#### Performance Measure Summary - Boston MA-NH-RI

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)	4,550	4,550	4,525	4,500	4,475	4,460
Rank	10	10	10	10	10	10
Commuters (1000s)	1,755	1,755	1,746	1,736	1,721	1,714
Daily Vehicle-Miles of Travel (1000s)						
Freeway	34,625	45,261	44,915	44,199	43,608	43,558
Arterial Streets	35,016	45,773	49,477	41,908	41,391	40,506
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)				29.5		
Congested System (% of lane-miles)				18.9		
Congested Time (number of "Rush Hours")				4.4		
Annual Excess Fuel Consumed						
Total Fuel (1000 gallons)	50,540	86,430	82,442	77,143	73,316	72,443
Rank	7	9	9	10	10	10
Fuel per Peak Auto Commuter (gallons)	20	34	33	31	31	30
Rank	3	6	6	7	7	7
Annual Delay						
Total Delay (1000s of person-hours)	122,348	209,231	198,324	192,426	184,486	179,172
Rank	6	10	10	10	10	10
Delay per Auto Commuter (pers-hrs)	50	86	82	80	77	75
Rank	2	5	5	6	6	6
Travel Time Index	1.12	1.28	1.28	1.28	1.28	1.28
Rank	10	21	20	20	19	19
Commuter Stress Index	1.13	1.31	1.30	1.31		
Rank	14	26	28	21		
Freeway Planning Time Index (95th Pctile)		1.96	1.84	1.89		
Rank		17	22	20		
Congestion Cost						
Total Cost (\$ millions)	2,732	4,470	4,294	4,083	3,850	3,693
Rank	6	10	10	10	10	10
Cost per Auto Commuter (\$)	1,103	1,805	1,743	1,667	1,635	1,578
Rank	4	5	7	8	8	8
Truck Congestion						
Annual Person-Hours of Delay (000)	4,894	7,478	7,382	7,256	7,066	6,863
Rank	7	11	10	10	10	10
Annual Gallons of Wasted Fuel (000)	8,454	12,917	12,460	11,718	11,588	11,450
Rank	8	11	12	12	12	12
Annual Congestion Cost (\$ million)	262	368	406	382	356	329
Rank	7	11	11	10	10	11
Annual Greenhouse Gases (CO2) Produced	501.704	050.015			I	
Excess Due to Congestion (tons)	501,726	858,015				
Rank Due to All Travel (tone)	0.505.240	16 400 070				
Due to All Travel (tons) Rank	9,595,249	16,409,079				
	8	10				
Truck Annual Greenhouse Gases (CO2) Produced	02.220	141.000		1	I	
Excess Due to Truck Congestion (tons)	92,328	141,069				
Rank Due to Truck Travel (tons)	1 754 266	2 680 375				
Due to Truck Travel (tons)	1,754,266	2,680,375				
Rank	12	14				

<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)	4,440	4,395	4,355	4,320	4,295	4,250
Rank	10	10	10	10	10	9
Commuters (1000s)	1,704	1,697	1,695	1,678	1,661	1,641
Daily Vehicle-Miles of Travel (1000s)						
Freeway	41,311	41,470	40,905	42,357	42,102	40,700
Arterial Streets	38,188	36,019	35,240	34,942	34,732	34,955
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	2.75	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)	71,602	70,862	70,078	68,658	67,307	64,002
Rank	10	10	10	10	10	11
Fuel per Peak Auto Commuter (gallons)	30	29	30	29	29	26
Rank	5	6	4	4	4	5
Annual Delay	+					
Total Delay (1000s of person-hours)	174,013	169,166	164,282	159,476	154,889	144,533
Rank	10	105,100	10 1,202	10	10	11,555
Delay per Auto Commuter (pers-hrs)	72	70	69	67	65	62
Rank	6	7	6	6	5	5
Travel Time Index	1.27	1.27	1.27	1.27	1.26	1.26
Rank	19	19	19	19	19	19
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	3,657	3,503	3,353	3,224	2,990	2,719
Rank	10	10	10	10	10	11
Cost per Auto Commuter (\$)	1,524	1,497	1,473	1,475	1,478	1,403
Rank	8	8	6	6	6	7
Truck Congestion						
Annual Person-Hours of Delay (000)	6,666	6,480	6,293	6,109	5,933	5,536
Rank	11	11	11	11	11	12
Annual Gallons of Wasted Fuel (000)	11,317	11,200	11,076	10,852	10,638	10,116
Rank	12	12	12	13	13	13
Annual Congestion Cost (\$ million)	320	294	277	295	267	243
Rank	11	12	12	12	12	12
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						
D ( T 1 T 1 ( )						
Due to Truck Travel (tons)						

