THE 2001 URBAN MOBILITY REPORT

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THE 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.

- **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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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.

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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.

- **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.

HOW 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.

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).

WHAT 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.

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

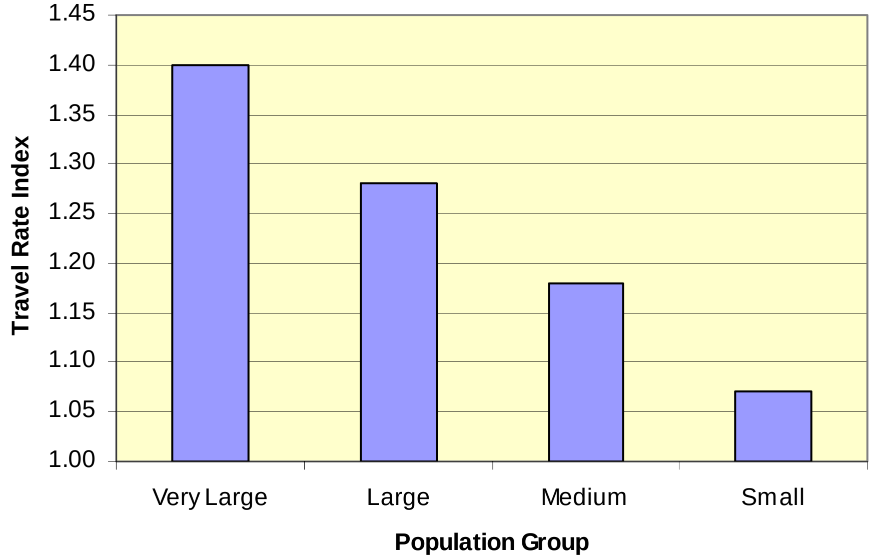
In general, it appears that traffic congestion is worse in the larger urban areas than in the smaller ones. There are instances in the smaller areas where conditions at a localized roadway bottleneck or intersection may resemble the conditions that exist in much larger urban areas. But, as urban areas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

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

ARE 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 that 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.

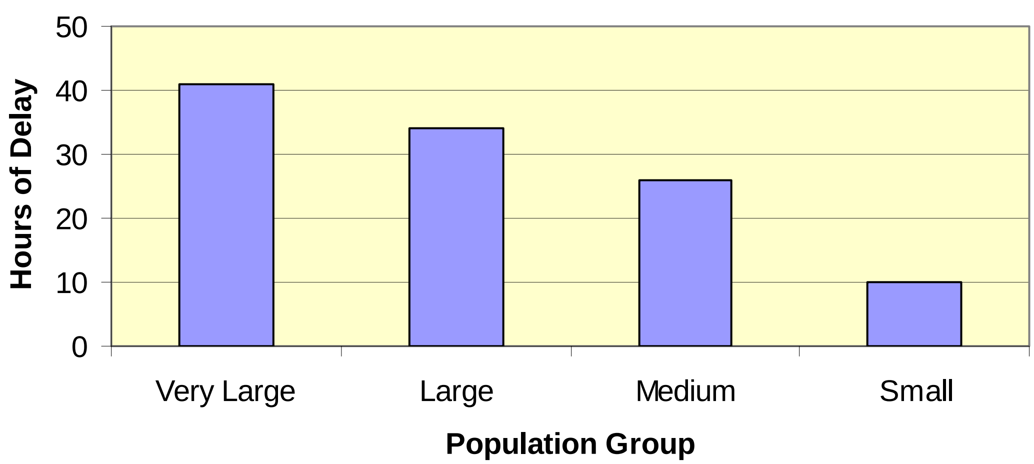
Conclusions

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.

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).

