REPAIR PRIORITIES

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Transportation for America, a program of Smart Growth America, is an alliance of elected, business, and civic leaders from communities across the country, united to ensure that states and the federal government step up to invest in smart, homegrown, locally-driven transportation solutions. These are the investments that hold the key to our future economic prosperity.

Smart Growth America envisions a country where no matter where you live, or who you are, you can enjoy living in a place that is healthy, prosperous, and resilient. We empower communities through technical assistance, advocacy, and thought leadership to realize our vision of livable places, healthy people, and shared prosperity.

Taxpayers for Common Sense is an independent, nonpartisan voice for taxpayers working to ensure that taxpayer dollars are spent responsibly and that government operates within its means.

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Transportation for America

TAXPAYERS for COMMON SENSE

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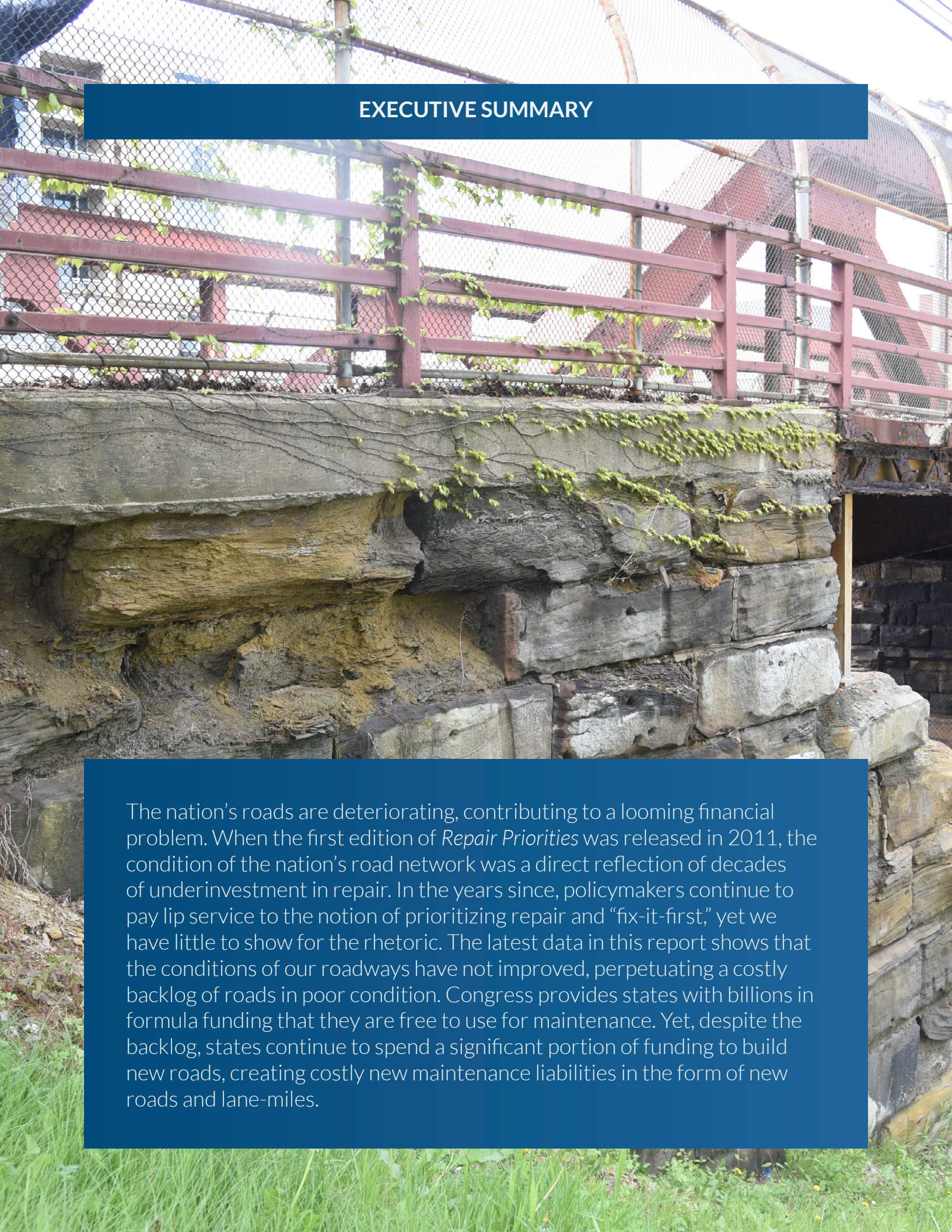
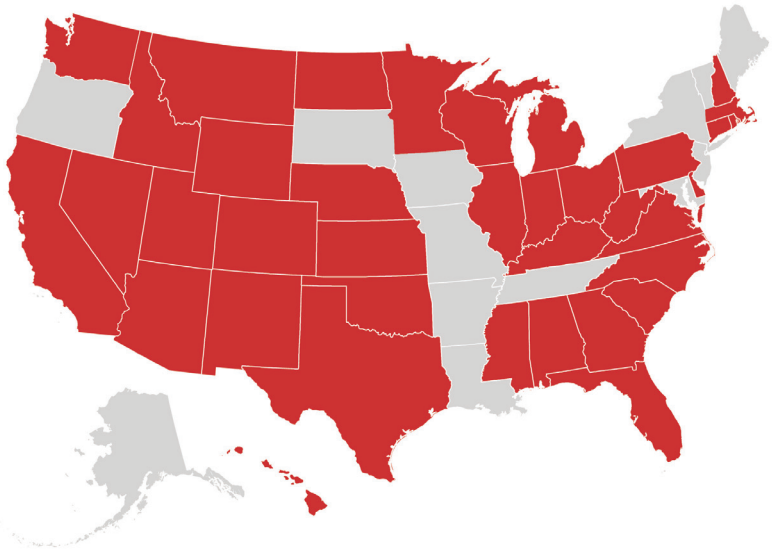


EXECUTIVE SUMMARY

The nation's roads are deteriorating, contributing to a looming financial problem. When the first edition of *Repair Priorities* was released in 2011, the condition of the nation's road network was a direct reflection of decades of underinvestment in repair. In the years since, policymakers continue to pay lip service to the notion of prioritizing repair and "fix-it-first," yet we have little to show for the rhetoric. The latest data in this report shows that the conditions of our roadways have not improved, perpetuating a costly backlog of roads in poor condition. Congress provides states with billions in formula funding that they are free to use for maintenance. Yet, despite the backlog, states continue to spend a significant portion of funding to build new roads, creating costly new maintenance liabilities in the form of new roads and lane-miles.

The nation is falling behind when it comes to the condition of our roads. **Between 2009 and 2017, the percentage of the roads nationwide in poor condition increased from 14 to 20 percent.** The percentage of roads in "good condition" increased only slightly: from 36 to 38 percent over that eight-year period.

Thirty-seven states saw an increase in the percentage of roads in poor condition between 2009-2017.



This is especially concerning given that Congress provided additional federal funding for transportation infrastructure twice over that time period. We also benefited from the one-time boost provided by the 2009 American Recovery and Reinvestment Act, which significantly increased the funding available for road repair for several years. Despite these injections of funds, states prioritized new or expanded roads and failed to make a dent in the backlog of roads in poor condition.

