

Performance Measure Summary – Seattle, WA

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 Seattle WA

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	3,100	3,050	3,005	2,965	2,900	2,810
Rank	14	14	14	14	14	15
Urban Area (square miles)	1,265	1,260	1,260	1,260	1,250	1,240
Population Density (persons/sq mile)	2,451	2,421	2,385	2,353	2,320	2,266
Peak Travelers (1000s)	1,696	1,665	1,632	1,604	1,563	1,492
Freeway						
Daily Vehicle-Miles of Travel (1000s)	30,670	30,500	30,800	30,500	30,650	30,500
Lane-Miles	1,850	1,830	1,810	1,790	1,745	1,740
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	27,130	27,100	26,200	25,800	23,600	24,100
Lane-Miles	5,800	5,745	5,530	5,425	5,230	5,100
Public Transportation						
Annual Psgr-Miles of Travel (millions)	1,181	1,102	1,060	1,016	1,004	912
Annual Unlinked Psgr Trips (millions)	182	169	160	156	152	140
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)	3.18	2.80	2.32	2.11	1.63	1.48
System Performance	2007	2006	2005	2004	2003	2002
Congested Travel (% of peak VMT)	66	66	70	68	69	66
Congested System (% of lane-miles)	51	51	51	47	48	48
Congested Time (number of "Rush Hours")	7.2	7.2	7.2	7.2	7.4	7.4
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	87	105	113	101	73	111
Transit Riders or Carpoolers (millions)	23	28	30	27	20	31
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	50,541	51,984	52,482	48,825	49,058	45,327
Rank	15	15	15	14	14	14
Fuel per Peak Traveler (gallons)	30	31	32	30	31	30
Rank	15	15	14	14	11	12
Annual Delay						
Total Delay (1000s of person-hours)	73,636	74,556	74,987	68,453	67,277	62,839
Rank	15	15	15	14	14	14
Delay per Peak Traveler (person-hours)	43	45	46	43	43	42
Rank	19	14	15	17	15	15
Delay due to Incidents (percent)	54	54	54	54	54	54
Travel Time Index	1.29	1.30	1.31	1.29	1.30	1.27
Rank	20	17	15	18	13	17
Congestion Cost						
Total Cost (\$ millions)	1,591	1,556	1,482	1,287	1,213	1,104
Rank	15	15	15	15	15	15
Cost per Peak Traveler (\$)	938	935	908	802	776	740
Rank	17	17	19	22	14	14

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 Seattle WA, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	2,740	2,685	2,655	2,625	2,590
Rank	15	15	15	14	14
Urban Area (square miles)	1,235	1,225	1,220	1,215	1,205
Population Density (persons/sq mile)	2,219	2,192	2,176	2,160	2,149
Peak Travelers (1000s)	1,430	1,380	1,341	1,305	1,267
Freeway					
Daily Vehicle-Miles of Travel (1000s)	30,000	29,400	29,380	28,555	27,900
Lane-Miles	1,715	1,695	1,690	1,670	1,650
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	23,750	23,420	23,145	22,930	22,475
Lane-Miles	5,050	4,920	4,720	4,530	4,240
Public Transportation					
Annual Psgr-Miles of Travel (millions)	940	938	903	868	895
Annual Unlinked Psgr Trips (millions)	145	145	142	136	138
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)	1.63	1.63	1.40	1.13	1.33
System Performance	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)	66	68	68	70	70
Congested System (% of lane-miles)	48	51	52	55	56
Congested Time (number of "Rush Hours")	7.4	7.4	7.4	7.4	7.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	124	133	153	154	179
Transit Riders or Carpoolers (millions)	34	37	44	44	53
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	44,602	45,688	47,389	47,382	46,571
Rank	14	14	12	11	10
Fuel per Peak Traveler (gallons)	31	33	35	36	37
Rank	10	8	6	5	3
Annual Delay					
Total Delay (1000s of person-hours)	61,843	63,940	66,296	66,285	65,571
Rank	15	13	12	12	11
Delay per Peak Traveler (person-hours)	43	46	49	51	52
Rank	14	9	6	4	5
Delay due to Incidents (percent)	53	53	53	53	53
Travel Time Index	1.27	1.28	1.30	1.30	1.31
Rank	16	12	6	6	4
Congestion Cost					
Total Cost (\$ millions)	1,081	1,091	1,076	1,043	1,032
Rank	15	13	12	12	9
Cost per Peak Traveler (\$)	756	791	803	800	815
Rank	13	9	4	4	5

