

# THE 2001 URBAN MOBILITY REPORT

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**The Urban Mobility Report is  
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May 2001



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# T HE SHORT REPORT

## ... FOR READERS WHO ARE NOT STUCK IN TRAFFIC

The 18 years of data presented in this report document the growth of congestion levels on the major roads systems of 68 U.S. urban areas. The data provide a relatively easy to understand view of an issue that is widely discussed, but perhaps not as well understood. The data speak to increasing traffic demands and a transportation network that is not expanding as rapidly, and hints at some of the other causes of traffic problems.

Major transportation system improvements require time for planning, design and implementation, and often a significant amount of funding as well. Communicating the condition and the need for improvements is a goal of this report. The decisions about which, and how much, improvement to fund will be made at the local level according to a variety of local goals, but there are some broad conclusions that can be drawn from this research database that apply to the areas studied.

- **Congestion is growing in areas of every size.** The 68 urban areas in this report range from New York City down to those with 100,000 population. All of the size categories show more severe congestion that lasts a longer period of time and affects more of the transportation network in 1999 than in 1982. The average annual delay per person climbed from 11 hours in 1982 to 36 hours in 1999. And delay over the same period quintupled in areas with less than 1 million people.
- **Congestion costs can be expressed in a lot of different factors, but they are all increasing.** The total congestion “bill” for the 68 areas in 1999 came to \$78 billion, which was the value of 4.5 billion hours of delay and 6.8 billion gallons of excess fuel consumed. To keep congestion from growing between 1998 and 1999 would have required 1,800 new lane-miles of freeway and 2,500 new lane-miles of streets—OR—6.1 million new trips taken by either carpool or transit, or perhaps satisfied by some electronic means—OR—some combination of these actions. These events did not happen, and congestion increased.
- **Road expansions slow the growth in congestion.** In areas where the rate of roadway additions were approximately equal to travel growth, travel time grew at about one-fourth to one-third as fast as areas where traffic volume grew much faster than roads were added.
- **By themselves, however, additional roadways do not seem to be the answer.** The need for new roads exceeds the funding capacity and the ability to gain environmental and public approval. The answer to the question “Can more roads solve all of the problem?” doesn’t lie in esoteric or theoretical discussions as in practical limitations. In many of the nation’s most congested corridors there doesn’t seem to be the space, money and public approval to add enough road space to create an acceptable condition. Only about half of the new roads needed to address congestion with an “all roads” approach was added between 1982 and 1999. And the percentage is actually slightly smaller in the smallest areas—where one might expect roads to top a shorter list of improvements than in larger and more diverse urban areas.

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- **The “Solution” is really a diverse set of options that require funding commitments, as well as a variety of changes in the ways that transportation systems are used.** The chosen options will vary from area to area, but the growth in congestion over the past 18 years suggests that more needs to be done.
  - More roads and more transit are part of the equation. Some of the growth will need to be accommodated with new systems, and some older system elements expanded.
  - More efficient operations can derive benefits from existing systems. Some of these can be accelerated by information technology and intelligent transportation systems, some are the result of educating travelers about their options, and providing a more diverse set of options than are currently available.
  - The way that travelers use the transportation network can be modified to accommodate more demand. The longer periods of high travel volume (the “peak period” instead of one “rush hour”) already accomplish this, but there are ways to give incentives and improve conditions for working, shopping and a variety of other activities as well as improving the travel situation.
  - There are a variety of techniques that are being tested in urban areas to change the way that developments occur – these also appear to be part, but not all, of the solution. Some of these have been labeled “smart growth” actions, but most are just familiar methods of arranging land use patterns to reduce the use of private vehicles and sustain or improve the “quality of life” in urban areas. The typical suburban development pattern will be part of most cities for many years, but there are a number of other patterns and modifications to existing developments that make transit, walking and bicycling more acceptable for some trips.
- **Improving the reliability of the transportation system is an important aspect of the programs in most large cities.** Identifying and clearing accidents and vehicle breakdowns, addressing construction and maintenance activity impacts on congestion and providing more reliable and predictable travel times are goals for congested corridors. Future reports will examine the impacts of these activities and their role in urban congestion as it relates to moving both people and freight.

This year’s report is the product of a cooperative arrangement between the Texas Transportation Institute and 11 state transportation agency sponsors. The Urban Mobility Study continues to research new data and new estimation methods to measure and communicate transportation issues to a range of audiences.

More information is available on the study website: <http://mobility.tamu.edu>.

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## ACKNOWLEDGMENTS

This is the first report of a new phase of a research study that builds on past congestion reports. The new study is sponsored by a coalition of states including the original study sponsor, the Texas Department of Transportation. The authors wish to thank the following members of the Urban Mobility Study Steering Committee for providing expertise, direction and comments.

California—John Wolf

Colorado—Tim Baker

Florida—Anita Vandervalk

Kentucky—Rob Bostrom

Maryland—James Dooley

Minnesota—Tim Henkel

New York—Gerard Cioffi

Oregon—Brian Gregor

Texas—Dan Mings

Virginia—Catherine McGhee

Washington—Charles Howard

Several of these states have used portions of their allocation of State Planning and Research funds from the Federal Highway Administration, U.S. Department of Transportation for this project.

The authors also wish to thank members of the Texas Transportation Institute for their assistance in report preparation, publication and information dispersal. It is their efforts that make our information accessible to professionals and the public.

Pam Rowe—Report Preparation

Tobey Nutt and Laura Wright—Web Page Creation and Maintenance

Bernie Fette, Julie Goss and Michelle Hoelscher—Media Relations

Pat McConal, Michelle Walker and Chris Pourteau—Report Production

Kim Miller—Cover Artwork

Dolores Hott and Debra Svec—Distribution

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## INTRODUCTION

Congestion and mobility issues have been discussed and debated for a long time—probably for as long as persons have chosen to live in close proximity to one another. The Urban Mobility Study attempts to provide some information about one part of those issues in ways that everyone can understand. This report attempts to address many of the issues that the motoring public, transportation officials, and policy makers often raise regarding traffic congestion and urban mobility in a way that is useful to these different “information markets”.

### ***Brief Review of the Study History***

The Urban Mobility Study attempts to develop use statistics from generally available data sources and provide information on trends in mobility levels. The Texas Department of Transportation identified a need in the early 1980s for a technique that allowed them to communicate with the public about the effect of increased transportation funding. The Texas Transportation Institute developed and applied a method to assess road congestion levels at a relatively broad scale—the urbanized area. Over the years, the study has evolved in several ways.

- ◆ The list of urban areas has expanded from the five largest Texas cities to 68 U.S. areas with a range of populations above 100,000.
- ◆ The list of measures has changed from a few traffic density measures to several travel time measures that can be used to evaluate several travel modes.
- ◆ The sponsor list has grown from the Texas DOT to eleven state DOTs.

### ***What Is the Focus of this Study?***

As a more diverse set of solutions to reduce roadway congestion are pursued in urban areas, the measurement techniques must also evolve. Despite the change in the measures, the study will continue to incorporate a few basic elements, including:

- ◆ **Urban area information**—to be used as a benchmark of the mobility changes that have been experienced in each urban area—not as a guide to which project, corridor or mode should be selected for funding.
- ◆ **Public information**—another source of data that citizens and transportation professionals can use to discuss which projects, programs and policies should be pursued.
- ◆ **Trend information**—as new information becomes available, it has to be meshed with the existing database to form consistent measures and a comparable database. This information identifies how the areawide mobility level has changed over a period of time.

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- ◆ **Free-flow speed comparisons**—used for consistency between urban areas. Individual areas may wish to use some other standard, but for the speed and delay measures in this study, free-flow or “speed limit” speeds appear appropriate. A uniform value provides easily understood benchmarks for comparisons. Other travel time or speed values are also appropriate for evaluations of individual corridors or for subarea studies.

The information in this report may assist in identifying whether the existing system performance and the improvements that might be made are adequate to meet the needs of the traveling public. No matter the transportation improvement solutions that are pursued, measuring congestion and mobility is one part of the public participation and decision-making process.

### ***What is Different About This Year’s Report?***

The layout of the report is somewhat different this year. This report will focus less on the data tables and more on the issues addressed by the data. Many of the “issues” associated with urban mobility are discussed with some important trend or magnitude information shown by the data tables. The individual urban area information—all of the tables included in past reports—are included in an appendix to this report with links from each “issue” to the relevant tables.

### ***New Measure***

One important additional measure used in this report is the Travel Time Index (TTI)—a comparison of total travel time in the peak to travel time in free flow conditions. The TTI is different from the Travel Rate Index (TRI) because it includes delay from both heavy traffic demand and roadway incidents. The TRI only focuses on delay caused by heavy traffic demand. The TTI and TRI each illustrate the effect of a range of transportation improvements and address a central concern of urban residents—time it takes to travel in the peak periods.

### ***New Methodology***

A 1986 report (*1*) from FHWA summarized an analysis package to calculate freeway delay using the Highway Performance Monitoring System (HPMS) database. The program used travel and roadway information from each urban area to calculate both the recurring and incident delay that would result from the traffic levels on the roadways. The program simulated delay conditions on an urban freeway by generating incidents based on incident pattern data from a few U.S. cities from the 1960s and 1970s. The traffic incidents generated in the program could range from a breakdown on the roadway shoulder to a full freeway closure for an hour or more. The ratios of incident delay to recurring delay calculated in the FHWA report were used in previous Urban Mobility Study reports. In the latest Urban Mobility Study report, the FHWA program has been replicated so that the ratios can be updated annually with the current travel and roadway information. Thus, any changes in roadway configuration—such as more or fewer freeway breakdown lanes—will be reflected in the incident delay in the report.

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## **H**OW DOES THE LOCAL MOBILITY LEVEL INFLUENCE URBAN TRAVELER DECISIONS?

Travelers and businesses use a number of factors to evaluate their trip and the transport system. This report evaluates some but not all of these. Here are some questions that people ask about travel—this reinforces the idea that the topic is broad and place the report in the proper context.

*Can I get there?*—This is often the first question asked by those without ready access to a personal vehicle. It may also include questions about parking near the destination.

*How long is the trip?*—Sometimes this is related to distance, but usually it is a time measure. It includes, for example, time spent waiting for transit service or walking from a parking place to a destination.

*What are my travel mode options?*—How many ways are there to make the trip that satisfy my needs?

*What route do I take?*—What roads, paths or transit routes do I use? And do these change depending on when I'm traveling?

*When do I leave?*—This relates to trip time and to the variability in trip time for the mode and route chosen. Travel time variability is particularly important to freight shippers involved in just-in-time manufacturing.

*Will I be comfortable and safe?*—Many times the uncertainty in these two factors will be an incentive to take a known mode/route rather than experiment.

*Is the trip convenient?* – This relates to a mix of route, mode and time choices and frequently explains why driving alone is chosen even when it costs more.

*How much will it cost?*—Frequently users seem to view their time, vehicle operating costs and out-of-pocket expenses (e.g., tolls, fares) differently even though all can be expressed in monetary terms.

*Do I need to make this trip?*—In the context of urban areas, this is often thought of as a question that leads to an “electronic trip” to telecommute or “teleshop.” It is also a significant question for those without easily available travel options and in areas with climatic extremes.

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## **WHAT IS THE SOURCE OF DATA FOR THIS REPORT?**

This research study uses data from federal, state, and local agencies to develop planning estimates of the level of mobility within an urban area. The analyses presented in this report are the results of previous research (2-5) conducted at the Texas Transportation Institute (TTI). The methodology developed by the previous research provides a procedure that yields a quantitative estimate of urbanized area mobility levels, utilizing generally available data, while minimizing the need for extensive data collection.

The methodology primarily uses the Federal Highway Administration's Highway Performance Monitoring System (HPMS) database, with supporting information from various state and local agencies (6). The HPMS database is used because of its relative consistency and comprehensive nature. State departments of transportation collect, review, and report the data. Since each state classifies roadways in a slightly different manner, TTI reviews and adjusts the data, and then state and local agencies familiar with each urban area review the data. Special studies of issues or areas provide more detailed information and the Urban Mobility Study procedures have been modified to take advantage of some of these.

### ***Urban Area Boundaries***

This process is of particular importance when urban boundaries are redrawn due to realignments or when local agencies update the boundary to account for urban growth. These changes may significantly change the size of the urban area, which also causes a change in system length, travel and mobility estimates. When the urban boundary is not altered every year in fast growth areas, some data items take on a "stair-step appearance." Significant changes thus caused by the data compilation methods, are addressed by altering statistics to present a trend closer to actual experience for each year.

### ***Changes from Previous Years***

Sometimes the trends change, however, and in this year's report many of the urban areas have some slight data changes to their input data to make the Urban Mobility Study statistics more consistent with the original HPMS data. This may cause some areas to move up or down in the rankings in some of the measures. A list of the urban areas and changes to their input and output data resulting from this updating process is included in Appendix B (which can be found on the Urban Mobility Study website: <http://mobility.tamu.edu>).

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## **W**HAT IS IN THIS REPORT?

The database developed for this research contains vehicle travel, population, urban area size, and lane-miles of freeway and principal arterial streets from 1982 to 1999. The Travel Rate Index (TRI), Travel Time Index (TTI) and travel delay are used as the basis of measuring urban mobility levels and comparing areawide roadway systems.

This report includes many of the statistics reported in previous editions of this report. Some new measures are presented and the formats of some statistics have been altered. While most of the large urban areas in the United States are included in the study, it would be incorrect to assume that the totals represent an estimate of national congestion impacts.

The report presents data in either a ranking format or in population groups. The population group comparisons are not without inconsistencies, given the diversity of land use patterns, community goals, fiscal capacity, etc., between cities. Analyzing trends for areas of different sizes does, however, provide some information regarding the extent and growth of congestion.

The report is organized around questions associated with urban mobility. These questions may show the national trend or trend within the various population groups. They do not typically focus on individual area statistics. The area information is contained in Appendix A at the end of the report.

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## **IS CONGESTION WORSE IN LARGE AREAS?**

While this seems to have a very simplistic answer, it is a frequently asked question. Areawide congestion levels tend to be worse in the larger urban areas. There are, however, some isolated pockets of very bad traffic congestion in smaller urban areas that rival some from the larger cities.

### ***Conclusions***

In general, it appears that traffic congestion is worse in the larger urban areas than in the smaller ones. There are instances in the smaller areas where conditions at a localized roadway bottleneck or intersection may resemble the conditions that exist in much larger urban areas. But, as urban areas get larger, so does the overall congestion level.

See Table A-2 in the Appendix for information on individual urban areas.

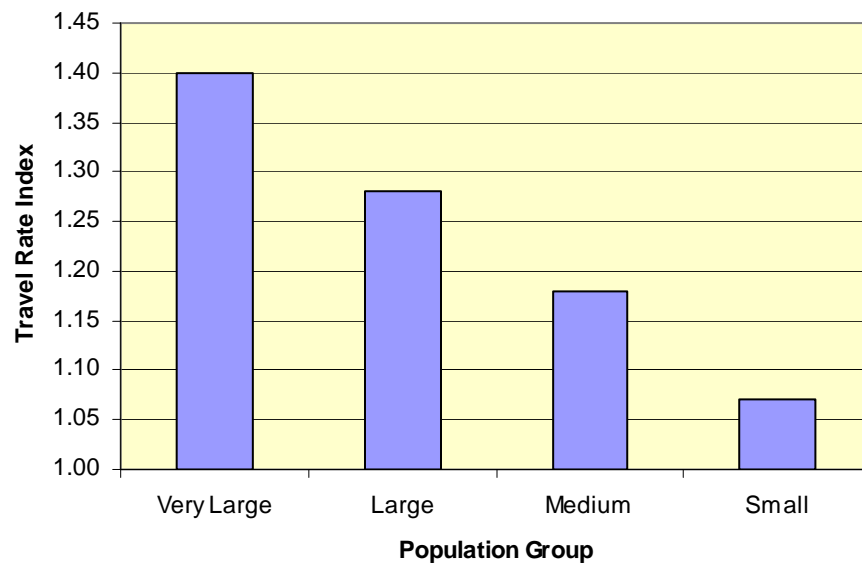
The simplest way to look at this problem is to examine the Travel Rate Index (TRI) that measures the amount of additional time needed to make a trip during a “normally congested” peak travel period rather than at other times of the day. The 1999 statistics show:

- ◆ The average TRI for all 68 urban areas is 1.32. Thus, an average a 20-minute non-peak trip takes over 26 minutes to complete during the peak due to regular heavy traffic demand.
- ◆ The average TRI for each population group ranges from 1.40 in the Very Large areas down to 1.07 in the Small urban areas (see Exhibit 1).
- ◆ 20 of the 68 urban areas have a TRI of at least 1.30. Every one of these 20 urban areas is in the Very Large or Large population groups—they have populations greater than one million.
- ◆ 49 urban areas have a TRI of at least 1.15. This group includes only one urban area from the Small population group (Colorado Springs).



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**Exhibit 1. Peak Travel Conditions -  
1999 Travel Rate Index**



Note: See Table A-2 for individual urban area values.

Note: The Travel Rate Index is a ratio of peak period to free-flow travel time. A value of 1.3 indicates a free-flow trip of 20 minutes takes 26 minutes in the peak

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## **A**RE SMALLER URBAN AREAS AFFECTED MORE BY ROADWAY INCIDENTS THAN LARGER ONES?

Heavy traffic demand is not the only contributor to traffic congestion. Roadway incidents—vehicle breakdowns, accidents, etc—can also increase the amount of delay time. One way to analyze the problem is to compare the delay that is caused by heavy traffic with the delay caused by incidents. This comparison is shown in Exhibit 2 as the percentage of the total delay represented by each.

### **Conclusions**

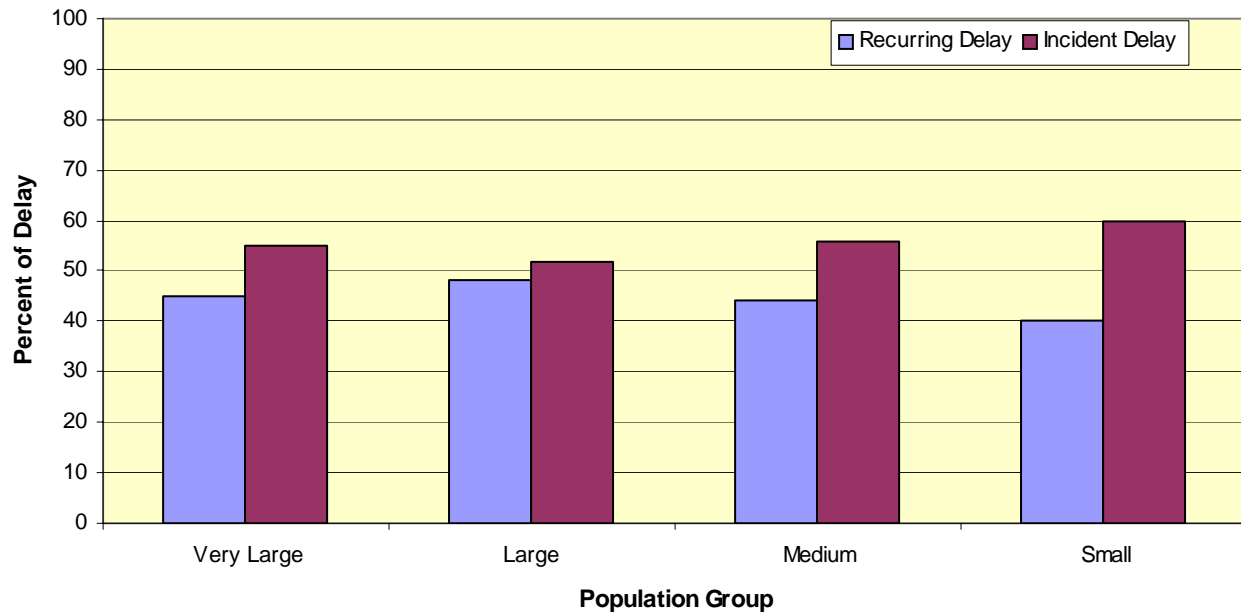
Incidents have a significant effect on delay in areas of all sizes. In general, more delay is caused by incidents than heavy traffic demand. The small and medium areas have a greater percentage of total delay due to incidents than larger areas.

The 1999 statistics show:

- ◆ On average, incident delay comprises 54 percent of the delay in the 68 urban areas.
- ◆ The amount of delay that is attributed to incidents ranges from 60 percent in the Small areas down to 52 percent in the Large areas.
- ◆ 14 of the 68 urban areas have at least 60 percent of delay caused by incidents. Four of these urban areas are from the Small areas. Five are from the Large areas; however, these five (Kansas City, Buffalo, Oklahoma City, Norfolk and Pittsburgh) are some of the lesser-congested areas within the Large group.
- ◆ 56 urban areas have more of their delay caused by incidents rather than heavy traffic demand.
- ◆ In general, the high percentages of congestion due to incidents are found in areas where congestion levels are lower. If less congestion is seen on normal days, the days when multiple incidents occur become a more significant concern.

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**Exhibit 2. 1999 Recurring and Incident Delay**



Recurring delay—delay caused by heavy traffic demand.

Incident delay—delay caused by vehicle breakdowns, accidents, etc.

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## **IS THE INDIVIDUAL RESIDENT IN THE LARGER URBAN AREAS AFFECTED MORE BY TRAFFIC CONGESTION?**

The amount of travel delay experienced per person can be expressed as an annual amount to illustrate the “congestion time penalty.” Annual hours of delay per person accounts for travel delay due to both heavy traffic and roadway incidents.

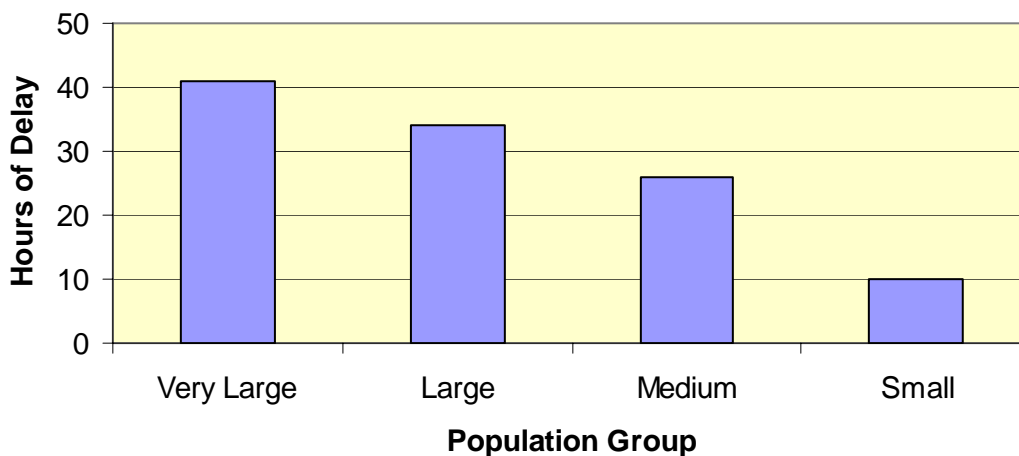
### **Conclusions**

Yes. On average residents and travelers in larger areas experience more delay. Table A-2, however, notes some smaller areas with delays similar to much larger cities.

The 1999 statistics show:

- ◆ The average annual delay per person in the 68 urban areas is 36 hours (or the equivalent of about one work week of lost time).
- ◆ The annual delay per person ranges from 41 wasted hours in the Very Large areas down to 10 wasted hours in the Small urban areas (see Exhibit 3).
- ◆ 16 of the 68 urban areas had over 40 hours of delay per person. All of these 16 urban areas were either in the Very Large or Large population group.
- ◆ 47 of the 68 urban areas had over 20 hours of delay per person. Only one of these urban areas, Colorado Springs, was from the Small population group.

**Exhibit 3. 1999 Annual Delay Per Person**



Note: See Table A-2 for individual urban area values.

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## HOW CONGESTED ARE THE ROADS?

One way to address this question is to look at the percentage of the daily traffic on the freeways and principal arterial streets that is congested in each urban area (i.e., the traffic that has to deal with speeds less than freeflow).

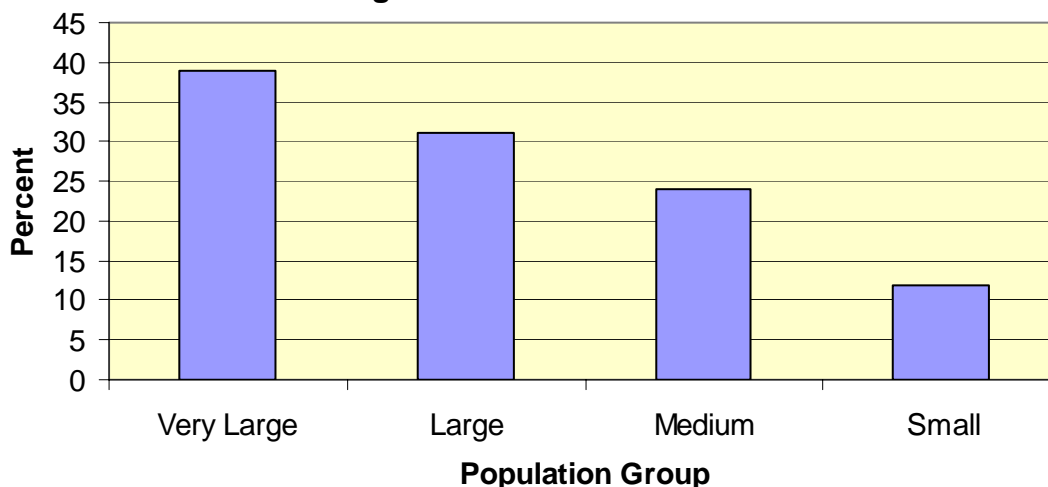
### **Conclusions**

On average, one-third of the daily traffic in the 68 urban areas is congested. Almost three times as much of the daily traffic is congested in the Very Large areas as in the Small areas. This points to the fact that congestion tends to be worse in the larger urban areas and that about one-third of the traffic must suffer through congested conditions.

See Table A-18 in the appendix for information on individual urban areas.

- ◆ Overall, in the 68 urban areas, 33 percent of the daily traffic is congested. In other words, one-third of the daily traffic is moving at less than freeflow speeds. These speeds might be just less than those occurring in uncongested times or they may be much slower and near stop-and-go conditions.
- ◆ The percentage of congested daily traffic ranges from 39 percent in the Very Large urban areas down to 12 percent in the Small areas (see Exhibit 4).
- ◆ These percentages also provide some insight into the length of the congested period in the different-sized urban areas. With 39 percent of the daily traffic congested, the congested periods in the Very Large urban areas may last 5 to 6 hours a day. In the Small areas, the 12 percent of congested daily traffic may mean that the congested periods last between 1 and 2 hours each day.

**Exhibit 4. Percent of Travel That Occurred in Congested Conditions in 1999**



Note: See Table A-18 for individual urban area values.

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## **IS MOBILITY IMPROVING?**

The first question that usually comes up in a discussion of mobility issues is “How bad is it now?” The question that naturally follows is “How much worse is it today than a few years ago?” Some of the same measures that were used to analyze the congestion level in the urban areas can also show the trends in mobility that exists in urban America as well. The Travel Rate Index, Travel Time Index, and Percentage of Congested Daily Travel are used below to show the trends in mobility.

### ***Conclusions***

On average, mobility is not improving in the 68 urban areas in this report. The congested periods are getting longer with more traffic subjected to congested conditions. The time to complete a congested period trip also continues to get longer.

The need for attention to transportation projects is illustrated in these trends. Major projects or programs require a significant planning and development time—10 years is not an unrealistic timeframe to go from an idea to a completed project or to an accepted program. At recent growth rates, the urban area average congestion values will jump to the next highest classification—medium areas in 2009 will have congestion problems of large areas in 1999.

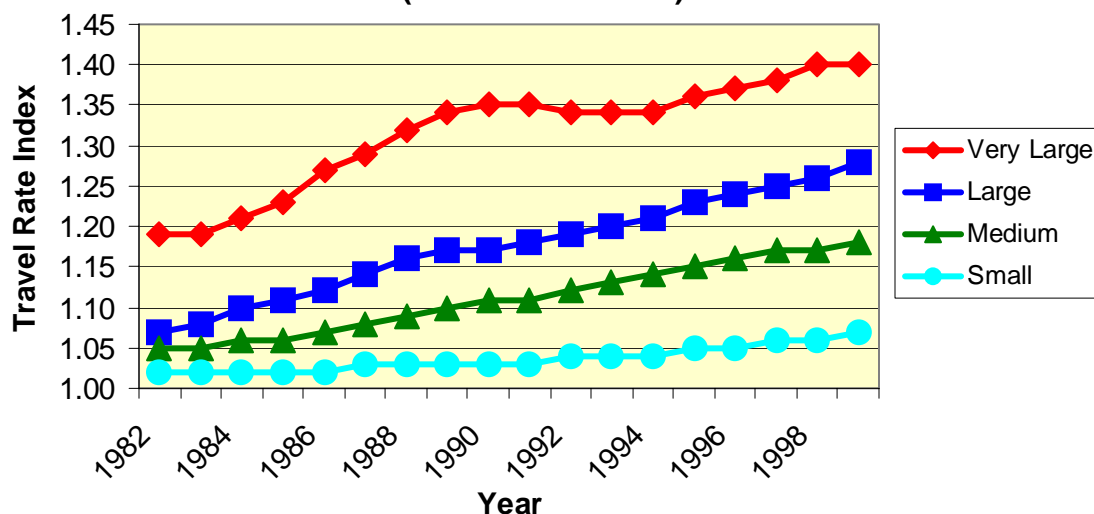
See Tables A-3, A-4 and A-19 for individual urban area values.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

The Travel Rate Index (TRI) measures the amount of additional time needed to make a trip in the peak period rather than at other times of the day. This measure is based solely on the regular traffic congestion on the roadways. This gives us an idea of how much of the change in traffic congestion is due solely to more cars using the roadways and/or not enough travelers choosing one of the other travel modes or travel options. The 1999 statistics show:

- ◆ The time penalty from heavy traffic demand has increased in 34 areas by about a point or more per year in the short-term (7 point increase in the TRI between 1992 and 1999). This means that an additional 1.5 minutes of time has been added to a 20-minute congested period trip between 1992 and 1999.
- ◆ The time penalty from heavy traffic demand has increased in 32 areas by about a point or more per year in the long-term (17 point increase in the TRI between 1982 and 1999). This means that an additional 3.5 minutes have been added to a 20-minute congested period trip between 1992 and 1999.
- ◆ 2 urban areas have experienced a small decrease in the short-term (1992 to 1999). New Orleans lost 1 point and San Jose lost 3 points. Both of these decreases amount to less than one minute of time recovered from a 20-plus-minute congested period trip.
- ◆ In the long term (1982 to 1999), the Very Large and Large urban areas have experienced the most increase in time penalty (21 points). This equates to over 4 additional minutes added to a 20-minute congested period trip during this time period. In the short term (1992 to 1999), the Large urban areas have seen the greatest increase in time penalty (9 points). This equates to almost 2 minutes of additional travel time added to a 20-minute congested period trip see Exhibits 5 and 6).
- ◆ To put this in perspective (since 2 minutes does not sound like that much time) in a relatively large city where ½ million trips might occur in the peak period, a 10-point decline would equate to over 16,000 hours of delay in one peak period or almost 33,000 hours per day.

