ARIZONA DEPARTMENT OF TRANSPORTATION

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# SURVEY OF METHODS AND PRACTICES OF HIGH PERFORMING STATE HIGHWAY AGENCIES

## Final Report

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16. Abstract


The literature review identified several methodologies used to measure performance, each having advantages and disadvantages. From this review a new methodology was created in an effort to sustain most of the advantages identified in the previous studies while eliminating many of the disadvantages. The primary concern was to eliminate the state comparison methodology and focus on measurement of improvement over time.

The new methodology primarily uses the same measurement categories identified in a study by David Hartgen from the University of North Carolina at Charlotte. Data from 1992 to 1998 was obtained from the FHWA's annual book of *Highway Statistics* and entered into a three year rolling average formula. This formula created five data points by averaging each three-year group of data from 1992 to 1998. Then an average annual percentage change in each category was calculated. The five states showing the largest percentage improvement in each of the output categories were identified as "high performing."

The high performing states were probed in an effort to identify methodologies and strategies that caused improvement in the respective categories. The probes resulted in the identification of several successful methodologies. These methodologies are identified in the body of the report.


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# METRIC (SI*) CONVERSION FACTORS

## APPROXIMATE CONVERSIONS TO SI UNITS

| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| in | inches | 2.54 | centimeters | cm |
| ft | feet | 0.3048 | meters | m |
| yd | yards | 0.914 | meters | m |
| mi | miles | 1.61 | kilometers | km |
| | | **AREA** | | |
| $in^2$ | square inches | 6.452 | centimeters squared | $cm^2$ |
| $ft^2$ | square feet | 0.0929 | meters squared | $m^2$ |
| $yd^2$ | square yards | 0.836 | meters squared | $m^2$ |
| $mi^2$ | square miles | 2.59 | kilometers squared | $km^2$ |
| ac | acres | 0.395 | hectares | ha |
| | | **MASS (weight)** | | |
| oz | ounces | 28.35 | grams | g |
| lb | pounds | 0.454 | kilograms | kg |
| T | short tons (2000 lb) | 0.907 | megagrams | Mg |
| | | **VOLUME** | | |
| fl oz | fluid ounces | 29.57 | millimeters | mL |
| gal | gallons | 3.785 | liters | L |
| $ft^3$ | cubic feet | 0.0328 | meters cubed | $m^3$ |
| $yd^3$ | cubic yards | 0.765 | meters cubed | $m^3$ |

Note: Volumes greater than 1000 L shall be shown in $m^3$.

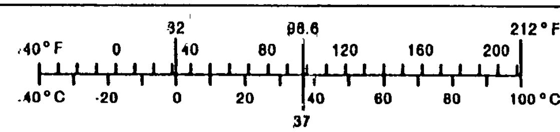
| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **TEMPERATURE (exact)** | | |
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |

These factors conform to the requirement of FHWA Order 5190.1A

*SI is the symbol for the International System of Measurements

## APPROXIMATE CONVERSIONS TO SI UNITS

| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| mm | millimeters | 0.039 | inches | in |
| m | meters | 3.28 | feet | ft |
| yd | meters | 1.09 | yards | yd |
| km | kilometers | 0.621 | miles | mi |
| | | **AREA** | | |
| $mm^2$ | millimeters squared | 0.0016 | square inches | $in^2$ |
| $m^2$ | meters squared | 10.764 | square feet | $ft^2$ |
| $yd^2$ | kilometers squared | 0.39 | square miles | $mi^2$ |
| ha | hectares (10,000 $m^2$) | 2.53 | acres | ac |
| | | **MASS (weight)** | | |
| g | grams | 0.0353 | ounces | oz |
| kg | kilograms | 2.205 | pounds | lb |
| Mg | megagrams (1000 kg) | 1.103 | short tons | T |
| | | **VOLUME** | | |
| mL | millimeters | 0.034 | fluid ounces | fl oz |
| L | liters | 0.264 | gallons | gal |
| $m^3$ | meters cubed | 35.315 | cubic feet | $ft^3$ |
| $m^3$ | meters cubed | 1.308 | cubic yards | $yd^3$ |
| | | **TEMPERATURE (exact)** | | |
| °C | Celsius temperature | 9/5 (then add 32) | Fahrenheit temperature | °F |



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# Executive Summary

The purpose of this research was:

1. Evaluate current research in the area of state highway agency performance measurement.
2. Create an effective performance measurement methodology for state highway agencies.
3. Identify state highway agencies with the most improved performance.
4. Probe these state highway agencies to determine what methodologies and strategies were utilized to achieve the performance improvement.

The literature review identified several methodologies used to measure performance, each having advantages and disadvantages. From this review a new methodology was created in an effort to sustain most of the advantages identified in the previous studies while eliminating many of the disadvantages. The primary concern was to eliminate the state comparison methodology and focus on measurement of improvement over time.

The new methodology primarily uses the same measurement categories identified in a study by David Hartgen from the University of North Carolina at Charlotte. Data from 1992 to 1998 was obtained from the FHWA's *Highway Statistics* and entered into a three year rolling average formula. This formula created five data points by averaging each three year group of data from 1992 to 1998. Then a percentage change in each category was calculated. The five states showing the largest percentage improvement in each of the output categories were identified as high performing.

The high performing states were probed in an effort to identify methodologies and strategies that caused improvement in the respective categories. The probes resulted in the identification of several successful methodologies. These methodologies are identified in the body of this report.

# I. Overview and Statement of Problem

## Performance Measurement

Performance measurement is one of the most important support tools managers need to guide their organizations. The ability to assess performance provides a picture of the past and affords guidance as to how to proceed in the future. It can highlight success and failure, and can cause the manager to completely reassess the methods and strategies currently in use. Unfortunately, as beneficial as it may be, the measurement of performance is very complex and often controversial.

Performance measurement, in theory, should be used as a tool to identify the accomplishment of goals or the lack thereof. It should tell the manager where things were done correctly and where performance is not to expected levels. But to truly understand the idea behind performance measurement, it is necessary to have a clear definition of performance.

Performance, for the purposes of this research, is defined as the accomplishment of desired goals. A critical question then is how can performance be measured? The first step is to identify “desired goals” and determine how feasible these goals are in relation to available resources. The second step, measurement, is also important to performance appraisal as it determines the evaluation process that defines goal attainment.

The identification of goals varies by specific situations. Because of this, controversy often results when measurements are compared. This fact is manifested in the case of trying to measure the performance of state highway agencies (SHA). There are fifty states and probably fifty sets of individual goals. These goals are based upon a variety of conditions, unique to each state. With such diversity how can one system be used to measure all of the SHAs?

## Measurement of State Highway Agency Performance

Currently there are several schools of thought concerning the measurement of SHA performance. The most popular measurement system (not to be confused with the most widely accepted) is to select a set of criteria, measure each state at a point in time, and develop a ranking from 1 to 50 of each state’s relative performance. David Hartgen of the University of North Carolina at Charlotte (UNCC) has been publishing a study of this type yearly since 1992. His study measures twelve criteria on an input versus output basis.

The Hartgen study uses the total miles of roadway under state control to identify the size of the roadway system in each state. The system size data is used to normalize the output data. The base data for the UNCC research is taken from the Federal Highway Administration’s (FHWA) *Highway Statistics.* This data is collected by the Federal Highway Administration, but the raw data is provided by each individual state.

The UNCC approach has several inherent problems. First and foremost is the idea of ranking state highway agencies against one another. There is no need to create a competitive atmosphere among the states. If it is performance that is to be measured then the states should be measured individually because each state has its own unique individual goals. It is conceivable that one state would accept a downturn in certain performance categories for a potential upswing in others. As an example, if a state has significant commercial growth it may put more money into new construction. This may increase the traffic congestion for the short term which in turn may lower its ranking in the UNCC study. The position change in the UNCC study then is a result of the state setting goals at improving roadway conditions at the expense of near term congestion.

The goals of each state are not identified or considered in the UNCC study and because of this it is not known if a state is actually making strides at improvement. Very little is known about how the states are doing things differently. The results may reflect a difference of opinion as to appropriate goals instead of actual improvements in performance.

A second problem with this study and others of this type is that the techniques, information, and methodologies used to achieve improvements are not reported. In the UNCC report a state could make a jump of 10 places in the ranking one year and the reader would be provided with no more information as to why other than the statement that “success can be attributed to slight, but important, improvements in nine of twelve measuring categories.” What is this really saying? That the SHA improved in nine categories of course, but what caused the improvement? The purpose of measuring performance is to provide guidance for management decisions. But the UNCC study does not provide causal information. The report discloses that a SHA’s relative position is changing, but the key question of why, is not addressed.

The third issue that is not addressed in the UNCC report or any report of this type is the issue of external factors. Each state has its own set of goals and this is primarily because each state is different. Each state has to deal with varying conditions that include weather, natural disasters, sources of funding, labor cost and many other external factors. Because of these external factors, the data must be analyzed very carefully.

**SHA Performance Data**

SHA ranking studies depend on data that is reported by each state to the Federal Highway Administration. Therefore, there is always the issue of discrepancies in the way the data is recorded and reported. Often, the data reported to the FHWA is not the most accurate and sometimes it is not even comparable between states. For instance, when examining roadway conditions there are several ways of measuring this criterion and many states use different methods. Although all states are required to use some type of mechanical device, equipment technology varies tremendously. Some states use profilographs or profilometers that are nearly 20 years old while others use newer and more accurate equipment. Obviously the introduction of newer equipment, with better precision, will cause a state to report very different roadway conditions than were reported in previous years. This is not because the roadway conditions have changed drastically, but rather it is because the equipment now in use is more sensitive and has better precision. However, when the state reports this new data it will essentially be reporting what appears to be a decrease in roadway conditions. Obviously this does not mean that the roads are worse, but that is what the FHWA data conveys to a casual reader.

## A Better SHA Performance Measurement Methodology

How can these problems be remedied? The first step to eliminating these problems is to develop a better measurement methodology. It is important to develop a performance measurement tool for SHAs that measures performance changes across time. Criteria are also a serious issue that must be evaluated and data sources must be carefully selected. Finally, how to measure actual performance must be carefully defined.

The methodology must look at each state individually. Additionally, it must take into consideration differences in external factors that might affect performance measures, and it must recognize that the data obtained from the FHWA may not always be correct.

An "across time" type of study can use the same general input/output criteria utilized in the UNCC study. This type of analysis will measure changes in performance and identify how the SHA is accomplishing its goals. In situations where there are large distributions of money towards certain tasks, or situations in which a SHA has previously shown poor results in a category, it will be possible to see if efforts at improvement are succeeding. The success will be measured as a percentage improvement from the prior year of measurement. A three year averaging of the data can be employed to provide a leveling of one time events or impacts by removing or lessening the data "noise."

Upon completion of an initial study of all states, those states showing the largest improvement in each category can be probed to discover the possible reasons for their performance improvements. This is an integral part of the study because this is the portion that will allow a SHA to learn what causes superior performance. The probing of high performing SHAs will hopefully identify the reason for their improvements. However, it is conceivable that in some cases a valid reason may not be available. In these cases this situation will be noted in the report.

The data used will still be from the FHWA's annual book *Highway Statistics* used in previous SHA studies. This may cause some problems, but this issue will be addressed in the form of a brief analysis of the sources of the data and suggestions to improve data accuracy. Hopefully, the existence of a report such as this will spur the improvement of the state submitted raw data.

## Summary

Ultimately, the goal of this research is to reduce the controversy surrounding existing SHA performance measurement methodologies by creating a new and better methodology for measuring SHA performance. The basic approach will be to:

1. Evaluate and select measurement criteria
2. Measure, over time, SHA performance in each of the selected categories.
3. Determine which SHAs have shown significant improvement in each of the measurement categories

4. Probe high performing SHAs to determine the causes driving performance improvement.

## II. Literature Review

### Introduction to Literature Review

A review of literature related to the development of SHA performance measurement methodologies focused on three types of literature:

1. Comparative Analyses of States. These are reports that evaluate SHAs on a national level by comparing SHAs to one another and to national averages.
2. Highway Users Federation (HUF) Studies. These reports focus on the performance of individual states.
3. Special Purpose Studies. These are special studies funded by individual states but usually completed by external organizations.

### Comparative Analyses of States

The idea of comparing SHAs to each other using reported results in several categories of measurement criteria is one type of SHA performance measurement methodology. A report issued annually by a team at the University of North Carolina Charlotte (UNCC) may be the most controversial of such efforts.

In 1992 David Hartgen of the Center for Interdisciplinary Transportation Studies at the University of North Carolina Charlotte (UNCC) published a report on SHA performance using a competitive ranking system. The UNCC report rank orders state highway agencies based on a variety of inputs and outputs. The inputs are identified as “Resources” and the outputs as “Results.” The resources and results used in the UNCC study are:

*Inputs*

1. Receipts for State Owned Highways
2. Capital and Bridge Disbursements
3. Maintenance Disbursements
4. Administrative Disbursements
5. Total Disbursements

*Outputs*

1. Rural Interstate Pavement Conditions
2. Urban Interstate Pavement Conditions
3. Rural Other Principal Arterial Pavement Conditions
4. Urban Interstate Congestion
5. Bridge Condition
6. Fatal Accident Rate
7. Rural Other Principal Arterial Narrow Lane Width

Hartgen obtained the data for the UNCC report from the Federal Highway Administration's (FHWA) *Highway Statistics* (FHWA 1992-1998). The FHWA's *Highway Statistics* is a compilation of data submitted by the individual states.

The purpose of the UNCC comparison is to identify how the states are performing in relation to one another. The FHWA data used to compile the report is normalized using total miles of roadway under state control. This factor is used to identify "system size" in order to make the statistics comparable between large and small system states. The ranking is developed based on the normalized statistics. States showing large increases or decreases in ranked position from the previous year's report are specifically noted and the categories to which the gains/losses are attributed are noted. The UNCC report however, offers no explanation to the nature of or causes contributing to a change in ranking.

This is one of the limitations inherent to this type of study. The author outlines several other limitations that he claims are "neither fatal nor preemptive," (Hartgen 1999) but they do require consideration before conclusions are drawn from the report. Hartgen's noted limitations include:

1. No use of lagged variables
2. No consideration of travel from neighboring states
3. No consideration of differing labor and material costs nationwide
4. Errors or omissions in the source of the data (FHWA State Reported Statistics)
5. Selection of analysis criteria
6. No analysis of external factors affecting each state such as population increases, natural disasters, etc.

Criticisms of this study are rooted in these limitations. Many believe that these limitations have drastic effects on the outcome of the study (Humphrey, et al. 1993). The primary criticism to the report, however, deals with the lack of explanation when a state makes a large move in either direction on the ranking scale. The categories that exhibited a large change are identified, yet the reasons for the changes are never addressed. The use of lagged variables would partly address this issue by identifying changes in rank caused by implementation of new policy. Due to the long lead time in many cases between implementation of a policy change and the change in performance results, states often exhibit an unexplained rise or drop in their ranking (Hartgen 1998). The lagged variables would identify this delayed effect, however, the specific policy change implemented by the SHA would still not be identified.

It can be argued, very effectively, that labor and material costs vary tremendously across states and in different regions of the country. Recent studies have shown that labor costs alone can differ by nearly 100% from one region of the country to another (Nationwide Variations in Cost of Highway Construction. 1990). The UNCC normalization procedure does not address this issue.

Another concern is data inconsistency within the FHWA's *Highway Statistics*. This inconsistency is caused by a lack of standards for the reporting of state data to the FHWA. The FHWA provides guidelines, to better conform the data of each state to FHWA databases, but these guidelines do not ensure that the actual measurement of the data is consistent (Humphrey, *et al.* 1993). Variables include the level of technology used by each state to measure and record data, the personnel employed to measure and record the data, and the internal performance standards that are set by individual states. As an example, large differences occur in the way states report road condition. Some states use very new and accurate technology to measure road condition, and others use antiquated and inaccurate equipment to measure the same parameter (Sissel 1999). Such discrepancies are not addressed in the UNCC methodology.

Finally, the issues of "spill over" traffic and high interstate through travel are not addressed. The condition of roadways and bridges, traffic congestion and fatalities are all drastically affected where neighboring states provide large amounts of "spill over" or through traffic. The higher traffic volumes cause deteriorated road conditions, a higher number of fatalities and increased congestion.

Even with the above limitations, the UNCC study is still considered useful (Humphrey, *et al.* 1993) as it is the only national report of its kind. The study is rooted in solid principles, but is lacking in many specifics. The inability to address the issues of "spill over" traffic, differing labor costs, inaccuracy of reference data, and the delayed effect of policy implementation cause skepticism about supposed conclusions.

**Highway Users Federation Reports**

During recent years the Highway Users Federation (HUF) has been employed by many states to perform effectiveness studies of individual SHAs and transportation programs. The HUF studies are primarily concerned with the extent to which the SHA meets the needs of the state's citizens with respect to time effectiveness, cost effectiveness, and safety. These studies involve in-depth analyses of the state's program taken as a whole. They often include internal audit reports as well as in-depth interviews with members of the SHA of interest. Often, members of the State Legislature are also interviewed.

These studies differ from the comparative type UNCC study in many aspects. Each study performed by HUF is undertaken not only to evaluate the performance of the individual state, but to additionally consider the individual needs and unique characteristics of the state. In essence, these studies deal solely with one individual state. In some cases information about peer SHAs is reviewed and used for comparative comments.

To complete a peer review HUF identifies states that are similar with respect to the state being studied. The peer states are then evaluated in various statistical categories and the peer data is compared to the state in question (Humphrey, *et al.* 1993).

The other primary difference between the HUF studies and the completely comparative UNCC study is that HUF reports are very detailed and are used primarily as a management tool. The HUF studies identify potential improvement measures and courses of action that could improve the SHA efficiency and effectiveness. These suggestions are based solely on the data from the state analyzed and the suggestions clearly reference the differing demographic, social, financial, and geographic needs of the state. HUF sees this step as a necessity and clearly states that the comparison of states may even be unnecessary because such investigations do not or can not consider the individuality of each state (Lamm, *et al.* 1993).

There are limitations even with this type of individual SHA study. HUF only performs individual studies for states when requested to do so, and a requested study is only a single point in time "snapshot" of conditions. Not every state has access to the results of studies performed for other states, nor do states request their own studies on a regular basis.

## Individual Special Purpose Studies

Individual special purpose studies are undertaken by individual states. They are usually performed by an impartial, independent agency. These studies are undertaken primarily to identify the causes of specific problems or to assess the current level of SHA performance. A private agency is usually commissioned to perform the study but, in some cases, the SHA self performs the work. The reports generated from these studies are similar to the previously discussed HUF reports.

There are several advantages to this type of study. The primary advantage is that the focus of the study is to solve a particular problem. Each state contracts the independent agency for a specific reason that affects only their SHA. Another advantage is that usually a private agency will perform the study and will present an objective view of the agency being studied. However, this methodology can also be a disadvantage as the study is relevant only to the state in question.

### *Nebraska*

Based on independent research the Nebraska Department of Roads prepared a report to the Governor's office in order to respond to the issue of high taxes (primarily gasoline taxes) in the state. This study took an approach similar to the HUF studies by comparing Nebraska to several "peer" states. The study compared raw statistics of categories such as condition of roadways, fiscal information and demographics (Nebraska Department of Roads 1986). Unfortunately this study had a methodology problem in that the "peer" states selected were not necessarily equivalent peers. Only neighboring states were used for the comparison and these do not necessarily have the same social, demographic or geographic characteristics as Nebraska.

### *New Jersey*

New Jersey published a report dealing with the differing costs of highway construction nationwide. This study was conducted primarily to make a case to the U.S. Congress that costs of construction and maintenance are tremendously different across the country due to varying socioeconomic and labor conditions (Nationwide Variations in the Cost of Highway Construction 1990). At the time of publication the New Jersey Transportation Coordinating Council felt that the cost of construction was so high in New Jersey that the state was not receiving proper consideration during the allocation of ISTEA[1] funds (Humphrey, *et al.* 1993).

[1] ISTEA is the common name for the Intermodal Surface Transportation Efficiency Act if 1991. ISTEA was enacted to establish a new approach to transportation planning. For the first time Federal Transportation Law called for long range multi-modal planning, active

The New Jersey study used the FHWA statistics reported by each state to measure construction and maintenance costs and concluded that not only do construction costs differ significantly around the country, but in some cases costs can differ by as much as 100% between states. This is an extremely important factor when considering the effectiveness and efficiency of SHAs in meeting the needs of their citizens.

### *Texas*

Texas has undertaken several studies regarding SHA performance measurement. The studies have used what is called the Analytic Hierarchy Process (AHP). This is a system similar to the FHWA's Highway Performance Monitoring System (HPMS). The basic idea of this system is to select criteria for measurement, collect raw data in each of the measurement categories and weight each criterion prior to creating a composite study.

The Texas studies concluded that not all of the criteria measured are equally important when dealing with performance measurement. The AHP studies have dealt primarily with determining how the criteria should be weighted. The Analytical Hierarchy Process shows how to weigh measured criteria when considering economics, geographic conditions, demographics, and social differences (Hagguist 1992).

## Summary

It is clear that each of the three types of studies reviewed have limitations and flaws, but it is also clear that each has value as a performance measurement tool.

Ignoring the differences among states when creating a composite study not only skews conclusions, but it leaves out the key component of understanding how to improve performance at the individual state level.

Probing each SHA in depth is very important for gaining understanding about how changes in policy and/or strategy will affect the transportation system as a whole. This is a necessary step in any evaluation because it answers the question of "why?" The idea of identifying what criteria holds priority is a necessary function in order to realize what factors are important in measuring performance. And finally, the idea of addressing the differences from state to state that cause a comparison to become invalid is important.

Ultimately an effective study would be one that combines the three types of studies, eliminating most of the limitations that makes each incomplete.

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involvement of local governments and the public at large, greater attention to the existing system, social equity, fiscal accountability and environmental responsibility in order to qualify for Federal funds.

# III. Criteria Selection and Methodology

## Selection of Measurement Criteria

To measure performance it is necessary to select equitable measurement criteria that satisfy the definition of performance. Performance, for the purposes of this research, is defined as the efficiency and effectiveness by which desired results are achieved using available resources. To adequately measure criteria that satisfy this definition two items must be scrutinized.

### *Desired Results*

The desired results of the state highway agency activities must be specified. The desired results are defined as the areas in which the SHA wishes to show improvement or growth. This is dictated by the customers, or taxpayers, within the state and from whom the funding for the agency is derived.

Taxpayers and the FHWA often identify several areas in which a state highway agency must perform and these areas therefore establish measurements of performance (Beuchner 1999).

1. Roadway Safety. This includes the fatal accident rate, the condition of bridges and pavements throughout the state, and lane width of roadways (particularly rural roads).
2. Traffic Congestion. This deals primarily with commuter traffic issues and focuses on Urban roadways.
3. Pavement Condition. This refers to the smoothness of the roadways as smoothness can have a large effect on the vehicles that travel upon these roadways. To a lesser extent it is a safety issue because poor pavement condition can result in unsafe driving conditions.

### *Resources*

The resources are the funds that the SHA uses to build and operate the state's transportation system. The way in which the money is distributed can dictate the effectiveness of strategies used to obtain desired results. Therefore the resources are identified as the following (Hartgen 1998):

1. Total Funds Available. This statistic is identified by FHWA as Total Receipts for State Owned Highways. This identifies the total amount of money available to the SHA.
2. Capital and Bridge Disbursements. This identifies the allocation of funds for the construction of bridges, new roadway construction, widening, engineering design, right-of-way, and safety.
3. Maintenance Disbursements. This includes all funds allocated to improving the condition of existing roadways and bridges, equipment for the maintenance, and programs such as snow removal.

4. Administrative Disbursement. This identifies all funds allocated to general administration, planning and research that is not related to specific projects.
5. Total Disbursements. This is the sum of the four disbursement categories listed above and also includes law enforcement agency costs, bond interest and bond retirement.

These items are the major points of comparison to measure efficiency and effectiveness. The amount of money supplied in relation to the size of the system, as well as where the funds are allocated, will identify possible strategies that SHA is using to achieve desired results. Disbursement allocations provide an indication of state goals and priorities.

## Measurement Criteria

In the case of this study the following criteria have been selected to measure state highway agency (SHA) performance. This selection of criteria follows that used in the ranking studies at UNCC. The same criteria were chosen because the items measured in the UNCC study are sound and they do allow for measurement of performance over time. The criteria are identified in two categories: Resources, which focuses on the resources available to the SHA, and results, which measures the efficiency and effectiveness of the use of the SHA resources.

### *Resources*

1. Receipts for State Owned Highways
2. Capital and Bridge Disbursements
3. Maintenance Disbursements
4. Administrative Disbursements
5. Total Disbursements

### *Results*

1. Rural Interstate Pavement Conditions
2. Urban Interstate Pavement Condition
3. Rural Other Principal Arterial Pavement Conditions
4. Urban Interstate Congestion
5. Bridge Condition
6. Fatal Accident Rate
7. Rural Other Principal Arterial Narrow Lane Width

The focus of this research will be on the results. The seven results selected will be analyzed using a percentage change methodology. However, an analysis of the input data will be included for selected high performing SHAs.

## Statistical Data

This research relies on data from two sources:

1. The Federal Highway Administration’s *Highway Statistics* (FHWA 1992 - 1998) and,
2. *Better Roads Magazine* (Better Roads 1992-1998).

***Federal Highway Administration Statistics***

The Federal Highway Administration annually publishes *Highway Statistics*. The raw data for this highway statistics book is provided by the individual states. The FHWA book is separated into six sections, the focus of which for the purposes of this research, is Section IV: Highway Finance, and Section V: Roadway Extent, Characteristics, and Performance (FHWA 1998).

The data for the measurement criteria used in this research are reported in these two sections on an individual state basis. Because of this, the reliability and accuracy of the data must be addressed. The first step to doing so is to identify the “chain” involved in data reporting. Figure 3.1 identifies the data sequence for the FHWA Book *Highway Statistics* and Figure 3.2 identifies the data sequence for *Better Roads Magazine*.

**Figure 3.1: FHWA *Highway Statistics* Data Sequence**

Step 1. SHAs are provided with format requirements by the FHWA for recording and reporting annual data. This information package is delivered to the individual state highway agencies. It outlines a methodology for reporting the data to the FHWA. Specific requirements about the measurements used to derive the data are not included in this package. The purpose of this package is solely to identify the categories of data to be reported and the manner in which each state must organize the data in order to aid in data synthesis.

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Step 2. Individual SHAs divide and delegate the data reporting tasks among departments both within the SHA and among local municipalities. The execution of this task is at the discretion of each individual state agency and no limitations or guidelines are provided by the FHWA.

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Step 3. Data is collected by the designated departments or local municipalities, and returned to the SHA Headquarters. Data is then reviewed and entered on the official FHWA reporting forms.

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Step 4. Official state data is delivered to the FHWA. This data is reviewed and re-entered into the FHWA publishing format and delivered to the publisher. The data is also formatted to conform to the FHWA web page posting requirements.

↓

Step 5. The publisher of *Highway Statistics* receives the data and conforms the FHWA publishing format to the necessary requirements for publishing the final document. In some cases, re-entry of tables and figures is required to correct for size limitations.

↓

Step 6. *Highway Statistics* is published and distributed.

**Figure 3.2: *Better Roads Magazine* Bridge Condition Data Sequence**

Step 1. SHAs are provided with format requirements by the FHWA for recording and reporting annual data. This information package is delivered to the individual state highway agencies. It outlines a methodology for reporting the data to the FHWA. Specific requirements about the measurements used to derive the data are not included in this package. The purpose of this package is solely to identify the categories of data to be reported and the manner in which each state must organize their data in order to aid in data synthesis.

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Step 2. Individual SHAs divide and delegate the data reporting tasks among departments both within the SHA and among local municipalities. The execution of this task is at the discretion of each individual state agency and no limitations or guidelines are provided by the FHWA.

