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24TH ANNUAL HIGHWAY REPORT

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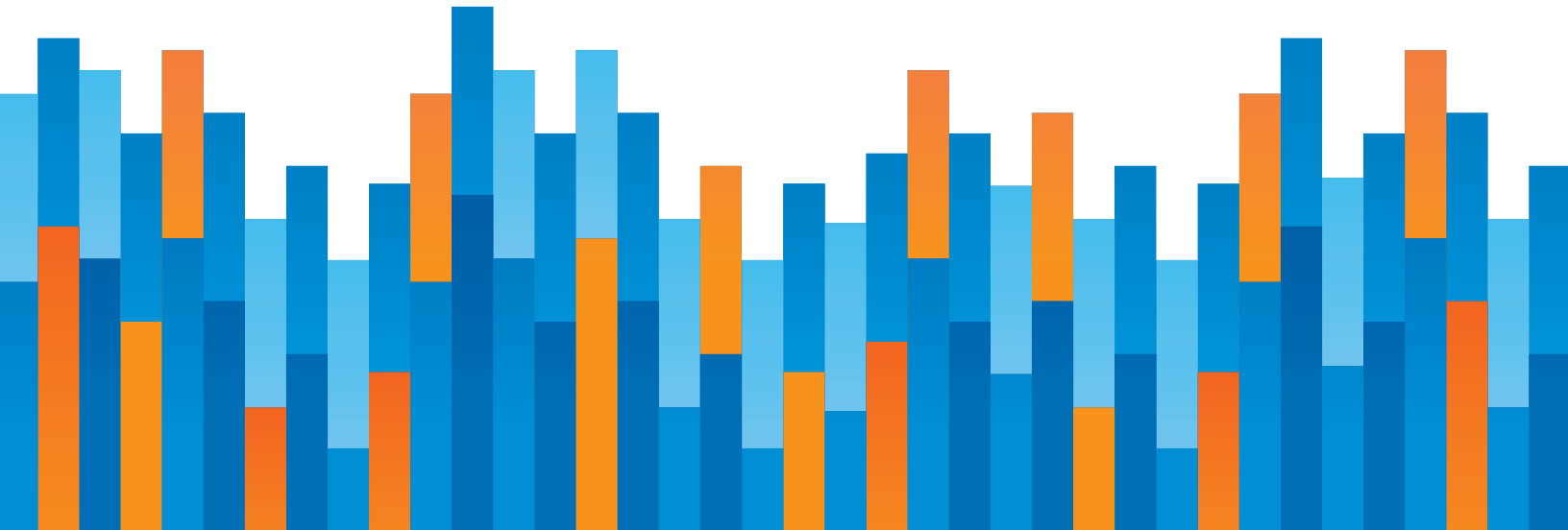

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Reason Foundation's nonpartisan public policy research promotes choice, competition and a dynamic market economy as the foundation for human dignity and progress. Reason produces rigorous, peer-reviewed research and directly engages the policy process, seeking strategies that emphasize cooperation, flexibility, local knowledge and results. Through practical and innovative approaches to complex problems, Reason seeks to change the way people think about issues, and promote policies that allow and encourage individuals and voluntary institutions to flourish.

EXECUTIVE SUMMARY

Reason Foundation's *Annual Highway Report* has tracked the performance of the 50 state-owned highway systems from 1984 to 2016. The 24th *Annual Highway Report* ranks the performance of state highway systems in 2016, with congestion and bridge condition data from 2017. Each state's overall rating is determined by rankings in 13 categories, including highway expenditures per mile, Interstate and primary road pavement conditions, urbanized area congestion, bridge conditions and fatality rates. The study is based on spending and performance data state highway agencies submitted to the federal government. This study also reviews changes in highway performance over the past year.

Although individual state highway sections (roads, bridges, pavements) steadily deteriorate over time due to age, traffic and weather, they are improved by maintenance and reconstruction. As a result, system performance can improve even as individual roads and bridges deteriorate. Table ES1 summarizes recent system trends for key indicators. Despite a decades-long trend of steady, incremental improvement, from 2013 to 2016, the overall condition of the total system has worsened. The four disbursement measures for the U.S. state-owned highway system improved between 2015 and 2016 (states expended fewer dollars on their highway systems in 2016 than in 2015). However, six of the eight performance measures worsened, including all of the pavement rankings and all three fatality rate rankings. The significant increase in the fatality rate is particularly troubling. The structurally deficient bridges ranking improved significantly (a smaller percentage of bridges is structurally deficient) and urbanized area congestion improved slightly. The Urban Other Principal Arterial ranking is new to this year's report.

States do not need to engage in a spending bonanza to improve their systems. But there is some evidence that a small increase in spending could yield a significantly better system.

TABLE ES1: PERFORMANCE OF STATE-OWNED HIGHWAYS, 2012-2015

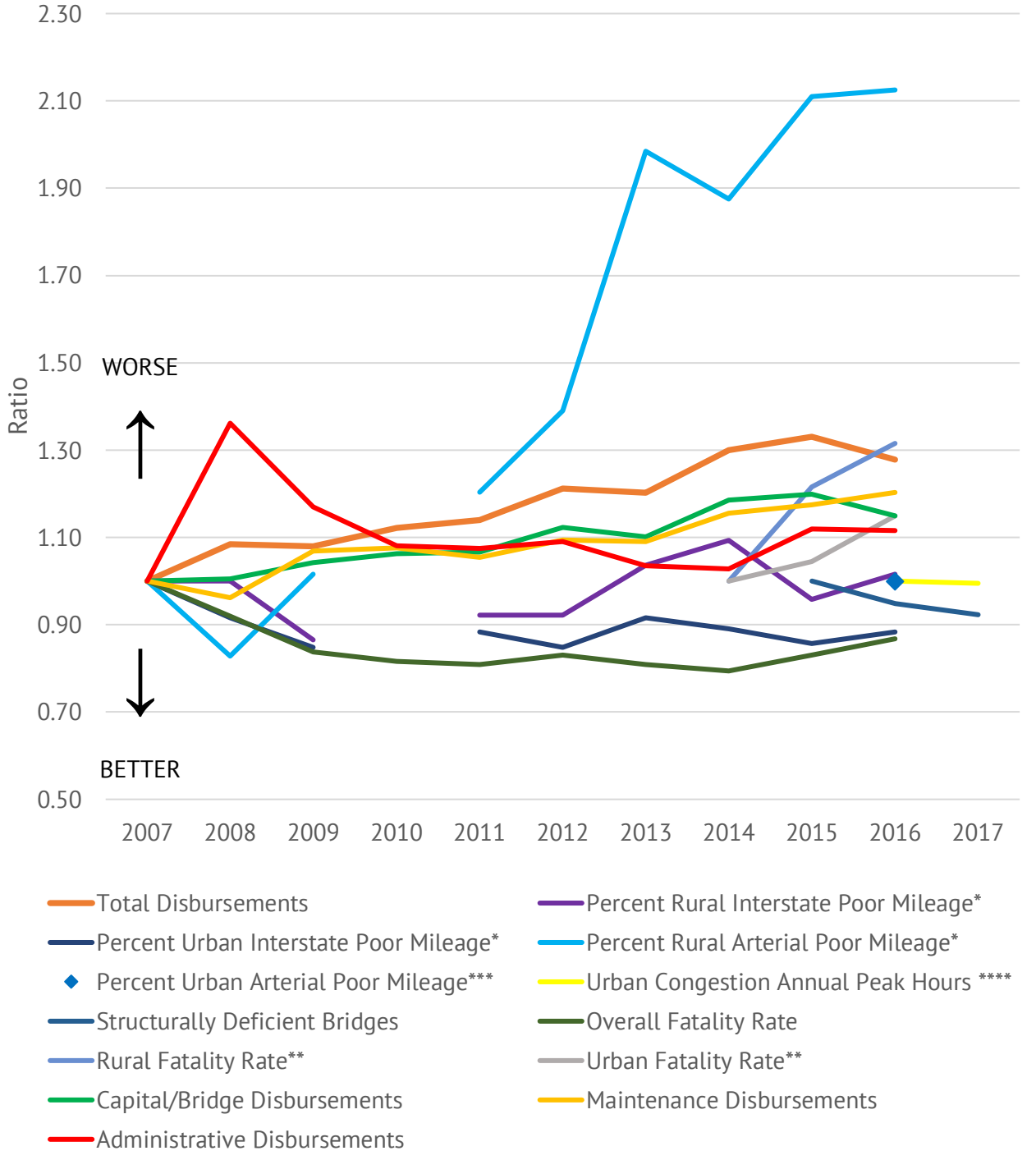
Statistic	2013	2015	2016	Percent Change	
				2013 – 2016	2015– 2016
Mileage Under State Control (Thousands)	815,024	814,154	836,775	2.67	2.78
Total Disbursements per Lane Mile, $	160,997	178,116	171,025	6.22	-3.98
Disbursements per Mile, Capital/Bridges, $	84,494	91,992	88,212	4.40	-4.10
Disbursements per Mile, Maintenance, $	25,996	28,020	28,687	10.35	-2.38
Disbursements per Mile, Administration, $	9,980	10,864	10,825	8.47	-0.36
Consumer Price Index (1983=1.00)	233.0	237.0	240.0	3.00	1.27
Rural Interstate, Percent Poor Condition	2.00	1.85	1.96	-2.00	5.95
Urban Interstate, Percent Poor Condition	5.37	5.02	5.18	-3.54	3.19
Rural Other Principal Arterial, Percent Poor Condition	1.27	1.35	1.36	7.09	0.74
Urban Other Principal Arterial, Percent Poor Condition*	N/A	N/A	13.97	N/A	N/A
Urbanized Area Congestion**	N/A	34.95	34.77	N/A	-0.52
Structurally Deficient Bridges, Poor Condition	9.60	9.10	8.86	-7.71	-2.64
Fatality Rate per 100 Million Vehicle-Miles All Roadways	1.10	1.13	1.18	7.27	4.42
Rural Fatality Rate per 100 Million Vehicle-Miles, All Arterials***	1.30	1.58	1.71	31.54	8.23
Urban Fatality Rate per 100 Million Vehicle-Miles, All Arterials***	0.67	0.70	0.77	14.93	10.00

* Urban Other Principal Arterial Condition was first measured in 2016.

** 2015 and 2016 used "peak hours spent in congestion" in 2015 and in 2016. 2013 used a different metric that is not listed because it is not comparable.

*** Rural Fatality Rate per 100 Million Vehicle-Miles, All Arterials and Urban Fatality Rate per 100 million Vehicle-Miles, All Arterials use 2014 data instead of 2013 data.

FIGURE ES1: TRENDS IN HIGHWAY SYSTEM PERFORMANCE, 2007–2017



* Data for Pavement Condition is not included for 2010
** Data for Rural Fatality Rate and Urban Fatality Rate starts in 2014
*** Data for Percent Urban Arterial Miles starts in 2016
**** Data for Urban Congestion Annual Peak Hours starts in 2016. The previous measure of congestion is not comparable.

Unlike prior years, the top-performing states tend to be a mix of high-population and low-population states. Very rural states may have a slight advantage. While rural North Dakota led the rankings for the second year in a row, Virginia and Missouri, two of the 20 most populated states in the country, were 2nd and 3rd. Maine and Kentucky rounded out the top five states.

Several other states with major cities also fared well: Tennessee (7th), North Carolina (17th), and Ohio (18th).

At the bottom of the overall rankings are New Jersey, Alaska, Rhode Island, Hawaii and Massachusetts. States with large populations and small geographic areas may be at a slight disadvantage, but three of the five worst performing states rank in the bottom 10 in population.

System performance problems in each measured category seem to be concentrated in a few states:

- Almost a third (31%) of the rural Interstate mileage in poor condition is in just three states: Alaska, Colorado and Washington.
- A third (33%) of the urban Interstate mileage in poor condition is in just five states: Hawaii, Louisiana, Delaware, California and New York.
- A significant share (12%) of the rural primary mileage in poor condition is in just four states: Alaska, Hawaii, Rhode Island and Massachusetts.
- Almost half (45%) of the urban arterial primary mileage in poor condition is in just seven states: Rhode Island, California, Massachusetts, Washington, New Jersey, Nebraska and New York.
- Automobile commuters in 10 states spend more than the national average of 35 hours annually stuck in peak-hour traffic congestion: New Jersey, New York, California, Georgia, Massachusetts, Illinois, Maryland, Texas, Washington and Minnesota.
- Although a majority of states saw the percentage of structurally deficient bridges decline, five states report more than 18% of their bridges as structurally deficient: Rhode Island, Iowa, West Virginia, South Dakota and Pennsylvania.
- After decades of improvement, fatality rates are increasing and eight states have overall fatality rates of 1.5 per 100 million vehicle-miles travelled or higher: South Carolina, Mississippi, Kentucky, Alaska, Louisiana, Arkansas, Montana and Alabama.

- After decades of improvement, rural fatality rates are increasing and nine states have rural fatality rates of 2.0 per 100 million vehicle-miles traveled or higher: Hawaii, North Carolina, Florida, California, Mississippi, New York, Kansas, South Carolina and Oregon.
- After decades of improvement, urban fatality rates are increasing and 13 states have urban fatality rates of 1.0 per 100 million vehicle-miles traveled or higher: New Mexico, Arizona, Hawaii, Florida, Arkansas, Kentucky, South Carolina, Louisiana, Oklahoma, Alaska, Tennessee, Wyoming and Nevada.

While system performance is down overall this year, nearly half of the states (21 of 50) made progress in 2016 compared to 2015. However, a 10-year average of state overall performance data indicates that system performance problems are concentrated in the bottom 10 states. These states are finding it difficult to improve. There is also increasing evidence that higher-level road systems (Interstates, other freeways and principal arterials) are in better shape than lower-level road systems, particularly local roads.

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PART 1

STATE HIGHWAY PERFORMANCE RANKINGS

The Reason *24th Annual Highway Report* rates state highway systems on cost versus quality using a method developed in the early 1990s by David T. Hartgen, Ph.D., emeritus professor at the University of North Carolina at Charlotte. This method has since been refined by Hartgen, M. Gregory Fields, Ph.D., Baruch Feigenbaum, and Spence Purnell. Since states have different budgets, system sizes, and traffic and geographic circumstances, their comparative performance depends on both system performance and the resources available. To determine relative performance across the country, state highway system budgets (per mile of responsibility) are compared with system performance, state by state. States with high ratings typically have better-than-average system conditions (good for road users) along with relatively low per-mile expenditures (good for taxpayers).

The following table shows the overall highway performance of the state highway systems using 2016 and 2017 data. This year's leading states are North Dakota, Virginia, Missouri, Maine and Kentucky**.** At the other end of the rankings are Massachusetts, Hawaii, Rhode Island, Alaska and New Jersey.

Unlike prior years, the top-performing states tend to be a mix of high-population and low-population states. Very rural states may have a slight advantage (Tables 1, 2, 3, 4, and Figure 1). But several states with large urban areas also rank highly: Virginia (2nd), Missouri (3rd), Tennessee (7th), North Carolina (17th), and Ohio (18th). Although it is tempting to ascribe these ratings solely to geographic circumstances, a more careful review suggests that numerous other factors—terrain, climate, truck volumes, urbanization, system age, budget priorities, unit cost differences, state budget circumstances and management/ maintenance philosophies, just to name a few—are all affecting overall performance. The remainder of this report reviews the statistics underlying these overall ratings in more detail.

TABLE 1: OVERALL HIGHWAY PERFORMANCE RANKINGS, 2016

Overall	State
1	North Dakota
2	Virginia
3	Missouri
4	Maine
5	Kentucky
6	Kansas
7	Tennessee
8	Montana
9	Utah
10	Alabama
11	Wyoming
12	Oregon
13	Idaho
14	South Dakota
15	Nebraska
16	West Virginia
17	North Carolina
18	Ohio
19	Vermont
20	South Carolina
21	New Mexico
22	Minnesota
23	Texas
24	New Hampshire
25	Mississippi
26	Georgia
27	Nevada
28	Illinois
29	Arizona
30	Michigan
31	Iowa
32	Arkansas
33	Indiana
34	Louisiana
35	Pennsylvania
36	Colorado
37	Washington
38	Wisconsin
39	Maryland
40	Florida
41	Oklahoma
42	Delaware
43	California
44	Connecticut
45	New York
46	Massachusetts
47	Hawaii
48	Rhode Island
49	Alaska
50	New Jersey

TABLE 2: OVERALL HIGHWAY PERFORMANCE RANKINGS IN ALPHABETICAL ORDER, 2016	
State	Overall
Alabama	10
Alaska	49
Arizona	29
Arkansas	32
California	43
Colorado	36
Connecticut	44
Delaware	42
Florida	40
Georgia	26
Hawaii	47
Idaho	13
Illinois	28
Indiana	33
Iowa	31
Kansas	6
Kentucky	5
Louisiana	34
Maine	4
Maryland	39
Massachusetts	46
Michigan	30
Minnesota	22
Mississippi	25
Missouri	3
Montana	8
Nebraska	15
Nevada	27
New Hampshire	24
New Jersey	50
New Mexico	21
New York	45
North Carolina	17
North Dakota	1
Ohio	18
Oklahoma	41
Oregon	12
Pennsylvania	35
Rhode Island	48
South Carolina	20
South Dakota	14
Tennessee	7
Texas	23
Utah	9
Vermont	19
Virginia	2
Washington	37
West Virginia	16
Wisconsin	38
Wyoming	11