**Exhibit 5. Congestion Trends in Urban Areas  
(Travel Rate Index)**



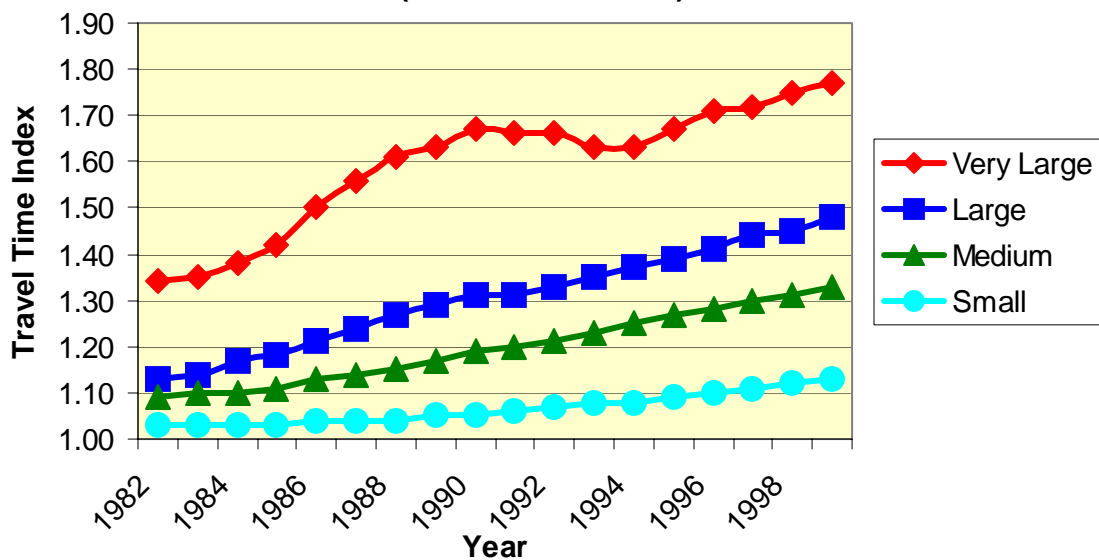
Note: See Table A-3 for individual urban area values.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

The Travel Time Index (TTI) measures the amount of additional time needed to make a trip in the congested period rather than at other times of the day. This measure is based on both delay due to the traffic demand on the roadways and roadway incidents. This gives an idea of how much of the change in traffic congestion is due to the combined effect of more cars using the roadways and more or worse roadway incidents. The 1999 statistics show:

- ◆ The time penalty from heavy traffic demand and incidents on the roadway increased in 44 areas by about a point or more per year in the short term (7 point increase in the TTI between 1992 and 1999). This means that an additional 1.5 minutes or more of time were added to a 20-minute congested period trip during this time.
- ◆ The time penalty from heavy traffic demand and incidents on the roadway increased in 47 areas by about a point or more per year in the long term (17 point increase in the TTI between 1982 and 1999). This means that an additional 3.5 minutes or more of time were added to a 20-minute congested period trip during this time.
- ◆ 3 areas have shown a small decrease in the short term (1992 to 1999). Seattle had a 1-point decline, New Orleans declined 4 points, and Tampa declined 5 points. Up to one minute of time was saved on a 20-plus minute congested period trip during this time.
- ◆ Over the long (1982 to 1999) and short (1992 to 1999) terms, the Large urban areas have experienced the greatest increase in the time penalty due to heavy traffic demand and roadway incidents. The TTI increased 35 points between 1982 and 1999 and 15 points between 1982 and 1999. An additional 7 minutes was added to a congested period trip in the long term and 3 minutes was added to a short-term trip in the Large urban areas.

**Exhibit 6. Congestion Trends in Urban Areas  
(Travel Time Index)**



Note: See Table A-4 for individual urban area values.



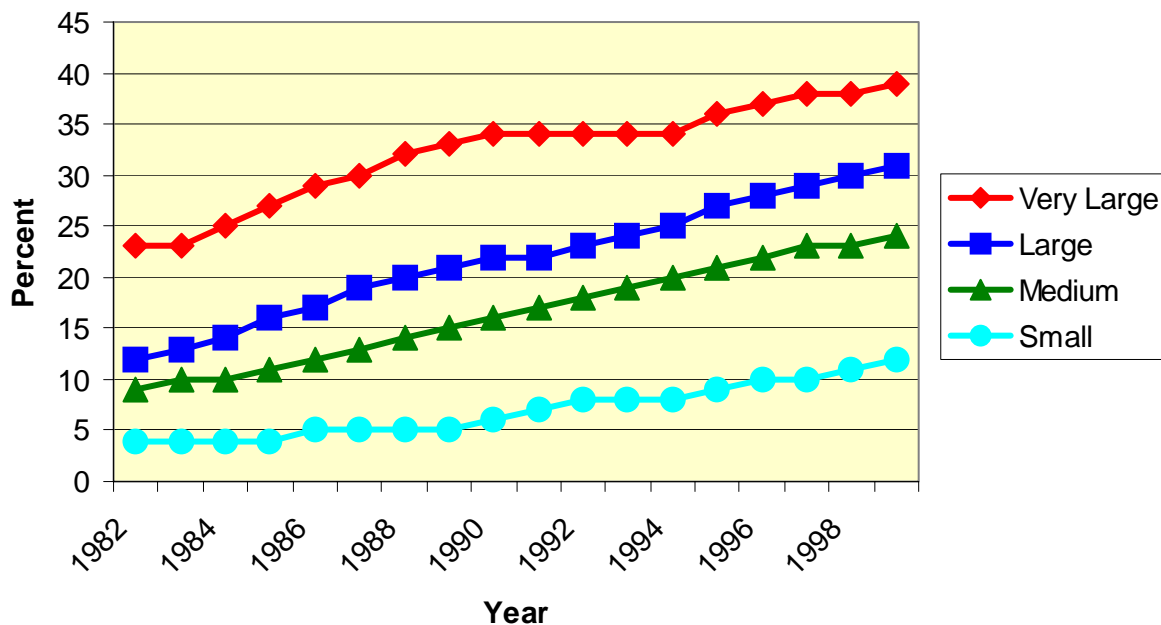
**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

The percentage of daily traffic that is congested also sheds some light on how the mobility levels have changed in urban America. The percentage of the daily congested travel is the travel on the freeways and principal arterial streets in an urban area that is moving at less than freeflow speeds (i.e., this is the traffic that has to deal with stop-and-go conditions).

The 1999 statistics show:

- ◆ The average percentage of the daily traffic from all 68 urban areas that is congested nearly doubled from 17 percent in 1982 to 33 percent in 1999. This means that the average length of the congested period increased from about 2 to 3 hours in 1982 to 5 or 6 hours by 1999.
- ◆ The Large urban areas have seen the greatest increases in the percentage of congested daily travel with an increase of 8 percentage points in the short term and 19 percentage points in the long term (see Exhibit 7).
- ◆ The Small urban areas have seen the smallest increases in the percentage of congested daily travel with an increase of 4 percentage points in the short term and 8 percentage points in the long term.

**Exhibit 7. Change in Percentage of Congested Daily Travel**



Note: See Table A-19 for individual urban area values.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

## **H**AS THE CONGESTED PERIOD LENGTHENED?

One side effect of traffic congestion is that when motorists cannot complete their trip in a reasonable length of time, they tend to try to find a different route or starting time so that they can reach their destination in a time that is satisfactory. When many motorists make this type of adjustment in their commute, the congested period tends to lengthen because everyone is trying to get an 'easier' trip, which they find at the edge of the congested period. The only problem is that the start time for this 'easier' trip continues to move earlier or later.

### ***Conclusions***

The congested periods are getting longer in the 68 urban areas. The congested periods range from about 3 hours in length in the Small urban areas up to 8 hours in length in some Very Large urban areas. And although congestion levels are different, the percentage of daily traffic that may encounter congestion in Medium sized urban areas is approaching that of Large and Very Large areas.

See Table A-20 for individual urban area values.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

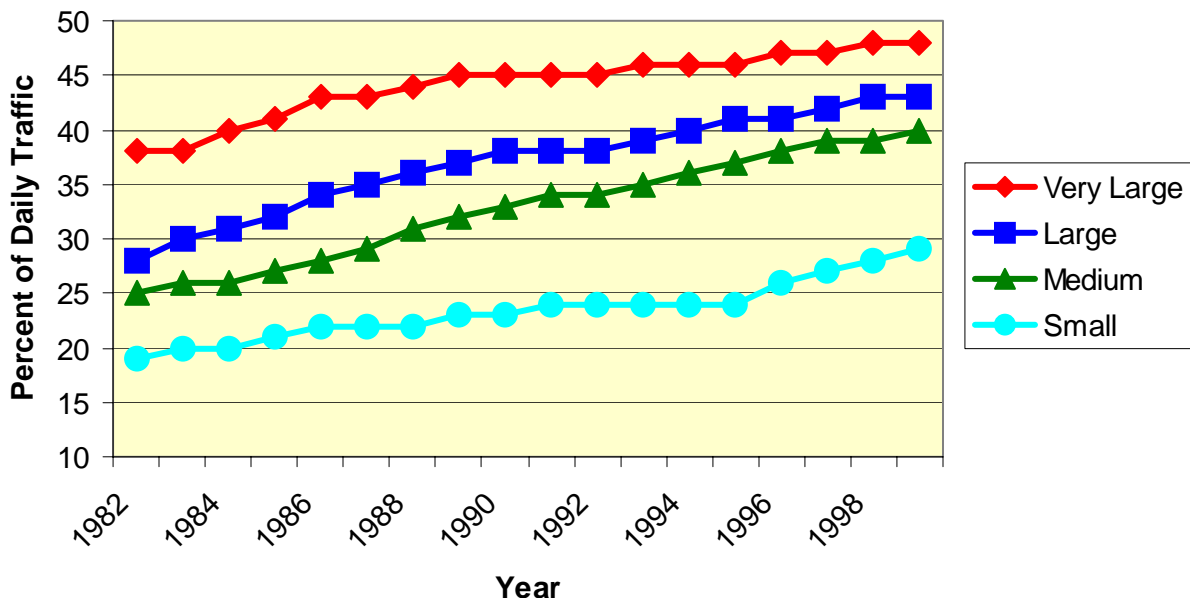
Table 1 and Exhibit 8 show the growth in the congested period. The measure used in these exhibits is the percentage of the daily traffic that happens during the time that may be congested. It provides some general information about the length of the congested period. This is only a general characterization of the urban area situation, rather than a measure of a specific corridor. In general, the higher this percentage, the longer the congested period is. Table 1 translates these percentages into blocks of time. The statistics from 1982 to 1999 show:

- ◆ On average, the percentage of daily traffic in the congested periods in the 68 urban areas has increased from 32 percent (about 5 hours per day) in 1982 to 45 percent (about 7 hours per day) in 1999.
- ◆ In 1999, the amount of daily traffic in the congested periods ranges from 48 percent in the Very Large urban areas down to 28 percent in the Small urban areas (see Exhibit 8).

**Table 1. How Long Do The Congested Periods Last?**

| Percent of Daily Traffic in the Congested Period | Approximate Length of the Congested Period (hours) | 1999 Congested Period Length (average for each size group) |
|--|--|--|
| 20   | Less than 3  |  |
| 25   | ± 3  |  |
| 30   | ± 4  | Small average  |
| 35   | ± 5  |  |
| 40   | ± 6  | Medium average   |
| 45   | ± 7  | Large average  |
| 50   | ± 8  | Very Large average   |

**Exhibit 8. Change in Congested Period Travel**



Note: See Table A-20 for individual urban area values.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

## **C**AN MORE ROAD SPACE REDUCE CONGESTION GROWTH?

The analysis in this section (shown in Exhibits 9 and 10) addresses the issue of whether or not roadway additions made significant differences in the delay experienced by drivers in urban areas between 1982 and 1999. This period illustrates several instances of rapid population growth, usually accompanied by road congestion growth. The length of time needed to plan and construct major transportation improvements means that very few areas see a rapid increase in economic activity and population without a significant growth in congestion.

Three measures will be used to answer this question.

### ***Conclusions***

The analysis shows that changes in roadway supply have an effect on the amount of recurring delay—delay due to heavy traffic demand—in an area. Additional roadway reduces the rate of increase in the amount of time it takes travelers to make congested period trips. In general, as the lane-mile construction “deficit” gets smaller, meaning that urban areas keep pace with travel growth by adding capacity at about the same rate, the travel time increase is smaller. It appears that the growth in facilities has to be at a rate greater than travel growth in order to maintain constant travel times, if road construction is the only solution used to address mobility concerns.

This conclusion examines the rate of growth in travel and roadway mileage—and the impact of these two factors on congestion growth. In some areas of rapid traffic growth, the response has been to build more capacity. In other areas relatively little new capacity has been provided. It is important to separate these two types of responses to traffic growth if the road construction effect is to be understood. Unfortunately, it is unclear from this analysis if urban areas can add enough capacity over long periods of time so that this trend can be sustained.

See Table A-3 and A-11 for individual urban area values.

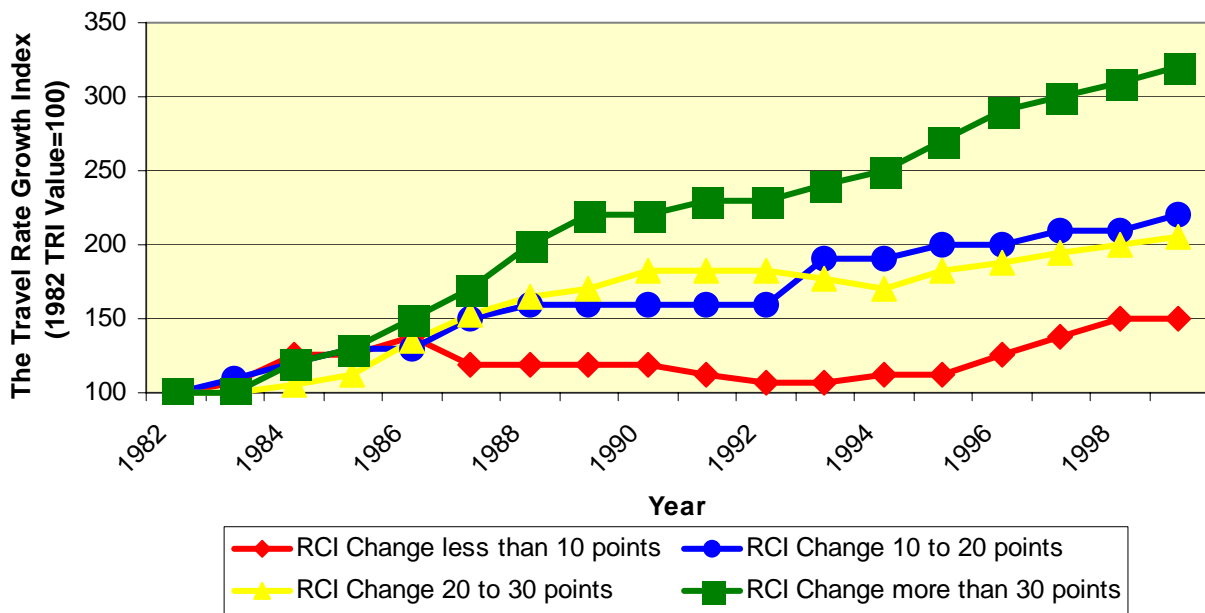
**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

1. The Roadway Congestion Index (RCI) compares growth of traffic to new roadway. The measure should not be interpreted as indicating new roadway is the only method for alleviating congestion, but rather a measure that indicates the construction response to traffic growth.
2. The Travel Rate Index (TRI) is a mobility measure that shows the additional time required to complete a trip during congested times versus other times of the day. The TRI accounts for only recurrent delay.
3. The lane-mile construction deficit is a ratio that indicates the amount of additional roadway needed to keep pace with travel growth. If roadway capacity has been added at the same rate as travel, the deficit will be zero.

The first comparison (Exhibit 9) is of the change in the RCI (how quickly travel is outpacing roadway expansion) and the change in the mobility level (TRI). If road growth is faster than the traffic growth, the RCI will decline. If additional roads slow down the growth of delay, areas where the RCI does not increase rapidly will also see relatively slow growth in the TRI.

The 68 urban areas were divided into four groups based on their change in the RCI between 1982 and 1999. These groups were: 1) greater than a 30 point RCI increase, 2) between a 20 and 30 point increase in RCI, 3) between a 10 and 20 point increase in RCI, and 4) less than a 10 point increase in RCI. The Travel Rate Growth Index is based on an approach similar to the Consumer Price Index to show relative changes in mobility. The 1982 TRI values were assigned an index value of 100, and the change in the index reflects the annual percent change that occurred in the time penalty represented by the TRI. A general trend appears to hold—the greater that travel growth outpaced roadway expansion, the more the overall mobility level declined.

**Exhibit 9. The Effect of Roadway Increases on Travel Rate  
(1982 to 1999)**



Note: See Table A-3 for individual urban area values.

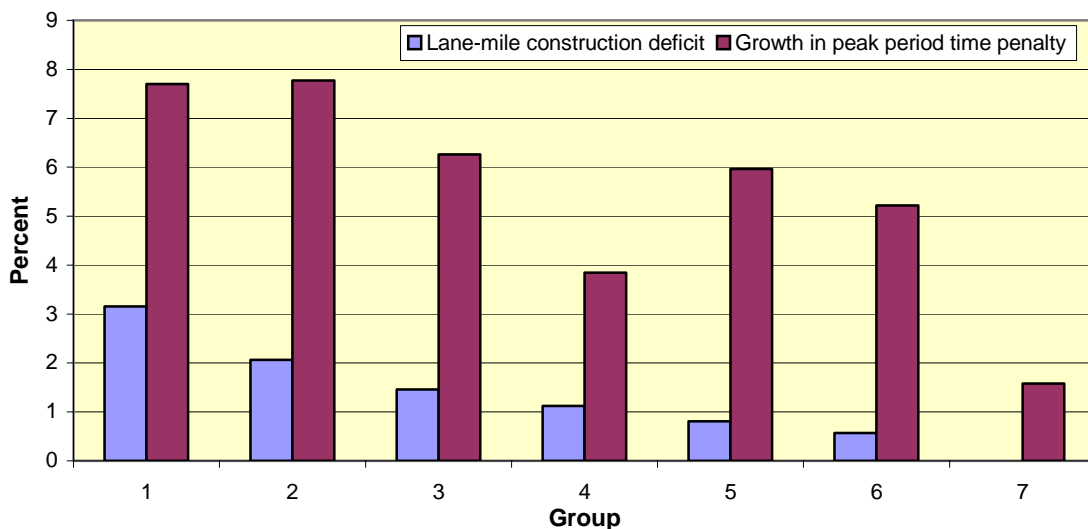
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The second comparison is between the construction deficit (the amount of needed but unconstructed roadway) and the Travel Rate Index (see Exhibit 10). The 68 urban areas were placed in order ranging from the area with the greatest annual lane-mile deficit percentage down to the lowest. The 68 urban areas were divided into seven groups—six sets of 10 and one set of eight (group 7)—for graphical purposes.

The average lane-mile deficit percentage ranged from about 3.2 in Group 1 to approximately zero in Group 7. The annual growth in the TRI ranged from 7.7 in Group 1 to 1.6 in Group 7. While the relationship is not uniform, there does appear to be a relationship. The correlation coefficient ( $R^2$ ) between the lane-mile construction deficit and the growth in congestion is 0.44 meaning that 44 percent of the variability in the travel rate index can be explained by the variation in construction deficit.

In general, as the lane-mile deficit decreases, the growth in congestion penalty decreases as well. In other words, as more roads are built, the amount of additional time required to make congested period trips increases at a slower rate than in areas where less roadway is constructed.

**Exhibit 10. How Much Does Lack of Road Construction Affect Travel Rates?**



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## HOW MUCH MORE ROAD CONSTRUCTION WOULD BE NEEDED?

This is a difficult question to answer for at least two reasons.

- ◆ Most urban areas implement a wide variety of projects and programs to deal with traffic congestion. Each of these projects or programs can add to the overall mobility level for the area. Thus, isolating the effects of roadway construction is difficult because these other programs and projects are making a contribution at the same time.
- ◆ The relevancy of the analysis is questionable. Many areas focus on managing the growth of congestion, particularly in rapid growth areas. The analysis presented here is not intended to suggest that road construction is the best or only method to address congestion, but some readers will interpret it that way.

### Conclusions

This analysis shows that it would be almost impossible to attempt to maintain a constant congestion level with road construction only. Over the past 2 decades, only about 50 percent of the needed mileage was actually added. This means that it would require at least twice the level of current-day road expansion funding to attempt this road construction strategy. An even larger problem in some areas would be to find projects on which to spend this funding for several years. Most urban areas are pursuing a range of congestion management strategies, with road widening or construction being one of them.

This analysis assumes that enough road construction should take place so that the areawide congestion level is kept constant. For every percent increase in vehicle-miles of travel, there should be a similar percent increase in the lane-miles of roadway. Based on these assumptions, the percentage of the “Needed” roadway that has been “Added” can be calculated (see Table 2). The 1982 to 1999 statistics show:

- ◆ Over the 17-year period, less than half of the roadway that was needed to maintain a constant congestion level was actually added. These percentages are actually a little higher than the amount that was “constructed” since they also include roadway mileage that was added through shifting urban boundaries and not just new construction.
- ◆ Table 2 also shows that the larger urban areas have done a little better, on average, at maintaining pace with the growth of travel.

**Table 2. Percentage of Roadway Added**

| 1999 Population Group Average | Avg. Annual Growth in Vehicle-Miles of Travel (1982 to 1999) | Percentage of Roadway Added <sup>1</sup> |
|-------------------------------|--|--|
| Very Large areas              | 3.6  | 50                                       |
| Large areas                   | 3.0  | 51                                       |
| Medium areas                  | 4.0  | 49                                       |
| Small areas                   | 4.3  | 45                                       |
| 68 area average               | 3.6  | 48                                       |

<sup>1</sup> Lane-miles added divided by lane-miles needed. Lane-miles needed are based maintaining a constant congestion level with the VMT growth rate.

Note: Assumes that all added lane-miles are roadway system expansion. The database does not include data concerning the addition of lane-miles through changing urban boundaries.

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## **D**ON'T ADDITIONAL LANES JUST FILL UP? WHY SHOULD WE ADD THEM?

Yes, many times the additional lanes do fill up with cars. In many situations, that is the desired effect. If transportation agencies built roadways that did not get used, they would be (rightly) questioned about wasting taxpayer funds.

What many citizens mean when they ask the question is “Why don’t I see much relief in my travel time?” The answer lies in what Anthony Downs (7) described as the triple convergence. When more peak-hour road capacity is provided (e.g., more freeway lanes) travel moves toward that peak hour from: 1) other times, 2) other roads and 3) other modes. The beneficial effects—in the weeks just after opening the roadway—are felt by those who continue to travel on the edges of the peak period, and/or on parallel roadways.

In the long-term, some argue, the capacity makes it easier to travel and thus easier to develop and support “urban sprawl.” These are important and complicated issues. The database used in this study is not detailed enough to address these effects. But they should be part of the analysis of alternative transportation improvements.



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## HOW MANY NEW CARPOOLS OR BUS RIDERS WOULD BE NEEDED IF CARPOOLS WERE THE ONLY SOLUTION?

Just as a “roadway construction” only solution was examined, this analysis will focus on the changes in occupancy level needed to accommodate travel growth. The results from this analysis show the increase in occupancy level in order to maintain existing congestion levels.

### **Conclusions**

An increase of 0.03 to 0.05 persons per vehicle would have to occur every year to keep pace with increasing demand. Thus, 3 to 5 percent of vehicles would have to turn into carpools or use transit. It may be very difficult to convince this many persons to begin ridesharing, however, some success with this solution in conjunction with some others may give an urban area the opportunity to stay close in the race to maintain a constant mobility level.

Vehicle travel volume growth is estimated with the annual growth rate for the previous five years. Passenger-miles of travel are estimated using the standard 1.25 persons per vehicle value used elsewhere in the study. The “next year” passenger travel estimate divided by the “previous year” vehicle travel volume gives the vehicle occupancy ratio needed to accommodate one year of growth. The added passenger-miles of travel is divided by a simple national average trip length to estimate the number of additional trips that would have to be made by carpool or transit. The following observations result from the 1999 statistics shown in Table 3:

- ◆ 6.1 million trips would have to be made as carpools or bus trips in the 68 urban areas resulting from almost 55 million additional miles of travel
- ◆ On average, the occupancy of each vehicle in the 68 urban areas would have to rise by 0.04 persons or, in other words, 4 out of every 100 vehicles would have to become a new 2-person carpool to handle one year’s growth.
- ◆ The average occupancy would have to increase the greatest in the Smaller areas (0.05 persons per vehicle) to account for the additional traffic.
- ◆ The average occupancy would have to increase the least in the Very Large areas (0.03 persons per vehicle) to account for the additional traffic.

**Table 3. Illustration of Auto Occupancy Increase to Prevent Mobility Decline**

| Population Group Average | Growth in Person Travel |                  |                              | Rise in Occupancy Level to Maintain 1999 Mobility Level <sup>3</sup> |
|--------------------------|-------------------------|------------------|------------------------------|--|
|                          | Percent <sup>1</sup>    | Additional Miles | Estimated Trips <sup>2</sup> |  |
| Very Large areas         | 1.9                     | 2,058,000        | 229,000                      | .03  |
| Large areas              | 2.9                     | 921,000          | 102,000                      | .04  |
| Medium areas             | 3.0                     | 397,000          | 44,000                       | .04  |
| Small areas              | 3.3                     | 119,000          | 13,000                       | .05  |
| 68 area average          | 2.5                     | 807,000          | 90,000                       | .04  |
| 68 area total            |                         | 54,888,000       | 6,098,670                    |  |

<sup>1</sup> Annual growth in person-miles of travel between 1994 and 1999.

<sup>2</sup> Assumes an average trip length of 9 miles (8).

<sup>3</sup> From an assumed base level of 1.25 persons per vehicle in every urban area.

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## **WHAT IS THE EFFECT ON MOBILITY OF CHANGES IN ROAD DENSITY AND FREQUENCY?**

Road density—roads per square mile—and road frequency—roads per person—are two measures that might be useful in investigating the “can roads solve the problem?” question.

### ***Conclusions***

It appears from observation that there is some relationship between the change in mobility level from 1994 to 1999 and the change in road density and frequency. Statistically, however, the relationship is not very strong. There are at least two other factors affecting mobility level beyond road density and frequency.

- ◆ Traffic from outside the urban area can have an effect on mobility levels and not affect road frequency.
- ◆ Lane-miles that are added at locations with little or no congestion within the urban area can affect the road density and not have any effect on the mobility level.

There are some deficiencies in the database and definitions we use. Still, it is clear that a variety of factors not included in the database affect mobility levels. The correlation coefficients indicate between 13 and 27 percent of mobility variation is explained by changes in roadway frequency and density.

The first comparison is of the Travel Rate Index and the growth in road density (lane-miles per square mile). The 68 urban areas were placed in order ranging from the area with the largest decline in the mobility level between 1994 and 1999 (as measured by TRI increases) down to the smallest. The 68 urban areas were divided into seven groups—six sets of 10 and one set of eight (group 7)—for graphical purposes.

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Exhibit 11 shows that the average annual growth in the TRI ranged from 16.4 in Group 1 down to -0.5 in Group 7. The annual growth in the road density ranged from -1.2 in Group 1 to 0.3 in Group 7. The relationship does not appear to be very well defined. The groups with the largest growth in road density occurred in Groups 1 and 4. The groups with the smallest growth in road density occurred in Groups 3 and 7. The correlation coefficient ( $R^2$ ) between the growth in the TRI and the growth in the road density is -0.13 meaning that 13 percent of the variability in the growth in the TRI can be explained by the change in the road density.

It could be that changes in road density do very little to affect mobility. Travel and land use patterns adjust to new road capacity and may be responsible for changing the location of congestion but not the level. It is difficult to reconcile that finding, however, with other comparisons in this report that show new road capacity slows the growth of congestion.

Another reason behind the lack of significance could be the data used. The Highway Performance Monitoring System (HPMS) data used in this analysis is based on urban boundaries. As urban boundaries change—mostly they grow—lane-miles of roadway are added or deleted from the database. New lane-miles on the fringe of the urban boundary can have very little effect on the overall mobility level of the urban area as they may be lightly traveled with no congestion. Thus, when they are added to the existing lane-miles, they have very little weighted effect on increasing the areawide travel speed. In some cases, however, the change in lane-miles might have been due to widened freeways or brand new facilities that do carry a great deal of traffic. In some urban areas, these facilities may have a large effect on overall mobility levels. The point is that just because the road density (lane-miles per square mile) increases for the entire urban area, it does not necessarily mean that the lane-miles were in locations that raise the mobility level as estimated in our methodology.

**Exhibit 11. Effect of Changes in Road Density - 1994 to 1999**



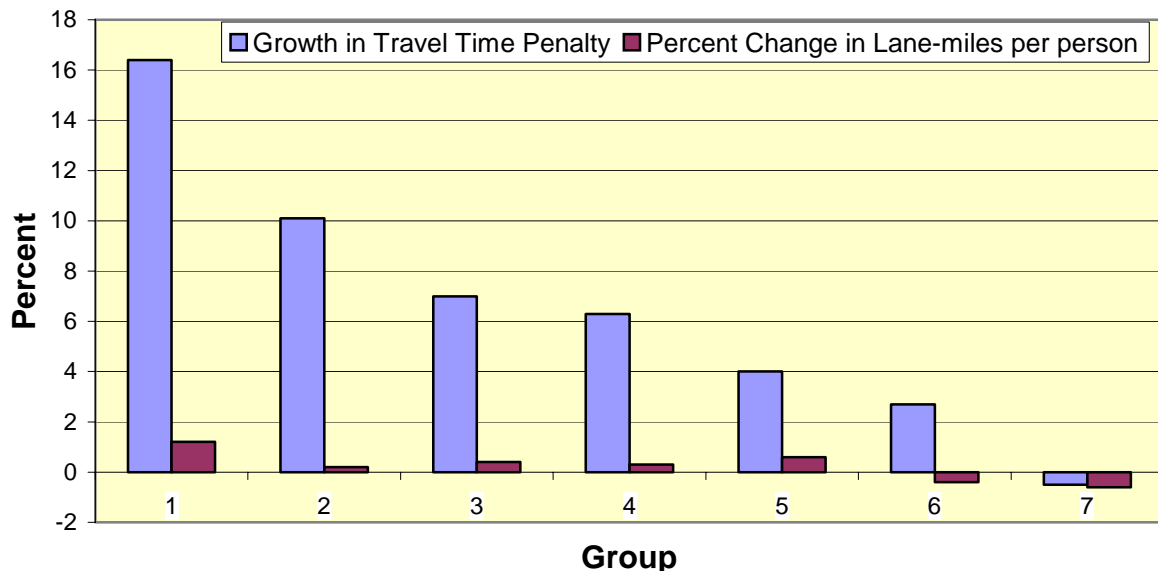
**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

The second comparison is of the change in Travel Rate Index and the growth in road frequency (lane-miles per person). The 68 urban areas were placed in order ranging from the area with the largest change in the mobility level (TRI) down to the smallest. The 68 urban areas were divided into seven groups—six sets of 10 and one set of eight (group 7)—for graphical purposes.

Exhibit 12 shows that the average annual growth in the TRI ranged from 16.4 in Group 1 down to -0.5 in Group 7. The annual growth in the road frequency ranged from -1.2 in Group 1 to 0.6 in Group 7. Once again, the relationship does not appear to be very well defined. The largest growth in road density occurred in Groups 1 and 5. The smallest growth in road density occurred in Groups 6 and 7 as expected. The correlation coefficient ( $R^2$ ) between the growth in the TRI and the growth in the road density is -0.27 which shows that 27 percent of the variability in the growth in the travel time penalty can be explained by the change in the lane-miles per person.

One potential reason for the small correlation coefficient—despite the results being statistically significant—could be that the mobility level for an area is also affected by persons who do not live within the urban boundary. Some of the persons traveling in the congested period are from outer suburbs not in the urban area. Other motorists are from out-of-town and may be in town for business or shopping. Both of these groups contribute to a lower mobility level but do not contribute to the road frequency since they are not in the population of the urban area.

**Exhibit 12. Effect of Changes in Road Frequency - 1994 to 1999**



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## **CAN AN “AGGRESSIVE ROAD BUILDING” STRATEGY BE SUSTAINED?**

One way to deal with traffic congestion is to add more capacity. It is part of the commonly accepted “wisdom” around the congestion issue that a city cannot “build its way out of congestion.” One way to test this idea is to analyze the road growth versus travel growth relationship over several years.

### ***Conclusions***

Based on this analysis, it is apparent that maintaining a significant roadway expansion program is difficult because few urban areas have done it. Only 12 urban areas have had at least five consecutive years of road construction that paralleled the growth of traffic in the area, and half of those for only five years.