<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)	4,190	4,150	4,100	4,050	4,000	3,960
Rank	9	9	9	9	10	10
Commuters (1000s)	1,611	1,593	1,570	1,542	1,517	1,499
Daily Vehicle-Miles of Travel (1000s)						
Freeway	39,925	40,000	40,300	40,675	38,585	37,300
Arterial Streets	35,060	35,515	35,580	35,540	34,600	34,000
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)	65,070	67,340	66,440	65,444	64,172	63,258
Rank	12	12	12	12	12	11
Fuel per Peak Auto Commuter (gallons)	26	28	27	28	26	26
Rank	6	5	5	5	5	5
Annual Delay						
Total Delay (1000s of person-hours)	139,946	144,829	142,893	140,750	138,015	136,049
Rank	11	11	12	12	12	12
Delay per Auto Commuter (pers-hrs)	61	64	64	64	64	64
Rank	6	5	5	5	5	5
Travel Time Index	1.26	1.27	1.27	1.27	1.27	1.27
Rank	21	19	19	18	17	14
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	2,722	2,692	2,564	2,424	2,283	2,162
Rank	12	11	12	12	12	12
Cost per Auto Commuter (\$)	1,345	1,447	1,466	1,494	1,515	1,534
Rank	7	6	6	6	6	6
Truck Congestion			<u>.</u>			
Annual Person-Hours of Delay (000)	5,361	5,548	5,474	5,392	5,287	5,211
Rank	13	13	12	12	12	12
Annual Gallons of Wasted Fuel (000)	10,284	10,643	10,501	10,343	10,143	9,998
Rank	13	13	13	13	13	13
Annual Congestion Cost (\$ million)  Rank	249	241 13	224 12	210 12	194 12	181 12
	13	13	12	12	12	12
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						
Rank Due to Truck Travel (tons)						
Rank		 				
IXAIIK						

<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)	3,930	3,920	3,900	3,875	3,880	3,760
Rank	10	10	8	9	7	7
Commuters (1000s)	1,484	1,478	1,464	1,452	1,448	1,397
Daily Vehicle-Miles of Travel (1000s)						
Freeway	36,000	35,200	34,100	33,000	32,000	30,600
Arterial Streets	32,865	32,500	32,000	31,600	30,500	29,500
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)	62,230	60,908	58,954	56,049	55,303	51,232
Rank	10	9	9	9	9	9
Fuel per Peak Auto Commuter (gallons)	27	26	25	23	25	23
Rank	4	4	3	6	2	3
Annual Delay						
Total Delay (1000s of person-hours)	133,838	130,994	126,792	120,544	118,941	110,184
Rank	10	10	10	10	9	10
Delay per Auto Commuter (pers-hrs)	63	62	61	58	57	55
Rank	5	5	5	5	5	5
Travel Time Index	1.27	1.26	1.26	1.24	1.24	1.23
Rank	13	14	13	15	12	13
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	2,071	2,012	1,888	1,712	1,654	1,520
Rank	10	10	10	10	9	9
Cost per Auto Commuter (\$)	1,541	1,528	1,520	1,496	1,509	1,419
Rank	6	6	6	6	6	6
Truck Congestion						
Annual Person-Hours of Delay (000)	5,126	5,018	4,856	4,618	4,556	4,221
Rank	12	11	10	10	10	10
Annual Gallons of Wasted Fuel (000)	9,836	9,626	9,317	8,858	8,740	8,097
Rank	13	11	11	11	11	11
Annual Congestion Cost (\$ million)  Rank	170 12	163 11	152 10	136 10	133 10	123 10
	12	11	10	10	10	10
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	 	 				
Naiik						

<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)	3,700	3,680	3,655	3,640	3,630	3,620
Rank	7	7	7	7	7	7
Commuters (1000s)	1,372	1,359	1,344	1,336	1,327	1,320
Daily Vehicle-Miles of Travel (1000s)						
Freeway	29,875	29,860	29,495	29,500	29,865	29,340
Arterial Streets	28,300	27,000	25,600	24,500	24,000	23,600
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)	46,988	43,872	42,506	40,580	39,324	38,902
Rank	9	9	9	9	9	9
Fuel per Peak Auto Commuter (gallons)	20	19	19	18	16	16
Rank	7	7	5	5	7	5
Annual Delay						
Total Delay (1000s of person-hours)	101,056	94,355	91,417	87,275	84,574	83,666
Rank	10	10	10	10	9	8
Delay per Auto Commuter (pers-hrs)	51	48	47	45	44	44
Rank	5	6	7	7	7	5
Travel Time Index	1.21	1.21	1.21	1.20	1.19	1.19
Rank	19	16	15	15	15	14
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile) Rank						
Congestion Cost	1 267	1 220	1 1/2	1 000	1.026	002
Total Cost (\$ millions) Rank	1,367 10	1,238 10	1,163 10	1,088 10	1,026	992 8
Cost per Auto Commuter (\$)	1,331	1,283	1,280	1,255	1,253	1,277
Rank	7	7	6	6	6	5
Truck Congestion	,	,	0	0		<u>J</u>
Annual Person-Hours of Delay (000)	3,871	3,614	3,502	3,343	3,239	3,205
Rank	10	10	10	10	10	9,203
Annual Gallons of Wasted Fuel (000)	7,426	6,934	6,718	6,414	6,215	6,148
Rank	11	11	11	11	11	10
Annual Congestion Cost (\$ million)	111	102	97	92	88	86
Rank	10	11	10	10	10	9
Annual Greenhouse Gases (CO2) Produced						
Excess Due to Congestion (tons)						
Rank	1					
Due to All Travel (tons)						
Due to All Travel (tons) Rank	 			 		
Due to All Travel (tons)  Rank  Truck Annual Greenhouse Gases (CO2) Produced	 			  		  
Due to All Travel (tons) Rank	  			  		   
Due to All Travel (tons) Rank  Truck Annual Greenhouse Gases (CO2) Produced Excess Due to Truck Congestion (tons)	  			   		   