Because of this, we are facing a looming spending gap. As of 2017, Transportation for America estimates that we would need to spend **$231.4 billion per year** just to keep our existing road network in acceptable repair and bring the backlog of roads in poor condition into good repair over a six-year period, the typical length of a federal transportation reauthorization. It is significantly more expensive to rehabilitate roads that have fallen into poor repair than to preserve roads in good condition on an ongoing basis through routine pavement preservation. **By comparison, all highway capital expenditures across all government units totaled $105.4 billion in 2015, only a portion of which goes to repair.**

This is more than a money problem—it's a priorities problem. The latest available data shows states have made some improvement in their spending since we released the first edition of *Repair Priorities* in 2011. That edition found that between 2004 and 2008, states collectively spent $21 billion per year on road expansion and $16 billion per year on repair and preservation. States have increased their spending on road repair in the years since, spending $21.4 billion on average on road repair annually between 2009-2014 (the latest year with available data) and $21.3 billion annually on road expansion. Spending on road repair accounted for 30 percent of states' total capital spending on highways over that time, while road expansion accounted for 29 percent.

However, this means that states are still spending just as much on road expansion as road repair. These investments in expansion don't just redirect funds away from much needed investments in repair; they continually grow our annual spending need, widening the gap. Every new lane-mile of road costs approximately $24,000 per year to preserve in a state of good repair. By expanding roads, we are borrowing against the future.

So what will it take to fix the system?

Transportation for America and Taxpayers for Common Sense are calling on Congress to address this in any infrastructure package they consider, including the upcoming 2020 federal transportation bill. Congress should take the following actions in the 2020 transportation bill to get us back on track:

1. **Guarantee measurable outcomes for American taxpayers with any new funding:** The next transportation bill should set clear, quantifiable outcomes the program is expected to accomplish. Congress could set a goal for repairing all roads in poor condition and write a bill that clearly moves the ball forward toward that goal. If it cannot be done in the next six-year authorization bill, Congress should make clear what is feasible.

2. **Require that states repair their existing systems before expanding:** Congress should require that states dedicate available highway formula funding to repairing the existing system first. Historically, states have used this formula funding for new road construction. Congress could grant states additional flexibility if they are able to demonstrate that they are keeping their roads in good condition above a certain percentage threshold.

3. **Require project sponsors to demonstrate that they can afford to maintain new roadway capacity projects:** To supplement this formula funding now dedicated to repair and maintenance, Congress should create a competitive program to fund highway capacity expansion projects similar to the New Starts transit capital program. Projects should be evaluated for funding based on clear performance criteria to ensure that funded projects produce substantial benefit for the cost, and project sponsors should demonstrate that they can operate and maintain the asset throughout its useful life, ensuring a plan for long-term upkeep.

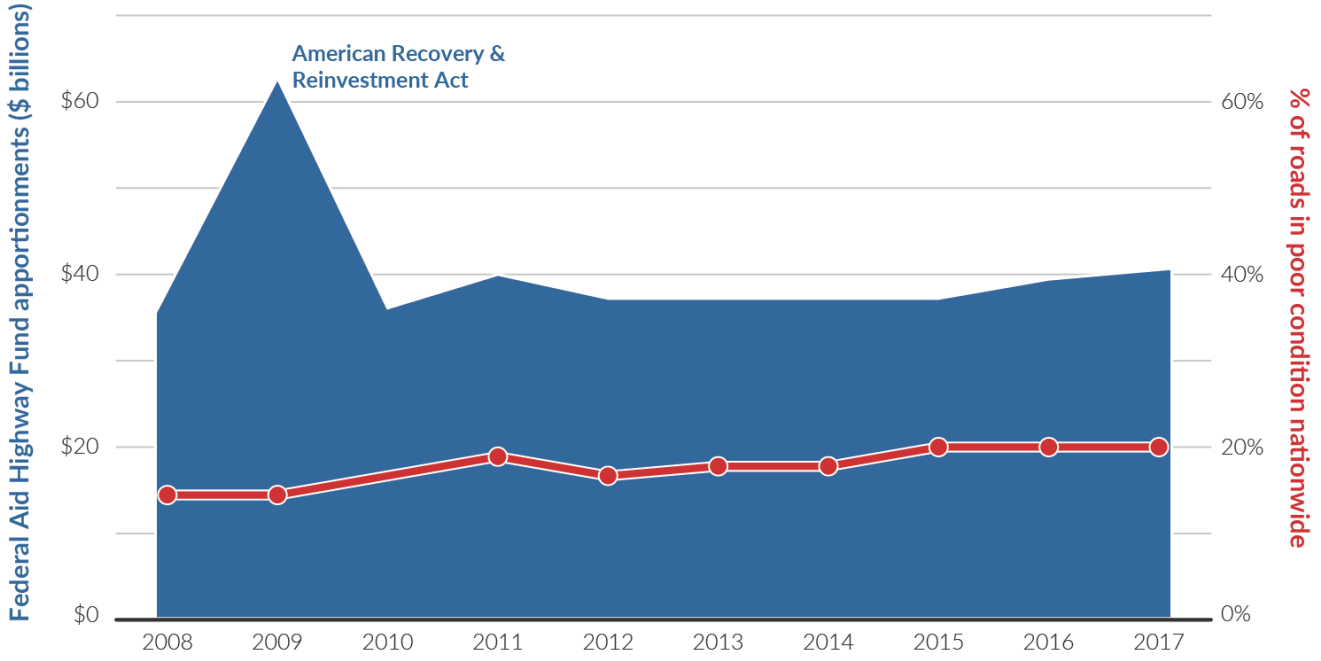
4. **Track progress and require that FHWA publish results:** The Moving Ahead for Progress in the 21st Century (MAP-21) Act in 2012 established a requirement that states and metro areas set performance targets for the pavement conditions of the interstate and non-interstate highways they maintain. Yet FHWA did not make those targets publicly available until spring 2019, seven years after passage of the law. The new transportation bill should establish stronger reporting requirements to ensure that our investments produce the needed results.

Repair Priorities 2019 provides a national snapshot and state-by-state evaluation of current roadway pavement conditions, spending trends, and unmet needs. It also recommends crucial actions federal policymakers should take in the next transportation reauthorization bill to get the nation's roads—and spending priorities—back on track.

INTRODUCTION

The nation's roads are deteriorating, contributing to a looming financial problem. When we released the first edition of *Repair Priorities* in 2011, the poor condition of the nation's road network was a direct reflection of decades of decisions to underinvest in repair. In the years since, policymakers continue to pay lip service to the notion of prioritizing repair and "fix-it-first," yet we have little to show for the rhetoric. The latest data in this report shows that the conditions of our roadways have not improved, perpetuating a costly backlog of roads in poor condition. Congress provides states with billions in formula funding that they are free to use for maintenance. Yet, despite the backlog, states continue to spend a significant portion of funding to build new roads, creating costly new maintenance liabilities in the form of new roads and lane-miles. We need to take much stronger action as a nation to reverse the deterioration of our infrastructure. We need a different set of priorities—not simply a higher level of overall investment. We now have years of evidence that simply increasing funding for highways does not solve the problem—**the same spending patterns persist: underinvestment in repair and overinvestment in expanding a highway system that we cannot afford to maintain.**

Percentage of roads in poor condition vs. federal appropriations



Despite more spending, our roads are not getting better

The nation is falling behind when it comes to the condition of our roads. Between 2009 and 2017, the percentage of the roads nationwide in "poor condition"—a category defined by the Federal Highway Administration (FHWA) on a scale of good, fair, and poor—increased from 14 percent to 20 percent. The percentage of roads in "good condition" increased only slightly: from 36 percent to 38 percent over that nine-year period.

This is especially concerning given that, in addition to passing two long-term reauthorizations of federal transportation spending during this time, Congress also provided a massive boost of additional one-time funding with the 2009 American Recovery and Reinvestment Act. Even though the stimulus, as it is more commonly known, injected billions of dollars into the surface transportation system, we still failed to make a dent in the backlog of roads in poor condition.

