THE 2002 URBAN MOBILITY REPORT

David Schrank
Assistant Research Scientist

and

Tim Lomax
Research Engineer

Texas Transportation Institute
The Texas A&M University System
http://mobility.tamu.edu

The Urban Mobility Report is
Sponsored by:

California Department of Transportation
Colorado Department of Transportation
Florida Department of Transportation
Kentucky Transportation Cabinet
Maryland State Highway Administration
Minnesota Department of Transportation
New York State Department of Transportation
Oregon Department of Transportation
Texas Department of Transportation
Virginia Department of Transportation

June 2002

THE SHORT REPORT

…. FOR READERS WHO ARE NOT STUCK IN TRAFFIC

The 19 years of data in the Urban Mobility Study are used to identify trends and examine issues related to urban congestion. This study includes information for 75 U.S. urban areas from 1982 to 2000. The measures and discussions presented in this edition of the Annual Report provide a basis for discussion about the significance of the mobility problems and the need for solutions. Improvements might include a variety of projects, programs, strategies and practices but they all have three important things in common.

To be broadly effective, they must: 1) gain public confidence, 2) have sufficient funding and 3) provide a valued service. The mix of improvements will be different depending on local conditions and needs but gaining consensus on a plan – whether at the national, state or local level – appears to be a very important early step. The relatively easy-to-understand information in the 2002 Annual Mobility Report can be used to help communicate some basic statistics about mobility and travel time reliability issues.

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.

What has Happened?

- **Congestion is growing in areas of every size.** The 75 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 2000 than in 1982. The average annual delay per peak road traveler climbed from 16 hours in 1982 to 62 hours in 2000. And delay over the same period more than quadrupled in areas with less than 1 million people.
- **Many more trips were accommodated on the transportation system**. From 1982 to 2000 in the 75 urban areas studied, passenger-miles of travel increased over 85 percent on the freeways and major streets and about 25 percent on the transit systems. This additional travel contributed to rising congestion but also represented increased economic activity—individuals and businesses pursuing improvements in quality of life and business opportunities.
- **Congestion costs can be expressed in a lot of different factors, but they are all increasing.** The total congestion "bill" for the 75 areas in 2000 came to $67.5 billion, which was the value of 3.6 billion hours of delay and 5.7 billion gallons of excess fuel consumed.

To keep congestion from growing between 1999 and 2000 would have required 1,780 new lane-miles of freeway and 2,590 new lane-miles of streets—OR—an average of 6.2 million additional new trips per day taken by either carpool or transit, or perhaps satisfied by some electronic means—OR operational improvements that allowed three percent more travel to be handled on the existing systems—OR—some combination of these actions. These events did not happen, and congestion increased.

- **Several changes have been made to the study methodology and reporting**. The speed estimating procedures have been improved with several datasets from urban traffic operations centers. While this results in less overall delay in many areas the trend in congestion growth does not change. The new procedures have been used with the old data to produce a consistent set of information. A better estimate of the effects of congestion is used—delay per peak period traveler replaces delay per capita.

What Should be Done?

- **Road expansions slow the growth of 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. In many of the nation's most congested corridors there does not seem to be the space, money and public approval to add enough roadway 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 2000. The percentage is 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. And many of the "added" roads were previously built streets and freeways that were reclassified from rural to urban.
- **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 effectiveness of options will vary from area to area, but the growth in congestion over the past 19 years suggests that more needs to be done.
  - More capacity—More roads and more transit are part of the equation. Some of the growth will need to be accommodated with new systems and expansions of existing systems.
  - Greater efficiency—More efficient operations such as access management and improved signal timing will be key to addressing some congestion problems. 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. Improved traffic signal timing and coordination, freeway entrance ramp signals, reducing the effect of vehicle crashes and breakdowns, communicating transit routing and scheduling information are only a few of the options that should be pursued in cities of all sizes.

- ➢ Manage the demand—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. Projects that use tolls or pricing incentives can be tailored to meet both transportation needs and economic equity concerns. The key will be to provide better conditions for travel to shopping, school, health care and a variety of other activities.
- ➢ Development patterns—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. Most of these techniques 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.
- ➢ A vision of the future is important. A consensus about how the urban area should arrange the jobs, schools, homes, shops, parks and other land uses is difficult to achieve, but is an important exercise. Even if complete agreement is not achieved, the discussion will help inform transportation agencies and citizens about key decision criteria. Policies and programs can be created to support strategies that move toward the vision.
- ➢ Realistic expectations are also part of the solution. Very large cities will be congested. Some locations in smaller cities around key activity centers will also be congested. But congestion does not have to be an all-day event either. Identifying solutions and funding sources that meet a variety of community goals is challenging enough without attempting to eliminate congestion in all locations.

- **Improving the reliability of the transportation system is an important emerging issue.** Predictable and regular travel times have a certain value for urban travelers and businesses. Crashes, vehicle breakdowns, weather, special events, construction and maintenance activities affect the reliability of transportation systems. There are many programs and strategies that may not significantly change the average mobility levels, but can reduce travel time variations and frustration with transportation services.

This year's report is the product of a cooperative arrangement between the Texas Transportation Institute and 10 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

ACKNOWLEDGMENTS

The authors wish to thank the following members of the Urban Mobility Study Steering Committee for providing expertise, direction and comments. Without their guidance and ideas, this report and study would not be as useful.

California—John Wolf
Colorado—Tim Baker
Florida—Gordon Morgan
Kentucky—Rob Bostrom
Maryland—James Dooley
Minnesota—Tim Henkel
New York—Gerard Cioffi
Oregon—Brian Gregor
Texas—Kevin Lancaster
Virginia—Catherine McGhee

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

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

Pam Rowe—Report Preparation
Tobey Nutt and Amy Jackson—Web Page Creation and Maintenance
Bernie Fette, Julie Goss, Michelle Hoelscher, Rose Matejka and Jennifer Ryan—Media Relations
Pat McConal, Michelle Walker and Chris Pourteau—Report Production
John Henry—Cover Artwork
Dolores Hott and Debra Svec—Distribution

TABLE OF CONTENTS

Page

LIST OF EXHIBITS

INTRODUCTION

The Annual Report of the Urban Mobility Study provides some information about congestion and mobility issues in ways that everyone can understand. This report focuses on the trends from 1982 to 2000 and analyzes 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 Overview of the Study

The Urban Mobility Study uses statistics from generally available data sources and provides information about mobility trends at the urban area level of detail. The report includes information about how traffic congestion has changed over the last 20 years, as well as some relatively uncomplicated explanations about ways to improve mobility. The study also provides more data for individual cities at the website: http://mobility.tamu.edu

The 2002 Annual Report also includes information about the nature and importance of reliable and predictable transportation service based on other databases. It also examines the effect of high-occupancy vehicle lanes and ramp metering programs in a few areas. These and other operational treatments are important aspects of transportation system improvement programs, but there is much less data to analyze their effects. The states that sponsor the Urban Mobility Study are also engaged in many other interesting projects that are improving the technical tools and the ability to communicate the resulting message to many different participants in the transportation decision-making process.

What is Next?

Future Urban Mobility Study reports will include more information about operational improvements and their effects on particular roadways and corridors. Local and state transportation agencies and national transportation groups also have information of this type; links to many of these are also on the website. Some treatments that allow more traffic volume to pass through a section of roadway during peak travel periods may, in fact, result in worse delay statistics being reported in the Annual Report.

The Urban Mobility Study is developing methods to estimate the beneficial effects of these treatments and improving the databases necessary to make useful comparisons. A report to be released in Fall 2002 will further investigate the effects of the operational treatments using a variety of databases from both national and local sources. Some of these data are presented in the report "Monitoring Urban Roadways in 2000" (website: http://mobility.tamu.edu/mmp).

WHAT IS NEW FOR THIS YEAR?

1. **We have chosen to emphasize the mobility ISSUES and what we might be able to learn from the data this year**. The statistics and methodology descriptions are still included along with much more information on the website: http://mobility.tamu.edu

   Issues and trends dominate this year's report, however. The 19-year history of the database and the coming re-authorization of the federal transportation legislation provided the impetus to move away from a simple reporting of the numbers, to a slightly deeper attempt to understand what the data say.

2. **We have examined the "SOLUTION" side of urban mobility in more detail than in the past**. This is not a comprehensive treatment, and more information will be published in the fall of 2002. Operational improvements and high-occupancy vehicle treatments are included in this report. The Fall 2002 report will provide a more integrated look at the urban transportation system—incorporating the effects of many improvement types into the Travel Time Index statistics.

3. **We have improved the SPEED ESTIMATING procedure**. Using the new computer models that simulate traffic conditions and the more extensive traffic monitoring data we have collected, the relationships between traffic volume and speed are closer to the real world experience. Future changes in estimating the effects of operational improvements (see #2) will also likely affect the methods we use to estimate speeds and delay in the next several years. But simplifying assumptions and estimating procedures will be needed until more data collection programs are deployed.

4. **The improved speed estimates have resulted in LESS DELAY than we have previously estimated**. This does not mean that congestion is not a problem; in fact, the trend remains the same—congestion increasing in every city size category. It means that the time penalty for peak period trips is not as great as previously estimated. This is primarily the result of the large volume of trips using the off-peak direction of the roadway to travel at speeds close to the speed limit. The measures for all years of the study are recalculated with the new trends.

5. **DELAY PER PEAK TRAVELER is a new mobility measure**. We have used commuting surveys to estimate the number of travelers using the roads during the peak period, and divided the annual delay estimates by those people. This provides a more realistic idea of the amount of extra time that motorists spend traveling during peak hours.

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 methodology developed by several previous research studies (1,2,3,4,5) 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 annually. Since each state classifies roadways in a slightly different manner, TTI reviews and adjusts the data to make it comparable 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. Comparisons between cities are always difficult; local and state studies are typically more detailed and relevant for specific areas. Trends for individual cities are probably more applicable. However, assumptions used in the Annual Mobility Report do not fully account for operational improvements. This is an issue that needs further attention.

Urban Area Boundary Effects

Urban boundaries are redrawn at different intervals in the study states. Official realignments and local agency boundary updates are sometimes made to reflect 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. The effect in the Urban Mobility Study database is that travel and roadways that previously existed in rural areas are added to the urban area statistics. It is important to recognize that newly constructed roads are only a portion of the "added" roads.

When the urban boundary is not altered every year in fast growth areas, the HPMS data items take on a "stair-step appearance." Each year the Annual Report process closely re-examines the most recent years to see if any of the trends or data should be altered (e.g., smoothing some of the stair steps into more continuous curves) to more closely reflect actual experience. This changes some data and measures for previous years. Any analysis should use the most recent report and data—they include the best estimates of the mobility statistics.

Why Is Free-Flow Travel Speed the Congestion Threshold?

The conditions in the middle of the day (or middle of the night) are the ones that travelers generally identify as desirable and use for comparison purposes. It is also relatively easy to understand that those conditions are not achievable during the peak travel periods without significant funding, environmental concerns and social effects. The decisions to make substantial improvements to achieve some desirable condition using investments in road, transit, operations, demand management or other strategies are products of detailed studies—studies that are not replicated in this report.

For the purposes of a national study, therefore, it is reasonable to set a congestion measurement baseline that everyone generally understands and can identify. Free-flow speed—which we estimate is 60 mph on freeways and 35 mph on major streets—is such a baseline. Speeds less than that will be an indication of delay. It is not intended to be the target for peak-hour conditions in urban corridors. The target setting exercise is discussed in more detail in a report section addressing "acceptable conditions" as targets.

Why Use Traffic Counts and Estimates Instead of "Real" Traffic Speeds?

Because there are not enough cities collecting enough high quality traffic speed data, estimates are necessary. The Urban Mobility Study seeks to understand congestion and mobility levels in many urban areas, and unfortunately, the best common database is one that has roadway design and traffic information. The estimation procedures are used to develop travel time and speed measures that can be used to communicate to a variety of audiences. This Annual Report also has some travel speed data from urban traffic operations centers, but until that information is more widely available, estimates will be required.

In the near future, these reports will also include estimates of the effects from several key improvements such as incident management, ramp metering, traffic signal coordination and high-occupancy vehicles lanes. The benefits of these projects are only indirectly included in the current methodology. When more cities and states conduct thorough evaluation studies and the comparison techniques are improved, the operations and demand management programs will be more completely characterized.

Detailed Speed Data and Reliability Information

The high quality speed data that are available were collected as part of the Mobility Monitoring Program (http://mobility.tamu.edu/mmp), a joint research effort of Texas Transportation Institute and Cambridge Systematics for the Federal Highway Administration (7). The MMP collected and analyzed detailed traffic volume and speed data for freeways in 10 cities. The data are prepared for 5-minute time intervals for sections of freeway between one-half and three miles in length. The base data sets were examined for quality and reasonable values and analyzed for a few key performance measures.

The continuous nature of this database provides a very good picture of the variation in conditions through the year—significantly better information than was available before. Variation or reliability in transportation conditions was studied with 2000 data. Some of that data is used in this report. More will be used as 2001 data is collected and analyzed for more than 20 cities.

The detailed traffic operations center data also does not cover very much of the transportation system of the travel even in the best cities. The percentage of the freeway system that was monitored during 2000 in the ten Mobility Monitoring Program cities varied from 12 to 62 percent. There was very little arterial street condition data. It is difficult to construct a set of measures or interpret the meaning of data under these conditions. While the data are very useful for examining issues they are less useful for area or trend comparisons. Even the evaluation of incidents is hampered by the lack of arterial street data. Traffic that changes route from the freeway to a street experiences delay, but that delay is not counted because there is no monitoring equipment. So the "real" traffic data does not include all of the delay that occurs. Estimates are required to obtain a full picture of the congestion situation.

About the Measures . . .

The primary measures used in the Annual Report are relatively easy to understand and visualize. They reflect travel time concerns and can be applied to a variety of evaluation cases. More information on these measures is available on the website: http://mobility.tamu.edu

Travel Time Index—the ratio of peak period travel time to free-flow travel time. The TTI expresses the average amount of extra time it takes to travel in the peak relative to free-flow travel. A TTI of 1.3, for example, indicates a 20-minute off-peak trip will take 26 minutes during the peak travel periods. Free-flow travel speeds are used because they are an easy and familiar comparison standard, not because they should be the goal for urban transportation system improvements.

Delay per Peak Road Traveler—the hours of extra travel time divided by the average number of road users during the peak periods. This is an annual measure indicating the sum of all the extra travel time that would occur during the year for the average peak road user.

Cost of Congestion—the value of the extra time and fuel that is consumed during congested travel. The value of time for 2000 is estimated for passenger vehicles and trucks and the fuel costs are the per-gallon average price for each state. The value of a person's time is derived from the perspective of the individual's value of their time, rather than being based on the wage rate. Only the value of truck operating time is included; the value of the commodities is not. The value of time is the same for all urban areas.

Change in Congestion—not a particular measure, but a concept used in many analyses. The trends in congestion are often more important than the absolute mobility levels, because they indicate if the right amount of improvement is being funded.

Percent of Congestion—is expressed for three elements—travel, lane-miles and time. Each element examines a different dimension of declining mobility levels. Congested travel examines the miles of travel that occur on congested roads during the peak periods. Congested lane-miles indicate the road space that operates at less than free-flow speeds during the peak. Congested time refers to an estimate of how long "rush hour" conditions exist (i.e., the amount of time that travelers might find congestion on area roadways).

Interpreting the Measures and Rankings

The mobility performance measures and the rankings based on them are useful for a variety of purposes. They are especially good at identifying multi-year trends and in comparing relative levels of congestion. As evidenced by the continual refinement of the measures, estimation procedures and data, however, this series of reports is still a "work-in-progress."

One element of this uncertainty is the value for the measures themselves. All estimation procedures have simplifying assumptions that are not correct for every situation. And traffic data reflects the day-to-day variation in activity that affects traveler experiences. There are also locations or corridors in each urban area, especially those over one million population, where mobility levels are much lower than average. Those who frequently travel in these places will get a biased view of the urban areawide mobility level.

Most of the measures presented in the report address roadway systems. While the problems and solutions are not solely focused on roads, much of the data that are available relate to roads and vehicle travel. This also reflects the fact that more than 90 percent of the trips in urban areas are made by private vehicle. Major activity centers and travel corridors clearly benefit from travel modes other than private vehicles, and those analyses will be expanded in coming reports. So, while using road statistics may not provide a complete picture of urban mobility levels, they do allow some useful comparisons.

On the "solution" side of the measures, the current database and methodology include the effect of lane additions and traffic volume reductions. The effect of a range of demand management and operational improvements, however, are not included. Most larger urban areas are pursuing these improvements and data and evaluation studies are more available than a decade ago. The effect of these solutions is being investigated for a report to be published in Fall 2002.

Another key manifestation of uncertainty is the ranking of the measures. Estimating the measures creates one set of variations—the "real" measure could be higher or lower—and the relatively close spacing of the measures mean that the rankings should be considered as an indication of the range within which the true measure lies. There are many instances where one or two hours of delay or one or two index points could move an urban area several ranking spots.

We recommend that several measures, as well as the trend in the measures over several years, be considered before any "official rank" is determined. Just as the report indicates there is no single "solution" to the mobility problems in most areas, there is also no single "best" measure.

HOW CONGESTED ARE THE ROADS AND IS IT GROWING?

Just as David Letterman has other segments of his show, there is more to congestion than the Top 10 list. The trend in congestion growth is also important. Where and when congestion occurs is important within an urban network, as well as for comparing urban areas to each other. And when making comparisons, it is important to recognize facts such as, 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 locations in larger cities.

Conclusions

In general, traffic congestion is worse in the larger urban areas than in the smaller ones. Traffic congestion levels have increased in every area over the history of the study. The congested time is lengthening and now incorporates more road and more travel than in the past. And congestion levels have risen in all size categories, indicating that even the smaller areas are not able to keep pace with rising demand.

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 2010 will have congestion problems of large areas in 2000.

See Exhibits A-2 to A-5 for more information on individual urban areas.

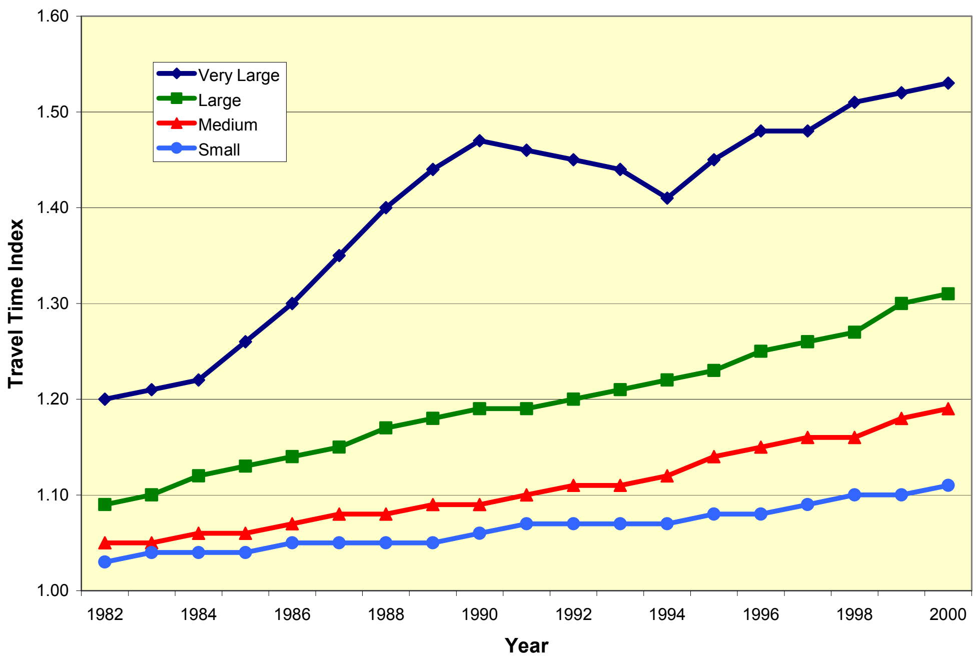
The simplest way to look at this problem is to examine the Travel Time Index (TTI). It measures the amount of additional time needed to make a trip during a typical peak travel period in comparison to traveling at free-flow speeds. The delay experienced by peak period travelers is also a useful mobility measure. The 2000 statistics show:

- The average TTI for all 75 urban areas is 1.39. Thus, an average 20-minute off-peak trip takes almost 28 minutes to complete during the peak due to heavy traffic demand and incidents.
- Congestion problems tend to be more severe in larger cities. The average TTI for each individual population group ranges from 1.53 in the Very Large areas down to 1.11 in the Small urban areas.
- 22 of the 75 urban areas have a TTI of at least 1.30. Every one of these 22 urban areas is in the Very Large and Large population groups—they have populations greater than one million.
- There are three urban areas from the Medium population group in the top 30 urban areas—Austin, Charlotte, and Albuquerque.

Is congestion increasing in all urban areas?

Yes. Using both the Travel Time Index (Exhibit 1) and annual delay per peak traveler (Exhibit 2), congestion does appear to be increasing in cities of all sizes.

Exhibit 1. Growth in Peak Period Travel Time, 1982 to 2000

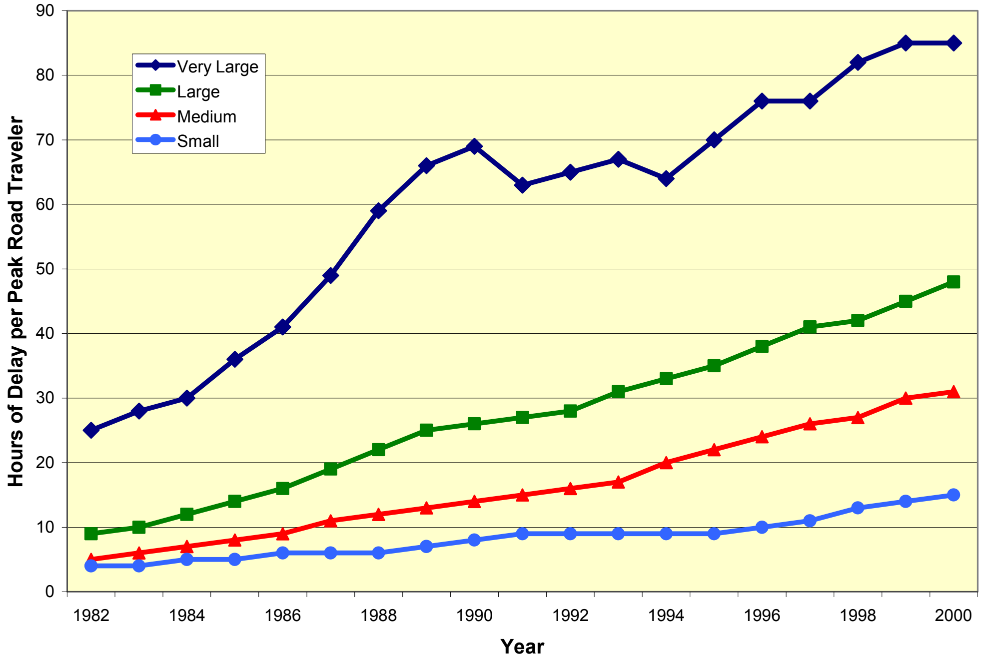


Note: See Exhibit A-3 for more information.

Note: The Travel Time Index is a ratio of average peak period to free-flow travel time. A value of 1.30 indicates a free-flow trip of 20 minutes takes 26 minutes in the peak due to heavy traffic demand and incidents.

- The trend in the Very Large cities in the early 1990s is dominated by the California recession and roadway construction in Houston. Recent economic growth has likewise resulted in significant mobility declines.
- The average increase in the travel time penalty was 25 points (1.14 to 1.39) between 1982 and 2000. This 25-point increase would add 25 percent more travel time to a trip made during the peak compared to the off-peak.
- The largest average increase in travel time penalty occurred in the Very Large population group between 1982 and 2000 – from 1.20 to 1.53. Thus, a 20-minute off-peak trip increased from 24 minutes to over 30 minutes during peak driving times.
- The smallest average increase in travel time penalty occurred in the Small urban areas between 1982 and 2000 – from 1.03 to 1.11. The 8-point increase equated to less than 2 minutes of additional time on a 20-minute off-peak trip that was made during peak driving times.
- The average increase in the travel time penalty over the recent past (between 1994 and 2000) was 10 points.
- The rate of increase in the travel time penalty was greater in the short term than long term with an increase of 1.5 points per year between 1994 and 2000 versus an increase of 1.2 points per year between 1982 and 2000.

Exhibit 2. Growth in Annual Delay per Peak Road Traveler, 1982 to 2000



Note: See Exhibit A-4 for more information.

- The average delay per peak road traveler in the 75 urban areas is 62 hours.
- The average increase in delay per traveler was 17 hours between 1994 and 2000.
- The California recession and the roadway construction on projects in Houston resulted in mobility improvements in the Very Large city average between 1990 and 1994.
- The average increase in delay per traveler was 46 hours between 1982 and 2000.
- The largest increase in delay per traveler occurred in the Very Large urban areas with an increase of 60 hours between 1982 and 2000.
- The smallest increase in delay per traveler occurred in the Small urban areas with an increase of 11 hours between 1982 and 2000.
- The rate of increase in delay was greater in the short term than long term with an average increase of 1.2 hours per year between 1982 and 2000 versus an increase of 1.6 hours per year between 1994 and 2000.
- The average delay per peak road traveler in the Very Large population group is about the same as the average delay in the Large and Medium population groups combined.
- The average delay per peak road traveler in the Large population group is about the same as the average delay in the Medium and Small population groups combined.

WHAT IS A REALISTIC CONGESTION GOAL?

There are three ways to answer this question.

There is not a Single Answer.

The first answer is, "There is no way to tell." The answer relates to several conflicting objective and subjective components. Environmental effects, cost, land requirements, economic competitiveness, expected effects of land use decisions and many other concerns compete for public approval during road, transit and other program funding decisions. These issues are resolved in many different ways within the same city. And cities differ on their view of the best approach to an overall strategy. Portland, Oregon and the San Francisco-Oakland Bay Area have pursued varying land use arrangements and greater transit investment than other metropolitan areas in an effort to create a desirable future. Other cities are using road additions and improved operating strategies to achieve their goals. Most areas use a variety of strategies, but only a few use any reduction targets. Of the few that do, some speak in terms of returning conditions to those of some past year, or in terms of some percent of travel that is congested. Many areas are targeting a goal of slowing the growth of congestion, rather than a reduction. But there is no common standard.

What is your Population?

The second answer is, "It depends on the population of the city you live in." Exhibit 3 shows that peak period travel time penalties rise as the population increases. Urban areas with populations larger than 1 million have a small chance of having a Travel Time Index value of less than about 1.20. Almost all cities larger than 500,000 included in the 2002 Annual Mobility Report have a congestion level in excess of 1.15. Of the cities with less than 500,000, none have congestion levels in excess of 1.20. These characteristics ignore topographic or geographic constraints and they relate more to what other cities have been able to do, than to what residents and business leaders of a city hope to accomplish. But there appear to be some limitations imposed by urban area population levels. As metropolitan areas grow, their economics grow as well and become more diverse. This increases the number of trips that people and businesses make, thus increasing transportation demand.

What is "Acceptable?"

The third answer is more detailed and relates to roadway type, urban location project planning, areawide vision and general areawide congestion levels. This answer builds on the idea that travelers accept lower speeds on streets than they are willing to accept on freeways, and that they do not expect to walk or bicycle at freeway speeds either.

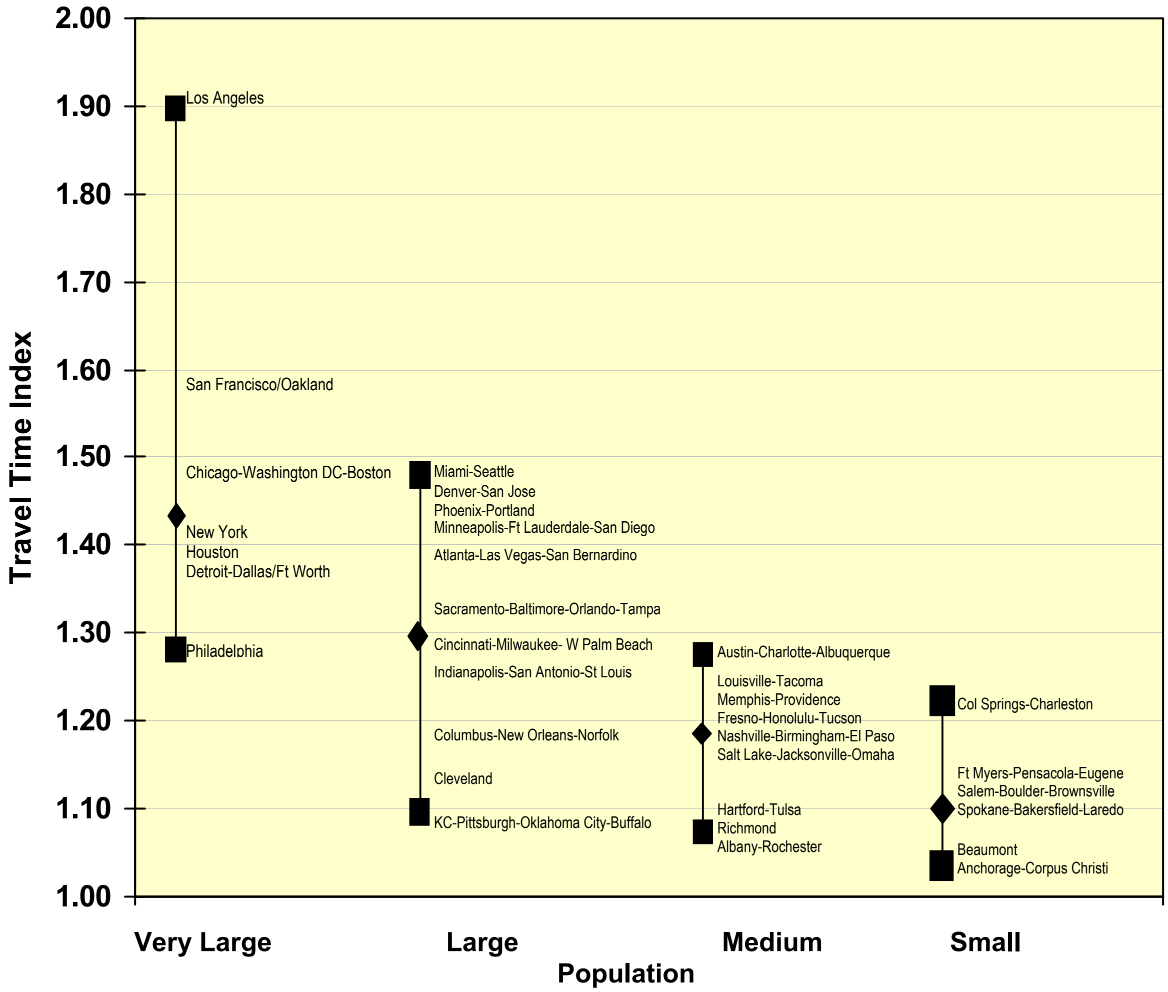
It also seems that residents of large cities may have a greater tolerance for congestion levels than citizens in small towns. People and firms in larger metropolitan areas accept more congestion because they get more economic payoffs from being there despite the congestion. Firms have a larger labor pool and more suppliers to draw from. People have more jobs to choose from, more opportunities to specialize in their chosen line of work, and more opportunities to get higher pay rates. And, people generally expect the off-peak periods to be uncongested.