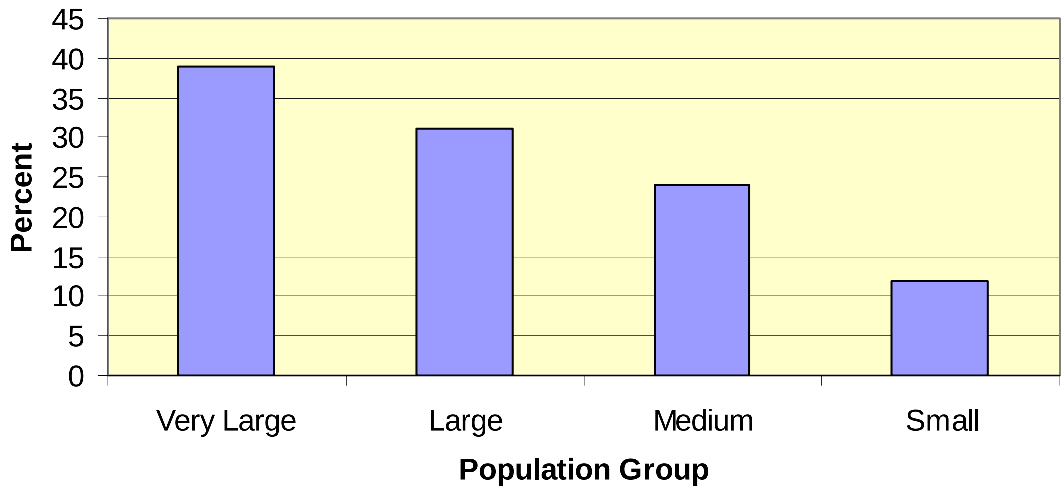
Conclusions

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 Occured in Congested Conditions in 1999



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

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.

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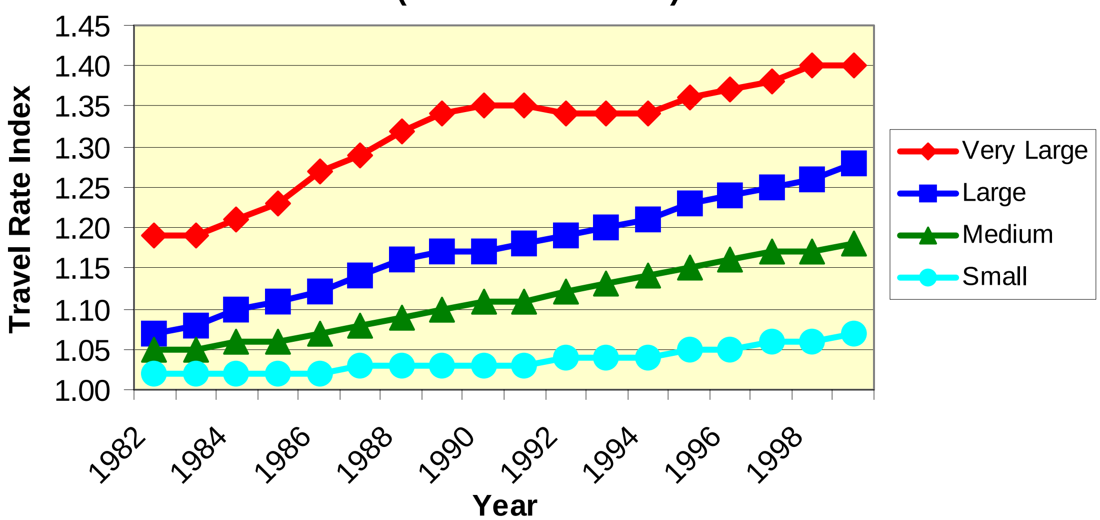
The Travel Rate Index (TRI) measures the amount of additional time needed to make a trip in the peak period rather than at other times of the day. This measure is based solely on the regular traffic congestion on the roadways. This gives us an idea of how much of the change in traffic congestion is due 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.