About the data in this report

The analysis in this report uses data from the Federal Highway Administration's (FHWA) "Highway Statistics Series," a collection of reports released annually based on data submitted to FHWA by every state and the District of Columbia.[1] Transportation for America has made updates to the methodology since our colleagues at Smart Growth America and Taxpayers for Common Sense released *Repair Priorities* 2014, most notably examining a wider range of years to better assess trends, and evaluating the pavement condition of and funding needed to repair all public roads in the country, rather than focusing more narrowly on roads managed by states. A more detailed discussion of this report's methodology can be found in Appendices A and B.

While this report uses data published by FHWA, all conclusions drawn in the report are those of Transportation for America.

1 Federal Highway Administration. (2017). Highway Statistics Series. Available at https://www.fhwa.dot.gov/policyinformation/statistics.cfm.

We are facing a looming spending gap

There is a sizable gap between what states and localities are spending on road repair and the amount we would need to spend to keep roads in good condition over time. While previous editions of *Repair Priorities* have looked exclusively at what states would need to spend to repair and preserve state-owned roads, we chose to look at all of the nation's publicly-managed roads across jurisdictions with this edition to better understand the magnitude of the gap.

$169 billion per year just to keep our good roads "good."

As of 2017, we would need to spend an estimated $168.6 billion per year exclusively on road repair just to preserve the nation's roads that are currently in good and fair condition in that acceptable state through routine pavement management practices.

$63 billion per year on top of that to address the backlog of poor roads.

We are also facing a substantial financial burden to bring the backlog of roads currently in poor condition into good repair. It is significantly more expensive to rehabilitate roads that have fallen into poor repair than to preserve roads in good condition on an ongoing basis through routine pavement preservation. We estimate that the total cost to bring the nation's current backlog of roads in poor condition into good repair is approximately $376.4 billion, or $62.7 billion per year over a six-year federal transportation bill.

Taken together, this means we are currently facing a total need of $231.4 billion per year just to keep our existing road network in acceptable repair.

For comparison, all highway capital expenditures across all government units totaled $105.4 billion in 2015, only a portion of which goes to repair.[1] Policymakers treat roads as economic assets on their balance sheets, but they are also major financial liabilities. They bring guaranteed costs over their life cycles—costs that are rarely fully accounted for on the front end. The true cost of our roads is likely even higher than the figures above, which do not account for bridge repair needs and other costs associated with maintaining our road network, such as snow removal, stormwater management, and traffic enforcement.

1 All highway expenditures (capital outlay, maintenance and services, administration, highway law enforcement, bond retirement, etc., and repair) across all government units totaled $223 billion in 2015. See: https://www.fhwa.dot.gov/policyinformation/statistics/2015/hf2.cfm.

THE COST TO MAINTAIN THE NATION'S ROADS

$169 billion
per year just to keep our good roads "good."

$62 billion
per year on top of that to address the backlog of poor roads.

That's a total need of **$231.4 billion** per year just to keep our existing road network in acceptable repair.

For comparison, all highway capital expenditures across all government units totaled **$105.4 billion** in 2015, only a portion of which goes to repair.

Roads are major financial liabilities. They come with guaranteed costs over their life cycles.

$24,000 annually per lane mile to keep roads in a state of good repair

X

223,494 lane miles added to the full public road network 2009-2017

=

$5 billion needed annually to maintain these recently added lane miles

Transportation for America

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Not just a money problem—a priorities problem

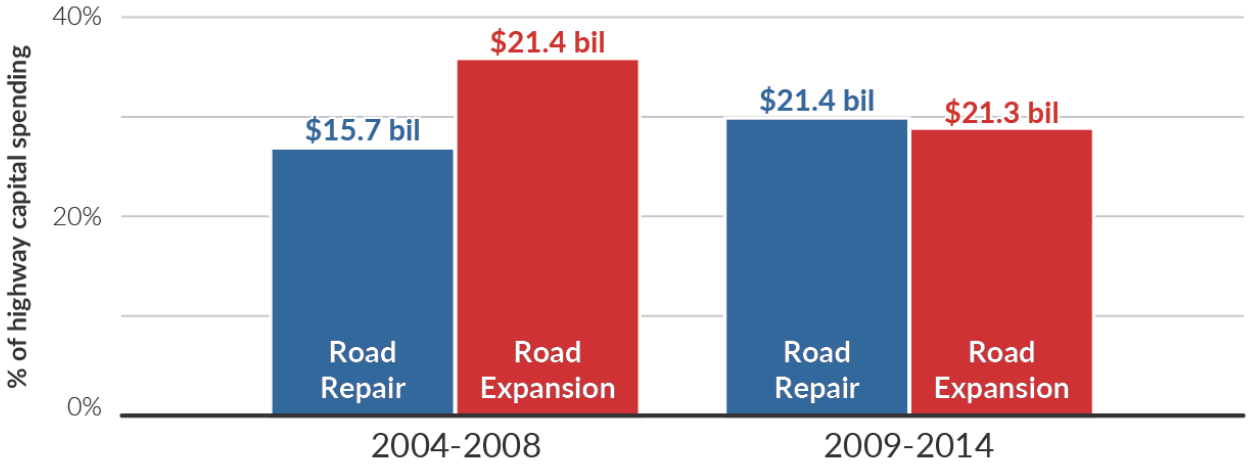
The numbers are clear: we cannot afford to maintain the roads we have, let alone the new roads we keep adding to the system. The rhetoric on transportation funding in most states and Washington, DC is all about "repairing our crumbling roads and bridges." But do our priorities match this rhetoric?

This report evaluates how well states are aligning their actual spending priorities with that notion.

The latest available data shows states have made some improvement in their spending since we released the first edition of *Repair Priorities* in 2011. That report found that between 2004 and 2008, states collectively spent $21 billion per year on road expansion and $16 billion per year on repair and preservation. States have increased their spending on road repair in the years since, spending $21.3 billion on average on road expansion annually between 2009-2014 (the latest year with available data) and $21.4 billion on road repair. Spending on road repair accounted for 30 percent of states' total capital spending on highways over that time, while road expansion accounted for 29 percent.

However, that means states are still spending just as much on road expansion as road repair. These investments in expansion don't just redirect funds away from much needed investments in repair; they continually grow our annual spending need, widening the gap. Every new lane-mile of road costs approximately $24,000 per year to preserve in a state of good repair through ongoing pavement management.[2] By expanding roads, we are borrowing against the future.