This analysis shows which urban areas have had road additions that have kept pace with traffic growth in the area. This was done by analyzing traffic growth for each 6-year period of data in the UMS database and comparing the growth in traffic with the additional lane-miles of roadway added in the same period. There are 13 time periods in the analysis with the first time period from 1982 to 1987 and the last period from 1994 to 1999. The urban areas were sorted by the size of the addition deficit. Urban areas in the top 15 list of roadway additions in relation to traffic growth for five or more consecutive periods were considered to have “kept pace” by adding roadway. The bottom 15 areas with five or more years of significantly more traffic growth than road additions were categorized as having lost ground. Obviously, not all the 68 urban areas attempted to remedy congestion problems with new construction, and this analysis does not cover all these options.

While a period of several years with slow road growth in relation to traffic volume growth does not necessarily indicate a problem—because other solutions may have been pursued—the list does correspond reasonably well with rapid increases in congestion. There are, however, some interesting anomalies. Seattle remained in the “Keeping Pace” list for many years while traffic congestion also grew rapidly. It may be that the rapid growth in the Seattle suburbs caused both significant new street construction and several roadway miles to be incorporated into the growing urban boundary. This is a consistent effect of the general study methodology, but road additions in the suburbs would not necessarily offset growing congestion in older portions of the urban area.

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Several cities are in the “Keeping Pace” category because the local population, employment, traffic volume and economy were not growing rapidly and the road additions needed to offset the volume growth were relatively low. Likewise several of the “Losing Ground” cities showed relatively little growth in congestion. Many of these are also small and medium areas where small differences in road additions or traffic growth can significantly move the placing of an urban area. These areas are also typically less congested and thus better able to handle a few years of traffic growth without substantial mobility decline. These instances reinforce the complicated nature of the congestion issue and the need for locally developed plans and analyses.

**Table 4. How Have Cities Fared In Long-Term Road Building Programs?**

| Urban Area            | Population Group | “Keeping Pace”           |       |                          | “Losing Ground”          |        |                          |
|-----------------------|------------------|--------------------------|-------|--------------------------|--------------------------|--------|--------------------------|
|                       |                  | No. of Consecutive Years | Years | Growth in Hours of Delay | No. of Consecutive Years | Years  | Growth in Hours of Delay |
| Chicago               | Very Large       |                          |       |                          | 5                        | 88-92  | 4                        |
| Houston               | Very Large       | 9                        | 88-96 | 6                        |                          |        |                          |
| Los Angeles           | Very Large       | 5                        | 93-97 | 1                        |                          |        |                          |
| San Francisco-Oakland | Very Large       | 9                        | 90-98 | -1                       |                          |        |                          |
| Atlanta               | Large            |                          |       |                          | 5                        | 95-99  | 10                       |
| Cleveland             | Large            |                          |       |                          | 5                        | 89-93  | 5                        |
| Columbus              | Large            |                          |       |                          | 6                        | 87-92  | 10                       |
| Denver                | Large            | 6                        | 87-92 | 8                        |                          |        |                          |
| Fort Worth            | Large            | 5                        | 92-96 | 6                        |                          |        |                          |
| Indianapolis          | Large            |                          |       |                          | 5                        | 87-91  | 5                        |
|                       |                  |                          |       |                          | 5                        | 93-97  | 21                       |
| New Orleans           | Large            | 5                        | 87-91 | 4                        |                          |        |                          |
| Orlando               | Large            |                          |       |                          | 8                        | 88-95  | 12                       |
| San Antonio           | Large            |                          |       |                          | 6                        | 94-99  | 15                       |
| San Diego             | Large            | 5                        | 94-98 | 4                        | 6                        | 87-92  | 10                       |
| San Jose              | Large            | 8                        | 92-99 | 3                        |                          |        |                          |
| Seattle               | Large            | 10                       | 88-97 | 11                       |                          |        |                          |
| St. Louis             | Large            | 10                       | 90-99 | 26                       |                          |        |                          |
| Albany                | Medium           |                          |       |                          | 8                        | 87-94  | 3                        |
| Albuquerque           | Medium           |                          |       |                          | 7                        | 93-99  | 16                       |
| Hartford              | Medium           |                          |       |                          | 6                        | 91-96  | 0                        |
| Jacksonville          | Medium           |                          |       |                          | 6                        | 90-95  | 13                       |
| Louisville            | Medium           |                          |       |                          | 7                        | 93-99  | 14                       |
| Memphis               | Medium           |                          |       |                          | 8                        | 91-98  | 11                       |
| Rochester             | Medium           |                          |       |                          | 5                        | 90-904 | 2                        |
| Salt Lake City        | Medium           |                          |       |                          | 9                        | 89-97  | 13                       |
| Bakersfield           | Small            | 5                        | 87-91 | 2                        |                          |        |                          |
| Beaumont              | Small            |                          |       |                          | 5                        | 92-96  | 0                        |
| Colorado Springs      | Small            |                          |       |                          | 5                        | 95-99  | 9                        |
| Salem                 | Small            | 5                        | 94-98 | 5                        |                          |        |                          |

Note: Only urban areas with five or more consecutive years in the same category are shown.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

## **W**HAT DOES CONGESTION COST US?

One major reason motorists are concerned is that traffic congestion hits most Americans in a place they hold dearly—their wallet. The price tag for wasted time and fuel associated with congestion is in the billions of dollars. Table 5 summarizes the congestion cost information for the 68 urban areas in the study. Some of the highlights from the 1999 statistics include:

- ◆ In 1999, congestion (based on wasted time and fuel) cost about \$78 billion in the 68 urban areas. Almost \$45 billion (58 percent) was from the 10 urban areas with the highest congestion cost.
- ◆ The average cost for each of the 68 urban areas was \$1.1 billion. The average costs associated with each population group ranged from about \$4.7 billion in the Very Large urban areas down to \$40 million in the Small areas.
- ◆ The average cost per person in the 68 urban areas was \$630 in 1999. The cost ranged from \$920 per person in Very Large urban areas down to \$230 per person in the Small areas.

**Table 5. Cost of Congestion in 1999**

| <b>Population Group<br/>Average</b> | <b>Annual Cost due to Congestion</b> |                                |
|-------------------------------------|--------------------------------------|--------------------------------|
|                                     | <b>Cost (\$million)</b>              | <b>Average Per Person (\$)</b> |
| Very Large areas average            | 4,700                                | 920                            |
| Large areas average                 | 970                                  | 760                            |
| Medium areas average                | 310                                  | 580                            |
| Small areas average                 | 40                                   | 230                            |
| 68 area average                     | 1,145                                | 630                            |
| 68 area total                       | \$77,800                             |                                |

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## How MUCH FUEL IS WASTED IN CONGESTION?

One of the components of congestion cost is the amount of additional fuel that is burned by vehicles due to such things as stop-and-go traffic or idling at traffic signals. The extent to which fuel is wasted is shown by the 1999 statistics:

- ◆ Table 6 shows that 6.8 billion gallons of fuel was wasted in the 68 urban areas. This amount of fuel would fill 136 super-tankers or 680,000 gasoline tank trucks. If you placed 680,000 gasoline tank trucks back-to-back, they would stretch from Miami to San Francisco and back.
- ◆ The top 10 areas accounted for 3.9 billion gallons (57%).
- ◆ Persons in Los Angeles and Atlanta waste more fuel than anywhere else with around 84 gallons per person per year.
- ◆ On average, 55 gallons of fuel are wasted per person per year in the 68 urban areas.
- ◆ The amount of wasted fuel per person ranges from 80 gallons per year in the Very Large urban areas to 19 gallons per year in the Small areas.

**Table 6. Wasted Fuel in 1999**

| Population Group Average | Annual Gallons of Wasted Fuel |                    |
|--------------------------|-------------------------------|--------------------|
|                          | Total (million)               | Average Per Person |
| Very Large areas         | 409                           | 80                 |
| Large areas              | 86                            | 68                 |
| Medium areas             | 28                            | 51                 |
| Small areas              | 4                             | 19                 |
| 68 area average          | 100                           | 55                 |
| 68 area total            | 6,822                         |                    |



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## **WHAT DO ALL THE ESTIMATES MEAN?**

The results and statistics from the Mobility Study can be applied to the search for solutions to the mobility problems. It is very important that the role of transportation in American cities be understood as one of many elements that determine the concept of “quality of life.” Road congestion is slow speeds caused by heavy traffic and/or narrow roadways due to construction, incidents, or too few lanes for the demand. It has corollaries in transit, sidewalks and the Internet. Over the last 20 years, traffic volumes have increased faster than road capacity and the alternative modes have not provided the needed relief either because they are not extensive enough, or they are not used for enough trips.

Urban residents trade off a variety of factors and cost elements in the search for the best situation. Transportation professionals, as well as developers, land planners, government officials, and others, are realizing that these trade-offs are made across a spectrum that might best be represented as several niche markets, rather than one or two large ones. Schools, shops, jobs, parking, health care and many other issues “compete” in some sense with transportation issues for attention and investment.

Some general conclusions can be drawn from the 1982 to 1999 database.

1. We are not doing enough—There aren’t enough improvements to the system to keep congestion from growing. Hours of delay, the time of day and the miles of road that are congested have grown every year.
2. It will be difficult for most big cities to address their mobility needs by only constructing more roads. This is partly a funding issue—transportation spending should probably double in larger cities if there is an interest in reducing congestion. It is also, however, an issue of project approval since many Americans do not want major transportation projects near their home or neighborhood. It is difficult to imagine many urban street and freeway corridors with an extra 4, 6 or 8 lanes, but it is entirely possible that that is what will be required if the goal is to significantly reduce congestion by adding roads.
3. Transit improvements, better operations, adjusted work hours, telecommuting and a range of other efficiency options do not seem to offer the promise of large increases in person carrying capacity for the current system. But they are absolutely vital components of an overall solution.
4. Several policy options, such as value pricing or peak-travel restrictions, present opportunities to improving transportation, but they are difficult to get approved. They require some changes in the way transportation services are viewed and some changes in the way we live and travel.

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Some of the solution lies in better management—improving on practices that are already known and developing new expertise. In the 1950s and 1960s, state highway agencies managed the construction of a large highway system. In the 1970s transportation agencies tried to improve the system by managing the supply, and in the 1980s a variety of transportation and planning agencies and private sector companies started to manage the demand patterns. In the 1990s, the management effort was focused on better system operations for roads and transit.

Most large city transportation agencies are pursuing all of these traditional projects and programs. The mix may be different in each city and the pace of implementation varies according to overall funding, commitment, location of problems, public support and other factors. It seems that these same agencies could also provide some information about the expected outcome of the transportation system improvements. Big city residents should expect congestion on roads for 1 or 2 hours in the morning and in the evening. The agencies should be able to improve the performance and reliability of the service at other hours, but they cannot expand the system or improve the operation enough to eliminate congestion.

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## **H**OW SHOULD WE ADDRESS THE MOBILITY PROBLEM?

Just as congestion has a number of potential causes, there are several ways to begin to address the problem. Generally, the approaches can be grouped under four main strategies – adding capacity, increasing the efficiency of the existing system, better management of construction and maintenance projects, and managing the demand. The benefits associated with these improvements include reduced congestion, delay, and travel time. Emissions may be reduced due to the reduction in demand or congestion, improved efficiencies and the change in the way travelers use the system. Congestion may also increase over time due to the new development that occurs or is encouraged by the new transportation facilities.

### ***Add Capacity***

Adding capacity is probably the best known, and probably most frequently used, improvement option. Pursuing an “add capacity” strategy can mean more traffic lanes, additional buses or new bus routes, new roadways or improved design components as well as a number of other options. Grade separations and better design of intersections, along with managed lanes and dedicated HOV lanes can also contribute to moving more traffic through a given spot in the same or less time. Finally, the addition of, or improvements to heavy rail, commuter rail, bus system, and improvement in the freight rail system all can assist in adding capacity to varying degrees.

### ***Manage the Demand***

Demand management strategies include a variety of methods to move trips away from the peak travel periods. These are either a function of making it easier to combine trips via ridesharing or transit use, or providing methods to reduce vehicle trips via tele-travel or different development designs.

The fact is, transportation system demand and land use patterns are linked and influence each other. There are a variety of strategies that can be implemented to either change the way that travelers affect the system or the approaches used to plan and design the shops, offices, homes, schools, medical facilities and other land uses.

Relatively few neighborhoods, office parks, etc. will be developed for auto-free characteristics—that is not the goal of most of these treatments. The idea is that some characteristics can be incorporated into new developments so that new economic development does not generate the same amount of traffic volume as existing developments. Among the tools that can be employed are better management of arterial street access, incorporating bicycle and pedestrian elements, better parking strategies, assessing transportation impact before a development is approved for construction, and encouraging more diverse development patterns.

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### ***Increase Efficiency of System***

Sometimes, the more traditional approach of simply adding more capacity is not possible or not desirable. However, improvements can still be made by increasing the efficiency of the existing system.

The basic transportation system—the roads, transit vehicles and facilities, sidewalks and more—is designed to accommodate a certain amount of use. Some locations, however, present bottlenecks, or constraints, to smooth flow. At other times, high volume congests the entire system, so strategies to improve system efficiency by improving peak hour mobility are in order. The community benefits from reduced congestion and reduced emissions, as well as more efficiently utilizing the infrastructure already in place. Among the strategies that fall into this category are tools that make improvements in intersections, traffic signals, special event management (e.g., managing traffic before and after large sporting or entertainment events) and incident management. In addition such strategies as one-way streets, electronic toll collection systems, and changeable lane assignments are often helpful.

### ***Manage Construction and Maintenance Projects***

When construction takes place to provide more lanes, new roadways, or improved intersections, or during maintenance of the existing road system, the effort to improve mobility can itself cause congestion. Better techniques in managing construction and maintenance programs can make a difference. Some of the strategies involve methods to improve the construction phase by shortening duration of construction, or moving the construction to periods where traffic volume is relatively low. Among the strategies that might be considered include providing contractor incentives for completing work ahead of schedule or penalties for missed construction milestones, adjustments in the contract working day, using design-build strategies, or maintenance of traffic strategies during construction to minimize delays.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

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# APPENDIX A

Table A-1. Urban Area Information

| Population Group | Urban Area                           | 1999 Population | Population Growth |      |              |      | 1999 Urban Area |                                  |
|------------------|--------------------------------------|-----------------|-------------------|------|--------------|------|-----------------|----------------------------------|
|                  |                                      |                 | 1982 to 1999      |      | 1992 to 1999 |      | Size (sq. mi.)  | Population Density (pers/sq.mi.) |
|                  |                                      |                 | Change (%)        | Rank | Change (%)   | Rank |                 |                                  |
| Vlg              | New York, NY-Northeastern, NJ        | 16,430          | 6                 | 60   | 3            | 56   | 4,060           | 4,045                            |
| Vlg              | Los Angeles, CA                      | 12,600          | 27                | 38   | 6            | 46   | 2,260           | 5,575                            |
| Vlg              | Chicago, IL-Northwestern, IN         | 8,085           | 14                | 52   | 8            | 38   | 2,765           | 2,925                            |
| Vlg              | Philadelphia, PA-NJ                  | 4,580           | 13                | 53   | 2            | 59   | 1,375           | 3,330                            |
| Vlg              | San Francisco-Oakland, CA            | 4,025           | 22                | 44   | 6            | 46   | 1,255           | 3,205                            |
| Vlg              | Detroit, MI                          | 4,020           | 6                 | 60   | 1            | 63   | 1,315           | 3,055                            |
| Vlg              | Washington, DC-MD-VA                 | 3,490           | 29                | 32   | 6            | 46   | 1,020           | 3,420                            |
| Vlg              | Houston, TX                          | 3,130           | 30                | 31   | 8            | 38   | 1,710           | 1,830                            |
| Vlg              | Boston, MA                           | 3,020           | 6                 | 60   | 2            | 59   | 1,160           | 2,605                            |
| Lrg              | Atlanta, GA                          | 2,860           | 78                | 6    | 26           | 7    | 1,805           | 1,585                            |
| Lrg              | San Diego, CA                        | 2,700           | 52                | 16   | 9            | 36   | 755             | 3,575                            |
| Lrg              | Phoenix, AZ                          | 2,575           | 80                | 4    | 27           | 5    | 1,110           | 2,320                            |
| Lrg              | Dallas, TX                           | 2,385           | 32                | 27   | 15           | 17   | 1,640           | 1,455                            |
| Lrg              | Minneapolis-St. Paul, MN             | 2,330           | 33                | 26   | 10           | 32   | 1,225           | 1,900                            |
| Lrg              | Baltimore, MD                        | 2,160           | 27                | 38   | 6            | 46   | 745             | 2,900                            |
| Lrg              | Miami-Hialeah, FL                    | 2,100           | 21                | 46   | 9            | 36   | 555             | 3,785                            |
| Lrg              | St. Louis, MO-IL                     | 2,005           | 8                 | 57   | 2            | 59   | 1,130           | 1,775                            |
| Lrg              | Seattle-Everett, WA                  | 1,995           | 39                | 21   | 8            | 38   | 870             | 2,295                            |
| Lrg              | Cleveland, OH                        | 1,880           | 7                 | 59   | 5            | 51   | 820             | 2,295                            |
| Lrg              | Denver, CO                           | 1,860           | 38                | 22   | 16           | 14   | 830             | 2,240                            |
| Lrg              | Pittsburgh, PA                       | 1,790           | -1                | 67   | 1            | 63   | 1,005           | 1,780                            |
| Lrg              | San Jose, CA                         | 1,670           | 28                | 33   | 11           | 28   | 385             | 4,340                            |
| Lrg              | Portland-Vancouver, OR-WA            | 1,490           | 32                | 27   | 20           | 11   | 490             | 3,040                            |
| Lrg              | Ft. Lauderdale-Hywood-Pomp. Bch., FL | 1,470           | 38                | 22   | 14           | 22   | 510             | 2,880                            |
| Lrg              | San Bernardino-Riverside, CA         | 1,405           | 56                | 15   | 8            | 38   | 540             | 2,600                            |
| Lrg              | Kansas City, MO-KS                   | 1,390           | 28                | 33   | 16           | 14   | 975             | 1,425                            |
| Lrg              | Sacramento, CA                       | 1,370           | 65                | 10   | 15           | 17   | 405             | 3,385                            |
| Lrg              | Fort Worth, TX                       | 1,370           | 26                | 40   | 14           | 22   | 1,010           | 1,355                            |
| Lrg              | Cincinnati, OH-KY                    | 1,280           | 13                | 53   | 5            | 51   | 660             | 1,940                            |
| Lrg              | Milwaukee, WI                        | 1,265           | 5                 | 63   | 3            | 56   | 570             | 2,220                            |
| Lrg              | Las Vegas, NV                        | 1,260           | 180               | 1    | 53           | 1    | 285             | 4,420                            |
| Lrg              | San Antonio, TX                      | 1,240           | 31                | 30   | 5            | 51   | 495             | 2,505                            |
| Lrg              | Orlando, FL                          | 1,120           | 84                | 3    | 27           | 5    | 630             | 1,780                            |
| Lrg              | New Orleans, LA                      | 1,105           | 2                 | 64   | 1            | 63   | 370             | 2,985                            |
| Lrg              | Buffalo-Niagara Falls, NY            | 1,075           | 0                 | 66   | 0            | 67   | 570             | 1,885                            |
| Lrg              | Oklahoma City, OK                    | 1,040           | 63                | 11   | 34           | 3    | 700             | 1,485                            |
| Lrg              | Norfolk, VA                          | 1,030           | 34                | 25   | 7            | 45   | 845             | 1,220                            |
| Lrg              | Columbus, OH                         | 1,025           | 23                | 43   | 8            | 38   | 485             | 2,115                            |
| Lrg              | Indianapolis, IN                     | 1,015           | 18                | 49   | 6            | 46   | 495             | 2,050                            |
| Med              | Memphis, TN-AR-MS                    | 975             | 28                | 33   | 11           | 28   | 420             | 2,320                            |
| Med              | Providence-Pawtucket, RI-MA          | 910             | 10                | 56   | 5            | 51   | 520             | 1,750                            |
| Med              | Salt Lake City, UT                   | 895             | 32                | 27   | 10           | 32   | 390             | 2,295                            |
| Med              | Tampa, FL                            | 880             | 63                | 11   | 23           | 10   | 575             | 1,530                            |
| Med              | Jacksonville, FL                     | 850             | 38                | 22   | 12           | 25   | 735             | 1,155                            |
| Med              | Louisville, KY-IN                    | 835             | 8                 | 57   | 2            | 59   | 405             | 2,060                            |
| Med              | Honolulu, HI                         | 695             | 22                | 44   | 1            | 63   | 185             | 3,755                            |
| Med              | Tucson, AZ                           | 670             | 49                | 17   | 18           | 13   | 315             | 2,125                            |
| Med              | Austin, TX                           | 650             | 71                | 7    | 15           | 17   | 410             | 1,585                            |
| Med              | El Paso, TX-NM                       | 650             | 44                | 18   | 15           | 17   | 240             | 2,710                            |
| Med              | Nashville, TN                        | 640             | 28                | 33   | 8            | 38   | 590             | 1,085                            |
| Med              | Hartford-Middletown, CT              | 640             | 13                | 53   | 4            | 55   | 380             | 1,685                            |
| Med              | Charlotte, NC                        | 625             | 79                | 5    | 25           | 8    | 325             | 1,925                            |
| Med              | Rochester, NY                        | 620             | -3                | 68   | 0            | 67   | 340             | 1,825                            |
| Med              | Tacoma, WA                           | 605             | 44                | 18   | 11           | 28   | 350             | 1,730                            |
| Med              | Omaha, NE-IA                         | 590             | 18                | 49   | 10           | 32   | 235             | 2,510                            |
| Med              | Albuquerque, NM                      | 565             | 28                | 33   | 8            | 38   | 275             | 2,055                            |
| Med              | Fresno, CA                           | 550             | 59                | 13   | 12           | 25   | 185             | 2,975                            |
| Med              | Albany-Schenectady-Troy, NY          | 505             | 1                 | 65   | 3            | 56   | 370             | 1,365                            |
| Sml              | Colorado Springs, CO                 | 440             | 57                | 14   | 29           | 4    | 245             | 1,795                            |
| Sml              | Bakersfield, CA                      | 390             | 70                | 8    | 20           | 11   | 185             | 2,110                            |
| Sml              | Spokane, WA                          | 330             | 20                | 47   | 10           | 32   | 175             | 1,885                            |
| Sml              | Corpus Christi, TX                   | 315             | 26                | 40   | 11           | 28   | 200             | 1,575                            |
| Sml              | Eugene-Springfield, OR               | 220             | 16                | 51   | 13           | 24   | 110             | 2,000                            |
| Sml              | Salem, OR                            | 190             | 19                | 48   | 12           | 25   | 75              | 2,535                            |
| Sml              | Laredo, TX                           | 180             | 89                | 2    | 44           | 2    | 50              | 3,600                            |
| Sml              | Brownsville, TX                      | 150             | 67                | 9    | 25           | 8    | 50              | 3,000                            |
| Sml              | Beaumont, TX                         | 145             | 26                | 40   | 16           | 14   | 110             | 1,320                            |
| Sml              | Boulder, CO                          | 115             | 44                | 18   | 15           | 17   | 45              | 2,555                            |
|                  | 68 area average                      | 1,830           |                   |      |              |      | 710             | 2,575                            |
|                  | Very large area average              | 6,600           |                   |      |              |      | 1,880           | 3,510                            |
|                  | Large area average                   | 1,640           |                   |      |              |      | 765             | 2,145                            |
|                  | Medium area average                  | 705             |                   |      |              |      | 380             | 1,855                            |
|                  | Small area average                   | 250             |                   |      |              |      | 125             | 2,000                            |

Notes: Vlg – Very Large urban areas—over 3 million population. Med – Medium urban areas—over 500,000 and less than 1 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population. Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-2. 1999 Urban Mobility Conditions

| Population Group | Urban Area                              | Travel Rate Index |      | Travel Time Index |      | Annual Delay per Person |      |
|------------------|---|-------------------|------|-------------------|------|-------------------------|------|
|                  |   | 1999              | Rank | 1999              | Rank | Person-Hours            | Rank |
| Vlg              | Los Angeles, CA                         | 1.55              | 1    | 2.06              | 1    | 56                      | 1    |
| Vlg              | San Francisco-Oakland, CA               | 1.45              | 2    | 1.77              | 3    | 42                      | 10   |
| Lrg              | Seattle-Everett, WA                     | 1.44              | 3    | 1.81              | 2    | 53                      | 2    |
| Vlg              | Washington, DC-MD-VA                    | 1.42              | 4    | 1.71              | 4    | 46                      | 5    |
| Vlg              | Chicago, IL-Northwestern, IN            | 1.40              | 5    | 1.69              | 7    | 34                      | 23   |
| Lrg              | San Diego, CA                           | 1.40              | 5    | 1.64              | 9    | 37                      | 19   |
| Vlg              | Boston, MA                              | 1.37              | 7    | 1.71              | 4    | 42                      | 10   |
| Lrg              | Portland-Vancouver, OR-WA               | 1.36              | 8    | 1.65              | 8    | 34                      | 23   |
| Lrg              | Atlanta, GA                             | 1.35              | 9    | 1.63              | 10   | 53                      | 2    |
| Lrg              | Las Vegas, NV                           | 1.35              | 9    | 1.57              | 16   | 21                      | 45   |
| Lrg              | Denver, CO                              | 1.34              | 11   | 1.61              | 11   | 45                      | 7    |
| Vlg              | Houston, TX                             | 1.33              | 12   | 1.61              | 11   | 50                      | 4    |
| Vlg              | New York, NY-Northeastern, NJ           | 1.32              | 13   | 1.70              | 6    | 34                      | 23   |
| Lrg              | Miami-Hialeah, FL                       | 1.32              | 13   | 1.58              | 14   | 42                      | 10   |
| Vlg              | Detroit, MI                             | 1.31              | 15   | 1.59              | 13   | 41                      | 16   |
| Lrg              | Minneapolis-St. Paul, MN                | 1.31              | 15   | 1.58              | 14   | 38                      | 17   |
| Lrg              | San Jose, CA                            | 1.31              | 15   | 1.56              | 17   | 42                      | 10   |
| Lrg              | Sacramento, CA                          | 1.31              | 15   | 1.55              | 18   | 34                      | 23   |
| Lrg              | San Bernardino-Riverside, CA            | 1.31              | 15   | 1.50              | 19   | 38                      | 17   |
| Lrg              | Phoenix, AZ                             | 1.30              | 20   | 1.50              | 19   | 31                      | 31   |
| Lrg              | Ft. Lauderdale-Hollywood-Pomp. Bch., FL | 1.28              | 21   | 1.44              | 27   | 29                      | 34   |
| Lrg              | Dallas, TX                              | 1.27              | 22   | 1.47              | 21   | 46                      | 5    |
| Med              | Tacoma, WA                              | 1.27              | 22   | 1.46              | 24   | 27                      | 37   |
| Lrg              | Cincinnati, OH-KY                       | 1.26              | 24   | 1.47              | 21   | 32                      | 29   |
| Lrg              | St. Louis, MO-IL                        | 1.26              | 24   | 1.46              | 24   | 44                      | 9    |
| Med              | Austin, TX                              | 1.25              | 26   | 1.47              | 21   | 45                      | 7    |
| Lrg              | Baltimore, MD                           | 1.25              | 26   | 1.45              | 26   | 31                      | 31   |
| Lrg              | Indianapolis, IN                        | 1.25              | 26   | 1.43              | 29   | 37                      | 19   |
| Med              | Charlotte, NC                           | 1.25              | 26   | 1.42              | 31   | 32                      | 29   |
| Med              | Albuquerque, NM                         | 1.24              | 30   | 1.43              | 29   | 33                      | 27   |
| Lrg              | Orlando, FL                             | 1.24              | 30   | 1.42              | 31   | 42                      | 10   |
| Lrg              | Milwaukee, WI                           | 1.24              | 30   | 1.40              | 34   | 22                      | 43   |
| Med              | Louisville, KY-IN                       | 1.23              | 33   | 1.42              | 31   | 37                      | 19   |
| Lrg              | San Antonio, TX                         | 1.23              | 33   | 1.32              | 43   | 24                      | 39   |
| Vlg              | Philadelphia, PA-NJ                     | 1.22              | 35   | 1.44              | 27   | 26                      | 38   |
| Med              | Honolulu, HI                            | 1.22              | 35   | 1.34              | 38   | 19                      | 48   |
| Med              | Tucson, AZ                              | 1.21              | 37   | 1.39              | 35   | 23                      | 42   |
| Med              | Tampa, FL                               | 1.21              | 37   | 1.38              | 36   | 35                      | 22   |
| Lrg              | Columbus, OH                            | 1.21              | 37   | 1.37              | 37   | 29                      | 34   |
| Lrg              | Fort Worth, TX                          | 1.21              | 37   | 1.34              | 38   | 33                      | 27   |
| Med              | Salt Lake City, UT                      | 1.19              | 41   | 1.34              | 38   | 18                      | 51   |
| Lrg              | New Orleans, LA                         | 1.19              | 41   | 1.31              | 45   | 18                      | 51   |
| Lrg              | Cleveland, OH                           | 1.18              | 43   | 1.31              | 45   | 20                      | 46   |
| Lrg              | Norfolk, VA                             | 1.17              | 44   | 1.33              | 41   | 24                      | 39   |
| Med              | Providence-Pawtucket, RI-MA             | 1.17              | 44   | 1.33              | 41   | 28                      | 36   |
| Med              | Nashville, TN                           | 1.17              | 44   | 1.32              | 43   | 42                      | 10   |
| Med              | Fresno, CA                              | 1.16              | 47   | 1.29              | 47   | 18                      | 51   |
| Med              | Jacksonville, FL                        | 1.16              | 47   | 1.28              | 49   | 30                      | 33   |
| Med              | Memphis, TN-AR-MS                       | 1.15              | 49   | 1.29              | 47   | 22                      | 43   |
| Sml              | Colorado Springs, CO                    | 1.15              | 49   | 1.27              | 50   | 20                      | 46   |
| Med              | Omaha, NE-IA                            | 1.13              | 51   | 1.23              | 51   | 19                      | 48   |
| Med              | El Paso, TX-NM                          | 1.13              | 51   | 1.22              | 52   | 14                      | 55   |
| Lrg              | Oklahoma City, OK                       | 1.11              | 53   | 1.21              | 53   | 17                      | 54   |
| Lrg              | Kansas City, MO-KS                      | 1.10              | 54   | 1.20              | 54   | 24                      | 39   |
| Med              | Hartford-Middletown, CT                 | 1.10              | 54   | 1.19              | 55   | 19                      | 48   |
| Lrg              | Pittsburgh, PA                          | 1.09              | 56   | 1.16              | 56   | 14                      | 55   |
| Sml              | Eugene-Springfield, OR                  | 1.08              | 57   | 1.16              | 56   | 10                      | 58   |
| Sml              | Salem, OR                               | 1.08              | 57   | 1.16              | 56   | 14                      | 55   |
| Sml              | Spokane, WA                             | 1.06              | 59   | 1.12              | 59   | 10                      | 58   |
| Lrg              | Buffalo-Niagara Falls, NY               | 1.06              | 59   | 1.11              | 60   | 8                       | 62   |
| Med              | Rochester, NY                           | 1.06              | 59   | 1.11              | 60   | 8                       | 62   |
| Med              | Albany-Schenectady-Troy, NY             | 1.05              | 62   | 1.09              | 62   | 10                      | 58   |
| Sml              | Bakersfield, CA                         | 1.05              | 62   | 1.09              | 62   | 6                       | 65   |
| Sml              | Boulder, CO                             | 1.05              | 62   | 1.09              | 62   | 5                       | 66   |
| Sml              | Brownsville, TX                         | 1.05              | 62   | 1.09              | 62   | 3                       | 68   |
| Sml              | Laredo, TX                              | 1.05              | 62   | 1.09              | 62   | 5                       | 66   |
| Sml              | Beaumont, TX                            | 1.04              | 67   | 1.08              | 67   | 9                       | 61   |
| Sml              | Corpus Christi, TX                      | 1.04              | 67   | 1.07              | 68   | 7                       | 64   |
|                  | 68 area average                         | 1.32              |      | 1.58              |      | 36                      |      |
|                  | Very large area average                 | 1.40              |      | 1.77              |      | 41                      |      |
|                  | Large area average                      | 1.28              |      | 1.48              |      | 34                      |      |
|                  | Medium area average                     | 1.18              |      | 1.33              |      | 26                      |      |
|                  | Small area average                      | 1.07              |      | 1.13              |      | 10                      |      |

Notes: Only includes estimated freeway and principal arterial street travel conditions.  
Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.



