#### **Performance Measure Summary - Worcester MA-CT**

There are several inventory and performance measures listed in the pages of this Urban Area Report for the years from 1982 to 2020. There is no single performance measure that experts agree "says it all". A few key points should be recognized by users of the Urban Mobility Scorecard data.

**Use the trends** - The multi-year performance measures are better indicators, in most cases, than any single year. 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. (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 atop several 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. It is calculated as the ratio of travel time in the peak period to travel time in free-flow. A value of 1.30 indicates that a 20-minute free-flow trip takes 26 minutes in the peak.

**Planning Time Index** - A travel time reliability measure that represents the total travel time that should be planned for a trip. Computed with the 95th percentile travel time it represents the amount of time that should be planned for a commute trip to be late for only 1 day a month. If it is computed with the 80th percentile travel time it represents the amount of time that should be planned for a trip to be late for only 1 day a week. A PTI of 2.00 means that for a 20-minute trip in light traffic, 40 minutes should be planned.

**Peak Commuters** - Number of travelers who begin a trip during the morning or evening peak travel periods (6 to 10 a.m. and 3 to 7 p.m.). "Commuters" are private vehicle users unless specifically noted.

**Annual Delay per Commuter** - A yearly sum of all the per-trip delays for those persons who travel in the peak period (6 to 10 a.m. and 3 to 7 p.m.). This measure illustrates the effect of traffic slowdowns as well as the length of each trip.

**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** - These values are derived from time periods with lighter traffic volumes in the INRIX speed database. They are used as the national comparison thresholds. Other speed thresholds may be appropriate for urban project evaluations or sub-region studies.

**Excess Fuel Consumed** - Increased fuel consumption due to travel in congested conditions rather than free-flow conditions.

**Congestion Cost** - Value of travel delay for 2020 (estimated at \$20.17 per hour of person travel and \$55.24 per hour of truck time) and excess fuel consumption estimated using state average cost per gallon.

**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), so increases include both new growth and development that was previously in areas designated as rural.

Number of Rush Hours -Time when the road system might have congestion.

Annual Greenhouse Gases (CO2) Produced -Tons of CO2 produced from all vehicle travel.

Excess Greenhouse Gases (CO2) Produced due to Congestion-Tons of CO2 produced due to congested portion of travel. The excess CO2 is a subset of the total CO2 produced.

Inventory Measures	2020	2019	2018	2017	2016	2015
Urban Area Information						
Population (1000s)	500	500	500	495	495	495
Rank	80	80	80	80	80	80
Commuters (1000s)	251	251	251	248	248	248
Daily Vehicle-Miles of Travel (1000s)						
Freeway	5,482	7,166	7,090	6,916	7,020	7,343
Arterial Streets	4,445	5,811	6,188	5,825	5,436	5,018
Cost Components						
Value of Time (\$/hour)	20.17	19.14	18.71	18.12	17.91	17.69
Commercial Cost (\$/hour)	55.24	49.49	54.71	52.14	50.20	46.87
Gasoline (\$/gallon)	2.41	2.62	2.88	2.35	2.17	2.31
Diesel (\$/gallon)	2.91	2.99	3.22	2.55	2.31	2.63
System Performance	2020	2019	2018	2017	2016	2015
Congested Travel (% of peak VMT)				9.4		
Congested System (% of lane-miles)				6.9		
Congested Time (number of "Rush Hours")				0.7		
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	3,802	5,575	5,472	5,504	5,373	5,247
Rank	73	79	78	77	77	77
Fuel per Peak Auto Commuter (gallons)	12	17	17	17	17	17
Rank	39	78	74	68	68	65
Annual Delay						
Total Delay (1000s of person-hours)	8,922	13,085	13,180	13,338	12,851	12,228
Rank	73	77	77	77	77	77
Delay per Auto Commuter (pers-hrs)	28	42	42	43	42	41
Rank	36	71	69	63	62	63
Travel Time Index	1.10	1.13	1.13	1.14	1.14	1.14
Rank	29	83	82	79	79	79
Commuter Stress Index	1.11	1.14	1.14	1.15		
Rank	31	86	84	78		
Freeway Planning Time Index (95th Pctile)		1.22	1.20	1.24		
Rank		87	90	87		
Congestion Cost						
Total Cost (\$ millions)	201	283	287	286	271	255
Rank	73	77	77	77	77	77
Cost per Auto Commuter (\$)	603	849	862	868	842	799
Rank	38	61	58	54	56	56
Truck Congestion	404	570	- 4.6	505	57.4	5.4.6
Annual Person-Hours of Delay (000)	404	570	546	595	574	546
Rank	75	80	80	79	78	78
Annual Gallons of Wasted Fuel (000)	626	883	825	874	853	833
Rank Annual Congestion Cost (\$ million)	78 21	86 28	86 30	85 31	84 29	84 26
Rank	75	81	80	79	77	78
Annual Greenhouse Gases (CO2) Produced	13	01	00	1)	11	70
Excess Due to Congestion (tons)	37,871	55,541		1		
Rank	73	79		<u></u>		<u></u>
Due to All Travel (tons)	1,701,696	2,495,649				
Rank	60	2,473,047				
Truck Annual Greenhouse Gases (CO2) Produced						
Excess Due to Truck Congestion (tons)	6,792	9,583				
Rank	78	9,383				
Due to Truck Travel (tons)	400,347	564,840				
Rank	64	70		<u></u>		
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<sup>\*</sup> Note: Zeroes in the table reflect values less than 0.5.