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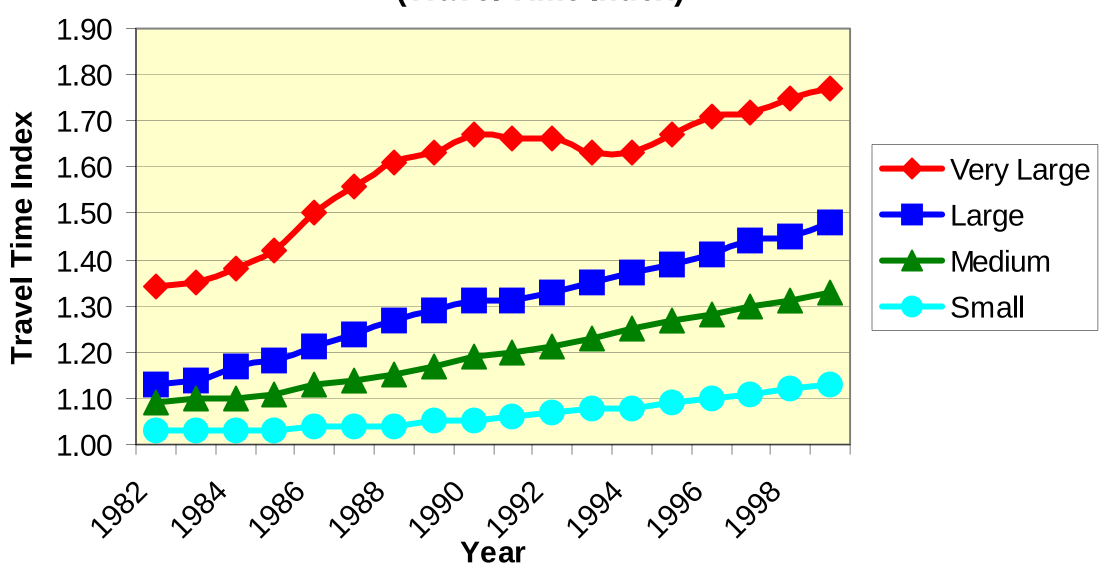
The Travel Time Index (TTI) measures the amount of additional time needed to make a trip in the congested period rather than at other times of the day. This measure is based on both delay due to the traffic demand on the roadways and roadway incidents. This gives an idea of how much of the change in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



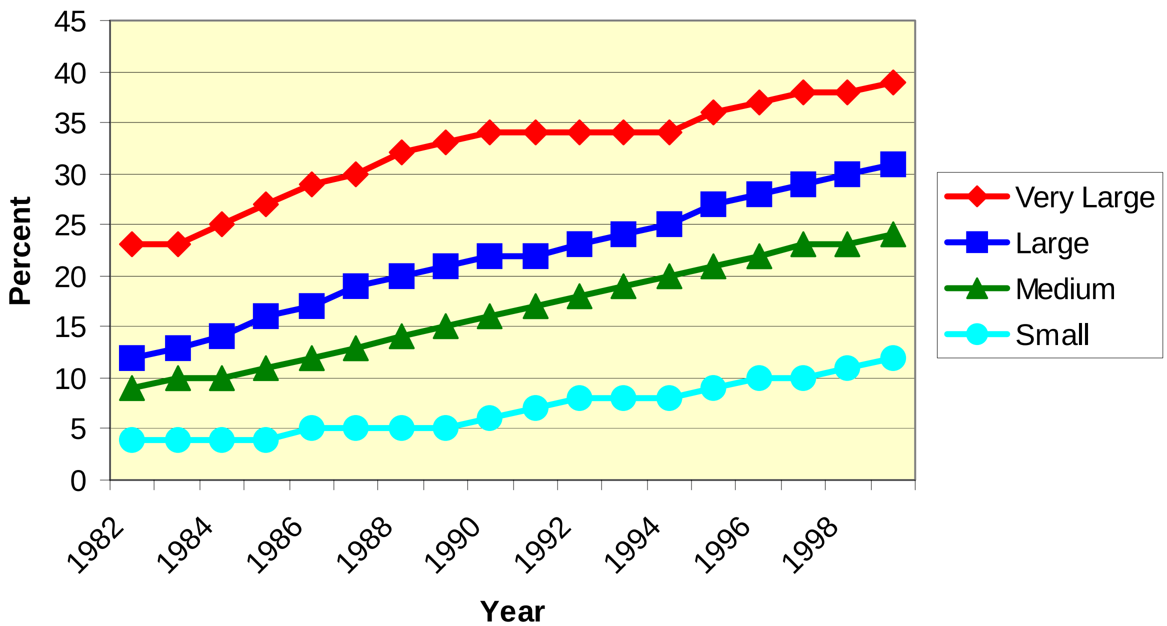
Note: See Table A-4 for individual urban area values.