**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-3. Point Change in Travel Rate Index, 1982 to 1999

| Population Group | Urban Area                           | Travel Rate Index |      |      |      | Point Change in Peak-Period Time Penalty |      |                            |      |
|------------------|--------------------------------------|-------------------|------|------|------|--|------|----------------------------|------|
|                  |                                      | 1982              | 1987 | 1992 | 1999 | Long-Term<br>1982 to 1999                |      | Short-Term<br>1992 to 1999 |      |
|                  |                                      |                   |      |      |      | Points                                   | Rank | Points                     | Rank |
| Lrg              | Atlanta, GA                          | 1.08              | 1.17 | 1.16 | 1.35 | 27                                       | 5    | 19                         | 1    |
| Lrg              | Minneapolis-St. Paul, MN             | 1.04              | 1.10 | 1.13 | 1.31 | 27                                       | 5    | 18                         | 2    |
| Lrg              | Denver, CO                           | 1.09              | 1.13 | 1.19 | 1.34 | 25                                       | 9    | 15                         | 3    |
| Lrg              | Portland-Vancouver, OR-WA            | 1.05              | 1.11 | 1.21 | 1.36 | 31                                       | 2    | 15                         | 3    |
| Lrg              | San Antonio, TX                      | 1.04              | 1.08 | 1.08 | 1.23 | 19                                       | 24   | 15                         | 3    |
| Lrg              | Indianapolis, IN                     | 1.03              | 1.04 | 1.11 | 1.25 | 22                                       | 16   | 14                         | 6    |
| Med              | Albuquerque, NM                      | 1.03              | 1.06 | 1.11 | 1.24 | 21                                       | 19   | 13                         | 7    |
| Lrg              | St. Louis, MO-IL                     | 1.08              | 1.11 | 1.13 | 1.26 | 18                                       | 26   | 13                         | 7    |
| Med              | Austin, TX                           | 1.07              | 1.11 | 1.13 | 1.25 | 18                                       | 26   | 12                         | 9    |
| Vlg              | Boston, MA                           | 1.10              | 1.20 | 1.25 | 1.37 | 27                                       | 5    | 12                         | 9    |
| Lrg              | Cleveland, OH                        | 1.02              | 1.03 | 1.07 | 1.18 | 16                                       | 33   | 11                         | 11   |
| Sml              | Colorado Springs, CO                 | 1.02              | 1.03 | 1.04 | 1.15 | 13                                       | 38   | 11                         | 11   |
| Lrg              | Ft. Lauderdale-Hywood-Pomp. Bch., FL | 1.08              | 1.13 | 1.17 | 1.28 | 20                                       | 22   | 11                         | 11   |
| Vlg              | Houston, TX                          | 1.23              | 1.27 | 1.22 | 1.33 | 10                                       | 47   | 11                         | 11   |
| Lrg              | Las Vegas, NV                        | 1.06              | 1.14 | 1.24 | 1.35 | 29                                       | 4    | 11                         | 11   |
| Lrg              | Dallas, TX                           | 1.06              | 1.14 | 1.17 | 1.27 | 21                                       | 19   | 10                         | 16   |
| Med              | Louisville, KY-IN                    | 1.08              | 1.10 | 1.13 | 1.23 | 15                                       | 35   | 10                         | 16   |
| Vlg              | New York, NY-Northeastern, NJ        | 1.10              | 1.14 | 1.22 | 1.32 | 22                                       | 16   | 10                         | 16   |
| Lrg              | Sacramento, CA                       | 1.07              | 1.16 | 1.21 | 1.31 | 24                                       | 12   | 10                         | 16   |
| Vlg              | Chicago, IL-Northwestern, IN         | 1.17              | 1.27 | 1.31 | 1.40 | 23                                       | 13   | 9                          | 20   |
| Lrg              | Cincinnati, OH-KY                    | 1.04              | 1.08 | 1.17 | 1.26 | 22                                       | 16   | 9                          | 20   |
| Lrg              | Fort Worth, TX                       | 1.04              | 1.10 | 1.12 | 1.21 | 17                                       | 32   | 9                          | 20   |
| Med              | Nashville, TN                        | 1.07              | 1.11 | 1.08 | 1.17 | 10                                       | 47   | 9                          | 20   |
| Lrg              | Phoenix, AZ                          | 1.12              | 1.16 | 1.21 | 1.30 | 18                                       | 26   | 9                          | 20   |
| Lrg              | Baltimore, MD                        | 1.07              | 1.12 | 1.17 | 1.25 | 18                                       | 26   | 8                          | 25   |
| Med              | Tucson, AZ                           | 1.07              | 1.07 | 1.13 | 1.21 | 14                                       | 36   | 8                          | 25   |
| Med              | Charlotte, NC                        | 1.05              | 1.11 | 1.18 | 1.25 | 20                                       | 22   | 7                          | 27   |
| Lrg              | Columbus, OH                         | 1.03              | 1.06 | 1.14 | 1.21 | 18                                       | 26   | 7                          | 27   |
| Lrg              | Milwaukee, WI                        | 1.05              | 1.10 | 1.17 | 1.24 | 19                                       | 24   | 7                          | 27   |
| Lrg              | Oklahoma City OK                     | 1.03              | 1.03 | 1.04 | 1.11 | 8  | 52   | 7                          | 27   |
| Med              | Providence-Pawtucket, RI-MA          | 1.04              | 1.07 | 1.10 | 1.17 | 13                                       | 38   | 7                          | 27   |
| Med              | Salt Lake City, UT                   | 1.03              | 1.05 | 1.12 | 1.19 | 16                                       | 33   | 7                          | 27   |
| Lrg              | San Diego, CA                        | 1.08              | 1.21 | 1.33 | 1.40 | 32                                       | 1    | 7                          | 27   |
| Med              | Tacoma, WA                           | 1.04              | 1.10 | 1.20 | 1.27 | 23                                       | 13   | 7                          | 27   |
| Lrg              | Kansas City, MO-KS                   | 1.01              | 1.02 | 1.04 | 1.10 | 9  | 50   | 6                          | 35   |
| Vlg              | Detroit, MI                          | 1.10              | 1.15 | 1.26 | 1.31 | 21                                       | 19   | 5                          | 36   |
| Med              | El Paso, TX-NM                       | 1.02              | 1.04 | 1.08 | 1.13 | 11                                       | 45   | 5                          | 36   |
| Sml              | Eugene-Springfield, OR               | 1.02              | 1.02 | 1.03 | 1.08 | 6  | 55   | 5                          | 36   |
| Med              | Fresno, CA                           | 1.03              | 1.06 | 1.11 | 1.16 | 13                                       | 38   | 5                          | 36   |
| Med              | Memphis, TN-AR-MS                    | 1.03              | 1.05 | 1.10 | 1.15 | 12                                       | 44   | 5                          | 36   |
| Lrg              | Norfolk, VA                          | 1.08              | 1.16 | 1.12 | 1.17 | 9  | 50   | 5                          | 36   |
| Vlg              | Philadelphia, PA-NJ                  | 1.09              | 1.15 | 1.17 | 1.22 | 13                                       | 38   | 5                          | 36   |
| Lrg              | San Bernardino-Riverside, CA         | 1.05              | 1.15 | 1.26 | 1.31 | 26                                       | 8    | 5                          | 36   |
| Vlg              | Washington, DC-MD-VA                 | 1.17              | 1.30 | 1.37 | 1.42 | 25                                       | 9    | 5                          | 36   |
| Vlg              | Los Angeles, CA                      | 1.30              | 1.45 | 1.51 | 1.55 | 25                                       | 9    | 4                          | 45   |
| Med              | Omaha, NE-IA                         | 1.03              | 1.07 | 1.09 | 1.13 | 10                                       | 47   | 4                          | 45   |
| Sml              | Brownsville, TX                      | 1.01              | 1.02 | 1.02 | 1.05 | 4  | 59   | 3                          | 47   |
| Lrg              | Orlando, FL                          | 1.10              | 1.15 | 1.21 | 1.24 | 14                                       | 36   | 3                          | 47   |
| Sml              | Salem, OR                            | 1.01              | 1.02 | 1.05 | 1.08 | 7  | 54   | 3                          | 47   |
| Vlg              | San Francisco-Oakland, CA            | 1.22              | 1.43 | 1.42 | 1.45 | 23                                       | 13   | 3                          | 47   |
| Lrg              | Seattle-Everett, WA                  | 1.14              | 1.28 | 1.41 | 1.44 | 30                                       | 3    | 3                          | 47   |
| Med              | Albany-Schenectady-Troy, NY          | 1.01              | 1.02 | 1.03 | 1.05 | 4  | 59   | 2                          | 52   |
| Sml              | Boulder, CO                          | 1.01              | 1.02 | 1.03 | 1.05 | 4  | 59   | 2                          | 52   |
| Lrg              | Buffalo-Niagara Falls, NY            | 1.02              | 1.02 | 1.04 | 1.06 | 4  | 59   | 2                          | 52   |
| Med              | Jacksonville, FL                     | 1.03              | 1.06 | 1.14 | 1.16 | 13                                       | 38   | 2                          | 52   |
| Sml              | Laredo, TX                           | 1.02              | 1.03 | 1.03 | 1.05 | 3  | 65   | 2                          | 52   |
| Med              | Rochester, NY                        | 1.01              | 1.02 | 1.04 | 1.06 | 5  | 56   | 2                          | 52   |
| Sml              | Spokane, WA                          | 1.02              | 1.04 | 1.04 | 1.06 | 4  | 59   | 2                          | 52   |
| Sml              | Bakersfield, CA                      | 1.01              | 1.01 | 1.04 | 1.05 | 4  | 59   | 1                          | 59   |
| Sml              | Corpus Christi, TX                   | 1.02              | 1.03 | 1.03 | 1.04 | 2  | 67   | 1                          | 59   |
| Med              | Hartford-Middletown, CT              | 1.05              | 1.08 | 1.09 | 1.10 | 5  | 56   | 1                          | 59   |
| Med              | Honolulu, HI                         | 1.09              | 1.15 | 1.21 | 1.22 | 13                                       | 38   | 1                          | 59   |
| Lrg              | Miami-Hialeah, FL                    | 1.14              | 1.20 | 1.31 | 1.32 | 18                                       | 26   | 1                          | 59   |
| Lrg              | Pittsburgh, PA                       | 1.06              | 1.06 | 1.08 | 1.09 | 3  | 65   | 1                          | 59   |
| Sml              | Beaumont, TX                         | 1.02              | 1.03 | 1.04 | 1.04 | 2  | 67   | 0                          | 65   |
| Lrg              | San Jose, CA                         | 1.20              | 1.30 | 1.31 | 1.31 | 11                                       | 45   | 0                          | 65   |
| Lrg              | New Orleans, LA                      | 1.14              | 1.18 | 1.20 | 1.19 | 5  | 56   | -1                         | 67   |
| Med              | Tampa, FL                            | 1.13              | 1.15 | 1.24 | 1.21 | 8  | 52   | -3                         | 68   |
|                  | 68 area average                      | 1.12              | 1.20 | 1.25 | 1.32 | 20                                       |      | 7                          |      |
|                  | Very large area average              | 1.19              | 1.29 | 1.34 | 1.40 | 21                                       |      | 6                          |      |
|                  | Large area average                   | 1.07              | 1.14 | 1.19 | 1.28 | 21                                       |      | 9                          |      |
|                  | Medium area average                  | 1.05              | 1.08 | 1.12 | 1.18 | 13                                       |      | 6                          |      |
|                  | Small area average                   | 1.02              | 1.03 | 1.04 | 1.07 | 5  |      | 3                          |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-4. Point Change in Travel Time Index, 1982 to 1999

| Population Group | Urban Area                           | Point Change in Peak-Period Time Penalty |      |      |      |                           |      |                            |      |
|------------------|--------------------------------------|--|------|------|------|---------------------------|------|----------------------------|------|
|                  |                                      | Travel Time Index                        |      |      |      | Long-Term<br>1982 to 1999 |      | Short-Term<br>1992 to 1999 |      |
|                  |                                      | 1982                                     | 1987 | 1992 | 1999 | Points                    | Rank | Points                     | Rank |
| Lrg              | Atlanta, GA                          | 1.14                                     | 1.30 | 1.27 | 1.63 | 49                        | 7    | 36                         | 1    |
| Lrg              | Minneapolis-St. Paul, MN             | 1.06                                     | 1.17 | 1.24 | 1.58 | 52                        | 4    | 34                         | 2    |
| Lrg              | Denver, CO                           | 1.17                                     | 1.23 | 1.34 | 1.61 | 44                        | 10   | 27                         | 3    |
| Vlg              | New York, NY-Northeastern, NJ        | 1.18                                     | 1.28 | 1.44 | 1.70 | 52                        | 4    | 26                         | 4    |
| Lrg              | Portland-Vancouver, OR-WA            | 1.09                                     | 1.20 | 1.39 | 1.65 | 56                        | 1    | 26                         | 4    |
| Med              | Albuquerque, NM                      | 1.05                                     | 1.10 | 1.18 | 1.43 | 38                        | 19   | 25                         | 6    |
| Med              | Austin, TX                           | 1.12                                     | 1.20 | 1.23 | 1.47 | 35                        | 22   | 24                         | 7    |
| Vlg              | Boston, MA                           | 1.18                                     | 1.38 | 1.47 | 1.71 | 53                        | 3    | 24                         | 7    |
| Lrg              | St. Louis, MO-IL                     | 1.13                                     | 1.18 | 1.22 | 1.46 | 33                        | 23   | 24                         | 7    |
| Lrg              | Indianapolis, IN                     | 1.05                                     | 1.08 | 1.20 | 1.43 | 38                        | 19   | 23                         | 10   |
| Vlg              | Houston, TX                          | 1.44                                     | 1.52 | 1.39 | 1.61 | 17                        | 48   | 22                         | 11   |
| Med              | Louisville, KY-IN                    | 1.14                                     | 1.17 | 1.22 | 1.42 | 28                        | 31   | 20                         | 12   |
| Lrg              | San Antonio, TX                      | 1.06                                     | 1.12 | 1.12 | 1.32 | 26                        | 36   | 20                         | 12   |
| Sml              | Colorado Springs, CO                 | 1.03                                     | 1.05 | 1.08 | 1.27 | 24                        | 40   | 19                         | 14   |
| Lrg              | Sacramento, CA                       | 1.11                                     | 1.27 | 1.36 | 1.55 | 44                        | 10   | 19                         | 14   |
| Lrg              | Cincinnati, OH-KY                    | 1.07                                     | 1.13 | 1.29 | 1.47 | 40                        | 16   | 18                         | 16   |
| Lrg              | Cleveland, OH                        | 1.04                                     | 1.05 | 1.13 | 1.31 | 27                        | 34   | 18                         | 16   |
| Lrg              | Dallas, TX                           | 1.09                                     | 1.25 | 1.29 | 1.47 | 38                        | 19   | 18                         | 16   |
| Med              | Nashville, TN                        | 1.13                                     | 1.20 | 1.14 | 1.32 | 19                        | 45   | 18                         | 16   |
| Lrg              | Fort Worth, TX                       | 1.07                                     | 1.17 | 1.18 | 1.34 | 27                        | 34   | 16                         | 20   |
| Lrg              | Las Vegas, NV                        | 1.10                                     | 1.24 | 1.41 | 1.57 | 47                        | 9    | 16                         | 20   |
| Med              | Tucson, AZ                           | 1.13                                     | 1.13 | 1.23 | 1.39 | 26                        | 36   | 16                         | 20   |
| Lrg              | Ft. Lauderdale-Hywood-Pomp. Bch., FL | 1.13                                     | 1.21 | 1.29 | 1.44 | 31                        | 29   | 15                         | 23   |
| Lrg              | Phoenix, AZ                          | 1.20                                     | 1.27 | 1.35 | 1.50 | 30                        | 30   | 15                         | 23   |
| Med              | Providence-Pawtucket, RI-MA          | 1.07                                     | 1.13 | 1.18 | 1.33 | 26                        | 36   | 15                         | 23   |
| Vlg              | Chicago, IL-Northwestern, IN         | 1.30                                     | 1.48 | 1.55 | 1.69 | 39                        | 17   | 14                         | 26   |
| Lrg              | Columbus, OH                         | 1.05                                     | 1.09 | 1.23 | 1.37 | 32                        | 26   | 14                         | 26   |
| Med              | Tacoma, WA                           | 1.07                                     | 1.17 | 1.32 | 1.46 | 39                        | 17   | 14                         | 26   |
| Lrg              | Oklahoma City, OK                    | 1.05                                     | 1.05 | 1.08 | 1.21 | 16                        | 52   | 13                         | 29   |
| Med              | Salt Lake City, UT                   | 1.06                                     | 1.09 | 1.21 | 1.34 | 28                        | 31   | 13                         | 29   |
| Lrg              | Baltimore, MD                        | 1.12                                     | 1.23 | 1.33 | 1.45 | 33                        | 23   | 12                         | 31   |
| Lrg              | Kansas City, MO-KS                   | 1.02                                     | 1.05 | 1.08 | 1.20 | 18                        | 47   | 12                         | 31   |
| Med              | Memphis, TN-AR-MS                    | 1.05                                     | 1.08 | 1.17 | 1.29 | 24                        | 40   | 12                         | 31   |
| Vlg              | Philadelphia, PA-NJ                  | 1.16                                     | 1.27 | 1.32 | 1.44 | 28                        | 31   | 12                         | 31   |
| Med              | Charlotte, NC                        | 1.10                                     | 1.20 | 1.31 | 1.42 | 32                        | 26   | 11                         | 35   |
| Lrg              | Milwaukee, WI                        | 1.08                                     | 1.17 | 1.29 | 1.40 | 32                        | 26   | 11                         | 35   |
| Lrg              | Norfolk, VA                          | 1.16                                     | 1.31 | 1.22 | 1.33 | 17                        | 48   | 11                         | 35   |
| Lrg              | San Diego, CA                        | 1.13                                     | 1.32 | 1.53 | 1.64 | 51                        | 6    | 11                         | 35   |
| Sml              | Eugene-Springfield, OR               | 1.03                                     | 1.03 | 1.06 | 1.16 | 13                        | 55   | 10                         | 39   |
| Med              | Fresno, CA                           | 1.06                                     | 1.11 | 1.19 | 1.29 | 23                        | 42   | 10                         | 39   |
| Lrg              | San Bernardino-Riverside, CA         | 1.08                                     | 1.23 | 1.41 | 1.50 | 42                        | 12   | 9                          | 41   |
| Vlg              | Detroit, MI                          | 1.18                                     | 1.29 | 1.51 | 1.59 | 41                        | 14   | 8                          | 42   |
| Med              | El Paso, TX-NM                       | 1.05                                     | 1.08 | 1.14 | 1.22 | 17                        | 48   | 8                          | 42   |
| Lrg              | Orlando, FL                          | 1.16                                     | 1.25 | 1.35 | 1.42 | 26                        | 36   | 7                          | 44   |
| Sml              | Salem, OR                            | 1.02                                     | 1.04 | 1.09 | 1.16 | 14                        | 54   | 7                          | 44   |
| Vlg              | San Francisco-Oakland, CA            | 1.35                                     | 1.70 | 1.70 | 1.77 | 42                        | 12   | 7                          | 44   |
| Med              | Omaha, NE-IA                         | 1.06                                     | 1.13 | 1.17 | 1.23 | 17                        | 48   | 6                          | 47   |
| Sml              | Brownsville, TX                      | 1.02                                     | 1.03 | 1.04 | 1.09 | 7                         | 59   | 5                          | 48   |
| Sml              | Spokane, WA                          | 1.03                                     | 1.06 | 1.07 | 1.12 | 9                         | 57   | 5                          | 48   |
| Med              | Albany-Schenectady-Troy, NY          | 1.02                                     | 1.03 | 1.05 | 1.09 | 7                         | 59   | 4                          | 50   |
| Sml              | Boulder, CO                          | 1.02                                     | 1.03 | 1.05 | 1.09 | 7                         | 59   | 4                          | 50   |
| Lrg              | Buffalo-Niagara Falls, NY            | 1.04                                     | 1.04 | 1.07 | 1.11 | 7                         | 59   | 4                          | 50   |
| Sml              | Laredo, TX                           | 1.03                                     | 1.04 | 1.05 | 1.09 | 6                         | 64   | 4                          | 50   |
| Vlg              | Washington, DC-MD-VA                 | 1.30                                     | 1.55 | 1.67 | 1.71 | 41                        | 14   | 4                          | 50   |
| Sml              | Bakersfield, CA                      | 1.02                                     | 1.02 | 1.06 | 1.09 | 70                        | 59   | 3                          | 55   |
| Med              | Jacksonville, FL                     | 1.05                                     | 1.11 | 1.25 | 1.28 | 23                        | 42   | 3                          | 55   |
| Lrg              | Pittsburgh, PA                       | 1.10                                     | 1.11 | 1.13 | 1.16 | 6                         | 64   | 3                          | 55   |
| Med              | Rochester, NY                        | 1.02                                     | 1.04 | 1.08 | 1.11 | 9                         | 57   | 3                          | 55   |
| Lrg              | San Jose, CA                         | 1.33                                     | 1.50 | 1.53 | 1.56 | 23                        | 42   | 3                          | 55   |
| Med              | Hartford-Middletown, CT              | 1.09                                     | 1.15 | 1.17 | 1.19 | 10                        | 56   | 2                          | 60   |
| Vlg              | Los Angeles, CA                      | 1.57                                     | 1.91 | 2.04 | 2.06 | 49                        | 7    | 2                          | 60   |
| Sml              | Beaumont, TX                         | 1.04                                     | 1.04 | 1.07 | 1.08 | 4                         | 67   | 1                          | 62   |
| Sml              | Corpus Christi, TX                   | 1.04                                     | 1.05 | 1.06 | 1.07 | 3                         | 68   | 1                          | 62   |
| Med              | Honolulu, HI                         | 1.15                                     | 1.23 | 1.33 | 1.34 | 19                        | 45   | 1                          | 62   |
| Lrg              | Miami-Hialeah, FL                    | 1.25                                     | 1.36 | 1.58 | 1.58 | 33                        | 23   | 0                          | 65   |
| Lrg              | Seattle-Everett, WA                  | 1.26                                     | 1.56 | 1.82 | 1.81 | 55                        | 2    | -1                         | 66   |
| Lrg              | New Orleans, LA                      | 1.26                                     | 1.32 | 1.35 | 1.31 | 5                         | 66   | -4                         | 67   |
| Med              | Tampa, FL                            | 1.23                                     | 1.27 | 1.43 | 1.38 | 15                        | 53   | -5                         | 68   |
|                  | 68 area average                      | 1.22                                     | 1.37 | 1.46 | 1.58 | 36                        |      | 12                         |      |
|                  | Very large area average              | 1.34                                     | 1.56 | 1.66 | 1.77 | 33                        |      | 11                         |      |
|                  | Large area average                   | 1.13                                     | 1.24 | 1.33 | 1.48 | 35                        |      | 15                         |      |
|                  | Medium area average                  | 1.09                                     | 1.14 | 1.21 | 1.33 | 24                        |      | 12                         |      |
|                  | Small area average                   | 1.03                                     | 1.04 | 1.07 | 1.13 | 10                        |      | 6                          |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-5. Hours Change in Annual Delay per Person, 1982 to 1999

| Population Group | Urban Area                           | Annual Hours of Delay per Person |      |      |      | Long-Term Change 1982 to 1999 |      | Short-Term Change 1992 to 1999 |      |
|------------------|--------------------------------------|----------------------------------|------|------|------|-------------------------------|------|--------------------------------|------|
|                  |                                      | 1982                             | 1987 | 1992 | 1999 | Hours                         | Rank | Hours                          | Rank |
| Lrg              | Atlanta, GA                          | 11                               | 30   | 25   | 53   | 42                            | 1    | 28                             | 1    |
| Med              | Nashville, TN                        | 13                               | 22   | 15   | 42   | 29                            | 13   | 27                             | 2    |
| Lrg              | St. Louis, MO-IL                     | 10                               | 16   | 20   | 44   | 34                            | 5    | 24                             | 3    |
| Med              | Austin, TX                           | 9                                | 18   | 22   | 45   | 36                            | 3    | 23                             | 4    |
| Vlg              | Houston, TX                          | 27                               | 31   | 27   | 50   | 23                            | 29   | 23                             | 4    |
| Lrg              | Indianapolis, IN                     | 3                                | 6    | 15   | 37   | 34                            | 5    | 22                             | 6    |
| Lrg              | Dallas, TX                           | 8                                | 21   | 26   | 46   | 38                            | 2    | 20                             | 7    |
| Lrg              | Denver, CO                           | 13                               | 17   | 25   | 45   | 32                            | 8    | 20                             | 7    |
| Med              | Louisville, KY-IN                    | 8                                | 12   | 17   | 37   | 29                            | 13   | 20                             | 7    |
| Lrg              | Minneapolis-St. Paul, MN             | 3                                | 12   | 18   | 38   | 35                            | 4    | 20                             | 7    |
| Med              | Albuquerque, NM                      | 4                                | 9    | 14   | 33   | 29                            | 13   | 19                             | 11   |
| Lrg              | Fort Worth, TX                       | 5                                | 12   | 14   | 33   | 28                            | 18   | 19                             | 11   |
| Lrg              | Kansas City, MO-KS                   | 2                                | 4    | 8    | 24   | 22                            | 33   | 16                             | 13   |
| Lrg              | Cincinnati, OH-KY                    | 4                                | 8    | 18   | 32   | 28                            | 18   | 14                             | 14   |
| Sml              | Colorado Springs, CO                 | 1                                | 3    | 6    | 20   | 19                            | 39   | 14                             | 14   |
| Med              | Providence-Pawtucket, RI-MA          | 3                                | 9    | 14   | 28   | 25                            | 24   | 14                             | 14   |
| Lrg              | San Antonio, TX                      | 5                                | 10   | 10   | 24   | 19                            | 39   | 14                             | 14   |
| Vlg              | New York, NY-Northeastern, NJ        | 8                                | 12   | 21   | 34   | 26                            | 21   | 13                             | 18   |
| Vlg              | Boston, MA                           | 12                               | 25   | 30   | 42   | 30                            | 11   | 12                             | 19   |
| Lrg              | Cleveland, OH                        | 1                                | 2    | 8    | 20   | 19                            | 39   | 12                             | 19   |
| Lrg              | Columbus, OH                         | 3                                | 7    | 17   | 29   | 26                            | 21   | 12                             | 19   |
| Lrg              | Portland-Vancouver, OR-WA            | 4                                | 10   | 22   | 34   | 30                            | 11   | 12                             | 19   |
| Med              | Tucson, AZ                           | 5                                | 5    | 11   | 23   | 18                            | 43   | 12                             | 19   |
| Med              | Charlotte, NC                        | 6                                | 14   | 23   | 32   | 26                            | 21   | 9                              | 24   |
| Vlg              | Chicago, IL-Northwestern, IN         | 11                               | 19   | 25   | 34   | 23                            | 29   | 9                              | 24   |
| Lrg              | Ft. Lauderdale-Hywood-Pomp. Bch., FL | 7                                | 13   | 20   | 29   | 22                            | 33   | 9                              | 24   |
| Med              | Memphis, TN-AR-MS                    | 2                                | 5    | 13   | 22   | 20                            | 38   | 9                              | 24   |
| Lrg              | Norfolk, VA                          | 9                                | 21   | 15   | 24   | 15                            | 48   | 9                              | 24   |
| Lrg              | Oklahoma City OK                     | 4                                | 5    | 8    | 17   | 13                            | 51   | 9                              | 24   |
| Lrg              | Orlando, FL                          | 10                               | 18   | 33   | 42   | 32                            | 8    | 9                              | 24   |
| Lrg              | Milwaukee, WI                        | 4                                | 9    | 14   | 22   | 18                            | 43   | 8                              | 31   |
| Vlg              | Philadelphia, PA-NJ                  | 8                                | 16   | 18   | 26   | 18                            | 43   | 8                              | 31   |
| Med              | Tacoma, WA                           | 5                                | 12   | 19   | 27   | 22                            | 33   | 8                              | 31   |
| Sml              | Eugene-Springfield, OR               | 1                                | 1    | 3    | 10   | 9                             | 56   | 7                              | 34   |
| Med              | Omaha, NE-IA                         | 3                                | 8    | 12   | 19   | 16                            | 46   | 7                              | 34   |
| Lrg              | Phoenix, AZ                          | 12                               | 17   | 24   | 31   | 19                            | 39   | 7                              | 34   |
| Lrg              | Sacramento, CA                       | 9                                | 23   | 27   | 34   | 25                            | 24   | 7                              | 34   |
| Sml              | Salem, OR                            | 1                                | 3    | 7    | 14   | 13                            | 51   | 7                              | 34   |
| Lrg              | Baltimore, MD                        | 8                                | 18   | 25   | 31   | 23                            | 29   | 6                              | 39   |
| Med              | Fresno, CA                           | 4                                | 8    | 12   | 18   | 14                            | 50   | 6                              | 39   |
| Lrg              | San Bernardino-Riverside, CA         | 6                                | 19   | 32   | 38   | 32                            | 8    | 6                              | 39   |
| Med              | El Paso, TX-NM                       | 2                                | 4    | 9    | 14   | 12                            | 54   | 5                              | 42   |
| Med              | Jacksonville, FL                     | 5                                | 10   | 25   | 30   | 25                            | 24   | 5                              | 42   |
| Med              | Salt Lake City, UT                   | 3                                | 5    | 13   | 18   | 15                            | 48   | 5                              | 42   |
| Lrg              | San Diego, CA                        | 8                                | 22   | 32   | 37   | 29                            | 13   | 5                              | 42   |
| Sml              | Spokane, WA                          | 2                                | 5    | 5    | 10   | 8                             | 58   | 5                              | 42   |
| Vlg              | Washington, DC-MD-VA                 | 18                               | 34   | 41   | 46   | 28                            | 18   | 5                              | 42   |
| Med              | Albany-Schenectady-Troy, NY          | 1                                | 3    | 6    | 10   | 9                             | 56   | 4                              | 48   |
| Lrg              | Buffalo-Niagara Falls, NY            | 2                                | 2    | 4    | 8    | 6                             | 62   | 4                              | 48   |
| Vlg              | Detroit, MI                          | 12                               | 21   | 37   | 41   | 29                            | 13   | 4                              | 48   |
| Lrg              | Las Vegas, NV                        | 5                                | 13   | 17   | 21   | 16                            | 46   | 4                              | 48   |
| Sml              | Laredo, TX                           | 1                                | 1    | 2    | 5    | 4                             | 65   | 3                              | 52   |
| Lrg              | Pittsburgh, PA                       | 6                                | 8    | 11   | 14   | 8                             | 58   | 3                              | 52   |
| Med              | Rochester, NY                        | 1                                | 2    | 5    | 8    | 7                             | 61   | 3                              | 52   |
| Vlg              | San Francisco-Oakland, CA            | 20                               | 40   | 39   | 42   | 22                            | 33   | 3                              | 52   |
| Lrg              | San Jose, CA                         | 19                               | 38   | 39   | 42   | 23                            | 29   | 3                              | 52   |
| Sml              | Beaumont, TX                         | 4                                | 5    | 7    | 9    | 5                             | 63   | 2                              | 57   |
| Sml              | Boulder, CO                          | 1                                | 2    | 3    | 5    | 4                             | 65   | 2                              | 57   |
| Med              | Hartford-Middletown, CT              | 6                                | 14   | 17   | 19   | 13                            | 51   | 2                              | 57   |
| Lrg              | Miami-Hialeah, FL                    | 17                               | 24   | 40   | 42   | 25                            | 24   | 2                              | 57   |
| Lrg              | New Orleans, LA                      | 10                               | 13   | 16   | 18   | 8                             | 58   | 2                              | 57   |
| Med              | Tampa, FL                            | 13                               | 18   | 33   | 35   | 22                            | 33   | 2                              | 57   |
| Sml              | Bakersfield, CA                      | 1                                | 2    | 5    | 6    | 5                             | 63   | 1                              | 63   |
| Sml              | Brownsville, TX                      | 1                                | 1    | 2    | 3    | 2                             | 68   | 1                              | 63   |
| Sml              | Corpus Christi, TX                   | 3                                | 4    | 6    | 7    | 4                             | 65   | 1                              | 63   |
| Med              | Honolulu, HI                         | 8                                | 13   | 19   | 19   | 11                            | 55   | 0                              | 66   |
| Vlg              | Los Angeles, CA                      | 31                               | 50   | 57   | 56   | 25                            | 24   | -1                             | 67   |
| Lrg              | Seattle-Everett, WA                  | 19                               | 39   | 55   | 53   | 34                            | 5    | -2                             | 68   |
|                  | 68 area average                      | 11                               | 20   | 27   | 36   | 25                            |      | 9                              |      |
|                  | Very large area average              | 15                               | 26   | 33   | 41   | 26                            |      | 8                              |      |
|                  | Large area average                   | 8                                | 16   | 23   | 34   | 26                            |      | 11                             |      |
|                  | Medium area average                  | 5                                | 10   | 16   | 26   | 21                            |      | 10                             |      |
|                  | Small area average                   | 2                                | 3    | 5    | 10   | 8                             |      | 5                              |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-6. Annual Hours of Delay, 1999