These variations in "unacceptable" travel conditions might be extended to urban geographic variations (see Exhibit 4). Travelers and urban residents generally expect peak period congestion near downtowns, other major activity centers or at geographic constraints such as major water crossings during peak hours. This does not mean that congestion is "desirable;" rather, it recognizes that widening freeways and streets in downtowns is much more difficult and disruptive than residents might be willing to approve and pay for. By the same reasoning, it is likely that travelers believe that free-flow travel is the goal for rural roadways. The areas between downtown and the rural areas probably have an acceptable speed somewhere between.

What congestion level should we expect?

Areas with populations over 3 million (Very Large) should expect a minimum peak period travel time penalty of 30 percent. Areas over 1 million (Large and Very Large) should expect a time penalty of at least 15 percent with a more likely value being 25 to 30 percent. Areas over one-half million (all except Small) should expect at least a 10 percent time penalty in the peak with typical values being closer to 15 or 20 percent. Areas less than a half million (Small) should expect a time penalty of up to 20 percent.

Exhibit 3. What Congestion Level Should We Expect?
(Range of Travel Time Index Values in Each Group)



Note: See Exhibit A-2 for more information.

Note: Urban area names are positioned close to their travel time index value.

- The TTI values range from 1.28 (Philadelphia) to 1.90 (Los Angeles) in the Very Large population group. The median value for this group is 1.43.
- The TTI values range from 1.08 (Buffalo-Niagara Falls) to 1.45 (Seattle-Everett and Miami) in the Large population group. The median value for this group is 1.29.
- In the Medium population group, the TTI values range from 1.06 (Rochester) to 1.27 (Austin, Charlotte, Albuquerque). The median value for this group is 1.19.
- The TTI values range from 1.04 (Corpus Christi and Anchorage) to 1.20 (Colorado Springs) in the Small population group. The median value for this group is 1.09.

What is an example of "acceptable" travel conditions?

Exhibit 4 illustrates how the "acceptable travel conditions" concept might be presented in a large urban area. Locations near large employment or other activity centers might more likely accept higher peak congestion levels because of the higher activity levels and greater impacts of road widening. And locations in the suburbs and rural areas expect higher speeds. We do not expect to travel at 60 mph speeds on streets, or to bicycle at 60 mph. Buses that stop to load and unload passengers will not be able to maintain the same speed as private vehicles. The speeds would be compared to current and estimated future conditions.

The type of matrix in Exhibit 4 could be used to identify transportation system elements that are in greatest need. Where the speeds do not meet the "acceptable" levels, improvement alternatives could be investigated.

Achieving conditions closer to the acceptable level might include operational treatments, high-occupancy vehicle lanes, toll highways, transit improvements, parking pricing, road pricing projects or other treatments that seek to provide slightly better service for all, more reliable conditions for all, or better service for some segment of travelers and freight shippers.

Exhibit 4. Example of Acceptable Travel Speed Matrix

PEAK PERIOD						
Area Type	Acceptable Travel Speed (miles per hour)					
	Freeway Mainlane	Freeway HOV Lane	Major Street	Bus on Street	Rail in Street	Bike
Central Business District	35	60	12	8	10	10
Central City/ Major Activity Center	40	60	15	12	12	11
Suburban	45	60	25	15	20	12
Fringe	50	65	30	20	25	15
OFF-PEAK PERIOD						
Area Type	Acceptable Travel Speed (miles per hour)					
	Freeway Mainlane	Freeway HOV Lane	Major Street	Bus on Street	Rail in Street	Bike
Central Business District	50	65	20	12	12	12
Central City/ Major Activity Center	60	65	25	15	15	13
Suburban	60	65	30	17	23	15
Fringe	60	65	35	25	27	15

Source: Reference (8)

Note: **For illustration purposes only**. *When this concept is used to evaluate the transportation system, the speeds should reflect a consensus of input from technical and non-technical groups. Consensus might be more easily achieved if a relatively brief explanation about the relationship between transportation service, economic development, social and environmental considerations, transportation funding, and land use patterns were included. It could also identify current operating conditions for facilities in each matrix cell so that comparisons can be made.*

HOW FAR HAS CONGESTION SPREAD?

Traffic congestion affects a broader segment of the transportation system each year. Several dimensions are explored within this report. Congestion has spread to **more cities**, to **more** of the **road system** and **trips** in cities, to **more time** during the day and to **more days** of the week in some locations.

Conclusions

Congestion has spread significantly over the 19 years of the study. A few notable changes include

- 22 urban areas have a TTI above 1.3 compared with one such area in 1982.
- 66 percent of the peak period travel is congested compared to 33 percent in 1982.
- 58 percent of the major road system is congested compared to 34 percent in 1982.
- The peak period when congestion might be encountered has grown from about 4.5 hours to about 7 hours.

See Exhibits A-3, A-10, A-12, A-13 in the Appendix for more information.

Congested Travel

The amount of traffic experiencing congestion in the peak travel periods has doubled in 19 years of the study from 33 percent in 1982 to 66 percent in 2000. This means that two of every three cars experience congestion in their morning or evening trip. Exhibit 5 provides more information on this trend.

Congested Time

From the traffic database that is used for this study, it is uncertain exactly how long the congested periods last in each urban area. What we can estimate is the amount of travel that occurs during congested times. Exhibit 6 shows the estimated relationship between the amount of traffic in the peak period and the approximate length of the congested periods. Exhibit 7 also shows the average length of the congested periods for each population group for 1982 and 2000.

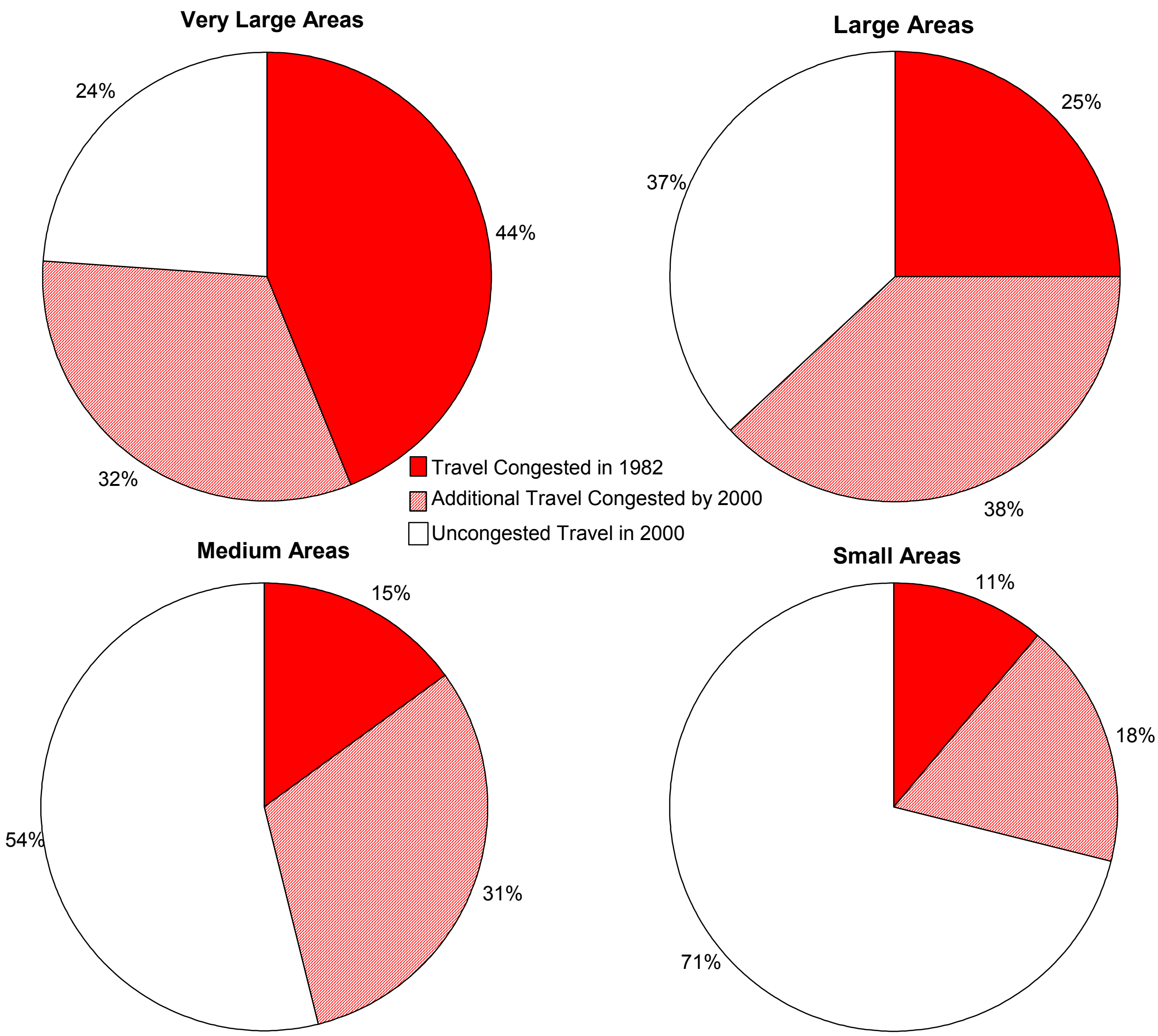
Congested Roads

The amount of roadway (freeway and principal arterial street) that is congested during the peak period is shown in Exhibit 8. The percentage of the major roadway system that is congested has risen from 34 percent in 1982 to 58 percent in 2000.

How much travel is congested?

On average, about two-thirds of the traffic on the roads during peak driving times experience congestion. This amount has doubled over the 19 years of data in this study. (See Exhibit A-11 for more information).

Exhibit 5. Percent of Peak Period Travel That is Congested



- The amount of peak period traffic experiencing congestion has risen from 33 percent in 1982 to 66 percent in 2000 in the 75 study areas.
- The range of peak period traffic experiencing congestion grew from between 11 percent and 44 percent in 1982, to between 29 percent and 76 percent in 2000.
- The Large population group experienced the greatest growth in percentage points for the amount of congested peak period travel with an increase of 38 percentage points between 1982 and 2000.

How long are the roadways congested?

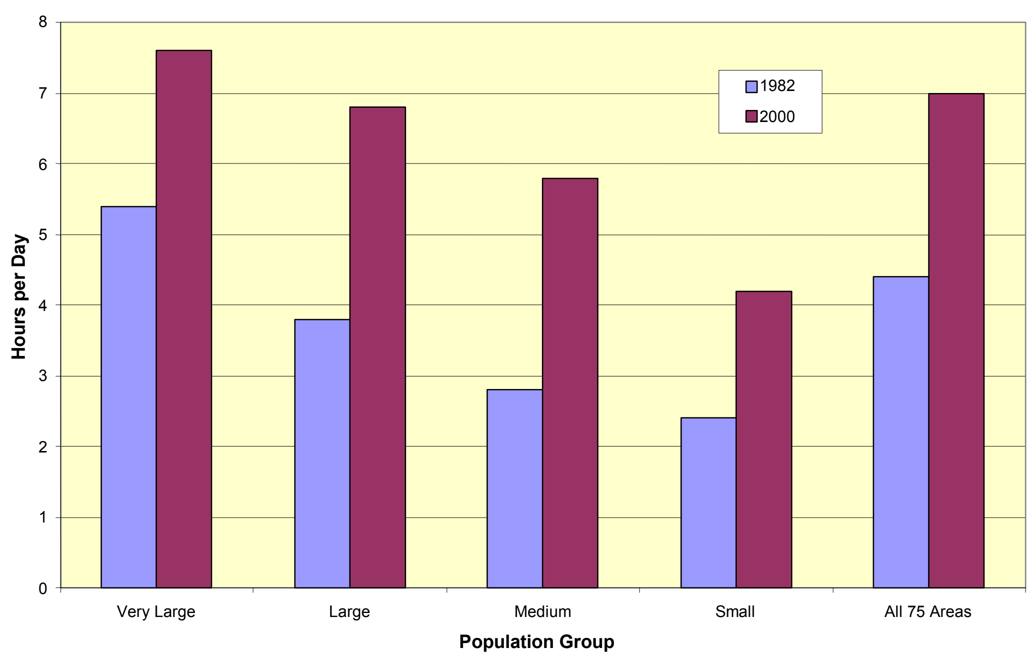
One measure that travelers use to evaluate the transportation system is the time during the day when traffic congestion has to be factored into their plans. For all but the most congested sections in the largest cities, these "rush hours" are confined to just a few hours. But, that time has grown.

If all of the travel in the 75 urban areas is examined, the roadway system is congested for about seven hours per day. The length of the congested period varies greatly from the Small urban areas (just over four hours) to Very Large urban areas (about 7.5 hours). (See Exhibit A-12 for more information).

Exhibit 6. Relationship Between Traffic and Length of the Congested Periods

Percent of Daily Traffic in the Congested Period	Approximate Length of the Congested Period (hours)	2000 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 7. Length of Congested Periods

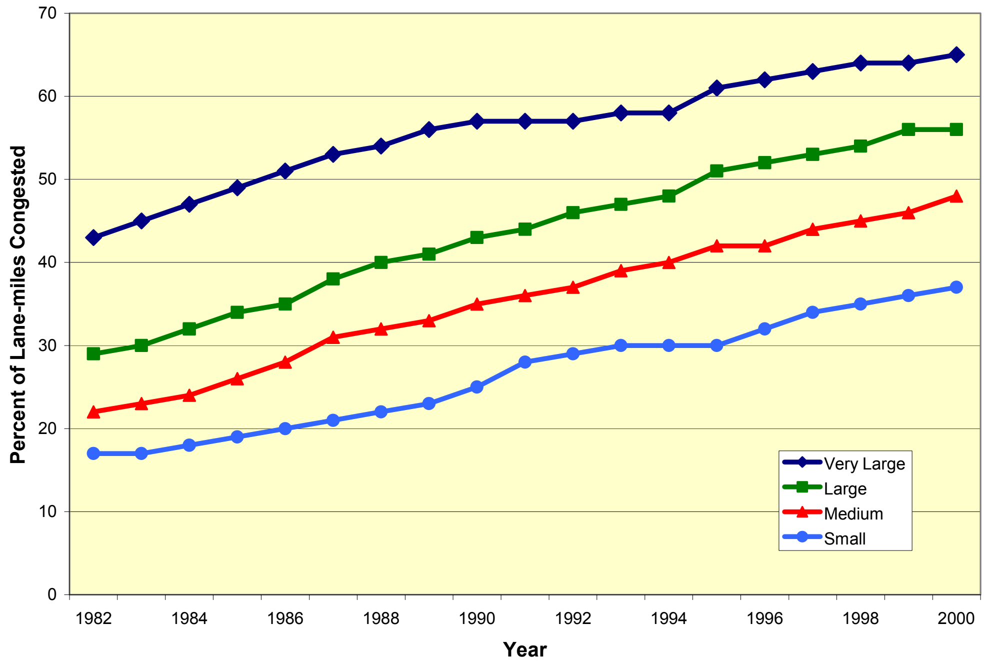


- The average amount of time the roadways are congested has increased from about 4.5 hours in 1982 to about 7 hours in 2000 in the 75 study areas.
- The average amount of time the roadways are congested ranged from approximately 2.5 hours in the Small urban areas to about 5.5 hours in the Very Large urban areas in 1982.
- The average amount of time the roadways are congested ranged from approximately 4 hours in the Small urban areas to about 7.5 hours in the Very Large urban areas in 1982.
- The greatest increase in the peak period occurred in the Medium and Large urban areas with an increase of about 3 hours between 1982 and 2000.

How much of the roads are congested?

The amount of major roads (freeways and principal arterials) that are congested varies from about 35 percent in the Small urban areas to about 65 percent in the Very Large urban areas in 2000. The average for all 75 urban areas is 58 percent in 2000. (See Exhibit A-13 for more information).

Exhibit 8. Percentage of Roads That are Congested



- The percentage of lane miles of roadways (freeways and principal arterials) that contained congested travel during the peak period has risen from 34 percent in 1982 to 58 percent in 2000 in the 75 study areas.
- The percentage of lane miles of roadways (freeways and principal arterials) that contained congested travel during the peak driving times ranged from 37 percent in the Small population group to 65 percent in the Very Large population group.
- The Large population group experienced the greatest percentage point increase between 1982 and 2000 with a jump of 27 percentage points (29 percent in 1982 to 56 percent in 2000).
- The Medium and Small population groups experienced the greatest percent change in their congested lane-miles, both increasing by 118 percent between 1982 and 2000. The percentage of lane-miles congested increased from 22 to 48 percent in the Medium population group. The change in the Small population group was from 17 to 37 percent over the same time.
- Medium areas have the same percentage of congested roadway as the average of the Very Large areas in 1982.

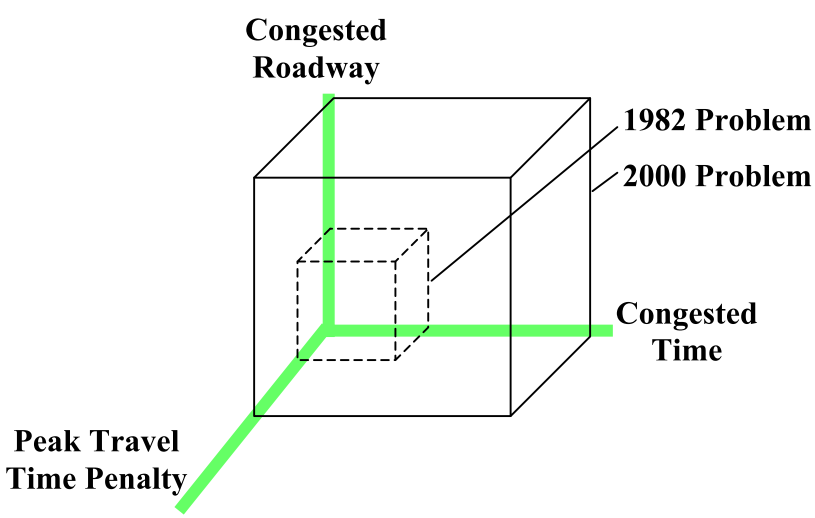
CONGESTION TRENDS – A THREE-DIMENSIONAL PROBLEM

Summarizing the growing congestion problem as a three-dimensional picture (Exhibit 9) illustrates the aspects felt by travelers. Congestion now affects more of the time spent traveling. And more roadway. And results in greater travel time penalties than in 1982. The numbers show:

- Congested roadway expanding from 34 percent to 58 percent.
- Congested travel during the peak period growing from 33 percent to 66 percent
- Travel time penalties for the average peak period trip growing from 14 percent to 39 percent.

The "box" that U.S. transportation systems are in is expanding in a bad way. The problem is not simply that it takes more time to get around. Congested conditions exist on roads and at times they did not a few years ago. This means that individuals and businesses must plan for more time to accomplish trips. It also means that there is more uncertainty associated with making travel plans. A congested system has less ability to handle vehicle crashes, vehicle breakdowns, special events, weather or other difficulties without a significant increase in travel times. This issue is explored in the report section on reliability in transportation service.

Exhibit 9. Conceptual View of the Expanding Box of Congestion Problems



WHAT DOES CONGESTION COST US?

Congestion has several effects on travelers, businesses, agencies and cities. One significant element is the value of the additional time and wasted fuel. The 75 areas do not include all of the congestion in the U.S., but a substantial portion of the delay and extra fuel are included. Of the 75 urban areas in the study, the top 12 include about two-thirds of the delay estimated for 2000, and the top 20 areas account for 80 percent of annual delay. Some other highlights include:

- In 2000, congestion (based on wasted time and fuel) cost about $68 billion in the 75 urban areas. (See Exhibits 10, A-7 and A-8 for more information).
- The average cost for each of the 75 urban areas was $900 million. The average cost associated with each population group ranged from about $4.2 billion in the Very Large urban areas down to $32 million in the Small areas.
- The average cost per peak road traveler in the 75 urban areas was $1,160 in 2000. The cost ranged from $1,590 per person in Very Large urban areas down to $245 per person in the Small areas.
- Exhibit A-6 shows that 5.7 billion gallons of fuel were wasted in the 75 urban areas. This amount of fuel would fill 114 super-tankers or 570,000 gasoline tank trucks. If you placed 570,000 gasoline tank trucks back-to-back, they would stretch from New York to Las Vegas and back.
- The top 10 areas accounted for 3.5 billion gallons (62 percent) of wasted fuel.
- Peak road travelers in Los Angeles waste more fuel than anywhere else with 204 gallons per person per year.
- On average, 99 gallons of fuel are wasted per peak road traveler in 2000 in the 75 urban areas.
- The amount of wasted fuel per peak traveler ranges from 134 gallons per year in the Very Large urban areas to 22 gallons per year in the Small areas.

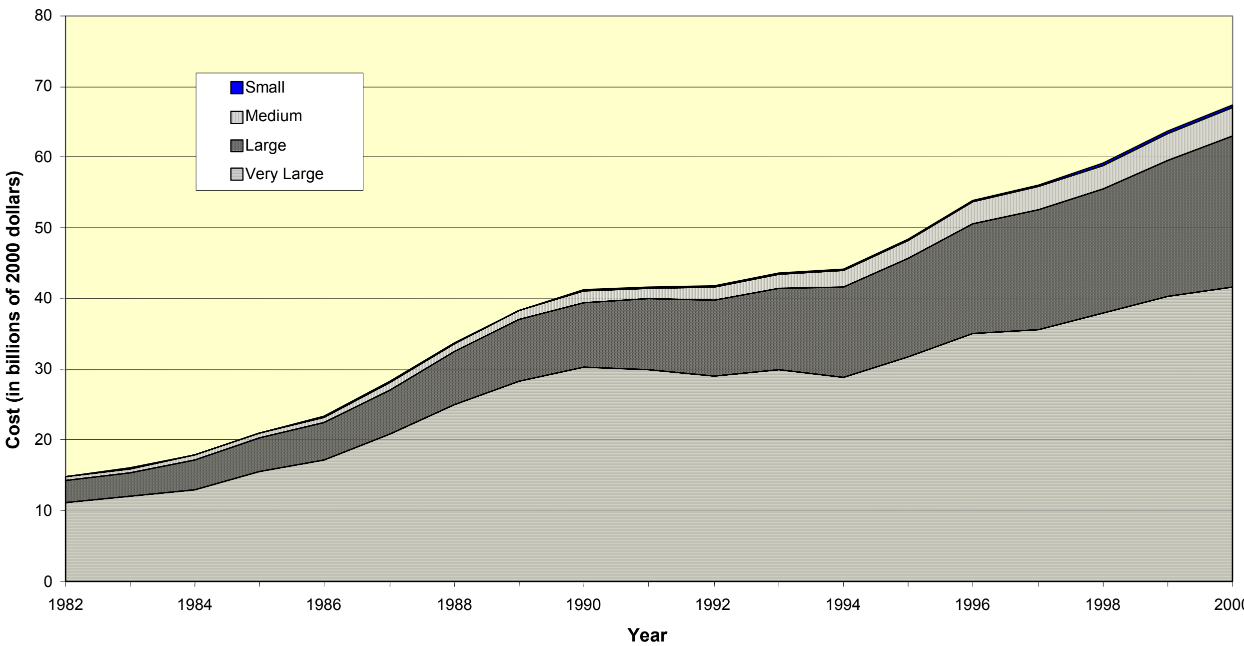
Exhibit 10. Cost of Congestion in 2000

Population Group	Annual Cost Due to Congestion		Annual per Traveler Statistics	
	Average Cost ($million)	Average Per Traveler ($)	Average Delay (hours)	Average Fuel (gallons)
Very large areas	4,170	1,590	85	134
Large areas	705	915	48	79
Medium areas	195	595	31	52
Small areas	32	245	15	22
75 area	900	1,160	62	99
75 area total	$67.5 Billion		3.6 Billion	5.7 Billion

What is the total cost of congestion in the 75 areas?

The total cost of congestion for each population size group is shown in Exhibit 11. This cost accounts for the amount of wasted time and fuel due to traffic congestion. The total cost of congestion in the 75 urban areas is almost $68 billion in 2000. (See Exhibit A-7 for more information).

Exhibit 11. Annual Cost of Congestion

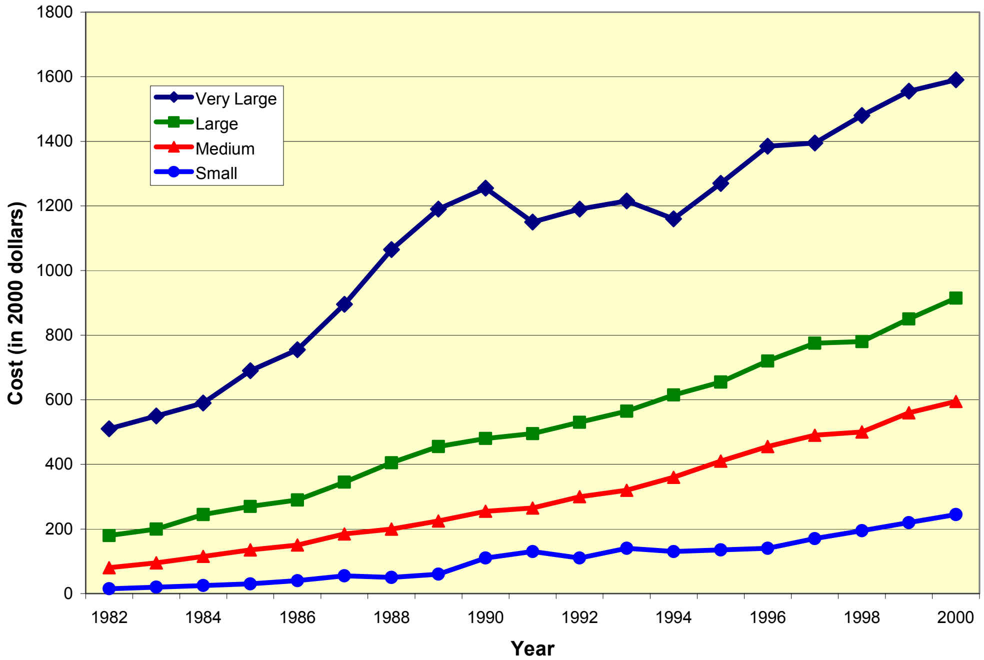


- The average annual cost of congestion in 2000 was about $900 million in the 75 urban areas studied.
- The Very Large population group accounted for about $42 billion in congestion cost in 2000. This was up from about $11 billion (2000 dollars) in 1982.
- The Very Large population group accounted for about 62 percent of the total congestion cost in 2000. The remaining congestion cost was split among the population groups as follows: 31 percent Large, 6 percent Medium, and 1 percent Small.
- Eighteen urban areas had a total annual congestion cost of at least $1 billion each.

What is the cost of congestion for me?

The total cost of congestion is divided by the estimated number of travelers on the roadway in the peak periods to determine the effect of congestion on an individual (Exhibit 12). It is estimated that the proportion of travelers on the roads during the peak periods range from about 30 to 50 percent in the 75 urban areas (9). The average annual cost to each of these travelers is about $1,160. (See Exhibit A-8 for more information).

Exhibit 12. Annual Cost per Peak Road Traveler

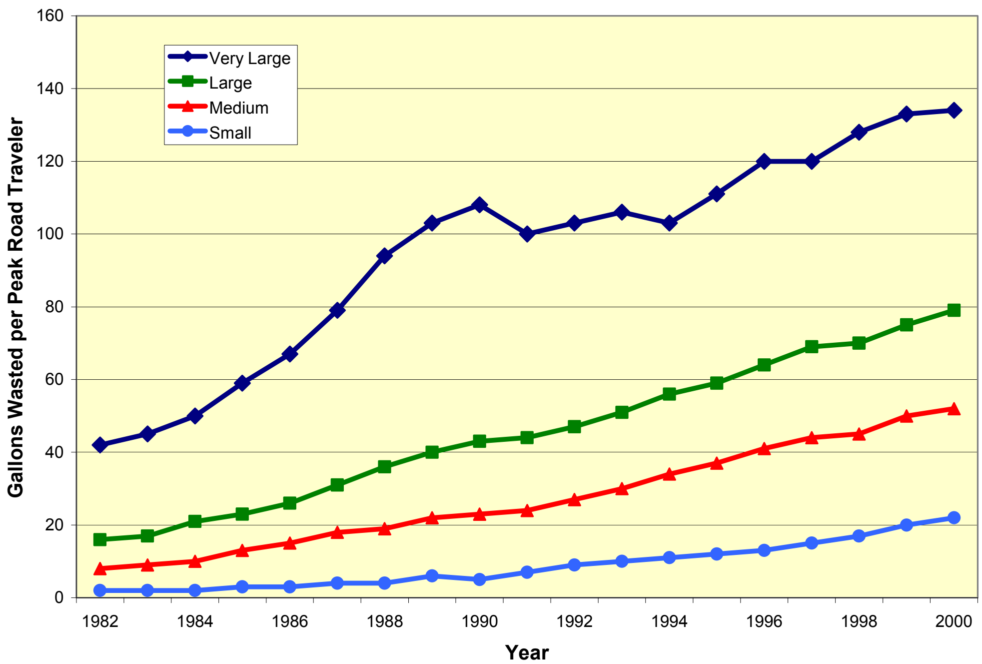


- The average cost of congestion for each peak road traveler in the 75 urban areas was $1,160 in 2000.
- The average cost of congestion per peak road traveler ranged from $1,590 in the Very Large population group to $245 in the Small population group in 2000. The cost for travelers in the Large population group was $915 while the cost for each traveler in the Medium population group was $595 per year.
- The Very Large population group had the largest increase in cost per traveler with $1,080 more cost in 2000 than in 1982. The cost for travelers in the other population groups grew by $735 in the Large, $515 in the Medium, and $230 in the Small.