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.

HAS 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.

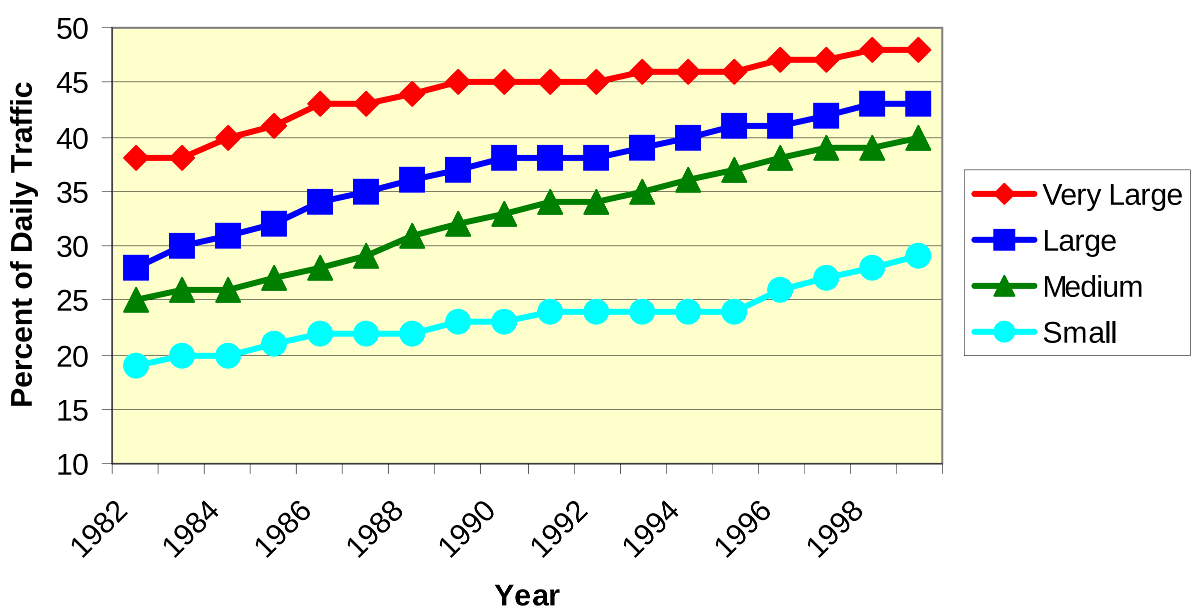
Table 1 and Exhibit 8 show the growth in the congested period. The measure used in these exhibits is the percentage of the daily traffic that happens during the time that may be congested. It provides some general information about the length of the congested period. This is only a general characterization 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.

CAN 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.

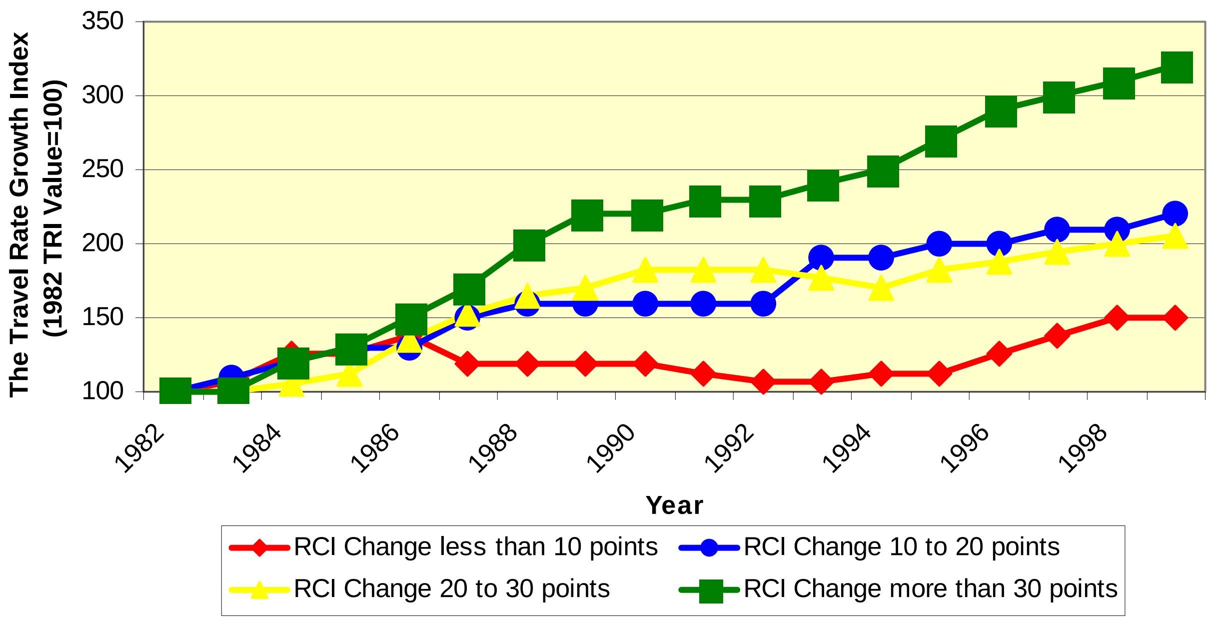
See Table A-3 and A-11 for individual urban area values.