| Population Group | Urban Area                           | Annual Person-Hours of Delay (000) |           |           |      | Annual Delay per Person |      |
|------------------|--------------------------------------|------------------------------------|-----------|-----------|------|-------------------------|------|
|                  |                                      | Recurring                          | Incident  | Total     | Rank | Hours                   | Rank |
| Vlg              | Los Angeles, CA                      | 350,065                            | 361,035   | 711,100   | 1    | 56                      | 1    |
| Lrg              | Atlanta, GA                          | 72,635                             | 79,900    | 152,535   | 8    | 53                      | 2    |
| Lrg              | Seattle-Everett, WA                  | 50,080                             | 55,085    | 105,165   | 12   | 53                      | 2    |
| Vlg              | Houston, TX                          | 67,365                             | 88,105    | 155,470   | 7    | 50                      | 4    |
| Lrg              | Dallas, TX                           | 50,310                             | 58,475    | 108,785   | 11   | 46                      | 5    |
| Vlg              | Washington, DC-MD-VA                 | 83,015                             | 77,230    | 160,245   | 6    | 46                      | 5    |
| Med              | Austin, TX                           | 12,625                             | 16,825    | 29,450    | 35   | 45                      | 7    |
| Lrg              | Denver, CO                           | 39,545                             | 43,500    | 83,045    | 17   | 45                      | 7    |
| Lrg              | St. Louis, MO-IL                     | 39,655                             | 47,750    | 87,405    | 16   | 44                      | 9    |
| Lrg              | Orlando, FL                          | 22,500                             | 24,750    | 47,250    | 23   | 42                      | 10   |
| Lrg              | Miami-Hialeah, FL                    | 41,155                             | 46,915    | 88,070    | 15   | 42                      | 10   |
| Vlg              | Boston, MA                           | 56,415                             | 70,385    | 126,800   | 9    | 42                      | 10   |
| Lrg              | San Jose, CA                         | 32,145                             | 37,460    | 69,605    | 19   | 42                      | 10   |
| Med              | Nashville, TN                        | 10,775                             | 15,855    | 26,630    | 37   | 42                      | 10   |
| Vlg              | San Francisco-Oakland, CA            | 90,405                             | 78,475    | 168,880   | 4    | 42                      | 10   |
| Vlg              | Detroit, MI                          | 73,475                             | 91,560    | 165,035   | 5    | 41                      | 16   |
| Lrg              | San Bernardino-Riverside, CA         | 29,510                             | 23,775    | 53,285    | 21   | 38                      | 17   |
| Lrg              | Minneapolis-St. Paul, MN             | 38,445                             | 50,865    | 89,310    | 14   | 38                      | 17   |
| Lrg              | San Diego, CA                        | 55,910                             | 44,270    | 100,180   | 13   | 37                      | 19   |
| Lrg              | Indianapolis, IN                     | 18,305                             | 19,165    | 37,470    | 28   | 37                      | 19   |
| Med              | Louisville, KY-IN                    | 13,245                             | 17,725    | 30,970    | 31   | 37                      | 19   |
| Med              | Tampa, FL                            | 13,795                             | 16,905    | 30,700    | 32   | 35                      | 22   |
| Vlg              | New York, NY-Northeastern, NJ        | 205,145                            | 360,660   | 565,805   | 2    | 34                      | 23   |
| Vlg              | Chicago IL-Northwestern, IN          | 135,960                            | 135,460   | 271,420   | 3    | 34                      | 23   |
| Lrg              | Portland-Vancouver, OR-WA            | 24,300                             | 26,730    | 51,030    | 22   | 34                      | 23   |
| Lrg              | Sacramento, CA                       | 22,535                             | 23,520    | 46,055    | 24   | 34                      | 23   |
| Lrg              | Fort Worth, TX                       | 22,285                             | 23,080    | 45,365    | 25   | 33                      | 27   |
| Med              | Albuquerque, NM                      | 8,725                              | 10,065    | 18,790    | 46   | 33                      | 27   |
| Lrg              | Cincinnati, OH-KY                    | 18,320                             | 22,965    | 41,285    | 27   | 32                      | 29   |
| Med              | Charlotte, NC                        | 10,160                             | 9,955     | 20,115    | 44   | 32                      | 29   |
| Lrg              | Phoenix, AZ                          | 41,205                             | 38,700    | 79,905    | 18   | 31                      | 31   |
| Lrg              | Baltimore, MD                        | 29,650                             | 36,565    | 66,215    | 20   | 31                      | 31   |
| Med              | Jacksonville, FL                     | 11,650                             | 13,775    | 25,425    | 40   | 30                      | 33   |
| Lrg              | Ft. Lauderdale-Hywood-Pomp. Bch., FL | 22,415                             | 20,600    | 43,015    | 26   | 29                      | 34   |
| Lrg              | Columbus, OH                         | 13,230                             | 16,270    | 29,500    | 33   | 29                      | 34   |
| Med              | Providence-Pawtucket, RI-MA          | 9,570                              | 16,085    | 25,655    | 39   | 28                      | 36   |
| Med              | Tacoma, WA                           | 7,985                              | 8,210     | 16,195    | 49   | 27                      | 37   |
| Vlg              | Philadelphia, PA-NJ                  | 45,660                             | 71,445    | 117,105   | 10   | 26                      | 38   |
| Lrg              | San Antonio, TX                      | 17,915                             | 11,570    | 29,485    | 34   | 24                      | 39   |
| Lrg              | Norfolk, VA                          | 9,560                              | 15,415    | 24,975    | 42   | 24                      | 39   |
| Lrg              | Kansas City, MO-KS                   | 11,035                             | 21,630    | 32,665    | 30   | 24                      | 39   |
| Med              | Tucson, AZ                           | 7,245                              | 8,460     | 15,705    | 50   | 23                      | 42   |
| Med              | Memphis, TN-AR-MS                    | 8,665                              | 12,580    | 21,245    | 43   | 22                      | 43   |
| Lrg              | Milwaukee, WI                        | 14,190                             | 13,615    | 27,805    | 36   | 22                      | 43   |
| Lrg              | Las Vegas, NV                        | 14,005                             | 12,260    | 26,265    | 38   | 21                      | 45   |
| Sml              | Colorado Springs, CO                 | 3,345                              | 5,410     | 8,755     | 56   | 20                      | 46   |
| Lrg              | Cleveland, OH                        | 16,490                             | 20,370    | 36,860    | 29   | 20                      | 46   |
| Med              | Omaha, NE-IA                         | 4,860                              | 6,575     | 11,435    | 53   | 19                      | 48   |
| Med              | Honolulu, HI                         | 6,975                              | 6,445     | 13,420    | 51   | 19                      | 48   |
| Med              | Hartford-Middletown, CT              | 4,305                              | 7,675     | 11,980    | 52   | 19                      | 48   |
| Med              | Salt Lake City, UT                   | 7,790                              | 8,570     | 16,360    | 48   | 18                      | 51   |
| Med              | Fresno, CA                           | 4,125                              | 5,855     | 9,980     | 54   | 18                      | 51   |
| Lrg              | New Orleans, LA                      | 9,470                              | 10,420    | 19,890    | 45   | 18                      | 51   |
| Lrg              | Oklahoma City, OK                    | 6,540                              | 10,650    | 17,190    | 47   | 17                      | 54   |
| Med              | El Paso, TX-NM                       | 4,130                              | 5,225     | 9,355     | 55   | 14                      | 55   |
| Lrg              | Pittsburgh, PA                       | 10,015                             | 15,380    | 25,395    | 41   | 14                      | 55   |
| Sml              | Salem, OR                            | 1,030                              | 1,605     | 2,635     | 61   | 14                      | 55   |
| Med              | Albany-Schenectady-Troy, NY          | 2,165                              | 2,945     | 5,110     | 58   | 10                      | 58   |
| Sml              | Spokane, WA                          | 1,315                              | 1,930     | 3,245     | 60   | 10                      | 58   |
| Sml              | Eugene-Springfield, OR               | 860                                | 1,260     | 2,120     | 64   | 10                      | 58   |
| Sml              | Beaumont, TX                         | 535                                | 815       | 1,350     | 65   | 9                       | 61   |
| Lrg              | Buffalo-Niagara Falls, NY            | 2,980                              | 5,380     | 8,360     | 57   | 8                       | 62   |
| Med              | Rochester, NY                        | 1,555                              | 3,230     | 4,785     | 59   | 8                       | 62   |
| Sml              | Corpus Christi, TX                   | 740                                | 1,465     | 2,205     | 63   | 7                       | 64   |
| Sml              | Bakersfield, CA                      | 975                                | 1,355     | 2,330     | 62   | 6                       | 65   |
| Sml              | Laredo, TX                           | 450                                | 515       | 965       | 66   | 5                       | 66   |
| Sml              | Boulder, CO                          | 275                                | 315       | 590       | 67   | 5                       | 66   |
| Sml              | Brownsville, TX                      | 230                                | 260       | 490       | 68   | 3                       | 68   |
|                  | 68 area total                        | 2,063,930                          | 2,419,300 | 4,483,240 |      |                         |      |
|                  | 68 area average                      | 30,350                             | 35,580    | 65,930    |      | 36                      |      |
|                  | Very large area average              | 123,050                            | 148,260   | 271,320   |      | 41                      |      |
|                  | Large area average                   | 26,540                             | 29,230    | 55,780    |      | 34                      |      |
|                  | Medium area average                  | 7,910                              | 10,150    | 18,070    |      | 26                      |      |
|                  | Small area average                   | 970                                | 1,490     | 2,470     |      | 10                      |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
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Med – Medium urban areas—over 500,000 and less than 1 million population.  
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**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-7. Wasted Fuel in 1999

| Population Group | Urban Area                          | Annual Gallons of Fuel Wasted (million) |                |       |      | Annual Excess Fuel Consumed per Person (gallons) |      |
|------------------|-------------------------------------|---|----------------|-------|------|--|------|
|                  |                                     | Recurring Delay                         | Incident Delay | Total | Rank | Person (gallons)                                 | Rank |
| Vlg              | Los Angeles, CA                     | 524                                     | 540            | 1,064 | 1    | 84   | 1    |
| Vlg              | New York, NY-Northeastern, NJ       | 312                                     | 548            | 860   | 2    | 52   | 25   |
| Vlg              | Chicago, IL-Northwestern, IN        | 202                                     | 201            | 403   | 3    | 50   | 28   |
| Vlg              | San Francisco-Oakland, CA           | 141                                     | 122            | 263   | 4    | 65   | 10   |
| Vlg              | Detroit, MI                         | 110                                     | 138            | 248   | 5    | 62   | 14   |
| Vlg              | Washington, DC-MD-VA                | 125                                     | 117            | 242   | 6    | 69   | 7    |
| Lrg              | Atlanta, GA                         | 114                                     | 125            | 239   | 7    | 84   | 1    |
| Vlg              | Houston, TX                         | 104                                     | 135            | 239   | 7    | 76   | 4    |
| Vlg              | Boston, MA                          | 84                                      | 105            | 189   | 9    | 63   | 13   |
| Vlg              | Philadelphia, PA-NJ                 | 68                                      | 107            | 175   | 10   | 38   | 38   |
| Lrg              | Dallas, TX                          | 78                                      | 90             | 168   | 11   | 70   | 6    |
| Lrg              | Seattle-Everett, WA                 | 77                                      | 85             | 162   | 12   | 81   | 3    |
| Lrg              | San Diego, CA                       | 88                                      | 70             | 158   | 13   | 59   | 18   |
| Lrg              | Minneapolis-St. Paul, MN            | 61                                      | 80             | 141   | 14   | 61   | 15   |
| Lrg              | St. Louis, MO-IL                    | 61                                      | 74             | 135   | 15   | 67   | 8    |
| Lrg              | Miami-Hialeah, FL                   | 60                                      | 68             | 128   | 16   | 61   | 15   |
| Lrg              | Denver, CO                          | 59                                      | 65             | 124   | 17   | 67   | 8    |
| Lrg              | Phoenix, AZ                         | 62                                      | 58             | 120   | 18   | 47   | 32   |
| Lrg              | San Jose, CA                        | 50                                      | 58             | 108   | 19   | 65   | 10   |
| Lrg              | Baltimore, MD                       | 46                                      | 57             | 103   | 20   | 48   | 31   |
| Lrg              | San Bernardino-Riverside, CA        | 46                                      | 37             | 83    | 21   | 59   | 18   |
| Lrg              | Portland-Vancouver, OR-WA           | 38                                      | 41             | 79    | 22   | 53   | 22   |
| Lrg              | Sacramento, CA                      | 35                                      | 37             | 72    | 23   | 53   | 22   |
| Lrg              | Fort Worth, TX                      | 34                                      | 36             | 70    | 24   | 51   | 26   |
| Lrg              | Orlando, FL                         | 32                                      | 36             | 68    | 25   | 61   | 15   |
| Lrg              | Cincinnati, OH-KY                   | 30                                      | 38             | 68    | 25   | 53   | 22   |
| Lrg              | Ft. Lauderdale-Hwood-Pomp. Bch., FL | 34                                      | 31             | 65    | 27   | 44   | 35   |
| Lrg              | Cleveland, OH                       | 27                                      | 33             | 60    | 28   | 32   | 45   |
| Lrg              | Indianapolis, IN                    | 28                                      | 30             | 58    | 29   | 57   | 20   |
| Lrg              | Kansas City, MO-KS                  | 17                                      | 34             | 51    | 30   | 37   | 40   |
| Med              | Louisville, KY-IN                   | 21                                      | 27             | 48    | 31   | 57   | 20   |
| Lrg              | Columbus, OH                        | 21                                      | 26             | 47    | 32   | 46   | 33   |
| Med              | Austin, TX                          | 20                                      | 26             | 46    | 33   | 71   | 5    |
| Lrg              | San Antonio, TX                     | 28                                      | 18             | 46    | 33   | 37   | 40   |
| Med              | Tampa, FL                           | 20                                      | 24             | 44    | 35   | 50   | 28   |
| Lrg              | Milwaukee, WI                       | 22                                      | 21             | 43    | 36   | 34   | 42   |
| Med              | Nashville, TN                       | 17                                      | 24             | 41    | 37   | 64   | 12   |
| Med              | Providence-Pawtucket, RI-MA         | 15                                      | 25             | 40    | 38   | 44   | 35   |
| Med              | Jacksonville, FL                    | 18                                      | 21             | 39    | 39   | 46   | 33   |
| Lrg              | Norfolk, VA                         | 15                                      | 24             | 39    | 39   | 38   | 38   |
| Lrg              | Las Vegas, NV                       | 21                                      | 18             | 39    | 39   | 31   | 46   |
| Lrg              | Pittsburgh, PA                      | 15                                      | 22             | 37    | 42   | 21   | 56   |
| Med              | Charlotte, NC                       | 16                                      | 16             | 32    | 43   | 51   | 26   |
| Med              | Memphis, TN-AR-MS                   | 13                                      | 19             | 32    | 43   | 33   | 43   |
| Lrg              | New Orleans, LA                     | 14                                      | 15             | 29    | 45   | 26   | 53   |
| Med              | Albuquerque, NM                     | 13                                      | 15             | 28    | 46   | 50   | 28   |
| Lrg              | Oklahoma City, OK                   | 11                                      | 17             | 28    | 46   | 27   | 52   |
| Med              | Tacoma, WA                          | 13                                      | 13             | 26    | 48   | 43   | 37   |
| Med              | Salt Lake City, UT                  | 12                                      | 14             | 26    | 48   | 29   | 50   |
| Med              | Tucson, AZ                          | 10                                      | 12             | 22    | 50   | 33   | 43   |
| Med              | Honolulu, HI                        | 11                                      | 10             | 21    | 51   | 30   | 47   |
| Med              | Hartford-Middletown, CT             | 7                                       | 12             | 19    | 52   | 30   | 47   |
| Med              | Omaha, NE-IA                        | 7                                       | 10             | 17    | 53   | 29   | 50   |
| Med              | Fresno, CA                          | 6                                       | 8              | 14    | 54   | 25   | 54   |
| Med              | El Paso, TX-NM                      | 6                                       | 8              | 14    | 54   | 22   | 55   |
| Sml              | Colorado Springs, CO                | 5                                       | 8              | 13    | 56   | 30   | 47   |
| Lrg              | Buffalo-Niagara Falls, NY           | 5                                       | 8              | 13    | 56   | 12   | 63   |
| Med              | Rochester, NY                       | 3                                       | 5              | 8     | 58   | 13   | 62   |
| Med              | Albany-Schenectady-Troy, NY         | 3                                       | 4              | 7     | 59   | 14   | 59   |
| Sml              | Spokane, WA                         | 2                                       | 3              | 5     | 60   | 15   | 58   |
| Sml              | Salem, OR                           | 2                                       | 2              | 4     | 61   | 21   | 56   |
| Sml              | Eugene-Springfield, OR              | 1                                       | 2              | 3     | 62   | 14   | 59   |
| Sml              | Corpus Christi, TX                  | 1                                       | 2              | 3     | 62   | 10   | 65   |
| Sml              | Bakersfield, CA                     | 1                                       | 2              | 3     | 62   | 8  | 66   |
| Sml              | Beaumont, TX                        | 1                                       | 1              | 2     | 65   | 14   | 59   |
| Sml              | Laredo, TX                          | 1                                       | 1              | 2     | 65   | 11   | 64   |
| Sml              | Boulder, CO                         | 0                                       | 0              | 0     | 67   | 0  | 67   |
| Sml              | Brownsville, TX                     | 0                                       | 0              | 0     | 67   | 0  | 67   |
|                  | 68 area total                       | 3,140                                   | 3,680          | 6,820 |      |  |      |
|                  | 68 area average                     | 45                                      | 55             | 100   |      | 55   |      |
|                  | Very large area average             | 185                                     | 225            | 410   |      | 62   |      |
|                  | Large area average                  | 40                                      | 45             | 85    |      | 52   |      |
|                  | Medium area average                 | 13                                      | 15             | 28    |      | 39   |      |
|                  | Small area average                  | 2                                       | 2              | 4     |      | 14   |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-8. 1999 Annual Congestion Cost

| Population Group | Urban Area                          | Annual Cost Due to Congestion (\$ millions) |       |        | Rank |
|------------------|-------------------------------------|---|-------|--------|------|
|                  |                                     | Delay                                       | Fuel  | Total  |      |
| Vlg              | Los Angeles, CA                     | 10,880                                      | 1,690 | 12,570 | 1    |
| Vlg              | New York, NY-Northeastern, NJ       | 8,720                                       | 1,025 | 9,745  | 2    |
| Vlg              | Chicago, IL-Northwestern, IN        | 4,135                                       | 470   | 4,605  | 3    |
| Vlg              | San Francisco-Oakland, CA           | 2,635                                       | 420   | 3,055  | 4    |
| Vlg              | Detroit, MI                         | 2,530                                       | 280   | 2,810  | 5    |
| Vlg              | Washington, DC-MD-VA                | 2,460                                       | 270   | 2,730  | 6    |
| Vlg              | Houston, TX                         | 2,410                                       | 255   | 2,665  | 7    |
| Lrg              | Atlanta, GA                         | 2,385                                       | 235   | 2,620  | 8    |
| Vlg              | Boston, MA                          | 1,940                                       | 215   | 2,155  | 9    |
| Vlg              | Philadelphia, PA-NJ                 | 1,795                                       | 195   | 1,990  | 10   |
| Lrg              | Dallas, TX                          | 1,685                                       | 180   | 1,865  | 11   |
| Lrg              | Seattle-Everett, WA                 | 1,630                                       | 230   | 1,860  | 12   |
| Lrg              | San Diego, CA                       | 1,570                                       | 250   | 1,820  | 13   |
| Lrg              | Minneapolis-St. Paul, MN            | 1,405                                       | 160   | 1,565  | 14   |
| Lrg              | St. Louis, MO-IL                    | 1,355                                       | 140   | 1,495  | 15   |
| Lrg              | Miami-Hialeah, FL                   | 1,335                                       | 150   | 1,485  | 16   |
| Lrg              | Denver, CO                          | 1,270                                       | 145   | 1,415  | 17   |
| Lrg              | Phoenix, AZ                         | 1,220                                       | 165   | 1,385  | 18   |
| Lrg              | San Jose, CA                        | 1,080                                       | 170   | 1,250  | 19   |
| Lrg              | Baltimore, MD                       | 1,035                                       | 115   | 1,150  | 20   |
| Lrg              | San Bernardino-Riverside, CA        | 830   | 135   | 965    | 21   |
| Lrg              | Portland-Vancouver, OR-WA           | 795   | 115   | 910    | 22   |
| Lrg              | Sacramento, CA                      | 715   | 115   | 830    | 23   |
| Lrg              | Orlando, FL                         | 715   | 75    | 790    | 24   |
| Lrg              | Fort Worth, TX                      | 705   | 75    | 780    | 25   |
| Lrg              | Cincinnati, OH-KY                   | 655   | 80    | 735    | 26   |
| Lrg              | Ft. Lauderdale-Hwood-Pomp. Bch., FL | 660   | 75    | 735    | 26   |
| Lrg              | Cleveland, OH                       | 585   | 70    | 655    | 28   |
| Lrg              | Indianapolis, IN                    | 585   | 60    | 645    | 29   |
| Lrg              | Kansas City, MO-KS                  | 515   | 55    | 570    | 30   |
| Med              | Louisville, KY-IN                   | 480   | 50    | 530    | 31   |
| Med              | Tampa, FL                           | 465   | 55    | 520    | 32   |
| Lrg              | Columbus, OH                        | 460   | 55    | 515    | 33   |
| Med              | Austin, TX                          | 460   | 50    | 510    | 34   |
| Lrg              | San Antonio, TX                     | 460   | 50    | 510    | 34   |
| Lrg              | Milwaukee, WI                       | 430   | 50    | 480    | 36   |
| Lrg              | Las Vegas, NV                       | 400   | 65    | 465    | 37   |
| Med              | Nashville, TN                       | 410   | 45    | 455    | 38   |
| Med              | Providence-Pawtucket, RI-MA         | 400   | 45    | 445    | 39   |
| Med              | Jacksonville, FL                    | 395   | 45    | 440    | 40   |
| Lrg              | Norfolk, VA                         | 390   | 40    | 430    | 41   |
| Lrg              | Pittsburgh, PA                      | 380   | 40    | 420    | 42   |
| Med              | Memphis, TN-AR-MS                   | 330   | 35    | 365    | 43   |
| Med              | Charlotte, NC                       | 315   | 30    | 345    | 44   |
| Lrg              | New Orleans, LA                     | 305   | 30    | 335    | 45   |
| Med              | Albuquerque, NM                     | 290   | 35    | 325    | 46   |
| Lrg              | Oklahoma City, OK                   | 275   | 30    | 305    | 47   |
| Med              | Tacoma, WA                          | 255   | 40    | 295    | 48   |
| Med              | Salt Lake City, UT                  | 255   | 30    | 285    | 49   |
| Med              | Tucson, AZ                          | 235   | 30    | 265    | 50   |
| Med              | Honolulu, HI                        | 210   | 30    | 240    | 51   |
| Med              | Hartford-Middletown, CT             | 190   | 25    | 215    | 52   |
| Med              | Omaha, NE-IA                        | 175   | 20    | 195    | 53   |
| Med              | Fresno, CA                          | 145   | 25    | 170    | 54   |
| Med              | El Paso, TX-NM                      | 145   | 15    | 160    | 55   |
| Sml              | Colorado Springs, CO                | 130   | 15    | 145    | 56   |
| Lrg              | Buffalo-Niagara Falls, NY           | 130   | 15    | 145    | 56   |
| Med              | Albany-Schenectady-Troy, NY         | 80  | 10    | 90     | 58   |
| Med              | Rochester, NY                       | 75  | 10    | 85     | 59   |
| Sml              | Spokane, WA                         | 50  | 10    | 60     | 60   |
| Sml              | Salem, OR                           | 40  | 5     | 45     | 61   |
| Sml              | Eugene-Springfield, OR              | 35  | 5     | 40     | 62   |
| Sml              | Bakersfield, CA                     | 35  | 5     | 40     | 62   |
| Sml              | Corpus Christi, TX                  | 35  | 0     | 35     | 64   |
| Sml              | Beaumont, TX                        | 25  | 0     | 25     | 65   |
| Sml              | Laredo, TX                          | 15  | 0     | 15     | 66   |
| Sml              | Boulder, CO                         | 10  | 0     | 10     | 67   |
| Sml              | Brownsville, TX                     | 10  | 0     | 10     | 67   |
|                  | 68 total                            | 69,155                                      | 8,635 | 77,790 |      |
|                  | 68 area average                     | 1,020                                       | 125   | 1,145  |      |
|                  | Very large area average             | 4,170                                       | 530   | 4,700  |      |
|                  | Large area average                  | 865   | 105   | 970    |      |
|                  | Medium area average                 | 280   | 35    | 315    |      |
|                  | Small area average                  | 39  | 4     | 43     |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.



**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-9. Cost of Congestion

| Population Group | Urban Area                          | Annual Cost Due to Congestion (\$ millions) |                 |        |       | Annual Congestion Cost per Person |      |
|------------------|-------------------------------------|---|-----------------|--------|-------|-----------------------------------|------|
|                  |                                     | Delay                                       | Fuel            | Total  | Rank  | \$                                | Rank |
|                  |                                     | Vlg   | Los Angeles, CA | 10,880 | 1,690 | 12,570                            | 1    |
| Vlg              | New York, NY-Northeastern, NJ       | 8,720                                       | 1,025           | 9,745  | 2     | 595                               | 24   |
| Vlg              | Chicago, IL-Northwestern, IN        | 4,135                                       | 470             | 4,605  | 3     | 570                               | 28   |
| Vlg              | San Francisco-Oakland, CA           | 2,635                                       | 420             | 3,055  | 4     | 760                               | 8    |
| Vlg              | Detroit, MI                         | 2,530                                       | 280             | 2,810  | 5     | 700                               | 16   |
| Vlg              | Washington, DC-MD-VA                | 2,460                                       | 270             | 2,730  | 6     | 780                               | 6    |
| Vlg              | Houston, TX                         | 2,410                                       | 255             | 2,665  | 7     | 850                               | 4    |
| Lrg              | Atlanta, GA                         | 2,385                                       | 235             | 2,620  | 8     | 915                               | 3    |
| Vlg              | Boston, MA                          | 1,940                                       | 215             | 2,155  | 9     | 715                               | 12   |
| Vlg              | Philadelphia, PA-NJ                 | 1,795                                       | 195             | 1,990  | 10    | 435                               | 38   |
| Lrg              | Dallas, TX                          | 1,685                                       | 180             | 1,865  | 11    | 780                               | 6    |
| Lrg              | Seattle-Everett, WA                 | 1,630                                       | 230             | 1,860  | 12    | 930                               | 2    |
| Lrg              | San Diego, CA                       | 1,570                                       | 250             | 1,820  | 13    | 675                               | 18   |
| Lrg              | Minneapolis-St. Paul, MN            | 1,405                                       | 160             | 1,565  | 14    | 670                               | 19   |
| Lrg              | St. Louis, MO-IL                    | 1,355                                       | 140             | 1,495  | 15    | 745                               | 11   |
| Lrg              | Miami-Hialeah, FL                   | 1,335                                       | 150             | 1,485  | 16    | 705                               | 14   |
| Lrg              | Denver, CO                          | 1,270                                       | 145             | 1,415  | 17    | 760                               | 8    |
| Lrg              | Phoenix, AZ                         | 1,220                                       | 165             | 1,385  | 18    | 540                               | 31   |
| Lrg              | San Jose, CA                        | 1,080                                       | 170             | 1,250  | 19    | 750                               | 10   |
| Lrg              | Baltimore, MD                       | 1,035                                       | 115             | 1,150  | 20    | 530                               | 32   |
| Lrg              | San Bernardino-Riverside, CA        | 830   | 135             | 965    | 21    | 685                               | 17   |
| Lrg              | Portland-Vancouver, OR-WA           | 795   | 115             | 910    | 22    | 610                               | 22   |
| Lrg              | Sacramento, CA                      | 715   | 115             | 830    | 23    | 605                               | 23   |
| Lrg              | Orlando, FL                         | 715   | 75              | 790    | 24    | 705                               | 14   |
| Lrg              | Fort Worth, TX                      | 705   | 75              | 780    | 25    | 570                               | 28   |
| Lrg              | Cincinnati, OH-KY                   | 655   | 80              | 735    | 26    | 575                               | 26   |
| Lrg              | Ft. Lauderdale-Hwood-Pomp. Bch., FL | 660   | 75              | 735    | 26    | 500                               | 34   |
| Lrg              | Cleveland, OH                       | 585   | 70              | 655    | 28    | 350                               | 46   |
| Lrg              | Indianapolis, IN                    | 585   | 60              | 645    | 29    | 635                               | 20   |
| Lrg              | Kansas City, MO-KS                  | 515   | 55              | 570    | 30    | 410                               | 40   |
| Med              | Louisville, KY-IN                   | 480   | 50              | 530    | 31    | 635                               | 20   |
| Med              | Tampa, FL                           | 465   | 55              | 520    | 32    | 590                               | 25   |
| Lrg              | Columbus, OH                        | 460   | 55              | 515    | 33    | 500                               | 34   |
| Med              | Austin, TX                          | 460   | 50              | 510    | 34    | 785                               | 5    |
| Lrg              | San Antonio, TX                     | 460   | 50              | 510    | 34    | 410                               | 40   |
| Lrg              | Milwaukee, WI                       | 430   | 50              | 480    | 36    | 380                               | 43   |
| Lrg              | Las Vegas, NV                       | 400   | 65              | 465    | 37    | 370                               | 45   |
| Med              | Nashville, TN                       | 410   | 45              | 455    | 38    | 710                               | 13   |
| Med              | Providence-Pawtucket, RI-MA         | 400   | 45              | 445    | 39    | 490                               | 36   |
| Med              | Jacksonville, FL                    | 395   | 45              | 440    | 40    | 520                               | 33   |
| Lrg              | Norfolk, VA                         | 390   | 40              | 430    | 41    | 415                               | 39   |
| Lrg              | Pittsburgh, PA                      | 380   | 40              | 420    | 42    | 235                               | 56   |
| Med              | Memphis, TN-AR-MS                   | 330   | 35              | 365    | 43    | 375                               | 44   |
| Med              | Charlotte, NC                       | 315   | 30              | 345    | 44    | 550                               | 30   |
| Lrg              | New Orleans, LA                     | 305   | 30              | 335    | 45    | 305                               | 53   |
| Med              | Albuquerque, NM                     | 290   | 35              | 325    | 46    | 575                               | 26   |
| Lrg              | Oklahoma City, OK                   | 275   | 30              | 305    | 47    | 295                               | 54   |
| Med              | Tacoma, WA                          | 255   | 40              | 295    | 48    | 490                               | 36   |
| Med              | Salt Lake City, UT                  | 255   | 30              | 285    | 49    | 320                               | 51   |
| Med              | Tucson, AZ                          | 235   | 30              | 265    | 50    | 395                               | 42   |
| Med              | Honolulu, HI                        | 210   | 30              | 240    | 51    | 345                               | 47   |
| Med              | Hartford-Middletown, CT             | 190   | 25              | 215    | 52    | 335                               | 48   |
| Med              | Omaha, NE-IA                        | 175   | 20              | 195    | 53    | 330                               | 49   |
| Med              | Fresno, CA                          | 145   | 25              | 170    | 54    | 310                               | 52   |
| Med              | El Paso, TX-NM                      | 145   | 15              | 160    | 55    | 245                               | 55   |
| Lrg              | Buffalo-Niagara Falls, NY           | 130   | 15              | 145    | 56    | 135                               | 62   |
| Sml              | Colorado Springs, CO                | 130   | 15              | 145    | 56    | 330                               | 49   |
| Med              | Albany-Schenectady-Troy, NY         | 80  | 10              | 90     | 58    | 180                               | 58   |
| Med              | Rochester, NY                       | 75  | 10              | 85     | 59    | 135                               | 62   |
| Sml              | Spokane, WA                         | 50  | 10              | 60     | 60    | 180                               | 58   |
| Sml              | Salem, OR                           | 40  | 5               | 45     | 61    | 235                               | 56   |
| Sml              | Bakersfield, CA                     | 35  | 5               | 40     | 62    | 105                               | 65   |
| Sml              | Eugene-Springfield, OR              | 35  | 5               | 40     | 62    | 180                               | 58   |
| Sml              | Corpus Christi, TX                  | 35  | 0               | 35     | 64    | 110                               | 64   |
| Sml              | Beaumont, TX                        | 25  | 0               | 25     | 65    | 170                               | 61   |
| Sml              | Laredo, TX                          | 15  | 0               | 15     | 66    | 85                                | 66   |
| Sml              | Boulder, CO                         | 10  | 0               | 10     | 67    | 85                                | 66   |
| Sml              | Brownsville, TX                     | 10  | 0               | 10     | 67    | 65                                | 68   |
|                  | 68 total                            | 69,155                                      | 8,635           | 77,790 |       |                                   |      |
|                  | 68 area average                     | 1,020                                       | 125             | 1,145  |       | 625                               |      |
|                  | Very large area average             | 4,170                                       | 530             | 4,700  |       | 710                               |      |
|                  | Large area average                  | 865   | 105             | 970    |       | 590                               |      |
|                  | Medium area average                 | 280   | 35              | 315    |       | 445                               |      |
|                  | Small area average                  | 39  | 4               | 43     |       | 170                               |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
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Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-10. 1999 Annual Individual Congestion Cost