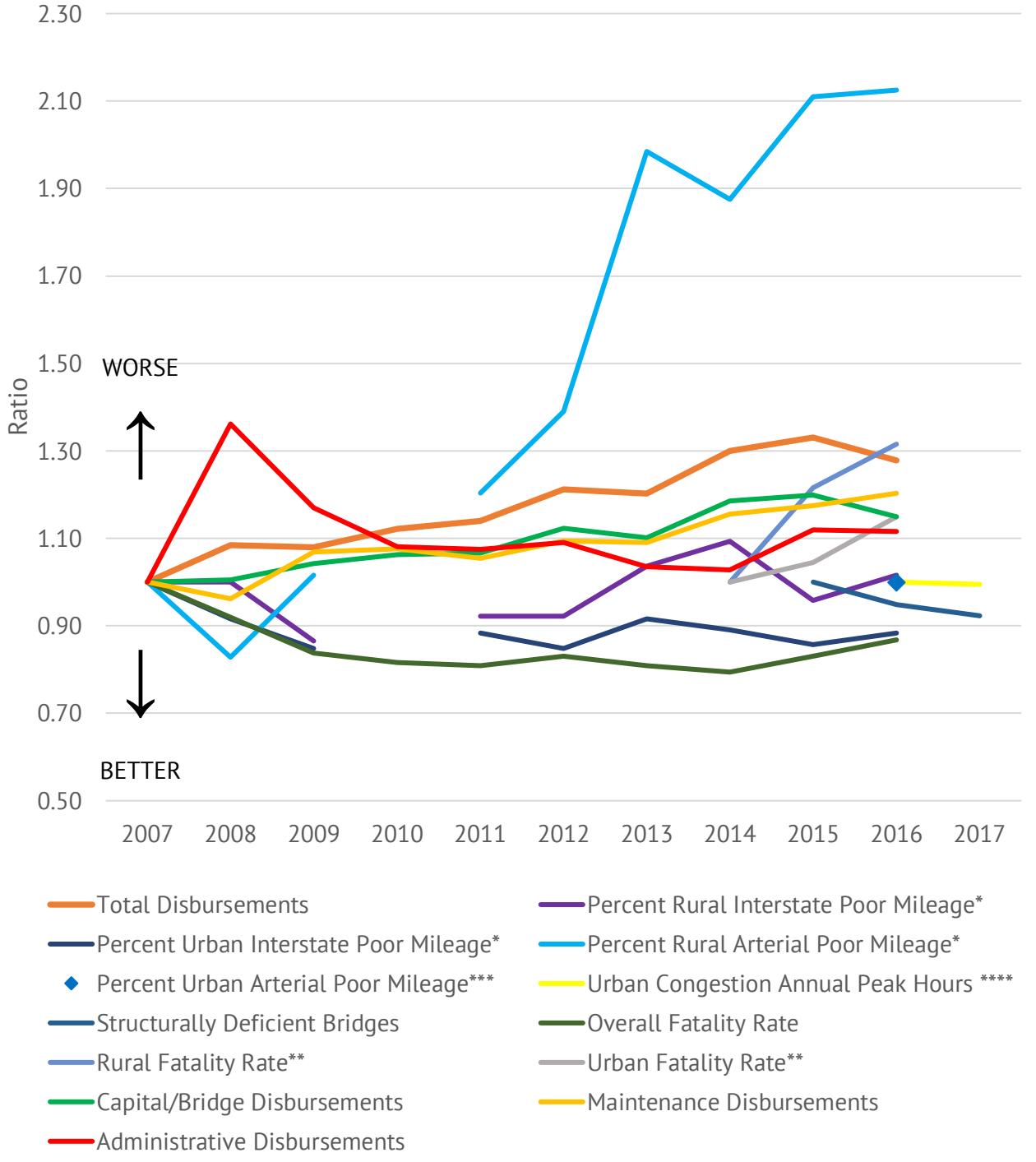
TABLE 3: HIGHWAY PERFORMANCE RANKINGS BY CATEGORY, 2016

State	Overall	Total Disbursements per Mile	Capital & Bridge Disbursements per Mile	Maintenance Disbursements per Mile	Admin Disbursements per Mile	Rural Interstate Pavement Condition	Urban Interstate Pavement Condition	Rural Arterial Pavement Condition	Urban Arterial Pavement Condition	Urbanized Area Congestion	Structurally Deficient Bridges	Overall Fatality Rate	Rural Fatality Rate	Urban Fatality Rate
Alabama	10	16	16	2	35	16	30	12	2	18	22	43	40	36
Alaska	49	29	41	30	32	48	19	50	19	6	36	47	37	41
Arizona	29	32	35	14	42	29	6	17	17	36	4	40	36	49
Arkansas	32	10	12	11	3	40	44	44	38	13	17	45	39	46
California	43	40	30	44	44	45	47	35	49	48	19	18	47	21
Colorado	36	33	34	32	27	47	28	27	33	37	13	23	33	32
Connecticut	44	46	47	33	50	42	18	34	22	30	24	11	4	26
Delaware	42	43	28	49	49	NA	48	1	13	38	6	24	19	29
Florida	40	49	49	41	37	6	5	2	1	40	3	42	48	47
Georgia	26	22	30	15	41	30	21	14	4	47	7	31	28	35
Hawaii	47	41	42	39	34	NA	50	48	39	19	15	21	50	48
Idaho	13	23	11	17	13	26	14	20	25	11	28	41	41	24
Illinois	28	42	46	35	22	8	4	3	16	45	26	16	15	27
Indiana	33	30	36	42	21	43	43	32	21	27	21	14	29	18
Iowa	31	20	29	19	15	33	36	43	30	3	49	27	21	16
Kansas	6	19	24	10	16	7	9	4	7	16	25	33	44	37
Kentucky	5	18	18	16	1	12	16	10	8	25	23	48	23	45
Louisiana	34	17	21	24	6	39	49	38	37	29	44	46	16	43
Maine	4	15	10	28	5	1	26	7	27	7	41	20	11	10
Maryland	39	44	44	45	36	27	39	21	34	44	14	7	3	23
Massachusetts	46	48	45	43	48	37	31	47	48	46	30	1	1	12
Michigan	30	38	27	27	25	34	42	19	41	34	35	19	7	30
Minnesota	22	25	31	29	23	35	40	25	6	41	11	3	6	4
Mississippi	25	9	15	4	14	38	37	24	29	12	39	49	46	1
Missouri	3	3	2	12	4	17	17	5	14	24	40	32	24	33
Montana	8	7	8	8	12	19	13	31	32	5	31	44	35	11
Nebraska	15	13	14	23	2	18	24	29	45	8	45	17	25	8
Nevada	27	34	32	22	45	13	25	26	5	33	2	29	32	38
New Hampshire	24	24	22	37	26	1	7	36	23	26	38	15	18	25
New Jersey	50	50	50	50	46	1	45	46	46	50	29	4	10	22
New Mexico	21	6	4	1	39	25	3	22	20	14	20	39	34	50
New York	45	47	48	47	43	41	46	30	44	49	37	5	45	5
North Carolina	17	5	6	9	10	20	15	23	18	23	34	30	49	13
North Dakota	1	11	25	3	8	9	1	15	28	4	43	22	22	2
Ohio	18	28	39	21	19	31	29	18	35	28	18	13	5	15
Oklahoma	41	37	33	46	38	36	41	37	40	15	42	38	26	42
Oregon	12	21	13	25	31	15	23	9	15	17	12	34	42	19
Pennsylvania	35	39	38	34	28	32	32	41	31	35	46	25	20	28
Rhode Island	48	45	43	48	47	1	10	49	50	31	50	2	2	14
South Carolina	20	1	1	5	7	28	27	42	9	21	32	50	43	44
South Dakota	14	4	5	6	18	23	8	33	42	9	47	28	14	9
Tennessee	7	14	19	18	24	11	12	16	11	32	8	35	17	40
Texas	23	27	26	26	22	22	33	13	36	43	1	37	38	34
Utah	9	31	17	40	29	10	11	11	3	20	5	9	31	17
Vermont	19	26	23	38	40	1	1	39	26	10	10	6	8	3
Virginia	2	12	7	31	20	14	22	6	12	39	16	10	12	6
Washington	37	35	37	36	30	46	38	28	47	42	9	8	9	20
West Virginia	16	2	3	7	9	21	20	40	10	2	48	36	27	31
Wisconsin	38	36	40	20	33	44	35	45	43	22	27	12	13	7
Wyoming	11	8	9	13	17	24	34	8	24	1	33	26	30	39

TABLE 4: OVERALL HIGHWAY PERFORMANCE RANKING TRENDS, 2013-2016

State	Year			Change in Rank	
	2013	2015	2016	2015-2016	2013-2016
Alabama	20	17	10	+7	+10
Alaska	50	48	49	-1	+1
Arizona	24	16	29	-13	-5
Arkansas	33	29	32	-3	+1
California	42	42	43	-1	-1
Colorado	35	31	36	-5	-1
Connecticut	44	46	44	+2	0
Delaware	37	19	42	-23	-5
Florida	32	35	40	-5	-8
Georgia	21	18	26	-8	-5
Hawaii	48	47	47	0	+1
Idaho	16	7	13	-6	+3
Illinois	29	28	28	0	+1
Indiana	36	34	33	+1	+3
Iowa	40	15	31	-16	+9
Kansas	3	2	6	-4	-3
Kentucky	14	13	5	+8	+9
Louisiana	34	37	34	+3	0
Maine	5	23	4	+19	+1
Maryland	38	40	39	+1	-1
Massachusetts	46	44	46	-2	0
Michigan	31	32	30	+2	+1
Minnesota	27	25	22	+3	+5
Mississippi	10	11	25	-14	-15
Missouri	12	9	3	+6	+9
Montana	6	6	8	-2	-2
Nebraska	4	4	15	-11	-11
Nevada	22	20	27	-7	-5
New Hampshire	26	30	24	+6	+2
New Jersey	49	50	50	0	-1
New Mexico	11	24	21	+3	-10
New York	45	45	45	0	0
North Carolina	15	14	17	-3	-2
North Dakota	7	1	1	0	+6
Ohio	9	26	18	+6	-9
Oklahoma	17	33	41	-8	-24
Oregon	23	21	12	+9	+11
Pennsylvania	39	41	35	+6	+4
Rhode Island	47	49	48	+1	-1
South Carolina	1	5	20	-15	-19
South Dakota	2	3	14	-11	-12
Tennessee	18	12	7	+5	+11
Texas	19	22	23	-1	-4
Utah	13	10	9	+1	+4
Vermont	41	39	19	+20	+22
Virginia	30	27	2	+25	+28
Washington	43	43	37	+6	+6
West Virginia	25	36	16	+20	+9
Wisconsin	28	38	38	0	-10
Wyoming	8	8	11	-3	-3

FIGURE 1: OVERALL HIGHWAY PERFORMANCE RANK, 2007–2017



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** Data for Rural Fatality Rate and Urban Fatality Rate starts in 2014
*** Data for Percent Urban Arterial Miles starts in 2016
**** Data for Urban Congestion Annual Peak Hours starts in 2016. The previous measure of congestion is not comparable.

Despite the methodological changes, the overall rankings were not dramatically different from the previous version of the *Annual Highway Report*. However, four states' overall ranking improved by double digits, while seven states' overall ranking declined by 10 or more spots:

- **Virginia improved 25 positions, from 27th to 2nd in the overall rankings**, as the number of structurally deficient bridges decreased and the state benefited from the report no longer measuring narrow rural arterial lanes (the state ranked 49th last year).
- **Vermont improved 20 positions, from 39th to 19th in the overall rankings**, as the state benefited from the report's increased emphasis on fatality rates (Vermont ranked 6th, 8th and 3rd in Overall Fatality Rate, Rural Fatality Rate and Urban Fatality Rate respectively) and the elimination of the Narrow Rural Arterial Lane ranking (the state ranked 47th last year).
- **West Virginia improved 20 positions, from 36th to 16th in the overall rankings,** as the fatality rate decreased somewhat and the state benefited from the report no longer measuring narrow rural arterial lanes (the state ranked 50th last year).
- **Maine improved 19 positions, from 23rd to 4th in the overall rankings**, as the state benefited from the report no longer measuring narrow rural arterial lanes (the state ranked 42nd last year). Maine's previous ranking (using 2015 data) may have been an aberration as several years ago it ranked 5th (using 2013 data).
- **Delaware declined 23 positions, from 19th to 42nd in the overall rankings,** as disbursements increased significantly and urban Interstate pavement condition deteriorated significantly. Delaware's previous ranking (using 2015 data) may have been an aberration as several years ago it ranked 37th (using 2013 data).
- **Iowa declined 16 positions, from 15th to 31st in the overall rankings,** as rural arterial pavement condition declined and the percentage of structurally deficient bridges increased. Iowa's previous ranking (using 2015 data) may have been an aberration as several years ago it ranked 40th (using 2013 data).
- **South Carolina declined 15 positions, from 5th to 20th in the overall rankings,** as rural Interstate pavement condition and rural arterial pavement condition both declined significantly. The percentage of deficient bridges also increased significantly. South Carolina also has the highest fatality rate in the country for the second year in a row.

- **Mississippi declined 14 positions, from 11th to 25th in the overall rankings**, as rural Interstate pavement condition declined and the number of structurally deficient bridges increased substantially.
- **Arizona declined 13 positions, from 16th to 29th in the overall rankings,** as the state was negatively affected by the report's increased emphasis on fatality rate (Arizona ranked 40th, 36th and 39th in Overall Fatality Rate, Rural Fatality Rate and Urban Fatality Rate) and elimination of the Narrow Rural Arterial Lanes category (Arizona ranked 1st last year). Arizona's previous rankings (using 2015 data) may have been an aberration as several years ago it ranked 24th (using 2013 data).
- **Nebraska declined 11 positions, from 4th to 15th in the overall rankings,** as the state rankings worsened in many categories, with a significant increase in the percentage of structurally deficient bridges.
- **South Dakota declined 11 positions, from 3rd to 14th in the overall rankings,** as rural Interstate pavement condition and rural arterial pavement condition declined significantly. The percentage of structurally deficient bridges also increased significantly.

Sample State Rankings

Determining a state's overall ranking includes using data from 13 different categories. States that perform poorly overall often excel in one or more categories, and states that perform well often struggle in one or more categories. Legislative actions can significantly affect a state's ranking. Finally, there is a lag in the data. As a result, states with a high-quality system today may have a lower ranking because they struggled when the data were compiled and vice versa. This text box provides a little more context on six of the states.

Georgia: Georgia has historically ranked in the top 20 of the *Annual Highway Report* but this year it slipped to 26th. While this may sound troubling, it reaffirms Georgia's 2015 decision to revamp its transportation funding system. Prior to 2015, Georgia had county gasoline sales taxes that went to the county general fund instead of to the Department of Transportation for roadway funding. As part of the 2015 change, including the imposition of an electric vehicle fee, Georgia dedicated substantially more money to transportation with a minimal gas tax increase. Due to the lag in the data, Georgia's numbers are expected to start improving with 2017 and 2018 data. The worsening of Georgia's pavement conditions between 2012 and 2016 shows the importance of dedicating gas tax revenue to highways.

Virginia: Virginia ranks 2nd in this year's *Annual Highway Report*, a significant increase from last year. The state is able to maintain smooth pavement conditions with low overall disbursements. Most states that rank in the top 20 are able to maintain a good quality system at a low overall cost. The state has also worked to significantly decrease its percentage of structurally deficient bridges. Virginia also benefited this year due to two changes in the metrics. Both the increased focus on fatality rate (the state typically has one of the lowest fatality rates outside the Northeast) and the elimination of the narrow arterial lanes category (Virginia ranked 49th last year) helped the state's rankings. However, the state still has room for improvement. It's urbanized area congestion ranking is 39th (or 12th worst). Virginia may need to dedicate more of its resources to reducing congestion.

Florida: Florida ranks 40th in this year's *Annual Highway Report,* a decline from last year's ranking of 35th. The state excels in some parts of the rankings but still ranks poorly overall. And in other state DOT quality rankings, Florida places higher. Why is there a discrepancy? While Florida's pavement condition is excellent (its worst ranking in the four pavement categories is 6th) and it has few structurally deficient

bridges (3rd overall), its average disbursements are high (ranging from 37th to 49th) and its fatality rate is very high (ranging from 42nd to 48th). Florida excels in some rankings but it trails in many others, leading to its overall ranking of 40th. If the state can reduce its average disbursements and fatality rate even slightly, its ranking will improve significantly.

New Jersey: For the second year in a row New Jersey ranks 50th. This is due to the state's fifth quintile rankings (41st to 50th) in many categories. New Jersey spends the highest amount of revenue per roadway mile, ranking 50th in three of the disbursement categories and 46th in the fourth category. The state also ranks last in the country in congestion. It ranks 45th, 46th and 46th in the categories of Urban Interstate Pavement Condition, Rural Principal Arterial Pavement Condition and Urban Principal Arterial Pavement Condition. The state does rank well in several categories. It ties for 1st in Rural Interstate Pavement Condition and its Overall Fatality Rate is 4th. However, the state ranks poorly on far more categories than it ranks highly. Several years ago, New Jersey increased its gas tax by 23 cents. Unfortunately, due to system inefficiency including high costs, we remain skeptical that the increased revenue will improve the overall system.

Ohio: Overall, less populated states may have a slight edge in the rankings. However, many higher population states continue to rank highly. Ohio, 7th in population, is one of these states. While, Ohio has only one top 10 ranking (Rural Fatality Rate is 5th), its high overall ranking is a result of it not placing in the bottom 10 in any category. It ranks in the second quintile (11th to 20th) in five categories, the third quintile (21st to 30th) in four categories and the fourth quintile (31st to 40th) in three categories. Ohio illustrates two ranking realities. First, a state with large metro areas can rank highly, and second, a state with an absence of poor rankings has a better overall ranking than a state with several excellent rankings but several poor rankings as well.

Utah: Utah shows that efficient DOTs tend to have better rankings. The state has long been considered an innovative DOT, winning several national awards for administration and creativity. The state has been a thought leader in many groups, including the American Association of State Highway and Transportation Officials (AASHTO). Utah's efficiency is the result of having an executive who is a transportation official rather than a politician, a metric-driven project selection process and a collaborative relationship among the federal, state and local governments.

PART 2

METHODOLOGICAL CHANGES

The *Annual Highway Report*'s goal is to provide an accurate, current evaluation of state highway systems. In order to meet that goal, we made a number of changes to this year's report based on two factors: data availability and nationwide population/demographic changes. In addition, certain states have expressed concerns about some of our metrics and we have tried to take those concerns into account as well. We explain the changes in the following paragraphs. The report's technical and quantitative metrics are detailed in the appendix:

- **Increase the category rankings from 11 to 13**. Previous versions of the *Annual Highway Report* have included 11 categories, including four measuring disbursements, three measuring pavement quality, one measuring roadway congestion and three measuring safety. In order to give the roadway pavement and safety categories the same weight as the disbursements and to include a richer array of data, we have added a fourth pavement and a fourth safety category. (We discuss the fourth pavement category below and the fourth safety category in the third bullet below.)

  The fourth pavement category is Urban Other Arterial Pavement Condition. In previous reports, we have measured both rural and urban Interstate condition but only rural arterial condition. Given the increasing urbanization of the country (particularly growth in exurbs and suburbs) we think it is important to weight rural

and urban pavement conditions equally. This new weighting will provide a more accurate sampling of the country's pavement quality.

- **Calculate rankings using lane-miles**, which is the length of the highway system multiplied by the number of lanes on a highway (a five-mile road with two lanes equals 10 lane-miles while a five-mile road with six lanes equals 30 lane-miles) instead of using centerline-miles, which is the length of the highway system (a five-mile road equals five centerline-miles regardless of number of lanes).

  Using centerline-miles worked well for more than 20 years. We used centerline-miles because the cost of building the first mile of a highway from Point A to Point B (including right of way acquisition and pre-construction) is much more expensive than the cost to build an additional mile of that highway also from Point A to Point B. However, as more-populated states widen their roadways and less-populated states do not, the average width (number of lanes) of a state roadway differs significantly from 2.06 in West Virginia to 3.66 in New Jersey. As a result, we think lane-miles is a better metric for today's state highway systems.

- **Make substantial changes to the safety rankings**. Given the availability of data, we revised our safety metrics.