How much fuel is wasted in congestion?

As with cost, the amount of fuel wasted in congestion is divided by the estimated number of travelers on the roads during peak driving times. This provides an estimate of the amount of fuel each individual wastes during peak driving times because of congestion (Exhibit 13). Almost 100 gallons are wasted per traveler in the 75 urban areas. (See Exhibit A-6 for more information).

Exhibit 13. Wasted Fuel per Peak Road Traveler



- The average amount of wasted fuel per peak traveler in 2000 was 99 gallons in the 75 study areas.
- The amount of wasted fuel per peak road traveler ranged from 22 gallons in the Small population group to 134 gallons in the Very Large population group in 2000.
- The total amount of wasted fuel in the 75 urban areas was approximately 5.7 billion gallons in 2000. To put this in perspective, if you filled tanker trucks with this wasted fuel and placed them back-to-back, they would stretch from New York City to Las Vegas and back again.

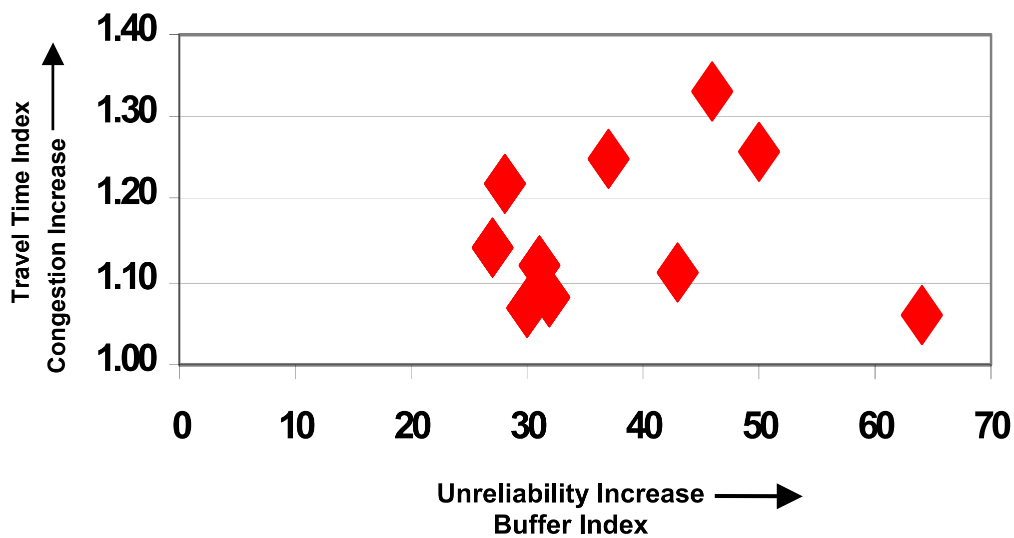
RELATING MOBILITY AND RELIABILITY

Mobility—the ease of getting to a destination—and—reliability—the predictability of travel times for usual trips—are related concepts. The mobility measure, the Travel Time Index, can be thought of as the time penalty for traveling in the peak period. The reliability measure, the Buffer Index, describes how much more time above the average should be budgeted to make an on-time trip. Reliability problems can be caused by simple variations in demand, as well as by vehicle crashes or breakdowns, weather, special events, construction, maintenance and other regular and irregular events. It can present difficulties for commuters and off-peak travelers, and for individuals and businesses (7).

With both of these measures one can tell how congested a transportation system is and how much variation there is in the congestion. This is particularly important when evaluating the wide range of improvement types that are being implemented. Traditional roadway and transit line construction and some operating improvements such as traffic signal system enhancements are oriented toward the typical, daily congestion levels. Others, such as crash and vehicle breakdown detection and removal programs, address the reliability issue. Most projects, programs and strategies have some benefits for each aspect of urban transportation problems.

Exhibit 14 indicates that there is a general consistency between mobility and reliability measures. That is, at the urban area level, places that are congested are also relatively unreliable. The data are for some freeways in a few cities selected because their archived databases were relatively complete and readily accessible for year 2000 data. The statistics developed from this database should not be used to compare systems or cities to each other. But, the data are used in the next section to analyze some aspects of reliability. Future reports will explore the subject in greater depth. For more information about the reliability database, see: http://mobility.tamu.edu/mmp.

Exhibit 14. Mobility and Reliability



How Reliable is the Transportation System?

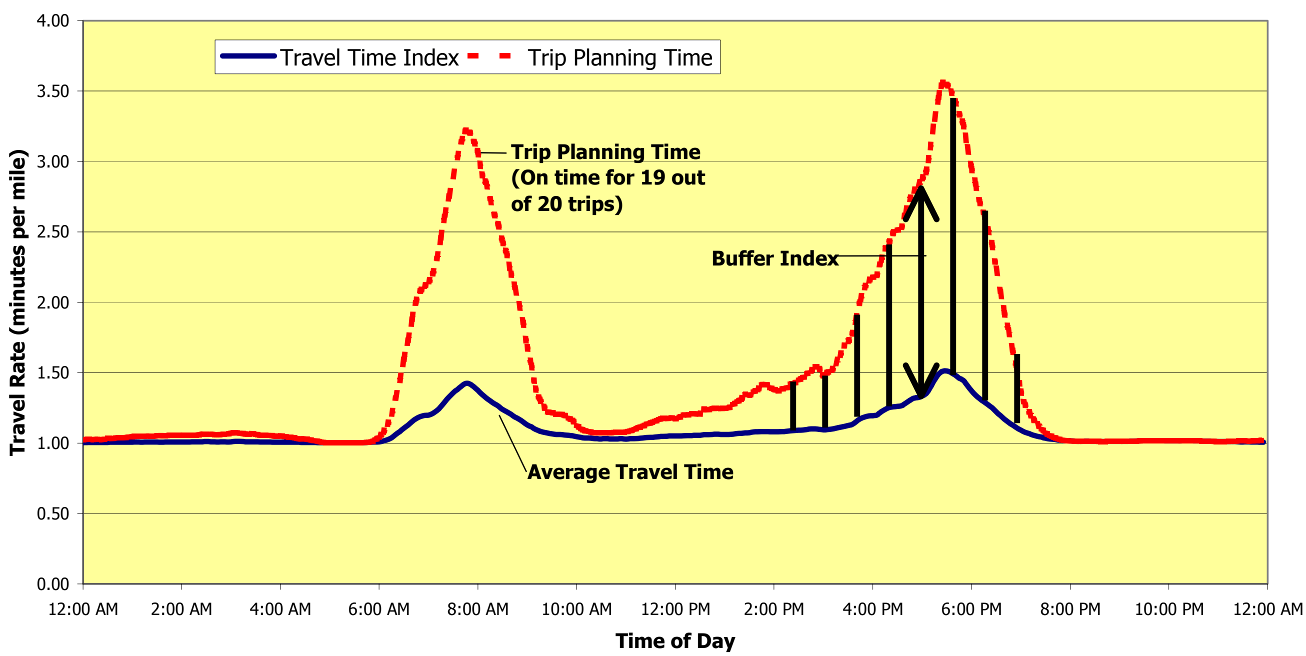
The ability to predict travel times is highly valued by travelers and businesses. It affects the starting time and route used by travelers on a day-to-day basis, and the decisions about travel mode for typical trips and for day-to-day variations in decisions.

If travelers assume each trip will take the average travel time, they will be late for half of their trips. It has not been determined what level of certainty should be used for trip planning purposes, but it seems reasonable that a supervisor might allow an employee to be late one day per month. This translates into a need to be on time for approximately 19 out of 20 days, or 95 percent of the time.

Average Time and Planning Time

Exhibit 15 uses the archived data from Houston in 2000 to generate a line showing the average travel rate for each 5-minute period of a weekday (the lower line). This line is an illustration of the travel time index—the ratio between the traffic speeds and free-flow travel (e.g., 60 mph or 1 minute per mile).

Exhibit 15. Houston Freeway System Average Time and Trip Planning Travel Times



The upper line depicts the travel time that has to be allowed in order to encompass 95 percent (19 out of 20) of the trips. The difference between the average line and the 95th percentile line is the extra time that has to be budgeted, an illustration of the Buffer Index measure (Equation 1). In the middle of the evening peak, the sources of travel time variation are so significant that an extra two minutes per mile should be budgeted as the buffer in addition to the average travel time of 1.5 minutes per mile.

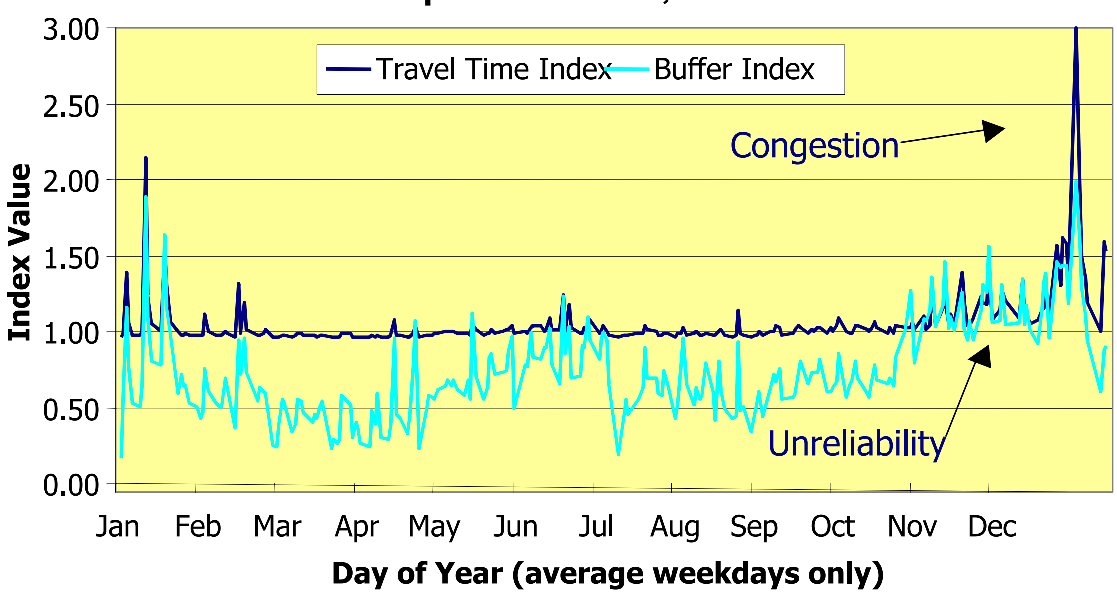
$$\text{Buffer Index (BI)} = \frac{\underset{\text{(in minutes per mile)}}{\text{95 percent confidence travel rate}} - \underset{\text{(in minutes per mile)}}{\text{Average travel rate}}}{\underset{\text{(in minutes per mile)}}{\text{Average travel rate}}} \times 100\% \qquad \text{Equation 1}$$

What does all this mean? If you are a commuter who travels between about 7:00 a.m. and 9:00 a.m., your trip takes an average of about 30 percent longer (that is, the TTI value is 1.3) than in the off peak. A 20-mile, 20-minute trip in the off-peak would take an average of 26 minutes in a typical home-to-work trip. The Buffer Index during this time is between 50 and 100 percent resulting in a Trip Planning Time of 2.1 minutes per mile. So if your boss wants you to begin work on time 95 percent of the days, you should plan on 42 minutes of travel time (20 miles times an average of 2.1 minutes per mile of trip for the peak period). But, to arrive by 8:00 a.m., you might have to leave your home around 7:00 a.m. because the system is even less reliable in the period between 7:30 a.m. and 8:00 a.m.

Effect of Ramp Metering on Travel Time Variations

The ramp meters—traffic signals that regulate the flow of traffic on freeway entrance ramps—in Minneapolis-St. Paul were turned off in October 2000. The results of this systemwide experiment are clearly visible in the peak period data in Exhibit 16. The Travel Time Index measures average congestion levels and the Buffer Index describes the amount of extra travel time needed to arrive on time.

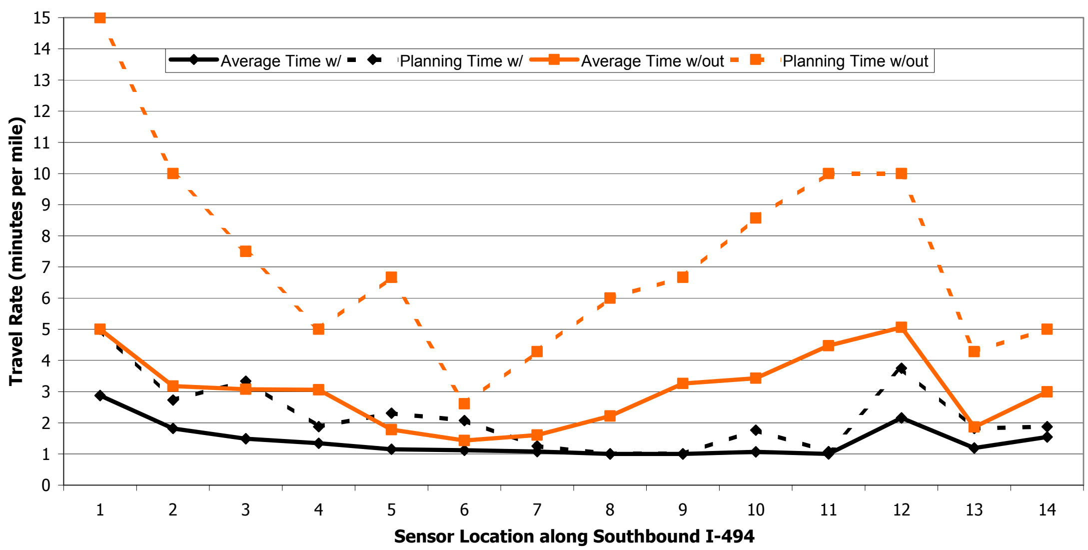
Exhibit 16. Congestion and Reliability in Minneapolis-St. Paul, 2000



Congestion is relatively low except for the snowstorm-related slowdowns in January and December (7). The snowstorms also significantly deteriorated reliability levels. But the ramp meter system clearly improved the reliability of transportation service. When it was turned off in October 2000, the Buffer Index increased from between 50 percent and 100 percent to between 100 and 150 percent. It might be interpreted that turning off the ramp meter system had the effect of a small snowstorm.

Exhibit 17 is another view of the effect of the ramp meter shutdown. Travel rate (expressed in minutes per mile) data for almost eight miles of the I-494 corridor is shown for the days just before and just after the ramp meter shutdown. Except for the sections from sensors 5 to 7 and 13 to 14, the average differences were at least 1 minute per mile (each sensor is used to estimate approximately one-half mile of freeway). The most substantial differences, however, are in the differences in the Planning Time (95th percentile of trips) travel conditions. At the apparent corridor bottleneck at sensor 12, the travel rate doubles from five to ten minutes per mile for the on-time arrival planning time.

Exhibit 17. With (10/11/2000) and Without (10/18/2000) Ramp Metering Morning Peak Hour (7-8 a.m.)



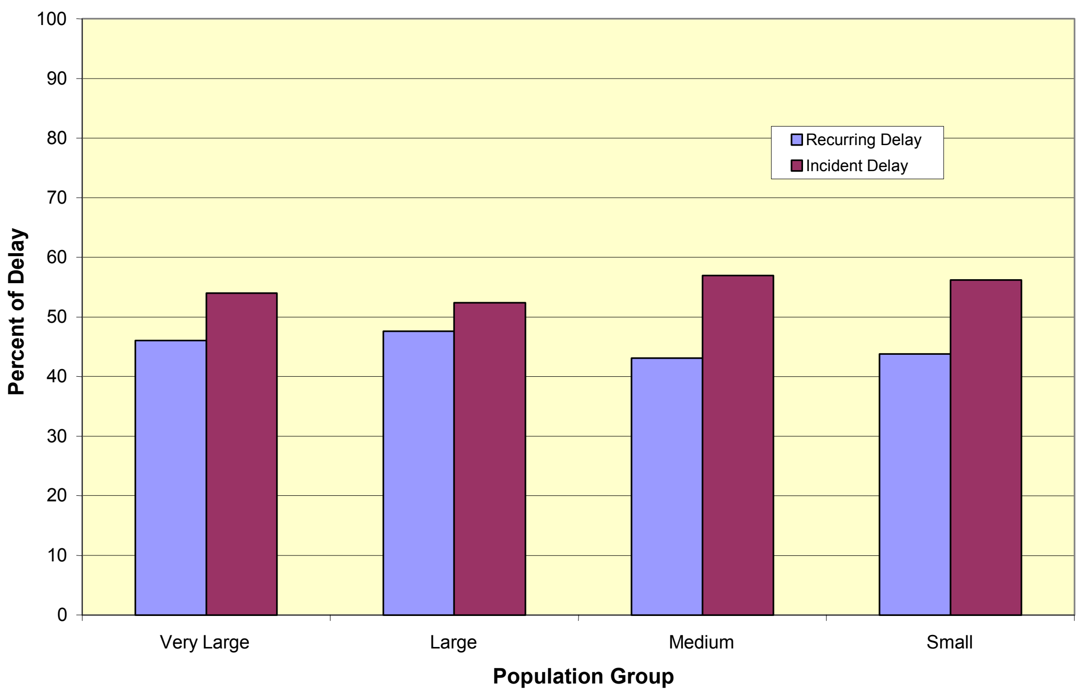
The average travel conditions upstream of the bottleneck greatly deteriorate in terms of both time required to get through the area and the distance upstream that speeds are relatively low. As far back as sensor 8, the average travel rate is greater than two minutes per mile (speed less than 30 mph), and on the worst unmetered days (i.e., Planning Time Without) traffic flows faster than 20 mph only at sensor 6.

There were many reasons for the ramp meter test in Minneapolis-St. Paul, and subsequently the metering strategy has been modified to reduce long wait times on some ramps. There is also a more comprehensive evaluation and communication plan for information about the performance of the ramp meter system and its relationship to long-term community goals. But it is also clear that the metering provided substantial safety and traffic flow benefits. The metering experiment report produced by Cambridge Systematics (10) refers to a 22 percent increase in freeway travel time and the freeway system travel time becoming twice as unpredictable without the ramp meters.

THE EFFECT OF INCIDENTS – CRASHES AND VEHICLE BREAKDOWNS

The Urban Mobility Study methodology includes an estimate of the delay due to incidents. This estimate is based on roadway design characteristics and incident rates and durations from a few detailed studies. These give a broad overview, but an incomplete picture of the effect of the temporary roadway blockages. Exhibit 18 illustrates the broad conclusions. Incidents cause somewhere between 52 and 58 percent of total delay experienced by motorists in all urban area population groups. (See Exhibit A-5 for more information).

Exhibit 18. 2000 Recurring and Incident Delay



A more complete understanding of how incidents affect travelers will be possible as continuous travel speed and traffic count monitoring equipment is deployed on freeways and major streets in U.S. cities. Unfortunately, that equipment is in place and recording data in only a few cities. These can, however, give us a view of how travel speeds and volumes change during incidents.

Exhibit 19 illustrates the speeds for a typical day on southbound U.S. 183 in northwest Austin, Texas. Average speeds decline as traffic approaches the Duval Road bottleneck area. Downstream of Duval Road, speeds pick up to near the speed limit. Speeds are at their lowest at 7:30 a.m., reaching a low of 25 mph.

Exhibit 19. Typical Freeway Operating Conditions on US 183, Austin

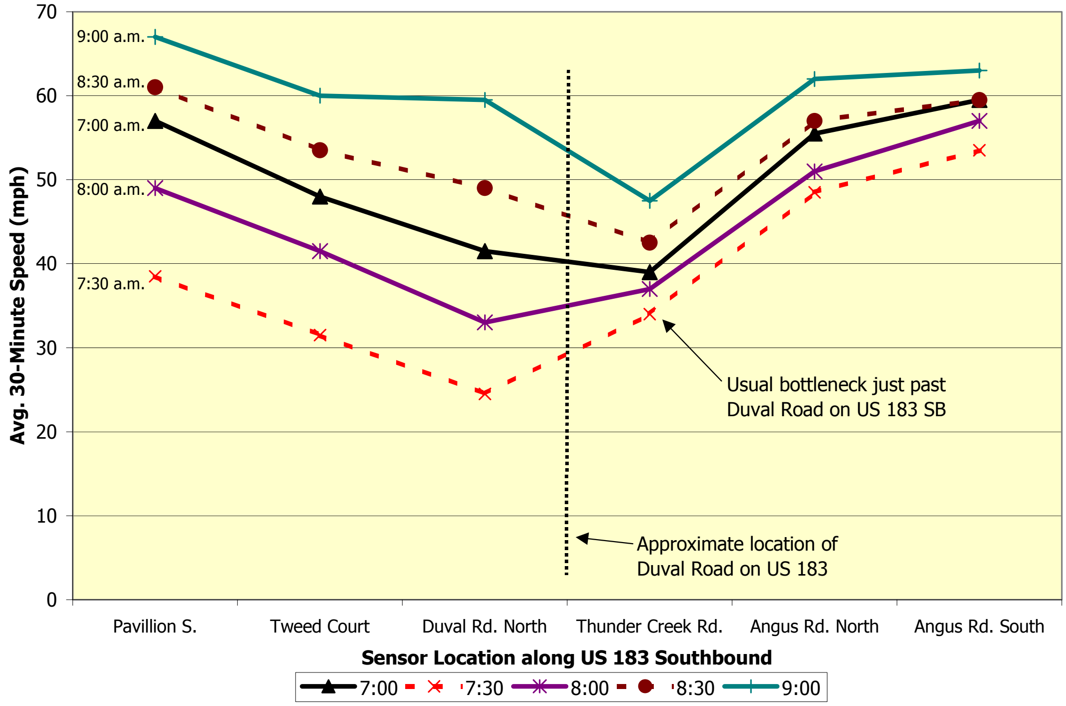
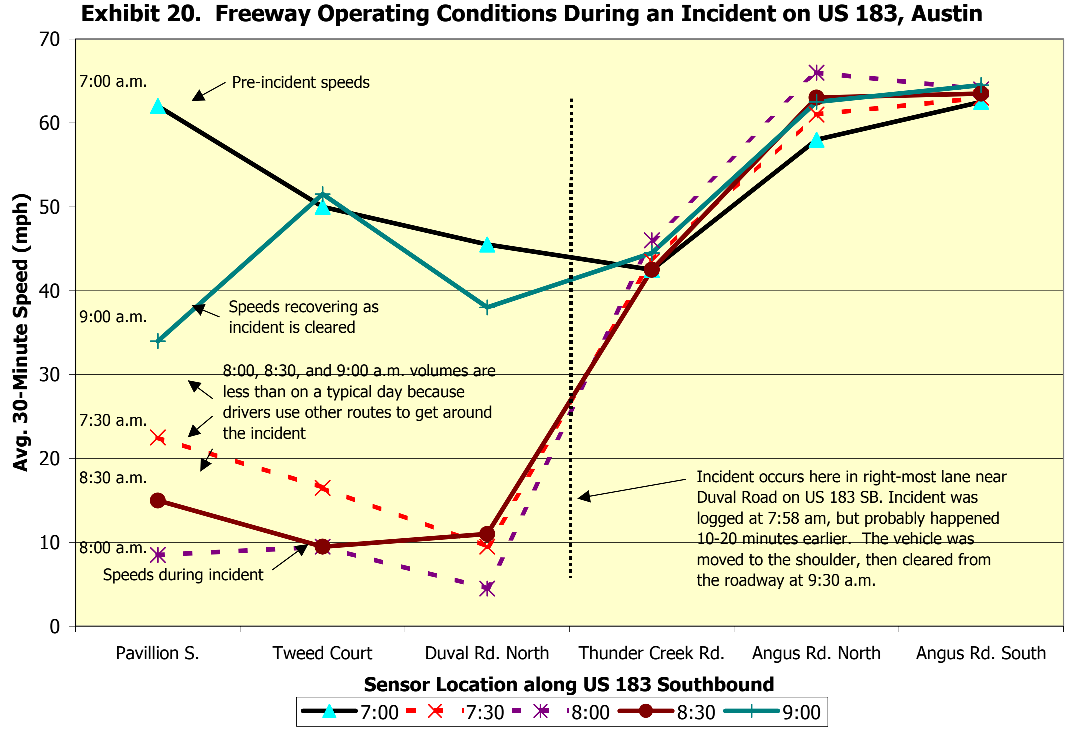


Exhibit 20 is a graph of the speeds following an incident near Duval Road. This incident blocked the right lane for a short time and was moved to the right shoulder. The speeds are much slower and extend over a greater length of road upstream of Duval Road. Downstream of the incident, speeds are higher than normal. For the 60 to 90 minutes after the incident, volume is lower due to the combination of fewer vehicles getting past the incident, and drivers diverting their trips away from U.S. 183.

Exhibit 20. Freeway Operating Conditions During an Incident on US 183, Austin



The difference in speed between 60 mph and the 30-minute average speed is the delay for that time period. Summing these differences for the two days shows an average speed of approximately 49 mph for a typical day and 41 mph for the incident day. While this may not seem significant, it is the difference between 22 percent extra travel time to make a trip (for 49 mph) and 46 percent extra travel time.

Incident Management Programs

Addressing these problems requires a program of monitoring, evaluation and action.

- Monitoring—Motorists calling on their cell phones are often the way a stalled vehicle or a crash is reported, but closed circuit cameras enable the responses to be more effective and targeted. Shortening the time to detect a disabled vehicle can greatly reduce the total delay due to an incident.

- Evaluation—An experienced team of transportation and emergency response staff provide ways for the incident to be quickly and appropriately addressed. Cameras and on-scene personnel are key elements in this evaluation phase.

- Action—Freeway service patrols (i.e., highway helpers, motorist assistance programs) and tow trucks are two well-known response mechanisms that not only reduce the time of the blockage but can also remove the incident from the area and begin to return the traffic flow to normal. Even in states where a motorist can legally move a wrecked vehicle from the travel lanes, many drivers wait for enforcement personnel dramatically increasing the delay. Public information campaigns that are effective at changing motorists' behavior (that is, move vehicles from the travel lanes when allowed by law) are particularly important.

The benefits of these programs can be significant. Benefit/cost ratios from the reduction in delay between 3:1 and 10:1 are common for freeway service patrols (11). An incident management program can also reduce "secondary" crashes—collisions within the stop-and-go traffic caused by the initial incident. And actively managing incidents shows the public that agencies are monitoring the road and doing what they can to reduce travel time and frustration.

CAN MORE ROAD SPACE REDUCE CONGESTION GROWTH?

The analysis in this section (shown in Exhibit 21) addresses the issue of whether or not roadway additions made significant differences in the delay experienced by drivers in urban areas between 1982 and 2000. 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.

Two measures will be used to answer this question.

1. The Travel Time Index (TTI) is a mobility measure that shows the additional time required to complete a trip during congested times versus other times of the day. The TTI accounts for both recurrent delay and delay caused by roadway incidents.

2. The difference between lane-mile increases and traffic growth compares the change in supply and demand. If roadway capacity has been added at the same rate as travel, the deficit will be zero. The two changes are expressed in percentage terms to make them easily comparable. The changes are oriented toward road supply because transportation agencies have more control over changes in roadway supply than over demand changes. In most cases in the UMS database, traffic volume grows faster than lane-miles.

Conclusions

The analysis shows that **changes** in roadway supply have an effect on the **change** in delay. 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 "deficit" gets smaller, meaning that urban areas come closer to matching capacity growth and travel growth, the travel time increase is smaller. It appears that the growth in facilities has to be at a rate slightly greater than travel growth in order to maintain constant travel times, if additional roads are the only solution used to address mobility concerns.

It seems clear that adding roadway at about the same rate as traffic grows will slow the growth of congestion. But it is equally clear that if only six of the 75 areas studied were able to accomplish that, there needs to be a broader set of solutions applied to the problem.

Analyses that only examine comparisons such as travel growth vs. delay change or roadway growth vs. delay change are missing the point. The only comparison relevant to the question of road, traffic volume and congestion growth is the relationship between all three factors. Comparisons of only two of these elements will provide false answers.

See Exhibits A-3 and A-14 for individual urban area values.

