Performance Measure Summary – Pittsburgh, PA

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 Pittsburgh PA

Inventory Measures	2007	2006	2005	2004	2003	2002
Urban Area Information						
Population (1000s)	1,815	1,815	1,805	1,800	1,795	1,760
Rank	23	23	22	22	21	22
Urban Area (square miles)	1,215	1,215	1,210	1,210	1,200	1,160
Population Density (persons/sq mile)	1,494	1,494	1,492	1,488	1,496	1,517
Peak Travelers (1000s)	1,016	1,015	1,005	999	991	964
Freeway						
Daily Vehicle-Miles of Travel (1000s)	12,405	12,155	12,330	12,500	12,210	11,700
Lane-Miles	1,275	1,260	1,260	1,255	1,250	1,215
Arterial Streets						
Daily Vehicle-Miles of Travel (1000s)	17,360	17,420	17,760	17,985	18,070	17,805
Lane-Miles	3,685	3,680	3,675	3,675	3,670	3,655
Public Transportation						
Annual Psgr-Miles of Travel (millions)	356	319	316	311	334	353
Annual Unlinked Psgr Trips (millions)	72	72	70	70	71	78
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 ($/gallon)	2.97	2.68	2.28	1.94	1.51	1.36
System Performance	**2007**	**2006**	**2005**	**2004**	**2003**	**2002**
Congested Travel (% of peak VMT)	24	24	26	27	25	27
Congested System (% of lane-miles)	31	31	32	32	31	35
Congested Time (number of "Rush Hours")	3.4	3.4	3.6	3.8	3.8	3.6
Annual Increase Needed to Maintain Constant Congestion Level:						
Lane-miles	8	23	55	67	78	61
Transit Riders or Carpoolers (millions)	2	5	12	14	17	13
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	8,753	8,655	9,215	9,572	9,281	9,485
Rank	45	47	44	44	44	42
Fuel per Peak Traveler (gallons)	9	9	9	10	9	10
Rank	71	72	70	69	70	67
Annual Delay						
Total Delay (1000s of person-hours)	15,334	14,989	16,157	16,691	16,217	16,424
Rank	41	42	40	39	39	38
Delay per Peak Traveler (person-hours)	15	15	16	17	16	17
Rank	70	72	69	66	66	66
Delay due to Incidents (percent)	58	57	58	57	57	56
Travel Time Index	1.09	1.09	1.09	1.10	1.09	1.10
Rank	70	70	66	63	66	61
Congestion Cost						
Total Cost ($ millions)	304	285	292	288	269	263
Rank	43	43	43	40	41	38
Cost per Peak Traveler ($)	300	281	291	289	271	273
Rank	72	74	71	70	69	68

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 Pittsburgh PA, Continued

Inventory Measures	2001	2000	1999	1998	1997
Urban Area Information					
Population (1000s)	1,765	1,770	1,770	1,775	1,785
Rank	22	22	22	21	21
Urban Area (square miles)	1,130	1,100	1,060	1,020	1,000
Population Density (persons/sq mile)	1,562	1,609	1,670	1,740	1,785
Peak Travelers (1000s)	944	924	903	884	868
Freeway					
Daily Vehicle-Miles of Travel (1000s)	11,310	11,130	11,300	10,910	10,540
Lane-Miles	1,190	1,190	1,195	1,190	1,190
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	17,600	17,350	17,200	17,080	17,175
Lane-Miles	3,650	3,645	3,630	3,620	3,610
Public Transportation					
Annual Psgr-Miles of Travel (millions)	399	344	318	324	305
Annual Unlinked Psgr Trips (millions)	83	79	78	77	76
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 ($/gallon)	1.54	1.51	1.11	1.06	1.19
System Performance	**2001**	**2000**	**1999**	**1998**	**1997**
Congested Travel (% of peak VMT)	26	25	25	24	25
Congested System (% of lane-miles)	35	35	35	34	34
Congested Time (number of "Rush Hours")	3.6	3.4	3.4	3.2	3.0
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	37	30	64	44	47
Transit Riders or Carpoolers (millions)	8	6	13	9	9
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	9,205	8,813	9,286	8,390	8,746
Rank	43	42	38	38	37
Fuel per Peak Traveler (gallons)	10	10	10	9	10
Rank	69	67	68	68	64
Annual Delay					
Total Delay (1000s of person-hours)	16,074	15,300	16,373	14,858	15,571
Rank	34	35	33	34	34
Delay per Peak Traveler (person-hours)	17	17	18	17	18
Rank	65	65	64	64	60
Delay due to Incidents (percent)	56	56	57	56	56
Travel Time Index	1.10	1.09	1.10	1.09	1.09
Rank	62	67	63	64	62
Congestion Cost					
Total Cost ($ millions)	256	237	242	213	222
Rank	36	39	34	34	34
Cost per Peak Traveler ($)	271	256	268	241	256
Rank	69	68	66	66	63