  We continue to rank bridge quality. However, this year we measure only structurally deficient bridges (those with deteriorated conditions that need maintenance in the near future to ensure continued safety) and not functionally obsolete ones (those that have narrower lanes or shoulders but no structural concerns). While neither condition is ideal, structurally deficient bridges are a much bigger problem. Functionally obsolete bridges are older, are built to different design standards, and tend to be located in northeastern states with more mature infrastructure. Penalizing states with safe but old infrastructure negatively affects certain states and is poor policy.

  We eliminated the ranking of narrow arterial lanes (those less than 12 feet wide) for two reasons. First, some states measure their roadways by eye while other use advanced laser measures. States that have switched to laser measures have found that many of their arterial lanes that they thought were 12 feet wide are actually 11 feet 10 inches wide. Given that states use both measures, comparing states measured with lasers to those measured by eye is not accurate. Second, states with narrower lanes tend to have older roadways not built to today's design standards. Penalizing states with older roads is poor policy.

As a result of eliminating the narrow arterial lane ranking and increasing the safety rankings to four, we needed two new categories. Our other safety ranking—fatalities—is considered the most important safety ranking. Given the troubling increase in fatalities and the differences between urban and rural fatality rates, we decided to split the fatality ratings into three categories and include each in the rankings. We continue to rank total fatalities but we have added new categories for rural fatality and urban fatality rates. State rankings vary substantially on this metric, with some states' rural fatality rate being 30 or more slots different from their urban fatality rate.

We believe these rankings will improve the quality of the report. Next year, we will evaluate these changes and may make additional changes if needed.

PART 3

BACKGROUND DATA

State highway system sizes range from approximately 1,000 miles to more than 80,000 miles. States with larger geographic areas and larger populations tend to have larger systems. Some states, such as North Carolina, maintain all of their roads on the state level, except for subdivision and other local roads. Other states, such as Florida, have robust county road systems. State-controlled highway mileage and state highway agency miles are not included in the rankings. They are included in this report as background information and are used to weight the financial data.

STATE-CONTROLLED MILES

State-controlled mileage encompasses the state highway systems, state-agency toll roads, some ferry services, and smaller systems serving universities and state-owned properties. It includes the Interstate System, the National Highway System, and most federal aid system roads. Nationwide in 2016, 813,417 miles were under state control (Table 5, State-Controlled Highway Mileage), 737 miles fewer than in 2015 (814,154), the last time this assessment was completed. Small annual changes in state-controlled miles are to be expected, as state systems are expanded to meet increasing needs. Often jurisdictions assume responsibility for mileage previously under state control. The smallest state-owned road systems are Hawaii (1,012 miles) and Rhode Island (1,192 miles); the largest are Texas (80,854 miles) and North Carolina (80,676 miles).

TABLE 5: STATE-CONTROLLED HIGHWAY MILEAGE

2016 Size	State	Mileage
1	Texas	80,854
2	North Carolina	80,676
3	Virginia	58,861
4	Pennsylvania	41,659
5	South Carolina	41,534
6	West Virginia	34,689
7	Missouri	33,981
8	Kentucky	28,220
9	Ohio	20,365
10	Georgia	18,029
11	Illinois	16,742
12	Louisiana	16,702
13	New York	16,442
14	Arkansas	16,432
15	California	16,112
16	Washington	15,497
17	Tennessee	14,286
18	Minnesota	13,516
19	Oklahoma	13,355
20	Florida	12,193
21	New Mexico	12,148
22	Wisconsin	11,740
23	Indiana	11,215
24	Alabama	11,078
25	Montana	10,995
26	Mississippi	10,981
27	Kansas	10,531
28	Nebraska	10,064
29	Colorado	9,899
30	Michigan	9,764
31	Iowa	9,503
32	South Dakota	9,431
33	Oregon	9,132
34	Maine	8,648
35	Alaska	7,965
36	Arizona	7,874
37	North Dakota	7,433
38	Wyoming	7,225
39	Utah	6,404
40	Delaware	5,490
41	Nevada	5,462
42	Maryland	5,444
43	Idaho	4,992
44	Connecticut	4,057
45	New Hampshire	4,005
46	Massachusetts	3,615
47	New Jersey	3,344
48	Vermont	2,629
49	Rhode Island	1,192
50	Hawaii	1,012
	U.S. Total	813,417
	Average	16,268

STATE HIGHWAY AGENCY (SHA) MILES

State highways are generally the Interstates and other major US-numbered and state-numbered roads (major and minor arterials). A few states also manage major portions of the rural road system (collectors and local roads). In 2016, 779,457 miles were the responsibility of the 50 state highway agencies (Table 6, State Highway Agency Mileage), identical to 2015, the last time this assessment was completed.

For calculating state rankings, we use lane-miles as discussed in Part 2. In 2016, the 50 state highway agencies were responsible for 1,874,470 lane-miles. The average number of lanes *per mile* is 2.52 lanes, but a few states (New Jersey, Florida, California and Massachusetts) manage significantly wider roads, averaging more than 3.0 lanes per mile.

TABLE 6: STATE HIGHWAY AGENCY MILEAGE, BY AVERAGE NUMBER OF LANES/MILE

2016 Size	State	SHA Miles	SHA Lane-Miles	Ratio
1	New Jersey	2,331	8,545	3.67
2	Florida	12,106	43,921	3.63
3	California	15,091	51,279	3.40
4	Massachusetts	2,990	9,466	3.17
5	Arizona	6,780	19,636	2.90
6	Maryland	5,151	14,766	2.87
7	Michigan	9,668	27,451	2.84
8	Utah	5,881	16,065	2.73
9	Georgia	17,912	48,675	2.72
10	Alabama	10,929	29,609	2.71
11	Tennessee	13,888	37,284	2.68
12	Illinois	15,917	42,187	2.65
13	Connecticut	3,719	9,829	2.64
14	Hawaii	943	2,489	2.64
15	Washington	7,071	18,522	2.62
16	Rhode Island	1,099	2,862	2.60
17	Indiana	10,616	27,432	2.58
18	Mississippi	10,888	28,050	2.58
19	Ohio	19,229	49,529	2.58
20	Iowa	8,884	22,722	2.56
21	New York	15,042	38,304	2.55
22	Colorado	9,046	22,896	2.53
23	Wisconsin	11,740	29,707	2.53
24	Nevada	5,403	13,652	2.53
25	Minnesota	11,753	29,259	2.49
26	Oklahoma	12,254	30,373	2.48
27	New Mexico	11,994	29,689	2.48
28	Idaho	4,992	12,335	2.47
29	Texas	80,483	195,952	2.43
30	Oregon	7,655	18,589	2.43
31	Louisiana	16,677	39,312	2.36
32	Wyoming	6,733	15,758	2.34
33	Kansas	10,293	24,009	2.33
34	North Dakota	7,414	17,229	2.32
35	South Dakota	7,756	17,875	2.30
36	Arkansas	16,432	37,765	2.30
37	Missouri	33,856	77,679	2.29
38	Vermont	2,629	6,001	2.28
39	Montana	11,016	25,132	2.28
40	Nebraska	9,944	22,544	2.27
41	Kentucky	27,650	62,066	2.24
42	Pennsylvania	39,737	88,242	2.22
43	Delaware	5,412	11,869	2.19
44	South Carolina	41,340	90,462	2.19
45	Virginia	58,821	127,889	2.17
46	North Carolina	79,637	171,959	2.16
47	New Hampshire	3,900	8,399	2.15
48	Maine	8,352	17,540	2.10
49	Alaska	5,629	11,689	2.08
50	West Virginia	34,407	71,003	2.06
	U.S. Total	779,457	1,874,470	2.40
	Weighted Average	15,589	37,489	

PART 4

PERFORMANCE INDICATORS

The *Annual Highway Report* ranks each state in 13 categories. Four of the categories measure **spending**: Capital and Bridge Disbursements, Maintenance Disbursements, Administrative Disbursements and Total Disbursements. The remaining nine categories measure **performance**. Four of the categories measure pavement quality: Rural Interstate Pavement Condition, Urban Interstate Pavement Condition, Rural Other Principal Arterial Pavement Condition and Urban Other Principal Arterial Pavement. One of the categories measures congestion: Urban Area Congestion. Four of the categories measure safety: Structurally Deficient Bridges, Overall Fatality Rate, Rural Fatality Rate and Urban Fatality Rate.

The four spending categories are considered together, weighted equally and then averaged to get one overall spending score. The nine performance categories are also considered together, weighted equally and then averaged to get one overall performance score. Then the spending and performance composite scores are added together, weighted by the number of metrics, and averaged to create one total score for each state. Therefore, each measure, whether spending efficiency or system performance, is weighted equally.

This part of the report includes detailed data and trends for each category. Rankings include a table showing the state, the ranking and a composite score. Each ranking also includes a color-coded map with the composite score for each state.

CAPITAL AND BRIDGE DISBURSEMENTS

Capital and bridge disbursements are the costs to build new, and widen existing, highways and bridges. Capital and bridge disbursements for state-owned roads equal 51.6% of total disbursements, totaling $71.75 billion in 2016, about 4.4% less than was spent in 2015 ($74.90 billion), the last time this assessment was completed.

This year, we measure capital and bridge disbursements per lane-mile. In past years, we measured them in centerline-miles. The average 2016 per-mile disbursement is $36,681 (Table 7, Capital and Bridge Disbursements per State-Controlled Mile, 2016, Figure 2). We also calculated disbursements in centerline-miles to compare 2016 disbursements to previous years. Centerline-mile disbursements decreased about 4.1%, from $91,992 per mile in 2015 to $88,212 per mile in 2016. This significant decrease bucks a generally steady spending trend over the last decade. Since 2007, these per-mile disbursements have increased about 15%, while the Consumer Price Index (CPI) has increased about 18%.[1]

In 2016, South Carolina, Missouri, West Virginia, New Mexico and South Dakota reported the lowest per-mile capital and bridge expenditures. New Jersey, Florida, New York, Connecticut and Illinois reported the highest per-mile

TABLE 7: CAPITAL AND BRIDGE DISBURSEMENTS PER STATE-CONTROLLED LANE-MILE, 2016

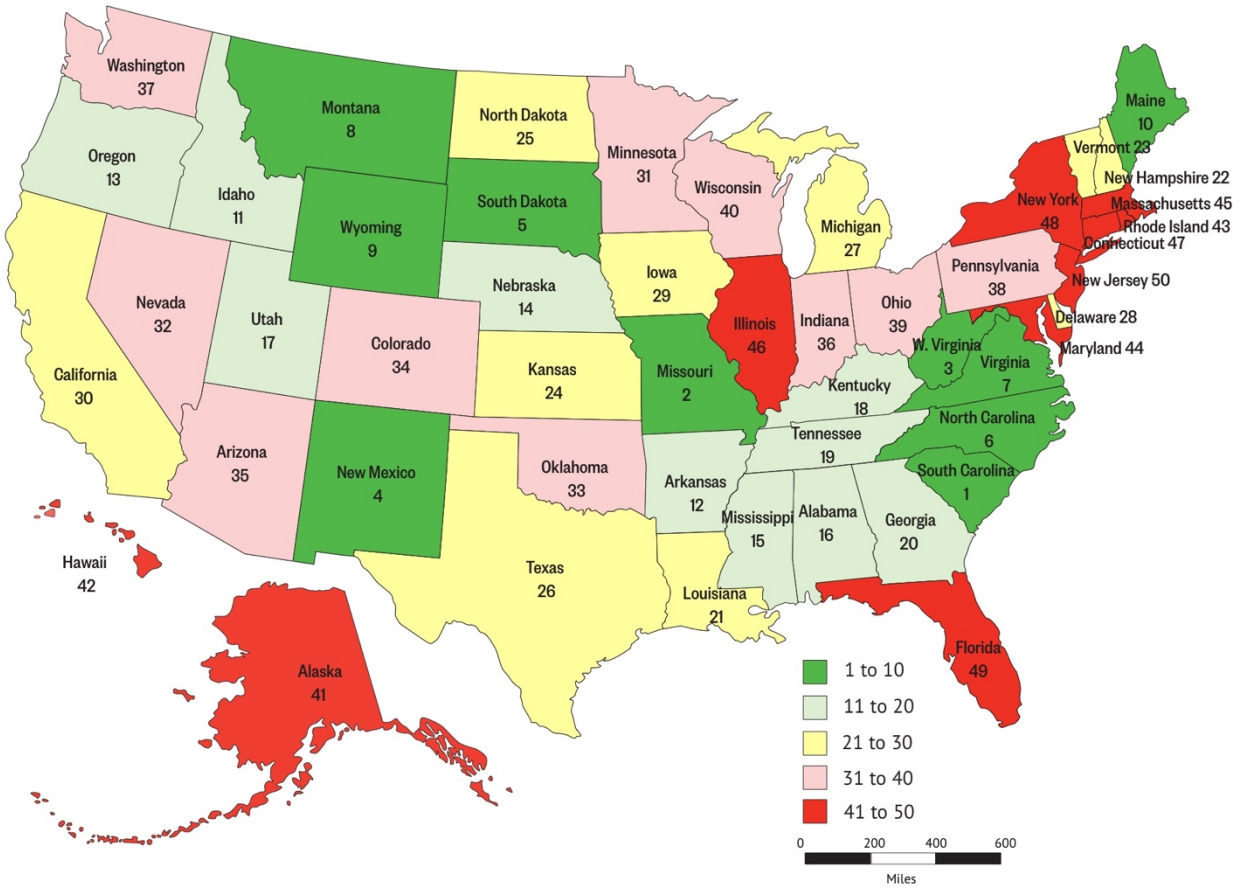
2016 Rank	State	Disbursement
1	South Carolina	$8,154
2	Missouri	$9,736
3	West Virginia	$11,595
4	New Mexico	$13,051
5	South Dakota	$15,018
6	North Carolina	$15,367
7	Virginia	$15,745
8	Montana	$17,741
9	Wyoming	$18,529
10	Maine	$23,323
11	Idaho	$24,310
12	Arkansas	$24,555
13	Oregon	$24,570
14	Nebraska	$25,108
15	Mississippi	$25,635
16	Alabama	$25,903
17	Utah	$26,119
18	Kentucky	$26,163
19	Tennessee	$26,495
20	Georgia	$26,612
21	Louisiana	$27,652
22	New Hampshire	$27,822
23	Vermont	$30,615
24	Kansas	$31,761
25	North Dakota	$31,838
26	Texas	$36,450
27	Michigan	$36,723
28	Delaware	$37,332
29	Iowa	$38,218
30	California	$40,406
31	Minnesota	$41,717
32	Nevada	$43,535
33	Oklahoma	$43,807
34	Colorado	$45,137
35	Arizona	$46,262
36	Indiana	$46,769

expenditures. The states with the largest percentage shifts from 2015 to 2016 were Delaware and Nevada (which increased per-mile expenditures by more than 35%) and Texas and Hawaii (which decreased per-mile expenditures by more than 39%). Some of the disbursements per state-controlled mile can vary widely from year to year—reflecting funding actions and project schedules.

* Massachusetts' latest disbursement data is from 2010.

37	Washington	$47,548
38	Pennsylvania	$50,354
39	Ohio	$50,811
40	Wisconsin	$52,280
41	Alaska	$54,413
42	Hawaii	$72,796
43	Rhode Island	$87,136
44	Maryland	$90,441
45	Massachusetts*	$92,972
46	Illinois	$95,116
47	Connecticut	$96,956
48	New York	$102,418
49	Florida	$137,875
50	New Jersey	$214,678
	Weighted Average	$36,681

FIGURE 2: CAPITAL AND BRIDGE DISBURSEMENTS PER STATE-CONTROLLED LANE-MILE



MAINTENANCE DISBURSEMENTS

Maintenance disbursements are the costs to perform routine upkeep, such as filling in potholes and repaving roads. Maintenance disbursements comprise about 16.8% of total disbursements, totaling $23.33 billion in 2016, about 2.3% more than in 2015 ($22.81 billion), the last time this assessment was completed.

This year we measure maintenance disbursements per lane-mile. In past years, we measured them in centerline-miles. The average 2016 per-mile disbursement is $11,929 (Table 8, Maintenance Disbursements per State-Controlled Mile, 2016, Figure 3). We also calculated disbursements in centerline-miles to compare 2016 disbursements to previous years. Centerline-miles disbursements increased about 0.5%, from $28,020 per mile in 2015 to $28,687 per mile in 2016. This very slight increase maintains a generally steady spending trend over the last decade. Since 2007, these per-mile disbursements have increased about 15%, while the Consumer Price Index (CPI) has increased about 18%.[2]

In 2016, New Mexico, Alabama, North Dakota, Mississippi and South Carolina reported the lowest per-mile capital and bridge expenditures. New Jersey, Delaware, Rhode Island, New York and Oklahoma

TABLE 8: MAINTENANCE DISBURSEMENTS PER STATE CONTROLLED LANE-MILE, 2016

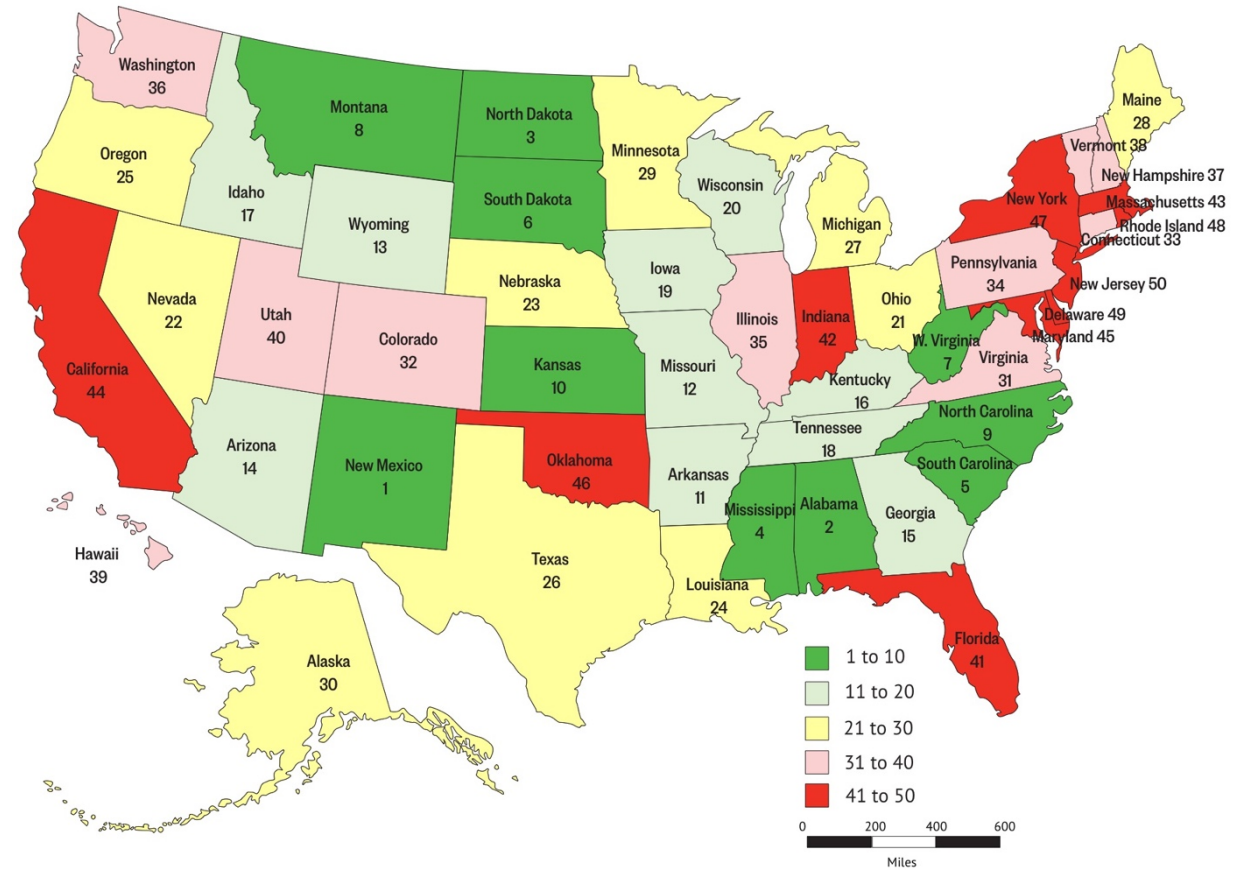
2016 Rank	State	Disbursement
1	New Mexico	$479
2	Alabama	$1,021
3	North Dakota	$1,657
4	Mississippi	$2,912
5	South Carolina	$3,039
6	South Dakota	$3,917
7	West Virginia	$4,934
8	Montana	$5,034
9	North Carolina	$5,352
10	Kansas	$5,353
11	Arkansas	$5,834
12	Missouri	$6,116
13	Wyoming	$6,413
14	Arizona	$6,487
15	Georgia	$7,006
16	Kentucky	$7,372
17	Idaho	$7,896
18	Tennessee	$8,032
19	Iowa	$8,578
20	Wisconsin	$8,631
21	Ohio	$9,102
22	Nevada	$9,367
23	Nebraska	$9,915
24	Louisiana	$10,293
25	Oregon	$10,332
26	Texas	$11,505
27	Michigan	$12,048
28	Maine	$12,109
29	Minnesota	$12,268
30	Alaska	$13,364
31	Virginia	$13,652
32	Colorado	$14,491
33	Connecticut	$16,281
34	Pennsylvania	$16,498
35	Illinois	$16,903
36	Washington	$17,267

reported the highest per-mile expenditures. The states with the largest percentage shifts from 2015 to 2016 were Delaware and Oklahoma (which increased per-mile expenditures by 89% and 62% respectively) and New Mexico and Delaware (which decreased per-mile expenditures by 69% and 46% respectively). Some of the disbursements per state-controlled mile can vary widely from year to year, reflecting funding actions and project schedules.

