35	35
Congested Time (number of "Rush Hours")	7.4	7.2	6.8	6.4	6.2
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	49,530	41,813	31,715	25,182	22,084
Rank	2	3	4	4	5
Fuel per Peak Traveler (gallons)	35	31	24	19	17
Rank	2	2	3	3	4
Annual Delay					
Total Delay (1000s of person-hours)	67,854	57,712	43,445	35,408	30,348
Rank	4	4	5	6	6
Delay per Peak Traveler (person-hours)	48	43	32	27	23
Rank	2	2	3	5	7
Delay due to Incidents (percent)	48	49	50	50	50
Travel Time Index	1.27	1.25	1.20	1.16	1.14
Rank	2	2	4	4	5
Congestion Cost					
Total Cost (\$ millions)	702	607	445	351	296
Rank	4	4	5	6	6
Cost per Peak Traveler (\$)	500	447	332	266	228
Rank	2	2	4	5	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.

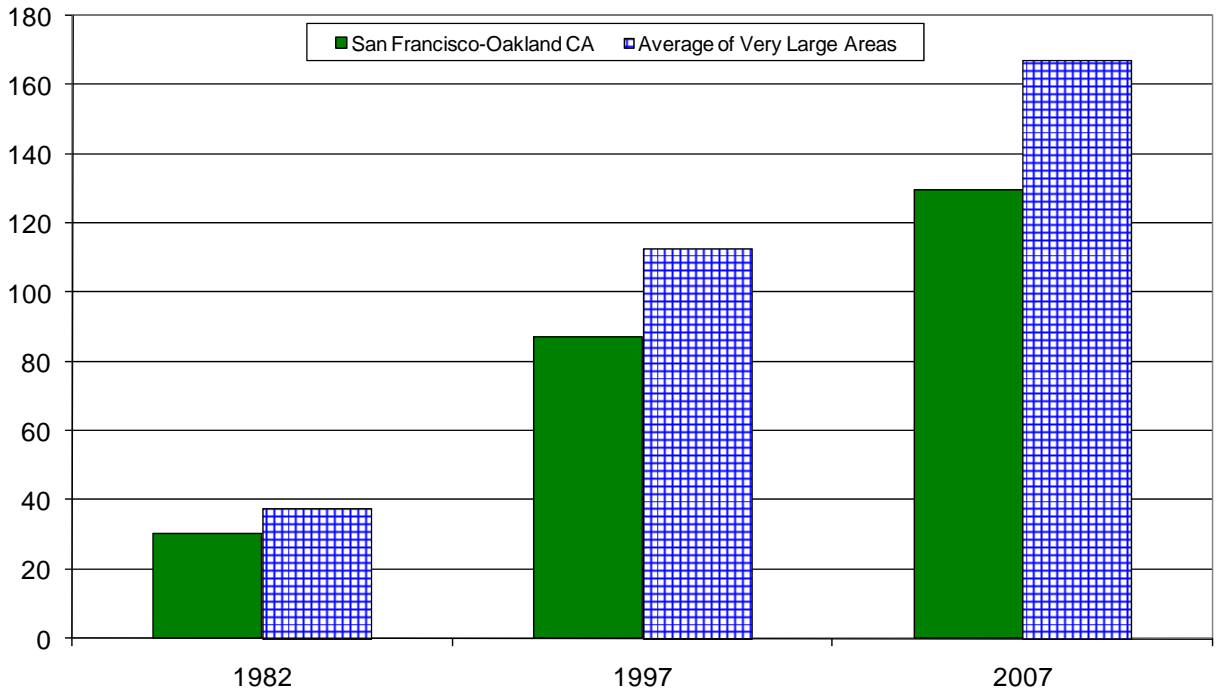
Growth in Delay per Peak Traveler



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
San Francisco-Oakland CA**

Operations Strategies	2007	2006	2005	2004
Freeway Ramp Metering				
Percent of Roadway Miles	49	49	49	49
Annual Delay Reduction (1000 hours)	2,777	2,814	2,966	2,762
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	65	65	65	66
Service Patrols				
Percent of Roadway Miles	100	94	94	95
Annual Delay Reduction (1000 hours)	7,280	7,091	5,313	4,826
Arterial Signal Coordination				
Percent of Roadway Miles	83	82	75	75
Annual Delay Reduction (1000 hours)	605	650	655	555
Arterial Access Management				
Percent of Roadway Miles	49	49	45	45
Annual Delay Reduction (1000 hours)	1,487	1,865	1,822	2,055
HOV Lanes				
Daily Passenger-miles of travel (1000s)	2,375	2,230	2,191	2,147
HOV User Delay Savings	5,526	5,351	4,777	4,285
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	17,675	17,772	15,531	14,482
Annual Delay Saved per Peak Traveler (hours)	8	8	7	6
Annual Congestion Cost Savings (\$million)	360.8	349.0	292.0	258.3
Travel Time Index with Strategies	1.420	1.442	1.416	1.387
Travel Time Index (Base)	1.478	1.500	1.466	1.433
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	2,460	2,377	2,283	2,233
Unlinked Passenger Trips (million)	423	420	418	415
Travel Time Index (combined road and transit)	1.427	1.449	1.420	1.391
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.531	1.549	1.508	1.476
Annual Increase				
Delay (1000 hours)	31,835	31,155	28,163	26,627
Delay per Peak Traveler (hours)	14	13	12	12
Congestion Cost (\$million)	658.9	619.0	535.4	480.2

**Benefits from Public Transportation Service and Operations Strategies in
San Francisco-Oakland CA, Continued**

Operations Strategies	2003	2002	2001	2000
Freeway Ramp Metering				
Percent of Roadway Miles	50	50	50	50
Annual Delay Reduction (1000 hours)	2,139	2,291	2,557	2,456
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	67	67	--	--
Service Patrols				
Percent of Roadway Miles	96	95	88	80
Annual Delay Reduction (1000 hours)	4,720	4,805	3,825	3,425
Arterial Signal Coordination				
Percent of Roadway Miles	72	72	73	74
Annual Delay Reduction (1000 hours)	607	663	595	597
Arterial Access Management				
Percent of Roadway Miles	45	44	45	45
Annual Delay Reduction (1000 hours)	1,613	1,345	1,176	1,414
HOV Lanes				
Daily Passenger-miles of travel (1000s)	2,104	2,062	2,021	1,980
HOV User Delay Savings	4,097	4,119	3,890	3,854
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	13,176	13,222	12,041	11,746
Annual Delay Saved per Peak Traveler (hours)	6	6	6	6
Annual Congestion Cost Savings (\$million)	223.9	218.7	198.5	188.6
Travel Time Index with Strategies	1.373	1.367	1.356	1.360
Travel Time Index (Base)	1.416	1.410	1.396	1.399
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	2,170	2,279	2,494	2,364
Unlinked Passenger Trips (million)	417	444	465	437
Travel Time Index (combined road and transit)	1.376	1.369	1.352	1.357
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.456	1.453	1.453	1.450
Annual Increase				
Delay (1000 hours)	24,842	26,304	30,126	28,210
Delay per Peak Traveler (hours)	11	12	15	14
Congestion Cost (\$million)	425.7	438.7	502.1	456.8

**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