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 Pittsburgh PA, Continued

Inventory Measures	1996	1995	1994	1993	1992
Urban Area Information					
Population (1000s)	1,780	1,775	1,770	1,770	1,770
Rank	20	20	20	19	19
Urban Area (square miles)	945	940	920	900	820
Population Density (persons/sq mile)	1,884	1,888	1,924	1,967	2,159
Peak Travelers (1000s)	844	822	800	782	763
Freeway					
Daily Vehicle-Miles of Travel (1000s)	10,310	10,105	9,420	9,350	9,135
Lane-Miles	1,190	1,190	1,170	1,170	1,120
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	17,515	17,505	17,275	17,385	17,265
Lane-Miles	3,605	3,590	3,575	3,570	3,565
Public Transportation					
Annual Psgr-Miles of Travel (millions)	326	322	331	391	307
Annual Unlinked Psgr Trips (millions)	76	77	77	81	79
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 ($/gallon)	1.26	1.19	1.04	1.09	1.14
System Performance	**1996**	**1995**	**1994**	**1993**	**1992**
Congested Travel (% of peak VMT)	25	25	22	22	23
Congested System (% of lane-miles)	34	34	33	33	33
Congested Time (number of "Rush Hours")	3.2	3.0	3.0	3.0	3.0
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	53	59	60	88	116
Transit Riders or Carpoolers (millions)	11	12	12	17	23
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	8,848	8,800	7,453	7,487	7,574
Rank	34	33	35	33	31
Fuel per Peak Traveler (gallons)	10	11	9	10	10
Rank	61	54	58	52	48
Annual Delay					
Total Delay (1000s of person-hours)	15,778	15,757	13,421	13,461	13,640
Rank	31	30	32	27	27
Delay per Peak Traveler (person-hours)	19	19	17	17	18
Rank	56	53	56	52	46
Delay due to Incidents (percent)	56	56	55	55	55
Travel Time Index	1.10	1.10	1.08	1.08	1.09
Rank	57	53	57	56	50
Congestion Cost					
Total Cost ($ millions)	221	214	175	171	169
Rank	33	31	32	30	27
Cost per Peak Traveler ($)	262	260	219	219	221
Rank	61	54	58	57	50

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 Pittsburgh PA, Continued

Inventory Measures	1991	1990	1989	1988	1987
Urban Area Information					
Population (1000s)	1,775	1,780	1,785	1,785	1,790
Rank	19	19	19	19	19
Urban Area (square miles)	770	750	730	725	715
Population Density (persons/sq mile)	2,305	2,373	2,445	2,462	2,503
Peak Travelers (1000s)	747	732	726	721	716
Freeway					
Daily Vehicle-Miles of Travel (1000s)	8,600	8,195	7,800	7,500	7,190
Lane-Miles	1,070	1,020	950	900	900
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	17,730	17,775	17,265	16,895	16,170
Lane-Miles	3,560	3,560	3,550	3,540	3,535
Public Transportation					
Annual Psgr-Miles of Travel (millions)	408	411	396	383	403
Annual Unlinked Psgr Trips (millions)	88	88	88	90	88
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 ($/gallon)	1.16	1.30	1.06	0.98	0.98
System Performance	**1991**	**1990**	**1989**	**1988**	**1987**
Congested Travel (% of peak VMT)	24	24	22	22	21
Congested System (% of lane-miles)	33	29	29	25	25
Congested Time (number of "Rush Hours")	3.2	3.2	3.2	3.2	3.0
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	130	148	139	145	119
Transit Riders or Carpoolers (millions)	26	29	27	28	22
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	7,975	8,143	6,826	6,628	5,892
Rank	27	25	26	26	25
Fuel per Peak Traveler (gallons)	11	11	9	9	8
Rank	44	43	46	42	44
Annual Delay					
Total Delay (1000s of person-hours)	14,394	14,586	12,246	11,868	10,508
Rank	24	23	24	25	24
Delay per Peak Traveler (person-hours)	19	20	17	16	15
Rank	39	37	40	41	39
Delay due to Incidents (percent)	55	55	54	54	54
Travel Time Index	1.09	1.09	1.08	1.08	1.07
Rank	48	47	47	43	43
Congestion Cost					
Total Cost ($ millions)	174	171	135	124	106
Rank	26	25	26	25	25
Cost per Peak Traveler ($)	233	234	186	172	148
Rank	43	40	44	41	43