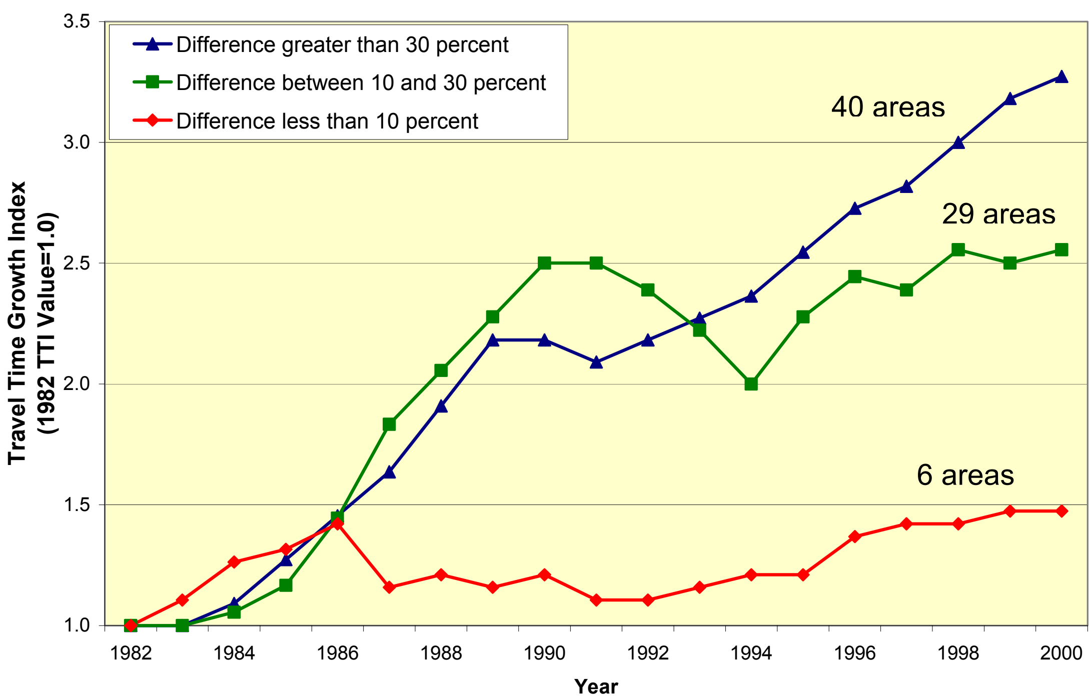
Exhibit 21 shows the ratio of changes in travel to changes in roadway expansion and the resulting change in the mobility level (TTI). If road growth is faster than the traffic growth, conditions should improve. If additional roads slow down the growth of delay, areas where roads are added at a rate close to traffic growth, there will also be a relatively slow growth in the TTI.

The 75 urban areas were divided into three groups based on the differences in lane-mile growth and traffic growth. This means that if an area's traffic volume grew relatively slowly, the road capacity would need to only grow slowly to maintain a balance. Faster traffic growth rates would require more road capacity growth. The three groups were arranged using data from 1982 to 2000:

- Significant mismatch—Traffic growth was 30 percent or more greater than the growth in road capacity for the 40 urban areas in this group.
- Closer match—Traffic growth was between 10 percent and 30 percent more than road capacity growth. There were 29 urban areas in this group.
- Narrow gap—Road growth was within 10 percent of traffic growth for the 6 urban areas in this group.

The resulting growth in the average Travel Time Index values is charted in Exhibit 21. The average 1982 values were assigned a value of 1.0 so that the increases could be compared (in a manner similar to the Consumer Price Index).

Exhibit 21. Road Growth and Mobility Level



Note: See Exhibit A-14 for individual urban area values.
Note: Legend represents difference between traffic growth and road additions.

The recession in California in the early 1990s affected the middle line. The combination of the economy and increased road construction efforts in Texas affected the lower line in the mid- to late-1980s. But, a general trend appears to hold—the more that travel growth outpaced roadway expansion, the more the overall mobility level declined. The urban areas with significant capacity additions had their congestion levels increase at a much lower rate than those areas where travel increased at a much higher rate than capacity expansion. Another significant finding is the number of areas in each group. Only six urban areas were in the Narrow Gap group; of those, four had populations greater than 1 million.

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 would be to find suitable roads that can be widened, or areas where roads can be added, year after year. Most urban areas are pursuing a range of congestion management strategies, with road widening or construction being one of them.
>
> See Exhibit A-14 for individual urban area values.

This analysis uses the premise 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, it is assumed that 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 (Exhibit 22). The 1982 to 2000 statistics show:

- Over the 19-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.
- Exhibit 23 also shows that the larger urban areas have done a little better, on average, at maintaining pace with the growth of travel.

How much road has been added?

Not as much as our statistics indicate. And even at that level, the amount of added roadway is considerably less than that needed to match travel volume growth. The roadway growth in the UMS database includes the roads that were added because the urban boundary grew to include areas that previously were classified as rural. These existing, but newly urbanized, roads appear as additions to the urban databases, but do not have the same effect as new roadway.

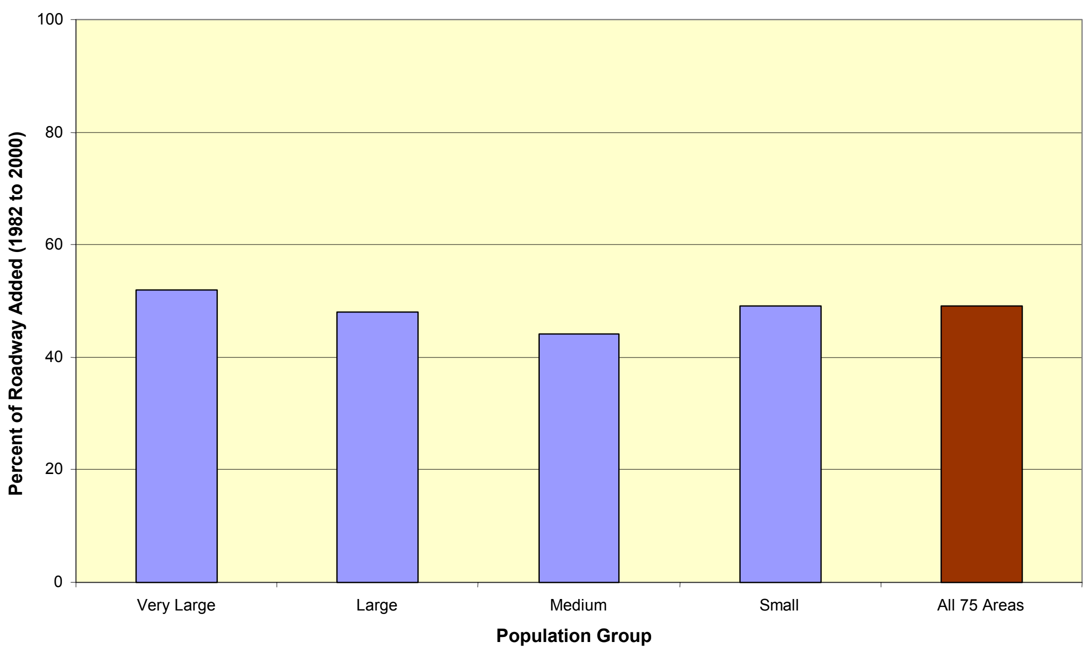
Exhibit 22. Vehicle Travel and Roadway Additions

2000 Population Group Average	Avg. Annual Growth in Vehicle-Miles of Travel (1982 to 2000)	Percentage of Needed Roadway Added[1]
Very Large areas	3.5	49
Large areas	3.1	52
Medium areas	4.0	48
Small areas	4.1	44
75 area average	3.5	49

[1] Lane-miles added divided by lane-miles needed. "Lane-miles needed" are based on matching the VMT growth rate.

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

Exhibit 23. Percent of Roadway Added



- Over the 19-year period, less than half (49 percent) of the roadway that was needed to maintain a constant congestion level was actually added.
- The Very Large population group has added the largest percentage of lane-miles (52 percent) in an attempt to keep pace with congestion growth.
- The Medium population group has added the lowest percentage of lane-miles (44 percent) in an attempt to keep pace with congestion growth.

CAN AN "AGGRESSIVE ROAD BUILDING" STRATEGY BE SUSTAINED?

One way to deal with traffic congestion is to add more capacity. However, 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 very few urban areas have done it for more than two or three years. Only three urban areas have had at least five consecutive years of road construction that paralleled the growth of traffic in the area.

The analysis in Exhibit 24 shows which urban areas have had road additions that kept pace with traffic growth in the area. Traffic growth for each 6-year period of UMS data was compared with additional lane-miles of roadway for the same period. The urban areas were sorted by the size of the road addition deficit. Urban areas where roadway additions were within one-half percent of traffic growth for five or more consecutive periods were considered to have "kept pace." Urban areas with five or more years of significantly more traffic growth than road additions (annual differences of more than three percent) were categorized as having lost ground. Obviously, not all the 75 urban areas attempted to remedy congestion problems with new construction; 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. Tampa-St. Petersburg-Clearwater remained in the "Keeping Pace" list for five years while traffic congestion also grew fairly rapidly as shown by the 13-hour increase in delay per traveler over the same period. It may be that the rapid land area growth in the Tampa suburbs caused both significant new street construction and several roadway miles to be incorporated into the growing urban boundary but relatively few roadway lanes were added in the congested areas.

Several other cities could have qualified for the "Keeping Pace" category due to economic activity slowdowns. When the local economy slowed or was in recession, population, employment, and traffic volume do not typically grow rapidly. The road additions needed to offset the volume growth are relatively low. The wide range of delay growth in the "Losing Ground" cities reinforces the complicated nature of the congestion issue and the need for locally developed plans and analyses.

Exhibit 24. How Have Cities Fared In Long-Term Road Building Programs?

Urban Area	Population Group	Number of Consecutive Years	Years	Growth in Hours of Delay	Annual Growth Rate (percent)	
					Vehicle Travel	Lane-Miles
KEEPING PACE						
Houston	Very Large	8	88-95	6	5.9	6.9
Tampa	Large	5	87-92	13	6.8	6.0
Jacksonville	Medium	5	96-00	-5	3.3	2.1
Richmond	Medium	5	90-94	7	3.8	1.7
Bakersfield	Small	11	87-97	4	3.3	1.3
Fort Myers	Small	5	93-97	5	6.4	6.0
LOSING GROUND						
Chicago	Very Large	5	87-91	16	6.2	4.0
Detroit	Very Large	5	89-93	33	3.1	1.6
Indianapolis	Large	11	87-97	46	5.3	1.7
Jacksonville	Medium	8	87-94	19	5.3	1.4
Louisville	Medium	10	91-00	31	4.6	2.3

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

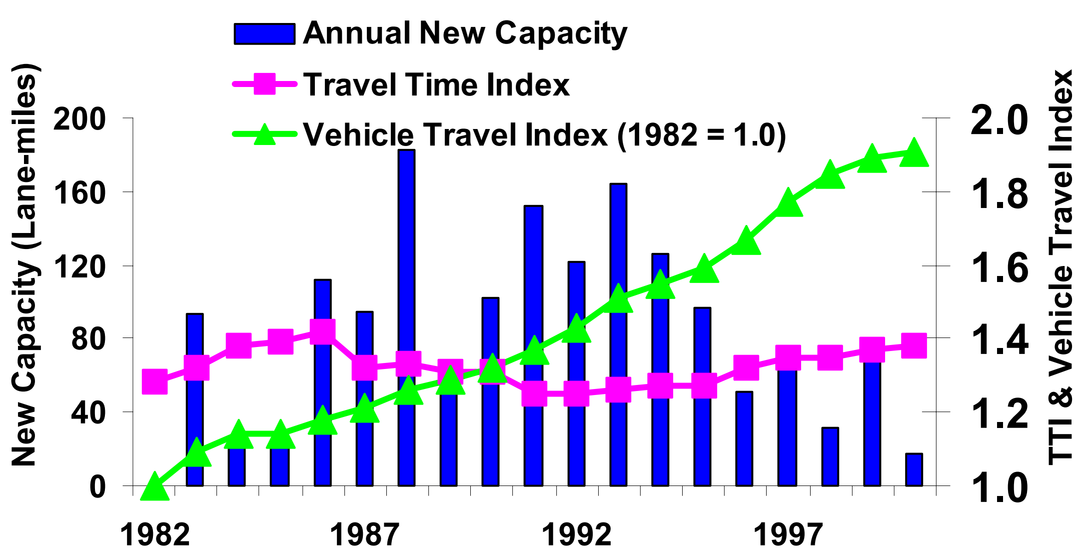
BUT ROADS CAN'T SOLVE ALL THE PROBLEMS

The benefits of adding capacity to the roadway system can be seen in Houston's experience. The period from 1986 to 1995 saw substantial freeway and major street additions in all years except one (Exhibit 25). Freeway and major street vehicle travel increased 34 percent over this period, but the peak period travel time penalty decreased from 42 percent to 27 percent.

Houston's experience also illustrates the difficulty in sustaining the "build" approach (12). The substantial increases in toll highways, freeway widening, HOV lanes, transit operations and facilities were not replicated after 1995. A booming economy and relatively rapid traffic growth—while representing some desirable elements for society—also made the mobility challenge tougher. Vehicle travel increased 20 percent from 1995 to 2000 and the travel time index increased from 1.27 to 1.38, the 8th fastest rate of the 75 urban areas in the study over that period.

Houston's long-range transportation plan (13) still includes more roadway expansion projects, but also includes a continuation of the operational improvements—incident management programs, ramp metering, traffic signal coordination and synchronization—transit and carpool projects, intermodal connections and bicycle and pedestrian improvements. This multifaceted improvement program is described in the Solutions section of this report and is typical of large metropolitan areas.

Exhibit 25. Houston's Congestion History



Don't Additional Lanes Just Fill Up? Why Should We Add Them?

Yes, many times the additional lanes do eventually 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 (14) described as the triple convergence. When more peak-hour road capacity is provided (e.g., more freeway lanes) travel moves toward the peak hour from: 1) other times, 2) other roads and 3) other modes. The beneficial traffic effects—after an initial period—are felt by those who continue to travel on the edges of the peak period, and/or on parallel roadways. Travelers who do not change their departure time from either early or late in the peak period may see a free-flow trip. Enough demand has moved to the middle of the peak to decrease volumes below those that cause congestion. A similar change occurs on streets that parallel the freeway—some trips shift to the freeway from the street, and the street is congested for a shorter period of time each day. The near-term result of a wider roadway is often a shorter period of congestion, rather than the elimination of congestion in the peak period.

The benefits of new or widened roadways are estimated in the Annual Report database by reductions in the percentage of congested travel and in lower daily volume per roadway lane. These two changes reduce the average congestion level, reduce the travel delay and reduce the amount of traffic that is subjected to a delay penalty.

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 and the methodology used in the analysis only accommodates these effects in relatively simple terms. To the extent that lower travel times are the important decision metric, the database captures the effects of additional lanes. The database does not, however, identify the broader public policy question of "Is this a good idea?" Those considerations should be part of the analysis of alternative transportation improvements for travel corridors and urban areas.

HOW MANY NEW CARPOOLS OR BUS RIDERS WOULD BE NEEDED IF THEY 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

The 75 urban areas in the Urban Mobility Study added more than 56 million additional miles of daily person travel in 2000. To accomplish a goal of maintaining a constant congestion level in these areas by only adding transit riders of carpoolers, there would have to be a substantial growth in these modes. The growth would be equivalent to an additional 3 or 4 percent of all vehicles becoming carpools, or expanding transit systems by more than one-third of the current ridership each year.

It may be very difficult to convince this many persons to begin ridesharing or riding transit. As indicated elsewhere in this report, some success with this solution, in conjunction with other techniques may give an urban area the opportunity to slow the mobility decline.

See Exhibit A-15 for individual urban area values.

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. Average trip lengths vary by metropolitan area. The length of a trip can have an effect on how much exposure a traveler has to congestion. For purposes of comparison, however, this report assumes one trip length for all areas. The following observations result from the 2000 statistics shown in Exhibit A-15.

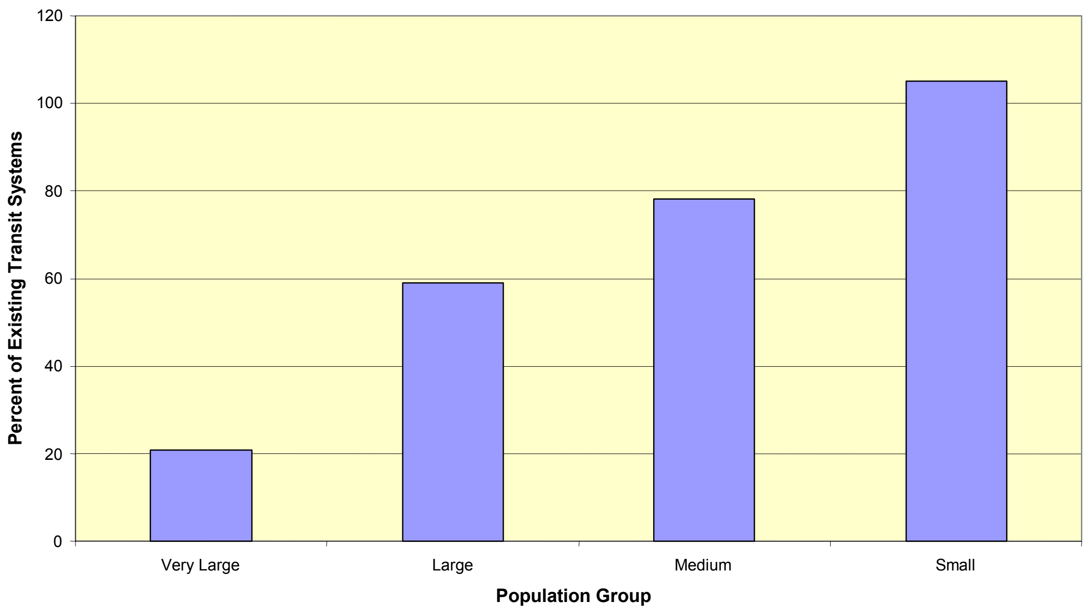
- 6.2 million trips per day would have to be made as carpools or bus trips in the 75 urban areas to handle the 56 million additional person-miles of travel if congestion levels are to remain constant.
- On average, the occupancy of each vehicle in the 75 urban areas would have to rise by 0.04 persons 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 and Medium areas (0.04 persons per vehicle) to account for the additional traffic.
- The average occupancy would have to increase the least in the Large and Very Large areas (0.03 persons per vehicle) to account for the additional traffic.

How many trips would be needed on transit?

Transit, like ridesharing, park-and-ride lots and high-occupancy vehicle lanes, typically have a greater effect on the congestion statistics in a corridor, rather than across a region. Transit and these other elements "compete" very well with the single-occupant vehicle in serving dense activity centers and congested travel corridors. But it is also useful to examine the data at the urban area level. Ridership statistics were gathered for the 75 urban areas to determine how much more travel the systems would have to handle to offset congestion growth – again, if transit expansion was the only method to address travel growth. The additional passenger-miles of travel (or estimated trips) from the roadway were compared with the number of trips from existing transit service.

There are no other U.S. cities with ridership like New York City. Approximately one out of five U.S. transit trips are made in the New York area. Including these statistics would not present a useful comparison for typical cities over 3 million population; the New York data were removed from this comparison. The transit ridership increase that would be needed for each year in the remaining areas is shown in Exhibit 26.

Exhibit 26. Increase in Existing Transit System to Hold Congestion Constant



Note: The New York urban area statistics have been removed from the calculation.

- The Very Large urban areas would have to increase transit trips by over 20 percent to maintain a constant congestion level.
- The Large (59 percent) and Medium (78 percent) urban areas would have to add more than half as many transit trips as they already have to maintain a constant congestion level.
- The Small urban areas would have to more than double (105 percent) their existing transit ridership to maintain their congestion level.

ARE HIGH-OCCUPANCY VEHICLE LANES A SUCCESSFUL SOLUTION?

The Urban Mobility Study (UMS) methodology for quantifying mobility levels is not limited to applications of roadways and private passenger vehicle travel. The methodology and measures are versatile enough to show the benefits of multimodal programs either at an areawide level or at a corridor level. An application of the travel time measures to high-occupancy vehicle lane evaluations is shown in this analysis.

Exhibit 27 is a summary of the effect of HOV lane operations in several urban corridors. While this is only a partial list of HOV projects, it provides a view of the usefulness of the data, as well as an idea of the mobility contribution provided by the facilities. The exhibit includes information about the typical peak period operating conditions (three hours in the morning and evening) on the HOV lane and freeway mainlanes. Including the statistics from six hours of operation tends to diminish the measured effects of the HOV lanes in some corridors where the significant benefits are for one hour in each peak. Some other aspects of the corridor operations such as the variation in travel time and the effects of park-and-ride service or transit operations are also not fully explored in these statistics.

The travel time index (TTI) is the ratio of peak period speeds to free-flow conditions—in this case 60 mph. A TTI of 1.5, for example, indicates a 20-minute trip in the off-peak takes 30 minutes (20 times 1.5) if the same trip is made in the peak.

Most of the mainlane TTI values are above 1.30 (a speed of 45 mph) while only four of the HOV operations exceed that value. Consequently, there are significant differences in the Travel Time Index values for HOV lanes and freeways. The TTI values are averaged by including the number of persons using each facility; those values are shown in the Combined TTI column.

The greatest index point improvements are found for those projects where the peak-period mainlane speeds are very low and the HOV lane usage is relatively high compared to the mainlanes. The relatively fast and reliable speeds (indicated by the lower TTI values) attract riders into the HOV lanes causing the HOV travel time index values to be a larger part of the combined index. Ten of the projects have index point improvements of 20 or more. But many of the other projects are also identified as "good" projects by the residents of those areas and the users of the facilities.

The data for corridors in a city or region can be combined to produce an average "with and without" Travel Time Index. Exhibit 28 illustrates the averages for the six urban areas with several HOV projects.

Assessing the effect of a few HOV projects on the urban area Travel Time Index, however, is not a particularly useful exercise. Any small set of transportation projects will have a relatively small effect on the areawide average mobility statistics in a large urban area. The significance of the improvements is at the corridor level where the difference in travel conditions is focused.

Exhibit 27. Mobility Levels in HOV Corridors

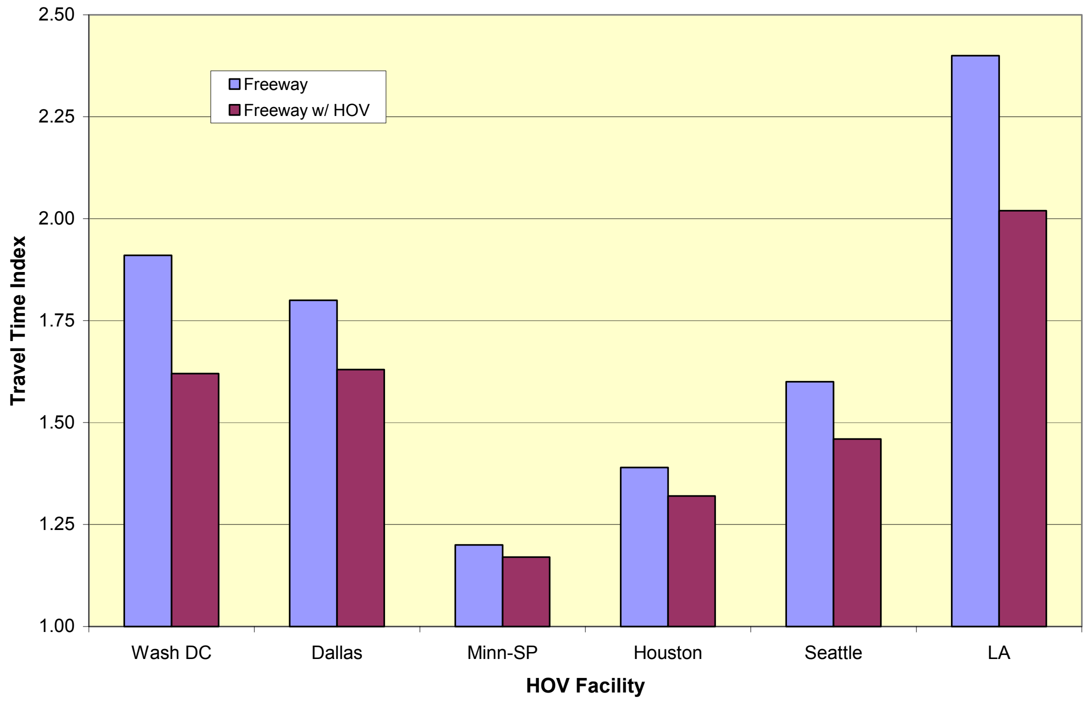
Segment	High-Occupancy Vehicle Lanes Passengers	High-Occupancy Vehicle Lanes TTI	Mainlanes Passengers	Mainlanes TTI	Combined TTI	Index Point Improvement[1]
Washington DC						
I-95 Shirley Hwy	16,600	1.01	19,800	2.17	1.64	53
I-66	9,500	1.31	19,800	2.35	2.01	34
VA267	5,200	1.19	14,000	1.76	1.60	16
I-270	4,400	1.26	13,600	1.87	1.72	15
New York						
Long Island Expwy	4,450	1.03	22,050	2.09	1.91	18
Miami-Dade County						
I-95	3,170	1.40	7,950	1.94	1.79	15
Minneapolis-St. Paul						
I-394	7,120	1.09	14,260	1.20	1.16	4
I-35W	5,170	1.09	12,920	1.20	1.17	3
Houston						
I-10W	9,370	1.03	16,000	1.60	1.39	21
I-45N	8,820	1.09	22,000	1.28	1.22	6
I-45S	5,800	1.09	21,000	1.30	1.25	5
US290	7,045	1.05	18,000	1.38	1.29	9
US59S	8,200	1.18	28,000	1.44	1.38	6
Dallas						
I-30 E	8,040	1.08	23,250	1.60	1.47	13
I-35N	5,270	1.04	17,110	1.75	1.58	17
I-635	5,660	1.03	20,030	1.94	1.74	20
Seattle						
I-5 N of CBD	9,580	1.18	17,960	1.59	1.45	14
I-5 S of CBD	13,440	1.18	24,880	1.53	1.42	11
I-405 N of I-90	6,020	1.26	15,725	1.91	1.73	18
I-405 S of I-90	8,920	1.13	11,230	1.91	1.56	35
I-90	3,365	1.00	15,010	1.25	1.20	5
SR 167	4,250	1.05	9,035	1.69	1.48	21
SR 520	2,725	1.00	8,180	1.30	1.23	7
Los Angeles County						
I-10	6,100	1.15	9,060	2.78	2.12	66
SR 91	3,350	1.25	7,385	2.33	1.99	34
I-110	6,625	1.23	8,100	2.56	1.96	60
I-210	3,440	1.32	8,750	1.96	1.78	18
I-405	3,430	1.51	7,390	2.34	2.08	26

[1]Mainlane TTI minus Combined TTI.

Note: Speeds in excess of 60 miles per hour were entered as 60. That speed is considered the freeflow speed for this analysis.

In addition to the two listed facilities, the Minneapolis-St. Paul area has a program that allows buses to use the freeway shoulders to bypass congested traffic. This improves the travel speed and schedule reliability with a relatively inexpensive treatment. The travel time savings are highly variable due to the operating procedures that control the difference in speed between the mainlanes and buses. The routes that use the shoulders had a 9.2 percent increase over a two-year period when the overall system ridership decreased 6.5 percent, illustrating the favorable passenger reaction to improved speed and reliability attributes (15).

Exhibit 28. Effects of HOV Lanes in Freeway Corridors



How Does Perception of Congestion Match Reality?

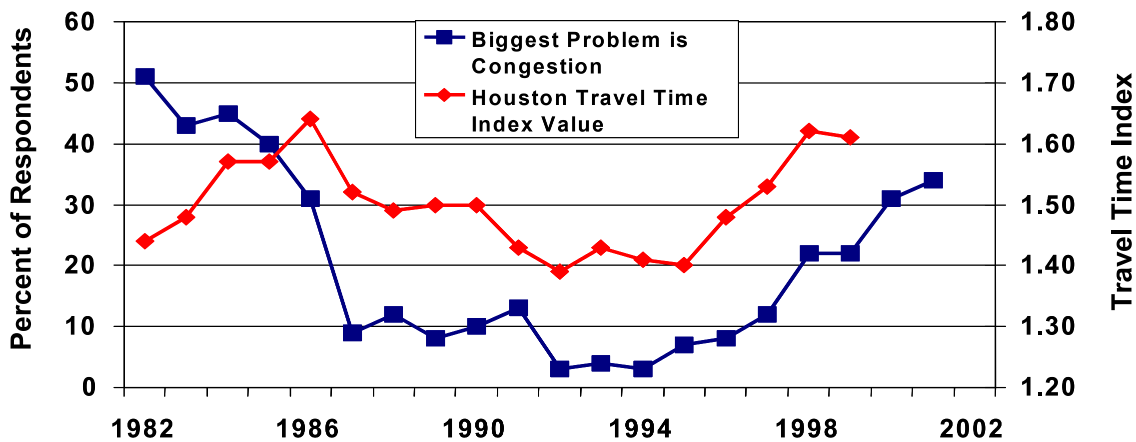
While we are only beginning to understand the relationship between objective data-driven mobility measures and the public's perception of congestion, we have identified two surveys that examine opinions over several years. It appears from these surveys that congestion trends are important, in addition to the measures of time lost for any particular year.

Exhibit 29 shows the long-term relationship for Houston, Texas between the Travel Time Index (TTI) and the percentage of Houston area residents who report that congestion is the biggest problem facing Houston that year (16). Other issues that were rated #1 since 1980 were the economy and crime. Congestion was rated higher than either of these from 1982 to 1985 and for 2000 and 2001. From the late 1980s to mid-1990s, Houston's congestion levels ranked it between #5 and #20 in the U.S., but with a relatively high Travel Time Index of at least 1.4.

Several surveys conducted for the Federal Highway Administration on the opinons of Americans about major highways, lists traffic flow as the lowest rated of the eight categories with only 45 percent reporting satisfied or very satisfied. The traffic flow category was also the only one where satisfaction levels declined from 1995 to 2000 (17). These opinions match the decline in mobility levels described in this report.

This is not a comprehensive treatment of the subject, and more surveys will be researched in future years, but these data point to a relationship between congestion change and perception. Newspaper and television reporters also frequently refer to this relationship when discussing local transportation issues.

Exhibit 29. Stephen Klineberg (Rice University) Survey Results



HOW SHOULD WE ADDRESS THE MOBILITY PROBLEM?

Just as congestion has a number of potential causes, there are several ways 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 delay, and more predictable and lower trip times. Emissions may be reduced due to the reduction in demand or congestion, improved efficiencies and the change in the way travelers use the system. The locations of congestion may also move over time due to the new development that occurs or is encouraged by the new transportation facilities.

More Travel Options

While not a specific improvement, providing more options for how a trip is made, the time of travel and the way that transportation service is paid for may be a useful mobility improvement framework for urban areas. For many trips and in many cities, the alternatives for a peak period trip are to travel earlier or later, avoid the trip or travel in congestion. Given the range of choices that Americans enjoy in many other aspects of daily life, these are relatively few and not entirely satisfying options.