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.

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?

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[1]
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

[1] 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.

DON'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.

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[3]
	Percent[1]	Additional Miles	Estimated Trips[2]	
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	

[1] Annual growth in person-miles of travel between 1994 and 1999.
[2] Assumes an average trip length of 9 miles (*8*).
[3] From an assumed base level of 1.25 persons per vehicle in every urban area.

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.

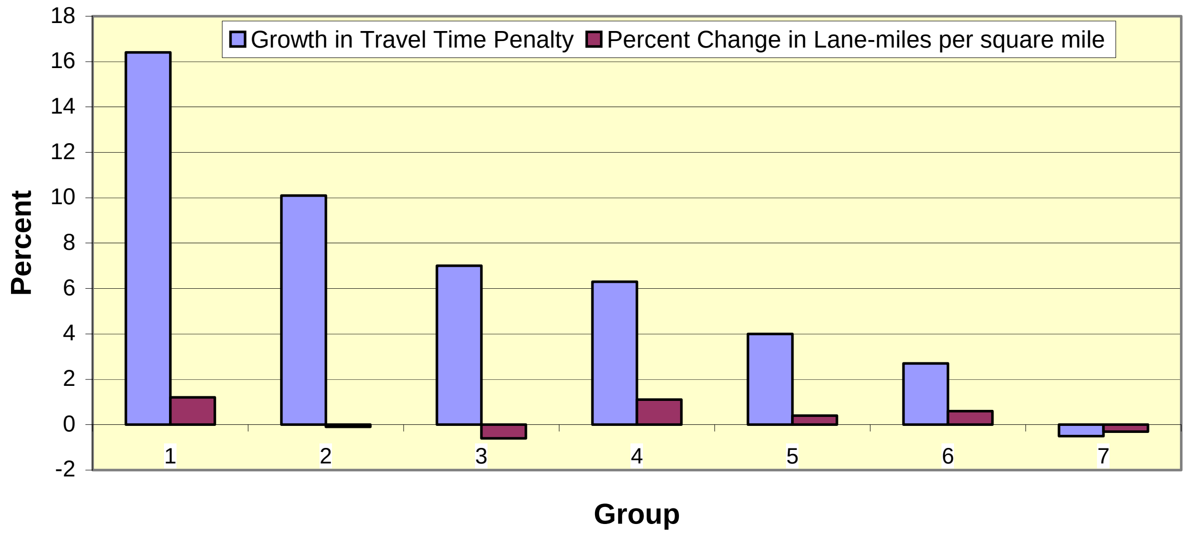
The first comparison is of the Travel Rate Index and the growth in road density (lane-miles per square mile). The 68 urban areas were placed in order ranging from the area with the largest decline in the mobility level between 1994 and 1999 (as measured by TRI increases) down to the smallest. The 68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