Inventory Measures	2014	2013	2012	2011	2010	2009
Urban Area Information						
Population (1000s)	490	485	480	475	470	460
Rank	80	80	80	80	80	80
Commuters (1000s)	245	247	245	242	238	232
Daily Vehicle-Miles of Travel (1000s)						
Freeway	6,392	6,225	5,680	5,764	5,751	5,700
Arterial Streets	5,489	5,056	4,780	4,740	4,729	4,716
Cost Components						
Value of Time (\$/hour)	17.67	17.39	17.14	16.79	16.28	16.01
Commercial Cost (\$/hour)	44.82	41.23	39.66	44.62	42.50	41.83
Gasoline (\$/gallon)	3.42	3.58	3.53	3.49	2.82	2.27
Diesel (\$/gallon)	3.65	3.94	3.93	3.73	3.04	2.70
System Performance	2014	2013	2012	2011	2010	2009
Congested Travel (% of peak VMT)						
Congested System (% of lane-miles)						
Congested Time (number of "Rush Hours")						
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	5,122	5,057	4,864	4,902	4,852	4,709
Rank	78	78	78	78	78	78
Fuel per Peak Auto Commuter (gallons)	17	18	17	18	19	16
Rank	65	54	61	49	40	54
Annual Delay						
Total Delay (1000s of person-hours)	11,729	11,373	10,739	10,723	10,514	10,107
Rank	77	77	77	77	77	77
Delay per Auto Commuter (pers-hrs)	40	40	39	40	39	39
Rank	63	60	61	49	53	47
Travel Time Index	1.14	1.14	1.13	1.13	1.13	1.13
Rank	78	76	84	83	82	82
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	249	238	222	219	206	192
Rank	77	77	77	77	77	77
Cost per Auto Commuter (\$)	759	744	712	732	742	724
Rank	59	60	63	61	60	63
Truck Congestion						. = -
Annual Person-Hours of Delay (000)	523	508	479	479	469	451
Rank	78	78	80	77	77	76 748
Annual Gallons of Wasted Fuel (000)	813	803	773	778	770	748
Rank	84	84	84	83	83	83
Annual Congestion Cost (\$ million)  Rank	25 79	23 79	21 79	23   78	21 78	20 76
	/9	19	19	/8	/8	/0
Annual Greenhouse Gases (CO2) Produced				ı	I	
Excess Due to Congestion (tons)  Rank						
Nank Due to All Travel (tons)						
Rank			 			 -
Truck Annual Greenhouse Gases (CO2) Produced				ı	I	
Excess Due to Truck Congestion (tons)  Rank						
Nank Due to Truck Travel (tons)						
Rank						
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<sup>\*</sup> Note: Zeroes in the table reflect values less than 0.5.