* Massachusetts' latest disbursement data is from 2010.

37	New Hampshire	$17,951
38	Vermont	$18,445
39	Hawaii	$22,248
40	Utah	$22,717
41	Florida	$23,123
42	Indiana	$24,269
43	Massachusetts*	$25,033
44	California	$25,425
45	Maryland	$30,561
46	Oklahoma	$31,190
47	New York	$36,247
48	Rhode Island	$36,902
49	Delaware	$37,040
50	New Jersey	$60,646
	Weighted Average	$11,929

FIGURE 3: MAINTENANCE DISBURSEMENTS PER STATE CONTROLLED LANE-MILE



ADMINISTRATIVE DISBURSEMENTS

Administrative disbursements typically include general and main-office expenditures in support of state-administered highways. They do not include project-related costs but occasionally include "parked" funds, which are funds from bond sales or asset sales awaiting later expenditure. Therefore, they vary widely from year to year. Administrative disbursements comprise about 6.3% of total disbursements, totaling $8.81 billion in 2016, nearly identical to 2015 ($8.85 billion), the last time this assessment was completed.

This year, we measure administrative disbursements per lane-mile. In past years, we measured them in centerline-miles. The average 2016 per-mile disbursement is $4,501 (Table 9, Administrative Disbursements per State-Controlled Mile, 2016, Figure 4). We also calculated disbursements in centerline-miles to compare 2016 disbursements to previous years. Centerline-mile disbursements decreased about 0.4%, from $10,864 per mile in 2015 to $10,825 per mile in 2016. This very slight decrease maintains a generally steady spending trend over the last decade. Since 2007, these per-mile disbursements have increased about 15%, while the Consumer Price Index (CPI) has increased about 18%.[3]

In 2016, Kentucky, Nebraska, Arkansas, Missouri and Maine reported the lowest administrative expenditures. Connecticut,

TABLE 9: ADMINISTRATIVE DISBURSEMENTS PER STATE-CONTROLLED LANE-MILE, 2016

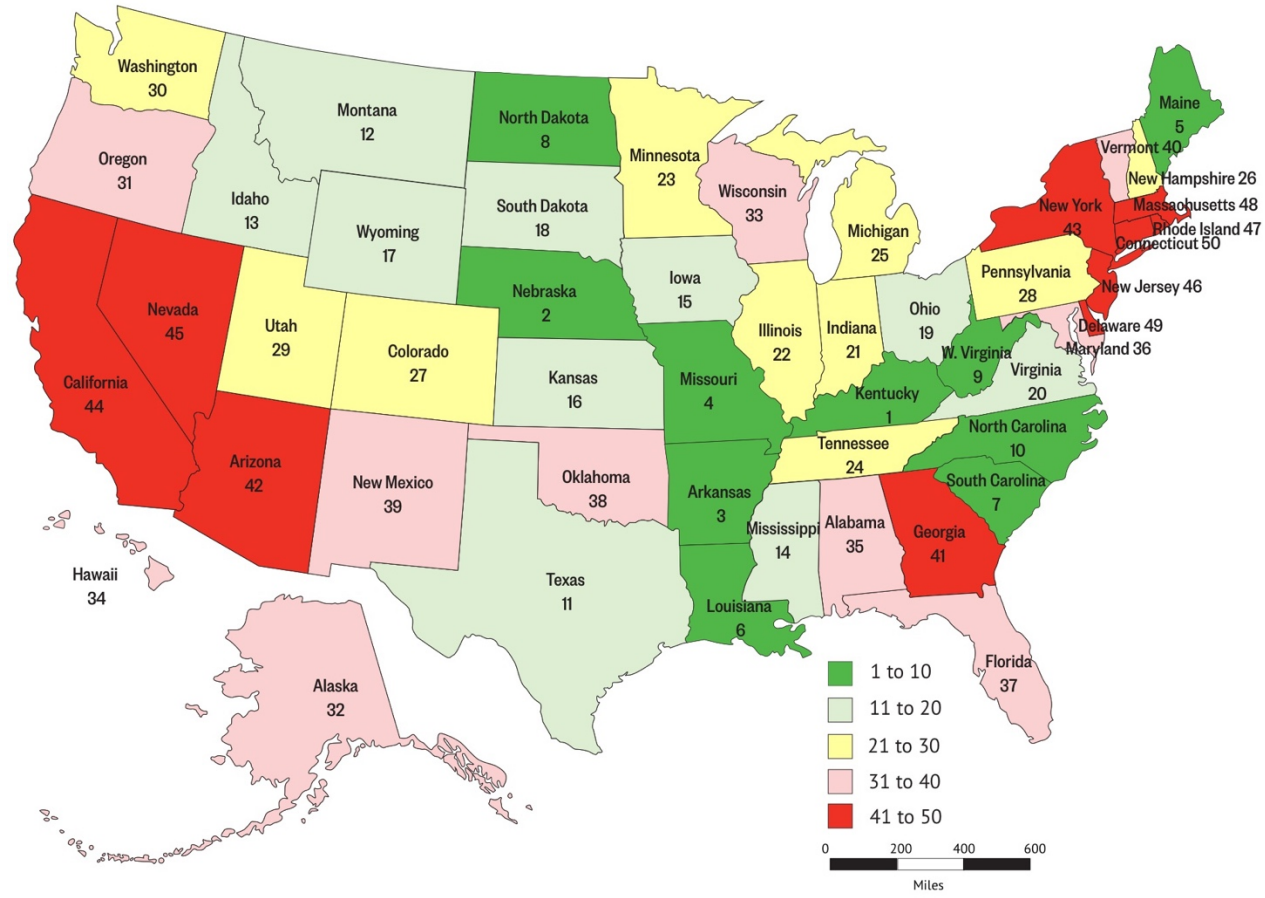
2016 Rank	State	Disbursement
1	Kentucky	$490
2	Nebraska	$846
3	Arkansas	$916
4	Missouri	$928
5	Maine	$1,142
6	Louisiana	$1,228
7	South Carolina	$1,310
8	North Dakota	$1,343
9	West Virginia	$1,362
10	North Carolina	$1,524
11	Texas	$1,873
12	Montana	$2,175
13	Idaho	$2,451
14	Mississippi	$2,587
15	Iowa	$2,650
16	Kansas	$2,772
17	Wyoming	$3,004
18	South Dakota	$3,100
19	Ohio	$3,119
20	Virginia	$3,143
21	Indiana	$3,544
22	Illinois	$3,890
23	Minnesota	$4,687
24	Tennessee	$4,740
25	Michigan	$5,107
26	New Hampshire	$5,260
27	Colorado	$5,337
28	Pennsylvania	$5,408
29	Utah	$5,414
30	Washington	$5,451
31	Oregon	$5,968
32	Alaska	$6,078
33	Wisconsin	$6,916
34	Hawaii	$7,001
35	Alabama	$7,151
36	Maryland	$7,418

Delaware, Massachusetts, Rhode Island and New Jersey reported the highest per-mile expenditures. The states with the largest percentage shifts from 2015 to 2016 were Delaware (which increased per-mile expenditures by more than 214%) and Ohio and New Hampshire (which decreased per-mile expenditures by 60% and 48% respectively). Some of the disbursements per state-controlled mile can vary widely from year to year, reflecting funding actions and project schedules.

* Massachusetts' latest disbursement data is from 2010.

37	Florida	$7,780
38	Oklahoma	$8,484
39	New Mexico	$9,659
40	Vermont	$9,928
41	Georgia	$10,638
42	Arizona	$10,954
43	New York	$11,315
44	California	$11,357
45	Nevada	$12,468
46	New Jersey	$14,035
47	Rhode Island	$17,162
48	Massachusetts*	$23,950
49	Delaware	$25,120
50	Connecticut	$35,028
	Weighted Average	$4,501

FIGURE 4: ADMINISTRATIVE DISBURSEMENTS PER STATE CONTROLLED LANE-MILE



The Difference Between Maintenance and Administrative Disbursements

Certain disbursement data can be counted in one of several categories. One example is benefits (vacation, health care, etc.) of state Department of Transportation maintenance workers. Certain states such as New Jersey count the benefits as a maintenance disbursement since the employees are conducting routine highway maintenance. Other states such as Connecticut count the benefits as an administrative disbursement since benefits are an administrative expense. Not surprisingly, of the two states New Jersey has the worse ranking in Maintenance Disbursements and Connecticut has the worse ranking in Administrative Disbursements. As a result, it is important to look at both the individual disbursement categories and disbursements as a whole**,** as states have some leeway in their classification of certain expenditures.

TOTAL DISBURSEMENTS

Since capital and bridge, maintenance, and administrative disbursements make up the majority of expenditures (74.7% in 2016), this report measures them individually and collectively. Total Disbursements include those three funding categories, plus three others: Highway Law Enforcement and Safety, Interest, and Bond Retirement. In total, the 50 states disbursed about $139.0 billion for state-owned roads in 2016, a 4.1% decrease from $145.0 billion in 2015, the last time this assessment was completed.

This year, we measure average state disbursements per lane-mile. In past years, we measured them in centerline-miles. The average 2016 per-mile disbursement is $71,117 per lane-mile (Table 10, Total Disbursements per State-Controlled Mile, 2016, Figure 5). We also calculated disbursements in centerline-miles to compare 2016 disbursements to previous years. Centerline-mile disbursements decreased about 4.0% from $178,116 per mile in 2016 to $171,025 per mile in 2015. Over the last decade, highway spending has held steady. This small decrease maintains a generally steady spending trend over the last decade. Since 2007, these per-mile disbursements have increased about 15%, while the Consumer Price Index (CPI) has increased about 18%.[4]

In 2016, South Carolina, West Virginia, Missouri, South Dakota and North Carolina

TABLE 10: TOTAL DISBURSEMENTS PER STATE CONTROLLED LANE-MILE

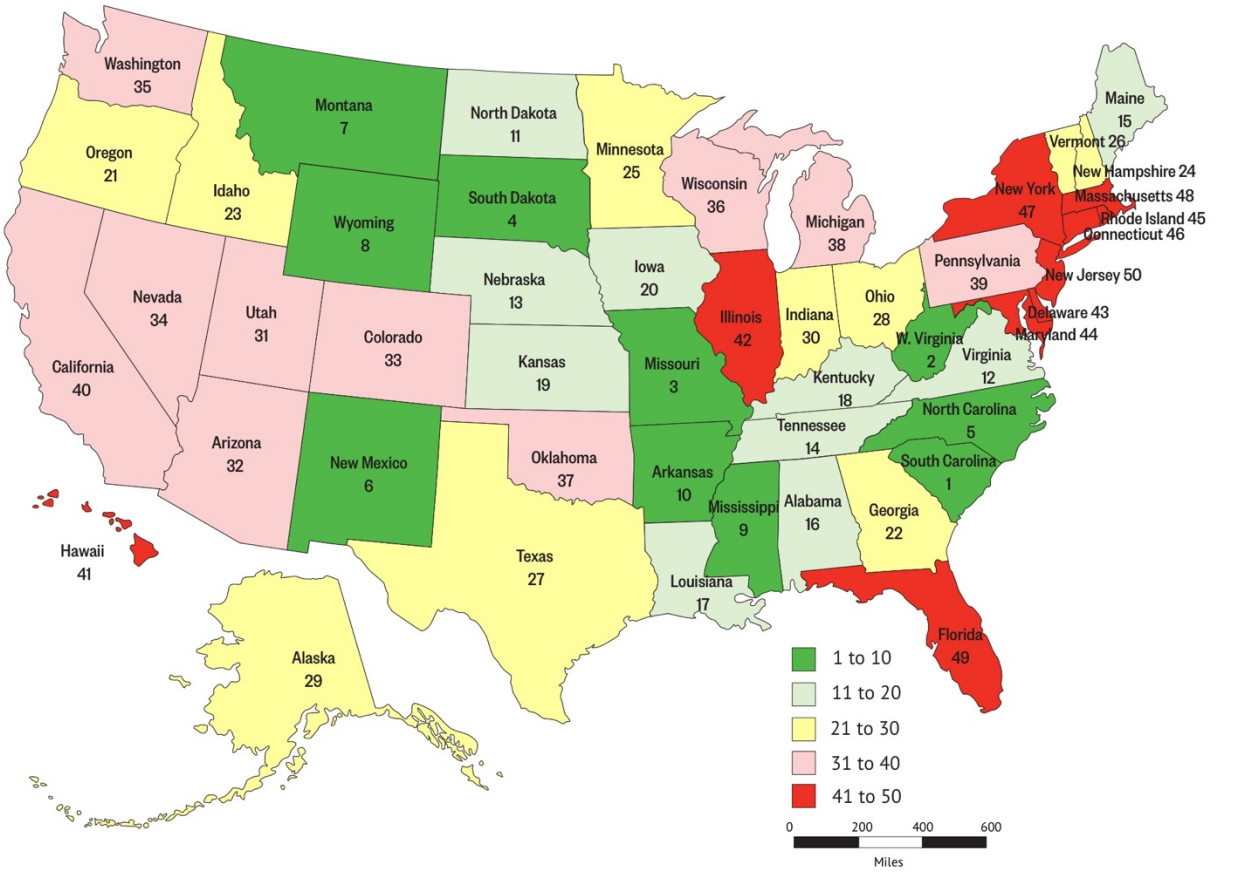
2016 Rank	State	Disbursement
1	South Carolina	$13,255
2	West Virginia	$19,625
3	Missouri	$23,534
4	South Dakota	$23,700
5	North Carolina	$24,587
6	New Mexico	$28,187
7	Montana	$29,299
8	Wyoming	$30,441
9	Mississippi	$34,883
10	Arkansas	$35,878
11	North Dakota	$37,024
12	Virginia	$37,875
13	Nebraska	$39,228
14	Tennessee	$40,138
15	Maine	$41,847
16	Alabama	$44,077
17	Louisiana	$45,621
18	Kentucky	$45,829
19	Kansas	$53,157
20	Iowa	$55,065
21	Oregon	$57,173
22	Georgia	$58,772
23	Idaho	$59,373
24	New Hampshire	$64,176
25	Minnesota	$70,740
26	Vermont	$72,032
27	Texas	$72,622
28	Ohio	$75,849
29	Alaska	$77,165
30	Indiana	$78,475
31	Utah	$79,029
32	Arizona	$84,551
33	Colorado	$84,695
34	Nevada	$88,236
35	Washington	$90,702

reported the lowest expenditures. New Jersey, Florida, Massachusetts, New York and Connecticut reported the highest per-mile expenditures. The states with the largest percentage shifts from 2015 to 2016 were Delaware (which increased per-mile expenditures by more than 103%) and Oregon, Hawaii, Louisiana, Arizona, New Hampshire and Texas (which each decreased per-mile expenditures by more than 30%). Some of the disbursements per state-controlled mile can vary widely from year to year—reflecting funding actions and project schedules.

* Massachusetts' latest disbursement data is from 2010.

36	Wisconsin	$93,376
37	Oklahoma	$94,664
38	Michigan	$99,626
39	Pennsylvania	$101,129
40	California	$125,397
41	Hawaii	$126,932
42	Illinois	$143,606
43	Delaware	$164,801
44	Maryland	$181,323
45	Rhode Island	$194,769
46	Connecticut	$209,157
47	New York	$215,466
48	Massachusetts*	$216,066
49	Florida	$241,100
50	New Jersey	$511,266
	Weighted Average	$71,117

FIGURE 5: TOTAL DISBURSEMENTS PER STATE CONTROLLED LANE-MILE



RURAL INTERSTATE PAVEMENT CONDITION

Rural Interstates are typically four- to six-lane roadways connecting urban areas. One measurement of roadway condition is pavement condition. In most states road pavement condition is measured using special machines that determine the roughness of road surfaces. A few states continue to use visual ratings, which are then converted to roughness. In 2016, about 1.96% of U.S. rural Interstates—566 miles out of 28,820—were reported to be in poor condition. (Table 11, Percent Rural Interstate Mileage in Poor Condition, 2016, Figure 6). This is a slight improvement from 2015, the last time this assessment was completed, when 529 miles out of 28,657 (about 1.85 %) of rural Interstate pavement was rated poor.