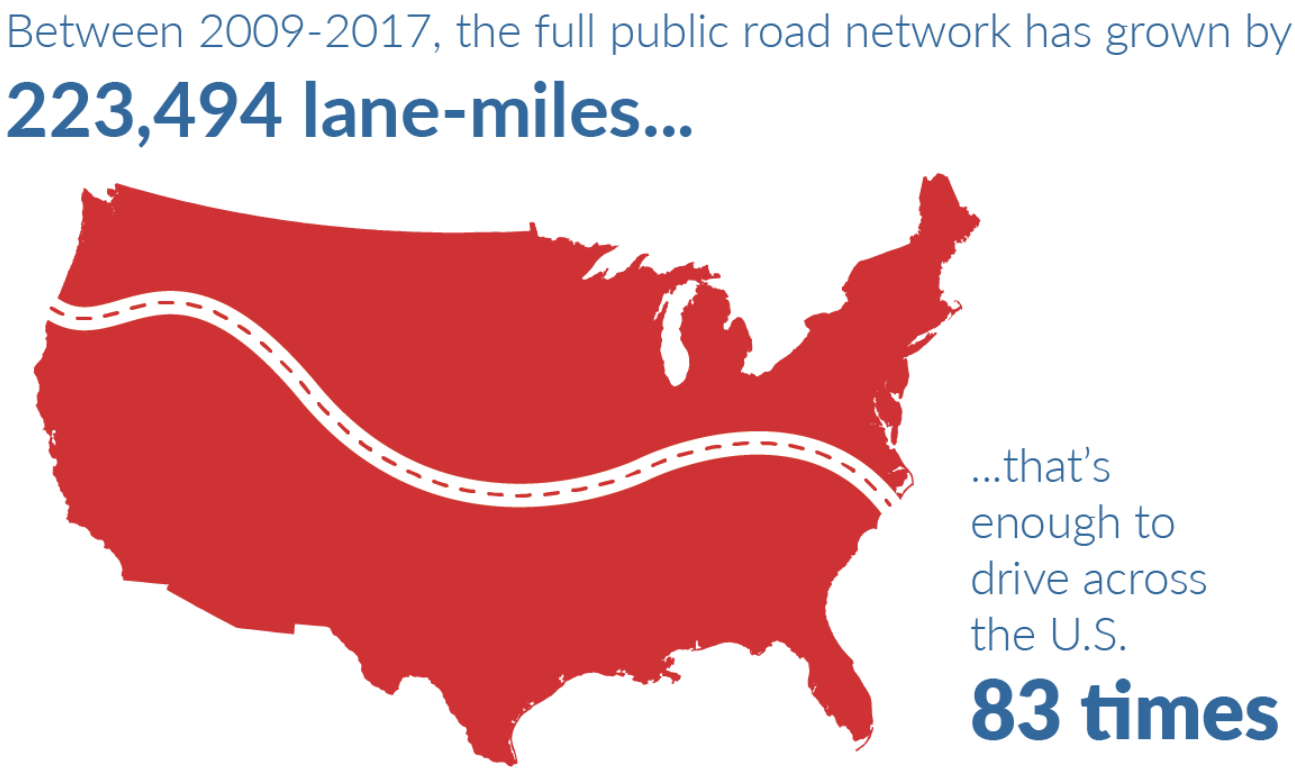
Average annual state DOT expenditures on road expansion & repair



Note: "Road Expansion," and "Road Repair" are categories defined by T4America based on expenditure categories reported by FHWA. Other highway capital expenditures reported by FHWA that are not included in these two categories include: engineering, traffic operations, bridge repair and expansion, safety, and road relocation. See Appendix A for a detailed discussion of the methodology behind these figures.

2 See Appendix B of this report for a full discussion of how the annualized cost to preserve a lane-mile of road was estimated. This figure represents a national cost estimate. Actual costs vary substantially from state to state.

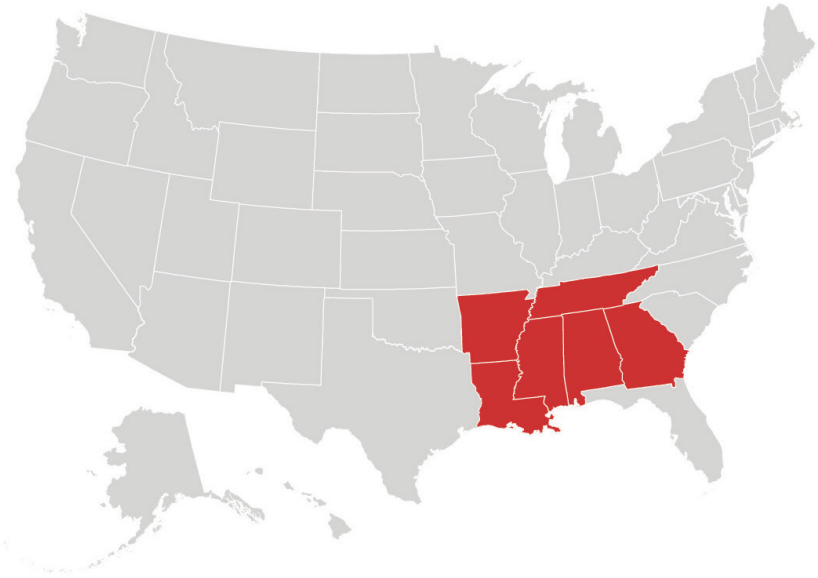
While FHWA has not yet published data on spending after 2014, spending patterns likely have not changed in the years since based on how much the nation's road network has grown. State transportation departments alone added 16,663 lane-miles to the network of roads they maintain between 2011-2017.[3] And they've kept up the pace; they added 5,325 of those lane-miles just since 2015.



The full public road network across all jurisdictions grew by 223,494 lane-miles nationally between 2009-2017, further adding to the financial burden to keep our roads in good repair. Those new lane miles could run back-and-forth across the width of America 83 times.

We now have to spend **an additional $5 billion per year just to keep those new roads in good condition**. That is more than **Tennessee, Mississippi, Alabama, Georgia, Louisiana**, and **Arkansas** receive together in federal highway apportionments each year.[4]

3 FHWA has not published this data for 2009 and 2010.
4 Federal Highway Administration. (2017). Fiscal Year (FY) 2017 Supplementary Tables - Apportionments Pursuant to the Fixing America's Surface Transportation Act. Available at https://www.fhwa.dot.gov/legsregs/directives/notices/n4510812/n4510812_t1.cfm.



The $5 billion per year required to maintain just the lane miles added between 2009-2017 is more than **Tennessee, Mississippi, Alabama, Georgia, Louisiana, and Arkansas** receive together in federal highway apportionments each year.

An urban problem: we aren't spending enough on repair in the places where most Americans live. States are spending comparable amounts on repair for roads in rural areas versus those in urban areas—about $10.7 billion per year on average—despite the fact that pavement conditions have remained significantly worse in urban areas. As of 2017, 18 percent of rural roads were in poor condition while 47 percent were good condition. By contrast, 37 percent of urban roads were in poor condition and just 28 percent were in good condition.

Urban areas also house approximately 80 percent of the nation's population.[5] Urban roads impact more people and see more wear-and-tear and therefore require more investment in upkeep, yet our spending priorities ignore that reality.

What needs to happen

Policymakers at the federal, state, and local level must do more to reverse the deterioration of our nation's road network. We may need additional funding, but more funding will not solve this problem without making significant changes to our priorities for that spending. We now have years of evidence that funding increases have only perpetuated the same spending patterns.

Congress needs to step in and put strong measures in place to prioritize the right outcomes with any new funding: direct resources to preserving the roads we have in the areas that need it most, and make a real commitment to halting costly roadway expansion by holding states and localities accountable. The recommendations section of this report lays out an approach for addressing these needs in the next federal transportation reauthorization bill.

5 United States Census. (2016). "Measuring America: Our Changing Landscape." Available at https://www.census.gov/library/visualizations/2016/comm/acs-rural-urban.html.

AN URBAN ROADS PROBLEM

80%
of the population lives in urban areas

States are spending comparable amounts on repair for roads in rural & urban areas

URBAN — **$10.7 billion**

RURAL — **$10.7 billion**

But pavement conditions have remained significantly worse in urban areas

ROADS IN GOOD CONDITION

URBAN — **28%**

RURAL — **47%**

ROADS IN POOR CONDITION

URBAN — **37%**

RURAL — **18%**

Urban roads impact more people and see more wear-and-tear and therefore require more investment in upkeep—yet our spending priorities ignore this reality.