Inventory Measures	2008	2007	2006	2005	2004	2003
Urban Area Information						
Population (1000s)	455	450	445	435	430	425
Rank	79	79	78	78	78	77
Commuters (1000s)	229	225	222	215	211	208
Daily Vehicle-Miles of Travel (1000s)						
Freeway	5,675	5,730	5,550	5,645	5,515	5,260
Arterial Streets	4,730	4,825	4,830	4,865	4,780	4,760
Cost Components						
Value of Time (\$/hour)	16.07	15.47	15.06	14.58	14.10	13.73
Commercial Cost (\$/hour)	40.77	39.30	37.88	36.51	35.19	33.92
Gasoline (\$/gallon)	3.32	2.98	2.67	2.28	2.02	1.53
Diesel (\$/gallon)	4.32	3.53	2.87	2.56	2.05	1.64
System Performance	2008	2007	2006	2005	2004	2003
Congested Travel (% of peak VMT)						
Congested System (% of lane-miles)						
Congested Time (number of "Rush Hours")						
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	4,996	4,901	4,794	4,547	4,377	4,194
Rank	77	77	76	77	76	76
Fuel per Peak Auto Commuter (gallons)	18	18	18	17	17	16
Rank	49	49	47	48	46	49
Annual Delay						
Total Delay (1000s of person-hours)	10,215	10,020	9,800	9,296	8,949	8,575
Rank	77	77	77	77	76	74
Delay per Auto Commuter (pers-hrs)	38	38	38	37	36	36
Rank	47	48	45	48	52	50
Travel Time Index	1.13	1.13	1.13	1.12	1.12	1.12
Rank	84	84	81	86	83	81
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	201	188	178	162	150	138
Rank	77	77	77	77	75	74
Cost per Auto Commuter (\$)	726	740	745	731	726	714
Rank	54	59	57	58	58	58
Truck Congestion	456		425	44.5	200	202
Annual Person-Hours of Delay (000)	456	447	437	415	399	383
Rank	76 704	78 779	77	75 722	74 605	74 666
Annual Gallons of Wasted Fuel (000) Rank	794	778 82	761 82	722 83	695 81	666 80
Rank Annual Congestion Cost (\$ million)	83	82 19	82 18	83 16	14	13
Rank	77	78	76	75	74	13 74
Annual Greenhouse Gases (CO2) Produced	//	70	70	13	/4	/+
Excess Due to Congestion (tons)				ı		
Rank						
Due to All Travel (tons)						 -
Rank						
Truck Annual Greenhouse Gases (CO2) Produced						
Excess Due to Truck Congestion (tons)						_
Rank						 -
Due to Truck Travel (tons)						 
Rank			 			<u></u>
TOTAL						

<sup>\*</sup> Note: Zeroes in the table reflect values less than 0.5.

Inventory Measures	2002	2001	2000	1999	1998	1997
Urban Area Information						
Population (1000s)	420	420	415	415	410	405
Rank	77	75	75	73	73	73
Commuters (1000s)	202	199	194	191	186	181
Daily Vehicle-Miles of Travel (1000s)						
Freeway	5,150	5,075	5,000	4,900	4,750	4,650
Arterial Streets	4,700	4,600	4,470	4,350	4,270	4,190
Cost Components						
Value of Time (\$/hour)	13.43	13.22	12.85	12.43	12.17	11.98
Commercial Cost (\$/hour)	32.69	31.51	30.38	29.28	28.89	28.50
Gasoline (\$/gallon)	1.40	1.70	1.58	1.13	1.08	1.28
Diesel (\$/gallon)	1.45	1.65	1.61	1.19	1.21	1.33
System Performance	2002	2001	2000	1999	1998	1997
Congested Travel (% of peak VMT)						
Congested System (% of lane-miles)						
Congested Time (number of "Rush Hours")						
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	4,027	3,878	3,694	3,511	3,315	3,146
Rank	74	73	74	74	74	73
Fuel per Peak Auto Commuter (gallons)	16	15	14	14	13	12
Rank	42	47	50	42	42	47
Annual Delay						
Total Delay (1000s of person-hours)	8,232	7,928	7,552	7,177	6,778	6,431
Rank	73	73	73	72	72	72
Delay per Auto Commuter (pers-hrs)	36	35	34	32	31	30
Rank	45	45	49	57	56	56
Travel Time Index	1.11	1.11	1.11	1.10	1.10	1.10
Rank	83	83	79	83	80	80
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	128	123	113	103	95	89
Rank	73	73	73	72	72	72
Cost per Auto Commuter (\$)	698	682	670	659	635	612
Rank	58	56	58	57	59	56
Truck Congestion	2.5	254	225	222	202	205
Annual Person-Hours of Delay (000)	367	354	337	320	302	287
Rank	74	74 616	72	74 559	73	73 500
Annual Gallons of Wasted Fuel (000) Rank	639	616 79	586 77	558 76	527 76	500
Rank Annual Congestion Cost (\$ million)	12	/9 11	10	/6 9	9	76 8
Rank	74	74	74	73	71	8 74
Annual Greenhouse Gases (CO2) Produced	/	/	/+	13	/ 1	/+
Excess Due to Congestion (tons)		<u></u>				_
Rank			 			<u></u>
Due to All Travel (tons)			 			
Rank				 		
Truck Annual Greenhouse Gases (CO2) Produced						
Excess Due to Truck Congestion (tons)						
Rank			 			
Due to Truck Travel (tons)			 			
Rank			 			
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<sup>\*</sup> Note: Zeroes in the table reflect values less than 0.5.