Rural Interstate mileage in poor condition varies widely by state. In 2016, five states reported no poor mileage (Maine, New Hampshire, New Jersey, Rhode Island and Vermont) and 16 more reported less than 1% poor mileage. On the other hand, three states (Alaska, Colorado and Washington) reported more than 5% poor

TABLE 11: PERCENT RURAL INTERSTATE MILEAGE IN POOR CONDITION

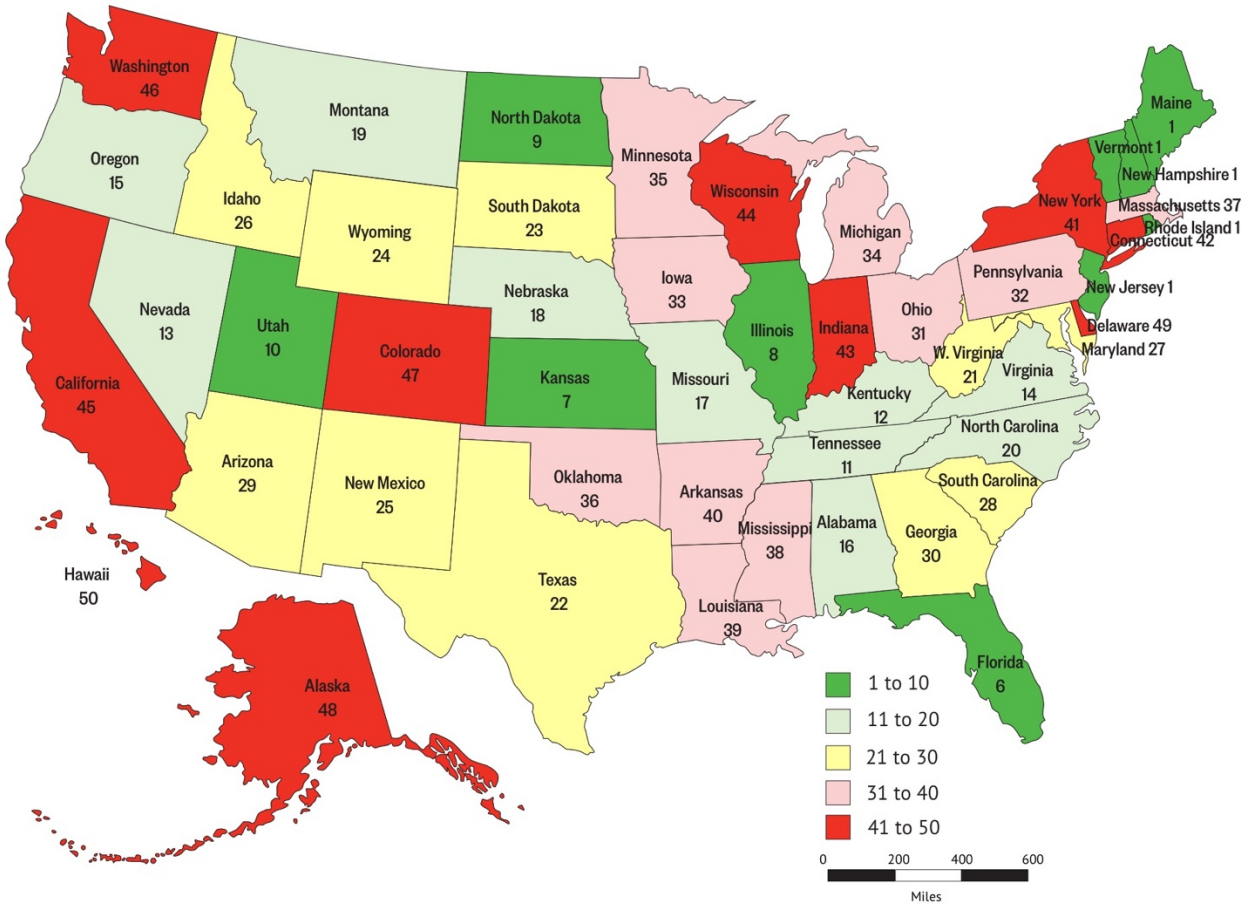
2016 Rank	State	Percent Rural Interstate Mileage in Poor Condition
1	Maine	0.00
1	New Hampshire	0.00
1	New Jersey	0.00
1	Rhode Island	0.00
1	Vermont	0.00
6	Florida	0.14
7	Kansas	0.16
8	Illinois	0.16
9	North Dakota	0.20
10	Utah	0.29
11	Tennessee	0.32
12	Kentucky	0.32
13	Nevada	0.45
14	Virginia	0.50
15	Oregon	0.61
16	Alabama	0.71
17	Missouri	0.71
18	Nebraska	0.73
19	Montana	0.82
20	North Carolina	0.93
21	West Virginia	0.98
22	Texas	1.00
23	South Dakota	1.05
24	Wyoming	1.24
25	New Mexico	1.31
26	Idaho	1.35
27	Maryland	1.41
28	South Carolina	1.47
29	Arizona	1.53
30	Georgia	1.54
31	Ohio	1.56
32	Pennsylvania	1.58
33	Iowa	1.71
34	Michigan	2.14

mileage. The three states together have about 8% of U.S. rural Interstate mileage (2,150 miles of 28,220), but have 26% of the poor-condition mileage. Additionally, in 2016, California reported the largest change in rural pavement condition. The state has 2.5 times more rural pavement in poor condition than in 2015.

Delaware and Hawaii are the only states with no rural mileage in their Interstate systems.

35	Minnesota	2.14
36	Oklahoma	2.50
37	Massachusetts	2.82
38	Mississippi	3.07
39	Louisiana	3.23
40	Arkansas	3.42
41	New York	3.44
42	Connecticut	3.45
43	Indiana	3.46
44	Wisconsin	4.15
45	California	4.90
46	Washington	5.83
47	Colorado	6.48
48	Alaska	10.64
49	Delaware	N/A
50	Hawaii	N/A
	Weighted Average	1.96

FIGURE 6: PERCENT OF RURAL INTERSTATES IN POOR CONDITION



URBAN INTERSTATE PAVEMENT CONDITION

The urban Interstates consist of major multi-lane Interstates in and near urbanized areas. The pavement condition of the urban Interstate system worsened from 2015 to 2016, increasing from 5.02% in poor condition to 5.18% (Table 12, Percent Urban Interstate Mileage in Poor Condition, 2016, Figure 7). In 2016, 958 of the 18,505 miles of urban Interstates were rated as poor, as compared to 940 poor-condition miles out of 18,730 miles in 2015, the last time this assessment was completed.

Between 2015 and 2016, the percentage of poor urban Interstate mileage increased in 29 states, decreased in 20 states and remained about the same in the one remaining state. The percent of poor mileage changed less than one percentage point in 35 of the states. Hawaii and Rhode Island led the states in reducing poor-condition mileage (by 3.3 and 2.8 percentage points, respectively) while Delaware and California led the states in increasing poor-condition mileage (by 10.3 and 3.4 percentage points, respectively).

The condition of urban Interstate miles also varies widely by state. In

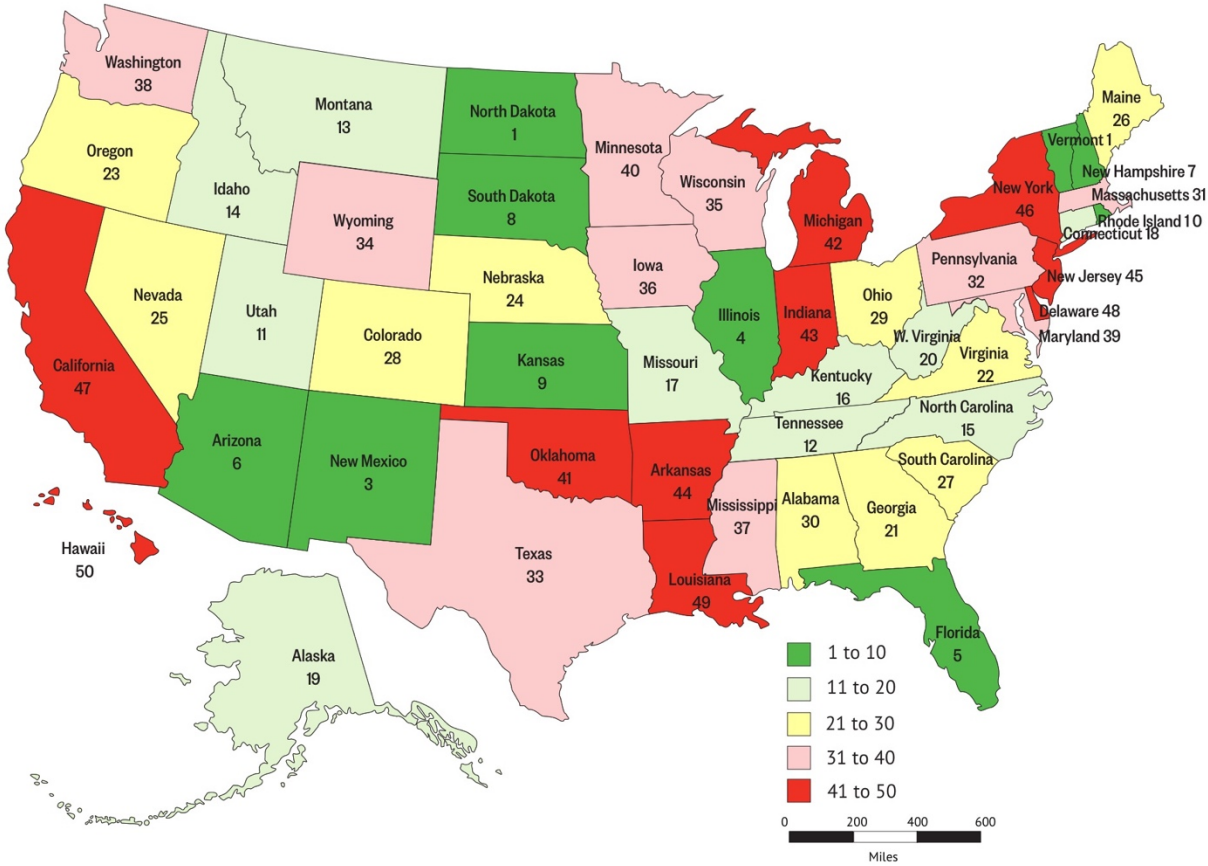
TABLE 12: PERCENT URBAN INTERSTATE MILEAGE IN POOR CONDITION

2016 Rank	State	Percent Urban Interstate Mileage in Poor Condition
1	North Dakota	0.00
1	Vermont	0.00
3	New Mexico	0.66
4	Illinois	0.74
5	Florida	1.05
6	Arizona	1.19
7	New Hampshire	1.20
8	South Dakota	1.33
9	Kansas	1.77
10	Rhode Island	1.92
11	Utah	1.98
12	Tennessee	2.01
13	Montana	2.04
14	Idaho	2.17
15	North Carolina	2.20
16	Kentucky	2.27
17	Missouri	2.42
18	Connecticut	2.52
19	Alaska	2.56
20	West Virginia	2.61
21	Georgia	2.64
22	Virginia	2.76
23	Oregon	2.99
24	Nebraska	3.13
25	Nevada	3.33
26	Maine	3.41
27	South Carolina	3.95
28	Colorado	4.28
29	Ohio	4.30
30	Alabama	4.48
31	Massachusetts	4.59
32	Pennsylvania	4.75
33	Texas	5.44
34	Wyoming	5.66
35	Wisconsin	5.88

2016, two states (North Dakota and Vermont) reported no poor mileage and two other states (New Mexico and Illinois) reported less than 1% in poor condition. The bottom five states (Hawaii, Louisiana, Delaware, California and New York) reported more than 10% poor mileage. These five states, collectively, only have about 14% of the urban Interstate mileage in the U.S. (3,004 of 18,730 miles) but have over 33% of the poor mileage (319 of 958 miles).

36	Iowa	5.92
37	Mississippi	5.93
38	Washington	6.27
39	Maryland	6.51
40	Minnesota	6.67
41	Oklahoma	7.37
42	Michigan	7.65
43	Indiana	7.81
44	Arkansas	9.68
45	New Jersey	9.84
46	New York	10.68
47	California	12.12
48	Delaware	12.20
49	Louisiana	12.90
50	Hawaii	21.82
	Weighted Average	5.18

FIGURE 7: PERCENT OF URBAN INTERSTATES IN POOR CONDITION



RURAL OTHER PRINCIPAL ARTERIAL PAVEMENT CONDITION

Rural Other Principal Arterials (ROPA) are two- to four-lane roadways connecting different cities or regions. The condition of major rural arterials worsened slightly from 2015 to 2016, by about 0.01 percentage points. Overall, about 1.36% of the ROPA system—1,173 miles out of 86,113—was reported to be in poor condition (Table 13, Percent Rural Other Principal Arterial Mileage in Poor Condition, 2015, Figure 8). This compares with about 1.35% (1,192 of 88,155 miles) in 2015, the last time this assessment was completed. This is the highest amount of poor condition mileage since before 2000. (It should be noted that as cities grow, the urbanized area around them grows as well. As this occurs, roads near cities are often reclassified from rural to urban. If these roads were in good condition already, their reclassification has the effect of increasing the percentage of rural roads in poor condition.)

Between 2015 and 2016 most states saw minor changes in ROPA pavement condition. Forty states saw decreases/increases of poor condition mileage of one percentage point or less, with 18 states seeing decreases, 21 states seeing increases, and one state seeing no change. Of the remaining 10 states, most had changes of less than 2%. However, the percentage of the ROPA system in poor condition in Connecticut and New Jersey decreased by 6.1 and 2.3 points, respectively,

TABLE 13: PERCENT RURAL OTHER PRINCIPAL ARTERIAL MILEAGE IN POOR CONDITION

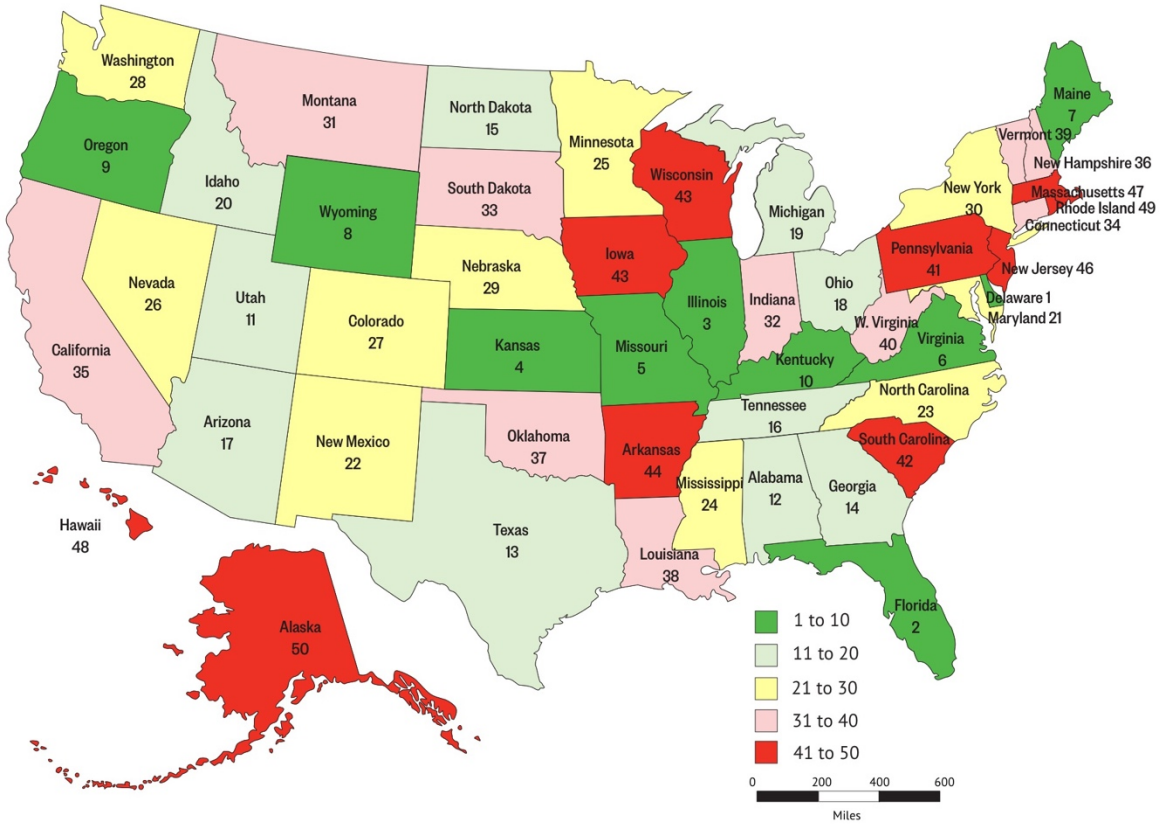
2016 Rank	State	Percent Rural Other Principal Arterial Mileage in Poor Condition
1	Delaware	0.00
2	Florida	0.12
3	Illinois	0.21
4	Kansas	0.27
5	Missouri	0.36
6	Virginia	0.37
7	Maine	0.39
8	Wyoming	0.41
9	Oregon	0.41
10	Kentucky	0.42
11	Utah	0.43
12	Alabama	0.45
13	Texas	0.48
14	Georgia	0.51
15	North Dakota	0.65
16	Tennessee	0.73
17	Arizona	0.76
18	Ohio	0.79
19	Michigan	0.85
20	Idaho	0.85
21	Maryland	0.93
22	New Mexico	0.99
23	North Carolina	1.06
24	Mississippi	1.12
25	Minnesota	1.15
26	Nevada	1.20
27	Colorado	1.21
28	Washington	1.22
29	Nebraska	1.30
30	New York	1.36
31	Montana	1.41
32	Indiana	1.49
33	South Dakota	1.55

while the poor mileage in Massachusetts increased by 2.3 points.

One state, Delaware, reported zero poor condition ROPA mileage in 2016. Twenty-one additional states reported 1% or less ROPA mileage in poor condition. On the other hand, four states (Alaska, Rhode Island, Hawaii and Massachusetts) reported more than 5% of their ROPA mileage to be in poor condition. These four states have just over 1% of the U.S. ROPA mileage, but 12% of the mileage that is in poor condition. Alaska's ROPA system has the most significant problem. By itself it has 10% of the poor ROPA mileage in the country.

34	Connecticut	1.68
35	California	2.07
36	New Hampshire	2.16
37	Oklahoma	2.17
38	Louisiana	2.22
39	Vermont	2.27
40	West Virginia	2.27
41	Pennsylvania	2.50
42	South Carolina	2.65
43	Iowa	2.96
44	Arkansas	3.27
45	Wisconsin	3.83
46	New Jersey	4.38
47	Massachusetts	5.08
48	Hawaii	6.41
49	Rhode Island	13.40
50	Alaska	21.36
	Weighted Average	1.36

FIGURE 8: PERCENT OF RURAL OTHER PRINCIPAL ARTERIAL MILEAGE IN POOR CONDITION



URBAN OTHER PRINCIPAL ARTERIAL PAVEMENT CONDITION

Urban Other Principal Arterials (UOPA) are four- to eight-lane roadways connecting different parts of an urban region. UOPA Condition is one of the new categories added to this year's *Highway Report*. We have analyzed the past five years of data to provide an accurate depiction of these roadways.