| Population Group | Urban Area                         | Annual Congestion Cost |      |
|------------------|------------------------------------|------------------------|------|
|                  |                                    | Per Person (dollars)   | Rank |
| Vlg              | Los Angeles, CA                    | 1,000                  | 1    |
| Lrg              | Seattle-Everett, WA                | 930                    | 2    |
| Lrg              | Atlanta, GA                        | 915                    | 3    |
| Vlg              | Houston, TX                        | 850                    | 4    |
| Med              | Austin, TX                         | 785                    | 5    |
| Vlg              | Washington, DC-MD-VA               | 780                    | 6    |
| Lrg              | Dallas, TX                         | 780                    | 6    |
| Vlg              | San Francisco-Oakland, CA          | 760                    | 8    |
| Lrg              | Denver, CO                         | 760                    | 8    |
| Lrg              | San Jose, CA                       | 750                    | 10   |
| Lrg              | St. Louis, MO-IL                   | 745                    | 11   |
| Vlg              | Boston, MA                         | 715                    | 12   |
| Med              | Nashville, TN                      | 710                    | 13   |
| Lrg              | Miami-Hialeah, FL                  | 705                    | 14   |
| Lrg              | Orlando, FL                        | 705                    | 14   |
| Vlg              | Detroit, MI                        | 700                    | 16   |
| Lrg              | San Bernardino-Riverside, CA       | 685                    | 17   |
| Lrg              | San Diego, CA                      | 675                    | 18   |
| Lrg              | Minneapolis-St. Paul, MN           | 670                    | 19   |
| Lrg              | Indianapolis, IN                   | 635                    | 20   |
| Med              | Louisville, KY-IN                  | 635                    | 20   |
| Lrg              | Portland-Vancouver, OR-WA          | 610                    | 22   |
| Lrg              | Sacramento, CA                     | 605                    | 23   |
| Vlg              | New York, NY-Northeastern, NJ      | 595                    | 24   |
| Med              | Tampa, FL                          | 590                    | 25   |
| Lrg              | Cincinnati, OH-KY                  | 575                    | 26   |
| Med              | Albuquerque, NM                    | 575                    | 26   |
| Vlg              | Chicago, IL-Northwestern, IN       | 570                    | 28   |
| Lrg              | Fort Worth, TX                     | 570                    | 28   |
| Med              | Charlotte, NC                      | 550                    | 30   |
| Lrg              | Phoenix, AZ                        | 540                    | 31   |
| Lrg              | Baltimore, MD                      | 530                    | 32   |
| Med              | Jacksonville, FL                   | 520                    | 33   |
| Lrg              | Ft. Lauderdale-Hood-Pomp. Bch., FL | 500                    | 34   |
| Lrg              | Columbus, OH                       | 500                    | 34   |
| Med              | Providence-Pawtucket, RI-MA        | 490                    | 36   |
| Med              | Tacoma, WA                         | 490                    | 36   |
| Vlg              | Philadelphia, PA-NJ                | 435                    | 38   |
| Lrg              | Norfolk, VA                        | 415                    | 39   |
| Lrg              | Kansas City, MO-KS                 | 410                    | 40   |
| Lrg              | San Antonio, TX                    | 410                    | 40   |
| Med              | Tucson, AZ                         | 395                    | 42   |
| Lrg              | Milwaukee, WI                      | 380                    | 43   |
| Med              | Memphis, TN-AR-MS                  | 375                    | 44   |
| Lrg              | Las Vegas, NV                      | 370                    | 45   |
| Lrg              | Cleveland, OH                      | 350                    | 46   |
| Med              | Honolulu, HI                       | 345                    | 47   |
| Med              | Hartford-Middletown, CT            | 335                    | 48   |
| Med              | Omaha, NE-IA                       | 330                    | 49   |
| Sml              | Colorado Springs, CO               | 330                    | 49   |
| Med              | Salt Lake City, UT                 | 320                    | 51   |
| Med              | Fresno, CA                         | 310                    | 52   |
| Lrg              | New Orleans, LA                    | 305                    | 53   |
| Lrg              | Oklahoma City, OK                  | 295                    | 54   |
| Med              | El Paso, TX-NM                     | 245                    | 55   |
| Lrg              | Pittsburgh, PA                     | 235                    | 56   |
| Sml              | Salem, OR                          | 235                    | 56   |
| Med              | Albany-Schenectady-Troy, NY        | 180                    | 58   |
| Sml              | Spokane, WA                        | 180                    | 58   |
| Sml              | Eugene-Springfield, OR             | 180                    | 58   |
| Sml              | Beaumont, TX                       | 170                    | 61   |
| Lrg              | Buffalo-Niagara Falls, NY          | 135                    | 62   |
| Med              | Rochester, NY                      | 135                    | 62   |
| Sml              | Corpus Christi, TX                 | 110                    | 64   |
| Sml              | Bakersfield, CA                    | 105                    | 65   |
| Sml              | Laredo, TX                         | 85                     | 66   |
| Sml              | Boulder, CO                        | 85                     | 66   |
| Sml              | Brownsville, TX                    | 65                     | 68   |
|                  | 68 area average                    | 625                    |      |
|                  | Very large area average            | 710                    |      |
|                  | Large area average                 | 590                    |      |
|                  | Medium area average                | 445                    |      |
|                  | Small area average                 | 170                    |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
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 Sml – Small urban areas—less than 500,000 population.



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Table A-11. Illustration of Annual Capacity Increase Required to Prevent Congestion Growth

| Population Growth | Urban Area                           | Average Annual VMT Growth (%) <sup>1</sup> | Annual Lane-Miles Needed |       | Lane-Mile "Deficiency" |       | 1999   | 1999   |
|-------------------|--------------------------------------|--|--------------------------|-------|------------------------|-------|--------|--------|
|                   |                                      |  | Freeway                  | PAS   | Freeway                | PAS   | Travel | Travel |
|                   |                                      |  |                          |       |                        |       | Rate   | Time   |
|                   |                                      |  |                          |       |                        |       | Index  | Index  |
| Vlg               | New York, NY-Northeastern, NJ        | 2.9  | 192                      | 213   | 162                    | 173   | 1.32   | 1.70   |
| Vlg               | Chicago, IL-Northwestern, IN         | 2.4  | 64                       | 135   | 56                     | 112   | 1.40   | 1.69   |
| Lrg               | Phoenix, AZ                          | 4.7  | 45                       | 143   | 1                      | 127   | 1.30   | 1.50   |
| Lrg               | Atlanta, GA                          | 3.9  | 90                       | 88    | 64                     | 44    | 1.35   | 1.63   |
| Lrg               | Dallas, TX                           | 4.0  | 84                       | 105   | 42                     | 65    | 1.27   | 1.47   |
| Lrg               | San Antonio, TX                      | 4.5  | 49                       | 41    | 45                     | 46    | 1.23   | 1.32   |
| Vlg               | Houston, TX                          | 4.2  | 102                      | 116   | 82                     | 6     | 1.33   | 1.61   |
| Vlg               | Los Angeles, CA                      | 0.8  | 45                       | 92    | 29                     | 55    | 1.55   | 2.06   |
| Lrg               | Denver, CO                           | 4.3  | 44                       | 73    | 37                     | 42    | 1.34   | 1.61   |
| Lrg               | Minneapolis-St. Paul, MN             | 3.2  | 49                       | 41    | 39                     | 35    | 1.31   | 1.58   |
| Vlg               | Philadelphia, PA-NJ                  | 1.8  | 32                       | 57    | 33                     | 36    | 1.22   | 1.44   |
| Lrg               | Kansas City, MO-KS                   | 2.9  | 50                       | 32    | 30                     | 33    | 1.10   | 1.20   |
| Lrg               | Milwaukee, WI                        | 3.9  | 24                       | 49    | 18                     | 43    | 1.24   | 1.40   |
| Vlg               | Boston, MA                           | 1.8  | 23                       | 37    | 18                     | 35    | 1.37   | 1.71   |
| Lrg               | Fort Worth, TX                       | 5.3  | 65                       | 94    | 38                     | 12    | 1.21   | 1.34   |
| Vlg               | Detroit, MI                          | 1.1  | 20                       | 48    | 13                     | 36    | 1.31   | 1.59   |
| Lrg               | Seattle-Everett, WA                  | 2.4  | 31                       | 37    | 23                     | 24    | 1.44   | 1.81   |
| Med               | Charlotte, NC                        | 8.2  | 37                       | 41    | 16                     | 30    | 1.25   | 1.42   |
| Lrg               | San Diego, CA                        | 2.3  | 42                       | 44    | 24                     | 22    | 1.40   | 1.64   |
| Lrg               | Oklahoma City OK                     | 2.9  | 21                       | 30    | 20                     | 25    | 1.11   | 1.21   |
| Lrg               | Pittsburgh, PA                       | 1.4  | 16                       | 21    | 11                     | 32    | 1.09   | 1.16   |
| Med               | Providence-Pawtucket, RI-MA          | 3.5  | 22                       | 28    | 19                     | 24    | 1.17   | 1.33   |
| Lrg               | San Bernardino-Riverside, CA         | 1.7  | 15                       | 37    | 10                     | 31    | 1.31   | 1.50   |
| Med               | Austin, TX                           | 4.1  | 23                       | 30    | 19                     | 21    | 1.25   | 1.47   |
| Lrg               | Baltimore, MD                        | 2.0  | 29                       | 29    | 12                     | 28    | 1.25   | 1.45   |
| Lrg               | Cincinnati, OH-KY                    | 3.1  | 30                       | 26    | 25                     | 15    | 1.26   | 1.47   |
| Lrg               | Cleveland, OH                        | 2.1  | 27                       | 24    | 19                     | 21    | 1.18   | 1.31   |
| Vlg               | San Francisco-Oakland, CA            | 2.0  | 46                       | 41    | 21                     | 19    | 1.45   | 1.77   |
| Lrg               | Orlando, FL                          | 3.6  | 25                       | 55    | 18                     | 20    | 1.24   | 1.42   |
| Lrg               | St. Louis, MO-IL                     | 1.7  | 29                       | 37    | 2                      | 36    | 1.26   | 1.46   |
| Med               | Nashville, TN                        | 3.4  | 26                       | 21    | 15                     | 19    | 1.17   | 1.32   |
| Lrg               | Columbus, OH                         | 2.4  | 20                       | 14    | 18                     | 14    | 1.21   | 1.37   |
| Lrg               | Ft. Lauderdale-Hywood-Pomp. Bch., FL | 2.6  | 19                       | 36    | 17                     | 12    | 1.28   | 1.44   |
| Lrg               | Portland-Vancouver, OR-WA            | 3.0  | 21                       | 28    | 17                     | 12    | 1.36   | 1.65   |
| Med               | El Paso, TX-NM                       | 3.0  | 9                        | 22    | 8                      | 20    | 1.13   | 1.22   |
| Med               | Tucson, AZ                           | 4.6  | 8                        | 34    | 0                      | 27    | 1.21   | 1.39   |
| Sml               | Colorado Springs, CO                 | 5.0  | 11                       | 20    | 11                     | 14    | 1.15   | 1.27   |
| Lrg               | Las Vegas, NV                        | 5.4  | 22                       | 26    | 1                      | 23    | 1.35   | 1.57   |
| Lrg               | Indianapolis, IN                     | 2.0  | 14                       | 23    | 10                     | 13    | 1.25   | 1.43   |
| Med               | Louisville, KY-IN                    | 3.2  | 22                       | 21    | 13                     | 10    | 1.23   | 1.42   |
| Med               | Omaha, NE-IA                         | 3.8  | 11                       | 26    | 7                      | 15    | 1.13   | 1.23   |
| Lrg               | Buffalo-Niagara Falls, NY            | 1.6  | 10                       | 17    | 9                      | 12    | 1.06   | 1.11   |
| Med               | Fresno, CA                           | 4.5  | 8                        | 21    | 7                      | 14    | 1.16   | 1.29   |
| Lrg               | Norfolk, VA                          | 3.2  | 21                       | 21    | 9                      | 11    | 1.17   | 1.33   |
| Med               | Hartford-Middletown, CT              | 2.1  | 13                       | 9     | 12                     | 7     | 1.10   | 1.19   |
| Lrg               | San Jose, CA                         | 2.6  | 29                       | 31    | 13                     | 5     | 1.31   | 1.56   |
| Med               | Albuquerque, NM                      | 2.0  | 5                        | 18    | 5                      | 12    | 1.24   | 1.43   |
| Med               | Memphis, TN-AR-MS                    | 2.4  | 12                       | 24    | 2                      | 15    | 1.15   | 1.29   |
| Med               | Albany-Schenectady-Troy, NY          | 2.0  | 11                       | 11    | 7                      | 8     | 1.05   | 1.09   |
| Lrg               | Sacramento, CA                       | 0.8  | 5                        | 9     | 9                      | 6     | 1.31   | 1.55   |
| Med               | Tacoma, WA                           | 2.4  | 7                        | 14    | 5                      | 8     | 1.27   | 1.46   |
| Med               | Jacksonville, FL                     | 2.8  | 19                       | 30    | -15                    | 27    | 1.16   | 1.28   |
| Sml               | Laredo, TX                           | 10.6                                       | 9                        | 22    | 3                      | 8     | 1.05   | 1.09   |
| Sml               | Corpus Christi, TX                   | 1.3  | 4                        | 4     | 4                      | 6     | 1.04   | 1.07   |
| Sml               | Spokane, WA                          | 1.8  | 2                        | 10    | 1                      | 9     | 1.06   | 1.12   |
| Sml               | Eugene-Springfield, OR               | 3.9  | 4                        | 5     | 4                      | 5     | 1.08   | 1.16   |
| Sml               | Beaumont, TX                         | 7.1  | 9                        | 13    | 5                      | 3     | 1.04   | 1.08   |
| Lrg               | Miami-Hialeah, FL                    | 1.6  | 12                       | 43    | -7                     | 15    | 1.32   | 1.58   |
| Med               | Rochester, NY                        | 1.3  | 7                        | 3     | 6                      | 2     | 1.06   | 1.11   |
| Vlg               | Washington, DC-MD-VA                 | 1.5  | 28                       | 36    | 2                      | 6     | 1.42   | 1.71   |
| Sml               | Bakersfield, CA                      | 1.9  | 3                        | 11    | 3                      | 3     | 1.05   | 1.09   |
| Sml               | Salem, OR                            | 2.0  | 2                        | 6     | 1                      | 4     | 1.08   | 1.16   |
| Sml               | Boulder, CO                          | 2.9  | 1                        | 3     | 1                      | 3     | 1.05   | 1.09   |
| Sml               | Brownsville, TX                      | 2.3  | 1                        | 3     | 1                      | 2     | 1.05   | 1.09   |
| Med               | Honolulu, HI                         | 0.2  | 1                        | 0     | -1                     | 0     | 1.22   | 1.34   |
| Med               | Salt Lake City, UT                   | 0.8  | 4                        | 4     | 0                      | -1    | 1.19   | 1.34   |
| Med               | Tampa, FL                            | 3.7  | 16                       | 38    | 3                      | -5    | 1.21   | 1.38   |
| Lrg               | New Orleans, LA                      | 1.7  | 7                        | 17    | 5                      | -16   | 1.19   | 1.31   |
|                   | 68 area total                        |  | 1,800                    | 2,540 | 1,160                  | 1,600 |        |        |
|                   | 68 area average                      | 2.5  | 27                       | 37    | 17                     | 23    | 1.32   | 1.58   |
|                   | Very large area average              | 1.9  | 61                       | 86    | 46                     | 53    | 1.40   | 1.77   |
|                   | Large area average                   | 2.9  | 32                       | 42    | 19                     | 27    | 1.28   | 1.48   |
|                   | Medium area average                  | 3.0  | 14                       | 21    | 7                      | 13    | 1.18   | 1.33   |
|                   | Small area average                   | 3.3  | 5                        | 10    | 3                      | 6     | 1.07   | 1.13   |

<sup>1</sup> VMT increase includes urban area land size increases. These rates are much higher than the true vehicle travel increase rates. Represents average annual growth rate of freeway and principal arterial street travel between 1994 and 1999.

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-12. If Road Expansion Were the Only Congestion Reduction Technique

| <i>Population Group</i> | <i>1982 to 1987</i>          |   | <i>1988 to 1993</i>          |   | <i>1994 to 1999</i>          |   | <i>1982 to 1999</i>          |   |
|-------------------------|------------------------------|---|------------------------------|---|------------------------------|---|------------------------------|---|
|                         | <i>Percent Growth in VMT</i> | <i>Percent of Roadway Added<sup>1</sup></i> | <i>Percent Growth in VMT</i> | <i>Percent of Roadway Added<sup>1</sup></i> | <i>Percent Growth in VMT</i> | <i>Percent of Roadway Added<sup>1</sup></i> | <i>Percent Growth in VMT</i> | <i>Percent of Roadway Added<sup>1</sup></i> |
| 68 Area                 | 4.8                          | 42  | 3.4                          | 69  | 2.5                          | 39  | 3.6                          | 50  |
| Very Large              | 4.3                          | 46  | 2.7                          | 74  | 1.9                          | 34  | 3.0                          | 51  |
| Large                   | 5.2                          | 37  | 4.0                          | 69  | 2.9                          | 39  | 4.0                          | 49  |
| Medium                  | 5.2                          | 43  | 4/3                          | 51  | 3.0                          | 45  | 4.3                          | 45  |
| Small                   | 5.4                          | 53  | 2.6                          | 53  | 3.3                          | 39  | 3.6                          | 48  |

<sup>1</sup> Lane miles added divided by lane-miles needed.

Notes: Vlg – Very Large urban areas—over 3 million population.

Lrg – Large urban areas—over 1 million and less than 3 million population.

Med – Medium urban areas—over 500,000 and less than 1 million population.

Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-13. Illustration of Annual Occupancy Increase Needed to Prevent Mobility Decline

| Population Group | Urban Area                          | Growth in Person Travel |                  |                              | Occupancy Level to Maintain 1999 Mobility Level <sup>3</sup> |
|------------------|-------------------------------------|-------------------------|------------------|------------------------------|--|
|                  |                                     | Percent <sup>1</sup>    | Additional Miles | Estimated Trips <sup>2</sup> |  |
| Sml              | Laredo, TX                          | 10.4                    | 186,000          | 20,665                       | 1.38   |
| Med              | Charlotte, NC                       | 8.1                     | 1,065,000        | 118,335                      | 1.35   |
| Sml              | Beaumont, TX                        | 7.1                     | 223,000          | 24,780                       | 1.34   |
| Lrg              | Las Vegas, NV                       | 5.4                     | 682,000          | 75,780                       | 1.32   |
| Lrg              | Fort Worth, TX                      | 5.2                     | 1,666,000        | 185,110                      | 1.32   |
| Sml              | Colorado Springs, CO                | 4.9                     | 295,000          | 32,780                       | 1.31   |
| Lrg              | Phoenix, AZ                         | 4.7                     | 2,051,000        | 227,890                      | 1.31   |
| Lrg              | San Antonio, TX                     | 4.5                     | 1,143,000        | 127,000                      | 1.31   |
| Med              | Tucson, AZ                          | 4.5                     | 406,000          | 45,110                       | 1.31   |
| Med              | Fresno, CA                          | 4.4                     | 286,000          | 31,780                       | 1.31   |
| Lrg              | Denver, CO                          | 4.3                     | 1,575,000        | 175,000                      | 1.30   |
| Vlg              | Houston, TX                         | 4.2                     | 2,819,000        | 313,220                      | 1.30   |
| Med              | Austin, TX                          | 4.1                     | 650,000          | 72,220                       | 1.30   |
| Lrg              | Dallas, TX                          | 4.0                     | 2,315,000        | 257,220                      | 1.30   |
| Lrg              | Atlanta, GA                         | 3.9                     | 2,768,000        | 307,555                      | 1.30   |
| Sml              | Eugene-Springfield, OR              | 3.9                     | 102,000          | 11,335                       | 1.30   |
| Lrg              | Milwaukee, WI                       | 3.8                     | 768,000          | 85,335                       | 1.30   |
| Med              | Omaha, NE-IA                        | 3.8                     | 354,000          | 39,335                       | 1.30   |
| Med              | Tampa, FL                           | 3.7                     | 626,000          | 69,555                       | 1.30   |
| Lrg              | Orlando, FL                         | 3.6                     | 915,000          | 101,665                      | 1.30   |
| Med              | Providence-Pawtucket, RI-MA         | 3.5                     | 575,000          | 63,890                       | 1.29   |
| Med              | Nashville, TN                       | 3.4                     | 620,000          | 68,890                       | 1.29   |
| Med              | Louisville, KY-IN                   | 3.2                     | 574,000          | 63,780                       | 1.29   |
| Lrg              | Minneapolis-St. Paul, MN            | 3.2                     | 1,350,000        | 150,000                      | 1.29   |
| Lrg              | Norfolk, VA                         | 3.2                     | 516,000          | 57,335                       | 1.29   |
| Lrg              | Cincinnati, OH-KY                   | 3.1                     | 771,000          | 85,665                       | 1.29   |
| Med              | El Paso, TX-NM                      | 3.0                     | 275,000          | 30,555                       | 1.29   |
| Sml              | Boulder, CO                         | 2.9                     | 38,000           | 4,220                        | 1.29   |
| Lrg              | Kansas City, MO-KS                  | 2.9                     | 882,000          | 98,000                       | 1.29   |
| Vlg              | New York, NY-Northeastern, NJ       | 2.9                     | 5,708,000        | 634,220                      | 1.29   |
| Lrg              | Oklahoma City, OK                   | 2.9                     | 510,000          | 56,665                       | 1.29   |
| Lrg              | Portland-Vancouver, OR-WA           | 2.9                     | 682,000          | 75,780                       | 1.29   |
| Med              | Jacksonville, FL                    | 2.8                     | 568,000          | 63,110                       | 1.28   |
| Lrg              | Ft. Lauderdale-Hwood-Pomp. Bch., FL | 2.6                     | 650,000          | 72,220                       | 1.28   |
| Lrg              | San Jose, CA                        | 2.6                     | 865,000          | 96,110                       | 1.28   |
| Vlg              | Chicago, IL-Northwestern, IN        | 2.4                     | 2,694,000        | 299,335                      | 1.28   |
| Lrg              | Columbus, OH                        | 2.4                     | 468,000          | 52,000                       | 1.28   |
| Med              | Memphis, TN-AR-MS                   | 2.4                     | 378,000          | 42,000                       | 1.28   |
| Lrg              | Seattle-Everett, WA                 | 2.4                     | 1,000,000        | 111,110                      | 1.28   |
| Med              | Tacoma, WA                          | 2.4                     | 248,000          | 27,555                       | 1.28   |
| Sml              | Brownsville, TX                     | 2.3                     | 24,000           | 2,665                        | 1.28   |
| Lrg              | San Diego, CA                       | 2.3                     | 1,234,000        | 137,110                      | 1.28   |
| Lrg              | Cleveland, OH                       | 2.1                     | 635,000          | 70,555                       | 1.28   |
| Med              | Hartford-Middletown, CT             | 2.1                     | 276,000          | 30,665                       | 1.28   |
| Med              | Albany-Schenectady-Troy, NY         | 2.0                     | 218,000          | 24,220                       | 1.28   |
| Lrg              | Baltimore, MD                       | 2.0                     | 770,000          | 85,555                       | 1.27   |
| Sml              | Salem, OR                           | 2.0                     | 64,000           | 7,110                        | 1.28   |
| Vlg              | San Francisco-Oakland, CA           | 2.0                     | 1,497,000        | 166,335                      | 1.27   |
| Med              | Albuquerque, NM                     | 1.9                     | 210,000          | 23,335                       | 1.27   |
| Sml              | Bakersfield, CA                     | 1.9                     | 98,000           | 10,890                       | 1.27   |
| Lrg              | Indianapolis, IN                    | 1.9                     | 442,000          | 49,110                       | 1.27   |
| Vlg              | Boston, MA                          | 1.8                     | 877,000          | 97,445                       | 1.27   |
| Vlg              | Philadelphia, PA-NJ                 | 1.8                     | 1,038,000        | 115,335                      | 1.27   |
| Sml              | Spokane, WA                         | 1.8                     | 91,000           | 10,110                       | 1.27   |
| Lrg              | New Orleans, LA                     | 1.7                     | 241,000          | 26,780                       | 1.27   |
| Lrg              | San Bernardino-Riverside, CA        | 1.7                     | 580,000          | 64,445                       | 1.27   |
| Lrg              | St. Louis, MO-IL                    | 1.7                     | 778,000          | 86,445                       | 1.27   |
| Lrg              | Buffalo-Niagara Falls, NY           | 1.6                     | 222,000          | 24,665                       | 1.27   |
| Lrg              | Miami-Hialeah, FL                   | 1.6                     | 622,000          | 69,110                       | 1.27   |
| Vlg              | Washington, DC-MD-VA                | 1.5                     | 1,006,000        | 111,780                      | 1.27   |
| Sml              | Corpus Christi, TX                  | 1.3                     | 66,000           | 7,335                        | 1.27   |
| Lrg              | Pittsburgh, PA                      | 1.3                     | 350,000          | 38,890                       | 1.27   |
| Med              | Rochester, NY                       | 1.3                     | 104,000          | 11,555                       | 1.27   |
| Vlg              | Detroit, MI                         | 1.1                     | 809,000          | 89,890                       | 1.26   |
| Vlg              | Los Angeles, CA                     | 0.8                     | 2,077,000        | 230,780                      | 1.26   |
| Med              | Salt Lake City, UT                  | 0.8                     | 103,000          | 11,445                       | 1.26   |
| Lrg              | Sacramento, CA                      | 0.7                     | 174,000          | 19,335                       | 1.26   |
| Med              | Honolulu, HI                        | 0.2                     | 15,000           | 1,665                        | 1.25   |
|                  | 68 area total                       |                         | 54,888,000       | 6,098,670                    |  |
|                  | 68 area average                     | 2.5                     | 807,000          | 90,000                       | 1.29   |
|                  | Very large area average             | 1.9                     | 2,058,000        | 229,000                      | 1.28   |
|                  | Large area average                  | 2.9                     | 921,000          | 102,000                      | 1.29   |
|                  | Medium area average                 | 3.0                     | 397,000          | 44,000                       | 1.29   |
|                  | Small area average                  | 3.3                     | 119,000          | 13,000                       | 1.30   |

<sup>1</sup> VMT increase includes urban area land size increases. These rates are much higher than the true vehicle travel increase rates. Represents average annual growth rate of freeway and principal arterial street travel between 1994 and 1999.

