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16. Abstract

This research report represents the seventh year of a ten-year research effort focused on quantifying urban mobility. This study contains the facility information for 50 urban areas throughout the country. The database used for this research contains information on vehicle travel, system length, and urban area characteristics from 1982 to 1992. Various federal, state, and local agencies provided the information used to update and verify the primary database. The primary database and original source of most of the information is the Federal Highway Administration's Highway Performance Monitoring System (HPMS).

Vehicle travel and system length data were combined to develop Roadway Congestion Index (RCI) values for 50 urban areas including the seven largest in Texas. The RCI values provide an indicator of the relative mobility level within an urban area.

An analysis of the cost of congestion was also performed using travel delay and increased fuel consumption as estimated quantities. The impact of congestion was also estimated by the amount of additional facility capacity required to provide urban mobility. Congestion costs were estimated on an areawide, per registered vehicle, and per capita basis

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URBAN ROADWAY CONGESTION - 1982 TO 1992
VOLUME 2: METHODOLOGY AND URBANIZED AREA DATA

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IMPLEMENTATION STATEMENT

This report provides information that will assist the Texas Department of Transportation in planning future transportation needs for urban areas in Texas. This report quantifies congestion levels and the economic impact of congestion on urban motorists in seven large cities in Texas. The report also presents data for other large U.S. metropolitan areas to assist in determining mobility trends and the performance of Texas' roadway networks relative to others. This report is valuable for identifying transportation trends and prioritizing future needs.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation. In addition, this report is not intended for construction, bidding, or permit purposes. David L. Schrank, Shawn M. Turner, and Timothy J. Lomax (Texas Professional Engineer certification number 54597) prepared this research report.

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SUMMARY

This report represents the seventh year of a planned ten-year study to measure and monitor urban mobility in 50 urbanized areas throughout the United States. This research study estimates the level of congestion in the seven largest Texas urban areas and 43 other areas representing a cross-section of urban areas throughout the country. Quantitative estimates of mobility levels allow comparisons of transportation systems in the various urbanized areas and assist the transportation community in analyzing urban mobility.

The level of congestion in an urban area was estimated using procedures developed in previous research (1-8). The Roadway Congestion Index (RCI) combines the daily vehicle-kilometers of travel (DVKT) per lane-kilometer for freeways and principal arterial street systems in a ratio comparing the existing value to values identified with congested conditions. Equation S-1 illustrates how the areawide and congested level travel per lane values are combined into the RCI values for each urban area.

$$\text{Roadway Congestion Index} = \frac{\left(\frac{\text{Freeway VKT}}{\text{Ln.-Km.}}\right)_{\text{Freeway}} \times \text{Freeway VKT} + \left(\frac{\text{Prin Art Str VKT}}{\text{Ln.-Km.}}\right)_{\text{PrinArtStr}} \times \text{PrinArtStr VKT}}{13{,}000 \times \text{Freeway VKT} + 5{,}000 \times \text{PrinArtStr VKT}} \quad \text{Eq. S-1}$$

An RCI value of 1.0 or greater indicates that congested conditions exist areawide. It should be noted that urban areas with areawide values less than 1.0 may have sections of roadway that experience periods of heavy congestion, but the average mobility level within the urban area could be defined as uncongested. The RCI analyses presented in this report are intended to evaluate entire urban areas and not specific locations. The nature of the RCI equation (Eq. S-1) is to underestimate point or specific facility congestion if the overall system has "good" operational characteristics.

AREAWIDE MOBILITY

Table S-1 combines the freeway and principal arterial street system DVKT and DVKT per lane-kilometer into the 1992 estimated Roadway Congestion Index (RCI). The ten most congested urban areas in the study are displayed. The RCI values range from 1.54 (Los Angeles) to 1.17 (Atlanta). All of these urban areas have surpassed the RCI value at which undesirable levels of congestion occur (1.0).

Table S-1. 1992 Roadway Congestion Index Value

Urban Area	Freeway/Expressway		Principal Arterial Street		Roadway/[3] Congestion Index	Rank
	DVKT[1] (1000)	DVKT/[2] Ln-Km	DVKT[1] (1000)	DVKT/[2] Ln-Km		
Los Angeles CA	180,240	20,750	132,830	6,600	1.54	1
Washington DC	44,190	16,940	29,790	7,970	1.36	2
San Fran-Oak CA	68,100	17,410	22,830	6,110	1.33	3
Miami FL	15,090	14,990	27,050	7,530	1.30	4
Chicago IL	63,110	16,070	52,810	7,050	1.28	5
San Bernardino-Riv CA	24,330	16,600	17,310	5,120	1.22	6
San Diego CA	44,760	15,980	15,620	5,590	1.22	6
Seattle-Everett WA	32,640	15,960	15,780	6,030	1.22	6
Detroit MI	46,050	15,710	39,450	5,740	1.19	9
Atlanta GA	42,670	15,140	16,100	6,170	1.17	10

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometers of travel per lane-kilometer.
[3] See Equation S-1.

See Table 1 for complete listing of urban areas.
Source: TTI Analysis

Table S-2 displays the ten urban areas which have experienced the greatest growth in congestion between 1982 and 1992. The RCI values reflect the level of congestion occurring in the urban areas. San Diego experienced a 56 percent increase in congestion during the eleven-year period. The congestion increase rate in all cities in the top ten exceeded two percent per year.

Table S-2. Fastest Congestion Growth Areas

Rank of % Change		Urban Area	Percent Change		Year				
1982-92	1987-92		1982-92	1987-92	1982	1987	1990	1991	1992
1	7	San Diego CA	56	13	0.78	1.08	1.22	1.22	1.22
2	1	Salt Lake City UT	43	29	0.63	0.70	0.85	0.88	0.90
3	2	Columbus OH	37	19	0.68	0.78	0.89	0.91	0.93
4	41	San Fran-Oak CA	32	2	1.01	1.31	1.36	1.34	1.33
5	10	Minn-St. Paul MN	30	11	0.76	0.89	0.96	0.96	0.99
6	34	Sacramento CA	30	4	0.80	1.00	1.02	1.04	1.04
7	25	Atlanta GA	29	5	0.91	1.11	1.14	1.16	1.17
8	21	Seattle-Everett WA	28	7	0.95	1.14	1.20	1.20	1.22
9	28	Dallas TX	27	5	0.84	1.02	1.05	1.06	1.07
10	42	Indianapolis IN	27	0	0.67	0.85	0.84	0.84	0.85

See Table 2 for complete listing of urban areas.

Source: TTI Analysis

The ten urban areas with the smallest growth in congestion between 1982 and 1992 are shown in Table S-3. Phoenix and Houston experienced decreases in congestion with Phoenix showing the greatest decrease (6 percent). Congestion increases in these ten urban areas were less than one percent per year.

Table S-3. Slowest Congestion Growth Areas

Rank of % Change		Urban Area	Percent Change		Year				
1982-92	1987-92		1982-92	1987-92	1982	1987	1990	1991	1992
1	1	Phoenix AZ	-6	-8	1.15	1.18	1.05	1.08	1.08
2	2	Houston TX	-4	-6	1.17	1.19	1.12	1.11	1.12
3	11	Pittsburgh PA	4	3	0.78	0.79	0.82	0.82	0.81
4	8	Philadelphia PA	5	-1	1.00	1.06	1.05	1.05	1.05
5	14	Jacksonville FL	7	3	0.91	0.94	0.93	0.95	0.97
6	30	San Bernardino-Riv CA	10	7	1.11	1.14	1.21	1.22	1.22
7	28	Ft. Lauderdale FL	10	7	0.87	0.90	0.94	0.95	0.96
8	12	Corpus Christi TX	10	3	0.67	0.72	0.72	0.72	0.74
9	38	Memphis TN	11	10	0.83	0.84	0.89	0.91	0.92
10	16	Orlando FL	11	4	0.72	0.77	0.77	0.78	0.80

See Table 2 for complete listing of urban areas

Source: TTI Analysis

Table S-4 lists the top ten urban areas based on the amount of fuel wasted annually due to congested travel. Los Angeles tops the list with almost 2.5 billion liters of wasted fuel annually. New York is second with about 2.2 billion liters. Dallas is tenth in this group with 380 million

liters of fuel wasted annually. These ten areas consume 10 billion liters annually due to congestion in their urban areas.

Table S-4. Annual Excess Fuel Consumed Due to Traffic Congestion in 1992

Urban Area	Annual Liters of Fuel Wasted (million)				Annual Excess Fuel Consumed per Capita (liters)	Rank[1]
	Recurring	Incident	Total	Rank[1]		
Los Angeles CA	1,147	1,344	2,491	1	210	5
New York NY	761	1,414	2,175	2	128	13
San Fran-Oak CA	387	489	876	3	230	3
Chicago IL	375	434	809	4	108	20
Washington DC	292	516	808	5	246	1
Detroit MI	235	387	622	6	155	11
Houston TX	237	321	558	7	192	6
Boston MA	126	356	482	8	163	9
Seattle-Everett WA	171	228	399	9	217	4
Dallas TX	140	240	380	10	182	7

Notes: [1] Rank value of 1 associated with greatest fuel consumption.

See Table 6 for complete listing of urban areas.

Source: TTI Analysis

Table S-5 combines existing freeway and principal arterial street distances with (1988 to 1992) recent annual traffic volume growth rates to produce the number of additional lane-kilometers for both freeway and principal arterial streets which would be necessary to avoid increases in areawide congestion. This value illustrates the amount of roadway that would have to be added *every year* to maintain a constant congestion level. The average amount of roadway which was added annually during this time period was also calculated. The annual deficiency in construction of lane-kilometers of freeway and principal arterial streets is shown. Detroit leads this list of cities with a deficiency of 297 lane-kilometers annually between 1988 and 1992 (92 lane-kilometers of freeway and 205 lane-kilometers of principal arterial streets).

Table S-5. Illustration of Annual Capacity Increase Required to Prevent Congestion Growth

Urban Area	Existing (1992) Lane-km		Average Annual VKT Growth (%)[1]	Annual Freeway Lane-km		Annual Prin.Art. Lane-km		Lane-km Deficiency	
	Fwy	Prin.Art.		Needed	Added	Needed	Added	Fwy	Prin.Art
Detroit MI	2,930	6,875	5.61	164	72	386	181	92	205
Chicago IL	3,928	7,487	5.57	219	95	417	360	124	57
Baltimore MD	2,174	2,689	4.49	98	52	121	-12	46	133
Los Angeles CA	8,686	20,125	1.90	165	175	383	201	-10	182
New York NY	9,741	12,276	2.11	206	97	259	207	109	52
Miami FL	1,006	3,590	4.90	49	20	176	85	29	91
Cincinnati OH	1,473	1,328	5.66	83	28	75	12	55	63
Columbus OH	1,304	1,022	5.31	69	10	54	14	59	40
Minn-St. Paul MN	2,431	1,852	4.41	107	30	82	72	77	10
Salt Lake City UT	845	684	8.80	74	18	60	30	56	30

[1] Average Annual Growth rate of Freeway and Principal Arterial Streets DVKT between 1987-1991.

See Table 8 for complete listing of urban areas.

Source: TTI Analysis

The urban areas with the highest annual congestion costs are shown in Table S-6. Delay and fuel costs comprise the total congestion costs. These eleven urban areas have an annual combined congestion cost of over $33 billion. Los Angeles and New York had the highest total congestion costs with values of $8.33 billion and $7.25 billion, respectively. The final two urban areas in the table, Dallas and Philadelphia, each had a total congestion cost of $1.24 billion annually.

Table S-6. Component and Total Congestion Costs by Urban Area for 1992

Urban Area	Annual Cost Due to Congestion ($ millions)			Rank
	Delay	Fuel	Total	
Los Angeles CA	7,420	910	8,330	1
New York NY	6,450	800	7,250	2
San Fran-Oak CA	2,570	320	2,890	3
Chicago IL	2,420	310	2,730	4
Washington DC	2,410	300	2,710	5
Detroit MI	1,870	220	2,090	6
Houston TX	1,640	190	1,830	7
Boston MA	1,420	170	1,590	8
Seattle-Everett WA	1,180	150	1,330	9
Dallas TX	1,110	130	1,240	10
Philadelphia PA	1,110	130	1,240	10

See Table 9 for complete listing of urban areas.

Source: TTI Analysis and Local Transportation Agency Reference

Congestion costs can be used in relation to registered vehicles to show the economic impact on each automobile in the urban area. Table S-7 lists the top ten congestion costs per registered vehicle for 1992. Washington D.C. ranks first with a cost of $1,580 per vehicle. Dallas and Houston have costs of $750 and $810 per vehicle, respectively, or approximately $3 per workday.

Table S-7. 1992 Congestion Cost per Vehicle

Urban Area	Total Congestion Cost	
	Per Registered Vehicle (dollars)	Rank
Washington DC	1,580	1
San Bernardino-Riv. CA	1,260	2
New York NY	1,190	3
Los Angeles CA	1,060	4
Seattle-Everett WA	990	5
Boston MA	950	6
San Fran-Oak CA	930	7
San Jose CA	860	8
Houston TX	810	9
Dallas TX	750	10

See Table 10 for complete listing of urban areas.

Source: TTI Analysis

Expressing congestion costs on a per capita basis illustrates the congestion "tax" paid by residents (Table S-8). The highest 1992 cost per capita occurred in Washington, D.C. with a cost per capita of $820. Atlanta and Detroit had the smallest cost per capita ($520) of the top eleven urban areas with a cost of approximately $2 per capita for each workday.

Table S-8. 1992 Congestion Cost per Capita

Urban Area	Total Congestion Cost	
	Per Registered Vehicle (dollars)	Rank
Washington DC	820	1
San Bernardino-Riv. CA	770	2
San Fran-Oak CA	760	3
Seattle-Everett WA	720	4
Los Angeles CA	700	5
Houston, TX	630	6
Dallas, TX	590	7
San Jose CA	590	7
Boston MA	540	9
Atlanta GA	520	10
Detroit MI	520	10

See Table 10 for complete listing of urban areas.

Source: TTI Analysis

INTRODUCTION

Volume 2 of this report contains supporting data for Volume 1, "Urban Roadway Congestion - 1982 to 1992." It is divided into five appendices.

Appendix A contains a set of tables which correspond to those in the research report with the English unit equivalents. Each table from the report has a matching table in Appendix A. There are some tables which are repeated in Appendix A to provide a complete set of equivalent tables based on the English system.

Appendix B provides background information concerning the development of the congestion measurement methodology utilized in the report.

Appendix C contains congestion level and congestion cost data for each of the study areas. Levels of congestion are shown for each urban area for 1982 to 1992. Background information and methodology used to calculate congestion cost are shown.

Appendix D shows travel and system length statistics for the urban areas for 1982 to 1992. Included in this section are the same 1992 statistics which are normalized by population and urban area size.

Appendix E contains the congestion statistics for each urban area for 1982 to 1992. The tables are organized by individual urban area, rather than by topic or statistic. They are useful for analyses of congestion trends on urban area roadway systems.

APPENDIX A

ENGLISH UNIT EQUIVALENT TABLES

Table A-1. 1992 Roadway Congestion Index

Urban Area	Freeway/Expressway		Principal Arterial Street		Roadway[3] Congestion Index	Rank
	DVMT[1] (1000)	DVMT/[2] Ln-Mile	DVMT[1] (1000)	DVMT/[2] Ln-Mile		
Los Angeles CA	111,950	20,750	82,500	6,600	1.54	1
Washington DC	27,450	16,940	18,500	7,970	1.36	2
San Fran-Oak CA	42,300	17,410	14,180	6,110	1.33	3
Miami FL	9,370	14,990	16,800	7,530	1.30	4
Chicago IL	39,200	16,070	32,800	7,050	1.28	5
San Bernardino-Riv CA	15,110	16,600	10,750	5,120	1.22	6
San Diego CA	27,800	15,980	9,700	5,590	1.22	6
Seattle-Everett WA	20,280	15,960	9,800	6,030	1.22	6
Detroit MI	28,600	15,710	24,500	5,740	1.19	9
Atlanta GA	26,500	15,140	10,000	6,170	1.17	10
New York NY	83,500	13,800	55,320	7,260	1.14	11
Houston TX	30,500	14,700	11,140	5,110	1.12	12
Honolulu HI	5,090	13,570	1,750	7,430	1.10	13
New Orleans LA	5,050	13,470	4,200	6,410	1.10	13
Portland OR	7,970	13,860	3,910	6,460	1.10	13
Phoenix AZ	9,750	13,930	18,110	5,470	1.08	16
Boston MA	21,900	14,450	13,000	4,560	1.07	17
Dallas TX	24,500	14,000	8,550	4,890	1.07	17
San Jose CA	16,610	13,840	7,400	5,360	1.07	17
Tampa FL	3,800	12,260	4,650	6,640	1.07	17
Denver CO	12,500	13,020	11,000	5,910	1.05	21
Philadelphia PA	19,390	12,010	21,650	6,640	1.05	21
Baltimore MD	17,600	13,040	9,900	5,930	1.04	23
Sacramento CA	10,120	12,640	7,740	6,240	1.04	23
Cincinnati OH	11,910	13,020	4,500	5,450	1.01	25
Milwaukee WI	7,840	13,060	5,200	4,910	1.00	26
Minn-St. Paul MN	19,000	12,580	6,800	5,910	0.99	27
Jacksonville FL	5,760	12,650	6,150	4,800	0.97	28
Ft. Lauderdale FL	7,750	11,920	6,350	5,520	0.96	29
Albuquerque NM	2,500	10,870	4,300	5,580	0.95	30
Austin TX	5,650	12,280	2,200	4,940	0.95	30
Cleveland OH	14,160	12,000	6,300	5,530	0.95	30
St. Louis MO	18,930	11,140	12,480	6,590	0.95	30
Fort Worth TX	12,800	12,190	4,340	4,820	0.94	34
Columbus OH	9,460	11,680	3,580	5,630	0.93	35
Memphis TN	5,030	11,430	5,010	5,110	0.92	36
Nashville TN	6,000	10,910	5,500	5,730	0.92	36
Norfolk VA	5,870	10,480	4,780	6,370	0.92	36
Hartford CT	6,750	11,160	3,840	5,860	0.91	39
Louisville KY	6,530	10,790	3,330	6,330	0.90	40
Salt Lake City UT	5,780	11,000	2,580	6,060	0.90	40
San Antonio TX	9,940	11,290	5,940	5,280	0.90	40
Charlotte NC	3,200	10,490	3,200	5,520	0.89	43
Indianapolis IN	8,320	10,800	4,250	4,800	0.85	44
Oklahoma City OK	7,300	10,070	3,970	5,510	0.83	45
Pittsburgh PA	9,140	8,160	11,100	5,980	0.81	46
Orlando FL	6,050	10,080	4,850	4,450	0.80	47
Kansas City MO	13,700	9,720	4,890	4,490	0.77	48
El Paso TX	3,500	9,860	3,330	3,890	0.76	49
Corpus Christi TX	1,680	8,910	1,640	4,370	0.74	50
Northeastern Avg	26,530	12,790	19,040	6,310	1.05	
Midwestern Avg	15,410	12,220	9,380	5,660	0.97	
Southern Avg	7,670	12,170	6,500	5,840	1.00	
Southwestern Avg	10,830	12,000	6,650	5,120	0.95	
Western Avg	28,580	15,620	16,410	6,100	1.20	
Texas Avg	12,650	11,890	5,300	4,760	0.93	
Total Avg	16,630	12,850	10,760	5,750	1.03	
Maximum Value	111,950	20,750	82,500	7,970	1.54	
Minimum Value	1,680	8,160	1,640	3,890	0.74	

Notes: [1] Daily vehicle-miles of travel.
[2] Daily vehicle-miles of travel per lane-mile.
[3] See Equation 1.

Source: TTI Analysis

Table A-2. Roadway Congestion Index Values, 1982 to 1992

Rank of % Change		Urban Area	Percent Change		Year							
1982-92	1987-92		1982-92	1987-92	1982	1984	1986	1987	1988	1990	1991	1992
1	1	Phoenix AZ	(6)	(8)	1.15	1.10	1.20	1.18	1.04	1.05	1.08	1.08
2	2	Houston TX	(4)	(6)	1.17	1.25	1.21	1.19	1.15	1.12	1.11	1.12
3	11	Pittsburgh PA	4	3	0.78	0.76	0.79	0.79	0.81	0.82	0.82	0.81
4	8	Philadelphia PA	5	(1)	1.00	1.04	1.06	1.06	1.07	1.05	1.05	1.05
5	14	Jacksonville FL	7	3	0.91	0.96	0.95	0.94	0.95	0.93	0.95	0.97
6	30	San Bernardino-Riv CA	10	7	1.11	1.13	1.15	1.14	1.18	1.21	1.22	1.22
7	28	Ft. Lauderdale FL	10	7	0.87	0.86	0.85	0.90	0.90	0.94	0.95	0.96
8	12	Corpus Christi TX	10	3	0.67	0.69	0.71	0.72	0.70	0.72	0.72	0.74
9	38	Memphis TN	11	10	0.83	0.79	0.80	0.84	0.86	0.89	0.91	0.92
10	16	Orlando FL	11	4	0.72	0.73	0.76	0.77	0.78	0.77	0.78	0.80
11	4	New Orleans LA	12	(4)	0.98	1.05	1.09	1.14	1.13	1.12	1.12	1.10
12	47	Detroit MI	12	14	1.06	1.07	1.05	1.04	1.07	1.13	1.16	1.19
13	33	New York NY	13	8	1.01	0.99	1.06	1.06	1.10	1.14	1.14	1.14
14	3	Austin TX	13	(5)	0.84	0.86	0.94	1.00	0.96	0.94	0.94	0.95
15	23	Tampa FL	14	5	0.94	1.03	0.96	1.02	1.03	1.05	1.05	1.07
16	6	St. Louis MO	14	(1)	0.83	0.88	0.93	0.96	0.98	0.95	0.95	0.95
17	37	Oklahoma City OK	15	9	0.72	0.75	0.76	0.76	0.78	0.79	0.81	0.83
18	19	Louisville KY	15	5	0.78	0.82	0.80	0.86	0.87	0.86	0.88	0.90
19	5	Norfolk VA	16	(1)	0.79	0.81	0.90	0.93	0.94	0.96	0.93	0.92
20	19	San Antonio TX	17	5	0.77	0.82	0.88	0.86	0.86	0.88	0.89	0.90
21	48	Cincinnati OH	17	16	0.86	0.82	0.84	0.87	0.88	0.96	0.99	1.01
22	29	Cleveland OH	19	7	0.80	0.83	0.86	0.89	0.97	0.94	0.95	0.95
23	13	Boston MA	19	3	0.90	0.95	1.04	1.04	1.12	1.06	1.06	1.07
24	39	Denver CO	19	11	0.88	0.93	0.97	0.95	0.99	1.03	1.03	1.05
25	15	Nashville TN	19	3	0.77	0.83	0.86	0.89	0.94	0.89	0.90	0.92
26	21	Honolulu HI	20	5	0.92	0.95	1.03	1.05	1.07	1.09	1.10	1.10
27	18	Hartford CT	20	5	0.76	0.86	0.85	0.87	0.90	0.89	0.89	0.91
28	25	Milwaukee WI	20	5	0.83	0.87	0.90	0.95	0.94	0.99	1.00	1.00
29	32	El Paso TX	21	7	0.63	0.65	0.75	0.71	0.74	0.74	0.75	0.76
30	27	Washington DC	21	5	1.12	1.11	1.27	1.29	1.30	1.34	1.33	1.36
31	6	Albuquerque NM	22	(1)	0.78	0.89	0.96	0.96	0.96	0.98	0.96	0.95
32	34	Fort Worth TX	24	8	0.76	0.80	0.87	0.87	0.87	0.90	0.92	0.94
33	45	Miami FL	24	14	1.05	1.10	1.14	1.14	1.18	1.27	1.28	1.30
34	46	Baltimore MD	24	14	0.84	0.85	0.88	0.91	0.92	1.01	1.02	1.04
35	36	Kansas City MO	24	8	0.62	0.60	0.68	0.71	0.72	0.74	0.75	0.77
36	35	San Jose CA	24	8	0.86	0.91	0.97	0.99	1.00	1.05	1.08	1.07
37	43	Charlotte NC	25	13	0.71	0.76	0.78	0.79	0.80	0.86	0.89	0.89
38	42	Chicago IL	25	11	1.02	1.05	1.15	1.15	1.18	1.25	1.27	1.28
39	22	Los Angeles CA	26	5	1.22	1.32	1.42	1.47	1.52	1.55	1.56	1.54
40	40	Portland OR	26	11	0.87	0.88	0.97	0.99	1.04	1.08	1.08	1.10
41	9	Indianapolis IN	27	0	0.67	0.75	0.81	0.85	0.85	0.84	0.84	0.85
42	23	Dallas TX	27	5	0.84	0.94	1.04	1.02	1.02	1.05	1.06	1.07
43	30	Seattle-Everett WA	28	7	0.95	1.02	1.09	1.14	1.17	1.20	1.20	1.22
44	26	Atlanta GA	29	5	0.91	0.97	1.09	1.11	1.14	1.14	1.16	1.17
45	17	Sacramento CA	30	4	0.80	0.88	0.95	1.00	1.03	1.02	1.04	1.04
46	41	Minn-St. Paul MN	30	11	0.76	0.84	0.89	0.89	0.90	0.95	0.96	0.99
47	10	San Fran-Oak CA	32	2	1.01	1.12	1.24	1.31	1.33	1.36	1.34	1.33
48	49	Columbus OH	37	19	0.68	0.71	0.75	0.78	0.79	0.89	0.91	0.93
49	50	Salt Lake City UT	43	29	0.63	0.65	0.68	0.70	0.72	0.85	0.88	0.90
50	44	San Diego CA	56	13	0.78	0.91	1.00	1.08	1.13	1.22	1.22	1.22
		Northeastern Avg			0.92	0.94	0.99	1.00	1.03	1.04	1.04	1.05
		Midwestern Avg			0.80	0.83	0.87	0.89	0.91	0.94	0.96	0.97
		Southern Avg			0.86	0.90	0.93	0.95	0.97	0.98	0.99	1.00
		Southwestern Avg			0.83	0.87	0.93	0.92	0.91	0.93	0.94	0.95
		Western Avg			0.95	1.01	1.09	1.13	1.16	1.20	1.20	1.20
		Texas Avg			0.81	0.86	0.91	0.91	0.90	0.91	0.91	0.93
		Total Avg			0.86	0.90	0.95	0.97	0.99	1.01	1.02	1.03
		Maximum Value			1.22	1.32	1.42	1.47	1.52	1.55	1.56	1.54
		Minimum Value			0.62	0.60	0.68	0.70	0.70	0.72	0.72	0.74

Source: TTI Analysis

Table A-3. Speed Relationships with Average Daily Traffic (ADT) per Lane Volumes

Functional Class	Parameters	Severity of Congestion[1,2]			
		Uncongested	Moderate	Heavy	Severe
Freeway/Expressway	ADT/Lane	Under 15,000	15,000 - 17,500	17,501 - 20,000	Over 20,000
	Speed (mph)	60	38	33	30
Principal Arterial Streets	ADT/Lane	Under 5,750	5,750 - 7,000	7,001 - 8,500	Over 8,500
	Speed (mph)	35	28	25	23

Notes: [1] Assumes congested freeway operation when ADT/Lane exceeds 15,000.
[2] Assumes congested principal arterial street operations when ADT/lane exceeds 5,750.

Source: TTI Analysis and Houston-Galveston Regional Transportation Study (Appendix B)

Table A-4. Daily Vehicle Hours of Delay for 1992

Urban Area	Daily Vehicle Hours of Delay (000)				Annual Hours of Delay per Capita	Rank[1]
	Recurring	Incident	Total	Rank[1]		
Northeastern Cities						
Baltimore MD	54	99	154	18	19	22
Boston MA	93	260	353	8	30	9
Hartford CT	13	24	37	41	15	30
New York NY	576	1,051	1,627	2	24	13
Philadelphia PA	126	169	295	9	15	30
Pittsburgh PA	48	74	122	21	16	28
Washington DC	223	388	610	5	46	1
Midwestern Cities						
Chicago IL	287	332	620	4	21	19
Cincinnati OH	30	26	56	33	11	39
Cleveland OH	35	29	65	30	9	42
Columbus OH	29	25	54	34	14	36
Detroit MI	183	297	480	6	30	9
Indianapolis IN	9	11	20	48	5	49
Kansas City MO	13	29	43	38	9	42
Louisville KY	13	15	28	43	9	42
Milwaukee WI	24	25	49	36	10	41
Minn-St. Paul MN	59	58	116	22	14	36
Oklahoma City OK	12	14	26	44	9	42
St. Louis MO	60	68	128	20	16	28
Southern Cities						
Atlanta GA	126	139	265	12	29	12
Charlotte NC	18	18	36	42	18	24
Ft. Lauderdale FL	34	44	79	25	15	30
Jacksonville FL	27	34	60	32	20	20
Memphis TN	12	14	26	44	7	46
Miami FL	103	127	230	13	30	9
Nashville TN	19	20	39	40	17	26
New Orleans LA	26	39	66	29	15	30
Norfolk VA	26	49	74	26	19	22
Orlando FL	18	24	42	39	12	38
Tampa FL	23	28	51	35	18	24
Southwestern Cities						
Albuquerque NM	11	12	23	46	11	39
Austin TX	23	26	49	36	22	17
Corpus Christi TX	2	2	5	50	4	50
Dallas TX	100	170	269	11	32	8
Denver CO	74	77	152	19	24	13
El Paso TX	7	7	14	49	6	47
Fort Worth TX	39	65	104	23	22	17
Houston TX	171	231	402	7	35	6
Phoenix AZ	104	87	192	16	24	13
Salt Lake City UT	12	10	21	47	6	47
San Antonio TX	34	37	71	28	15	30
Western Cities						
Honolulu HI	24	39	63	31	23	16
Los Angeles CA	864	1,011	1,875	1	40	4
Portland OR	33	54	87	24	20	20
Sacramento CA	39	35	74	26	15	30
San Bernardino-Riv CA	104	121	225	14	43	2
San Diego CA	103	71	173	17	17	26
San Fran-Oak CA	281	355	635	3	42	3
San Jose CA	91	107	198	15	33	7
Seattle-Everett WA	126	167	292	10	40	4
Northeastern Avg	162	295	457		24	
Midwestern Avg	63	77	140		13	
Southern Avg	39	49	88		18	
Southwestern Avg	52	66	118		18	
Western Avg	185	218	402		30	
Texas Avg	54	77	130		19	
Total Avg	91	124	216		20	
Maximum Value	864	1,051	1,875		46	
Minimum Value	2	2	5		4	

Notes: [1] Rank value of 1 associated with most congested conditions.

Source: TTI Analysis

Table A-5. Annual Hours of Delay per Capita

Urban Area	Annual Delay per Capita					% Change 1986 - 1992
	1986	1988	1990	1991	1992	
Northeastern Cities						
Baltimore MD	13	14	16	16	19	46
Boston MA	26	30	29	29	30	15
Hartford CT	9	13	14	14	15	67
New York NY	19	21	22	22	24	26
Philadelphia PA	15	17	15	15	15	0
Pittsburgh PA	13	15	16	16	16	23
Washington DC	36	39	43	42	46	28
Midwestern Cities						
Chicago IL	17	16	18	19	21	24
Cincinnati OH	6	8	9	10	11	83
Cleveland OH	4	6	8	8	9	125
Columbus OH	9	10	14	14	14	56
Detroit MI	21	23	26	28	30	43
Indianapolis IN	3	4	5	5	5	67
Kansas City MO	5	6	6	6	9	80
Louisville KY	6	6	6	7	9	50
Milwaukee WI	8	9	9	10	10	25
Minn-St. Paul MN	10	12	13	13	14	40
Oklahoma City OK	7	8	7	8	9	29
St. Louis MO	15	15	16	17	16	7
Southern Cities						
Atlanta GA	29	29	28	28	29	0
Charlotte NC	14	15	17	18	18	29
Ft. Lauderdale FL	11	12	14	14	15	36
Jacksonville FL	15	16	19	18	20	33
Memphis TN	5	6	6	7	7	40
Miami FL	22	28	31	31	30	36
Nashville TN	14	19	18	18	17	21
New Orleans LA	15	16	16	15	15	0
Norfolk VA	18	20	20	19	19	6
Orlando FL	11	11	11	11	12	9
Tampa FL	15	17	17	18	18	20
Southwestern Cities						
Albuquerque NM	8	9	11	10	11	38
Austin TX	23	23	22	21	22	(4)
Corpus Christi TX	3	3	2	3	4	33
Dallas TX	34	32	33	32	32	(6)
Denver CO	18	18	21	23	24	33
El Paso TX	4	4	4	4	6	50
Fort Worth TX	21	20	20	21	22	5
Houston TX	33	32	33	34	35	6
Phoenix AZ	20	23	22	23	24	20
Salt Lake City UT	3	4	5	6	6	100
San Antonio TX	15	13	13	14	15	0
Western Cities						
Honolulu HI	19	20	20	21	23	21
Los Angeles CA	37	39	40	39	40	8
Portland OR	12	16	17	17	20	67
Sacramento CA	12	14	16	15	15	25
San Bernardino-Riv CA	40	42	43	42	43	8
San Diego CA	12	18	18	18	17	42
San Fran-Oak CA	39	43	44	43	42	8
San Jose CA	30	33	33	33	33	10
Seattle-Everett WA	28	36	38	37	40	43
Northeastern Avg	19	21	22	22	24	26
Midwestern Avg	9	10	11	12	13	44
Southern Avg	15	17	18	18	18	20
Southwestern Avg	17	16	17	17	18	6
Western Avg	25	29	30	29	30	20
Texas Avg	19	18	18	19	19	0
Total Avg	16	18	19	19	20	25
Maximum Value	40	43	44	43	46	15
Minimum Value	3	3	2	3	4	33

Table A-6. Annual Excess Fuel Consumed Due to Traffic Congestion in 1992

Urban Area	Annual Gallons of Fuel Wasted (million)				Annul Excess Fuel Consumed per Person (gallons)	Rank[1]
	Recurring	Incident	Total	Rank[1]		
Northeastern Cities						
Baltimore MD	25	45	70	18	34	23
Boston MA	43	119	161	8	54	9
Hartford CT	6	11	17	41	27	33
New York NY	261	476	736	2	43	13
Philadelphia PA	54	72	126	11	25	36
Pittsburgh PA	21	32	52	22	28	29
Washington DC	99	173	272	5	83	1
Midwestern Cities						
Chicago IL	128	148	276	4	37	19
Cincinnati OH	14	12	27	32	22	38
Cleveland OH	17	14	30	29	17	42
Columbus OH	13	11	24	34	26	35
Detroit MI	80	130	210	6	53	10
Indianapolis IN	4	5	9	48	10	49
Kansas City MO	6	14	20	38	17	42
Louisville KY	6	6	12	43	14	45
Milwaukee WI	11	11	22	36	18	41
Minn-St. Paul MN	27	26	53	21	25	36
Oklahoma City OK	6	6	12	43	16	44
St. Louis MO	27	30	57	20	29	28
Southern Cities						
Atlanta GA	57	63	121	12	53	10
Charlotte NC	8	8	16	42	32	25
Ft. Lauderdale FL	16	20	36	25	28	29
Jacksonville FL	12	15	27	32	36	21
Memphis TN	6	6	12	43	13	46
Miami FL	45	55	100	14	52	12
Nashville TN	9	9	18	40	30	27
New Orleans LA	12	18	30	29	27	33
Norfolk VA	12	22	34	26	35	22
Orlando FL	8	11	19	39	22	38
Tampa FL	10	12	22	36	31	26
Southwestern Cities						
Albuquerque NM	5	5	10	46	20	40
Austin TX	11	12	23	35	41	16
Corpus Christi TX	1	1	2	50	8	50
Dallas TX	47	80	127	10	61	7
Denver CO	34	35	69	19	43	13
El Paso TX	3	3	7	49	12	47
Fort Worth TX	18	31	49	23	41	16
Houston TX	80	107	187	7	64	6
Phoenix AZ	46	38	84	16	41	16
Salt Lake City UT	5	4	9	46	11	48
San Antonio TX	16	17	33	27	28	29
Western Cities						
Honolulu HI	11	18	29	31	42	15
Los Angeles CA	386	452	838	1	71	5
Portland OR	15	25	40	24	37	19
Sacramento CA	18	16	33	27	28	29
San Bernardino-Riv CA	47	55	102	13	78	2
San Diego CA	49	33	82	17	33	24
San Fran-Oak CA	130	164	295	3	77	3
San Jose CA	42	49	91	15	60	8
Seattle-Everett WA	58	76	134	9	73	4
Northeastern Avg	72	131	205		42	
Midwestern Avg	29	35	63		24	
Southern Avg	18	22	39		33	
Southwestern Avg	24	30	55		34	
Western Avg	85	99	182		55	
Texas Avg	25	36	61		36	
Total Avg	46	63	108		38	
Maximum Value	386	452	838		83	
Minimum Value	1	1	2		1	

Notes: [1] Rank value of 1 associated with greatest fuel consumption.

Source: TTI Analysis

Table A-7. Annual Wasted Fuel Due to Congestion

Urban Area	Annual Wasted Gallons (millions)					% Change 1986 - 1992	Rank
	1986	1989	1990	1991	1992		
Cincinnati OH	12	19	20	23	27	125	1
Cleveland OH	15	25	26	27	30	100	2
Corpus Christi TX	1	1	1	2	2	100	2
Kansas City MO	10	12	13	13	20	100	2
Salt Lake City UT	5	7	7	9	10	100	2
Hartford CT	9	15	15	15	17	89	6
Indianapolis IN	5	8	8	8	9	80	7
San Diego CA	46	78	79	80	82	78	8
El Paso TX	4	4	4	5	7	75	9
Portland OR	23	32	33	33	40	74	10
Columbus OH	14	17	22	22	24	71	11
Memphis TN	7	9	9	11	12	71	11
Seattle-Everett WA	81	118	121	125	134	65	13
Minn-St. Paul MN	33	44	47	49	53	61	14
Charlotte NC	10	13	14	15	16	60	15
Baltimore MD	44	53	57	58	70	59	16
Ft. Lauderdale FL	23	29	33	33	36	57	17
Sacramento CA	21	30	31	31	33	57	17
Jacksonville FL	18	24	25	25	27	50	19
Louisville KY	8	9	9	10	12	50	19
Detroit MI	143	171	183	195	210	47	21
Miami FL	69	95	99	100	100	45	22
Albuquerque NM	7	10	10	10	10	43	23
Denver CO	49	55	61	65	69	41	24
Washington DC	193	232	238	245	272	41	24
San Bernardino-Riv CA	73	81	92	97	102	40	26
Honolulu HI	21	24	25	25	29	38	27
Nashville TN	13	18	18	18	18	38	27
Tampa FL	16	19	20	22	22	38	27
New York NY	547	689	691	692	736	35	30
Phoenix AZ	62	74	75	79	84	35	30
Oklahoma City OK	9	10	10	10	12	33	32
Atlanta GA	92	104	107	109	121	32	33
Chicago IL	212	221	237	249	276	30	34
Milwaukee WI	17	20	21	22	22	29	35
Orlando FL	15	16	17	18	19	27	36
Pittsburgh PA	41	49	51	50	52	27	36
San Jose CA	72	86	86	90	91	26	38
Boston MA	130	160	155	158	161	24	39
Norfolk VA	28	33	34	34	34	21	40
San Fran-Oak CA	246	297	297	294	293	19	41
Los Angeles CA	709	804	818	825	838	18	42
Philadelphia PA	107	117	119	121	126	18	42
San Antonio TX	28	29	29	30	33	18	42
Austin TX	20	22	22	23	23	15	45
Fort Worth TX	43	43	46	48	49	14	46
St. Louis MO	51	61	56	58	57	12	47
Houston TX	169	173	177	183	187	11	48
New Orleans LA	28	30	31	30	30	7	49
Dallas TX	120	116	123	126	127	6	50
Northeastern Avg	153	188	189	191	205	34	
Midwestern Avg	44	51	54	57	63	43	
Southern Avg	29	36	37	38	39	34	
Southwestern Avg	46	48	50	53	55	20	
Western Avg	144	172	176	178	182	26	
Texas Avg	55	55	58	59	61	11	
Total Avg	74	88	90	92	97	31	
Maximum Value	709	804	818	825	838	18	
Minimum Value	1	1	1	2	2	100	

Table A-8. Illustration of Annual Capacity Increase Required to Prevent Congestion Growth

Urban Area	Existing (1992) Lane-mile		Average Annual VMT Growth (%)[1]	Annual Freeway Lane-mile		Annual Prin. Art. Lane-mile		Lane-mile Deficiency	
	Fwy	Prin. Art.		Needed	Added	Needed	Added	Fwy	Prin. Art
Detroit MI	1,820	4,270	5.61	102	45	240	113	57	127
Chicago IL	2,440	4,650	5.57	136	59	259	224	77	35
Baltimore MD	1,350	1,670	4.49	61	33	75	(8)	28	83
Los Angeles CA	5,395	12,500	1.90	103	109	238	125	(6)	113
New York NY	6,050	7,625	2.11	128	60	161	129	68	32
Miami FL	625	2,230	4.90	31	13	109	53	18	56
Cincinnati OH	915	825	5.66	52	18	47	8	34	39
Columbus OH	810	635	5.31	43	6	34	9	37	25
Minn-St. Paul MN	1,510	1,150	4.41	67	19	51	45	48	6
Salt Lake City UT	525	425	8.80	46	11	37	19	35	18
Denver CO	960	1,860	2.95	28	25	55	6	3	49
San Diego CA	1,740	1,735	2.59	45	11	45	29	34	16
Kansas City MO	1,410	1,090	2.87	40	16	31	11	24	20
Washington DC	1,620	2,320	3.03	49	33	70	43	16	27
Ft. Lauderdale FL	650	1,150	4.16	27	18	48	15	9	33
Phoenix AZ	700	3,310	5.46	38	45	181	133	(7)	48
Orlando FL	600	1,090	3.54	21	11	39	10	10	29
Dallas TX	1,750	1,750	2.01	35	19	35	14	16	21
Seattle-Everett WA	1,270	1,625	3.71	47	33	60	38	14	22
San Antonio TX	880	1,125	3.14	28	15	35	14	13	21
Fort Worth TX	1,050	900	2.80	29	13	25	9	16	16
San Jose CA	1,200	1,380	2.85	34	13	39	28	21	11
Cleveland OH	1,180	1,140	3.74	44	48	43	8	(4)	35
Memphis TN	440	980	5.87	26	15	58	44	11	14
Charlotte NC	305	580	5.04	15	6	29	15	9	14
Pittsburgh PA	1,120	1,855	2.96	33	43	55	23	(10)	32
Oklahoma City OK	725	720	2.87	21	5	21	16	16	5
Milwaukee WI	600	1,060	2.39	14	4	25	18	10	7
Louisville KY	605	525	2.59	16	10	14	4	6	10
Portland OR	575	605	3.44	20	9	21	16	11	5
Norfolk VA	560	750	3.75	21	26	28	10	(5)	18
Sacramento CA	800	1,240	4.33	35	31	54	48	4	6
Atlanta GA	1,750	1,620	2.00	35	25	32	33	10	(1)
Nashville TN	550	960	3.14	17	28	30	11	(11)	19
Honolulu HI	375	235	3.63	14	11	9	5	3	4
Philadelphia PA	1,615	3,260	1.42	23	54	46	8	(31)	38
Tampa FL	310	700	3.03	9	5	21	19	4	2
Corpus Christi TX	188	374	2.93	6	1	11	12	5	(1)
El Paso TX	355	855	1.50	5	1	13	13	4	0
Hartford CT	605	655	2.82	17	14	18	18	3	0
Jacksonville FL	455	1,280	2.43	11	9	31	30	2	1
Indianapolis IN	770	885	1.47	11	13	13	9	(2)	4
Austin TX	460	445	1.89	9	10	8	6	(1)	2
Albuquerque NM	230	770	2.25	5	6	17	18	(1)	(1)
Houston TX	2,075	2,180	2.80	58	71	61	50	(13)	11
New Orleans LA	375	655	1.20	4	9	8	9	(5)	(1)
St. Louis MO	1,700	1,895	2.19	37	54	41	38	(17)	3
San Bernardino-Riv CA	910	2,100	3.35	30	10	70	105	20	(35)
San Fran-Oak CA	2,430	2,320	1.19	29	26	27	64	3	(37)
Boston MA	1,515	2,850	(0.47)	(7)	1	(13)	40	(8)	(53)

Notes: [1] Average annual growth rate of freeway and principal arterial streets between 1988 and 1992.
[2] Lane-miles added from 1988 to 1992.

Table A-9. Component and Total Congestion Costs by Urban Area for 1992

Urban Area	Annual Cost Due to Congestion ($ millions)			Rank
	Delay	Fuel	Total	
Los Angeles CA	7,280	1,170	8,450	1
New York NY	6,350	1,020	7,370	2
San Fran-Oak CA	2,500	410	2,910	3
Chicago IL	2,400	390	2,790	4
Washington DC	2,370	380	2,750	5
Detroit MI	1,850	280	2,130	6
Houston TX	1,580	240	1,820	7
Boston MA	1,380	220	1,600	8
Seattle-Everett WA	1,150	190	1,340	9
Philadelphia PA	1,130	170	1,300	10
Dallas TX	1,070	170	1,240	11
Atlanta GA	1,040	150	1,190	12
San Bernardino-Riv CA	880	140	1,020	13
Miami FL	880	130	1,010	14
San Jose CA	770	130	900	15
Phoenix AZ	740	110	850	16
San Diego CA	690	110	800	17
Baltimore MD	600	100	700	18
Denver CO	590	100	690	19
St. Louis MO	500	70	570	20
Pittsburgh PA	470	70	540	21
Minn-St. Paul MN	450	70	520	22
Fort Worth TX	410	60	470	23
Portland OR	340	50	390	24
Ft. Lauderdale FL	310	50	360	25
Norfolk VA	290	50	340	27
Sacramento CA	290	50	340	27
San Antonio TX	280	40	320	28
Cleveland OH	260	40	300	30
Honolulu HI	250	50	300	30
New Orleans LA	260	40	300	30
Jacksonville FL	240	40	280	32
Cincinnati OH	220	40	260	33
Columbus OH	210	30	240	34
Tampa FL	200	30	230	35
Austin TX	190	30	220	37
Milwaukee WI	190	30	220	37
Orlando FL	170	30	200	38
Kansas City MO	170	20	190	39
Nashville TN	150	20	170	40
Charlotte NC	140	20	160	42
Hartford CT	140	20	160	42
Louisville KY	110	20	130	43
Memphis TN	100	20	120	44
Oklahoma City OK	100	10	110	45
Albuquerque NM	90	10	100	46
Indianapolis IN	80	10	90	48
Salt Lake City UT	80	10	90	48
El Paso TX	60	10	70	49
Corpus Christi TX	20	0	20	50
Northeastern Avg	1,780	280	2,060	
Midwestern Avg	540	80	620	
Southern Avg	340	50	390	
Southwestern Avg	460	70	530	
Western Avg	1,570	250	1,820	
Texas Avg	520	80	600	
Total Avg	840	130	970	
Maximum Value	7,280	1,170	8,450	
Minimum Value	20	0	20	

Table A-10. Estimated Unit Costs of Congestion in 1992

Urban Area	Total Congestion Cost	
	Per Registered Vehicle (dollars)	Per Capita (dollars)
Northeastern Cities		
Baltimore MD	650	340
Boston MA	960	540
Hartford CT	320	270
New York NY	1,210	430
Philadelphia PA	460	260
Pittsburgh PA	430	290
Washington DC	1,610	840
Midwestern Cities		
Chicago IL	690	370
Cincinnati OH	270	210
Cleveland OH	200	170
Columbus OH	300	260
Detroit MI	740	530
Indianapolis IN	150	100
Kansas City MO	250	160
Louisville KY	260	150
Milwaukee WI	410	180
Minn-St. Paul MN	300	250
Oklahoma City OK	230	160
St. Louis MO	550	280
Southern Cities		
Atlanta GA	670	520
Charlotte NC	390	320
Ft. Lauderdale FL	340	280
Jacksonville FL	440	360
Memphis TN	180	130
Miami FL	700	530
Nashville TN	330	300
New Orleans LA	340	270
Norfolk VA	400	350
Orlando FL	260	220
Tampa FL	350	320
Southwestern Cities		
Albuquerque NM	240	200
Austin TX	440	400
Corpus Christi TX	90	70
Dallas TX	750	590
Denver CO	490	430
El Paso TX	180	110
Fort Worth TX	470	400
Houston TX	810	630
Phoenix AZ	660	420
Salt Lake City UT	130	110
San Antonio TX	370	270
Western Cities		
Honolulu HI	560	430
Los Angeles CA	1,070	710
Portland OR	560	370
Sacramento CA	260	280
San Bernardino-Riv CA	1,280	780
San Diego CA	540	320
San Fran-Oak CA	930	760
San Jose CA	870	600
Seattle-Everett WA	1,000	720
Northeastern Avg	800	420
Midwestern Avg	360	230
Southern Avg	400	330
Southwestern Avg	420	330
Western Avg	780	550
Texas Avg	440	350
Total Avg	520	360
Maximum Value	1,610	840
Minimum Value	90	70

Table A-11. 1992 Rankings of Urban Area by Estimated Impact of Congestion

Urban Area	Roadway Congestion Index	Congestion Cost per Capita	Congestion Cost per Registered Vehicle
Northeastern Cities			
Baltimore MD	23	23	16
Boston MA	17	9	6
Hartford CT	39	32	35
New York NY	11	13	3
Philadelphia PA	21	35	23
Pittsburgh PA	46	28	26
Washington DC	2	1	1
Midwestern Cities			
Chicago IL	5	19	13
Cincinnati OH	25	39	38
Cleveland OH	30	42	45
Columbus OH	35	35	36
Detroit MI	9	10	11
Indianapolis IN	44	49	48
Kansas City MO	48	43	42
Louisville KY	40	45	39
Milwaukee WI	26	41	27
Minn-St. Paul MN	27	37	36
Oklahoma City OK	45	43	44
St. Louis MO	30	29	19
Southern Cities			
Atlanta GA	10	12	14
Charlotte NC	43	24	29
Ft. Lauderdale FL	29	29	32
Jacksonville FL	28	21	24
Memphis TN	36	46	46
Miami FL	4	10	12
Nashville TN	36	27	34
New Orleans LA	13	32	32
Norfolk VA	36	22	28
Orlando FL	47	38	39
Tampa FL	17	24	31
Southwestern Cities			
Albuquerque NM	30	40	43
Austin TX	30	17	24
Corpus Christi TX	50	50	50
Dallas TX	17	8	10
Denver CO	21	13	21
El Paso TX	49	47	46
Fort Worth TX	34	17	22
Houston TX	12	6	9
Phoenix AZ	16	16	15
Salt Lake City UT	40	47	49
San Antonio TX	40	32	30
Western Cities			
Honolulu HI	13	13	17
Los Angeles CA	1	5	4
Portland OR	13	19	17
Sacramento CA	23	29	39
San Bernardino-Riv CA	6	2	2
San Diego CA	6	24	20
San Fran-Oak CA	3	3	7
San Jose CA	17	7	8
Seattle-Everett WA	6	4	5

Source: TTI Analysis

Table A-12. Congestion Index and Cost Values, 1991 and 1992

Urban Area	Roadway Congestion Index				Congestion Cost per Capita[1]		Annual Congestion Cost[1] ($ millions)	
	1991 Value	1992 Value	1991 Rank	1992 Rank	1991	1992	1991	1992
Northeastern Cities								
Baltimore MD	1.02	1.04	24	23	280	340	570	700
Boston MA	1.06	1.07	18	17	520	540	1,520	1,600
Hartford CT	0.89	0.91	39	39	240	270	150	160
New York NY	1.14	1.14	11	11	400	430	6,710	7,370
Philadelphia PA	1.05	1.05	20	21	260	260	1,210	1,300
Pittsburgh PA	0.82	0.81	45	46	270	290	500	540
Washington DC	1.33	1.36	3	2	740	840	2,420	2,750
Midwestern Cities								
Chicago IL	1.27	1.28	5	5	330	370	2,460	2,790
Cincinnati OH	0.99	1.01	26	25	180	210	210	260
Cleveland OH	0.95	0.95	29	30	140	170	250	300
Columbus OH	0.91	0.93	36	35	240	260	220	240
Detroit MI	1.16	1.19	9	9	480	530	1,920	2,130
Indianapolis IN	0.84	0.85	44	44	80	100	80	90
Kansas City MO	0.75	0.77	48	48	110	160	120	190
Louisville KY	0.88	0.90	42	40	120	150	90	130
Milwaukee WI	1.00	1.00	25	26	170	180	210	220
Minn-St. Paul MN	0.96	0.99	27	27	230	250	470	520
Oklahoma City OK	0.81	0.83	46	45	130	160	100	110
St. Louis MO	0.95	0.95	29	30	280	280	560	570
Southern Cities								
Atlanta GA	1.16	1.17	9	10	490	520	1,050	1,190
Charlotte NC	0.89	0.89	39	43	320	320	150	160
Ft. Lauderdale FL	0.95	0.96	29	29	250	280	320	360
Jacksonville FL	0.95	0.97	29	28	330	360	240	280
Memphis TN	0.91	0.92	36	36	120	130	100	120
Miami FL	1.28	1.30	4	4	530	530	990	1,010
Nashville TN	0.90	0.92	38	36	310	300	180	170
New Orleans LA	1.12	1.10	12	13	270	270	300	300
Norfolk VA	0.93	0.92	34	36	340	350	320	340
Orlando FL	0.78	0.80	47	47	200	220	170	200
Tampa FL	1.05	1.07	20	17	310	320	220	230
Southwestern Cities								
Albuquerque NM	0.96	0.95	27	30	180	200	90	100
Austin TX	0.94	0.95	33	30	380	400	210	220
Corpus Christi TX	0.72	0.74	50	50	50	70	20	20
Dallas TX	1.06	1.07	18	17	580	590	1,190	1,240
Denver CO	1.03	1.05	23	21	400	430	640	690
El Paso TX	0.75	0.76	48	49	80	110	40	70
Fort Worth TX	0.92	0.94	35	34	380	400	450	470
Houston TX	1.11	1.12	13	12	600	630	1,750	1,820
Phoenix AZ	1.08	1.08	15	16	400	420	780	850
Salt Lake City UT	0.88	0.90	42	40	100	110	80	90
San Antonio TX	0.89	0.90	39	40	240	270	280	320
Western Cities								
Honolulu HI	1.10	1.10	14	13	380	430	250	300
Los Angeles CA	1.56	1.54	1	1	690	710	8,090	8,450
Portland OR	1.08	1.10	15	13	310	370	320	390
Sacramento CA	1.04	1.04	22	23	260	280	310	340
San Bernardino-Riv CA	1.22	1.22	6	6	740	780	940	1,020
San Diego CA	1.22	1.22	6	6	320	320	760	800
San Fran-Oak CA	1.34	1.33	2	3	760	760	2,840	2,910
San Jose CA	1.08	1.07	15	17	580	600	870	900
Seattle-Everett WA	1.20	1.22	8	6	660	720	1,200	1,340

Notes: [1] Cost includes and fuel.

Source: TTI Analysis and Local Transportation Agency References

Table A-13. Component and Total Congestion Costs by Urban Area for 1986

Urban Area	Annual Cost Due to Congestion ($ millions)				
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total
Northeastern Cities					
Baltimore MD	110	180	-	-	-
Boston MA	240	630	-	-	-
Hartford CT	20	40	-	-	-
New York NY	1,280	2,360	-	-	-
Philadelphia PA	330	420	-	-	-
Pittsburgh PA	110	170	-	-	-
Washington DC	480	810	-	-	-
Midwestern Cities					
Chicago IL	670	780	-	-	-
Cincinnati OH	40	40	-	-	-
Cleveland OH	50	40	-	-	-
Columbus OH	50	40	-	-	-
Detroit MI	380	600	-	-	-
Indianapolis IN	10	20	0	0	40
Kansas City MO	20	40	0	10	70
Louisville KY	30	30	0	0	60
Milwaukee WI	60	60	10	10	130
Minn-St. Paul MN	110	110	20	20	250
Oklahoma City OK	30	30	0	0	70
St. Louis MO	160	180	90	100	540
Southern Cities					
Atlanta GA	290	320	40	50	690
Charlotte NC	30	30	-	-	-
Ft. Lauderdale FL	70	90	10	10	180
Jacksonville FL	50	70	10	10	140
Memphis TN	20	20	0	0	50
Miami FL	210	260	30	40	550
Nashville TN	40	50	10	10	100
New Orleans LA	80	110	10	20	220
Norfolk VA	60	130	-	-	-
Orlando FL	40	60	10	10	110
Tampa FL	50	60	10	10	130
Southwestern Cities					
Albuquerque NM	20	20	0	0	50
Austin TX	60	70	10	10	150
Corpus Christi TX	0	0	0	0	10
Dallas TX	290	500	40	70	910
Denver CO	160	170	20	30	380
El Paso TX	10	10	0	0	30
Fort Worth TX	110	180	20	30	330
Houston TX	480	640	70	90	1,290
Phoenix AZ	220	200	30	30	490
Salt Lake City UT	20	20	0	0	40
San Antonio TX	90	100	10	10	210
Western Cities					
Honolulu HI	50	90	10	10	160
Los Angeles CA	2,200	2,570	340	400	5,510
Portland OR	60	90	10	10	170
Sacramento CA	70	60	10	10	160
San Bernardino-Riv CA	220	260	40	40	560
San Diego CA	180	120	30	20	350
San Fran-Oak CA	730	920	110	140	1,900
San Jose CA	220	260	30	40	560
Seattle-Everett WA	230	300	40	50	620
Northeastern Avg	370	660	-	-	-
Midwestern Avg	130	160	20	20	170
Southern Avg	90	110	10	20	240
Southwestern Avg	130	170	20	30	350
Western Avg	440	520	70	80	1,110
Texas Avg	150	220	20	30	420
Total Avg	210	290	30	40	480
Maximum Value	2,200	2,570	340	400	5,510
Minimum Value	0	0	0	0	10

Notes: - Denotes data not available.

Source: TTI Analysis and Local Transportation Agency References

Table A-14. Estimated Impact of Congestion in 1986

Urban Area	Annual Congestion Cost		Roadway Congestion Index
	Per Registered Vehicle (dollars)	Per Capita (dollars)	
Northeastern Cities			
Baltimore MD	-	-	0.88
Boston MA	-	-	1.04
Hartford CT	-	-	0.85
New York NY	-	-	1.06
Philadelphia PA	-	-	1.06
Pittsburgh PA	-	-	0.79
Washington DC	-	-	1.27
Midwestern Cities			
Chicago IL	-	-	1.15
Cincinnati OH	-	-	0.84
Cleveland OH	-	-	0.86
Columbus OH	-	-	0.75
Detroit MI	-	-	1.05
Indianapolis IN	70	40	0.81
Kansas City MO	120	60	0.68
Louisville KY	140	80	0.80
Milwaukee WI	250	110	0.90
Minn-St. Paul MN	160	130	0.89
Oklahoma City OK	150	90	0.76
St. Louis MO	580	280	0.93
Southern Cities			
Atlanta GA	490	410	1.09
Charlotte NC	-	-	0.78
Ft. Lauderdale FL	190	160	0.85
Jacksonville FL	240	210	0.95
Memphis TN	90	60	0.80
Miami FL	410	310	1.14
Nashville TN	220	200	0.86
New Orleans LA	270	200	1.09
Norfolk VA	-	-	0.90
Orlando FL	200	160	0.76
Tampa FL	230	210	0.96
Southwestern Cities			
Albuquerque NM	140	110	0.96
Austin TX	340	330	0.94
Corpus Christi TX	40	40	0.71
Dallas TX	600	480	1.04
Denver CO	300	250	0.97
El Paso TX	80	60	0.75
Fort Worth TX	360	290	0.87
Houston TX	680	460	1.21
Phoenix AZ	440	280	1.20
Salt Lake City UT	60	50	0.68
San Antonio TX	260	210	0.88
Western Cities			
Honolulu HI	330	270	1.03
Los Angeles CA	720	510	1.42
Portland OR	290	170	0.97
Sacramento CA	150	170	0.95
San Bernardino-Riv CA	820	570	1.15
San Diego CA	320	180	1.00
San Fran-Oak CA	710	550	1.24
San Jose CA	580	420	0.97
Seattle-Everett WA	590	400	1.09
Northeastern Avg	-	-	0.99
Midwestern Avg	210	110	0.87
Southern Avg	260	210	0.93
Southwestern Avg	300	230	0.93
Western Avg	500	360	1.09
Texas Avg	340	270	0.91
Total Avg	320	240	0.95
Maximum Value	820	570	1.42
Minimum Value	40	40	0.68

Notes: - Denotes data not available.