Overall, about 14% of the UOPA system—8,713 miles out of 62,643—was reported to be in poor condition (Table 14, Percent Urban Other Principal Arterial Mileage in Poor Condition, 2016, Figure 9). Overall urban arterial pavement condition is in much worse condition than rural arterials, rural Interstates or urban Interstates, with the percent in poor condition at 1.36%, 1.96% and 5.18% respectively.

The percent UOPA mileage in poor condition varies drastically by state, from Florida with 1.96% to Rhode

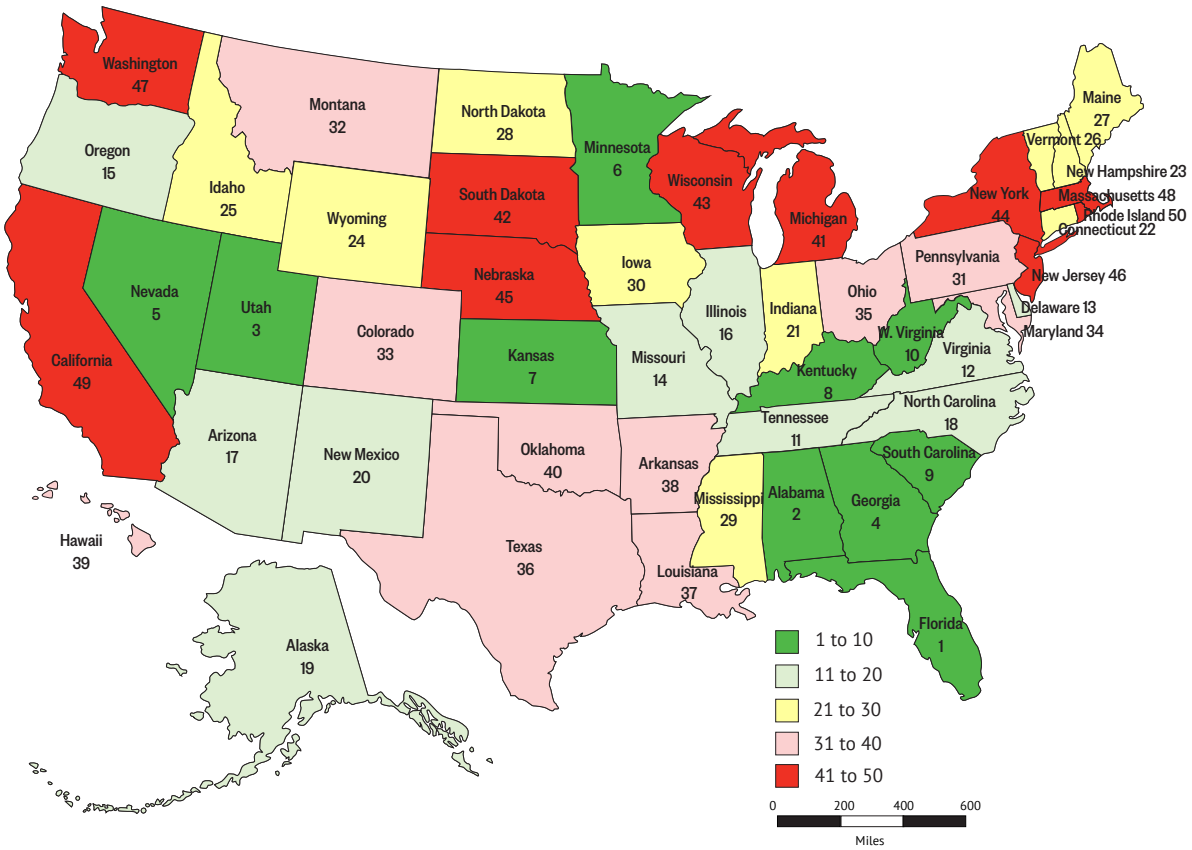
TABLE 14: PERCENT URBAN OTHER PRINCIPAL ARTERIAL MILEAGE IN POOR CONDITION

2016 Rank	State	Percent Urban Other Principal Arterial Mileage in Poor Condition
1	Florida	1.96
2	Alabama	2.58
3	Utah	2.62
4	Georgia	2.74
5	Nevada	3.69
6	Minnesota	3.86
7	Kansas	3.92
8	Kentucky	4.73
9	South Carolina	4.89
10	West Virginia	5.09
11	Tennessee	5.91
12	Virginia	6.35
13	Delaware	6.67
14	Missouri	7.01
15	Oregon	7.03
16	Illinois	8.17
17	Arizona	8.22
18	North Carolina	8.44
19	Alaska	8.70
20	New Mexico	9.15
21	Indiana	9.35
22	Connecticut	10.00
23	New Hampshire	10.36
24	Wyoming	10.38
25	Idaho	10.62
26	Vermont	11.01
27	Maine	11.41
28	North Dakota	11.76
29	Mississippi	13.08
30	Iowa	13.20
31	Pennsylvania	13.22
32	Montana	13.39
33	Colorado	13.48
34	Maryland	13.86

Island at 33.03%. Nine states reported less than 5% of UOPA miles in poor condition. On the other hand, seven states (Rhode Island, California, Massachusetts, Washington, New Jersey, Nebraska and New York) reported more than 20% of their UOPA mileage to be in poor condition. These seven states have 24% of the U.S. ROPA mileage, but 45% of the mileage that is in poor condition.

35	Ohio	14.34
36	Texas	14.45
37	Louisiana	15.20
38	Arkansas	16.23
39	Hawaii	16.54
40	Oklahoma	16.64
41	Michigan	16.92
42	South Dakota	19.01
43	Wisconsin	19.30
44	New York	21.04
45	Nebraska	22.52
46	New Jersey	22.78
47	Washington	23.00
48	Massachusetts	24.56
49	California	30.51
50	Rhode Island	33.03
	Weighted Average	13.97

FIGURE 9: PERCENT OF URBAN OTHER PRINCIPAL ARTERIAL MILEAGE IN POOR CONDITION



URBANIZED AREA CONGESTION

There is no universally accepted definition of traffic congestion. In reporting to the federal government, the states have in the past used peak-hour traffic volume-to-capacity (V/C) ratios, as calculated in the Transportation Research Board's Highway Capacity Manual, as a congestion measure. Through 2009, the Federal Highway Administration (FHWA) summed up these V/C calculations to determine the state mileage in various V/C categories. Since 2009, however, these tables have not been published by FHWA. Instead, FHWA has been reporting periodic statistics based on travel delays from mobile devices, but only for selected regions and roads, not for states.

This change by FHWA has necessitated changes in this report's state-level congestion metric. The *22nd Annual Highway Report* used a congestion metric derived from the *Urban Mobility Report*, renamed the *Urban Mobility Scorecard* (UMS).[5] The 2015 UMS was published jointly by the Texas A&M Transportation Institute and INRIX in August 2015, and reported data for 2014. The congestion measure selected, the *average annual delay per auto commuter (in hours),* captured delay in all three dimensions of congestion. It also had the advantages of being straightforward and relevant to the average citizen, was easily calculated, and was more current. Unfortunately, the UMS has not been updated and INRIX has

TABLE 15: ANNUAL PEAK HOURS SPENT IN CONGESTION PER AUTO COMMUTER

2016 Rank	State	Peak Hours Spent in Congestion per Auto Commuter
1	Wyoming	7.25
2	West Virginia	8.40
3	Iowa	8.49
4	North Dakota	8.52
5	Montana	9.05
6	Alaska	9.33
7	Maine	9.50
8	Nebraska	9.75
9	South Dakota	9.98
10	Vermont	10.17
11	Idaho	10.49
12	Mississippi	10.57
13	Arkansas	11.36
14	New Mexico	11.67
15	Oklahoma	12.00
16	Kansas	12.12
17	Oregon	12.12
18	Alabama	12.25
19	Hawaii	13.04
20	Utah	13.39
21	South Carolina	13.52
22	Wisconsin	13.68
23	North Carolina	14.80
24	Missouri	16.38
25	Kentucky	17.21
26	New Hampshire	18.28
27	Indiana	18.93
28	Ohio	19.19
29	Louisiana	19.59
30	Connecticut	19.77
31	Rhode Island	21.00
32	Tennessee	21.29
33	Nevada	21.78
34	Michigan	22.63
35	Pennsylvania	24.24
36	Arizona	27.32
37	Colorado	27.34
38	Delaware	28.06

changed the methodology for some of its internal metrics.

As a result, the past two *Annual Highway Reports* use data directly from the INRIX *Global Traffic Scorecard*. This report uses 2017 congestion data.[6] The metric selected was the "*peak hours spent in congestion per auto commuter annually*." This measure, straightforward and relevant to the average citizen, is taken directly from the INRIX *Scorecard* and uses real-time traffic data.

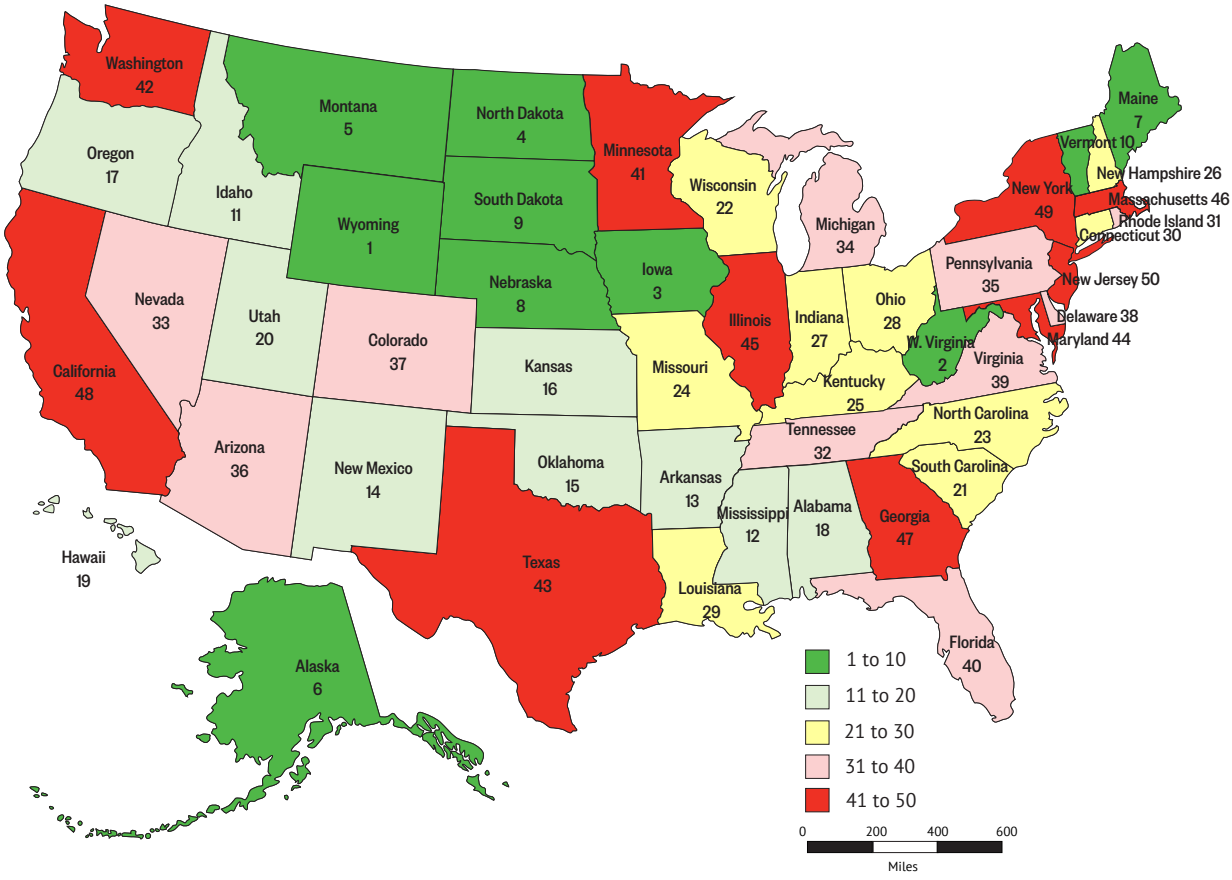
39	Virginia	32.56
40	Florida	33.87
41	Minnesota	35.07
42	Washington	37.40
43	Texas	38.73
44	Maryland	39.32
45	Illinois	44.11
46	Massachusetts	44.27
47	Georgia	51.55
48	California	60.91
49	New York	62.76
50	New Jersey	70.15
	Weighted Average	34.77

For 2017, INRIX defines congestion as a speed below 65% of the free-flow speed, which is the typical uncongested speed on that road segment, and defines peak hours locally based on the actual driving habits in each city, as opposed to the more typical fixed peak periods of 6:00 AM–9:00 AM and 4:00 PM–7:00 PM. (The INRIX data, which are computed only for selected cities, are extended to all U.S. metropolitan areas and then rolled up by state. See the Appendix for details.)

In 2017, the average annual peak hours spent in congestion in the urbanized areas across the United States was 34.77 hours (see Table 15, Peak Hours Spent in Congestion per Auto Commuter, Figure 10). Annual peak hours spent in congestion range from 7.25 in Wyoming to 70.15 in New Jersey. The congestion problem is primarily concentrated in the major cities of just a few states.

Commuters in nine states spent fewer than 10 hours sitting in peak-hour congestion in 2016. Commuters in 31 additional states spent less than 35 hours sitting in peak-hour congestion. Only the bottom 10 states exceed the U.S. congestion delay average, but their totals skew the average peak hours spent in congestion upward. Commuters in the bottom four states (New Jersey, New York, California and Georgia) spent more than 50 hours per year in traffic congestion.

FIGURE 10: ANNUAL PEAK HOURS SPENT IN AUTO CONGESTION PER COMMUTER



STRUCTURALLY DEFICIENT BRIDGES

Federal law mandates the uniform inspection of all bridges for structural and functional adequacy at least every two years; bridges rated "deficient" are eligible for federal repair dollars. The National Bridge Inventory (NBI) is the source of the bridge data below, although we also use summaries provided in *Better Roads* (see Appendix). Since the NBI contains some recent inspections and some as old as two years, the age of the "average" inspection is about one year old. So, a "December 2017" summary from the NBI would represent, on average, bridge condition as of 2016.

This year's ranking measures structurally deficient bridges (those with deteriorated conditions that need maintenance in the near future to ensure continued safety) but not functionally obsolete ones (those that have narrower lanes or shoulders but no structural concerns). While neither condition is ideal, structurally deficient bridges are a much bigger problem. Functionally obsolete bridges are older and built to different design standards and tend to be located in states with more mature infrastructure.

The condition of the nation's highway bridges in 2017 improved slightly from 2015, the last time this assessment was completed. Of the 612,408 highway bridges reported, 54,254 (8.86%) were rated deficient for 2017 (Table 16, Percent of Structurally Deficient Bridges, 2017, Figure 11). This represents a 0.74% improvement over 2015 when 58,485 of 609,285 (9.60%) were rated as deficient. Two

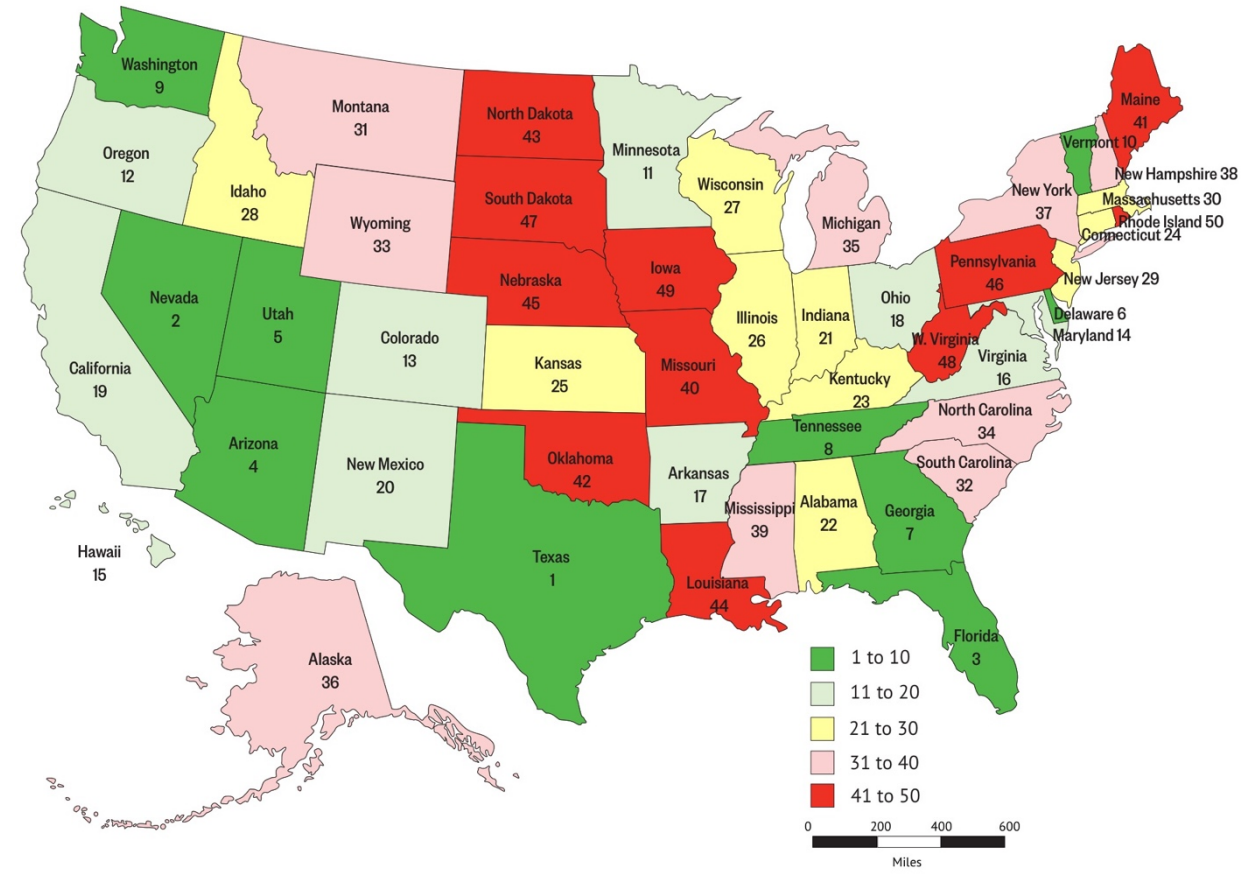
TABLE 16: PERCENT STRUCTURALLY DEFICIENT BRIDGES, 2017

2017 Rank	State	Percent Structurally Deficient Bridges
1	Texas	1.57
2	Nevada	1.59
3	Florida	2.14
4	Arizona	2.48
5	Utah	2.85
6	Delaware	4.44
7	Georgia	4.66
8	Tennessee	4.73
9	Washington	4.85
10	Vermont	5.23
11	Minnesota	5.32
12	Oregon	5.45
13	Colorado	5.60
14	Maryland	5.62
15	Hawaii	5.81
16	Virginia	5.92
17	Arkansas	5.95
18	Ohio	6.04
19	California	6.25
20	New Mexico	6.28
21	Indiana	7.44
22	Alabama	7.44
23	Kentucky	7.77
24	Connecticut	7.83
25	Kansas	8.46
26	Illinois	8.60
27	Wisconsin	8.74
28	Idaho	8.75
29	New Jersey	8.85
30	Massachusetts	9.28
31	Montana	9.71
32	South Carolina	9.91
33	Wyoming	9.91
34	North Carolina	10.20
35	Michigan	10.51

states reported less than 2% of their bridges to be structurally deficient: Texas and Nevada at 1.57% and 1.59% respectively. Two states reported more than 20% of their bridges as structurally deficient: Rhode Island and Iowa, at 23.26% and 20.93% respectively. The majority of states (39) reported at least some improvement in the percentage of structurally deficient bridges between 2015 and 2017, with Pennsylvania, Oklahoma and Wyoming seeing the most improvement (2.7, 2.4 and 2.1 percentage points, respectively). Of the 11 states that reported a higher percentage of deficient bridges, two saw increases of more than one percentage point: West Virginia at 3.85% and Montana at 1.87%.