Transportation for America

TAXPAYERS for COMMON SENSE

PRIORITIES AT THE STATE LEVEL

On a national level, it is clear that we are not making progress to improve the condition of the nation's roads. Yet unfortunately, some states are ***still spending to expand their road networks*** at the expense of their existing roads—an irresponsible use of taxpayer dollars. While pavement conditions worsened slightly at the national level between 2009-2017—even with billions in federal and state spending devoted to repair— the outlook is worse for many states, **thirty-seven** of which saw an increase in the percentage of roads in poor condition. Yet a number of states have made changes to their spending and shifted funds away from road expansion to repair and preservation since the release of *Repair Priorities* in 2011.

Outlook by state

A number of states have made changes since 2011, shifting funds away from road expansion to repair and preservation. **West Virginia**, for example, devoted 31 percent of the state's highway capital budget to road expansion between 2009 and 2014 and just 19 percent to road repair, and saw the percentage of roads in poor condition increase from 28 percent to 31 percent between 2009 and 2017.

Yet on a state-by-state basis, the story is also more complex:

- Some states are spending a significant portion of their available funding on repair and are seeing pavement conditions improve over time—like **New Jersey**.
- Some states are devoting more of their available funds to road repair, but are still seeing worsening pavement conditions because the backlog is too great; for example, **Michigan**. These states may need additional funds to keep their roads in good condition.
- Other states, like **Tennessee**, have been able to maintain a large percentage of their roads in good condition with their available funding, allowing them to devote funds to road expansion without compromising the quality of their existing system.[6]

This section provides detailed information on state-by-state spending priorities and pavement conditions.

FHWA must release newer spending data

FHWA's nearly five-year lag in publishing this spending data undermines the transparency and accountability this data is supposed to help provide. A number of states have made significant changes to their spending priorities in recent years, but the publicly available data FHWA provides makes it impossible for taxpayers to see these improvements.

For example, **Mississippi** has been making exactly the kind of drastic shift in priorities in recent years that many states need to make to address their deteriorating roads. In 2016, the Mississippi Department of Transportation (MDOT) shifted from directing more than 70 percent of funds annually toward expansion and spending less than 10 percent on repair to a relatively equal split. Faced with evidence that the condition of the state's roads was rapidly worsening, MDOT made a responsible—but difficult and often unpopular—decision to halt some expansion projects already in the pipeline.

Mississippi should be held up as a leader nationally for making this needed shift despite the challenges, yet there is no evidence of this shift in FHWA's data because it is so out of date. Other states have likely made changes to their spending for worse or better that the public cannot see.

6 The number of miles reported in FHWA's pavement condition tables for Tennessee is significantly lower for 2017 than previous years. However, the state's reported pavement conditions are relatively consistent over the study years, indicating that they are likely accurate despite the discrepancy.

Spending by state

A number of states have made changes to their spending and shifted funds away from road expansion to repair and preservation since the release of the first edition of *Repair Priorities* in 2011.

South Dakota is leading the nation, having dedicated 69 percent of its highway capital budget to road repair between 2009-2014. **North Dakota** is a close second, with 68 percent of its highway capital spending going to road repair over that time. **Maine, Michigan, Nebraska**, **New Jersey,** and **Wyoming** all allocated more than 50 percent of their highway capital budgets to road repair. These states are highlighted in green in Table I.

Not all states did so well, however. **Arizona, Indiana, Mississippi, Nevada, North Carolina, Texas,** and **Utah** all devoted more than 45 percent of their available highway capital funds to road expansion between 2009 and 2014. See A4 in Appendix A for a more detailed comparison of states' spending on expansion versus repair between 2009 and 2014.

Table I: Highway capital spending on state-managed roads, 2009-2014 (thousands)

State	Annual avg. capital spending	Roadway expansion as % of total capital spending	Roadway repair as % of total capital spending	Other capital expenditures as % of total capital spending
Alabama	$1,054,459	28%	41%	31%
Alaska	$428,207	18%	39%	43%
Arizona	$1,189,547	52%	15%	33%
Arkansas	$907,555	45%	19%	36%
California	$3,910,413	16%	35%	49%
Colorado	$817,182	30%	30%	40%
Connecticut	$760,472	19%	21%	60%
Delaware	$324,368	36%	19%	45%
Florida	$4,527,857	26%	37%	37%
Georgia	$1,482,486	27%	34%	38%
Hawaii	$266,414	32%	31%	36%
Idaho	$461,386	19%	36%	45%
Illinois	$2,935,776	20%	40%	40%
Indiana	$1,919,996	49%	20%	31%
Iowa	$845,951	31%	40%	29%
Kansas	$1,012,787	34%	33%	33%
Kentucky	$1,439,153	36%	30%	34%
Louisiana	$1,775,066	29%	22%	49%

State	Annual avg. capital spending	Roadway expansion as % of total capital spending	Roadway repair as % of total capital spending	Other capital expenditures as % of total capital spending
Maine*	$276,535	11%	65%	23%
Maryland	$1,335,539	25%	20%	56%
Massachusetts*	$1,050,132	4%	23%	74%
Michigan	$1,506,953	8%	54%	38%
Minnesota	$1,063,864	28%	31%	41%
Mississippi	$1,193,357	77%	4%	19%
Missouri	$1,466,900	31%	20%	49%
Montana	$466,541	21%	45%	35%
Nebraska	$529,745	5%	53%	42%
Nevada	$577,713	54%	21%	25%
New Hampshire*	$276,432	26%	45%	28%
New Jersey*	$2,476,888	7%	57%	35%
New Mexico	$482,148	19%	39%	42%
New York*	$3,794,065	7%	43%	50%
North Carolina	$2,420,087	55%	11%	34%
North Dakota	$523,825	10%	68%	23%
Ohio	$2,251,767	17%	40%	43%
Oklahoma	$1,166,559	33%	27%	40%
Oregon	$767,224	14%	25%	61%
Pennsylvania*	$3,873,959	29%	22%	48%
Rhode Island*	$240,421	3%	20%	77%
South Carolina	$767,133	24%	32%	44%
South Dakota	$367,747	12%	69%	19%
Tennessee	$1,484,522	36%	16%	47%
Texas	$7,259,320	48%	15%	38%
Utah*	$1,460,836	47%	26%	28%
Vermont	$222,675	10%	46%	44%
Virginia	$1,296,917	31%	19%	50%
Washington	$2,777,625	35%	21%	45%
West Virginia	$893,885	31%	19%	49%
Wisconsin*	$1,583,255	36%	33%	31%
Wyoming	$390,763	15%	54%	30%
Total	**$72,304,409**	**29%**	**30%**	**41%**

**These states did not provide data to FHWA for at least one year of the analysis. Therefore, results may be skewed.*

Road conditions by state

While pavement conditions worsened slightly at the national level between 2009 and 2017—even with billions in spending devoted to repair—the outlook is worse for a number of states. **Thirty-seven states** saw an increase in the percentage of roads in poor condition between 2009 and 2017. These states are highlighted in Table II.

A number of states also saw their roads improve between 2009 and 2017. **Arkansas, Kansas, Maryland, New Jersey,** and **Vermont** saw the biggest decreases in the percentage of their roads in poor condition.

However, these changes also need to be put in context. The states that saw the biggest changes in pavement condition aren't necessarily the states whose roads are in the best and worst condition as of 2017. Or, put another way, having the biggest change is not the same as having the best current conditions.

Thirty-seven states saw an increase in the percentage of roads in poor condition between 2009-2017.