Source: TTI Analysis and Local Transportation Agency References

Table A-15. Component and Total Congestion Costs by Urban Area for 1987

Urban Area	Annual Cost Due to Congestion ($ millions)				
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total
Northeastern Cities					
Baltimore MD	120	200	20	30	360
Boston MA	240	620	30	90	970
Hartford CT	20	40	0	10	80
New York NY	1,390	2,570	200	370	4,540
Philadelphia PA	360	460	50	60	940
Pittsburgh PA	120	190	20	30	360
Washington DC	540	900	80	140	1,660
Midwestern Cities					
Chicago IL	680	780	100	120	1,680
Cincinnati OH	50	50	10	10	110
Cleveland OH	60	50	10	10	130
Columbus OH	60	50	10	10	120
Detroit MI	400	620	60	90	1,170
Indianapolis IN	10	20	0	0	40
Kansas City MO	20	50	0	10	80
Louisville KY	30	30	0	0	80
Milwaukee WI	60	70	10	10	150
Minn-St. Paul MN	150	140	20	20	340
Oklahoma City OK	30	30	0	0	70
St. Louis MO	180	200	20	30	430
Southern Cities					
Atlanta GA	330	360	50	50	790
Charlotte NC	40	40	10	10	80
Ft. Lauderdale FL	80	100	10	20	210
Jacksonville FL	60	80	10	10	170
Memphis TN	20	30	0	0	60
Miami FL	240	290	40	40	600
Nashville TN	50	50	10	10	120
New Orleans LA	80	120	10	20	240
Norfolk VA	70	150	10	20	250
Orlando FL	50	60	10	10	120
Tampa FL	60	70	10	10	140
Southwestern Cities					
Albuquerque NM	20	30	0	0	60
Austin TX	70	80	10	10	170
Corpus Christi TX	0	0	0	0	10
Dallas TX	270	470	40	70	860
Denver CO	160	170	30	30	390
El Paso TX	10	10	0	0	30
Fort Worth TX	110	180	20	30	330
Houston TX	480	640	70	100	1,290
Phoenix AZ	240	210	40	30	520
Salt Lake City UT	20	20	0	0	50
San Antonio TX	90	100	10	20	220
Western Cities					
Honolulu HI	50	90	10	20	170
Los Angeles CA	2,350	2,760	370	430	5,910
Portland OR	70	120	10	20	220
Sacramento CA	90	70	10	10	190
San Bernardino-Riv CA	240	280	40	40	590
San Diego CA	240	160	40	30	460
San Fran-Oak CA	850	1,070	130	170	2,230
San Jose CA	250	300	40	50	640
Seattle-Everett WA	290	380	50	60	770
Northeastern Avg	400	710	60	100	1,270
Midwestern Avg	140	170	20	30	370
Southern Avg	100	120	10	20	250
Southwestern Avg	130	170	20	30	360
Western Avg	490	580	80	90	1,240
Texas Avg	150	210	20	30	420
Total Avg	230	310	40	50	620
Maximum Value	2,350	2,760	370	430	5,910
Minimum Value	0	0	0	0	10

Source: TTI Analysis and Local Transportation Agency References

Table A-16. Estimated Impact of Congestion in 1987

Urban Area	Total Congestion Cost		Roadway Congestion Index
	Per Registered Vehicle (dollars)	Per Capita (dollars)	
Northeastern Cities			
Baltimore MD	370	190	0.91
Boston MA	640	340	1.04
Hartford CT	160	130	0.87
New York NY	790	280	1.06
Philadelphia PA	350	230	1.06
Pittsburgh PA	300	200	0.79
Washington DC	1,030	560	1.29
Midwestern Cities			
Chicago IL	430	230	1.15
Cincinnati OH	130	100	0.87
Cleveland OH	90	70	0.89
Columbus OH	160	140	0.78
Detroit MI	410	300	1.04
Indianapolis IN	70	40	0.85
Kansas City MO	120	70	0.71
Louisville KY	170	100	0.86
Milwaukee WI	290	120	0.95
Minn-St. Paul MN	210	180	0.89
Oklahoma City OK	140	90	0.76
St. Louis MO	450	220	0.96
Southern Cities			
Atlanta GA	520	450	1.11
Charlotte NC	230	200	0.79
Ft. Lauderdale FL	220	180	0.90
Jacksonville FL	290	250	0.94
Memphis TN	100	70	0.84
Miami FL	450	340	1.14
Nashville TN	250	220	0.89
New Orleans LA	290	230	1.14
Norfolk VA	320	290	0.93
Orlando FL	200	160	0.77
Tampa FL	250	220	1.02
Southwestern Cities			
Albuquerque NM	150	120	0.96
Austin TX	370	360	1.00
Corpus Christi TX	50	40	0.72
Dallas TX	550	450	1.02
Denver CO	300	260	0.95
El Paso TX	90	60	0.71
Fort Worth TX	350	290	0.87
Houston TX	610	460	1.19
Phoenix AZ	440	280	1.18
Salt Lake City UT	70	60	0.70
San Antonio TX	270	210	0.86
Western Cities			
Honolulu HI	340	270	1.05
Los Angeles CA	770	540	1.47
Portland OR	350	210	0.99
Sacramento CA	160	190	1.00
San Bernardino-Riv CA	840	580	1.14
San Diego CA	350	220	1.08
San Fran-Oak CA	760	630	1.31
San Jose CA	650	470	0.99
Seattle-Everett WA	670	480	1.14
Northeastern Avg	520	280	1.00
Midwestern Avg	220	140	0.89
Southern Avg	280	240	0.95
Southwestern Avg	300	240	0.92
Western Avg	540	400	1.13
Texas Avg	330	270	0.91
Total Avg	350	250	0.97
Maximum Value	1,030	630	1.47
Minimum Value	50	40	0.70

Source: TTI Analysis and Local Transportation Agency References

Table A-17. Component and Total Congestion Costs by Urban Area for 1988

Urban Area	Annual Cost Due to Congestion ($ millions)				
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total
Northeastern Cities					
Baltimore MD	130	220	20	40	400
Boston MA	300	840	50	130	1,310
Hartford CT	30	60	10	10	110
New York NY	1,580	2,880	240	440	5,130
Philadelphia PA	390	490	60	70	1,010
Pittsburgh PA	150	210	20	30	410
Washington DC	580	960	90	160	1,790
Midwestern Cities					
Chicago IL	700	810	110	130	1,760
Cincinnati OH	70	60	10	10	150
Cleveland OH	80	60	10	10	160
Columbus OH	60	50	10	10	130
Detroit MI	450	730	70	110	1,360
Indianapolis IN	20	30	0	0	60
Kansas City MO	30	60	0	10	100
Louisville KY	30	30	0	0	70
Milwaukee WI	70	70	10	10	170
Minn-St. Paul MN	160	150	30	30	360
Oklahoma City OK	30	40	10	10	80
St. Louis MO	180	200	30	30	430
Southern Cities					
Atlanta GA	340	370	50	60	820
Charlotte NC	40	40	10	10	100
Ft. Lauderdale FL	80	110	10	20	220
Jacksonville FL	70	80	10	10	170
Memphis TN	30	30	0	0	70
Miami FL	290	360	50	60	750
Nashville TN	60	70	10	10	160
New Orleans LA	90	130	10	20	260
Norfolk VA	80	160	10	20	270
Orlando FL	50	60	10	10	130
Tampa FL	70	80	10	10	170
Southwestern Cities					
Albuquerque NM	30	30	0	0	70
Austin TX	70	80	10	10	180
Corpus Christi TX	0	0	0	0	10
Dallas TX	300	510	50	80	950
Denver CO	180	190	30	30	430
El Paso TX	10	20	0	0	40
Fort Worth TX	110	190	20	30	350
Houston TX	510	690	80	110	1,390
Phoenix AZ	280	260	50	40	620
Salt Lake City UT	20	20	0	0	50
San Antonio TX	100	110	20	20	240
Western Cities					
Honolulu HI	60	100	10	20	200
Los Angeles CA	2,580	3,020	420	490	6,510
Portland OR	80	130	10	20	240
Sacramento CA	100	90	20	10	220
San Bernardino-Riv CA	260	310	40	50	660
San Diego CA	310	210	50	40	600
San Fran-Oak CA	900	1,140	150	190	2,380
San Jose CA	270	320	50	50	690
Seattle-Everett WA	330	430	50	70	890
Northeastern Avg	450	810	70	120	1,450
Midwestern Avg	160	190	20	30	400
Southern Avg	110	140	20	20	280
Southwestern Avg	150	190	20	30	390
Western Avg	540	640	90	100	1,380
Texas Avg	160	230	30	40	450
Total Avg	250	350	40	60	700
Maximum Value	2,580	3,020	420	490	6,510
Minimum Value	0	0	0	0	10

Source: TTI Analysis and Local Transportation Agency References

Table A-18. Estimated Impact of Congestion in 1988

Urban Area	Total Congestion Cost		Roadway Congestion Index
	Per Registered Vehicle (dollars)	Per Capita (dollars)	
Northeastern Cities			
Baltimore MD	390	210	0.92
Boston MA	850	450	1.12
Hartford CT	230	190	0.90
New York NY	880	310	1.10
Philadelphia PA	370	240	1.07
Pittsburgh PA	340	220	0.81
Washington DC	1,090	590	1.30
Midwestern Cities			
Chicago IL	440	240	1.18
Cincinnati OH	160	130	0.88
Cleveland OH	110	90	0.97
Columbus OH	180	160	0.79
Detroit MI	470	350	1.07
Indianapolis IN	110	70	0.85
Kansas City MO	150	90	0.72
Louisville KY	160	90	0.87
Milwaukee WI	320	140	0.94
Minn-St. Paul MN	220	190	0.90
Oklahoma City OK	180	120	0.78
St. Louis MO	460	220	0.98
Southern Cities			
Atlanta GA	540	430	1.14
Charlotte NC	260	220	0.80
Ft. Lauderdale FL	230	180	0.90
Jacksonville FL	290	250	0.95
Memphis TN	110	80	0.86
Miami FL	550	410	1.18
Nashville TN	310	290	0.94
New Orleans LA	310	240	1.13
Norfolk VA	340	300	0.94
Orlando FL	200	170	0.78
Tampa FL	290	260	1.03
Southwestern Cities			
Albuquerque NM	170	140	0.96
Austin TX	370	350	0.96
Corpus Christi TX	50	40	0.70
Dallas TX	590	480	1.02
Denver CO	320	280	0.99
El Paso TX	100	70	0.74
Fort Worth TX	360	300	0.87
Houston TX	650	490	1.15
Phoenix AZ	530	340	1.04
Salt Lake City UT	70	60	0.72
San Antonio TX	280	200	0.86
Western Cities			
Honolulu HI	400	300	1.07
Los Angeles CA	840	580	1.52
Portland OR	390	230	1.04
Sacramento CA	180	210	1.03
San Bernardino-Riv CA	910	630	1.18
San Diego CA	440	280	1.13
San Fran-Oak CA	790	660	1.33
San Jose CA	700	510	1.00
Seattle-Everett WA	760	550	1.17
Northeastern Avg	590	320	1.03
Midwestern Avg	250	160	0.91
Southern Avg	310	260	0.97
Southwestern Avg	320	250	0.91
Western Avg	600	440	1.16
Texas Avg	340	280	0.90
Total Avg	390	270	0.99
Maximum Value	1,090	660	1.52
Minimum Value	50	40	0.70

Source: TTI Analysis and Local Transportation Agency References

Table A-19. Component and Total Congestion Costs by Urban Area for 1989

Urban Area	Annual Cost Due to Congestion ($ millions)				
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total
Northeastern Cities					
Baltimore MD	150	260	30	40	470
Boston MA	320	880	50	140	1,390
Hartford CT	40	70	10	10	130
New York NY	1,810	3,380	300	560	6,040
Philadelphia PA	400	520	60	80	1,060
Pittsburgh PA	160	230	20	30	440
Washington DC	650	1,110	110	180	2,060
Midwestern Cities					
Chicago IL	780	900	130	150	1,970
Cincinnati OH	70	60	10	10	160
Cleveland OH	100	80	20	10	220
Columbus OH	70	60	10	10	150
Detroit MI	500	820	80	130	1,530
Indianapolis IN	20	30	0	10	70
Kansas City MO	30	60	0	10	100
Louisville KY	30	40	10	10	80
Milwaukee WI	70	80	10	10	180
Minn-St. Paul MN	170	160	30	30	390
Oklahoma City OK	40	40	10	10	90
St. Louis MO	220	250	30	40	540
Southern Cities					
Atlanta GA	370	410	60	70	910
Charlotte NC	50	50	10	10	110
Ft. Lauderdale FL	100	120	20	20	250
Jacksonville FL	80	100	10	20	210
Memphis TN	30	30	10	10	80
Miami FL	330	410	50	70	870
Nashville TN	70	70	10	10	160
New Orleans LA	90	140	10	20	270
Norfolk VA	80	170	10	30	290
Orlando FL	50	70	10	10	140
Tampa FL	70	80	10	10	170
Southwestern Cities					
Albuquerque NM	40	40	10	10	90
Austin TX	80	80	10	10	180
Corpus Christi TX	0	0	0	0	10
Dallas TX	310	530	50	90	990
Denver CO	200	210	30	30	480
El Paso TX	10	20	0	0	40
Fort Worth TX	120	200	20	30	370
Houston TX	550	740	90	120	1,500
Phoenix AZ	300	270	50	40	670
Salt Lake City UT	30	20	0	0	60
San Antonio TX	100	110	20	20	250
Western Cities					
Honolulu HI	70	110	10	20	220
Los Angeles CA	2,820	3,300	490	570	7,180
Portland OR	90	150	20	30	280
Sacramento CA	120	110	20	20	260
San Bernardino-Riv CA	280	330	50	60	720
San Diego CA	350	230	60	40	680
San Fran-Oak CA	980	1,240	170	220	2,620
San Jose CA	300	350	50	60	760
Seattle-Everett WA	380	500	60	80	1,020
Northeastern Avg	500	920	80	150	1,660
Midwestern Avg	180	220	30	40	460
Southern Avg	120	150	20	20	310
Southwestern Avg	160	200	30	30	420
Western Avg	600	700	100	120	1,530
Texas Avg	170	240	30	40	480
Total Avg	280	380	50	60	780
Maximum Value	2,820	3,380	490	570	7,180
Minimum Value	0	0	0	0	10

Source: TTI Analysis and Local Transportation Agency References

Table A-20. Estimated Impact of Congestion in 1989

Urban Area	Total Congestion Cost		Roadway Congestion Index
	Per Registered Vehicle (dollars)	Per Capita (dollars)	
Northeastern Cities			
Baltimore MD	460	250	0.98
Boston MA	840	470	1.09
Hartford CT	260	220	0.89
New York NY	1,020	370	1.12
Philadelphia PA	380	250	1.05
Pittsburgh PA	360	240	0.82
Washington DC	1,230	670	1.33
Midwestern Cities			
Chicago IL	480	270	1.21
Cincinnati OH	170	140	0.94
Cleveland OH	150	120	0.96
Columbus OH	200	180	0.82
Detroit MI	530	390	1.09
Indianapolis IN	120	70	0.86
Kansas City MO	150	90	0.72
Louisville KY	170	100	0.86
Milwaukee WI	330	140	0.97
Minn-St. Paul MN	240	200	0.92
Oklahoma City OK	180	120	0.78
St. Louis MO	570	280	0.96
Southern Cities			
Atlanta GA	590	460	1.14
Charlotte NC	300	250	0.82
Ft. Lauderdale FL	250	200	0.92
Jacksonville FL	360	300	0.93
Memphis TN	120	90	0.90
Miami FL	610	470	1.25
Nashville TN	320	290	0.90
New Orleans LA	320	250	1.13
Norfolk VA	360	310	0.95
Orlando FL	200	180	0.77
Tampa FL	270	260	1.03
Southwestern Cities			
Albuquerque NM	210	180	0.98
Austin TX	370	360	0.96
Corpus Christi TX	50	40	0.70
Dallas TX	620	500	1.02
Denver CO	350	310	1.01
El Paso TX	100	70	0.74
Fort Worth TX	380	320	0.87
Houston TX	690	520	1.13
Phoenix AZ	560	360	1.03
Salt Lake City UT	90	80	0.81
San Antonio TX	290	210	0.87
Western Cities			
Honolulu HI	440	330	1.07
Los Angeles CA	920	640	1.54
Portland OR	420	270	1.07
Sacramento CA	210	250	1.01
San Bernardino-Riv CA	930	650	1.17
San Diego CA	480	310	1.18
San Fran-Oak CA	870	720	1.36
San Jose CA	760	550	1.03
Seattle-Everett WA	810	610	1.20
Northeastern Avg	650	350	1.04
Midwestern Avg	270	170	0.92
Southern Avg	330	280	0.98
Southwestern Avg	340	270	0.92
Western Avg	650	480	1.18
Texas Avg	360	290	0.90
Total Avg	420	300	1.00
Maximum Value	1,230	720	1.54
Minimum Value	50	40	0.70

Source: TTI Analysis and Local Transportation Agency References

Table A-21. Component and Total Congestion Costs by Urban Area for 1990

Urban Area	Annual Cost Due to Congestion ($ millions)				
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total
Northeastern Cities					
Baltimore MD	170	300	30	50	550
Boston MA	330	910	60	160	1,460
Hartford CT	40	80	10	10	150
New York NY	1,950	3,630	350	640	6,560
Philadelphia PA	430	570	70	90	1,160
Pittsburgh PA	170	260	30	40	500
Washington DC	730	1,230	130	210	2,300
Midwestern Cities					
Chicago IL	900	1,040	160	190	2,290
Cincinnati OH	90	70	20	10	190
Cleveland OH	110	90	20	20	240
Columbus OH	100	80	20	10	200
Detroit MI	570	940	90	150	1,760
Indianapolis IN	30	40	0	10	80
Kansas City MO	40	70	10	10	120
Louisville KY	40	40	10	10	90
Milwaukee WI	80	90	10	10	200
Minn-St. Paul MN	190	190	30	30	440
Oklahoma City OK	40	40	10	10	90
St. Louis MO	220	250	30	40	530
Southern Cities					
Atlanta GA	410	460	70	70	1,010
Charlotte NC	60	60	10	10	130
Ft. Lauderdale FL	110	150	20	30	310
Jacksonville FL	90	110	20	20	240
Memphis TN	40	40	10	10	90
Miami FL	370	460	60	70	970
Nashville TN	70	80	10	10	170
New Orleans LA	100	150	20	30	290
Norfolk VA	90	180	20	30	320
Orlando FL	60	80	10	10	160
Tampa FL	80	90	10	20	200
Southwestern Cities					
Albuquerque NM	40	40	10	10	100
Austin TX	80	90	10	20	210
Corpus Christi TX	0	10	0	0	10
Dallas TX	360	620	60	100	1,140
Denver CO	240	250	40	40	580
El Paso TX	20	20	0	0	40
Fort Worth TX	140	230	20	40	420
Houston TX	600	810	100	140	1,650
Phoenix AZ	330	290	50	50	720
Salt Lake City UT	30	30	10	0	70
San Antonio TX	110	120	20	20	270
Western Cities					
Honolulu HI	80	120	20	30	240
Los Angeles CA	3,080	3,610	540	630	7,860
Portland OR	100	160	20	30	310
Sacramento CA	130	120	20	20	300
San Bernardino-Riv CA	340	400	60	70	870
San Diego CA	370	250	70	50	740
San Fran-Oak CA	1,050	1,330	190	240	2,810
San Jose CA	320	370	60	70	820
Seattle-Everett WA	420	550	70	100	1,140
Northeastern Avg	550	1,000	90	170	1,810
Midwestern Avg	200	240	30	40	520
Southern Avg	130	170	20	30	350
Southwestern Avg	180	230	30	40	470
Western Avg	660	770	120	140	1,680
Texas Avg	190	270	30	50	540
Total Avg	310	420	50	70	860
Maximum Value	3,080	3,630	540	640	7,860
Minimum Value	0	10	0	0	10

Source: TTI Analysis and Local Transportation Agency References

Table A-22. Estimated Impact of Congestion in 1990

Urban Area	Total Congestion Cost		Roadway Congestion Index
	Per Registered Vehicle (dollars)	Per Capita (dollars)	
Northeastern Cities			
Baltimore MD	530	270	1.01
Boston MA	880	490	1.06
Hartford CT	280	240	0.89
New York NY	1,090	390	1.14
Philadelphia PA	420	260	1.05
Pittsburgh PA	400	270	0.82
Washington DC	1,370	740	1.34
Midwestern Cities			
Chicago IL	570	310	1.25
Cincinnati OH	200	160	0.96
Cleveland OH	160	140	0.94
Columbus OH	270	240	0.89
Detroit MI	610	440	1.13
Indianapolis IN	130	80	0.84
Kansas City MO	160	100	0.74
Louisville KY	190	110	0.86
Milwaukee WI	370	160	0.99
Minn-St. Paul MN	270	220	0.95
Oklahoma City OK	190	130	0.79
St. Louis MO	530	270	0.95
Southern Cities			
Atlanta GA	630	480	1.14
Charlotte NC	350	290	0.86
Ft. Lauderdale FL	300	240	0.94
Jacksonville FL	400	330	0.93
Memphis TN	140	100	0.89
Miami FL	680	520	1.27
Nashville TN	340	310	0.89
New Orleans LA	330	270	1.12
Norfolk VA	390	350	0.96
Orlando FL	220	190	0.77
Tampa FL	310	290	1.05
Southwestern Cities			
Albuquerque NM	230	190	0.98
Austin TX	410	380	0.94
Corpus Christi TX	50	40	0.72
Dallas TX	710	570	1.05
Denver CO	420	370	1.03
El Paso TX	120	80	0.74
Fort Worth TX	420	350	0.90
Houston TX	750	570	1.12
Phoenix AZ	600	380	1.05
Salt Lake City UT	90	80	0.85
San Antonio TX	310	230	0.88
Western Cities			
Honolulu HI	470	360	1.09
Los Angeles CA	1,010	690	1.55
Portland OR	460	300	1.08
Sacramento CA	240	270	1.02
San Bernardino-Riv CA	1,110	740	1.21
San Diego CA	510	320	1.22
San Fran-Oak CA	930	760	1.36
San Jose CA	800	580	1.05
Seattle-Everett WA	880	660	1.20
Northeastern Avg	710	380	1.04
Midwestern Avg	310	200	0.94
Southern Avg	370	310	0.98
Southwestern Avg	370	300	0.93
Western Avg	710	520	1.20
Texas Avg	400	320	0.91
Total Avg	470	330	1.01
Maximum Value	1,370	760	1.55
Minimum Value	50	40	0.72

Source: TTI Analysis and Local Transportation Agency References

Table A-23. Component and Total Congestion Costs by Urban Area for 1991

Urban Area	Annual Cost Due to Congestion ($ millions)				
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total
Northeastern Cities					
Baltimore MD	180	310	30	50	570
Boston MA	350	970	60	160	1,520
Hartford CT	40	80	10	10	150
New York NY	2,010	3,740	330	620	6,710
Philadelphia PA	450	600	70	90	1,210
Pittsburgh PA	170	260	30	40	500
Washington DC	770	1,310	130	210	2,420
Midwestern Cities					
Chicago IL	980	1,130	160	190	2,460
Cincinnati OH	100	90	20	10	210
Cleveland OH	120	100	20	20	250
Columbus OH	100	80	20	10	220
Detroit MI	630	1,030	100	160	1,920
Indianapolis IN	30	40	0	10	80
Kansas City MO	40	70	10	10	120
Louisville KY	40	40	10	10	90
Milwaukee WI	90	90	10	10	210
Minn-St. Paul MN	210	200	30	30	470
Oklahoma City OK	40	50	10	10	100
St. Louis MO	230	260	30	40	560
Southern Cities					
Atlanta GA	430	480	60	70	1,050
Charlotte NC	60	60	10	10	150
Ft. Lauderdale FL	120	160	20	20	320
Jacksonville FL	90	120	10	20	240
Memphis TN	40	50	10	10	100
Miami FL	390	470	60	70	990
Nashville TN	70	80	10	10	180
New Orleans LA	100	150	20	20	300
Norfolk VA	90	190	10	30	320
Orlando FL	60	80	10	10	170
Tampa FL	90	100	10	20	220
Southwestern Cities					
Albuquerque NM	40	40	10	10	90
Austin TX	90	100	10	20	210
Corpus Christi TX	10	10	0	0	20
Dallas TX	380	650	60	100	1,190
Denver CO	270	280	40	50	640
El Paso TX	20	20	0	0	40
Fort Worth TX	150	250	20	40	450
Houston TX	650	870	100	140	1,750
Phoenix AZ	360	310	60	50	780
Salt Lake City UT	40	30	10	10	80
San Antonio TX	120	130	20	20	280
Western Cities					
Honolulu HI	80	130	20	30	250
Los Angeles CA	3,200	3,750	520	610	8,090
Portland OR	110	170	20	30	320
Sacramento CA	140	120	20	20	310
San Bernardino-Riv CA	370	440	60	70	940
San Diego CA	390	260	70	40	760
San Fran-Oak CA	1,070	1,360	180	230	2,840
San Jose CA	340	400	60	70	870
Seattle-Everett WA	440	590	70	100	1,200
Northeastern Avg	570	1,040	90	170	1,870
Midwestern Avg	220	260	30	40	560
Southern Avg	140	180	20	30	370
Southwestern Avg	190	240	30	40	500
Western Avg	680	800	110	130	1,730
Texas Avg	200	290	30	50	560
Total Avg	330	450	50	70	900
Maximum Value	3,200	3,750	520	620	8,090
Minimum Value	10	10	0	0	20

Source: TTI Analysis and Local Transportation Agency References

Table A-24. Estimated Impact of Congestion in 1991

Urban Area	Total Congestion Cost		Roadway Congestion Index
	Per Registered Vehicle (dollars)	Per Capita (dollars)	
Northeastern Cities			
Baltimore MD	540	280	1.02
Boston MA	920	520	1.06
Hartford CT	280	240	0.89
New York NY	1,110	400	1.14
Philadelphia PA	430	260	1.05
Pittsburgh PA	410	270	0.82
Washington DC	1,430	740	1.33
Midwestern Cities			
Chicago IL	610	330	1.27
Cincinnati OH	230	180	0.99
Cleveland OH	170	140	0.95
Columbus OH	290	240	0.91
Detroit MI	670	480	1.16
Indianapolis IN	130	80	0.84
Kansas City MO	160	110	0.75
Louisville KY	200	120	0.88
Milwaukee WI	390	170	1.00
Minn-St. Paul MN	280	230	0.96
Oklahoma City OK	200	130	0.81
St. Louis MO	550	280	0.95
Southern Cities			
Atlanta GA	640	490	1.16
Charlotte NC	390	320	0.89
Ft. Lauderdale FL	310	250	0.95
Jacksonville FL	400	330	0.95
Memphis TN	160	120	0.91
Miami FL	690	530	1.28
Nashville TN	340	310	0.90
New Orleans LA	340	270	1.12
Norfolk VA	390	340	0.93
Orlando FL	230	200	0.78
Tampa FL	340	310	1.05
Southwestern Cities			
Albuquerque NM	220	180	0.96
Austin TX	420	380	0.94
Corpus Christi TX	70	50	0.72
Dallas TX	740	580	1.06
Denver CO	460	400	1.03
El Paso TX	120	80	0.75
Fort Worth TX	450	380	0.92
Houston TX	780	600	1.11
Phoenix AZ	630	400	1.08
Salt Lake City UT	120	100	0.88
San Antonio TX	320	240	0.89
Western Cities			
Honolulu HI	500	380	1.10
Los Angeles CA	1,040	690	1.56
Portland OR	470	310	1.08
Sacramento CA	240	260	1.04
San Bernardino-Riv CA	1,180	740	1.22
San Diego CA	520	320	1.22
San Fran-Oak CA	930	760	1.34
San Jose CA	850	580	1.08
Seattle-Everett WA	900	660	1.20
Northeastern Avg	730	390	1.04
Midwestern Avg	320	210	0.96
Southern Avg	390	310	0.99
Southwestern Avg	390	310	0.94
Western Avg	740	520	1.20
Texas Avg	420	330	0.91
Total Avg	480	330	1.02
Maximum Value	1,430	760	1.56
Minimum Value	70	50	0.72

Source: TTI Analysis and Local Transportation Agency References

Table A-25. Component and Total Congestion Costs by Urban Area for 1992

Urban Area	Annual Cost Due to Congestion ($ millions)				
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total
Northeastern Cities					
Baltimore MD	210	390	40	60	700
Boston MA	360	1,020	60	160	1,600
Hartford CT	50	90	10	10	160
New York NY	2,250	4,100	360	660	7,370
Philadelphia PA	480	650	70	100	1,300
Pittsburgh PA	190	280	30	40	540
Washington DC	870	1,500	140	240	2,750
Midwestern Cities					
Chicago IL	1,110	1,290	180	210	2,790
Cincinnati OH	120	100	20	20	260
Cleveland OH	140	120	20	20	300
Columbus OH	110	100	20	10	240
Detroit MI	710	1,140	110	170	2,130
Indianapolis IN	40	40	0	10	90
Kansas City MO	50	120	10	10	190
Louisville KY	50	60	10	10	130
Milwaukee WI	90	100	10	20	220
Minn-St. Paul MN	230	220	40	30	520
Oklahoma City OK	50	50	0	10	110
St. Louis MO	230	270	30	40	570
Southern Cities					
Atlanta GA	500	540	70	80	1,190
Charlotte NC	70	70	10	10	160
Ft. Lauderdale FL	130	180	20	30	360
Jacksonville FL	110	130	20	20	280
Memphis TN	50	50	10	10	120
Miami FL	400	480	60	70	1,010
Nashville TN	70	80	10	10	170
New Orleans LA	110	150	20	20	300
Norfolk VA	100	190	20	30	340
Orlando FL	80	90	10	20	200
Tampa FL	90	110	10	20	230
Southwestern Cities					
Albuquerque NM	40	50	0	10	100
Austin TX	90	100	10	20	220
Corpus Christi TX	10	10	0	0	20
Dallas TX	400	670	70	100	1,240
Denver CO	290	300	50	50	690
El Paso TX	30	30	0	10	70
Fort Worth TX	150	260	20	40	470
Houston TX	670	910	100	140	1,820
Phoenix AZ	400	340	60	50	850
Salt Lake City UT	40	40	10	0	90
San Antonio TX	130	150	20	20	320
Western Cities					
Honolulu HI	100	150	20	30	300
Los Angeles CA	3,360	3,920	540	630	8,450
Portland OR	130	210	20	30	390
Sacramento CA	160	130	30	20	340
San Bernardino-Riv CA	410	470	70	70	1,020
San Diego CA	410	280	60	50	800
San Fran-Oak CA	1,110	1,390	180	230	2,910
San Jose CA	350	420	60	70	900
Seattle-Everett WA	500	650	80	110	1,340
Northeastern Avg	630	1,150	100	180	2,060
Midwestern Avg	240	300	40	50	630
Southern Avg	150	190	20	30	390
Southwestern Avg	210	260	30	40	540
Western Avg	720	850	120	140	1,830
Texas Avg	210	300	30	50	590
Total Avg	360	480	60	80	980
Maximum Value	3,350	4,100	540	660	8,450
Minimum Value	10	10	0	0	20

Source: TTI Analysis and Local Transportation Agency References

Table A-26. Estimated Impact of Congestion 1992

Urban Area	Total Congestion Cost		Roadway Congestion Index
	Per Registered Vehicle (dollars)	Per Capita (dollars)	
Northeastern Cities			
Baltimore MD	650	340	1.04
Boston MA	960	540	1.07
Hartford CT	320	270	0.91
New York NY	1,210	430	1.14
Philadelphia PA	460	260	1.05
Pittsburgh PA	430	290	0.81
Washington DC	1,610	840	1.36
Midwestern Cities			
Chicago IL	690	370	1.28
Cincinnati OH	270	210	1.01
Cleveland OH	200	170	0.95
Columbus OH	300	260	0.93
Detroit MI	740	530	1.19
Indianapolis IN	150	100	0.85
Kansas City MO	250	160	0.77
Louisville KY	260	150	0.90
Milwaukee WI	410	180	1.00
Minn-St. Paul MN	300	250	0.99
Oklahoma City OK	230	160	0.83
St. Louis MO	550	280	0.95
Southern Cities			
Atlanta GA	670	520	1.17
Charlotte NC	390	320	0.89
Ft. Lauderdale FL	340	280	0.96
Jacksonville FL	440	360	0.97
Memphis TN	180	130	0.92
Miami FL	700	530	1.30
Nashville TN	330	300	0.92
New Orleans LA	340	270	1.10
Norfolk VA	400	350	0.92
Orlando FL	260	220	0.80
Tampa FL	350	320	1.07
Southwestern Cities			
Albuquerque NM	240	200	0.95
Austin TX	440	400	0.95
Corpus Christi TX	90	70	0.74
Dallas TX	750	590	1.07
Denver CO	490	430	1.05
El Paso TX	180	110	0.76
Fort Worth TX	470	400	0.94
Houston TX	810	630	1.12
Phoenix AZ	660	420	1.08
Salt Lake City UT	130	110	0.90
San Antonio TX	370	270	0.90
Western Cities			
Honolulu HI	560	430	1.10
Los Angeles CA	1,070	710	1.54
Portland OR	560	370	1.10
Sacramento CA	260	280	1.04
San Bernardino-Riv CA	1,280	780	1.22
San Diego CA	540	320	1.22
San Fran-Oak CA	930	760	1.33
San Jose CA	870	600	1.07
Seattle-Everett WA	1,000	720	1.22
Northeastern Avg	800	420	1.05
Midwestern Avg	360	230	0.97
Southern Avg	400	330	1.00
Southwestern Avg	420	330	0.95
Western Avg	780	550	1.20
Texas Avg	440	350	0.93
Total Avg	520	360	1.03
Maximum Value	1,610	840	1.54
Minimum Value	90	70	0.74

Source: TTI Analysis and Local Transportation Agency References

Table A-27. 1992 Freeway System Length and Travel Volume

Urban Area	DVMT[1] (1000)	Lane-Miles	Avg. No. Lanes[2]	DVMT/Lane-Miles[3]	Rank[4]
Los Angeles CA	111,950	5,400	8.2	2,075	1
San Fran-Oak CA	42,300	2,430	6.8	1,741	2
Washington DC	27,450	1,620	5.4	1,694	3
San Bernardino-Riv CA	15,110	910	7.2	1,660	4
Chicago IL	39,200	244	5.7	1,607	5
San Diego CA	27,800	174	7.6	1,598	6
Seattle-Everett WA	20,280	127	6.0	1,596	7
Detroit MI	28,600	182	5.9	1,571	8
Atlanta GA	26,500	175	6.3	1,514	9
Miami FL	9,370	630	5.4	1,499	10
Houston TX	30,500	208	6.3	1,470	11
Boston MA	21,900	152	5.9	1,445	12
Dallas TX	24,500	175	5.9	1,400	13
Phoenix AZ	9,750	700	5.7	1,393	14
Portland OR	7,970	580	5.2	1,386	15
San Jose CA	16,610	120	6.7	1,384	16
New York NY	83,500	605	5.7	1,380	17
Honolulu HI	5,090	380	5.3	1,357	18
New Orleans LA	5,050	380	5.8	1,347	19
Milwaukee WI	7,840	600	5.6	1,306	20
Baltimore MD	17,600	135	5.5	1,304	21
Cincinnati OH	11,910	920	5.7	1,302	22
Denver CO	12,500	960	5.2	1,302	22
Jacksonville FL	5,760	460	4.6	1,265	24
Sacramento CA	10,120	800	7.0	1,264	25
Minn-St. Paul MN	19,000	151	4.9	1,258	26
Austin TX	5,650	460	5.6	1,228	27
Tampa FL	3,800	310	5.0	1,226	28
Fort Worth TX	12,800	105	5.9	1,219	29
Philadelphia PA	19,390	162	5.1	1,201	30
Cleveland OH	14,160	118	4.8	1,200	31
Ft. Lauderdale FL	7,750	650	5.4	1,192	32
Columbus OH	9,460	810	5.8	1,168	33
Memphis TN	5,030	440	5.4	1,143	34
San Antonio TX	9,940	880	5.4	1,129	35
Hartford CT	6,750	610	5.6	1,116	36
St. Louis MO	18,930	170	5.7	1,114	37
Salt Lake City UT	5,780	530	5.7	1,100	38
Nashville TN	6,000	550	4.7	1,091	39
Albuquerque NM	2,500	230	5.0	1,087	40
Indianapolis IN	8,320	770	5.3	1,080	41
Louisville KY	6,530	610	4.6	1,079	42
Charlotte NC	3,200	310	4.2	1,049	43
Norfolk VA	5,870	560	4.7	1,048	44
Orlando FL	6,050	600	4.9	1,008	45
Oklahoma City OK	7,300	730	5.2	1,007	46
El Paso TX	3,500	360	5.3	9,860	47
Kansas City MO	13,700	141	4.4	9,720	48
Corpus Christi TX	1,680	190	5.5	8,910	49
Pittsburgh PA	9,140	112	4.3	8,160	50
Northeastern Avg	26,530	198	5.36	1,279	51
Midwestern Avg	15,410	121	5.30	1,222	52
Southern Avg	7,670	600	5.13	1,217	53
Southwestern Avg	10,830	830	5.59	1,200	54
Western Avg	28,580	163	6.67	1,562	55
Texas Avg	12,650	970	5.70	1,189	57
Total Avg	16,630	118	5.58	1,285	59
Maximum Value	111,950	605	8.20	2,075	60
Minimum Value	1,680	190	4.20	8,160	61

Notes:
[1] Daily vehicle-miles of travel.
[2] Average number of lanes.
[3] Daily vehicle-miles of travel per lane-mile of freeway.
[4] Rank value of 1 associated with most congested condition. Ranked by DVMT/lane-mile.

Source: TTI Analysis and Local Transportation Agency References

Table A-28. 1992 Principal Arterial Street System Length and Travel Volume

Urban Area	DVMT[1] (1000)	Lane-Miles	Avg. No. Lanes[2]	DVMT/Lane-Miles[3]	Rank[4]
Washington DC	18,500	2,320	4.0	7,970	1
Miami FL	16,800	2,230	4.4	7,530	2
Honolulu HI	1,750	240	3.8	7,430	3
New York NY	55,320	7,630	3.4	7,260	4
Chicago IL	32,800	4,650	3.8	7,050	5
Philadelphia PA	21,650	3,260	3.3	6,640	6
Tampa FL	4,650	700	3.8	6,640	6
Los Angeles CA	82,500	12,500	4.1	6,600	8
St. Louis MO	12,480	1,900	3.6	6,590	9
Portland OR	3,910	610	3.4	6,460	10
New Orleans LA	4,200	660	4.2	6,410	11
Norfolk VA	4,780	750	3.5	6,370	12
Louisville KY	3,330	530	3.6	6,330	13
Sacramento CA	7,740	1,240	4.2	6,240	14
Atlanta GA	10,000	1,620	3.8	6,170	15
San Fran-Oak CA	14,180	2,320	4.0	6,110	16
Salt Lake City UT	2,580	430	3.8	6,060	17
Seattle-Everett WA	9,800	1,630	3.5	6,030	18
Pittsburgh PA	11,100	1,860	3.2	5,980	19
Baltimore MD	9,900	1,670	4.1	5,930	20
Denver CO	11,000	1,860	3.9	5,910	21
Minn-St. Paul MN	6,800	1,150	3.4	5,910	21
Hartford CT	3,840	660	3.8	5,860	23
Detroit MI	24,500	4,270	4.4	5,740	24
Nashville TN	5,500	960	3.5	5,730	25
Columbus OH	3,580	640	3.5	5,630	26
San Diego CA	9,700	1,740	3.5	5,590	27
Albuquerque NM	4,300	770	3.9	5,580	28
Cleveland OH	6,300	1,140	3.0	5,530	29
Charlotte NC	3,200	580	3.2	5,520	30
Ft. Lauderdale FL	6,350	1,150	4.4	5,520	30
Oklahoma City OK	3,970	720	3.3	5,510	32
Phoenix AZ	18,110	3,310	4.2	5,470	33
Cincinnati OH	4,500	830	3.3	5,450	34
San Jose CA	7,400	1,380	4.2	5,360	35
San Antonio TX	5,940	1,130	3.6	5,280	36
San Bernardino-Riv CA	10,750	2,100	4.2	5,120	37
Houston TX	11,140	2,180	4.5	5,110	38
Memphis TN	5,010	980	4.5	5,110	38
Austin TX	2,200	450	4.2	4,940	40
Milwaukee WI	5,200	1,060	3.4	4,910	41
Dallas TX	8,550	1,750	4.8	4,890	42
Fort Worth TX	4,340	900	4.2	4,820	43
Indianapolis IN	4,250	890	3.7	4,800	44
Jacksonville FL	6,150	1,280	3.8	4,800	44
Boston MA	13,000	2,850	2.4	4,560	46
Kansas City MO	4,890	1,090	3.6	4,490	47
Orlando FL	4,850	1,090	3.7	4,450	48
Corpus Christi TX	1,640	370	4.1	4,370	49
El Paso TX	3,330	860	4.2	3,890	50
Northeastern Avg	19,040	2,890	3.46	6,310	51
Midwestern Avg	9,380	1,570	3.55	5,660	52
Southern Avg	6,500	1,090	3.89	5,840	53
Southwestern Avg	6,650	1,270	4.13	5,120	54
Western Avg	16,410	2,640	3.88	6,100	55
Texas Avg	5,300	1,090	4.23	4,760	57
Total Avg	10,760	1,780	3.80	5,750	59
Maximum Value	82,500	12,500	4.80	7,970	60
Minimum Value	1,640	240	2.40	3,890	61

Notes:
[1] Daily vehicle-miles of travel.
[2] Average number of lanes.
[3] Daily vehicle-miles of travel per lane-mile of freeway.
[4] Rank value of 1 associated with most congested condition. Ranked by DVMT/lane-mile.

Source: TTI Analysis and Local Transportation Agency References

Table A-29. Freeway and Expressway Recurring and Incident Hours of Daily Delay for 1992[1]

Urban Area	Recurring Hours of Delay				Incident Hours of Delay			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Baltimore MD	6,420	7,130	19,800	33,350	14,760	16,390	45,540	76,690
Boston MA	5,750	18,950	40,810	65,510	20,110	66,320	142,820	229,250
Hartford CT	1,170	2,550	2,450	6,170	3,170	6,900	6,610	16,680
New York NY	77,680	95,150	125,240	298,070	194,210	237,880	313,090	745,180
Philadelphia PA	5,740	5,410	19,830	30,980	12,050	11,360	41,650	65,060
Pittsburgh PA	1,800	3,570	6,230	11,600	5,230	10,350	18,060	33,640
Washington DC	8,780	34,130	87,220	130,130	19,320	75,080	191,870	286,270
Chicago IL	17,700	17,320	124,660	159,680	21,240	20,780	149,590	191,610
Cincinnati OH	8,670	9,870	4,220	22,760	6,940	7,900	3,370	18,210
Cleveland OH	9,520	5,890	8,220	23,630	6,660	4,120	5,760	16,540
Columbus OH	1,190	5,170	12,910	19,270	830	3,620	9,040	13,490
Detroit MI	11,010	7,180	68,740	86,930	24,220	15,790	151,220	191,230
Indianapolis IN	2,740	610	750	4,100	4,120	920	1,120	6,160
Kansas City MO	3,750	930	2,660	7,340	11,610	2,900	8,260	22,770
Louisville KY	590	340	1,010	1,940	650	370	1,110	2,130
Milwaukee WI	2,690	4,550	7,420	14,660	2,690	4,550	7,420	14,660
Minn-St. Paul MN	7,950	2,500	25,950	36,400	7,160	2,250	23,360	32,770
Oklahoma City OK	1,720	2,050	0	3,770	1,890	2,260	0	4,150
St. Louis MO	9,320	6,970	3,790	20,080	11,180	8,360	4,540	24,080
Atlanta GA	5,750	32,520	49,690	87,960	6,330	35,780	54,660	96,770
Charlotte NC	2,650	1,330	2,200	6,180	2,120	1,060	1,760	4,940
Ft. Lauderdale FL	5,440	8,670	3,260	17,370	8,160	13,000	4,880	26,040
Jacksonville FL	3,200	6,930	1,110	11,240	4,800	10,400	1,660	16,860
Memphis TN	2,150	1,090	610	3,850	2,370	1,200	670	4,240
Miami FL	8,440	4,680	21,860	34,980	12,660	7,030	32,790	52,480
Nashville TN	4,140	1,670	2,050	7,860	4,560	1,840	2,250	8,650
New Orleans LA	2,190	9,300	3,790	15,280	3,950	16,730	6,820	27,500
Norfolk VA	2,270	6,240	6,060	14,570	5,660	15,610	15,160	36,430
Orlando FL	3,770	2,100	4,540	10,410	5,660	3,140	6,810	15,610
Tampa FL	700	1,320	4,300	6,320	1,050	1,980	6,450	9,480
Albuquerque NM	690	1,150	1,160	3,000	750	1,260	1,280	3,290
Austin TX	4,720	6,670	6,990	18,380	5,190	7,340	7,690	20,220
Corpus Christi TX	850	340	0	1,190	940	370	0	1,310
Dallas TX	13,430	25,760	46,390	85,580	24,170	46,360	83,500	154,030
Denver CO	7,220	11,570	24,950	43,740	7,220	11,570	24,950	43,740
El Paso TX	1,670	2,360	790	4,820	1,830	2,600	870	5,300
Fort Worth TX	5,100	9,790	17,630	32,520	9,180	17,620	31,730	58,530
Houston TX	13,780	33,640	95,210	142,630	19,290	47,100	133,290	199,680
Phoenix AZ	4,650	5,610	28,980	39,240	1,860	2,240	11,590	15,690
Salt Lake City UT	1,530	2,860	2,530	6,920	920	1,720	1,520	4,160
San Antonio TX	2,800	7,910	15,300	26,010	3,080	8,700	16,840	28,620
Honolulu HI	1,660	4,690	10,500	16,850	2,980	8,430	18,900	30,310
Los Angeles CA	24,320	22,880	559,760	606,960	29,180	27,450	671,710	728,340
Portland OR	4,370	3,860	11,640	19,870	8,740	7,720	23,280	39,740
Sacramento CA	5,560	9,310	1,780	16,650	3,340	5,590	1,070	10,000
San Bernardino-Riv CA	2,980	10,960	60,780	74,720	3,580	13,150	72,940	89,670
San Diego CA	20,430	19,460	45,170	85,060	12,260	11,680	27,100	51,040
San Fran-Oak CA	25,330	31,020	172,130	228,480	32,930	40,330	223,770	297,030
San Jose CA	8,650	12,150	44,930	65,730	10,380	14,580	53,920	78,880
Seattle-Everett WA	6,770	34,200	52,970	93,940	9,470	47,880	74,150	131,500
Northeastern Avg	15,340	23,840	43,080	82,260	38,410	60,610	108,520	207,540
Midwestern Avg	6,400	5,280	21,690	33,370	8,270	6,150	30,400	44,820
Southern Avg	3,700	6,900	9,040	19,640	5,210	9,800	12,170	27,180
Southwestern Avg	5,130	9,790	21,810	36,730	6,770	13,350	28,480	48,600
Western Avg	11,120	16,500	106,630	134,250	12,540	19,650	129,650	161,840
Texas Avg	6,050	12,350	26,040	44,440	9,100	18,580	39,130	66,810
Total Avg	7,630	11,250	37,220	56,100	12,250	18,590	54,770	85,610
Maximum Value	77,680	95,150	559,760	732,590	194,210	237,880	671,710	1,103,800
Minimum Value	590	340	0	930	650	370	0	1,020

Notes: [1] Delay calculated based on vehicular speed in Table A-3.

Source: TTI Analysis

Table A-30. Principal Arterial Street Recurring and Incident Hours of Daily Delay for 1992[1]

Urban Area	Recurring Hours of Delay				Incident Hours of Delay			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Baltimore MD	1,540	2,870	16,300	20,710	1,690	3,150	17,930	22,770
Boston MA	5,080	5,420	17,180	27,680	5,590	5,970	18,900	30,460
Hartford CT	1,440	2,500	2,760	6,700	1,580	2,750	3,030	7,360
New York NY	18,080	57,820	202,280	278,180	19,880	63,600	222,510	305,990
Philadelphia PA	7,550	19,110	68,240	94,900	8,300	21,030	75,060	104,390
Pittsburgh PA	5,540	6,550	24,570	36,660	6,100	7,200	27,030	40,330
Washington DC	7,950	14,540	69,930	92,420	8,750	15,990	76,920	101,660
Chicago IL	13,840	36,900	77,010	127,750	15,220	40,590	84,710	140,520
Cincinnati OH	1,420	1,570	4,050	7,040	1,560	1,720	4,450	7,730
Cleveland OH	1,500	5,170	4,930	11,600	1,650	5,680	5,420	12,750
Columbus OH	1,230	1,600	7,330	10,160	1,360	1,760	8,060	11,180
Detroit MI	4,220	20,240	71,640	96,100	4,640	22,260	78,800	105,700
Indianapolis IN	1,980	1,090	1,570	4,640	2,180	1,200	1,720	5,100
Kansas City MO	1,430	1,800	2,860	6,090	1,580	1,980	3,150	6,710
Louisville KY	870	3,610	6,870	11,350	950	3,970	7,560	12,480
Milwaukee WI	1,760	2,770	4,930	9,460	1,930	3,050	5,420	10,400
Minn-St. Paul MN	1,200	4,090	17,250	22,540	1,320	4,500	18,970	24,790
Oklahoma City OK	1,170	2,570	4,870	8,610	1,280	2,820	5,360	9,460
St. Louis MO	6,110	12,230	21,530	39,870	6,720	13,450	23,680	43,850
Atlanta GA	3,170	6,350	28,700	38,220	3,490	6,980	31,570	42,040
Charlotte NC	490	2,240	8,930	11,660	540	2,470	9,820	12,830
Ft. Lauderdale FL	2,600	5,640	8,520	16,760	2,860	6,200	9,370	18,430
Jacksonville FL	4,260	1,800	9,370	15,430	4,690	1,970	10,300	16,960
Memphis TN	1,910	3,540	3,170	8,620	2,100	3,890	3,480	9,470
Miami FL	1,800	10,800	55,410	68,010	1,980	11,880	60,950	74,810
Nashville TN	2,450	4,390	3,920	10,760	2,700	4,830	4,310	11,840
New Orleans LA	2,220	2,520	6,180	10,920	2,440	2,770	6,790	12,000
Norfolk VA	1,110	2,050	7,830	10,990	1,220	2,250	8,610	12,080
Orlando FL	160	710	6,860	7,730	180	790	7,550	8,520
Tampa FL	2,270	3,420	11,280	16,970	2,500	3,760	12,400	18,660
Albuquerque NM	2,360	2,610	3,220	8,190	2,590	2,870	3,540	9,000
Austin TX	1,110	1,780	1,990	4,880	1,230	1,960	2,190	5,380
Corpus Christi TX	450	420	150	1,020	500	460	160	1,120
Dallas TX	4,390	4,020	5,670	14,080	4,830	4,420	6,240	15,490
Denver CO	4,210	5,390	21,080	30,680	4,630	5,930	23,190	33,750
El Paso TX	360	290	1,120	1,770	390	310	1,230	1,930
Fort Worth TX	1,910	1,750	2,470	6,130	2,100	1,920	2,720	6,740
Houston TX	4,320	13,330	10,950	28,600	4,750	14,670	12,050	31,470
Phoenix AZ	12,430	20,990	31,700	65,120	13,670	23,090	34,870	71,630
Salt Lake City UT	2,150	1,760	990	4,900	2,370	1,940	1,080	5,390
San Antonio TX	1,650	1,840	4,120	7,610	1,810	2,030	4,530	8,370
Honolulu HI	930	780	5,820	7,530	1,020	860	6,400	8,280
Los Angeles CA	20,050	84,590	152,190	256,830	22,060	93,050	167,410	282,520
Portland OR	1,140	5,120	6,680	12,940	1,250	5,640	7,350	14,240
Sacramento CA	1,900	4,780	15,730	22,410	2,090	5,260	17,300	24,650
San Bernardino-Riv CA	7,810	7,500	13,580	28,890	8,590	8,250	14,940	31,780
San Diego CA	1,800	10,260	5,630	17,690	1,980	11,290	6,200	19,470
San Fran-Oak CA	2,540	6,620	43,140	52,300	2,800	7,280	47,450	57,530
San Jose CA	3,150	3,810	18,250	25,210	3,460	4,190	20,080	27,730
Seattle-Everett WA	2,430	5,350	24,110	31,890	2,670	5,880	26,520	35,070
Northeastern Avg	6,740	15,540	57,320	79,600	7,410	17,100	63,050	87,560
Midwestern Avg	3,060	7,800	18,740	29,600	3,370	8,580	20,610	32,560
Southern Avg	2,040	3,950	13,650	19,640	2,250	4,340	15,010	21,600
Southwestern Avg	3,210	4,930	7,590	15,730	3,530	5,420	8,350	17,300
Western Avg	4,640	14,310	31,680	50,630	5,100	15,740	34,850	55,690
Texas Avg	2,030	3,350	3,780	9,160	2,230	3,680	4,160	10,070
Total Avg	3,670	8,580	22,900	35,150	4,040	9,440	25,190	38,670
Maximum Value	20,050	84,590	202,280	306,920	22,060	93,050	222,510	337,620
Minimum Value	160	290	150	600	180	310	160	650

Notes: [1] Delay calculated based on vehicular speed in Table A-3.

Source: TTI Analysis

Table A-31. Congested Daily Vehicle-Miles of Travel by Average Annual Daily Traffic per Lane Volumes

Functional Class	Parameters	Uncongested	Congested Daily VMT[1,2]		
			Moderate	Heavy	Severe
Freeway/Expressway	ADT/Lane	Under 15,000	15,000 - 17,500	17,501 - 20,000	Over 20,000
	Speed (mph)	60	38	33	30
Principal Arterial Streets	ADT/Lane	Under 5,750	5,750 - 7,000	7,001 - 8,500	Over 8,500
	Speed (mph)	35	28	25	23

Note: [1] Assumes congested freeway operation when ADT/Lane exceeds 15,000.
[2] Assumes congested principal arterial street operations when ADT/lane exceeds 5,750.