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Step 3. Data is collected by the designated departments or local municipalities, and returned to the SHA Headquarters. Data is then reviewed and entered on the official FHWA reporting forms.

↓

Step 4. Official state data is delivered to the FHWA. This data is reviewed and re-entered into the FHWA publishing format. The data is also formatted to conform to the FHWA summary requirements for the National Bridge Inventory.

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Step 5. Individual state data is summarized to create the "National Average" data published in *Highway Statistics*.

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Step 6. The publisher of the *Better Roads Magazine* collects the individual state data and national average data from the FHWA and publishes the findings annually in the November issue of the magazine.

In both the FHWA book and the *Better Roads* publication, the data passes through a minimum of four points of entry. Each point of entry is defined as a point in time at which the data must be entered into a different system to pass to the next step. This essentially means that a person (s), computer or computer scanning device must read the data and re-enter it a minimum of four times. Each data handling step increases the chance of errors in the data.

A second issue is that of the reliability and accuracy in recording and reporting the data. Because there are no limitations on the way the state highway agency delegates the process of data collection, each agency can record and report the data in different ways, as long as it ultimately conforms to the FHWA reporting requirements and format. Therefore, states can be measuring, recording and reporting their data differently, and agencies within a state may, also, be reporting data differently. At the state level the problem exists both between internal departments and with external municipal agencies. A good example of this problem is the case of Arizona. The Arizona Department of Transportation (ADOT) reported a 400% increase in the category of "Rural Other Principle Arterial Lane Width Greater Than 12 ft Wide." When questioned, ADOT reported that this spike was attributed to nothing more than a data reporting error from a smaller municipality.

The third issue is that there are no specific data measurement requirements. The FHWA outlines the categories to be measured, but does not specify any methodology for measurement. As an example, the measurement of roadway conditions is dependent upon "Mechanical Means" according to the FHWA. The FHWA, however, does not set forth any requirements regarding the quality of equipment to be used in measuring roadway condition. Because of this, some agencies may be using technology with better precision than others. There is also the potential for different pieces of equipment to be used within states. Therefore, the statistics book includes information having many different levels of data precision.

Each of these problems could be solved with a simple directive from the FHWA. The FHWA should clearly outline a methodology for maintaining consistency among measurements. The publication of some type of standard guideline addressing the internal measurement and reporting of data among states would help to standardize the way in which the states measure and report data, and would increase the reliability of the data. Another key issue is the number of times the data must change hands. The process can today be improved by the construction of a consistent electronic data format to be used by all states.

**Three Year Rolling Average**

To address the effect of one time events causing data spikes, a three year rolling average method is proposed. This technique will provide a smoothing of data so that one time events do not unduly influence performance measurement. These events could include natural disasters, periodic climatic changes, major alterations of state spending, or other external circumstances.

The three year rolling average data smoothing technique is a method whereby the data from a specific year is grouped with the data from the previous and following years. These three data points are then averaged to create a single data point identified as the "three year rolling average" for the median year of the group. To determine the three year rolling average data point for the year 1992, data is collected from the 1991, 1992 and 1993 statistics, and the three points are averaged to create a new data value for 1992.

The three year rolling average decreases the effects of data spikes. It is a procedure that helps identify real trends in each agency by lessening the impact of one time events. However, the three year rolling average method is only effective when performing an archival study. The three year rolling average data point will not be indicative of current conditions, but rather will display data trends related to the two years prior to the current year.

**High Performing States**

High performing states will be identified as those showing the largest percentage improvement in a particular measurement category across the time span of 1992 to 1998. To identify the percentage change across the time span of 1992 to 1998 a simple formula is employed. The formula is:

$$\mathbf{i = ((P-F)/P) \times 100}$$

where

**i** = the percentage change
**F** = the three year rolling average data value for 1998
**P** = the three year rolling average data value for 1992

This equation calculates the percentage change over the specified time period. In some cases the value “P” may be zero, and in such a case the equation will produce an infinite value. In those situations the results are not included in the list of high performing states because of suspicions about data reliability. In addition, those states where the value “F” is at or near zero are also excluded from the study because of suspicions of data reliability.

The high performing states will be used as reference from which performance strategies are extracted. A probe of the high performing states will be executed to determine the causes driving their performance improvement. The causes will then be analyzed to determine the feasibility of implementation in other SHAs. Furthermore, the resource/disbursement or “input” data will be used to identify potential financial trends during this period. The financial, or input, analysis will help to determine the implementation feasibility, but will also serve to identify the financial background supporting SHA strategies.

The original and three year rolling average data for both “input” and “output” categories, using the above system of measurement, can be found in Appendix ‘A’ for Input Data and Appendix ‘B’ for Output Data.

## IV. Results and Analysis

### Selection of High Performing State Highway Agencies

To identify high performing SHAs, statistical data from the FHWA's *Highway Statistics* was analyzed using a three year rolling average and percentage change formula described in the previous section. The percentage change in each measurement category was determined and the five states showing the largest rate of improvement in each category were selected for the next phase of research, probing the states for improvement methodologies.

The following tables for each measurement category show the three year rolling average data for the five SHAs showing the largest percentage improvement over the time period from 1992 to 1998. Arizona DOT data is also presented. Values in the tables below are rounded to the nearest tenth.

### Probing the State Highway Agencies

The high performing SHAs for each measurement category were probed, via email and phone surveys, to determine the cause for their improvement. The primary goal for this probe was to identify innovative methodologies that could be used by other state highway agencies to improve their own performance. In some cases this goal was accomplished and specific details of processes leading to improvement are identified, however in other cases the causes for improvement could not be specifically identified. The results of these probes are described here, organized by category and identified by state.

**Rural Interstate Pavement Condition**

**Table 4.1: Rural Interstate Pavement Condition ***

| | 1993 | 1997 | Improvement |
|---|---|---|---|
| Florida | 3.8% | 0.1% | 97.2% |
| Maryland | 9.3% | 0.3% | 96.8% |
| Virginia | 3.9% | 0.5% | 87.9% |
| Texas | 2.7% | 0.4% | 84.7% |
| Indiana | 1.5% | 0.2% | 83.9% |
| *Arizona* | *0.9%* | *0.8%* | *17.6%* |
| *National Average* | *5.8%* | *4.01%* | *30.3%* |

*The percentage of each state's Rural Interstate miles rated at greater than 171 inches/mile of roughness based on the International Roughness Index.

***Florida***

Florida displayed the largest improvement in the area of Rural Interstate Pavement Condition from 1992 to 1998. When contacted Bruce Dietrich, the State's Pavement Design Engineer, suggested several reasons for this change. The largest contributing factor was the Interstate 10 (I-10) improvement project which took place from 1993 to 1996. This project involved the grinding of the concrete pavement on the entire length of I-10 in North Florida. Since the I-10 interstate highway constitutes a large percentage of Florida's Rural Interstate Pavement, the improvement of this highway lead to a significant overall improvement of the Interstate system in Florida.

A second contributing factor was better data from their pavement management system. This was the result of better measuring technology. Prior to 1993 Florida was utilizing bumper profiling devices to measure the ride roughness on the interstate. This technology was replaced with laser sensors and digital imaging systems that not only measure roughness in a different way, but are also much more complex. This change may have caused the measurement process to incur somewhat of a "learning curve" according to Mr. Dietrich, and may have caused the data from those years to skew slightly. However, once the new technology was assimilated into the pavement management system the data output by the new equipment was truly indicative of the actual pavement conditions.

The new technology, while providing better data, had no real physical effect on the system and the rate of improvement can be largely attributed to the grinding and overlay on Interstate 10.

***Maryland***

Maryland showed the second largest improvement in the area of Rural Interstate Pavement condition for several reasons. Pete Stephanos, Maryland's Pavement Design Chief, was able to identify both methodological changes as well as physical improvement projects that contributed to the improvement of Maryland's rural interstate.

Primarily, the milling and overlaying of their open grade friction course pavements caused the physical improvement during the period of 1992 to 1996. This was a result of an initiative by the Maryland Department of Transportation to improve the ride on their roads. The milling and overlaying produced the desired results at the time, which, of course, was to improve the ride.

However, an additional initiative to improve ride came in 1997. According to Mr Stephanos, it was at that time that the Maryland Department of Transportation focused more support and funding towards the maintenance and construction of roads. The additional funding afforded more resources for the rehabilitation of the interstate system. The open grade friction course, over a number of years, cracks and contributes to a rougher ride. The new initiative allowed for the replacement of the open grade friction course with Stone Matrix Asphalt (SMA) and Superpave mix pavements. This applied not only to the rehabilitation of the Interstates, but to all new road construction in Maryland as the state construction specifications were changed to specify only SMA or Superpave mix designs[2].

As with Florida, Maryland's improvement can be attributed primarily to the "quick fix" of milling and overlaying their interstate roadways. However, Mr. Stephanos, and others at the Maryland Department of Transportation, believe that the new specifications and methodologies will allow them to build better roads for the future.

***Virginia***

Virginia showed the third largest improvement of their Rural Interstate Pavement from 1992 to 1998. Chuck Larson, the State Pavement Engineer, attributed this improvement to both the structure and the aggressiveness of the Construction and Maintenance Programs in Virginia.

The Pavement Management System (PMS) in Virginia is very decentralized. Virginia's PMS is organized by district with each district having a dedicated Pavement Management Engineer. The district engineer is responsible for the roadway condition evaluation as well as the needs assessment for the district pavement as a whole. The district engineers report their findings at monthly meetings of a statewide pavement management team called the "Maintenance Program Leadership Group." The team is comprised of one representative from each district as well as the State Maintenance Engineer. This team is responsible for the collaborative evaluation of every mile of roadway in the state and ultimately, the allocation of the funds for maintenance

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[2] For descriptions of Superpave and Stone Matrix Asphalt Mix Designs consult pages 232-243 in *Materials For Civil and Construction Engineers* by Michael S. Mamlouk and John P. Zaniewski, Addison Wesley, Menlo Park, California, 1999.

and repair. The funding source is also unique in Virginia as the maintenance and rehabilitation programs are supported entirely with state funds. Because of this the "Maintenance Program Leadership Group" can often be more aggressive with the needs evaluation and funds distribution process.

In addition to their unique structure and aggressiveness with regards to maintenance and rehabilitation, Virginia is very aggressive with the new construction of roadways. Virginia utilizes either the Stone Matrix Asphalt or Superpave mix designs for all new construction.

***Texas***

Texas was included as a high performing SHA in both the areas of Rural Interstate Pavement Condition and Urban Interstate Pavement Condition. Joe Graph, Texas' Director of Maintenance, attributed this high level of performance to their Pavement Management System (PMS) and its structure.

Texas has a Pavement Management System (PMS) that reflects the relative size of the state. The PMS is very decentralized and is organized by district (twenty five total) across the state. Because Texas is so large each district office operates with essentially the same organizational structure, responsibilities, and in some cases, comparable geography as a state department of transportation.

Within the district offices, the Pavement Management System manages all pavement, both interstate and rural other principal arterial, and is responsible for needs assessment and conditions analysis for the roadways. Each district office PMS evaluates the roadway conditions visually and creates a conditions analysis report. In this report recommendations are made to the state Department of Transportation for the purposes of funds allocation. The funds allocation process is completed at the state departmental level and each district office is allocated funds based on the recommendations made by each of its 'sub-departments.' However, each main district office is given full discretion with the allocation of the budgeted funds within the district. As an example, if the district office was allocated funds for the purposes of mowing and a drought made mowing unnecessary the district could chose to use those funds for roadway maintenance. This is a key factor to the success of the Texas Department of Transportation, according to Mr. Graff. Essentially, this structure allows each district office to manage their areas with minimal interference at the state departmental level. This ensures that the decisions being made for each district are made by those who know the district best.

In addition to its PMS and unique structure, the Texas Department of Transportation has made several initiatives, in recent years, to improve their maintenance and construction programs. According to Mr. Graff the maintenance budget in Texas remained at $650 million a year from 1987 to 1997 but has increased tremendously in the last two years. The 2000 maintenance budget is close to $900 million.

Concerning new construction, in the late 1980's Texas began using a coarser mix design for new asphalt construction, moving from 1/2" aggregates to 5/8" aggregates. This Coarse Matrix High Binder (CMHB) mix is similar to the Stone Matrix Asphalt mix design currently being utilized by other high performing SHAs and has significantly improved the condition and life span of the roadways in Texas.

***Indiana***

Indiana demonstrated the fifth largest improvement in this category for the period of 1992 to 1998. William Flora, the State's Pavement Engineer, attributes this improvement to the existence of the Pavement Management System and the focus of the PMS towards interstate roadways.

Indiana's pavement management follows a complex, but very effective process. Roadway condition data is collected, through outsourcing, and a condition report is created identifying the condition of all interstate roadways in the state. Upon completion of this data collection phase, Indiana utilizes a software program that analyzes the data and creates a list of projects based on selected criteria. The project list is then prioritized and field studies are performed to determine the specific conditions of the selected projects. The scope of each project is then identified and used as a basic outline for the work to be performed. This process allows the Indiana DOT to effectively identify the projects that are truly high priorities and those that are not. In addition, because this process is performed at the state level, the project selection process is usually more effective in contributing to the accomplishment of the state goals.

**Summary**

Several key elements to successful Rural Interstate Pavement Management were outlined by each of the states contacted. These methodologies include:

a. Pavement Management System (PMS). This system, whether entirely at the state level or organized by district, is critical to conditions analysis and needs assessment. Typically a PMS will include data collection, reporting of the conditions data, the identification of high priority projects.
b. Aggressive Maintenance Program. The SHAs showing the largest improvements were those who focused on maintenance in recent years. This includes milling, grinding, thin overlays and crack seals.
c. Superpave and Stone Matrix Asphalt Mixes. Many successful SHAs are changing their construction specifications to require Superpave and Stone Matrix Asphalt Mixes. These mixes are readily accepted by most experts as having a longer life span and being vastly superior overall to mixes used in the past.
d. Decentralized Decision Making for Large States. Some large states have been very successful by organizing their SHA into districts and allowing each district to operate individually with full budgetary discretion.
*e.* New Construction. Any new construction initiatives that comprise a significant amount of the state's proportion of interstates will contribute to significant improvement in pavement condition.

**Urban Interstate Pavement Condition**

**Table 4.2: Urban Interstate Pavement Condition ***

| | 1993 | 1997 | Improvement |
|---|---|---|---|
| Hawaii | 31.8% | 1.5% | 95.4% |
| Texas | 17.1% | 0.9% | 94.3% |
| Wyoming | 14.9% | 1.2% | 92.3% |
| Minnesota | 19.2% | 1.9% | 90.3% |
| Alabama | 14.7% | 1.6% | 88.9% |
| *Arizona* | *1.8%* | *0.8%* | *56.9%* |
| *National Average* | *13.1%* | *8.58%* | *34.3%* |

*The percentage of each state's Urban Interstate miles rated at greater than 171 inches/mile of roughness based on the International Roughness Index.

***Hawaii***

Hawaii did not respond to queries in time to be included in the study. However, research shows that a discrepancy exists in the way Hawaii recognizes and reports the existence of Urban Interstate roadways. According to the FHWA's *Highway Statistics* (FHWA 1992-1998) Hawaii reported forty four miles of Urban Interstate in 1992 yet only three miles in 1998. This being the case it is unlikely that the percentage improvement Hawaii displayed during this period is due to anything other than a change in the roadway mileage classification.

***Texas***

Texas was the second highest performing agency in this category and attributed their improvement to the same programs described in the Rural Interstate Pavement Condition category. Texas utilizes decentralized decision making (via districts) and a pavement management system. For further information about these programs in Texas, refer to the previous section under the "Texas" heading.

***Wyoming***

Ken Shulz, Wyoming's Maintenance Engineer, attributed Wyoming's improvement to a focus on preventative maintenance, both during construction and after. Because Wyoming has so few people, in relation to states with similar lane mileage, damage caused by volume isn't the biggest issue regarding roadway maintenance. In some 'Urban' areas roadways only get 30,000 vehicles per day as a maximum volume. Some other 'Urban' areas of the country get that volume by the end of the morning traffic peak. The biggest issues facing the Wyoming DOT are freeze/thaw damage and truck traffic statewide.

Wyoming contains a highly traveled trucking route from the Mid-West to California and in some areas trucks comprise 50% of the daily volume. Both the high truck volume ratio and the freeze/thaw damage can create critical maintenance issues. However, these particular maintenance issues can be dealt with in the design process with moderate success, which is why Wyoming focuses more on preventative maintenance than repair.

Another reason Wyoming adopted a preventative attitude is that "We are a 'Donor State.' Funding has been down in the 90's so we don't always have the money for big maintenance and construction (Shulz 1999)." This is evident in Table A4 in Appendix A as it demonstrates that Wyoming's maintenance budget has been decreasing since 1993 and the capital and bridge disbursements have been increasing.

It would seem that the Wyoming philosophy of "preventative maintenance" has been successful. Even in periods of lower funding Wyoming has continued to improve their Urban Interstate conditions without a new major maintenance initiative.

***Minnesota***

Minnesota demonstrated the fourth largest improvement in the condition of their Urban Interstate from 1992 to 1998. Gary Thompson, Minnesota's Metro Maintenance Engineer, attributes this improvement primarily to the large repair initiative in recent years. Minnesota has been repairing large segments of their Urban Interstate by milling and thin overlays. There has been a 36% increase in maintenance disbursements from 1993 to 1997.

Thin overlays are typically used for short-term repairs in most areas and will remedy such defects as minor to moderate cracking and unevenness of surfaces, with a life expectancy of approximately eight years. The Minnesota Pavement Management System has been utilizing thin overlays as the primary method of repair.

Upon realizing the potential cost effectiveness of this methodology Minnesota increased the number of projects subject to the overlaying process and decreased the need, in the short term, for complete rehabilitation or reconstruction. However, according to Mr. Thompson, in the coming years it will be necessary to completely reconstruct many of the roadways in Minnesota as the remaining life of the temporary repairs grows shorter.

In addition to this repair methodology, Minnesota has implemented a requirement of a sixty year concrete design for all new roadways. This concrete mix is similar to a Superpave asphalt mix design and has a life expectancy, without major rehabilitation requirements, of sixty years. This change in construction specifications did not occur during the time period of interest to this study, however, it is the hope of the Minnesota DOT that it will foster continued improvement in roadway conditions in the future.

### *Alabama*

Alabama demonstrated the fifth largest improvement in Urban Interstate Pavement Condition and Larry Lockett, the State's Materials and Tests Engineer, attributes this improvement to Alabama's Pavement Management System.

Alabama has a dedicated Pavement Management System organized by nine districts. This district organization aids the centralized Pavement Management System through the State Maintenance Team. This team is comprised of the State Maintenance Engineer, the State Materials and Tests Engineer, the State FHWA Pavement Operations Engineer, the State Assistant Maintenance Engineer, the District Maintenance Engineers, and the District FHWA Operations Engineers. This team is responsible for the needs assessment and project prioritization for all state roadways. During team meetings it is the responsibility of the two district representatives, from each district, to report their conditions analysis and their individual needs assessments. This system gives each district an equal voice at the state level and allows for a cooperative effort throughout the state.

In addition to the success of their managerial structure, the Alabama DOT focuses on preventative maintenance through quality control of construction materials. Beginning in 1989 a reliability specification was required for the quality control of all hot mix asphalt used in the state. In addition Alabama has been moving toward meeting their goal of using 100% Superpave mixes in all construction, a goal which they met in 1999. They are also beginning to utilize Stone Matrix Asphalt mix designs, in an effort to reduce maintenance needs while prolonging roadway life.

### Summary

Many of the key items identified in successful Rural Interstate Pavement management apply to Urban Interstate Pavement management. Methodologies of high performing SHAs include:

a. Pavement Management System (PMS). This system, whether entirely on the state level or organized by district, is critical to conditions analysis and needs assessment. Typically a PMS will be responsible for conditions data collection, reporting of the conditions data, and the selection of high priority projects.
b. Superpave and Stone Matrix Asphalt Mixes. Many successful SHAs are changing their construction specifications to require Superpave and Stone Matrix Asphalt Mixes. These mixes are readily accepted by most experts as having a longer life span and being vastly superior overall to mixes used in the past, and should reduce future maintenance costs.
c. Decentralized Pavement Management System with a Centralized Group Decision Process. Some states have been successful by delegating the functional tasks of the PMS to the district level while maintaining a centralized decision making process.

d. Quality Control. As a part of having new construction programs SHAs are utilizing quality control specifications. These specifications are used to ensure that all materials meet requirements set forth in preventative maintenance efforts.
e. Aggressive Maintenance Program. Milling, grinding, thin overlays and crack seals provide immediate short-term benefits. This philosophy is only a temporary solution, but in some cases is only being used to prepare for new construction in coming years.

**Rural Other Principal Arterial Pavement Condition**

**Table 4.3: Rural Other Principal Arterial Pavement Condition ***

| | 1993 | 1997 | Improvement |
|---|---|---|---|
| Idaho | 3.4% | 0.3% | 92.3% |
| Mississippi | 4.5% | 0.4% | 91.9% |
| Delaware | 38.3% | 3.4% | 91.2% |
| Oklahoma | 15.1% | 1.7% | 88.9% |
| Kentucky | 0.6% | 0.1% | 88.8% |
| *Arizona* | *1.4%* | *0.7%* | *50.1%* |
| *National Average* | *3.1%* | *1.7%* | *42.3%* |

*The percentage of each state's Rural Other Principal Arterial miles rated at greater than 221 inches/mile of roughness based on the International Roughness Index.

***Idaho***

Idaho demonstrated the largest improvement in this category primarily due to a challenge issued by the director of the Idaho DOT stated Michael Santi, the state's Pavement Engineer. Each year a percentage improvement goal of roadway conditions is set forth by the Director of the Idaho DOT. This challenge is indicative of the focus on pavement management in Idaho. To aide in this initiative a gas tax increase was passed in 1995 that contributes directly to the maintenance program for roadway surface improvements. As a result the Idaho maintenance budget (Table A4 Appendix A) increased nearly 20% that year and has remained steady since. However, in 1992 and 1993 the maintenance budget was even higher than in 1996 and 1997. Therefore, the data supports that the gas tax did cause an increase in the maintenance budget, but the reasons for the disbursement drop-off in 1994 is unclear.

In addition to the high support level for maintenance of roadways, Idaho maintains a decentralized organizational structure. Idaho is organized into six districts that operate primarily as independent units. Conditions analysis is done on the state level, but only for the purposes of providing the State DOT and the districts with the conditions data. It is the responsibility of each district to use the data to formulate needs assessments and prioritize project lists. The districts are also responsible for the complete management of all funds allocated to the district and have almost complete discretion in doing so. However, there is a checks and balances system in place. This is the primary responsibility of the State DOT organization with respect to the districts. Each district must submit their plans for approval by the state office. In addition, the state office is responsible for all dealings with the FHWA, allowing each district more time to focus on the development of their programs.

***Mississippi***

Mississippi demonstrated the second largest improvement in the category of Rural Other Principal Arterial Pavement Condition caused primarily by a new construction initiative, says George Devaugn, Mississippi's Assistant State Construction Engineer.

In 1987 a four-lane road program was initiated by the Mississippi Department of Transportation. This program called for the widening of many of the state's rural roadways, from two lanes to four, nearly doubling the lane miles of Rural Other Principal Arterial Pavement in the state. In addition, the state construction specifications were changed in 1990 to call for 100% Superpave mixes in all new construction. This specification change, coupled with the large amount of new construction in rural areas, vastly improved the condition of the pavements across the state.

Grinding and thin overlays are often used to rehabilitate and repair existing roadways, however, because of the amount of recent roadway construction in rural areas the need for maintenance on the newer roads is minimal. Repair of pre-existing roadways has occurred throughout the period of 1992 to 1998 using overlays, however, these repairs to existing roadways did not affect the statistics nearly as much as the new construction initiative. Appendix 'B' shows that capital and bridge disbursements were up 34% from 1992 to 1998 and maintenance disbursements were up 53% for the period.

***Delaware***

Delaware demonstrated more than an 80% improvement in this category. This is due largely to the reconstruction of two major rural roadways and the new construction of a stretch of Rural Other Principal Arterial (ROPA) Pavement. The capital and bridge disbursments were up 81% from the period of 1992 to 1998.

According to Al Guckes, the State's Pavement Management Engineer, since 1993 US 113 and State Route 896 were both dualized adding nearly eighty lane miles to Delaware's ROPA Pavement. In addition, State Route 1 was constructed during that time period adding over one hundred and thirty five lane miles to Delaware's ROPA Pavement. These three projects comprised a large percentage of the ROPA pavement and because of this, they led to a dramatic improvement in pavement condition.

In addition to the reconstruction and new construction initiatives, the Delaware DOT has a dedicated Pavement Management System (PMS). The structure reflects the small size of the state as Delaware's PMS is mostly centralized. It is organized by three districts, however all conditions analysis is outsourced by the state department of transportation. Funds are allocated at the state departmental level, although each district office is involved in the needs assessment process and does make recommendations to the state level.

***Oklahoma***

Oklahoma demonstrated the third largest improvement in this category but according to Masoud Pajoh, the state's Pavement Engineer, this improvement is due only to a change in the way data was reported to the FHWA.

Oklahoma does not have a dedicated pavement management system and until 1993 had been collecting data in a manner different than the International Roughness Index (IRI) required by FHWA. Because of this the data reported to the FHWA was extrapolated from the data collected by the Oklahoma DOT and, according to Masoud, it was not comparable to actual IRI data. However, in 1993 the Oklahoma DOT began collecting the IRI data with the intention of implementing a dedicated pavement management program in the near future.

***Kentucky***

Kentucky demonstrated several strategies that contributed to the improvement in the condition of their Rural Other Principal Arterial Pavement. Dexter Newman, Kentucky's Director of Construction, helped to identify these strategies.

Kentucky has a dedicated pavement management system that is organized by district yet remains fairly centralized in operations, according to Mr. Newman. Kentucky has twelve districts that each report to the state Pavement Management Section. The district offices are responsible for conditions measurement as well as making needs recommendations to the state level; however, decisions regarding allocation of maintenance and construction funds are made at the state level. Because of the representation of each district, at the state level, the needs assessment of the state as a whole is more accurate than if the system were totally centralized or totally decentralized. As a result the pavement management system is more effective.

In addition to their interesting structure, Kentucky has supported initiatives for repair and resurfacing. In recent years a $55 million resurfacing program was approved for the resurfacing of non-interstate roadways. This effort has substantially improved the condition of the rural roadways in Kentucky. Using the three year rolling average data, Kentucky's maintenance disbursements have increased 70% from the period of 1993 to 1997.

Kentucky utilizes a system of construction evaluation and education. The pavement management system includes a pavement management team. This team is comprised of representatives from all agencies involved with Kentucky's roadway construction.

**Summary**

Rural Other Principal Arterial Pavement Management, in most states, is part of the same program as Interstate Pavement Management. Because of this many of the same strategies are successful in this category. Methodologies of high performing SHAs include:

a. Pavement Management System (PMS). This system, whether entirely on the state level or organized by district, is critical to conditions analysis and needs assessment. Typically a PMS will be responsible for conditions data collection, reporting of the conditions data, the selection of high priority projects.
b. Superpave and Stone Matrix Asphalt Mixes. Many successful SHAs are changing their construction specifications to require Superpave and Stone Matrix Asphalt Mixes. These mixes are readily accepted by most experts as having a longer life span and being vastly superior overall to mixes used in the past, and should reduce future maintenance costs.
c. New Construction / Widening Initiatives. Many successful SHAs are widening and reconstructing many of their Rural Other Principal Arterial roadways. The widening adds to the overall lane mileage of the state, thereby lessening the percentage of low quality pavement. The new construction dilutes the percentage of substandard roads by both adding more total lane mileage and adding high quality lane mileage.
d. Decentralized Decision Making for Large States. Some states have been very successful by organizing their SHA into districts and allowing each district to operate individually with full discretion with their budgets. This type of organizational structure is typically utilized by those states that have relatively large roadway systems and are decentralized in population.
e. Centralization of the state highway agency. Some states have also shown success by managing at the state level. Districts are still involved with the process but usually only as advocates or representatives on state level committees. This structure is typically utilized by those states that have relatively small roadway systems and a centralized population.