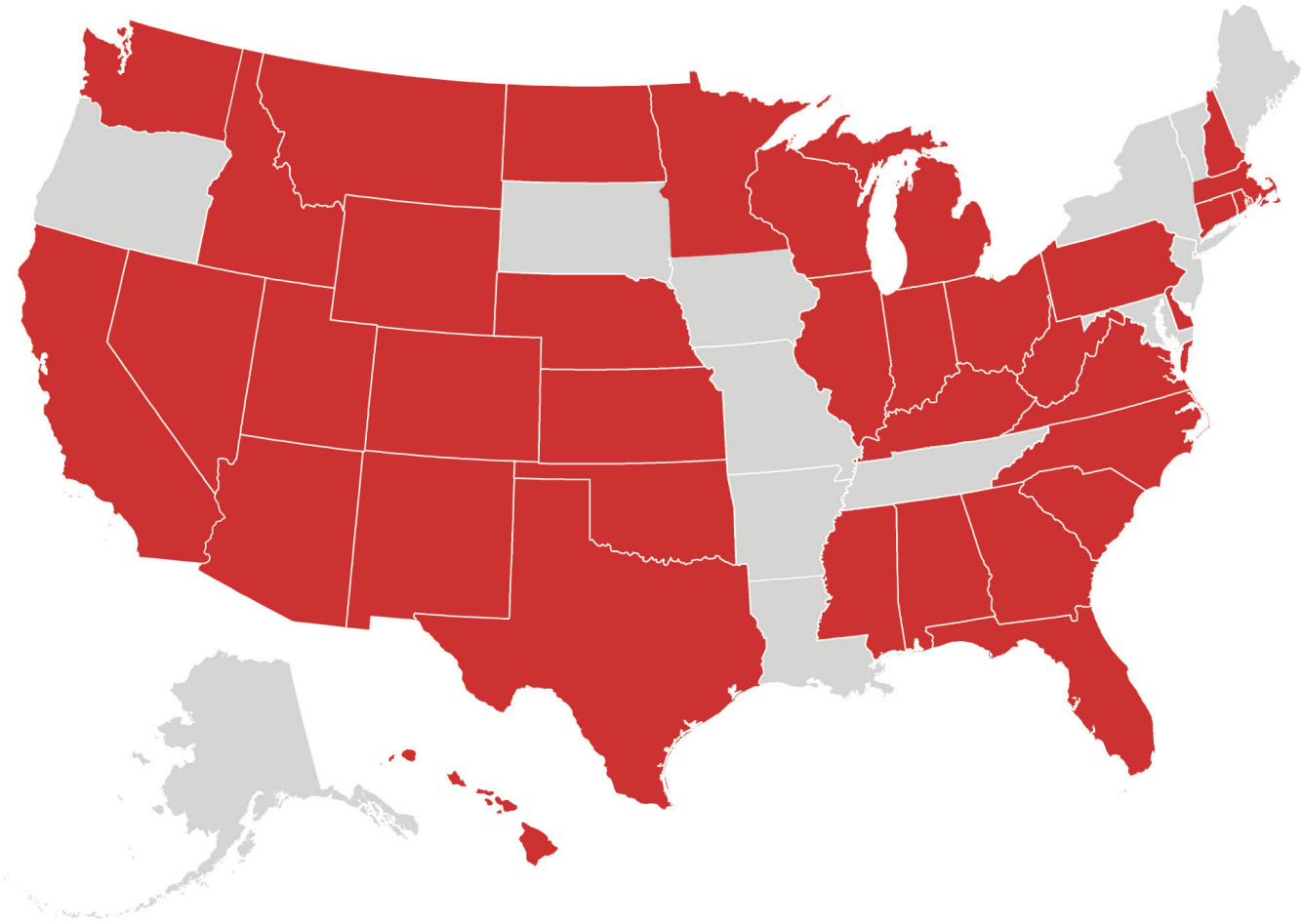


Table II: Change in pavement conditions by state, 2009-2017

Comparison of roads reported in poor condition across all jurisdictions, 2009-2017			
State	2009	2017	Change in % roads in poor condition
Alabama	11%	14%	3%
Alaska	20%	20%	0%
Arizona	8%	19%	11%
Arkansas**	18%	9%	-9%
California	32%	45%	13%
Colorado	8%	22%	14%
Connecticut	15%	34%	19%
Delaware	15%	19%	4%
Florida	3%	8%	5%
Georgia**	0%	5%	5%
Hawaii	38%	42%	4%
Idaho	1%	5%	4%
Illinois	4%	19%	16%
Indiana**	10%	13%	3%
Iowa**	15%	9%	-6%
Kansas	9%	10%	1%
Kentucky	2%	10%	7%
Louisiana	25%	25%	0%
Maine	25%	22%	-3%
Maryland**	31%	11%	-20%
Massachusetts**	14%	30%	16%
Michigan	11%	24%	13%
Minnesota	8%	15%	7%
Mississippi	18%	30%	12%
Missouri	26%	23%	-2%
Montana	4%	11%	8%
Nebraska	6%	7%	1%
Nevada	7%	14%	7%
New Hampshire	20%	25%	6%
New Jersey	45%	34%	-11%

Comparison of roads reported in poor condition across all jurisdictions, 2009-2017			
State	2009	2017	Change in % roads in poor condition
New Mexico	21%	31%	10%
New York**	25%	19%	-5%
North Carolina	7%	13%	6%
North Dakota	2%	10%	8%
Ohio	5%	18%	13%
Oklahoma	32%	33%	1%
Oregon	7%	7%	0%
Pennsylvania	25%	30%	5%
Rhode Island	20%	53%	33%
South Carolina	13%	18%	5%
South Dakota	16%	14%	-2%
Tennessee**	6%	5%	-1%
Texas	8%	11%	3%
Utah	6%	22%	16%
Vermont	34%	17%	-18%
Virginia**	3%	10%	8%
Washington	11%	29%	18%
West Virginia	28%	31%	3%
Wisconsin	17%	29%	12%
Wyoming	7%	8%	1%
U.S. Total	14%	20%	6%

*** These states saw a major change in the number of miles reported in FHWA's pavement condition tables for 2009 vs. 2017. This is likely due to inconsistencies in reporting practices and means the results for these states may be skewed.*

Eleven states have at least 30 percent of their road network in poor condition as of 2017. **California, Connecticut, Hawaii, New Jersey**, and **Rhode Island** had the highest percentage of roads in poor condition. These states are highlighted in red in Table III.

By contrast **Georgia, Idaho, Nebraska, Oregon,** and **Tennessee** had the lowest percentage of their roads in poor condition as of 2017. And **Georgia, Maryland, Nebraska, North Dakota, Tennessee,** and **Wyoming** had the highest percentage of roads in good condition as of 2017. See Tables A2 and A3 in Appendix A for more detailed information on state pavement conditions in 2009 and 2017.