Source: TTI Analysis and Houston-Galveston Regional Transportation Study (Volume 2, Appendix B)

Table A-32. Principal Arterial Street Recurring and Incident Hours of Daily Delay for 1992

Urban Area	Daily VMT		State Average Fuel Cost, ($/gallon)	Registered Autos (1000)	Population (1000)	Population per Registered Vehicle
	Freeway (1000)	Prin. Art. St. (1000)				
Northeastern Cities						
Baltimore MD	17,600	9,900	1.40	1,080	2,040	1.90
Boston MA	21,900	13,000	1.35	1,670	2,960	1.77
Hartford CT	6,750	3,840	1.41	530	620	1.16
New York NY	83,500	55,320	1.39	6,100	16,950	2.78
Philadelphia PA	19,390	21,650	1.34	2,820	5,000	1.77
Pittsburgh PA	9,140	11,100	1.34	1,250	1,880	1.50
Washington DC	27,450	18,500	1.39	1,710	3,290	1.92
Midwestern Cities						
Chicago IL	39,200	32,800	1.43	4,050	7,520	1.86
Cincinnati OH	11,910	4,500	1.34	970	1,220	1.26
Cleveland OH	14,160	6,300	1.34	1,500	1,790	1.19
Columbus OH	9,460	3,580	1.34	800	950	1.19
Detroit MI	28,600	24,500	1.33	2,880	4,000	1.39
Indianapolis IN	8,320	4,250	1.30	590	960	1.61
Kansas City MO	13,700	4,890	1.20	770	1,200	1.56
Louisville KY	6,530	3,330	1.29	460	820	1.75
Milwaukee WI	7,840	5,200	1.33	540	1,230	2.27
Minn-St. Paul MN	19,000	6,800	1.33	1,730	2,110	1.22
Oklahoma City OK	7,300	3,970	1.28	490	750	1.51
St. Louis MO	18,930	12,480	1.20	1,030	1,990	1.92
Southern Cities						
Atlanta GA	26,500	10,000	1.26	1,770	2,280	1.28
Charlotte NC	3,200	3,200	1.34	410	500	1.22
Ft. Lauderdale FL	7,750	6,350	1.33	1,040	1,290	1.23
Jacksonville FL	5,760	6,150	1.33	620	760	1.23
Memphis TN	5,030	5,010	1.32	640	880	1.37
Miami FL	9,370	16,800	1.33	1,460	1,920	1.32
Nashville TN	6,000	5,500	1.32	530	590	1.11
New Orleans LA	5,050	4,200	1.36	890	1,100	1.24
Norfolk VA	5,870	4,780	1.35	840	970	1.15
Orlando FL	6,050	4,850	1.33	750	880	1.18
Tampa FL	3,800	4,650	1.33	640	720	1.11
Southwestern Cities						
Albuquerque NM	2,500	4,300	1.33	430	530	1.22
Austin TX	5,650	2,200	1.30	510	570	1.10
Corpus Christi TX	1,680	1,640	1.30	230	290	1.24
Dallas TX	24,500	8,550	1.30	1,640	2,080	1.27
Denver CO	12,500	11,000	1.39	1,400	1,600	1.14
El Paso TX	3,500	3,330	1.30	350	570	1.60
Fort Worth TX	12,800	4,340	1.30	1,000	1,200	1.20
Houston TX	30,500	11,140	1.30	2,260	2,910	1.29
Phoenix AZ	9,750	18,110	1.33	1,290	2,020	1.56
Salt Lake City UT	5,780	2,580	1.39	730	860	1.18
San Antonio TX	9,940	5,940	1.30	880	1,190	1.35
Western Cities						
Honolulu HI	5,090	1,750	1.64	530	690	1.30
Los Angeles CA	111,950	82,500	1.39	7,880	11,850	1.50
Portland OR	7,970	3,910	1.38	700	1,060	1.51
Sacramento CA	10,120	7,740	1.39	1290	1,190	0.93
San Bernardino-Riv CA	15,110	10,750	1.39	800	1,300	1.63
San Diego CA	27,800	9,700	1.39	1,490	2,480	1.67
San Fran-Oak CA	42,300	14,180	1.39	3,120	3,810	1.22
San Jose CA	16,610	7,400	1.39	1,040	1,510	1.45
Seattle-Everett WA	20,280	9,800	1.38	1,330	1,840	1.38
Northeastern Avg	26,530	19,040	1.37	2,160	4,670	1.83
Midwestern Avg	15,410	9,380	1.31	1,320	2,040	1.56
Southern Avg	7,670	6,500	1.33	870	1,080	1.22
Southwestern Avg	10,830	6,650	1.32	980	1,250	1.29
Western Avg	28,580	16,410	1.42	2,020	2,860	1.40
Texas Avg	12,650	5,300	1.30	980	1,260	1.29
Total Avg	16,630	10,760	1.34	1,390	2,170	1.43
Maximum Value	111,950	82,500	1.64	7,880	16,950	2.78
Minimum Value	1,680	1,640	1.20	230	290	0.93

Source: TTI Analysis and Local Transportation Agency References

Table A-33. 1992 Congested Daily Vehicle-Miles of Travel

Urban Area	Daily Vehicle-Miles of Travel		Percent of Peak-Period[1,2] VMT on Congested Roads		Peak Period Congested Daily VMT[1,3]		
	Freeway (1000)	Prin.Art.St. (1000)	Freeway (%)	Prin.Art.St. (%)	Freeway (1000)	Prin.Art.St. (1000)	Freeway & Prin.Art.St. (1000)
Northeastern Cities							
Baltimore MD	17,600	9,900	30	35	2,380	1,560	3,940
Boston MA	21,900	13,000	45	40	4,430	2,340	6,770
Hartford CT	6,750	3,840	15	35	460	600	1,060
New York NY	83,500	55,320	60	85	22,550	21,160	43,700
Philadelphia PA	19,390	21,650	25	75	2,180	7,310	9,490
Pittsburgh PA	9,140	11,100	20	60	820	3,000	3,820
Washington DC	27,450	18,500	70	85	8,650	7,080	15,720
Midwestern Cities							
Chicago IL	39,200	32,800	60	70	10,580	10,330	20,920
Cincinnati OH	11,910	4,500	35	30	1,880	610	2,480
Cleveland OH	14,160	6,300	30	35	1,910	990	2,900
Columbus OH	9,460	3,580	30	50	1,280	800	2,080
Detroit MI	28,600	24,500	45	65	5,790	7,170	12,960
Indianapolis IN	8,320	4,250	10	25	370	480	850
Kansas City MO	13,700	4,890	10	25	620	550	1,170
Louisville KY	6,530	3,330	5	60	150	900	1,040
Milwaukee WI	7,840	5,200	30	35	1,060	820	1,880
Minn-St. Paul MN	19,000	6,800	30	55	2,570	1,680	4,250
Oklahoma City OK	7,300	3,970	10	40	330	710	1,040
St. Louis MO	18,930	12,480	20	60	1,700	3,370	5,070
Southern Cities							
Atlanta GA	26,500	10,000	50	65	5,960	2,930	8,890
Charlotte NC	3,200	3,200	35	60	500	860	1,370
Ft. Lauderdale FL	7,750	6,350	40	50	1,400	1,430	2,820
Jacksonville FL	5,760	6,150	35	50	910	1,380	2,290
Memphis TN	5,030	5,010	15	35	340	790	1,130
Miami FL	9,370	16,800	60	65	2,530	4,910	7,440
Nashville TN	6,000	5,500	25	40	680	990	1,670
New Orleans LA	5,050	4,200	50	50	1,140	950	2,080
Norfolk VA	5,870	4,780	40	40	1,060	860	1,920
Orlando FL	6,050	4,850	30	25	820	550	1,360
Tampa FL	3,800	4,650	25	65	430	1,360	1,790
Southwestern Cities							
Albuquerque NM	2,500	4,300	20	40	230	770	1,000
Austin TX	5,650	2,200	55	45	1,400	450	1,840
Corpus Christi TX	1,680	1,640	15	15	110	110	220
Dallas TX	24,500	8,550	55	35	6,060	1,350	7,410
Denver CO	12,500	11,000	55	50	3,090	2,480	5,570
El Paso TX	3,500	3,330	25	10	390	150	540
Fort Worth TX	12,800	4,340	40	30	2,300	590	2,890
Houston TX	30,500	11,140	70	50	9,610	2,510	12,110
Phoenix AZ	9,750	18,110	60	70	2,630	5,700	8,340
Salt Lake City UT	5,780	2,580	20	45	520	520	1,040
San Antonio TX	9,940	5,940	40	25	1,790	670	2,460
Western Cities							
Honolulu HI	5,090	1,750	50	75	1,150	590	1,730
Los Angeles CA	111,950	82,500	75	55	37,780	20,420	58,200
Portland OR	7,970	3,910	40	60	1,430	1,060	2,490
Sacramento CA	10,120	7,740	30	50	1,370	1,740	3,110
San Bernardino-Riv CA	15,110	10,750	70	55	4,760	2,660	7,420
San Diego CA	27,800	9,700	50	35	6,260	1,530	7,780
San Fran-Oak CA	42,300	14,180	80	60	15,230	3,830	19,060
San Jose CA	16,610	7,400	60	60	4,480	2,000	6,480
Seattle-Everett WA	20,280	9,800	70	55	6,390	2,430	8,810
Northeastern Avg	26,530	19,040	38	59	5,920	6,150	12,070
Midwestern Avg	15,410	9,380	26	46	2,350	2,370	4,720
Southern Avg	7,670	6,500	37	50	1,430	1,550	2,980
Southwestern Avg	10,830	6,650	41	38	2,560	1,390	3,950
Western Avg	28,580	16,410	58	56	8,760	4,030	12,790
Texas Avg	12,650	5,300	43	30	3,100	830	3,930
Total Avg	16,630	10,760	39	49	3,850	2,800	6,650
Maximum Value	111,950	82,500	80	85	37,780	21,160	58,200
Minimum Value	1,680	1,640	5	10	110	110	220

Notes: [1] Daily vehicle-miles of travel.
[2] Represents the percentage of daily vehicle-miles of travel on each roadway system during the peak period operating on congested conditions.
[3] Daily vehicle-miles of travel multiplied by peak-period vehicle travel and percent of congested daily VMT.

Source: TTI Analysis and Local Transportation Agency References

Table A-34. Recurring and Incident Delay Relationships for 1992

Urban Area	Peak Period Congested Daily VMT[1]			Ratio of Incident[2] Delay to Recurring Delay		Daily Recurring Vehicle[3] Hours of Delay			Daily Incident Vehicle[3] Hours of Delay		
	Freeway (1000)	Prin.Art.St. (1000)	Freeway and Prin. Art. St. (1000)	Freeway	Prin.Art.St.	Freeway	Hours of Delay Prin.Art.St.	Total	Freeway	Prin.Art.St.	Total
Northeastern Cities											
Baltimore MD	2,380	1,560	3,940	2.3	1.1	33,350	20,700	54,050	76,700	22,770	99,470
Boston MA	4,430	2,340	6,770	3.5	1.1	65,500	27,690	93,190	229,250	30,460	259,710
Hartford CT	460	600	1,060	2.7	1.1	6,170	6,690	12,860	16,670	7,360	24,030
New York NY	22,550	21,160	43,700	2.5	1.1	298,070	278,180	576,250	745,180	306,000	1,051,180
Philadelphia PA	2,180	7,310	9,490	2.1	1.1	30,980	94,900	125,880	65,060	104,390	169,450
Pittsburgh PA	820	3,000	3,820	2.9	1.1	11,600	36,660	48,260	33,640	40,330	73,960
Washington DC	8,650	7,080	15,720	2.2	1.1	130,130	92,420	222,550	286,280	101,660	387,940
Midwestern Cities											
Chicago IL	10,580	10,330	20,920	1.2	1.1	159,680	127,750	287,430	191,620	140,520	332,140
Cincinnati OH	1,880	610	2,480	0.8	1.1	22,760	7,030	29,800	18,210	7,740	25,950
Cleveland OH	1,910	990	2,900	0.7	1.1	23,630	11,590	35,220	16,540	12,750	29,290
Columbus OH	1,280	800	2,080	0.7	1.1	19,270	10,160	29,430	13,490	11,180	24,670
Detroit MI	5,790	7,170	12,960	2.2	1.1	86,920	96,090	183,020	191,230	105,700	296,930
Indianapolis IN	370	480	850	1.5	1.1	4,100	4,640	8,750	6,160	5,110	11,260
Kansas City MO	620	550	1,170	3.1	1.1	7,340	6,090	13,440	22,770	6,700	29,470
Louisville KY	150	900	1,040	1.1	1.1	1,940	11,340	13,280	2,140	12,480	14,610
Milwaukee WI	1,060	820	1,880	1.0	1.1	14,660	9,460	24,120	14,660	10,400	25,070
Minn-St. Paul MN	2,570	1,680	4,250	0.9	1.1	36,410	22,540	58,940	32,760	24,790	57,560
Oklahoma City OK	330	710	1,040	1.1	1.1	3,770	8,600	12,370	4,150	9,460	13,610
St. Louis MO	1,700	3,370	5,070	1.2	1.1	20,070	39,870	59,940	24,090	43,860	67,940
Southern Cities											
Atlanta GA	5,960	2,930	8,890	1.1	1.1	87,960	38,220	126,180	96,760	42,040	138,800
Charlotte NC	500	860	1,370	0.8	1.1	6,180	11,660	17,840	4,940	12,830	17,770
Ft. Lauderdale FL	1,400	1,430	2,820	1.5	1.1	17,370	16,760	34,120	26,050	18,430	44,480
Jacksonville FL	910	1,380	2,290	1.5	1.1	11,240	15,430	26,670	16,860	16,970	33,830
Memphis TN	340	790	1,130	1.1	1.1	3,850	8,610	12,460	4,240	9,470	13,710
Miami FL	2,530	4,910	7,440	1.5	1.1	34,990	68,010	102,990	52,480	74,810	127,290
Nashville TN	680	990	1,670	1.1	1.1	7,860	10,760	18,620	8,650	11,830	20,480
New Orleans LA	1,140	950	2,080	1.8	1.1	15,280	10,910	26,190	27,500	12,000	39,500
Norfolk VA	1,060	860	1,920	2.5	1.1	14,570	10,980	25,560	36,340	12,080	48,520
Orlando FL	820	550	1,360	1.5	1.1	10,400	7,740	18,140	15,610	8,510	24,120
Tampa FL	430	1,360	1,790	1.5	1.1	6,320	16,970	23,290	9,480	18,660	28,150

Table A-34. Recurring and Incident Delay Relationships for 1992 (continued)

Urban Area	Peak Period Congested Daily VMT[1]			Ratio of Incident[2] Delay to Recurring Delay		Daily Recurring Vehicle[3] Hours of Delay			Daily Incident Vehicle[3] Hours of Delay		
	Freeway (1000)	Prin.Art.St. (1000)	Freeway and Prin. Art. St. (1000)	Freeway	Prin.Art.St.	Freeway	Hours of Delay Prin.Art.St.	Total	Freeway	Prin.Art.St.	Total
Southwestern Cities											
Albuquerque NM	230	770	1,000	1.1	1.1	3,000	8,810	11,180	3,300	9,000	12,300
Austin TX	1,400	450	1,840	1.1	1.1	18,390	4,890	23,280	20,230	5,380	25,600
Corpus Christi TX	110	110	220	1.1	1.1	1,190	1,020	2,210	1,310	1,130	2,430
Dallas TX	6,060	1,350	7,410	1.8	1.1	85,570	14,080	99,650	154,030	15,490	169,520
Denver CO	3,090	2,480	5,570	1.0	1.1	43,740	30,680	74,420	43,740	33,750	77,490
El Paso TX	390	150	540	1.1	1.1	4,820	1,760	6,580	5,310	1,930	7,240
Fort Worth TX	2,300	590	2,890	1.8	1.1	32,510	6,130	38,640	58,530	6,740	65,260
Houston TX	9,610	2,510	12,110	1.4	1.1	142,630	28,610	171,240	199,680	31,470	231,150
Phoenix AZ	2,630	5,700	8,340	0.4	1.1	39,250	65,120	104,360	15,700	71,630	87,330
Salt Lake City UT	520	520	1,040	0.6	1.1	6,920	4,900	11,820	4,150	5,390	9,540
San Antonio TX	1,790	670	2,460	1.1	1.1	26,010	7,610	33,620	28,610	8,370	36,990
Western Cities											
Honolulu HI	1,150	590	1,730	1.8	1.1	16,840	7,530	24,370	30,310	8,280	38,600
Los Angeles CA	37,780	20,420	58,200	1.2	1.1	606,950	256,840	863,790	728,340	282,520	1,010,860
Portland OR	1,430	1,060	2,490	2.0	1.1	19,870	12,940	32,820	39,750	14,240	53,980
Sacramento CA	1,370	1,740	3,110	0.6	1.1	16,650	22,420	39,060	9,990	24,660	34,650
San Bernardino-Riv CA	4,760	2,660	7,420	1.2	1.1	74,720	28,890	103,610	89,660	31,780	121,440
San Diego CA	6,260	1,530	7,780	0.6	1.1	85,070	17,700	102,760	51,040	19,460	70,500
San Fran-Oak CA	15,230	3,830	19,060	1.3	1.1	228,480	52,290	280,780	297,030	57,520	354,550
San Jose CA	4,480	2,000	6,480	1.2	1.1	65,730	25,200	90,940	78,880	27,730	106,600
Seattle-Everett WA	6,390	2,430	8,810	1.4	1.1	93,930	31,890	125,820	131,510	35,070	166,580
Northeastern Avg	5,923	6,149	12,072	2.6	1.1	82,257	79,606	11,863	207,538	87,567	295,105
Midwestern Avg	2,353	2,368	4,721	1.3	1.1	33,380	29,598	62,978	44,817	32,558	77,375
Southern Avg	1,432	1,546	2,978	1.4	1.1	19,638	19,641	39,279	27,181	21,605	48,786
Southwestern Avg	2,558	1,390	3,948	1.1	1.1	36,730	15,725	52,455	48,598	17,297	65,895
Western Avg	8,760	4,027	12,787	1.3	1.1	134,249	50,634	184,882	161,833	55,697	217,530
Texas Avg	3,096	830	3,926	1.3	1.1	44,447	9,156	53,603	66,814	10,072	76,885
Total Avg	3,848	2,800	6,648	1.5	1.1	56,093	35,143	91,236	85,613	38,657	124,270
Maximum Value	37,783	21,160	58,202	3.5	1.1	606,950	278,181	863,786	745,177	305,999	1,051,176
Minimum Value	113	110	223	0.4	1.1	1,189	1,024	2,213	1,308	1,126	2,434

Notes: [1] Daily vehicle-kilometers of travel. Represents the percentage of Daily Vehicle-Kilometers of travel on each roadway system during the peak period operating in congested conditions.
[2] Percentage of Incident Delay related to Recurring Delay.
[3] Facility delays as calculated by type and urban area.

Source: TTI Analysis and Local Transportation Agency References

Table A-35. Component and Total Congestion Costs by Urban Area for 1992

Urban Area	Annual Cost Due to Congestion ($ millions)					Rank
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total	
Los Angeles CA	3,360	3,920	540	630	8,450	1
New York NY	2,250	4,100	360	660	7,370	2
San Fran-Oak CA	1,110	1,390	180	230	2,910	3
Chicago IL	1,110	1,290	180	210	2,790	4
Washington DC	870	1,500	140	240	2,750	5
Detroit MI	710	1,140	110	170	2,130	6
Houston TX	670	910	100	140	1,820	7
Boston MA	360	1,020	60	160	1,600	8
Seattle-Everett WA	500	650	80	110	1,340	9
Philadelphia PA	480	650	70	100	1,300	10
Dallas TX	400	670	70	100	1,240	11
Atlanta GA	500	540	70	80	1,190	12
San Bernardino-Riv CA	410	470	70	70	1,020	13
Miami FL	400	480	60	70	1,010	14
San Jose CA	350	420	60	70	900	15
Phoenix AZ	400	340	60	50	850	16
San Diego CA	410	280	60	50	800	17
Baltimore MD	210	390	40	60	700	18
Denver CO	290	300	50	50	690	19
St. Louis MO	230	270	30	40	570	20
Pittsburgh PA	190	280	30	40	540	21
Minn-St. Paul MN	230	220	40	30	520	22
Fort Worth TX	150	260	20	40	470	23
Portland OR	130	210	20	30	390	24
Ft. Lauderdale FL	130	180	20	30	360	25
Norfolk VA	100	190	20	30	340	27
Sacramento CA	160	130	30	20	340	27
San Antonio TX	130	150	20	20	320	28
Cleveland OH	140	120	20	20	300	30
New Orleans LA	110	150	20	20	300	30
Honolulu HI	100	150	20	30	300	30
Jacksonville FL	110	130	20	20	280	32
Cincinnati OH	120	100	20	20	260	33
Columbus OH	110	100	20	10	240	34
Tampa FL	90	110	10	20	230	35
Austin TX	90	100	10	20	220	37
Milwaukee WI	90	100	10	20	220	37
Orlando FL	80	90	10	20	200	38
Kansas City MO	50	120	10	10	190	39
Nashville TN	70	80	10	10	170	40
Hartford CT	50	90	10	10	160	42
Charlotte NC	70	70	10	10	160	42
Louisville KY	50	60	10	10	130	43
Memphis TN	50	50	10	10	120	44
Oklahoma City OK	50	50	0	10	110	45
Albuquerque NM	40	50	0	10	100	46
Salt Lake City UT	40	40	10	0	90	48
Indianapolis IN	40	40	0	10	90	48
El Paso TX	30	30	0	10	70	49
Corpus Christi TX	10	10	0	0	20	50
Northeastern Avg	630	1,150	100	180	2,060	
Midwestern Avg	240	300	40	50	630	
Southern Avg	150	190	20	30	390	
Southwestern Avg	210	260	30	40	540	
Western Avg	720	850	120	140	1,820	
Texas Avg	210	300	30	50	590	
Total Avg	360	480	60	80	970	
Maximum Value	3,350	4,100	540	660	8,440	
Minimum Value	10	10	0	0	20	

Source: TTI Analysis and Local Transportation Agency References

APPENDIX B

DEVELOPMENT OF THE URBAN AREAWIDE CONGESTION MEASUREMENT METHODOLOGY

(Reprinted from TTI Research Report 1131-3)

Previous research (1-8) on areawide mobility levels in Texas resulted in a methodology to compare urban roadway congestion levels. This section summarizes the purpose, data base, analysis procedure, and major findings of that research effort and an FHWA research report on urban freeway congestion.

Purpose of Congestion Measurement Techniques

Transportation professionals and the general public are increasingly aware of the traffic congestion levels experienced in major cities. This interest resulted in research to develop a procedure that would allow quantitative comparisons of urbanized areawide traffic volumes and roadway length. Obviously, a procedure that utilizes generally available data would be more desirable than one which required new or more extensive data collection.

Previous Urban Mobility Comparison Studies

Lack of comparable and significant urban travel data has hampered the analysis of congestion levels on a national basis. The amount of roadway system performance statistics collected and reported by local and state agencies varies significantly across the nation. Differences in roadway functional classification terminology have resulted in significant variations between major and minor arterial street facility length. The Highway Performance Monitoring System (HPMS) data base (13) compiled by FHWA since 1980 was used as the basic source of data for this analysis. Local planning and transportation agencies and state departments of transportation (DOT) were also contacted to obtain relevant data and provide local review.

HPMS data is submitted to FHWA by state DOTs and includes information on state and locally maintained roadway systems. This should give a more accurate representation of the urbanized area roadway condition than information that could be developed from a single organization. The differences in functional classification and the amount of data used to update the database each year varies in each state. Locally developed planning data were, therefore, used to provide another source of information concerning the urban roadway system.

The boundary chosen for inclusion in a mobility analysis is also significant. City or county jurisdictions vary in the percentage of urbanized area included and the density of development. State laws pertaining to municipal incorporation and the time and manner in which the area developed also have a substantial impact on land use patterns.

In conducting the initial relative mobility studies, data availability proved to be the largest problem. Consistent data that allowed an accurate comparative assessment of urban congestion are not available from any agency or group of agencies. Data collected in several ways by many sources were acquired. In the opinion of the research staff and reviewers of the research report, however, the quantitative measures used in the studies (1-8) did provide a reasonably accurate measure of overall urban mobility. The general nature of the mobility assessment and the variety of data sources, as well as the experience of the reviewing agencies, combined to provide analysis results consistent with the accuracy level desired.

Comparability of the measures was achieved using several estimates of both travel and area statistics. For example, in defining urbanized area, it was not always possible to use jurisdictional limits as the defining boundaries due to either lack of data on related travel measures or non-comparability of information. County boundaries may appear to provide consistency, but variations in county size, as well as percentage of urbanization, significantly impaired the utility of county-based data. This study uses a population density of more than 1,000 persons per square kilometer as the criterion for urbanized area delineation.

A 1986 FHWA research report entitled, "Quantification of Urban Freeway Congestion and Analysis of Remedial Measures" (16) utilized the HPMS data base to develop detailed estimates of congestion due to recurring delay (usual, high traffic volumes) and incident delay. Freeway systems in the 37 Metropolitan Statistical Areas (MSAs) with populations greater than one million were analyzed for travel delay and excess fuel consumption. The study ranked the urbanized areas according to a congestion severity index (total delay per million vehicle-kilometers of travel) for 1984 and 2005. The future values were derived from the traffic volume growth estimates in HPMS and applied to the existing roadway system to illustrate the effect a construction moratorium would have on the systems.

The 1984 FHWA rankings are compared to those developed within this report. It should be noted that the FHWA report (16) focused on relatively detailed estimates of urbanized area freeway delay for large MSAs, while this project analyzed planning level estimates of delay, fuel, and insurance costs for freeways and principal arterial streets. While not directly comparable, these studies should illustrate areas of concern to transportation planners.

Study Design

The urbanized area traffic volume level that was consistent with desirable overall mobility was determined using data derived from the Houston area. During the late 1960s and early 1970s, citizens in Houston enjoyed one of the best transportation systems in the nation. Peak-hour speed on most facilities was reasonable, and congestion did not extend for a significant period beyond either peak hour. By 1980, however, Houston had acquired, and probably deserved, a reputation as one of the most congested cities in the country. At some point, transportation mobility had declined from desirable to undesirable.

The initial focus of the 1982 research effort (1) was to develop an estimate of the initial point at which mobility levels could be described as undesirable. Having estimated this point, the measures of mobility levels associated with that time could be assumed to be representative of undesirable congestion levels.

Houston's Experience with Declining Mobility

The Houston data detailing the increase in congestion were analyzed to provide a basis for quantitative indicators of mobility decline. The rapid increase in congestion on Houston area freeways and arterial streets during the 1970s emphasized the need for actions to restore and maintain good mobility.

The disparity between increases in freeway lane-kilometers and freeway travel during the 1970s in Houston is quantified in Table B-1 and Figure B-1. The rate of new freeway construction in the 1970s was one-sixth that of the 1960s, while daily freeway VKT increased at approximately

the same rate throughout the 20-year period (2). Vehicle registration, population, and traffic volume counts were thoroughly analyzed and also indicated the shift from relatively good mobility to relatively poor mobility in only a few years.

Table B-1. City of Houston Growth Trends, 1950 to 1985

Year	Annual Average Population (1000)	Annual Average Vehicles (1000)	Freeway Travel in VKT per Day[1] (1000)	Freeway Capacity (lane-kilometers)	Daily VKT per Freeway Lane-Km
1950	595[2]	240	322	40	8,400
1955	690[2]	375	998	161	6,200
1960	940[2]	480	1,682	298	5,600
1965	1,085	625	5,514	733	7,500
1970	1,235	775	11,785	1,224	9,600
1975	1,440	1,000	18,298	1,449	12,700
1980	1,610	1,270	26,259	1,546	17,000
1985	1,730	1,450	33,166	1,771	18,700
Percent Increase per Year					
1960-70	2.8	4.9	19.6	15.1	5.5
1970-80	2.6	5.1	8.4	2.4	5.9

Notes: [1] VKT--Vehicle-Kilometers of Travel
[2] As of April 1

Source: References 1, 2, 13, 14

Congestion increases were also apparent in the travel delay estimates. Peak-period volume and travel time information were utilized to generate the data in Table B-2 and Figure B-2. Six major radial freeways were evaluated in each of four travel studies conducted by the Houston-Galveston Regional Transportation Study (HGRTS) (17). The dramatic (380 percent) increase in delay between I-610 and Beltway 8 (Figure B-2) from 1969 to 1979 indicates the decline in mobility outside the central city area. The decrease in delay inside I-610 (a major circumferential freeway approximately eight kilometers from downtown) may be attributable to several factors, including the completion of certain freeway sections and the traffic metering effect of I-610. As on most radial freeways, the number of lanes outside Loop 610 is less than that inside the Loop. Volumes, however, are not significantly lower, resulting in greater congestion outside I-610.

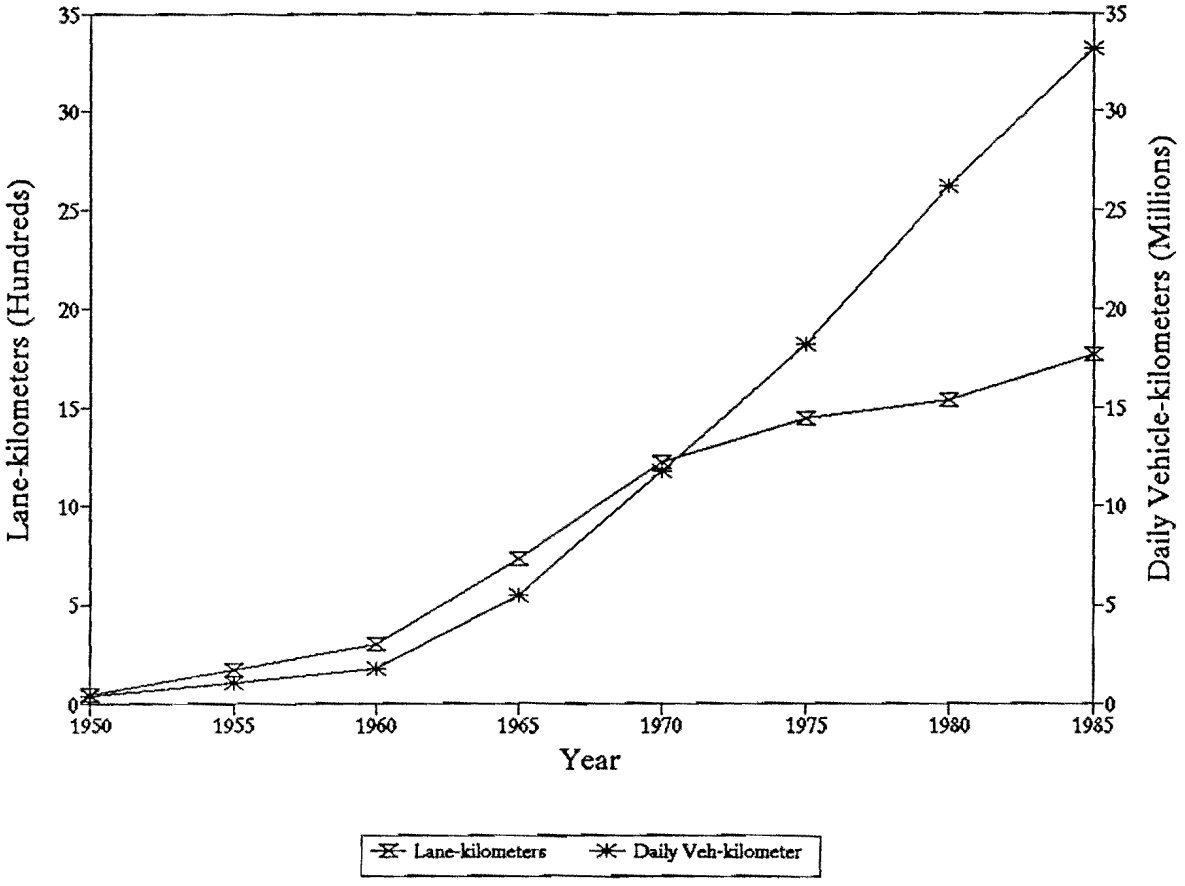

Figure B-1. Freeway Capacity and Travel in Houston, 1950 to 1986

Note: The values presented are averages of the six freeways studied (I-10W, I-10E, US 59S, US 59N, I-45S, I-45N).

Source: References 1, 3

Table B-2. Average Evening Peak-Period Delay by Freeway Segment Per Major Radial Freeway

Year	Inside I-610 (veh-hours)	I-610 to Beltway 8 (veh-hours)	Total (veh-hours)
1969	1,315	390	1,705
1973	1,560	685	2,245
1976	2,110	1,165	3,275
1979	1,830	1,860	3,690
1982	1,480	3,000	4,480
1985	1,615	2,565	4,180

Note: Evening peak period used for analysis was 3:30 to 6:30 P.M.

Source: References 1, 3, 16

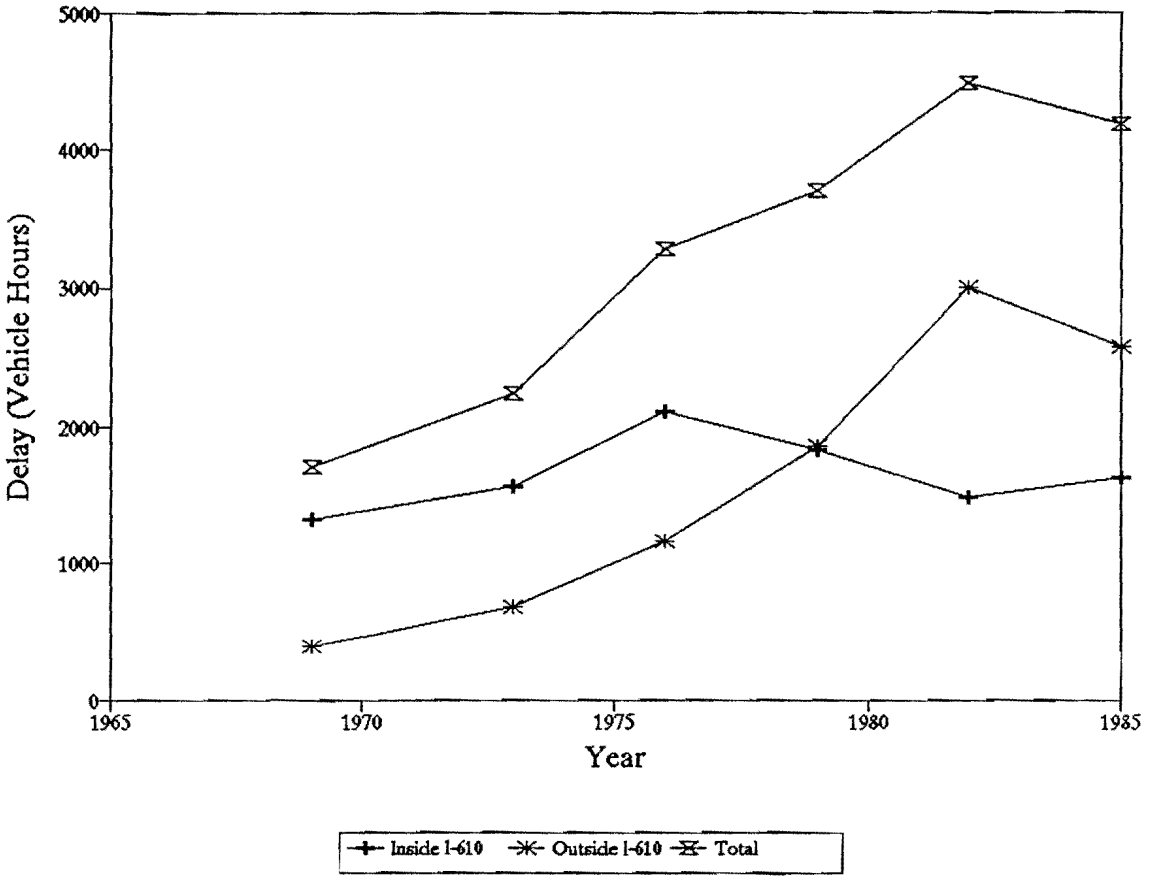

Figure B-2. Delay by Segments for Houston Freeways, P.M. Peak Period

Note: The values presented are averages of the six freeways studied (I-10W, I-10E, US 59S, US 59N, I-45S, I-45N).

Source: References 1, 3, 16

The maximum freeway service flow rate for level-of-service C (LOS C) is 1,550 passenger cars per lane per hour (volume/capacity ratio equal to 0.77) for a 113 kph design speed facility (15). Using average values for k-factor (the percentage of daily traffic volume during the peak hour) and directional distribution, and including some adjustment for trucks, these values can be interpreted to indicate that 15,000 vehicles per lane per day is an estimate of the beginning of level-of-service D operation. (The development of this value is consistent with the planning level analysis methodology presented in this report.)

The use of the boundary between level-of-service C and D as the beginning of congestion is consistent with reports by the Department of Transportation to Congress on the status of highways in the United States (19) (congestion begins at a volume/capacity ratio of 0.8) and the AASHTO Policy on Geometric Design of Highways and Streets (19) (urban freeways and streets should be designed for level-of-service C). While the use of a single number tends to mask the myriad of factors used in roadway capacity analyses, the level of accuracy of the data base, and the planning nature of the ultimate use of the results of this methodology are compatible with this approach.

Figure B-3 quantifies the increase in congested freeway lane-kilometers in Harris County between 1965 and 1985. Although it is not known what percentage of the freeway system exceeding 15,000 vehicles per lane per day (operating at LOS D or worse in the peak hour) is an "acceptable" measure, it can be assumed that the 10 percent value in 1970 did not suggest county-wide deficiencies; however, the 45 percent in 1980 would appear to suggest that such deficiencies did exist.

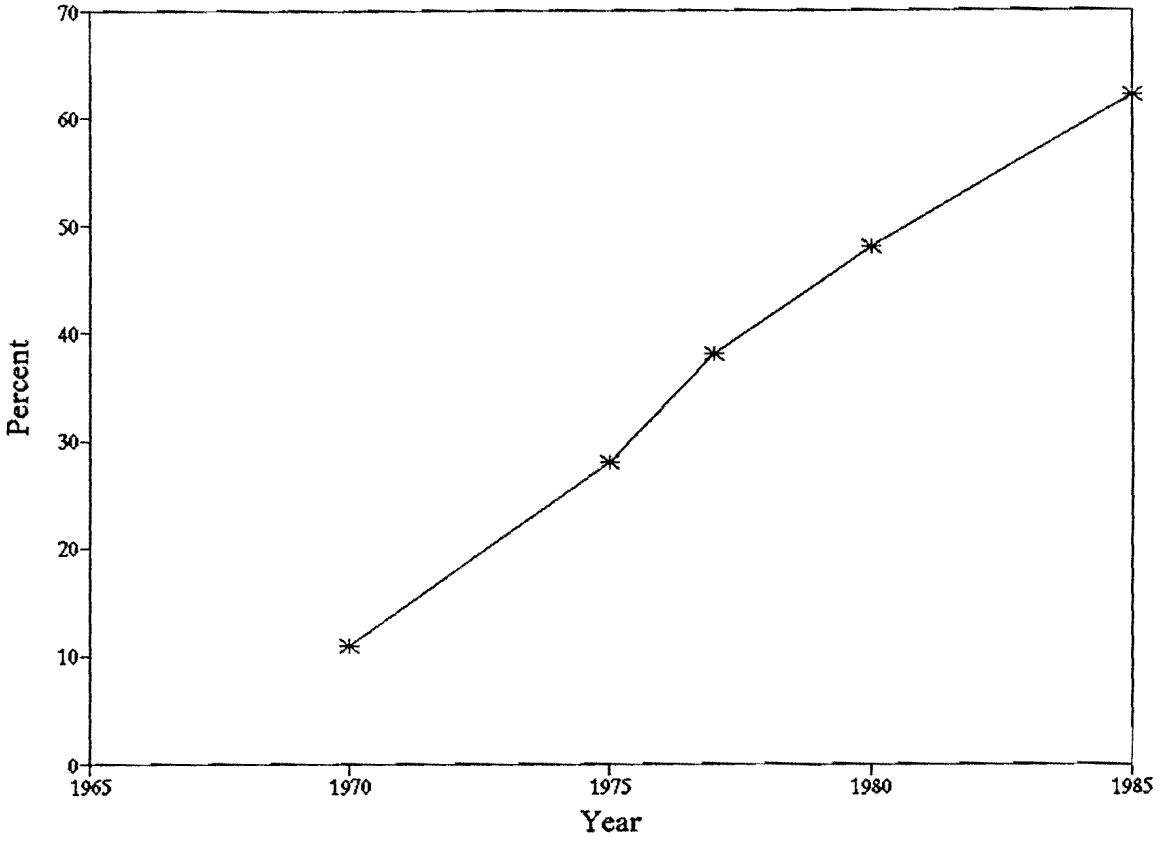

Figure B-3. Percent of Freeway Lane-kilometers with more than 15,000 ADT for Harris County (Houston), 1970 to 1985

Source: 1, 3, 17

The data available to the study team did not allow the determination of a specific date at which Houston's traffic problems became critical. For purposes of the overall analysis, however, this was not required. Prior to 1975, mobility in Houston could be characterized as "reasonably good." Peak-period speeds on freeways and major arterials were fairly high, and traffic delay was not a major concern. By the late 1970s, however, peak-period travel delay had doubled from 1970 levels, and volume per lane values reflected two or more hours of congested operation during both the morning and evening peak periods. Congested freeway lane-kilometers in Harris County (Figure B-2) increased from 10 percent in 1970 to 40 percent in 1978. When rural areas of Harris County were subtracted from the analysis, the 1978 congested urban freeway system length approached 50 percent.

Congestion Indicator Determination

The data on mobility decline for Houston indicated that an "unacceptable" level of transportation service was reached somewhere in the 1975-1976 time frame. That assumption allowed quantitative measures of impending congestion problems to be developed and compared for the major urbanized areas of Texas. The following factors, listed in apparent order of reliability and usefulness, represent guidelines that can be used to determine if congestion in an urbanized area is becoming critical.

Traffic Per Lane

As shown previously, 15,000 vehicles per lane per day for freeways can be interpreted to represent the beginning of LOS D operation. Once traffic volume has entered that range, congestion is becoming critical. As a measure of approaching congestion, the 13,000 vehicles per lane per day value used by the Federal Highway Administration in the highway needs estimate (20) and by the Texas Department of Highways and Public Transportation in their Project Development Process (21) would appear to represent a more appropriate value. That standard also was attained on an average urbanized area basis in Houston during the period (1975-76) when mobility was becoming unacceptable.

The corresponding measure for urban arterial streets would appear to be approximately 5,000 vehicles per lane per day. This value was not reached in Houston until 1979-80, but the design of the Houston area principal arterial street system would not accommodate traffic volumes representative of congestion in other urbanized areas. An inconsistent arterial system with respect to both the number of lanes and continuous roadway length, reduced the levels of traffic volume necessary to cause undesirable congestion. This value is also in general agreement with values presented in the Highway Capacity Manual (16).

- Urbanized Area Average Traffic Volume
  - Freeway: 13,000 daily vehicle-kilometers of travel per lane-kilometer
  - Principal Arterial Street: 5,000 daily vehicle-kilometers of travel per lane-kilometer

Roadway Congestion Index

Combining the freeway and principal arterial street traffic volume per lane values into one indicator (Equation B-1) generates a value to compare the major mobility providing roadways of each urbanized area. Weighing the vehicle-kilometers of travel (VKT) per lane values by the amount of VKT in each functional class provides flexibility in applying the formula to areas with very different freeway and street travel characteristics. The congestion levels are normalized, with a value of 1.0 representing the beginning of undesirable mobility levels.

$$\textit{Roadway Congestion Index} = \frac{\dfrac{\textit{Freeway}}{\textit{VKT/Ln.-Km.}} \times \dfrac{\textit{Freeway}}{\textit{VKT}} + \dfrac{\textit{Prin Art Str}}{\textit{VKT/Ln.-Km.}} \times \dfrac{\textit{PrinArtStr}}{\textit{VKT}}}{13{,}000 \times \dfrac{\textit{Freeway}}{\textit{VKT}} + 5{,}000 \times \dfrac{\textit{PrinArtStr}}{\textit{VKT}}} \qquad \text{Eq. B-1}$$

Percentage of Congested Freeway

The percentage of the freeway system operating under congested conditions (15,000 vehicles per lane per day or more) was determined to be another description of congestion and mobility levels. Those data for the Houston area were presented previously (Figure B-3). From that information, using the 1975-76 time frame, it appears that once 30 percent of the lane-kilometers are operating at or above 15,000 vehicles per day, mobility has become significantly impaired.

- Percentage of Freeway System with ADT Greater than 15,000 Per Lane: 30 percent.

Summary

These measures are only some of the variables examined during the assessment of possible mobility indicators (2). While all of the measures have limitations due to the reliability and accuracy of the data base, the three indicators below are illustrative of urban travel conditions:

- Urbanized Area traffic volumes,
- Roadway Congestion Index, and
- Percentage of freeway system with ADT per lane greater than 15,000.

These factors are also available without any new data collection requirements, which allows the use of historical traffic data collected during the usual urban planning process. A single variable may not be indicative of the traffic congestion in an urbanized area, but if all of the measures are examined, the relative mobility levels should become apparent. The analysis in the following section used the indicators to assess relative mobility levels in the study areas.

APPENDIX C

CONGESTION CLASSIFICATION AND COST ESTIMATES

Relationship Between Travel Demand and Urban Area Population

In previous reports (4,5,6,7,8), reference was made to relationships of DVKT and facility lane-kilometers to urban area population and size. The relationship between travel demand, lane-kilometers, and population indicates on what facilities motorists place the highest demand, while the relationship between DVKT, facility lane-kilometers, and area size indicates the density of both the freeway and principal arterial street systems.

Tables C-1 and C-2 show the relationship between travel, facility length, urban area population, and size. In both tables, the urban areas are ranked by DVKT and facility lane-kilometers per person. Comparison of the summary statistics of these tables indicates:

- The DVKT per person value shows each geographic region studied depends on the freeway system for service of the majority of travel demand;
- The freeway systems in the Texas region and the principal arterial street systems in the Southern region are the most dense across the regions; and
- The greatest travel per capita occurs on the freeways in the Western region and on the principal arterial street system in the Southern region.

Tables C-3 through C-13 show the congestion information for the freeways and principal arterial street travel for 1982 through 1992.

Table C-1. Summary of Freeway Travel Frequency and Urban Population Statistics for 1992

Urban Area	Population (1000)	Urban Area (sq. km.)	Population Density Person/sq km	DVKT[1] per Person	Rank[3]	Lane Km[2] per 1000 Persons	Rank[3]
Northeastern Cities							
Baltimore MD	2,040	1,680	1,210	13.89	21	1.06	26
Boston MA	2,960	2,770	1,070	11.91	31	0.82	14
Hartford CT	620	950	650	17.68	9	1.58	49
New York NY	16,950	8,420	2,010	7.94	44	0.58	6
Philadelphia PA	5,000	3,600	1,390	6.25	50	0.52	1
Pittsburgh PA	1,880	2,120	880	7.84	46	0.97	19
Washington DC	3,290	2,400	1,370	13.44	24	0.79	11
Midwestern Cities							
Chicago IL	7,520	5,150	1,460	8.40	43	0.52	1
Cincinnati OH	1,220	1,630	750	15.71	16	1.21	38
Cleveland OH	1,790	1,710	1,050	12.74	26	1.06	26
Columbus OH	950	910	1,050	16.04	14	1.37	44
Detroit MI	4,000	3,340	1,200	11.51	32	0.74	9
Indianapolis IN	960	1,150	830	14.02	20	1.30	41
Kansas City MO	1,200	1,640	730	18.39	4	1.90	50
Louisville KY	820	1,000	820	12.90	25	1.19	36
Milwaukee WI	1,230	1,420	860	10.26	36	0.79	11
Minn-St. Paul MN	2,110	3,080	680	14.49	19	1.16	35
Oklahoma City OK	750	1,350	550	15.78	15	1.56	48
St. Louis MO	1,990	1,920	1,040	15.36	17	1.38	45
Southern Cities							
Atlanta GA	2,280	4,400	520	18.76	2	1.24	39
Charlotte NC	500	750	670	10.30	35	0.98	22
Ft. Lauderdale FL	1,290	1,130	1,140	9.71	39	0.82	14
Jacksonville FL	760	1,400	540	12.19	28	0.97	19
Memphis TN	880	1,130	780	9.21	41	0.81	13
Miami FL	1,920	1,270	1,510	7.86	45	0.53	3
Nashville TN	590	1,420	410	16.37	12	1.50	47
New Orleans LA	1,100	930	1,180	7.39	49	0.55	4
Norfolk VA	970	2,110	460	9.79	38	0.93	18
Orlando FL	880	1,070	820	11.08	33	1.09	30
Tampa FL	720	1,170	610	8.55	42	0.69	7
Southwestern Cities							
Albuquerque NM	530	670	780	7.66	48	0.71	8
Austin TX	570	950	600	16.10	13	1.30	41
Corpus Christi TX	290	470	610	9.47	40	1.06	26
Dallas TX	2,080	3,760	550	18.97	1	1.35	43
Denver CO	1,600	2,330	690	12.57	27	0.97	19
El Paso TX	570	540	1,040	9.97	37	1.01	24
Fort Worth TX	1,200	2,200	550	17.18	10	1.42	46
Houston TX	2,910	4,250	690	16.87	11	1.14	34
Phoenix AZ	2,020	2,720	740	7.76	47	0.56	5
Salt Lake City UT	860	1,230	700	10.82	34	0.98	22
San Antonio TX	1,190	1,270	930	13.49	23	1.19	36
Western Cities							
Honolulu HI	690	470	1,470	11.96	30	0.89	17
Los Angeles CA	11,850	5,780	2,050	15.21	18	0.74	9
Portland OR	1,060	1,100	960	12.11	29	0.87	16
Sacramento CA	1,190	990	1,200	13.69	22	1.08	29
San Bernardino-Riv CA	1,300	1,320	980	18.71	3	1.13	32
San Diego CA	2,480	1,890	1,310	18.05	5	1.13	32
San Fran-Oak CA	3,810	2,330	1,630	17.90	6	1.03	25
San Jose CA	1,510	1,190	1,260	17.76	7	1.29	40
Seattle-Everett WA	1,840	1,890	970	17.74	8	1.11	31
Northeastern Avg	4,670	3,130	1,230	11.28		0.90	
Midwestern Avg	2,040	2,030	920	13.80		1.18	
Southern Avg	1,080	1,530	790	11.02		0.92	
Southwestern Avg	1,250	1,850	720	12.81		1.06	
Western Avg	2,860	1,880	1,320	15.90		1.03	
Texas Avg	1,260	1,920	710	14.58		1.21	
Total Avg	2,170	2,010	960	12.99		1.03	
Maximum Value	16,950	8,420	2,050	18.97		1.90	
Minimum Value	290	470	410	6.25		0.52	

Notes: [1] Daily vehicle-kilometers of travel per person.
[2] Lane-kilometers per 1000 persons.
[3] Rank value of 1 associated with most congested condition.

Source: TTI Analysis and Local Transportation Agency References

Table C-2. Principal Arterial Street Travel Frequency and Population Density Statistics for 1992

Urban Area	Population (1000)	Urban Area (sq. km.)	Population Density Person/sq km	DVKT[1] per Person	Rank[3]	Lane Km[2] per 1000 Persons	Rank[3]
Northeastern Cities							
Baltimore MD	2,040	1,680	1,210	7.81	27	1.32	21
Boston MA	2,960	2,770	1,070	7.07	30	1.55	31
Hartford CT	620	950	650	10.05	13	1.72	37
New York NY	16,950	8,420	2,010	5.25	47	0.72	2
Philadelphia PA	5,000	3,600	1,390	6.97	32	1.05	11
Pittsburgh PA	1,880	2,120	880	9.53	15	1.59	34
Washington DC	3,290	2,400	1,370	9.06	19	1.14	15
Midwestern Cities							
Chicago IL	7,520	5,150	1,460	7.02	31	1.00	8
Cincinnati OH	1,220	1,630	750	5.94	43	1.09	13
Cleveland OH	1,790	1,710	1,050	5.67	46	1.03	9
Columbus OH	950	910	1,050	6.05	41	1.08	12
Detroit MI	4,000	3,340	1,200	9.87	14	1.72	37
Indianapolis IN	960	1,150	830	7.16	28	1.50	28
Kansas City MO	1,200	1,640	730	6.57	35	1.47	26
Louisville KY	820	1,000	820	6.57	35	1.03	9
Milwaukee WI	1,230	1,420	860	6.81	33	1.38	23
Minn-St. Paul MN	2,110	3,080	680	5.18	48	0.89	4
Oklahoma City OK	750	1,350	550	8.58	21	1.56	32
St. Louis MO	1,990	1,920	1,040	10.13	12	1.53	29
Southern Cities							
Atlanta GA	2,280	4,400	520	7.08	29	1.14	15
Charlotte NC	500	750	670	10.30	11	1.87	40
Ft. Lauderdale FL	1,290	1,130	1,140	7.95	25	1.43	25
Jacksonville FL	760	1,400	540	13.02	6	2.70	50
Memphis TN	880	1,130	780	9.16	18	1.79	39
Miami FL	1,920	1,270	1,510	14.09	3	1.87	40
Nashville TN	590	1,420	410	15.01	1	2.62	48
New Orleans LA	1,100	930	1,180	6.15	40	0.97	6
Norfolk VA	970	2,110	460	7.97	24	1.26	19
Orlando FL	880	1,070	820	8.87	20	2.00	43
Tampa FL	720	1,170	610	10.47	9	1.58	33
Southwestern Cities							
Albuquerque NM	530	670	780	13.19	5	2.37	45
Austin TX	570	950	600	6.26	38	1.27	20
Corpus Christi TX	290	470	610	9.24	17	2.11	44
Dallas TX	2,080	3,760	550	6.62	34	1.35	22
Denver CO	1,600	2,330	690	11.08	8	1.87	40
El Paso TX	570	540	1,040	9.47	16	2.43	46
Fort Worth TX	1,200	2,200	550	5.83	45	1.21	17
Houston TX	2,910	4,250	690	6.17	39	1.21	17
Phoenix AZ	2,020	2,720	740	14.41	2	2.64	49
Salt Lake City UT	860	1,230	700	4.81	49	0.79	3
San Antonio TX	1,190	1,270	930	8.07	23	1.53	29
Western Cities							
Honolulu HI	690	470	1,470	4.11	50	0.55	1
Los Angeles CA	11,850	5,780	2,050	11.21	7	1.71	36
Portland OR	1,060	1,100	960	5.94	43	0.92	5
Sacramento CA	1,190	990	1,200	10.47	9	1.67	35
San Bernardino-Riv CA	1,300	1,320	980	13.31	4	2.61	47
San Diego CA	2,480	1,890	1,310	6.30	37	1.13	14
San Fran-Oak CA	3,810	2,330	1,630	6.01	42	0.98	7
San Jose CA	1,510	1,190	1,260	7.92	26	1.48	27
Seattle-Everett WA	1,840	1,890	970	8.58	21	1.42	24
Northeastern Avg	4,670	3,130	1,230	7.96		1.30	
Midwestern Avg	2,040	2,030	920	7.13		1.27	
Southern Avg	1,080	1,530	790	10.01		1.75	
Southwestern Avg	1,250	1,850	720	8.65		1.71	
Western Avg	2,860	1,880	1,320	8.20		1.38	
Texas Avg	1,260	1,920	710	7.38		1.59	
Total Avg	2,170	2,010	960	8.41		1.50	
Maximum Value	16,950	8,420	2,050	15.01		2.70	
Minimum Value	290	470	410	4.11		0.55	

Notes: [1] Daily vehicle-kilometers of travel per person.
[2] Lane-kilometers per 1000 persons.
[3] Rank value of 1 associated with most congested condition.