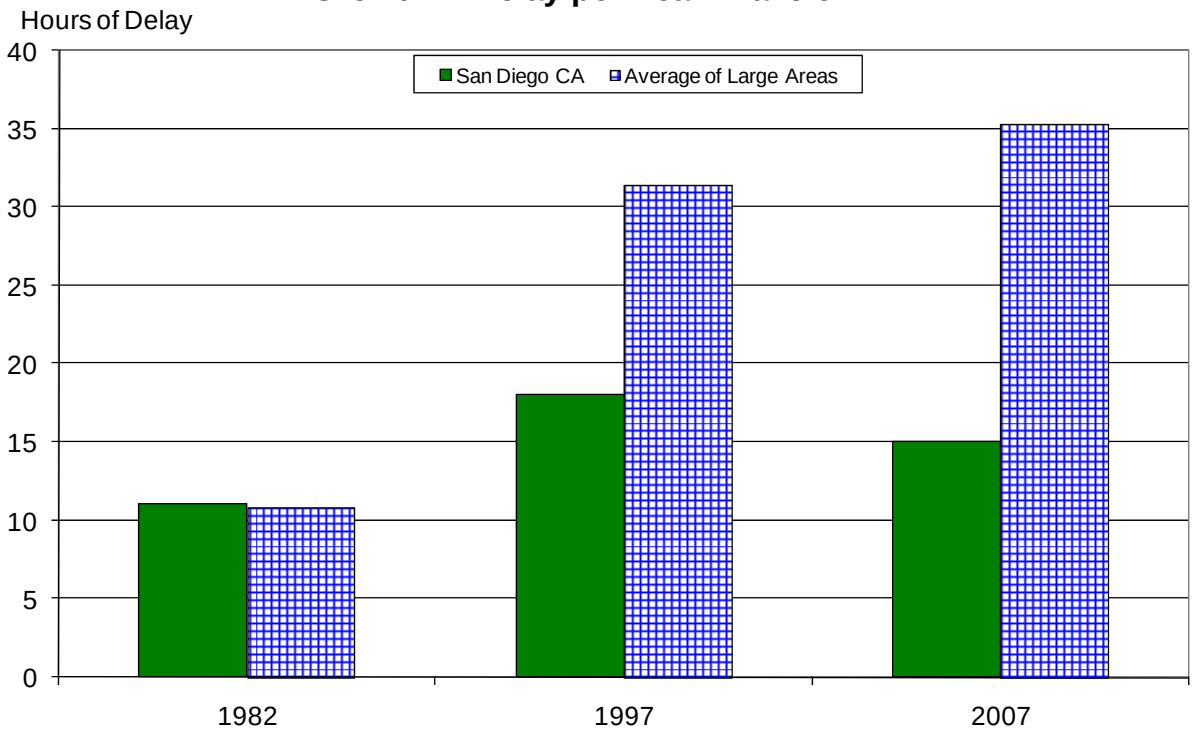
Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.
Note: Zeroes in the table reflect values less than 0.5.