Table III: Percentage of public roads across jurisdictions in good, fair, and poor condition, 2017

State	Public centerline miles of roads reported	% in poor condition	% in fair condition	% in good condition	% with unreported condition
Alabama	24,814	14%	33%	53%	0%
Alaska	3,612	20%	31%	39%	10%
Arizona	12,260	19%	38%	41%	2%
Arkansas**	9,741	9%	55%	36%	0%
California	54,010	45%	37%	17%	1%
Colorado	16,560	22%	44%	32%	2%
Connecticut	6,335	34%	44%	21%	0%
Delaware	1,584	19%	37%	44%	0%
Florida	27,563	8%	40%	51%	1%
Georgia**	16,828	5%	31%	64%	0%
Hawaii	1,552	42%	41%	17%	0%
Idaho	9,751	5%	50%	43%	1%
Illinois	31,100	19%	42%	39%	0%
Indiana**	15,286	13%	31%	54%	2%
Iowa**	5,143	9%	32%	53%	6%
Kansas	24,344	10%	46%	44%	0%
Kentucky	12,878	10%	44%	45%	1%
Louisiana	13,267	25%	38%	35%	1%
Maine	6,169	22%	36%	41%	0%
Maryland**	2,917	11%	23%	66%	0%
Massachusetts**	5,324	30%	41%	29%	1%
Michigan	34,246	24%	35%	41%	0%
Minnesota	30,888	15%	33%	52%	0%
Mississippi	21,755	30%	41%	29%	0%

State	Public centerline miles of roads reported	% in poor condition	% in fair condition	% in good condition	% with unreported condition
Missouri	30,075	23%	45%	32%	0%
Montana	12,538	11%	34%	54%	0%
Nebraska	16,252	7%	28%	64%	1%
Nevada	7,433	14%	33%	53%	0%
New Hampshire	3,550	25%	30%	44%	0%
New Jersey	10,893	34%	44%	22%	0%
New Mexico	11,867	31%	37%	32%	0%
New York**	16,803	19%	33%	46%	2%
North Carolina	21,499	13%	44%	42%	1%
North Dakota	12,197	10%	26%	64%	0%
Ohio	30,075	18%	33%	49%	0%
Oklahoma	30,235	33%	38%	29%	0%
Oregon	17,784	7%	52%	41%	0%
Pennsylvania	28,631	30%	40%	30%	0%
Rhode Island	1,761	53%	36%	11%	0%
South Carolina	21,094	18%	46%	35%	0%
South Dakota	14,969	14%	46%	40%	0%
Tennessee**	5,191	5%	17%	75%	3%
Texas	80,065	11%	66%	22%	1%
Utah	9,177	22%	39%	38%	0%
Vermont	3,758	17%	33%	49%	0%
Virginia**	12,752	10%	44%	45%	1%
Washington	20,162	29%	45%	25%	0%
West Virginia	10,487	31%	43%	25%	0%
Wisconsin	28,334	29%	38%	33%	0%
Wyoming	7,937	8%	27%	65%	0%
U.S. Total	853,446	20%	41%	38%	1%

*** These states saw a major change in the number of miles reported in FHWA's pavement condition tables for 2009 vs. 2017. This is likely due to inconsistencies in reporting practices and means 2017 results for these states may be skewed.*

RECOMMENDATIONS: WHAT WILL IT TAKE TO FIX THE SYSTEM?

More funding alone won't fix our deteriorating roads. By continuing to expand the nation's road network, some states are both directing limited resources away from needed repair investments and continuously increasing the total cost to preserve our road network in the future. Funding increases have only perpetuated these problematic spending patterns. That isn't a funding problem—it's a policy problem. Transportation for America and Taxpayers for Common Sense are calling on Congress to address this in any infrastructure package they consider, including the upcoming 2020 federal transportation reauthorization. The long-term federal transportation law governs how we spend some $61 billion annually on highways and transit programs. The current policy—the FAST Act—was passed four years ago and expires in September 2020, but discussions about the next bill are already underway. Yet so far those discussions have focused far too much on money, and far too little on what policies or reforms are needed. What will several hundred billion dollars more buy for the American people?

Congress should take the following actions in the 2020 transportation bill to get us back on track.

Guarantee measurable outcomes for American taxpayers with any new funding

We can no longer ask the American taxpayer for more funding to fix crumbling roads and bridges without more assurances that the money will actually make things better. Continuing to do so will only erode trust. Federal policymakers can typically agree across political party lines that more funding is needed for transportation—what they have failed to do is establish a clear vision for what that funding will achieve for the nation. It should be no surprise then that states are spending a substantial share of their transportation funds on building new roads.

The next transportation bill should set clear, quantifiable outcomes for the program to accomplish. For example, this analysis estimates **a total annual need of $231.4 billion per year** to keep our good and fair existing roads in that acceptable state and bring the backlog of roads in poor condition into good repair over a six-year period. **Congress could set a goal for repairing all roads in poor condition and write a bill that clearly moves the ball forward toward that goal**. If it can't be done in the next six-year authorization bill then Congress should make clear what is feasible—such as reducing the percentage by half so that no more than 10 percent of the nation's roads will be in poor condition by 2026. These are the kinds of concrete, tangible goals that have been sorely missing from federal transportation policy for far too long.

Require states to repair their existing systems before expanding

Congress should require that states dedicate available highway formula funding to repairing and maintaining the existing system first. Historically, states have used this formula funding for new road construction. Continually expanding the system while neglecting regular repair has created this current backlog of costly repair needs. It's also encouraged sprawling, car-oriented development that increases the length and number of car trips. As a result, states return to the federal government every few years requesting more funds to address unmet "needs," when those needs could have been prevented or delayed with more responsible spending practices. Congress could also grant states additional flexibility with their funds if they are able to demonstrate that they are keeping their roads in good condition above a certain percentage threshold.

Require project sponsors to demonstrate they can afford to maintain new roadway capacity projects

In the transit program, major new projects are stringently evaluated before receiving federal funding to ensure that: 1) they support federal goals, 2) the project sponsor has the funding to operate and maintain the new asset, and 3) the project sponsor can manage the new asset without shortchanging the rest of their system. **These same commonsense principles are not applied to the highway program.**

In other words, under our current federal program, a project sponsor can build a new road that they cannot afford to maintain, even as they are failing to maintain the rest of their system in a good state of repair. **It is time to require a higher level of asset management in the highway program.**

The new transportation program should focus on getting greater efficiency from the roads we have already built and ensuring that we have a plan for operating and maintaining what we build.

Taking another cue from the transit program, to supplement the funding distributed by formula to states dedicated to highway repair and maintenance, Congress should also create a competitive program to fund new highway capacity expansion projects. Project sponsors should demonstrate that they can operate and maintain the asset throughout its useful life, and projects should be evaluated for funding based on clear performance criteria to ensure that funded projects produce substantial benefits for the cost. This could include demonstrating improvement in access to jobs and services, reducing vehicle miles traveled and greenhouse gas emissions, improving safety, reducing the cost of managing the transportation system, providing better outcomes for disadvantaged populations, or accomplishing other policy goals.

Track progress and require that FHWA publish results

The Moving Ahead for Progress in the 21st Century (MAP-21) Act in 2012 established new requirements that state departments of transportation and metropolitan planning organizations set performance targets for the pavement conditions of the interstate and non-interstate highways they maintain, and the Fixing America's Surface Transportation (FAST) Act of 2015 reaffirmed this requirement.

As of 2017, all states reported their roadway pavement conditions targets to FHWA. But for some perplexing reason, it took until spring of 2019 for those targets to be available to the public, and they are difficult to digest in their current form.[7] FHWA also has not reported a baseline of current conditions for many states, which makes it impossible to tell if any state's target would represent an improvement over current conditions or a deterioration.

Further, the highway spending data reported by FHWA is unacceptably out of date—the most recent publicly available data on state highway capital spending used in this analysis is from 2014. This delay is an unacceptable failure that Congress and the president should require FHWA to fix before asking taxpayers to provide more funding for transportation.

How can the public have any idea whether or not federal spending is accomplishing what has been promised without better data? The new transportation bill should establish stronger reporting requirements to ensure that our investments produce the needed results. Congress should also require that FHWA publish up-to-date information on state highway expenditures.

See how your state's targets for road conditions measure up:

FHWA has finally made states' targets available. See whether your state has set ambitious targets to improve pavement condition or expects to see roads continue to deteriorate (or has not yet provided its baseline data): https://www.fhwa.dot.gov/tpm/reporting/state/. Transportation for America will be releasing a full national analysis of all state performance targets later this year.