Source: TTI Analysis and Local Transportation Agency References

Table C-3. Percent of Congested DVKT by AADT Congestion Ranges for 1982

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	14	6	0	20	4	7	14	25
Boston MA	4	10	16	30	11	6	18	35
Hartford CT	9	1	0	10	7	10	3	20
New York NY	28	10	17	55	22	29	24	75
Philadelphia PA	8	4	8	20	17	10	43	70
Pittsburgh PA	15	0	0	15	20	13	17	50
Washington DC	38	10	12	60	9	25	46	80
Midwestern Cities								
Chicago IL	9	15	26	50	15	21	24	60
Cincinnati OH	19	0	1	20	9	7	4	20
Cleveland OH	20	0	0	20	20	0	0	20
Columbus OH	6	12	7	25	6	16	8	30
Detroit MI	17	13	10	40	25	9	26	60
Indianapolis IN	5	0	0	5	4	9	2	15
Kansas City MO	4	1	0	5	8	5	7	20
Louisville KY	3	2	0	5	14	32	4	50
Milwaukee WI	10	10	0	20	6	18	6	30
Minn-St. Paul MN	13	7	0	20	10	14	16	40
Oklahoma City OK	3	2	0	5	3	9	21	33
St. Louis MO	9	11	0	20	25	10	30	65
Southern Cities								
Atlanta GA	16	20	4	40	18	24	18	60
Charlotte NC	20	0	0	20	23	21	1	45
Ft. Lauderdale FL	9	4	7	20	27	14	4	45
Jacksonville FL	25	0	0	25	7	7	21	35
Memphis TN	8	2	0	10	14	12	4	30
Miami FL	7	28	10	45	2	10	48	60
Nashville TN	5	12	3	20	6	23	6	35
New Orleans LA	37	3	0	40	13	5	27	45
Norfolk VA	32	2	1	35	0	9	21	30
Orlando FL	25	0	0	25	3	5	12	20
Tampa FL	3	8	9	20	12	20	28	60
Southwestern Cities								
Albuquerque NM	5	0	0	5	16	14	5	35
Austin TX	15	25	10	50	6	26	8	40
Corpus Christi TX	5	0	0	5	3	3	4	10
Dallas TX	9	5	31	45	8	17	0	25
Denver CO	30	13	2	45	26	3	21	50
El Paso TX	15	0	0	15	1	4	0	5
Fort Worth TX	9	3	18	30	10	8	7	25
Houston TX	2	9	54	65	18	3	29	50
Phoenix AZ	44	6	0	50	30	17	18	65
Salt Lake City UT	4	4	2	10	17	2	16	35
San Antonio TX	21	7	7	35	4	1	0	5
Western Cities								
Honolulu HI	4	13	23	40	19	19	27	65
Los Angeles CA	17	19	39	75	8	22	5	35
Portland OR	16	4	10	30	33	6	21	60
Sacramento CA	25	0	0	25	16	12	12	40
San Bernardino-Riv CA	60	0	0	60	50	0	0	50
San Diego CA	23	12	0	35	25	0	0	25
San Fran-Oak CA	18	12	35	65	35	3	22	60
San Jose CA	7	18	20	45	37	2	1	40
Seattle-Everett WA	23	9	8	40	9	21	20	50

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-4. Percent of Congested DVKT by AADT Congestion Ranges for 1983

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	16	4	0	20	2	6	17	25
Boston MA	6	9	15	30	6	11	18	35
Hartford CT	9	1	0	10	11	10	4	25
New York NY	20	20	15	55	19	27	29	75
Philadelphia PA	9	3	8	20	25	18	27	70
Pittsburgh PA	9	6	0	15	19	16	20	55
Washington DC	22	27	11	60	9	13	58	80
Midwestern Cities								
Chicago IL	14	18	18	50	16	24	25	65
Cincinnati OH	16	3	1	20	9	8	3	20
Cleveland OH	20	0	0	20	20	0	0	20
Columbus OH	8	11	6	25	24	7	4	35
Detroit MI	12	12	11	35	24	7	24	55
Indianapolis IN	5	0	0	5	6	6	3	15
Kansas City MO	2	3	0	5	11	1	8	20
Louisville KY	1	2	2	5	10	35	5	50
Milwaukee WI	11	9	0	20	5	21	4	30
Minn-St. Paul MN	10	8	2	20	5	21	14	40
Oklahoma City OK	3	2	0	5	3	9	21	33
St. Louis MO	7	13	0	20	26	14	25	65
Southern Cities								
Atlanta GA	16	19	5	40	13	27	20	60
Charlotte NC	20	0	0	20	29	7	14	50
Ft. Lauderdale FL	10	4	6	20	25	15	5	45
Jacksonville FL	25	0	0	25	9	16	10	35
Memphis TN	10	0	0	10	14	13	3	30
Miami FL	19	12	14	45	9	22	29	60
Nashville TN	11	2	7	20	5	17	13	35
New Orleans LA	25	12	3	40	19	3	23	45
Norfolk VA	32	2	1	35	0	8	22	30
Orlando FL	25	0	0	25	5	2	13	20
Tampa FL	3	5	12	20	10	18	32	60
Southwestern Cities								
Albuquerque NM	5	0	0	5	27	6	7	40
Austin TX	13	28	9	50	7	26	7	40
Corpus Christi TX	5	0	0	5	2	3	5	10
Dallas TX	13	5	32	50	4	18	3	25
Denver CO	18	19	8	45	17	12	21	50
El Paso TX	15	0	0	15	2	3	0	5
Fort Worth TX	9	3	23	35	13	5	7	25
Houston TX	13	10	42	65	12	5	33	50
Phoenix AZ	48	7	0	55	34	15	16	65
Salt Lake City UT	1	9	0	10	8	5	22	35
San Antonio TX	21	7	7	35	4	1	5	10
Western Cities								
Honolulu HI	1	10	29	40	20	16	29	65
Los Angeles CA	16	15	49	80	12	6	17	35
Portland OR	20	4	6	30	29	7	24	60
Sacramento CA	25	0	0	25	16	12	12	40
San Bernardino-Riv CA	60	0	0	60	50	0	0	50
San Diego CA	25	10	0	35	22	3	0	25
San Fran-Oak CA	12	21	37	70	17	18	25	60
San Jose CA	3	9	38	50	37	2	1	40
Seattle-Everett WA	13	23	9	45	13	15	27	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-5. Percent of Congested DVKT by AADT Congestion Ranges for 1984

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	15	8	2	25	3	7	20	30
Boston MA	11	7	17	35	6	8	21	35
Hartford CT	8	2	0	10	7	10	8	25
New York NY	32	8	15	55	25	33	17	75
Philadelphia PA	10	4	6	20	14	25	31	70
Pittsburgh PA	8	3	4	15	18	12	25	55
Washington DC	20	31	14	65	12	15	53	80
Midwestern Cities								
Chicago IL	8	12	35	55	15	16	34	65
Cincinnati OH	11	7	2	20	7	8	5	20
Cleveland OH	20	5	0	25	20	0	0	20
Columbus OH	7	7	11	25	22	10	3	35
Detroit MI	13	13	14	40	12	18	30	60
Indianapolis IN	5	0	0	5	5	5	5	15
Kansas City MO	2	2	1	5	11	1	8	20
Louisville KY	1	2	2	5	22	25	3	50
Milwaukee WI	13	12	0	25	13	18	4	35
Minn-St. Paul MN	11	5	4	20	7	14	24	45
Oklahoma City OK	3	2	0	5	4	11	25	40
St. Louis MO	10	5	5	20	20	10	35	65
Southern Cities								
Atlanta GA	22	18	5	45	24	21	20	65
Charlotte NC	20	0	0	20	29	9	12	50
Ft. Lauderdale FL	8	5	7	20	17	14	14	45
Jacksonville FL	19	6	0	25	11	8	21	40
Memphis TN	6	4	0	10	13	11	6	30
Miami FL	18	12	15	45	15	4	41	60
Nashville TN	10	10	0	20	5	12	23	40
New Orleans LA	7	14	24	45	12	6	32	50
Norfolk VA	10	24	1	35	0	9	21	30
Orlando FL	20	2	3	25	3	8	14	25
Tampa FL	1	5	14	20	15	19	31	65
Southwestern Cities								
Albuquerque NM	4	1	0	5	22	16	7	45
Austin TX	15	22	13	50	10	27	8	45
Corpus Christi TX	5	0	0	5	2	5	3	10
Dallas TX	17	7	26	50	14	6	10	30
Denver CO	4	27	14	45	12	6	32	50
El Paso TX	15	0	0	15	3	2	0	5
Fort Worth TX	12	5	18	35	14	6	10	30
Houston TX	12	12	46	70	11	6	38	55
Phoenix AZ	48	12	0	60	34	15	16	65
Salt Lake City UT	6	4	0	10	20	7	13	40
San Antonio TX	17	7	11	35	2	1	7	10
Western Cities								
Honolulu HI	3	9	33	45	15	15	35	65
Los Angeles CA	16	16	48	80	11	5	24	40
Portland OR	20	5	5	30	37	5	18	60
Sacramento CA	18	7	0	25	17	16	12	45
San Bernardino-Riv CA	29	31	0	60	33	17	0	50
San Diego CA	12	14	9	35	24	6	0	30
San Fran-Oak CA	5	21	49	75	6	18	36	60
San Jose CA	7	3	40	50	33	5	7	45
Seattle-Everett WA	15	17	18	50	11	19	25	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-6. Percent of Congested DVKT by AADT Congestion Ranges for 1985

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	14	5	6	25	4	6	25	35
Boston MA	15	5	15	35	6	7	22	35
Hartford CT	8	2	0	10	6	10	9	25
New York NY	20	21	14	55	21	19	35	75
Philadelphia PA	18	3	4	25	8	27	40	75
Pittsburgh PA	5	3	7	15	21	26	13	60
Washington DC	33	12	20	65	10	24	46	80
Midwestern Cities								
Chicago IL	5	9	41	55	17	8	45	70
Cincinnati OH	9	8	3	20	6	13	6	25
Cleveland OH	17	6	2	25	20	0	0	20
Columbus OH	9	7	9	25	19	13	3	35
Detroit MI	11	11	13	35	6	11	38	55
Indianapolis IN	5	0	0	5	3	5	7	15
Kansas City MO	2	1	2	5	11	3	6	20
Louisville KY	0	1	4	5	6	39	5	50
Milwaukee WI	10	15	0	25	3	24	8	35
Minn-St. Paul MN	6	6	8	20	11	14	20	45
Oklahoma City OK	3	2	0	5	4	11	25	40
St. Louis MO	5	12	3	20	16	14	35	65
Southern Cities								
Atlanta GA	23	19	8	50	19	22	24	65
Charlotte NC	20	5	0	25	32	2	21	55
Ft. Lauderdale FL	8	5	7	20	12	22	16	50
Jacksonville FL	22	8	0	30	12	10	18	40
Memphis TN	8	2	0	10	14	9	7	30
Miami FL	28	5	17	50	11	3	56	70
Nashville TN	8	7	0	15	8	13	19	40
New Orleans LA	9	14	22	45	10	5	35	50
Norfolk VA	5	34	1	40	7	2	21	30
Orlando FL	18	0	7	25	6	6	13	25
Tampa FL	3	5	12	20	14	10	41	65
Southwestern Cities								
Albuquerque NM	6	4	0	10	21	10	9	40
Austin TX	20	18	17	55	8	23	14	45
Corpus Christi TX	5	0	0	5	2	6	2	10
Dallas TX	20	10	20	50	15	7	8	30
Denver CO	15	15	15	45	22	11	17	50
El Paso TX	20	0	0	20	3	2	0	5
Fort Worth TX	14	7	14	35	15	7	8	30
Houston TX	13	9	48	70	9	5	41	55
Phoenix AZ	49	16	0	65	31	20	19	70
Salt Lake City UT	5	2	3	10	23	5	12	40
San Antonio TX	15	6	19	40	6	2	7	15
Western Cities								
Honolulu HI	8	6	31	45	22	17	31	70
Los Angeles CA	14	17	49	80	8	11	26	45
Portland OR	16	10	4	30	36	11	13	60
Sacramento CA	24	3	3	30	14	10	21	45
San Bernardino-Riv CA	43	17	0	60	28	19	8	55
San Diego CA	13	5	17	35	22	8	0	30
San Fran-Oak CA	6	15	54	75	8	16	36	60
San Jose CA	9	5	41	55	27	13	10	50
Seattle-Everett WA	20	11	19	50	12	11	32	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-7. Percent of Congested DVKT by AADT Congestion Ranges for 1986

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	15	7	3	25	5	8	22	35
Boston MA	12	8	20	40	7	6	22	35
Hartford CT	5	3	2	10	3	13	9	25
New York NY	23	22	10	55	22	9	44	75
Philadelphia PA	18	3	4	25	14	13	48	75
Pittsburgh PA	4	7	9	20	21	20	19	60
Washington DC	25	24	16	65	13	20	47	80
Midwestern Cities								
Chicago IL	4	8	43	55	12	10	48	70
Cincinnati OH	11	7	2	20	9	7	9	25
Cleveland OH	17	6	2	25	12	8	0	20
Columbus OH	7	11	7	25	18	11	11	40
Detroit MI	13	11	16	40	4	7	50	60
Indianapolis IN	5	0	0	5	6	3	6	15
Kansas City MO	3	0	2	5	7	7	6	20
Louisville KY	2	1	2	5	7	30	13	50
Milwaukee WI	6	17	2	25	1	24	10	35
Minn-St. Paul MN	10	10	25	25	11	7	33	50
Oklahoma City OK	3	2	0	5	4	11	25	40
St. Louis MO	11	7	2	20	18	17	30	65
Southern Cities								
Atlanta GA	18	20	12	50	16	22	27	65
Charlotte NC	23	2	0	25	6	30	19	55
Ft. Lauderdale FL	15	5	5	25	6	14	30	50
Jacksonville FL	28	2	0	30	18	8	14	40
Memphis TN	10	0	0	10	21	6	8	35
Miami FL	21	11	18	50	12	22	36	70
Nashville TN	9	6	0	15	7	11	22	40
New Orleans LA	12	15	23	50	6	4	40	50
Norfolk VA	16	9	20	45	3	4	23	30
Orlando FL	22	2	6	30	1	9	15	25
Tampa FL	4	9	7	20	11	20	34	65
Southwestern Cities								
Albuquerque NM	3	6	1	10	25	8	7	40
Austin TX	19	14	22	55	9	11	25	45
Corpus Christi TX	10	0	0	10	2	5	3	10
Dallas TX	7	13	35	55	15	10	5	30
Denver CO	17	15	18	50	25	10	15	50
El Paso TX	15	5	0	20	3	2	0	5
Fort Worth TX	5	10	25	40	15	10	5	30
Houston TX	8	15	52	75	12	8	35	55
Phoenix AZ	11	39	20	70	31	13	26	70
Salt Lake City UT	3	5	2	10	30	4	11	45
San Antonio TX	6	6	28	40	6	3	6	15
Western Cities								
Honolulu HI	11	6	28	45	23	16	31	70
Los Angeles CA	6	12	62	80	9	9	32	50
Portland OR	12	15	3	30	29	20	11	60
Sacramento CA	22	6	2	30	11	24	10	45
San Bernardino-Riv CA	17	35	13	65	21	17	17	55
San Diego CA	23	4	13	40	13	17	0	30
San Fran-Oak CA	7	6	62	75	13	8	39	60
San Jose CA	4	11	40	55	14	17	24	55
Seattle-Everett WA	18	21	16	55	17	4	34	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-8. Percent of Congested DVKT by AADT Congestion Ranges for 1987

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	15	5	5	25	7	5	23	35
Boston MA	17	10	13	40	8	4	23	35
Hartford CT	5	3	2	10	9	13	8	30
New York NY	20	18	17	55	16	13	46	75
Philadelphia PA	15	7	3	25	13	12	50	75
Pittsburgh PA	3	9	8	20	20	13	27	60
Washington DC	21	25	19	65	13	18	54	85
Midwestern Cities								
Chicago IL	5	12	38	55	14	8	48	70
Cincinnati OH	16	7	2	25	11	6	8	25
Cleveland OH	16	7	2	25	11	14	0	25
Columbus OH	2	10	13	25	14	15	11	40
Detroit MI	13	7	20	40	4	6	50	60
Indianapolis IN	4	1	0	5	6	4	5	15
Kansas City MO	4	0	1	5	6	4	10	20
Louisville KY	2	1	2	5	8	31	16	55
Milwaukee WI	7	14	9	30	9	19	7	35
Minn-St. Paul MN	5	8	17	30	15	6	34	55
Oklahoma City OK	3	2	0	5	0	14	21	35
St. Louis MO	8	7	5	20	23	11	31	65
Southern Cities								
Atlanta GA	13	20	17	50	11	22	32	65
Charlotte NC	24	1	0	25	9	18	28	55
Ft. Lauderdale FL	18	6	6	30	6	17	27	50
Jacksonville FL	20	8	2	30	11	16	18	45
Memphis TN	10	0	0	10	18	8	9	35
Miami FL	21	14	15	50	11	4	55	70
Nashville TN	15	3	2	20	7	6	27	40
New Orleans LA	14	14	22	50	9	2	39	50
Norfolk VA	8	14	23	45	6	8	21	35
Orlando FL	20	2	8	30	3	4	18	25
Tampa FL	7	3	10	20	12	15	38	65
Southwestern Cities								
Albuquerque NM	1	4	5	10	24	10	6	40
Austin TX	22	11	22	55	7	15	23	45
Corpus Christi TX	10	0	0	10	2	5	3	10
Dallas TX	19	11	25	55	14	9	7	30
Denver CO	16	18	16	50	26	12	12	50
El Paso TX	7	13	0	20	3	2	0	5
Fort Worth TX	14	8	18	40	11	12	7	30
Houston TX	12	9	49	70	12	8	30	50
Phoenix AZ	3	25	42	70	32	18	20	70
Salt Lake City UT	4	9	2	15	17	14	9	40
San Antonio TX	6	3	31	40	4	2	9	15
Western Cities								
Honolulu HI	12	6	27	45	36	15	19	70
Los Angeles CA	4	11	65	80	13	12	25	50
Portland OR	17	11	7	35	12	24	24	60
Sacramento CA	16	13	1	30	7	24	14	45
San Bernardino-Riv CA	11	40	14	65	23	15	17	55
San Diego CA	13	19	13	45	5	25	0	30
San Fran-Oak CA	8	4	68	80	9	11	40	60
San Jose CA	7	8	45	60	9	8	38	55
Seattle-Everett WA	24	19	22	65	11	18	26	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-9. Percent of Congested DVKT by AADT Congestion Ranges for 1988

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	12	5	8	25	7	5	23	35
Boston MA	12	13	20	45	9	9	22	40
Hartford CT	6	4	5	15	9	13	8	30
New York NY	22	15	18	55	13	16	51	80
Philadelphia PA	16	7	2	25	11	10	54	75
Pittsburgh PA	10	3	7	20	7	10	43	60
Washington DC	20	27	18	65	9	22	54	85
Midwestern Cities								
Chicago IL	6	12	38	56	15	15	35	65
Cincinnati OH	16	11	3	30	6	7	12	25
Cleveland OH	14	10	1	25	14	13	3	30
Columbus OH	2	10	13	25	6	24	10	40
Detroit MI	11	8	26	45	9	5	46	60
Indianapolis IN	9	1	0	10	12	3	5	20
Kansas City MO	2	1	2	5	9	8	8	25
Louisville KY	2	0	3	5	17	28	10	55
Milwaukee WI	6	11	13	30	12	15	8	35
Minn-St. Paul MN	7	8	15	30	14	8	33	55
Oklahoma City OK	5	5	0	10	1	11	23	35
St. Louis MO	9	3	8	20	14	13	28	55
Southern Cities								
Atlanta GA	9	18	18	45	12	18	35	65
Charlotte NC	21	4	0	25	6	16	38	60
Ft. Lauderdale FL	18	6	6	30	5	20	25	50
Jacksonville FL	28	2	0	30	11	20	14	45
Memphis TN	10	0	0	10	14	8	13	35
Miami FL	14	16	30	60	1	18	51	70
Nashville TN	10	10	5	25	5	6	29	40
New Orleans LA	18	7	25	50	5	2	43	50
Norfolk VA	4	18	23	45	9	10	16	35
Orlando FL	21	2	7	30	4	5	16	25
Tampa FL	10	3	12	25	8	12	45	65
Southwestern Cities								
Albuquerque NM	7	8	5	20	20	11	4	35
Austin TX	20	15	20	55	14	14	17	45
Corpus Christi TX	10	0	0	10	3	6	1	10
Dallas TX	16	9	30	55	15	15	5	35
Denver CO	12	21	17	50	28	12	10	50
El Paso TX	7	13	0	20	3	2	0	5
Fort Worth TX	12	6	22	40	13	13	4	30
Houston TX	11	11	48	70	7	28	15	50
Phoenix AZ	23	9	28	60	16	17	37	70
Salt Lake City UT	8	6	1	15	17	15	8	40
San Antonio TX	8	6	26	40	7	2	11	20
Western Cities								
Honolulu HI	11	11	28	50	32	13	25	70
Los Angeles CA	4	4	67	75	12	11	32	55
Portland OR	18	10	7	35	11	26	23	60
Sacramento CA	14	15	1	30	11	22	17	50
San Bernardino-Riv CA	6	43	16	65	23	16	16	55
San Diego CA	13	10	27	50	5	19	6	30
San Fran-Oak CA	10	5	65	80	9	3	48	60
San Jose CA	10	9	41	60	11	4	45	60
Seattle-Everett WA	22	24	24	70	11	15	29	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-10. Percent of Congested DVKT by AADT Congestion Ranges for 1989

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	6	9	10	25	6	8	21	35
Boston MA	8	16	21	45	7	8	25	40
Hartford CT	6	5	4	15	9	16	10	35
New York NY	26	8	26	60	15	11	54	80
Philadelphia PA	14	7	4	25	14	9	52	75
Pittsburgh PA	12	0	8	20	9	9	42	60
Washington DC	10	29	26	65	8	20	57	85
Midwestern Cities								
Chicago IL	9	8	38	55	13	17	35	65
Cincinnati OH	20	7	3	30	10	3	12	25
Cleveland OH	15	11	4	30	10	13	7	30
Columbus OH	3	10	12	25	6	25	14	45
Detroit MI	11	5	29	45	5	8	47	60
Indianapolis IN	8	2	0	10	13	3	4	20
Kansas City MO	2	1	2	5	8	9	8	25
Louisville KY	2	0	3	5	18	26	11	55
Milwaukee WI	10	9	11	30	12	15	8	35
Minn-St. Paul MN	7	8	15	30	17	6	32	55
Oklahoma City OK	6	4	0	10	7	11	17	35
St. Louis MO	8	4	8	20	8	17	35	60
Southern Cities								
Atlanta GA	8	12	25	45	12	12	41	65
Charlotte NC	25	5	0	30	8	13	39	60
Ft. Lauderdale FL	21	10	4	35	10	18	22	50
Jacksonville FL	27	8	0	35	15	17	18	50
Memphis TN	10	0	0	10	10	14	11	35
Miami FL	12	15	33	60	2	8	60	70
Nashville TN	15	7	3	25	5	5	30	40
New Orleans LA	9	20	21	50	15	3	32	50
Norfolk VA	4	16	25	45	11	5	19	35
Orlando FL	22	2	6	30	1	6	18	25
Tampa FL	8	7	10	25	20	9	36	65
Southwestern Cities								
Albuquerque NM	7	8	5	20	18	11	11	40
Austin TX	20	17	18	55	17	17	11	45
Corpus Christi TX	10	0	0	10	6	3	1	10
Dallas TX	17	14	24	55	13	15	7	35
Denver CO	15	19	16	50	18	14	18	50
El Paso TX	9	11	0	20	2	2	1	5
Fort Worth TX	13	10	17	40	9	12	9	30
Houston TX	7	19	44	70	9	23	18	50
Phoenix AZ	18	8	34	60	18	17	35	70
Salt Lake City UT	6	3	6	15	18	14	8	40
San Antonio TX	6	16	18	40	7	2	11	20
Western Cities								
Honolulu HI	10	10	30	50	28	12	28	70
Los Angeles CA	4	3	68	75	10	15	30	55
Portland OR	16	6	13	35	10	25	25	60
Sacramento CA	14	12	4	30	3	17	30	50
San Bernardino-Riv CA	5	38	22	65	22	21	12	55
San Diego CA	13	8	29	50	4	24	2	30
San Fran-Oak CA	11	5	64	80	6	3	51	60
San Jose CA	9	13	38	60	9	7	44	60
Seattle-Everett WA	9	35	26	70	14	8	33	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-11. Percent of Congested DVKT by AADT Congestion Ranges for 1990

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	6	8	11	25	4	5	26	35
Boston MA	11	15	19	45	8	7	25	40
Hartford CT	5	6	4	15	12	12	11	35
New York NY	28	10	22	60	14	17	49	80
Philadelphia PA	12	6	7	25	13	14	48	75
Pittsburgh PA	4	6	10	20	14	9	37	60
Washington DC	12	20	33	65	6	26	53	85
Midwestern Cities								
Chicago IL	7	11	37	55	16	19	30	65
Cincinnati OH	18	8	4	30	10	3	12	25
Cleveland OH	18	10	2	30	10	10	10	30
Columbus OH	2	12	16	30	8	15	22	45
Detroit MI	11	6	28	45	9	13	43	65
Indianapolis IN	8	1	1	10	13	1	6	20
Kansas City MO	3	2	0	5	5	3	17	25
Louisville KY	3	0	2	5	14	29	12	55
Milwaukee WI	8	10	12	30	12	9	14	35
Minn-St. Paul MN	7	6	17	30	14	4	37	55
Oklahoma City OK	6	4	0	10	9	11	15	35
St. Louis MO	10	2	8	20	13	29	18	60
Southern Cities								
Atlanta GA	6	13	26	45	9	14	42	65
Charlotte NC	25	5	0	30	3	20	37	60
Ft. Lauderdale FL	24	13	3	40	7	19	24	50
Jacksonville FL	27	8	0	35	11	15	24	50
Memphis TN	9	1	0	10	8	15	12	35
Miami FL	18	9	33	60	2	8	60	70
Nashville TN	17	5	3	25	4	9	27	40
New Orleans LA	9	25	16	50	12	10	28	50
Norfolk VA	4	16	25	45	10	9	16	35
Orlando FL	19	5	6	30	1	4	20	25
Tampa FL	5	8	12	25	18	9	38	65
Southwestern Cities								
Albuquerque NM	6	9	5	20	15	20	5	40
Austin TX	18	20	17	55	15	15	15	45
Corpus Christi TX	10	0	0	10	7	2	1	10
Dallas TX	12	16	27	55	16	10	9	35
Denver CO	12	13	25	50	11	14	25	50
El Paso TX	10	9	1	20	2	2	1	5
Fort Worth TX	9	12	19	40	14	8	8	30
Houston TX	6	21	43	70	11	22	17	50
Phoenix AZ	7	32	21	60	26	23	21	70
Salt Lake City UT	7	6	2	15	18	11	11	40
San Antonio TX	6	18	16	40	7	3	10	20
Western Cities								
Honolulu HI	12	13	25	50	28	12	30	70
Los Angeles CA	4	3	68	75	12	19	24	55
Portland OR	16	8	11	35	7	26	27	60
Sacramento CA	15	11	4	30	2	13	35	50
San Bernardino-Riv CA	13	23	34	70	25	17	13	55
San Diego CA	14	13	23	50	8	20	2	30
San Fran-Oak CA	14	8	58	80	4	9	47	60
San Jose CA	12	11	37	60	13	6	41	60
Seattle-Everett WA	11	38	21	70	10	8	37	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-12. Percent of Congested DVKT by AADT Congestion Ranges for 1991

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	6	7	12	25	3	8	24	35
Boston MA	7	16	22	45	11	6	23	40
Hartford CT	6	5	4	15	14	11	10	35
New York NY	28	13	19	60	15	15	50	80
Philadelphia PA	12	5	8	25	11	20	44	75
Pittsburgh PA	4	6	10	20	16	14	30	60
Washington DC	8	22	35	65	7	21	57	85
Midwestern Cities								
Chicago IL	7	9	39	55	15	18	32	65
Cincinnati OH	17	10	3	30	11	5	14	30
Cleveland OH	18	9	3	30	11	10	9	30
Columbus OH	3	12	15	30	9	14	22	45
Detroit MI	10	6	29	45	9	14	42	65
Indianapolis IN	8	1	1	10	14	1	5	20
Kansas City MO	2	2	1	5	4	5	16	25
Louisville KY	3	0	2	5	12	30	13	55
Milwaukee WI	9	11	10	30	11	9	15	35
Minn-St. Paul MN	8	7	15	30	11	6	38	55
Oklahoma City OK	6	4	0	10	8	10	17	35
St. Louis MO	10	2	8	20	12	27	21	60
Southern Cities								
Atlanta GA	4	17	24	45	10	17	38	65
Charlotte NC	30	5	0	35	4	13	43	60
Ft. Lauderdale FL	23	13	4	40	10	17	23	50
Jacksonville FL	25	9	1	35	16	13	21	50
Memphis TN	13	2	0	15	10	14	11	35
Miami FL	20	10	30	60	3	10	57	70
Nashville TN	17	6	2	25	5	10	25	40
New Orleans LA	9	24	16	49	10	12	28	50
Norfolk VA	8	18	19	45	10	9	16	35
Orlando FL	18	5	7	30	2	3	20	25
Tampa FL	4	9	12	25	24	11	37	72
Southwestern Cities								
Albuquerque NM	7	8	5	20	18	18	4	40
Austin TX	19	21	15	55	15	17	13	45
Corpus Christi TX	9	1	0	10	10	3	2	15
Dallas TX	12	14	29	55	15	11	9	35
Denver CO	12	18	25	55	7	15	28	50
El Paso TX	11	8	1	20	2	1	2	5
Fort Worth TX	9	10	21	40	13	9	8	30
Houston TX	8	19	43	70	10	21	19	50
Phoenix AZ	10	30	20	60	27	18	25	70
Salt Lake City UT	8	9	3	20	22	10	8	40
San Antonio TX	5	16	19	40	6	4	10	20
Western Cities								
Honolulu HI	10	13	27	50	26	10	34	70
Los Angeles CA	5	3	67	75	11	16	28	55
Portland OR	16	8	11	35	7	25	28	60
Sacramento CA	15	12	3	30	5	10	35	50
San Bernardino-Riv CA	11	13	46	70	25	17	13	55
San Diego CA	13	13	24	50	7	19	4	30
San Fran-Oak CA	11	13	56	80	6	7	47	60
San Jose CA	12	11	37	60	12	3	45	60
Seattle-Everett WA	8	36	26	70	10	11	34	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Table C-13. Percent of Congested DVKT by AADT Congestion Ranges for 1992

Urban Area	Freeway and Expressway				Principal Arterial Street			
	Moderate	Heavy	Severe	Total	Moderate	Heavy	Severe	Total
Northeastern Cities								
Baltimore MD	8	7	15	30	5	6	24	35
Boston MA	6	14	25	45	12	8	20	40
Hartford CT	4	6	5	15	12	13	10	35
New York NY	21	19	20	60	10	20	55	85
Philadelphia PA	7	5	13	25	11	17	47	75
Pittsburgh PA	5	6	9	20	16	11	33	60
Washington DC	8	20	42	70	14	15	56	85
Midwestern Cities								
Chicago IL	11	7	42	60	13	22	35	70
Cincinnati OH	16	14	5	35	10	7	13	30
Cleveland OH	15	7	8	30	7	16	12	35
Columbus OH	3	9	18	30	11	9	30	50
Detroit MI	9	4	32	45	5	16	44	65
Indianapolis IN	8	1	1	10	15	5	5	25
Kansas City MO	6	1	3	10	9	7	9	25
Louisville KY	2	1	2	5	8	21	31	60
Milwaukee WI	8	9	13	30	11	10	14	35
Minn-St. Paul MN	10	2	18	30	6	12	37	55
Oklahoma City OK	5	5	0	10	9	13	18	40
St. Louis MO	11	6	3	20	15	19	26	60
Southern Cities								
Atlanta GA	5	20	25	50	10	12	43	65
Charlotte NC	19	7	9	35	5	14	41	60
Ft. Lauderdale FL	16	18	6	40	13	17	20	50
Jacksonville FL	13	19	3	35	22	6	22	50
Memphis TN	9	4	2	15	12	14	9	35
Miami FL	21	8	31	60	4	12	49	65
Nashville TN	15	5	5	25	14	16	10	40
New Orleans LA	10	30	10	50	16	12	22	50
Norfolk VA	9	17	14	40	7	9	24	40
Orlando FL	14	6	10	30	1	3	21	25
Tampa FL	4	6	15	25	16	14	36	66
Southwestern Cities								
Albuquerque NM	7	7	6	20	17	12	11	40
Austin TX	19	19	17	55	16	15	14	45
Corpus Christi TX	12	3	0	15	9	5	1	15
Dallas TX	13	17	25	55	16	9	10	35
Denver CO	13	15	27	55	12	10	28	50
El Paso TX	11	11	3	25	3	2	5	10
Fort Worth TX	10	12	18	40	14	8	8	30
Houston TX	10	18	42	70	12	23	15	50
Phoenix AZ	11	9	40	60	21	23	26	70
Salt Lake City UT	6	8	6	20	26	13	6	45
San Antonio TX	6	13	21	40	9	6	10	25
Western Cities								
Honolulu HI	8	15	27	50	16	9	50	75
Los Angeles CA	5	3	67	75	8	20	27	55
Portland OR	13	8	19	40	10	25	25	60
Sacramento CA	13	15	2	30	8	12	30	50
San Bernardino-Riv CA	5	12	53	70	23	14	18	55
San Diego CA	17	11	22	50	6	20	9	35
San Fran-Oak CA	14	12	54	80	6	9	45	60
San Jose CA	12	12	36	60	13	10	37	60
Seattle-Everett WA	8	27	35	70	8	11	36	55

AADT per lane ranges:

	Moderate	Heavy	Severe
Freeway and Expressway	15,000-17,500	17,501-20,000	Over 20,000
Principal Arterial Street	5,750-7,000	7,001-8,500	Over 8,500

Source: TTI Analysis and Local Transportation Agency References

Delay in travel time represents a significant cost to the motoring public. This section attempts to quantify these costs to the drivers in terms of time and fuel. The delay calculations are affected by a number of constants and urbanized area/state specific variables that will be discussed in the following sections.

Cost Estimate Constants

The congestion cost estimate calculations are utilized in the following derived constant values.

1. Occupancy—1.25 persons per vehicle,
2. 250 working days per year,
3. Average cost of time (14)—$10.50 per person hour,[1]
4. Commercial vehicle operating cost (13)—$1.34 per kilometer,
5. Vehicle mix—95 percent passenger and 5 percent commercial, and
6. Vehicular speeds: Table C-14 (17).

These constants were applied to all study areas consistently for the cost estimate calculations.

Table C-14. Congested Daily Vehicle-Kilometers of Travel by Average Annual Daily Traffic per Lane Volumes

Functional Class	Parameters	Uncongested	Congested DVKT[1,2]		
			Moderate	Heavy	Severe
Freeway/Expressway	ADT/Lane	Under 15,000	15,000 - 17,500	17,501 - 20,000	Over 20,000
	Speed (kph)[3]	100	61	53	48
Principal Arterial Streets	ADT/Lane	Under 5,750	5,750 - 7,000	7,001 - 8,500	Over 8,500
	Speed (kph)[3]	60	45	40	37

Note: [1] Assumes congested freeway operation when ADT/Lane exceeds 15,000.
[2] Assumes congested principal arterial street operations when ADT/lane exceeds 5,750.
[3] Moderate, heavy, and severe values represent a "soft" conversion from miles per hour

Source: TTI Analysis and Houston-Galveston Regional Transportation Study (Appendix B)

[1]Referenced value of $8.00/hr in 1985 adjusted with the Consumer Price Index to value used for 1992 wage rate.

Cost Estimate Variables

In addition to the derived constants, five urbanized area/state specific variables were identified and used in the congestion cost estimate calculations. These variables are illustrated in Table C-15.

Daily Vehicle-Kilometers of Travel

The daily vehicle-kilometers of travel (DVKT) is the average daily traffic (ADT) of a section of roadway multiplied by the length (in kilometers) of that section of roadway. This allows the daily volume of all urban facilities to be represented in terms that can be quantified and utilized in cost calculations. DVKT was estimated for the freeways and principal arterial streets located in each study urbanized area. These estimates originate from the HPMS data base and other local transportation data sources and are presented in a previous section of this report.

Fuel Costs

Statewide average fuel cost estimates were obtained from 1992 data published by the American Automobile Association (AAA). These data represent the average reported fuel cost for 1992. Values for different fuel types used in motor vehicles, i.e., diesel and gasoline, did not vary enough to be reported separately. Therefore, an average rate for fuel was used in cost estimate calculations.

Registered Vehicles

The registered vehicle data were obtained from the county Tax Assessor's office in each study area. These data represent the passenger automobiles and light trucks (pick-ups) registered within the study area in 1992.

Table C-15. 1992 Congestion Cost Estimate Variables

Urban Area	Daily VKT		State Average Fuel Cost, ($/liter)	Registered Autos (1000)	Population (1000)	Population per Registered Vehicle
	Freeway (1000)	Prin. Art. St. (1000)				
Northeastern Cities						
Baltimore MD	28,340	15,940	0.37	1,080	2,040	1.90
Boston MA	35,250	20,920	0.36	1,670	2,960	1.77
Hartford CT	10,870	6,180	0.37	530	620	1.16
New York NY	134,440	89,070	0.37	6,100	16,950	2.78
Philadelphia PA	31,220	34,860	0.35	2,820	5,000	1.77
Pittsburgh PA	14,710	17,870	0.35	1,250	1,880	1.50
Washington DC	44,190	29,790	0.37	1,710	3,290	1.92
Midwestern Cities						
Chicago IL	63,110	52,810	0.38	4,050	7,520	1.86
Cincinnati OH	19,180	7,250	0.35	970	1,220	1.26
Cleveland OH	22,800	10,140	0.35	1,500	1,790	1.19
Columbus OH	15,230	5,760	0.35	800	950	1.19
Detroit MI	46,050	39,450	0.35	2,880	4,000	1.39
Indianapolis IN	13,390	6,840	0.34	590	960	1.61
Kansas City MO	22,060	7,870	0.32	770	1,200	1.56
Louisville KY	10,510	5,350	0.34	460	820	1.75
Milwaukee WI	12,610	8,370	0.35	540	1,230	2.27
Minn-St. Paul MN	30,590	10,950	0.35	1,730	2,110	1.22
Oklahoma City OK	11,750	6,390	0.34	490	750	1.51
St. Louis MO	30,480	20,090	0.32	1,030	1,990	1.92
Southern Cities						
Atlanta GA	42,670	16,100	0.33	1,770	2,280	1.28
Charlotte NC	5,150	5,150	0.35	410	500	1.22
Ft. Lauderdale FL	12,480	10,220	0.35	1,040	1,290	1.23
Jacksonville FL	9,270	9,890	0.35	620	760	1.23
Memphis TN	8,100	8,070	0.35	640	880	1.37
Miami FL	15,090	27,050	0.35	1,460	1,920	1.32
Nashville TN	9,660	8,860	0.35	530	590	1.11
New Orleans LA	8,130	6,760	0.36	890	1,100	1.24
Norfolk VA	9,450	7,690	0.36	840	970	1.15
Orlando FL	9,740	7,810	0.35	750	880	1.18
Tampa FL	6,120	7,490	0.35	640	720	1.11
Southwestern Cities						
Albuquerque NM	4,030	6,920	0.35	430	530	1.22
Austin TX	9,100	3,540	0.34	510	570	1.10
Corpus Christi TX	2,700	2,630	0.34	230	290	1.24
Dallas TX	39,450	13,770	0.34	1,640	2,080	1.27
Denver CO	20,130	17,710	0.37	1,400	1,600	1.14
El Paso TX	5,640	5,350	0.34	350	570	1.60
Fort Worth TX	20,610	6,990	0.34	1,000	1,200	1.20
Houston TX	49,110	17,940	0.34	2,260	2,910	1.29
Phoenix AZ	15,700	29,150	0.35	1,290	2,020	1.56
Salt Lake City UT	9,300	4,150	0.37	730	860	1.18
San Antonio TX	16,000	9,560	0.34	880	1,190	1.35
Western Cities						
Honolulu HI	8,190	2,810	0.43	530	690	1.30
Los Angeles CA	180,240	132,830	0.37	7,880	11,850	1.50
Portland OR	12,830	6,300	0.36	700	1,060	1.51
Sacramento CA	16,290	12,450	0.37	1290	1,190	0.93
San Bernardino-Riv CA	24,330	17,310	0.37	800	1,300	1.63
San Diego CA	44,760	15,620	0.37	1,490	2,480	1.67
San Fran-Oak CA	68,100	22,830	0.37	3,120	3,810	1.22
San Jose CA	26,730	11,910	0.37	1,040	1,510	1.45
Seattle-Everett WA	32,640	15,780	0.36	1,330	1,840	1.38
Northeastern Avg	42,710	30,660	0.36	2,160	4,670	1.83
Midwestern Avg	24,810	15,110	0.35	1,320	2,040	1.56
Southern Avg	12,350	10,460	0.35	870	1,080	1.22
Southwestern Avg	17,430	10,700	0.35	980	1,250	1.29
Western Avg	46,010	26,430	0.37	2,020	2,860	1.40
Texas Avg	20,370	8,540	0.34	980	1,260	1.29
Total Avg	26,770	17,330	0.35	1,390	2,170	1.43
Maximum Value	180,240	132,830	0.43	7,880	16,950	2.78
Minimum Value	2,700	2,630	0.32	230	290	0.93

Source: TTI Analysis and Local Transportation Agency References

Population

Population data were obtained from the combination of 1990 U.S. Census Bureau estimates and 1992 population estimates reported in the Federal Highway Administration's Highway Performance Monitoring System (HPMS).

Cost Estimate Calculations

The first step in the cost estimate procedure was to convert DVKT into vehicle-hours of delay. Vehicle-hours of delay is the basis for the delay and fuel cost calculations. To obtain vehicle-hours of delay, vehicle-kilometers of travel on congested roadways during each peak period was estimated. This was accomplished by the use of two factors.

Highway Performance Monitoring System (HPMS) data were used to determine the percentage of urbanized area DVKT occurring on congested facilities. Two functional classes, freeways/expressways and principal arterial streets, were considered in the calculation of this factor. Congested conditions for these facilities were defined by the following ADT per lane values:

- Freeways/Expressways-------ADT per lane greater than 15,000, and
- Principal Arterial Streets--------ADT per lane greater than 5,750.

Using these values, the percentage of DVKT operating in congested conditions could be calculated for each functional class. This percentage adjusts DVKT to congested DVKT, the first step in the process to obtain travel volume that occurs during congested conditions.

The congested daily travel values were adjusted by a factor to represent the percentage of travel occurring in the peak period. This factor was calculated using the Texas Department of Transportation's (TxDOT) 1986 Automatic Traffic Recorder Data (23) for the study areas in Texas. Using these data, the percentage of ADT occurring during the morning and evening peak periods was estimated using these data. These data indicated that a relatively consistent value

of 45 percent of total daily traffic occurred during the peak periods. This factor was applied to all the study areas.

Once the DVKT was converted to peak-period congested vehicle-kilometers of travel (Table C-16), the recurring vehicle-hours of delay were computed (Equation C-1). Recurring delay is caused by the peak facility conditions during normal operations. This value does not include delay resulting from accidents, construction, or maintenance operations.

$$\begin{matrix}\textit{Recurring}\\ \textit{Vehicle-Hours of}\\ \textit{Delay per Day}\end{matrix} = \frac{\textit{Peak-Period Congested DVKT}}{\textit{Avg. Peak-Period Speed}} - \frac{\textit{Peak-Period Congested DVKT}}{\textit{Avg. Off-Peak Speed}} \qquad \text{Eq. C-1}$$

This calculation was performed for both freeways and principal arterial streets in a study area; the total recurring vehicle-hours of delay is the sum of the two. The result of these calculations is shown in Table C-17.

Another type of delay encountered by vehicles is incident delay. This is the delay that results from an accident or disabled vehicle. Incident vehicle-hours of delay vary for each area by facility type, i.e., freeway/expressway or arterial street. For the freeway system in individual study areas, the ratio of recurring to incident delay reported by Lindley (16) were used. The resulting incident delay was calculated using Equation C-2.

$$\begin{matrix}\textit{Frwy Incident}\\ \textit{Vehicle-Hours of Delay}\\ \textit{per Day}\end{matrix} = \begin{matrix}\textit{Peak-Period}\\ \textit{Frwy Vehicle-Hours of Delay}\\ \textit{per Day}\end{matrix} \times \begin{matrix}\textit{Frwy}\\ \textit{Incident/Recurring}\\ \textit{Ratio}\end{matrix} \qquad \text{Eq. C-2}$$

Table C-16. 1992 Congested Daily Vehicle-Kilometers of Travel

Urban Area	Daily Vehicle-Kilometers of Travel		Percent of Peak-Period[1,2] VKT on Congested Roads		Peak Period Congested DVKT[1,3]		
	Freeway (1000)	Prin.Art.St. (1000)	Freeway (%)	Prin.Art.St. (%)	Freeway (1000)	Prin.Art.St. (1000)	Freeway & Prin.Art.St. (1000)
Northeastern Cities							
Baltimore MD	28,340	15,940	30	35	3,830	2,510	6,340
Boston MA	35,250	20,920	45	40	7,140	3,770	10,900
Hartford CT	10,870	6,180	15	35	730	970	1,710
New York NY	134,440	89,070	60	85	36,300	34,070	70,360
Philadelphia PA	31,220	34,860	25	75	3,510	11,760	15,280
Pittsburgh PA	14,710	17,870	20	60	1,320	4,830	6,150
Washington DC	44,190	29,790	70	85	13,920	11,390	25,310
Midwestern Cities							
Chicago IL	63,110	52,810	60	70	17,040	16,630	33,670
Cincinnati OH	19,180	7,250	35	30	3,020	980	4,000
Cleveland OH	22,800	10,140	30	35	3,080	1,600	4,680
Columbus OH	15,230	5,760	30	50	2,060	1,300	3,350
Detroit MI	46,050	39,450	45	65	9,320	11,540	20,860
Indianapolis IN	13,390	6,840	10	25	600	770	1,370
Kansas City MO	22,060	7,870	10	25	990	890	1,880
Louisville KY	10,510	5,350	5	60	240	1,450	1,680
Milwaukee WI	12,610	8,370	30	35	1,700	1,320	3,020
Minn-St. Paul MN	30,590	10,950	30	55	4,130	2,710	6,840
Oklahoma City OK	11,750	6,390	10	40	530	1,150	1,680
St. Louis MO	30,480	20,090	20	60	2,740	5,430	8,170
Southern Cities							
Atlanta GA	42,670	16,100	50	65	9,600	4,710	14,310
Charlotte NC	5,150	5,150	35	60	810	1,390	2,200
Ft. Lauderdale FL	12,480	10,220	40	50	2,250	2,300	4,550
Jacksonville FL	9,270	9,890	35	50	1,460	2,230	3,690
Memphis TN	8,100	8,070	15	35	550	1,270	1,820
Miami FL	15,090	27,050	60	65	4,070	7,910	11,980
Nashville TN	9,660	8,860	25	40	1,090	1,590	2,680
New Orleans LA	8,130	6,760	50	50	1,830	1,520	3,350
Norfolk VA	9,450	7,690	40	40	1,700	1,380	3,080
Orlando FL	9,740	7,810	30	25	1,310	880	2,190
Tampa FL	6,120	7,490	25	65	690	2,190	2,880
Southwestern Cities							
Albuquerque NM	4,030	6,920	20	40	360	1,250	1,610
Austin TX	9,100	3,540	55	45	2,250	720	2,970
Corpus Christi TX	2,700	2,630	15	15	180	180	360
Dallas TX	39,450	13,770	55	35	9,760	2,170	11,930
Denver CO	20,130	17,710	55	50	4,980	3,980	8,970
El Paso TX	5,640	5,350	25	10	630	240	870
Fort Worth TX	20,610	6,990	40	30	3,710	940	4,650
Houston TX	49,110	17,940	70	50	15,470	4,040	19,500
Phoenix AZ	15,700	29,150	60	70	4,240	9,180	13,420
Salt Lake City UT	9,300	4,150	20	45	840	840	1,680
San Antonio TX	16,000	9,560	40	25	2,880	1,080	3,960
Western Cities							
Honolulu HI	8,190	2,810	50	75	1,840	950	2,790
Los Angeles CA	180,240	132,830	75	55	60,830	32,870	93,710
Portland OR	12,830	6,300	40	60	2,310	1,700	4,010
Sacramento CA	16,290	12,450	30	50	2,200	2,800	5,000
San Bernardino-Riv CA	24,330	17,310	70	55	7,660	4,280	11,950
San Diego CA	44,760	15,620	50	35	10,070	2,460	12,530
San Fran-Oak CA	68,100	22,830	80	60	24,520	6,160	30,680
San Jose CA	26,730	11,910	60	60	7,220	3,220	10,430
Seattle-Everett WA	32,640	15,780	70	55	10,280	3,910	14,190
Northeastern Avg	42,710	30,660	38	59	9,540	9,900	19,440
Midwestern Avg	24,810	15,110	26	46	3,790	3,810	7,600
Southern Avg	12,350	10,460	37	50	2,310	2,490	4,790
Southwestern Avg	17,430	10,700	41	38	4,120	2,240	6,360
Western Avg	46,010	26,430	58	56	14,100	6,480	20,590
Texas Avg	20,370	8,540	43	30	4,980	1,340	6,320
Total Avg	26,770	17,330	39	49	6,200	4,510	10,700
Maximum Value	180,240	132,830	80	85	60,830	34,070	93,710
Minimum Value	2,700	2,630	5	10	180	180	360

Notes: [1] Daily vehicle-kilometers of travel.

[2] Represents the percentage of daily vehicle-kilometers of travel on each roadway system during the peak period operating on congested conditions.

[3] Daily vehicle-kilometers of travel multiplied by peak-period vehicle travel and percent of congested DVKT.

Source: TTI Analysis and Local Transportation Agency References

Table C-17. Recurring and Incident Delay Relationships for 1992

Urban Area	Peak Period Congested DVKT[1]			Ratio of Incident[2] Delay to Recurring Delay		Daily Recurring Vehicle[3] Hours of Delay		Total	Daily Incident Vehicle[3] Hours of Delay		Total
	Freeway (1000)	Prin.Art.St. (1000)	Freeway and Prin. Art. St. (1000)	Freeway	Prin.Art.St.	Freeway	Hours of Delay Prin.Art.St.		Freeway	Prin.Art.St.	
Northeastern Cities											
Baltimore MD	3,830	2,510	6,340	2.3	1.1	35,030	19,720	54,750	80,570	21,690	102,270
Boston MA	7,140	3,770	10,900	3.5	1.1	68,670	26,260	94,930	240,350	28,880	269,230
Hartford CT	730	970	1,710	2.7	1.1	6,490	6,340	12,830	17,510	6,970	24,490
New York NY	36,300	34,070	70,360	2.5	1.1	313,550	265,250	578,800	783,890	291,770	1,075,660
Philadelphia PA	3,510	11,760	15,280	2.1	1.1	32,540	90,420	122,960	68,330	99,470	167,800
Pittsburgh PA	1,320	4,830	6,150	2.9	1.1	12,180	34,810	46,990	35,310	38,290	73,600
Washington DC	13,920	11,390	25,310	2.2	1.1	136,370	88,010	224,380	300,020	96,810	396,830
Midwestern Cities											
Chicago IL	17,040	16,630	33,670	1.2	1.1	167,470	121,610	289,090	200,970	133,770	334,740
Cincinnati OH	3,020	980	4,000	0.8	1.1	24,000	6,660	30,670	19,200	7,330	26,530
Cleveland OH	3,080	1,600	4,680	0.7	1.1	24,920	11,030	35,960	17,450	12,140	29,580
Columbus OH	2,060	1,300	3,350	0.7	1.1	20,190	9,660	29,860	14,140	10,630	24,760
Detroit MI	9,320	11,540	20,860	2.2	1.1	91,190	91,720	182,910	200,620	100,890	301,510
Indianapolis IN	600	770	1,370	1.5	1.1	4,350	4,350	8,700	6,530	4,790	11,310
Kansas City MO	990	890	1,880	3.1	1.1	7,760	5,770	13,530	24,060	6,340	30,400
Louisville KY	240	1,450	1,680	1.1	1.1	2,040	10,820	12,860	2,250	11,900	14,150
Milwaukee WI	1,700	1,320	3,020	1.0	1.1	15,400	8,970	24,370	15,400	9,870	25,270
Minn-St. Paul MN	4,130	2,710	6,840	0.9	1.1	38,260	21,500	59,760	34,430	23,650	58,080
Oklahoma City OK	530	1,150	1,680	1.1	1.1	3,980	8,180	12,160	4,380	9,000	13,380
St. Louis MO	2,740	5,430	8,170	1.2	1.1	21,200	37,880	59,070	25,440	41,670	67,100
Southern Cities											
Atlanta GA	9,600	4,710	14,310	1.1	1.1	92,190	36,400	128,590	101,410	40,040	141,450
Charlotte NC	810	1,390	2,200	0.8	1.1	6,520	11,130	17,650	5,210	12,240	17,460
Ft. Lauderdale FL	2,250	2,300	4,550	1.5	1.1	18,290	15,920	34,210	27,430	17,510	44,950
Jacksonville FL	1,460	2,230	3,690	1.5	1.1	11,830	14,560	26,390	17,750	16,010	33,760
Memphis TN	550	1,270	1,820	1.1	1.1	4,070	8,160	12,230	4,480	8,980	13,460
Miami FL	4,070	7,910	11,980	1.5	1.1	36,790	64,950	101,730	55,180	71,440	126,620
Nashville TN	1,090	1,590	2,680	1.1	1.1	8,310	10,190	18,500	9,150	11,210	20,350
New Orleans LA	1,830	1,520	3,350	1.8	1.1	16,040	10,340	26,370	28,870	11,370	40,240
Norfolk VA	1,700	1,380	3,080	2.5	1.1	15,300	10,450	25,750	38,250	11,500	49,750
Orlando FL	1,310	880	2,190	1.5	1.1	10,960	7,390	18,360	16,450	8,130	24,580
Tampa FL	690	2,190	2,880	1.5	1.1	6,630	16,120	22,760	9,950	17,740	27,680

Table C-17. Recurring and Incident Delay Relationships for 1992 (continued)

Urban Area	Peak Period Congested DVKT[1]			Ratio of Incident[2] Delay to Recurring Delay		Daily Recurring Vehicle[3] Hours of Delay			Daily Incident Vehicle[3] Hours of Delay		
	Freeway (1000)	Prin.Art.St. (1000)	Freeway and Prin. Art. St. (1000)	Freeway	Prin.Art.St.	Freeway	Hours of Delay Prin.Art.St.	Total	Freeway	Prin.Art.St.	Total
Southwestern Cities											
Albuquerque NM	360	1,250	1,610	1.1	1.1	3,150	7,730	10,880	3,460	8,500	11,960
Austin TX	2,250	720	2,970	1.1	1.1	19,340	4,630	23,970	21,280	5,090	26,370
Corpus Christi TX	180	180	360	1.1	1.1	1,260	960	2,220	1,390	1,060	2,440
Dallas TX	9,760	2,170	11,930	1.8	1.1	89,840	13,270	103,110	161,710	14,600	176,310
Denver CO	4,980	3,980	8,970	1.0	1.1	45,930	29,150	75,070	45,930	32,060	77,990
El Paso TX	630	240	870	1.1	1.1	5,080	1,660	6,750	5,590	1,830	7,420
Fort Worth TX	3,710	940	4,650	1.8	1.1	34,130	5,780	39,910	61,440	6,350	67,800
Houston TX	15,470	4,040	19,500	1.4	1.1	149,560	27,210	176,760	209,380	29,930	239,310
Phoenix AZ	4,240	9,180	13,420	0.4	1.1	41,170	61,760	102,930	16,470	67,940	84,410
Salt Lake City UT	840	840	1,680	0.6	1.1	7,270	4,590	11,860	4,360	5,050	9,420
San Antonio TX	2,880	1,080	3,960	1.1	1.1	27,280	7,210	34,490	30,010	7,930	37,940
Western Cities											
Honolulu HI	1,840	950	2,790	1.8	1.1	17,660	7,160	24,820	31,790	7,870	39,660
Los Angeles CA	60,830	32,870	93,710	1.2	1.1	635,680	244,900	880,580	762,810	269,390	1,032,210
Portland OR	2,310	1,700	4,010	2.0	1.1	20,890	12,340	33,230	41,770	13,580	55,350
Sacramento CA	2,200	2,800	5,000	0.6	1.1	17,540	21,360	38,890	10,520	23,490	34,010
San Bernardino-Riv CA	7,660	4,280	11,950	1.2	1.1	78,260	27,290	105,550	93,910	30,020	123,930
San Diego CA	10,070	2,460	12,530	0.6	1.1	89,450	16,880	106,320	53,670	18,570	72,230
San Fran-Oak CA	24,520	6,160	30,680	1.3	1.1	239,640	49,880	289,520	311,530	54,870	366,390
San Jose CA	7,220	3,220	10,430	1.2	1.1	68,970	23,960	92,930	82,760	26,350	109,120
Seattle-Everett WA	10,280	3,910	14,190	1.4	1.1	98,460	30,380	128,840	137,840	33,420	171,260
Northeastern Avg	9,540	9,900	19,440	2.6	1.1	86,400	75,830	162,230	218,000	83,410	301,410
Midwestern Avg	3,790	3,810	7,600	1.3	1.1	35,070	28,180	63,240	47,070	31,000	78,070
Southern Avg	2,310	2,490	4,790	1.4	1.1	20,630	18,690	39,320	28,560	20,560	49,120
Southwestern Avg	4,120	2,240	6,360	1.1	1.1	38,550	14,900	53,450	51,000	16,390	67,400
Western Avg	14,100	6,480	20,590	1.3	1.1	140,730	48,240	188,960	169,620	53,060	222,680
Texas Avg	4,980	1,340	6,320	1.3	1.1	46,640	8,670	55,320	70,110	9,540	79,660
Total Avg	6,200	4,510	10,700	1.5	1.1	58,860	33,450	92,320	89,850	36,800	126,650
Maximum Value	60,830	34,070	93,710	3.5	1.1	635,680	265,250	880,580	783,890	291,770	1,075,660
Minimum Value	180	180	360	0.4	1.1	1,260	960	2,220	1,390	1,060	2,440

Notes: [1] Daily vehicle-kilometers of travel. Represents the percentage of Daily Vehicle-Kilometers of travel on each roadway system during the peak period operating in congested conditions.
[2] Percentage of Incident Delay related to Recurring Delay.
[3] Facility delays as calculated by type and urban area.

Source: TTI Analysis and Local Transportation Agency References

An incident will have varying effects on different types of facilities; for the purpose of this study, incident delay for arterial streets is defined as 110 percent of arterial street recurring delay. This incident delay factor was calculated using Equation C-3.

$$\begin{matrix}\textit{Principal Arterial Street Incident} \\ \textit{Vehicle-Hour Delay} \\ \textit{per Day}\end{matrix} = \begin{matrix}\textit{Principal Artrial Street Recurring} \\ \textit{Vehicle-Hour Delay} \\ \textit{per Day}\end{matrix} \times 1.1 \qquad \text{Eq. C-3}$$

The factor of 1.1 is based on the following assumptions as they relate to delay:

1. Arterial street system designs are more consistent from city to city than freeway design;

2. The side streets, drives, median openings, and other appurtenances associated with arterial streets allow numerous opportunities to remove incidents from the travelled way; and

3. Historical data shows the accident rate on arterial streets to be approximately twice that of freeways but, as stated in the second assumption, there is a greater opportunity to remove the incident from the roadway.

Table C-17 shows the results of the freeway and principal arterial street recurring and incident delay calculations.

Prior to calculating the congestion costs, two other variables were calculated to simplify the cost equations. These variables are the average vehicular speed and the average fuel economy for the vehicles operating in congested conditions. The average vehicular speed is a weighted average of the operating speeds on the facility under consideration, and is defined by Equation C-4.

$$\underset{(kph)}{Avg.\ Speed} = \frac{(Frwy speed^{1} x Peak\text{-}Period Frwy VKT) + (Prin.Art. Speed^{1} x Peak\text{-}Period Prin.Art.Str. VKT)}{Total\ Peak\text{-}Period\ VKT} \qquad \text{Eq. C-4}$$

[1] Speeds determined by congestion severity (Table C-1).

Congestion Cost

Two cost components can be associated with congestion: delay cost and fuel cost. These costs can be directly related to the vehicle-hours of delay. Table C-18 is a summary of the cost calculations for the component congestion cost per each urbanized area.

The average fuel economy represents the fuel consumption of the vehicles operating in congested conditions. The equation (Equation C-5) is a linear regression applied to a modified version of fuel consumption reported by Raus (24).

$$\underset{(kph)}{Average\ Fuel\ Economy} = 3.74 + 0.11\ \underset{(kph)}{(Average\ Vehicular\ Speed)} \qquad \text{Eq. C-5}$$

Delay Cost - The delay cost is the cost of lost time due to congested roadways. This cost was calculated by Equation C-6.

$$\underset{Delay Cost}{Annual} = \frac{Vehicle\text{-}Hrs. of Delay}{Day} \times \frac{1.25 person}{Vehicle} \times \frac{\$10.25}{Hour} \times \frac{250 Workdays}{Year} \qquad \text{Eq. C-6}$$

where: vehicle-hours of delay/day is the combined freeway and principal arterial street representing the city's recurring or incident delay.

This equation is used to separately calculate delay costs resulting from both incident and recurring delays.

Table C-18. Component and Total Congestion Costs by Urban Area for 1992

Urban Area	Annual Cost Due to Congestion ($ millions)					Rank
	Recurring Delay	Incident Delay	Recurring Fuel	Incident Fuel	Total	
Los Angeles CA	3,420	4,000	420	490	8,330	1
New York NY	2,260	4,190	280	520	7,250	2
San Fran-Oak CA	1,140	1,430	140	180	2,890	3
Chicago IL	1,120	1,300	140	170	2,730	4
Washington DC	870	1,540	110	190	2,710	5
Detroit MI	710	1,160	80	140	2,090	6
Houston TX	700	940	80	110	1,830	7
Boston MA	370	1,050	40	130	1,590	8
Seattle-Everett WA	500	680	70	80	1,330	9
Dallas TX	410	700	50	80	1,240	11
Philadelphia PA	470	640	60	70	1,240	11
Atlanta GA	500	550	60	60	1,170	12
San Bernardino-Riv CA	410	480	50	60	1,000	13
Miami FL	390	490	50	50	980	14
San Jose CA	360	430	50	50	890	15
Phoenix AZ	400	320	40	40	800	17
San Diego CA	420	290	40	50	800	17
Baltimore MD	210	400	30	50	690	18
Denver CO	300	300	30	40	670	19
St. Louis MO	230	260	20	30	540	20
Pittsburgh PA	180	280	20	30	510	22
Minn-St. Paul MN	230	230	20	30	510	22
Fort Worth TX	160	270	20	30	480	23
Portland OR	130	220	20	20	390	24
Ft. Lauderdale FL	130	180	20	20	350	25
Norfolk VA	100	190	20	20	330	26
Sacramento CA	150	130	20	20	320	27
San Antonio TX	140	140	10	20	310	28
Cleveland OH	140	120	10	20	290	30
Honolulu HI	100	150	20	20	290	30
New Orleans LA	100	160	10	20	290	30
Cincinnati OH	120	110	10	20	260	33
Jacksonville FL	100	130	10	20	260	33
Columbus OH	110	100	10	20	240	34
Austin TX	100	100	10	10	220	35
Milwaukee WI	90	100	10	10	210	37
Tampa FL	90	100	10	10	210	37
Kansas City MO	50	120	10	10	190	39
Orlando FL	70	100	10	10	190	39
Nashville TN	70	80	10	10	170	41
Hartford CT	50	100	10	10	170	41
Charlotte NC	70	70	0	10	160	42
Louisville KY	50	50	0	10	110	44
Memphis TN	50	50	0	10	110	44
Oklahoma City OK	50	50	0	10	110	44
Albuquerque NM	40	50	0	10	100	46
Indianapolis IN	30	50	0	10	90	48
Salt Lake City UT	40	40	0	10	90	48
El Paso TX	30	30	0	10	70	49
Corpus Christi TX	10	10	0	0	20	50
Northeastern Avg	630	1,170	80	140	2,020	
Midwestern Avg	240	300	30	40	610	
Southern Avg	150	190	20	20	380	
Southwestern Avg	210	260	20	30	530	
Western Avg	740	870	90	110	1,800	
Texas Avg	220	310	30	40	600	
Total Avg	360	490	40	60	960	
Maximum Value	3,420	4,190	420	520	8,330	
Minimum Value	10	10	0	0	20	

Source: TTI Analysis and Local Transportation Agency References

Fuel Cost - Fuel cost was also related to vehicle-hours of delay per day and speed by Equation C-7 for passenger vehicles and Equation C-8 for commercial vehicles.

$$\frac{Passenger}{Fuel\,Cost} = \frac{\frac{Vehicle\text{-}Hrs\,of\,Delay}{Day} \times 95\% \times Avg.Speed \times Avg.Fuel\,Cost}{Avg.Fuel\,Economy} \qquad \text{Eq. C-7}$$

$$\frac{Commercial}{Fuel\,Cost} = \frac{\frac{Vehicle\text{-}Hrs\,of\,Delay}{Day} \times 5\% \times Avg.Speed \times Avg.Fuel\,Cost}{Avg.Fuel\,Economy} \qquad \text{Eq. C-8}$$

where: vehicle-hours of delay is the combined value for freeways and principal arterial streets representing either recurring or incident delay.

These calculations were completed for both incident and recurring delay. The respective portions, i.e., incident and recurring, were combined in Equation C-9 to determine the yearly fuel cost due to congestion resulting from incident and recurring delay.

$$\frac{Average\,Urbanized\,Area}{Fuel\,Cost} = (Passenger\,Fuel\,Cost + Commercial\,Fuel\,Cost) \times \frac{250\,Days}{Year} \qquad \text{Eq. C-9}$$

This calculation was done for each study area using the specific area/state fuel cost, peak-period congested VKT, and vehicle-hours of recurring and incident delay per day.

Results of Cost Estimate Calculations

Using the methods and equations discussed in the previous sections, the annual cost for each urbanized area was calculated (Table C-17). Reviewing the component costs of delay and fuel, it is shown that congestion costs associated with delay make up the majority of annual congestion cost.

Table C-19 illustrates the impacts of the component and total congestion cost in terms of per capita and per registered vehicle.

Table C-20 illustrates the categorical ranking of the urban study areas by annual congestion cost, annual cost per capita, and annual cost per registered vehicle.