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 Seattle WA, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	2,570	2,535	2,490	2,435	2,395
Rank	13	14	14	14	14
Urban Area (square miles)	1,200	1,185	1,170	1,160	1,135
Population Density (persons/sq mile)	2,142	2,139	2,128	2,099	2,110
Peak Travelers (1000s)	1,236	1,202	1,160	1,118	1,080
Freeway					
Daily Vehicle-Miles of Travel (1000s)	27,005	26,365	26,075	25,425	24,205
Lane-Miles	1,625	1,605	1,590	1,560	1,530
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	22,080	21,430	20,600	20,115	19,175
Lane-Miles	4,010	3,745	3,265	3,100	2,975
Public Transportation					
Annual Psgr-Miles of Travel (millions)	839	749	761	733	732
Annual Unlinked Psgr Trips (millions)	129	119	118	117	117
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)	1.35	1.25	1.16	1.19	1.22
System Performance	1996	1995	1994	1993	1992
Congested Travel (% of peak VMT)	67	67	68	66	66
Congested System (% of lane-miles)	54	55	55	55	53
Congested Time (number of "Rush Hours")	7.4	7.4	7.4	7.4	7.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	192	192	199	230	219
Transit Riders or Carpoolers (millions)	58	60	66	78	73
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	42,843	42,321	40,693	39,595	37,005
Rank	9	9	9	8	8
Fuel per Peak Traveler (gallons)	35	35	35	35	34
Rank	5	3	3	3	3
Annual Delay					
Total Delay (1000s of person-hours)	60,733	60,239	57,729	56,411	52,034
Rank	10	9	9	9	9
Delay per Peak Traveler (person-hours)	49	50	50	50	48
Rank	7	7	4	4	5
Delay due to Incidents (percent)	53	54	54	54	55
Travel Time Index	1.29	1.29	1.29	1.28	1.28
Rank	5	5	3	5	5
Congestion Cost					
Total Cost (\$ millions)	938	904	839	804	723
Rank	9	9	9	9	8
Cost per Peak Traveler (\$)	759	752	723	719	669
Rank	7	4	3	3	5

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The Mobility Data for Seattle WA, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	2,350	2,250	2,195	2,130	2,090
Rank	14	14	14	14	13
Urban Area (square miles)	1,115	1,100	1,075	1,060	1,015
Population Density (persons/sq mile)	2,108	2,045	2,042	2,009	2,059
Peak Travelers (1000s)	1,043	983	950	914	888
Freeway					
Daily Vehicle-Miles of Travel (1000s)	23,015	22,240	21,135	19,500	18,615
Lane-Miles	1,515	1,505	1,495	1,470	1,445
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	18,485	17,830	17,045	16,285	15,590
Lane-Miles	2,730	2,500	2,330	2,280	2,215
Public Transportation					
Annual Psgr-Miles of Travel (millions)	685	663	624	574	469
Annual Unlinked Psgr Trips (millions)	112	111	106	100	99
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)	1.14	1.09	1.10	1.02	1.02
System Performance	1991	1990	1989	1988	1987
Congested Travel (% of peak VMT)	65	65	60	52	48
Congested System (% of lane-miles)	54	54	50	48	43
Congested Time (number of "Rush Hours")	7.2	7.2	7.2	6.6	6.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	238	235	230	212	220
Transit Riders or Carpoolers (millions)	81	82	80	71	71
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	34,736	32,018	28,515	23,948	19,434
Rank	8	9	10	11	14
Fuel per Peak Traveler (gallons)	33	33	30	26	22
Rank	4	4	4	4	5
Annual Delay					
Total Delay (1000s of person-hours)	48,479	45,056	39,852	34,163	27,570
Rank	8	10	11	12	14
Delay per Peak Traveler (person-hours)	46	46	42	37	31
Rank	5	5	5	6	8
Delay due to Incidents (percent)	55	56	56	56	57
Travel Time Index	1.27	1.26	1.24	1.21	1.18
Rank	5	5	7	9	8
Congestion Cost					
Total Cost (\$ millions)	655	584	491	400	312
Rank	8	9	11	12	14
Cost per Peak Traveler (\$)	628	594	517	438	352
Rank	5	4	5	6	7