36	Alaska	10.52
37	New York	10.52
38	New Hampshire	10.89
39	Mississippi	11.76
40	Missouri	12.60
41	Maine	13.26
42	Oklahoma	14.02
43	North Dakota	14.03
44	Louisiana	14.11
45	Nebraska	14.73
46	Pennsylvania	18.32
47	South Dakota	18.58
48	West Virginia	18.98
49	Iowa	20.93
50	Rhode Island	23.26
	Weighted Average	8.86

FIGURE 11: PERCENT STRUCTURALLY DEFICIENT BRIDGES, 2017



OVERALL FATALITY RATE

The fatality rate is an important overall measure of each state's road performance. The nation's highway fatality rate worsened from 1.13 in 2015, the last time this assessment was completed, to 1.18 in 2016 (Table 17, Overall Fatality Rate per 100 Million Vehicle-Miles, 2016, Figure 12). The fatality rate has increased over the last several years after a decades-long downward trend. While there is no one cause, distracted driving appears to be the biggest contributor. In 2016, 37,434 fatalities were reported, more than the 35,069 fatalities reported in 2015, as VMT (vehicle-miles of travel) increased to 3.17 trillion from 3.09 trillion in 2015. There were more fatalities in 2016 than in any year since 2007.

For 2016, Massachusetts reported the overall lowest fatality rate, 0.63, while South Carolina reported the highest, 1.86. Most states (31 of 50) reported an increase in their fatality rates compared to

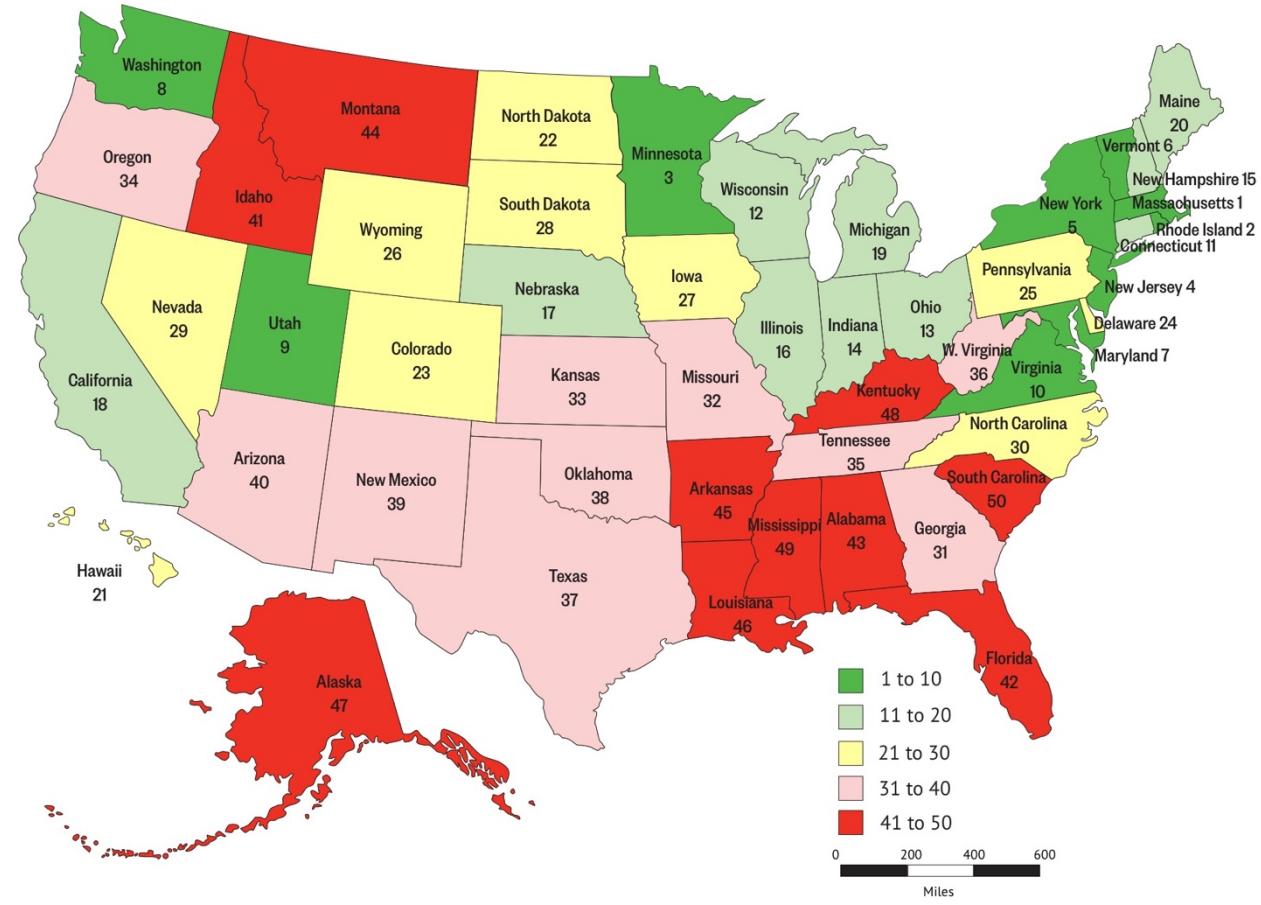
TABLE 17: OVERALL FATALITY RATE PER 100 MILLION VEHICLE-MILES, 2016

2016 Rank	State	Fatality Rate per 100 Million Vehicle-Miles
1	Massachusetts	0.63
2	Rhode Island	0.64
3	Minnesota	0.66
4	New Jersey	0.78
5	New York	0.83
6	Vermont	0.84
7	Maryland	0.85
8	Washington	0.88
9	Utah	0.89
10	Virginia	0.90
11	Connecticut	0.93
12	Wisconsin	0.95
13	Ohio	0.95
14	Indiana	0.99
15	New Hampshire	1.01
16	Illinois	1.01
17	Nebraska	1.05
18	California	1.07
19	Michigan	1.07
20	Maine	1.09
21	Hawaii	1.13
22	North Dakota	1.16
23	Colorado	1.17
24	Delaware	1.17
25	Pennsylvania	1.17
26	Wyoming	1.20
27	Iowa	1.21
28	South Dakota	1.22
29	Nevada	1.22
30	North Carolina	1.24
31	Georgia	1.27
32	Missouri	1.28
33	Kansas	1.34
34	Oregon	1.35
35	Tennessee	1.35
36	West Virginia	1.38
37	Texas	1.39
38	Oklahoma	1.39
39	New Mexico	1.44

2015, led by New Mexico, Alaska and Iowa, which worsened 0.36, 0.31 and 0.25 points, respectively. Two states' rates were unchanged and 17 states saw their fatality rate decrease, with Montana and Wyoming reporting the largest rate decrease of 0.31 each.

40	Arizona	1.46
41	Idaho	1.47
42	Florida	1.47
43	Alabama	1.50
44	Montana	1.51
45	Arkansas	1.52
46	Louisiana	1.54
47	Alaska	1.60
48	Kentucky	1.69
49	Mississippi	1.69
50	South Carolina	1.86
	Weighted Average	1.18

FIGURE 12: OVERALL FATALITY RATE PER 100 MILLION VEHICLE-MILES, 2016



RURAL FATALITY RATE

Rural fatality rate is one of the new categories added to this year's *Highway Report*. Given the troubling increase in highway fatalities and other changes we made to the safety metrics in the report, we have added a new category examining rural fatality rate. We have analyzed the past three years of data to place the ratings in context.

The nation's rural highway fatality rate worsened from 1.58 in 2015, to 1.71 in 2016, (Table 18, Rural Fatality Rate per 100 Million Vehicle-Miles, 2016, Figure 13). The rural fatality rate has increased over the last several years after a decades-long downward trend. While there is no one cause, distracted driving appears to be the biggest contributor. In 2016, 8,032 rural fatalities were reported, more than the 7,130 rural fatalities reported in 2015, as rural VMT (vehicle-miles of travel) increased to 0.47 trillion from 0.45 trillion in 2015. There were more rural fatalities in 2016 than in any year since 2007.

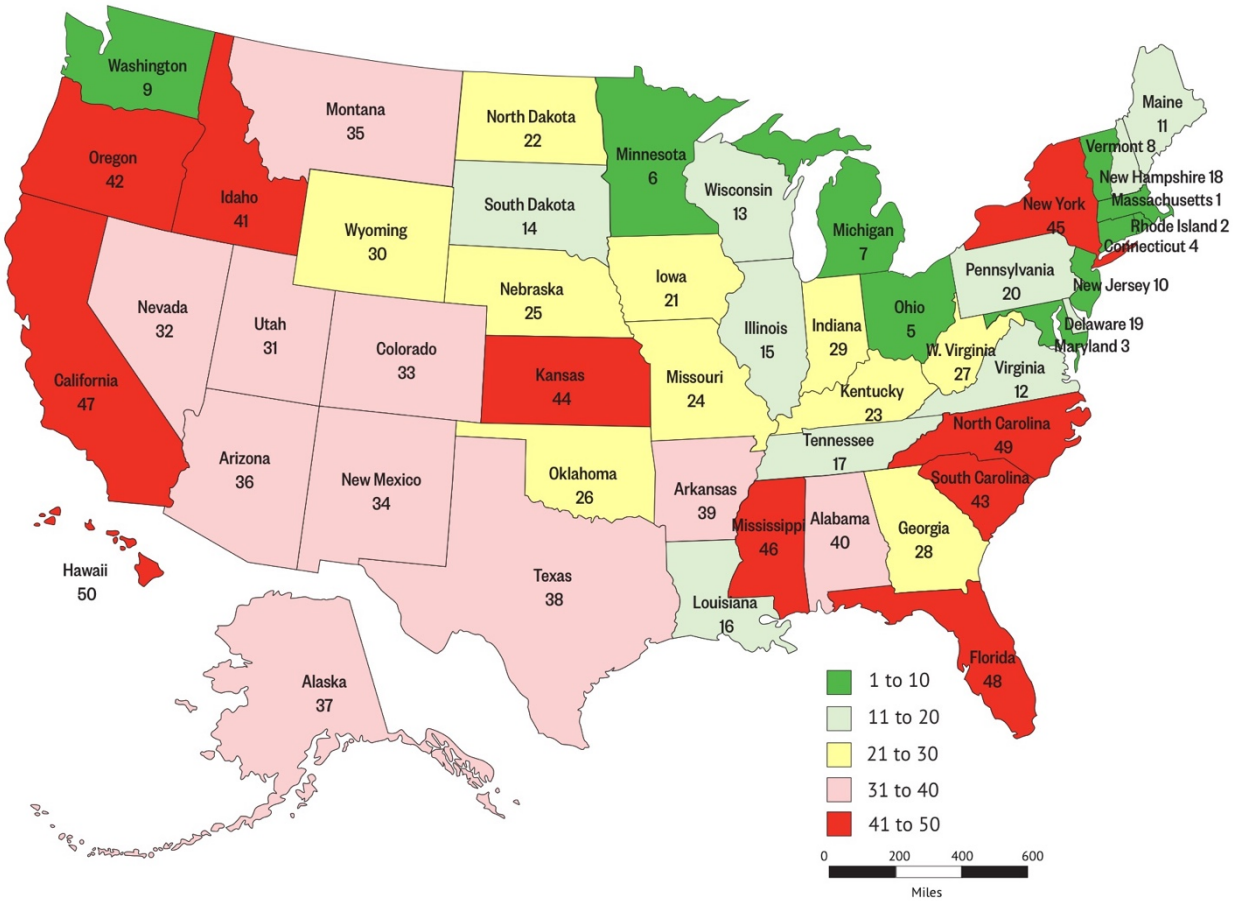
TABLE 18: FATALITY RATE PER 100 MILLION RURAL VEHICLE-MILES, 2016

2016 Rank	State	Fatality Rate per 100 Million Rural Vehicle-Miles
1	Massachusetts	0.24
2	Rhode Island	0.50
3	Maryland	0.60
4	Connecticut	0.66
5	Ohio	0.69
6	Minnesota	0.70
7	Michigan	0.70
8	Vermont	0.71
9	Washington	0.79
10	New Jersey	0.99
11	Maine	1.01
12	Virginia	1.02
13	Wisconsin	1.03
14	South Dakota	1.03
15	Illinois	1.06
16	Louisiana	1.09
17	Tennessee	1.10
18	New Hampshire	1.14
19	Delaware	1.16
20	Pennsylvania	1.19
21	Iowa	1.20
22	North Dakota	1.26
23	Kentucky	1.27
24	Missouri	1.29
25	Nebraska	1.29
26	Oklahoma	1.31
27	West Virginia	1.34
28	Georgia	1.37
29	Indiana	1.38
30	Wyoming	1.44
31	Utah	1.45
32	Nevada	1.49
33	Colorado	1.51
34	New Mexico	1.56
35	Montana	1.60

For 2016, Massachusetts reported the lowest rural fatality rate, 0.24, while Hawaii reported the highest, 6.99. Most states (30 of 50) reported an increase in their rural fatality rates compared to 2015, led by Hawaii and Florida, which worsened 3.28 and 2.25 points, respectively. Twenty states saw their fatality rates decrease, with Connecticut reporting the largest rate decrease of 1.00.

36	Arizona	1.61
37	Alaska	1.64
38	Texas	1.65
39	Arkansas	1.72
40	Alabama	1.81
41	Idaho	1.89
42	Oregon	2.06
43	South Carolina	2.08
44	Kansas	2.23
45	New York	2.27
46	Mississippi	2.47
47	California	3.18
48	Florida	3.87
49	North Carolina	4.90
50	Hawaii	6.99
	Weighted Average	1.71

FIGURE 13: FATALITY RATE PER 100 MILLION RURAL VEHICLE MILES, 2016



URBAN FATALITY RATE

Urban fatality rate is one of the new categories added to this year's *Highway Report*. The troubling increase in highway fatalities, in addition to other changes we made to the safety metrics in the report, convinced us to add a new category to examine the urban fatality rate. We have analyzed the past three years of data to place the ratings in context.

The nation's urban highway fatality rate worsened from 0.70 in 2015 to 0.77 in 2016 (Table 19, Urban Fatality Rate per 100 Million Vehicle-Miles, 2016, Figure 14). The urban fatality rate has increased over the last several years after a decades-long downward trend. While there is no one cause, distracted driving appears to be the biggest contributor. In 2016, 9,917 urban fatalities were reported, more than the 8,704 urban fatalities reported in 2015, as urban VMT (vehicle-miles of travel) increased to 1.29 trillion from 1.25 trillion in 2015. There were more urban fatalities in 2016 than in any year since 2007.

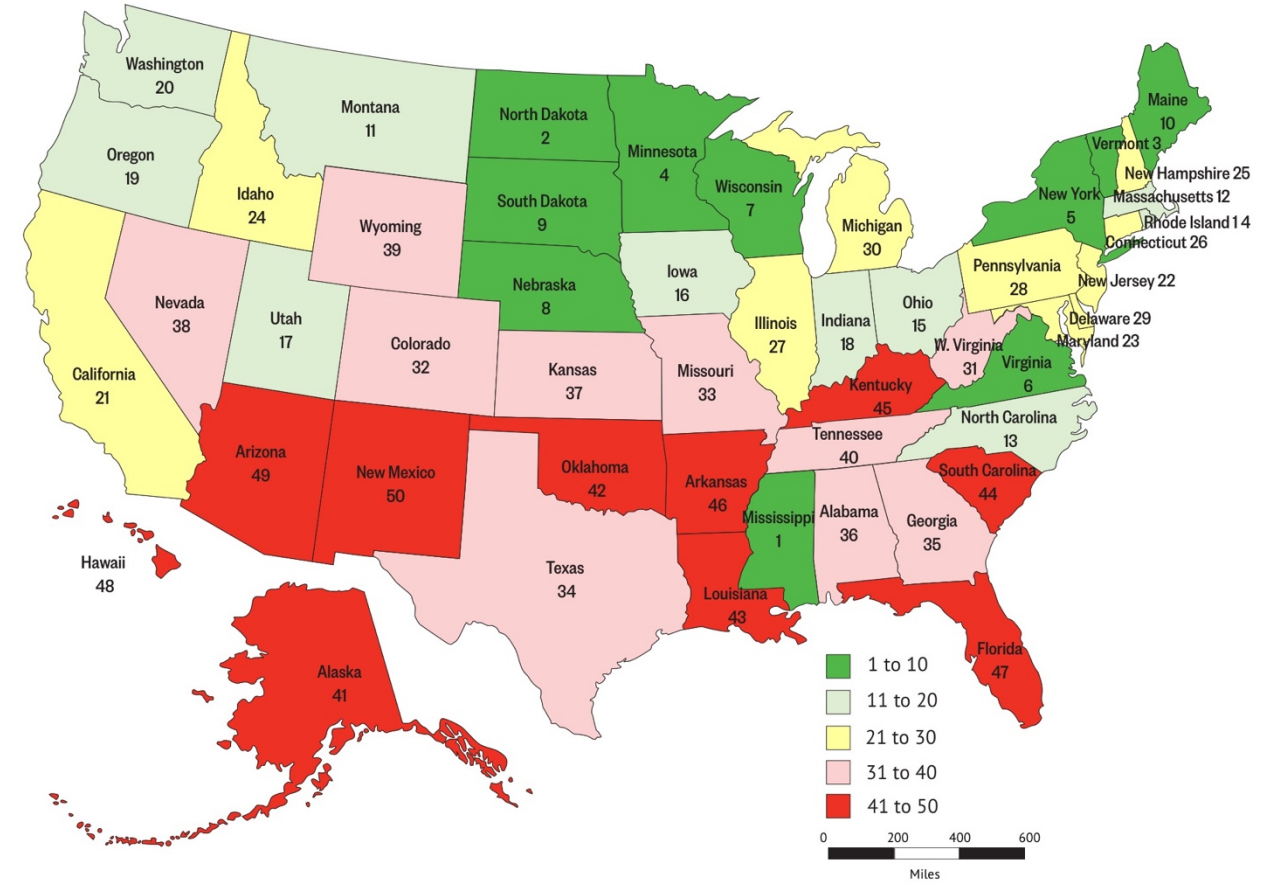
TABLE 19: FATALITY RATE PER 100 MILLION URBAN VEHICLE-MILES

2016 Rank	State	Fatality Rate per 100 Million Urban Vehicle-Miles
1	Mississippi	0.06
2	North Dakota	0.14
3	Vermont	0.27
4	Minnesota	0.33
5	New York	0.35
6	Virginia	0.39
7	Wisconsin	0.43
8	Nebraska	0.44
9	South Dakota	0.46
10	Maine	0.46
11	Montana	0.53
12	Massachusetts	0.55
13	North Carolina	0.58
14	Rhode Island	0.58
15	Ohio	0.59
16	Iowa	0.60
17	Utah	0.61
18	Indiana	0.61
19	Oregon	0.61
20	Washington	0.62
21	California	0.62
22	New Jersey	0.68
23	Maryland	0.68
24	Idaho	0.68
25	New Hampshire	0.70
26	Connecticut	0.72
27	Illinois	0.72
28	Pennsylvania	0.74
29	Delaware	0.78
30	Michigan	0.81
31	West Virginia	0.86
32	Colorado	0.90
33	Missouri	0.92
34	Texas	0.94
35	Georgia	0.95

For 2016, Mississippi reported the lowest urban fatality rate, 0.06, while New Mexico reported the highest, 1.81. Most states (35 of 50) reported an increase in their urban fatality rates compared to 2015, led by New Mexico, Kansas and Maryland, which worsened 0.78, 0.47, and 0.42 points, respectively. Three states' rates were unchanged and 12 states saw their fatality rate decrease, led by Mississippi, Vermont and North Dakota, which improved by 0.68, 0.47, and 0.39 points respectively.