Table C-19. Estimated Impact of Congestion 1992

Urban Area	Total Congestion Cost	
	Per Registered Vehicle (dollars)	Per Capita (dollars)
Northeastern Cities		
Baltimore MD	640	340
Boston MA	950	540
Hartford CT	310	270
New York NY	1,190	430
Philadelphia PA	440	250
Pittsburgh PA	410	270
Washington DC	1,580	820
Midwestern Cities		
Chicago IL	670	360
Cincinnati OH	260	210
Cleveland OH	190	160
Columbus OH	300	250
Detroit MI	720	520
Indianapolis IN	150	90
Kansas City MO	250	160
Louisville KY	250	140
Milwaukee WI	400	180
Minn-St. Paul MN	300	240
Oklahoma City OK	220	150
St. Louis MO	520	270
Southern Cities		
Atlanta GA	660	520
Charlotte NC	370	300
Ft. Lauderdale FL	330	270
Jacksonville FL	420	340
Memphis TN	170	130
Miami FL	670	510
Southwestern Cities		
Nashville TN	320	290
New Orleans LA	330	270
Norfolk VA	390	340
Orlando FL	250	210
Tampa FL	330	300
Albuquerque NM	230	190
Austin TX	430	400
Corpus Christi TX	90	70
Dallas TX	750	590
Denver CO	480	420
El Paso TX	180	110
Fort Worth TX	480	400
Houston TX	810	630
Phoenix AZ	620	400
Salt Lake City UT	130	110
San Antonio TX	360	270
Western Cities		
Honolulu HI	550	420
Los Angeles CA	1,060	700
Portland OR	560	370
Sacramento CA	250	270
San Bernardino-Riv CA	1,260	770
San Diego CA	540	320
San Fran-Oak CA	930	760
San Jose CA	860	590
Seattle-Everett WA	990	720
Northeastern Avg	790	420
Midwestern Avg	350	230
Southern Avg	390	320
Southwestern Avg	410	330
Western Avg	780	550
Texas Avg	440	350
Total Avg	510	350
Maximum Value	1,580	820
Minimum Value	90	70

Source: TTI Analysis and Local Transportation Agency References

Table C-20. 1992 Rankings of Urban Area by Estimated Impact of Congestion

Urban Area	Total Congestion Cost	Congestion Cost per Capita	Congestion Cost per Registered Vehicle
Northeastern Cities			
Baltimore MD	18	21	15
Boston MA	8	9	6
Hartford CT	41	28	35
New York NY	2	13	3
Philadelphia PA	10	35	23
Pittsburgh PA	21	28	26
Washington DC	5	1	1
Midwestern Cities			
Chicago IL	4	20	12
Cincinnati OH	32	38	38
Cleveland OH	29	42	45
Columbus OH	34	35	36
Detroit MI	6	10	11
Indianapolis IN	47	49	48
Kansas City MO	38	42	39
Louisville KY	43	45	39
Milwaukee WI	35	41	27
Minn-St. Paul MN	22	37	36
Oklahoma City OK	43	44	44
St. Louis MO	20	28	20
Southern Cities			
Atlanta GA	12	10	14
Charlotte NC	42	25	29
Ft. Lauderdale FL	25	28	31
Jacksonville FL	32	21	25
Memphis TN	43	46	47
Miami FL	14	12	12
Nashville TN	40	27	34
New Orleans LA	29	28	31
Norfolk VA	26	21	28
Orlando FL	38	38	39
Tampa FL	35	25	31
Southwestern Cities			
Albuquerque NM	46	40	43
Austin TX	35	16	24
Corpus Christi TX	50	50	50
Dallas TX	10	7	10
Denver CO	19	14	21
El Paso TX	49	47	46
Fort Worth TX	23	16	21
Houston TX	7	6	9
Phoenix AZ	16	16	16
Salt Lake City UT	47	47	49
San Antonio TX	27	28	30
Western Cities			
Honolulu HI	29	14	18
Los Angeles CA	1	5	4
Portland OR	24	19	17
Sacramento CA	27	28	39
San Bernardino-Riv CA	13	2	2
San Diego CA	17	24	19
San Fran-Oak CA	3	3	7
San Jose CA	15	7	8
Seattle-Everett WA	9	4	5

Source: TTI Analysis and Local Transportation Agency References

APPENDIX D

FREEWAY AND PRINCIPAL ARTERIAL STREET TRAVEL AND SYSTEM LENGTH STATISTICS 1982 TO 1992

Table D-1. Summary of Normalized Freeway Travel and Distance Statistics for 1992

Urban Area	Normalized by Population Density							
	VKT per Person	Rank	VKT per Sq Km	Rank	Lane-km per 1000 Persons	Rank	Lane-km per Sq Km	Rank
Northeastern Cities								
Baltimore MD	11.47	33	22.35	21	0.88	36	1.72	23
Boston MA	11.15	35	19.16	31	0.77	38	1.33	36
Hartford CT	27.17	6	28.42	9	2.43	6	2.55	2
New York NY	3.94	50	12.76	44	0.29	50	0.92	45
Philadelphia PA	4.50	49	10.04	50	0.37	46	0.84	50
Pittsburgh PA	8.88	42	12.62	46	1.09	27	1.55	31
Washington DC	9.80	39	21.64	24	0.58	44	1.28	39
Midwestern Cities								
Chicago IL	5.76	47	13.51	43	0.35	48	0.84	49
Cincinnati OH	21.02	13	25.28	16	1.61	14	1.94	13
Cleveland OH	12.16	30	20.48	26	1.01	30	1.71	24
Columbus OH	15.30	22	25.79	14	1.31	22	2.20	7
Detroit MI	9.62	40	18.52	32	0.62	42	1.18	42
Indianapolis IN	16.92	17	22.56	20	1.57	15	2.09	10
Kansas City MO	25.20	8	29.56	4	2.60	3	3.04	1
Louisville KY	15.78	18	20.75	25	1.46	17	1.92	15
Milwaukee WI	11.88	31	16.50	36	0.91	32	1.26	40
Minn-St. Paul MN	21.17	12	23.33	19	1.69	12	1.86	16
Oklahoma City OK	28.52	5	25.38	15	2.82	2	2.51	3
St. Louis MO	14.83	23	24.70	17	1.34	21	2.22	6
Southern Cities								
Atlanta GA	36.30	2	30.17	2	2.40	7	1.99	12
Charlotte NC	15.48	20	16.57	35	1.48	16	1.58	29
Ft. Lauderdale FL	8.51	43	15.62	39	0.72	40	1.31	37
Jacksonville FL	22.43	10	19.62	28	1.78	10	1.55	32
Memphis TN	11.79	32	14.80	41	1.03	28	1.29	38
Miami FL	5.19	48	12.64	45	0.35	49	0.85	48
Nashville TN	39.53	1	26.34	12	3.62	1	2.41	4
New Orleans LA	6.26	46	11.89	49	0.46	45	0.88	47
Norfolk VA	21.41	11	15.75	38	2.04	9	1.51	33
Orlando FL	13.53	28	17.81	33	1.34	20	1.77	21
Tampa FL	13.94	26	13.76	42	1.13	26	1.12	44
Southwestern Cities								
Albuquerque NM	9.83	38	12.34	48	0.91	33	1.13	43
Austin TX	26.94	7	25.90	13	2.18	8	2.11	9
Corpus Christi TX	15.49	19	15.23	40	1.74	11	1.70	25
Dallas TX	34.24	3	30.51	1	2.44	5	2.18	8
Denver CO	18.32	15	20.24	27	1.41	18	1.56	30
El Paso TX	9.59	41	16.05	37	0.98	31	1.63	27
Fort Worth TX	31.52	4	27.63	10	2.60	4	2.27	5
Houston TX	24.63	9	27.15	11	1.67	13	1.85	17
Phoenix AZ	10.44	37	12.49	47	0.76	39	0.90	46
Salt Lake City UT	15.48	21	17.40	34	1.40	19	1.59	28
San Antonio TX	14.45	24	21.72	23	1.28	23	1.93	14
Western Cities								
Honolulu HI	8.14	44	19.25	30	0.60	43	1.42	34
Los Angeles CA	7.42	45	24.48	18	0.36	47	1.18	41
Portland OR	12.57	29	19.47	29	0.90	34	1.40	35
Sacramento CA	11.41	34	22.02	22	0.90	35	1.74	22
San Bernardino-Riv CA	19.01	14	30.11	3	1.15	24	1.81	19
San Diego CA	13.76	27	29.03	5	0.86	37	1.81	18
San Fran-Oak CA	10.97	36	28.79	6	0.63	41	1.65	26
San Jose CA	14.06	25	28.58	7	1.02	29	2.07	11
Seattle-Everett WA	18.23	16	28.54	8	1.14	25	1.79	20
Northeastern Avg	10.99		18.14		0.91		1.45	
Midwestern Avg	16.51		22.20		1.44		1.90	
Southern Avg	17.67		17.72		1.49		1.48	
Southwestern Avg	19.17		20.60		1.58		1.71	
Western Avg	12.84		25.58		0.84		1.65	
Texas Avg	22.41		23.46		1.84		1.95	
Total Avg	15.92		20.90		1.30		1.66	
Maximum Value	39.53		30.51		3.62		3.04	
Minimum Value	3.94		10.04		0.29		0.84	

Source: TTI Analysis and Local Transportation Agency References

Table D-2. Summary of Normalized Principal Arterial Street Travel and System Length Statistics for 1992

Urban Area	Normalized by Population Density							
	VKT per Person	Rank	VKT per Sq Km	Rank	Lane-km per 1000 Persons	Rank	Lane-km per Sq Km	Rank
Northeastern Cities								
Baltimore MD	6.44	38	12.57	27	1.09	38	2.12	30
Boston MA	6.62	36	11.37	30	1.45	29	2.49	20
Hartford CT	15.44	10	16.17	13	2.65	11	2.75	14
New York NY	2.61	50	8.45	47	0.36	50	1.17	49
Philadelphia PA	5.02	45	11.22	32	0.75	46	1.69	40
Pittsburgh PA	10.80	17	15.34	15	1.81	22	2.56	17
Washington DC	6.61	37	14.59	19	0.83	43	1.83	36
Midwestern Cities								
Chicago IL	4.81	46	11.30	31	0.68	47	1.60	43
Cincinnati OH	7.95	31	9.55	43	1.46	27	1.75	38
Cleveland OH	5.41	43	9.12	46	0.98	40	1.65	42
Columbus OH	5.78	41	9.74	41	1.03	39	1.73	39
Detroit MI	8.24	29	15.86	14	1.44	30	2.76	13
Indianapolis IN	8.65	27	11.53	28	1.81	21	2.40	23
Kansas City MO	9.00	23	10.55	36	2.01	20	2.36	25
Louisville KY	8.04	30	10.57	35	1.26	33	1.66	41
Milwaukee WI	7.89	32	10.94	33	1.60	25	2.24	28
Minn-St. Paul MN	7.57	33	8.34	48	1.29	32	1.42	47
Oklahoma City OK	15.51	8	13.79	21	2.82	6	2.49	19
St. Louis MO	9.78	20	16.28	12	1.48	26	2.47	21
Southern Cities								
Atlanta GA	13.71	12	11.38	29	2.21	18	1.84	35
Charlotte NC	15.48	9	16.57	11	2.81	7	3.00	11
Ft. Lauderdale FL	6.97	34	12.80	25	1.26	34	2.31	26
Jacksonville FL	23.97	2	20.94	6	4.98	2	4.36	1
Memphis TN	11.73	15	14.75	18	2.29	16	2.88	12
Miami FL	9.31	21	22.67	3	1.23	35	3.01	10
Nashville TN	36.23	1	24.14	1	6.34	1	4.23	3
New Orleans LA	5.21	44	9.89	40	0.82	45	1.54	45
Norfolk VA	17.43	4	12.82	24	2.75	8	2.01	32
Orlando FL	10.84	16	14.28	20	2.44	14	3.21	8
Tampa FL	17.06	5	16.84	9	2.57	12	2.54	18
Southwestern Cities								
Albuquerque NM	16.91	6	21.22	5	3.04	5	3.80	6
Austin TX	10.48	19	10.09	38	2.13	19	2.04	31
Corpus Christi TX	15.12	11	14.85	17	3.45	4	3.40	7
Dallas TX	11.95	14	10.65	34	2.44	13	2.18	29
Denver CO	16.14	7	17.80	8	2.72	9	3.02	9
El Paso TX	9.11	22	15.24	16	2.34	15	3.92	5
Fort Worth TX	10.69	18	9.37	45	2.22	17	1.94	33
Houston TX	9.00	24	9.91	39	1.76	23	1.94	34
Phoenix AZ	19.38	3	23.19	2	3.55	3	4.24	2
Salt Lake City UT	6.89	35	7.75	49	1.13	37	1.27	48
San Antonio TX	8.64	28	12.98	23	1.64	24	2.46	22
Western Cities								
Honolulu HI	2.79	49	6.59	50	0.37	49	0.89	50
Los Angeles CA	5.46	42	18.04	7	0.83	44	2.74	15
Portland OR	6.17	40	9.55	43	0.95	41	1.47	46
Sacramento CA	8.72	26	16.84	9	1.40	31	2.70	16
San Bernardino-Riv CA	13.53	13	21.42	4	2.65	10	4.19	4
San Diego CA	4.80	47	10.13	37	0.86	42	1.81	37
San Fran-Oak CA	3.68	48	9.65	42	0.60	48	1.58	44
San Jose CA	6.27	39	12.74	26	1.17	36	2.37	24
Seattle-Everett WA	8.82	25	13.79	21	1.46	28	2.29	27
Northeastern Avg	7.65		12.81		1.28		2.09	
Midwestern Avg	8.22		11.47		1.49		2.05	
Southern Avg	15.27		16.10		2.70		2.81	
Southwestern Avg	12.21		13.91		2.40		2.75	
Western Avg	6.69		13.20		1.14		2.23	
Texas Avg	10.71		11.87		2.28		2.56	
Total Avg	10.29		13.52		1.86		2.41	
Maximum Value	36.23		24.14		6.34		4.36	
Minimum Value	2.61		6.59		0.36		0.89	

Source: TTI Analysis

Table D-3. Summary of 1982 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	16,490	1,590	5.0	10,400	0.84
Boston MA	25,610	2,270	5.5	11,280	0.90
Hartford CT	6,960	720	5.0	9,600	0.76
New York NY	101,700	8,440	5.2	12,060	1.01
Philadelphia PA	19,920	2,010	5.0	9,900	1.00
Pittsburgh PA	8,890	1,250	4.1	7,120	0.78
Washington DC	25,900	2,000	4.9	12,970	1.12
Midwestern Cities					
Chicago IL	40,980	3,290	5.4	12,450	1.02
Cincinnati OH	13,660	1,210	5.2	11,310	0.86
Cleveland OH	16,100	1,550	4.6	10,420	0.80
Columbus OH	9,710	1,140	5.6	8,550	0.68
Detroit MI	32,520	2,380	5.7	13,650	1.06
Indianapolis IN	8,470	1,080	5.1	7,850	0.67
Kansas City MO	14,330	1,830	4.0	7,840	0.62
Louisville KY	6,300	690	4.3	9,100	0.78
Milwaukee WI	9,020	870	5.3	10,370	0.83
Minn-St. Paul MN	18,030	1,900	4.4	9,490	0.76
Oklahoma City OK	9,380	1,070	4.9	8,760	0.72
St. Louis MO	19,380	1,950	5.3	9,950	0.83
Southern Cities					
Atlanta GA	25,380	2,200	5.7	11,550	0.91
Charlotte NC	2,840	400	4.0	7,060	0.71
Ft. Lauderdale FL	8,600	840	5.2	10,270	0.87
Jacksonville FL	6,200	550	4.0	11,320	0.91
Memphis TN	4,750	480	5.1	9,830	0.83
Miami FL	9,580	830	5.2	11,550	1.05
Nashville TN	5,230	560	4.3	9,290	0.77
New Orleans LA	6,280	520	5.6	12,000	0.98
Norfolk VA	6,230	660	4.2	9,440	0.79
Orlando FL	6,960	760	4.3	9,190	0.72
Tampa FL	3,190	310	4.7	10,420	0.94
Southwestern Cities					
Albuquerque NM	2,470	310	4.7	8,080	0.78
Austin TX	4,560	430	5.2	10,680	0.84
Corpus Christi TX	2,090	260	5.2	8,130	0.67
Dallas TX	27,160	2,500	5.3	10,880	0.84
Denver CO	13,360	1,280	5.1	10,440	0.88
El Paso TX	4,120	520	4.9	7,880	0.63
Fort Worth TX	13,890	1,460	5.0	9,530	0.76
Houston TX	33,940	2,210	5.9	15,330	1.17
Phoenix AZ	4,590	340	4.8	13,570	1.15
Salt Lake City UT	4,620	640	5.5	7,180	0.63
San Antonio TX	12,240	1,220	4.9	10,000	0.77
Western Cities					
Honolulu HI	5,960	520	5.0	11,380	0.92
Los Angeles CA	121,540	7,330	8.1	16,590	1.22
Portland OR	7,630	710	4.9	10,770	0.87
Sacramento CA	8,530	1,010	6.8	8,410	0.80
San Bernardino-Riv CA	18,870	1,300	6.7	14,470	1.11
San Diego CA	24,270	2,450	7.3	9,920	0.78
San Fran-Oak CA	46,470	3,540	6.7	13,120	1.01
San Jose CA	19,420	1,740	6.2	11,170	0.86
Seattle-Everett WA	19,750	1,620	5.7	12,210	0.95
Northeastern Avg	29,350	2,610	5.0	10,480	0.92
Midwestern Avg	16,490	1,580	5.0	9,980	0.80
Southern Avg	7,750	740	4.8	10,180	0.86
Southwestern Avg	11,190	1,020	5.1	10,150	0.83
Western Avg	30,270	2,250	6.4	12,010	0.95
Texas Avg	14,000	1,230	5.2	10,350	0.81
Total Avg	17,680	1,530	5.2	10,490	0.86
Maximum Value	121,540	8,440	8.1	16,590	1.22
Minimum Value	2,090	260	4.0	7,060	0.62

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-4. Summary of 1982 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	12,040	2,420	3.8	4,990	0.84
Boston MA	20,540	4,150	2.3	4,940	0.90
Hartford CT	3,780	870	3.4	4,350	0.76
New York NY	71,380	10,790	3.4	6,620	1.01
Philadelphia PA	30,590	4,350	2.8	7,040	1.00
Pittsburgh PA	14,260	2,460	2.9	5,810	0.78
Washington DC	21,400	2,820	3.4	7,590	1.12
Midwestern Cities					
Chicago IL	33,670	5,590	3.4	6,030	1.02
Cincinnati OH	4,860	1,250	3.3	3,900	0.86
Cleveland OH	7,240	1,770	2.9	4,090	0.80
Columbus OH	3,680	900	3.2	4,080	0.68
Detroit MI	31,120	5,720	4.3	5,450	1.06
Indianapolis IN	6,070	1,330	3.6	4,570	0.67
Kansas City MO	6,130	1,630	3.4	3,750	0.62
Louisville KY	4,230	790	3.7	5,360	0.78
Milwaukee WI	6,910	1,500	3.0	4,610	0.83
Minn-St. Paul MN	6,920	1,470	3.2	4,730	0.76
Oklahoma City OK	4,430	930	3.0	4,780	0.72
St. Louis MO	14,420	2,700	3.0	5,330	0.83
Southern Cities					
Atlanta GA	10,530	1,960	3.4	5,360	0.91
Charlotte NC	3,780	720	3.0	5,210	0.71
Ft. Lauderdale FL	8,790	1,640	4.2	5,350	0.87
Jacksonville FL	8,240	1,650	3.5	5,000	0.91
Memphis TN	5,310	1,080	4.1	4,930	0.83
Miami FL	19,110	3,020	4.2	6,330	1.05
Nashville TN	5,720	1,270	2.9	4,490	0.77
New Orleans LA	5,310	910	4.0	5,840	0.98
Norfolk VA	5,260	1,070	3.3	4,920	0.79
Orlando FL	5,740	1,470	3.7	3,900	0.72
Tampa FL	5,140	880	3.8	5,850	0.94
Southwestern Cities					
Albuquerque NM	4,600	920	3.5	5,020	0.78
Austin TX	2,570	550	4.0	4,690	0.84
Corpus Christi TX	2,010	500	3.6	4,030	0.67
Dallas TX	10,370	2,500	4.6	4,140	0.84
Denver CO	14,750	2,810	3.6	5,250	0.88
El Paso TX	4,190	1,220	3.9	3,420	0.63
Fort Worth TX	5,890	1,260	3.9	4,660	0.76
Houston TX	15,660	2,870	3.8	5,450	1.17
Phoenix AZ	24,040	3,990	3.3	6,020	1.15
Salt Lake City UT	2,340	450	3.1	5,200	0.63
San Antonio TX	5,680	1,510	3.2	3,750	0.77
Western Cities					
Honolulu HI	2,000	320	3.5	6,200	0.92
Los Angeles CA	92,000	17,650	3.9	5,210	1.22
Portland OR	4,470	830	3.1	5,390	0.87
Sacramento CA	8,040	1,340	3.9	6,020	0.80
San Bernardino-Riv CA	12,360	2,290	4.0	5,410	1.11
San Diego CA	9,870	2,300	3.3	4,290	0.78
San Fran-Oak CA	15,590	2,950	3.7	5,280	1.01
San Jose CA	8,440	1,900	3.9	4,440	0.86
Seattle-Everett WA	11,000	2,160	3.2	5,100	0.95
Northeastern Avg	24,850	3,980	3.1	5,910	0.92
Midwestern Avg	10,810	2,130	3.3	4,720	0.80
Southern Avg	7,540	1,430	3.6	5,200	0.86
Southwestern Avg	8,370	1,690	3.7	4,690	0.83
Western Avg	18,200	3,530	3.6	5,260	0.95
Texas Avg	6,620	1,490	3.9	4,310	0.81
Total Avg	12,850	2,390	3.5	5,080	0.86
Maximum Value	92,000	17,650	4.6	7,590	1.22
Minimum Value	2,000	320	2.3	3,420	0.62

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-5. Summary of 1983 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	16,990	1,650	5.2	10,290	0.84
Boston MA	27,070	2,280	5.5	11,880	0.93
Hartford CT	7,760	810	5.0	9,640	0.79
New York NY	103,430	8,560	5.3	12,090	1.02
Philadelphia PA	21,650	2,040	5.0	10,590	1.03
Pittsburgh PA	9,850	1,370	4.2	7,200	0.76
Washington DC	26,000	2,000	5.0	13,020	1.11
Midwestern Cities					
Chicago IL	41,600	3,310	5.5	12,570	1.02
Cincinnati OH	13,660	1,270	5.2	10,740	0.83
Cleveland OH	16,450	1,550	4.6	10,650	0.82
Columbus OH	10,400	1,160	5.6	8,970	0.71
Detroit MI	31,640	2,380	5.7	13,280	1.03
Indianapolis IN	9,230	1,090	5.1	8,490	0.70
Kansas City MO	14,470	1,870	4.0	7,750	0.62
Louisville KY	7,140	720	4.4	9,860	0.82
Milwaukee WI	9,340	870	5.3	10,740	0.84
Minn-St. Paul MN	19,590	1,900	4.5	10,310	0.81
Oklahoma City OK	9,560	1,090	4.9	8,800	0.72
St. Louis MO	20,990	2,000	5.3	10,510	0.87
Southern Cities					
Atlanta GA	27,380	2,270	6.0	12,060	0.95
Charlotte NC	3,060	410	4.0	7,450	0.76
Ft. Lauderdale FL	8,630	850	5.2	10,210	0.86
Jacksonville FL	6,490	580	4.0	11,190	0.92
Memphis TN	4,830	520	5.1	9,230	0.80
Miami FL	10,090	830	5.2	12,170	1.09
Nashville TN	5,310	560	4.4	9,430	0.79
New Orleans LA	6,440	530	5.6	12,120	1.00
Norfolk VA	6,430	680	4.3	9,510	0.79
Orlando FL	7,260	760	4.3	9,490	0.75
Tampa FL	3,450	310	4.7	11,290	1.01
Southwestern Cities					
Albuquerque NM	2,600	310	4.7	8,500	0.83
Austin TX	5,100	450	5.4	11,320	0.88
Corpus Christi TX	2,210	270	5.2	8,300	0.69
Dallas TX	29,620	2,540	5.3	11,650	0.89
Denver CO	13,590	1,280	5.1	10,620	0.89
El Paso TX	4,330	540	4.9	8,030	0.64
Fort Worth TX	14,860	1,510	5.2	9,870	0.79
Houston TX	36,310	2,270	6.0	16,000	1.21
Phoenix AZ	4,690	370	4.9	12,650	1.13
Salt Lake City UT	4,790	680	5.5	7,080	0.63
San Antonio TX	12,820	1,250	4.9	10,280	0.79
Western Cities					
Honolulu HI	6,030	520	5.0	11,520	0.94
Los Angeles CA	127,740	7,450	8.1	17,140	1.27
Portland OR	8,650	770	4.9	11,200	0.90
Sacramento CA	9,340	1,010	6.8	9,210	0.84
San Bernardino-Riv CA	19,080	1,310	6.7	14,540	1.12
San Diego CA	26,520	2,500	7.3	10,630	0.83
San Fran-Oak CA	48,300	3,560	6.7	13,570	1.05
San Jose CA	20,050	1,760	6.2	11,370	0.88
Seattle-Everett WA	21,080	1,670	5.7	12,650	0.99
Northeastern Avg	30,390	2,670	5.0	10,670	0.93
Midwestern Avg	17,010	1,600	5.0	10,220	0.82
Southern Avg	8,120	750	4.8	10,380	0.88
Southwestern Avg	11,900	1,040	5.2	10,390	0.85
Western Avg	31,870	2,280	6.4	12,430	0.98
Texas Avg	15,040	1,260	5.3	10,780	0.84
Total Avg	18,480	1,560	5.3	10,750	0.88
Maximum Value	127,740	8,560	8.1	17,140	1.27
Minimum Value	2,210	270	4.0	7,080	0.62

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-6. Summary of 1983 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	12,530	2,440	3.8	5,140	0.84
Boston MA	20,910	4,190	2.3	5,000	0.93
Hartford CT	4,530	890	3.4	5,070	0.79
New York NY	74,140	10,950	3.4	6,770	1.02
Philadelphia PA	31,430	4,440	2.8	7,070	1.03
Pittsburgh PA	14,390	2,550	3.0	5,640	0.76
Washington DC	21,410	2,930	3.5	7,310	1.11
Midwestern Cities					
Chicago IL	34,780	5,780	3.4	6,020	1.02
Cincinnati OH	5,100	1,250	3.3	4,080	0.83
Cleveland OH	7,290	1,770	2.9	4,110	0.82
Columbus OH	3,980	920	3.2	4,330	0.71
Detroit MI	30,450	5,750	4.3	5,300	1.03
Indianapolis IN	5,990	1,340	3.6	4,480	0.70
Kansas City MO	6,210	1,630	3.4	3,800	0.62
Louisville KY	4,380	800	3.7	5,490	0.82
Milwaukee WI	6,890	1,510	3.0	4,550	0.84
Minn-St. Paul MN	7,160	1,480	3.2	4,840	0.81
Oklahoma City OK	4,670	970	3.0	4,790	0.72
St. Louis MO	14,950	2,700	3.0	5,530	0.87
Southern Cities					
Atlanta GA	11,330	2,080	3.4	5,460	0.95
Charlotte NC	4,120	740	3.0	5,570	0.76
Ft. Lauderdale FL	8,690	1,670	4.2	5,190	0.86
Jacksonville FL	8,890	1,740	3.5	5,110	0.92
Memphis TN	5,470	1,090	4.1	5,000	0.80
Miami FL	19,800	3,060	4.2	6,470	1.09
Nashville TN	6,110	1,300	3.0	4,690	0.79
New Orleans LA	5,510	910	4.0	6,060	1.00
Norfolk VA	5,320	1,080	3.3	4,930	0.79
Orlando FL	5,960	1,500	3.7	3,980	0.75
Tampa FL	5,420	880	3.8	6,170	1.01
Southwestern Cities		930			
Albuquerque NM	4,960		3.5	5,360	0.83
Austin TX	2,750	580	4.0	4,750	0.88
Corpus Christi TX	2,090	510	3.6	4,130	0.69
Dallas TX	11,330	2,570	4.6	4,410	0.89
Denver CO	15,130	2,870	3.6	5,270	0.89
El Paso TX	4,360	1,260	3.9	3,470	0.64
Fort Worth TX	6,190	1,290	3.9	4,810	0.79
Houston TX	16,660	2,970	3.8	5,610	1.21
Phoenix AZ	24,090	4,010	3.4	6,010	1.13
Salt Lake City UT	2,460	470	3.2	5,260	0.63
San Antonio TX	5,930	1,550	3.2	3,820	0.79
Western Cities		320			
Honolulu HI	2,090		3.5	6,500	0.94
Los Angeles CA	96,930	17,870	3.9	5,420	1.27
Portland OR	4,480	830	3.1	5,410	0.90
Sacramento CA	8,370	1,370	3.9	6,120	0.84
San Bernardino-Riv CA	13,300	2,350	4.0	5,660	1.12
San Diego CA	10,450	2,330	3.3	4,480	0.83
San Fran-Oak CA	16,460	2,980	3.7	5,530	1.05
San Jose CA	8,710	1,940	3.9	4,490	0.88
Seattle-Everett WA	11,790	2,200	3.2	5,360	0.99
Northeastern Avg	25,620	4,060	3.2	6,000	0.93
Midwestern Avg	10,990	2,160	3.3	4,780	0.82
Southern Avg	7,880	1,460	3.7	5,330	0.88
Southwestern Avg	8,720	1,730	3.7	4,810	0.85
Western Avg	19,180	3,580	3.6	5,440	0.98
Texas Avg	7,040	1,530	3.9	4,430	0.84
Total Avg	13,330	2,430	3.5	5,200	0.88
Maximum Value	96,930	17,870	4.6	7,310	1.27
Minimum Value	2,090	320	2.3	3,470	0.62

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-7. Summary of 1984 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	17,520	1,710	5.4	10,220	0.85
Boston MA	27,840	2,290	5.5	12,140	0.95
Hartford CT	8,590	830	5.1	10,360	0.86
New York NY	105,160	9,060	5.5	11,600	0.99
Philadelphia PA	21,950	2,040	5.0	10,740	1.04
Pittsburgh PA	10,400	1,390	4.2	7,470	0.76
Washington DC	29,080	2,210	5.2	13,170	1.11
Midwestern Cities					
Chicago IL	43,090	3,340	5.5	12,900	1.05
Cincinnati OH	13,930	1,300	5.3	10,690	0.82
Cleveland OH	16,760	1,550	4.6	10,840	0.83
Columbus OH	10,550	1,180	5.6	8,970	0.71
Detroit MI	33,420	2,400	5.7	13,930	1.07
Indianapolis IN	9,800	1,090	5.1	8,960	0.75
Kansas City MO	15,100	2,010	4.1	7,500	0.60
Louisville KY	7,410	760	4.4	9,790	0.82
Milwaukee WI	9,470	880	5.3	10,790	0.87
Minn-St. Paul MN	20,930	1,980	4.5	10,570	0.84
Oklahoma City OK	9,760	1,090	5.0	8,910	0.75
St. Louis MO	23,200	2,210	5.4	10,520	0.88
Southern Cities					
Atlanta GA	29,150	2,370	6.0	12,270	0.97
Charlotte NC	3,220	430	4.0	7,550	0.76
Ft. Lauderdale FL	8,760	850	5.3	10,260	0.86
Jacksonville FL	7,170	590	4.0	12,210	0.96
Memphis TN	4,850	550	5.1	8,870	0.79
Miami FL	10,420	850	5.3	12,320	1.10
Nashville TN	5,870	600	4.4	9,720	0.83
New Orleans LA	6,680	530	5.6	12,580	1.05
Norfolk VA	6,720	690	4.3	9,710	0.81
Orlando FL	7,490	790	4.4	9,490	0.73
Tampa FL	4,090	350	4.7	11,550	1.03
Southwestern Cities					
Albuquerque NM	2,750	310	4.7	9,000	0.89
Austin TX	5,800	530	5.4	10,910	0.86
Corpus Christi TX	2,190	270	5.2	8,240	0.69
Dallas TX	32,080	2,610	5.7	12,300	0.94
Denver CO	14,070	1,290	5.1	10,930	0.93
El Paso TX	4,510	560	5.0	8,120	0.65
Fort Worth TX	15,590	1,550	5.2	10,040	0.80
Houston TX	39,250	2,380	6.0	16,470	1.25
Phoenix AZ	5,070	450	5.0	11,250	1.10
Salt Lake City UT	4,860	680	5.5	7,190	0.65
San Antonio TX	13,600	1,260	4.9	10,760	0.82
Western Cities					
Honolulu HI	6,220	530	5.0	11,710	0.95
Los Angeles CA	134,250	7,530	8.2	17,820	1.32
Portland OR	8,970	820	4.9	10,920	0.88
Sacramento CA	10,430	1,030	6.9	10,130	0.88
San Bernardino-Riv CA	19,510	1,320	6.8	14,780	1.13
San Diego CA	29,750	2,540	7.3	11,730	0.91
San Fran-Oak CA	51,870	3,560	6.8	14,580	1.12
San Jose CA	21,320	1,800	6.3	11,820	0.91
Seattle-Everett WA	22,400	1,710	5.8	13,070	1.02
Northeastern Avg	31,510	2,790	5.1	10,810	0.94
Midwestern Avg	17,780	1,650	5.0	10,360	0.83
Southern Avg	8,580	780	4.8	10,590	0.90
Southwestern Avg	12,710	1,080	5.2	10,470	0.87
Western Avg	33,860	2,320	6.4	12,950	1.01
Texas Avg	16,150	1,310	5.3	10,980	0.86
Total Avg	19,460	1,610	5.3	10,970	0.90
Maximum Value	134,250	9,060	8.2	17,820	1.32
Minimum Value	2,190	270	4.0	7,190	0.60

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-8. Summary of 1984 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	13,330	2,480	3.8	5,380	0.85
Boston MA	21,170	4,200	2.3	5,040	0.95
Hartford CT	5,020	900	3.5	5,570	0.86
New York NY	74,690	10,950	3.4	6,820	0.99
Philadelphia PA	31,890	4,510	2.8	7,070	1.04
Pittsburgh PA	14,620	2,670	3.0	5,470	0.76
Washington DC	22,350	3,120	3.8	7,150	1.11
Midwestern Cities					
Chicago IL	36,320	5,950	3.5	6,110	1.05
Cincinnati OH	5,190	1,250	3.3	4,160	0.82
Cleveland OH	7,320	1,770	2.9	4,130	0.83
Columbus OH	4,030	940	3.2	4,280	0.71
Detroit MI	30,790	5,800	4.3	5,310	1.07
Indianapolis IN	6,540	1,340	3.7	4,860	0.75
Kansas City MO	6,300	1,640	3.5	3,830	0.60
Louisville KY	4,420	800	3.7	5,550	0.82
Milwaukee WI	7,490	1,510	3.0	4,950	0.87
Minn-St. Paul MN	7,490	1,500	3.2	5,000	0.84
Oklahoma City OK	5,360	1,010	3.0	5,290	0.75
St. Louis MO	15,690	2,750	3.1	5,700	0.88
Southern Cities					
Atlanta GA	12,010	2,150	3.4	5,590	0.97
Charlotte NC	4,200	760	3.0	5,550	0.76
Ft. Lauderdale FL	8,710	1,690	4.3	5,150	0.86
Jacksonville FL	8,920	1,770	3.5	5,040	0.96
Memphis TN	5,660	1,110	4.1	5,090	0.79
Miami FL	20,130	3,100	4.3	6,490	1.10
Nashville TN	6,910	1,370	3.1	5,050	0.83
New Orleans LA	5,810	910	4.1	6,390	1.05
Norfolk VA	5,470	1,090	3.3	5,040	0.81
Orlando FL	5,700	1,560	3.7	3,650	0.73
Tampa FL	5,880	920	3.7	6,410	1.03
Southwestern Cities					
Albuquerque NM	5,430	940	3.5	5,760	0.89
Austin TX	2,940	610	4.0	4,800	0.86
Corpus Christi TX	2,170	520	3.6	4,220	0.69
Dallas TX	12,300	2,660	4.6	4,630	0.94
Denver CO	16,270	2,870	3.7	5,660	0.93
El Paso TX	4,540	1,290	3.9	3,530	0.65
Fort Worth TX	6,460	1,330	3.9	4,870	0.80
Houston TX	17,480	3,090	3.8	5,660	1.25
Phoenix AZ	24,640	4,030	3.4	6,120	1.10
Salt Lake City UT	2,700	480	3.3	5,580	0.65
San Antonio TX	6,310	1,580	3.2	4,000	0.82
Western Cities					
Honolulu HI	2,130	320	3.5	6,600	0.95
Los Angeles CA	102,120	18,110	4.0	5,640	1.32
Portland OR	4,500	830	3.2	5,430	0.88
Sacramento CA	8,730	1,450	4.0	6,020	0.88
San Bernardino-Riv CA	13,930	2,530	4.0	5,510	1.13
San Diego CA	11,410	2,380	3.4	4,790	0.91
San Fran-Oak CA	17,370	3,060	3.8	5,680	1.12
San Jose CA	9,270	1,990	3.9	4,660	0.91
Seattle-Everett WA	12,540	2,270	3.3	5,520	1.02
Northeastern Avg	26,150	4,120	3.2	6,070	0.94
Midwestern Avg	11,410	2,190	3.4	4,930	0.83
Southern Avg	8,130	1,490	3.7	5,410	0.90
Southwestern Avg	9,200	1,760	3.7	4,980	0.87
Western Avg	20,220	3,660	3.7	5,540	1.01
Texas Avg	7,460	1,580	3.9	4,530	0.86
Total Avg	13,850	2,480	3.5	5,320	0.90
Maximum Value	102,120	18,110	4.6	7,150	1.32
Minimum Value	2,130	320	2.3	3,530	0.60

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-9. Summary of 1985 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	19,590	1,930	5.4	10,140	0.84
Boston MA	29,300	2,330	5.6	12,550	0.98
Hartford CT	8,610	840	5.2	10,280	0.85
New York NY	106,350	9,080	5.5	11,710	1.00
Philadelphia PA	22,230	2,070	5.0	10,740	1.04
Pittsburgh PA	10,710	1,420	4.2	7,560	0.78
Washington DC	32,010	2,240	5.2	14,310	1.19
Midwestern Cities					
Chicago IL	46,160	3,430	5.5	13,460	1.08
Cincinnati OH	14,240	1,320	5.3	10,790	0.83
Cleveland OH	16,190	1,550	4.6	10,470	0.81
Columbus OH	10,730	1,210	5.7	8,890	0.71
Detroit MI	34,540	2,500	5.7	13,840	1.06
Indianapolis IN	10,110	1,110	5.1	9,100	0.76
Kansas City MO	16,410	2,030	4.1	8,090	0.65
Louisville KY	7,570	770	4.4	9,790	0.82
Milwaukee WI	9,760	890	5.3	11,030	0.88
Minn-St. Paul MN	22,030	2,040	4.6	10,780	0.85
Oklahoma City OK	9,940	1,100	5.0	9,010	0.75
St. Louis MO	23,850	2,280	5.4	10,470	0.89
Southern Cities					
Atlanta GA	31,280	2,440	6.0	12,830	1.02
Charlotte NC	3,440	430	4.1	7,910	0.77
Ft. Lauderdale FL	8,970	870	5.3	10,310	0.85
Jacksonville FL	7,330	600	4.0	12,300	0.96
Memphis TN	4,910	590	5.2	8,360	0.75
Miami FL	11,450	870	5.3	13,170	1.13
Nashville TN	6,300	680	4.5	9,210	0.81
New Orleans LA	6,890	530	5.6	12,970	1.07
Norfolk VA	7,200	710	4.3	10,160	0.84
Orlando FL	8,420	850	4.4	9,960	0.76
Tampa FL	4,580	420	4.9	10,940	1.00
Southwestern Cities					
Albuquerque NM	2,930	310	4.7	9,330	0.93
Austin TX	6,760	580	5.3	11,670	0.91
Corpus Christi TX	2,250	270	5.2	8,480	0.71
Dallas TX	33,970	2,640	5.7	12,870	0.98
Denver CO	14,570	1,290	5.1	11,310	0.96
El Paso TX	5,020	560	5.0	9,040	0.70
Fort Worth TX	16,210	1,570	5.6	10,330	0.82
Houston TX	38,830	2,380	6.0	16,290	1.23
Phoenix AZ	5,680	470	5.1	12,170	1.13
Salt Lake City UT	5,180	680	5.6	7,670	0.68
San Antonio TX	14,620	1,290	5.0	11,350	0.87
Western Cities					
Honolulu HI	6,420	530	5.0	12,090	0.96
Los Angeles CA	141,100	7,650	8.2	18,450	1.36
Portland OR	9,540	830	4.9	11,500	0.93
Sacramento CA	11,110	1,030	6.9	10,780	0.92
San Bernardino-Riv CA	19,720	1,340	6.8	14,670	1.12
San Diego CA	31,640	2,570	7.4	12,320	0.95
San Fran-Oak CA	55,810	3,650	6.8	15,270	1.17
San Jose CA	22,430	1,820	6.4	12,330	0.95
Seattle-Everett WA	23,910	1,770	5.8	13,500	1.05
Northeastern Avg	32,690	2,840	5.2	11,040	0.95
Midwestern Avg	18,460	1,690	5.1	10,480	0.84
Southern Avg	9,160	820	4.9	10,740	0.91
Southwestern Avg	13,280	1,090	5.3	10,960	0.90
Western Avg	35,740	2,360	6.5	13,440	1.05
Texas Avg	16,810	1,330	5.4	11,430	0.89
Total Avg	20,380	1,650	5.3	11,250	0.92
Maximum Value	141,100	9,080	8.2	18,450	1.36
Minimum Value	2,250	270	4.0	7,560	0.65

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-10. Summary of 1985 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	13,880	2,600	3.8	5,340	0.84
Boston MA	21,710	4,220	2.3	5,150	0.98
Hartford CT	5,100	920	3.5	5,560	0.85
New York NY	75,190	10,950	3.4	6,870	1.00
Philadelphia PA	32,850	4,670	2.8	7,040	1.04
Pittsburgh PA	15,210	2,660	3.0	5,720	0.78
Washington DC	23,880	3,200	3.9	7,450	1.19
Midwestern Cities					
Chicago IL	36,820	5,990	3.6	6,150	1.08
Cincinnati OH	5,300	1,260	3.3	4,220	0.83
Cleveland OH	7,460	1,770	2.9	4,210	0.81
Columbus OH	4,070	950	3.2	4,290	0.71
Detroit MI	30,970	5,860	4.4	5,280	1.06
Indianapolis IN	6,600	1,340	3.7	4,910	0.76
Kansas City MO	6,840	1,660	3.5	4,130	0.65
Louisville KY	4,440	810	3.7	5,510	0.82
Milwaukee WI	7,760	1,550	3.1	5,020	0.88
Minn-St. Paul MN	7,870	1,510	3.4	5,200	0.85
Oklahoma City OK	5,390	1,040	3.0	5,190	0.75
St. Louis MO	16,520	2,790	3.1	5,930	0.89
Southern Cities					
Atlanta GA	13,470	2,170	3.4	6,200	1.02
Charlotte NC	4,340	790	3.0	5,500	0.77
Ft. Lauderdale FL	8,690	1,710	4.3	5,090	0.85
Jacksonville FL	8,960	1,800	3.6	4,990	0.96
Memphis TN	5,670	1,160	4.2	4,890	0.75
Miami FL	20,450	3,160	4.3	6,480	1.13
Nashville TN	7,380	1,420	3.1	5,210	0.81
New Orleans LA	5,970	920	4.1	6,510	1.07
Norfolk VA	5,650	1,090	3.4	5,200	0.84
Orlando FL	5,850	1,610	3.7	3,640	0.76
Tampa FL	6,180	960	3.8	6,450	1.00
Southwestern Cities					
Albuquerque NM	5,800	970	3.5	6,000	0.93
Austin TX	3,220	640	4.0	5,000	0.91
Corpus Christi TX	2,210	520	3.8	4,280	0.71
Dallas TX	12,800	2,700	4.6	4,750	0.98
Denver CO	16,860	2,870	3.7	5,870	0.96
El Paso TX	4,640	1,290	4.0	3,600	0.70
Fort Worth TX	6,670	1,350	3.9	4,930	0.82
Houston TX	17,470	3,110	3.9	5,620	1.23
Phoenix AZ	25,290	4,060	3.4	6,230	1.13
Salt Lake City UT	2,890	530	3.4	5,440	0.68
San Antonio TX	6,900	1,640	3.3	4,200	0.87
Western Cities					
Honolulu HI	2,000	330	3.6	6,070	0.96
Los Angeles CA	107,600	18,350	4.0	5,860	1.36
Portland OR	4,770	840	3.3	5,700	0.93
Sacramento CA	9,100	1,510	4.0	6,010	0.92
San Bernardino-Riv CA	14,100	2,540	4.0	5,540	1.12
San Diego CA	12,080	2,420	3.4	5,000	0.95
San Fran-Oak CA	18,320	3,120	3.8	5,870	1.17
San Jose CA	9,750	2,000	4.0	4,860	0.95
Seattle-Everett WA	12,980	2,320	3.3	5,600	1.05
Northeastern Avg	26,830	4,170	3.2	6,160	0.95
Midwestern Avg	11,670	2,210	3.4	5,000	0.84
Southern Avg	8,420	1,520	3.7	5,470	0.91
Southwestern Avg	9,520	1,790	3.8	5,080	0.90
Western Avg	21,190	3,720	3.7	5,610	1.05
Texas Avg	7,700	1,610	3.9	4,630	0.89
Total Avg	14,320	2,510	3.6	5,400	0.92
Maximum Value	107,600	18,350	4.6	7,450	1.36
Minimum Value	2,000	330	2.3	3,600	0.65

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-11. Summary of 1986 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	20,950	1,960	5.4	10,710	0.88
Boston MA	32,300	2,370	5.7	13,650	1.04
Hartford CT	8,920	860	5.3	10,360	0.85
New York NY	115,270	9,100	5.5	12,670	1.06
Philadelphia PA	22,740	2,090	5.0	10,870	1.06
Pittsburgh PA	11,110	1,470	4.2	7,580	0.79
Washington DC	36,070	2,320	5.2	15,520	1.27
Midwestern Cities					
Chicago IL	49,820	3,510	5.6	14,190	1.15
Cincinnati OH	14,350	1,320	5.3	10,870	0.84
Cleveland OH	17,240	1,550	4.6	11,150	0.86
Columbus OH	11,770	1,230	5.7	9,560	0.75
Detroit MI	34,890	2,540	5.8	13,720	1.05
Indianapolis IN	11,130	1,110	5.1	10,010	0.81
Kansas City MO	17,560	2,040	4.2	8,620	0.68
Louisville KY	7,700	810	4.4	9,570	0.80
Milwaukee WI	10,170	890	5.3	11,480	0.90
Minn-St. Paul MN	23,440	2,080	4.7	11,290	0.89
Oklahoma City OK	10,110	1,110	5.0	9,100	0.76
St. Louis MO	25,150	2,290	5.5	11,000	0.93
Southern Cities					
Atlanta GA	34,660	2,540	6.0	13,630	1.09
Charlotte NC	3,590	440	4.1	8,110	0.78
Ft. Lauderdale FL	9,180	890	5.3	10,270	0.85
Jacksonville FL	7,520	630	4.1	11,970	0.95
Memphis TN	5,330	590	5.2	9,070	0.80
Miami FL	11,710	870	5.3	13,470	1.14
Nashville TN	6,840	680	4.6	10,000	0.86
New Orleans LA	6,960	530	5.7	13,110	1.09
Norfolk VA	7,980	720	4.5	11,130	0.90
Orlando FL	8,560	850	4.6	10,030	0.76
Tampa FL	4,730	430	4.9	10,890	0.96
Southwestern Cities					
Albuquerque NM	3,110	310	4.7	9,900	0.96
Austin TX	7,250	610	5.5	11,840	0.94
Corpus Christi TX	2,290	270	5.2	8,350	0.71
Dallas TX	36,350	2,660	5.8	13,680	1.04
Denver CO	14,960	1,310	5.2	11,400	0.97
El Paso TX	5,510	560	5.1	9,910	0.75
Fort Worth TX	17,310	1,570	5.6	11,030	0.87
Houston TX	38,830	2,430	6.1	15,970	1.21
Phoenix AZ	7,440	500	5.2	14,900	1.20
Salt Lake City UT	5,550	720	5.6	7,750	0.68
San Antonio TX	14,890	1,300	5.1	11,420	0.88
Western Cities					
Honolulu HI	6,770	530	5.2	12,740	1.03
Los Angeles CA	148,300	7,730	8.2	19,190	1.42
Portland OR	10,180	850	5.0	12,050	0.97
Sacramento CA	11,910	1,050	6.9	11,380	0.95
San Bernardino-Riv CA	20,400	1,350	6.9	15,080	1.15
San Diego CA	33,840	2,620	7.4	12,940	1.00
San Fran-Oak CA	59,450	3,680	6.8	16,160	1.24
San Jose CA	22,960	1,830	6.5	12,560	0.97
Seattle-Everett WA	24,960	1,790	5.8	13,960	1.09
Northeastern Avg	35,340	2,880	5.2	11,620	0.99
Midwestern Avg	19,440	1,710	5.1	10,880	0.87
Southern Avg	9,730	840	4.9	11,060	0.93
Southwestern Avg	13,950	1,110	5.4	11,470	0.93
Western Avg	37,640	2,380	6.5	14,010	1.09
Texas Avg	17,490	1,340	5.5	11,740	0.91
Total Avg	21,600	1,670	5.4	11,720	0.95
Maximum Value	148,300	9,100	8.2	19,190	1.42
Minimum Value	2,290	270	4.1	7,580	0.68

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-12. Summary of 1986 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	14,380	2,640	3.8	5,450	0.88
Boston MA	21,590	4,240	2.3	5,090	1.04
Hartford CT	5,180	940	3.5	5,500	0.85
New York NY	76,400	10,980	3.4	6,960	1.06
Philadelphia PA	34,490	4,750	2.8	7,260	1.06
Pittsburgh PA	15,790	2,700	3.0	5,840	0.79
Washington DC	25,600	3,300	4.1	7,760	1.27
Midwestern Cities					
Chicago IL	40,220	6,010	3.6	6,700	1.15
Cincinnati OH	5,220	1,260	3.3	4,150	0.84
Cleveland OH	7,620	1,770	2.9	4,300	0.86
Columbus OH	4,190	950	3.2	4,410	0.75
Detroit MI	31,310	5,960	4.4	5,260	1.05
Indianapolis IN	6,600	1,350	3.7	4,880	0.81
Kansas City MO	6,900	1,670	3.5	4,140	0.68
Louisville KY	4,400	810	3.7	5,470	0.80
Milwaukee WI	7,570	1,560	3.3	4,850	0.90
Minn-St. Paul MN	8,210	1,530	3.4	5,370	0.89
Oklahoma City OK	5,440	1,040	3.1	5,240	0.76
St. Louis MO	17,330	2,790	3.2	6,220	0.93
Southern Cities					
Atlanta GA	14,580	2,200	3.4	6,630	1.09
Charlotte NC	4,440	810	3.0	5,520	0.78
Ft. Lauderdale FL	8,660	1,710	4.3	5,050	0.85
Jacksonville FL	9,050	1,810	3.6	5,000	0.95
Memphis TN	6,050	1,180	4.2	5,120	0.80
Miami FL	20,610	3,180	4.3	6,480	1.14
Nashville TN	7,740	1,450	3.1	5,340	0.86
New Orleans LA	6,180	930	4.1	6,620	1.09
Norfolk VA	5,840	1,120	3.5	5,220	0.90
Orlando FL	5,920	1,650	3.7	3,590	0.76
Tampa FL	5,880	970	3.8	6,080	0.96
Southwestern Cities					
Albuquerque NM	6,040	990	3.5	6,100	0.96
Austin TX	3,530	660	4.2	5,340	0.94
Corpus Christi TX	2,250	520	3.8	4,380	0.71
Dallas TX	13,250	2,700	4.7	4,900	1.04
Denver CO	17,190	2,890	3.7	5,950	0.97
El Paso TX	4,690	1,300	4.1	3,620	0.75
Fort Worth TX	6,840	1,370	3.9	5,000	0.87
Houston TX	17,400	3,150	4.1	5,530	1.21
Phoenix AZ	25,500	4,090	3.5	6,240	1.20
Salt Lake City UT	2,940	540	3.4	5,450	0.68
San Antonio TX	7,380	1,660	3.4	4,450	0.88
Western Cities					
Honolulu HI	2,320	340	3.6	6,860	1.03
Los Angeles CA	113,360	18,690	4.0	6,060	1.42
Portland OR	5,060	850	3.3	5,980	0.97
Sacramento CA	9,470	1,560	4.0	6,070	0.95
San Bernardino-Riv CA	14,280	2,540	4.0	5,610	1.15
San Diego CA	12,640	2,460	3.4	5,130	1.00
San Fran-Oak CA	19,320	3,180	3.8	6,080	1.24
San Jose CA	9,970	2,010	4.1	4,950	0.97
Seattle-Everett WA	13,400	2,330	3.3	5,740	1.09
Northeastern Avg	27,630	4,220	3.3	6,260	0.99
Midwestern Avg	12,080	2,220	3.4	5,080	0.87
Southern Avg	8,630	1,550	3.7	5,510	0.93
Southwestern Avg	9,730	1,810	3.8	5,180	0.93
Western Avg	22,200	3,770	3.7	5,830	1.09
Texas Avg	7,910	1,620	4.0	4,750	0.91
Total Avg	14,800	2,540	3.6	5,500	0.95
Maximum Value	113,360	18,690	4.7	7,760	1.42
Minimum Value	2,250	340	2.3	3,590	0.68

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-13. Summary of 1987 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	22,110	1,960	5.4	11,300	0.91
Boston MA	32,530	2,400	5.8	13,560	1.04
Hartford CT	9,440	890	5.4	10,660	0.87
New York NY	118,520	9,320	5.5	12,710	1.06
Philadelphia PA	24,350	2,150	5.1	11,330	1.06
Pittsburgh PA	11,580	1,510	4.2	7,690	0.79
Washington DC	36,890	2,370	5.2	15,590	1.29
Midwestern Cities					
Chicago IL	49,820	3,520	5.6	14,160	1.15
Cincinnati OH	15,390	1,360	5.3	11,310	0.87
Cleveland OH	18,010	1,550	4.6	11,650	0.89
Columbus OH	12,380	1,250	5.7	9,920	0.78
Detroit MI	35,100	2,590	5.8	13,540	1.04
Indianapolis IN	12,300	1,140	5.1	10,760	0.85
Kansas City MO	19,190	2,140	4.3	8,960	0.71
Louisville KY	8,660	840	4.4	10,350	0.86
Milwaukee WI	10,980	890	5.3	12,400	0.95
Minn-St. Paul MN	25,150	2,240	4.8	11,240	0.89
Oklahoma City OK	10,190	1,130	5.0	9,040	0.76
St. Louis MO	26,230	2,300	5.5	11,390	0.96
Southern Cities					
Atlanta GA	36,970	2,640	6.1	14,000	1.11
Charlotte NC	3,710	450	4.1	8,230	0.79
Ft. Lauderdale FL	9,980	900	5.4	11,070	0.90
Jacksonville FL	7,680	640	4.5	11,930	0.94
Memphis TN	6,010	610	5.3	9,820	0.84
Miami FL	11,950	890	5.4	13,370	1.14
Nashville TN	7,250	690	4.6	10,470	0.89
New Orleans LA	7,490	530	5.7	14,090	1.14
Norfolk VA	8,320	720	4.5	11,480	0.93
Orlando FL	8,920	880	4.7	10,170	0.77
Tampa FL	5,310	450	4.9	11,790	1.02
Southwestern Cities					
Albuquerque NM	3,260	320	5.0	10,130	0.96
Austin TX	8,290	640	5.5	12,880	1.00
Corpus Christi TX	2,420	290	5.3	8,330	0.72
Dallas TX	35,580	2,670	5.8	13,310	1.02
Denver CO	15,380	1,380	5.2	11,170	0.95
El Paso TX	5,150	560	5.2	9,140	0.71
Fort Worth TX	17,710	1,590	5.7	11,110	0.87
Houston TX	41,540	2,640	6.2	15,730	1.19
Phoenix AZ	7,370	550	5.3	13,470	1.18
Salt Lake City UT	6,130	760	5.6	8,110	0.70
San Antonio TX	14,490	1,310	5.1	11,040	0.86
Western Cities					
Honolulu HI	6,980	530	5.2	13,140	1.05
Los Angeles CA	155,990	7,860	8.2	19,850	1.47
Portland OR	10,790	870	5.0	12,410	0.99
Sacramento CA	12,970	1,060	6.9	12,200	1.00
San Bernardino-Riv CA	20,690	1,380	6.9	15,030	1.14
San Diego CA	37,280	2,640	7.4	14,120	1.08
San Fran-Oak CA	63,720	3,710	6.8	17,170	1.31
San Jose CA	23,490	1,840	6.5	12,800	0.99
Seattle-Everett WA	26,730	1,840	5.8	14,560	1.14
Northeastern Avg	36,490	2,940	5.2	11,840	1.00
Midwestern Avg	20,280	1,740	5.1	11,230	0.89
Southern Avg	10,330	860	5.0	11,490	0.95
Southwestern Avg	14,300	1,160	5.4	11,310	0.92
Western Avg	39,850	2,410	6.5	14,590	1.13
Texas Avg	17,880	1,390	5.5	11,650	0.91
Total Avg	22,570	1,710	5.4	11,990	0.97
Maximum Value	155,990	9,320	8.2	19,850	1.47
Minimum Value	2,420	290	4.1	7,690	0.70

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-14. Summary of 1987 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	14,520	2,700	3.9	5,370	0.91
Boston MA	22,060	4,310	2.3	5,110	1.04
Hartford CT	5,160	940	3.5	5,480	0.87
New York NY	78,070	11,110	3.4	7,030	1.06
Philadelphia PA	36,310	5,180	2.9	7,000	1.06
Pittsburgh PA	15,950	2,740	3.1	5,830	0.79
Washington DC	27,430	3,380	4.1	8,110	1.29
Midwestern Cities					
Chicago IL	40,190	6,020	3.6	6,680	1.15
Cincinnati OH	5,340	1,270	3.3	4,200	0.87
Cleveland OH	7,790	1,770	2.9	4,400	0.89
Columbus OH	4,290	960	3.2	4,480	0.78
Detroit MI	31,470	6,040	4.4	5,210	1.04
Indianapolis IN	6,600	1,360	3.7	4,850	0.85
Kansas City MO	7,000	1,670	3.5	4,180	0.71
Louisville KY	4,790	810	3.7	5,890	0.86
Milwaukee WI	7,470	1,580	3.3	4,730	0.95
Minn-St. Paul MN	8,370	1,550	3.4	5,420	0.89
Oklahoma City OK	5,580	1,050	3.1	5,290	0.76
St. Louis MO	18,060	2,810	3.2	6,430	0.96
Southern Cities					
Atlanta GA	15,050	2,250	3.4	6,700	1.11
Charlotte NC	4,570	820	3.0	5,570	0.79
Ft. Lauderdale FL	8,860	1,720	4.3	5,140	0.90
Jacksonville FL	9,060	1,840	3.6	4,940	0.94
Memphis TN	6,330	1,220	4.3	5,210	0.84
Miami FL	20,930	3,220	4.3	6,500	1.14
Nashville TN	7,910	1,460	3.1	5,430	0.89
New Orleans LA	6,530	1,000	4.2	6,540	1.14
Norfolk VA	6,210	1,130	3.5	5,510	0.93
Orlando FL	5,950	1,660	3.7	3,590	0.77
Tampa FL	6,250	980	3.8	6,360	1.02
Southwestern Cities					
Albuquerque NM	6,280	1,050	3.5	6,000	0.96
Austin TX	3,460	670	4.2	5,180	1.00
Corpus Christi TX	2,400	520	3.8	4,660	0.72
Dallas TX	13,200	2,720	4.7	4,850	1.02
Denver CO	17,070	2,950	3.8	5,790	0.95
El Paso TX	4,830	1,300	4.2	3,730	0.71
Fort Worth TX	6,840	1,380	3.9	4,940	0.87
Houston TX	16,910	3,170	4.2	5,330	1.19
Phoenix AZ	26,520	4,130	3.6	6,420	1.18
Salt Lake City UT	3,000	560	3.5	5,410	0.70
San Antonio TX	7,730	1,690	3.4	4,570	0.86
Western Cities					
Honolulu HI	2,340	350	3.7	6,770	1.05
Los Angeles CA	118,830	18970	4.0	6,270	1.47
Portland OR	5,150	850	3.3	6,040	0.99
Sacramento CA	9,880	1,610	4.0	6,140	1.00
San Bernardino-Riv CA	14,330	2,610	4.0	5,490	1.14
San Diego CA	13,170	2,510	3.4	5,240	1.08
San Fran-Oak CA	20,400	3,230	3.9	6,320	1.31
San Jose CA	10,210	2,030	4.1	5,030	0.99
Seattle-Everett WA	14,410	2,370	3.3	6,070	1.14
Northeastern Avg	28,500	4,340	3.3	6,280	1.00
Midwestern Avg	12,250	2,240	3.4	5,150	0.89
Southern Avg	8,880	1,570	3.7	5,590	0.95
Southwestern Avg	9,840	1,830	3.9	5,170	0.92
Western Avg	23,190	3,840	3.7	5,930	1.13
Texas Avg	7,910	1,640	4.1	4,750	0.91
Total Avg	15,220	2,580	3.6	5,550	0.97
Maximum Value	118,830	18,970	4.7	8,110	1.47
Minimum Value	2,340	350	2.3	3,590	0.70

