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	
2005 Values	**Above 1M Population**	**Below 1M Population**
Delay per Traveler -	5 Hours	3 Hours
Travel Time Index -	5 Index Points	3 Index Points
Total Delay -	5 Hours x Average Population	3 Hours x Average Population
1982 to 2005 Trends		
Delay per Traveler -	5 Hours	3 Hours
Total Delay -	5 Hours x Average Population	3 Hours x Average Population

The Mobility Data for San Francisco-Oakland, CA

Inventory Measures	2005	2004	2003	2002	2001	2000
Urban Area Information						
Population (1000s)	4,140	4,130	4,125	4,120	4,045	4,035
Rank	9	8	8	8	7	6
Urban Area (square miles)	1,270	1,270	1,265	1,265	1,260	1,255
Popn Density (persons/sq mile)	3,260	3,252	3,261	3,257	3,210	3,215
Peak Travelers (1000s)	2,153	2,139	2,129	2,097	2,027	1,989
Freeway						
Daily Vehicle-Miles of Travel (1000s)	50,000	49,300	48,985	48,585	47,000	46,500
Lane Miles	2,475	2,450	2,420	2,415	2,400	2,335
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	31,100	30,900	30,420	30,245	28,690	29,855
Lane Miles	5,240	5,205	5,165	5,115	5,050	5,005
Public Transportation						
Annual Psgr-Miles of Travel (millions)	2,283	2,233	2,170	2,279	2,494	2,364
Annual Unlinked Psgr Trips (millions)	418	415	417	444	465	437
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 ($/gallon)	2.62	2.28	1.78	1.66	1.93	1.72
System Performance						
Congested Travel (% of peak VMT)	81	81	79	77	76	77
Congested System (% of lane-miles)	58	58	58	58	58	58
Congested Time (number of "Rush Hours")	8.0	8.0	8.0	8.0	8.0	8.0
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	94	107	120	142	86	116
Transit Riders or Carpoolers (millions)	34	39	44	52	30	42
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	100,525	93,323	89,504	87,423	81,772	83,315
Rank	6	5	6	6	6	4
Fuel per Peak Traveler (gallons)	47	44	42	42	40	42
Rank	2	4	3	3	4	3
Annual Delay						
Total Delay (1000s of person-hours)	129,919	119,892	115,146	111,500	104,581	106,500
Rank	7	8	8	8	8	6
Delay per Peak Traveler (person-hrs)	60	56	54	53	52	54
Rank	2	5	7	7	7	5
Delay due to Incidents (percent)	49	50	49	49	49	49
Travel Time Index	1.41	1.38	1.37	1.36	1.35	1.36
Rank	3	4	4	4	3	2
Congestion Cost						
Total Cost ($ millions)	2,414	2,126	1,947	1,838	1,717	1,688
Rank	7	8	8	8	8	6
Cost per Peak Traveler ($)	1,121	994	915	876	847	849
Rank	3	6	6	8	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.

The Mobility Data for San Francisco-Oakland, CA, Continued

Inventory Measures	1999	1998	1997	1996	1995	1994
Urban Area Information						
Population (1000s)	4,025	4,015	3,960	3,890	3,880	3,870
Rank	6	7	7	7	7	7
Urban Area (square miles)	1,255	1,250	1,240	1,230	1,220	1,210
Popn Density (persons/sq mile)	3,207	3,212	3,194	3,163	3,180	3,198
Peak Travelers (1000s)	1,956	1,923	1,869	1,805	1,773	1,745
Freeway						
Daily Vehicle-Miles of Travel (1000s)	45,710	45,145	43,800	42,795	42,330	40,550
Lane Miles	2,335	2,335	2,280	2,270	2,250	2,210
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	29,125	28,260	28,000	28,685	28,295	28,445
Lane Miles	4,980	4,940	4,850	4,810	4,770	4,720
Public Transportation						
Annual Psgr-Miles of Travel (millions)	2,204	2,140	2,082	2,061	1,991	2,035
Annual Unlinked Psgr Trips (millions)	420	414	412	404	401	407
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 ($/gallon)	1.59	1.27	1.40	1.21	1.27	1.16
System Performance						
Congested Travel (% of peak VMT)	76	78	77	79	77	76
Congested System (% of lane-miles)	58	58	58	58	56	53
Congested Time (number of "Rush Hours")	8.0	7.8	7.8	7.8	7.8	7.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	120	85	65	71	56	22
Transit Riders or Carpoolers (millions)	43	30	22	25	19	8
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	78,803	77,070	71,382	75,604	73,025	66,985
Rank	4	4	4	4	4	4
Fuel per Peak Traveler (gallons)	40	40	38	42	41	38
Rank	3	3	3	3	3	3
Annual Delay						
Total Delay (1000s of person-hours)	106,519	103,247	95,734	103,263	99,350	89,961
Rank	5	5	6	4	4	6
Delay per Peak Traveler (person-hrs)	54	54	51	57	56	52
Rank	6	4	8	3	3	6
Delay due to Incidents (percent)	50	50	50	50	50	50
Travel Time Index	1.36	1.35	1.33	1.36	1.35	1.32
Rank	2	2	4	2	2	2
Congestion Cost						
Total Cost ($ millions)	1,622	1,523	1,404	1,464	1,377	1,205
Rank	5	5	7	4	4	6
Cost per Peak Traveler ($)	829	792	751	811	776	691
Rank	5	5	8	4	4	8