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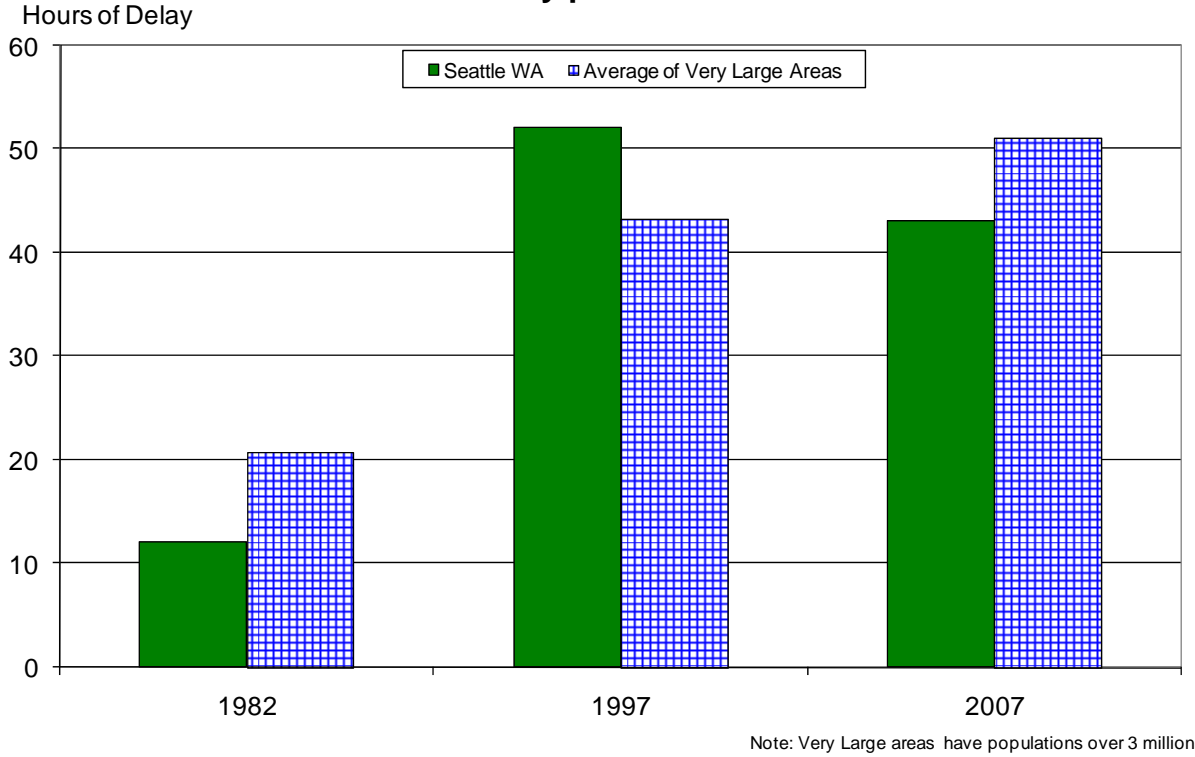
The Mobility Data for Seattle WA, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	2,050	2,010	1,975	1,915	1,860
Rank	13	13	13	13	14
Urban Area (square miles)	990	965	945	920	900
Population Density (persons/sq mile)	2,071	2,083	2,090	2,082	2,067
Peak Travelers (1000s)	863	840	818	785	755
Freeway					
Daily Vehicle-Miles of Travel (1000s)	17,080	16,395	15,680	15,140	14,560
Lane-Miles	1,430	1,405	1,380	1,365	1,345
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	14,520	13,735	12,825	12,015	11,000
Lane-Miles	2,165	2,125	2,085	2,030	2,000
Public Transportation					
Annual Psgr-Miles of Travel (millions)	545	280	236	236	236
Annual Unlinked Psgr Trips (millions)	109	118	111	111	111
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)	41	37	34	29	25
Congested System (% of lane-miles)	38	33	31	29	27
Congested Time (number of "Rush Hours")	5.8	5.4	5.2	4.8	4.4
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	--	--	--	--	--
Transit Riders or Carpoolers (millions)	--	--	--	--	--
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	14,436	12,030	10,372	7,907	6,250
Rank	14	15	15	15	16
Fuel per Peak Traveler (gallons)	17	14	13	10	8
Rank	8	11	12	18	24
Annual Delay					
Total Delay (1000s of person-hours)	20,578	17,527	15,187	11,613	9,399
Rank	15	15	16	16	16
Delay per Peak Traveler (person-hours)	24	21	19	15	12
Rank	11	14	18	23	28
Delay due to Incidents (percent)	57	56	57	56	56
Travel Time Index	1.14	1.12	1.11	1.09	1.07
Rank	13	15	16	20	26
Congestion Cost					
Total Cost (\$ millions)	225	195	164	121	96
Rank	15	15	15	15	16
Cost per Peak Traveler (\$)	261	232	201	154	127
Rank	12	15	16	20	28