The Mobility Data for Pittsburgh PA, Continued

Inventory Measures	1986	1985	1984	1983	1982
Urban Area Information					
Population (1000s)	1,790	1,790	1,795	1,800	1,810
Rank	18	18	17	15	15
Urban Area (square miles)	710	710	710	680	680
Population Density (persons/sq mile)	2,521	2,521	2,528	2,647	2,662
Peak Travelers (1000s)	709	703	698	695	691
Freeway					
Daily Vehicle-Miles of Travel (1000s)	6,900	6,655	6,460	6,110	5,635
Lane-Miles	900	880	865	850	800
Arterial Streets					
Daily Vehicle-Miles of Travel (1000s)	16,030	15,500	15,065	14,655	14,825
Lane-Miles	3,525	3,525	3,515	3,510	3,510
Public Transportation					
Annual Psgr-Miles of Travel (millions)	396	397	360	360	360
Annual Unlinked Psgr Trips (millions)	92	90	91	91	91
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 ($/gallon)	0.96	1.25	1.27	1.30	1.35
System Performance	**1986**	**1985**	**1984**	**1983**	**1982**
Congested Travel (% of peak VMT)	20	18	18	18	18
Congested System (% of lane-miles)	25	25	25	25	25
Congested Time (number of "Rush Hours")	2.9	2.9	2.8	2.8	2.8
Annual Increase Needed to Maintain Constant Congestion Level:					
Lane-miles	- -	- -	- -	- -	- -
Transit Riders or Carpoolers (millions)	- -	- -	- -	- -	- -
Annual Excess Fuel Consumed					
Total Fuel (1000 gallons)	5,935	4,929	4,723	4,394	4,390
Rank	22	24	22	22	21
Fuel per Peak Traveler (gallons)	8	7	7	6	6
Rank	41	40	37	41	36
Annual Delay					
Total Delay (1000s of person-hours)	10,812	8,811	8,545	7,912	7,916
Rank	22	23	22	22	21
Delay per Peak Traveler (person-hours)	15	13	12	11	11
Rank	35	37	37	38	35
Delay due to Incidents (percent)	54	54	54	54	53
Travel Time Index	1.08	1.07	1.06	1.06	1.06
Rank	37	39	42	39	37
Congestion Cost					
Total Cost ($ millions)	106	87	82	73	71
Rank	22	24	22	23	21
Cost per Peak Traveler ($)	149	123	117	104	102
Rank	40	43	41	42	38

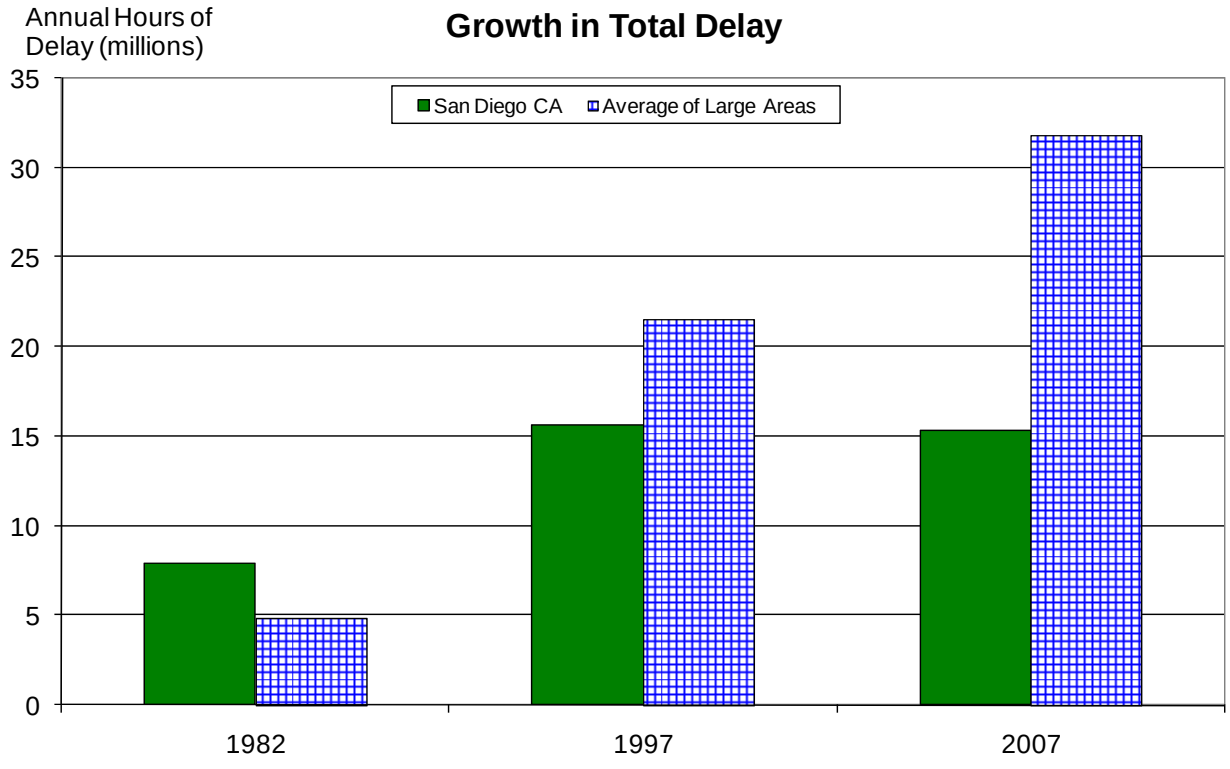
Note: System Performance statistics for 2000 through 2007 data reflect the effects of operational treatments.
Note: Zeroes in the table reflect values less than 0.5.