**Urban Interstate Congestion**

**Table 4.4: Urban Interstate Congestion ***

| | 1993 | 1997 | Improvement |
|---|---|---|---|
| West Virginia | 27.2% | 8.4% | 69.3% |
| Alaska | 46.3% | 15.1% | 67.4% |
| Idaho | 53.8% | 18.2% | 66.2% |
| Utah | 54.9% | 27.7% | 49.5% |
| Nebraska | 45.9% | 25.6% | 44.2% |
| *Arizona* | *22.9%* | *15.9%* | *30.8%* |
| *National Average* | *47.7%* | *36.4%* | *23.4%* |

*The percentage of each state's Urban Interstate mileage that has a volume/capacity ratio of 0.71 or higher.

***West Virginia***

West Virginia demonstrated the largest improvement in the category of Urban Interstate Congestion. Robert Watson, West Virginia's Intermodal Unit Manager, attributed this improvement to two things:

- Changes in their Highway Capacity Manual
- Expansion of roadways that were at or near capacity

In 1994 West Virginia's Highway Capacity Manual, which is used to regulate traffic flow and volume capacity, was changed. "Capacity on three lane Interstates was increased from 2000 pc/ph/pl (passenger cars / per hour / per lane) to 2200 pc/ph/pl. This technical change would reduce the amount of mileage recorded with a volume/capacity ratio of 0.71, since the capacity definition was changed to allow more vehicles."

West Virginia has been and is currently expanding the number of lanes on portions of its Interstate System. Many of these projects address areas that are rated at or near capacity. These expansions are typically from two lanes to three lanes per direction. These improvements not only improve the statistics through the addition of physical capacity, but also improve theoretically since capacity calculations on the improved facility(3 lane) will be based on 2200 pc/ph/pl rather than a 2 lane 2000 pc/ph/pl (Watson 2000).

### *Alaska*

Alaska demonstrated the second largest improvement in Urban Interstate Congestion but did not respond to inquiries about this matter.

### *Idaho*

Idaho demonstrated the third largest improvement in Urban Interstate Congestion. When contacted Gary Sanderson, P.E., Planning Services Manager, Idaho Transportation attributed the success to the interstate improvements around Boise and Pocatello.

In 1993 the Idaho DOT widened I-84 from two lanes to three lanes in the five miles through Boise. In 1997 they improved the portion of I-15 through Pocatello for two lanes to three. This improvement has had a significant impact on the interstate congestion around these two cities.

### *Utah*

Utah demonstrated the fourth largest improvement in Urban Interstate Congestion. When contacted Walter Steinvoch, Urban Transportation Planning Manager at the Utah Department of Transportation, explained that the improvement was related to the extensive construction on the interstates through Salt Lake City. This construction in effect has shut down most of the Urban Interstate mileage and detoured the traffic onto alternate routes, thus the significant improvement in Urban Interstate Congestion is really an illusion.

### *Nebraska*

Nebraska demonstrated the fifth largest improvement in Urban Interstate Congestion. When contacted Terry Gibson, Nebraska’s Assistant Roadway Design Engineer, attributes the improvement to a major reconstructive effort on the Urban Interstate around Omaha.

The interstate around Omaha has been an ongoing project for 17 years. In 1983 planning started for the reconstruction of the interstate and the first contracts were let in 1987. The project is budgeted at over $320 million with a completion date of Spring 2000. The project included rebuilding all on and off ramps onto the interstate, along with widening it from two lanes in each direction to four lanes in each direction. Two major interchanges were rebuilt. These were the I-180 to I-480 interchange and the I-680 to I-80 interchange. This work has significantly improved the traffic flow in and around the city of Omaha.

## Summary

Because Alaska did not respond to queries and Utah did not provide a methodology for improvement, effective strategies that can be reported in this category are somewhat limited. However, methodologies utilized by the other three states inlcude:

a. Changes in Volume/Capacity Specifications. This technical change would reduce the amount of mileage recorded with a volume/capacity ratio of 0.71, since the capacity definition was changed to allow more vehicles.
b. Widening of Existing Interstates. This increases the total lane mileage on the interstates thus increasing total capacity.
c. New Construction. In addition to the widening of existing roads the construction of new Interstates is necessary to keep up with population growth.

## Bridge Condition

**Table 4.5: Bridge Condition ***

| | 1993 | 1997 | Improvement |
|---|---|---|---|
| Nevada | 10.0% | 6.7% | 33.3% |
| Wisconsin | 29.3% | 21.0% | 28.4% |
| Connecticut | 13.0% | 9.7% | 25.6% |
| New Jersey | 40.6% | 31.0% | 23.8% |
| Maine | 43.3% | 33.7% | 22.3% |
| *Arizona* | *6.3%* | *6.0%* | *5.3%* |
| *National Average* | *31.1%* | *29.4%* | *5.5%* |

*The percentage of each state's highway bridges that are rated as substandard or deficient based on the federal bridge rating system.

### *Nevada*

Nevada displayed the largest improvement in the area of Bridge Condition from 1992 to 1998. When contacted Marc Grenert, Nevada's Principal Bridge Engineer, suggested several reasons for this change. The largest factor is that Clark County (Las Vegas) is experiencing massive growth. This county alone has added between 200-300 bridges to the state network in the last eight years. This large induction of new bridges has resulted in a dilution of the impact existing substandard bridges have on the state's rankings.

The Nevada bridge network is relatively new. The majority of its bridges being build in the last 30-40 years. This is well under the 50-75 year lifespan for bridges and results in very few bridges being added to the substandard list each year.

### *Wisconsin*

Wisconsin demonstrated the second largest improvement in this category. When contacted Jose Aldayvrez, Wisconsin's Bridge Management Engineer, attributed the success to a partnership between the counties. Wisconsin has decentralized its bridge maintenance to their individual counties.

The district managers take direct responsibility for the bridges in their counties/districts. The district managers then maximize their funds for bridge maintenance by utilizing county forces to do most of the work. The district managers have a scheduled meeting twice a year where they share current problems and successful strategies with their fellow district managers. From these meetings the managers gain insight on how to most effectively and efficiently manage their bridges.

### *Connecticut*

Connecticut displayed the third largest improvement in the area of Bridge Condition. According to Sandy Capodasi, Secretary II at the Connecticut DOT, the start of their program goes back to June of 1983 when the Mianus River Bridge carrying I-95 over the Mainaus River in Greenwich collapsed. After this collapse the Connecticut General Assembly, in a special session, established the State's Special Transportation Fund and provided the funding to sustain a Ten-Year Transportation Infrastructure Program and particularly the State Bridge Program.

Connecticut Department of Transportation has two major programs that they use to address bridge needs. The first program is the Infrastructure Renewal Program (IRP) and the second is ongoing highway projects. The goal of the IRB is to rehabilitate, restore, and/or replace a projected 1620 of the more than 3800 bridges on the state system. It was estimated that this program would require $1.1 billion in State Bridge bonds to be matched with approximately $534 million in Federal Highway Bridge Funds. This ten-year program was scheduled through fiscal year 1994. After 1994 it was anticipated that the program would reach a more manageable level being continued at $20 million annually in State Bridge Bonds, and a matching Federal Bridge allotment. This money was to improve the federally eligible bridges as well as the non-federally eligible bridges identified as deficient in any given year.

To date the IRP has rehabilitated, restored, or replaced 2,788 of the 3,733 bridges on the state highway system at a cost of almost $2.3 billion. Of these 2,788 bridges work on 1,675 was completed under a department-established program to permanently repair and restore, by vendor contracts, specific structural elements. Elements such as the parapets, bearing pads, abutments, underwater footings, and the deck were included in the initiative. The other 1,113 bridges were rehabilitated under the contract rehabilitation and replacement program in which bridges listed in "poor" condition were advertised for competitive construction bids.

### *New Jersey*

New Jersey demonstrated the fourth largest improvement in Bridge Condition. When contacted, Harry Capers, of the New Jersey Department of Transportation Structural Engineering Department, attributes the success to a program that was started in 1988. Before the new program was started they had a "first in – first out" system for scheduling work. They would fund the first proposals that made it through the system and would continue to allocate funding in this manner until funds ran out. This resulted in a system that did not allocate funds by need or priority, but rather by the speed in which the proposals arrived. Because of this many bridges in need of repair were left in poor condition while other bridges, in better condition, were repaired.

This changed when a priority based system was implemented in 1988. This program began with the evaluation and categorization of all bridges in the state. A priority listing was then compiled to use for project selection.

They then looked at how to get the "most bang for the buck." In prior years the institutional processes of doing things did not always lead to an efficient means of allocating funds, but after some changes in leadership, new and innovated methods were implemented. For example, funds were allocated to start a massive deck rehabilitation program, which gave them the highest impact for the lowest investment.

### *Maine*

Maine rounds out the top five states in most improved Bridge Condition. However, Steve Abbot, Maine's Bridge Management Engineer, believes they should not be ranked as an improving state. The ranking of bridges as substandard are based on two criteria depending on the state's desire for federal funds to repair the bridge. If the state desires the federal dollars then the measurement criteria are more stringent. Utilizing the more stringent standard Maine upgraded 225 bridges in their condition report. This contributed to most of the improvement shown by the state for the period on discussion.

Maine started a capital improvement plan in 1996 to work on their bridge system. Their system currently has an average age of 70 years. They feel that starting in 2005-2010 many of their bridges will approach the end of their lifespan and the number of substandard and deficient bridges will increase.

## Summary

Several strategies were identified by the contacted SHAs however, much of the improvement noted was due to nothing more than system growth or the reclassification of deficient bridges. The significant points are:

a. A bridge classification system that ensures that those bridges in the worst condition have priority for repairs.

b. Parts of the country experiencing growth have built many new bridges thus increasing the bridge population and diluting the significance of deficient bridges.
c. Decentralization of the management throughout the state. This gives each district more control over the repair process and allows for the potential maximization of funds when district labor is utilized.
d. In the early 1990's the criteria for a bridge to be classified as substandard changed and many bridges previously considered substandard were then reclassified as standard. This resulted in an improvement in the data without any physical improvement to the bridges.

**Fatal Accident Rate**

**Table 4.6: Fatal Accident Rate ***

| | 1993 | 1996 | Improvement |
|---|---|---|---|
| Alaska | 2.09 | 1.70 | 18.8% |
| New York | 1.43 | 1.27 | 11.7% |
| West Virginia | 2.12 | 1.88 | 11.2% |
| Massachusetts | 0.93 | 0.83 | 11.2% |
| California | 1.40 | 1.25 | 10.3% |
| *Arizona* | *1.95* | *2.09* | *-7.4%* |
| *National Average* | *1.6* | *1.6* | *2.9%* |

*The number of fatal accidents per 100 million vehicle miles for each state as a whole. Three year rolling average data for 1997 was not included as the measurement systems used prior to that year do not produce comparable statistics.

***Alaska***

Alaska displayed the largest improvement rate in the area of Fatal Accident Rate. Carl Gonder, of the Alaska Department of Transportation Operations Research Analyst Highway Data Section, attributed this improvement to Alaska's strict enforcement of speeding, driving while intoxicated, and other public safety laws.

***New York***

New York showed the second best improvement in the Fatal Accident Rate. When contacted Robert Limgoes, Civil Engineer II at the New York DOT Traffic Engineering and Highway Safety Department, attributed the improvement to a variety of programs implemented by the State DOT and other state agencies such as the Department of Motor Vehicles and the State Highway Patrol. Contributing to the improvement were:

- Safety Shoulder Rumble Strips (SAFESTRIP) program which involved the installing of audible shoulder rumble strips to alert drivers when their vehicles are leaving the roadway.
- Skid Accident Reduction Program aimed at educating drivers on how to avoid slippery pavement accidents.
- Safety Appurtenance Program (SAFETAP) that addresses roadside safety in all resurfacing projects.

In addition, the enforcement of the mandatory seat belt use law that was enacted in 1984 (the first state to mandate the use of seat belts for the front occupant), and the state's renewed strict enforcement of the driving while intoxicated laws contribute.

New York continues to constantly pursue safety-related actions such as design, work zone safety, and roadway access. A concentrated effort of all state agencies in the area of safety seems to be successful.

***West Virginia***

West Virginia ranks third in the Fatal Accident Rate improvement. When contacted, Roger Russel, West Virginia's Traffic Operations Section Engineer, attributes the improvement to the state's aggressive construction of two lane highways and the state's 1993 seat belt law.

West Virginia is a rural state having topography that lends itself to difficult driving. Most of the states fatal accidents occur on State Numbered Routes (31%), US Numbered Routes (27%), and County Routes (25%). These are mostly two lane routes that were constructed using older standards. The West Virginia's Division of Highways has, for the past several years, had an aggressive program of reconstructing two lane roads to new standards and of replacing old roadways with new four lane highways. These new four lane roads, in many cases, resulted in much shorter travel paths for motorists. The new roads have shortened what were long trips on multiple, dangerous, two lane highways.

In September of 1993 the West Virginia state government passed a seat belt law mandating the use of seat belts for all front seat passengers and all rear seat passenger under 18 years of age.

***Massachusetts***

Massachusetts ranked fourth in improvement of fatal accident rate. When contacted Bill Bent, of the Massachusetts Department of Transportation Safety Management Division, attributed their success to several new programs and enhancements to existing programs. Programs making the most significant impact are:

- Improved Air Medical Ambulance Teams

- Rumble Strip Installation
- Radar Drone Activators
- Governor's Safety Outreach Program.

In the last ten years the medical community has upgraded the air ambulance system in the state. With the state's heavy traffic volume and geography traditional ambulances were taking too long to get to the accident scene and were slow in delivering patients to the hospitals. The addition of air medical ambulances has significantly shortened the transport time. They are now used whenever a life is in danger.

The state has completed an extensive rumble strip installation plan. Rumble strips have been installed on the shoulders of all interstates. Massachusetts has also installed rumble strips in the center of some very high volume two lane roads. Route 88, that goes to the beach at Cape Cod, and Route 20, going to Chaftin. These are two of the state's busiest recreation areas and the roads into both have been the scene of many fatalities. Rumble strips have been extremely effective in waking sleepy drivers who are crossing the centerline and headed towards a head-on collision.

On major interstates Massachusetts has installed radar drones. These radar drones alert large vehicles (Semi-Trailer Trucks) that are attempting to exit the interstate system at a dangerously fast speed. By slowing these large vehicles Massachusetts has substantially decreased the rollover accident rate.

Finally the Massachusetts Governor intimated a Safety/Outreach campaign. This campaign is focused on many issues. The use of seatbelts and the use of child seats. It focuses on the danger of driving while intoxicated (DUI). A unique aspect of this program is that it is directed at high school age drivers, and specifically calls attention to the driving dangers on Prom nights. Massachusetts has implemented a strong media campaign to ensure that safe driving is on the mind of these young drivers during this specific night.

***California***

California rates fifth in this category. Steve Kohler, of the California Highway Patrol, attributes California's success to improved automotive technology and to several programs that have been enacted in the last several years. Such programs included:

- Safety Belt Compliance
- DUI Enforcement
- Speed Enforcement
- Grass Root Education Efforts

The Safety Belt compliance law that was a secondary law in 1986 became a primary law in 1993. The full enforcement of this law and the Child Safety Seat law passed in 1983 have increased compliance enormously, in addition a high visibility media campaign has been advantageous.

Driving Under the Influence Enforcement has substantially increased with the California Highway Patrol (CHIP) mounting a broad statewide public awareness campaign coupled with a strong enforcement component.

CHIP has committed a large percentage of its personnel and resources to speed enforcement. These include specifically anti-lock breaks and airbags.

Finally the Grass Root efforts of organizations such as MADD, Buckle-Up Baby, and Safety Belt Safe USA have contributed to safety awareness. All of these programs together have helped to reduce the fatality rate in California. The technological improvements in automobiles are also a major contributor to fatality reduction.

**Summary**

Improvement of Fatal Accident Rates has been accomplished by utilizing the following methodologies:

a. The increased enforcement of driving while intoxicated (DUI) laws.
b. The enforcement of seatbelt laws. Many seatbelt laws were enacted in the early 1980's so new drivers have grown-up with having to use them.
c. Rumble Strips installed on roadway shoulders to alert sleepy drivers that their vehicle is leaving the roadway.
d. Improved medial evacuation equipment, most significantly air ambulances (helicopters).
e. Organization such has Mother's Against Drunk Driving (MADD) and Student's Against Drunk Driving (SADD) that have educated drivers on the dangers of drinking and driving.

**Rural Other Principle Arterial Lane Width**

**Table 4.7: Rural Other Principal Arterial Lane Width ***

| | 1993 | 1997 | Improvement |
|---|---|---|---|
| Alaska | 3.1% | 0.4% | 87.9% |
| New Jersey | 12.1% | 2.9% | 75.7% |
| Rhode Island | 28.0% | 9.6% | 65.7% |
| Alabama | 10.0% | 4.0% | 59.9% |
| Idaho | 3.9% | 1.7% | 56.7% |
| *Arizona* | *0.3%* | *0.6%* | *-142.5%* |
| *National Average* | *14.4%* | *12.4%* | *17.0%* |

*The percentage of each state's Rural Other Principal Arterial Lane mileage that has lane widths of less than 12 feet wide.

***Alaska***

Alaska displayed the largest improvement in the Rural Other Principle Arterial Lane Width (ROPA). When contacted Carl Gonder, of the Alaska Department of Transportation, stated they have no specific program to improve these roads. His only thought is they have been converting gravel roads to paved roads thus increasing the quantity of ROPA roads.

***New Jersey***

New Jersey showed the second largest improvement in ROPA Lane Width. When contacted Harry Capers, a Structural Engineer at the New Jersey Department of Transportation, attributes the improvement not to a single program, but rather to two things working in combination. First is a redesignation of the rural other principle arterial roadways to urban roads. This coupled with their ongoing maintenance has drastically improved the data reported to FHWA. A road classification change unfortunately does not mean an improved road.

***Rhode Island***

Rhode Island demonstrated the third largest improvement in this category. When contacted Joe Bucci of the Rhode Island Department of Transportation identified no specific programs to improve the width of the ROPA roads but offered some thought on other programs and policy changes that have effected this area.

During this time period Rhode Island expanded urban boundaries resulting in a reduction of ROPA mileage. In addition Rhode Island has undergone numerous resurfacing and striping projects which did not necessarily widen the actual paved roadway, but due to re-stripping the marked travel lanes have been made wider at the expense of the paved shoulder.

Rhode Island conducted a major update to the Highway Performance Monitoring System (HPMS) with old data corrected and changed as needed. The lane widths being a measured item in the HPMS and any field data update surveys taken after a resurfacing or stripping contract would reflect the change in lane width from eleven feet to 12 feet.

Mr. Bucci stated that since Rhode Island does not have much mileage in the ROPA category, any change in data reported would result in a large percentage change.

### *Alabama*

Alabama demonstrated the fourth largest improvement in this category. However, Stephen Walker, of the Alabama Department of Transportation, stated that Alabama has no specific program targeting ROPA mileage, but rather treats all roads equally. Mr. Walker attributes most of the improvement to new construction and resurfacing projects that have recently improved substandard roads to meet Alabama's criteria regarding pavement condition.

### *Idaho*

Idaho is the fifth most improved state in ROPA Lane Width. When contacted Gary Sanderson, the Planning Services Manager at the Idaho Department of Transportation states they have no "magical program" that accounts for the improvement. They use, as part of the HPMS data gathering and the Pavement Management System, a unique way to show management why they need the money. They put the lane widths into a laptop computer data-recording program in the field or in the office from a video of the roadway. One of the Pavement Management reports is a listing of all roadway sections that are deficient in width or pavement condition. The information is then forwarded to the management team that schedules the projects and appropriates the money for widening or other roadway construction projects. The program, though not "magical," is effective for their state.

## Summary

Top performing states in this category focused on bringing the ROPA roads to a lane width of 12 ft. Methodologies that resulted in improvements include:

a. Ensuring that management understands what roads need to be widened
b. During road re-striping the roadways are striped at the standard width while the road is not widened thus adding additional roadway width by eliminating part of the paved shoulder.
c. The addition of more mileage to the program. Existing gravel roads have been paved to the new standard. This increases the total mileage thus diluting the impact of the non-standard roads.

d. The re-designation of the ROPA roads to Urban roads.

## V. Conclusions and Recommendations

### Conclusions

The purpose of this research was:

1. Evaluate current research in the area of state highway agency performance measurement.
2. Create an effective performance measurement methodology for state highway agencies.
3. Identify high performing state highway agencies.
4. Probe the high performing state highway agencies to determine what methodologies and strategies are being utilized to maintain a high level of performance improvement.

The literature review identified several methodologies used to measure performance, each having advantages and disadvantages. From this review a new methodology was created in an effort to sustain most of the advantages identified in the previous studies while eliminating many of the disadvantages. The primary concern was to eliminate the state comparison methodology and focus on measurement of improvement over time.

The new methodology primarily uses the same measurement categories identified in a study by David Hartgen from the University of North Carolina at Charlotte. Data from 1992 to 1998 was obtained from the FHWA's *Highway Statistics* and entered into a three year rolling average formula. This formula created five data points by averaging each three year group of data from 1992 to 1998. Then an average annual percentage change in each category was calculated. The five states showing the largest percentage improvement in each of the output categories were identified as high performing.

The high performing states were probed in an effort to identify methodologies and strategies that caused improvement in the respective categories. The probes resulted in the identification of several successful methodologies.

### Recommendations

Several different methodologies are being utilized successfully by high performing states. The following is a list of recommendations, organized by the seven output measurement categories, to improve state highway agency performance.

### Pavement Condition – Rural and Urban Interstate and Rural Other Principal Arterial

Pavement management techniques utilized by the high performing states are not typically different for the type of roadway. In most cases all roadway maintenance is treated on a conditions priority basis and roads are repaired accordingly. Methodologies that have attributed to the success of the high performing agencies in the area of pavement condition include:

a. Pavement Management System (PMS). Several types of management systems were identified, both centralized and district oriented. These systems are typically responsible for the roadway condition data collection, whether through outsourcing or self performance, analysis of this data, needs assessment for all pavement, and in some cases the creation of project scopes and recommendations of priority projects.
b. Aggressive Maintenance Program. The SHAs showing the largest improvements were those who focused on maintenance in recent years. This includes milling, grinding, thin overlays and crack seals. This philosophy is only a temporary solution, but in some cases is only being used to prepare for new construction in coming years at the end of the life span of current pavement.
c. Superpave and Stone Matrix Asphalt Mixes. Many successful SHAs are changing their construction specifications to require Superpave and Stone Matrix Asphalt Mixes. These mixes are readily accepted by most experts as having a longer life span and being vastly superior overall to mixes used in the past. In addition, quality control initiatives are typically included in the more successful construction programs. This often includes procurement control, which analyzes both vendor quality and materials quality, and performance based procurement for contractors, which includes stringent evaluation of previous contractor performance.
d. Decentralized Decision Making in Large States. Some states have been very successful by organizing their SHA into districts and allowing each district to operate individually with full budgetary discretion.
e. New Construction. Any new construction or complete reconstruction initiatives that comprise a significant amount of the state's proportion of roadways will contribute to significant improvement in this category. This is obviously a better alternative than high volumes of maintenance from the value engineering standpoint, however, funds available do not always support the need for new construction.

**Urban Interstate Congestion**

Because one of the five high performing states did not respond to queries improvement methodologies in this category are somewhat limited. However, recommended methodologies utilized by the states include:

a. Widening of Existing Interstates. This increases the total lane mileage on the interstates thus increasing physical capacity.
b. New Construction. In addition to the widening of existing roads the construction of new Interstates is necessary to keep up with population growth.
c. Changes in Volume/Capacity Specifications. This technical change would reduce the amount of mileage recorded with a volume/capacity ratio of 0.71, since the capacity definition was changed to allow more vehicles.

## Bridge Condition

Probes in the area of Bridge Condition did not yield many useful strategies, but did reveal several circumstances that may have contributed to the improvement of the conditions data. For instance, in the early 1990's a change in classification criteria resulted in the reclassification of many bridges throughout the country. This factor led to significant changes in data when no actual changes had been made to the actual condition of the bridges.

Growth increases across the country resulted in the construction of many new bridges which diluted the number of substandard bridges.

However, in some cases strategies were identified but were very similar to those regarding Pavement Management. These methodologies include:

a. A bridge condition management system that ensure that those bridges in the greatest need of repair are first on the list to receive attention. The key to this is establishing a system by which all bridges are evaluated on a schedule and conditions data is analyzed regularly to identify deterioration and the need for repair.
b. Decentralization of the state highway agency. Some states have been very successful by organizing their SHA into districts and allowing each district to operate individually with full discretion with their bridge budgets.
c. New Construction. Any new construction or complete reconstruction initiatives that comprise a significant amount of the state's proportion of bridges will contribute to significant improvement in this category. This is obviously a better alternative than high volumes of maintenance from the value engineering standpoint, however, funds available do not always support new construction.

## Fatal Accident Rate

Several strategies were identified in this category, however many have existed for decades. In most cases the strict enforcement of existing laws was suggested. Enforcement increases most often occurred in the areas of Driving Under the Influence (DUI) Laws, Driving While Intoxicated (DWI) Laws, and Mandatory Seatbelt Laws. Additional initiatives involved education and training for safe driving, however, these initiatives and increased law enforcement typically involved increased funding allocation to the Department of Public Safety or Police Departments, which may not involve the state highway agency. Updating and increasing the availability of medical evacuation equipment such as helicopters also contributed to the decrease, but is also not usually a state highway agency action.

However, in addition to the increased enforcement of existing laws, several SHAs are constructing "Rumble Strips." These strips are installed on shoulders and in some cases medians, and are designed as divots in the roadway that create both sounds and vibrations to alert sleepy drivers when they are driving off course.

## Rural Other Principal Arterial Narrow Lane Width

Probes in this category, much like Bridge Condition, resulted in few strategies for improvement. In most cases population expansion resulted in the reclassification of ROPA roads to Urban roads. Population growth also contributed to a high percentage of new construction, which diluted the percentage of ROPA roadways less than twelve feet wide. Also, re-striping of roadways to standard width often leads to data supporting a wider roadway when there was no physical pavement width change. Unfortunately, this strategy does not actually widen the road, it just eliminates the shoulder.

## Future Studies

Probes of the high performing states identified in this study further validated the relevance of the criteria used to define high performance, however, the probes also revealed some of the inadequacies of the FHWA's *Highway Statistics* and the redundancy of the measurement categories used in the UNCC study.

Flaws exist in the FHWA statistics process because the data collection process lacks in structure. Each state is responsible for reporting their own data with minimal guidelines for both gathering and reporting data. Improvements must be made to this process so that the statistics are more reliable. The FHWA should mandate specific criteria and methodologies for data collection and should improve the data reporting process, perhaps by moving to electronic database submissions.

In addition, the criteria by which performance is measured should be reevaluated. The seven output criteria used in this study were used because they were believed to be an equitable measure of performance, however, upon probing the high performing agencies it was determined that several criteria could be combined. High performing SHAs did not make the distinction between rural and urban interstate, or rural other principal arterial pavement during data collection. The classification of the pavement was not typically as much of a concern for the states as was the condition of the pavement. For this reason one category for pavement condition should encompass all classifications and utilize only one evaluation measurement range on the International Roughness Index.

Future studies of this type should reevaluate the measurement criteria and statistics to be used. The FHWA's *Highway Statistics* reports many other categories than those used in this study and each should be considered. The book is an equitable beginning, but must not be considered entirely accurate as the statistics reported may not necessarily be indicative of actual conditions.