The Internet has facilitated electronic "trips." There are a variety of time-shift methods that involve relationships between communication and transportation. Using a computer or phone to work at home for a day, or just one or two hours, can reduce the peak system demand levels without dramatically altering lifestyles.

Using information and pricing options can improve the usefulness of road space as well as offering a service that some residents find very valuable. People who are late for a meeting, a family gathering or other important event could use a priced lane to show that importance on a few or many occasions – a choice that does not exist for most trips.

The diversity of transportation needs is not matched by the number of travel alternatives. The private auto offers flexibility in time of travel, route and comfort level. Transit can offer some advantages in avoiding congestion or unreliable travel conditions. But many of the mobility improvements below can be part of creating a broader set of options.

Add Capacity

Adding capacity is 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 roadway intersection design, along with managed lanes and dedicated bus and carpool priority lanes, can also contribute to moving more traffic through a given spot in the same or less time. 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. In growing areas, adding capacity of all types is essential to handle the growing demand and avoid rapidly rising congestion.

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 is 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. These changes are not a congestion panacea, but they are part of a package of techniques that are being used to address "quality-of-life" concerns—congestion being only one of many.

Increase Efficiency of the 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. These treatments are particularly effective in three ways. They are relatively low cost and high benefit which is efficient from a funding perspective. They can usually be implemented quickly and can be tailored to individual situations making them more useful because they are flexible. And they are usually a distinct, visible change; it is obvious that the operating agencies are reacting to the situation and attempting improvements.

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, freeway entrance ramps, 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.

Freeway entrance ramp metering (i.e., traffic signals that regulate the traffic flow entering the freeway) and incident management (i.e., finding and removing stalled or crashed vehicles) are two operations treatments highlighted in this report. When properly implemented, monitored and aggressively managed, they can decrease the average travel time and significantly improve the predictability of transportation service. Both can decrease vehicle crashes by smoothing traffic flow and reducing unexpected stop-and-go conditions. Both treatments can also enhance conditions for both private vehicles and transit.

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.

Role of Pricing

Urban travelers pay for congestion by sitting in traffic or on crowded transit vehicles. Anthony Downs (14) among many, has suggested this is the price that Americans are willing to pay for the benefits that they derive from the land development and activity arrangements that cause the congestion. But for most Americans there is no mechanism that allows them to show that they place a higher value on certain trips. Finding a way to incorporate a pricing mechanism into some travel corridors could provide an important option for urban residents and freight shippers.

A fee has been charged on some transportation projects for a long time. Toll highways and transit routes are two familiar examples. An extension of this concept would treat transportation services like most other aspects of society. There would be a direct charge for using more important system elements. Price is used to regulate the use and demand patterns of telephones, movie seats, electricity, food and many other elements of the economy. In addition to direct charges, transportation facilities and operations are typically paid for by per-gallon fees, sales taxes or property taxes. One could also include the extra time spent in congestion as another way to pay for transportation.

Electronic tolling methods provide a way for travelers to pay for their travel without being penalized by stopping to pay a fee. Electronics can also be used to reduce the fee for travelers in certain social programs (e.g., welfare to work) or to vary the fee by time of day or congestion level. Implementing these special lanes as an addition to roads (rather than converting existing lanes) has been the most common method of instituting pricing options in a corridor. This offers a choice of a premium service for a fee, or lower speed, less reliable travel with no additional fee.

Importance of Evaluating Transportation Systems

Providing the public and decision-makers with a sufficient amount of understandable information can help "make the case" for transportation. Part of the implementation and operation of transportation projects and programs should be a commitment to collecting evaluation data. These statistics not only improve the effectiveness of individual projects, but they also provide the comparative data needed to balance transportation needs and opportunities with other societal imperatives whether those are other infrastructure assets or other programs.

THE BIG PICTURE

There are many statistics in the Annual Mobility Study that can be applied to the search for solutions to mobility problems. It is very important, however, 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 19 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 2000 database.

1. There is some good news. We have handled a lot more travel. Congestion time penalties are three to four times greater than in 1982, but almost double the amount of travel has been accommodated.
2. 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.
3. 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 may be required if the goal is to significantly reduce congestion by adding roads.
4. 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.
5. 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 are already known and utilized 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 and they may be able to slow the growth of congestion, but they cannot expand the system or improve the operation enough to eliminate congestion.

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 Schrank, David and Tim Lomax. Texas Transportation Institute, "2001 Annual Urban Mobility Report, May 2001.

6 Federal Highway Administration. "Highway Performance Monitoring System," 1982 to 2000 Data. February 2002.

7 Lomax, Tim, Shawn Turner and Richard Margiotta. Texas Transportation Institute and Cambridge Systematics, Inc. "Monitoring Urban Roadways in 2000: Using Archived Operations Data for Reliability and Mobility Measurement." December 2001.

8 The Keys to Estimating Mobility in Urban Areas: Applying Definitions and Measures That Everyone Understands. Sponsored by Departments of Transportation in California, Colorado, Kentucky, Minnesota, New York, Oregon, Pennsylvania, Texas and Washington, 1998 (http://mobility.tamu.edu/ums).

9 Office of Highway Information Management, Federal Highway Administration, "2000 Nationwide Personal Transportation Survey," 2002.

10 Cambridge Systematics, Inc. Twin Cities Ramp Meter Evaluation. February 2001.

11 Fenno, D. and Ogden, M. Freeway Service Patrols: A State of the Practice. Transportation Research Record No. 1634, Transportation Research Board, Washington, D.C., 1998.

12 Texas Transportation Institute. Travel Rate Improvement Program for the Houston Area Preserving Mobility in the 21st Century. Sponsored by Greater Houston Partnership, Chamber of Commerce Division, June 2001 (http://www.houston.org/trip2000.pdf).

13 Houston-Galveston Area Council. 2022 Metropolitan Transportation Plan, www.hgac.cog.tx.us/transportation, February 2000.

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

15 SRF Consulting Group. Study of Bus-Only Shoulders, Minnesota Department of Transportation. Report Number 1998-O6U. 1998.

16 Stephen L. Klineberg. Facing the New Realities: Findings from 20 Years of Houston Surveys, Draft Report, Rice University, February 2002.

17 Keever, David B., et al. "Moving Ahead: The American Public Speaks on Roadways and Transportation in Communities," Report no. FHWA-OP-01-017, February 2001.

(From Report Methodology Description—Appendix B)

18 American Automobile Association, "Fuel Gauge Report," 2000.

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

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

21 Research Triangle Institute. Nationwide Personal Transportation Survey. Research Triangle Park, NC, 1995. http://www.cta.ornl.gov/npts/1995/doc/index.shtml

Exhibit A-1. Urban Area Information

Population Group	Urban Area	2000 Population	Population Growth 1982 to 2000 Change (%)	Population Growth 1982 to 2000 Rank	Population Growth 1994 to 2000 Change (%)	Population Growth 1994 to 2000 Rank	2000 Urban Area Size (sq. mi.)	2000 Urban Area Population Density (pers/sq.mi.)
Vlg	New York, NY-Northeastern, NJ	17,090	10	65	6	44	4,065	4,205
Vlg	Los Angeles, CA	12,680	28	44	6	44	2,265	5,600
Vlg	Chicago, IL-Northwestern, IN	8,090	14	58	5	50	2,775	2,915
Vlg	Philadelphia, PA-NJ	4,590	12	62	1	71	1,385	3,315
Vlg	San Francisco-Oakland, CA	4,030	22	50	4	57	1,255	3,210
Vlg	Detroit, MI	4,025	6	70	0	74	1,315	3,060
Vlg	Dallas-Fort Worth, TX	3,800	55	17	18	12	1,920	1,980
Vlg	Washington, DC-MD-VA	3,560	32	37	3	62	1,030	3,455
Vlg	Houston, TX	3,375	41	24	15	16	1,740	1,940
Vlg	Boston, MA	3,025	6	70	1	71	1,160	2,610
Lrg	Atlanta, GA	2,975	85	4	24	5	1,815	1,640
Lrg	San Diego, CA	2,710	52	18	6	44	755	3,590
Lrg	Phoenix, AZ	2,600	82	6	22	8	1,120	2,320
Lrg	Minneapolis-St. Paul, MN	2,475	41	24	14	19	1,235	2,005
Lrg	Miami-Hialeah, FL	2,270	31	39	17	14	560	4,055
Lrg	Baltimore, MD	2,170	28	44	2	67	750	2,895
Lrg	St. Louis, MO-IL	2,040	9	66	3	62	1,130	1,805
Lrg	Seattle-Everett, WA	2,000	39	28	5	50	875	2,285
Lrg	Tampa-St Petersburg-Clearwater, FL	1,950	37	30	10	29	1,335	1,460
Lrg	Denver, CO	1,910	41	24	14	19	840	2,275
Lrg	Cleveland, OH	1,885	8	68	4	57	825	2,285
Lrg	Pittsburgh, PA	1,790	-1	75	1	71	1,010	1,770
Lrg	San Jose, CA	1,675	29	43	9	35	385	4,350
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	1,560	46	21	18	12	520	3,000
Lrg	Portland-Vancouver, OR-WA	1,500	33	35	15	16	495	3,030
Lrg	Norfolk-Newport News-Virginia Beach, VA	1,500	36	31	7	41	985	1,525
Lrg	Kansas City, MO-KS	1,420	30	41	8	37	1,000	1,420
Lrg	San Bernardino-Riverside, CA	1,410	57	16	6	44	545	2,585
Lrg	Sacramento, CA	1,395	68	12	14	19	410	3,400
Lrg	Milwaukee, WI	1,365	13	61	10	29	575	2,375
Lrg	Cincinnati, OH-KY	1,285	14	58	2	67	660	1,945
Lrg	San Antonio, TX	1,250	30	41	3	62	500	2,500
Lrg	Las Vegas, NV	1,200	167	1	33	1	290	4,140
Lrg	Orlando, FL	1,200	97	2	21	10	650	1,845
Lrg	Buffalo-Niagara Falls, NY	1,110	3	72	4	57	575	1,930
Lrg	New Orleans, LA	1,105	8	68	2	67	370	2,985
Lrg	Oklahoma City, OK	1,080	69	11	27	3	690	1,565
Lrg	Columbus, OH	1,040	25	48	5	50	485	2,145
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	1,030	79	7	20	11	590	1,745
Lrg	Indianapolis, IN	1,020	19	55	5	50	495	2,060
Med	Memphis, TN-AR-MS	975	28	44	8	37	420	2,320
Med	Providence-Pawtucket, RI-MA	915	11	64	3	62	525	1,745
Med	Salt Lake City, UT	900	32	37	9	35	395	2,280
Med	Jacksonville, FL	865	41	24	10	29	735	1,175
Med	Louisville, KY-IN	840	9	66	2	67	410	2,050
Med	Tulsa, OK	800	67	13	10	29	405	1,975
Med	Austin, TX	730	78	8	24	5	415	1,760
Med	Nashville, TN	700	33	35	14	19	595	1,175
Med	Honolulu, HI	695	22	50	0	74	140	4,965
Med	Tucson, AZ	680	51	19	12	25	315	2,160
Med	Birmingham, AL	670	12	62	4	57	605	1,105
Med	El Paso, TX-NM	655	46	21	13	24	245	2,675
Med	Rochester, NY	650	2	74	5	50	345	1,885
Med	Charlotte, NC	645	84	5	22	8	330	1,955
Med	Hartford-Middletown, CT	645	14	58	3	62	380	1,695
Med	Richmond, VA	640	31	39	7	41	415	1,540
Med	Omaha, NE-IA	625	25	48	15	16	240	2,605
Med	Tacoma, WA	605	44	23	6	44	350	1,730
Med	Albuquerque, NM	595	35	33	10	29	280	2,125
Med	Fresno, CA	555	61	15	8	37	185	3,000
Med	Albany-Schenectady-Troy, NY	515	3	72	4	57	375	1,375
Sml	Colorado Springs, CO	465	66	14	26	4	250	1,860
Sml	Charleston, SC	455	34	34	8	37	280	1,625
Sml	Bakersfield, CA	405	76	9	16	15	185	2,190
Sml	Spokane, WA	330	20	54	5	50	175	1,885
Sml	Corpus Christi, TX	315	26	47	7	41	200	1,575
Sml	Pensacola, FL	305	36	31	11	27	190	1,605
Sml	Fort Myers-Cape Coral, FL	290	49	20	14	19	270	1,075
Sml	Anchorage, AK	260	18	56	6	44	190	1,370
Sml	Eugene-Springfield, OR	220	16	57	10	29	110	2,000
Sml	Salem, OR	195	22	50	11	27	80	2,440
Sml	Laredo, TX	185	95	3	32	2	50	3,700
Sml	Brownsville, TX	155	72	10	24	5	50	3,100
Sml	Beaumont, TX	145	21	53	12	25	110	1,320
Sml	Boulder, CO	110	38	29	5	50	45	2,445
	75 area average	1,770					690	2,656
	Very large area average	6,425					1,890	3,400
	Large area average	1,665					750	2,220
	Medium area average	725					385	1,885
	Small area average	275					155	1,775

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

Exhibit A-2. 2000 Urban Mobility Conditions

Population Group	*Urban Area*	*Travel Time Index*		*Annual Delay per Peak Road Traveler*	
		Value	*Rank*	*Person–Hours*	*Rank*
Vlg	Los Angeles, CA	1.90	1	136	1
Vlg	San Francisco-Oakland, CA	1.59	2	92	2
Vlg	Chicago, IL-Northwestern, IN	1.47	3	67	11
Vlg	Washington, DC-MD-VA	1.46	4	84	3
Lrg	Seattle-Everett, WA	1.45	5	82	4
Lrg	Miami-Hialeah, FL	1.45	5	69	10
Vlg	Boston, MA	1.45	5	67	11
Lrg	San Jose, CA	1.42	8	74	6
Lrg	Denver, CO	1.42	8	67	11
Vlg	New York, NY-Northeastern, NJ	1.41	10	73	8
Lrg	Phoenix, AZ	1.40	11	59	18
Lrg	Portland-Vancouver, OR-WA	1.40	11	47	23
Vlg	Houston, TX	1.38	13	75	5
Lrg	Minneapolis-St. Paul, MN	1.38	13	54	20
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	1.37	15	61	16
Lrg	San Diego, CA	1.37	15	51	21
Lrg	Atlanta, GA	1.36	17	70	9
Lrg	Las Vegas, NV	1.35	18	38	37
Lrg	San Bernardino-Riverside, CA	1.34	19	64	15
Vlg	Detroit, MI	1.34	19	55	19
Vlg	Dallas-Fort Worth, TX	1.33	21	74	6
Lrg	Sacramento, CA	1.31	22	42	34
Lrg	Orlando, FL	1.29	23	66	14
Lrg	Baltimore, MD	1.29	23	50	22
Lrg	Tampa-St Petersburg-Clearwater, FL	1.29	23	45	26
Vlg	Philadelphia, PA-NJ	1.28	26	42	34
Med	Austin, TX	1.27	27	61	16
Med	Charlotte, NC	1.27	27	47	23
Med	Albuquerque, NM	1.26	29	45	26
Lrg	Cincinnati, OH-KY	1.26	29	43	30
Lrg	Milwaukee, WI	1.26	29	32	41
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	1.25	32	44	28
Med	Louisville, KY-IN	1.24	33	46	25
Lrg	Indianapolis, IN	1.24	33	43	30
Lrg	San Antonio, TX	1.23	35	43	30
Lrg	St. Louis, MO-IL	1.23	35	43	30
Med	Tacoma, WA	1.23	35	34	39
Med	Providence-Pawtucket, RI-MA	1.21	38	41	36
Med	Memphis, TN-AR-MS	1.21	38	34	39
Sml	Colorado Springs, CO	1.20	40	27	44
Med	Tucson, AZ	1.20	40	25	46
Med	Fresno, CA	1.20	40	24	49
Med	Honolulu, HI	1.20	40	24	49
Lrg	Columbus, OH	1.19	44	36	38
Sml	Charleston, SC	1.19	44	26	45
Med	Nashville, TN	1.18	46	44	28
Lrg	Norfolk-Newport News-Virginia Beach, VA	1.18	46	25	46
Lrg	New Orleans, LA	1.18	46	22	53
Med	Birmingham, AL	1.17	49	31	43
Med	El Paso, TX-NM	1.17	49	21	55
Med	Salt Lake City, UT	1.17	49	20	57
Med	Jacksonville, FL	1.15	52	32	41
Med	Omaha, NE-IA	1.15	52	25	46
Sml	Fort Myers-Cape Coral, FL	1.15	52	16	60
Sml	Pensacola, FL	1.14	55	24	49
Lrg	Cleveland, OH	1.13	56	21	55
Med	Hartford-Middletown, CT	1.12	57	23	52
Med	Tulsa, OK	1.12	57	19	58
Sml	Eugene-Springfield, OR	1.12	57	14	63
Med	Richmond, VA	1.10	60	22	53
Lrg	Kansas City, MO-KS	1.10	60	19	58
Lrg	Pittsburgh, PA	1.10	60	15	61
Sml	Salem, OR	1.10	60	15	61
Lrg	Oklahoma City, OK	1.09	64	12	65
Sml	Boulder, CO	1.09	64	10	69
Lrg	Buffalo-Niagara Falls, NY	1.08	66	11	67
Sml	Spokane, WA	1.08	66	11	67
Sml	Brownsville, TX	1.08	66	5	74
Med	Albany-Schenectady-Troy, NY	1.06	69	13	64
Sml	Bakersfield, CA	1.06	69	8	70
Med	Rochester, NY	1.06	69	8	70
Sml	Laredo, TX	1.06	69	6	72
Sml	Beaumont, TX	1.05	73	12	65
Sml	Corpus Christi, TX	1.04	74	6	72
Sml	Anchorage, AK	1.04	74	4	75
	75 area average	1.39		62	
	Very large area average	1.53		85	
	Large area average	1.30		48	
	Medium area average	1.18		31	
	Small area average	1.11		15	

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

Exhibit A-3. Point Change in Travel Time Index, 1982 to 2000

Population Group	Urban Area	Travel Time Index					Point Change in Peak-Period Time Penalty: Long-Term 1982 to 2000		Short-Term 1994 to 2000	
		1982	1990	1994	1999	2000	Points	Rank	Points	Rank
Vlg	Los Angeles, CA	1.34	1.91	1.69	1.88	1.90	56	1	21	1
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	1.08	1.14	1.17	1.32	1.37	29	10	20	2
Vlg	San Francisco-Oakland, CA	1.21	1.50	1.40	1.49	1.59	38	2	19	3
Lrg	Denver, CO	1.10	1.17	1.24	1.38	1.42	32	5	18	4
Lrg	Minneapolis-St. Paul, MN	1.03	1.12	1.20	1.35	1.38	35	3	18	4
Lrg	Portland-Vancouver, OR-WA	1.05	1.16	1.25	1.37	1.40	35	3	15	6
Lrg	San Antonio, TX	1.05	1.08	1.08	1.21	1.23	18	32	15	6
Lrg	San Diego, CA	1.06	1.25	1.23	1.33	1.37	31	7	14	8
Vlg	Chicago, IL-Northwestern, IN	1.19	1.37	1.34	1.49	1.47	28	12	13	9
Vlg	Dallas-Fort Worth, TX	1.07	1.18	1.20	1.32	1.33	26	18	13	9
Lrg	Phoenix, AZ	1.13	1.21	1.27	1.37	1.40	27	17	13	9
Lrg	Atlanta, GA	1.08	1.14	1.24	1.32	1.36	28	12	12	12
Sml	Colorado Springs, CO	1.02	1.04	1.08	1.18	1.20	18	32	12	12
Lrg	San Bernardino-Riverside, CA	1.04	1.24	1.22	1.31	1.34	30	9	12	12
Med	Charlotte, NC	1.08	1.16	1.16	1.24	1.27	19	29	11	15
Vlg	Houston, TX	1.28	1.31	1.27	1.37	1.38	10	52	11	15
Med	Austin, TX	1.08	1.12	1.17	1.26	1.27	19	29	10	17
Vlg	Boston, MA	1.14	1.27	1.35	1.43	1.45	31	7	10	17
Lrg	Milwaukee, WI	1.05	1.12	1.16	1.25	1.26	21	25	10	17
Vlg	New York, NY-Northeastern, NJ	1.13	1.31	1.31	1.40	1.41	28	12	10	17
Med	Fresno, CA	1.05	1.13	1.11	1.20	1.20	15	38	9	21
Lrg	Orlando, FL	1.09	1.16	1.20	1.27	1.29	20	28	9	21
Med	Providence-Pawtucket, RI-MA	1.04	1.12	1.12	1.20	1.21	17	35	9	21
Lrg	Sacramento, CA	1.07	1.20	1.22	1.26	1.31	24	19	9	21
Lrg	San Jose, CA	1.18	1.44	1.33	1.39	1.42	24	19	9	21
Med	Albuquerque, NM	1.04	1.10	1.18	1.26	1.26	22	21	8	26
Lrg	Cincinnati, OH-KY	1.04	1.12	1.18	1.23	1.26	22	21	8	26
Med	El Paso, TX-NM	1.02	1.04	1.09	1.14	1.17	15	38	8	26
Med	Louisville, KY-IN	1.09	1.08	1.16	1.24	1.24	15	38	8	26
Lrg	Baltimore, MD	1.07	1.21	1.22	1.26	1.29	22	21	7	30
Med	Birmingham, AL	1.05	1.06	1.10	1.16	1.17	12	44	7	30
Sml	Eugene-Springfield, OR	1.02	1.04	1.05	1.09	1.12	10	52	7	30
Lrg	Las Vegas, NV	1.07	1.23	1.28	1.34	1.35	28	12	7	30
Med	Memphis, TN-AR-MS	1.03	1.09	1.14	1.19	1.21	18	32	7	30
Lrg	Miami-Hialeah FL	1.16	1.32	1.38	1.39	1.45	29	10	7	30
Vlg	Philadelphia, PA-NJ	1.11	1.18	1.21	1.28	1.28	17	35	7	30
Med	Tulsa, OK	1.02	1.05	1.05	1.10	1.12	10	52	7	30
Vlg	Washington, DC-MD-VA	1.18	1.34	1.39	1.49	1.46	28	12	7	30
Med	Nashville, TN	1.07	1.10	1.12	1.18	1.18	11	45	6	39
Lrg	Seattle-Everett, WA	1.13	1.34	1.39	1.48	1.45	32	5	6	39
Lrg	St. Louis, MO-IL	1.08	1.11	1.17	1.22	1.23	15	38	6	39
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	1.04	1.12	1.19	1.25	1.25	21	25	6	39
Sml	Charleston, SC	1.08	1.15	1.14	1.18	1.19	11	45	5	43
Med	Hartford-Middletown, CT	1.05	1.09	1.07	1.10	1.12	7	62	5	43
Lrg	Oklahoma City, OK	1.02	1.03	1.04	1.11	1.09	7	62	5	43
Med	Tacoma, WA	1.04	1.11	1.18	1.24	1.23	19	29	5	43
Med	Tucson, AZ	1.06	1.11	1.15	1.21	1.20	14	42	5	43
Sml	Boulder, CO	1.02	1.03	1.05	1.08	1.09	7	62	4	48
Lrg	Buffalo-Niagara Falls, NY	1.03	1.04	1.04	1.07	1.08	5	66	4	48
Lrg	Indianapolis, IN	1.03	1.06	1.20	1.23	1.24	21	25	4	48
Sml	Brownsville, TX	1.02	1.04	1.05	1.07	1.08	6	65	3	51
Lrg	Cleveland, OH	1.02	1.06	1.10	1.15	1.13	11	45	3	51
Sml	Fort Myers-Cape Coral, FL	1.04	1.09	1.12	1.14	1.15	11	45	3	51
Lrg	Kansas City, MO-KS	1.01	1.03	1.07	1.11	1.10	9	58	3	51
Lrg	Norfolk-Newport News-Virginia Beach, VA	1.08	1.15	1.15	1.21	1.18	10	52	3	51
Med	Omaha, NE-IA	1.04	1.09	1.12	1.15	1.15	11	45	3	51
Sml	Pensacola, FL	1.03	1.08	1.11	1.12	1.14	11	45	3	51
Sml	Salem, OR	1.02	1.04	1.07	1.09	1.10	8	59	3	51
Med	Albany-Schenectady-Troy, NY	1.02	1.04	1.04	1.06	1.06	4	70	2	59
Sml	Bakersfield, CA	1.01	1.03	1.04	1.05	1.06	5	66	2	59
Sml	Beaumont, TX	1.03	1.03	1.03	1.06	1.05	2	72	2	59
Lrg	Columbus, OH	1.03	1.10	1.17	1.22	1.19	16	37	2	59
Sml	Laredo, TX	1.02	1.03	1.04	1.07	1.06	4	70	2	59
Med	Richmond, VA	1.02	1.05	1.08	1.12	1.10	8	59	2	59
Med	Rochester, NY	1.01	1.03	1.04	1.06	1.06	5	66	2	59
Med	Salt Lake City, UT	1.03	1.08	1.15	1.17	1.17	14	42	2	59
Sml	Corpus Christi, TX	1.03	1.03	1.03	1.05	1.04	1	74	1	67
Vlg	Detroit, MI	1.12	1.28	1.33	1.35	1.34	22	21	1	67
Med	Jacksonville, FL	1.04	1.11	1.14	1.14	1.15	11	45	1	67
Lrg	Pittsburgh, PA	1.08	1.10	1.09	1.12	1.10	2	72	1	67
Sml	Spokane, WA	1.03	1.04	1.07	1.08	1.08	5	66	1	67
Sml	Anchorage, AK	1.04	1.05	1.04	1.04	1.04	0	75	0	72
Lrg	New Orleans, LA	1.10	1.16	1.20	1.20	1.18	8	59	-2	73
Med	Honolulu, HI	1.10	1.22	1.23	1.22	1.20	10	52	-3	74
Lrg	Tampa-St Petersburg-Clearwater, FL	1.19	1.26	1.32	1.29	1.29	10	52	-3	74
	75 area average	1.14	1.31	1.29	1.38	1.39	25		10	
	Very large area average	1.20	1.47	1.41	1.52	1.53	33		12	
	Large area average	1.08	1.18	1.21	1.29	1.30	22		9	
	Medium area average	1.05	1.09	1.13	1.18	1.18	13		5	
	Small area average	1.03	1.06	1.07	1.10	1.11	8		4	

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

Exhibit A-4. Hours Change in Annual Delay per Peak Road Traveler, 1982 to 2000

Population Group	Urban Area	1982	1990	1994	1999	2000	Long-Term Change 1982 to 2000 Hours	Long-Term Change 1982 to 2000 Rank	Short-Term Change 1994 to 2000 Hours	Short-Term Change 1994 to 2000 Rank
Vlg	San Francisco-Oakland, CA	26	81	54	75	92	66	2	38	1
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	7	18	26	48	61	54	9	35	2
Lrg	San Antonio, TX	6	13	11	39	43	37	29	32	3
Lrg	Denver, CO	13	22	36	61	67	54	9	31	4
Med	Austin, TX	10	20	31	56	61	51	12	30	5
Vlg	Dallas-Fort Worth, TX	12	35	47	80	74	62	3	27	6
Lrg	Orlando, FL	11	23	41	56	66	55	8	25	7
Vlg	Los Angeles, CA	47	137	112	134	136	89	1	24	8
Lrg	San Bernardino-Riverside, CA	8	42	41	56	64	56	7	23	9
Vlg	Chicago, IL-Northwestern, IN	16	45	45	67	67	51	12	22	10
Lrg	Minneapolis-St. Paul, MN	3	18	32	57	54	51	12	22	10
Vlg	New York, NY-Northeastern, NJ	20	57	51	73	73	53	11	22	10
Med	Charlotte, NC	9	24	26	41	47	38	27	21	13
Lrg	San Diego, CA	8	35	30	45	51	43	19	21	13
Lrg	San Jose, CA	23	96	53	68	74	51	12	21	13
Lrg	Atlanta, GA	12	24	50	62	70	58	6	20	16
Lrg	Phoenix, AZ	15	31	39	55	59	44	18	20	16
Med	Providence-Pawtucket, RI-MA	3	18	21	37	41	38	27	20	16
Vlg	Houston, TX	40	49	56	83	75	35	31	19	19
Sml	Colorado Springs, CO	2	5	9	25	27	25	42	18	20
Lrg	Portland-Vancouver, OR-WA	5	16	29	42	47	42	20	18	20
Vlg	Washington, DC-MD-VA	24	54	66	91	84	60	5	18	20
Med	Nashville, TN	13	20	27	42	44	31	35	17	23
Lrg	Cincinnati, OH-KY	4	15	27	39	43	39	25	16	24
Med	Louisville, KY-IN	9	11	30	47	46	37	29	16	24
Med	Memphis, TN-AR-MS	3	12	19	30	34	31	35	15	26
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	3	15	30	43	44	41	21	14	27
Med	Albuquerque, NM	5	17	32	56	45	40	24	13	28
Med	Birmingham, AL	6	10	18	29	31	25	42	13	28
Med	Fresno, CA	7	16	11	21	24	17	51	13	28
Med	Tulsa, OK	3	6	6	13	19	16	55	13	28
Vlg	Boston, MA	21	43	55	63	67	46	17	12	32
Lrg	Milwaukee WI	5	12	20	31	32	27	41	12	32
Vlg	Philadelphia, PA-NJ	13	24	30	43	42	29	38	12	32
Lrg	Baltimore, MD	9	37	39	44	50	41	21	11	35
Med	El Paso, TX-NM	2	4	10	17	21	19	49	11	35
Med	Hartford-Middletown, CT	6	16	12	20	23	17	51	11	35
Lrg	Las Vegas, NV	6	25	27	36	38	32	32	11	35
Lrg	Seattle-Everett, WA	20	59	71	90	82	62	3	11	35
Lrg	St. Louis, MO-IL	11	19	32	40	43	32	32	11	35
Sml	Eugene-Springfield, OR	2	4	5	10	14	12	62	9	41
Lrg	Miami-Hialeah, FL	19	45	60	61	69	50	16	9	41
Med	Omaha, NE-IA	4	11	16	25	25	21	45	9	41
Lrg	Sacramento, CA	11	31	34	35	42	31	35	8	44
Med	Tacoma, WA	6	21	26	37	34	28	40	8	44
Med	Tucson, AZ	4	11	17	25	25	21	45	8	44
Sml	Charleston, SC	10	22	19	25	26	16	55	7	47
Lrg	Columbus, OH	4	18	29	43	36	32	32	7	47
Sml	Pensacola, FL	3	12	17	20	24	21	45	7	47
Sml	Beaumont, TX	4	5	6	13	12	8	66	6	50
Lrg	Buffalo-Niagara Falls, NY	2	5	5	8	11	9	64	6	50
Lrg	Cleveland, OH	1	7	15	23	21	20	48	6	50
Lrg	Indianapolis, IN	4	8	37	39	43	39	25	6	50
Med	Richmond, VA	3	9	16	26	22	19	49	6	50
Sml	Fort Myers-Cape Coral, FL	3	7	11	15	16	13	60	5	55
Lrg	Oklahoma City, OK	3	5	7	16	12	9	64	5	55
Med	Albany-Schenectady-Troy, NY	2	8	9	12	13	11	63	4	57
Sml	Boulder, CO	2	3	6	9	10	8	66	4	57
Med	Rochester, NY	1	3	4	8	8	7	68	4	57
Sml	Salem, OR	2	7	11	14	15	13	60	4	57
Sml	Bakersfield, CA	2	5	5	7	8	6	71	3	61
Lrg	Kansas City, MO-KS	2	7	16	23	19	17	51	3	61
Sml	Laredo, TX	1	2	3	7	6	5	72	3	61
Lrg	Norfolk-Newport News-Virginia Beach, VA	10	19	22	32	25	15	57	3	61
Sml	Brownsville, TX	1	3	3	5	5	4	73	2	65
Sml	Corpus Christi, TX	4	5	4	7	6	2	74	2	65
Med	Jacksonville, FL	7	21	31	32	32	25	42	1	67
Lrg	Pittsburgh, PA	8	14	14	19	15	7	68	1	67
Med	Salt Lake City, UT	3	8	19	18	20	17	51	1	67
Sml	Anchorage, AK	4	6	4	4	4	0	75	0	70
Sml	Spokane, WA	4	7	11	12	11	7	68	0	70
Lrg	New Orleans, LA	8	14	26	24	22	14	58	-4	72
Vlg	Detroit, MI	14	42	60	57	55	41	21	-5	73
Lrg	Tampa-St Petersburg-Clearwater, FL	16	30	50	47	45	29	38	-5	73
Med	Honolulu, HI	10	32	33	32	24	14	58	-9	75
	75 area average	16	44	45	60	62	46		17	
	Very large area average	25	69	64	85	85	60		21	
	Large area average	9	26	33	45	48	39		15	
	Medium area average	5	14	20	30	31	26		11	
	Small area average	4	8	9	14	15	11		6	