Notes: Vlg – Very Large urban areas—over 3 million population.  
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Table A-14. Congested Lane-Miles of Roadway

| Population Group | Urban Area                        | Peak Period Percent of Lane-Miles (%) |      |      |                           |      |      |
|------------------|-----------------------------------|---------------------------------------|------|------|---------------------------|------|------|
|                  |                                   | Freeway                               |      |      | Principal Arterial Street |      |      |
|                  |                                   | 1982                                  | 1990 | 1999 | 1982                      | 1990 | 1999 |
| Lrg              | Atlanta, GA                       | 25                                    | 30   | 70   | 45                        | 60   | 70   |
| Lrg              | Baltimore, MD                     | 20                                    | 35   | 50   | 40                        | 55   | 60   |
| Lrg              | Buffalo-Niagara Falls, NY         | 5                                     | 10   | 20   | 15                        | 25   | 30   |
| Lrg              | Cincinnati, OH-KY                 | 15                                    | 40   | 55   | 25                        | 40   | 40   |
| Lrg              | Cleveland, OH                     | 5                                     | 20   | 40   | 15                        | 40   | 50   |
| Lrg              | Columbus, OH                      | 10                                    | 25   | 40   | 20                        | 45   | 70   |
| Lrg              | Dallas, TX                        | 15                                    | 40   | 50   | 15                        | 25   | 40   |
| Lrg              | Denver, CO                        | 30                                    | 40   | 55   | 40                        | 45   | 75   |
| Lrg              | Fort Worth, TX                    | 10                                    | 30   | 45   | 10                        | 20   | 30   |
| Lrg              | Ft Lauderdale-Hwood-Pomp.Bch., FL | 40                                    | 30   | 45   | 30                        | 45   | 60   |
| Lrg              | Indianapolis, IN                  | 5                                     | 20   | 55   | 20                        | 35   | 65   |
| Lrg              | Kansas City, MO-KS                | 5                                     | 10   | 25   | 20                        | 35   | 50   |
| Lrg              | Las Vegas, NV                     | 5                                     | 45   | 45   | 45                        | 60   | 80   |
| Lrg              | Miami-Hialeah, FL                 | 30                                    | 55   | 60   | 50                        | 55   | 60   |
| Lrg              | Milwaukee, WI                     | 15                                    | 40   | 55   | 30                        | 30   | 45   |
| Lrg              | Minneapolis-St Paul, MN           | 15                                    | 25   | 55   | 30                        | 50   | 60   |
| Lrg              | New Orleans, LA                   | 40                                    | 50   | 35   | 50                        | 50   | 50   |
| Lrg              | Norfolk, VA                       | 0                                     | 30   | 40   | 20                        | 35   | 50   |
| Lrg              | Oklahoma City, OK                 | 15                                    | 15   | 35   | 15                        | 20   | 35   |
| Lrg              | Orlando, FL                       | 20                                    | 45   | 40   | 40                        | 45   | 55   |
| Lrg              | Phoenix, AZ                       | 55                                    | 40   | 60   | 35                        | 50   | 60   |
| Lrg              | Pittsburgh, PA                    | 5                                     | 10   | 10   | 45                        | 50   | 55   |
| Lrg              | Portland-Vancouver, OR-WA         | 15                                    | 50   | 65   | 20                        | 25   | 60   |
| Lrg              | Sacramento, CA                    | 20                                    | 40   | 70   | 50                        | 70   | 60   |
| Lrg              | San Antonio, TX                   | 10                                    | 20   | 40   | 15                        | 25   | 45   |
| Lrg              | San Bernardino-Riverside, CA      | 25                                    | 60   | 70   | 25                        | 45   | 50   |
| Lrg              | San Diego, CA                     | 30                                    | 70   | 70   | 50                        | 65   | 60   |
| Lrg              | San Jose, CA                      | 40                                    | 50   | 55   | 55                        | 70   | 60   |
| Lrg              | Seattle-Everett, WA               | 30                                    | 75   | 70   | 30                        | 50   | 70   |
| Lrg              | St Louis, MO-IL                   | 20                                    | 25   | 50   | 30                        | 45   | 65   |
| Med              | Albany-Schenectady-Troy, NY       | 5                                     | 5    | 10   | 20                        | 40   | 55   |
| Med              | Albuquerque, NM                   | 5                                     | 25   | 55   | 30                        | 45   | 45   |
| Med              | Austin, TX                        | 15                                    | 25   | 55   | 25                        | 40   | 60   |
| Med              | Charlotte, NC                     | 10                                    | 45   | 50   | 40                        | 45   | 60   |
| Med              | El Paso, TX-NM                    | 15                                    | 25   | 35   | 15                        | 20   | 35   |
| Med              | Fresno, CA                        | 5                                     | 15   | 20   | 25                        | 50   | 60   |
| Med              | Hartford-Middletown, CT           | 15                                    | 15   | 25   | 30                        | 45   | 50   |
| Med              | Honolulu, HI                      | 15                                    | 35   | 35   | 70                        | 75   | 75   |
| Med              | Jacksonville, FL                  | 5                                     | 30   | 30   | 20                        | 40   | 50   |
| Med              | Louisville, KY-IN                 | 10                                    | 20   | 45   | 60                        | 50   | 65   |
| Med              | Memphis, TN-AR-MS                 | 5                                     | 15   | 30   | 20                        | 45   | 55   |
| Med              | Nashville, TN                     | 15                                    | 25   | 30   | 50                        | 60   | 65   |
| Med              | Omaha, NE-IA                      | 10                                    | 20   | 20   | 30                        | 45   | 55   |
| Med              | Providence-Pawtucket, RI-MA       | 10                                    | 25   | 35   | 25                        | 40   | 55   |
| Med              | Rochester, NY                     | 5                                     | 10   | 20   | 30                        | 40   | 40   |
| Med              | Salt Lake City, UT                | 10                                    | 20   | 40   | 45                        | 60   | 75   |
| Med              | Tacoma, WA                        | 20                                    | 55   | 70   | 20                        | 30   | 40   |
| Med              | Tampa, FL                         | 40                                    | 40   | 30   | 55                        | 55   | 65   |
| Med              | Tucson, AZ                        | 10                                    | 35   | 35   | 55                        | 65   | 75   |
| Sml              | Bakersfield, CA                   | 5                                     | 5    | 20   | 10                        | 25   | 20   |
| Sml              | Beaumont, TX                      | 5                                     | 5    | 10   | 25                        | 20   | 30   |
| Sml              | Boulder, CO                       | 5                                     | 5    | 5    | 10                        | 25   | 65   |
| Sml              | Brownsville, TX                   | 0                                     | 5    | 5    | 15                        | 25   | 45   |
| Sml              | Colorado Springs, CO              | 5                                     | 10   | 30   | 20                        | 30   | 50   |
| Sml              | Corpus Christi, TX                | 5                                     | 5    | 10   | 20                        | 30   | 30   |
| Sml              | Eugene-Springfield, OR            | 0                                     | 0    | 15   | 35                        | 50   | 60   |
| Sml              | Laredo, TX                        | 0                                     | 5    | 5    | 15                        | 25   | 40   |
| Sml              | Salem, OR                         | 0                                     | 5    | 25   | 10                        | 20   | 35   |
| Sml              | Spokane, WA                       | 0                                     | 5    | 25   | 15                        | 20   | 30   |
| Vlg              | Boston, MA                        | 15                                    | 45   | 60   | 60                        | 70   | 75   |
| Vlg              | Chicago, IL-Northwestern, IN      | 35                                    | 55   | 65   | 50                        | 60   | 70   |
| Vlg              | Detroit, MI                       | 20                                    | 45   | 60   | 50                        | 55   | 60   |
| Vlg              | Houston, TX                       | 45                                    | 45   | 55   | 40                        | 35   | 50   |
| Vlg              | Los Angeles, CA                   | 65                                    | 85   | 85   | 0                         | 55   | 65   |
| Vlg              | New York, NY-Northeastern, NJ     | 20                                    | 40   | 50   | 40                        | 40   | 65   |
| Vlg              | Philadelphia, PA-NJ               | 15                                    | 25   | 35   | 45                        | 55   | 65   |
| Vlg              | San Francisco-Oakland, CA         | 40                                    | 70   | 75   | 45                        | 65   | 60   |
| Vlg              | Washington, DC-MD-VA              | 40                                    | 60   | 65   | 60                        | 75   | 75   |
|                  | 68 area average                   | 24                                    | 41   | 52   | 33                        | 48   | 59   |
|                  | Very large area average           | 35                                    | 55   | 63   | 36                        | 54   | 65   |
|                  | Large area average                | 18                                    | 35   | 50   | 32                        | 45   | 56   |
|                  | Medium area average               | 11                                    | 23   | 35   | 32                        | 46   | 56   |
|                  | Small area average                | 3                                     | 5    | 17   | 17                        | 26   | 35   |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-15. Congested Person-Miles of Travel

| Population Group | Urban Area                             | Peak Period Congested Percent of Person-Miles of Travel (%) |      |      |                           |      |      |
|------------------|--|---|------|------|---------------------------|------|------|
|                  |  | Freeway   |      |      | Principal Arterial Street |      |      |
|                  |  | 1982  | 1990 | 1999 | 1982                      | 1990 | 1999 |
| Lrg              | Atlanta, GA                            | 21  | 35   | 72   | 32                        | 55   | 81   |
| Lrg              | Baltimore, MD                          | 18  | 38   | 57   | 30                        | 56   | 65   |
| Lrg              | Buffalo-Niagara Falls, NY              | 4   | 10   | 17   | 12                        | 18   | 22   |
| Lrg              | Cincinnati, OH-KY                      | 14  | 40   | 63   | 23                        | 40   | 54   |
| Lrg              | Cleveland, OH                          | 7   | 18   | 47   | 14                        | 33   | 51   |
| Lrg              | Columbus, OH                           | 8   | 29   | 47   | 13                        | 36   | 68   |
| Lrg              | Dallas, TX                             | 16  | 43   | 60   | 16                        | 32   | 55   |
| Lrg              | Denver, CO                             | 27  | 43   | 70   | 39                        | 47   | 79   |
| Lrg              | Fort Worth, TX                         | 12  | 32   | 49   | 12                        | 25   | 42   |
| Lrg              | Ft Lauderdale-Hollywood-Pomp. Bch., FL | 30  | 39   | 60   | 21                        | 42   | 65   |
| Lrg              | Indianapolis, IN                       | 6   | 24   | 59   | 17                        | 27   | 68   |
| Lrg              | Kansas City, MO-KS                     | 3   | 8    | 25   | 10                        | 19   | 42   |
| Lrg              | Las Vegas, NV                          | 7   | 62   | 65   | 28                        | 66   | 83   |
| Lrg              | Miami-Hialeah, FL                      | 34  | 65   | 71   | 49                        | 70   | 71   |
| Lrg              | Milwaukee, WI                          | 14  | 43   | 64   | 21                        | 32   | 51   |
| Lrg              | Minneapolis-St Paul, MN                | 11  | 27   | 65   | 20                        | 45   | 70   |
| Lrg              | New Orleans, LA                        | 40  | 52   | 40   | 50                        | 52   | 55   |
| Lrg              | Norfolk, VA                            | 31  | 38   | 46   | 24                        | 38   | 46   |
| Lrg              | Oklahoma City, OK                      | 9   | 12   | 34   | 13                        | 17   | 34   |
| Lrg              | Orlando, FL                            | 24  | 53   | 51   | 36                        | 45   | 64   |
| Lrg              | Phoenix, AZ                            | 49  | 53   | 70   | 41                        | 57   | 70   |
| Lrg              | Pittsburgh, PA                         | 7   | 10   | 16   | 30                        | 35   | 41   |
| Lrg              | Portland-Vancouver, OR-WA              | 15  | 53   | 76   | 23                        | 41   | 71   |
| Lrg              | Sacramento, CA                         | 15  | 47   | 75   | 33                        | 68   | 70   |
| Lrg              | San Antonio, TX                        | 12  | 20   | 49   | 14                        | 22   | 53   |
| Lrg              | San Bernardino-Riverside, CA           | 24  | 69   | 76   | 22                        | 41   | 61   |
| Lrg              | San Diego, CA                          | 25  | 74   | 81   | 33                        | 70   | 67   |
| Lrg              | San Jose, CA                           | 48  | 61   | 65   | 61                        | 76   | 70   |
| Lrg              | Seattle-Everett, WA                    | 39  | 80   | 82   | 44                        | 61   | 77   |
| Lrg              | St Louis, MO-IL                        | 17  | 25   | 54   | 40                        | 46   | 71   |
| Med              | Albany-Schenectady-Troy, NY            | 2   | 2    | 8    | 12                        | 25   | 37   |
| Med              | Albuquerque, NM                        | 4   | 25   | 64   | 17                        | 35   | 59   |
| Med              | Austin, TX                             | 19  | 32   | 60   | 22                        | 42   | 65   |
| Med              | Charlotte, NC                          | 13  | 47   | 59   | 32                        | 47   | 69   |
| Med              | El Paso, TX-NM                         | 10  | 19   | 37   | 10                        | 15   | 37   |
| Med              | Fresno, CA                             | 4   | 17   | 24   | 20                        | 48   | 60   |
| Med              | Hartford-Middletown, CT                | 14  | 19   | 26   | 20                        | 41   | 48   |
| Med              | Honolulu, HI                           | 17  | 42   | 43   | 44                        | 71   | 73   |
| Med              | Jacksonville, FL                       | 5   | 33   | 40   | 18                        | 37   | 52   |
| Med              | Louisville, KY-IN                      | 14  | 20   | 49   | 41                        | 37   | 71   |
| Med              | Memphis, TN-AR-MS                      | 5   | 17   | 39   | 21                        | 40   | 55   |
| Med              | Nashville, TN                          | 15  | 22   | 36   | 36                        | 44   | 65   |
| Med              | Omaha, NE-IA                           | 8   | 18   | 21   | 19                        | 33   | 53   |
| Med              | Providence-Pawtucket, RI-MA            | 9   | 24   | 41   | 19                        | 45   | 56   |
| Med              | Rochester, NY                          | 3   | 9    | 16   | 15                        | 28   | 30   |
| Med              | Salt Lake City, UT                     | 7   | 22   | 48   | 24                        | 47   | 68   |
| Med              | Tacoma, WA                             | 13  | 46   | 70   | 18                        | 36   | 51   |
| Med              | Tampa, FL                              | 36  | 49   | 41   | 46                        | 57   | 68   |
| Med              | Tucson, AZ                             | 8   | 34   | 43   | 37                        | 51   | 72   |
| Sml              | Bakersfield, CA                        | 2   | 4    | 16   | 7                         | 17   | 21   |
| Sml              | Beaumont, TX                           | 5   | 5    | 10   | 18                        | 15   | 29   |
| Sml              | Boulder, CO                            | 2   | 2    | 3    | 9                         | 15   | 42   |
| Sml              | Brownsville, TX                        | 2   | 2    | 3    | 7                         | 17   | 30   |
| Sml              | Colorado Springs, CO                   | 3   | 6    | 32   | 13                        | 21   | 48   |
| Sml              | Corpus Christi, TX                     | 2   | 7    | 9    | 15                        | 20   | 17   |
| Sml              | Eugene-Springfield, OR                 | 0   | 0    | 18   | 18                        | 27   | 50   |
| Sml              | Laredo, TX                             | 2   | 2    | 4    | 11                        | 15   | 26   |
| Sml              | Salem, OR                              | 0   | 6    | 22   | 9                         | 19   | 35   |
| Sml              | Spokane, WA                            | 0   | 2    | 21   | 13                        | 17   | 27   |
| Vlg              | Boston MA                              | 20  | 53   | 72   | 47                        | 71   | 82   |
| Vlg              | Chicago, IL-Northwestern, IN           | 41  | 69   | 78   | 53                        | 69   | 82   |
| Vlg              | Detroit, MI                            | 21  | 53   | 70   | 45                        | 66   | 70   |
| Vlg              | Houston, TX                            | 54  | 60   | 68   | 50                        | 47   | 63   |
| Vlg              | Los Angeles, CA                        | 77  | 95   | 95   | 43                        | 65   | 80   |
| Vlg              | New York, NY-Northeastern, NJ          | 21  | 47   | 64   | 39                        | 67   | 78   |
| Vlg              | Philadelphia, PA-NJ                    | 15  | 33   | 47   | 42                        | 56   | 69   |
| Vlg              | San Francisco-Oakland, CA              | 52  | 84   | 85   | 60                        | 74   | 75   |
| Vlg              | Washington, DC-MD-VA                   | 40  | 71   | 78   | 63                        | 80   | 83   |
|                  | 68 area average                        | 31  | 53   | 65   | 37                        | 55   | 68   |
|                  | Very large area average                | 45  | 69   | 77   | 46                        | 67   | 77   |
|                  | Large area average                     | 20  | 42   | 60   | 31                        | 48   | 63   |
|                  | Medium area average                    | 11  | 26   | 41   | 25                        | 41   | 59   |
|                  | Small area average                     | 2   | 5    | 17   | 12                        | 18   | 31   |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-16. 1999 Roadway Congestion Index

| Population Group | Urban Area                          | Freeway/Expressway |                     | Principal Arterial Street |                     | Roadway Congestion Index | Rank |
|------------------|-------------------------------------|--------------------|---------------------|---------------------------|---------------------|--------------------------|------|
|                  |                                     | Daily VMT (000)    | Daily VMT Lane-Mile | Daily VMT (000)           | Daily VMT Lane-Mile |                          |      |
| Vlg              | Los Angeles, CA                     | 123,200            | 23,335              | 73,525                    | 6,755               | 1.58                     | 1    |
| Vlg              | San Francisco-Oakland, CA           | 45,710             | 19,575              | 14,930                    | 7,145               | 1.39                     | 2    |
| Vlg              | Washington, DC-MD-VA                | 33,875             | 18,210              | 19,850                    | 8,270               | 1.34                     | 3    |
| Vlg              | Chicago, IL-Northwestern, IN        | 48,550             | 18,250              | 41,660                    | 7,375               | 1.31                     | 4    |
| Lrg              | Seattle-Everett, WA                 | 24,130             | 18,560              | 9,390                     | 6,155               | 1.30                     | 5    |
| Vlg              | Boston, MA                          | 22,500             | 17,240              | 16,600                    | 8,060               | 1.28                     | 6    |
| Lrg              | Atlanta, GA                         | 40,630             | 17,780              | 16,025                    | 7,170               | 1.27                     | 7    |
| Lrg              | San Diego, CA                       | 31,775             | 17,850              | 10,600                    | 5,625               | 1.25                     | 8    |
| Lrg              | San Bernardino-Riverside, CA        | 16,270             | 18,490              | 11,100                    | 5,150               | 1.24                     | 9    |
| Lrg              | Portland-Vancouver, OR-WA           | 12,350             | 17,520              | 6,240                     | 6,640               | 1.24                     | 9    |
| Lrg              | Miami-Hialeah, FL                   | 12,920             | 17,225              | 17,450                    | 6,710               | 1.23                     | 11   |
| Lrg              | Phoenix, AZ                         | 16,995             | 17,705              | 18,160                    | 5,975               | 1.21                     | 12   |
| Lrg              | Denver, CO                          | 16,500             | 15,940              | 13,100                    | 7,595               | 1.20                     | 13   |
| Vlg              | Detroit, MI                         | 30,400             | 16,840              | 28,200                    | 6,500               | 1.20                     | 13   |
| Lrg              | Minneapolis-St. Paul, MN            | 26,165             | 16,880              | 8,100                     | 6,185               | 1.20                     | 13   |
| Lrg              | Sacramento, CA                      | 11,490             | 16,895              | 7,795                     | 6,525               | 1.20                     | 13   |
| Lrg              | San Jose, CA                        | 18,635             | 16,490              | 8,355                     | 6,990               | 1.19                     | 17   |
| Med              | Tacoma, WA                          | 5,250              | 17,500              | 3,035                     | 5,100               | 1.19                     | 17   |
| Lrg              | Las Vegas, NV                       | 6,270              | 15,675              | 3,820                     | 7,875               | 1.18                     | 19   |
| Lrg              | Ft. Lauderdale-Hwood-Pomp. Bch., FL | 11,935             | 16,575              | 8,355                     | 6,055               | 1.17                     | 20   |
| Vlg              | New York, NY-Northeastern, NJ       | 100,260            | 15,215              | 57,355                    | 7,855               | 1.15                     | 21   |
| Med              | Charlotte, NC                       | 7,000              | 15,555              | 3,490                     | 6,980               | 1.14                     | 22   |
| Med              | Albuquerque, NM                     | 3,875              | 16,850              | 4,820                     | 5,385               | 1.13                     | 23   |
| Lrg              | Cincinnati, OH-KY                   | 15,500             | 15,980              | 4,280                     | 5,190               | 1.12                     | 24   |
| Lrg              | Indianapolis, IN                    | 11,315             | 15,605              | 7,000                     | 6,085               | 1.11                     | 25   |
| Vlg              | Houston, TX                         | 37,725             | 15,400              | 16,545                    | 5,950               | 1.10                     | 26   |
| Med              | Tampa, FL                           | 6,000              | 13,795              | 7,600                     | 7,345               | 1.10                     | 26   |
| Med              | Louisville, KY-IN                   | 10,035             | 14,980              | 4,155                     | 6,490               | 1.09                     | 28   |
| Lrg              | Baltimore, MD                       | 21,755             | 14,800              | 9,070                     | 6,345               | 1.07                     | 29   |
| Med              | Austin, TX                          | 8,110              | 14,480              | 4,600                     | 6,345               | 1.06                     | 30   |
| Vlg              | Philadelphia, PA-NJ                 | 24,155             | 14,005              | 21,465                    | 6,870               | 1.06                     | 30   |
| Med              | Honolulu, HI                        | 5,715              | 14,290              | 1,900                     | 7,310               | 1.06                     | 30   |
| Lrg              | Dallas, TX                          | 30,900             | 14,645              | 15,740                    | 5,960               | 1.05                     | 33   |
| Lrg              | Orlando, FL                         | 8,725              | 12,375              | 11,600                    | 7,555               | 1.05                     | 33   |
| Lrg              | Columbus, OH                        | 11,700             | 14,355              | 3,975                     | 6,735               | 1.05                     | 33   |
| Med              | Tucson, AZ                          | 2,000              | 11,430              | 5,165                     | 7,025               | 1.05                     | 33   |
| Lrg              | Milwaukee, WI                       | 9,325              | 15,165              | 6,725                     | 5,255               | 1.05                     | 33   |
| Lrg              | St. Louis, MO-IL                    | 25,600             | 14,465              | 12,030                    | 5,455               | 1.03                     | 38   |
| Lrg              | San Antonio, TX                     | 15,420             | 14,345              | 4,790                     | 5,295               | 1.02                     | 39   |
| Med              | Nashville, TN                       | 10,245             | 13,570              | 4,260                     | 6,925               | 1.01                     | 40   |
| Med              | Jacksonville, FL                    | 9,355              | 13,365              | 7,100                     | 6,455               | 1.00                     | 41   |
| Med              | Salt Lake City, UT                  | 6,470              | 13,070              | 3,335                     | 7,170               | 1.00                     | 41   |
| Med              | Fresno, CA                          | 2,170              | 12,765              | 2,975                     | 6,465               | 1.00                     | 41   |
| Lrg              | Cleveland, OH                       | 17,320             | 13,745              | 6,375                     | 5,640               | 0.99                     | 44   |
| Lrg              | New Orleans, LA                     | 5,750              | 13,855              | 5,320                     | 5,455               | 0.99                     | 44   |
| Med              | Memphis, TN-AR-MS                   | 6,545              | 13,090              | 6,115                     | 6,085               | 0.98                     | 46   |
| Lrg              | Norfolk, VA                         | 7,300              | 11,230              | 5,630                     | 8,405               | 0.97                     | 47   |
| Lrg              | Fort Worth, TX                      | 16,650             | 13,590              | 8,850                     | 4,970               | 0.96                     | 48   |
| Med              | Providence-Pawtucket, RI-MA         | 8,255              | 12,800              | 5,040                     | 6,145               | 0.95                     | 49   |
| Med              | Hartford-Middletown, CT             | 7,980              | 12,975              | 2,330                     | 5,825               | 0.94                     | 50   |
| Med              | El Paso, TX-NM                      | 3,800              | 13,570              | 3,420                     | 4,815               | 0.94                     | 50   |
| Sml              | Eugene-Springfield, OR              | 1,300              | 11,820              | 820                       | 6,560               | 0.91                     | 52   |
| Med              | Omaha, NE-IA                        | 3,280              | 10,935              | 4,250                     | 6,160               | 0.90                     | 53   |
| Lrg              | Oklahoma City, OK                   | 8,985              | 12,310              | 5,205                     | 4,935               | 0.88                     | 54   |
| Sml              | Beaumont, TX                        | 1,525              | 11,730              | 1,000                     | 5,265               | 0.86                     | 55   |
| Sml              | Colorado Springs, CO                | 2,535              | 11,020              | 2,245                     | 5,615               | 0.85                     | 56   |
| Sml              | Salem, OR                           | 1,170              | 11,700              | 1,365                     | 4,875               | 0.85                     | 56   |
| Sml              | Spokane, WA                         | 1,450              | 11,155              | 2,630                     | 4,870               | 0.83                     | 58   |
| Sml              | Boulder, CO                         | 490                | 9,800               | 555                       | 6,165               | 0.83                     | 58   |
| Lrg              | Kansas City, MO-KS                  | 18,790             | 10,895              | 5,580                     | 5,095               | 0.79                     | 60   |
| Lrg              | Pittsburgh, PA                      | 11,300             | 9,455               | 9,480                     | 6,095               | 0.78                     | 61   |
| Med              | Rochester, NY                       | 5,365              | 10,730              | 1,060                     | 5,435               | 0.78                     | 61   |
| Med              | Albany-Schenectady-Troy, NY         | 5,330              | 9,780               | 3,245                     | 5,745               | 0.77                     | 63   |
| Sml              | Bakersfield, CA                     | 1,760              | 11,000              | 2,370                     | 4,085               | 0.77                     | 63   |
| Sml              | Brownsville, TX                     | 280                | 9,335               | 570                       | 4,750               | 0.75                     | 65   |
| Lrg              | Buffalo-Niagara Falls, NY           | 6,050              | 9,530               | 4,900                     | 4,735               | 0.72                     | 66   |
| Sml              | Corpus Christi, TX                  | 2,785              | 9,770               | 1,410                     | 4,210               | 0.71                     | 67   |
| Sml              | Laredo, TX                          | 430                | 5,060               | 1,010                     | 4,810               | 0.61                     | 68   |
|                  | 68 area average                     | 15,960             | 14,210              | 9,520                     | 6,160               | 1.14                     |      |
|                  | Very large area average             | 51,820             | 17,560              | 32,240                    | 7,200               | 1.28                     |      |
|                  | Large area average                  | 16,280             | 15,000              | 8,840                     | 6,130               | 1.09                     |      |
|                  | Medium area average                 | 6,150              | 13,450              | 4,100                     | 6,270               | 0.99                     |      |
|                  | Small area average                  | 1,370              | 10,240              | 1,400                     | 5,120               | 0.79                     |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-17. Roadway Congestion Index, 1982 to 1999

| Population Group | Urban Area                           | Roadway Congestion Index |      |      |      | Short-Term Change 1992 to 1999 |      | Long-Term Change 1982 to 1999 |      |
|------------------|--------------------------------------|--------------------------|------|------|------|--------------------------------|------|-------------------------------|------|
|                  |                                      | 1982                     | 1987 | 1992 | 1999 | Points                         | Rank | Points                        | Rank |
| Lrg              | San Jose, CA                         | 1.07                     | 1.22 | 1.22 | 1.19 | -3                             | 1    | 12                            | 6    |
| Med              | Tampa, FL                            | 0.91                     | 0.94 | 1.09 | 1.10 | 1                              | 2    | 19                            | 12   |
| Med              | Honolulu, HI                         | 0.79                     | 0.93 | 1.04 | 1.06 | 2                              | 3    | 27                            | 25   |
| Med              | Jacksonville, FL                     | 0.75                     | 0.83 | 0.98 | 1.00 | 2                              | 3    | 25                            | 21   |
| Vlg              | Los Angeles, CA                      | 1.29                     | 1.44 | 1.56 | 1.58 | 2                              | 3    | 29                            | 33   |
| Sml              | Beaumont, TX                         | 0.68                     | 0.71 | 0.83 | 0.86 | 3                              | 6    | 18                            | 10   |
| Lrg              | Miami-Hialeah, FL                    | 0.95                     | 1.04 | 1.20 | 1.23 | 3                              | 6    | 28                            | 29   |
| Sml              | Corpus Christi, TX                   | 0.57                     | 0.69 | 0.67 | 0.71 | 4                              | 8    | 14                            | 7    |
| Lrg              | Dallas, TX                           | 0.78                     | 0.94 | 1.01 | 1.05 | 4                              | 8    | 27                            | 25   |
| Vlg              | Detroit, MI                          | 0.89                     | 0.99 | 1.16 | 1.20 | 4                              | 8    | 31                            | 36   |
| Lrg              | New Orleans, LA                      | 0.92                     | 0.93 | 0.95 | 0.99 | 4                              | 8    | 7                             | 2    |
| Lrg              | Pittsburgh, PA                       | 0.70                     | 0.73 | 0.74 | 0.78 | 4                              | 8    | 8                             | 4    |
| Sml              | Laredo, TX                           | 0.55                     | 0.57 | 0.56 | 0.61 | 5                              | 13   | 6                             | 1    |
| Lrg              | Fort Worth, TX                       | 0.73                     | 0.88 | 0.90 | 0.96 | 6                              | 14   | 23                            | 15   |
| Med              | Rochester, NY                        | 0.51                     | 0.60 | 0.72 | 0.78 | 6                              | 14   | 27                            | 25   |
| Sml              | Salem, OR                            | 0.56                     | 0.70 | 0.79 | 0.85 | 6                              | 14   | 29                            | 33   |
| Vlg              | Washington, DC-MD-VA                 | 0.99                     | 1.22 | 1.28 | 1.34 | 6                              | 14   | 35                            | 49   |
| Sml              | Bakersfield, CA                      | 0.54                     | 0.59 | 0.70 | 0.77 | 7                              | 18   | 23                            | 15   |
| Med              | Hartford-Middletown, CT              | 0.61                     | 0.77 | 0.87 | 0.94 | 7                              | 18   | 33                            | 42   |
| Lrg              | San Diego, CA                        | 0.79                     | 1.04 | 1.18 | 1.25 | 7                              | 18   | 46                            | 61   |
| Vlg              | San Francisco-Oakland, CA            | 1.06                     | 1.31 | 1.32 | 1.39 | 7                              | 18   | 33                            | 42   |
| Med              | Albany-Schenectady-Troy, NY          | 0.46                     | 0.57 | 0.69 | 0.77 | 8                              | 22   | 31                            | 36   |
| Lrg              | Buffalo-Niagara Falls, NY            | 0.53                     | 0.56 | 0.64 | 0.72 | 8                              | 22   | 19                            | 12   |
| Lrg              | Orlando, FL                          | 0.82                     | 0.93 | 0.97 | 1.05 | 8                              | 22   | 23                            | 15   |
| Vlg              | Philadelphia, PA-NJ                  | 0.82                     | 0.92 | 0.98 | 1.06 | 8                              | 22   | 24                            | 20   |
| Med              | Memphis, TN-AR-MS                    | 0.71                     | 0.78 | 0.89 | 0.98 | 9                              | 26   | 27                            | 25   |
| Med              | Salt Lake City, UT                   | 0.66                     | 0.73 | 0.91 | 1.00 | 9                              | 26   | 34                            | 47   |
| Lrg              | San Bernardino-Riverside, CA         | 0.78                     | 1.01 | 1.15 | 1.24 | 9                              | 26   | 46                            | 61   |
| Sml              | Spokane, WA                          | 0.66                     | 0.73 | 0.74 | 0.83 | 9                              | 26   | 17                            | 9    |
| Lrg              | Baltimore, MD                        | 0.75                     | 0.87 | 0.97 | 1.07 | 10                             | 30   | 32                            | 40   |
| Lrg              | Las Vegas, NV                        | 0.69                     | 0.89 | 1.08 | 1.18 | 10                             | 30   | 49                            | 65   |
| Lrg              | Norfolk, VA                          | 0.89                     | 0.98 | 0.87 | 0.97 | 10                             | 30   | 8                             | 4    |
| Sml              | Brownsville, TX                      | 0.54                     | 0.55 | 0.64 | 0.75 | 11                             | 33   | 21                            | 14   |
| Vlg              | Houston, TX                          | 1.03                     | 1.07 | 0.99 | 1.10 | 11                             | 33   | 7                             | 2    |
| Med              | Omaha, NE-IA                         | 0.62                     | 0.76 | 0.79 | 0.90 | 11                             | 33   | 28                            | 29   |
| Lrg              | St. Louis, MO-IL                     | 0.87                     | 0.91 | 0.92 | 1.03 | 11                             | 33   | 16                            | 8    |
| Med              | El Paso, TX-NM                       | 0.62                     | 0.70 | 0.82 | 0.94 | 12                             | 37   | 32                            | 40   |
| Med              | Providence-Pawtucket, RI-MA          | 0.70                     | 0.84 | 0.83 | 0.95 | 12                             | 37   | 25                            | 21   |
| Med              | Tucson, AZ                           | 0.80                     | 0.78 | 0.93 | 1.05 | 12                             | 37   | 25                            | 21   |
| Sml              | Boulder, CO                          | 0.55                     | 0.64 | 0.70 | 0.83 | 13                             | 40   | 28                            | 29   |
| Med              | Fresno, CA                           | 0.67                     | 0.71 | 0.87 | 1.00 | 13                             | 40   | 33                            | 42   |
| Lrg              | Milwaukee, WI                        | 0.71                     | 0.84 | 0.92 | 1.05 | 13                             | 40   | 34                            | 47   |
| Lrg              | Sacramento, CA                       | 0.76                     | 0.98 | 1.07 | 1.20 | 13                             | 40   | 44                            | 59   |
| Lrg              | Seattle-Everett, WA                  | 1.07                     | 1.23 | 1.17 | 1.30 | 13                             | 40   | 23                            | 15   |
| Vlg              | Chicago, IL-Northwestern, IN         | 0.95                     | 1.06 | 1.17 | 1.31 | 14                             | 45   | 36                            | 51   |
| Lrg              | Cleveland, OH                        | 0.68                     | 0.70 | 0.85 | 0.99 | 14                             | 45   | 31                            | 36   |
| Lrg              | Ft. Lauderdale-Hywood-Pomp. Bch., FL | 0.69                     | 0.87 | 1.03 | 1.17 | 14                             | 45   | 48                            | 64   |
| Lrg              | Oklahoma City OK                     | 0.65                     | 0.74 | 0.74 | 0.88 | 14                             | 45   | 23                            | 15   |
| Lrg              | Columbus, OH                         | 0.63                     | 0.76 | 0.90 | 1.05 | 15                             | 49   | 42                            | 56   |
| Lrg              | Phoenix, AZ                          | 0.95                     | 1.02 | 1.06 | 1.21 | 15                             | 49   | 26                            | 24   |
| Med              | Charlotte, NC                        | 0.86                     | 1.05 | 0.98 | 1.14 | 16                             | 51   | 28                            | 29   |
| Lrg              | Kansas City, MO-KS                   | 0.50                     | 0.64 | 0.63 | 0.79 | 16                             | 51   | 29                            | 33   |
| Med              | Nashville, TN                        | 0.83                     | 0.91 | 0.85 | 1.01 | 16                             | 51   | 18                            | 10   |
| Vlg              | Boston, MA                           | 0.88                     | 1.05 | 1.11 | 1.28 | 17                             | 54   | 40                            | 55   |
| Lrg              | Portland-Vancouver, OR-WA            | 0.81                     | 0.95 | 1.07 | 1.24 | 17                             | 54   | 43                            | 58   |
| Med              | Tacoma, WA                           | 0.75                     | 0.85 | 1.02 | 1.19 | 17                             | 54   | 44                            | 59   |
| Vlg              | New York, NY-Northeastern, NJ        | 0.77                     | 0.89 | 0.97 | 1.15 | 18                             | 57   | 38                            | 52   |
| Med              | Austin, TX                           | 0.73                     | 0.83 | 0.87 | 1.06 | 19                             | 58   | 33                            | 42   |
| Lrg              | Indianapolis, IN                     | 0.64                     | 0.77 | 0.91 | 1.11 | 20                             | 59   | 47                            | 63   |
| Med              | Louisville, KY-IN                    | 0.78                     | 0.81 | 0.89 | 1.09 | 20                             | 59   | 31                            | 36   |
| Lrg              | Cincinnati, OH-KY                    | 0.70                     | 0.80 | 0.91 | 1.12 | 21                             | 61   | 42                            | 56   |
| Sml              | Colorado Springs, CO                 | 0.50                     | 0.62 | 0.64 | 0.85 | 21                             | 61   | 35                            | 49   |
| Sml              | Eugene-Springfield, OR               | 0.53                     | 0.61 | 0.70 | 0.91 | 21                             | 61   | 38                            | 52   |
| Lrg              | Denver, CO                           | 0.82                     | 0.87 | 0.97 | 1.20 | 23                             | 64   | 38                            | 52   |
| Lrg              | San Antonio, TX                      | 0.69                     | 0.80 | 0.77 | 1.02 | 25                             | 65   | 33                            | 42   |
| Med              | Albuquerque, NM                      | 0.62                     | 0.75 | 0.87 | 1.13 | 26                             | 66   | 51                            | 67   |
| Lrg              | Minneapolis-St. Paul, MN             | 0.66                     | 0.83 | 0.93 | 1.20 | 27                             | 67   | 54                            | 68   |
| Lrg              | Atlanta, GA                          | 0.77                     | 1.01 | 0.99 | 1.27 | 28                             | 68   | 50                            | 66   |
|                  | 68 area average                      | 0.83                     | 0.96 | 1.03 | 1.14 | 11                             |      | 31                            |      |
|                  | Very large area average              | 0.97                     | 1.11 | 1.18 | 1.28 | 10                             |      | 31                            |      |
|                  | Large area average                   | 0.75                     | 0.89 | 0.95 | 1.09 | 14                             |      | 34                            |      |
|                  | Medium area average                  | 0.68                     | 0.79 | 0.88 | 0.99 | 11                             |      | 31                            |      |
|                  | Small area average                   | 0.56                     | 0.64 | 0.69 | 0.79 | 10                             |      | 23                            |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.