Finally, a comparison should be made between the strategies of the high performing SHAs and the strategies of the low performing SHAs. Probes of the five states in each category that displayed the lowest rate of improvement would serve as a tool to further validate the methodologies of the high performing states. However, it is conceivable that a low performing state may be utilizing the same strategies as a high performer, yet yielding different results. In these cases it would be necessary to again probe the high performing states and compare their methodologies with those of the low performing states to discern specific differences in each methodology.

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# Appendix A: Input Data

This section presents the ‘Resource’ data for all fifty states. Information presented includes: Receipts for State Owned Highways, Capital and Bridge Disbursements, Maintenance Disbursements, Administrative Disbursements, and Total Disbursements.

**Table 1 Appendix A**

**Receipts for State Owned Highways (in thousands of $)**

**Original Data**

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|
| Alabama | 679,748 | 816,704 | 405810 | 829,949 | 846,092 | 810,476 | 808,976 |
| Alaska | 389,618 | 428,437 | 44111 | 432,146 | 447,752 | 430,459 | 399,697 |
| Arizona | 994,174 | 1,092,628 | 282209 | 787,079 | 1,220,525 | 934,629 | 937,693 |
| Arkansas | 491,747 | 542,138 | 284224 | 582,806 | 622,752 | 671,983 | 634,442 |
| California | 4,429,148 | 3,791,025 | 2000876 | 4,651,644 | 4,915,638 | 4,887,127 | 5,404,162 |
| Colorado | 566,435 | 644,799 | 317473 | 672,364 | 672,959 | 731,838 | 964,915 |
| Connecticut | 1,346,902 | 1,576,453 | 433449 | 1,201,142 | 1,393,305 | 1,211,089 | 1,340,577 |
| Delaware | 515,800 | 500,942 | 124500 | 426,296 | 463,438 | 417,678 | 692,993 |
| Florida | 2,238,906 | 3,810,193 | 1192787 | 2,873,051 | 3,250,882 | 3,486,983 | 4,286,878 |
| Georgia | 1,394,634 | 1,292,031 | 475853 | 1,366,466 | 1,450,337 | 1,560,079 | 1,718,360 |
| Hawaii | 364,320 | 385,394 | 89517 | 466,971 | 351,288 | 335,844 | 235,976 |
| Idaho | 225,599 | 237,154 | 130584 | 246,858 | 276,708 | 304,423 | 263,438 |
| Illinois | 2,410,734 | 2,573,234 | 1004410 | 2,411,828 | 2,353,386 | 2,169,369 | 2,678,221 |
| Indiana | 991,964 | 1,059,665 | 352353 | 963,059 | 922,492 | 1,093,666 | 1,503,489 |
| Iowa | 609,168 | 645,744 | 266649 | 696,539 | 674,251 | 722,331 | 699,281 |
| Kansas | 961,778 | 1,106,106 | 201788 | 702,689 | 767,995 | 754,003 | 1,040,056 |
| Kentucky | 899,284 | 1,752,216 | 573067 | 1,275,565 | 996,680 | 1,022,128 | 1,164,470 |
| Louisiana | 1,056,231 | 792,935 | 586716 | 1,192,059 | 1,325,249 | 1,297,172 | 1,380,754 |
| Maine | 347,480 | 310,756 | 170908 | 354,400 | 432,508 | 425,526 | 477,328 |
| Maryland | 941,846 | 1,076,820 | 434530 | 1,074,490 | 1,014,799 | 1,051,181 | 1,115,290 |
| Massachusetts | 1,667,962 | 2,126,288 | 529079 | 2,220,766 | 2,260,727 | 3,984,677 | 2,518,736 |
| Michigan | 1,361,245 | 976,609 | 480113 | 1,077,695 | 1,191,854 | 1,315,592 | 1,741,413 |
| Minnesota | 825,748 | 860,844 | 547320 | 808,440 | 851,011 | 928,596 | 933,036 |
| Mississippi | 453,644 | 466,380 | 286671 | 554,186 | 551,102 | 594,993 | 618,486 |
| Missouri | 875,312 | 915,599 | 575965 | 1,074,583 | 1,158,108 | 1,179,977 | 1,154,409 |
| Montana | 264,421 | 401,425 | 163292 | 316,971 | 353,761 | 346,712 | 354,525 |
| Nebraska | 306,816 | 383,088 | 196446 | 374,887 | 437,592 | 413,730 | 425,338 |
| Nevada | 327,778 | 328,190 | 229175 | 391,868 | 403,516 | 436,144 | 465,081 |
| New Hampshire | 399,099 | 319,151 | 122157 | 294,899 | 285,301 | 313,873 | 302,166 |
| New Jersey | 3,306,505 | 2,455,834 | 449349 | 1,600,604 | 3,371,637 | 2,109,599 | 2,129,823 |
| New Mexico | 383,707 | 451,719 | 282135 | 457,936 | 470,525 | 584,773 | 457,129 |
| New York | 3,124,313 | 3,906,490 | 1116140 | 4,384,986 | 3,652,071 | 4,528,842 | 4,698,524 |
| North Carolina | 1,489,842 | 1,599,243 | 1040844 | 1,860,652 | 1,816,071 | 1,935,879 | 2,393,544 |
| North Dakota | 161,812 | 162,099 | 53233 | 183,322 | 182,440 | 221,590 | 221,133 |
| Ohio | 1,596,499 | 1,637,471 | 1001840 | 1,872,422 | 2,256,202 | 2,183,850 | 2,492,262 |
| Oklahoma | 1,126,394 | 526,501 | 196423 | 586,217 | 656,053 | 704,873 | 1,408,613 |
| Oregon | 586,766 | 584,751 | 345041 | 590,035 | 678,682 | 651,273 | 717,135 |
| Pennsylvania | 3,297,837 | 3,462,296 | 1719828 | 3,273,912 | 2,843,637 | 3,237,805 | 3,798,956 |
| Rhode Island | 270,199 | 338,960 | 151055 | 289,434 | 299,673 | 232,202 | 339,506 |
| South Carolina | 584,657 | 589,558 | 266515 | 606,784 | 653,726 | 725,139 | 742,239 |
| South Dakota | 205,087 | 244,948 | 87747 | 248,228 | 246,947 | 298,838 | 299,584 |
| Tennessee | 1,112,844 | 959,289 | 486712 | 976,231 | 1,023,386 | 1,092,905 | 1,205,306 |
| Texas | 3,001,156 | 3,378,034 | 2164320 | 3,447,695 | 4,256,215 | 4,032,607 | 4,042,195 |
| Utah | 213,905 | 324,845 | 160626 | 399,648 | 455,462 | 1,135,887 | 808,000 |
| Vermont | 178,643 | 197,124 | 78587 | 167,506 | 153,300 | 193,183 | 168,813 |
| Virginia | 1,662,693 | 1,928,936 | 771406 | 2,000,954 | 2,037,826 | 2,186,592 | 2,240,379 |
| Washington | 1,140,616 | 1,148,498 | 722137 | 1,416,006 | 1,386,736 | 1,477,999 | 1,290,142 |
| West Virginia | 709,134 | 899,340 | 463018 | 786,341 | 861,062 | 945,698 | 890,365 |
| Wisconsin | 1,118,522 | 942,643 | 394592 | 858,207 | 965,712 | 965,220 | 876,798 |
| Wyoming | 221,864 | 241,300 | 62348 | 261,165 | 259,891 | 271,406 | 289,120 |
| **National Average** | **1,076,611** | **1,143,857** | **490,319** | **1,131,800** | **1,208,385** | **1,270,969** | **1,355,395** |

**Three Year Rolling Average**

| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
|---|---|---|---|---|---|---|
| Kentucky | 634,087 | 684,154 | 693,950 | 828,839 | 821,848 | -29.61% |
| New Hampshire | 287,389 | 301,565 | 308,003 | 436,786 | 425,969 | -48.22% |
| Hawaii | 789,670 | 720,639 | 763,271 | 980,744 | 1,030,949 | -30.55% |
| Kansas | 439,370 | 469,723 | 496,594 | 625,847 | 643,059 | -46.36% |
| Vermont | 3,407,016 | 3,481,182 | 3,856,053 | 4,818,136 | 5,068,976 | -48.78% |
| Wisconsin | 509,569 | 544,879 | 554,265 | 692,387 | 789,904 | -55.01% |
| Rhode Island | 1,118,935 | 1,070,348 | 1,009,299 | 1,268,512 | 1,314,990 | -17.52% |
| Pennsylvania | 380,414 | 350,579 | 338,078 | 435,804 | 524,703 | -37.93% |
| Connecticut | 2,413,962 | 2,625,344 | 2,438,907 | 3,203,639 | 3,674,914 | -52.24% |
| Illinois | 1,054,173 | 1,044,783 | 1,097,552 | 1,458,961 | 1,576,259 | -49.53% |
| Minnesota | 279,744 | 313,961 | 302,592 | 384,701 | 307,703 | -9.99% |
| New Jersey | 197,779 | 204,865 | 218,050 | 275,996 | 281,523 | -42.34% |
| Montana | 1,996,126 | 1,996,491 | 1,923,208 | 2,311,528 | 2,400,325 | -20.25% |
| Alabama | 801,327 | 791,692 | 745,968 | 993,072 | 1,173,216 | -46.41% |
| Maryland | 507,187 | 536,311 | 545,813 | 697,707 | 698,621 | -37.74% |
| Tennessee | 756,557 | 670,194 | 557,491 | 741,562 | 854,018 | -12.88% |
| West Virginia | 1,074,856 | 1,200,283 | 948,437 | 1,098,124 | 1,061,093 | 1.28% |
| Arizona | 811,961 | 857,237 | 1,034,675 | 1,271,493 | 1,334,392 | -64.34% |
| Oregon | 276,381 | 278,688 | 319,272 | 404,145 | 445,121 | -61.05% |
| New Mexico | 817,732 | 861,947 | 841,273 | 1,046,823 | 1,060,423 | -29.68% |
| Iowa | 1,441,110 | 1,625,378 | 1,670,191 | 2,822,057 | 2,921,380 | -102.72% |
| Delaware | 939,322 | 844,806 | 916,554 | 1,195,047 | 1,416,286 | -50.78% |
| Washington | 744,637 | 738,868 | 735,590 | 862,682 | 904,214 | -21.43% |
| Idaho | 402,232 | 435,746 | 463,986 | 566,760 | 588,194 | -46.23% |
| Nebraska | 788,959 | 855,382 | 936,219 | 1,137,556 | 1,164,165 | -47.56% |
| Texas | 276,379 | 293,896 | 278,008 | 339,148 | 351,666 | -27.24% |
| Mississippi | 295,450 | 318,140 | 336,308 | 408,736 | 425,553 | -44.04% |
| Arkansas | 295,048 | 316,411 | 341,520 | 410,509 | 434,914 | -47.40% |
| Indiana | 280,136 | 245,402 | 234,119 | 298,024 | 300,447 | -7.25% |
| South Carolina | 2,070,563 | 1,501,929 | 1,807,197 | 2,360,613 | 2,537,020 | -22.53% |
| Nevada | 372,520 | 397,263 | 403,532 | 504,411 | 504,142 | -35.33% |
| Missouri | 2,715,648 | 3,135,872 | 3,051,066 | 4,188,633 | 4,293,146 | -58.09% |
| Virginia | 1,376,643 | 1,500,246 | 1,572,522 | 1,870,867 | 2,048,498 | -48.80% |
| Alaska | 125,715 | 132,885 | 139,665 | 195,784 | 208,388 | -65.76% |
| California | 1,411,937 | 1,503,911 | 1,710,155 | 2,104,158 | 2,310,771 | -63.66% |
| North Carolina | 616,439 | 436,380 | 479,564 | 649,048 | 923,180 | -49.76% |
| Georgia | 505,519 | 506,609 | 537,919 | 639,997 | 682,363 | -34.98% |
| Oklahoma | 2,826,654 | 2,818,679 | 2,612,459 | 3,118,451 | 3,293,466 | -16.51% |
| Michigan | 253,405 | 259,816 | 246,721 | 273,770 | 290,460 | -14.62% |
| Florida | 480,243 | 487,619 | 509,008 | 661,883 | 707,035 | -47.22% |
| Colorado | 179,261 | 193,641 | 194,307 | 264,671 | 281,790 | -57.20% |
| Wyoming | 852,948 | 807,411 | 828,776 | 1,030,841 | 1,107,199 | -29.81% |
| South Dakota | 2,847,837 | 2,996,683 | 3,289,410 | 3,912,172 | 4,110,339 | -44.33% |
| New York | 233,125 | 295,040 | 338,579 | 663,666 | 799,783 | -243.07% |
| Maine | 151,451 | 147,739 | 133,131 | 171,330 | 171,765 | -13.41% |
| Ohio | 1,454,345 | 1,567,099 | 1,603,395 | 2,075,124 | 2,154,932 | -48.17% |
| Louisiana | 1,003,750 | 1,095,547 | 1,174,960 | 1,426,914 | 1,384,959 | -37.98% |
| North Dakota | 690,497 | 716,233 | 703,474 | 864,367 | 899,042 | -30.20% |
| Massachusetts | 818,586 | 731,814 | 739,504 | 929,713 | 935,910 | -14.33% |
| Utah | 175,171 | 188,271 | 194,468 | 264,154 | 273,472 | -56.12% |
| **National Average** | **903,595** | **921,992** | **943,501** | **1,203,718** | **1,278,250** | **-41.46%** |

Table 2 Appendix A

Capital and Bridge Disbursements (in thousands of $)

Original Data

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|
| Alabama | 327,518 | 470,233 | 384,292 | 436,663 | 469,574 | 439,077 | 535,282 |
| Alaska | 213,000 | 242,000 | 240,417 | 254,068 | 270,591 | 251,881 | 224,607 |
| Arizona | 488,274 | 454,634 | 468,587 | 430,605 | 562,387 | 516,319 | 616,493 |
| Arkansas | 325,826 | 345,648 | 368,078 | 359,411 | 439,680 | 507,686 | 481,334 |
| California | 2,089,004 | 2,090,728 | 2,385,554 | 2,223,505 | 2,319,581 | 2,556,213 | 2,533,949 |
| Colorado | 386,491 | 341,276 | 377,943 | 378,603 | 425,454 | 405,556 | 573,632 |
| Connecticut | 691,154 | 588,046 | 631,524 | 596,585 | 543,216 | 580,407 | 493,498 |
| Delaware | 193,959 | 205,535 | 223,266 | 240,412 | 223,464 | 213,453 | 248,520 |
| Florida | 1,440,203 | 1,675,637 | 1,800,280 | 2,088,012 | 2,140,695 | 2,110,615 | 2,427,630 |
| Georgia | 699,149 | 737,696 | 729,928 | 881,235 | 1,067,286 | 602,207 | 1,046,659 |
| Hawaii | 316,797 | 300,561 | 300,561 | 212,288 | 225,642 | 251,731 | 194,523 |
| Idaho | 111,528 | 124,933 | 151,259 | 143,008 | 152,683 | 175,454 | 173,947 |
| Illinois | 1,443,338 | 1,300,146 | 1,115,904 | 1,321,367 | 1,123,375 | 1,236,335 | 1,234,146 |
| Indiana | 567,006 | 560,516 | 523,871 | 508,280 | 524,973 | 577,280 | 785,504 |
| Iowa | 400,691 | 412,640 | 413,456 | 459,382 | 471,432 | 488,070 | 505,566 |
| Kansas | 352,267 | 379,849 | 491,551 | 559,875 | 691,346 | 605,028 | 569,036 |
| Kentucky | 683,377 | 482,610 | 636,465 | 561,870 | 576,251 | 599,653 | 656,549 |
| Louisiana | 650,766 | 598,835 | 594,918 | 552,283 | 544,885 | 486,455 | 643,033 |
| Maine | 143,850 | 136,176 | 153,053 | 156,027 | 264,316 | 210,921 | 182,268 |
| Maryland | 511,583 | 471,633 | 406,514 | 540,932 | 611,652 | 688,734 | 588,224 |
| Massachusetts | 871,763 | 821,113 | 1,198,735 | 1,346,997 | 1,381,369 | 1,292,750 | 1,751,205 |
| Michigan | 546,839 | 555,849 | 607,830 | 728,919 | 692,425 | 711,738 | 870,085 |
| Minnesota | 587,390 | 520,364 | 440,122 | 426,081 | 426,669 | 450,414 | 472,511 |
| Mississippi | 332,638 | 317,850 | 302,181 | 342,328 | 453,949 | 467,867 | 481,578 |
| Missouri | 464,531 | 497,980 | 623,366 | 631,104 | 699,981 | 788,264 | 741,430 |
| Montana | 191,070 | 190,349 | 196,416 | 183,346 | 212,829 | 205,288 | 211,567 |
| Nebraska | 244,117 | 264,521 | 334,578 | 279,909 | 303,781 | 298,901 | 265,811 |
| Nevada | 168,487 | 187,941 | 272,170 | 292,183 | 266,727 | 226,552 | 218,907 |
| New Hampshire | 86,815 | 167,893 | 121,556 | 129,216 | 130,233 | 129,121 | 147,780 |
| New Jersey | 1,250,419 | 953,446 | 916,404 | 730,561 | 687,466 | 729,364 | 720,772 |
| New Mexico | 245,616 | 312,089 | 290,816 | 310,607 | 249,988 | 271,001 | 261,029 |
| New York | 1,172,069 | 1,974,911 | 1,999,040 | 1,847,891 | 1,759,409 | 1,989,341 | 2,255,865 |
| North Carolina | 772,594 | 817,921 | 937,932 | 1,008,170 | 1,021,271 | 1,162,323 | 1,322,466 |
| North Dakota | 93,070 | 95,501 | 116,333 | 120,314 | 105,111 | 153,018 | 155,137 |
| Ohio | 679,950 | 741,026 | 927,496 | 964,441 | 914,203 | 1,059,826 | 1,263,858 |
| Oklahoma | 320,609 | 252,354 | 269,912 | 328,286 | 385,319 | 346,616 | 400,131 |
| Oregon | 335,881 | 317,148 | 352,162 | 315,752 | 353,368 | 384,468 | 450,821 |
| Pennsylvania | 1,223,271 | 1,285,148 | 1,562,771 | 1,443,354 | 1,351,022 | 1,792,605 | 1,546,071 |
| Rhode Island | 136,323 | 221,563 | 244,794 | 197,663 | 166,423 | 125,747 | 180,173 |
| South Carolina | 332,967 | 396,059 | 400,063 | 356,099 | 386,001 | 432,016 | 441,828 |
| South Dakota | 159,816 | 186,888 | 179,176 | 169,049 | 180,048 | 210,264 | 176,604 |
| Tennessee | 613,158 | 547,498 | 564,117 | 587,009 | 627,635 | 664,066 | 746,963 |
| Texas | 1,710,015 | 1,978,812 | 1,908,011 | 1,803,125 | 2,458,767 | 2,194,642 | 2,368,058 |
| Utah | 182,428 | 212,994 | 197,700 | 214,400 | 230,500 | 541,834 | 795,830 |
| Vermont | 87,148 | 95,091 | 66,303 | 74,730 | 73,797 | 82,592 | 83,841 |
| Virginia | 649,972 | 625,765 | 814,053 | 908,891 | 1,019,907 | 1,116,381 | 1,244,313 |
| Washington | 501,683 | 676,259 | 701,195 | 768,337 | 722,967 | 781,896 | 687,375 |
| West Virginia | 356,770 | 467,439 | 479,340 | 457,244 | 608,595 | 610,464 | 499,433 |
| Wisconsin | 626,822 | 563,034 | 561,027 | 527,999 | 551,312 | 592,673 | 599,797 |
| Wyoming | 127,015 | 140,931 | 168,617 | 151,824 | 159,092 | 160,289 | 189,597 |
| **National Average** | **542,141** | **566,101** | **603,033** | **611,005** | **644,573** | **669,508** | **725,305** |

Three Year Rolling Average Data

| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
|---|---|---|---|---|---|---|
| Alabama | 394,014 | 430,396 | 430,176 | 448,438 | 481,311 | -22.16% |
| Alaska | 231,806 | 245,495 | 255,025 | 258,847 | 249,026 | -7.43% |
| Arizona | 470,498 | 451,275 | 487,193 | 503,104 | 565,066 | -20.10% |
| Arkansas | 346,517 | 357,712 | 389,056 | 435,592 | 476,233 | -37.43% |
| California | 2,188,429 | 2,233,262 | 2,309,547 | 2,366,433 | 2,469,914 | -12.86% |
| Colorado | 368,570 | 365,941 | 394,000 | 403,204 | 468,214 | -27.04% |
| Connecticut | 636,908 | 605,385 | 590,442 | 573,403 | 539,040 | 15.37% |
| Delaware | 207,587 | 223,071 | 229,047 | 225,776 | 228,479 | -10.06% |
| Florida | 1,638,707 | 1,854,643 | 2,009,662 | 2,113,107 | 2,226,313 | -35.86% |
| Georgia | 722,258 | 782,953 | 892,816 | 850,243 | 905,384 | -25.35% |
| Hawaii | 305,973 | 271,137 | 246,164 | 229,887 | 223,965 | 26.80% |
| Idaho | 129,240 | 139,733 | 148,983 | 157,048 | 167,361 | -29.50% |
| Illinois | 1,286,463 | 1,245,806 | 1,186,882 | 1,227,026 | 1,197,952 | 6.88% |
| Indiana | 550,464 | 530,889 | 519,041 | 536,844 | 629,252 | -14.31% |
| Iowa | 408,929 | 428,493 | 448,090 | 472,961 | 488,356 | -19.42% |
| Kansas | 407,889 | 477,092 | 580,924 | 618,750 | 621,803 | -52.44% |
| Kentucky | 600,817 | 560,315 | 591,529 | 579,258 | 610,818 | -1.66% |
| Louisiana | 614,840 | 582,012 | 564,029 | 527,874 | 558,124 | 9.22% |
| Maine | 144,360 | 148,419 | 191,132 | 210,421 | 219,168 | -51.82% |
| Maryland | 463,243 | 473,026 | 519,699 | 613,773 | 629,537 | -35.90% |
| Massachusetts | 963,870 | 1,122,282 | 1,309,034 | 1,340,372 | 1,475,108 | -53.04% |
| Michigan | 570,173 | 630,866 | 676,391 | 711,027 | 758,083 | -32.96% |
| Minnesota | 515,959 | 462,189 | 430,957 | 434,388 | 449,865 | 12.81% |
| Mississippi | 317,556 | 320,786 | 366,153 | 421,381 | 467,798 | -47.31% |
| Missouri | 528,626 | 584,150 | 651,484 | 706,450 | 743,225 | -40.60% |
| Montana | 192,612 | 190,037 | 197,530 | 200,488 | 209,895 | -8.97% |
| Nebraska | 281,072 | 293,003 | 306,089 | 294,197 | 289,498 | -3.00% |
| Nevada | 209,533 | 250,765 | 277,027 | 261,821 | 237,395 | -13.30% |
| New Hampshire | 125,421 | 139,555 | 127,002 | 129,523 | 135,711 | -8.20% |
| New Jersey | 1,040,090 | 866,804 | 778,144 | 715,797 | 712,534 | 31.49% |
| New Mexico | 282,840 | 304,504 | 283,804 | 277,199 | 260,673 | 7.84% |
| New York | 1,715,340 | 1,940,614 | 1,868,780 | 1,865,547 | 2,001,538 | -16.68% |
| North Carolina | 842,816 | 921,341 | 989,124 | 1,063,921 | 1,168,687 | -38.66% |
| North Dakota | 101,635 | 110,716 | 113,919 | 126,148 | 137,755 | -35.54% |
| Ohio | 782,824 | 877,654 | 935,380 | 979,490 | 1,079,296 | -37.87% |
| Oklahoma | 280,958 | 283,517 | 327,839 | 353,407 | 377,355 | -34.31% |
| Oregon | 335,064 | 328,354 | 340,427 | 351,196 | 396,219 | -18.25% |
| Pennsylvania | 1,357,063 | 1,430,424 | 1,452,382 | 1,528,994 | 1,563,233 | -15.19% |
| Rhode Island | 200,893 | 221,340 | 202,960 | 163,278 | 157,448 | 21.63% |
| South Carolina | 376,363 | 384,074 | 380,721 | 391,372 | 419,948 | -11.58% |
| South Dakota | 175,293 | 178,371 | 176,091 | 186,454 | 188,972 | -7.80% |
| Tennessee | 574,924 | 566,208 | 592,920 | 626,237 | 679,555 | -18.20% |
| Texas | 1,865,613 | 1,896,649 | 2,056,634 | 2,152,178 | 2,340,489 | -25.45% |
| Utah | 197,707 | 208,365 | 214,200 | 328,911 | 522,721 | -164.39% |
| Vermont | 82,847 | 78,708 | 71,610 | 77,040 | 80,077 | 3.34% |
| Virginia | 696,597 | 782,903 | 914,284 | 1,015,060 | 1,126,867 | -61.77% |
| Washington | 626,379 | 715,264 | 730,833 | 757,733 | 730,746 | -16.66% |
| West Virginia | 434,516 | 468,008 | 515,060 | 558,768 | 572,831 | -31.83% |
| Wisconsin | 583,628 | 550,687 | 546,779 | 557,328 | 581,261 | 0.41% |
| Wyoming | 145,521 | 153,791 | 159,844 | 157,068 | 169,659 | -16.59% |
| **National Average** | **570,425** | **593,380** | **619,537** | **641,695** | **679,795** | **-19.17%** |