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-15. Summary of 1988 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	22,410	1,960	5.4	11,410	0.92
Boston MA	36,570	2,430	5.9	15,040	1.12
Hartford CT	9,760	890	5.5	11,020	0.90
New York NY	125,590	9,350	5.5	13,430	1.10
Philadelphia PA	26,850	2,250	5.2	11,910	1.07
Pittsburgh PA	11,880	1,530	4.3	7,770	0.81
Washington DC	38,000	2,400	5.2	15,850	1.30
Midwestern Cities					
Chicago IL	51,460	3,550	5.6	14,500	1.18
Cincinnati OH	15,700	1,360	5.3	11,540	0.88
Cleveland OH	20,400	1,590	4.6	12,800	0.97
Columbus OH	12,630	1,260	5.7	9,990	0.79
Detroit MI	37,060	2,640	5.8	14,040	1.07
Indianapolis IN	12,470	1,160	5.3	10,760	0.85
Kansas City MO	19,670	2,170	4.4	9,090	0.72
Louisville KY	9,720	910	4.4	10,690	0.87
Milwaukee WI	11,490	940	5.6	12,200	0.94
Minn-St. Paul MN	26,440	2,310	4.9	11,440	0.90
Oklahoma City OK	10,660	1,140	5.0	9,390	0.78
St. Louis MO	27,990	2,390	5.5	11,710	0.98
Southern Cities					
Atlanta GA	38,540	2,660	6.1	14,510	1.14
Charlotte NC	3,890	450	4.1	8,630	0.80
Ft. Lauderdale FL	10,380	930	5.4	11,120	0.90
Jacksonville FL	8,290	680	4.5	12,260	0.95
Memphis TN	6,360	610	5.4	10,390	0.86
Miami FL	12,690	930	5.4	13,710	1.18
Nashville TN	7,710	710	4.6	10,890	0.94
New Orleans LA	7,660	550	5.7	14,000	1.13
Norfolk VA	8,420	730	4.5	11,490	0.94
Orlando FL	9,310	890	4.8	10,420	0.78
Tampa FL	5,540	470	4.9	11,860	1.03
Southwestern Cities					
Albuquerque NM	3,580	330	5.0	10,850	0.96
Austin TX	8,400	680	5.6	12,430	0.96
Corpus Christi TX	2,430	300	5.3	8,160	0.70
Dallas TX	36,030	2,700	5.9	13,360	1.02
Denver CO	16,890	1,380	5.2	12,200	0.99
El Paso TX	5,350	560	5.2	9,490	0.74
Fort Worth TX	17,950	1,610	5.7	11,150	0.87
Houston TX	43,630	2,880	6.2	15,140	1.15
Phoenix AZ	9,420	840	5.6	11,250	1.04
Salt Lake City UT	6,560	770	5.6	8,490	0.72
San Antonio TX	14,570	1,320	5.2	11,040	0.86
Western Cities					
Honolulu HI	7,100	530	5.2	13,360	1.07
Los Angeles CA	164,450	7,990	8.2	20,590	1.52
Portland OR	11,430	870	5.0	13,150	1.04
Sacramento CA	13,560	1,090	6.9	12,470	1.03
San Bernardino-Riv CA	21,820	1,400	7.0	15,570	1.18
San Diego CA	40,310	2,730	7.4	14,770	1.13
San Fran-Oak CA	64,990	3,740	6.8	17,360	1.33
San Jose CA	24,080	1,850	6.6	13,000	1.00
Seattle-Everett WA	27,680	1,840	5.8	15,080	1.17
Northeastern Avg	38,720	2,970	5.3	12,350	1.03
Midwestern Avg	21,310	1,790	5.2	11,510	0.91
Southern Avg	10,800	870	5.0	11,750	0.97
Southwestern Avg	14,980	1,220	5.5	11,230	0.91
Western Avg	41,710	2,450	6.5	15,040	1.16
Texas Avg	18,340	1,440	5.6	11,540	0.90
Total Avg	23,720	1,740	5.5	12,260	0.99
Maximum Value	164,450	9,350	8.2	20,590	1.52
Minimum Value	2,430	300	4.1	7,770	0.70

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-16. Summary of 1988 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	14,750	2,740	4.0	5,390	0.92
Boston MA	20,700	4,330	2.3	4,780	1.12
Hartford CT	5,510	940	3.5	5,850	0.90
New York NY	80,030	11,450	3.4	6,990	1.10
Philadelphia PA	35,610	5,200	3.0	6,850	1.07
Pittsburgh PA	17,110	2,840	3.1	6,020	0.81
Washington DC	27,660	3,460	4.1	7,990	1.30
Midwestern Cities					
Chicago IL	41,960	6,050	3.6	6,940	1.18
Cincinnati OH	5,530	1,280	3.3	4,320	0.88
Cleveland OH	8,070	1,790	2.9	4,510	0.97
Columbus OH	4,450	970	3.2	4,610	0.79
Detroit MI	31,670	6,150	4.4	5,150	1.07
Indianapolis IN	6,620	1,370	3.7	4,840	0.85
Kansas City MO	7,070	1,680	3.5	4,200	0.72
Louisville KY	4,600	820	3.7	5,610	0.87
Milwaukee WI	7,610	1,590	3.4	4,770	0.94
Minn-St. Paul MN	8,530	1,560	3.4	5,460	0.90
Oklahoma City OK	5,550	1,050	3.1	5,260	0.78
St. Louis MO	18,470	2,810	3.2	6,570	0.98
Southern Cities					
Atlanta GA	15,750	2,400	3.5	6,570	1.14
Charlotte NC	4,580	840	3.0	5,470	0.80
Ft. Lauderdale FL	8,920	1,750	4.3	5,080	0.90
Jacksonville FL	9,120	1,870	3.7	4,880	0.95
Memphis TN	6,520	1,300	4.3	5,030	0.86
Miami FL	22,120	3,250	4.3	6,800	1.18
Nashville TN	8,670	1,470	3.2	5,890	0.94
New Orleans LA	6,540	1,000	4.2	6,550	1.13
Norfolk VA	6,380	1,140	3.5	5,580	0.94
Orlando FL	5,960	1,690	3.7	3,520	0.78
Tampa FL	6,540	1,010	3.8	6,500	1.03
Southwestern Cities					
Albuquerque NM	6,440	1,130	3.5	5,710	0.96
Austin TX	3,320	680	4.2	4,920	0.96
Corpus Christi TX	2,320	520	3.8	4,430	0.70
Dallas TX	13,120	2,730	4.8	4,810	1.02
Denver CO	16,820	2,950	3.8	5,690	0.99
El Paso TX	5,010	1,300	4.2	3,860	0.74
Fort Worth TX	6,760	1,390	4.0	4,860	0.87
Houston TX	16,410	3,190	4.2	5,150	1.15
Phoenix AZ	26,850	4,480	4.0	6,000	1.04
Salt Lake City UT	3,080	560	3.5	5,460	0.72
San Antonio TX	8,030	1,720	3.5	4,660	0.86
Western Cities					
Honolulu HI	2,460	350	3.7	7,090	1.07
Los Angeles CA	125,970	19,320	4.0	6,520	1.52
Portland OR	5,280	870	3.3	6,070	1.04
Sacramento CA	10,710	1,690	4.0	6,340	1.03
San Bernardino-Riv CA	14,730	2,700	4.0	5,450	1.18
San Diego CA	14,240	2,610	3.4	5,460	1.13
San Fran-Oak CA	21,800	3,320	3.9	6,560	1.33
San Jose CA	10,470	2,040	4.1	5,120	1.00
Seattle-Everett WA	14,190	2,370	3.4	5,980	1.17
Northeastern Avg	28,770	4,420	3.3	6,270	1.03
Midwestern Avg	12,510	2,260	3.4	5,190	0.91
Southern Avg	9,190	1,610	3.8	5,630	0.97
Southwestern Avg	9,830	1,880	4.0	5,050	0.91
Western Avg	24,430	3,920	3.8	6,060	1.16
Texas Avg	7,850	1,650	4.1	4,670	0.90
Total Avg	15,610	2,630	3.7	5,560	0.99
Maximum Value	125,970	19,320	4.8	7,990	1.52
Minimum Value	2,320	350	2.3	3,520	0.70

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-17. Summary of 1989 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	24,440	1,980	5.4	12,340	0.98
Boston MA	35,540	2,440	5.9	14,570	1.09
Hartford CT	9,950	930	5.5	10,660	0.89
New York NY	130,270	9,440	5.6	13,800	1.12
Philadelphia PA	29,420	2,420	5.1	12,140	1.05
Pittsburgh PA	12,480	1,580	4.3	7,910	0.82
Washington DC	40,280	2,450	5.3	16,460	1.33
Midwestern Cities					
Chicago IL	55,450	3,700	5.7	14,970	1.21
Cincinnati OH	17,530	1,430	5.5	12,240	0.94
Cleveland OH	21,270	1,710	4.7	12,460	0.96
Columbus OH	13,040	1,270	5.8	10,250	0.82
Detroit MI	39,530	2,720	5.8	14,530	1.09
Indianapolis IN	12,700	1,160	5.3	10,960	0.86
Kansas City MO	19,920	2,180	4.3	9,130	0.72
Louisville KY	9,890	940	4.6	10,500	0.86
Milwaukee WI	12,100	950	5.6	12,740	0.97
Minn-St. Paul MN	27,140	2,330	4.9	11,630	0.92
Oklahoma City OK	11,000	1,160	5.1	9,490	0.78
St. Louis MO	30,140	2,710	5.5	11,110	0.96
Southern Cities					
Atlanta GA	39,600	2,700	6.1	14,640	1.14
Charlotte NC	4,410	470	4.2	9,290	0.82
Ft. Lauderdale FL	11,000	950	5.4	11,580	0.92
Jacksonville FL	8,370	710	4.5	11,820	0.93
Memphis TN	6,850	610	5.4	11,200	0.90
Miami FL	13,440	930	5.4	14,400	1.25
Nashville TN	7,910	770	4.6	10,230	0.90
New Orleans LA	7,820	560	5.8	13,890	1.13
Norfolk VA	8,590	740	4.6	11,600	0.95
Orlando FL	9,370	930	4.9	10,120	0.77
Tampa FL	5,520	470	4.9	11,630	1.03
Southwestern Cities					
Albuquerque NM	3,720	350	5.0	10,740	0.98
Austin TX	8,530	680	5.6	12,470	0.96
Corpus Christi TX	2,450	300	5.3	8,220	0.70
Dallas TX	36,460	2,720	5.9	13,400	1.02
Denver CO	17,280	1,380	5.2	12,480	1.01
El Paso TX	5,310	560	5.2	9,430	0.74
Fort Worth TX	18,160	1,630	5.7	11,110	0.87
Houston TX	44,500	2,990	6.2	14,860	1.13
Phoenix AZ	11,350	970	5.6	11,650	1.03
Salt Lake City UT	8,180	820	5.6	9,960	0.81
San Antonio TX	14,770	1,330	5.2	11,120	0.87
Western Cities					
Honolulu HI	7,290	550	5.2	13,310	1.07
Los Angeles CA	171,750	8,240	8.2	20,840	1.54
Portland OR	12,030	890	5.0	13,580	1.07
Sacramento CA	14,250	1,180	6.9	12,120	1.01
San Bernardino-Riv CA	21,930	1,420	7.0	15,480	1.17
San Diego CA	43,080	2,770	7.4	15,560	1.18
San Fran-Oak CA	67,570	3,780	6.8	17,860	1.36
San Jose CA	25,020	1,870	6.6	13,400	1.03
Seattle-Everett WA	29,300	1,870	5.9	15,690	1.20
Northeastern Avg	40,340	3,030	5.3	12,550	1.04
Midwestern Avg	22,470	1,860	5.2	11,670	0.92
Southern Avg	11,170	900	5.1	11,850	0.98
Southwestern Avg	15,520	1,250	5.5	11,400	0.92
Western Avg	43,580	2,510	6.6	15,310	1.18
Texas Avg	18,600	1,460	5.6	11,520	0.90
Total Avg	24,760	1,790	5.5	12,430	1.00
Maximum Value	171,750	9,440	8.2	20,840	1.54
Minimum Value	2,450	300	4.2	7,910	0.70

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-18. Summary of 1989 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	15,010	2,700	4.0	5,570	0.98
Boston MA	20,370	4,360	2.3	4,680	1.09
Hartford CT	5,860	1,000	3.7	5,870	0.89
New York NY	81,840	11,830	3.4	6,920	1.12
Philadelphia PA	34,040	5,220	3.0	6,510	1.05
Pittsburgh PA	17,330	2,850	3.1	6,080	0.82
Washington DC	27,840	3,540	4.0	7,860	1.33
Midwestern Cities					
Chicago IL	45,050	6,520	3.8	6,910	1.21
Cincinnati OH	5,830	1,280	3.3	4,550	0.94
Cleveland OH	8,510	1,800	3.0	4,740	0.96
Columbus OH	4,890	970	3.3	5,070	0.82
Detroit MI	31,910	6,250	4.4	5,110	1.09
Indianapolis IN	6,640	1,370	3.7	4,850	0.86
Kansas City MO	7,040	16,80]	3.5	4,180	0.72
Louisville KY	4,650	820	3.7	5,670	0.86
Milwaukee WI	7,510	1,610	3.3	4,670	0.97
Minn-St. Paul MN	8,680	1,590	3.3	5,470	0.92
Oklahoma City OK	5,770	1,090	3.2	5,270	0.78
St. Louis MO	19,660	2,890	3.2	6,800	0.96
Southern Cities					
Atlanta GA	15,630	2,510	3.6	6,220	1.14
Charlotte NC	4,600	850	3.0	5,390	0.82
Ft. Lauderdale FL	9,020	1,770	4.3	5,100	0.92
Jacksonville FL	9,250	1,920	3.7	4,830	0.93
Memphis TN	6,630	1,310	4.3	5,060	0.90
Miami FL	23,840	3,280	4.3	7,280	1.25
Nashville TN	8,690	1,510	3.3	5,780	0.90
New Orleans LA	6,540	1,000	4.2	6,560	1.13
Norfolk VA	6,570	1,170	3.5	5,630	0.95
Orlando FL	6,160	1,710	3.7	3,610	0.77
Tampa FL	6,730	1,010	3.8	6,630	1.03
Southwestern Cities					
Albuquerque NM	6,760	1,130	3.5	6,000	0.98
Austin TX	3,300	680	4.2	4,820	0.96
Corpus Christi TX	2,330	530	3.8	4,390	0.70
Dallas TX	13,250	2,730	4.8	4,860	1.02
Denver CO	17,070	2,960	3.9	5,760	1.01
El Paso TX	5,110	1,340	4.2	3,830	0.74
Fort Worth TX	6,790	1,390	4.0	4,880	0.87
Houston TX	16,740	3,240	4.3	5,170	1.13
Phoenix AZ	26,800	4,590	4.0	5,840	1.03
Salt Lake City UT	3,140	570	3.5	5,490	0.81
San Antonio TX	8,340	1,740	3.5	4,800	0.87
Western Cities					
Honolulu HI	2,500	350	3.8	7,070	1.07
Los Angeles CA	128,490	19,610	4.0	6,550	1.54
Portland OR	5,430	890	3.3	6,070	1.07
Sacramento CA	10,960	1,740	4.0	6,310	1.01
San Bernardino-Riv CA	15,090	2,780	4.2	5,430	1.17
San Diego CA	14,380	2,690	3.4	5,350	1.18
San Fran-Oak CA	22,070	3,450	3.9	6,410	1.36
San Jose CA	10,880	2,070	4.2	5,260	1.03
Seattle-Everett WA	14,590	2,460	3.4	5,940	1.20
Northeastern Avg	28,900	4,500	3.4	6,210	1.04
Midwestern Avg	13,010	2,320	3.5	5,270	0.92
Southern Avg	9,420	1,640	3.8	5,640	0.98
Southwestern Avg	9,970	1,900	4.0	5,080	0.92
Western Avg	24,930	4,000	3.8	6,040	1.18
Texas Avg	7,980	1,660	4.1	4,680	0.90
Total Avg	15,920	2,690	3.7	5,580	1.00
Maximum Value	128,490	19,610	4.8	7,860	1.54
Minimum Value	2,330	350	2.3	3,610	0.70

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-19. Summary of 1990 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	25,440	2,010	5.4	12,640	1.01
Boston MA	34,790	2,450	5.9	14,220	1.06
Hartford CT	10,020	930	5.5	10,730	0.89
New York NY	133,500	9,500	5.6	14,050	1.14
Philadelphia PA	29,500	2,430	5.1	12,140	1.05
Pittsburgh PA	13,190	1,610	4.3	8,200	0.82
Washington DC	40,790	2,460	5.3	16,610	1.34
Midwestern Cities					
Chicago IL	61,230	3,900	5.7	15,680	1.25
Cincinnati OH	18,320	1,460	5.7	12,570	0.96
Cleveland OH	22,060	1,850	4.7	11,910	0.94
Columbus OH	14,490	1,290	5.8	11,250	0.89
Detroit MI	41,930	2,800	5.8	14,970	1.13
Indianapolis IN	12,960	1,220	5.3	10,590	0.84
Kansas City MO	20,210	2,190	4.4	9,230	0.74
Louisville KY	9,970	950	4.6	10,500	0.86
Milwaukee WI	12,380	960	5.6	12,920	0.99
Minn-St. Paul MN	28,640	2,380	4.9	12,020	0.95
Oklahoma City OK	11,170	1,160	5.1	9,630	0.79
St. Louis MO	29,790	2,720	5.5	10,950	0.95
Southern Cities					
Atlanta GA	40,190	2,750	6.1	14,600	1.14
Charlotte NC	4,650	480	4.2	9,630	0.86
Ft. Lauderdale FL	11,440	970	5.4	11,840	0.94
Jacksonville FL	8,660	720	4.6	11,960	0.93
Memphis TN	6,990	630	5.4	11,130	0.89
Miami FL	13,800	970	5.4	14,170	1.27
Nashville TN	8,050	790	4.6	10,200	0.89
New Orleans LA	8,000	580	5.8	13,810	1.12
Norfolk VA	8,770	750	4.6	11,720	0.96
Orlando FL	9,580	950	4.9	10,080	0.77
Tampa FL	5,840	480	4.9	12,100	1.05
Southwestern Cities					
Albuquerque NM	3,860	350	5.0	10,910	0.98
Austin TX	8,760	720	5.6	12,090	0.94
Corpus Christi TX	2,510	300	5.4	8,430	0.72
Dallas TX	38,120	2,750	5.9	13,850	1.05
Denver CO	18,140	1,420	5.2	12,730	1.03
El Paso TX	5,360	560	5.2	9,510	0.74
Fort Worth TX	19,060	1,640	5.8	11,610	0.90
Houston TX	45,450	3,090	6.3	14,700	1.12
Phoenix AZ	12,830	1,010	5.6	12,750	1.05
Salt Lake City UT	8,580	820	5.6	10,450	0.85
San Antonio TX	14,940	1,330	5.3	11,250	0.88
Western Cities					
Honolulu HI	7,440	550	5.2	13,590	1.09
Los Angeles CA	177,660	8,420	8.2	21,100	1.55
Portland OR	12,030	890	5.1	13,460	1.08
Sacramento CA	14,910	1,210	6.9	12,350	1.02
San Bernardino-Riv CA	23,470	1,440	7.1	16,290	1.21
San Diego CA	44,580	2,780	7.4	16,050	1.22
San Fran-Oak CA	68,570	3,850	6.8	17,820	1.36
San Jose CA	25,410	1,870	6.6	13,600	1.05
Seattle-Everett WA	30,460	1,950	6.0	15,640	1.20
Northeastern Avg	41,030	3,060	5.3	12,660	1.04
Midwestern Avg	23,600	1,910	5.3	11,850	0.94
Southern Avg	11,450	920	5.1	11,930	0.98
Southwestern Avg	16,150	1,270	5.5	11,660	0.93
Western Avg	44,950	2,550	6.6	15,540	1.20
Texas Avg	19,170	1,490	5.6	11,630	0.91
Total Avg	25,570	1,830	5.5	12,600	1.01
Maximum Value	177,660	9,500	8.2	21,100	1.55
Minimum Value	2,510	300	4.2	8,200	0.72

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-20. Summary of 1990 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	15,860	2,670	4.1	5,930	1.01
Boston MA	20,190	4,440	2.3	4,540	1.06
Hartford CT	6,040	1,020	3.7	5,910	0.89
New York NY	83,810	12,170	3.4	6,890	1.14
Philadelphia PA	34,440	5,230	3.1	6,580	1.05
Pittsburgh PA	17,570	2,930	3.2	5,990	0.82
Washington DC	28,750	3,620	4.0	7,940	1.34
Midwestern Cities					
Chicago IL	47,410	6,860	3.7	6,910	1.25
Cincinnati OH	5,910	1,320	3.3	4,480	0.96
Cleveland OH	9,640	1,800	3.0	5,350	0.94
Columbus OH	5,120	980	3.3	5,210	0.89
Detroit MI	33,610	6,280	4.4	5,350	1.13
Indianapolis IN	6,730	1,420	3.7	4,750	0.84
Kansas City MO	7,740	1,710	3.5	4,540	0.74
Louisville KY	4,740	840	3.6	5,660	0.86
Milwaukee WI	7,700	1,620	3.4	4,760	0.99
Minn-St. Paul MN	9,080	1,610	3.3	5,640	0.95
Oklahoma City OK	5,770	1,090	3.2	5,270	0.79
St. Louis MO	19,660	2,900	3.2	6,780	0.95
Southern Cities					
Atlanta GA	15,750	2,530	3.7	6,230	1.14
Charlotte NC	4,970	860	3.0	5,770	0.86
Ft. Lauderdale FL	9,340	1,800	4.3	5,200	0.94
Jacksonville FL	9,350	1,930	3.7	4,840	0.93
Memphis TN	6,820	1,380	4.3	4,950	0.89
Miami FL	25,450	3,340	4.3	7,620	1.27
Nashville TN	8,760	1,510	3.3	5,790	0.89
New Orleans LA	6,600	1,010	4.2	6,560	1.12
Norfolk VA	6,850	1,180	3.5	5,790	0.96
Orlando FL	6,600	1,720	3.7	3,830	0.77
Tampa FL	7,020	1,060	3.8	6,610	1.05
Southwestern Cities					
Albuquerque NM	6,920	1,160	3.7	5,970	0.98
Austin TX	3,360	690	4.2	4,860	0.94
Corpus Christi TX	2,450	540	3.9	4,540	0.72
Dallas TX	13,380	2,750	4.8	4,860	1.05
Denver CO	17,550	2,980	3.9	5,890	1.03
El Paso TX	5,150	1,340	4.2	3,830	0.74
Fort Worth TX	6,830	1,400	4.1	4,870	0.90
Houston TX	17,440	3,430	4.3	5,080	1.12
Phoenix AZ	28,350	5,020	4.1	5,640	1.05
Salt Lake City UT	3,280	570	3.6	5,730	0.85
San Antonio TX	8,440	1,750	3.5	4,810	0.88
Western Cities					
Honolulu HI	2,530	360	3.8	6,980	1.09
Los Angeles CA	129,400	19,970	4.0	6,480	1.55
Portland OR	5,970	910	3.3	6,570	1.08
Sacramento CA	11,260	1,770	4.0	6,360	1.02
San Bernardino-Riv CA	16,340	3,120	4.2	5,230	1.21
San Diego CA	15,040	2,750	3.4	5,460	1.22
San Fran-Oak CA	22,530	3,620	3.9	6,220	1.36
San Jose CA	10,910	2,080	4.2	5,230	1.05
Seattle-Everett WA	14,700	2,540	3.4	5,800	1.20
Northeastern Avg	29,520	4,590	3.4	6,250	1.04
Midwestern Avg	13,590	2,370	3.5	5,390	0.94
Southern Avg	9,770	1,670	3.8	5,740	0.98
Southwestern Avg	10,290	1,970	4.0	5,100	0.93
Western Avg	25,410	4,130	3.8	6,040	1.20
Texas Avg	8,150	1,700	4.1	4,690	0.91
Total Avg	16,380	2,750	3.7	5,640	1.01
Maximum Value	129,400	19,970	4.8	7,940	1.55
Minimum Value	2,450	360	2.3	3,830	0.72

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-21. Summary of 1991 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	26,150	2,040	5.4	12,790	1.02
Boston MA	34,900	2,450	5.9	14,260	1.06
Hartford CT	10,050	930	5.5	10,760	0.89
New York NY	133,150	9,530	5.6	13,970	1.14
Philadelphia PA	30,670	2,530	5.1	12,130	1.05
Pittsburgh PA	13,280	1,630	4.3	8,130	0.82
Washington DC	41,470	2,530	5.3	16,400	1.33
Midwestern Cities					
Chicago IL	62,760	3,920	5.7	16,010	1.27
Cincinnati OH	18,680	1,470	5.7	12,750	0.99
Cleveland OH	22,490	1,870	4.8	12,040	0.95
Columbus OH	14,890	1,300	5.8	11,490	0.91
Detroit MI	44,110	2,870	5.9	15,390	1.16
Indianapolis IN	13,120	1,230	5.3	10,650	0.84
Kansas City MO	20,790	2,190	4.4	9,500	0.75
Louisville KY	10,060	950	4.6	10,590	0.88
Milwaukee WI	12,570	970	5.6	13,020	1.00
Minn-St. Paul MN	29,320	2,410	4.9	12,180	0.96
Oklahoma City OK	11,470	1,170	5.2	9,830	0.81
St. Louis MO	30,110	2,730	5.6	11,030	0.95
Southern Cities					
Atlanta GA	41,460	2,780	6.2	14,930	1.16
Charlotte NC	4,830	480	4.2	10,000	0.89
Ft. Lauderdale FL	11,480	970	5.4	11,880	0.95
Jacksonville FL	8,810	720	4.6	12,160	0.95
Memphis TN	7,570	660	5.4	11,460	0.91
Miami FL	14,140	990	5.4	14,280	1.28
Nashville TN	8,390	810	4.6	10,320	0.90
New Orleans LA	8,110	590	5.8	13,810	1.12
Norfolk VA	8,960	810	4.6	11,130	0.93
Orlando FL	9,730	970	4.9	10,080	0.78
Tampa FL	5,880	490	4.9	11,970	1.05
Southwestern Cities					
Albuquerque NM	3,990	360	5.0	11,020	0.96
Austin TX	8,860	730	5.6	12,090	0.94
Corpus Christi TX	2,580	300	5.5	8,630	0.72
Dallas TX	38,480	2,760	5.9	13,940	1.06
Denver CO	18,390	1,440	5.2	12,770	1.03
El Paso TX	5,460	570	5.3	9,550	0.75
Fort Worth TX	19,800	1,660	5.9	11,940	0.92
Houston TX	47,500	3,240	6.3	14,640	1.11
Phoenix AZ	14,570	1,070	5.6	13,610	1.08
Salt Lake City UT	8,990	830	5.6	10,840	0.88
San Antonio TX	15,090	1,340	5.3	11,300	0.89
Western Cities					
Honolulu HI	7,570	550	5.2	13,820	1.10
Los Angeles CA	177,550	8,410	8.2	21,110	1.56
Portland OR	12,110	900	5.1	13,430	1.08
Sacramento CA	15,520	1,220	6.9	12,680	1.04
San Bernardino-Riv CA	24,100	1,460	7.2	16,540	1.22
San Diego CA	44,600	2,780	7.5	16,060	1.22
San Fran-Oak CA	67,620	3,850	6.8	17,570	1.34
San Jose CA	26,600	1,890	6.6	14,060	1.08
Seattle-Everett WA	30,590	1,960	5.9	15,570	1.20
Northeastern Avg	41,380	3,090	5.3	12,640	1.04
Midwestern Avg	24,200	1,920	5.3	12,040	0.96
Southern Avg	11,760	930	5.1	12,000	0.99
Southwestern Avg	16,700	1,300	5.6	11,850	0.94
Western Avg	45,140	2,560	6.6	15,650	1.20
Texas Avg	19,680	1,510	5.7	11,730	0.91
Total Avg	25,990	1,850	5.5	12,720	1.02
Maximum Value	177,550	9,530	8.2	21,110	1.56
Minimum Value	2,580	300	4.2	8,130	0.72

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-22. Summary of 1991 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	15,900	2,690	4.1	5,910	1.02
Boston MA	20,130	4,440	2.3	4,530	1.06
Hartford CT	6,120	1,050	3.8	5,850	0.89
New York NY	85,360	12,270	3.4	6,960	1.14
Philadelphia PA	34,810	5,250	3.1	6,630	1.05
Pittsburgh PA	17,830	2,990	3.2	5,970	0.82
Washington DC	29,380	3,700	4.0	7,930	1.33
Midwestern Cities					
Chicago IL	50,770	7,180	3.7	7,070	1.27
Cincinnati OH	6,920	1,330	3.3	5,210	0.99
Cleveland OH	9,740	1,810	3.0	5,380	0.95
Columbus OH	5,490	1,000	3.4	5,500	0.91
Detroit MI	35,710	6,480	4.4	5,510	1.16
Indianapolis IN	6,760	1,420	3.7	4,770	0.84
Kansas City MO	7,790	1,720	3.5	4,520	0.75
Louisville KY	5,020	840	3.6	6,000	0.88
Milwaukee WI	7,940	1,630	3.4	4,880	1.00
Minn-St. Paul MN	9,660	1,670	3.4	5,770	0.96
Oklahoma City OK	6,070	1,110	3.2	5,460	0.81
St. Louis MO	19,880	2,950	3.4	6,750	0.95
Southern Cities					
Atlanta GA	15,920	2,540	3.7	6,280	1.16
Charlotte NC	5,140	870	3.0	5,910	0.89
Ft. Lauderdale FL	9,660	1,810	4.3	5,330	0.95
Jacksonville FL	9,500	1,950	3.7	4,880	0.95
Memphis TN	7,250	1,460	4.3	4,970	0.91
Miami FL	25,760	3,350	4.3	7,690	1.28
Nashville TN	8,790	1,530	3.4	5,750	0.90
New Orleans LA	6,660	1,020	4.2	6,510	1.12
Norfolk VA	7,130	1,210	3.5	5,910	0.93
Orlando FL	7,080	1,740	3.7	4,070	0.78
Tampa FL	7,080	1,080	3.8	6,570	1.05
Southwestern Cities					
Albuquerque NM	6,840	1,210	3.8	5,670	0.96
Austin TX	3,460	700	4.2	4,940	0.94
Corpus Christi TX	2,490	560	4.0	4,410	0.72
Dallas TX	13,520	2,770	4.8	4,880	1.06
Denver CO	17,390	2,980	3.9	5,840	1.03
El Paso TX	5,270	1,350	4.2	3,900	0.75
Fort Worth TX	6,840	1,420	4.1	4,830	0.92
Houston TX	17,550	3,500	4.3	5,010	1.11
Phoenix AZ	29,000	5,180	4.1	5,590	1.08
Salt Lake City UT	3,670	620	3.6	5,920	0.88
San Antonio TX	8,770	1,800	3.6	4,890	0.89
Western Cities					
Honolulu HI	2,610	370	3.8	7,040	1.10
Los Angeles CA	131,550	19,960	4.0	6,590	1.56
Portland OR	6,170	940	3.3	6,550	1.08
Sacramento CA	11,270	1,800	4.1	6,280	1.04
San Bernardino-Riv CA	17,150	3,360	4.2	5,110	1.22
San Diego CA	15,300	2,790	3.5	5,490	1.22
San Fran-Oak CA	22,590	3,700	4.0	6,100	1.34
San Jose CA	10,990	2,090	4.2	5,250	1.08
Seattle-Everett WA	15,810	2,580	3.4	6,140	1.20
Northeastern Avg	29,930	4,630	3.4	6,250	1.04
Midwestern Avg	14,310	2,430	3.5	5,570	0.96
Southern Avg	10,000	1,690	3.8	5,810	0.99
Southwestern Avg	10,440	2,010	4.1	5,080	0.94
Western Avg	25,940	4,180	3.8	6,060	1.20
Texas Avg	8,270	1,730	4.2	4,700	0.91
Total Avg	16,790	2,790	3.7	5,700	1.02
Maximum Value	131,550	19,960	4.8	7,930	1.56
Minimum Value	2,490	370	2.3	3,900	0.72

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-23. Summary of 1992 Relative Mobility Values for Freeways and Expressways

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	28,340	2,170	5.5	13,040	1.04
Boston MA	35,250	2,440	5.9	14,450	1.07
Hartford CT	10,870	970	5.6	11,160	0.91
New York NY	134,440	9,740	5.7	13,800	1.14
Philadelphia PA	31,220	2,600	5.1	12,010	1.05
Pittsburgh PA	14,710	1,800	4.3	8,160	0.81
Washington DC	44,190	2,610	5.4	16,940	1.36
Midwestern Cities					
Chicago IL	63,110	3,930	5.7	16,070	1.28
Cincinnati OH	19,180	1,470	5.7	13,020	1.01
Cleveland OH	22,800	1,900	4.8	12,000	0.95
Columbus OH	15,230	1,300	5.8	11,680	0.93
Detroit MI	46,050	2,930	5.9	15,710	1.19
Indianapolis IN	13,390	1,240	5.3	10,800	0.85
Kansas City MO	22,060	2,270	4.4	9,720	0.77
Louisville KY	10,510	970	4.6	10,790	0.90
Milwaukee WI	12,610	970	5.6	13,060	1.00
Minn-St. Paul MN	30,590	2,430	4.9	12,580	0.99
Oklahoma City OK	11,750	1,170	5.2	10,070	0.83
St. Louis MO	30,480	2,740	5.7	11,140	0.95
Southern Cities					
Atlanta GA	42,670	2,820	6.3	15,140	1.17
Charlotte NC	5,150	490	4.2	10,490	0.89
Ft. Lauderdale FL	12,480	1,050	5.4	11,920	0.96
Jacksonville FL	9,270	730	4.6	12,650	0.97
Memphis TN	8,100	710	5.4	11,430	0.92
Miami FL	15,090	1,010	5.4	14,990	1.30
Nashville TN	9,660	890	4.7	10,910	0.92
New Orleans LA	8,130	600	5.8	13,470	1.10
Norfolk VA	9,450	900	4.7	10,480	0.92
Orlando FL	9,740	970	4.9	10,080	0.80
Tampa FL	6,120	500	5.0	12,260	1.07
Southwestern Cities					
Albuquerque NM	4,030	370	5.0	10,870	0.95
Austin TX	9,100	740	5.6	12,280	0.95
Corpus Christi TX	2,700	300	5.5	8,910	0.74
Dallas TX	39,450	2,820	5.9	14,000	1.07
Denver CO	20,130	1,550	5.2	13,020	1.05
El Paso TX	5,640	570	5.3	9,860	0.76
Fort Worth TX	20,610	1,690	5.9	12,190	0.94
Houston TX	49,110	3,340	6.3	14,700	1.12
Phoenix AZ	15,700	1,130	5.7	13,930	1.08
Salt Lake City UT	9,300	850	5.7	11,000	0.90
San Antonio TX	16,000	1,420	5.4	11,290	0.90
Western Cities					
Honolulu HI	8,190	600	5.3	13,570	1.10
Los Angeles CA	180,240	8,690	8.2	20,750	1.54
Portland OR	12,830	930	5.2	13,860	1.10
Sacramento CA	16,290	1,290	7.0	12,640	1.04
San Bernardino-Riv CA	24,330	1,470	7.2	16,600	1.22
San Diego CA	44,760	2,800	7.6	15,980	1.22
San Fran-Oak CA	68,100	3,910	6.8	17,410	1.33
San Jose CA	26,730	1,930	6.7	13,840	1.07
Seattle-Everett WA	32,640	2,040	6.0	15,960	1.22
Northeastern Avg	42,710	3,190	5.4	12,790	1.05
Midwestern Avg	24,810	1,940	5.3	12,220	0.97
Southern Avg	12,350	970	5.1	12,170	1.00
Southwestern Avg	17,430	1,340	5.6	12,000	0.95
Western Avg	46,010	2,630	6.7	15,620	1.20
Texas Avg	20,370	1,550	5.7	11,890	0.93
Total Avg	26,770	1,890	5.6	12,850	1.03
Maximum Value	180,240	9,740	8.2	20,750	1.54
Minimum Value	2,700	300	4.2	8,160	0.74

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

Table D-24. Summary of 1992 Relative Mobility Values for Principal Arterial Streets

Urban Area	DVKT[1] (1000)	Lane-km	Average No. Lanes	DVKT/[2] Lane-km	Congestion Index
Northeastern Cities					
Baltimore MD	15,940	2,690	4.1	5,930	1.04
Boston MA	20,920	4,590	2.4	4,560	1.07
Hartford CT	6,180	1,050	3.8	5,860	0.91
New York NY	89,070	12,280	3.4	7,260	1.14
Philadelphia PA	34,860	5,250	3.3	6,640	1.05
Pittsburgh PA	17,870	2,990	3.2	5,980	0.81
Washington DC	29,790	3,740	4.0	7,970	1.36
Midwestern Cities					
Chicago IL	52,810	7,490	3.8	7,050	1.28
Cincinnati OH	7,250	1,330	3.3	5,450	1.01
Cleveland OH	10,140	1,840	3.0	5,530	0.95
Columbus OH	5,760	1,020	3.5	5,630	0.93
Detroit MI	39,450	6,870	4.4	5,740	1.19
Indianapolis IN	6,840	1,420	3.7	4,800	0.85
Kansas City MO	7,870	1,750	3.6	4,490	0.77
Louisville KY	5,350	850	3.6	6,330	0.90
Milwaukee WI	8,370	1,710	3.4	4,910	1.00
Minn-St. Paul MN	10,950	1,850	3.4	5,910	0.99
Oklahoma City OK	6,390	1,160	3.3	5,510	0.83
St. Louis MO	20,090	3,050	3.6	6,590	0.95
Southern Cities					
Atlanta GA	16,100	2,610	3.8	6,170	1.17
Charlotte NC	5,150	930	3.2	5,520	0.89
Ft. Lauderdale FL	10,220	1,850	4.4	5,520	0.96
Jacksonville FL	9,890	2,060	3.8	4,800	0.97
Memphis TN	8,070	1,580	4.5	5,110	0.92
Miami FL	27,050	3,590	4.4	7,530	1.30
Nashville TN	8,860	1,550	3.5	5,730	0.92
New Orleans LA	6,760	1,050	4.2	6,410	1.10
Norfolk VA	7,690	1,210	3.5	6,370	0.92
Orlando FL	7,810	1,750	3.7	4,450	0.80
Tampa FL	7,490	1,130	3.8	6,640	1.07
Southwestern Cities					
Albuquerque NM	6,920	1,240	3.9	5,580	0.95
Austin TX	3,540	720	4.2	4,940	0.95
Corpus Christi TX	2,630	600	4.1	4,370	0.74
Dallas TX	13,770	2,820	4.8	4,890	1.07
Denver CO	17,710	2,990	3.9	5,910	1.05
El Paso TX	5,350	1,380	4.2	3,890	0.76
Fort Worth TX	6,990	1,450	4.2	4,820	0.94
Houston TX	17,940	3,510	4.5	5,110	1.12
Phoenix AZ	29,150	5,330	4.2	5,470	1.08
Salt Lake City UT	4,150	680	3.8	6,060	0.90
San Antonio TX	9,560	1,810	3.6	5,280	0.90
Western Cities					
Honolulu HI	2,810	380	3.8	7,430	1.10
Los Angeles CA	132,830	20,130	4.1	6,600	1.54
Portland OR	6,300	970	3.4	6,460	1.10
Sacramento CA	12,450	2,000	4.2	6,240	1.04
San Bernardino-Riv CA	17,310	3,380	4.2	5,120	1.22
San Diego CA	15,620	2,790	3.5	5,590	1.22
San Fran-Oak CA	22,830	3,740	4.0	6,110	1.33
San Jose CA	11,910	2,220	4.2	5,360	1.07
Seattle-Everett WA	15,780	2,620	3.5	6,030	1.22
Northeastern Avg	30,660	4,650	3.5	6,310	1.05
Midwestern Avg	15,110	2,530	3.6	5,660	0.97
Southern Avg	10,460	1,760	3.9	5,840	1.00
Southwestern Avg	10,700	2,050	4.1	5,120	0.95
Western Avg	26,430	4,250	3.9	6,100	1.20
Texas Avg	8,540	1,750	4.2	4,760	0.93
Total Avg	17,330	2,860	3.8	5,750	1.03
Maximum Value	132,830	20,130	4.8	7,970	1.54
Minimum Value	2,630	380	2.4	3,890	0.74

Notes: [1] Daily vehicle-kilometers of travel.
[2] Daily vehicle-kilometer of travel per lane-kilometer of roadway.

Source: TTI Analysis and Local Transportation Agency References

APPENDIX E

URBAN AREA
MOBILITY AND CONGESTION STATISTICS

Table E-1. Mobility and Congestion Variables in Albuquerque NM

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	2,471	2,600	2,753	2,930	3,107	3,260	3,582	3,719	3,864	3,993	4,025
Lane-Kilometers	306	306	306	314	314	322	330	346	354	362	370
VKT/lane-kilometer	8,079	8,500	9,000	9,333	9,897	10,125	10,854	10,744	10,909	11,022	10,870
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	5	5	5	10	10	10	20	20	20	20	20
Percent of Moderate Congestion	100.0	90.0	80.0	60.0	30.0	10.0	35.0	33.3	27.7	37	31.6
Percent of Heavy Congestion	0	10.0	20.0	40.0	60.0	40.0	40.0	40.0	46.8	39.1	37.5
Percent of Severe Congestion	0	0	-	-	10.0	50.0	25.0	26.7	25.5	23.9	31
Principal Arterial Streets											
Daily VKT (000)	4,605	4,959	5,426	5,796	6,038	6,279	6,440	6,762	6,923	6,843	6,923
Lane-kilometers	918	926	942	966	990	1,047	1,127	1,127	1,159	1,208	1,240
VKT/lane-kilometer	5,018	5,357	5,761	6,000	6,098	6,000	5,714	6,000	5,972	5,667	5,584
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	35	40	45	40	40	40	35	40	40	40	40
Percent of Moderate Congestion	47.8	67.5	49.1	53.3	63.3	60.0	58.1	43.4	37.9	45.8	42.6
Percent of Heavy Congestion	39.1	15.0	34.6	24.4	20.0	25.0	30.2	28.3	50.0	44.1	29.5
Percent of Severe Congestion	13.0	17.5	16.4	22.2	16.7	15.0	11.6	28.3	12.1	10.2	27.9
Population (000)	440	450	455	465	475	485	490	500	505	520	525
Urban Area (square kilometers)	544	544	544	648	648	648	648	648	660	673	673
Population Density	809	827	837	718	734	749	757	772	765	772	780
Registered Vehicles (000)	-	-	-	-	380	384	390	420	421	424	431
Fuel Cost ($/liter)	-	-	-	-	0.26	0.28	0.3	0.33	0.36	0.35	0.35
Total VKT (000)	11,682	12,544	13,405	14,266	14,720	15,174	15,627	16,380	16,491	16,343	16,678
Total Lane-Kilometers	2,673	2,705	2,713	2,724	2,818	2,892	2,946	2,950	2,953	2,979	2,995
Roadway Congestion Index	0.78	0.83	0.89	0.93	0.96	0.96	0.96	0.98	0.98	0.96	0.95

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}_{\textit{Ln.-Km.}} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT}_{\textit{Ln.-Km.}} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-2. Mobility and Congestion Variables in Atlanta GA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	25,382	27,378	29,149	31,282	34,663	36,974	38,543	39,598	40,186	41,458	42,665
Lane-Kilometers	2,198	2,270	2,375	2,439	2,544	2,640	2,657	2,705	2,753	2,777	2,818
VKT/lane-kilometer	11,549	12,060	12,275	12,825	13,627	14,003	14,509	14,640	14,596	14,928	15,143
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	40	40	45	50	50	50	45	45	45	45	50
Percent of Moderate Congestion	40.0	39.1	50.7	47.5	35.0	25.0	20.0	18.4	14.1	9.4	10.0
Percent of Heavy Congestion	50.0	47.8	39.3	37.5	40.0	40.0	40.0	26.3	28.3	38.1	40.0
Percent of Severe Congestion	10.0	13.0	10.0	15.0	25.0	35.0	40.0	55.3	57.6	52.6	50.0
Principal Arterial Streets											
Daily VKT (000)	10,529	11,334	12,011	13,468	14,579	15,054	15,754	15,633	15,746	15,923	16,100
Lane-kilometers	1,964	2,077	2,149	2,174	2,198	2,246	2,399	2,512	2,528	2,536	2,608
VKT/lane-kilometer	5361	5,457	5,588	6,196	6,634	6,703	6,567	6,224	6,229	6,279	6,173
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	60	60	65	65	65	65	65	65	65	65	65
Percent of Moderate Congestion	30.0	21.1	36.1	29.4	24.7	17.5	18.5	18.3	13.0	15.4	15.2
Percent of Heavy Congestion	40.0	45.6	32.8	33.6	33.7	33.8	27.7	18.3	22.1	25.6	19.0
Percent of Severe Congestion	30.0	33.3	31.2	36.9	41.7	48.8	53.9	63.4	64.9	59.0	65.8
Population (000)	1,610	1,610	1,610	1,615	1,695	1,770	1,900	2,000	2,100	2,150	2,275
Urban Area (square kilometers)	3,781	3,807	3,807	3,885	3,937	3,963	4,079	4,183	4,209	4,274	4,403
Population Density	426	423	423	416	431	447	466	478	499	503	517
Registered Vehicles (000)	-	-	-	-	1,411	1,522	1,530	1,549	1,600	1650	1774
Fuel Cost ($/liter)	-	-	-	-	0.25	0.27	0.29	0.32	0.34	0.33	0.33
Total VKT (000)	51,396	64,363	69,789	77,744	85,444	91,395	93,766	96,138	98,509	100,878	118,525
Total Lane-Kilometers	8,813	12,534	13,030	13,510	13,522	13,735	13,809	14,112	15,120	15,805	15,878
Roadway Congestion Index	0.91	0.95	0.97	1.02	1.09	1.11	1.14	1.14	1.14	1.16	1.17

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT]Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT]Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-3. Mobility and Congestion Variables in Austin TX

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	4,556	5,104	5,796	6,762	7,245	8,292	8,404	8,533	8,758	8,855	9,097
Lane-Kilometers	427	451	531	580	612	644	676	684	725	733	741
VKT/lane-kilometer	10,679	11,321	10,909	11,667	11,842	12,875	12,429	12,471	12,089	12,088	12,283
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	50	50	50	55	55	55	55	55	55	55	55
Percent of Moderate Congestion	30.0	26.5	30.0	36.5	33.1	40.0	36.4	36.4	32.6	34.3	35.0
Percent of Heavy Congestion	50.0	55.0	44.0	32.9	26.3	20.0	27.3	30.9	36.4	37.7	35.0
Percent of Severe Congestion	20.0	18.5	26.0	30.7	40.6	40.0	36.4	32.6	30.9	28.1	30.0
Principal Arterial Streets											
Daily VKT (000)	2,568	2,753	2,938	3,220	3,526	3,462	3,325	3,301	3,365	3,462	3,542
Lane-kilometers	547	580	612	644	660	668	676	684	692	700	716
VKT/lane-kilometer	4,691	4,750	4,803	5,000	5,341	5,181	4,917	4,824	4,860	4,943	4,944
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	40	40	45	45	45	45	45	45	45	45	45
Percent of Moderate Congestion	15.2	16.4	23.0	18.6	20.0	15.6	30.0	36.6	32.8	33.4	35.0
Percent of Heavy Congestion	65.3	65.5	59.0	51.4	24.4	33.3	30.0	38.0	34.4	36.7	35.0
Percent of Severe Congestion	19.4	18.2	18.0	30.0	55.6	51.1	40.0	25.4	32.8	29.9	30.0
Population (000)	380	380	420	450	465	480	505	520	540	560	565
Urban Area (square kilometers)	777	777	829	842	855	881	894	894	907	932	945
Population Density	489	489	507	535	544	545	565	582	596	601	598
Registered Vehicles (000)	-	-	-	-	454	468	485	496	506	510	514
Fuel Cost ($/liter)	-	-	-	-	0.25	0.28	0.3	0.32	0.35	0.34	0.34
Total VKT (000)	11,433	12,840	13,849	17,457	18,542	18,629	18,776	18,723	19,312	19,243	20,297
Total Lane-Kilometers	2,500	2,602	3,027	3,470	3,598	3,821	3,975	4,141	4,139	4,143	4,146
Roadway Congestion Index	0.84	0.88	0.86	0.91	0.94	1.00	0.96	0.96	0.94	0.94	0.95

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-4. Mobility and Congestion Variables in Baltimore MD

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	16,486	16,986	17,517	19,594	20,954	22,113	22,411	24,440	25,438	26,146	28,336
Lane-Kilometers	1,586	1,650	1,715	1,932	1,956	1,956	1,964	1,980	2,013	2,045	2,174
VKT/lane-kilometer	10,396	10,293	10,216	10,142	10,712	11,305	11,410	12,341	12,640	12,787	13,037
Incident Ratio	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	25	25	25	25	25	25	25	25	30
Percent of Moderate Congestion	71.4	80.0	59.1	54.2	59.1	56.8	46.5	24.0	22.6	23.5	28.0
Percent of Heavy Congestion	28.6	20.0	31.8	20.8	27.3	21.6	20.9	36.0	30.2	27.7	22.0
Percent of Severe Congestion	-	-	9.1	25.0	13.6	21.6	32.6	40.0	47.2	48.8	50.0
Principal Arterial Streets											
Daily VKT (000)	12,043	12,526	13,331	13,878	14,377	14,522	14,748	15,013	15,859	15,899	15,939
Lane-kilometers	2,415	2,439	2,479	2,600	2,640	2,705	2,737	2,697	2,673	2,689	2,689
VKT/lane-kilometer	4,987	5,135	5,377	5,337	5,445	5,369	5,388	5,567	5,934	5,913	5,928
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	25	25	30	35	35	35	35	35	35	35	35
Percent of Moderate Congestion	13.5	9.4	10.6	12.8	14.3	19.1	19.8	17.4	12.6	8.6	13.8
Percent of Heavy Congestion	28.9	24.5	21.7	16.7	23.4	13.1	14.0	22.1	12.6	23.5	16.1
Percent of Severe Congestion	57.7	66.0	67.8	70.5	62.3	67.9	66.3	60.5	74.7	67.9	70.1
Population (000)	1,700	1,750	1,820	1,840	1,860	1,875	1,905	1,915	1,990	2,020	2,040
Urban Area (square kilometers)	1,166	1,269	1,347	1,347	1,347	1,360	1,373	1,399	1,489	1,554	1,684
Population Density	1,459	1,379	1,351	1,366	1,381	1,379	1,388	1,369	1,336	1,300	1,212
Registered Vehicles (000)	-	-	-	-	986	994	1,008	1,016	1,031	1,054	1,075
Fuel Cost ($/liter)	-	-	-	-	-	0.28	0.31	0.35	0.38	0.37	0.37
Total VKT (000)	39,390	42,837	45,843	49,023	51,330	52,955	53,666	56,274	58,562	59,446	62,262
Total Lane-Kilometers	7,200	7,844	9,077	9,185	9,256	9,333	9,420	9,517	9,576	9,678	10,103
Roadway Congestion Index	0.84	0.84	0.85	0.84	0.88	0.91	0.92	0.98	1.01	1.02	1.04

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-5. Mobility and Congestion Variables in Boston MA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	25,607	27,072	27,845	29,302	32,297	32,530	36,571	35,541	34,792	34,905	35,251
Lane-Kilometers	2,270	2,278	2,294	2,335	2,367	2,399	2,431	2,439	2,447	2,447	2,439
VKT/lane-kilometer	11,280	11,883	12,137	12,552	13,646	13,560	15,043	14,571	14,217	14,263	14,452
Incident Ratio	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	30	30	35	35	40	40	45	45	45	45	45
Percent of Moderate Congestion	12.5	20.8	30.0	44.2	30.0	42.9	26.9	17.7	22.9	15.2	13.4
Percent of Heavy Congestion	33.3	29.2	20.0	11.6	20.0	23.8	28.2	35.3	34.3	34.9	31.3
Percent of Severe Congestion	54.2	50	50.0	44.2	50.0	33.3	44.9	47.1	42.9	50.0	55.2
Principal Arterial Streets											
Daily VKT (000)	20,536	20,914	21,172	21,711	21,590	22,057	20,705	20,367	20,189	20,125	20,922
Lane-kilometers	4,154	4,186	4,202	4,218	4,242	4,315	4,331	4,355	4,444	4,444	4,589
VKT/lane-kilometer	4,944	4,996	5,038	5,147	5,089	5,112	4,781	4,677	4,543	4,529	4,560
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	35	35	35	35	35	35	40	40	40	40	40
Percent of Moderate Congestion	30.2	18.3	17.0	16.0	18.9	21.4	21.3	18.7	19.2	28.2	30.4
Percent of Heavy Congestion	15.9	31.0	23.0	18.7	17.6	11.4	22.5	20.0	16.4	14.1	20.3
Percent of Severe Congestion	54.0	50.7	60.0	65.3	63.5	67.1	56.3	61.3	64.4	57.8	49.3
Population (000)	2,850	2,760	2,760	2,760	2,760	2,850	2,905	2,950	2,955	2,955	2,960
Urban Area (square kilometers)	2,357	2,668	2,668	2,668	2,668	2,681	2,707	2,758	2,771	2,771	2,771
Population Density	1,209	1,035	1,035	1,035	1,035	1,063	1,073	1,069	1,066	1,066	1,068
Registered Vehicles (000)	-	-	-	-	1,463	1,511	1,537	1,649	1,657	1,661	1,673
Fuel Cost ($/liter)	-	-	-	-	-	0.26	0.28	0.31	0.36	0.35	0.36
Total VKT (000)	70,277	72,142	73,154	75,131	78,017	78,779	79,312	82,780	82,659	83,142	84,319
Total Lane-Kilometers	14,818	14,815	14,815	14,822	14,820	14,822	14,825	14,825	15,010	15,131	15,131
Roadway Congestion Index	0.9	0.93	0.95	0.98	1.04	1.04	1.12	1.09	1.06	1.06	1.07

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-6. Mobility and Congestion Variables in Charlotte NC

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	2,842	3,059	3,220	3,437	3,590	3,711	3,888	4,411	4,653	4,830	5,152
Lane-Kilometers	403	411	427	435	443	451	451	475	483	483	491
VKT/lane-kilometer	7,060	7,451	7,547	7,907	8,109	8,232	8,625	9,288	9,633	10,000	10,492
Incident Ratio	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	20	25	25	25	25	30	30	35	35
Percent of Moderate Congestion	100.0	100.0	100.0	81.0	93.9	94.1	84.4	84.4	84.4	85.0	54.6
Percent of Heavy Congestion	-	-	-	19.1	6.1	5.9	15.6	15.6	15.6	15.0	19.3
Percent of Severe Congestion	-	-	-	-	-	-	-	-	-	-	26.1
Principal Arterial Streets											
Daily VKT (000)	3,775	4,122	4,202	4,339	4,444	4,572	4,580	4,597	4967	5,136	5,152
Lane-kilometers	725	741	757	789	805	821	837	853	861	869	934
VKT/lane-kilometer	5,211	5,565	5553	5,500	5,520	5,569	5,471	5,387	5,766	5,907	5,517
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	45	50	50	55	55	55	60	60	60	60	60
Percent of Moderate Congestion	50.9	57.1	57.6	58.6	10.3	16.7	10.8	11.9	4.4	6.3	8.0
Percent of Heavy Congestion	47.5	14.3	18.6	2.9	54.4	33.3	26.2	22.4	33.3	21.5	22.7
Percent of Severe Congestion	1.7	28.6	23.7	38.6	35.3	50.0	63.0	65.7	62.3	72.2	69.3
Population (000)	350	350	355	360	400	415	435	440	450	460	500
Urban Area (square kilometers)	518	544	570	583	583	596	596	622	622	673	751
Population Density	676	644	623	618	686	697	730	708	724	683	666
Registered Vehicles (000)	-	-	-	-	347	359	375	377	377	378	410
Fuel Cost ($/liter)	-	-	-	-	-	0.27	0.29	0.32	0.36	0.35	0.35
Total VKT (000)	10,859	11,283	11,507	12,383	12,399	12,370	13,910	14,823	16,335	17,034	18,333
Total Lane-Kilometers	2,903	2,964	2,998	3,053	3,078	3,159	3,199	3,299	3,350	3,452	3,655
Roadway Congestion Index	0.71	0.76	0.76	0.77	0.78	0.79	0.8	0.82	0.86	0.89	0.89

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-7. Mobility and Congestion Variables in Chicago IL

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	40,983	41,602	43,092	46,159	49,821	49,821	51,464	55,448	61,228	62,758	63,112
Lane-Kilometers	3,292	3,309	3,341	3,429	3,510	3,518	3,550	3,703	3,904	3,920	3,928
VKT/lane-kilometer	12,447	12,574	12,899	13,460	14,195	14,162	14,497	14,974	15,682	16,008	16,066
Incident Ratio	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	50	50	55	55	55	55	55	55	55	55	60
Percent of Moderate Congestion	18.5	28.3	14.5	9.2	6.8	9.2	10.9	16.4	12.2	13.3	17.3
Percent of Heavy Congestion	29.6	35.9	21.0	15.8	14.9	22.4	21.8	15.1	20.3	16.0	12.0
Percent of Severe Congestion	51.9	35.9	64.5	75.0	78.4	68.4	69.1	68.5	67.6	70.7	70.7
Principal Arterial Streets											
Daily VKT (000)	33,665	34,776	36,322	36,821	40,218	40,194	41,965	45,048	47,415	50,771	52,808
Lane-kilometers	5,587	5,780	5,949	5,989	6,005	6,021	6,046	6,521	6,859	7,181	7,487
VKT/lane-kilometer	6,026	6,017	6,106	6,148	6,697	6,675	6,941	6,909	6,913	7,071	7,054
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	60	65	65	70	70	70	65	65	65	65	70
Percent of Moderate Congestion	23.9	24.2	23.2	24.7	16.1	20.2	22.1	20.0	24.7	22.8	18.8
Percent of Heavy Congestion	35.8	36.4	24.6	11.1	14.8	11.9	23.4	26.3	28.6	28.5	31.3
Percent of Severe Congestion	40.3	39.4	52.2	64.2	69.1	67.9	54.6	53.8	46.8	48.7	50.0
Population (000)	7,080	7,100	7,100	7,100	7,160	7,200	7,340	7,405	7,510	7,515	7,515
Urban Area (square kilometers)	4,921	5,076	5,076	5,076	5,076	5,076	5,154	5,141	5,154	5,154	5,154
Population Density	1,439	1,399	1,399	1,399	1,410	1,418	1,424	1,440	1,457	1,458	1,458
Registered Vehicles (000)	-	-	-	-	3,938	3,960	4,033	4,058	4,038	4,046	4,050
Fuel Cost ($/liter)	-	-	-	-	-	0.28	0.31	0.34	0.39	0.37	0.38
Total VKT (000)	154,252	158,715	163,536	166,839	172,969	176,435	181,944	192,622	198,788	203,567	204,840
Total Lane-Kilometers	30,490	30,542	30,577	30,501	30,547	30,780	30,815	30,943	31,087	31,131	31,342
Roadway Congestion Index	1.02	1.02	1.05	1.08	1.15	1.15	1.18	1.21	1.25	1.27	1.28