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

Exhibit A-5. Annual Hours of Delay, 2000

Population Group	Urban Area	Annual Person-Hours of Delay (000)				Annual Delay per Peak Road Traveler		Annual Delay per Person	
		Recurring	Incident	Total	Rank	Hours	Rank	Hours	Rank
Vlg	Los Angeles, CA	392,830	399,140	791,970	1	136	1	62	1
Vlg	San Francisco-Oakland, CA	86,595	80,605	167,200	4	92	2	41	2
Vlg	Washington, DC-MD-VA	64,900	58,290	123,190	6	84	3	35	5
Lrg	Seattle-Everett, WA	31,065	36,485	67,550	14	82	4	34	7
Vlg	Houston, TX	53,645	67,300	120,945	7	75	5	36	4
Vlg	Dallas-Fort Worth, TX	64,970	76,155	141,125	5	74	6	37	3
Lrg	San Jose, CA	25,890	30,030	55,920	18	74	6	33	8
Vlg	New York, NY-Northeastern, NJ	137,625	262,490	400,115	2	73	8	23	21
Lrg	Atlanta, GA	46,305	50,940	97,245	9	70	9	33	8
Lrg	Miami-Hialeah, FL	34,830	40,020	74,850	11	69	10	33	8
Vlg	Boston, MA	36,635	48,210	84,845	10	67	11	28	13
Vlg	Chicago, IL-Northwestern, IN	112,240	109,060	221,300	3	67	11	27	17
Lrg	Denver, CO	31,505	34,660	66,165	15	67	11	35	5
Lrg	Orlando, FL	17,085	20,300	37,385	24	66	14	31	11
Lrg	San Bernardino-Riverside, CA	22,860	18,965	41,825	21	64	15	30	12
Med	Austin, TX	8,860	11,780	20,640	31	61	16	28	13
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	23,750	20,695	44,445	19	61	16	28	13
Lrg	Phoenix, AZ	38,350	34,240	72,590	12	59	18	28	13
Vlg	Detroit, MI	45,215	56,125	101,340	8	55	19	25	19
Lrg	Minneapolis-St. Paul, MN	26,240	36,895	63,135	17	54	20	26	18
Lrg	San Diego, CA	36,435	28,870	65,305	16	51	21	24	20
Lrg	Baltimore, MD	19,330	25,055	44,385	20	50	22	20	27
Med	Charlotte, NC	6,830	7,120	13,950	41	47	23	22	23
Lrg	Portland-Vancouver, OR-WA	15,895	18,465	34,360	25	47	23	23	21
Med	Louisville, KY-IN	7,500	10,355	17,855	34	46	25	21	24
Med	Albuquerque, NM	5,830	6,410	12,240	45	45	26	21	24
Lrg	Tampa-St Petersburg-Clearwater, FL	18,800	22,485	41,285	23	45	26	21	24
Med	Nashville, TN	5,785	8,385	14,170	40	44	28	20	27
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	9,500	11,510	21,010	30	44	28	20	27
Lrg	Cincinnati, OH-KY	11,260	14,125	25,385	28	43	30	20	27
Lrg	Indianapolis, IN	10,005	10,625	20,630	32	43	30	20	27
Lrg	San Antonio, TX	14,235	11,270	25,505	27	43	30	20	27
Lrg	St. Louis, MO-IL	18,935	22,755	41,690	22	43	30	20	27
Vlg	Philadelphia, PA-NJ	27,960	42,670	70,630	13	42	34	15	39
Lrg	Sacramento, CA	13,270	13,870	27,140	26	42	34	19	34
Med	Providence-Pawtucket, RI-MA	6,535	10,595	17,130	37	41	36	19	34
Lrg	Las Vegas, NV	11,495	10,155	21,650	29	38	37	18	36
Lrg	Columbus, OH	7,765	10,025	17,790	35	36	38	17	37
Med	Memphis, TN-AR-MS	6,230	9,230	15,460	39	34	39	16	38
Med	Tacoma, WA	4,035	4,435	8,470	48	34	39	14	42
Med	Jacksonville, FL	5,830	6,755	12,585	42	32	41	15	39
Lrg	Milwaukee, WI	10,025	10,335	20,360	33	32	41	15	39
Med	Birmingham, AL	3,910	5,700	9,610	47	31	43	14	42
Sml	Colorado Springs, CO	2,270	3,610	5,880	59	27	44	13	44
Sml	Charleston, SC	2,510	3,115	5,625	60	26	45	12	45
Lrg	Norfolk-Newport News-Virginia Beach, VA	6,705	10,715	17,420	36	25	46	12	45
Med	Omaha, NE-IA	3,055	4,015	7,070	52	25	46	11	47
Med	Tucson, AZ	3,600	4,080	7,680	51	25	46	11	47
Med	Fresno, CA	2,585	3,560	6,145	58	24	49	11	47
Med	Honolulu, HI	4,015	3,675	7,690	50	24	49	11	47
Sml	Pensacola, FL	1,630	1,800	3,430	62	24	49	11	47
Med	Hartford-Middletown, CT	2,580	4,225	6,805	54	23	52	11	47
Lrg	New Orleans, LA	5,250	6,175	11,425	46	22	53	10	53
Med	Richmond, VA	2,370	4,125	6,495	55	22	53	10	53
Lrg	Cleveland, OH	7,030	8,935	15,965	38	21	55	8	59
Med	El Paso, TX-NM	2,790	3,570	6,360	56	21	55	10	53
Med	Salt Lake City, UT	3,855	4,555	8,410	49	20	57	9	56
Lrg	Kansas City, MO-KS	4,635	7,760	12,395	44	19	58	9	56
Med	Tulsa, OK	2,480	4,485	6,965	53	19	58	9	56
Sml	Fort Myers-Cape Coral, FL	1,005	1,110	2,115	65	16	60	7	60
Lrg	Pittsburgh, PA	5,050	7,460	12,510	43	15	61	7	60
Sml	Salem, OR	600	740	1,340	69	15	61	7	60
Sml	Eugene-Springfield, OR	650	795	1,445	68	14	63	7	60
Med	Albany-Schenectady-Troy, NY	1,365	1,615	2,980	63	13	64	6	64
Sml	Beaumont, TX	355	495	850	71	12	65	6	64
Lrg	Oklahoma City, OK	2,635	3,625	6,260	57	12	65	6	64
Lrg	Buffalo-Niagara Falls, NY	2,090	3,470	5,560	61	11	67	5	67
Sml	Spokane, WA	760	1,000	1,760	66	11	67	5	67
Sml	Boulder, CO	240	270	510	72	10	69	5	67
Sml	Bakersfield, CA	715	870	1,585	67	8	70	4	70
Med	Rochester, NY	800	1,470	2,270	64	8	70	3	71
Sml	Corpus Christi, TX	370	530	900	70	6	72	3	71
Sml	Laredo, TX	240	270	510	72	6	72	3	71
Sml	Brownsville, TX	190	210	400	75	5	74	3	71
Sml	Anchorage, AK	225	250	475	74	4	75	2	75
	75 area total	1,653,375	1,916,250	3,569,625					
	75 area average	22,045	25,550	47,595		62		27	
	Very large area average	102,260	120,005	222,265		85		35	
	Large area average	17,610	19,360	36,970		48		22	
	Medium area average	4,325	5,720	10,045		31		14	
	Small area average	840	1,075	1,915		15		7	

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.

Exhibit A-6. Wasted Fuel, 2000

Population Group	Urban Area	Annual Gallons of Fuel Wasted (million) Recurring Delay[1]	Incident Delay[1]	Total[1]	Rank	Annual Excess Fuel Consumed per Peak Road Traveler Gallons	Rank	per Person Gallons	Rank
Vlg	Los Angeles, CA	589	599	1188	1	204	1	94	1
Vlg	San Francisco-Oakland, CA	140	130	270	4	149	2	67	2
Lrg	Seattle-Everett, WA	52	60	112	14	137	3	56	5
Vlg	Washington, DC-MD-VA	104	94	198	7	136	4	56	5
Vlg	Houston, TX	88	111	199	6	123	5	59	4
Vlg	New York, NY-Northeastern, NJ	226	432	658	2	120	6	39	21
Vlg	Dallas-Fort Worth, TX	105	123	228	5	120	6	60	3
Lrg	Atlanta, GA	79	87	166	8	119	8	56	5
Lrg	San Jose, CA	41	48	89	18	118	9	53	9
Vlg	Boston, MA	59	77	136	10	107	10	45	14
Lrg	Miami-Hialeah, FL	54	61	115	11	106	11	51	10
Lrg	Denver, CO	50	55	105	17	106	11	55	8
Lrg	San Bernardino-Riverside, CA	37	31	68	21	105	13	48	11
Vlg	Chicago, IL-Northwestern, IN	175	170	345	3	104	14	43	18
Med	Austin, TX	15	20	35	29	104	14	48	11
Lrg	Orlando, FL	26	32	58	24	103	16	48	11
Lrg	Phoenix, AZ	61	54	115	11	94	17	44	15
Lrg	Minneapolis-St. Paul, MN	45	63	108	16	93	18	44	15
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	36	32	68	21	93	18	44	15
Vlg	Detroit, MI	74	92	166	8	90	20	41	19
Lrg	San Diego, CA	63	49	112	14	88	21	41	19
Lrg	Baltimore, MD	33	42	75	19	84	22	35	25
Med	Charlotte, NC	12	12	24	40	81	23	37	23
Med	Louisville, KY-IN	13	18	31	34	80	24	37	23
Lrg	Portland-Vancouver, OR-WA	26	31	57	25	78	25	38	22
Med	Nashville, TN	10	14	24	40	75	26	34	27
Lrg	St. Louis, MO-IL	32	39	71	20	74	27	35	25
Lrg	Cincinnati, OH-KY	19	25	44	27	74	27	34	27
Lrg	Indianapolis, IN	17	18	35	29	73	29	34	27
Lrg	Sacramento, CA	23	23	46	26	72	30	33	31
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	15	19	34	31	72	30	33	31
Lrg	San Antonio, TX	24	18	42	28	71	32	34	27
Med	Providence-Pawtucket, RI-MA	11	18	29	37	69	33	32	33
Med	Albuquerque, NM	9	10	19	45	69	33	32	33
Vlg	Philadelphia, PA-NJ	45	70	115	11	68	35	25	39
Lrg	Tampa-St Petersburg-Clearwater, FL	28	34	62	23	68	35	32	33
Lrg	Columbus, OH	13	18	31	34	63	37	30	36
Lrg	Las Vegas, NV	18	16	34	31	60	38	28	37
Med	Memphis, TN-AR-MS	10	15	25	39	56	39	26	38
Med	Tacoma, WA	7	7	14	49	56	39	23	43
Med	Birmingham, AL	7	10	17	47	55	41	25	39
Lrg	Milwaukee, WI	17	17	34	31	54	42	25	39
Med	Jacksonville, FL	10	11	21	43	53	43	24	42
Lrg	Norfolk-Newport News-Virginia Beach, VA	12	18	30	36	43	44	20	44
Sml	Charleston, SC	4	5	9	59	42	45	20	44
Med	Honolulu, HI	7	6	13	50	41	46	19	46
Sml	Colorado Springs, CO	3	6	9	59	41	46	19	46
Med	Hartford-Middletown, CT	5	7	12	51	40	48	19	46
Med	Fresno, CA	4	6	10	57	39	49	18	49
Lrg	Cleveland, OH	13	16	29	37	38	50	15	57
Med	Tucson, AZ	6	6	12	51	38	50	18	49
Med	Omaha, NE-IA	5	6	11	53	38	50	18	49
Lrg	New Orleans, LA	9	10	19	45	37	53	17	52
Med	Richmond, VA	4	7	11	53	37	53	17	52
Med	Salt Lake City, UT	7	8	15	48	36	55	17	52
Sml	Pensacola, FL	2	3	5	62	35	56	16	55
Lrg	Kansas City, MO-KS	9	14	23	42	34	57	16	55
Med	El Paso, TX-NM	4	6	10	57	33	58	15	57
Med	Tulsa, OK	4	7	11	53	30	59	14	59
Sml	Fort Myers-Cape Coral, FL	2	2	4	64	29	60	14	59
Lrg	Pittsburgh, PA	8	12	20	44	24	61	11	61
Lrg	Oklahoma City, OK	5	6	11	53	22	62	10	62
Sml	Salem, OR	1	1	2	68	22	62	10	62
Med	Albany-Schenectady-Troy, NY	2	3	5	62	21	64	10	62
Sml	Spokane, WA	1	2	3	66	19	65	9	65
Sml	Eugene-Springfield, OR	1	1	2	68	19	65	9	65
Lrg	Buffalo-Niagara Falls, NY	3	6	9	59	17	67	8	67
Sml	Bakersfield, CA	1	2	3	66	16	68	7	68
Sml	Beaumont, TX	0	1	1	70	15	69	7	68
Med	Rochester, NY	1	3	4	64	13	70	6	70
Sml	Corpus Christi, TX	0	1	1	70	7	71	3	71
Sml	Anchorage, AK	0	1	1	70	5	72	3	72
Sml	Boulder, CO	0	1	1	70	5	72	3	72
Sml	Brownsville, TX	0	1	1	70	5	72	3	72
Sml	Laredo, TX	0	1	1	70	5	72	3	72
	75 area total	2,640	3,075	5,715					
	75 area average	35	40	75		99		43	
	Very large area average	160	190	350		134		55	
	Large area average	29	32	61		79		37	
	Medium area average	7	10	17		52		24	
	Small area average	1	2	3		22		10	

[1]Zero indicates less than 1 million gallons wasted.

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

Exhibit A-7. Cost of Congestion, 2000

Population Group	Urban Area	Annual Cost Due to Congestion ($ millions) Delay	Fuel	Total	Rank	Annual Congestion Cost per Peak Road Traveler $	Rank	per Person $	Rank
Vlg	Los Angeles, CA	12,585	2,050	14,635	1	2,510	1	1,155	1
Vlg	New York, NY-Northeastern, NJ	6,645	1,015	7,660	2	1,400	7	450	21
Vlg	Chicago, IL-Northwestern, IN	3,575	520	4,095	3	1,235	13	505	17
Vlg	San Francisco-Oakland, CA	2,745	465	3,210	4	1,770	2	795	2
Vlg	Dallas-Fort Worth, TX	2,320	320	2,640	5	1,390	8	695	3
Vlg	Washington, DC-MD-VA	2,020	305	2,325	6	1,595	4	655	6
Vlg	Houston, TX	2,005	280	2,285	7	1,410	6	675	4
Vlg	Detroit, MI	1,675	230	1,905	8	1,030	20	475	20
Lrg	Atlanta, GA	1,660	225	1,885	9	1,350	9	635	8
Vlg	Boston, MA	1,390	205	1,595	10	1,255	10	525	14
Lrg	Miami-Hialeah, FL	1,200	165	1,365	11	1,255	10	600	10
Lrg	Phoenix, AZ	1,185	175	1,360	12	1,115	17	525	14
Vlg	Philadelphia, PA-NJ	1,165	160	1,325	13	780	36	290	38
Lrg	Seattle-Everett, WA	1,130	185	1,315	14	1,605	3	660	5
Lrg	San Diego, CA	1,105	190	1,295	15	1,015	21	480	19
Lrg	Denver, CO	1,080	145	1,225	16	1,235	13	640	7
Lrg	Minneapolis-St. Paul, MN	1,070	150	1,220	17	1,050	19	495	18
Lrg	San Jose, CA	915	150	1,065	18	1,415	5	635	8
Lrg	Baltimore, MD	745	115	860	19	965	22	395	25
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	710	100	810	20	1,105	18	520	16
Lrg	San Bernardino-Riverside, CA	690	120	810	20	1,250	12	575	11
Lrg	St. Louis, MO-IL	710	95	805	22	840	28	395	25
Lrg	Tampa-St Petersburg-Clearwater, FL	660	85	745	23	815	33	380	32
Lrg	Orlando, FL	605	85	690	24	1,225	15	575	11
Lrg	Portland-Vancouver, OR-WA	575	95	670	25	910	23	445	22
Lrg	Sacramento, CA	460	80	540	26	840	28	385	29
Lrg	Cincinnati, OH-KY	440	65	505	27	855	26	395	25
Lrg	San Antonio, TX	420	55	475	28	810	34	380	32
Lrg	Las Vegas, NV	355	60	415	29	735	37	345	36
Med	Austin, TX	350	50	400	30	1,190	16	550	13
Lrg	Indianapolis, IN	345	50	395	31	825	31	385	29
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	345	50	395	31	835	30	385	29
Lrg	Milwaukee, WI	340	50	390	33	620	41	285	40
Lrg	Columbus, OH	305	40	345	34	705	38	330	37
Lrg	Norfolk-Newport News-Virginia Beach, VA	300	45	345	34	490	45	230	45
Med	Louisville, KY-IN	300	35	335	36	865	25	400	24
Med	Providence-Pawtucket, RI-MA	290	45	335	36	795	35	365	35
Lrg	Cleveland, OH	280	35	315	38	410	54	165	58
Med	Memphis, TN-AR-MS	250	35	285	39	635	40	290	38
Med	Nashville, TN	240	35	275	40	855	26	395	25
Med	Charlotte, NC	235	30	265	41	895	24	410	23
Med	Jacksonville, FL	215	30	245	42	615	42	285	40
Lrg	Kansas City, MO-KS	215	30	245	42	365	57	175	56
Lrg	Pittsburgh, PA	210	25	235	44	280	60	130	60
Med	Albuquerque, NM	195	30	225	45	820	32	380	32
Lrg	New Orleans, LA	185	30	215	46	415	53	195	52
Med	Birmingham, AL	165	25	190	47	615	42	285	40
Med	Salt Lake City, UT	145	25	170	48	410	54	190	54
Med	Tacoma, WA	140	30	170	48	685	39	280	43
Med	Honolulu, HI	125	30	155	50	485	46	225	46
Med	Tucson, AZ	130	20	150	51	480	47	220	47
Med	Hartford-Middletown, CT	120	20	140	52	470	48	215	49
Med	Tulsa, OK	120	15	135	53	365	57	170	57
Lrg	Oklahoma City, OK	110	15	125	54	245	63	115	62
Med	Omaha, NE-IA	110	15	125	54	435	51	200	51
Med	Richmond, VA	110	15	125	54	425	52	195	52
Med	El Paso, TX-NM	105	15	120	57	400	56	185	55
Med	Fresno, CA	100	20	120	57	470	48	215	49
Sml	Colorado Springs, CO	95	15	110	59	505	44	235	44
Lrg	Buffalo-Niagara Falls, NY	90	15	105	60	200	67	95	67
Sml	Charleston, SC	90	10	100	61	470	48	220	47
Med	Albany-Schenectady-Troy, NY	55	5	60	62	255	62	115	62
Sml	Pensacola, FL	50	0	50	63	350	59	165	58
Med	Rochester, NY	45	5	50	63	165	69	75	69
Sml	Fort Myers-Cape Coral, FL	30	0	30	65	220	65	105	65
Sml	Spokane, WA	30	0	30	65	195	68	90	68
Sml	Bakersfield, CA	25	0	25	67	130	70	60	70
Sml	Eugene-Springfield, OR	25	0	25	67	240	64	115	62
Sml	Salem, OR	25	0	25	67	275	61	130	60
Sml	Beaumont, TX	15	0	15	70	220	65	105	65
Sml	Corpus Christi, TX	15	0	15	70	100	71	50	71
Sml	Anchorage, AK	5	0	5	72	40	74	20	74
Sml	Boulder, CO	5	0	5	72	95	72	45	72
Sml	Laredo, TX	5	0	5	72	60	73	25	73
Sml	Brownsville, TX	0	0	5	72	30	75	15	75
	75 area total	58,500	9,000	67,500					
	75 area average	780	120	900		1,160		505	
	Very large area average	3,615	555	4,170		1,590		650	
	Large area average	615	90	705		915		425	
	Medium area average	170	25	195		595		275	
	Small area average	30	2	32		245		115	

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

Exhibit A-8. Individual's Congestion Cost, 2000

Population Group	Urban Area	Annual Congestion Cost per Peak Roadway Traveler $	per Peak Roadway Traveler Rank	per Person $	per Person Rank
Vlg	Los Angeles, CA	2,510	1	1,155	1
Vlg	San Franc,isco-Oakland, CA	1,770	2	795	2
Lrg	Seattle-Everett, WA	1,605	3	660	5
Vlg	Washington, DC-MD-VA	1,595	4	655	6
Lrg	San Jose, CA	1,415	5	635	8
Vlg	Houston, TX	1,410	6	675	4
Vlg	New York, NY-Northeastern, NJ	1,400	7	450	21
Vlg	Dallas-Fort Worth, TX	1,390	8	695	3
Lrg	Atlanta, GA	1,350	9	635	8
Lrg	Miami-Hialeah, FL	1,255	10	600	10
Vlg	Boston, MA	1,255	10	525	14
Lrg	San Bernardino-Riverside, CA	1,250	12	575	11
Lrg	Denver, CO	1,235	13	640	7
Vlg	Chicago, IL-Northwestern, IN	1,235	13	505	17
Lrg	Orlando, FL	1,225	15	575	11
Med	Austin, TX	1,190	16	550	13
Lrg	Phoenix, AZ	1,115	17	525	14
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	1,105	18	520	16
Lrg	Minneapolis-St. Paul, MN	1,050	19	495	18
Vlg	Detroit, MI	1,030	20	475	20
Lrg	San Diego, CA	1,015	21	480	19
Lrg	Baltimore, MD	965	22	395	25
Lrg	Portland-Vancouver, OR-WA	910	23	445	22
Med	Charlotte, NC	895	24	410	23
Med	Louisville, KY-IN	865	25	400	24
Lrg	Cincinnati, OH-KY	855	26	395	25
Med	Nashville, TN	855	26	395	25
Lrg	St. Louis, MO-IL	840	28	395	25
Lrg	Sacramento, CA	840	28	385	29
Lrg	Indianapolis, IN	825	30	385	29
Med	Albuquerque, NM	820	31	380	32
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	815	32	385	29
Lrg	Tampa-St Petersburg-Clearwater, FL	815	32	380	32
Lrg	San Antonio, TX	810	34	380	32
Med	Providence-Pawtucket, RI-MA	795	35	365	35
Vlg	Philadelphia, PA-NJ	780	36	290	38
Lrg	Las Vegas, NV	735	37	345	36
Lrg	Columbus, OH	705	38	330	37
Med	Tacoma, WA	685	39	280	43
Med	Memphis, TN-AR-MS	635	40	290	38
Lrg	Milwaukee, WI	620	41	285	40
Med	Birmingham, AL	615	42	285	40
Med	Jacksonville, FL	615	42	285	40
Sml	Colorado Springs, CO	505	44	235	44
Lrg	Norfolk-Newport News-Virginia Beach, VA	490	45	230	45
Med	Honolulu, HI	485	46	225	46
Med	Tucson, AZ	480	47	220	47
Sml	Charleston, SC	470	48	220	47
Med	Fresno, CA	470	48	215	49
Med	Hartford-Middletown, CT	470	48	215	49
Med	Omaha, NE-IA	435	51	200	51
Med	Richmond, VA	425	52	195	52
Lrg	New Orleans, LA	415	53	195	52
Med	Salt Lake City, UT	410	54	190	54
Lrg	Cleveland, OH	410	54	165	58
Med	El Paso, TX-NM	400	56	185	55
Lrg	Kansas City, MO-KS	365	57	175	56
Med	Tulsa, OK	365	57	170	57
Sml	Pensacola, FL	350	59	165	58
Lrg	Pittsburgh, PA	280	60	130	60
Sml	Salem, OR	275	61	130	60
Med	Albany-Schenectady-Troy, NY	255	62	115	62
Lrg	Oklahoma City, OK	245	63	115	62
Sml	Eugene-Springfield. OR	240	64	115	62
Sml	Beaumont. TX	220	65	105	65
Sml	Fort Myers-Cape Coral. FL	220	65	105	65
Lrg	Buffalo-Niagara Falls. NY	200	67	95	67
Sml	Spokane. WA	195	68	90	68
Med	Rochester. NY	165	69	75	69
Sml	Bakersfield. CA	130	70	60	70
Sml	Corpus Christi. TX	100	71	50	71
Sml	Boulder. CO	95	72	45	72
Sml	Laredo. TX	60	73	25	73
Sml	Anchorage. AK	40	74	20	74
Sml	Brownsville. TX	0	75	0	75
	75 area average	1,160		505	
	Very large area average	1,590		650	
	Large area average	915		425	
	Medium area average	595		275	
	Small area average	245		115	

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

Exhibit A-9. Congested Person-Miles of Travel, 1982 to 2000

Population Group	Urban Area	Percentage of Peak Period Person-Miles of Travel that are Congested					
		Freeway			Principal Arterial Street		
		1982	1990	2000	1982	1990	2000
Vlg	Boston, MA	20	53	72	47	71	82
Vlg	Chicago, IL-Northwestern, IN	41	69	78	53	69	82
Vlg	Dallas-Fort Worth, TX	17	42	59	17	30	59
Vlg	Detroit, MI	21	53	71	45	66	71
Vlg	Houston, TX	54	59	67	50	46	62
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	50	42	56	72
Vlg	San Francisco-Oakland, CA	52	84	85	60	74	75
Vlg	Washington, DC-MD-VA	40	71	79	63	80	84
Lrg	Atlanta, GA	21	39	78	32	55	83
Lrg	Baltimore, MD	18	38	59	30	56	68
Lrg	Buffalo-Niagara Falls, NY	4	10	21	12	18	26
Lrg	Cincinnati, OH-KY	14	40	64	23	40	55
Lrg	Cleveland, OH	7	18	42	14	33	46
Lrg	Columbus, OH	8	29	41	13	35	66
Lrg	Denver, CO	27	43	71	39	47	80
Lrg	Ft Lauderdale-Hollywood-Pompano Bch, FL	30	39	61	21	42	61
Lrg	Indianapolis, IN	6	24	59	17	27	73
Lrg	Kansas City, MO-KS	3	8	26	10	19	44
Lrg	Las Vegas, NV	7	52	61	25	56	71
Lrg	Miami-Hialeah, FL	34	65	77	49	70	77
Lrg	Milwaukee, WI	14	44	66	21	33	48
Lrg	Minneapolis-St Paul, MN	11	27	71	20	45	71
Lrg	New Orleans, LA	32	44	39	43	48	54
Lrg	Norfolk-Newport News-Virginia Beach, VA	25	36	42	25	39	49
Lrg	Oklahoma City, OK	7	12	30	13	17	33
Lrg	Orlando, FL	24	49	54	36	45	63
Lrg	Phoenix, AZ	49	53	81	41	57	62
Lrg	Pittsburgh, PA	7	10	16	30	35	37
Lrg	Portland-Vancouver, OR-WA	15	53	76	23	41	76
Lrg	Sacramento, CA	15	47	76	33	68	71
Lrg	San Antonio, TX	12	20	51	14	22	55
Lrg	San Bernardino-Riverside, CA	24	69	76	22	41	67
Lrg	San Diego, CA	25	74	83	33	70	68
Lrg	San Jose, CA	48	61	69	61	76	78
Lrg	Seattle-Everett, WA	39	80	80	44	61	76
Lrg	St Louis, MO-IL	17	25	54	40	46	71
Lrg	Tampa-St Petersburg-Clearwater, FL	30	45	41	57	63	68
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	19	40	55	17	34	55
Med	Albany-Schenectady-Troy, NY	2	2	8	12	25	38
Med	Albuquerque, NM	4	25	53	17	35	58
Med	Austin, TX	19	32	59	22	42	68
Med	Birmingham, AL	5	11	32	28	41	67
Med	Charlotte, NC	13	47	60	32	47	73
Med	El Paso, TX-NM	10	19	43	10	15	43
Med	Fresno, CA	4	16	28	20	45	59
Med	Hartford-Middletown, CT	14	18	35	20	36	54
Med	Honolulu, HI	17	42	42	44	71	71
Med	Jacksonville, FL	5	33	41	18	37	57
Med	Louisville, KY-IN	11	20	49	41	40	71
Med	Memphis, TN-AR-MS	5	17	44	21	40	52
Med	Nashville, TN	15	22	35	30	44	62
Med	Omaha, NE-IA	8	18	25	19	33	53
Med	Providence-Pawtucket, RI-MA	9	24	43	19	45	59
Med	Richmond, VA	2	10	24	16	25	39
Med	Rochester, NY	3	9	17	15	28	34
Med	Salt Lake City, UT	7	22	46	24	47	62
Med	Tacoma, WA	13	46	65	18	36	56
Med	Tucson, AZ	8	31	39	24	38	60
Med	Tulsa, OK	7	8	23	17	31	43
Sml	Anchorage, AK	0	0	2	19	23	33
Sml	Bakersfield, CA	2	4	15	7	17	23
Sml	Beaumont, TX	4	5	9	17	15	28
Sml	Boulder, CO	2	2	3	9	15	44
Sml	Brownsville, TX	2	2	3	9	17	32
Sml	Charleston, SC	10	23	31	32	53	66
Sml	Colorado Springs, CO	3	6	29	13	21	48
Sml	Corpus Christi, TX	2	7	7	15	20	21
Sml	Eugene-Springfield, OR	0	0	19	18	27	56
Sml	Fort Myers-Cape Coral, FL	0	0	4	15	30	46
Sml	Laredo, TX	2	2	4	11	15	22
Sml	Pensacola, FL	0	0	7	14	31	47
Sml	Salem, OR	0	6	23	9	19	36
Sml	Spokane, WA	0	2	24	13	17	27
	75 area average	30	52	65	37	54	68
	Very large area average	43	67	76	45	65	76
	Large area average	20	42	62	32	49	65
	Medium area average	9	22	40	22	38	57
	Small area average	2	6	17	17	26	40

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.