**Table 3 Appendix A**

**Maintenance Disbursements (in thousands of $)**

**Original Data**

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|
| Alabama | 134,450 | 157,868 | 179,326 | 221,082 | 239,188 | 219,187 | 173,483 |
| Alaska | 121,900 | 130,000 | 125,495 | 123,161 | 121,406 | 124,498 | 122,800 |
| Arizona | 68,907 | 74,471 | 71,724 | 76,205 | 85,150 | 70,109 | 80,569 |
| Arkansas | 113,232 | 111,443 | 104,751 | 116,415 | 121,943 | 128,621 | 130,053 |
| California | 511,977 | 612,198 | 601,447 | 563,991 | 601,521 | 632,779 | 704,725 |
| Colorado | 128,060 | 154,997 | 124,085 | 171,212 | 133,471 | 167,142 | 161,402 |
| Connecticut | 60,753 | 72,364 | 82,518 | 67,855 | 81,745 | 72,879 | 79,536 |
| Delaware | 55,562 | 59,733 | 69,078 | 60,087 | 78,068 | 76,651 | 100,737 |
| Florida | 282,812 | 311,412 | 375,355 | 425,667 | 463,498 | 413,780 | 423,879 |
| Georgia | 185,909 | 224,490 | 227,073 | 256,364 | 281,872 | 297,131 | 139,499 |
| Hawaii | 19,763 | 19,813 | 19,813 | 17,469 | 19,843 | 37,740 | 21,861 |
| Idaho | 49,296 | 58,673 | 59,035 | 57,632 | 60,604 | 54,780 | 55,062 |
| Illinois | 291,073 | 325,017 | 321,144 | 337,326 | 313,919 | 322,931 | 360,700 |
| Indiana | 201,342 | 209,589 | 198,168 | 208,483 | 236,356 | 226,539 | 300,951 |
| Iowa | 100,801 | 110,692 | 100,227 | 116,465 | 120,146 | 128,157 | 119,699 |
| Kansas | 81,227 | 104,387 | 94,798 | 106,755 | 98,155 | 103,171 | 115,699 |
| Kentucky | 152,045 | 154,157 | 175,554 | 194,427 | 187,779 | 181,977 | 192,700 |
| Louisiana | 59,191 | 121,414 | 150,064 | 135,863 | 150,169 | 131,855 | 150,762 |
| Maine | 114,900 | 116,580 | 105,013 | 115,913 | 137,848 | 143,333 | 130,782 |
| Maryland | 149,131 | 158,492 | 195,572 | 153,552 | 198,746 | 179,911 | 180,052 |
| Massachusetts | 146,150 | 155,638 | 159,507 | 123,484 | 233,224 | 156,413 | 209,644 |
| Michigan | 138,763 | 145,051 | 196,613 | 201,078 | 207,084 | 210,572 | 194,985 |
| Minnesota | 144,894 | 161,489 | 150,321 | 150,436 | 223,692 | 268,519 | 233,789 |
| Mississippi | 54,704 | 57,397 | 65,312 | 65,727 | 66,227 | 69,928 | 73,354 |
| Missouri | 210,439 | 218,493 | 275,994 | 251,071 | 287,519 | 281,421 | 253,895 |
| Montana | 42,087 | 53,339 | 61,176 | 66,800 | 61,778 | 61,632 | 66,663 |
| Nebraska | 51,993 | 55,918 | 56,782 | 58,682 | 44,526 | 62,580 | 63,144 |
| Nevada | 58,785 | 60,342 | 64,330 | 57,283 | 61,478 | 63,845 | 78,158 |
| New Hampshire | 98,469 | 84,585 | 89,028 | 80,184 | 91,969 | 100,645 | 86,214 |
| New Jersey | 358,862 | 328,351 | 322,665 | 335,496 | 327,246 | 389,000 | 362,205 |
| New Mexico | 63,812 | 59,565 | 115,306 | 71,731 | 89,312 | 74,512 | 62,266 |
| New York | 606,776 | 641,591 | 820,040 | 848,487 | 866,149 | 772,577 | 784,817 |
| North Carolina | 362,139 | 407,864 | 436,718 | 447,896 | 447,497 | 473,145 | 565,572 |
| North Dakota | 34,178 | 35,210 | 37,574 | 36,564 | 36,698 | 46,026 | 25,597 |
| Ohio | 460,687 | 440,968 | 372,777 | 419,478 | 421,397 | 402,568 | 309,543 |
| Oklahoma | 88,492 | 112,237 | 113,458 | 113,093 | 127,538 | 138,936 | 138,663 |
| Oregon | 120,773 | 160,585 | 103,730 | 124,043 | 173,805 | 155,084 | 169,911 |
| Pennsylvania | 764,351 | 802,039 | 813,511 | 789,490 | 875,269 | 999,149 | 1,194,673 |
| Rhode Island | 23,710 | 41,771 | 57,114 | 43,309 | 56,730 | 47,055 | 47,010 |
| South Carolina | 156,266 | 136,028 | 137,044 | 131,337 | 139,534 | 149,053 | 143,806 |
| South Dakota | 33,371 | 38,619 | 41,209 | 39,955 | 37,974 | 47,590 | 40,208 |
| Tennessee | 192,392 | 185,130 | 180,825 | 219,049 | 216,049 | 249,143 | 223,131 |
| Texas | 564,131 | 674,529 | 657,718 | 768,466 | 773,737 | 797,728 | 820,661 |
| Utah | 59,893 | 66,850 | 68,400 | 72,000 | 74,525 | 78,971 | 88,408 |
| Vermont | 36,024 | 22,539 | 36,080 | 38,565 | 39,795 | 45,173 | 49,306 |
| Virginia | 468,402 | 509,428 | 686,415 | 688,408 | 654,685 | 694,852 | 676,989 |
| Washington | 193,795 | 193,348 | 202,148 | 197,949 | 227,643 | 222,105 | 238,753 |
| West Virginia | 161,301 | 165,529 | 175,210 | 190,589 | 196,566 | 218,124 | 271,228 |
| Wisconsin | 116,788 | 123,971 | 132,435 | 134,425 | 140,649 | 146,905 | 143,407 |
| Wyoming | 52,018 | 52,084 | 63,451 | 67,841 | 68,018 | 71,834 | 78,300 |
| **National Averag** | **174,936** | **189,566** | **201,463** | **207,177** | **219,995** | **224,165** | **228,785** |

**Three Year Rolling Average Data**

| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
|---|---|---|---|---|---|---|
| Alabama | 157,215 | 186,092 | 213,199 | 226,486 | 210,619 | -33.97% |
| Alaska | 125,798 | 126,219 | 123,354 | 123,022 | 122,901 | 2.30% |
| Arizona | 71,701 | 74,133 | 77,693 | 77,155 | 78,609 | -9.64% |
| Arkansas | 109,809 | 110,870 | 114,370 | 122,326 | 126,872 | -15.54% |
| California | 575,207 | 592,545 | 588,986 | 599,430 | 646,342 | -12.37% |
| Colorado | 135,714 | 150,098 | 142,923 | 157,275 | 154,005 | -13.48% |
| Connecticut | 71,878 | 74,246 | 77,373 | 74,160 | 78,053 | -8.59% |
| Delaware | 61,458 | 62,966 | 69,078 | 71,602 | 85,152 | -38.55% |
| Florida | 323,193 | 370,811 | 421,507 | 434,315 | 433,719 | -34.20% |
| Georgia | 212,491 | 235,976 | 255,103 | 278,456 | 239,501 | -12.71% |
| Hawaii | 19,796 | 19,032 | 19,042 | 25,017 | 26,481 | -33.77% |
| Idaho | 55,668 | 58,447 | 59,090 | 57,672 | 56,815 | -2.06% |
| Illinois | 312,411 | 327,829 | 324,130 | 324,725 | 332,517 | -6.44% |
| Indiana | 203,033 | 205,413 | 214,336 | 223,793 | 254,615 | -25.41% |
| Iowa | 103,907 | 109,128 | 112,279 | 121,589 | 122,667 | -18.06% |
| Kansas | 93,471 | 101,980 | 99,903 | 102,694 | 105,675 | -13.06% |
| Kentucky | 160,585 | 174,713 | 185,920 | 188,061 | 187,485 | -16.75% |
| Louisiana | 110,223 | 135,780 | 145,365 | 139,296 | 144,262 | -30.88% |
| Maine | 112,164 | 112,502 | 119,591 | 132,365 | 137,321 | -22.43% |
| Maryland | 167,732 | 169,205 | 182,623 | 177,403 | 186,236 | -11.03% |
| Massachusetts | 153,765 | 146,210 | 172,072 | 171,040 | 199,760 | -29.91% |
| Michigan | 160,142 | 180,914 | 201,592 | 206,245 | 204,214 | -27.52% |
| Minnesota | 152,235 | 154,082 | 174,816 | 214,216 | 242,000 | -58.97% |
| Mississippi | 59,138 | 62,812 | 65,755 | 67,294 | 69,836 | -18.09% |
| Missouri | 234,975 | 248,519 | 271,528 | 273,337 | 274,278 | -16.73% |
| Montana | 52,201 | 60,438 | 63,251 | 63,403 | 63,358 | -21.37% |
| Nebraska | 54,898 | 57,127 | 53,330 | 55,263 | 56,750 | -3.37% |
| Nevada | 61,152 | 60,652 | 61,030 | 60,869 | 67,827 | -10.91% |
| New Hampshire | 90,694 | 84,599 | 87,060 | 90,933 | 92,943 | -2.48% |
| New Jersey | 336,626 | 328,837 | 328,469 | 350,581 | 359,484 | -6.79% |
| New Mexico | 79,561 | 82,201 | 92,116 | 78,518 | 75,363 | 5.28% |
| New York | 689,469 | 770,039 | 844,892 | 829,071 | 807,848 | -17.17% |
| North Carolina | 402,240 | 430,826 | 444,037 | 456,179 | 495,405 | -23.16% |
| North Dakota | 35,654 | 36,449 | 36,945 | 39,763 | 36,107 | -1.27% |
| Ohio | 424,811 | 411,074 | 404,551 | 414,481 | 377,836 | 11.06% |
| Oklahoma | 104,729 | 112,929 | 118,030 | 126,522 | 135,046 | -28.95% |
| Oregon | 128,363 | 129,453 | 133,859 | 150,977 | 166,267 | -29.53% |
| Pennsylvania | 793,300 | 801,680 | 826,090 | 887,969 | 1,023,030 | -28.96% |
| Rhode Island | 40,865 | 47,398 | 52,384 | 49,031 | 50,265 | -23.00% |
| South Carolina | 143,113 | 134,803 | 135,972 | 139,975 | 144,131 | -0.71% |
| South Dakota | 37,733 | 39,928 | 39,713 | 41,840 | 41,924 | -11.11% |
| Tennessee | 186,116 | 195,001 | 205,308 | 228,080 | 229,441 | -23.28% |
| Texas | 632,126 | 700,238 | 733,307 | 779,977 | 797,375 | -26.14% |
| Utah | 65,048 | 69,083 | 71,642 | 75,165 | 80,635 | -23.96% |
| Vermont | 31,548 | 32,395 | 38,147 | 41,178 | 44,758 | -41.87% |
| Virginia | 554,748 | 628,084 | 676,503 | 679,315 | 675,509 | -21.77% |
| Washington | 196,430 | 197,815 | 209,247 | 215,899 | 229,500 | -16.84% |
| West Virginia | 167,347 | 177,109 | 187,455 | 201,760 | 228,639 | -36.63% |
| Wisconsin | 124,398 | 130,277 | 135,836 | 140,660 | 143,654 | -15.48% |
| Wyoming | 55,851 | 61,125 | 66,437 | 69,231 | 72,717 | -30.20% |
| **National Average** | **188,655** | **199,402** | **209,545** | **217,112** | **224,315** | **-18.90%** |

**Table 4 Appendix A**

**Administrative Disbursements (in thousand of $)**

| | Orignal Data | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Alabama | 62,387 | 55,532 | 63,396 | 61,533 | 67,160 | 59,698 | 70,040 |
| Alaska | 20,900 | 28,900 | 26,825 | 27,330 | 28,220 | 28,298 | 27,000 |
| Arizona | 46,570 | 54,606 | 61,154 | 45,872 | 55,137 | 38,118 | 45,845 |
| Arkansas | 16,311 | 19,665 | 19,857 | 19,713 | 19,531 | 16,618 | 20,859 |
| California | 643,092 | 687,771 | 670,973 | 593,511 | 539,352 | 540,315 | 717,350 |
| Colorado | 14,320 | 32,813 | 91,909 | 57,480 | 57,418 | 35,986 | 43,843 |
| Connecticut | 56,593 | 64,163 | 68,447 | 62,672 | 61,008 | 62,111 | 67,027 |
| Delaware | 50,489 | 18,621 | 25,574 | 37,456 | 36,478 | 39,740 | 40,105 |
| Florida | 198,063 | 139,635 | 140,902 | 163,751 | 193,644 | 239,526 | 185,088 |
| Georgia | 70,845 | 79,274 | 85,607 | 93,437 | 107,136 | 112,641 | 63,349 |
| Hawaii | 23,175 | 22,879 | 22,879 | 24,122 | 24,621 | 24,667 | 29,238 |
| Idaho | 26,800 | 26,265 | 16,666 | 20,628 | 21,382 | 19,040 | 19,415 |
| Illinois | 188,024 | 204,262 | 179,950 | 221,807 | 242,195 | 265,864 | 182,337 |
| Indiana | 56,257 | 60,665 | 54,395 | 63,468 | 64,465 | 66,348 | 91,471 |
| Iowa | 72,179 | 42,995 | 43,022 | 47,466 | 42,556 | 41,476 | 42,518 |
| Kansas | 84,961 | 35,339 | 35,600 | 48,126 | 47,056 | 49,942 | 52,908 |
| Kentucky | 69,866 | 48,141 | 55,632 | 56,536 | 102,966 | 83,701 | 108,988 |
| Louisiana | 48,663 | 69,274 | 82,474 | 87,718 | 134,878 | 155,219 | 120,228 |
| Maine | 12,182 | 15,388 | 13,958 | 18,078 | 17,923 | 22,435 | 8,629 |
| Maryland | 66,124 | 83,413 | 137,388 | 142,579 | 48,127 | 49,875 | 54,051 |
| Massachusetts | 157,244 | 160,149 | 173,910 | 181,751 | 192,055 | 179,221 | 184,122 |
| Michigan | 156,682 | 167,344 | 97,288 | 91,590 | 109,717 | 52,582 | 62,238 |
| Minnesota | 75,463 | 65,433 | 39,178 | 67,565 | 88,175 | 70,306 | 86,617 |
| Mississippi | 30,559 | 39,939 | 39,278 | 32,848 | 34,355 | 38,023 | 46,944 |
| Missouri | 117,580 | 116,104 | 87,847 | 96,920 | 34,263 | 33,829 | 40,928 |
| Montana | 13,565 | 13,999 | 17,395 | 24,782 | 33,217 | 42,578 | 29,813 |
| Nebraska | 12,411 | 13,208 | 9,934 | 18,731 | 15,609 | 15,617 | 16,979 |
| Nevada | 14,258 | 15,903 | 18,864 | 21,134 | 21,068 | 24,394 | 32,227 |
| New Hampshire | 77,766 | 19,380 | 29,103 | 20,884 | 20,516 | 22,440 | 20,974 |
| New Jersey | 314,513 | 189,392 | 284,136 | 196,834 | 131,504 | 139,681 | 252,121 |
| New Mexico | 56,672 | 38,641 | 37,504 | 50,837 | 67,997 | 67,769 | 116,275 |
| New York | 395,821 | 444,099 | 477,549 | 409,335 | 520,363 | 325,472 | 216,349 |
| North Carolina | 103,318 | 115,180 | 115,071 | 116,954 | 136,527 | 169,661 | 151,049 |
| North Dakota | 14,744 | 17,264 | 18,537 | 18,897 | 21,033 | 20,397 | 23,452 |
| Ohio | 272,457 | 265,765 | 251,948 | 135,522 | 141,057 | 167,556 | 154,408 |
| Oklahoma | 97,740 | 64,855 | 51,021 | 58,043 | 62,880 | 56,230 | 68,400 |
| Oregon | 26,652 | 27,887 | 74,537 | 78,348 | 93,962 | 79,024 | 73,704 |
| Pennsylvania | 86,662 | 109,569 | 96,407 | 98,501 | 119,866 | 144,025 | 107,719 |
| Rhode Island | 7,133 | 6,635 | 8,370 | 7,690 | 8,753 | 11,051 | 11,856 |
| South Carolina | 446,219 | 59,249 | 20,259 | 68,349 | 44,895 | 42,925 | 48,189 |
| South Dakota | 15,527 | 18,055 | 17,987 | 17,989 | 16,247 | 20,224 | 20,798 |
| Tennessee | 60,486 | 68,042 | 62,429 | 83,889 | 94,431 | 88,144 | 86,283 |
| Texas | 265,972 | 341,505 | 387,771 | 426,196 | 348,275 | 277,141 | 301,227 |
| Utah | 27,131 | 30,182 | 25,062 | 33,047 | 34,784 | 38,449 | 44,608 |
| Vermont | 10,919 | 12,134 | 19,515 | 19,827 | 19,538 | 19,191 | 17,706 |
| Virginia | 116,231 | 138,704 | 157,466 | 157,866 | 154,097 | 147,135 | 183,985 |
| Washington | 126,056 | 138,493 | 148,812 | 189,315 | 142,654 | 168,997 | 149,175 |
| West Virginia | 28,878 | 49,826 | 42,047 | 57,699 | 56,640 | 43,911 | 57,045 |
| Wisconsin | 54,620 | 65,148 | 79,840 | 73,037 | 71,310 | 76,098 | 76,120 |
| Wyoming | 20,293 | 22,551 | 18,554 | 17,653 | 16,808 | 14,448 | 15,165 |
| | | | | | | | |
| **National Average** | **100,627** | **92,485** | **96,085** | **95,306** | **95,277** | **90,963** | **93,735** |

| | Three Year Rolling Average Data | | | | | Improvement |
|---|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | 1997 | |
| Alabama | 60,438 | 60,154 | 64,030 | 62,797 | 65,633 | -8.59% |
| Alaska | 25,542 | 27,685 | 27,458 | 27,949 | 27,839 | -9.00% |
| Arizona | 54,110 | 53,877 | 54,054 | 46,376 | 46,367 | 14.31% |
| Arkansas | 18,611 | 19,745 | 19,700 | 18,621 | 19,003 | -2.10% |
| California | 667,279 | 650,752 | 601,279 | 557,726 | 599,006 | 10.23% |
| Colorado | 46,347 | 60,734 | 68,936 | 50,295 | 45,749 | 1.29% |
| Connecticut | 63,068 | 65,094 | 64,042 | 61,930 | 63,382 | -0.50% |
| Delaware | 31,561 | 27,217 | 33,169 | 37,891 | 38,774 | -22.85% |
| Florida | 159,533 | 148,096 | 166,099 | 198,974 | 206,086 | -29.18% |
| Georgia | 78,575 | 86,106 | 95,393 | 104,405 | 94,375 | -20.11% |
| Hawaii | 22,978 | 23,293 | 23,874 | 24,470 | 26,175 | -13.92% |
| Idaho | 23,244 | 21,186 | 19,559 | 20,350 | 19,946 | 14.19% |
| Illinois | 190,745 | 202,006 | 214,651 | 243,289 | 230,132 | -20.65% |
| Indiana | 57,106 | 59,509 | 60,776 | 64,760 | 74,095 | -29.75% |
| Iowa | 52,732 | 44,494 | 44,348 | 43,833 | 42,183 | 20.00% |
| Kansas | 51,967 | 39,688 | 43,594 | 48,375 | 49,969 | 3.84% |
| Kentucky | 57,880 | 53,436 | 71,711 | 81,068 | 98,552 | -70.27% |
| Louisiana | 66,804 | 79,822 | 101,690 | 125,938 | 136,775 | -104.74% |
| Maine | 13,843 | 15,808 | 16,653 | 19,479 | 16,329 | -17.96% |
| Maryland | 95,642 | 121,127 | 109,365 | 80,194 | 50,684 | 47.01% |
| Massachusetts | 163,768 | 171,937 | 182,572 | 184,342 | 185,133 | -13.05% |
| Michigan | 140,438 | 118,741 | 99,532 | 84,630 | 74,846 | 46.71% |
| Minnesota | 60,025 | 57,392 | 64,973 | 75,349 | 81,699 | -36.11% |
| Mississippi | 36,592 | 37,355 | 35,494 | 35,075 | 39,774 | -8.70% |
| Missouri | 107,177 | 100,290 | 73,010 | 55,004 | 36,340 | 66.09% |
| Montana | 14,986 | 18,725 | 25,131 | 33,526 | 35,203 | -134.90% |
| Nebraska | 11,851 | 13,958 | 14,758 | 16,652 | 16,068 | -35.59% |
| Nevada | 16,342 | 18,634 | 20,355 | 22,199 | 25,896 | -58.47% |
| New Hampshire | 42,083 | 23,122 | 23,501 | 21,280 | 21,310 | 49.36% |
| New Jersey | 262,680 | 223,454 | 204,158 | 156,006 | 174,435 | 33.59% |
| New Mexico | 44,272 | 42,327 | 52,113 | 62,201 | 84,014 | -89.77% |
| New York | 439,156 | 443,661 | 469,082 | 418,390 | 354,061 | 19.38% |
| North Carolina | 111,190 | 115,735 | 122,851 | 141,047 | 152,412 | -37.07% |
| North Dakota | 16,848 | 18,233 | 19,489 | 20,109 | 21,627 | -28.36% |
| Ohio | 263,390 | 217,745 | 176,176 | 148,045 | 154,340 | 41.40% |
| Oklahoma | 71,205 | 57,973 | 57,315 | 59,051 | 62,503 | 12.22% |
| Oregon | 43,025 | 60,257 | 82,282 | 83,778 | 82,230 | -91.12% |
| Pennsylvania | 97,546 | 101,492 | 104,925 | 120,797 | 123,870 | -26.99% |
| Rhode Island | 7,379 | 7,565 | 8,271 | 9,165 | 10,553 | -43.01% |
| South Carolina | 175,242 | 49,286 | 44,501 | 52,056 | 45,336 | 74.13% |
| South Dakota | 17,190 | 18,010 | 17,408 | 18,153 | 19,090 | -11.05% |
| Tennessee | 63,652 | 71,453 | 80,250 | 88,821 | 89,619 | -40.80% |
| Texas | 331,749 | 385,157 | 387,414 | 350,537 | 308,881 | 6.89% |
| Utah | 27,458 | 29,430 | 30,964 | 35,427 | 39,280 | -43.05% |
| Vermont | 14,189 | 17,159 | 19,627 | 19,519 | 18,812 | -32.58% |
| Virginia | 137,467 | 151,345 | 156,476 | 153,033 | 161,739 | -17.66% |
| Washington | 137,787 | 158,873 | 160,260 | 166,989 | 153,609 | -11.48% |
| West Virginia | 40,250 | 49,857 | 52,129 | 52,750 | 52,532 | -30.51% |
| Wisconsin | 66,536 | 72,675 | 74,729 | 73,482 | 74,509 | -11.98% |
| Wyoming | 20,466 | 19,586 | 17,672 | 16,303 | 15,474 | 24.39% |
| | | | | | | |
| **National Average** | **96,399** | **94,625** | **95,556** | **93,849** | **93,325** | **3.19%** |

Table 5 Appendix A

**Total Disbursements (in thousands of $)**

| Original Data | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Alabama | 635,180 | 752,004 | 704,900 | 800,849 | 869,259 | 823,972 | 848,746 |
| Alaska | 389,619 | 428,437 | 420,310 | 432,146 | 447,752 | 430,459 | 399,697 |
| Arizona | 897,469 | 1,194,325 | 1,226,672 | 795,076 | 1,112,557 | 884,604 | 1,000,398 |
| Arkansas | 482,354 | 518,859 | 529,275 | 534,302 | 619,070 | 692,104 | 674,986 |
| California | 3,848,398 | 3,880,552 | 4,395,001 | 4,073,114 | 4,262,484 | 4,496,297 | 4,827,972 |
| Colorado | 568,956 | 568,826 | 661,548 | 662,430 | 680,157 | 686,824 | 852,318 |
| Connecticut | 1,295,878 | 1,573,698 | 1,333,294 | 1,132,185 | 1,182,034 | 1,153,459 | 1,395,239 |
| Delaware | 397,784 | 551,017 | 558,273 | 438,222 | 448,844 | 445,769 | 642,824 |
| Florida | 2,395,644 | 3,767,478 | 2,973,981 | 3,061,472 | 3,196,214 | 3,454,210 | 3,747,670 |
| Georgia | 1,341,854 | 1,287,946 | 1,229,685 | 1,431,227 | 1,667,592 | 1,363,091 | 1,548,827 |
| Hawaii | 403,203 | 419,737 | 373,480 | 349,330 | 331,509 | 371,518 | 307,390 |
| Idaho | 202,021 | 224,731 | 244,571 | 239,689 | 254,633 | 268,489 | 266,926 |
| Illinois | 2,380,876 | 2,647,979 | 2,038,777 | 2,282,428 | 2,326,837 | 2,261,110 | 2,572,372 |
| Indiana | 920,119 | 1,005,631 | 856,838 | 963,894 | 940,032 | 1,131,343 | 1,285,737 |
| Iowa | 640,566 | 640,925 | 628,526 | 700,956 | 716,114 | 730,007 | 746,059 |
| Kansas | 695,366 | 825,411 | 715,076 | 815,896 | 951,341 | 875,853 | 1,096,428 |
| Kentucky | 1,217,783 | 1,480,378 | 1,090,074 | 1,163,222 | 1,098,884 | 1,062,965 | 1,200,769 |
| Louisiana | 1,033,872 | 1,027,441 | 1,058,561 | 1,150,098 | 1,370,872 | 1,133,856 | 1,352,933 |
| Maine | 319,437 | 316,071 | 327,267 | 354,063 | 484,369 | 447,848 | 461,491 |
| Maryland | 931,518 | 1,048,294 | 877,084 | 987,886 | 1,065,905 | 1,081,350 | 1,090,006 |
| Massachusetts | 1,662,122 | 1,847,589 | 1,856,916 | 2,243,324 | 2,284,785 | 2,925,322 | 3,058,345 |
| Michigan | 1,118,906 | 1,049,295 | 1,137,364 | 1,230,594 | 1,253,170 | 1,244,928 | 1,746,605 |
| Minnesota | 908,312 | 851,671 | 734,175 | 716,600 | 817,665 | 882,789 | 881,581 |
| Mississippi | 464,308 | 492,542 | 484,960 | 519,334 | 667,847 | 634,196 | 658,231 |
| Missouri | 874,490 | 914,278 | 1,063,960 | 1,079,085 | 1,146,263 | 1,214,364 | 1,147,954 |
| Montana | 277,885 | 415,787 | 307,787 | 359,745 | 346,650 | 349,929 | 347,091 |
| Nebraska | 334,062 | 361,590 | 428,171 | 385,583 | 391,559 | 408,168 | 377,647 |
| Nevada | 279,130 | 312,569 | 401,490 | 437,948 | 419,293 | 380,524 | 388,696 |
| New Hampshire | 419,833 | 353,456 | 327,754 | 297,778 | 312,653 | 319,625 | 325,384 |
| New Jersey | 2,990,888 | 2,423,222 | 2,222,995 | 1,926,269 | 2,631,964 | 1,992,966 | 2,253,775 |
| New Mexico | 383,706 | 451,719 | 483,717 | 479,824 | 455,878 | 462,175 | 512,123 |
| New York | 2,847,266 | 3,933,113 | 4,010,793 | 3,931,632 | 3,852,098 | 3,961,708 | 5,017,704 |
| North Carolina | 1,372,941 | 1,535,335 | 1,714,028 | 1,769,501 | 1,830,900 | 1,986,352 | 2,235,343 |
| North Dakota | 152,543 | 157,687 | 181,925 | 186,591 | 173,159 | 231,504 | 215,930 |
| Ohio | 1,716,784 | 1,670,069 | 1,828,268 | 1,802,182 | 1,800,804 | 1,963,364 | 2,315,246 |
| Oklahoma | 1,208,296 | 512,888 | 533,508 | 606,370 | 680,830 | 648,902 | 689,281 |
| Oregon | 674,608 | 555,771 | 588,514 | 579,569 | 678,682 | 680,232 | 755,904 |
| Pennsylvania | 3,370,596 | 3,441,441 | 3,216,832 | 2,980,817 | 2,942,165 | 3,586,541 | 3,718,273 |
| Rhode Island | 255,764 | 341,265 | 347,955 | 287,123 | 295,477 | 225,334 | 339,227 |
| South Carolina | 590,276 | 656,284 | 610,585 | 610,040 | 632,956 | 695,987 | 711,616 |
| South Dakota | 222,423 | 255,693 | 250,762 | 240,379 | 247,049 | 298,874 | 248,704 |
| Tennessee | 928,074 | 865,495 | 875,683 | 961,261 | 1,009,477 | 1,071,868 | 1,132,372 |
| Texas | 2,791,038 | 3,374,192 | 3,399,000 | 3,275,438 | 3,968,872 | 3,889,522 | 3,926,454 |
| Utah | 293,197 | 330,382 | 314,405 | 344,751 | 365,669 | 697,896 | 994,058 |
| Vermont | 162,753 | 179,374 | 157,789 | 161,152 | 161,780 | 175,556 | 182,230 |
| Virginia | 1,628,449 | 1,580,194 | 1,858,676 | 1,930,067 | 2,130,843 | 2,162,633 | 2,418,908 |
| Washington | 1,071,645 | 1,401,690 | 1,241,997 | 1,420,347 | 1,324,422 | 1,395,861 | 1,309,287 |
| West Virginia | 684,991 | 889,546 | 775,724 | 780,879 | 935,405 | 940,327 | 892,392 |
| Wisconsin | 1,044,689 | 988,536 | 889,436 | 854,153 | 891,980 | 940,795 | 958,929 |
| Wyoming | 214,570 | 232,985 | 264,207 | 251,804 | 259,497 | 263,154 | 296,163 |
| | | | | | | | |
| **National Average** | **1,038,849** | **1,130,708** | **1,095,051** | **1,100,373** | **1,178,725** | **1,208,530** | **1,327,485** |