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 Pittsburgh PA

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	24	24	24	24
Service Patrols				
Percent of Roadway Miles	16	17	17	17
Annual Delay Reduction (1000 hours)	199	186	165	166
Arterial Signal Coordination				
Percent of Roadway Miles	15	14	11	11
Annual Delay Reduction (1000 hours)	28	24	27	29
Arterial Access Management				
Percent of Roadway Miles	17	17	17	17
Annual Delay Reduction (1000 hours)	204	208	199	292
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	431	418	392	487
Annual Delay Saved per Peak Traveler (hours)	0	0	0	0
Annual Congestion Cost Savings ($million)	8.7	8.2	7.3	8.5
Travel Time Index with Strategies	1.089	1.088	1.093	1.095
Travel Time Index (Base)	1.091	1.090	1.094	1.097
Public Transportation Service	**2007**	**2006**	**2005**	**2004**
Existing Service				
Annual Passenger-miles of travel (million)	356	319	316	311
Unlinked Passenger Trips (million)	72	72	70	70
Travel Time Index (combined road and transit)	1.088	1.087	1.092	1.094
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.098	1.098	1.101	1.103
Annual Increase				
Delay (1000 hours)	1,957	2,065	1,869	1,782
Delay per Peak Traveler (hours)	2	2	2	2
Congestion Cost ($million)	39.1	39.6	34.1	31.0

Benefits from Public Transportation Service and Operations Strategies in Pittsburgh PA, 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	15	15	15	15
Service Patrols				
Percent of Roadway Miles	17	17	18	18
Annual Delay Reduction (1000 hours)	128	110	111	104
Arterial Signal Coordination				
Percent of Roadway Miles	10	8	7	7
Annual Delay Reduction (1000 hours)	20	18	5	0
Arterial Access Management				
Percent of Roadway Miles	16	16	15	15
Annual Delay Reduction (1000 hours)	330	280	210	232
HOV Lanes				
Daily Passenger-miles of travel (1000s)	--	--	--	--
HOV User Delay Savings	--	--	--	--
Total Effect of Operations Treatments				
Annual Delay Reduction (1000 hours)	478	407	325	336
Annual Delay Saved per Peak Traveler (hours)	0	0	0	0
Annual Congestion Cost Savings ($million)	7.9	6.6	5.3	5.3
Travel Time Index with Strategies	1.093	1.097	1.096	1.094
Travel Time Index (Base)	1.095	1.099	1.098	1.095
Public Transportation Service	**2003**	**2002**	**2001**	**2000**
Existing Service				
Annual Passenger-miles of travel (million)	334	353	399	344
Unlinked Passenger Trips (million)	71	78	82	79
Travel Time Index (combined road and transit)	1.092	1.096	1.094	1.092
Condition if Public Transportation Service were Discontinued				
Travel Time Index	1.102	1.107	1.108	1.103
Annual Increase				
Delay (1000 hours)	1,987	2,155	2,576	1,949
Delay per Peak Traveler (hours)	2	2	3	2
Congestion Cost ($million)	33.1	34.9	41.5	30.5

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	
2007 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 2007 Trends		
Delay per Traveler -	5 Hours	3 Hours
Total Delay -	5 Hours x Average Population	3 Hours x Average Population