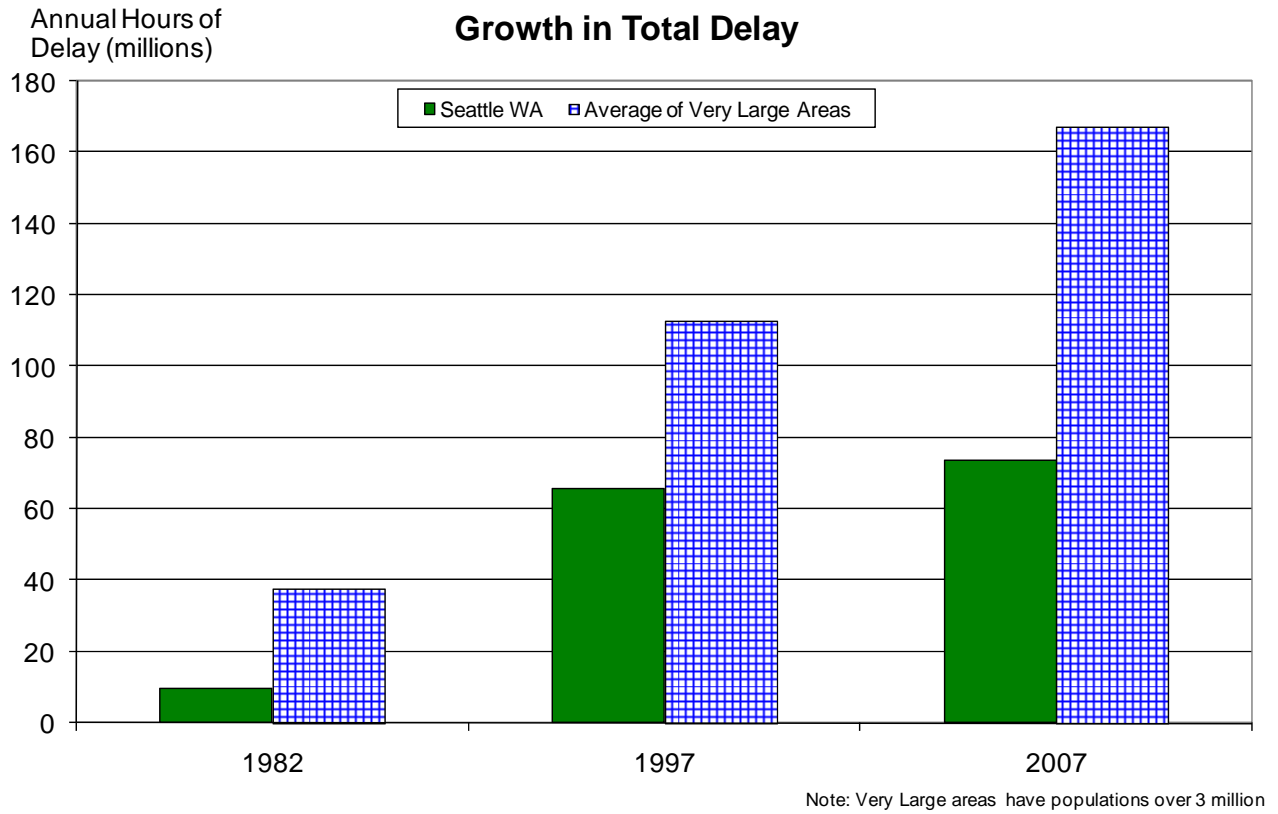
Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.