**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-18. 1999 Congested Travel

| Population Group | Urban Area                              | Percent of Peak Period Travel in Congestion |                    |       | Percent of Daily Travel in Congestion |      |
|------------------|---|---|--------------------|-------|---------------------------------------|------|
|                  |   | Freeway                                     | Principal Arterial | Total | Percent                               | Rank |
|                  |   |   |                    |       |                                       |      |
| Vlg              | Los Angeles, CA                         | 95  | 80                 | 89    | 45                                    | 1    |
| Vlg              | San Francisco-Oakland, CA               | 85  | 75                 | 83    | 41                                    | 2    |
| Vlg              | Chicago IL-Northwestern, IN             | 78  | 82                 | 80    | 40                                    | 3    |
| Lrg              | Seattle-Everett, WA                     | 82  | 77                 | 81    | 40                                    | 3    |
| Vlg              | Washington, DC-MD-VA                    | 78  | 83                 | 80    | 40                                    | 3    |
| Lrg              | San Diego, CA                           | 81  | 67                 | 77    | 39                                    | 6    |
| Vlg              | Boston, MA                              | 72  | 82                 | 76    | 38                                    | 7    |
| Lrg              | Atlanta, GA                             | 72  | 81                 | 75    | 37                                    | 8    |
| Lrg              | Denver, CO                              | 70  | 79                 | 74    | 37                                    | 8    |
| Lrg              | Portland-Vancouver, OR-WA               | 76  | 71                 | 74    | 37                                    | 8    |
| Lrg              | Las Vegas, NV                           | 65  | 83                 | 72    | 36                                    | 11   |
| Lrg              | Sacramento, CA                          | 75  | 70                 | 73    | 36                                    | 11   |
| Vlg              | Detroit, MI                             | 70  | 70                 | 70    | 35                                    | 13   |
| Lrg              | Miami-Hialeah, FL                       | 71  | 71                 | 71    | 35                                    | 13   |
| Vlg              | New York, NY-Northeastern, NJ           | 64  | 78                 | 69    | 35                                    | 13   |
| Lrg              | Phoenix, AZ                             | 70  | 70                 | 70    | 35                                    | 13   |
| Lrg              | San Bernardino-Riverside, CA            | 76  | 61                 | 70    | 35                                    | 13   |
| Vlg              | Houston, TX                             | 68  | 63                 | 66    | 33                                    | 18   |
| Lrg              | Minneapolis-St. Paul, MN                | 65  | 70                 | 66    | 33                                    | 18   |
| Lrg              | San Jose, CA                            | 65  | 70                 | 67    | 33                                    | 18   |
| Med              | Tucson, AZ                              | 43  | 72                 | 64    | 32                                    | 21   |
| Med              | Albuquerque, NM                         | 64  | 59                 | 61    | 31                                    | 22   |
| Med              | Austin, TX                              | 60  | 65                 | 62    | 31                                    | 22   |
| Med              | Charlotte, NC                           | 59  | 69                 | 62    | 31                                    | 22   |
| Lrg              | Cincinnati, OH-KY                       | 63  | 54                 | 61    | 31                                    | 22   |
| Lrg              | Ft. Lauderdale-Hollywood-Pomp. Bch., FL | 60  | 65                 | 62    | 31                                    | 22   |
| Lrg              | Indianapolis, IN                        | 59  | 68                 | 62    | 31                                    | 22   |
| Med              | Tacoma, WA                              | 70  | 51                 | 63    | 31                                    | 22   |
| Lrg              | Baltimore, MD                           | 57  | 65                 | 59    | 30                                    | 29   |
| Lrg              | St. Louis, MO-IL                        | 54  | 71                 | 59    | 30                                    | 29   |
| Lrg              | Dallas, TX                              | 60  | 55                 | 58    | 29                                    | 31   |
| Lrg              | Milwaukee, WI                           | 64  | 51                 | 59    | 29                                    | 31   |
| Lrg              | Orlando, FL                             | 51  | 64                 | 58    | 29                                    | 31   |
| Vlg              | Philadelphia, PA-NJ                     | 47  | 69                 | 57    | 29                                    | 31   |
| Med              | Louisville, KY-IN                       | 49  | 71                 | 55    | 28                                    | 35   |
| Med              | Tampa, FL                               | 41  | 68                 | 56    | 28                                    | 35   |
| Med              | Salt Lake City, UT                      | 48  | 68                 | 55    | 27                                    | 37   |
| Lrg              | Columbus, OH                            | 47  | 68                 | 52    | 26                                    | 38   |
| Med              | Honolulu, HI                            | 43  | 73                 | 50    | 25                                    | 39   |
| Lrg              | San Antonio, TX                         | 49  | 53                 | 50    | 25                                    | 39   |
| Lrg              | Cleveland, OH                           | 47  | 51                 | 48    | 24                                    | 41   |
| Lrg              | New Orleans, LA                         | 40  | 55                 | 47    | 24                                    | 41   |
| Lrg              | Fort Worth, TX                          | 49  | 42                 | 47    | 23                                    | 43   |
| Med              | Jacksonville, FL                        | 40  | 52                 | 45    | 23                                    | 43   |
| Med              | Memphis, TN-AR-MS                       | 39  | 55                 | 47    | 23                                    | 43   |
| Lrg              | Norfolk, VA                             | 46  | 46                 | 46    | 23                                    | 43   |
| Med              | Providence-Pawtucket, RI-MA             | 41  | 56                 | 47    | 23                                    | 43   |
| Med              | Fresno, CA                              | 24  | 60                 | 45    | 22                                    | 48   |
| Med              | Nashville, TN                           | 36  | 65                 | 45    | 22                                    | 48   |
| Sml              | Colorado Springs, CO                    | 32  | 48                 | 40    | 20                                    | 50   |
| Med              | El Paso, TX-NM                          | 37  | 37                 | 37    | 19                                    | 51   |
| Med              | Omaha, NE-IA                            | 21  | 53                 | 39    | 19                                    | 51   |
| Lrg              | Oklahoma City, OK                       | 34  | 34                 | 34    | 17                                    | 53   |
| Sml              | Eugene-Springfield, OR                  | 18  | 50                 | 30    | 15                                    | 54   |
| Med              | Hartford-Middletown, CT                 | 26  | 48                 | 31    | 15                                    | 54   |
| Sml              | Salem, OR                               | 22  | 35                 | 29    | 15                                    | 54   |
| Lrg              | Kansas City, MO-KS                      | 25  | 42                 | 29    | 14                                    | 57   |
| Lrg              | Pittsburgh, PA                          | 16  | 41                 | 27    | 14                                    | 57   |
| Sml              | Spokane, WA                             | 21  | 27                 | 25    | 13                                    | 59   |
| Sml              | Boulder, CO                             | 3   | 42                 | 24    | 12                                    | 60   |
| Sml              | Brownsville, TX                         | 3   | 30                 | 21    | 10                                    | 61   |
| Sml              | Laredo, TX                              | 4   | 26                 | 19    | 10                                    | 61   |
| Med              | Albany-Schenectady-Troy, NY             | 8   | 37                 | 19    | 9                                     | 63   |
| Sml              | Bakersfield, CA                         | 16  | 21                 | 19    | 9                                     | 63   |
| Sml              | Beaumont, TX                            | 10  | 29                 | 18    | 9                                     | 63   |
| Lrg              | Buffalo-Niagara Falls, NY               | 17  | 22                 | 19    | 9                                     | 63   |
| Med              | Rochester, NY                           | 16  | 30                 | 18    | 9                                     | 63   |
| Sml              | Corpus Christi, TX                      | 9   | 17                 | 12    | 6                                     | 68   |
|                  | 68 area average                         | 65  | 68                 | 66    | 33                                    |      |
|                  | Very large area average                 | 77  | 77                 | 77    | 39                                    |      |
|                  | Large area average                      | 60  | 63                 | 61    | 31                                    |      |
|                  | Medium area average                     | 41  | 59                 | 48    | 24                                    |      |
|                  | Small area average                      | 17  | 31                 | 24    | 12                                    |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.



**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-19. Change in Congested Daily Travel

| Population Group | Urban Area                             | Percentage Point Change               |      |      |      |                        |      |        |      |
|------------------|--|---------------------------------------|------|------|------|------------------------|------|--------|------|
|                  |  | Percent of Daily Travel in Congestion |      |      |      | Long-Term 1982 to 1999 |      |        |      |
|                  |  | 1982                                  | 1987 | 1992 | 1999 | Points                 | Rank | Points | Rank |
| Lrg              | Atlanta, GA                            | 12                                    | 22   | 22   | 37   | 25                     | 4    | 15     | 1    |
| Lrg              | Minneapolis-St. Paul, MN               | 7                                     | 14   | 18   | 33   | 26                     | 2    | 15     | 1    |
| Lrg              | San Antonio, TX                        | 6                                     | 11   | 11   | 25   | 19                     | 22   | 14     | 3    |
| Med              | Albuquerque, NM                        | 6                                     | 11   | 18   | 31   | 25                     | 4    | 13     | 4    |
| Med              | Austin, TX                             | 10                                    | 16   | 18   | 31   | 21                     | 13   | 13     | 4    |
| Sml              | Colorado Springs, CO                   | 4                                     | 6    | 8    | 20   | 16                     | 33   | 12     | 6    |
| Lrg              | Cleveland, OH                          | 4                                     | 5    | 13   | 24   | 20                     | 19   | 11     | 7    |
| Lrg              | Denver, CO                             | 16                                    | 20   | 26   | 37   | 21                     | 13   | 11     | 7    |
| Lrg              | Indianapolis, IN                       | 5                                     | 9    | 20   | 31   | 26                     | 2    | 11     | 7    |
| Med              | Louisville, KY-IN                      | 12                                    | 14   | 17   | 28   | 16                     | 33   | 11     | 7    |
| Lrg              | St. Louis, MO-IL                       | 13                                    | 16   | 19   | 30   | 17                     | 28   | 11     | 7    |
| Lrg              | Oklahoma City, OK                      | 5                                     | 5    | 7    | 17   | 12                     | 46   | 10     | 12   |
| Lrg              | Portland-Vancouver, OR-WA              | 9                                     | 17   | 27   | 37   | 28                     | 1    | 10     | 12   |
| Lrg              | Cincinnati, OH-KY                      | 8                                     | 12   | 22   | 31   | 23                     | 11   | 9      | 14   |
| Med              | Salt Lake City, UT                     | 6                                     | 9    | 18   | 27   | 21                     | 13   | 9      | 14   |
| Lrg              | Baltimore, MD                          | 12                                    | 18   | 22   | 30   | 18                     | 25   | 8      | 16   |
| Med              | Charlotte, NC                          | 12                                    | 20   | 23   | 31   | 19                     | 22   | 8      | 16   |
| Lrg              | Dallas, TX                             | 8                                     | 19   | 21   | 29   | 21                     | 13   | 8      | 16   |
| Sml              | Eugene-Springfield, OR                 | 4                                     | 4    | 7    | 15   | 11                     | 49   | 8      | 16   |
| Lrg              | Fort Worth, TX                         | 6                                     | 14   | 15   | 23   | 17                     | 28   | 8      | 16   |
| Vlg              | Houston, TX                            | 26                                    | 29   | 25   | 33   | 7                      | 55   | 8      | 16   |
| Med              | Nashville, TN                          | 13                                    | 17   | 14   | 22   | 9                      | 51   | 8      | 16   |
| Vlg              | New York, NY-Northeastern, NJ          | 14                                    | 19   | 27   | 35   | 21                     | 13   | 8      | 16   |
| Med              | Providence-Pawtucket, RI-MA            | 7                                     | 12   | 15   | 23   | 16                     | 33   | 8      | 16   |
| Vlg              | Boston, MA                             | 16                                    | 27   | 31   | 38   | 22                     | 12   | 7      | 25   |
| Lrg              | Columbus, OH                           | 5                                     | 9    | 19   | 26   | 21                     | 13   | 7      | 25   |
| Lrg              | Ft. Lauderdale-Hollywood-Pomp. Bch, FL | 12                                    | 18   | 24   | 31   | 19                     | 22   | 7      | 25   |
| Lrg              | Kansas City, MO-KS                     | 3                                     | 4    | 7    | 14   | 11                     | 49   | 7      | 25   |
| Lrg              | Sacramento, CA                         | 12                                    | 23   | 29   | 36   | 24                     | 8    | 7      | 25   |
| Lrg              | San Bernardino-Riverside, CA           | 11                                    | 21   | 28   | 35   | 24                     | 8    | 7      | 25   |
| Med              | Tacoma, WA                             | 7                                     | 15   | 24   | 31   | 24                     | 8    | 7      | 25   |
| Med              | Tucson, AZ                             | 14                                    | 16   | 25   | 32   | 18                     | 25   | 7      | 25   |
| Med              | El Paso, TX-NM                         | 5                                     | 8    | 13   | 19   | 14                     | 37   | 6      | 33   |
| Lrg              | Las Vegas, NV                          | 11                                    | 22   | 30   | 36   | 25                     | 4    | 6      | 33   |
| Med              | Memphis, TN-AR-MS                      | 6                                     | 10   | 17   | 23   | 17                     | 28   | 6      | 33   |
| Lrg              | Milwaukee, WI                          | 9                                     | 15   | 23   | 29   | 20                     | 19   | 6      | 33   |
| Lrg              | Norfolk, VA                            | 14                                    | 20   | 17   | 23   | 9                      | 51   | 6      | 33   |
| Vlg              | Philadelphia, PA-NJ                    | 16                                    | 22   | 23   | 29   | 13                     | 43   | 6      | 33   |
| Lrg              | Phoenix, AZ                            | 21                                    | 26   | 29   | 35   | 14                     | 37   | 6      | 33   |
| Sml              | Boulder, CO                            | 3                                     | 4    | 7    | 12   | 9                      | 51   | 5      | 40   |
| Vlg              | Chicago, IL-Northwestern, IN           | 23                                    | 31   | 35   | 40   | 17                     | 28   | 5      | 40   |
| Sml              | Salem, OR                              | 3                                     | 5    | 10   | 15   | 12                     | 46   | 5      | 40   |
| Sml              | Brownsville, TX                        | 3                                     | 4    | 6    | 10   | 7                      | 55   | 4      | 43   |
| Vlg              | Detroit, MI                            | 17                                    | 22   | 31   | 35   | 18                     | 25   | 4      | 43   |
| Med              | Fresno, CA                             | 8                                     | 11   | 18   | 22   | 14                     | 37   | 4      | 43   |
| Sml              | Laredo, TX                             | 4                                     | 5    | 6    | 10   | 6                      | 61   | 4      | 43   |
| Med              | Omaha, NE-IA                           | 7                                     | 13   | 15   | 19   | 12                     | 46   | 4      | 43   |
| Lrg              | Orlando, FL                            | 15                                    | 20   | 25   | 29   | 14                     | 37   | 4      | 43   |
| Sml              | Spokane, WA                            | 5                                     | 6    | 9    | 13   | 8                      | 54   | 4      | 43   |
| Med              | Albany-Schenectady-Troy, NY            | 3                                     | 4    | 6    | 9    | 6                      | 61   | 3      | 50   |
| Vlg              | Los Angeles, CA                        | 31                                    | 39   | 42   | 45   | 14                     | 37   | 3      | 50   |
| Lrg              | San Diego, CA                          | 14                                    | 28   | 36   | 39   | 25                     | 4    | 3      | 50   |
| Sml              | Bakersfield, CA                        | 2                                     | 3    | 7    | 9    | 7                      | 55   | 2      | 53   |
| Sml              | Beaumont, TX                           | 5                                     | 5    | 7    | 9    | 4                      | 65   | 2      | 53   |
| Lrg              | Buffalo-Niagara Falls, NY              | 4                                     | 4    | 7    | 9    | 5                      | 64   | 2      | 53   |
| Med              | Honolulu, HI                           | 12                                    | 19   | 23   | 25   | 13                     | 43   | 2      | 53   |
| Med              | Jacksonville, FL                       | 6                                     | 11   | 21   | 23   | 17                     | 28   | 2      | 53   |
| Lrg              | Pittsburgh, PA                         | 11                                    | 11   | 12   | 14   | 3                      | 66   | 2      | 53   |
| Med              | Rochester, NY                          | 3                                     | 4    | 7    | 9    | 6                      | 61   | 2      | 53   |
| Vlg              | San Francisco-Oakland, CA              | 27                                    | 39   | 39   | 41   | 14                     | 37   | 2      | 53   |
| Lrg              | Seattle-Everett, WA                    | 20                                    | 32   | 38   | 40   | 20                     | 19   | 2      | 53   |
| Vlg              | Washington, DC-MD-VA                   | 25                                    | 36   | 38   | 40   | 15                     | 36   | 2      | 53   |
| Med              | Hartford-Middletown, CT                | 8                                     | 12   | 14   | 15   | 7                      | 55   | 1      | 63   |
| Lrg              | Miami-Hialeah, FL                      | 22                                    | 28   | 34   | 35   | 13                     | 43   | 1      | 63   |
| Lrg              | San Jose, CA                           | 26                                    | 30   | 32   | 33   | 7                      | 55   | 1      | 63   |
| Sml              | Corpus Christi, TX                     | 5                                     | 6    | 7    | 6    | 1                      | 68   | -1     | 66   |
| Lrg              | New Orleans, LA                        | 22                                    | 25   | 26   | 24   | 2                      | 67   | -2     | 67   |
| Med              | Tampa, FL                              | 21                                    | 22   | 30   | 28   | 7                      | 55   | -2     | 67   |
|                  | 68 area average                        | 17                                    | 23   | 27   | 33   | 16                     |      | 6      |      |
|                  | Very large area average                | 23                                    | 30   | 34   | 39   | 16                     |      | 5      |      |
|                  | Large area average                     | 12                                    | 19   | 23   | 31   | 19                     |      | 8      |      |
|                  | Medium area average                    | 9                                     | 13   | 18   | 24   | 15                     |      | 6      |      |
|                  | Small area average                     | 4                                     | 5    | 8    | 12   | 8                      |      | 4      |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

Table A-20. Change in Travel During Congested Times

| Population Group | Urban Area                              | Percent of Daily Travel During Congested Times |      |      |      | Percentage Point Change |      |                         |      |
|------------------|---|--|------|------|------|-------------------------|------|-------------------------|------|
|                  |   | 1982   | 1987 | 1992 | 1999 | Long-Term 1982 to 1999  |      | Short-Term 1992 to 1999 |      |
|                  |   |  |      |      |      | Points                  | Rank | Points                  | Rank |
| Lrg              | San Antonio, TX                         | 23   | 28   | 26   | 41   | 18                      | 17   | 15                      | 1    |
| Med              | Albuquerque, NM                         | 21   | 25   | 33   | 46   | 25                      | 1    | 13                      | 2    |
| Sml              | Eugene-Springfield, OR                  | 18   | 20   | 23   | 36   | 18                      | 17   | 13                      | 2    |
| Sml              | Colorado Springs, CO                    | 17   | 21   | 21   | 32   | 15                      | 28   | 11                      | 4    |
| Med              | Louisville, KY-IN                       | 27   | 29   | 34   | 45   | 18                      | 17   | 11                      | 4    |
| Med              | Austin, TX                              | 24   | 30   | 33   | 43   | 19                      | 14   | 10                      | 6    |
| Lrg              | Minneapolis-St. Paul, MN                | 22   | 30   | 37   | 47   | 25                      | 1    | 10                      | 6    |
| Lrg              | Cincinnati, OH-KY                       | 23   | 28   | 36   | 45   | 22                      | 6    | 9                       | 8    |
| Lrg              | Indianapolis, IN                        | 21   | 26   | 36   | 45   | 24                      | 3    | 9                       | 8    |
| Med              | Nashville, TN                           | 30   | 36   | 32   | 41   | 11                      | 44   | 9                       | 8    |
| Lrg              | Oklahoma City, OK                       | 22   | 25   | 25   | 34   | 12                      | 42   | 9                       | 8    |
| Lrg              | Atlanta, GA                             | 26   | 41   | 40   | 48   | 22                      | 6    | 8                       | 12   |
| Lrg              | Cleveland, OH                           | 23   | 23   | 32   | 40   | 17                      | 23   | 8                       | 12   |
| Lrg              | Columbus, OH                            | 21   | 26   | 35   | 43   | 22                      | 6    | 8                       | 12   |
| Lrg              | Denver, CO                              | 30   | 33   | 39   | 47   | 17                      | 23   | 8                       | 12   |
| Med              | Providence-Pawtucket, RI-MA             | 23   | 31   | 30   | 38   | 15                      | 28   | 8                       | 12   |
| Sml              | Boulder, CO                             | 18   | 21   | 23   | 30   | 12                      | 42   | 7                       | 17   |
| Med              | Charlotte, NC                           | 32   | 43   | 39   | 46   | 14                      | 34   | 7                       | 17   |
| Med              | El Paso, TX-NM                          | 21   | 23   | 30   | 37   | 16                      | 26   | 7                       | 17   |
| Med              | Fresno, CA                              | 22   | 24   | 33   | 40   | 18                      | 17   | 7                       | 17   |
| Lrg              | Kansas City, MO-KS                      | 17   | 21   | 21   | 28   | 11                      | 44   | 7                       | 17   |
| Lrg              | Milwaukee, WI                           | 24   | 31   | 36   | 43   | 19                      | 14   | 7                       | 17   |
| Vlg              | New York, NY-Northeastern, NJ           | 26   | 34   | 39   | 46   | 20                      | 11   | 7                       | 17   |
| Med              | Omaha, NE-IA                            | 21   | 26   | 28   | 35   | 14                      | 34   | 7                       | 17   |
| Lrg              | Norfolk, VA                             | 34   | 39   | 33   | 39   | 5                       | 60   | 6                       | 25   |
| Lrg              | St. Louis, MO-IL                        | 33   | 36   | 36   | 42   | 9                       | 49   | 6                       | 25   |
| Med              | Tacoma, WA                              | 25   | 32   | 41   | 47   | 22                      | 6    | 6                       | 25   |
| Med              | Tucson, AZ                              | 28   | 27   | 37   | 43   | 15                      | 28   | 6                       | 25   |
| Lrg              | Baltimore, MD                           | 25   | 33   | 39   | 44   | 19                      | 14   | 5                       | 29   |
| Vlg              | Houston, TX                             | 42   | 44   | 40   | 45   | 3                       | 65   | 5                       | 29   |
| Med              | Memphis, TN-AR-MS                       | 24   | 27   | 34   | 39   | 15                      | 28   | 5                       | 29   |
| Sml              | Spokane, WA                             | 22   | 24   | 25   | 30   | 8                       | 55   | 5                       | 29   |
| Sml              | Brownsville, TX                         | 18   | 18   | 21   | 25   | 7                       | 57   | 4                       | 33   |
| Lrg              | Ft. Lauderdale-Hollywood-Pomp. Bch., FL | 23   | 33   | 42   | 46   | 23                      | 4    | 4                       | 33   |
| Med              | Hartford-Middletown, CT                 | 20   | 26   | 33   | 37   | 17                      | 23   | 4                       | 33   |
| Lrg              | Orlando, FL                             | 30   | 37   | 39   | 43   | 13                      | 38   | 4                       | 33   |
| Vlg              | Philadelphia, PA-NJ                     | 30   | 36   | 39   | 43   | 13                      | 38   | 4                       | 33   |
| Lrg              | Phoenix, AZ                             | 38   | 41   | 43   | 47   | 9                       | 49   | 4                       | 33   |
| Sml              | Salem, OR                               | 19   | 23   | 28   | 32   | 13                      | 38   | 4                       | 33   |
| Med              | Salt Lake City, UT                      | 22   | 24   | 36   | 40   | 18                      | 17   | 4                       | 33   |
| Med              | Albany-Schenectady-Troy, NY             | 15   | 19   | 23   | 26   | 11                      | 44   | 3                       | 41   |
| Sml              | Bakersfield, CA                         | 18   | 20   | 23   | 26   | 8                       | 55   | 3                       | 41   |
| Vlg              | Boston, MA                              | 34   | 43   | 45   | 48   | 14                      | 34   | 3                       | 41   |
| Lrg              | Buffalo-Niagara Falls, NY               | 18   | 19   | 21   | 24   | 6                       | 59   | 3                       | 41   |
| Vlg              | Chicago, IL-Northwestern, IN            | 38   | 43   | 46   | 49   | 11                      | 44   | 3                       | 41   |
| Lrg              | Fort Worth, TX                          | 24   | 34   | 35   | 38   | 14                      | 34   | 3                       | 41   |
| Lrg              | Portland-Vancouver, OR-WA               | 29   | 38   | 44   | 47   | 18                      | 17   | 3                       | 41   |
| Med              | Rochester, NY                           | 17   | 20   | 24   | 27   | 10                      | 48   | 3                       | 41   |
| Lrg              | Sacramento, CA                          | 26   | 39   | 44   | 47   | 21                      | 10   | 3                       | 41   |
| Sml              | Beaumont, TX                            | 23   | 24   | 30   | 32   | 9                       | 49   | 2                       | 50   |
| Sml              | Corpus Christi, TX                      | 19   | 23   | 22   | 24   | 5                       | 60   | 2                       | 50   |
| Lrg              | Dallas, TX                              | 27   | 37   | 41   | 43   | 16                      | 26   | 2                       | 50   |
| Lrg              | Las Vegas, NV                           | 23   | 34   | 44   | 46   | 23                      | 4    | 2                       | 50   |
| Lrg              | New Orleans, LA                         | 36   | 37   | 38   | 40   | 4                       | 62   | 2                       | 50   |
| Lrg              | Pittsburgh, PA                          | 23   | 24   | 25   | 27   | 4                       | 62   | 2                       | 50   |
| Lrg              | San Diego, CA                           | 28   | 42   | 46   | 48   | 20                      | 11   | 2                       | 50   |
| Lrg              | Seattle-Everett, WA                     | 44   | 47   | 46   | 48   | 4                       | 62   | 2                       | 50   |
| Vlg              | Detroit, MI                             | 34   | 40   | 46   | 47   | 13                      | 38   | 1                       | 58   |
| Med              | Honolulu, HI                            | 28   | 37   | 42   | 43   | 15                      | 28   | 1                       | 58   |
| Med              | Jacksonville, FL                        | 25   | 30   | 39   | 40   | 15                      | 28   | 1                       | 58   |
| Sml              | Laredo, TX                              | 18   | 19   | 19   | 20   | 2                       | 67   | 1                       | 58   |
| Lrg              | San Bernardino-Riverside, CA            | 27   | 41   | 46   | 47   | 20                      | 11   | 1                       | 58   |
| Vlg              | San Francisco-Oakland, CA               | 43   | 49   | 49   | 50   | 7                       | 57   | 1                       | 58   |
| Vlg              | Washington, DC-MD-VA                    | 40   | 47   | 48   | 49   | 9                       | 49   | 1                       | 58   |
| Vlg              | Los Angeles, CA                         | 48   | 50   | 50   | 50   | 2                       | 67   | 0                       | 65   |
| Lrg              | Miami-Hialeah, FL                       | 38   | 42   | 47   | 47   | 9                       | 49   | 0                       | 65   |
| Lrg              | San Jose, CA                            | 44   | 47   | 47   | 47   | 3                       | 65   | 0                       | 65   |
| Med              | Tampa, FL                               | 36   | 37   | 45   | 45   | 9                       | 49   | 0                       | 65   |
|                  | 68 area average                         | 32   | 38   | 41   | 45   | 13                      |      | 4                       |      |
|                  | Very large area average                 | 38   | 43   | 45   | 48   | 10                      |      | 3                       |      |
|                  | Large area average                      | 28   | 35   | 38   | 43   | 15                      |      | 5                       |      |
|                  | Medium area average                     | 25   | 29   | 34   | 40   | 15                      |      | 6                       |      |
|                  | Small area average                      | 19   | 22   | 24   | 29   | 10                      |      | 5                       |      |

Notes: Vlg – Very Large urban areas—over 3 million population.  
Lrg – Large urban areas—over 1 million and less than 3 million population.  
Med – Medium urban areas—over 500,000 and less than 1 million population.  
Sml – Small urban areas—less than 500,000 population.

**CAUTION:** See <http://mobility.tamu.edu/ums> for improved performance measures and updated data

# **A**PPENDIX B

## ***Methodology for 2001 Annual Report***

This appendix summarizes the methodology utilized to calculate many of the statistics shown in the Urban Mobility Report. The methodology is divided into eight sections.

- ◆ **Constants**
- ◆ **Travel Delay**
- ◆ **Travel Rate Index**
- ◆ **Travel Time Index**
- ◆ **Fuel Economy**
- ◆ **Wasted Fuel**
- ◆ **Congestion Cost**

Some of these sections refer to variables that were calculated in other sections. Generally, the sections are listed in the order that they will be needed to complete all calculations. An example calculation is shown with most equations utilizing 1999 Houston data. Because of rounding, some calculations may not exactly match the data in the accompanying tables.

This section of the Annual Report can be downloaded from the website at <http://mobility.tamu.edu>.