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-8. Mobility and Congestion Variables in Cincinnati OH

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	13,661	13,661	13,935	14,240	14,345	15,392	15,698	17,533	18,322	18,676	19,175
Lane-Kilometers	1,208	1,272	1,304	1,320	1,320	1,360	1,360	1,433	1,457	1,465	1,473
VKT/lane-kilometer	11,313	10,741	10,685	10,787	10,866	11,314	11,538	12,236	12,575	12,747	13,016
Incident Ratio	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	20	20	20	25	30	30	30	30	35
Percent of Moderate Congestion	96.4	80.8	56.3	47.3	55.0	65.5	54.1	66.7	60.0	57.5	47.9
Percent of Heavy Congestion	-	15.4	33.8	40	35.0	27.6	35.1	23.1	26.7	32.1	38.6
Percent of Severe Congestion	3.6	3.9	10	12.7	10.0	6.9	10.8	10.3	13.3	10.4	13.5
Principal Arterial Streets											
Daily VKT (000)	4,862	5,096	5,192	5,297	5,216	5,337	5,530	5,828	5,909	6,923	7,245
Lane-kilometers	1,248	1,248	1,248	1,256	1,256	1,272	1,280	1,280	1,320	1,328	1,328
VKT/lane-kilometer	3,897	4,084	4,161	4,218	4,154	4,196	4,321	4,553	4,476	5,212	5,455
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	20	20	20	25	25	25	25	25	25	30	30
Percent of Moderate Congestion	40.7	42.9	33.3	25.8	34.3	43.2	21.6	41.0	40.0	38.0	32.8
Percent of Heavy Congestion	37.0	37.6	40.0	48.4	28.6	24.3	29.7	12.8	12.5	14.3	22.6
Percent of Severe Congestion	22.2	19.5	26.7	25.8	37.1	32.4	48.7	46.2	47.5	47.7	44.7
Population (000)	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,140	1,140	1,200	1,220
Urban Area (square kilometers)	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,463	1,476	1,528	1,632
Population Density	779	779	779	779	779	779	779	779	772	785	748
Registered Vehicles (000)	-	-	-	-	880	889	905	938	928	934	970
Fuel Cost ($/liter)	-	-	-	-	-	0.27	0.3	0.34	0.36	0.35	0.35
Total VKT (000)	31,624	32,487	33,061	33,491	33,940	35,396	36,117	36,987	38,709	42,692	44,869
Total Lane-Kilometers	5,822	5,848	5,918	5,963	6,015	6,021	6,055	6,091	6,097	6,128	6,360
Roadway Congestion Index	0.86	0.83	0.82	0.83	0.84	0.87	0.88	0.94	0.96	0.99	1.01

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-9. Mobility and Congestion Variables in Cleveland OH

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	16,100	16,454	16,760	16,189	17,235	18,008	20,399	21,268	22,057	22,492	22,798
Lane-Kilometers	1,546	1,546	1,546	1,546	1,546	1,546	1,594	1,707	1,852	1,868	1,900
VKT/lane-kilometer	10,417	10,646	10,844	10,474	11,151	11,651	12,798	12,462	11,913	12,043	12,000
Incident Ratio	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	25	25	25	25	25	30	30	30	30
Percent of Moderate Congestion	100.0	100.0	81.8	69.2	69.2	64.3	54.6	50.0	60.0	60.0	51.6
Percent of Heavy Congestion	-	-	18.2	23.1	23.1	28.6	40.9	36.7	32.0	30.0	22.6
Percent of Severe Congestion	-	-	-	7.7	7.7	7.1	4.6	13.3	8.0	10.0	25.8
Principal Arterial Streets											
Daily VKT (000)	7,237	7,285	7,317	7,462	7,615	7,792	8,066	8,509	9,644	9,741	10,143
Lane-kilometers	1,771	1,771	1,771	1,771	1,771	1,771	1,787	1,795	1,803	1,811	1,835
VKT/lane-kilometer	4,086	4,114	4,132	4,214	4,300	4,400	4,514	4,740	5,348	5,378	5,526
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	20	20	20	20	20	25	30	30	30	30	35
Percent of Moderate Congestion	100	100	100	100	61.5	42.3	46.6	34.3	34.9	36.0	21.1
Percent of Heavy Congestion	-	-	-	-	38.5	57.7	44.8	41.8	33.3	33.7	45.6
Percent of Severe Congestion	-	-	-	-	-	-	8.6	23.9	31.8	30.3	33.3
Population (000)	1,750	1,750	1,750	1,750	1,750	1,750	1,785	1,785	1,790	1,790	1,790
Urban Area (square kilometers)	1,632	1,632	1,632	1,632	1,632	1,632	1,658	1,658	1,671	1,671	1,709
Population Density	1,073	1,073	1,073	1,073	1,073	1,073	1,077	1,077	1,072	1,072	1,047
Registered Vehicles (000)	-	-	-	-	1,441	1,444	1,475	1,480	1,485	1,494	1,500
Fuel Cost ($/liter)	-	-	-	-	-	0.27	0.3	0.34	0.36	0.35	0.35
Total VKT (000)	40,224	41,557	42,335	42,087	43,647	44,824	47,857	50,878	53,080	55,437	56,239
Total Lane-Kilometers	8,211	8,243	8,296	8,301	8,628	8,869	8,879	8,898	8,913	8,915	8,939
Roadway Congestion Index	0.8	0.82	0.83	0.81	0.86	0.89	0.97	0.96	0.94	0.95	0.95

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-10. Mobility and Congestion Variables in Columbus OH

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	9,708	10,401	10,546	10,731	11,769	12,381	12,630	13,041	14,490	14,893	15,231
Lane-Kilometers	1,135	1,159	1,175	1,208	1,232	1,248	1,264	1,272	1,288	1,296	1,304
VKT/lane-kilometer	8,553	8,972	8,973	8,887	9,556	9,923	9,994	10,253	11,250	11,491	11,679
Incident Ratio	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	25	25	25	25	25	25	25	25	30	30	30
Percent of Moderate Congestion	25.0	29.0	28.0	37.9	25.9	7.1	6.4	12.0	8.0	9.7	9.7
Percent of Heavy Congestion	47.7	45.2	28.0	24.1	44.4	39.3	40.0	40.0	40.0	39.7	29.7
Percent of Severe Congestion	27.3	25.8	44.0	37.9	29.6	53.6	53.6	48.0	52.0	50.7	60.7
Principal Arterial Streets											
Daily VKT (000)	3,679	3,977	4,033	4,073	4,186	4,291	4,452	4,894	5,120	5,490	5,756
Lane-kilometers	902	918	942	950	950	958	966	966	982	998	1,022
VKT/lane-kilometer	4,080	4,333	4,282	4,288	4,407	4,479	4,608	5,067	5,213	5,500	5,630
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	30	35	35	35	40	40	40	45	45	45	50
Percent of Moderate Congestion	20.6	69.1	63.3	55.6	43.4	35.7	14.0	12.8	18.5	19.6	21.5
Percent of Heavy Congestion	52.9	19.1	28.6	37.0	28.3	37.5	59.7	55.3	33.3	32.1	17.4
Percent of Severe Congestion	26.5	11.9	8.2	7.4	28.3	26.8	26.3	31.9	48.2	48.2	61.1
Population (000)	835	835	835	835	835	840	840	840	850	900	950
Urban Area (square kilometers)	790	790	790	790	790	790	790	790	803	816	907
Population Density	1,057	1,057	1,057	1,057	1,057	1,063	1,063	1,063	1,059	1,103	1,048
Registered Vehicles (000)	-	-	-	-	726	735	743	752	745	750	798
Fuel Cost ($/liter)	-	-	-	-	-	0.27	0.3	0.34	0.36	0.35	0.35
Total VKT (000)	20,057	20,742	21,033	21,413	22,247	23,029	23,857	26,512	29,597	33,269	34,156
Total Lane-Kilometers	4,589	4,746	4,867	5,038	5,041	5,052	5,102	5,141	5,142	5,146	5,175
Roadway Congestion Index	0.68	0.71	0.71	0.71	0.75	0.78	0.79	0.82	0.89	0.91	0.93

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}_{\textit{Ln.-Km.}} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT}_{\textit{Ln.-Km.}} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-11. Mobility and Congestion Variables in Corpus Christi TX

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	2,093	2,206	2,190	2,254	2,286	2,415	2,431	2,447	2,512	2,584	2,697
Lane-Kilometers	258	266	266	266	274	290	298	298	298	299	303
VKT/lane-kilometer	8,125	8,303	8,242	8,485	8,353	8,333	8,162	8,216	8,432	8,629	8,910
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	5	5	5	5	10	10	10	10	10	10	15
Percent of Moderate Congestion	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	90.0	78.2
Percent of Heavy Congestion	-	-	-	-	-	-	-	-	-	10.0	21.8
Percent of Severe Congestion	-	-	-	-	-	-	-	-	-	-	-
Principal Arterial Streets											
Daily VKT (000)	2,013	2,093	2,174	2,206	2,254	2,399	2,318	2335	2,447	2,487	2,632
Lane-kilometers	499	507	515	515	515	515	523	531	539	564	602
VKT/lane-kilometer	4,032	4,127	4,219	4,281	4,375	4,656	4,431	4,394	4,537	4,414	4,372
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	10	10	10	10	10	10	10	10	10	15	15
Percent of Moderate Congestion	25.5	16.1	20.0	22.2	24.2	21.3	23.5	56.4	67.4	66.3	57.6
Percent of Heavy Congestion	30.0	28.6	50.0	60.0	47.0	47.5	61.8	30.8	21.7	20.6	33.3
Percent of Severe Congestion	44.5	55.4	30.0	17.8	28.8	31.2	14.7	12.8	10.9	13.1	9.1
Population (000)	250	250	250	260	270	275	275	275	280	285	285
Urban Area (square kilometers)	440	440	440	440	453	453	453	453	453	466	466
Population Density	568	568	568	591	596	607	607	607	618	611	611
Registered Vehicles (000)	-	-	-	-	224	224	225	223	227	228	229
Fuel Cost ($/liter)	-	-	-	-	0.25	0.28	0.3	0.32	0.35	0.34	0.34
Total VKT (000)	8,554	8,705	8,630	8,874	9,869	10,119	10,074	10,259	10,546	10,702	10,727
Total Lane-Kilometers	2,280	2,355	2,486	2,573	2,668	2,813	2,908	3,017	3,019	3,030	3,043
Roadway Congestion Index	0.67	0.69	0.69	0.71	0.71	0.72	0.7	0.7	0.72	0.72	0.74

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-12. Mobility and Congestion Variables in Dallas TX

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	27,161	29,624	32,079	33,971	36,346	35,581	36,032	36,458	38,125	38,479	39,445
Lane-Kilometers	2,496	2,544	2,608	2,640	2,657	2,673	2,697	2,721	2,753	2,761	2,818
VKT/lane-kilometer	10,884	11,646	12,299	12,866	13,682	13,313	13,361	13,399	13,848	13,936	14,000
Incident Ratio	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	45	50	50	50	55	55	55	55	55	55	55
Percent of Moderate Congestion	20.0	26.5	33.3	39.0	13.0	34.6	29.4	31.5	22.4	21.4	23.0
Percent of Heavy Congestion	10.0	8.8	13.3	19.5	24.1	20.0	15.7	24.1	29.3	25.0	31.2
Percent of Severe Congestion	70.0	64.7	53.3	41.5	63.0	45.5	54.9	44.4	48.3	53.6	45.9
Principal Arterial Streets											
Daily VKT (000)	10,368	11,326	12,300	12,800	13,250	13,202	13,122	13,250	13,379	13,524	13,766
Lane-kilometers	2,504	2,568	2,657	2,697	2,705	2,721	2,729	2,729	2,753	2,769	2,818
VKT/lane-kilometer	4,141	4,411	4,630	4,746	4,899	4,852	4,808	4,855	4,860	4,884	4,886
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	25	25	30	30	30	30	35	35	35	35	35
Percent of Moderate Congestion	33.3	17.2	46.8	51.9	51.1	44.2	43.2	39.0	46.3	42.9	45.7
Percent of Heavy Congestion	66.7	72.8	21.3	22.2	31.9	31.5	43.2	42.1	26.8	30.8	26.1
Percent of Severe Congestion	-	10.0	31.9	25.9	17.0	24.4	13.5	19.0	26.8	26.3	28.3
Population (000)	1,810	1,830	1,845	1,865	1,890	1,910	1,950	1,970	1,990	2,070	2,080
Urban Area (square kilometers)	3,548	3,587	3,600	3,626	3,652	3,678	3,717	3,724	3,730	3,756	3,756
Population Density	510	510	512	514	518	519	525	529	534	551	554
Registered Vehicles (000)	-	-	-	-	1,521	1,570	1,598	1,586	1,601	1,611	1,639
Fuel Cost ($/liter)	-	-	-	-	0.25	0.28	0.3	0.32	0.35	0.34	0.34
Total VKT (000)	61,898	65,166	68,027	72,291	78,611	78,911	79,529	81,001	80,709	81,828	81,949
Total Lane-Kilometers	14,590	15,166	15,731	16,382	17,042	18,014	18,769	19,822	19,827	20,125	20,608
Roadway Congestion Index	0.84	0.89	0.94	0.98	1.04	1.02	1.02	1.02	1.05	1.06	1.07

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}_{\textit{Ln.-Km.}} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT}_{\textit{Ln.-Km.}} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-13. Mobility and Congestion Variables in Denver CO

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	13,363	13,588	14,071	14,571	14,957	15,376	16,889	17,275	18,145	18,394	20,125
Lane-Kilometers	1,280	1,280	1,288	1,288	1,312	1,377	1,385	1,385	1,425	1,441	1,546
VKT/lane-kilometer	10,440	10,616	10,925	11,313	11,399	11,170	12,198	12,477	12,734	12,765	13,021
Incident Ratio	1	1	1	1	1	1	1	1	1	1	1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	45	45	45	45	50	50	50	50	50	55	55
Percent of Moderate Congestion	67.9	40.0	8.9	34.8	33.3	30.8	23.1	29.4	22.4	22.1	24.2
Percent of Heavy Congestion	28.3	42.2	60.0	32.6	29.4	36.5	42.3	37.3	26.9	32.4	27.4
Percent of Severe Congestion	3.8	17.8	31.1	32.6	37.3	32.7	34.6	33.3	50.8	45.6	48.4
Principal Arterial Streets											
Daily VKT (000)	14,748	15,134	16,269	16,857	17,195	17,066	16,816	17,066	17,549	17,388	17,710
Lane-kilometers	2,809	2,874	2,874	2,874	2,890	2,946	2,954	2,962	2,979	2,979	2,995
VKT/lane-kilometer	5,249	5,266	5,661	5,866	5,950	5,792	5,692	5,761	5,892	5,838	5,914
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	50	50	50	50	50	50	50	50	50	50	50
Percent of Moderate Congestion	51.9	34.0	24.5	44.1	50.0	52.9	54.7	36.8	22.0	14.1	23.8
Percent of Heavy Congestion	5.8	24.0	12.2	22.0	19.6	23.5	24.5	28.1	28.0	29.7	19.1
Percent of Severe Congestion	42.3	42.0	63.3	33.9	30.4	23.5	20.8	35.1	50.0	56.3	57.1
Population (000)	1,350	1,350	1,450	1,485	1,500	1,510	1,550	1,565	1,580	1,580	1,600
Urban Area (square kilometers)	2,150	2,150	2,176	2,214	2,240	2,266	2,292	2,292	2,305	2,305	2,331
Population Density	628	628	666	671	670	666	676	683	685	685	686
Registered Vehicles (000)	-	-	-	-	1,249	1,324	1,360	1,360	1,387	1,392	1,400
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.32	0.32	0.37	0.36	0.37
Total VKT (000)	43,166	43,800	44,206	44,737	44,731	45,790	46,481	46,529	46,561	46,624	51,240
Total Lane-Kilometers	8,213	8,673	9,072	9,180	9,249	9,394	9,436	9,475	9,547	9,586	10,164
Roadway Congestion Index	0.88	0.89	0.93	0.96	0.97	0.95	0.99	1.01	1.03	1.03	1.05

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-14. Mobility and Congestion Variables in Detroit MI

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	32,522	31,645	33,416	34,543	34,889	35,098	37,062	39,526	41,932	44,114	46,046
Lane-Kilometers	2,383	2,383	2,399	2,496	2,544	2,592	2,640	2,721	2,801	2,866	2,930
VKT/lane-kilometer	13,649	13,280	13,930	13,842	13,715	13,540	14,037	14,527	14,968	15,393	15,714
Incident Ratio	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	40	35	40	35	40	40	45	45	45	45	45
Percent of Moderate Congestion	42.6	33.3	32.0	30.0	31.3	33.3	23.9	24.2	25.0	21.1	19.7
Percent of Heavy Congestion	31.9	33.3	32.0	30.0	26.6	16.7	17.9	11.3	11.7	12.9	9.1
Percent of Severe Congestion	25.5	33.3	36.0	40.0	42.2	50.0	58.2	64.5	63.3	66.0	71.2
Principal Arterial Streets											
Daily VKT (000)	31,121	30,445	30,791	30,968	31,306	31,467	31,669	31,910	33,609	35,710	39,445
Lane-kilometers	5,716	5,748	5,796	5,860	5,957	6,038	6,150	6,247	6,279	6,480	6,875
VKT/lane-kilometer	5,445	5,297	5,313	5,284	5,255	5,212	5,149	5,108	5,353	5,511	5,738
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	60	55	60	55	60	60	60	60	65	65	65
Percent of Moderate Congestion	41.2	44.4	20.0	10.0	6.5	6.3	15.1	8.2	13.8	12.9	8.2
Percent of Heavy Congestion	14.7	11.1	30.0	20.0	10.9	9.4	7.5	12.9	19.5	22.0	24.7
Percent of Severe Congestion	44.1	44.4	50.0	70.0	82.6	84.4	77.4	78.8	66.7	65.2	67.1
Population (000)	3,810	3,810	3,810	3,885	3,885	3,885	3,900	3,900	4,000	3,985	4,000
Urban Area (square kilometers)	2,823	2,953	3,082	3,212	3,225	3,225	3,238	3,238	3,250	3,263	3,341
Population Density	1,350	1,290	1,236	1,210	1,205	1,205	1,205	1,205	1,231	1,221	1,197
Registered Vehicles (000)	-	-	-	-	-	2,873	2,889	2,889	2,875	2,868	2,880
Fuel Cost ($/liter)	-	-	-	-	-	0.28	0.3	0.33	0.36	0.35	0.35
Total VKT (000)	99,804	100,884	102,407	106,888	116,150	115,659	123,363	127,274	129,159	131,023	133,918
Total Lane-Kilometers	19,747	19,756	19,808	20,653	20,631	20,640	20,658	20,663	20,777	20,858	20,716
Roadway Congestion Index	1.06	1.03	1.07	1.06	1.05	1.04	1.07	1.09	1.13	1.16	1.19

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-15. Mobility and Congestion Variables in El Paso TX

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	4,122	4,331	4,508	5,023	5,506	5,152	5,345	5,313	5,361	5,458	5,635
Lane-Kilometers	523	539	555	555	555	564	564	564	564	572	572
VKT/lane-kilometer	7,877	8,030	8,116	9,043	9,913	9,143	9,486	9,429	9,514	9,549	9,859
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	15	15	15	20	20	20	20	20	20	20	25
Percent of Moderate Congestion	100.0	100.0	100.0	100.0	75.0	36.1	34.3	45.0	50.0	52.9	43.9
Percent of Heavy Congestion	-	-	-	-	25.0	63.9	65.7	55.0	43.3	42.1	44.0
Percent of Severe Congestion	-	-	-	-	-	-	-	-	6.7	5.0	12.1
Principal Arterial Streets											
Daily VKT (000)	4,186	4,355	4,540	4,637	4,693	4,830	5,007	5,112	5,152	5,273	5,353
Lane-kilometers	1,224	1,256	1,288	1,288	1,296	1,296	1,296	1,336	1,344	1,352	1,377
VKT/lane-kilometer	3,421	3,468	3,525	3,600	3,621	3,727	3,863	3,825	3,832	3,899	3,889
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	5	5	5	5	5	5	5	5	5	5	10
Percent of Moderate Congestion	27.0	31.6	59.3	60.0	60.0	60.7	60.0	57.8	25.0	28.6	33.3
Percent of Heavy Congestion	73.0	68.4	40.7	40.0	40.0	39.3	40.0	31.7	48.8	27.9	16.7
Percent of Severe Congestion	-	-	-	-	-	-	-	10.4	26.3	43.6	50.0
Population (000)	450	450	450	455	480	500	510	520	540	560	565
Urban Area (square kilometers)	389	492	466	479	492	518	531	531	544	544	544
Population Density	1,158	914	965	950	975	965	961	979	993	1,030	1,039
Registered Vehicles (000)	-	-	-	-	347	352	359	344	345	346	353
Fuel Cost ($/liter)	-	-	-	-	0.25	0.28	0.3	0.32	0.35	0.34	0.34
Total VKT (000)	10,599	10,840	11,098	11,927	12,516	13,218	14,327	14,659	15,224	15,281	15,395
Total Lane-Kilometers	2,343	2,436	2,595	2,695	2,805	3,135	3,600	4,273	4,273	4,381	4,381
Roadway Congestion Index	0.63	0.64	0.65	0.7	0.75	0.71	0.74	0.74	0.74	0.75	0.76

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-16. Mobility and Congestion Variables in Fort Worth TX

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	13,886	14,860	15,593	16,213	17,308	17,710	17,952	18,161	19,062	19,803	20,608
Lane-Kilometers	1,457	1,505	1,554	1,570	1,570	1,594	1,610	1,634	1,642	1,658	1,691
VKT/lane-kilometer	9,530	9,872	10,036	10,328	11,026	11,111	11,150	11,113	11,608	11,942	12,190
Incident Ratio	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	30	35	35	35	40	40	40	40	40	40	40
Percent of Moderate Congestion	30.0	26.5	33.3	39.0	13.0	34.6	29.4	31.5	22.4	21.4	23.0
Percent of Heavy Congestion	10.0	8.8	13.3	19.5	24.1	20.0	15.7	24.1	29.3	25.0	31.2
Percent of Severe Congestion	60.0	64.7	53.3	41.5	63.0	45.5	54.9	44.4	48.3	53.6	45.9
Principal Arterial Streets											
Daily VKT (000)	5,893	6,190	6,464	6,665	6,843	6,843	6,762	6,794	6,826	6,843	6,987
Lane-kilometers	1,264	1,288	1,328	1,352	1,369	1,385	1,393	1,393	1,401	1,417	1,449
VKT/lane-kilometer	4,662	4,806	4,867	4,929	5,000	4,942	4,855	4,879	4,874	4,830	4,822
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	25	25	30	30	30	30	30	30	30	30	30
Percent of Moderate Congestion	40.0	50.0	46.8	51.9	51.1	34.2	43.2	29.0	46.3	42.9	45.7
Percent of Heavy Congestion	30.0	20.0	21.3	22.2	31.9	41.5	43.2	42.1	26.8	30.8	26.1
Percent of Severe Congestion	30.0	30.0	31.9	25.9	17.0	24.4	13.5	29.0	26.8	26.3	28.3
Population (000)	1,085	1,090	1,095	1,100	1,120	1,130	1,150	1,165	1,200	1,200	1,200
Urban Area (square kilometers)	2,098	2,098	2,111	2,124	2,137	2,150	2,189	2,189	2,202	2,202	2,202
Population Density	517	520	519	518	524	526	525	532	545	545	545
Registered Vehicles (000)	-	-	-	-	902	938	966	984	999	999	1,002
Fuel Cost ($/liter)	-	-	-	-	0.25	0.28	0.3	0.32	0.35	0.34	0.34
Total VKT (000)	33,329	35,090	36,629	38,925	42,330	42,490	42,823	43,617	45,193	46,413	47,347
Total Lane-Kilometers	7,857	8,166	8,472	8,821	9,177	9,700	10,106	10,674	10,676	11,038	11,049
Roadway Congestion Index	0.76	0.79	0.8	0.82	0.87	0.87	0.87	0.87	0.9	0.92	0.94

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}\,/\,\textit{Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT}\,/\,\textit{Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-17. Mobility and Congestion Variables in Ft. Lauderdale FL

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	8,597	8,630	8,758	8,968	9,177	9,982	10,385	10,996	11,439	11,479	12,478
Lane-Kilometers	837	845	853	869	894	902	934	950	966	966	1,047
VKT/lane-kilometer	10,269	10,210	10,264	10,315	10,270	11,071	11,121	11,576	11,842	11,883	11,923
Incident Ratio	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	20	20	25	30	30	35	40	40	40
Percent of Moderate Congestion	45.2	50.8	40.0	37.7	60.0	60.0	60.0	60.0	60.0	56.7	40.4
Percent of Heavy Congestion	19.4	19.2	25.0	26.4	20.0	20.0	20.0	28.0	32.0	33.3	45.6
Percent of Severe Congestion	35.5	30.0	35.0	35.9	20.0	20.0	20.0	12.0	8.0	10.0	14.0
Principal Arterial Streets											
Daily VKT (000)	8,791	8,694	8,710	8,694	8,662	8,855	8,919	9,024	9,338	9,660	10,224
Lane-kilometers	1,642	1,674	1,691	1,707	1,715	1,723	1,755	1,771	1,795	1,811	1,852
VKT/lane-kilometer	5,353	5,192	5,152	5,094	5,052	5,140	5,083	5,095	5,202	5,333	5,522
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	45	45	45	50	50	50	50	50	50	50	50
Percent of Moderate Congestion	60.5	55.6	36.5	24.4	11.5	12.4	10.1	20.0	14.3	18.8	25.5
Percent of Heavy Congestion	30.0	33.3	31.8	43.6	28.2	34.6	40.6	35.7	38.6	34.3	34.5
Percent of Severe Congestion	9.5	11.1	31.8	32.1	60.3	53.1	49.3	44.3	47.1	46.9	40.0
Population (000)	1,065	1,090	1,105	1,135	1,165	1,170	1,205	1,255	1,270	1,275	1,285
Urban Area (square kilometers)	881	1,010	1,036	1,036	1,036	1,062	1,088	1,114	1,114	1,114	1,127
Population Density	1,209	1,079	1,067	1,096	1,125	1,102	1,108	1,127	1,140	1,145	1,141
Registered Vehicles (000)	-	-	-	-	952	955	982	1,024	1,025	1,030	1,041
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.34	0.36	0.35	0.35
Total VKT (000)	30,010	30,229	30,976	32,250	32,762	35,634	35,979	38,273	39,121	40,902	45,854
Total Lane-Kilometers	5,284	5,379	5,505	5,517	5,542	6,055	6,773	6,783	6,791	6,791	6,802
Roadway Congestion Index	0.87	0.86	0.86	0.85	0.85	0.9	0.9	0.92	0.94	0.95	0.96

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-18. Mobility and Congestion Variables in Hartford CT

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	6,955	7,760	8,589	8,605	8,919	9,443	9,757	9,950	10,022	10,046	10,868
Lane-Kilometers	725	805	829	837	861	886	886	934	934	934	974
VKT/lane-kilometer	9,600	9,640	10,359	10,279	10,355	10,664	11,018	10,655	10,733	10,759	11,157
Incident Ratio	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	10	10	10	10	10	10	15	15	15	15	15
Percent of Moderate Congestion	90.0	90.0	80.0	80.8	48.2	50.0	43.8	38.6	35.0	38.8	26.7
Percent of Heavy Congestion	10.0	10.0	20.0	19.2	33.3	32.1	25.0	35.7	38.8	35.3	41.1
Percent of Severe Congestion	-	-	-	-	18.5	17.9	31.3	25.7	26.3	25.9	32.2
Principal Arterial Streets											
Daily VKT (000)	3,784	4,532	5,023	5,104	5,176	5,160	5,506	5,860	6,038	6,118	6,182
Lane-kilometers	869	894	902	918	942	942	942	998	1,022	1,047	1,055
VKT/lane-kilometer	4,352	5,072	5,571	5,561	5,496	5,479	5,846	5,871	5,906	5,846	5,863
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	20	25	25	25	25	30	30	35	35	35	35
Percent of Moderate Congestion	35.6	43.8	25	23.5	13.7	29.4	29.6	26.8	34.9	40.9	33.3
Percent of Heavy Congestion	48.9	41.7	41.7	41.2	51	45.1	42.6	44.6	34.9	31.8	36.1
Percent of Severe Congestion	15.6	14.6	33.3	35.3	35.3	25.5	27.8	28.6	30.2	27.3	30.6
Population (000)	565	570	575	575	585	590	600	605	610	610	615
Urban Area (square kilometers)	907	919	919	919	919	932	932	932	932	932	945
Population Density	623	620	625	625	636	633	644	649	654	654	651
Registered Vehicles (000)	450	460	470	480	500	510	510	520	524	525	528
Fuel Cost ($/liter)	-	-	-	-	-	0.29	0.32	0.36	0.38	0.37	0.37
Total VKT (000)	15,305	17,630	18,380	19,183	19,930	21,233	21,841	21,883	22,376	22,571	24,308
Total Lane-Kilometers	3,006	3,716	3,742	3,755	3,774	3,780	3,806	3,838	3,856	3,875	4,096
Roadway Congestion Index	0.76	0.79	0.86	0.85	0.85	0.87	0.9	0.89	0.89	0.89	0.91

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-19. Mobility and Congestion Variables in Honolulu HI

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	5,957	6,029	6,223	6,424	6,770	6,979	7,100	7,285	7,438	7,567	8,195
Lane-Kilometers	523	523	531	531	531	531	531	547	547	547	604
VKT/lane-kilometer	11,385	11,523	11,712	12,091	12,742	13,136	13,364	13,309	13,588	13,824	13,573
Incident Ratio	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	40	40	45	45	45	45	50	50	50	50	50
Percent of Moderate Congestion	9.7	3.6	6.9	17.1	24.4	26.1	20.5	20.8	22.6	19.1	15.0
Percent of Heavy Congestion	32.3	25.0	20.7	12.9	13.3	13.9	22.7	20.8	26.4	26.4	30.0
Percent of Severe Congestion	58.1	71.4	72.4	70.0	62.2	60.0	56.8	58.3	50.9	54.6	55.0
Principal Arterial Streets											
Daily VKT (000)	1,996	2,093	2,125	2,004	2,318	2,343	2,455	2,504	2,529	2,608	2,809
Lane-kilometers	322	322	322	330	338	346	346	354	362	370	378
VKT/lane-kilometer	6,200	6,500	6,600	6,073	6,857	6,767	7,093	7,068	6,982	7,043	7,426
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	65	65	65	70	70	70	70	70	70	70	75
Percent of Moderate Congestion	28.2	30.6	22.1	31.4	32.9	51.4	45.1	40.6	40.5	37.1	22.1
Percent of Heavy Congestion	29.6	25.0	23.4	24.3	23.3	21.4	18.3	17.4	16.7	14.5	11.6
Percent of Severe Congestion	42.3	44.4	54.5	44.3	43.8	27.1	36.6	42.0	42.9	48.3	66.3
Population (000)	570	580	585	585	595	610	655	660	660	670	685
Urban Area (square kilometers)	298	298	311	311	337	337	350	350	350	389	466
Population Density	1,914	1,947	1,882	1,882	1,767	1,812	1,873	1,888	1,888	1,725	1,469
Registered Vehicles (000)	-	-	-	-	490	492	496	498	508	509	527
Fuel Cost ($/liter)	-	-	-	-	0.29	0.31	0.34	0.37	0.44	0.43	0.43
Total VKT (000)	14,092	14,284	14,421	14,936	16,379	17,023	17,348	18,087	18,302	18,439	18,454
Total Lane-Kilometers	1,235	1,270	1,277	1,319	1,354	1,370	1,381	1,396	1,407	1,389	1,439
Roadway Congestion Index	0.92	0.94	0.95	0.96	1.03	1.05	1.07	1.07	1.09	1.1	1.1

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}|\textit{Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT}|\textit{Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-20. Mobility and Congestion Variables in Houston TX

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	33,939	36,314	39,252	38,825	38,825	41,538	43,631	44,500	45,450	47,495	49,105
Lane-Kilometers	2,214	2,270	2,383	2,383	2,431	2,640	2,882	2,995	3,091	3,244	3,341
VKT/lane-kilometer	15,331	15,996	16,473	16,294	15,970	15,732	15,140	14,860	14,703	14,640	14,699
Incident Ratio	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	65	65	70	70	75	70	70	70	70	70	70
Percent of Moderate Congestion	3.0	20.3	16.9	18.1	11.1	17.8	15.7	9.7	8.6	11.1	14.9
Percent of Heavy Congestion	13.6	15.6	16.9	12.5	19.8	12.3	15.7	27.8	30.0	27.6	25.7
Percent of Severe Congestion	83.3	64.1	66.2	69.4	69.1	69.9	68.6	62.5	61.4	61.3	59.5
Principal Arterial Streets											
Daily VKT (000)	15,657	16,664	17,485	17,469	17,404	16,905	16,406	16,744	17,436	17,549	17,935
Lane-kilometers	2,874	2,970	3,091	3,107	3,148	3,172	3,188	3,236	3,429	3,502	3,510
VKT/lane-kilometer	5,448	5,610	5,656	5,622	5,529	5,330	5,146	5,174	5,085	5,011	5,110
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	50	50	55	55	55	50	50	50	50	50	50
Percent of Moderate Congestion	35.6	24.2	20.3	17.1	21.8	24.0	14.3	18.0	21.5	20.8	24.1
Percent of Heavy Congestion	6.8	10.0	10.0	9.2	14.6	16.0	55.4	45.9	44.6	41.5	46.6
Percent of Severe Congestion	57.6	65.8	69.7	73.7	63.6	60.0	30.4	36.1	33.9	37.7	29.3
Population (000)	2,400	2,405	2,410	2,415	2,790	2,820	2,850	2,865	2,880	2,900	2,910
Urban Area (square kilometers)	3,963	3,989	4,015	4,092	4,144	4,170	4,222	4,235	4,248	4,248	4,248
Population Density	606	603	600	590	673	676	675	677	678	683	685
Registered Vehicles (000)	-	-	-	-	1901	2121	2,144	2,176	2,220	2,242	2,255
Fuel Cost ($/liter)	-	-	-	-	0.25	0.28	0.3	0.32	0.35	0.34	0.34
Total VKT (000)	87,077	90,319	92,245	92,741	99,269	103,238	111,370	115,297	116,934	117,667	117,933
Total Lane-Kilometers	16,203	17,353	18,233	18,829	21,386	23,226	26,444	27,354	27,372	27,451	27,692
Roadway Congestion Index	1.17	1.21	1.25	1.23	1.21	1.19	1.15	1.13	1.12	1.11	1.12

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-21. Mobility and Congestion Variables in Indianapolis IN

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	8,469	9,225	9,805	10,111	11,125	12,300	12,469	12,703	12,961	13,122	13,387
Lane-Kilometers	1,079	1,087	1,095	1,111	1,111	1,143	1,159	1,159	1,224	1,232	1,240
VKT/lane-kilometer	7,851	8,489	8,956	9,101	10,014	10,761	10,757	10,958	10,592	10,654	10,799
Incident Ratio	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	5	5	5	5	5	5	10	10	10	10	10
Percent of Moderate Congestion	100.0	100.0	100.0	100.0	100.0	90.0	90.0	85.0	76.9	76.8	76.0
Percent of Heavy Congestion	-	-	-	-	-	10.0	10.0	15.0	13.1	10.0	12.0
Percent of Severe Congestion	-	-	-	-	-	-	-	-	10.0	13.2	12.0
Principal Arterial Streets											
Daily VKT (000)	6,070	5,989	6,537	6,601	6,601	6,601	6,617	6,641	6,730	6,762	6,843
Lane-kilometers	1,328	1,336	1,344	1,344	1,352	1,360	1,369	1,369	1,417	1,417	1,425
VKT/lane-kilometer	4,570	4,482	4,862	4,910	4,881	4,852	4,835	4,853	4,750	4,773	4,802
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	15	15	15	15	15	15	20	20	20	20	25
Percent of Moderate Congestion	26.1	37.8	30.0	20.0	40.0	45.0	60.0	63.6	65.8	68.7	58.0
Percent of Heavy Congestion	58.7	37.8	32.6	30.0	20.0	25.0	16.7	15.2	5.3	7.4	20.0
Percent of Severe Congestion	15.2	24.3	37.4	50.0	40.0	30.0	23.3	21.2	29.0	23.9	22.0
Population (000)	860	860	860	865	895	925	930	930	945	950	955
Urban Area (square kilometers)	1,088	1,088	1,088	1,088	1,101	1,114	1,127	1,127	1,140	1,140	1,153
Population Density	791	791	791	795	813	831	825	825	829	834	829
Registered Vehicles (000)	-	-	-	-	525	544	562	581	582	583	592
Fuel Cost ($/liter)	-	-	-	-	0.26	0.28	0.3	0.33	0.35	0.34	0.34
Total VKT (000)	24,231	24,966	25,470	25,061	27,174	29,621	29,862	31,110	33,929	33,533	36,751
Total Lane-Kilometers	5,583	5,608	5,685	5,849	5,870	5,997	6,078	6,112	6,129	6,166	6,311
Roadway Congestion Index	0.67	0.7	0.75	0.76	0.81	0.85	0.85	0.86	0.84	0.84	0.85

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-22. Mobility and Congestion Variables in Jacksonville FL

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	6,199	6,488	7,173	7,326	7,519	7,680	8,292	8,372	8,662	8,807	9,266
Lane-Kilometers	547	580	588	596	628	644	676	708	725	725	733
VKT/lane-kilometer	11,324	11,194	12,205	12,297	11,974	11,925	12,262	11,818	11,956	12,156	12,648
Incident Ratio	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	25	25	25	30	30	30	30	35	35	35	35
Percent of Moderate Congestion	100.0	100.0	75.0	72.7	92.9	68.8	94.1	76.5	77.4	71.3	36.6
Percent of Heavy Congestion	-	-	25.0	27.3	7.1	25.0	5.9	23.5	22.6	26.3	56.1
Percent of Severe Congestion	-	-	-	-	-	6.3	-	-	-	2.3	7.3
Principal Arterial Streets											
Daily VKT (000)	8,243	8,887	8,919	8,960	9,048	9,064	9,121	9,249	9,346	9,499	9,893
Lane-kilometers	1,650	1,739	1,771	1,795	1,811	1,835	1,868	1,916	1,932	1,948	2,061
VKT/lane-kilometer	4,995	5,111	5,036	4,991	4,996	4,939	4,884	4,828	4,838	4,876	4,801
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	35	35	40	40	40	45	45	50	50	50	50
Percent of Moderate Congestion	19.2	26.7	27.7	29.7	45.7	23.8	24.4	29.2	21.6	32.4	43.2
Percent of Heavy Congestion	19.2	44.4	19.2	24.3	19.6	35.7	44.4	33.3	29.7	26.5	11.4
Percent of Severe Congestion	61.5	28.9	53.2	46.0	34.8	40.5	31.1	37.5	48.7	41.2	45.5
Population (000)	615	620	630	645	650	660	690	715	720	750	760
Urban Area (square kilometers)	1,347	1,347	1,373	1,373	1,386	1,386	1,386	1,399	1,399	1,399	1,399
Population Density	457	460	459	470	469	476	498	511	515	536	543
Registered Vehicles (000)	-	-	-	-	567	576	586	594	598	605	619
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.34	0.36	0.35	0.35
Total VKT (000)	22,197	25,765	25,974	26,109	26,229	25,961	26,641	28,721	28,634	29,215	30,236
Total Lane-Kilometers	4,162	5,802	5,815	5,843	5,828	5,596	5,804	5,810	5,901	5,901	5,901
Roadway Congestion Index	0.91	0.92	0.96	0.96	0.95	0.94	0.95	0.93	0.93	0.95	0.97

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-23. Mobility and Congestion Variables in Kansas City MO

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	14,329	14,466	15,102	16,406	17,557	19,191	19,674	19,916	20,214	20,793	22,057
Lane-Kilometers	1,827	1,868	2,013	2,029	2,037	2,141	2,165	2,182	2,190	2,190	2,270
VKT/lane-kilometer	7,841	7,746	7,504	8,087	8,621	8,962	9,086	9,129	9,232	9,496	9,716
Incident Ratio	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	5	5	5	5	5	5	5	5	5	5	10
Percent of Moderate Congestion	75.0	40.0	33.3	38.5	57.1	76.2	30.8	50	55.6	56.0	63
Percent of Heavy Congestion	25.0	60.0	55.6	23.1	4.8	4.8	23.1	11.1	44.4	32.0	11.1
Percent of Severe Congestion	-	-	11.1	38.5	38.1	19.1	46.2	38.9	-	12.0	25.9
Principal Arterial Streets											
Daily VKT (000)	6,126	6,207	6,295	6,843	6,899	7,004	7,068	7,036	7,744	7,792	7,873
Lane-kilometers	1,634	1,634	1,642	1,658	1,666	1,674	1,682	1,682	1,707	1,723	1,755
VKT/lane-kilometer	3,749	3,798	3,833	4,126	4,140	4,183	4,201	4,182	4,538	4,523	4,486
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	20	20	20	20	20	20	25	25	25	25	25
Percent of Moderate Congestion	42.1	53.5	53.3	54.6	36.4	29.8	32.4	30.8	16.9	17.2	36.5
Percent of Heavy Congestion	24.6	6.9	6.7	14.6	34.6	21.1	33.8	35.4	13.3	19.2	28.6
Percent of Severe Congestion	33.3	39.7	40.0	30.9	29.1	49.1	33.8	33.9	69.9	63.6	34.9
Population (000)	1,090	1,095	1,100	1,130	1,135	1,140	1,145	1,155	1,160	1,160	1,200
Urban Area (square kilometers)	1,425	1,437	1,450	1,476	1,502	1,528	1,554	1,580	1,580	1,580	1,645
Population Density	765	762	758	765	756	746	737	731	734	734	730
Registered Vehicles (000)	-	-	-	-	622	645	675	692	730	750	768
Fuel Cost ($/liter)	-	-	-	-	0.23	0.26	0.28	0.32	0.32	0.31	0.32
Total VKT (000)	32,211	32,916	33,559	36,297	37,729	39,361	40,688	42,219	44,223	45,028	52,639
Total Lane-Kilometers	9,444	9,493	9,552	11,096	11,103	11,360	11,391	11,523	11,603	11,581	11,729
Roadway Congestion Index	0.62	0.62	0.6	0.65	0.68	0.71	0.72	0.72	0.74	0.75	0.77

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-24. Mobility and Congestion Variables in Los Angeles CA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	121,539	127,737	134,250	141,100	148,297	155,993	164,445	171,755	177,655	177,551	180,240
Lane-Kilometers	7,326	7,454	7,535	7,648	7,728	7,857	7,986	8,243	8,420	8,412	8,686
VKT/lane-kilometer	16,591	17,136	17,817	18,451	19,190	19,855	20,593	20,836	21,098	21,106	20,751
Incident Ratio	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	75	80	80	80	80	80	75	75	75	75	75
Percent of Moderate Congestion	22.8	20.0	20.0	17.9	6.9	5.6	5.5	5.4	5.4	6.5	6.7
Percent of Heavy Congestion	25.3	18.8	20.0	21.4	14.9	13.3	5.5	4.3	4.3	4.3	4.4
Percent of Severe Congestion	51.9	61.2	60.0	60.7	78.2	81.1	89.0	90.3	90.3	89.3	88.9
Principal Arterial Streets											
Daily VKT (000)	92,003	96,930	102,122	107,596	113,360	118,834	125,966	128,486	129,396	131,553	132,825
Lane-kilometers	17,646	17,871	18,113	18,354	18,692	18,966	19,320	19,610	19,972	19,964	20,125
VKT/lane-kilometer	5,214	5,424	5,638	5,862	6,065	6,266	6,520	6,552	6,479	6,590	6,600
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	35	35	40	45	50	50	55	55	55	55	55
Percent of Moderate Congestion	23.9	34.6	27.9	17.2	18.3	26.0	22.2	18.5	22.0	19.8	13.8
Percent of Heavy Congestion	63.0	17.3	11.5	23.4	18.3	24.7	19.8	27.2	34.2	28.5	36.3
Percent of Severe Congestion	13.0	48.1	60.7	59.4	63.4	49.3	58.0	54.3	43.9	51.8	50.0
Population (000)	9,900	9,900	9,900	10,500	10,710	10,920	11,140	11,305	11,420	11,760	11,845
Urban Area (square kilometers)	4,740	4,740	4,740	5,180	5,310	5,439	5,569	5,620	5,659	5,659	5,776
Population Density	2,089	2,089	2,089	2,027	2,017	2,008	2,001	2,011	2,018	2,078	2,051
Registered Vehicles (000)	-	-	-	-	7,664	7,653	7,790	7,813	7,810	7,811	7,877
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.35	0.38	0.36	0.37
Total VKT (000)	266,286	284,059	296,134	315,906	326,577	353,566	377,407	394,392	403,584	397,912	400,848
Total Lane-Kilometers	36,792	37,555	37,566	38,168	38,371	38,745	39,548	40,099	40,368	40,553	41,182
Roadway Congestion Index	1.22	1.27	1.32	1.36	1.42	1.47	1.52	1.54	1.55	1.56	1.54

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-25. Mobility and Congestion Variables in Louisville KY

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	6,303	7,140	7,406	7,567	7,704	8,662	9,724	9,885	9,974	10,063	10,513
Lane-Kilometers	692	725	757	773	805	837	910	942	950	950	974
VKT/lane-kilometer	9,105	9,856	9,787	9,792	9,570	10,346	10,690	10,496	10,500	10,593	10,793
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	5	5	5	5	5	5	5	5	5	5	5
Percent of Moderate Congestion	53.9	12.5	10.0	7.7	35.1	41.1	47.2	43.3	56.8	56.8	42.0
Percent of Heavy Congestion	34.6	41.7	44.6	15.4	10.8	10.0	2.8	5.0	2.7	1.6	16.8
Percent of Severe Congestion	11.5	45.8	45.5	76.9	54.1	48.9	50.0	51.7	40.5	40.5	41.2
Principal Arterial Streets											
Daily VKT (000)	4,226	4,379	4,419	4,436	4,403	4,790	4,605	4,653	4,741	5,023	5,353
Lane-kilometers	789	797	797	805	805	813	821	821	837	837	845
VKT/lane-kilometer	5,357	5,495	5,545	5,510	5,470	5,891	5,608	5,667	5,663	6,000	6,333
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	50	50	50	50	50	55	55	55	55	55	60
Percent of Moderate Congestion	27.6	20.8	45.1	13.0	14.6	14.8	30.4	33.3	25.8	20.6	13.5
Percent of Heavy Congestion	63.8	69.8	49.0	77.8	60.0	55.7	51.8	47.4	53.2	55.3	35.1
Percent of Severe Congestion	8.6	9.4	5.9	9.3	25.5	29.5	17.9	19.3	21.0	24.1	51.4
Population (000)	770	780	780	785	785	790	805	805	810	810	815
Urban Area (square kilometers)	932	932	932	932	945	958	971	971	984	984	997
Population Density	826	837	837	842	830	824	829	829	823	823	817
Registered Vehicles (000)	-	-	-	-	444	450	457	460	461	463	465
Fuel Cost ($/liter)	-	-	-	-	0.26	0.27	0.29	0.33	0.35	0.34	0.34
Total VKT (000)	22,382	22,947	23,604	24,863	25,544	27,283	28,086	27,845	28,455	29,970	33,321
Total Lane-Kilometers	3,991	4,131	4,254	4,267	4,283	4,294	4,474	4,803	5,049	5,289	5,327
Roadway Congestion Index	0.78	0.82	0.82	0.82	0.8	0.86	0.87	0.86	0.86	0.88	0.9

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-26. Mobility and Congestion Variables in Memphis TN

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	4,750	4,830	4,854	4,911	5,329	6,005	6,360	6,851	6,987	7,567	8,098
Lane-Kilometers	483	523	547	588	588	612	612	612	628	660	708
VKT/lane-kilometer	9,833	9,231	8,868	8,356	9,068	9,816	10,395	11,197	11,128	11,463	11,432
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	10	10	10	10	10	10	10	10	10	15	15
Percent of Moderate Congestion	76.9	100.0	64.7	80.0	100.0	100.0	100.0	100.0	87.0	88.9	65.7
Percent of Heavy Congestion	23.1	-	35.3	20.0	-	-	-	-	13.0	11.1	23.6
Percent of Severe Congestion	-	-	-	-	-	-	-	-	-	-	10.7
Principal Arterial Streets											
Daily VKT (000)	5,313	5,474	5,659	5,667	6,054	6,327	6,521	6,633	6,818	7,245	8,066
Lane-kilometers	1,079	1,095	1,111	1,159	1,183	1,216	1,296	1,312	1,377	1,457	1,578
VKT/lane-kilometer	4,925	5,000	5,094	4,889	5,116	5,205	5,031	5,055	4,953	4,972	5,112
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	30	30	30	30	35	35	35	35	35	35	35
Percent of Moderate Congestion	47.1	45.7	45.0	46.0	62.5	52.0	40.0	28.8	21.7	29.0	33.9
Percent of Heavy Congestion	41.2	44.3	35.0	29.7	16.1	22.0	24.0	39.0	43.3	38.7	39.2
Percent of Severe Congestion	11.8	10.0	20.0	24.3	21.4	26.0	36.0	32.2	35.0	32.3	26.9
Population (000)	760	770	770	775	800	815	830	850	860	865	880
Urban Area (square kilometers)	907	907	907	932	984	1,036	1,088	1,088	1,101	1,101	1,127
Population Density	838	849	849	831	813	787	763	781	781	786	781
Registered Vehicles (000)	-	-	-	-	584	597	606	620	627	629	642
Fuel Cost ($/liter)	-	-	-	-	0.26	0.27	0.3	0.33	0.36	0.35	0.35
Total VKT (000)	18,657	20,175	17,559	20,540	21,213	23,108	24,097	25,135	25,971	26,610	27,996
Total Lane-Kilometers	3,114	3,450	3,713	4,172	4,394	4,957	4,964	4,988	5,002	5,009	5,123
Roadway Congestion Index	0.83	0.8	0.79	0.75	0.8	0.84	0.86	0.9	0.89	0.91	0.92

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}_{Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT}_{Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-27. Mobility and Congestion Variables in Miami FL

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	9,580	10,087	10,417	11,447	11,713	11,946	12,695	13,444	13,798	14,136	15,086
Lane-Kilometers	829	829	845	869	869	894	926	934	974	990	1,006
VKT/lane-kilometer	11,553	12,165	12,324	13,167	13,472	13,369	13,713	14,397	14,165	14,276	14,992
Incident Ratio	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	45	45	45	50	50	50	60	60	60	60	60
Percent of Moderate Congestion	14.8	42.9	40.0	55.3	42.0	42.9	23.3	19.2	30.8	33.6	34.6
Percent of Heavy Congestion	63.0	26.2	27.5	10.6	22.0	26.2	26.7	25.5	14.1	16.5	13.6
Percent of Severe Congestion	22.2	31.0	32.5	34.0	36.0	31.0	50.0	55.3	55.1	49.9	51.9
Principal Arterial Streets											
Daily VKT (000)	19,111	19,803	20,125	20,447	20,608	20,930	22,121	23,836	25,446	25,760	27,048
Lane-kilometers	3,019	3,059	3,099	3,156	3,180	3,220	3,252	3,276	3,341	3,349	3,590
VKT/lane-kilometer	6,331	6,474	6,494	6,480	6,481	6,500	6,802	7,275	7,617	7,692	7,534
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	60	60	60	70	70	70	70	70	70	70	65
Percent of Moderate Congestion	2.5	14.1	24.7	16.3	17.8	16.1	1.1	2.2	3.3	3.8	5.1
Percent of Heavy Congestion	16.5	37.2	6.9	4.4	31.1	5.4	25.8	12.0	10.9	13.9	19.2
Percent of Severe Congestion	81	48.7	68.5	79.4	51.1	78.5	73.1	85.9	85.9	82.3	75.6
Population (000)	1,730	1,720	1,750	1,775	1,780	1,785	1,810	1,840	1,850	1,880	1,920
Urban Area (square kilometers)	1,062	1,062	1,140	1,140	1,166	1,191	1,217	1,230	1,243	1,256	1,269
Population Density	1,629	1,620	1,536	1,558	1,527	1,498	1,487	1,496	1,488	1,497	1,513
Registered Vehicles (000)	-	-	-	-	1331	1336	1,351	1,412	1,426	1,431	1,459
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.34	0.36	0.35	0.35
Total VKT (000)	37,510	38,423	38,648	41,240	43,959	45,429	49,166	51,641	53,977	54,418	55,352
Total Lane-Kilometers	4,907	5,242	5,609	6,414	6,793	7,301	8,142	8,866	9,019	9,030	9,030
Roadway Congestion Index	1.05	1.09	1.1	1.13	1.14	1.14	1.18	1.25	1.27	1.28	1.3

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-28. Mobility and Congestion Variables in Milwaukee WI

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	9,016	9,338	9,467	9,765	10,167	10,980	11,487	12,099	12,381	12,574	12,614
Lane-Kilometers	869	869	877	886	886	886	942	950	958	966	966
VKT/lane-kilometer	10,370	10,741	10,789	11,027	11,482	12,400	12,197	12,737	12,924	13,017	13,058
Incident Ratio	1	1	1	1	1	1	1	1	1	1	1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	25	25	25	30	30	30	30	30	30
Percent of Moderate Congestion	51.4	53.3	50.8	39.4	25.8	23.8	20.5	32.1	27.8	28.6	26.3
Percent of Heavy Congestion	48.6	46.7	49.2	60.6	67.7	47.6	36.4	30.4	33.3	35.7	31.6
Percent of Severe Congestion	-	-	-	-	6.5	28.6	43.2	37.5	38.9	35.7	42.1
Principal Arterial Streets											
Daily VKT (000)	6,907	6,891	7,495	7,760	7,567	7,470	7,607	7,511	7,696	7,937	8,372
Lane-kilometers	1,497	1,513	1,513	1,546	1,562	1,578	1,594	1,610	1,618	1,626	1,707
VKT/lane-kilometer	4,613	4,553	4,952	5,021	4,845	4,735	4,773	4,665	4,756	4,881	4,906
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	30	30	35	35	35	35	35	35	35	35	35
Percent of Moderate Congestion	18.8	17.0	36.8	8.6	3.4	25.4	33.9	34.6	34.0	31.5	30.0
Percent of Heavy Congestion	59.4	70.2	52.6	69.0	67.8	54.0	44.6	41.8	26.4	25.9	29.6
Percent of Severe Congestion	21.9	12.8	10.5	22.4	28.8	20.6	21.4	23.6	39.6	42.6	40.4
Population (000)	1,210	1,210	1,210	1,210	1,215	1,220	1,225	1,225	1,230	1,225	1,230
Urban Area (square kilometers)	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425	1,425
Population Density	849	849	849	849	853	856	860	860	863	860	863
Registered Vehicles (000)	-	-	-	-	512	521	522	534	539	539	541
Fuel Cost ($/liter)	-	-	-	-	0.26	0.27	0.3	0.33	0.36	0.35	0.35
Total VKT (000)	33,081	33,757	37,531	39,107	41,129	42,504	44,772	45,212	46,141	47,413	47,651
Total Lane-Kilometers	7,454	7,461	7,490	7,515	7,559	7,620	7,668	7,718	7,709	7,794	7,870
Roadway Congestion Index	0.83	0.84	0.87	0.88	0.9	0.95	0.94	0.97	0.99	1	1

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-29. Mobility and Congestion Variables in Minn-St. Paul MN

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	18,032	19,586	20,930	22,033	23,442	25,148	26,436	27,145	28,642	29,318	30,590
Lane-Kilometers	1,900	1,900	1,980	2,045	2,077	2,238	2,310	2,335	2,383	2,407	2,431
VKT/lane-kilometer	9,492	10,309	10,569	10,776	11,287	11,237	11,443	11,628	12,020	12,181	12,583
Incident Ratio	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	20	20	25	30	30	30	30	30	30
Percent of Moderate Congestion	63.6	50	53.3	31.3	38.9	16.7	22.2	22.2	24.1	27.1	32.1
Percent of Heavy Congestion	36.4	41.7	26.7	31.3	38.9	25.0	25.9	25.9	20.7	21.4	7.1
Percent of Severe Congestion	-	8.3	20	37.5	22.2	58.3	51.9	51.9	55.2	51.4	60.7
Principal Arterial Streets											
Daily VKT (000)	6,923	7,165	7,487	7,873	8,211	8,372	8,533	8,678	9,080	9,660	10,948
Lane-kilometers	1,465	1,481	1,497	1,513	1,530	1,546	1,562	1,586	1,610	1,674	1,852
VKT/lane-kilometer	4,725	4,837	5,000	5,202	5,368	5,417	5,464	5,472	5,640	5,769	5,913
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	40	40	45	45	50	55	55	55	55	55	55
Percent of Moderate Congestion	23.2	12.7	16.0	24.4	21.7	26.9	25.0	30.0	25.3	20.0	10.0
Percent of Heavy Congestion	36.2	53.5	30.7	30.2	13.0	11.5	14.3	10.0	7.6	11.3	21.3
Percent of Severe Congestion	40.6	33.8	53.3	45.4	65.2	61.5	60.7	60.0	67.1	68.8	68.8
Population (000)	1,750	1,750	1,750	1,800	1,845	1,885	1,925	1,970	2,010	2,060	2110
Urban Area (square kilometers)	2,150	2,202	2,279	2,409	2,486	2,577	2,629	2,629	2,694	2,849	3,082
Population Density	814	795	768	747	742	731	732	749	746	723	685
Registered Vehicles (000)	-	-	-	-	1,531	1,574	1,604	1,632	1,662	1,698	1,730
Fuel Cost ($/liter)	-	-	-	-	0.26	0.29	0.31	0.34	0.36	0.35	0.35
Total VKT (000)	48,150	51,451	53,919	57,274	61,476	64,382	66,696	68,055	69,528	70,727	74,466
Total Lane-Kilometers	13,452	13,524	13,526	13,753	14,300	14,395	14,348	14,368	14,411	14,952	15,794
Roadway Congestion Index	0.76	0.81	0.84	0.85	0.89	0.89	0.9	0.92	0.95	0.96	0.99

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}|\textit{Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT}|\textit{Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-30. Mobility and Congestion Variables in Nashville TN