<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)	3,610	3,600	3,560	3,530	3,510	3,500
Rank	7	7	7	7	7	7
Commuters (1000s)	1,311	1,296	1,269	1,247	1,229	1,215
Daily Vehicle-Miles of Travel (1000s)						
Freeway	29,300	29,685	28,000	26,845	25,000	23,980
Arterial Streets	23,000	22,500	21,750	21,220	20,905	20,960
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)	38,647	37,043	35,069	33,191	31,353	29,500
Rank	8	7	7	7	8	8
Fuel per Peak Auto Commuter (gallons)	17	16	15	15	14	13
Rank	3	3	4	3	3	4
Annual Delay						
Total Delay (1000s of person-hours)	83,117	79,669	75,423	71,383	67,430	63,446
Rank	8	8	8	8	9	8
Delay per Auto Commuter (pers-hrs)	44	43	41	40	38	36
Rank	4	4	4	5	6	8
Travel Time Index	1.19	1.18	1.18	1.17	1.16	1.15
Rank	12	14	11	14	14	15
Commuter Stress Index						
Rank						
Freeway Planning Time Index (95th Pctile)						
Rank						
Congestion Cost						
Total Cost (\$ millions)	941	861	779	711	650	610
Rank	8	8	8	8	9	8
Cost per Auto Commuter (\$)	1,327	1,346	1,341	1,325	1,297	1,243
Rank	3	3	4	4	5	4
Truck Congestion						
Annual Person-Hours of Delay (000)	3,184	3,052	2,889	2,734	2,583	2,431
Rank	9	8	8	10	9	10
Annual Gallons of Wasted Fuel (000)	6,108	5,855	5,543	5,245	4,955	4,662
Rank	10	10	10	10	10	10
Annual Congestion Cost (\$ million)	83	79	73	68	64	61
Rank	9	8	9	10	9	10
Annual Greenhouse Gases (CO2) Produced						
Excess Due to Congestion (tons)						
Rank						
Due to All Travel (tons)						
Rank						
Truck Annual Greenhouse Gases (CO2) Produced			I			
Truck Annual Greenhouse Gases (CO2) Produced Excess Due to Truck Congestion (tons)						
Excess Due to Truck Congestion (tons) Rank	 		 	 	 	
Excess Due to Truck Congestion (tons)		  		  	  	  

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

Inventory Measures	1984	1983	1982
Urban Area Information			
Population (1000s)	3,485	3,475	3,450
Rank	7	6	6
Commuters (1000s)	1,199	1,185	1,166
Daily Vehicle-Miles of Travel (1000s)			
Freeway	22,750	21,775	20,670
Arterial Streets	20,640	20,485	20,240
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)	27,300	25,159	24,453
Rank	8	8	8
Fuel per Peak Auto Commuter (gallons)	12	10	10
Rank	4	4	5
Annual Delay			
Total Delay (1000s of person-hours)	58,714	54,110	52,591
Rank	9	9	8
Delay per Auto Commuter (pers-hrs)	34	31	31
Rank	10	11	10
Travel Time Index	1.14	1.13	1.13
Rank	16	16	14
Commuter Stress Index			
Rank			
Freeway Planning Time Index (95th Pctile)			
Rank			
Congestion Cost			
Total Cost (\$ millions)	548	488	462
Rank	9	9	8
Cost per Auto Commuter (\$)	1,192	1,150	1,154
Rank	5	5	5
Truck Congestion			
Annual Person-Hours of Delay (000)	2,249	2,073	2,015
Rank	10	9	9
Annual Gallons of Wasted Fuel (000)	4,315	3,977	3,865
Rank	10	9	9
Annual Congestion Cost (\$ million)	56	51	49
Rank	10	9	9
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.