Inventory Measures	1996	1995	1994	1993	1992	1991
Urban Area Information						
Population (1000s)	400	395	390	390	385	380
Rank	72	72	72	72	71	71
Commuters (1000s)	176	171	166	164	159	155
Daily Vehicle-Miles of Travel (1000s)						
Freeway	4,500	4,350	4,225	4,100	4,000	3,910
Arterial Streets	4,075	4,000	3,900	3,870	3,800	3,710
Cost Components						
Value of Time (\$/hour)	11.71	11.37	11.06	10.78	10.47	10.17
Commercial Cost (\$/hour)	28.12	27.75	27.38	27.02	26.66	26.30
Gasoline (\$/gallon)	1.31	1.22	1.07	1.15	1.14	1.23
Diesel (\$/gallon)	1.37	1.28	1.12	1.20	1.21	1.29
System Performance	1996	1995	1994	1993	1992	1991
Congested Travel (% of peak VMT)						
Congested System (% of lane-miles)						
Congested Time (number of "Rush Hours")						
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	2,931	2,689	2,504	2,345	2,192	1,994
Rank	73	73	73	73	73	73
Fuel per Peak Auto Commuter (gallons)	12	11	10	10	9	7
Rank	38	41	45	38	45	57
Annual Delay						
Total Delay (1000s of person-hours)	5,993	5,497	5,119	4,795	4,481	4,078
Rank	73	73	73	73	73	73
Delay per Auto Commuter (pers-hrs)	29	27	26	24	23	22
Rank	54	57	55	58	58	53
Travel Time Index	1.09	1.09	1.08	1.08	1.07	1.07
Rank	79	77	80	77	82	80
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	82	73	66	60	55	49
Rank	73	73	73	73	73	73
Cost per Auto Commuter (\$)	581	554	526	505	496	459
Rank	55	57	55	53	50	53
Truck Congestion						
Annual Person-Hours of Delay (000)	267	245	228	214	200	182
Rank	73	74	74	73	72	73
Annual Gallons of Wasted Fuel (000)	465	427	398	372	348	316
Rank	76	76 7	76	76	77	78 5
Annual Congestion Cost (\$ million)  Rank	8 73	73	6   74	6 72	5 73	5 70
	/3	/3	/4	12	13	/0
Annual Greenhouse Gases (CO2) Produced				ı	I	
Excess Due to Congestion (tons)  Rank						
Nank Due to All Travel (tons)						
Rank			 			 -
Truck Annual Greenhouse Gases (CO2) Produced				ı	I	
Excess Due to Truck Congestion (tons)  Rank						
Nank Due to Truck Travel (tons)						
Rank			 	 		
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<sup>\*</sup> Note: Zeroes in the table reflect values less than 0.5.