| Three Year Rolling Average Data | | | | | | |
|---|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
| Alabama | 697,361 | 752,584 | 791,669 | 831,360 | 847,326 | -21.5% |
| Alaska | 412,789 | 426,964 | 433,403 | 436,786 | 425,969 | -3.2% |
| Arizona | 1,106,155 | 1,072,024 | 1,044,768 | 930,746 | 999,186 | 9.7% |
| Arkansas | 510,163 | 527,479 | 560,882 | 615,159 | 662,053 | -29.8% |
| California | 4,041,317 | 4,116,222 | 4,243,533 | 4,277,298 | 4,528,918 | -12.1% |
| Colorado | 599,777 | 630,935 | 668,045 | 676,470 | 739,766 | -23.3% |
| Connecticut | 1,400,957 | 1,346,392 | 1,215,838 | 1,155,893 | 1,243,577 | 11.2% |
| Delaware | 502,358 | 515,837 | 481,780 | 444,278 | 512,479 | -2.0% |
| Florida | 3,045,701 | 3,267,644 | 3,077,222 | 3,237,299 | 3,466,031 | -13.8% |
| Georgia | 1,286,495 | 1,316,286 | 1,442,835 | 1,487,303 | 1,526,503 | -18.7% |
| Hawaii | 398,807 | 380,849 | 351,440 | 350,786 | 336,806 | 15.5% |
| Idaho | 223,774 | 236,330 | 246,298 | 254,270 | 263,349 | -17.7% |
| Illinois | 2,355,877 | 2,323,061 | 2,216,014 | 2,290,125 | 2,386,773 | -1.3% |
| Indiana | 927,529 | 942,121 | 920,255 | 1,011,756 | 1,119,037 | -20.6% |
| Iowa | 636,672 | 656,802 | 681,865 | 715,692 | 730,727 | -14.8% |
| Kansas | 745,284 | 785,461 | 827,438 | 881,030 | 974,541 | -30.8% |
| Kentucky | 1,262,745 | 1,244,558 | 1,117,393 | 1,108,357 | 1,120,873 | 11.2% |
| Louisiana | 1,039,958 | 1,078,700 | 1,193,177 | 1,218,275 | 1,285,887 | -23.6% |
| Maine | 320,925 | 332,467 | 388,566 | 428,760 | 464,569 | -44.8% |
| Maryland | 952,299 | 971,088 | 976,958 | 1,045,047 | 1,079,087 | -13.3% |
| Massachusetts | 1,788,876 | 1,982,610 | 2,128,342 | 2,484,477 | 2,756,151 | -54.1% |
| Michigan | 1,101,855 | 1,139,084 | 1,207,043 | 1,242,897 | 1,414,901 | -28.4% |
| Minnesota | 831,386 | 767,482 | 756,147 | 805,685 | 860,678 | -3.5% |
| Mississippi | 480,603 | 498,945 | 557,380 | 607,126 | 653,425 | -36.0% |
| Missouri | 950,909 | 1,019,108 | 1,096,436 | 1,146,571 | 1,169,527 | -23.0% |
| Montana | 333,820 | 361,106 | 338,061 | 352,108 | 347,890 | -4.2% |
| Nebraska | 374,608 | 391,781 | 401,771 | 395,103 | 392,458 | -4.8% |
| Nevada | 331,063 | 384,002 | 419,577 | 412,588 | 396,171 | -19.7% |
| New Hampshire | 367,014 | 326,329 | 312,728 | 310,019 | 319,221 | 13.0% |
| New Jersey | 2,545,702 | 2,190,829 | 2,260,409 | 2,183,733 | 2,292,902 | 9.9% |
| New Mexico | 439,714 | 471,753 | 473,140 | 465,959 | 476,725 | -8.4% |
| New York | 3,597,057 | 3,958,513 | 3,931,508 | 3,915,146 | 4,277,170 | -18.9% |
| North Carolina | 1,540,768 | 1,672,955 | 1,771,476 | 1,862,251 | 2,017,532 | -30.9% |
| North Dakota | 164,052 | 175,401 | 180,558 | 197,085 | 206,864 | -26.1% |
| Ohio | 1,738,374 | 1,766,840 | 1,810,418 | 1,855,450 | 2,026,471 | -16.6% |
| Oklahoma | 751,564 | 550,922 | 606,903 | 645,367 | 673,004 | 10.5% |
| Oregon | 606,298 | 574,618 | 615,588 | 646,161 | 704,939 | -16.3% |
| Pennsylvania | 3,342,956 | 3,213,030 | 3,046,605 | 3,169,841 | 3,415,660 | -2.2% |
| Rhode Island | 314,995 | 325,448 | 310,185 | 269,311 | 286,679 | 9.0% |
| South Carolina | 619,048 | 625,636 | 617,860 | 646,328 | 680,186 | -9.9% |
| South Dakota | 242,959 | 248,945 | 246,063 | 262,101 | 264,876 | -9.0% |
| Tennessee | 889,751 | 900,813 | 948,807 | 1,014,202 | 1,071,239 | -20.4% |
| Texas | 3,188,077 | 3,349,543 | 3,547,770 | 3,711,277 | 3,928,283 | -23.2% |
| Utah | 312,661 | 329,846 | 341,608 | 469,439 | 685,874 | -119.4% |
| Vermont | 166,639 | 166,105 | 160,240 | 166,163 | 173,189 | -3.9% |
| Virginia | 1,689,106 | 1,789,646 | 1,973,195 | 2,074,514 | 2,237,461 | -32.5% |
| Washington | 1,238,444 | 1,354,678 | 1,328,922 | 1,380,210 | 1,343,190 | -8.5% |
| West Virginia | 783,420 | 815,383 | 830,669 | 885,537 | 922,708 | -17.8% |
| Wisconsin | 974,220 | 910,708 | 878,523 | 895,643 | 930,568 | 4.5% |
| Wyoming | 237,254 | 249,665 | 258,503 | 258,152 | 272,938 | -15.0% |
| | | | | | | |
| **National Average** | **1,088,203** | **1,108,711** | **1,124,716** | **1,162,543** | **1,238,247** | **-13.79%** |

## Appendix B: Output Data

This section presents the 'output' data for all fifty states. Information presented includes: Rural Interstate Pavement Condition, Urban Interstate Pavement Condition, Rural Other Principal Arterial Pavement Condition, Bridge Condition, Urban Interstate Congestion, Fatal Accident Rate, and Rural Other Principal Arterial Narrow Lane Width.

**Table 1 Appendix B**
**Rural Interstate Pavement Condition**
**(% of Rural Interstate miles rated > 171 inches/mile of roughness)**

| Original Data | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Alabama | 8.80% | 6.15% | 0.67% | 0.67% | 0.00% | 0.00% | 0.00% |
| Alaska | 29.53% | 22.36% | 18.10% | 9.01% | 9.68% | 9.57% | 8.45% |
| Arizona | 0.58% | 1.52% | 0.71% | 1.51% | 0.20% | 0.70% | 1.41% |
| Arkansas | 4.53% | 31.80% | 31.27% | 30.75% | 30.50% | 28.28% | 42.24% |
| California | 5.60% | 2.88% | 5.83% | 8.32% | 5.95% | 5.91% | 5.90% |
| Colorado | 3.78% | 18.49% | 18.10% | 33.72% | 23.05% | 19.27% | 13.67% |
| Connecticut | 14.85% | 14.85% | 12.87% | 12.87% | 4.95% | 4.95% | 2.97% |
| Delaware | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Dist. of Columbia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Florida | 8.51% | 1.67% | 1.15% | 0.42% | 0.31% | 0.00% | 0.00% |
| Georgia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Hawaii | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Idaho | 8.65% | 8.27% | 4.70% | 4.70% | 3.20% | 1.51% | 1.52% |
| Illinois | 0.73% | 2.32% | 3.52% | 3.34% | 1.97% | 1.58% | 0.00% |
| Indiana | 1.09% | 1.45% | 1.82% | 1.64% | 0.59% | 0.12% | 0.00% |
| Iowa | 0.94% | 0.94% | 0.47% | 0.47% | 0.79% | 0.00% | 0.16% |
| Kansas | 0.57% | 4.87% | 4.58% | 1.00% | 0.00% | 2.44% | 1.00% |
| Kentucky | 0.73% | 0.74% | 5.22% | 7.65% | 0.00% | 0.00% | 0.00% |
| Louisiana | 8.33% | 8.39% | 5.76% | 0.16% | 3.93% | 6.37% | 9.15% |
| Maine | 1.28% | 0.32% | 0.32% | 0.00% | 0.00% | 0.00% | 0.00% |
| Maryland | 11.01% | 9.69% | 7.05% | 0.44% | 0.44% | 0.00% | 0.44% |
| Massachusetts | 5.88% | 0.62% | 0.62% | 2.47% | 2.47% | 1.85% | 0.62% |
| Michigan | 3.91% | 3.24% | 4.19% | 2.97% | 4.32% | 4.32% | 8.91% |
| Minnesota | 21.26% | 32.60% | 38.18% | 53.30% | 6.31% | 3.38% | 8.08% |
| Mississippi | 0.72% | 43.55% | 7.89% | 7.89% | 5.38% | 5.91% | 5.21% |
| Missouri | 0.00% | 4.80% | 0.74% | 0.25% | 0.25% | 2.22% | 2.11% |
| Montana | 6.92% | 8.44% | 8.44% | 3.78% | 3.78% | 0.88% | 0.88% |
| Nebraska | 0.00% | 16.25% | 16.25% | 12.36% | 0.00% | 4.35% | 5.72% |
| Nevada | 6.30% | 0.00% | 0.00% | 0.00% | 3.75% | 6.04% | 6.04% |
| New Hampshire | 0.56% | 0.57% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| New Jersey | 0.00% | 0.00% | 7.02% | 11.11% | 10.92% | 19.33% | 19.33% |
| New Mexico | 5.95% | 5.40% | 6.49% | 8.97% | 4.04% | 10.87% | 2.69% |
| New York | 4.74% | 3.51% | 3.51% | 4.77% | 4.77% | 2.38% | 2.38% |
| North Carolina | 11.16% | 6.48% | 12.95% | 9.35% | 16.28% | 14.58% | 13.39% |
| North Dakota | 0.00% | 3.58% | 6.23% | 6.23% | 5.27% | 0.00% | 0.00% |
| Ohio | 2.01% | 1.53% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Oklahoma | 3.72% | 2.52% | 2.52% | 4.99% | 4.99% | 3.33% | 3.33% |
| Oregon | 0.00% | 0.00% | 0.00% | 0.00% | 0.34% | 0.00% | 38.04% |
| Pennsylvania | 16.34% | 12.70% | 11.39% | 10.64% | 8.70% | 6.83% | 0.58% |
| Rhode Island | 0.00% | 0.00% | 4.76% | 4.76% | 4.76% | 0.00% | 0.00% |
| South Carolina | 4.64% | 2.25% | 0.60% | 0.00% | 0.00% | 0.00% | 0.00% |
| South Dakota | 2.69% | 7.61% | 6.52% | 4.61% | 4.61% | 7.79% | 5.72% |
| Tennessee | 0.00% | 1.89% | 0.95% | 0.14% | 0.00% | 0.00% | 0.00% |
| Texas | 0.04% | 0.00% | 7.94% | 6.17% | 0.54% | 0.54% | 0.14% |
| Utah | 0.52% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 2.08% |
| Vermont | 1.06% | 0.36% | 0.36% | 0.36% | 0.00% | 0.00% | 0.00% |
| Virginia | 1.02% | 0.51% | 10.03% | 7.63% | 0.42% | 0.42% | 0.56% |
| Washington | 11.38% | 3.99% | 3.39% | 3.19% | 4.99% | 4.59% | 0.40% |
| West Virginia | 3.06% | 2.85% | 3.05% | 7.63% | 7.19% | 1.31% | 1.10% |
| Wisconsin | 5.03% | 3.03% | 1.84% | 1.84% | 1.04% | 0.87% | 1.57% |
| Wyoming | 6.89% | 7.01% | 8.95% | 0.00% | 0.00% | 0.00% | 0.00% |
| **National Average** | **4.85%** | **6.39%** | **6.04%** | **6.01%** | **3.86%** | **3.72%** | **4.47%** |

| Three Year Rolling Average Data | | | | | | |
|---|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
| Alabama | 5.21% | 2.49% | 0.44% | 0.22% | 0.00% | 100.00% |
| Alaska | 23.33% | 16.49% | 12.26% | 9.42% | 9.23% | 60.42% |
| Arizona | 0.94% | 1.25% | 0.81% | 0.81% | 0.77% | 17.68% |
| Arkansas | 22.53% | 31.27% | 30.84% | 29.84% | 33.67% | -49.45% |
| California | 4.77% | 5.68% | 6.70% | 6.73% | 5.92% | -24.08% |
| Colorado | 13.45% | 23.44% | 24.96% | 25.35% | 18.66% | -38.71% |
| Connecticut | 14.19% | 13.53% | 10.23% | 7.59% | 4.29% | 69.77% |
| Delaware | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Dist. of Columbia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Florida | 3.78% | 1.08% | 0.63% | 0.25% | 0.10% | 97.24% |
| Georgia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Hawaii | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Idaho | 7.21% | 5.89% | 4.20% | 3.13% | 2.08% | 71.20% |
| Illinois | 2.19% | 3.06% | 2.94% | 2.30% | 1.18% | 45.95% |
| Indiana | 1.45% | 1.64% | 1.35% | 0.78% | 0.23% | 83.88% |
| Iowa | 0.79% | 0.63% | 0.58% | 0.42% | 0.32% | 59.87% |
| Kansas | 3.34% | 3.49% | 1.86% | 1.15% | 1.15% | 65.71% |
| Kentucky | 2.23% | 4.54% | 4.29% | 2.55% | 0.00% | 100.00% |
| Louisiana | 7.49% | 4.77% | 3.28% | 3.49% | 6.48% | 13.47% |
| Maine | 0.64% | 0.21% | 0.11% | 0.00% | 0.00% | 100.00% |
| Maryland | 9.25% | 5.73% | 2.64% | 0.29% | 0.29% | 96.84% |
| Massachusetts | 2.37% | 1.23% | 1.85% | 2.26% | 1.65% | 30.61% |
| Michigan | 3.78% | 3.47% | 3.83% | 3.87% | 5.85% | -54.86% |
| Minnesota | 30.68% | 41.36% | 32.60% | 21.00% | 5.92% | 80.70% |
| Mississippi | 17.38% | 19.77% | 7.05% | 6.39% | 5.50% | 68.37% |
| Missouri | 1.85% | 1.93% | 0.41% | 0.91% | 1.53% | 17.36% |
| Montana | 7.94% | 6.89% | 5.34% | 2.81% | 1.85% | 76.72% |
| Nebraska | 10.83% | 14.95% | 9.53% | 5.57% | 3.36% | 69.01% |
| Nevada | 2.10% | 0.00% | 1.25% | 3.26% | 5.28% | -151.22% |
| New Hampshire | 0.38% | 0.19% | 0.00% | 0.00% | 0.00% | 100.00% |
| New Jersey | 2.34% | 6.04% | 9.68% | 13.79% | 16.53% | -606.51% |
| New Mexico | 5.95% | 6.96% | 6.50% | 7.96% | 5.87% | 1.40% |
| New York | 3.92% | 3.93% | 4.35% | 3.98% | 3.18% | 18.94% |
| North Carolina | 10.20% | 9.59% | 12.86% | 13.40% | 14.75% | -44.59% |
| North Dakota | 3.27% | 5.34% | 5.91% | 3.83% | 1.76% | 46.22% |
| Ohio | 1.18% | 0.51% | 0.00% | 0.00% | 0.00% | 100.00% |
| Oklahoma | 2.92% | 3.34% | 4.17% | 4.44% | 3.88% | -33.09% |
| Oregon | 0.00% | 0.00% | 0.11% | 0.11% | 12.79% | 0.00% |
| Pennsylvania | 13.48% | 11.57% | 10.24% | 8.72% | 5.37% | 60.15% |
| Rhode Island | 1.59% | 3.17% | 4.76% | 3.17% | 1.59% | 0.00% |
| South Carolina | 2.50% | 0.95% | 0.20% | 0.00% | 0.00% | 100.00% |
| South Dakota | 5.61% | 6.25% | 5.25% | 5.67% | 6.04% | -7.78% |
| Tennessee | 0.95% | 0.99% | 0.36% | 0.05% | 0.00% | 100.00% |
| Texas | 2.66% | 4.71% | 4.89% | 2.42% | 0.41% | 84.68% |
| Utah | 0.17% | 0.00% | 0.00% | 0.00% | 0.69% | -298.96% |
| Vermont | 0.59% | 0.36% | 0.24% | 0.12% | 0.00% | 100.00% |
| Virginia | 3.85% | 6.05% | 6.03% | 2.82% | 0.47% | 87.89% |
| Washington | 6.25% | 3.53% | 3.86% | 4.26% | 3.33% | 46.81% |
| West Virginia | 2.99% | 4.51% | 5.95% | 5.37% | 3.20% | -7.12% |
| Wisconsin | 3.30% | 2.23% | 1.57% | 1.25% | 1.16% | 64.81% |
| Wyoming | 7.62% | 5.32% | 2.98% | 0.00% | 0.00% | 100.00% |
| **National Average** | **5.8%** | **6.15%** | **5.30%** | **4.53%** | **4.01%** | **30.32%** |

**Table 2 Appendix B**
**Urban Interstate Pavement Condition**
**(% of Urban Interstate miles rated > 171 inches/mile of roughness)**

| Original Data | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Alabama | 33.22% | 10.77% | 0.00% | 0.00% | 1.64% | 1.64% | 1.64% |
| Alaska | 7.27% | 5.56% | 5.66% | 7.41% | 3.77% | 0.00% | 0.00% |
| Arizona | 3.76% | 0.50% | 1.12% | 0.00% | 1.16% | 0.00% | 1.16% |
| Arkansas | 5.69% | 22.90% | 23.57% | 25.00% | 24.11% | 24.00% | 30.20% |
| California | 1.56% | 0.94% | 8.68% | 12.27% | 15.29% | 17.17% | 17.12% |
| Colorado | 0.00% | 3.23% | 3.23% | 17.30% | 12.37% | 10.81% | 8.70% |
| Connecticut | 17.50% | 21.07% | 19.18% | 19.18% | 10.70% | 8.16% | 7.76% |
| Delaware | 100.00% | 29.27% | 29.27% | 30.00% | 29.27% | 29.27% | 29.27% |
| Dist. of Columbia | 66.67% | 78.57% | 66.67% | 66.67% | 23.08% | 36.36% | 41.67% |
| Florida | 10.07% | 3.54% | 2.50% | 1.90% | 1.95% | 0.58% | 0.00% |
| Georgia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Hawaii | 56.82% | 36.36% | 2.33% | 2.33% | 2.33% | 2.04% | 0.00% |
| Idaho | 5.00% | 3.80% | 1.27% | 2.47% | 1.27% | 1.22% | 1.18% |
| Illinois | 7.59% | 10.16% | 18.80% | 17.95% | 11.84% | 10.66% | 0.00% |
| Indiana | 10.48% | 10.22% | 11.82% | 13.79% | 13.48% | 12.54% | 4.08% |
| Iowa | 4.08% | 3.40% | 8.11% | 8.16% | 10.20% | 12.24% | 14.29% |
| Kansas | 2.30% | 0.00% | 0.57% | 0.00% | 0.00% | 0.00% | 0.00% |
| Kentucky | 17.97% | 10.86% | 15.49% | 16.81% | 3.54% | 2.65% | 3.98% |
| Louisiana | 13.12% | 11.79% | 10.00% | 2.21% | 7.09% | 12.77% | 21.99% |
| Maine | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Maryland | 20.08% | 12.94% | 10.98% | 8.63% | 8.63% | 8.33% | 9.92% |
| Massachusetts | 5.79% | 2.48% | 1.74% | 1.99% | 2.23% | 1.73% | 0.99% |
| Michigan | 3.41% | 7.41% | 4.82% | 5.20% | 6.61% | 6.60% | 14.80% |
| Minnesota | 9.96% | 23.61% | 24.03% | 28.76% | 2.59% | 0.43% | 2.59% |
| Mississippi | 7.03% | 74.02% | 5.51% | 7.87% | 7.87% | 6.35% | 7.03% |
| Missouri | 5.74% | 9.84% | 4.08% | 4.35% | 4.34% | 6.23% | 7.53% |
| Montana | 0.00% | 1.89% | 1.89% | 13.21% | 13.21% | 1.85% | 1.75% |
| Nebraska | 45.45% | 45.45% | 44.44% | 27.91% | 2.33% | 11.11% | 11.11% |
| Nevada | 30.43% | 1.54% | 1.25% | 1.20% | 4.82% | 1.25% | 1.16% |
| New Hampshire | 0.00% | 27.08% | 0.00% | 0.00% | 0.00% | 0.00% | 2.08% |
| New Jersey | 0.00% | 0.00% | 0.33% | 11.88% | 11.88% | 35.55% | 35.55% |
| New Mexico | 16.48% | 18.68% | 21.50% | 12.96% | 9.26% | 27.78% | 12.04% |
| New York | 34.82% | 23.33% | 23.82% | 20.80% | 20.80% | 23.36% | 23.50% |
| North Carolina | 22.16% | 15.73% | 22.55% | 18.58% | 24.85% | 19.48% | 15.86% |
| North Dakota | 7.50% | 0.00% | 0.00% | 0.00% | 2.50% | 0.00% | 0.00% |
| Ohio | 3.44% | 1.24% | 2.02% | 2.56% | 2.56% | 1.21% | 0.67% |
| Oklahoma | 11.33% | 14.02% | 14.02% | 32.06% | 32.06% | 18.66% | 18.66% |
| Oregon | 2.27% | 0.68% | 2.05% | 0.68% | 1.37% | 0.68% | 63.01% |
| Pennsylvania | 15.29% | 8.84% | 10.41% | 14.79% | 9.58% | 8.74% | 3.45% |
| Rhode Island | 0.00% | 0.00% | 4.08% | 4.17% | 4.17% | 0.00% | 2.13% |
| South Carolina | 9.86% | 8.45% | 4.23% | 0.00% | 0.63% | 0.64% | 1.91% |
| South Dakota | 39.13% | 31.91% | 16.33% | 18.37% | 14.29% | 6.12% | 12.24% |
| Tennessee | 0.00% | 6.83% | 8.67% | 8.98% | 2.48% | 2.37% | 1.47% |
| Texas | 4.98% | 3.10% | 43.16% | 4.46% | 0.39% | 0.59% | 1.96% |
| Utah | 13.10% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 8.38% |
| Vermont | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Virginia | 12.58% | 6.88% | 6.78% | 10.05% | 4.56% | 4.59% | 4.74% |
| Washington | 14.18% | 17.94% | 11.45% | 13.74% | 19.47% | 17.11% | 3.42% |
| West Virginia | 10.87% | 12.77% | 11.11% | 10.99% | 9.89% | 4.44% | 4.26% |
| Wisconsin | 19.15% | 6.99% | 9.46% | 10.74% | 11.18% | 11.05% | 11.76% |
| Wyoming | 12.79% | 14.94% | 17.24% | 3.45% | 1.15% | 1.15% | 1.15% |
| **National Average** | **14.82%** | **13.23%** | **11.12%** | **10.84%** | **8.17%** | **8.19%** | **9.36%** |

| Three Year Rolling Average Data | | | | | | |
|---|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
| Alabama | 14.67% | 3.59% | 0.55% | 1.09% | 1.64% | 88.80% |
| Alaska | 6.16% | 6.21% | 5.61% | 3.73% | 1.26% | 79.59% |
| Arizona | 1.79% | 0.54% | 0.76% | 0.39% | 0.77% | 56.88% |
| Arkansas | 17.39% | 23.82% | 24.23% | 24.37% | 26.10% | -50.13% |
| California | 3.72% | 7.29% | 12.08% | 14.91% | 16.53% | -343.89% |
| Colorado | 2.15% | 7.92% | 10.96% | 13.49% | 10.62% | -394.02% |
| Connecticut | 19.25% | 19.81% | 16.36% | 12.68% | 8.87% | 53.91% |
| Delaware | 52.85% | 29.51% | 29.51% | 29.51% | 29.27% | 44.62% |
| Dist. of Columbia | 70.63% | 70.63% | 52.14% | 42.04% | 33.70% | 52.29% |
| Florida | 5.37% | 2.65% | 2.12% | 1.48% | 0.84% | 84.31% |
| Georgia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Hawaii | 31.84% | 13.67% | 2.33% | 2.23% | 1.46% | 95.43% |
| Idaho | 3.35% | 2.51% | 1.67% | 1.65% | 1.22% | 63.61% |
| Illinois | 12.18% | 15.64% | 16.20% | 13.49% | 7.50% | 38.44% |
| Indiana | 10.84% | 11.95% | 13.03% | 13.27% | 10.03% | 7.46% |
| Iowa | 5.20% | 6.56% | 8.83% | 10.20% | 12.24% | -135.61% |
| Kansas | 0.96% | 0.19% | 0.19% | 0.00% | 0.00% | 100.00% |
| Kentucky | 14.77% | 14.39% | 11.95% | 7.67% | 3.39% | 77.04% |
| Louisiana | 11.64% | 8.00% | 6.43% | 7.35% | 13.95% | -19.87% |
| Maine | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Maryland | 14.67% | 10.85% | 9.41% | 8.53% | 8.96% | 38.91% |
| Massachusetts | 3.34% | 2.07% | 1.99% | 1.98% | 1.65% | 50.50% |
| Michigan | 5.22% | 5.81% | 5.54% | 6.14% | 9.34% | -79.02% |
| Minnesota | 19.20% | 25.46% | 18.46% | 10.59% | 1.87% | 90.27% |
| Mississippi | 28.85% | 29.13% | 7.09% | 7.37% | 7.08% | 75.45% |
| Missouri | 6.55% | 6.09% | 4.25% | 4.97% | 6.03% | 7.91% |
| Montana | 1.26% | 5.66% | 9.43% | 9.42% | 5.60% | -345.57% |
| Nebraska | 45.12% | 39.27% | 24.89% | 13.78% | 8.18% | 81.86% |
| Nevada | 11.07% | 1.33% | 2.42% | 2.42% | 2.41% | 78.23% |
| New Hampshire | 9.03% | 9.03% | 0.00% | 0.00% | 0.69% | 92.31% |
| New Jersey | 0.11% | 4.07% | 8.03% | 19.77% | 27.66% | -25291.13% |
| New Mexico | 18.89% | 17.71% | 14.57% | 16.67% | 16.36% | 13.39% |
| New York | 27.32% | 22.65% | 21.81% | 21.65% | 22.55% | 17.45% |
| North Carolina | 20.14% | 18.95% | 22.00% | 20.97% | 20.07% | 0.38% |
| North Dakota | 2.50% | 0.00% | 0.83% | 0.83% | 0.83% | 66.67% |
| Ohio | 2.23% | 1.94% | 2.38% | 2.11% | 1.48% | 33.73% |
| Oklahoma | 13.12% | 20.03% | 26.04% | 27.59% | 23.13% | -76.23% |
| Oregon | 1.67% | 1.14% | 1.37% | 0.91% | 21.69% | -1198.14% |
| Pennsylvania | 11.52% | 11.35% | 11.59% | 11.04% | 7.26% | 36.97% |
| Rhode Island | 1.36% | 2.75% | 4.14% | 2.78% | 2.10% | -54.21% |
| South Carolina | 7.51% | 4.23% | 1.62% | 0.42% | 1.06% | 85.89% |
| South Dakota | 29.12% | 22.20% | 16.33% | 12.93% | 10.88% | 62.63% |
| Tennessee | 5.17% | 8.16% | 6.71% | 4.61% | 2.11% | 59.24% |
| Texas | 17.08% | 16.91% | 16.00% | 1.81% | 0.98% | 94.27% |
| Utah | 4.37% | 0.00% | 0.00% | 0.00% | 2.79% | 35.98% |
| Vermont | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Virginia | 8.75% | 7.90% | 7.13% | 6.40% | 4.63% | 47.08% |
| Washington | 14.52% | 14.38% | 14.89% | 16.77% | 13.33% | 8.19% |
| West Virginia | 11.58% | 11.62% | 10.66% | 8.44% | 6.20% | 46.50% |
| Wisconsin | 11.87% | 9.06% | 10.46% | 10.99% | 11.33% | 4.53% |
| Wyoming | 14.99% | 11.88% | 7.28% | 1.92% | 1.15% | 92.33% |
| **National Average** | **13.06%** | **11.73%** | **10.05%** | **9.07%** | **8.58%** | **34.32%** |