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

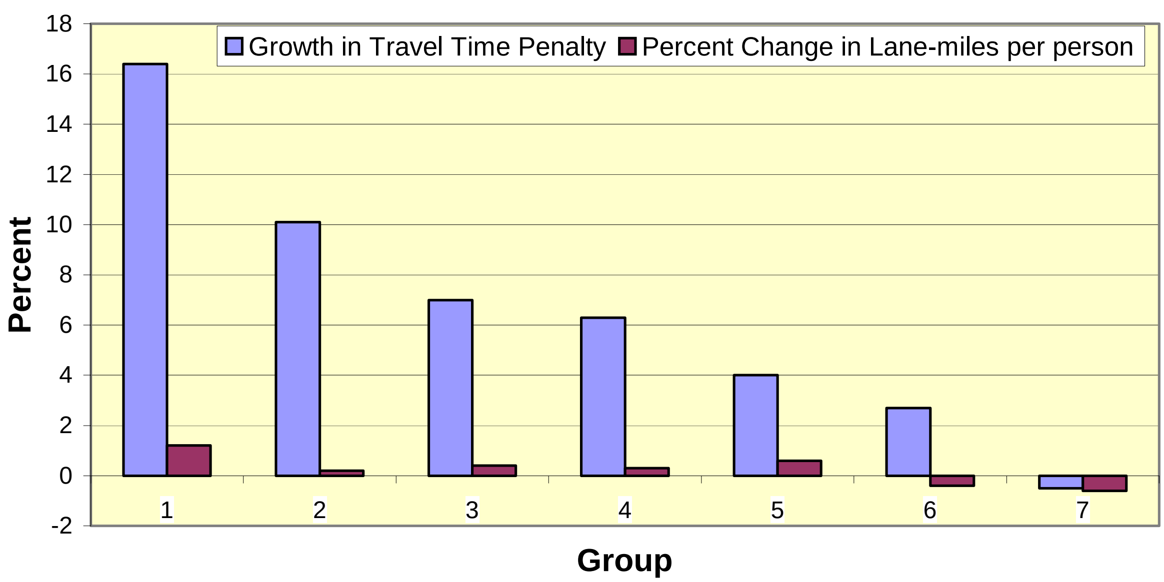


The second comparison is of the change in Travel Rate Index and the growth in road frequency (lane-miles per person). The 68 urban areas were placed in order ranging from the area with the largest change in the mobility level (TRI) down to the smallest. The 68 urban areas were divided into seven groups—six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



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.

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.

WHAT 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

Population Group Average	Annual Cost due to Congestion	
	Cost ($million)	Average Per Person ($)
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	

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	

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.

Some of the solution lies in better management—improving on practices that area 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.

HOW 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.

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.

REFERENCES

1 Lindley, Jeffrey A. A Methodology for Quantifying Urban Freeway Congestion. Transportation Research Board 1132. Transportation Research Board, National Research Council. Washington, DC, 1987.

2 Lomax, Timothy J., Dennis L. Christiansen, and A. V. Fitzgerald. Texas Transportation Institute, "Estimates of Relative Mobility In Major Texas Cities," Research Report 323-1F, 1982.

3 Lomax, Timothy J. Texas Transportation Institute, "Relative Mobility in Texas Cities, 1975 to 1984," Research Report 339-8, 1986.

4 Lomax, Timothy J., Diane L. Bullard, and James W. Hanks, Jr. Texas Transportation Institute, "The Impact of Declining Mobility In Major Texas and Other U.S. Cities," Research Report 431-1F, 1988.

5 Lomax, Timothy J., Dave Schrank, and Shawn Turner. Texas Transportation Institute, "Urban Roadway Congestion—1982 to 1994," Research Report 1131-9, August 1997.

6 Federal Highway Administration. "Highway Performance Monitoring System," 1982 to 1997 Data. February 1999.

7 Downs, Anthony. The Brookings Institution, "Stuck in Traffic: Coping with Peak-Hour Traffic Congestion." May 1992.

8 Office of Highway Information Management, Federal Highway Administration, "1995 Nationwide Personal Transportation Survey," 1997.

(From Report Methodology Description—Appendix B)

9 American Automobile Association, "Fuel Gauge Report," 1993.

10 Lindley, Jeffrey A. "Quantification of Urban Freeway Congestion and Analysis of Remedial Measures," FHWA-RD-87-052, October 1986.