Inventory Measures	1990	1989	1988	1987	1986	1985
Urban Area Information						
Population (1000s)	375	370	365	360	355	350
Rank	71	71	71	71	71	71
Commuters (1000s)	150	147	144	141	138	135
Daily Vehicle-Miles of Travel (1000s)						
Freeway	3,800	3,720	3,650	3,600	3,525	3,480
Arterial Streets	3,650	3,600	3,525	3,480	3,400	3,360
Cost Components						
Value of Time (\$/hour)	9.75	9.25	8.83	8.48	8.18	8.03
Commercial Cost (\$/hour)	25.95	25.60	25.26	24.93	24.60	24.27
Gasoline (\$/gallon)	1.04	1.06	0.98	0.98	0.96	1.25
Diesel (\$/gallon)	1.06	1.05	0.97	0.97	0.95	1.24
System Performance	1990	1989	1988	1987	1986	1985
Congested Travel (% of peak VMT)						
Congested System (% of lane-miles)						
Congested Time (number of "Rush Hours")						
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	1,863	1,707	1,575	1,359	1,226	1,050
Rank	73	70	70	73	71	74
Fuel per Peak Auto Commuter (gallons)	8	7	7	6	5	5
Rank	35	39	27	32	40	32
Annual Delay						
Total Delay (1000s of person-hours)	3,809	3,490	3,220	2,779	2,507	2,148
Rank	72	71	70	72	71	74
Delay per Auto Commuter (pers-hrs)	21	19	18	16	15	13
Rank	52	55	52	55	55	56
Travel Time Index	1.07	1.06	1.06	1.05	1.05	1.04
Rank	74	79	73	79	74	81
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	44	38	34	28	24	21
Rank	72	70	70	71	71	74
Cost per Auto Commuter (\$)	448	434	417	387	359	311
Rank	52	53	55	57	58	61
Truck Congestion						
Annual Person-Hours of Delay (000)	170	156	144	124	112	96
Rank	71	70	69	72	72	74
Annual Gallons of Wasted Fuel (000)	296	271	250	216	195	167
Rank	78	79 4	76	79	77	78
Annual Congestion Cost (\$ million)  Rank	4 71	4 68	4 66	3 68	3 67	2 73
	/1	08	00	08	07	13
Annual Greenhouse Gases (CO2) Produced				1	I	
Excess Due to Congestion (tons)  Rank						
Nank Due to All Travel (tons)						
Rank			 			 -
Truck Annual Greenhouse Gases (CO2) Produced				1	I	
Excess Due to Truck Congestion (tons)  Rank						
Nank Due to Truck Travel (tons)						
Rank			 			
IXGIIK						

<sup>\*</sup> Note: Zeroes in the table reflect values less than 0.5.

Inventory Measures	1984	1983	1982
Urban Area Information			
Population (1000s)	345	340	335
Rank	72	71	71
Commuters (1000s)	132	129	126
Daily Vehicle-Miles of Travel (1000s)			
Freeway	3,400	3,320	3,280
Arterial Streets	3,300	3,260	3,225
Cost Components			
Value of Time (\$/hour)	7.75	7.43	7.20
Commercial Cost (\$/hour)	23.94	23.63	23.31
Gasoline (\$/gallon)	1.27	1.30	1.35
Diesel (\$/gallon)	1.25	1.28	1.34
System Performance	1984	1983	1982
Congested Travel (% of peak VMT)			
Congested System (% of lane-miles)			
Congested Time (number of "Rush Hours")			
Annual Excess Fuel Consumed			
Total Fuel (1000 gallons)	894	769	643
Rank	77	75	76
Fuel per Peak Auto Commuter (gallons)	3	4	2
Rank	61	35	55
Annual Delay			
Total Delay (1000s of person-hours)	1,828	1,573	1,314
Rank	77	75	76
Delay per Auto Commuter (pers-hrs)	11	10	8
Rank	64	64	73
Travel Time Index	1.04	1.03	1.03
Rank	75	80	76
Commuter Stress Index			
Rank			
Freeway Planning Time Index (95th Pctile)			
Rank			
Congestion Cost			
Total Cost (\$ millions)	17	14	12
Rank	76	74	74
Cost per Auto Commuter (\$)	269	246	204
Rank	64	65	74
Truck Congestion			
Annual Person-Hours of Delay (000)	82	70	59
Rank	75	75	78
Annual Gallons of Wasted Fuel (000)	142	122	102
Rank	78	78	79
Annual Congestion Cost (\$ million)	2	2	1
Rank	71	68	78
Annual Greenhouse Gases (CO2) Produced			
Excess Due to Congestion (tons)			
Rank			
Due to All Travel (tons)			
Rank			
Truck Annual Greenhouse Gases (CO2) Produced			
Excess Due to Truck Congestion (tons)			
Rank			
Due to Truck Travel (tons)			
Rank			

<sup>\*</sup> Note: Zeroes in the table reflect values less than 0.5.