Exhibit A-10. Change in Congested Daily Travel, 1982 to 2000

Population Group	Urban Area	Percent of Daily Travel in Congestion[1] 1982	1990	1994	1999	2000	Percentage Point Change: Long-Term 1982 to 2000 Points	Rank	Short-Term 1994 to 2000 Points	Rank
Lrg	San Antonio, TX	6	10	12	25	26	20	16	14	1
Lrg	Atlanta, GA	12	22	29	37	40	28	2	11	2
Lrg	Minneapolis-St. Paul, MN	7	16	24	33	35	28	2	11	2
Med	Austin, TX	10	18	21	30	31	21	14	10	4
Lrg	Denver, CO	16	22	28	37	38	22	10	10	4
Med	Charlotte, NC	12	23	23	31	32	20	16	9	6
Vlg	Dallas-Fort Worth, TX	9	19	20	28	29	20	16	9	6
Sml	Eugene-Springfield, OR	4	6	7	15	16	12	50	9	6
Sml	Colorado Springs, CO	4	7	11	19	19	15	37	8	9
Med	Hartford-Middletown, CT	8	12	11	15	19	11	54	8	9
Med	Providence-Pawtucket, RI-MA	7	17	16	23	24	17	30	8	9
Med	Birmingham, AL	8	10	14	21	21	13	45	7	12
Lrg	Cincinnati, OH-KY	8	20	24	31	31	23	9	7	12
Med	El Paso, TX-NM	5	9	14	19	21	16	34	7	12
Vlg	Houston, TX	26	28	26	32	33	7	65	7	12
Med	Louisville, KY-IN	11	13	21	28	28	17	30	7	12
Vlg	New York, NY-Northeastern, NJ	14	27	28	35	35	21	14	7	12
Lrg	Oklahoma City, OK	4	7	8	17	15	11	54	7	12
Med	Tulsa, OK	5	8	7	12	14	9	60	7	12
Med	Albuquerque, NM	6	16	22	25	28	22	10	6	20
Lrg	Baltimore, MD	12	22	25	30	31	19	21	6	20
Sml	Charleston, SC	13	21	19	23	25	12	50	6	20
Lrg	Cleveland, OH	4	11	16	22	22	18	25	6	20
Med	Fresno, CA	8	18	17	23	23	15	37	6	20
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	12	20	25	30	31	19	21	6	20
Lrg	Kansas City, MO-KS	3	6	9	14	15	12	50	6	20
Lrg	Milwaukee, WI	9	20	23	29	29	20	16	6	20
Lrg	Orlando, FL	15	23	24	29	30	15	37	6	20
Lrg	Phoenix, AZ	21	28	30	35	36	15	37	6	20
Lrg	Portland-Vancouver, OR-WA	9	25	32	37	38	29	1	6	20
Lrg	San Bernardino-Riverside, CA	11	28	30	35	36	25	6	6	20
Lrg	St. Louis, MO-IL	13	17	23	29	29	16	34	6	20
Sml	Brownsville, TX	4	6	7	10	12	8	62	5	33
Vlg	Chicago, IL-Northwestern, IN	23	35	35	40	40	17	30	5	33
Lrg	Indianapolis, IN	5	13	27	31	32	27	4	5	33
Lrg	San Jose, CA	26	33	31	33	36	10	56	5	33
Med	Albany-Schenectady-Troy, NY	3	6	6	9	10	7	65	4	37
Sml	Bakersfield, CA	2	6	6	10	10	8	62	4	37
Vlg	Boston, MA	16	30	34	38	38	22	10	4	37
Sml	Boulder, CO	3	5	8	12	12	9	60	4	37
Vlg	Los Angeles, CA	31	42	41	45	45	14	42	4	37
Med	Memphis, TN-AR-MS	6	15	20	23	24	18	25	4	37
Med	Nashville, TN	12	15	18	22	22	10	56	4	37
Med	Omaha, NE-IA	7	13	16	19	20	13	45	4	37
Vlg	Philadelphia, PA-NJ	16	23	26	30	30	14	42	4	37
Med	Richmond, VA	4	8	10	16	14	10	56	4	37
Lrg	Sacramento, CA	12	28	33	36	37	25	6	4	37
Med	Salt Lake City, UT	6	14	22	27	26	20	16	4	37
Lrg	San Diego, CA	14	37	36	39	40	26	5	4	37
Med	Tucson, AZ	10	18	23	27	27	17	30	4	37
Sml	Beaumont, TX	5	4	5	9	8	3	72	3	51
Lrg	Buffalo-Niagara Falls, NY	4	7	8	9	11	7	65	3	51
Lrg	Columbus, OH	5	15	21	26	24	19	21	3	51
Vlg	Detroit, MI	17	30	32	35	35	18	25	3	51
Sml	Fort Myers-Cape Coral, FL	6	12	16	19	19	13	45	3	51
Lrg	Miami-Hialeah, FL	22	34	35	35	38	16	34	3	51
Sml	Pensacola, FL	5	12	15	17	18	13	45	3	51
Med	Rochester, NY	3	6	7	9	10	7	65	3	51
Lrg	Seattle-Everett, WA	20	37	36	39	39	19	21	3	51
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	9	19	24	27	27	18	25	3	51
Med	Jacksonville, FL	6	18	22	23	24	18	25	2	61
Sml	Laredo, TX	4	5	6	10	8	4	70	2	61
Lrg	Norfolk-Newport News-Virginia Beach, VA	12	19	20	24	22	10	56	2	61
Sml	Salem, OR	3	7	13	15	15	12	50	2	61
Vlg	San Francisco-Oakland, CA	27	41	39	41	41	14	42	2	61
Sml	Spokane, WA	5	7	11	13	13	8	62	2	61
Med	Tacoma, WA	7	21	29	31	31	24	8	2	61
Sml	Anchorage, AK	5	6	5	6	6	1	74	1	68
Lrg	Las Vegas, NV	10	27	31	32	32	22	10	1	68
Lrg	Pittsburgh, PA	11	12	12	14	13	2	73	1	68
Vlg	Washington, DC-MD-VA	25	37	39	40	40	15	37	1	68
Sml	Corpus Christi, TX	5	6	6	6	6	1	74	0	72
Med	Honolulu, HI	12	24	26	25	25	13	45	-1	73
Lrg	New Orleans, LA	19	23	24	24	23	4	70	-1	73
Lrg	Tampa-St Petersburg-Clearwater, FL	25	29	33	30	30	5	69	-3	75
	75 area average	17	26	28	33	33	16		5	
	Very large area average	22	33	33	38	38	16		5	
	Large area average	13	23	26	31	32	19		6	
	Medium area average	8	14	18	22	23	15		5	
	Small area average	6	9	11	14	15	9		4	

[1]Travel measured in person-miles.

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.

Exhibit A-11. Change in Congested Peak-Period Travel, 1982 to 2000

Population Group	Urban Area	Percent of Peak Period Travel in Congestion[1] 1982	1990	1994	1999	2000	Percentage Point Change Long-Term 1982 to 2000 Points	Long-Term 1982 to 2000 Rank	Short-Term 1994 to 2000 Points	Short-Term 1994 to 2000 Rank
Lrg	San Antonio TX	12	21	25	51	52	40	18	27	1
Lrg	Minneapolis-St. Paul MN	13	32	48	66	71	58	1	23	2
Lrg	Atlanta GA	24	44	58	74	79	55	3	21	3
Med	Austin TX	20	35	42	60	62	42	14	20	4
Med	Charlotte NC	25	47	45	62	64	39	19	19	5
Lrg	Denver CO	32	45	56	74	75	43	13	19	5
Sml	Eugene-Springfield OR	8	12	14	30	33	25	49	19	5
Vlg	Dallas-Fort Worth TX	17	39	41	57	59	42	14	18	8
Med	Hartford-Middletown CT	16	24	22	31	39	23	53	17	9
Med	Providence-Pawtucket RI-MA	14	33	32	47	49	35	29	17	9
Sml	Colorado Springs CO	8	13	22	37	38	30	37	16	11
Lrg	Oklahoma City OK	9	14	16	34	31	22	55	15	12
Lrg	Cincinnati OH-KY	17	40	48	61	62	45	9	14	13
Med	El Paso TX-NM	10	17	29	37	43	33	33	14	13
Vlg	Houston TX	53	56	51	65	65	12	68	14	13
Med	Louisville KY-IN	23	26	42	55	56	33	33	14	13
Med	Tulsa OK	11	16	15	24	29	18	60	14	13
Med	Birmingham AL	15	20	29	41	42	27	45	13	18
Lrg	Milwaukee WI	17	40	46	58	59	42	14	13	18
Lrg	Portland-Vancouver OR-WA	18	49	63	74	76	58	1	13	18
Lrg	St. Louis MO-IL	26	33	46	59	59	33	33	13	18
Lrg	Baltimore MD	23	45	49	59	61	38	21	12	22
Sml	Charleston SC	26	41	37	46	49	23	53	12	22
Lrg	Kansas City MO-KS	5	11	18	29	30	25	49	12	22
Vlg	New York NY-Northeastern NJ	28	54	57	69	69	41	17	12	22
Lrg	Phoenix AZ	43	55	60	70	72	29	39	12	22
Lrg	San Bernardino-Riverside CA	23	56	60	70	72	49	7	12	22
Med	Albuquerque NM	12	31	45	51	56	44	12	11	28
Vlg	Chicago IL-Northwestern IN	46	69	69	80	80	34	32	11	28
Lrg	Cleveland OH	8	22	32	45	43	35	29	11	28
Med	Fresno CA	16	36	34	45	45	29	39	11	28
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch FL	24	40	50	60	61	37	24	11	28
Lrg	Orlando FL	30	47	48	57	59	29	39	11	28
Lrg	Indianapolis IN	11	25	54	63	64	53	4	10	34
Lrg	San Jose CA	52	66	62	67	72	20	57	10	34
Vlg	Boston MA	32	60	68	76	77	45	9	9	36
Lrg	Sacramento CA	24	56	65	73	74	50	6	9	36
Med	Tucson AZ	19	36	45	54	54	35	29	9	36
Sml	Brownsville TX	7	11	15	21	23	16	63	8	39
Lrg	Buffalo-Niagara Falls NY	8	14	15	19	23	15	64	8	39
Vlg	Los Angeles CA	62	83	82	89	90	28	44	8	39
Lrg	Miami-Hialeah FL	44	68	69	71	77	33	33	8	39
Vlg	Philadelphia PA-NJ	31	45	52	60	60	29	39	8	39
Med	Richmond VA	8	16	21	32	29	21	56	8	39
Med	Salt Lake City UT	12	29	43	53	51	39	19	8	39
Lrg	Seattle-Everett WA	41	73	71	79	79	38	21	8	39
Lrg	W Palm Bch-Boca Raton-Delray Bch FL	18	38	47	54	55	37	24	8	39
Sml	Bakersfield CA	5	12	13	19	20	15	64	7	48
Sml	Beaumont TX	9	9	10	17	17	8	72	7	48
Sml	Boulder CO	6	10	17	24	24	18	60	7	48
Vlg	Detroit MI	33	59	64	70	71	38	21	7	48
Sml	Fort Myers-Cape Coral FL	13	25	32	38	39	26	47	7	48
Med	Memphis TN-AR-MS	12	29	41	47	48	36	27	7	48
Med	Omaha NE-IA	14	26	33	39	40	26	47	7	48
Sml	Pensacola FL	10	23	30	33	37	27	45	7	48
Lrg	San Diego CA	27	73	72	77	79	52	5	7	48
Med	Albany-Schenectady-Troy NY	6	12	13	19	19	13	67	6	57
Sml	Laredo TX	8	11	11	20	17	9	70	6	57
Med	Nashville TN	23	31	37	43	43	20	57	6	57
Med	Rochester NY	5	12	14	18	20	15	64	6	57
Lrg	Columbus OH	10	30	42	52	47	37	24	5	61
Med	Jacksonville FL	12	35	43	45	48	36	27	5	61
Lrg	Las Vegas NV	20	54	61	64	65	45	9	4	63
Lrg	Norfolk-Newport News-Virginia Beach VA	25	37	41	48	45	20	57	4	63
Sml	Salem OR	6	13	26	29	30	24	52	4	63
Vlg	San Francisco-Oakland CA	54	81	79	82	83	29	39	4	63
Sml	Spokane WA	9	13	22	25	26	17	62	4	63
Med	Tacoma WA	15	41	58	62	62	47	8	4	63
Vlg	Washington DC-MD-VA	51	75	77	80	81	30	37	4	63
Sml	Anchorage AK	11	13	10	12	12	1	75	2	70
Sml	Corpus Christi TX	10	13	11	13	12	2	74	1	71
Lrg	Pittsburgh PA	21	24	24	27	25	4	73	1	71
Lrg	New Orleans LA	37	46	47	47	46	9	70	-1	73
Med	Honolulu HI	24	48	52	51	49	25	49	-3	74
Lrg	Tampa-St Petersburg-Clearwater FL	49	58	65	61	60	11	69	-5	75
	75 area average	33	53	56	65	66	33		10	
	Very large area average	44	66	67	75	76	32		9	
	Large area average	25	45	51	61	63	38		12	
	Medium area average	15	29	36	45	46	31		10	
	Small area average	11	18	21	28	29	18		8	

[1]Travel measured in person-miles.

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

Exhibit A-12. Change in Travel During Congested Times, 1982 to 2000

Population Group	Urban Area	Percent of Daily Travel During Congested Times[1] 1982	1990	1994	1999	2000	Percentage Point Change: Long-Term 1982 to 2000 Points	Rank	Short-Term 1994 to 2000 Points	Rank
Lrg	San Antonio, TX	23	25	29	42	43	20	15	14	1
Sml	Eugene-Springfield, OR	18	23	25	36	37	19	20	12	2
Med	Austin, TX	24	35	35	44	45	21	11	10	3
Med	Charlotte, NC	32	43	37	46	46	14	38	9	4
Sml	Colorado Springs, CO	17	21	23	32	32	15	34	9	4
Med	Providence-Pawtucket, RI-MA	24	34	30	38	39	15	34	9	4
Med	Birmingham, AL	23	27	32	39	40	17	26	8	7
Med	Fresno, CA	22	32	32	39	40	18	23	8	7
Lrg	Milwaukee, WI	24	37	36	43	44	20	15	8	7
Med	Tulsa, OK	24	26	25	30	33	9	52	8	7
Vlg	Dallas-Fort Worth, TX	24	38	38	44	45	21	11	7	11
Med	El Paso, TX-NM	21	24	32	37	39	18	23	7	11
Med	Hartford-Middletown, CT	20	30	32	37	39	19	20	7	11
Lrg	Oklahoma City, OK	22	24	26	34	33	11	46	7	11
Med	Omaha, NE-IA	21	25	28	35	35	14	38	7	11
Lrg	Orlando, FL	30	38	38	44	45	15	34	7	11
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	19	31	39	45	46	27	1	7	11
Med	Albuquerque, NM	21	32	39	44	45	24	4	6	18
Lrg	Cincinnati, OH-KY	23	36	40	45	46	23	7	6	18
Lrg	Denver, CO	30	36	41	47	47	17	26	6	18
Lrg	Kansas City, MO-KS	17	21	23	28	29	12	44	6	18
Med	Louisville, KY-IN	27	28	39	45	45	18	23	6	18
Lrg	Phoenix, AZ	38	41	42	47	48	10	50	6	18
Lrg	Baltimore, MD	25	38	40	44	45	20	15	5	24
Sml	Boulder, CO	18	22	24	30	29	11	46	5	24
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	23	35	42	46	47	24	4	5	24
Vlg	Houston, TX	42	42	40	44	45	3	68	5	24
Lrg	Minneapolis-St. Paul, MN	22	34	42	47	47	25	2	5	24
Vlg	New York, NY-Northeastern, NJ	26	40	41	46	46	20	15	5	24
Vlg	Philadelphia, PA-NJ	30	37	40	45	45	15	34	5	24
Sml	Salem, OR	19	28	28	32	33	14	38	5	24
Med	Tucson, AZ	27	34	38	43	43	16	29	5	24
Sml	Beaumont, TX	22	25	27	32	31	9	52	4	33
Sml	Brownsville, TX	18	21	23	25	27	9	52	4	33
Lrg	Columbus, OH	21	32	37	42	41	20	15	4	33
Med	Nashville, TN	30	32	35	39	39	9	52	4	33
Sml	Spokane, WA	22	25	26	30	30	8	58	4	33
Med	Albany-Schenectady-Troy, NY	15	23	24	26	27	12	44	3	38
Lrg	Atlanta, GA	26	39	46	48	49	23	7	3	38
Lrg	Buffalo-Niagara Falls, NY	18	20	23	24	26	8	58	3	38
Vlg	Chicago, IL-Northwestern, IN	38	46	46	49	49	11	46	3	38
Lrg	Cleveland, OH	23	30	36	39	39	16	29	3	38
Sml	Fort Myers-Cape Coral, FL	30	38	35	38	38	8	58	3	38
Lrg	Indianapolis, IN	21	30	43	46	46	25	2	3	38
Med	Memphis, TN-AR-MS	24	34	37	39	40	16	29	3	38
Sml	Pensacola, FL	20	31	33	34	36	16	29	3	38
Lrg	Portland-Vancouver, OR-WA	29	41	45	47	48	19	20	3	38
Med	Rochester, NY	17	23	25	27	28	11	46	3	38
Lrg	Sacramento, CA	26	43	45	47	48	22	9	3	38
Lrg	San Bernardino-Riverside, CA	27	46	45	47	48	21	11	3	38
Lrg	San Diego, CA	28	47	46	48	49	21	11	3	38
Lrg	San Jose, CA	44	47	46	47	49	5	66	3	38
Sml	Bakersfield, CA	18	21	24	27	26	8	58	2	53
Sml	Corpus Christi, TX	19	22	21	24	23	4	67	2	53
Lrg	Norfolk-Newport News-Virginia Beach, VA	31	36	36	39	38	7	63	2	53
Med	Richmond, VA	22	25	28	30	30	8	58	2	53
Lrg	Seattle-Everett, WA	44	47	45	47	47	3	68	2	53
Lrg	St. Louis, MO-IL	33	36	40	42	42	9	52	2	53
Med	Tacoma, WA	25	36	45	47	47	22	9	2	53
Sml	Anchorage, AK	19	21	20	20	21	2	72	1	60
Vlg	Boston, MA	34	45	47	48	48	14	38	1	60
Sml	Charleston, SC	32	38	38	39	39	7	63	1	60
Vlg	Detroit, MI	34	44	46	47	47	13	43	1	60
Sml	Laredo, TX	18	19	18	20	19	1	75	1	60
Lrg	Las Vegas, NV	23	43	46	46	47	24	4	1	60
Lrg	Miami-Hialeah, FL	38	47	47	47	48	10	50	1	60
Lrg	Pittsburgh, PA	23	25	25	27	26	3	68	1	60
Vlg	San Francisco-Oakland, CA	43	49	49	50	50	7	63	1	60
Med	Jacksonville, FL	25	37	41	40	41	16	29	0	69
Vlg	Los Angeles, CA	48	50	50	50	50	2	72	0	69
Lrg	Tampa-St Petersburg-Clearwater, FL	44	45	46	45	46	2	72	0	69
Vlg	Washington, DC-MD-VA	40	47	49	49	49	9	52	0	69
Lrg	New Orleans, LA	36	37	40	40	39	3	68	-1	73
Med	Salt Lake City, UT	22	31	40	40	39	17	26	-1	73
Med	Honolulu, HI	28	42	44	43	42	14	38	-2	75
	75 area average	32	40	46	44	45	13		3	
	Very large area average	37	45	45	47	48	11		2	
	Large area average	29	38	40	44	44	15		4	
	Medium area average	24	31	34	39	39	15		5	
	Small area average	22	26	27	31	31	9		4	

[1]Travel measured in person-miles.

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.

Exhibit A-13. Congested Lane-Miles of Roadway, 1982 to 2000

Population Group	Urban Area	*Percentage of Lane-Miles of Roadway That are Congested in the Peak Period*					
		Freeway			*Principal Arterial Street*		
		1982	*1990*	*2000*	*1982*	*1990*	*2000*
Vlg	Boston, MA	15	45	60	60	70	75
Vlg	Chicago, IL-Northwestern, IN	40	60	65	50	60	75
Vlg	Dallas-Fort Worth, TX	20	40	50	20	25	50
Vlg	Detroit, MI	25	45	60	50	55	65
Vlg	Houston, TX	50	55	60	40	35	50
Vlg	Los Angeles, CA	70	85	85	35	55	70
Vlg	New York, NY-Northeastern, NJ	30	45	55	55	65	65
Vlg	Philadelphia, PA-NJ	15	30	40	55	60	65
Vlg	San Francisco-Oakland, CA	45	70	75	50	65	60
Vlg	Washington, DC-MD-VA	40	65	70	60	75	75
Lrg	Atlanta, GA	30	40	70	45	60	70
Lrg	Baltimore, MD	20	35	50	40	55	60
Lrg	Buffalo-Niagara Falls, NY	5	15	30	15	30	35
Lrg	Cincinnati, OH-KY	20	40	55	30	40	40
Lrg	Cleveland, OH	10	20	40	15	40	45
Lrg	Columbus, OH	10	30	35	20	45	65
Lrg	Denver, CO	30	45	60	45	45	75
Lrg	Ft Lauderdale-Hollywood-Pompano Bch, FL	50	40	50	30	45	55
Lrg	Indianapolis, IN	5	25	55	20	35	70
Lrg	Kansas City, MO-KS	5	10	30	20	35	55
Lrg	Las Vegas, NV	5	50	55	40	50	60
Lrg	Miami-Hialeah, FL	30	55	65	50	55	65
Lrg	Milwaukee, WI	15	45	60	30	30	40
Lrg	Minneapolis-St Paul, MN	15	30	60	30	50	65
Lrg	New Orleans, LA	35	50	40	40	45	50
Lrg	Norfolk-Newport News-Virginia Beach, VA	25	40	40	20	35	50
Lrg	Oklahoma City, OK	10	15	30	15	20	35
Lrg	Orlando, FL	25	50	45	40	45	60
Lrg	Phoenix, AZ	55	50	75	35	50	50
Lrg	Pittsburgh, PA	5	10	20	45	50	50
Lrg	Portland-Vancouver, OR-WA	15	50	65	20	30	60
Lrg	Sacramento, CA	20	40	70	50	70	60
Lrg	San Antonio, TX	10	25	45	15	25	45
Lrg	San Bernardino-Riverside, CA	30	60	70	25	40	55
Lrg	San Diego, CA	35	70	75	50	65	60
Lrg	San Jose, CA	40	50	60	55	70	65
Lrg	Seattle-Everett, WA	35	75	75	30	50	65
Lrg	St Louis, MO-IL	15	25	55	40	45	65
Lrg	Tampa-St Petersburg-Clearwater, FL	20	35	30	55	60	65
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	40	50	45	35	45	50
Med	Albany-Schenectady-Troy, NY	5	5	10	20	40	55
Med	Albuquerque, NM	5	25	55	30	45	55
Med	Austin, TX	25	30	55	30	45	60
Med	Birmingham, AL	5	15	25	40	60	75
Med	Charlotte, NC	10	45	50	40	45	65
Med	El Paso, TX-NM	15	25	40	15	20	35
Med	Fresno, CA	5	15	25	25	50	60
Med	Hartford-Middletown, CT	20	15	35	35	45	55
Med	Honolulu, HI	15	35	35	70	75	75
Med	Jacksonville, FL	5	30	35	20	40	55
Med	Louisville, KY-IN	10	20	45	60	55	65
Med	Memphis, TN-AR-MS	5	15	40	25	45	50
Med	Nashville, TN	15	25	35	40	60	65
Med	Omaha, NE-IA	10	20	25	30	45	55
Med	Providence-Pawtucket, RI-MA	10	25	40	25	45	60
Med	Richmond, VA	5	10	30	25	35	55
Med	Rochester, NY	5	10	20	30	40	45
Med	Salt Lake City, UT	10	25	50	45	65	70
Med	Tacoma, WA	20	55	60	20	30	40
Med	Tucson, AZ	10	40	40	35	45	65
Med	Tulsa, OK	10	10	20	15	40	45
Sml	Anchorage, AK	0	0	5	35	45	70
Sml	Bakersfield, CA	5	5	25	10	25	25
Sml	Beaumont, TX	5	5	10	25	20	30
Sml	Boulder, CO	5	5	5	10	25	65
Sml	Brownsville, TX	5	5	5	10	25	45
Sml	Charleston, SC	10	25	30	40	60	75
Sml	Colorado Springs, CO	5	10	30	20	30	55
Sml	Corpus Christi, TX	5	10	10	25	30	30
Sml	Eugene-Springfield, OR	0	0	15	35	50	65
Sml	Fort Myers-Cape Coral, FL	0	0	5	15	30	50
Sml	Laredo, TX	5	5	5	20	30	50
Sml	Pensacola, FL	0	0	5	25	40	55
Sml	Salem, OR	0	5	25	10	20	35
Sml	Spokane, WA	0	5	30	15	20	35
	75 area average	27	43	54	39	50	61
	Very large area average	38	56	64	47	57	66
	Large area average	21	38	53	35	47	57
	Medium area average	10	21	36	30	45	57
	Small area average	3	7	17	22	33	46

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.