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 San Francisco-Oakland, CA, Continued

Inventory Measures	1993	1992	1991	1990	1989	1988
Urban Area Information						
Population (1000s)	3,830	3,805	3,725	3,675	3,620	3,610
Rank	7	7	7	7	7	7
Urban Area (square miles)	1,200	1,150	1,120	1,100	1,075	1,050
Popn Density (persons/sq mile)	3,192	3,309	3,326	3,341	3,367	3,438
Peak Travelers (1000s)	1,701	1,663	1,602	1,558	1,520	1,502
Freeway						
Daily Vehicle-Miles of Travel (1000s)	41,500	40,695	40,600	40,600	41,015	40,460
Lane Miles	2,230	2,220	2,190	2,180	2,180	2,175
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	27,775	27,955	27,400	27,310	26,910	26,400
Lane Miles	4,660	4,595	4,535	4,490	4,410	4,375
Public Transportation						
Annual Psgr-Miles of Travel (millions)	2,087	2,080	2,108	2,049	1,914	1,864
Annual Unlinked Psgr Trips (millions)	416	432	427	410	403	401
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 ($/gallon)	1.23	1.28	1.11	1.14	1.14	1.05
System Performance						
Congested Travel (% of peak VMT)	76	76	76	77	75	73
Congested System (% of lane-miles)	53	57	57	57	57	57
Congested Time (number of "Rush Hours")	7.8	7.8	7.8	7.8	7.8	7.8
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	49	111	178	287	377	404
Transit Riders or Carpoolers (millions)	17	39	63	101	135	143
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	70,898	68,980	67,737	72,121	75,312	72,041
Rank	3	3	3	3	3	3
Fuel per Peak Traveler (gallons)	42	41	42	46	50	48
Rank	2	2	2	2	2	2
Annual Delay						
Total Delay (1000s of person-hours)	95,561	94,471	92,320	100,471	102,622	97,764
Rank	5	4	4	3	3	3
Delay per Peak Traveler (person-hrs)	56	57	58	64	67	65
Rank	4	2	2	2	2	2
Delay due to Incidents (percent)	50	50	48	48	48	48
Travel Time Index	1.34	1.34	1.33	1.36	1.38	1.37
Rank	2	2	2	2	2	2
Congestion Cost						
Total Cost ($ millions)	1,251	1,208	1,140	1,209	1,156	1,050
Rank	5	5	4	3	3	3
Cost per Peak Traveler ($)	736	727	711	776	760	699
Rank	4	2	2	2	2	2

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 San Francisco-Oakland, CA, Continued

Inventory Measures	1987	1986	1985	1984	1983	1982
Urban Area Information						
Population (1000s)	3,520	3,435	3,350	3,330	3,310	3,290
Rank	8	8	8	8	8	8
Urban Area (square miles)	1,000	960	890	850	830	800
Popn Density (persons/sq mile)	3,520	3,578	3,764	3,918	3,988	4,113
Peak Travelers (1000s)	1,454	1,405	1,357	1,339	1,317	1,296
Freeway						
Daily Vehicle-Miles of Travel (1000s)	38,675	36,905	34,575	32,215	30,500	29,790
Lane Miles	2,150	2,140	2,125	2,105	2,080	2,055
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	24,620	22,765	20,460	19,225	19,065	18,895
Lane Miles	4,315	4,285	4,230	4,210	4,150	4,120
Public Transportation						
Annual Psgr-Miles of Travel (millions)	1,700	1,621	1,650	1,671	1,671	1,671
Annual Unlinked Psgr Trips (millions)	412	420	435	491	491	491
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 ($/gallon)	1.05	1.03	1.35	1.36	1.39	1.46
System Performance						
Congested Travel (% of peak VMT)	67	63	59	51	45	43
Congested System (% of lane-miles)	52	50	45	40	35	35
Congested Time (number of "Rush Hours")	7.6	7.4	7.2	6.8	6.4	6.2
Annual Increase Needed To Maintain Constant Congestion Level:						
Lane-Miles	349	- -	- -	- -	- -	- -
Transit Riders or Carpoolers (millions)	118	- -	- -	- -	- -	- -
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	61,322	51,419	43,225	32,678	25,838	22,597
Rank	2	2	3	4	4	5
Fuel per Peak Traveler (gallons)	42	37	32	24	20	17
Rank	2	2	2	3	4	4
Annual Delay						
Total Delay (1000s of person-hours)	83,889	71,180	60,231	45,091	36,551	31,186
Rank	3	3	4	5	6	6
Delay per Peak Traveler (person-hrs)	58	51	44	34	28	24
Rank	2	2	2	3	6	7
Delay due to Incidents (percent)	47	48	49	50	50	50
Travel Time Index	1.33	1.28	1.26	1.20	1.16	1.15
Rank	2	2	2	4	4	5
Congestion Cost						
Total Cost ($ millions)	875	717	607	442	347	290
Rank	3	4	4	5	6	6
Cost per Peak Traveler ($)	602	510	447	330	263	224
Rank	2	2	2	4	5	7