**Table 3 Appendix B**

**Rural Other Principle Arterial Pavement Condidtion**

**(% of ROPA miles rated > 221 inches/mile of roughness)**

| Original Data | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|
| Alabama | 0.000% | 0.000% | 1.212% | 1.214% | 0.339% | 0.338% | 0.337% |
| Alaska | 6.728% | 2.446% | 0.612% | 0.617% | 0.864% | 0.370% | 0.000% |
| Arizona | 2.107% | 1.174% | 0.778% | 0.258% | 0.000% | 0.169% | 1.855% |
| Arkansas | 0.000% | 0.000% | 0.413% | 0.046% | 0.591% | 0.538% | 0.672% |
| California | 0.105% | 0.000% | 0.052% | 0.298% | 0.081% | 0.081% | 0.108% |
| Colorado | 0.000% | 0.000% | 0.000% | 12.636% | ######## | 14.364% | 11.636% |
| Connecticut | 4.580% | 0.760% | 0.760% | 0.758% | 1.901% | 1.141% | 1.145% |
| Delaware | 97.596% | 8.571% | 8.612% | 8.333% | 8.333% | 0.913% | 0.913% |
| Dist. of Columbia | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% |
| Florida | 0.274% | 0.274% | 0.952% | 1.365% | 0.968% | 1.290% | 0.646% |
| Georgia | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% |
| Hawaii | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% | 0.000% |
| Idaho | 6.695% | 2.258% | 1.129% | 0.832% | 0.119% | 0.476% | 0.179% |
| Illinois | 2.234% | 3.378% | 3.509% | 2.012% | 2.009% | 3.086% | 0.000% |
| Indiana | 0.000% | 0.058% | 1.457% | 1.882% | 2.354% | 0.762% | 0.117% |
| Iowa | 0.264% | 0.529% | 0.206% | 0.206% | 0.059% | 1.551% | 2.013% |
| Kansas | 0.095% | 0.727% | 0.316% | 0.158% | 0.126% | 0.346% | 0.095% |
| Kentucky | 0.000% | 1.452% | 0.307% | 0.298% | 0.050% | 0.049% | 0.098% |
| Louisiana | 17.729% | 9.959% | 9.308% | 0.000% | 1.236% | 9.406% | 2.508% |
| Maine | 3.083% | 1.370% | 0.779% | 0.767% | 0.635% | 0.762% | 0.889% |
| Maryland | 6.022% | 2.737% | 0.912% | 1.093% | 1.093% | 1.093% | 0.548% |
| Massachusetts | 0.413% | 0.617% | 0.313% | 0.314% | 2.508% | 1.597% | 0.641% |
| Michigan | 0.400% | 0.655% | 0.583% | 0.472% | 0.799% | 0.762% | 1.303% |
| Minnesota | 3.804% | 17.876% | 15.486% | 25.356% | 2.631% | 1.483% | 2.153% |
| Mississippi | 0.401% | 11.785% | 1.184% | 2.786% | 0.272% | 0.109% | 0.702% |
| Missouri | 4.479% | 2.160% | 0.625% | 0.164% | 0.197% | 1.213% | 0.839% |
| Montana | 0.618% | 0.496% | 1.487% | 1.449% | 0.191% | 0.191% | 0.343% |
| Nebraska | 1.605% | 1.494% | 1.494% | 6.375% | 2.015% | 1.872% | 1.767% |
| Nevada | 3.730% | 0.000% | 0.000% | 0.000% | 0.504% | 0.144% | 0.144% |
| New Hampshire | 0.000% | 6.100% | 2.208% | 1.542% | 1.542% | 1.535% | 1.094% |
| New Jersey | 0.000% | 0.000% | 4.461% | 0.000% | 0.000% | 11.445% | 11.466% |
| New Mexico | 2.471% | 3.613% | 8.926% | 7.650% | 5.175% | 4.616% | 4.503% |
| New York | 2.728% | 6.480% | 6.514% | 4.200% | 4.200% | 4.652% | 4.655% |
| North Carolina | 4.278% | 2.566% | 4.153% | 3.025% | 3.615% | 2.795% | 1.880% |
| North Dakota | 0.000% | 2.150% | 2.287% | 2.287% | 0.546% | 0.068% | 0.068% |
| Ohio | 0.178% | 0.059% | 0.136% | 0.180% | 0.316% | 0.135% | 0.180% |
| Oklahoma | 18.332% | 13.656% | 13.348% | 3.507% | 3.507% | 0.760% | 0.761% |
| Oregon | 1.958% | 1.126% | 0.346% | 49.347% | 1.095% | 0.106% | 1.694% |
| Pennsylvania | 7.400% | 4.470% | 1.454% | 2.181% | 2.662% | 1.932% | 1.123% |
| Rhode Island | 2.703% | 1.613% | 26.984% | 26.984% | ######## | 0.000% | 0.000% |
| South Carolina | 0.000% | 0.207% | 0.346% | 0.277% | 0.277% | 0.344% | 1.376% |
| South Dakota | 1.979% | 1.258% | 1.416% | 0.866% | 0.787% | 4.134% | 2.283% |
| Tennessee | 0.000% | 0.000% | 0.343% | 0.616% | 0.000% | 0.000% | 0.000% |
| Texas | 0.000% | 0.000% | 1.854% | 2.641% | 0.089% | 0.192% | 0.350% |
| Utah | 0.112% | 0.099% | 0.000% | 0.099% | 0.099% | 0.099% | 0.198% |
| Vermont | 2.034% | 1.887% | 0.631% | 0.629% | 3.470% | 3.470% | 5.994% |
| Virginia | 0.000% | 0.000% | 0.532% | 1.505% | 1.304% | 1.603% | 1.350% |
| Washington | 0.189% | 0.568% | 1.028% | 0.096% | 0.144% | 0.096% | 0.096% |
| West Virginia | 0.206% | 0.307% | 0.391% | 0.760% | 0.665% | 0.665% | 0.740% |
| Wisconsin | 2.075% | 0.527% | 0.177% | 0.670% | 0.893% | 1.817% | 3.630% |
| Wyoming | 0.000% | 1.530% | 1.041% | 0.061% | 0.551% | 0.000% | 0.000% |
| **National Average** | **4.19%** | **2.35%** | **2.60%** | **3.58%** | **2.08%** | **1.69%** | **1.50%** |

| Three Year Rolling Average Data | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
|---|---|---|---|---|---|---|
| Alabama | 0.40% | 0.81% | 0.92% | 0.63% | 0.34% | 16.36% |
| Alaska | 3.26% | 1.23% | 0.70% | 0.62% | 0.41% | 87.38% |
| Arizona | 1.35% | 0.74% | 0.35% | 0.14% | 0.67% | 50.14% |
| Arkansas | 0.14% | 0.15% | 0.35% | 0.39% | 0.60% | -335.87% |
| California | 0.05% | 0.12% | 0.14% | 0.15% | 0.09% | -72.37% |
| Colorado | 0.00% | 4.21% | 9.81% | 14.60% | 14.27% | 0.00% |
| Connecticut | 2.03% | 0.76% | 1.14% | 1.27% | 1.40% | 31.37% |
| Delaware | 38.26% | 8.51% | 8.43% | 5.86% | 3.39% | 91.15% |
| Dist. of Columbia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Florida | 0.50% | 0.86% | 1.10% | 1.21% | 0.97% | -93.63% |
| Georgia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Hawaii | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Idaho | 3.36% | 1.41% | 0.69% | 0.48% | 0.26% | 92.32% |
| Illinois | 3.04% | 2.97% | 2.51% | 2.37% | 1.70% | 44.14% |
| Indiana | 0.51% | 1.13% | 1.90% | 1.67% | 1.08% | -113.41% |
| Iowa | 0.33% | 0.31% | 0.16% | 0.60% | 1.21% | -262.70% |
| Kansas | 0.38% | 0.40% | 0.20% | 0.21% | 0.19% | 50.17% |
| Kentucky | 0.59% | 0.69% | 0.22% | 0.13% | 0.07% | 88.84% |
| Louisiana | 12.33% | 6.42% | 3.51% | 3.55% | 4.38% | 64.46% |
| Maine | 1.74% | 0.97% | 0.73% | 0.72% | 0.76% | 56.28% |
| Maryland | 3.22% | 1.58% | 1.03% | 1.09% | 0.91% | 71.73% |
| Massachusetts | 0.45% | 0.42% | 1.05% | 1.47% | 1.58% | -253.15% |
| Michigan | 0.55% | 0.57% | 0.62% | 0.68% | 0.95% | -74.81% |
| Minnesota | 12.39% | 19.57% | 14.49% | 9.82% | 2.09% | 83.14% |
| Mississippi | 4.46% | 5.25% | 1.41% | 1.06% | 0.36% | 91.90% |
| Missouri | 2.42% | 0.98% | 0.33% | 0.52% | 0.75% | 69.05% |
| Montana | 0.87% | 1.14% | 1.04% | 0.61% | 0.24% | 72.14% |
| Nebraska | 1.53% | 3.12% | 3.29% | 3.42% | 1.88% | -23.12% |
| Nevada | 1.24% | 0.00% | 0.17% | 0.22% | 0.26% | 78.78% |
| New Hampshire | 2.77% | 3.28% | 1.76% | 1.54% | 1.39% | 49.79% |
| New Jersey | 1.49% | 1.49% | 1.49% | 3.81% | 7.64% | -413.58% |
| New Mexico | 5.00% | 6.73% | 7.25% | 5.81% | 4.76% | 4.77% |
| New York | 5.24% | 5.73% | 4.97% | 4.35% | 4.50% | 14.09% |
| North Carolina | 3.67% | 3.25% | 3.60% | 3.15% | 2.76% | 24.62% |
| North Dakota | 1.48% | 2.24% | 1.71% | 0.97% | 0.23% | 84.62% |
| Ohio | 0.12% | 0.13% | 0.21% | 0.21% | 0.21% | -69.10% |
| Oklahoma | 15.11% | 10.17% | 6.79% | 2.59% | 1.68% | 88.91% |
| Oregon | 1.14% | 16.94% | 16.93% | 16.85% | 0.97% | 15.59% |
| Pennsylvania | 4.44% | 2.70% | 2.10% | 2.26% | 1.91% | 57.09% |
| Rhode Island | 10.43% | 18.53% | 26.98% | 17.99% | 8.99% | 13.79% |
| South Carolina | 0.18% | 0.28% | 0.30% | 0.30% | 0.67% | -260.92% |
| South Dakota | 1.55% | 1.18% | 1.02% | 1.93% | 2.40% | -54.82% |
| Tennessee | 0.11% | 0.32% | 0.32% | 0.21% | 0.00% | 100.00% |
| Texas | 0.62% | 1.50% | 1.53% | 0.97% | 0.21% | 65.99% |
| Utah | 0.07% | 0.07% | 0.07% | 0.10% | 0.13% | -87.45% |
| Vermont | 1.52% | 1.05% | 1.58% | 2.52% | 4.31% | -184.16% |
| Virginia | 0.18% | 0.68% | 1.11% | 1.47% | 1.42% | -699.75% |
| Washington | 0.60% | 0.56% | 0.42% | 0.11% | 0.11% | 81.17% |
| West Virginia | 0.30% | 0.49% | 0.61% | 0.70% | 0.69% | -129.04% |
| Wisconsin | 0.93% | 0.46% | 0.58% | 1.13% | 2.11% | -128.15% |
| Wyoming | 0.86% | 0.88% | 0.55% | 0.20% | 0.18% | 78.55% |
| **National average** | **3.05%** | **2.84%** | **2.75%** | **2.45%** | **1.76%** | **42.31%** |

**Table 4 Appendix B**
**Urban Interstate Congestion**
**(% of Urban Interstate miles Volume/Capacity Ratio>.071)**

| Original Data | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Alabama | 36.91% | 45.79% | 50.17% | 31.02% | 27.54% | 30.59% | 34.21% |
| Alaska | 54.55% | 37.04% | 47.17% | 11.11% | 11.32% | 13.21% | 20.75% |
| Arizona | 42.11% | 14.36% | 12.36% | 6.18% | 13.87% | 13.37% | 20.35% |
| Arkansas | 21.95% | 35.11% | 34.29% | 23.61% | 26.95% | 27.33% | 24.16% |
| California | 83.56% | 82.85% | 78.82% | 78.81% | 68.30% | 66.32% | 69.88% |
| Colorado | 48.63% | 48.39% | 44.09% | 47.57% | 46.24% | 43.24% | 47.83% |
| Connecticut | 82.92% | 83.47% | 81.22% | 56.73% | 56.79% | 64.90% | 58.78% |
| Delaware | 58.54% | 60.98% | 65.85% | 57.50% | 34.15% | 41.46% | 34.15% |
| Dist. of Columbia | 91.67% | 92.86% | 91.67% | 91.67% | 61.54% | 72.73% | 66.67% |
| Florida | 60.67% | 61.08% | 62.43% | 48.10% | 53.61% | 54.83% | 47.88% |
| Georgia | 37.56% | 48.16% | 65.52% | 67.82% | 72.35% | 68.88% | 29.29% |
| Hawaii | 54.55% | 54.55% | 58.14% | 55.81% | 41.86% | 44.90% | 38.78% |
| Idaho | 55.00% | 53.16% | 53.16% | 11.11% | 12.66% | 18.29% | 23.53% |
| Illinois | 52.44% | 48.89% | 51.66% | 45.04% | 45.17% | 46.52% | 47.76% |
| Indiana | 20.95% | 20.77% | 26.84% | 17.24% | 20.38% | 19.75% | 15.05% |
| Iowa | 17.69% | 21.09% | 21.62% | 23.13% | 17.69% | 17.69% | 21.09% |
| Kansas | 43.10% | 13.29% | 19.54% | 13.22% | 15.52% | 16.09% | 18.97% |
| Kentucky | 41.94% | 16.74% | 36.73% | 44.69% | 50.00% | 49.56% | 45.13% |
| Louisiana | 38.91% | 36.88% | 48.89% | 29.41% | 23.76% | 26.24% | 26.60% |
| Maine | 16.98% | 18.52% | 12.96% | 9.09% | 10.91% | 11.11% | 9.26% |
| Maryland | 91.34% | ######## | 75.69% | 64.71% | 64.31% | 65.08% | 70.24% |
| Massachusetts | 53.40% | 55.33% | 56.58% | 36.72% | 36.97% | 43.32% | 46.78% |
| Michigan | 72.09% | 70.14% | 59.44% | 42.60% | 43.09% | 45.20% | 51.40% |
| Minnesota | 54.11% | 58.80% | 73.39% | 63.09% | 68.10% | 65.09% | 71.12% |
| Mississippi | 12.50% | 22.05% | 36.22% | 29.92% | 24.41% | 21.43% | 27.34% |
| Missouri | 71.04% | 69.40% | 72.83% | 72.55% | 49.59% | 49.86% | 51.88% |
| Montana | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Nebraska | 56.82% | 40.91% | 40.00% | 34.88% | 30.23% | 24.44% | 22.22% |
| Nevada | 42.03% | 41.54% | 53.75% | 37.35% | 48.19% | 50.00% | 48.84% |
| New Hampshire | 29.79% | 33.33% | 50.00% | 29.17% | 33.33% | 33.33% | 43.75% |
| New Jersey | 62.63% | 64.00% | 75.82% | 43.56% | 49.83% | 50.50% | 57.81% |
| New Mexico | 28.57% | 25.27% | 20.56% | 16.67% | 20.37% | 20.37% | 22.22% |
| New York | 61.44% | 58.61% | 63.34% | 33.90% | 38.32% | 37.61% | 37.18% |
| North Carolina | 58.08% | 60.83% | 66.17% | 46.31% | 46.78% | 45.56% | 52.69% |
| North Dakota | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Ohio | 50.28% | 50.55% | 64.74% | 51.89% | 56.93% | 60.70% | 61.91% |
| Oklahoma | 24.63% | 26.64% | 26.64% | 27.75% | 26.79% | 28.23% | 29.19% |
| Oregon | 60.61% | 57.53% | 58.90% | 47.95% | 52.74% | 54.79% | 53.42% |
| Pennsylvania | 39.41% | 44.79% | 44.60% | 28.60% | 26.89% | 29.87% | 30.18% |
| Rhode Island | 75.51% | 71.43% | 77.55% | 54.17% | 45.83% | 51.06% | 53.19% |
| South Carolina | 67.61% | 61.27% | 66.20% | 46.20% | 46.84% | 50.32% | 56.69% |
| South Dakota | 43.48% | 40.43% | 40.82% | 42.86% | 0.00% | 0.00% | 0.00% |
| Tennessee | 55.32% | 54.04% | 61.92% | 54.80% | 57.28% | 53.25% | 55.75% |
| Texas | 54.87% | 51.31% | 53.93% | 40.64% | 43.79% | 46.34% | 54.42% |
| Utah | 67.26% | 62.50% | 34.91% | 18.34% | 28.99% | 31.36% | 22.75% |
| Vermont | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Virginia | 64.47% | 93.58% | 74.37% | 40.20% | 46.84% | 47.45% | 49.63% |
| Washington | 50.19% | 74.43% | 76.34% | 59.92% | 58.78% | 65.02% | 66.54% |
| West Virginia | 28.26% | 27.66% | 25.56% | 14.29% | 15.38% | 2.22% | 7.45% |
| Wisconsin | 65.25% | 67.13% | 65.54% | 50.34% | 44.12% | 41.28% | 42.35% |
| Wyoming | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| **National average** | **47.09%** | **46.71%** | **48.61%** | **37.22%** | **35.59%** | **36.48%** | **37.00%** |

| Three Year Rolling Average Data | | | | | | |
|---|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
| Alabama | 44.29% | 42.33% | 36.24% | 29.72% | 30.78% | 30.50% |
| Alaska | 46.25% | 31.77% | 23.20% | 11.88% | 15.09% | 67.36% |
| Arizona | 22.94% | 10.97% | 10.80% | 11.14% | 15.86% | 30.84% |
| Arkansas | 30.45% | 31.00% | 28.28% | 25.96% | 26.15% | 14.13% |
| California | 81.74% | 80.16% | 75.31% | 71.15% | 68.17% | 16.61% |
| Colorado | 47.04% | 46.68% | 45.96% | 45.68% | 45.77% | 2.69% |
| Connecticut | 82.54% | 73.81% | 64.92% | 59.47% | 60.15% | 27.12% |
| Delaware | 61.79% | 61.44% | 52.50% | 44.37% | 36.59% | 40.79% |
| Dist. of Columbia | 92.06% | 92.06% | 81.62% | 75.31% | 66.98% | 27.25% |
| Florida | 61.39% | 57.20% | 54.71% | 52.18% | 52.10% | 15.13% |
| Georgia | 50.41% | 60.50% | 68.56% | 69.68% | 56.84% | -12.75% |
| Hawaii | 55.74% | 56.17% | 51.94% | 47.52% | 41.84% | 24.93% |
| Idaho | 53.78% | 39.15% | 25.64% | 14.02% | 18.16% | 66.23% |
| Illinois | 51.00% | 48.53% | 47.29% | 45.58% | 46.48% | 8.85% |
| Indiana | 22.85% | 21.62% | 21.48% | 19.12% | 18.39% | 19.52% |
| Iowa | 20.13% | 21.95% | 20.81% | 19.50% | 18.82% | 6.51% |
| Kansas | 25.31% | 15.35% | 16.09% | 14.94% | 16.86% | 33.40% |
| Kentucky | 31.80% | 32.72% | 43.81% | 48.08% | 48.23% | -51.66% |
| Louisiana | 41.56% | 38.39% | 34.02% | 26.47% | 25.53% | 38.57% |
| Maine | 16.15% | 13.52% | 10.99% | 10.37% | 10.43% | 35.46% |
| Maryland | 90.58% | 81.70% | 68.24% | 64.70% | 66.54% | 26.53% |
| Massachusetts | 55.10% | 49.55% | 43.42% | 39.00% | 42.36% | 23.13% |
| Michigan | 67.22% | 57.39% | 48.37% | 43.63% | 46.56% | 30.73% |
| Minnesota | 62.10% | 65.09% | 68.19% | 65.43% | 68.10% | -9.67% |
| Mississippi | 23.59% | 29.40% | 30.18% | 25.25% | 24.39% | -3.41% |
| Missouri | 71.09% | 71.59% | 64.99% | 57.34% | 50.45% | 29.04% |
| Montana | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Nebraska | 45.91% | 38.60% | 35.04% | 29.85% | 25.63% | 44.17% |
| Nevada | 45.77% | 44.21% | 46.43% | 45.18% | 49.01% | -7.07% |
| New Hampshire | 37.71% | 37.50% | 37.50% | 31.94% | 36.81% | 2.39% |
| New Jersey | 67.48% | 61.13% | 56.41% | 47.97% | 52.71% | 21.89% |
| New Mexico | 24.80% | 20.83% | 19.20% | 19.14% | 20.99% | 15.38% |
| New York | 61.13% | 51.95% | 45.19% | 36.61% | 37.70% | 38.32% |
| North Carolina | 61.70% | 57.77% | 53.09% | 46.22% | 48.34% | 21.64% |
| North Dakota | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Ohio | 55.19% | 55.73% | 57.85% | 56.51% | 59.85% | -8.44% |
| Oklahoma | 25.97% | 27.01% | 27.06% | 27.59% | 28.07% | -8.10% |
| Oregon | 59.01% | 54.79% | 53.20% | 51.83% | 53.65% | 9.09% |
| Pennsylvania | 42.93% | 39.33% | 33.36% | 28.45% | 28.98% | 32.50% |
| Rhode Island | 74.83% | 67.72% | 59.18% | 50.35% | 50.03% | 33.14% |
| South Carolina | 65.02% | 57.89% | 53.08% | 47.79% | 59.80% | 40.53% |
| South Dakota | 41.57% | 41.37% | 27.89% | 14.29% | 0.00% | 100.00% |
| Tennessee | 57.09% | 56.92% | 58.00% | 55.11% | 55.43% | 2.92% |
| Texas | 53.37% | 48.63% | 46.12% | 43.59% | 48.18% | 9.72% |
| Utah | 54.89% | 38.58% | 27.42% | 26.23% | 27.70% | 49.53% |
| Vermont | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Virginia | 77.47% | 69.38% | 53.80% | 44.83% | 47.97% | 38.08% |
| Washington | 66.98% | 70.23% | 65.01% | 61.24% | 63.45% | 5.28% |
| West Virginia | 27.16% | 22.50% | 18.41% | 10.63% | 8.35% | 69.25% |
| Wisconsin | 65.97% | 61.00% | 53.33% | 45.24% | 42.58% | 35.45% |
| Wyoming | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| **National Average** | **47.47%** | **44.18%** | **40.47%** | **36.43%** | **36.36%** | **23.40%** |

**Table 5 Appendix B**
**Bridge Condition**
**(% Deficient Bridges)**

| Original Data | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Alabama | 40 | 38 | 35 | 31 | 31 | 30 | 30 |
| Alaska | 24 | 23 | 31 | 24 | 22 | 24 | 23 |
| Arizona | 7 | 6 | 6 | 6 | 7 | 6 | 5 |
| Arkansas | 34 | 30 | 30 | 29 | 28 | 27 | 28 |
| California | 19 | 19 | 18 | 19 | 18 | 17 | 18 |
| Colorado | 22 | 20 | 21 | 20 | 18 | 18 | 16 |
| Connecticut | 15 | 13 | 11 | 12 | 10 | 10 | 9 |
| Delaware | 28 | 21 | 23 | 22 | 22 | 20 | 19 |
| Dist. of Columbia | 20 | 28 | 30 | 34 | 36 | 38 | 37 |
| Florida | 27 | 27 | 27 | 25 | 25 | 26 | 26 |
| Georgia | 27 | 27 | 27 | 26 | 23 | 25 | 24 |
| Hawaii | 50 | 50 | 49 | 49 | 49 | 48 | 48 |
| Idaho | 10 | 10 | 9 | 35 | 19 | 16 | 19 |
| Illinois | 29 | 28 | 26 | 25 | 25 | 23 | 22 |
| Indiana | 37 | 34 | 29 | 28 | 27 | 26 | 26 |
| Iowa | 34 | 30 | 30 | 30 | 29 | 29 | 28 |
| Kansas | 36 | 34 | 34 | 30 | 29 | 28 | 26 |
| Kentucky | 38 | 37 | 36 | 35 | 34 | 35 | 33 |
| Louisiana | 42 | 38 | 37 | 37 | 37 | 37 | 36 |
| Maine | 51 | 39 | 40 | 38 | 34 | 34 | 33 |
| Maryland | 23 | 35 | 35 | 35 | 31 | 31 | 29 |
| Massachusetts | 55 | 31 | 42 | 42 | 41 | 41 | 37 |
| Michigan | 47 | 38 | 35 | 44 | 39 | 41 | 32 |
| Minnesota | 22 | 21 | 21 | 20 | 19 | 18 | 16 |
| Mississippi | 51 | 56 | 56 | 44 | 51 | 45 | 36 |
| Missouri | 47 | 45 | 44 | 43 | 42 | 40 | 38 |
| Montana | 20 | 20 | 20 | 20 | 21 | 21 | 21 |
| Nebraska | 37 | 35 | 34 | 33 | 32 | 31 | 30 |
| Nevada | 11 | 10 | 9 | 9 | 6 | 7 | 7 |
| New Hampshire | 43 | 42 | 43 | 51 | 36 | 35 | 32 |
| New Jersey | 41 | 41 | 40 | 38 | 32 | 32 | 29 |
| New Mexico | 33 | 35 | 34 | 35 | 35 | 35 | 35 |
| New York | 46 | 45 | 44 | 43 | 42 | 41 | 39 |
| North Carolina | 39 | 38 | 37 | 36 | 35 | 34 | 35 |
| North Dakota | 32 | 30 | 29 | 28 | 30 | 28 | 26 |
| Ohio | 29 | 29 | 28 | 44 | 43 | 41 | 40 |
| Oklahoma | 44 | 42 | 39 | 39 | 41 | 42 | 40 |
| Oregon | 22 | 24 | 23 | 21 | 20 | 20 | 23 |
| Pennsylvania | 40 | 40 | 40 | 41 | 41 | 40 | 39 |
| Rhode Island | 45 | 47 | 47 | 52 | 61 | 61 | 62 |
| South Carolina | 21 | 21 | 22 | 22 | 23 | 23 | 22 |
| South Dakota | 30 | 30 | 29 | 27 | 26 | 25 | 30 |
| Tennessee | 36 | 33 | 29 | 28 | 27 | 26 | 27 |
| Texas | 35 | 30 | 30 | 29 | 28 | 28 | 26 |
| Utah | 12 | 11 | 11 | 11 | 35 | 37 | 27 |
| Vermont | 38 | 37 | 38 | 38 | 41 | 40 | 38 |
| Virginia | 30 | 30 | 29 | 31 | 32 | 31 | 25 |
| Washington | 39 | 24 | 25 | 24 | 24 | 24 | 22 |
| West Virginia | 55 | 47 | 46 | 46 | 45 | 43 | 42 |
| Wisconsin | 31 | 30 | 27 | 24 | 23 | 21 | 19 |
| Wyoming | 12 | 13 | 12 | 16 | 17 | 16 | 16 |
| **National Average** | **32.47** | **30.63** | **30.33** | **30.76** | **30.24** | **29.71** | **28.35** |