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	5,233	5,313	5,868	6,303	6,843	7,245	7,712	7,905	8,050	8,388	9,660
Lane-Kilometers	564	564	604	684	684	692	708	773	789	813	886
VKT/lane-kilometer	9,286	9,429	9,720	9,212	10,000	10,465	10,886	10,229	10,204	10,317	10,909
Incident Ratio	-	-	-	-	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	20	15	15	20	25	25	25	25	25
Percent of Moderate Congestion	26.3	55.6	50.0	50.0	61.5	75.0	37.5	58.3	70.0	70.4	63.6
Percent of Heavy Congestion	57.9	11.1	50.0	50.0	38.5	16.7	40.6	29.2	20.0	22.2	18.2
Percent of Severe Congestion	15.8	33.3	-	-	-	8.3	21.9	12.5	10.0	7.4	18.2
Principal Arterial Streets											
Daily VKT (000)	5,716	6,110	6,915	7,382	7,736	7,913	8,670	8,694	8,758	8,791	8,855
Lane-kilometers	1,272	1,304	1,369	1,417	1,449	1,457	1,473	1,505	1,513	1,530	1,546
VKT/lane-kilometer	4,494	4,685	5,053	5,210	5,339	5,431	5,885	5,775	5,787	5,747	5,729
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	35	35	40	40	40	40	40	40	40	40	40
Percent of Moderate Congestion	17.2	13.6	12.1	20.5	18.1	18.0	10.8	13.6	10.0	13.1	34.7
Percent of Heavy Congestion	65.5	47.7	29.7	32.5	26.4	15.7	16.1	11.4	22.2	24.1	38.8
Percent of Severe Congestion	17.2	38.6	58.2	47.0	55.5	66.3	73.1	75.0	67.8	62.8	26.5
Population (000)	500	505	510	515	520	530	540	550	565	575	590
Urban Area (square kilometers)	984	1,062	1,114	1,140	1,178	1,217	1,256	1,282	1,295	1,373	1,425
Population Density	508	476	458	452	441	435	430	429	436	419	414
Registered Vehicles (000)	-	-	-	-	455	479	495	505	512	515	531
Fuel Cost ($/liter)	-	-	-	-	0.26	0.27	0.3	0.33	0.36	0.35	0.35
Total VKT (000)	16,369	16,504	17,332	19,204	21,031	22,361	24,237	24,702	25,127	26,409	28,017
Total Lane-Kilometers	2,822	2,824	2,996	3,098	3,746	4,236	4,408	4,437	4,466	4,543	4,741
Roadway Congestion Index	0.77	0.79	0.83	0.81	0.86	0.89	0.94	0.9	0.89	0.9	0.92

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-31. Mobility and Congestion Variables in New Orleans LA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	6,279	6,440	6,682	6,891	6,963	7,487	7,664	7,825	8,002	8,114	8,131
Lane-Kilometers	523	531	531	531	531	531	547	564	580	588	604
VKT/lane-kilometer	12,000	12,121	12,576	12,970	13,106	14,091	14,000	13,886	13,806	13,808	13,467
Incident Ratio	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Pct of Congested Freeway DVKT (ADT/lane greater than 15,000)	40	40	45	45	50	50	50	50	50	50	50
Percent of Moderate Congestion	91.8	63	15.9	20.0	23.6	28.6	36.0	17.7	17.8	16.9	20.0
Percent of Heavy Congestion	8.2	29.4	31.8	30.0	30.6	27.1	13.3	40.0	49.4	47.4	60.0
Percent of Severe Congestion	-	7.6	52.4	50.0	45.8	44.3	50.7	42.3	32.8	32.8	20.0
Principal Arterial Streets											
Daily VKT (000)	5,313	5,514	5,812	5,973	6,182	6,529	6,537	6,545	6,601	6,657	6,762
Lane-kilometers	910	910	910	918	934	998	998	998	1,006	1,022	1,055
VKT/lane-kilometer	5,841	6,062	6,389	6,509	6,621	6,540	6,548	6,556	6,560	6,512	6,412
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT (ADT/lane greater than 15,000)	45	45	50	50	50	50	50	50	50	50	50
Percent of Moderate Congestion	28.8	42.2	23.6	20.0	10.6	17.0	9.8	29.8	23.2	19.9	32.9
Percent of Heavy Congestion	11.9	6.3	12.7	10.0	8.5	4.3	4.9	5.3	20.3	23.4	23.3
Percent of Severe Congestion	59.3	51.6	63.6	70.0	80.9	78.7	85.4	64.9	56.5	56.8	43.8
Population (000)	1,080	1,080	1,075	1,070	1,070	1,060	1,055	1,050	1,080	1,095	1,100
Urban Area (square kilometers)	881	881	894	894	907	907	932	932	932	932	932
Population Density	1,226	1,226	1,203	1,197	1,180	1,169	1,131	1,126	1,158	1,174	1,180
Registered Vehicles (000)	-	-	-	-	817	825	830	849	874	881	886
Fuel Cost ($/liter)	-	-	-	-	0.25	0.28	0.31	0.32	0.37	0.36	0.36
Total VKT (000)	18,901	20,811	22,110	22,625	23,615	23,633	24,292	24,429	25,314	26,364	27,075
Total Lane-Kilometers	4,745	4,772	4,772	4,825	4,809	4,807	4,803	4,799	4,801	4,801	4,957
Roadway Congestion Index	0.98	1	1.05	1.07	1.09	1.14	1.13	1.13	1.12	1.12	1.1

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-32. Mobility and Congestion Variables in New York NY

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	101,704	103,434	105,157	106,349	115,268	118,520	125,588	130,273	133,501	133,147	134,435
Lane-Kilometers	8,436	8,557	9,064	9,080	9,097	9,322	9,354	9,443	9,499	9,531	9,741
VKT/lane-kilometer	12,055	12,087	11,601	11,712	12,672	12,714	13,426	13,796	14,054	13,970	13,802
Incident Ratio	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	55	55	55	55	55	55	55	60	60	60	60
Percent of Moderate Congestion	51.7	36.4	57.7	35.5	40.5	37.5	40.0	42.6	47.2	45.9	35.7
Percent of Heavy Congestion	17.2.0	36.4	15.4	38.7	40.5	32.5	26.7	13.0	17.0	21.8	31.0
Percent of Severe Congestion	31	27.3	26.9	25.8	18.9	30.0	33.3	44.4	35.9	32.3	33.3
Principal Arterial Streets											
Daily VKT (000)	71,379	74,141	74,688	75,187	76,403	78,069	80,033	81,836	83,809	85,362	89,065
Lane-kilometers	10,787	10,948	10,948	10,948	10,980	11,109	11,447	11,834	12,172	12,268	12,276
VKT/lane-kilometer	6,617	6,772	6,822	6,868	6,958	7,028	6,992	6,916	6,886	6,958	7,255
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	75	75	75	75	75	75	80	80	80	80	85
Percent of Moderate Congestion	29.6	25.0	33.3	27.5	29.4	21.8	16.1	19.3	18.0	18.9	12.0
Percent of Heavy Congestion	38.0	36.1	43.6	25.0	11.8	16.7	19.5	13.6	21.4	18.9	23.9
Percent of Severe Congestion	32.4	38.9	23.1	47.5	58.8	61.5	64.4	67.1	60.7	62.2	64.1
Population (000)	16,660	16,660	15,340	15,340	15,340	16,000	16,320	16,420	16,780	16,830	16,945
Urban Area (square kilometers)	8,236	8,159	8,184	8,184	8,184	8,184	8,249	8,249	8,249	8,252	8,418
Population Density	2,023	2,042	1,874	1,874	1,874	1,955	1,978	1,991	2,034	2,040	2,013
Registered Vehicles (000)	-	-	-	-	-	5,727	5,849	5,920	6,009	6,065	6,100
Fuel Cost ($/liter)	-	-	-	-	-	0.26	0.29	0.33	0.38	0.36	0.37
Total VKT (000)	295,997	302,656	310,551	311,966	330,073	338,494	356,507	363,076	363,876	364,219	366,919
Total Lane-Kilometers	54,597	54,907	55,286	55,418	56,442	56,463	56,529	56,640	56,794	56,899	57,345
Roadway Congestion Index	1.01	1.02	0.99	1	1.06	1.06	1.1	1.12	1.14	1.14	1.14

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-33. Mobility and Congestion Variables in Norfolk VA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	6,231	6,432	6,722	7,197	7,978	8,316	8,420	8,589	8,775	8,960	9,451
Lane-Kilometers	660	676	692	708	716	725	733	741	749	805	902
VKT/lane-kilometer	9,439	9,512	9,709	10,159	11,135	11,478	11,495	11,598	11,720	11,130	10,482
Incident Ratio	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	35	35	35	40	45	45	45	45	45	45	40
Percent of Moderate Congestion	90.7	90.9	29.1	13.3	36.4	17.3	7.8	7.7	7.7	18.0	22.2
Percent of Heavy Congestion	7.0	6.8	69.1	85.0	19.7	30.8	39.2	36.5	36.5	39.1	43.3
Percent of Severe Congestion	2.3	2.3	1.8	1.7	43.9	51.9	52.9	55.8	55.8	42.9	34.4
Principal Arterial Streets											
Daily VKT (000)	5,265	5,321	5,474	5,651	5,844	6,207	6,376	6,569	6,851	7,132	7,688
Lane-kilometers	1,071	1,079	1,087	1,087	1,119	1,127	1,143	1,167	1,183	1,208	1,208
VKT/lane-kilometer	4,917	4,933	5,037	5,200	5,223	5,507	5,577	5,628	5,789	5,907	6,367
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	30	30	30	30	30	35	35	35	35	35	40
Percent of Moderate Congestion	-	-	-	22.2	10.8	16.7	26.0	31.8	28.6	28.0	18.1
Percent of Heavy Congestion	29.4	27.8	29.4	7.4	13.5	23.8	28.0	13.6	24.5	25.0	20.8
Percent of Severe Congestion	70.6	72.2	70.6	70.4	75.7	59.5	46.0	54.6	46.9	47.0	61.1
Population (000)	770	780	790	800	840	870	895	920	925	950	965
Urban Area (square kilometers)	2,059	2,059	2,072	2,072	2,085	2,085	2,098	2,098	2,111	2,111	2,111
Population Density	374	379	381	386	403	417	427	439	438	450	457
Registered Vehicles (000)	-	-	-	-	743	770	791	816	824	830	840
Fuel Cost ($/liter)	-	-	-	-	-	0.27	0.3	0.32	0.36	0.35	0.36
Total VKT (000)	20,344	21,300	21,626	25,515	26,873	28,586	29,316	32,232	32,640	33,124	34,032
Total Lane-Kilometers	4,722	4,807	5,022	5,152	5,252	5340	5,406	5,514	5,603	5,682	5,793
Roadway Congestion Index	0.79	0.79	0.81	0.84	0.9	0.93	0.94	0.95	0.96	0.93	0.92

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}|\textit{Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT}|\textit{Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-34. Mobility and Congestion Variables in Oklahoma City OK

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	9,378	9,563	9,757	9,942	10,111	10,191	10,658	10,996	11,165	11,471	11,753
Lane-Kilometers	1,071	1,087	1,095	1,103	1,111	1,127	1,135	1,159	1,159	1,167	1,167
VKT/lane-kilometer	8,759	8,800	8,912	9,015	9,101	9,043	9,390	9,486	9,632	9,828	10,069
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	5	5	5	5	5	5	10	10	10	10	10
Percent of Moderate Congestion	50.0	50.0	50.0	50.0	50.0	50.0	53.9	58.0	55.4	58.0	54.2
Percent of Heavy Congestion	50.0	50.0	50.0	50.0	50.0	50.0	46.2	42.0	44.6	42.0	45.8
Percent of Severe Congestion	-	-	-	-	-	-	-	-	-	-	-
Principal Arterial Streets											
Daily VKT (000)	4,428	4,669	5,361	5,394	5,442	5,579	5,546	5,772	5,772	6,070	6,392
Lane-kilometers	926	974	1,014	1,038	1,038	1,055	1,055	1,095	1,095	1,111	1,159
VKT/lane-kilometer	4,783	4,793	5,286	5,194	5,240	5,290	5,260	5,272	5,272	5,464	5,514
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	30	30	35	35	35	35	35	35	35	35	40
Percent of Moderate Congestion	10.0	10.0	10.0	10.0	10	-	2.9	20.6	25.0	22.9	22.9
Percent of Heavy Congestion	30.0	30.0	30.0	30.0	30	40.0	31.4	32.4	31.3	28.6	31.4
Percent of Severe Congestion	70.0	70.0	70.0	70.0	70	60.0	65.7	47.1	43.8	48.6	45.7
Population (000)	640	670	690	730	735	725	720	730	735	740	745
Urban Area (square kilometers)	1,088	1,166	1,243	1,269	1,295	1,295	1,295	1,295	1,295	1,321	1,347
Population Density	588	575	555	575	568	560	556	564	568	560	553
Registered Vehicles (000)	-	-	-	-	448	468	468	483	488	491	492
Fuel Cost ($/liter)	-	-	-	-	0.25	0.27	0.29	0.31	0.35	0.34	0.34
Total VKT (000)	25,915	26,641	28,283	28,392	28,624	28,766	28,975	29,998	29,866	31,405	32,382
Total Lane-Kilometers	6,066	6,173	6,366	6,360	6,368	6,374	6,583	6,595	6,607	6,611	6,809
Roadway Congestion Index	0.72	0.72	0.75	0.75	0.76	0.76	0.78	0.78	0.79	0.81	0.83

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-35. Mobility and Congestion Variables in Orlando FL

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	6,955	7,261	7,487	8,420	8,557	8,919	9,314	9,370	9,580	9,732	9,741
Lane-Kilometers	757	765	789	845	853	877	894	926	950	966	966
VKT/lane-kilometer	9,191	9,495	9,490	9,962	10,028	10,165	10,423	10,122	10,085	10,075	10,083
Incident Ratio	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	25	25	25	25	30	30	30	30	30	30	30
Percent of Moderate Congestion	100.0	100.0	82.8	70.6	74.3	68.6	71.4	74.1	64.7	62.3	47.8
Percent of Heavy Congestion	-	-	6.9	-	5.7	5.7	5.7	5.2	16.2	15.2	18.8
Percent of Severe Congestion	-	-	10.3	29.4	20.0	25.7	22.9	20.7	19.1	22.5	33.3
Principal Arterial Streets											
Daily VKT (000)	5,740	5,957	5,699	5,852	5,917	5,949	5,957	6,158	6,601	7,084	7,809
Lane-kilometers	1,473	1,497	1,562	1,610	1,650	1,658	1,691	1,707	1,723	1,739	1,755
VKT/lane-kilometer	3,896	3,978	3,649	3,635	3,585	3,587	3,524	3,608	3,832	4,074	4,450
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	20	20	25	25	25	25	25	25	25	25	25
Percent of Moderate Congestion	13.2	26.6	12.9	23.4	4.7	9.6	13.5	5.0	5.2	6.1	4.2
Percent of Heavy Congestion	26.9	10.6	32.3	22.3	37.2	17.0	20.8	24.0	15.6	11.1	11.5
Percent of Severe Congestion	59.9	62.8	54.8	54.3	58.1	73.4	65.6	71.0	79.2	82.8	84.4
Population (000)	610	630	650	670	690	760	785	800	850	880	880
Urban Area (square kilometers)	984	984	1,010	1,010	1,023	1,023	1,036	1,036	1,062	1,062	1,075
Population Density	620	640	644	663	674	743	758	772	800	829	819
Registered Vehicles (000)	-	-	-	-	562	622	642	722	735	744	748
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.34	0.36	0.35	0.35
Total VKT (000)	18,745	20,838	22,962	24,477	25,910	26,472	27,451	28,516	30,155	33,430	35,304
Total Lane-Kilometers	3,635	3,761	3,878	3,986	4,152	4,624	4,743	4,833	4,862	4,878	4,878
Roadway Congestion Index	0.72	0.75	0.73	0.76	0.76	0.77	0.78	0.77	0.77	0.78	0.8

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-36. Mobility and Congestion Variables in Philadelphia PA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	19,924	21,655	21,952	22,226	22,741	24,351	26,847	29,423	29,503	30,671	31,218
Lane-Kilometers	2,013	2,045	2,045	2,069	2,093	2,149	2,254	2,423	2,431	2,528	2,600
VKT/lane-kilometer	9,900	10,591	10,736	10,743	10,865	11,330	11,911	12,143	12,136	12,134	12,006
Incident Ratio	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	20	25	25	25	25	25	25	25	25
Percent of Moderate Congestion	42.4	43.5	51.5	73.1	71.0	60.5	62.8	54.7	49.1	47.8	27.3
Percent of Heavy Congestion	18.2	17.4	18.2	11.5	12.9	27.9	27.5	28.3	22.6	20.6	18.2
Percent of Severe Congestion	39.4	39.1	30.3	15.4	16.1	11.6	9.8	17.0	28.3	31.7	54.6
Principal Arterial Streets											
Daily VKT (000)	30,590	31,427	31,886	32,852	34,494	36,306	35,605	34,035	34,438	34,808	34,857
Lane-kilometers	4,347	4,444	4,508	4,669	4,750	5,184	5,200	5,224	5,233	5,249	5,249
VKT/lane-kilometer	7,037	7,072	7,073	7,036	7,263	7,003	6,847	6,515	6,582	6,632	6,641
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	70	70	70	75	75	75	75	75	75	75	75
Percent of Moderate Congestion	24.7	35.6	19.7	10.5	18.8	17.4	14.3	18.3	17.3	15.2	14.5
Percent of Heavy Congestion	14.3	26.0	35.2	35.5	17.7	16.3	13.1	12.2	18.7	26.6	22.9
Percent of Severe Congestion	61.0	38.4	45.1	54.0	63.5	66.3	72.6	69.5	64.0	58.2	62.7
Population (000)	4,070	4,070	4,070	4,070	4,070	4,085	4,130	4,220	4,500	4,700	5,000
Urban Area (square kilometers)	2,512	2,512	2,849	2,849	2,849	2,888	2,901	2,979	3,108	3,212	3,600
Population Density	1,620	1,620	1,429	1,429	1,429	1,415	1,424	1,417	1,448	1,463	1,389
Registered Vehicles (000)	-	-	-	-	2,686	2,688	2,717	2,776	2,782	2,791	2,820
Fuel Cost ($/liter)	-	-	-	-	-	0.26	0.29	0.32	0.36	0.35	0.35
Total VKT (000)	82,881	85,515	86,982	91,293	95,230	101,074	103,438	105,656	105,872	107,506	113,758
Total Lane-Kilometers	16,960	16,987	17,019	17,328	17,328	17,399	17,502	18,027	19,022	19,705	20,115
Roadway Congestion Index	1	1.03	1.04	1.04	1.06	1.06	1.07	1.05	1.05	1.05	1.05

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-37. Mobility and Congestion Variables in Phoenix AZ

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	4,589	4,685	5,072	5,683	7,438	7,374	9,419	11,351	12,832	14,571	15,698
Lane-Kilometers	338	370	451	467	499	547	837	974	1,006	1,071	1,127
VKT/lane-kilometer	13,571	12,652	11,250	12,172	14,903	13,471	11,250	11,653	12,752	13,609	13,929
Incident Ratio	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	50	55	60	65	70	70	60	60	60	60	60
Percent of Moderate Congestion	87.9	87.7	80.5	75.9	15.8	4.5	38.5	30.3	12.1	15.9	18.3
Percent of Heavy Congestion	12.1	12.3	19.5	24.1	55.8	36.0	15.4	13.6	53.0	49.9	15.6
Percent of Severe Congestion	-	-	-	-	28.5	59.6	46.2	56.1	34.9	34.2	66.1
Principal Arterial Streets											
Daily VKT (000)	24,037	24,094	24,641	25,285	25,502	26,525	26,855	26,798	28,352	29,004	29,149
Lane-kilometers	3,993	4,009	4,025	4,057	4,089	4,130	4,476	4,589	5,023	5,184	5,329
VKT/lane-kilometer	6,020	6,010	6,122	6,232	6,236	6,423	6,000	5,840	5,644	5,595	5,470
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	65	65	65	70	70	70	70	70	70	70	70
Percent of Moderate Congestion	46.3	51.9	51.9	44.9	44.4	45.3	21.9	26.0	36.8	38.1	30.5
Percent of Heavy Congestion	25.9	23.1	23.1	28.6	18.5	26.4	24.7	24.7	32.4	25.4	32.2
Percent of Severe Congestion	27.8	25.0	25.0	26.5	37.0	28.3	53.4	49.3	30.9	36.5	37.3
Population (000)	1,430	1,520	1,590	1,650	1,735	1,820	1,830	1,875	1,895	1,930	2,022
Urban Area (square kilometers)	1,425	1,632	1,891	2,137	2,214	2,305	2,512	2,512	2,525	2,551	2,720
Population Density	1,004	932	841	772	783	790	728	746	750	757	744
Registered Vehicles (000)	-	-	-	-	1,108	1,167	1,173	1,185	1,200	1241	1,294
Fuel Cost ($/liter)	-	-	-	-	0.28	0.3	0.32	0.33	0.36	0.35	0.35
Total VKT (000)	44,203	44,623	45,057	45,776	46,344	49,699	61,275	60,092	63,843	66,689	68,860
Total Lane-Kilometers	9,183	9,191	9,183	10,595	10,800	11,246	11,597	13,777	13,996	14,445	15,841
Roadway Congestion Index	1.15	1.13	1.1	1.13	1.2	1.18	1.04	1.03	1.05	1.08	1.08

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\text{Roadway Congestion Index (RCI)} = \frac{\text{Freeway VKT/Ln.-Km.} \times \text{Freeway VKT} + \text{Prin. Art. Str. VKT/Ln.-Km.} \times \text{Prin. Art. Str. VKT}}{13{,}000^{1} \times \text{Freeway VKT} + 5{,}000^{1} \times \text{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-38. Mobility and Congestion Variables in Pittsburgh PA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	8,887	9,853	10,401	10,715	11,109	11,576	11,882	12,478	13,194	13,283	14,707
Lane-Kilometers	1,248	1,369	1,393	1,417	1,465	1,505	1,530	1,578	1,610	1,634	1,803
VKT/lane-kilometer	7,123	7,200	7,468	7,563	7,582	7,690	7,768	7,908	8,195	8,128	8,156
Incident Ratio	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	15	15	15	15	20	20	20	20	20	20	20
Percent of Moderate Congestion	100.0	57.1	50	36.4	18.2	14.3	50.0	60.0	20.0	20.0	22.7
Percent of Heavy Congestion	-	42.9	16.7	18.2	36.4	42.9	16.7	-	30.0	27.8	31.8
Percent of Severe Congestion	-	-	33.3	45.5	45.5	42.9	33.3	40.0	50.0	52.2	45.5
Principal Arterial Streets											
Daily VKT (000)	14,257	14,385	14,619	15,206	15,786	15,947	17,114	17,332	17,565	17,831	17,871
Lane-kilometers	2,455	2,552	2,673	2,657	2,705	2,737	2,842	2,850	2,930	2,987	2,987
VKT/lane-kilometer	5,807	5,637	5,470	5,724	5,836	5,826	6,023	6,082	5,995	5,970	5,984
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	50	55	55	60	60	60	60	60	60	60	60
Percent of Moderate Congestion	39.0	34.1	33.3	35.7	35.0	32.7	11.1	14.5	23.5	27.3	25.9
Percent of Heavy Congestion	26.8	29.6	21.4	42.9	33.3	21.2	17.5	14.5	14.7	22.7	19.1
Percent of Severe Congestion	34.2	36.4	45.2	21.4	31.7	46.2	71.4	71.0	61.8	50.0	55.0
Population (000)	1,810	1,810	1,810	1,810	1,810	1,810	1,845	1,850	1,865	1,865	1,875
Urban Area (square kilometers)	1,761	1,761	1,839	1,839	1,839	1,852	1,878	1,891	1,943	1,994	2,124
Population Density	1,028	1,028	984	984	984	977	983	978	960	935	883
Registered Vehicles (000)	-	-	-	-	1,190	1,192	1,214	1,220	1,234	1,239	1,247
Fuel Cost ($/liter)	-	-	-	-	-	0.26	0.29	0.32	0.36	0.35	0.35
Total VKT (000)	42,985	44,227	45,700	46,680	48,099	48,244	49,095	50,106	52,270	53,400	55,289
Total Lane-Kilometers	12,389	12,254	12,220	12,201	12,201	11,864	11,974	12,011	12,180	12,181	12,250
Roadway Congestion Index	0.78	0.76	0.76	0.78	0.79	0.79	0.81	0.82	0.82	0.82	0.81

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-39. Mobility and Congestion Variables in Portland OR

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	7,631	8,654	8,968	9,539	10,183	10,787	11,431	12,027	12,027	12,107	12,832
Lane-Kilometers	708	773	821	829	845	869	869	886	894	902	926
VKT/lane-kilometer	10,773	11,198	10,922	11,505	12,048	12,407	13,148	13,582	13,459	13,429	13,861
Incident Ratio	2	2	2	2	2	2	2	2	2	2	2
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	30	30	30	30	30	35	35	35	35	35	40
Percent of Moderate Congestion	53.3	66.7	68.0	51.9	40.6	48.1	50.0	47.1	46.1	46.8	31.6
Percent of Heavy Congestion	13.3	14.3	16.0	33.3	50.0	32.7	27.4	15.7	22.4	23.0	19.7
Percent of Severe Congestion	33.3	19.1	16.0	14.8	9.4	19.2	22.6	37.1	31.6	30.3	48.7
Principal Arterial Streets											
Daily VKT (000)	4,468	4,484	4,500	4,774	5,055	5,152	5,281	5,426	5,973	6,166	6,295
Lane-kilometers	829	829	829	837	845	853	869	894	910	942	974
VKT/lane-kilometer	5,388	5,408	5,427	5,702	5,981	6,038	6,074	6,072	6,566	6,547	6,463
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	60	60	60	60	60	60	60	60	60	60	60
Percent of Moderate Congestion	54.2	48.3	61.5	60.3	48.6	19.7	17.7	16.2	11.9	10.3	15.1
Percent of Heavy Congestion	10.2	12.1	7.7	17.8	33.3	39.4	42.7	41.2	43.3	42.4	42.5
Percent of Severe Congestion	35.6	39.7	30.8	21.9	18.1	40.9	39.7	42.7	44.8	47.3	42.5
Population (000)	1,010	1,000	1,010	1,030	1,040	1,045	1,025	1,025	1,030	1,040	1,060
Urban Area (square kilometers)	907	907	907	984	1,036	1,062	1,062	1,062	1,088	1,101	1,101
Population Density	1,114	1,103	1,114	1,047	1,004	984	965	965	947	945	963
Registered Vehicles (000)	-	-	-	-	595	616	618	660	680	684	700
Fuel Cost ($/liter)	-	-	-	-	0.24	0.26	0.28	0.35	0.37	0.36	0.36
Total VKT (000)	21,204	22,817	23,957	25,000	26,623	27,727	29,857	31,015	31,231	32,181	33,692
Total Lane-Kilometers	6,136	6,377	6,438	6,459	6,500	6,532	6,801	7,005	7,053	7,113	7,153
Roadway Congestion Index	0.87	0.9	0.88	0.93	0.97	0.99	1.04	1.07	1.08	1.08	1.1

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-40. Mobility and Congestion Variables in Sacramento CA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	8,533	9,338	10,433	11,109	11,914	12,969	13,556	14,249	14,909	15,520	16,285
Lane-Kilometers	1,014	1,014	1,030	1,030	1,047	1,063	1,087	1,175	1,208	1,224	1,288
VKT/lane-kilometer	8,413	9,206	10,125	10,781	11,385	12,205	12,474	12,123	12,347	12,684	12,644
Incident Ratio	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	25	25	25	30	30	30	30	30	30	30	30
Percent of Moderate Congestion	100.0	100.0	71.4	80.0	74.7	54.4	47.5	46.7	50.8	50.0	42.2
Percent of Heavy Congestion	-	-	28.6	10.0	20.0	42.1	49.2	40.0	36.5	40.0	50.0
Percent of Severe Congestion	-	-	-	10.0	5.3	3.5	3.4	13.3	12.7	10.0	7.8
Principal Arterial Streets											
Daily VKT (000)	8,042	8,372	8,726	9,097	9,475	9,877	10,715	10,964	11,262	11,270	12,453
Lane-kilometers	1,336	1,369	1,449	1,513	1,562	1,610	1,691	1,739	1,771	1,795	1,996
VKT/lane-kilometer	6,018	6,118	6,022	6,011	6,067	6,135	6,338	6,306	6,359	6,278	6,238
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	40	40	45	45	45	45	50	50	50	50	50
Percent of Moderate Congestion	40	40	37.9	31.6	24.4	15.8	22.2	5.9	3.3	8.7	15.3
Percent of Heavy Congestion	30	30	34.9	21.9	52.6	52.6	44.4	33.3	26.2	20.7	24.1
Percent of Severe Congestion	30	30	27.3	46.6	23.0	31.6	33.3	60.8	70.5	70.7	60.6
Population (000)	830	830	830	910	955	995	1,040	1,055	1,095	1,165	1,190
Urban Area (square kilometers)	725	725	725	829	855	881	907	919	932	945	992
Population Density	1,145	1,145	1,145	1,098	1,117	1,130	1,147	1,147	1,174	1,232	1,200
Registered Vehicles (000)	-	-	-	-	1,096	1,199	1,253	1,271	1,264	1,280	1,285
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.35	0.38	0.36	0.37
Total VKT (000)	24,441	26,847	29,056	30,706	31,105	33,248	35,362	36,772	38,027	38,555	38,614
Total Lane-Kilometers	4,589	4,648	4,687	4,703	4,774	4,917	5,163	5,371	5,627	5,833	6,099
Roadway Congestion Index	0.8	0.84	0.88	0.92	0.95	1	1.03	1.01	1.02	1.04	1.04

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}]\textit{Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT}]\textit{Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-41. Mobility and Congestion Variables in Salt Lake City UT

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	4,621	4,790	4,862	5,184	5,555	6,134	6,561	8,179	8,581	8,989	9,298
Lane-Kilometers	644	676	676	676	716	757	773	821	821	829	845
VKT/lane-kilometer	7,175	7,083	7,190	7,667	7,753	8,106	8,490	9,961	10,451	10,841	11,000
Incident Ratio	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	10	10	10	10	10	15	15	15	15	20	20
Percent of Moderate Congestion	37.5	14.3	64.7	54.6	33.3	28.6	53.3	38.9	45.0	37.8	30.4
Percent of Heavy Congestion	37.5	85.7	35.3	18.2	51.5	59.5	40.0	19.4	42.5	42.8	40.4
Percent of Severe Congestion	25.0	-	-	27.3	15.2	11.9	6.7	41.7	12.5	19.4	29.2
Principal Arterial Streets											
Daily VKT (000)	2,343	2,455	2,697	2,890	2,938	3,003	3,075	3,140	3,276	3,671	4,146
Lane-kilometers	451	467	483	531	539	555	564	572	572	620	684
VKT/lane-kilometer	5,196	5,259	5,583	5,439	5,448	5,406	5,457	5,493	5,732	5,922	6,059
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	35	35	40	40	45	40	40	40	40	40	45
Percent of Moderate Congestion	48.7	22.2	50.0	58.7	66.7	40.4	42.6	44.7	45.1	54.1	57.8
Percent of Heavy Congestion	5.1	14.8	17.5	10.9	9.3	36.2	38.3	36.2	27.5	24.6	29.6
Percent of Severe Congestion	46.2	63.0	32.5	30.4	24.1	23.4	19.2	19.2	27.5	21.3	12.7
Population (000)	680	700	720	750	760	765	785	785	800	840	860
Urban Area (square kilometers)	932	932	932	958	984	1,023	1,114	1,191	1,217	1,217	1,230
Population Density	729	751	772	783	772	748	705	659	657	690	699
Registered Vehicles (000)	-	-	-	-	621	653	671	699	698	702	731
Fuel Cost ($/liter)	-	-	-	-	0.26	0.29	0.31	0.33	0.38	0.36	0.37
Total VKT (000)	17,993	18,946	19,254	20,157	20,973	21,891	22,769	23,461	24,422	25,644	25,935
Total Lane-Kilometers	4,097	4114	4,109	4,130	4,286	4,318	4,313	4,564	4,572	4,598	4,643
Roadway Congestion Index	0.63	0.63	0.65	0.68	0.68	0.7	0.72	0.81	0.85	0.88	0.9

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-42. Mobility and Congestion Variables in San Antonio TX

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	12,236	12,824	13,605	14,619	14,893	14,490	14,571	14,772	14,941	15,094	15,995
Lane-Kilometers	1,224	1,248	1,264	1,288	1,304	1,312	1,320	1,328	1,328	1,336	1,417
VKT/lane-kilometer	10,000	10,277	10,764	11,350	11,420	11,043	11,037	11,121	11,248	11,295	11,290
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	35	35	35	40	40	40	40	40	40	40	40
Percent of Moderate Congestion	60.0	60.0	50.0	38.5	14.6	13.9	20.0	15.0	14.6	12.5	16.2
Percent of Heavy Congestion	20.0	20.0	20.0	15.0	15.4	8.3	15.0	40.0	43.9	40.0	32.4
Percent of Severe Congestion	20.0	20.0	30.0	46.5	70.0	77.8	65.0	45.0	41.5	47.5	51.4
Principal Arterial Streets											
Daily VKT (000)	5,675	5,933	6,311	6,899	7,382	7,728	8,034	8,340	8,436	8,775	9,563
Lane-kilometers	1,513	1,554	1,578	1,642	1,658	1,691	1,723	1,739	1,755	1,795	1,811
VKT/lane-kilometer	3,750	3,819	4,000	4,201	4,451	4,571	4,664	4,796	4,807	4,888	5,280
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	5	10	10	15	15	15	20	20	20	20	25
Percent of Moderate Congestion	77.3	39.4	23.1	41.5	38.5	29.3	36.0	33.3	33.3	28.3	34.5
Percent of Heavy Congestion	18.2	12.1	10.0	10.0	23.1	8.6	8.0	8.8	13.7	22.1	24.1
Percent of Severe Congestion	4.6	48.5	66.9	48.5	38.5	62.1	56.0	57.9	52.9	49.6	41.4
Population (000)	950	960	980	995	1,020	1,050	1,165	1,165	1,170	1,180	1,185
Urban Area (square kilometers)	1,114	1,140	1,140	1,166	1,191	1,217	1,230	1,243	1,256	1,256	1,269
Population Density	853	842	860	854	856	863	947	937	931	939	934
Registered Vehicles (000)	-	-	-	-	800	819	846	862	871	874	877
Fuel Cost ($/liter)	-	-	-	-	0.25	0.28	0.3	0.32	0.35	0.34	0.34
Total VKT (000)	28,677	30,273	30,518	33,767	35,914	36,417	36,890	39,007	40,760	41,459	42,984
Total Lane-Kilometers	6,632	6,868	7,139	7,515	7,963	8,634	9,431	10,483	10,835	11,239	11,239
Roadway Congestion Index	0.77	0.79	0.82	0.87	0.88	0.86	0.86	0.87	0.88	0.89	0.9

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-43. Mobility and Congestion Variables in San Bernardino-Riv CA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	18,869	19,079	19,513	19,723	20,399	20,689	21,816	21,928	23,474	24,102	24,327
Lane-Kilometers	1,304	1,312	1,320	1,344	1,352	1,377	1,401	1,417	1,441	1,457	1,465
VKT/lane-kilometer	14,469	14,540	14,780	14,671	15,083	15,029	15,575	15,477	16,291	16,541	16,604
Incident Ratio	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	60	60	60	60	65	65	65	65	70	70	70
Percent of Moderate Congestion	100.0	100.0	48.3	72.3	26.7	16.7	9.1	6.4	18.8	16.3	6.5
Percent of Heavy Congestion	-	-	51.7	27.7	53.3	62.1	66.7	59.2	32.5	17.7	16.9
Percent of Severe Congestion	-	-	-	-	20.0	21.2	24.2	34.4	48.8	66.0	76.6
Principal Arterial Streets											
Daily VKT (000)	12,365	13,299	13,927	14,104	14,281	14,329	14,732	15,086	16,342	17,147	17,308
Lane-kilometers	2,286	2,351	2,528	2,544	2,544	2,608	2,705	2,777	3,123	3,357	3,381
VKT/lane-kilometer	5,408	5,658	5,510	5,544	5,614	5,494	5,446	5,432	5,232	5,108	5,119
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	50	50	50	55	55	55	55	55	55	55	55
Percent of Moderate Congestion	100.0	100.0	66.7	50.9	38.5	41.5	41.5	40.6	46.2	45.7	41.1
Percent of Heavy Congestion	-	-	33.3	34.1	30.8	27.7	28.3	37.7	30.8	31	24.7
Percent of Severe Congestion	-	-	-	15	30.8	30.8	30.2	21.7	23.1	23.3	34.3
Population (000)	945	950	965	970	990	1,015	1,040	1,100	1,170	1,275	1,300
Urban Area (square kilometers)	1,036	1,114	1,166	1,217	1,243	1,256	1,256	1,256	1,269	1,295	1,321
Population Density	912	853	828	797	796	808	828	876	922	985	984
Registered Vehicles (000)	-	-	-	-	678	709	726	769	780	797	798
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.35	0.38	0.36	0.37
Total VKT (000)	22,753	25,618	27,925	28,288	30,601	32,128	34,673	38,096	40,329	43,491	43,834
Total Lane-Kilometers	4,978	5,012	5,152	5,216	5,274	5,434	5,856	6,099	6,521	7,517	7,728
Roadway Congestion Index	1.11	1.12	1.13	1.12	1.15	1.14	1.18	1.17	1.21	1.22	1.22

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-44. Mobility and Congestion Variables in San Diego, CA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	24,271	26,525	29,753	31,637	33,842	37,280	40,306	43,084	44,581	44,597	44,758
Lane-Kilometers	2,447	2,496	2,536	2,568	2,616	2,640	2,729	2,769	2,777	2,777	2,801
VKT/lane-kilometer	9,918	10,629	11,733	12,320	12,935	14,119	14,770	15,558	16,052	16,058	15,977
Incident Ratio	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	35	35	35	35	40	45	50	50	50	50	50
Percent of Moderate Congestion	66.7	72.7	34.3	37.8	58.2	28.4	26.7	26.0	28.8	26.4	33.9
Percent of Heavy Congestion	33.3	27.3	40.0	13.5	9.1	41.9	20.0	15.1	24.7	26.4	22.8
Percent of Severe Congestion	-	-	25.7	48.7	32.7	29.7	53.3	58.9	46.6	47.2	43.3
Principal Arterial Streets											
Daily VKT (000)	9,869	10,449	11,407	12,075	12,639	13,170	14,240	14,377	15,037	15,295	15,617
Lane-kilometers	2,302	2,335	2,383	2,415	2,463	2,512	2,608	2,689	2,753	2,785	2,793
VKT/lane-kilometer	4,287	4,476	4,787	5,000	5,131	5,244	5,460	5,347	5,462	5,491	5,591
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	25	25	30	30	30	30	30	30	30	30	35
Percent of Moderate Congestion	100.0	90.0	80.0	75.0	42.9	17.4	15.4	12.1	26.7	24.7	16.5
Percent of Heavy Congestion	-	10.0	20.0	25.0	57.1	82.6	65.4	81.8	66.7	63.6	58.8
Percent of Severe Congestion	-	-	-	-	-	-	19.2	6.1	6.7	11.7	24.7
Population (000)	1,780	1,800	1,830	1,890	1,980	2,070	2,175	2,220	2,295	2,350	2,480
Urban Area (square kilometers)	1,580	1,619	1,658	1,684	1,722	1,761	1,800	1,826	1,839	1,839	1,891
Population Density	1,127	1,112	1,104	1,123	1,150	1,175	1,208	1,216	1,248	1,278	1,312
Registered Vehicles (000)	-	-	-	-	1,096	1,318	1,385	1,415	1,435	1,458	1,488
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.35	0.38	0.36	0.37
Total VKT (000)	57,722	59,227	60,005	63,677	65,986	71,022	76,440	80,960	83,086	83,293	84,151
Total Lane-Kilometers	8,024	8,047	8,203	8,298	8,386	8,567	8,876	8,910	9,174	9,396	9,533
Roadway Congestion Index	0.78	0.83	0.91	0.95	1	1.08	1.13	1.18	1.22	1.22	1.22

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \frac{\textit{Freeway VKT}}{} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \frac{\textit{Prin. Art. Str. VKT}}{}}{13{,}000^{1} \times \frac{\textit{Freeway VKT}}{} + 5{,}000^{1} \times \frac{\textit{Prin. Art. Str. VKT}}{}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-45. Mobility and Congestion Variables in San Fran-Oak CA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	46,473	48,300	51,866	55,811	59,449	63,724	64,988	67,572	68,570	67,620	68,103
Lane-Kilometers	3,542	3,558	3,558	3,655	3,679	3,711	3,743	3,784	3,848	3,848	3,912
VKT/lane-kilometer	13,120	13,575	14,577	15,271	16,160	17,171	17,361	17,860	17,820	17,573	17,407
Incident Ratio	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	65	70	75	75	75	80	80	80	80	80	80
Percent of Moderate Congestion	26.5	16.4	6.5	7.7	9.1	9.6	11.9	13.8	17.1	13.8	17.2
Percent of Heavy Congestion	19.1	30.1	28.6	20.5	7.8	4.8	6.0	5.8	10.2	16.1	14.9
Percent of Severe Congestion	54.4	53.4	64.9	71.8	83.1	85.5	82.1	80.5	72.7	70.1	67.8
Principal Arterial Streets											
Daily VKT (000)	15,593	16,462	17,372	18,322	19,320	20,399	21,799	22,073	22,532	22,588	22,830
Lane-kilometers	2,954	2,979	3,059	3,123	3,180	3,228	3,325	3,445	3,623	3,703	3,735
VKT/lane-kilometer	5,278	5,527	5,679	5,866	6,076	6,319	6,557	6,407	6,220	6,100	6,112
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	60	60	60	60	60	60	60	60	60	60	60
Percent of Moderate Congestion	59.2	27.6	9.3	13.6	21.2	15.7	14.8	10.1	6.7	10.2	9.3
Percent of Heavy Congestion	4.2	29.3	29.3	27.2	14.1	18.1	4.9	5.1	15.6	11.4	15.1
Percent of Severe Congestion	36.6	43.1	61.3	59.3	64.7	66.3	80.3	84.8	77.8	78.4	75.6
Population (000)	3,290	3,310	3,330	3,350	3,435	3,520	3,610	3,620	3,675	3,725	3,805
Urban Area (square kilometers)	2,007	2,020	2,046	2,072	2,098	2,124	2,150	2,163	2,189	2,266	2,331
Population Density	1,639	1,638	1,627	1,617	1,637	1,657	1,679	1,674	1,679	1,644	1,632
Registered Vehicles (000)	-	-	-	-	2,684	2,943	3,008	3,011	3,015	3,036	3,120
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.35	0.38	0.36	0.37
Total VKT (000)	84,691	90,785	99,667	107,099	110,201	115,757	120,415	125,250	123,890	123,941	125,124
Total Lane-Kilometers	13,479	13,699	13,796	13,827	13,809	14,113	14,371	14,408	14,503	14,757	14,894
Roadway Congestion Index	1.01	1.05	1.12	1.17	1.24	1.31	1.33	1.36	1.36	1.34	1.33

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-46. Mobility and Congestion Variables in San Jose CA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	19,425	20,053	21,316	22,427	22,959	23,490	24,078	25,019	25,406	26,597	26,734
Lane-Kilometers	1,739	1,763	1,803	1,819	1,827	1,835	1,852	1,868	1,868	1,892	1,932
VKT/lane-kilometer	11,171	11,374	11,821	12,327	12,564	12,798	13,004	13,397	13,603	14,060	13,838
Incident Ratio	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	45	50	50	55	55	60	60	60	60	60	60
Percent of Moderate Congestion	14.5	4.6	14.8	16.9	6.3	11.8	17.1	14.3	19.4	20.0	20.0
Percent of Heavy Congestion	39.1	18.5	6.6	9.2	20.3	13.2	14.5	22.1	18.1	18.6	19.9
Percent of Severe Congestion	46.4	76.9	78.7	73.9	73.4	75.0	68.4	63.6	62.5	61.4	60.1
Principal Arterial Streets											
Daily VKT (000)	8,443	8,710	9,266	9,749	9,966	10,207	10,465	10,876	10,908	10,988	11,914
Lane-kilometers	1,900	1,940	1,988	2,004	2,013	2,029	2,045	2,069	2,085	2,093	2,222
VKT/lane-kilometer	4,444	4,490	4,660	4,863	4,952	5,032	5,118	5,257	5,232	5,250	5,362
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	40	40	45	50	55	55	60	60	60	60	60
Percent of Moderate Congestion	92.5	92.4	74.2	54.9	24.3	17.1	16.8	15.5	22.2	20.0	22.1
Percent of Heavy Congestion	4.5	4.6	10.0	25.0	31.4	14.3	7.4	11.3	8.9	5.0	16.7
Percent of Severe Congestion	3.0	3.0	15.8	20.1	44.3	68.6	75.8	73.2	68.9	75.0	61.3
Population (000)	1,200	1,250	1,275	1,300	1,340	1,355	1,370	1,390	1,410	1,500	1,505
Urban Area (square kilometers)	1,049	1,062	1,075	1,088	1,101	1,114	1,127	1,153	1,166	1,166	1,191
Population Density	1,144	1,177	1,186	1,195	1,217	1,217	1,216	1,206	1,210	1,287	1,263
Registered Vehicles (000)	-	-	-	-	968	979	991	1,005	1,015	1,021	1,039
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.35	0.38	0.36	0.37
Total VKT (000)	35,494	38,658	41,672	44,064	44,555	47,716	50,058	51,826	52,236	52,930	53,265
Total Lane-Kilometers	5,756	5,809	5,881	5,905	5,939	5,947	5,994	6,020	6,141	6,255	6,285
Roadway Congestion Index	0.86	0.88	0.91	0.95	0.97	0.99	1	1.03	1.05	1.08	1.07

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT}]\textit{Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT}]\textit{Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-47. Mobility and Congestion Variables in Seattle-Everett WA

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	19,755	21,083	22,403	23,909	24,955	26,726	27,676	29,302	30,461	30,590	32,643
Lane-Kilometers	1,618	1,666	1,715	1,771	1,787	1,835	1,835	1,868	1,948	1,964	2,045
VKT/lane-kilometer	12,209	12,652	13,066	13,500	13,964	14,561	15,079	15,690	15,636	15,574	15,965
Incident Ratio	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	40	45	50	50	55	65	70	70	70	70	70
Percent of Moderate Congestion	58.3	28.6	28.9	40.0	32.2	37.2	30.1	12.2	15.7	11.8	11.0
Percent of Heavy Congestion	22.2	50.0	34.6	22.0	37.3	29.5	34.9	50.0	54.2	51.8	39.3
Percent of Severe Congestion	19.4	21.4	36.5	38.0	30.5	33.3	34.9	37.8	30.1	36.5	49.8
Principal Arterial Streets											
Daily VKT (000)	11,004	11,785	12,542	12,977	13,403	14,410	14,192	14,587	14,699	15,810	15,778
Lane-kilometers	2,157	2,198	2,270	2,318	2,335	2,375	2,375	2,455	2,536	2,576	2,616
VKT/lane-kilometer	5,101	5,363	5,525	5,597	5,741	6,068	5,976	5,941	5,797	6,138	6,031
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	50	55	55	55	55	55	55	55	55	55	55
Percent of Moderate Congestion	17.7	23.6	19.3	21.8	30.7	20.6	19.4	24.6	18.2	18.6	14.0
Percent of Heavy Congestion	41.2	27.3	35.1	20.0	8.1	32.4	26.4	13.9	15.2	20.0	19.3
Percent of Severe Congestion	41.2	49.1	45.6	58.2	61.3	47.1	54.2	61.5	66.7	61.4	66.7
Population (000)	1,440	1,480	1,520	1,540	1,565	1,595	1,625	1,680	1,730	1,820	1,840
Urban Area (square kilometers)	1,684	1,684	1,684	1,761	1,800	1,826	1,852	1,852	1,878	1,878	1,891
Population Density	855	879	903	874	869	874	878	907	921	969	973
Registered Vehicles (000)	-	-	-	-	1,048	1,145	1,169	1,265	1,291	1,331	1,335
Fuel Cost ($/liter)	-	-	-	-	0.27	0.28	0.31	0.32	0.37	0.36	0.36
Total VKT (000)	41,631	47,785	47,928	49,697	51,885	56,846	62,838	65,675	65,752	69,388	77,132
Total Lane-Kilometers	9,354	9,750	9,861	10,367	10,370	10,586	10,686	10,735	10,742	10,798	10,903
Roadway Congestion Index	0.95	0.99	1.02	1.05	1.09	1.14	1.17	1.2	1.2	1.2	1.22

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-48. Mobility and Congestion Variables in St. Louis MO

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	19,376	20,986	23,200	23,852	25,148	26,227	27,990	30,139	29,785	30,107	30,477
Lane-Kilometers	1,948	1,996	2,206	2,278	2,286	2,302	2,391	2,713	2,721	2,729	2,737
VKT/lane-kilometer	9,946	10,512	10,518	10,470	11,000	11,392	11,707	11,110	10,947	11,032	11,135
Incident Ratio	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	20	20	20	20	20	20	20	20	20
Percent of Moderate Congestion	42.9	36.1	52.6	26.7	56.0	42.9	46.4	37.8	50.0	50.0	56.7
Percent of Heavy Congestion	57.1	63.9	23.7	60.0	36.0	33.3	15.0	21.6	10.0	10.6	30.0
Percent of Severe Congestion	-	-	23.7	13.3	8.0	23.8	38.6	40.5	40.0	39.4	13.3
Principal Arterial Streets											
Daily VKT (000)	14,418	14,949	15,689	16,519	17,332	18,056	18,467	19,658	19,658	19,884	20,093
Lane-kilometers	2,705	2,705	2,753	2,785	2,785	2,809	2,809	2,890	2,898	2,946	3,051
VKT/lane-kilometer	5,330	5,527	5,699	5,931	6,223	6,427	6,573	6,802	6,783	6,749	6,586
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	65	65	65	65	65	65	55	60	60	60	60
Percent of Moderate Congestion	37.8	39.6	30.4	25.0	28.1	35.1	25.5	13.6	21.1	19.9	25.4
Percent of Heavy Congestion	15.6	20.8	16.1	21.2	26.3	17.5	23.6	28.8	49.1	45.3	31.8
Percent of Severe Congestion	46.7	39.6	53.6	53.9	45.6	47.4	50.9	57.6	29.8	34.8	42.9
Population (000)	1,850	1,850	1,850	1,925	1,930	1,940	1,950	1,955	1,960	1,970	1,985
Urban Area (square kilometers)	1,684	1,813	1,813	1,813	1,813	1,839	1,865	1,878	1,891	1,904	1,917
Population Density	1,099	1,020	1,020	1,062	1,065	1,055	1,046	1,041	1,037	1,035	1,036
Registered Vehicles (000)	-	-	-	-	935	939	947	953	1,001	1,020	1,032
Fuel Cost ($/liter)	-	-	-	-	1.02	0.26	0.28	0.32	0.32	0.31	0.32
Total VKT (000)	46,191	52,703	55,761	57,340	59,879	62,560	65,662	72,239	72,914	74,509	77,056
Total Lane-Kilometers	10,405	11,296	11,375	11,394	11,415	11,594	11,632	11,508	11,534	11,571	11,603
Roadway Congestion Index	0.83	0.87	0.88	0.89	0.93	0.96	0.98	0.96	0.95	0.95	0.95

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\dfrac{\textit{Freeway VKT}}{\textit{VKT/Ln.-Km.}} \times \textit{Freeway VKT} + \dfrac{\textit{Prin. Art. Str. VKT}}{\textit{VKT/Ln.-Km.}} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-49. Mobility and Congestion Variables in Tampa FL

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	3,188	3,453	4,089	4,580	4,733	5,313	5,538	5,522	5,844	5,877	6,118
Lane-Kilometers	306	306	354	419	435	451	467	475	483	491	499
VKT/lane-kilometer	10,421	11,289	11,545	10,942	10,889	11,786	11,862	11,627	12,100	11,967	12,258
Incident Ratio	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	20	20	20	20	20	20	25	25	25	25	25
Percent of Moderate Congestion	17.1	14.3	6.7	14.9	19.6	35.8	38.1	30.4	17.7	16.3	17.0
Percent of Heavy Congestion	40.0	24.3	23.3	25.1	45.1	13.0	11.9	27.8	33.3	34.3	22.6
Percent of Severe Congestion	42.9	61.4	70.0	60.0	35.3	51.2	50.0	41.7	49.0	49.4	60.4
Principal Arterial Streets											
Daily VKT (000)	5,136	5,418	5,885	6,182	5,877	6,247	6,545	6,730	7,020	7,084	7,487
Lane-kilometers	877	877	918	958	966	982	1,006	1,014	1,063	1,079	1,127
VKT/lane-kilometer	5,853	6,174	6,412	6,454	6,083	6,361	6,504	6,635	6,606	6,567	6,643
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	60	60	65	65	65	65	65	65	65	65	65
Percent of Moderate Congestion	19.2	15.8	22.5	20.9	16.7	18.0	12.4	31.4	28.1	36.4	23.4
Percent of Heavy Congestion	34.0	30.3	28.8	15.1	31.0	22.5	18.6	12.8	13.5	16.7	22.0
Percent of Severe Congestion	46.9	54.0	48.8	64.0	52.4	59.6	69.0	55.8	58.4	56.9	55.6
Population (000)	540	560	570	580	615	645	665	670	700	710	715
Urban Area (square kilometers)	907	907	1,010	1,010	1,062	1,101	1,127	1,127	1,153	1,166	1,166
Population Density	596	618	564	574	579	586	590	595	607	609	613
Registered Vehicles (000)	-	-	-	-	560	583	599	637	639	641	644
Fuel Cost ($/liter)	-	-	-	-	0.27	0.29	0.31	0.34	0.36	0.35	0.35
Total VKT (000)	16,034	17,523	17,995	18,729	19,299	19,694	23,649	23,738	25,322	26,163	27,209
Total Lane-Kilometers	4,824	4,880	4,906	4,915	4,946	5,078	5,223	5,223	5,253	5,297	5,313
Roadway Congestion Index	0.94	1.01	1.03	1	0.96	1.02	1.03	1.03	1.05	1.05	1.07

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

Table E-50. Mobility and Congestion Variables in Washington DC

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Freeway											
Daily VKT (000)	25,897	26,002	29,085	32,015	36,072	36,885	37,996	40,282	40,789	41,466	44,186
Lane-Kilometers	1,996	1,996	2,209	2,238	2,325	2,367	2,397	2,447	2,455	2,528	2,608
VKT/lane-kilometer	12,972	13,024	13,167	14,306	15,516	15,585	15,850	16,461	16,613	16,404	16,941
Incident Ratio	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Pct of Congested Freeway DVKT											
(ADT/lane greater than 15,000)	60	60	65	65	65	65	65	65	65	65	70
Percent of Moderate Congestion	63.3	36.4	30.6	50.0	38.2	32.9	30.3	16.0	17.8	12.2	10.5
Percent of Heavy Congestion	16.7	45.5	47.2	19.2	36.8	38.4	40.9	44.0	30.1	33.8	29.0
Percent of Severe Congestion	20.0	18.2	22.2	30.8	25.0	28.8	28.8	40.0	52.1	54.1	60.5
Principal Arterial Streets											
Daily VKT (000)	21,397	21,413	22,347	23,876	25,599	27,434	27,660	27,837	28,755	29,383	29,785
Lane-kilometers	2,818	2,930	3,123	3,204	3,301	3,381	3,462	3,542	3,623	3,703	3,735
VKT/lane-kilometer	7,594	7,308	7,155	7,452	7,756	8,114	7,991	7,859	7,938	7,935	7,974
Incident Ratio	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Pct of Congested Prin. Art. DVKT											
(ADT/lane greater than 15,000)	80	80	80	80	80	85	85	85	85	85	85
Percent of Moderate Congestion	11.4	11.6	15.2	12.4	15.9	15.1	11.0	9.5	7.1	8.8	15.7
Percent of Heavy Congestion	31.4	15.9	19.0	29.6	25.6	20.9	25.6	23.8	30.6	24.1	18.0
Percent of Severe Congestion	57.1	72.5	65.8	58.0	58.5	64.0	63.4	66.7	62.4	67.1	66.3
Population (000)	2,700	2,780	2,810	2,860	2,920	2,980	3,040	3,080	3,100	3,280	3,285
Urban Area (square kilometers)	2,059	2,072	2,085	2,098	2,111	2,124	2,150	2,163	2,176	2,383	2,396
Population Density	1,311	1,342	1,348	1,363	1,383	1,403	1,414	1,424	1,425	1,377	1,371
Registered Vehicles (000)	-	-	-	-	1,588	1,609	1,643	1,665	1,673	1,688	1,708
Fuel Cost ($/liter)	-	-	-	-	-	0.28	0.31	0.33	0.38	0.36	0.37
Total VKT (000)	72,384	73,163	78,681	86,272	93,808	97,553	98,978	101,398	103,560	104,766	109,958
Total Lane-Kilometers	11,284	11,540	12,186	12,614	13,128	13,276	13,442	13,608	13,775	13,899	14,081
Roadway Congestion Index	1.12	1.11	1.11	1.19	1.27	1.29	1.3	1.33	1.34	1.33	1.36

Note: A Congestion Index value above 1.0 indicates an undesirable level of congestion.
" - " denotes data unavailable.

$$\textit{Roadway Congestion Index (RCI)} = \frac{\textit{Freeway VKT/Ln.-Km.} \times \textit{Freeway VKT} + \textit{Prin. Art. Str. VKT/Ln.-Km.} \times \textit{Prin. Art. Str. VKT}}{13{,}000^{1} \times \textit{Freeway VKT} + 5{,}000^{1} \times \textit{Prin. Art. Str. VKT}}$$

[1] Congestion Indicator Levels—Interstate and Expressway = 13,000 VKT/lane-kilometers
Principal Arterial = 5,000 VKT/lane-kilometers

REFERENCES

1. Texas Transportation Institute. "Estimates of Relative Mobility In Major Texas Cities," Research Report 323-1F, 1982.

2. Texas Transportation Institute. "Relative Mobility In Texas Cities, 1975 to 1984," Research Report 339-8, 1986.

3. Texas Transportation Institute. "The Impact Of Declining Mobility In Major Texas and Other U.S. Cities," Research Report 431-1F, 1988.

4. Texas Transportation Institute. "Roadway Congestion In Major Urbanized Areas: 1982 to 1987," Research Report 1131-2, 1989.

5. Texas Transportation Institute. "Roadway Congestion In Major Urbanized Areas: 1982 to 1988," Research Report 1131-3, 1990.

6. Texas Transportation Institute. "1989 Roadway Congestion Estimates and Trends," Research Report 1131-4, 1991.

7. "Estimates of Urban Roadway Congestion—1990," Research Report 1131-5, 1993.

8. United States General Accounting Office. "Traffic Congestion: Trends, Measures, and Effects," Washington, D.C., 1989.

9. National Council on Public Works Improvements. "Fragile Foundations: A Report on America's Public Works," Washington, D.C., 1988.

10. United States Department of Transportation, Federal Highway Administration. "Highway Performance Monitoring System," 1982 to 1991 Data.

11. Chui, Margaret K. and William E. McFarland. "The Value of Travel Time: New Estimates Developed Using a Speed Choice Model," Texas Transportation Institute, January 1987.

12. "Private Truck Counsel of America Cost Index Survey," Houston Post, July 6, 1987.

13. Lindley, Jeffrey A. "Quantification of Urban Freeway Congestion and Analysis of Remedial Measures," Federal Highway Administration, FHWA/RD-87/052, October 1986.

14. Morris, D. E. and Michael Ogden. "Houston-Galveston Regional Transportation Study," Texas Transportation Institute, January 1990.

15. Transportation Research Board, Special Report 209, "Highway Capacity Manual," 1985.

16. Report of the Secretary of Transportation to the United States Congress. "The Status of the Nation's Highways: Condition and Performance," June 1985.

17. United States Department of Transportation, Federal Highway Administration, "1980-3R Study."

18. American Association of State Highway and Transportation Officials. *A Policy on Geometric Design of Highways and Streets*, 1984.

19. Texas Department of Highways and Public Transportation. "Ten-Year Project Development Plan Documentation and Support Data," 1986.

20. State Department of Highways and Public Transportation. "Permanent Automatic Traffic Recorder Data—1950-1984."

21. Raus, J. "A Method for Estimating Fuel Consumption and Vehicle Emissions on Urban Arterials and Networks," Report No. FHWA-TS-81-210, April 1981.