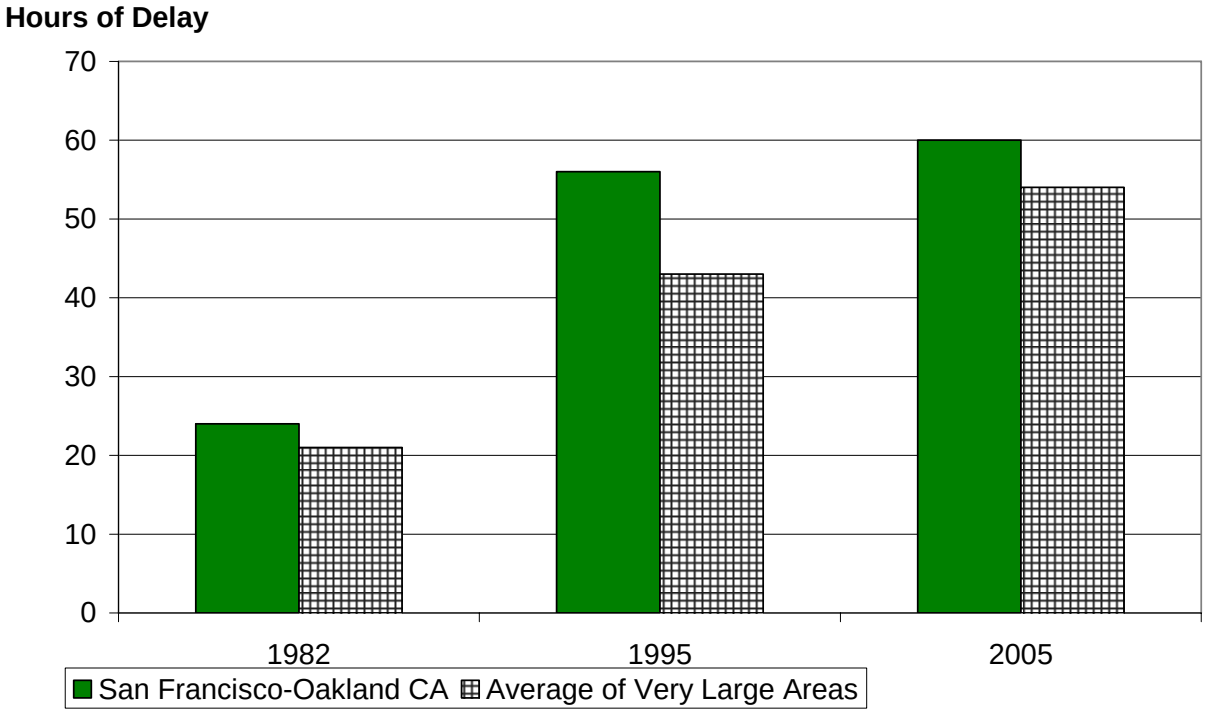
Note: System Performance statistics for 2000 through 2005 data reflect the effects of operational treatments.

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

Benefits From Public Transportation Service and Operations Strategies for San Francisco-Oakland, CA