36	Alabama	0.96
37	Kansas	0.98
38	Nevada	1.01
39	Wyoming	1.03
40	Tennessee	1.03
41	Alaska	1.04
42	Oklahoma	1.04
43	Louisiana	1.06
44	South Carolina	1.09
45	Kentucky	1.11
46	Arkansas	1.13
47	Florida	1.19
48	Hawaii	1.32
49	Arizona	1.52
50	New Mexico	1.81
	Weighted Average	0.77

FIGURE 14: FATALITY RATE PER 100 MILLION URBAN VEHICLE–MILES



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APPENDIX: TECHNICAL NOTES

This brief technical appendix summarizes the definitions and sources of the data used in this assessment. The discussion is based on the assumption that comparative cost-effectiveness requires data on system condition or performance, information on the costs to operate and improve the system, and an understanding of the relationship between economic activity and tax revenues.

This report relies heavily on the *Highway Statistics* series, which is compiled by the Federal Highway Administration (FHWA) from data reported by each state. We also use bridge condition data from the National Bridge Inventory and highway fatality rates reported by each state, and for congestion, we use data from INRIX Research and the *American Community Survey*. This assessment compares states with one another based on self-reported data. In general, we use the data as posted in the various data tables. We do not attempt to audit the data; instead, we assume the data to be correct. However, in cases where the data are clearly incorrect, we make appropriate adjustments to the data and footnote the changes made.

MEASURES OF MILEAGE

In general, larger highway systems require more resources to build and maintain than smaller systems. Accordingly, it is important to weight systems so that states can be compared accurately. In this study, mileage is the basic measure for bringing the states to a common baseline. Highway width is also important in differentiating system size (number of lanes), as more pavement generally requires more resources. This study does not rank states based on the size of their highway systems. However, it does use average highway width differences, as derived from state highway agency lane width measures, to measure overall financial performance.

***"State-Owned" Highway Mileage*:** In each state, the "state-owned" highway system consists of the State Highway System, and other systems such as toll roads, state parks, universities, prisons, medical facilities, etc. Each state's responsibility for roads varies. In some, for instance North Carolina, the state is responsible for almost all roads outside of municipalities, while in others, such as New Jersey, the state is responsible for primarily the major multiple-lane roads. In addition, other features such as bridges also vary, with some states having many and others few.

The source of data for the state-owned mileage is Table HM-10, *Highway Statistics 2016* (https://www.fhwa.dot.gov/policyinformation/statistics/2016/) and includes both state highway agency mileage and other jurisdiction mileage controlled by the state.

***State Highway Agency (SHA) Mileage*:** The total numbers of miles and lane-miles for the SHA system are available for each state. From these data, the average lane-miles per centerline-mile is calculated and then used to weight overall financial performance. The source of data for SHA mileage is Table HM-81, Highway Statistics 2016 (https://www.fhwa.dot.gov/policyinformation/statistics/2016/).

DISBURSEMENTS FOR STATE-OWNED HIGHWAYS

There are several types of disbursements for state-administered highways: capital and bridge work, maintenance and highway services, administration, research and planning, law enforcement and safety, interest (on bond payments) and bond retirement. Disbursement data are collected for the first three categories (Capital and Bridge Disbursements, Maintenance Disbursements, Administrative Disbursements) as well as for the total expenditures (Total Disbursements). Disbursements by state-administered agencies fund

the state highway agency, other toll and turnpike state agencies, and state universities, parks, prisons, etc.

The source of all these data is Table SF-4, Highway Statistics 2016 (https://www.fhwa.dot.gov/policyinformation/statistics/2016/). These disbursements are divided by "lane-miles under state control" to arrive at a relative measure of expenditure per unit of responsibility. The national average is the weighted average, obtained by summing the financial numbers for all states, then dividing by the sum of all state-administered mileage. Since large per-mile expenditures are also a burden on taxpayers, the states are ranked inversely by this measure, with the highest per-mile expenditures rated the lowest. (In the case where a state has not reported current disbursement data (Massachusetts),[7] the most recent available disbursement data are divided by the most recent available mileage data to derive the disbursements per mile.)

***Capital and Bridge Disbursements and Maintenance Disbursements*:** "Capital" actions are those intended to reconstruct or improve the system, whereas "maintenance" actions are those intended to preserve or repair the system, but not improve it. However, the definitions of these categories vary somewhat between the states. Most states use private sector contracts to build and reconstruct the system, although in some cases they may also use their own workforces for some projects. Most states also conduct maintenance largely with agency forces and the work is generally light in character, but many also conduct some major repairs, such as thick overlays, using contracted forces from the private sector.

***Administrative Disbursements*:** Administrative disbursements are intended to include all non-project-specific disbursements, and typically include most main-office and regional-office costs, research, planning and similar activities. Sometimes this category also includes bond restructurings and other non-project-specific financial actions. As a result, administrative disbursement can sometimes vary widely from year to year.

***Total Disbursements*:** Total disbursements represent total state outlays for state-administered roads, and include several categories not detailed above. Usually, states disburse about 2% to 3% less in funds than they collect, the difference resulting from timing differences and delays in project completion. However, states sometimes collect revenues that are not immediately expended, such as major bond sales, which show up as major increases in "receipts" without a similar increase in disbursements. And sometimes, later-year disbursements can be higher than receipts as states transfer money into projects without increasing revenues.

MEASURES OF SYSTEM CONDITION

There are nine measures of highway system condition: Rural Interstate Poor-Condition Mileage, Urban Interstate Poor-Condition Mileage, Rural Other Principal Arterial (ROPA) Poor-Condition Mileage, Urban Other Principal Arterial (UOPA) Poor-Condition Mileage, Urbanized Area Congestion, Structurally Deficient Bridges, Fatality Rate, Rural Fatality Rate and Urban Fatality Rate.

***Poor Condition Mileage*:** Perhaps no measure is more fundamental to road performance than road condition. There are numerous ways of defining road condition, but the one used for the U.S. higher-road system is the International Roughness Index (IRI), a measure of surface "bumpiness" in inches of vertical deviation per mile of length. The states use a variety of procedures in gathering these data, but most use mechanical or laser equipment driven over the road system. They often supplement these data with detailed information on road distress features, but this information is not generally used in federal reporting. A few states, however, still use visual ratings as the basis of their reports. Lower "roughness index" scores equate to a smoother road. Roads classified as poor typically have visible bumps and ruts leading to a rough ride. Long, smooth sections (greater than one mile in length) tend to dampen out short rough ones, so if a state has long, smooth sections in its database it can report very little "rough mileage" as a percent of the system.

The source of road roughness data is Table HM-64, *Highway Statistics 2016* (https://www.fhwa.dot.gov/policyinformation/statistics/2016/), which shows miles by roughness, for several functional classes, for each state. This mileage is then converted into a percent, to account for different sizes of systems (rural Interstate, urban Interstate and rural other principal arterials) in each state. The national average is the weighted average, obtained by dividing the sum of all poor-rated mileage by the sum of all state-administered mileage.

***Rural Interstate Poor-Condition Mileage*:** Rural Interstate mileage is all mileage outside of urban areas. By convention, Interstate sections with an IRI roughness of greater than 170 inches of roughness per mile (about three inches of vertical variation per 100 feet of road) are classified as "poor" in most reports. By comparison, sections with less than 60 inches of roughness per mile (about one inch of vertical deviation per 100 feet) would be classified as "excellent." (Delaware and Hawaii have no rural Interstate mileage and are not rated on this measure.)

***Urban Interstate Poor-Condition Mileage*:** Urban Interstate mileage is all mileage inside census-defined urban areas. It is calculated the same way as rural Interstate mileage is calculated. The IRI cutoff for urban Interstates is the same as for rural Interstates: 170 inches per mile or higher, for "poor" mileage.

***Rural Other Principal Arterial Poor-Condition Mileage*:** Rural other principal arterials (ROPAs) are the major inter-city or regional connectors, off the Interstate system. They can be US-numbered and state-numbered roads, and sometimes toll roads or parkways. This system is generally a top priority of most state highway agencies because of its importance to the economic competitiveness of the state. By convention, ROPA sections with an IRI greater than 220 inches per mile of roughness (about four inches of vertical deviation per 100 feet) are classified as "poor" in most reports. The cutoff is higher than for Interstates since speeds on these roads are typically lower, resulting in a smoother trip.

Urban Other Principal Arterial Poor-Condition Mileage: Urban other principal arterials (UOPAs) are the major connectors within an urban area, off the Interstate system. They can be US-numbered and state-numbered roads, and sometimes toll roads or parkways. The IRI cutoff for urban other principal arterials is the same as for rural principal arterials: 220 inches per mile or higher for "poor" mileage.

Urbanized Area Congestion: The Urbanized Area Congestion metric is measured as the *average number of hours spent in congestion during peak hours annually per automobile commuter*. For this measure, congestion is defined as a speed below 65% of the free-flow speed, which is the typical uncongested speed on that road segment, and peak hours are locally defined based on the actual driving habits in each city, as opposed to the more typical fixed peak periods of 6:00 AM–9:00 AM and 4:00 PM–7:00 PM. This metric captures the three dimensions of congestion (intensity, duration and extent), it uses real time traffic data, and it is straightforward in both calculation and interpretation. Additionally, updates for the previous measure are not available.

This is the second report using the average number of hours spent in congestion metric. In the prior (22nd) *Annual Highway Report*, congestion was measured as the *annual delay per auto commuter (in hours)*. It was that extra time vehicles spent traveling at congested speeds rather than free-flow speeds, delay that typically occurred during peak periods. This delay was calculated using data from the 2010 Census and the *2015 Urban Mobility Scorecard* (UMS).

There are three data sources required to calculate the current metric: the 2017 INRIX *Global Traffic Scorecard* and its supporting materials (http://inrix.com/scorecard/), the *2016 American Community Survey* (https://www.census.gov/acs/www/data/data-tables-and-tools/index.php) and Table HM-74 from the FHWA *Highway Statistics* series (https://www.fhwa.dot.gov/policyinformation/statistics/2016/)

The INRIX *Global Traffic Scorecard* provides 2017 empirical congestion data for 1,064 cities in 38 countries, including 240 cities here in the U.S. Data items include the Peak Hours Spent in Congestion metric for each city. The *American Community Survey* data used are the Means of Transportation data for workers 16 years and over (Table S0802). These data are used to calculate the number of auto commuters (the workers 16 years and older who drove alone or carpooled, with the carpoolers being divided by the average carpool occupancy rate of 2.2).[8] Table HM-74 (Daily Vehicle-Miles of Travel (DVMT) by Measured Pavement Roughness / Present Serviceability Rating) includes data on all urbanized areas in the U.S. (i.e., those with populations above 50,000). The DVMT data for multi-state urbanized areas are apportioned by state and the percentages of the DVMT in each state are calculated based on total reported DVMT.

Using *American Community Survey* data as the base table, the INRIX city data are linked to the ACS metro areas. Sixty-eight of the 240 INRIX cities are either micropolitan areas (populations below 50,000) or are included with one or more other INRIX cities in a single metropolitan area. (We use only the largest INRIX city available to represent each metro area and exclude the smaller cities in the metro areas, as well as the micropolitan areas.) The DVMT percentages for the multi-state cities are now linked to the base table.

The Peak Hours Spent in Congestion metric is calculated for each non-INRIX metro based on national averages of groupings of the numbers of auto commuters. (We use national averages rather than state averages because the number of data points for the individual states is most often inadequate for a good average.) The metric is then weighted by the number of auto commuters. An MS Excel pivot table is used to sum the Weighted Peak Hours Spent in Congestion metric and the Auto Commuters totals by state. Finally, the former is divided by the latter to get the state's Peak Hours Spent in Congestion figure.

Structurally Deficient Bridges: As a result of several major bridge disasters in the 1960s and 1970s, states are required to inspect bridges biennially (every year if a bridge is rated structurally deficient) and maintain uniform records of inspections.

This year, we include structurally obsolete bridges only and not functionally deficient bridges. Structurally obsolete bridges have deteriorated structural conditions and need maintenance in the near future to ensure continued safety. Functionally obsolete bridges have narrower lanes or shoulders but no structural problems. While neither condition is ideal, structurally deficient bridges are a much bigger problem. Functionally obsolete bridges are older and built to different design standards and tend to be located in states with more mature infrastructure.

This data source, titled the *National Bridge Inventory* (NBI), provides information on deficient bridges. Since the NBI contains a mixture of bridges inspected at different times, some as long as two years ago, the "average" inspection age is about one year. So, an October 2017 summary from the *Inventory* would represent, on average, bridge condition as of October 2016.

While deficient bridge data are in the NBI, we use the annual summary of bridge deficiencies prepared by *Better Roads*, a trade publication, as our source. This summary, published since 1979, contains very recent information, gathered from each state shortly before the end of each calendar year, using a proprietary survey sent to state bridge engineers. The 2017 *Better Roads Bridge Inventory* (http://www.equipmentworld.com/2017-better-roads-bridge-inventory-2-year-decline-in-deficient-u-s-bridges-snapped/) contains data collected through October 2017.

Overall Fatality Rate: Road safety is a very important measure of system performance, and fatality rates are a key measure of safety. The overall state fatality rate has long been seen as a measure of state performance in road safety.

The fatality rate includes two components: a count of fatalities and a measure of travel, i.e., vehicle-miles. The sources of each are Tables FI-20 and VM-2, *Highway Statistics 2016* (https://www.fhwa.dot.gov/policyinformation/statistics/2016/). Table FI-20 provides a count of fatalities by state and highway functional class and Table VM-2 provides an estimate of annual vehicle-miles of travel for each state by functional class. The national average fatality rates are the weighted averages across the states.

Rural Fatality Rate: The Rural Fatality Rate applies to rural areas of the state. It is calculated in the same manner as the Overall Fatality Rate.

Urban Fatality Rate: The Urban Fatality Rate applies to urban areas of the state. It is calculated in the same manner as the Overall Fatality Rate.

OVERALL RATINGS

The 2016 overall ratings for each state are developed in several steps:

- First, the relative performance of each state on each of 13 performance measures is determined by computing each state's "performance ratio." This is defined as the ratio of each state's measure to the weighted U.S. mean for the measure. The mathematical structure is as follows:

  M_{is} = Measure "i" for state "s" (e.g., percent of rural Interstates in poor condition, for North Carolina)

  R_{is} = Performance Ratio for measure "i", state "s"
  = M_{is}/**M,** where **M** is the weighted average of M_{is} across the 50 states.

- The four financial performance ratios are combined to calculate the average financial performance. The performance ratios are adjusted for the average lane-miles of each state's system for an accurate comparison.

  Financial Performance (FP) for state "s" = $((\sum_{1}^{4} R_{is})/4)^*$ (**L**/L_s)

  where L_s is the average SHA lanes-per-mile for measure "i" for state "s", and **L** is the weighted average of the SHA lanes-per-mile, over 50 states.

- The nine system performance ratios (eight for Delaware and Hawaii, which have no rural Interstates) are combined to calculate the average system performance.

  System Performance (SP) for state "s" = $(\sum_{1}^{7} R_{is})/9$

- Then, financial performance and system performance are combined into an overall performance measure:

  Overall Performance for state "s" = (FP*4 + SP*7)/13

  In lieu of 9 and 13, Delaware and Hawaii use 8 and 12 since they have no rural Interstates. In final weighting, all metrics are weighted equally.

Since several state agencies are included in each state's reports, this report should *not* be viewed as a cost-effectiveness comparison of the state highway departments. Instead, it should be viewed as an assessment of how the state, as a whole, is managing the state-owned roads.

ENDNOTES

1 "U.S. Consumer Price Index Data from 2013 to 2019." https://www.usinflationcalculator.com, Inflation Calendar, April 10, 2019. https://www.usinflationcalculator.com/inflation/consumer-price-index-and-annual-percent-changes-from-1913-to-2008/, 9 May 2019.

2 "U.S. Consumer Price Index Data from 2013 to 2019." https://www.usinflationcalculator.com.

3 Ibid.

4 Ibid.

5 Lomax, Tim, David Shrank and Bill Eisele. *2015 Urban Mobility Report*. Texas A & M University. August 2015. http://mobility.tamu.edu/ums/, 4 February 2016.

6 Cookson, Graham and Bob Pishue. "2018 INRIX Global Traffic Scorecard." INRIX. February 2019. http://inrix.com/scorecard/. 12 April 2019.

7 Per correspondence with Massachusetts, the state has not submitted data since 2010. However, the state is reorganizing its department and plans to submit data for the 2017 year.

8 Polzin, Steve and Alan Pisarski. "Commuting in America 2013." American Association of State Highway and Transportation Officials. January 2014. 12 April 2019.