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Growth in Delay per Peak Traveler



Growth in Total Delay



**Benefits from Public Transportation Service and Operations Strategies in
Seattle WA**

Operations Strategies	2007	2006	2005	2004
Freeway Ramp Metering				
Percent of Roadway Miles	50	50	51	51
Annual Delay Reduction (1000 hours)	1,177	1,298	686	665
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	67	68	69	69
Service Patrols				
Percent of Roadway Miles	78	78	79	79
Annual Delay Reduction (1000 hours)	3,760	3,852	3,062	2,854
Arterial Signal Coordination				
Percent of Roadway Miles	70	67	65	65
Annual Delay Reduction (1000 hours)	433	422	409	370
Arterial Access Management				
Percent of Roadway Miles	7	6	6	4
Annual Delay Reduction (1000 hours)	151	190	192	145
HOV Lanes				
Daily Passenger-miles of travel (1000s)	1,100	1,000	956	927
HOV User Delay Savings	1,281	1,268	1,190	1,055
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	6,802	7,030	5,540	5,089
Annual Delay Saved per Peak Traveler (hours)	4	4	3	3
Annual Congestion Cost Savings (\$million)	145.6	145.9	109.3	95.8
Travel Time Index with Strategies	1.289	1.300	1.307	1.287
Travel Time Index (Base)	1.315	1.328	1.330	1.308
Public Transportation Service	2007	2006	2005	2004
Existing Service				
Annual Passenger-miles of travel (million)	1,181	1,102	1,060	1,016
Unlinked Passenger Trips (million)	182	169	160	156
Travel Time Index (combined road and transit)	1.295	1.308	1.310	1.290
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.344	1.356	1.358	1.335
Annual Increase				
Delay (1000 hours)	12,521	11,526	11,088	10,209
Delay per Peak Traveler (hours)	7	7	7	6
Congestion Cost (\$million)	261.4	233.1	212.7	185.5

**Benefits from Public Transportation Service and Operations Strategies in
Seattle WA, Continued**

Operations Strategies	2003	2002	2001	2000
Freeway Ramp Metering				
Percent of Roadway Miles	47	47	45	43
Annual Delay Reduction (1000 hours)	973	916	823	672
Freeway Incident Management				
Cameras				
Percent of Roadway Miles	63	63	56	46
Service Patrols				
Percent of Roadway Miles	75	75	44	12
Annual Delay Reduction (1000 hours)	2,833	2,339	1,381	556
Arterial Signal Coordination				
Percent of Roadway Miles	61	49	40	41
Annual Delay Reduction (1000 hours)	330	315	297	326
Arterial Access Management				
Percent of Roadway Miles	4	3	3	3
Annual Delay Reduction (1000 hours)	206	154	142	159
HOV Lanes				
Daily Passenger-miles of travel (1000s)	898	871	844	818
HOV User Delay Savings	1,068	734	601	498
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	5,409	4,457	3,244	2,212
Annual Delay Saved per Peak Traveler (hours)	3	3	2	2
Annual Congestion Cost Savings (\$million)	97.6	78.6	57.0	38.0
Travel Time Index with Strategies	1.301	1.271	1.270	1.281
Travel Time Index (Base)	1.325	1.290	1.284	1.291
Public Transportation Service	2003	2002	2001	2000
Existing Service				
Annual Passenger-miles of travel (million)	1,004	912	940	938
Unlinked Passenger Trips (million)	152	140	145	145
Travel Time Index (combined road and transit)	1.306	1.275	1.268	1.275
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.357	1.317	1.312	1.318
Annual Increase				
Delay (1000 hours)	10,694	9,474	9,883	9,639
Delay per Peak Traveler (hours)	7	6	7	7
Congestion Cost (\$million)	186.3	158.7	164.1	155.3

**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