Exhibit A-14. Illustration of Annual Capacity Increase Required to Prevent Congestion Growth

Population Group	Urban Area	Average Annual VMT Growth (%)[1]	Annual Lane-Miles Needed		Lane-Mile "Deficiency"		2000 Travel Time Index
			Freeway	PAS	Freeway	PAS	
Vlg	New York NY-Northeastern, NJ	2.5	167	185	146	149	1.41
Vlg	Dallas-Fort Worth, TX	4.2	132	173	100	102	1.33
Lrg	Atlanta, GA	4.4	101	98	76	61	1.36
Lrg	Phoenix, AZ	5.0	51	153	3	131	1.40
Vlg	Chicago, IL-Northwestern, IN	1.9	52	110	43	86	1.47
Vlg	Houston, TX	3.7	91	103	76	11	1.38
Lrg	San Diego, CA	3.1	56	57	39	48	1.37
Vlg	Philadelphia, PA-NJ	1.8	32	56	32	45	1.28
Lrg	Minneapolis-St. Paul, MN	3.4	54	45	38	38	1.38
Lrg	San Antonio, TX	3.7	39	34	38	38	1.23
Lrg	Denver, CO	3.9	40	68	33	36	1.42
Lrg	Kansas City, MO-KS	2.8	49	31	34	33	1.10
Vlg	Detroit, MI	1.5	27	65	18	47	1.34
Lrg	Orlando, FL	5.1	37	83	25	38	1.29
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	4.9	25	63	21	40	1.25
Lrg	St. Louis, MO-IL	0.7	13	14	-10	65	1.23
Lrg	Seattle-Everett, WA	2.5	32	38	27	25	1.45
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	3.3	24	46	22	25	1.37
Med	Providence-Pawtucket, RI-MA	3.7	24	30	21	25	1.21
Lrg	Milwaukee, WI	3.3	20	43	16	29	1.26
Med	Austin, TX	4.7	27	35	20	24	1.27
Vlg	Boston, MA	1.3	17	26	18	26	1.45
Med	Charlotte, NC	7.7	37	39	16	27	1.27
Lrg	Cincinnati, OH-KY	3.0	29	25	23	18	1.26
Vlg	San Francisco-Oakland, CA	2.1	48	44	31	10	1.59
Lrg	Baltimore, MD	2.0	29	28	13	25	1.29
Lrg	Buffalo-Niagara Falls, NY	2.4	15	25	15	21	1.08
Vlg	Los Angeles, CA	0.7	39	79	9	27	1.90
Lrg	San Bernardino-Riverside, CA	1.4	12	30	8	28	1.34
Med	Tucson, AZ	4.4	8	32	0	29	1.20
Med	Birmingham, AL	3.0	20	13	19	9	1.17
Lrg	Sacramento, CA	1.7	12	20	11	17	1.31
Lrg	Las Vegas, NV	5.2	22	25	4	23	1.35
Med	El Paso, TX-NM	3.0	8	21	8	17	1.17
Med	Fresno, CA	6.0	12	30	5	20	1.20
Lrg	Portland-Vancouver, OR-WA	3.1	22	29	18	7	1.40
Lrg	San Jose, CA	2.3	20	33	61	-36	1.42
Lrg	Cleveland, OH	1.6	20	18	10	14	1.13
Vlg	Washington, DC-MD-VA	1.3	25	32	8	16	1.46
Med	Louisville, KY-IN	2.6	18	17	13	10	1.24
Med	Hartford-Middletown, CT	2.7	17	11	14	8	1.12
Med	Omaha, NE-IA	3.4	10	24	6	16	1.15
Med	Tulsa, OK	2.9	15	12	14	8	1.12
Lrg	Norfolk-Newport News-Virginia Beach, VA	1.9	17	22	5	15	1.18
Sml	Colorado Springs, CO	3.7	8	15	8	10	1.20
Med	Nashville, TN	2.2	17	14	5	13	1.18
Lrg	Oklahoma City, OK	1.9	14	20	11	7	1.09
Med	Albany-Schenectady-Troy, NY	2.2	12	13	7	10	1.06
Sml	Bakersfield, CA	3.9	7	23	1	16	1.06
Lrg	Columbus, OH	1.8	15	11	7	10	1.19
Lrg	Miami-Hialeah, FL	2.0	15	55	2	15	1.45
Med	Richmond, VA	1.4	9	7	7	9	1.10
Lrg	Pittsburgh, PA	0.3	3	4	3	11	1.10
Med	Memphis, TN-AR-MS	2.2	11	22	0	12	1.21
Med	Jacksonville, FL	2.7	20	31	-15	26	1.15
Sml	Spokane, WA	2.2	3	12	1	10	1.08
Med	Tacoma, WA	1.8	5	10	4	7	1.23
Sml	Charleston, SC	2.6	6	11	0	10	1.19
Sml	Salem, OR	3.0	3	8	2	8	1.10
Sml	Eugene-Springfield, OR	4.0	4	5	4	5	1.12
Sml	Corpus Christi, TX	1.5	4	5	3	5	1.04
Lrg	Indianapolis, IN	1.0	7	11	3	5	1.24
Med	Albuquerque, NM	1.2	3	11	3	3	1.26
Sml	Laredo, TX	8.8	8	19	1	5	1.06
Sml	Pensacola, FL	3.8	4	20	2	4	1.14
Sml	Beaumont, TX	6.6	9	13	5	0	1.05
Sml	Fort Myers-Cape Coral, FL	3.9	2	13	2	3	1.15
Med	Rochester, NY	1.1	5	2	4	0	1.06
Sml	Brownsville, TX	2.0	1	2	1	2	1.08
Sml	Anchorage, AK	1.8	3	2	1	1	1.04
Sml	Boulder, CO	2.2	1	2	1	1	1.09
Lrg	Tampa-St Petersburg-Clearwater, FL	2.2	14	53	-6	4	1.29
Med	Honolulu, HI	-0.3	-1	-1	-3	-1	1.20
Med	Salt Lake City, UT	0.0	0	0	-5	-4	1.17
Lrg	New Orleans, LA	1.0	4	10	2	-13	1.18
	75 area total		1,780	2,590	1,210	1,645	
	75 area average	2.8	24	35	16	22	1.39
	Very large area average	2.1	63	87	48	52	1.53
	Large area average	2.7	27	40	18	26	1.30
	Medium area average	2.8	13	18	7	13	1.18
	Small area average	3.6	5	11	2	6	1.11

[1] VMT and lane-mile increases include urban area land size increases. These rates are much higher than the "true" increase rates—that is, those based on new travel or road construction. The rates shown are the average annual growth rates for freeways and principal arterial streets between 1995 and 2000.

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.

Exhibit A-15. Illustration of Annual Occupancy Increase Needed to Prevent Mobility Decline

Population Group	*Urban Area*	*Growth in Daily Person Travel[1]* *Percent[2]*	*Additional Miles*	*Estimated Trips[3]*	*Occupancy Level Increase to Maintain 2000 Mobility Level[4] (persons per vehicle)*
Sml	Laredo, TX	8.8	155,000	17,220	0.11
Med	Charlotte, NC	7.7	1,069,000	118,780	0.10
Sml	Beaumont, TX	6.6	212,000	23,555	0.08
Med	Fresno, CA	6.0	429,000	47,665	0.08
Lrg	Las Vegas, NV	5.2	699,000	77,665	0.07
Lrg	Orlando, FL	5.1	1,434,000	159,335	0.06
Lrg	Phoenix, AZ	5.0	2,340,000	260,000	0.06
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	4.9	987,000	109,665	0.06
Med	Austin, TX	4.7	811,000	90,110	0.06
Lrg	Atlanta, GA	4.4	3,214,000	357,110	0.05
Med	Tucson, AZ	4.4	406,000	45,110	0.06
Vlg	Dallas-Fort Worth, TX	4.2	3,829,000	425,445	0.05
Sml	Eugene-Springfield, OR	4.0	108,000	12,000	0.05
Sml	Bakersfield, CA	3.9	224,000	24,890	0.05
Lrg	Denver, CO	3.9	1,486,000	165,110	0.05
Sml	Fort Myers-Cape Coral, FL	3.9	120,000	13,335	0.05
Sml	Pensacola, FL	3.8	206,000	22,890	0.05
Sml	Colorado Springs, CO	3.7	223,000	24,780	0.05
Vlg	Houston, TX	3.7	2,495,000	277,220	0.05
Med	Providence-Pawtucket, RI-MA	3.7	633,000	70,335	0.05
Lrg	San Antonio, TX	3.7	960,000	106,665	0.05
Lrg	Minneapolis-St. Paul, MN	3.4	1,515,000	168,335	0.04
Med	Omaha, NE-IA	3.4	327,000	36,335	0.04
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	3.3	873,000	97,000	0.04
Lrg	Milwaukee, WI	3.3	673,000	74,780	0.04
Lrg	Portland-Vancouver, OR-WA	3.1	728,000	80,890	0.04
Lrg	San Diego, CA	3.1	1,755,000	195,000	0.04
Med	Birmingham, AL	3.0	463,000	51,445	0.04
Lrg	Cincinnati, OH-KY	3.0	749,000	83,220	0.04
Med	El Paso, TX-NM	3.0	275,000	30,555	0.04
Sml	Salem, OR	3.0	97,000	10,780	0.04
Med	Tulsa, OK	2.9	311,000	34,555	0.04
Lrg	Kansas City, MO-KS	2.8	882,000	98,000	0.04
Med	Hartford-Middletown, CT	2.7	365,000	40,555	0.03
Med	Jacksonville, FL	2.7	589,000	65,445	0.03
Sml	Charleston, SC	2.6	190,000	21,110	0.03
Med	Louisville, KY-IN	2.6	467,000	51,890	0.03
Vlg	New York, NY-Northeastern, NJ	2.5	5,037,000	559,665	0.03
Lrg	Seattle-Everett, WA	2.5	982,000	109,110	0.03
Lrg	Buffalo-Niagara Falls, NY	2.4	344,000	38,220	0.03
Lrg	San Jose, CA	2.3	771,000	85,665	0.03
Med	Albany-Schenectady-Troy, NY	2.2	243,000	27,000	0.03
Sml	Boulder, CO	2.2	29,000	3,220	0.03
Med	Memphis, TN-AR-MS	2.2	352,000	39,110	0.03
Med	Nashville, TN	2.2	397,000	44,110	0.03
Sml	Spokane, WA	2.2	112,000	12,445	0.03
Lrg	Tampa-St Petersburg-Clearwater, FL	2.2	717,000	79,665	0.03
Vlg	San Francisco-Oakland, CA	2.1	1,624,000	180,445	0.03
Lrg	Baltimore, MD	2.0	773,000	85,890	0.02
Sml	Brownsville, TX	2.0	23,000	2,555	0.03
Lrg	Miami-Hialeah, FL	2.0	813,000	90,335	0.03
Vlg	Chicago, IL-Northwestern, IN	1.9	2,195,000	243,890	0.02
Lrg	Norfolk-Newport News-Virginia Beach, VA	1.9	440,000	48,890	0.02
Lrg	Oklahoma City, OK	1.9	330,000	36,665	0.02
Sml	Anchorage, AK	1.8	46,000	5,110	0.02
Lrg	Columbus, OH	1.8	356,000	39,555	0.02
Vlg	Philadelphia, PA-NJ	1.8	1,078,000	119,780	0.02
Med	Tacoma, WA	1.8	184,000	20,445	0.02
Lrg	Sacramento, CA	1.7	423,000	47,000	0.02
Lrg	Cleveland, OH	1.6	463,000	51,445	0.02
Sml	Corpus Christi, TX	1.5	77,000	8,555	0.02
Vlg	Detroit, MI	1.5	1,118,000	124,220	0.02
Med	Richmond, VA	1.4	175,000	19,445	0.02
Lrg	San Bernardino-Riverside, CA	1.4	486,000	54,000	0.02
Vlg	Boston, MA	1.3	636,000	70,665	0.02
Vlg	Washington, DC-MD-VA	1.3	898,000	99,780	0.02
Med	Albuquerque, NM	1.2	132,000	14,665	0.02
Med	Rochester, NY	1.1	90,000	10,000	0.01
Lrg	Indianapolis, IN	1.0	229,000	25,445	0.01
Lrg	New Orleans, LA	1.0	139,000	15,445	0.01
Vlg	Los Angeles, CA	0.7	1,784,000	198,220	0.01
Lrg	St. Louis, MO-IL	0.7	333,000	37,000	0.01
Lrg	Pittsburgh, PA	0.3	67,000	7,445	0.02
Med	Salt Lake City, UT	0.0	5,000	555	0.01
Med	Honolulu, HI	-0.3	-26,000	-2,890	0.01
	75 area total		56,174,000	6,241,550	
	75 area average	2.8	749,000	83,220	0.04
	Very large area average	2.1	2,069,000	229,930	0.03
	Large area average	2.7	865,000	96,150	0.03
	Medium area average	2.8	367,000	40,730	0.04
	Small area average	3.6	130,000	14,460	0.04

[1] Travel measured in person-miles.
[2] VMT increase includes 1995 to 2000 urban area land size increases. These rates are much higher than the true vehicle travel increase rates.
[3] Calculated using an average trip length of 9 miles. These are the number of new carpool or transit trips that would be needed each year to maintain current mobility level.
[4] The average vehicle occupancy rate would have to increase this much to accommodate the new person trips with no new vehicle trips to maintain current mobility level.

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.

Exhibit A-16. Mobility Levels in HOV Corridors

Segment	*Length (miles)*	*High-Occupancy Lanes*				*Mainlanes*			*Combined TTI*	*Index Point Improvement*
		Passengers	*% of Total*	*Speed*	*TTI*	*Passengers*	*Speed*	*TTI*		
Washington DC										
I-95 Shirley Hwy	55	16,600	46	59	1.01	19,800	28	2.17	1.64	53
I-66	34	9,500	32	46	1.31	19,800	26	2.35	2.01	34
VA267	49	5,200	27	50	1.19	14,000	34	1.76	1.60	16
I-270	54	4,400	24	48	1.26	13,600	32	1.87	1.72	15
New York										
Long Island Expressway	60	4,450	17	58	1.03	22,050	29	2.09	1.91	18
Miami-Dade County										
I-95	25	3,170	29	43	1.40	7,950	31	1.94	1.79	15
Minneapolis-St. Paul										
I-394	19	7,120	33	55	1.09	14,260	50	1.20	1.16	4
I-35W	12	5,170	29	55	1.09	12,920	50	1.20	1.17	3
Houston										
I-10W	25	9,370	37	58	1.03	16,000	38	1.60	1.39	21
I-45N	39	8,820	29	55	1.09	22,000	47	1.28	1.22	6
I-45S	30	5,800	22	55	1.09	21,000	46	1.30	1.25	5
US290	27	7,045	28	57	1.05	18,000	43	1.38	1.29	9
US59S	23	8,200	23	51	1.18	28,000	42	1.44	1.38	6
Dallas										
I-30 E	10	8,040	26	55	1.08	23,250	38	1.60	1.47	13
I-35N	13	5,270	24	58	1.04	17,110	34	1.75	1.58	17
I-635	27	5,660	22	58	1.03	20,030	31	1.94	1.74	20
Seattle										
I-5 N of CBD	19	9,580	35	51	1.18	17,960	38	1.59	1.45	14
I-5 S of CBD	15	13,440	35	49	1.18	24,880	39	1.53	1.42	11
I-405 N of I-90	22	6,020	28	48	1.26	15,725	31	1.91	1.73	18
I-405 S of I-90	19	8,920	44	53	1.13	11,230	31	1.91	1.56	35
I-90	28	3,365	18	60	1.00	15,010	48	1.25	1.20	5
SR 167	7	4,250	32	57	1.05	9,035	36	1.69	1.48	21
SR 520	3	2,725	25	60	1.00	8,180	46	1.30	1.23	7
Los Angeles – LA County										
I-10	22	6,100	40	52	1.15	9,060	22	2.78	2.12	66
SR 91	29	3,350	31	48	1.25	7,385	26	2.33	1.99	34
I-110	29	6,625	45	49	1.23	8,100	23	2.56	1.96	60
I-210	37	3,440	28	45	1.32	8,750	31	1.96	1.78	18
I-405	19	3,430	32	40	1.51	7,390	26	2.34	2.08	26

Note: Speeds in excess of 60 miles per hour were entered as 60 since that is considered the freeflow speed for this analysis.

Exhibit A-17. 2000 Roadway Congestion Index, 2000

Population Group	Urban Area	Freeway/Expressway Daily VMT (000)	Freeway/Expressway Daily VMT per Lane-Mile	Principal Arterial Street Daily VMT (000)	Principal Arterial Street Daily VMT per Lane-Mile	Roadway Congestion Index	Rank
Vlg	Los Angeles, CA	126,495	23,425	72,500	6,620	1.59	1
Vlg	San Francisco-Oakland, CA	47,980	20,550	15,150	7,045	1.45	2
Vlg	Washington, DC-MD-VA	34,535	18,320	20,060	8,325	1.35	3
Lrg	San Jose, CA	16,530	18,680	10,655	7,375	1.34	4
Lrg	Atlanta, GA	42,940	18,550	16,165	7,200	1.32	5
Lrg	San Diego, CA	33,745	18,800	11,090	6,060	1.32	5
Vlg	Chicago, IL-Northwestern, IN	48,400	18,160	42,145	7,425	1.31	7
Vlg	Boston, MA	22,890	17,610	16,525	8,060	1.30	8
Lrg	Miami-Hialeah, FL	13,585	18,115	18,600	6,890	1.28	9
Lrg	Phoenix, AZ	19,425	18,860	18,025	5,880	1.27	10
Lrg	Portland-Vancouver, OR-WA	12,595	17,865	6,255	6,655	1.27	10
Lrg	San Bernardino-Riverside, CA	16,600	18,865	11,220	5,245	1.26	12
Lrg	Sacramento, CA	12,170	17,765	7,685	6,405	1.25	13
Lrg	Denver, CO	16,905	16,335	13,640	7,795	1.23	14
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	12,750	17,585	8,5,90	6,180	1.23	14
Lrg	Las Vegas, NV	6,850	16,505	3,845	7,930	1.23	14
Lrg	Seattle-Everett, WA	22,455	17,475	9,100	5,965	1.23	14
Vlg	Detroit, MI	31,125	17,150	29,415	6,730	1.22	18
Lrg	Minneapolis-St. Paul, MN	27,095	17,150	8,075	6,235	1.22	18
Med	Tacoma, WA	5,305	17,685	2,975	5,130	1.20	20
Vlg	New York, NY-Northeastern, NJ	101,295	15,350	57,990	7,935	1.16	21
Med	Charlotte, NC	7,640	15,915	3,505	6,875	1.15	22
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	8,365	16,400	7,600	6,010	1.15	22
Lrg	Cincinnati, OH-KY	15,745	16,150	4,210	5,105	1.13	24
Lrg	Indianapolis, IN	11,260	15,530	7,240	6,765	1.13	24
Lrg	Tampa-St Petersburg-Clearwater, FL	8,460	13,115	18,020	7,430	1.13	24
Med	Austin, TX	8,800	15,305	4,875	6,590	1.11	27
Lrg	Orlando, FL	9,430	12,920	13,000	8,050	1.11	27
Lrg	Baltimore, MD	22,660	15,365	9,000	6,270	1.10	29
Vlg	Dallas-Fort Worth, TX	48,700	15,460	24,200	5,875	1.10	29
Vlg	Philadelphia, PA-NJ	25,445	14,625	21,325	7,025	1.10	29
Med	Albuquerque, NM	3,770	16,045	4,920	5,405	1.09	32
Vlg	Houston, TX	37,900	15,315	16,470	5,860	1.09	32
Med	Louisville, KY-IN	10,040	14,985	4,210	6,525	1.09	32
Lrg	Milwaukee, WI	9,700	15,770	6,745	5,110	1.08	35
Med	Tucson, AZ	2,150	11,620	5,205	7,130	1.06	36
Lrg	San Antonio, TX	15,775	14,810	5,115	5,590	1.05	37
Med	Honolulu, HI	5,625	14,060	1,905	7,325	1.04	38
Lrg	St. Louis, MO-IL	25,740	14,460	11,040	5,675	1.03	39
Lrg	Columbus, OH	11,850	13,940	3,900	6,555	1.02	40
Med	Jacksonville, FL	9,835	13,565	7,340	6,585	1.02	40
Med	Memphis, TN-AR-MS	6,890	13,645	6,000	5,940	1.00	42
Med	Birmingham, AL	8,685	12,865	3,515	7,990	0.99	43
Med	Fresno, CA	2,550	12,750	3,135	6,400	0.99	43
Sml	Charleston, SC	2,815	11,980	2,955	7,035	0.98	45
Med	El Paso, TX-NM	3,975	14,195	3,455	4,800	0.98	45
Med	Nashville, TN	10,000	13,160	4,140	6,785	0.98	45
Med	Providence-Pawtucket, RI-MA	8,465	13,125	5,280	6,400	0.98	45
Lrg	Cleveland, OH	17,285	13,505	6,400	5,615	0.97	49
Med	Hartford-Middletown, CT	8,405	13,450	2,375	5,865	0.97	49
Lrg	New Orleans, LA	5,615	13,530	5,315	5,450	0.97	49
Med	Salt Lake City, UT	6,415	12,830	3,230	6,945	0.97	49
Sml	Fort Myers-Cape Coral, FL	400	8,890	2,090	6,145	0.96	53
Lrg	Norfolk-Newport News-Virginia Beach, VA	11,270	12,880	6,800	6,125	0.96	53
Sml	Eugene-Springfield, OR	1,335	12,135	850	6,800	0.94	55
Sml	Pensacola, FL	1,130	10,275	3,240	6,000	0.92	56
Med	Omaha, NE-IA	3,300	11,000	4,320	6,215	0.90	57
Lrg	Oklahoma City, OK	8,930	12,070	5,330	4,870	0.87	58
Sml	Salem, OR	1,190	11,900	1,395	5,075	0.87	58
Med	Tulsa, OK	6,270	11,720	2,455	6,060	0.87	58
Sml	Colorado Springs, CO	2,515	10,935	2,330	5,825	0.86	61
Sml	Beaumont, TX	1,560	11,555	1,025	5,000	0.84	62
Med	Richmond, VA	7,000	11,025	2,850	6,065	0.83	63
Sml	Spokane, WA	1,500	11,110	2,560	4,740	0.82	64
Sml	Boulder, CO	490	9,800	555	5,840	0.81	65
Lrg	Kansas City, MO-KS	19,310	11,160	5,550	5,090	0.81	65
Med	Rochester, NY	5,510	11,020	1,095	5,475	0.80	67
Med	Albany-Schenectady-Troy, NY	5,500	10,000	3,265	5,780	0.78	68
Sml	Brownsville, TX	280	9,335	605	5,040	0.78	68
Lrg	Pittsburgh, PA	11,130	9,355	9,240	5,940	0.77	70
Sml	Bakersfield, CA	1,930	10,160	2,650	4,610	0.76	71
Lrg	Buffalo-Niagara Falls, NY	6,365	10,025	5,025	4,855	0.76	71
Sml	Corpus Christi, TX	2,815	9,705	1,375	4,105	0.70	73
Sml	Anchorage, AK	1,430	7,335	665	6,335	0.62	74
Sml	Laredo, TX	415	4,370	1,000	4,545	0.56	75
	75 area average	15,375	14,120	9,220	6,220	1.15	
	Very large area average	52,475	17,595	31,580	7,090	1.28	
	Large area average	15,750	15,450	9,085	6,210	1.12	
	Medium area average	6,480	13,330	3,810	6,300	0.98	
	Small area average	1,415	9,965	1,665	5,505	0.81	

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.

Exhibit A-18. Roadway Congestion Index, 1982 to 2000

Population Group	Urban Area	Roadway Congestion Index 1982	1990	1994	1999	2000	Short-Term Change 1994 to 2000 Points	Rank	Long-Term Change 1982 to 2000 Points	Rank
Med	Honolulu, HI	0.79	1.03	1.07	1.06	1.04	-3	1	25	22
Med	Salt Lake City, UT	0.66	0.84	1.00	1.00	0.97	-3	1	31	37
Lrg	Tampa-St Petersburg-Clearwater, FL	1.07	1.10	1.16	1.12	1.13	-3	1	6	4
Lrg	New Orleans, LA	0.92	0.94	0.99	0.99	0.97	-2	4	5	3
Med	Jacksonville, FL	0.75	0.94	1.02	1.00	1.02	0	5	27	24
Sml	Anchorage, AK	0.58	0.62	0.61	0.61	0.62	1	6	4	2
Vlg	Washington, DC-MD-VA	0.99	1.24	1.34	1.34	1.35	1	6	36	48
Sml	Laredo, TX	0.55	0.56	0.54	0.61	0.56	2	8	1	1
Sml	Charleston, SC	0.85	0.96	0.95	0.98	0.98	3	9	13	8
Lrg	Pittsburgh, PA	0.70	0.75	0.74	0.78	0.77	3	9	7	6
Med	Richmond, VA	0.67	0.75	0.79	0.83	0.83	4	11	16	13
Lrg	St. Louis, MO-IL	0.87	0.91	0.99	1.03	1.03	4	11	16	13
Sml	Bakersfield, CA	0.54	0.64	0.71	0.78	0.76	5	13	22	18
Lrg	Norfolk-Newport News-Virginia Beach, VA	0.84	0.91	0.91	0.97	0.96	5	13	12	7
Sml	Pensacola, FL	0.61	0.84	0.87	0.88	0.92	5	13	31	37
Sml	Spokane, WA	0.66	0.74	0.77	0.83	0.82	5	13	16	13
Sml	Beaumont, TX	0.65	0.74	0.78	0.86	0.84	6	17	19	17
Lrg	Cleveland, OH	0.68	0.83	0.91	0.98	0.97	6	17	29	30
Sml	Corpus Christi, TX	0.57	0.67	0.64	0.71	0.70	6	17	13	8
Sml	Fort Myers-Cape Coral, FL	0.83	0.95	0.9	0.95	0.96	6	17	13	8
Med	Memphis, TN-AR-MS	0.71	0.88	0.94	0.98	1.00	6	17	29	30
Lrg	Miami-Hialeah, FL	0.95	1.20	1.22	1.23	1.28	6	17	33	45
Med	Rochester, NY	0.51	0.69	0.74	0.78	0.80	6	17	29	30
Med	Albany-Schenectady-Troy, NY	0.46	0.68	0.71	0.77	0.78	7	24	32	42
Vlg	Detroit, MI	0.89	1.08	1.15	1.20	1.22	7	24	33	45
Lrg	Buffalo-Niagara Falls, NY	0.53	0.60	0.68	0.72	0.76	8	26	23	20
Lrg	Columbus, OH	0.63	0.85	0.94	1.04	1.02	8	26	39	57
Lrg	Indianapolis, IN	0.64	0.83	1.05	1.13	1.13	8	26	49	68
Med	Nashville, TN	0.83	0.85	0.90	0.98	0.98	8	26	15	12
Sml	Salem, OR	0.56	0.79	0.79	0.85	0.87	8	26	31	37
Sml	Boulder, CO	0.55	0.65	0.72	0.83	0.81	9	31	26	23
Sml	Brownsville, TX	0.54	0.62	0.69	0.75	0.78	9	31	24	21
Vlg	Houston, TX	1.03	1.04	1.00	1.08	1.09	9	31	6	4
Vlg	Los Angeles, CA	1.29	1.59	1.50	1.58	1.59	9	31	30	35
Lrg	Baltimore, MD	0.75	0.95	1.00	1.07	1.10	10	35	35	47
Lrg	Las Vegas, NV	0.69	1.06	1.13	1.18	1.23	10	35	54	71
Lrg	Oklahoma City, OK	0.65	0.73	0.77	0.88	0.87	10	35	22	18
Med	Omaha, NE-IA	0.62	0.75	0.80	0.90	0.90	10	35	28	27
Vlg	Philadelphia, PA-NJ	0.82	0.94	1.00	1.10	1.10	10	35	28	27
Med	Tacoma, WA	0.75	0.91	1.10	1.19	1.20	10	35	45	64
Vlg	Boston, MA	0.88	1.09	1.19	1.28	1.30	11	41	42	62
Lrg	Kansas City, MO-KS	0.50	0.63	0.70	0.79	0.81	11	41	31	37
Med	Tucson, AZ	0.78	0.89	0.95	1.05	1.06	11	41	28	27
Med	Albuquerque, NM	0.62	0.85	0.97	1.08	1.09	12	44	47	66
Med	Hartford-Middletown, CT	0.61	0.82	0.85	0.94	0.97	12	44	36	48
Med	Louisville, KY-IN	0.78	0.80	0.97	1.09	1.09	12	44	31	37
Med	Tulsa, OK	0.73	0.76	0.75	0.83	0.87	12	44	14	11
Lrg	Cincinnati, OH-KY	0.70	0.92	1.00	1.12	1.13	13	48	43	63
Med	El Paso, TX-NM	0.62	0.73	0.85	0.94	0.98	13	48	36	48
Lrg	Sacramento, CA	0.76	1.05	1.12	1.2	1.25	13	48	49	68
Med	Birmingham, AL	0.69	0.78	0.85	0.98	0.99	14	51	30	35
Vlg	Chicago, IL-Northwestern, IN	0.95	1.18	1.17	1.31	1.31	14	51	36	48
Vlg	Dallas-Fort Worth, TX	0.73	0.96	0.96	1.07	1.10	14	51	37	54
Med	Fresno, CA	0.67	0.86	0.85	0.98	0.99	14	51	32	42
Vlg	New York, NY-Northeastern, NJ	0.77	0.99	1.02	1.15	1.16	14	51	39	57
Lrg	San Bernardino-Riverside, CA	0.78	1.14	1.12	1.24	1.26	14	51	48	67
Vlg	San Francisco-Oakland, CA	1.06	1.35	1.31	1.39	1.45	14	51	39	57
Lrg	Seattle-Everett, WA	1.07	1.21	1.09	1.22	1.23	14	51	16	13
Lrg	Orlando, FL	0.82	0.95	0.96	1.07	1.11	15	59	29	30
Lrg	Portland-Vancouver, OR-WA	0.81	1.02	1.12	1.24	1.27	15	59	46	65
Med	Providence-Pawtucket, RI-MA	0.71	0.89	0.82	0.95	0.98	16	61	27	24
Lrg	San Diego, CA	0.79	1.19	1.16	1.25	1.32	16	61	53	70
Lrg	Milwaukee, WI	0.71	0.93	0.91	1.05	1.08	17	63	37	54
Lrg	W Palm Bch-Boca Raton-Delray Bch, FL	0.57	0.84	0.98	1.11	1.15	17	63	58	75
Sml	Colorado Springs, CO	0.50	0.62	0.68	0.85	0.86	18	65	36	48
Lrg	Minneapolis-St. Paul, MN	0.66	0.89	1.04	1.20	1.22	18	65	56	74
Lrg	Atlanta, GA	0.77	0.98	1.13	1.27	1.32	19	67	55	73
Sml	Eugene-Springfield, OR	0.53	0.68	0.75	0.91	0.94	19	67	41	60
Lrg	San Jose, CA	1.07	1.24	1.15	1.19	1.34	19	67	27	24
Lrg	Ft. Lauderdale-Hollywood-Pompano Bch, FL	0.69	0.90	1.03	1.17	1.23	20	70	54	71
Med	Austin, TX	0.73	0.90	0.90	1.07	1.11	21	71	38	56
Med	Charlotte, NC	0.86	1.05	0.94	1.14	1.15	21	71	29	30
Lrg	Denver, CO	0.82	0.92	1.02	1.20	1.23	21	71	41	60
Lrg	Phoenix, AZ	0.95	1.01	1.04	1.21	1.27	23	74	32	42
Lrg	San Antonio, TX	0.69	0.74	0.81	1.03	1.05	24	75	36	48
	75 area average	0.82	1.01	1.04	1.14	1.15	11		33	
	Very large area average	0.95	1.17	1.17	1.26	1.28	11		33	
	Large area average	0.76	0.93	0.99	1.09	1.12	13		36	
	Medium area average	0.68	0.83	0.88	0.97	0.98	10		30	
	Small area average	0.61	0.72	0.74	0.81	0.81	7		20	

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.