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

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

APPENDIX A

Table A-1. Urban Area Information

Population Group	Urban Area	1999 Population	Population Growth 1982 to 1999 Change (%)	1982 to 1999 Rank	1992 to 1999 Change (%)	1992 to 1999 Rank	1999 Urban Area Size (sq. mi.)	1999 Urban Area Population Density (pers/sq.mi.)
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.
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-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.
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Sml – Small urban areas—less than 500,000 population.

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

Population Group	Urban Area	Travel Rate Index 1982	1987	1992	1999	Point Change in Peak-Period Time Penalty: Long-Term 1982 to 1999 Points	Rank	Short-Term 1992 to 1999 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.
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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	Travel Time Index				Point Change in Peak–Period Time Penalty: Long–Term 1982 to 1999		Point Change in Peak–Period Time Penalty: Short–Term 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.
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Table A-6. Annual Hours of Delay, 1999

Population Group	Urban Area	Annual Person-Hours of Delay (000) Recurring	Incident	Total	Rank	Annual Delay per Person 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	

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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-7. Wasted Fuel in 1999

Population Group	Urban Area	Annual Gallons of Fuel Wasted (million)				Annual Excess Fuel Consumed per Person (gallons)	Rank
		Recurring Delay	Incident Delay	Total	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 Ciity, 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) Delay	Fuel	Total	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
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 Ciity, 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.

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	1,000	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.
Lrg – Large urban areas—over 1 million and less than 3 million population.
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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)	Annual Congestion Cost 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-Hwood-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 Ciity, 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.
Lrg – Large urban areas—over 1 million and less than 3 million population.
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CAUTION: See http://mobility.tamu.edu/ums for improved performance measures and updated data

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

Population Growth	*Urban Area*	*Average Annual VMT Growth (%)*[1]	*Annual Lane-Miles Needed*		*Lane-Mile "Deficiency"*		*1999 Travel Rate Index*	*1999 Travel Time Index*
			Freeway	*PAS*	*Freeway*	*PAS*		
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

[1] 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.

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

Population Group	*1982 to 1987*		*1988 to 1993*		*1994 to 1999*		*1982 to 1999*	
	Percent Growth in VMT	*Percent of Roadway Added*[1]	*Percent Growth in VMT*	*Percent of Roadway Added*[1]	*Percent Growth in VMT*	*Percent of Roadway Added*[1]	*Percent Growth in VMT*	*Percent of Roadway Added*[1]
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

[1] 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.

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

Population Group	Urban Area	Growth in Person Travel Percent[1]	Growth in Person Travel Additional Miles	Growth in Person Travel Estimated Trips[2]	Occupancy Level to Maintain 1999 Mobility Level[3]
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 Ciity, 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

[1] 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.
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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-14. Congested Lane-Miles of Roadway

Population Group	Urban Area	Peak Period Percent of Lane-Miles (%) Freeway 1982	Freeway 1990	Freeway 1999	Principal Arterial Street 1982	Principal Arterial Street 1990	Principal Arterial Street 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 Ciity, 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.
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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

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Table A-16. 1999 Roadway Congestion Index

Population Group	Urban Area	Freeway/Expressway Daily VMT (000)	Freeway/Expressway Daily VMT Lane-Mile	Principal Arterial Street Daily VMT (000)	Principal Arterial Street Daily VMT Lane-Mile	Roadway Congestion Index	Rank
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 Ciity, 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 1982	1987	1992	1999	Short-Term Change 1992 to 1999 Points	Rank	Long-Term Change 1982 to 1999 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	

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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	

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Table A-19. Change in Congested Daily Travel

Population Group	Urban Area	Percent of Daily Travel in Congestion 1982	1987	1992	1999	Percentage Point Change Long-Term 1982 to 1999 Points	Rank	Short-Term 1992 to 1999 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	

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Table A-20. Change in Travel During Congested Times

Population Group	Urban Area	Percent of Daily Travel During Congested Times 1982	1987	1992	1999	Percentage Point Change Long-Term 1982 to 1999 Points	Rank	Short-Term 1992 to 1999 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

APPENDIX 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.