| Three Year Rolling Average Data | | | | | | |
|---|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
| Alabama | 37.7 | 34.7 | 32.3 | 30.7 | 30.3 | 19.47% |
| Alaska | 26.0 | 26.0 | 25.7 | 23.3 | 23.0 | 11.54% |
| Arizona | 6.3 | 6.0 | 6.3 | 6.3 | 6.0 | 5.26% |
| Arkansas | 31.3 | 29.7 | 29.0 | 28.0 | 27.7 | 11.70% |
| California | 18.7 | 18.7 | 18.3 | 18.0 | 17.7 | 5.36% |
| Colorado | 21.0 | 20.3 | 19.7 | 18.7 | 17.3 | 17.46% |
| Connecticut | 13.0 | 12.0 | 11.0 | 10.7 | 9.7 | 25.64% |
| Delaware | 24.0 | 22.0 | 22.3 | 21.3 | 20.3 | 15.28% |
| Dist. of Columbia | 26.0 | 30.7 | 33.3 | 36.0 | 37.0 | -42.31% |
| Florida | 27.0 | 26.3 | 25.7 | 25.3 | 25.7 | 4.94% |
| Georgia | 27.0 | 26.7 | 25.3 | 24.7 | 24.0 | 11.11% |
| Hawaii | 49.7 | 49.3 | 49.0 | 48.7 | 48.3 | 2.68% |
| Idaho | 9.7 | 18.0 | 21.0 | 23.3 | 18.0 | -86.21% |
| Illinois | 27.7 | 26.3 | 25.3 | 24.3 | 23.3 | 15.66% |
| Indiana | 33.3 | 30.3 | 28.0 | 27.0 | 26.3 | 21.00% |
| Iowa | 31.3 | 30.0 | 29.7 | 29.3 | 28.7 | 8.51% |
| Kansas | 34.7 | 32.7 | 31.0 | 29.0 | 27.7 | 20.19% |
| Kentucky | 37.0 | 36.0 | 35.0 | 34.7 | 34.0 | 8.11% |
| Louisiana | 39.0 | 37.3 | 37.0 | 37.0 | 36.7 | 5.98% |
| Maine | 43.3 | 39.0 | 37.3 | 35.3 | 33.7 | 22.31% |
| Maryland | 31.0 | 35.0 | 33.7 | 32.3 | 30.3 | 2.15% |
| Massachusetts | 42.7 | 38.3 | 41.7 | 41.3 | 39.7 | 7.03% |
| Michigan | 40.0 | 39.0 | 39.3 | 41.3 | 37.3 | 6.67% |
| Minnesota | 21.3 | 20.7 | 20.0 | 19.0 | 17.7 | 17.19% |
| Mississippi | 54.3 | 52.0 | 50.3 | 46.7 | 44.0 | 19.02% |
| Missouri | 45.3 | 44.0 | 43.0 | 41.7 | 40.0 | 11.76% |
| Montana | 20.0 | 20.0 | 20.3 | 20.7 | 21.0 | -5.00% |
| Nebraska | 35.3 | 34.0 | 33.0 | 32.0 | 31.0 | 12.26% |
| Nevada | 10.0 | 9.3 | 8.0 | 7.3 | 6.7 | 33.33% |
| New Hampshire | 42.7 | 45.3 | 43.3 | 40.7 | 34.3 | 19.53% |
| New Jersey | 40.7 | 39.7 | 36.7 | 34.0 | 31.0 | 23.77% |
| New Mexico | 34.0 | 34.7 | 34.7 | 35.0 | 35.0 | -2.94% |
| New York | 45.0 | 44.0 | 43.0 | 42.0 | 40.7 | 9.63% |
| North Carolina | 38.0 | 37.0 | 36.0 | 35.0 | 34.7 | 8.77% |
| North Dakota | 30.3 | 29.0 | 29.0 | 28.7 | 28.0 | 7.69% |
| Ohio | 28.7 | 33.7 | 38.3 | 42.7 | 41.3 | -44.19% |
| Oklahoma | 41.7 | 40.0 | 39.7 | 40.7 | 41.0 | 1.60% |
| Oregon | 23.0 | 22.7 | 21.3 | 20.3 | 21.0 | 8.70% |
| Pennsylvania | 40.0 | 40.3 | 40.7 | 40.7 | 40.0 | 0.00% |
| Rhode Island | 46.3 | 48.7 | 53.3 | 58.0 | 61.3 | -32.37% |
| South Carolina | 21.3 | 21.7 | 22.3 | 22.7 | 22.7 | -6.25% |
| South Dakota | 29.7 | 28.7 | 27.3 | 26.0 | 27.0 | 8.99% |
| Tennessee | 32.7 | 30.0 | 28.0 | 27.0 | 26.7 | 18.37% |
| Texas | 31.7 | 29.7 | 29.0 | 28.3 | 27.3 | 13.68% |
| Utah | 11.3 | 11.0 | 19.0 | 27.7 | 33.0 | -191.18% |
| Vermont | 37.7 | 37.7 | 39.0 | 39.7 | 39.7 | -5.31% |
| Virginia | 29.7 | 30.0 | 30.7 | 31.3 | 29.3 | 1.12% |
| Washington | 29.3 | 24.3 | 24.3 | 24.0 | 23.3 | 20.45% |
| West Virginia | 49.3 | 46.3 | 45.7 | 44.7 | 43.3 | 12.16% |
| Wisconsin | 29.3 | 27.0 | 24.7 | 22.7 | 21.0 | 28.41% |
| Wyoming | 12.3 | 13.7 | 15.0 | 16.3 | 16.3 | -32.43% |
| **National Average** | **31.1** | **30.6** | **30.4** | **30.2** | **29.4** | **5.50%** |

**Table 6 Appendix B**
**Fatal Accident Rate**
**(fatalities/100 million vehicle miles)**

| Original Data | | | | | | |
|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
| Alabama | 2.01 | 1.93 | 1.95 | 1.96 | 1.99 | 1.96 |
| Alaska | 2.32 | 2.27 | 1.69 | 1.82 | 1.73 | 1.55 |
| Arizona | 2 | 1.8 | 2.05 | 2.30 | 2.03 | 1.95 |
| Arkansas | 2.22 | 2.17 | 2.14 | 2.02 | 1.94 | 2.00 |
| California | 1.42 | 1.38 | 1.39 | 1.33 | 1.29 | 1.15 |
| Colorado | 1.65 | 1.56 | 1.55 | 1.63 | 1.54 | 1.41 |
| Connecticut | 1.01 | 1.2 | 1.05 | 1.02 | 1.05 | 1.10 |
| Delaware | 1.71 | 1.51 | 1.49 | 1.49 | 1.37 | 1.50 |
| Dist. of Columbia | 1.32 | 1.58 | 1.89 | 1.56 | 1.75 | 1.71 |
| Florida | 1.9 | 1.97 | 1.98 | 1.99 | 1.92 | 1.88 |
| Georgia | 1.52 | 1.59 | 1.55 | 1.56 | 1.57 | 1.51 |
| Hawaii | 1.51 | 1.51 | 1.39 | 1.52 | 1.67 | 1.47 |
| Idaho | 1.92 | 1.71 | 1.87 | 1.89 | 1.76 | 1.71 |
| Illinois | 1.43 | 1.39 | 1.51 | 1.49 | 1.36 | 2.00 |
| Indiana | 1.4 | 1.29 | 1.40 | 1.33 | 1.32 | 1.23 |
| Iowa | 1.62 | 1.6 | 1.61 | 1.72 | 1.53 | 1.47 |
| Kansas | 1.39 | 1.56 | 1.54 | 1.57 | 1.71 | 1.58 |
| Kentucky | 1.89 | 1.92 | 1.74 | 1.78 | 1.72 | 1.73 |
| Louisiana | 2.33 | 2.11 | 1.99 | 1.99 | 1.84 | 2.10 |
| Maine | 1.56 | 1.38 | 1.33 | 1.35 | 1.22 | 1.30 |
| Maryland | 1.39 | 1.38 | 1.36 | 1.34 | 1.21 | 1.22 |
| Massachusetts | 0.97 | 0.96 | 0.86 | 0.87 | 0.78 | 0.82 |
| Michigan | 1.4 | 1.48 | 1.48 | 1.61 | 1.48 | 1.40 |
| Minnesota | 1.2 | 1.13 | 1.27 | 1.17 | 1.13 | 1.09 |
| Mississippi | 2.47 | 2.59 | 2.41 | 2.50 | 2.27 | 2.35 |
| Missouri | 1.64 | 1.53 | 1.65 | 1.66 | 1.64 | 1.63 |
| Montana | 2.02 | 1.94 | 2.00 | 1.98 | 1.89 | 2.37 |
| Nebraska | 1.52 | 1.51 | 1.48 | 1.43 | 1.48 | 1.53 |
| Nevada | 2.06 | 2.01 | 2.09 | 1.98 | 2.22 | 1.97 |
| New Hampshire | 1.09 | 1.04 | 1.00 | 1.01 | 1.14 | 1.07 |
| New Jersey | 1.17 | 1.21 | 1.14 | 1.18 | 1.21 | 1.10 |
| New Mexico | 2.16 | 2.04 | 1.89 | 2.01 | 1.92 | 1.82 |
| New York | 1.51 | 1.45 | 1.34 | 1.36 | 1.20 | 1.24 |
| North Carolina | 1.66 | 1.77 | 1.74 | 1.72 | 1.68 | 1.58 |
| North Dakota | 1.3 | 1.32 | 1.20 | 0.99 | 1.19 | 1.25 |
| Ohio | 1.37 | 1.37 | 1.23 | 1.21 | 1.21 | 1.22 |
| Oklahoma | 1.52 | 1.64 | 1.64 | 1.55 | 1.70 | 1.74 |
| Oregon | 1.48 | 1.61 | 1.49 | 1.66 | 1.52 | 1.43 |
| Pennsylvania | 1.55 | 1.55 | 1.43 | 1.41 | 1.40 | 1.44 |
| Rhode Island | 0.95 | 0.97 | 0.87 | 0.93 | 0.91 | 0.93 |
| South Carolina | 2.05 | 2.15 | 2.02 | 2.02 | 2.07 | 1.93 |
| South Dakota | 1.95 | 1.59 | 1.85 | 1.83 | 1.82 | 1.61 |
| Tennessee | 2.05 | 2 | 2.03 | 2.01 | 1.92 | 1.82 |
| Texas | 1.65 | 1.61 | 1.54 | 1.54 | 1.75 | 1.55 |
| Utah | 1.44 | 1.52 | 1.67 | 1.52 | 1.45 | 1.51 |
| Vermont | 1.45 | 1.69 | 1.12 | 1.53 | 1.16 | 1.36 |
| Virginia | 1.2 | 1.23 | 1.22 | 1.18 | 1.13 | 1.28 |
| Washington | 1.2 | 1.26 | 1.21 | 1.17 | 1.30 | 1.16 |
| West Virginia | 2.22 | 2.21 | 1.93 | 1.99 | 1.80 | 1.86 |
| Wisconsin | 1.23 | 1.27 | 1.24 | 1.29 | 1.25 | 1.17 |
| Wyoming | 1.59 | 1.48 | 1.94 | 1.96 | 1.64 | 1.54 |
| | | | | | | |
| **National Average** | **1.62** | **1.61** | **1.58** | **1.59** | **1.54** | **1.54** |

| Three Year Rolling Average Data | | | | | |
|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | **Improvement** |
| Alabama | 2.0 | 1.9 | 2.0 | 2.0 | -0.24% |
| Alaska | 2.1 | 1.9 | 1.7 | 1.7 | 18.84% |
| Arizona | 1.9 | 2.1 | 2.1 | 2.1 | -7.43% |
| Arkansas | 2.2 | 2.1 | 2.0 | 2.0 | 8.81% |
| California | 1.4 | 1.4 | 1.3 | 1.3 | 10.26% |
| Colorado | 1.6 | 1.6 | 1.6 | 1.5 | 3.71% |
| Connecticut | 1.1 | 1.1 | 1.0 | 1.1 | 2.50% |
| Delaware | 1.6 | 1.5 | 1.5 | 1.5 | 7.55% |
| Dist. of Columbia | 1.6 | 1.7 | 1.7 | 1.7 | -4.94% |
| Florida | 2.0 | 2.0 | 2.0 | 1.9 | 0.97% |
| Georgia | 1.6 | 1.6 | 1.6 | 1.5 | 0.37% |
| Hawaii | 1.5 | 1.5 | 1.5 | 1.6 | -5.85% |
| Idaho | 1.8 | 1.8 | 1.8 | 1.8 | 2.52% |
| Illinois | 1.4 | 1.5 | 1.5 | 1.6 | -11.86% |
| Indiana | 1.4 | 1.3 | 1.4 | 1.3 | 5.18% |
| Iowa | 1.6 | 1.6 | 1.6 | 1.6 | 2.45% |
| Kansas | 1.5 | 1.6 | 1.6 | 1.6 | -8.01% |
| Kentucky | 1.9 | 1.8 | 1.7 | 1.7 | 5.74% |
| Louisiana | 2.1 | 2.0 | 1.9 | 2.0 | 7.73% |
| Maine | 1.4 | 1.4 | 1.3 | 1.3 | 9.31% |
| Maryland | 1.4 | 1.4 | 1.3 | 1.3 | 8.88% |
| Massachusetts | 0.9 | 0.9 | 0.8 | 0.8 | 11.21% |
| Michigan | 1.5 | 1.5 | 1.5 | 1.5 | -2.98% |
| Minnesota | 1.2 | 1.2 | 1.2 | 1.1 | 5.78% |
| Mississippi | 2.5 | 2.5 | 2.4 | 2.4 | 4.71% |
| Missouri | 1.6 | 1.6 | 1.7 | 1.6 | -2.39% |
| Montana | 2.0 | 2.0 | 2.0 | 2.1 | -4.90% |
| Nebraska | 1.5 | 1.5 | 1.5 | 1.5 | 1.65% |
| Nevada | 2.1 | 2.0 | 2.1 | 2.1 | -0.36% |
| New Hampshire | 1.0 | 1.0 | 1.0 | 1.1 | -2.70% |
| New Jersey | 1.2 | 1.2 | 1.2 | 1.2 | 0.78% |
| New Mexico | 2.0 | 2.0 | 1.9 | 1.9 | 5.68% |
| New York | 1.4 | 1.4 | 1.3 | 1.3 | 11.74% |
| North Carolina | 1.7 | 1.7 | 1.7 | 1.7 | 3.86% |
| North Dakota | 1.3 | 1.2 | 1.1 | 1.1 | 10.21% |
| Ohio | 1.3 | 1.3 | 1.2 | 1.2 | 8.21% |
| Oklahoma | 1.6 | 1.6 | 1.6 | 1.7 | -4.03% |
| Oregon | 1.5 | 1.6 | 1.6 | 1.5 | -0.44% |
| Pennsylvania | 1.5 | 1.5 | 1.4 | 1.4 | 6.06% |
| Rhode Island | 0.9 | 0.9 | 0.9 | 0.9 | 0.70% |
| South Carolina | 2.1 | 2.1 | 2.0 | 2.0 | 3.32% |
| South Dakota | 1.8 | 1.8 | 1.8 | 1.8 | 2.47% |
| Tennessee | 2.0 | 2.0 | 2.0 | 1.9 | 5.53% |
| Texas | 1.6 | 1.6 | 1.6 | 1.6 | -0.93% |
| Utah | 1.5 | 1.6 | 1.5 | 1.5 | 2.97% |
| Vermont | 1.4 | 1.4 | 1.3 | 1.4 | 4.91% |
| Virginia | 1.2 | 1.2 | 1.2 | 1.2 | 1.64% |
| Washington | 1.2 | 1.2 | 1.2 | 1.2 | 1.12% |
| West Virginia | 2.1 | 2.0 | 1.9 | 1.9 | 11.23% |
| Wisconsin | 1.2 | 1.3 | 1.3 | 1.2 | 0.89% |
| Wyoming | 1.7 | 1.8 | 1.8 | 1.7 | -2.67% |
| | | | | | |
| **National Average** | **1.6** | **1.6** | **1.6** | **1.6** | **2.85%** |

**Table 7 Appendix C**
**Rural Other Principle Arterial Narrow Lane Width**
**(% of ROPA miles w/ lane width < 12 FT wide)**

| | Original Data | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Alabama | 10.90% | 10.57% | 8.63% | 6.31% | 4.07% | 4.05% | 3.95% |
| Alaska | 1.53% | 5.50% | 2.14% | 1.23% | 0.37% | 0.37% | 0.37% |
| Arizona | 0.00% | 0.42% | 0.35% | 0.34% | 1.18% | 0.42% | 0.25% |
| Arkansas | 42.54% | 41.76% | 42.47% | 40.46% | 42.27% | 41.06% | 40.30% |
| California | 5.70% | 5.90% | 5.78% | 5.23% | 5.23% | 5.29% | 5.21% |
| Colorado | 15.83% | 15.24% | 11.55% | 9.82% | 9.76% | 9.09% | 11.95% |
| Connecticut | 6.49% | 2.28% | 0.38% | 0.00% | 0.00% | 0.00% | 0.00% |
| Delaware | 0.48% | 1.43% | 1.91% | 1.39% | 0.46% | 0.91% | 0.91% |
| Dist. of Columbia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Florida | 16.13% | 13.85% | 12.59% | 9.93% | 6.54% | 6.88% | 6.80% |
| Georgia | 3.55% | 1.20% | 1.59% | 1.47% | 1.65% | 1.65% | 2.19% |
| Hawaii | 80.00% | 80.00% | 30.08% | 35.20% | 28.80% | 32.00% | 39.20% |
| Idaho | 4.87% | 3.57% | 3.39% | 2.73% | 2.49% | 1.43% | 1.20% |
| Illinois | 12.08% | 15.62% | 16.01% | 20.27% | 19.98% | 19.96% | 19.92% |
| Indiana | 4.61% | 6.87% | 6.24% | 6.18% | 6.12% | 6.21% | 6.32% |
| Iowa | 9.34% | 8.96% | 8.75% | 8.75% | 9.87% | 11.82% | 9.83% |
| Kansas | 8.19% | 8.13% | 7.96% | 8.11% | 6.84% | 4.75% | 5.01% |
| Kentucky | 20.10% | 22.87% | 17.25% | 15.84% | 14.71% | 16.25% | 16.16% |
| Louisiana | 7.48% | 14.90% | 14.99% | 15.09% | 14.83% | 14.27% | 14.32% |
| Maine | 26.76% | 27.40% | 26.75% | 26.60% | 27.06% | 27.19% | 27.19% |
| Maryland | 4.93% | 5.29% | 3.65% | 3.10% | 3.10% | 2.91% | 5.85% |
| Massachusetts | 3.31% | 6.48% | 11.29% | 5.97% | 6.58% | 6.39% | 5.45% |
| Michigan | 23.40% | 25.23% | 22.44% | 20.45% | 21.42% | 24.03% | 22.88% |
| Minnesota | 12.00% | 11.74% | 11.06% | 8.72% | 7.00% | 8.68% | 8.61% |
| Mississippi | 3.04% | 2.69% | 1.47% | 1.39% | 2.07% | 2.07% | 0.05% |
| Missouri | 18.33% | 16.95% | 14.25% | 14.26% | 14.25% | 14.52% | 14.45% |
| Montana | 6.56% | 6.56% | 4.65% | 4.27% | 3.81% | 2.94% | 2.97% |
| Nebraska | 5.62% | 4.77% | 4.77% | 4.74% | 4.73% | 4.70% | 4.79% |
| Nevada | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| New Hampshire | 3.76% | 4.58% | 5.08% | 5.29% | 4.41% | 4.39% | 4.38% |
| New Jersey | 7.17% | 17.02% | 12.08% | 6.25% | 3.75% | 3.38% | 1.69% |
| New Mexico | 6.45% | 10.23% | 10.25% | 6.49% | 7.40% | 7.34% | 6.73% |
| New York | 23.62% | 23.16% | 23.62% | 23.60% | 23.60% | 23.81% | 22.42% |
| North Carolina | 18.26% | 18.65% | 18.15% | 17.20% | 16.31% | 15.64% | 14.73% |
| North Dakota | 6.50% | 6.55% | 6.55% | 5.90% | 5.94% | 4.33% | 4.33% |
| Ohio | 22.90% | 22.90% | 24.43% | 22.89% | 22.65% | 20.94% | 20.09% |
| Oklahoma | 2.85% | 5.68% | 5.68% | 4.52% | 3.51% | 4.60% | 3.63% |
| Oregon | 7.55% | 8.41% | 8.48% | 8.96% | 9.65% | 7.59% | 7.24% |
| Pennsylvania | 42.46% | 41.54% | 42.67% | 42.59% | 46.43% | 42.91% | 37.25% |
| Rhode Island | 39.19% | 22.58% | 22.22% | 7.94% | 7.94% | 10.45% | 10.45% |
| South Carolina | 6.32% | 6.22% | 6.36% | 6.71% | 6.43% | 5.64% | 5.57% |
| South Dakota | 3.23% | 3.94% | 3.70% | 3.62% | 2.99% | 2.48% | 1.50% |
| Tennessee | 34.03% | 27.90% | 29.46% | 30.25% | 29.28% | 26.79% | 24.64% |
| Texas | 5.77% | 5.60% | 5.25% | 5.19% | 5.28% | 5.27% | 5.01% |
| Utah | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Vermont | 17.29% | 18.55% | 19.24% | 22.01% | 22.40% | 22.08% | 27.13% |
| Virginia | 28.41% | 29.27% | 27.48% | 28.60% | 29.73% | 29.74% | 27.33% |
| Washington | 38.01% | 39.51% | 36.45% | 32.47% | 32.07% | 31.78% | 31.30% |
| West Virginia | 23.46% | 23.36% | 49.46% | 49.81% | 48.67% | 48.19% | 47.09% |
| Wisconsin | 11.14% | 10.98% | 9.45% | 9.47% | 9.98% | 8.64% | 7.20% |
| Wyoming | 0.30% | 1.84% | 1.84% | 1.84% | 1.84% | 1.84% | 1.76% |
| **National Average** | **13.91%** | **14.13%** | **12.49%** | **11.63%** | **11.35%** | **11.23%** | **11.07%** |

| | Three Year Rolling Average Data | | | | | |
|---|---|---|---|---|---|---|
| | 1993 | 1994 | 1995 | 1996 | 1997 | **Improvement** |
| Alabama | 10.03% | 8.50% | 6.34% | 4.81% | 4.02% | 59.89% |
| Alaska | 3.06% | 2.96% | 1.25% | 0.66% | 0.37% | 87.88% |
| Arizona | 0.25% | 0.37% | 0.62% | 0.65% | 0.62% | -142.53% |
| Arkansas | 42.26% | 41.56% | 41.73% | 41.26% | 41.21% | 2.48% |
| California | 5.79% | 5.64% | 5.41% | 5.25% | 5.24% | 9.48% |
| Colorado | 14.21% | 12.20% | 10.38% | 9.56% | 10.27% | 27.72% |
| Connecticut | 3.05% | 0.89% | 0.13% | 0.00% | 0.00% | 100.00% |
| Delaware | 1.27% | 1.58% | 1.26% | 0.92% | 0.76% | 40.12% |
| Dist. of Columbia | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Florida | 14.19% | 12.12% | 9.68% | 7.78% | 6.74% | 52.50% |
| Georgia | 2.11% | 1.42% | 1.57% | 1.59% | 1.83% | 13.41% |
| Hawaii | 63.36% | 48.43% | 31.36% | 32.00% | 33.33% | 47.39% |
| Idaho | 3.94% | 3.23% | 2.87% | 2.22% | 1.71% | 56.70% |
| Illinois | 14.57% | 17.30% | 18.75% | 20.07% | 19.95% | -36.93% |
| Indiana | 5.91% | 6.43% | 6.18% | 6.17% | 6.22% | -5.30% |
| Iowa | 9.02% | 8.82% | 9.13% | 10.15% | 10.51% | -16.55% |
| Kansas | 8.09% | 8.07% | 7.64% | 6.57% | 5.54% | 31.57% |
| Kentucky | 20.07% | 18.65% | 15.93% | 15.60% | 15.71% | 21.74% |
| Louisiana | 12.46% | 14.99% | 14.97% | 14.73% | 14.47% | -16.20% |
| Maine | 26.97% | 26.92% | 26.81% | 26.95% | 27.15% | -0.67% |
| Maryland | 4.62% | 4.01% | 3.28% | 3.04% | 3.95% | 14.48% |
| Massachusetts | 7.02% | 7.91% | 7.95% | 6.32% | 6.14% | 12.58% |
| Michigan | 23.69% | 22.71% | 21.44% | 21.97% | 22.78% | 3.86% |
| Minnesota | 11.60% | 10.51% | 8.93% | 8.13% | 8.10% | 30.22% |
| Mississippi | 2.40% | 1.85% | 1.64% | 1.84% | 1.40% | 41.69% |
| Missouri | 16.51% | 15.15% | 14.25% | 14.35% | 14.41% | 12.73% |
| Montana | 5.92% | 5.16% | 4.25% | 3.67% | 3.24% | 45.27% |
| Nebraska | 5.05% | 4.76% | 4.75% | 4.72% | 4.74% | 6.28% |
| Nevada | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| New Hampshire | 4.47% | 4.98% | 4.92% | 4.69% | 4.39% | 1.84% |
| New Jersey | 12.09% | 11.78% | 7.36% | 4.46% | 2.94% | 75.68% |
| New Mexico | 8.98% | 8.99% | 8.04% | 7.08% | 7.16% | 20.27% |
| New York | 23.47% | 23.46% | 23.61% | 23.67% | 23.28% | 0.81% |
| North Carolina | 18.35% | 18.00% | 17.22% | 16.39% | 15.56% | 15.22% |
| North Dakota | 6.54% | 6.34% | 6.13% | 5.39% | 4.87% | 25.51% |
| Ohio | 23.41% | 23.41% | 23.33% | 22.16% | 21.23% | 9.32% |
| Oklahoma | 4.74% | 5.30% | 4.57% | 4.21% | 3.92% | 17.36% |
| Oregon | 8.15% | 8.62% | 9.03% | 8.73% | 8.16% | -0.12% |
| Pennsylvania | 42.23% | 42.27% | 43.90% | 43.98% | 42.20% | 0.07% |
| Rhode Island | 28.00% | 17.58% | 12.70% | 8.77% | 9.61% | 65.67% |
| South Carolina | 6.30% | 6.43% | 6.50% | 6.26% | 5.88% | 6.67% |
| South Dakota | 3.62% | 3.75% | 3.44% | 3.03% | 2.32% | 35.86% |
| Tennessee | 30.46% | 29.20% | 29.66% | 28.77% | 26.90% | 11.69% |
| Texas | 5.54% | 5.35% | 5.24% | 5.25% | 5.19% | 6.35% |
| Utah | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Vermont | 18.36% | 19.94% | 21.22% | 22.16% | 23.87% | -30.00% |
| Virginia | 28.39% | 28.45% | 28.60% | 29.36% | 28.93% | -1.93% |
| Washington | 37.99% | 36.14% | 33.66% | 32.11% | 31.72% | 16.51% |
| West Virginia | 32.09% | 40.88% | 49.31% | 48.89% | 47.98% | -49.51% |
| Wisconsin | 10.53% | 9.97% | 9.63% | 9.36% | 8.61% | 18.24% |
| Wyoming | 1.32% | 1.84% | 1.84% | 1.84% | 1.81% | -36.86% |
| **National Average** | **13.51%** | **12.75%** | **11.83%** | **11.41%** | **11.22%** | **16.96%** |