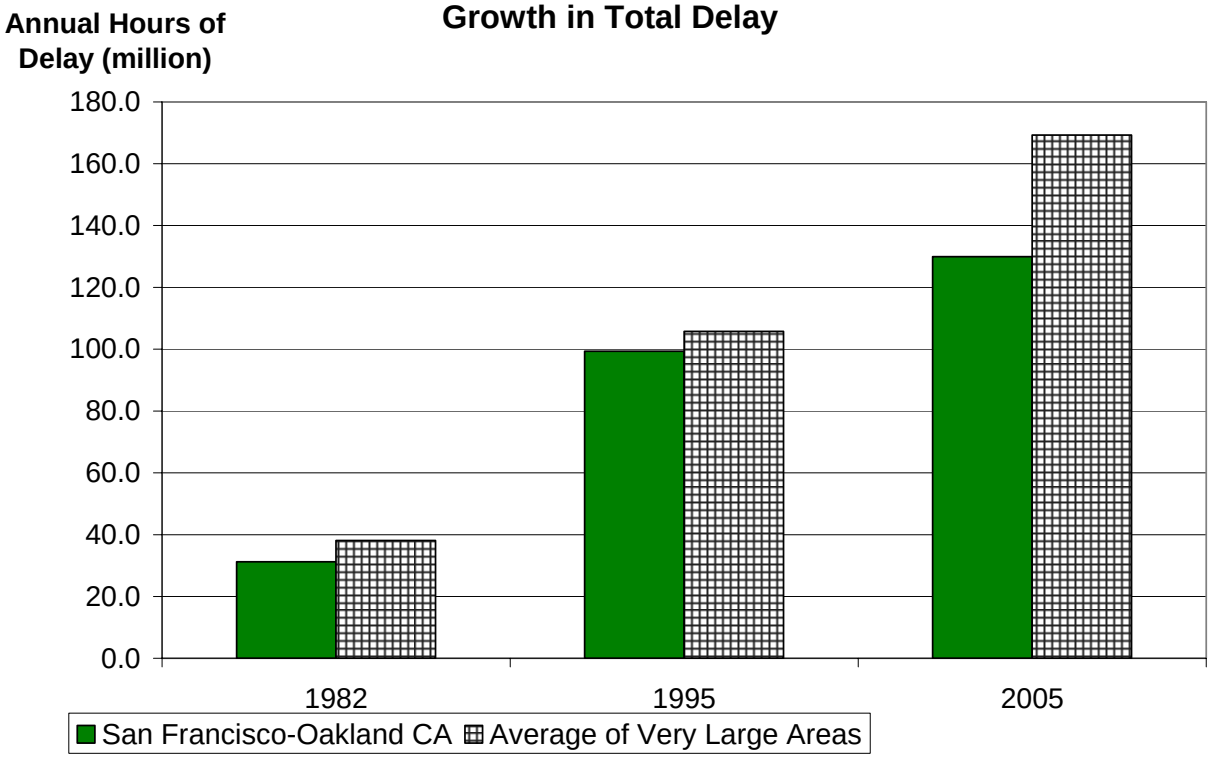
Operations Strategies	2005	2004	2003	2002	2001	2000
Freeway Ramp Metering						
Percent of Roadway Miles	49	49	50	50	50	50
Annual Delay Reduction (1000 hours)	2,975	2,762	2,139	2,291	2,557	2,456
Freeway Incident Management						
Cameras						
Percent of Roadway Miles	65	66	67	67	--	--
Service Patrols						
Percent of Roadway Miles	94	95	96	95	88	80
Annual Delay Reduction (1000 hours)	6,480	5,885	5,761	5,864	4,846	4,343
Arterial Signal Coordination						
Percent of Roadway Miles	75	75	72	72	73	74
Annual Delay Reduction (1000 hours)	654	555	607	663	595	597
Arterial Access Management						
Percent of Roadway Miles	45	45	45	44	45	45
Annual Delay Reduction (1000 hours)	1,820	2,055	1,613	1,345	1,176	1,414
HOV Lanes						
Daily Passenger-miles of Travel (1000s)	2,191	2,147	2,104	2,062	2,021	1,980
HOV User Delay Savings	4,777	4,285	4,097	4,119	3,890	3,854
Total Effect of Operations Treatments						
Annual Delay Reduction (1000 hours)	16,705	15,541	14,217	14,281	13,063	12,664
Annual Delay Saved per Peak Traveler (hours)	8	7	7	7	6	6
Annual Congestion Cost Savings ($million)	305.8	272.0	237.9	233.0	211.8	198.6
Travel Time Index with Strategies	1.413	1.383	1.370	1.364	1.353	1.357
Travel Time Index (Base)	1.466	1.433	1.416	1.410	1.396	1.399
Public Transportation Service						
Existing Service						
Annual Passenger-miles of Travel (million)	2,283	2,233	2,170	2,279	2,494	2,364
Unlinked Passenger Trips (million)	418	415	417	444	465	437
Travel Time Index (combined road and transit)	1.365	1.340	1.329	1.322	1.308	1.314
Condition if Public Transportation Service were Discontinued						
Travel Time Index	1.502	1.476	1.456	1.452	1.451	1.447
Annual Delay Increase (1000 hours)	26,263	26,201	24,890	25,538	29,001	26,929
Annual Delay Increase per Peak Traveler (hours)	12	12	12	12	14	14
Annual Congestion Cost Increase ($million)	487.2	464.9	420.8	420.6	476.1	426.4

Growth in Delay per Peak Traveler



Very Large areas have populations over 3 million

Growth in Total Delay



Very Large areas have populations over 3 million