7 Federal Highway Administration. (2019). State Performance Dashboard and Reports. Available at https://www.fhwa.dot.gov/tpm/reporting/state/.

APPENDICES

Appendix A: Calculating road conditions, lane-miles added, and spending

This appendix presents the methodology and detailed state data for three major calculations used in this report.

- Total and change in lane-miles for each state between 2009 and 2017 (Table A1);
- Pavement conditions for public roads (across jurisdictions) in 2009 and 2017 (Tables A2 and A3); and
- Average annual capital spending on road expansion and repair by state for years 2009-2014 (Table A4).

The project team used data from FHWA's Highway Statistics Series for all of the calculations in this Appendix.[8]

An outside advisory team of former state DOT chief executives, senior infrastructure system managers and engineers at the Pennsylvania Department of Transportation reviewed this methodology for the first edition of *Repair Priorities* published in 2011. All modifications made to the methodology for this edition are noted in the text below.

Determining lane-miles added

For this edition of *Repair Priorities*, the project team calculated (1) the number of lane-miles added across all jurisdictions in each state between 2009-2017, as well as (2) the number of lane-miles added to the road networks managed by state departments of transportation between 2011-2017 (data is unavailable for 2009 and 2010). The team used FHWA's "Highway Statistics Series" (FHWA Tables HM-60 and HM-81); see Table A1 below.[9,10]

FHWA reports the size of state road networks in lane-miles, a measure of road length that takes road capacity into account (for example, one mile of a four-lane highway is reported as four lane-miles), and also reports the size of state road networks in terms of centerline miles, a measure that only accounts for road length (one mile of a four-lane highway is reported as one centerline mile). This analysis uses the total lane-miles—rather than centerline miles—added to each state's road network between 2009 and 2017 to capture additional lanes added to existing roads as well as new roads constructed. In some situations, lane-miles were added to or subtracted from the total state road network through transfer of responsibility to/from other jurisdictions. As a result, Table A1 shows some negative lane-mile changes from 2009 to 2017 and some major increases that may not be due entirely to new construction.

8 Federal Highway Administration. (2017). Highway Statistics Series. Available at https://www.fhwa.dot.gov/policyinformation/statistics.cfm.
9 FHWA Highway Statistics. (2017). "Functional System Lane Length - 2017; Lane-Miles." Table HM-60. Available at https://www.fhwa.dot.gov/policyinformation/statistics/2017/hm60.cfm.
10 FHWA Highway Statistics. (2011). "State Highway Agency-Owned Public Roads - 2017 1/Rural and Urban Miles; Estimated Lane-Miles and Daily Travel." Table HM-81. Available at: https://www.fhwa.dot.gov/policyinformation/statistics/2017/hm81.cfm.

Table A1: Lane-miles added 2009-2017

State	State-managed roads			All jurisdictions		
	2011 lane-miles	2017 lane-miles	Lane-miles added 2011-2017	2009 lane-miles	2017 lane-miles	Lane-miles added 2011-2017
Alabama	29,324	29,652	328	194,126	211,339	(561)
Alaska	11,653	11,721	68	31,945	31,597	(2,237)
Arizona	19,341	19,650	310	131,356	144,959	3,477
Arkansas	37,357	37,854	497	204,710	210,532	5,649
California	49,598	51,279	1,681	385,860	394,383	12,443
Colorado	22,934	22,969	36	183,587	184,913	988
Connecticut	9,838	9,824	(14)	45,638	45,855	157
Delaware	11,797	11,892	95	13,656	13,954	185
Florida	42,956	44,205	1,249	268,350	274,149	4,441
Georgia	48,397	49,142	745	256,952	272,017	10,458
Hawaii	2,492	2,489	(4)	9,539	9,781	167
Idaho	12,225	12,329	104	98,590	107,376	7,891
Illinois	42,097	42,181	84	292,845	306,614	13,411
Indiana	27,879	28,417	537	198,265	202,417	(84)
Iowa	22,740	22,748	9	235,751	235,048	452
Kansas	23,988	23,999	12	286,962	289,948	3,316
Kentucky	61,799	62,160	361	164,491	167,092	1,961
Louisiana	39,375	39,310	(65)	129,034	130,020	(489)
Maine	17,617	17,526	(91)	46,771	46,851	(32)
Maryland	14,762	14,797	35	69,049	70,792	(91)
Massachusetts	9,570	9,612	42	76,332	77,557	850
Michigan	27,442	27,449	7	255,882	256,207	(524)
Minnesota	29,306	29,267	(39)	283,378	286,708	1,830
Mississippi	27,294	28,136	842	156,532	161,909	5,416
Missouri	75,999	77,726	1,727	270,903	276,619	3,780
Montana	25,049	25,174	125	150,125	150,257	(2,542)
Nebraska	22,474	22,557	83	190,478	193,712	3,347
Nevada	13,360	14,153	793	73,242	101,666	22,940
New Hampshire	8,410	8,425	15	33,008	33,328	248
New Jersey	8,480	8,529	49	84,463	85,000	(222)
New Mexico	29,160	29,678	518	142,939	161,015	18,187
New York	38,216	38,318	103	242,920	239,763	(2,855)

State	State-managed roads			All jurisdictions		
	2011 lane-miles	2017 lane-miles	Lane-miles added 2011-2017	2009 lane-miles	2017 lane-miles	Lane-miles added 2011-2017
North Carolina	170,221	172,619	2,398	262,871	227,544	3,348
North Dakota	16,996	17,242	247	175,976	177,882	1,886
Ohio	49,349	49,550	201	262,024	262,377	(301)
Oklahoma	30,252	30,429	177	234,747	234,729	501
Oregon	18,606	18,597	(8)	122,163	162,575	40,294
Pennsylvania	88,450	88,243	(207)	255,552	251,271	1,289
Rhode Island	2,916	2,861	(55)	13,513	12,741	(931)
South Carolina	90,233	90,465	233	139,952	162,694	23,214
South Dakota	18,210	17,936	(273)	169,359	167,838	112
Tennessee	36,858	37,320	463	196,969	203,474	1,617
Texas	194,763	196,295	1,532	669,190	679,917	5,621
Utah	15,812	15,847	35	94,410	103,208	7,337
Vermont	6,037	6,001	(36)	29,672	29,276	(105)
Virginia	126,124	128,189	2,065	160,727	163,648	2,271
Washington	18,397	18,511	114	174,723	167,112	(6,443)
West Virginia	71,588	71,003	(586)	79,452	80,114	475
Wisconsin	29,593	29,731	139	231,264	239,027	1,385
Wyoming	15,794	15,777	(16)	58,387	63,319	4,400
U.S. Total	1,863,124	1,879,787	16,663	8,538,631	8,762,124	223,494

Source – Calculated based on data in the following tables:

- FHWA Highway Statistics. (2011). "State Highway Agency-Owned Public Roads - 2011 1/Rural and Urban Miles; Estimated Lane-Miles and Daily Travel." Table HM-81.http://www.fhwa.dot.gov/policyinformation/statistics/2011/hm81.cfm.
- FHWA Highway Statistics. (2017). "State Highway Agency-Owned Public Roads - 2008 1/Rural and Urban Miles; Estimated Lane-Miles and Daily Travel." Table HM-81. https://www.fhwa.dot.gov/policyinformation/statistics/2017/hm81.cfm.
- FHWA Highway Statistics. (2009)). "Functional System Lane Length - 2017; Lane-Miles." Table HM-60. https://www.fhwa.dot.gov/policyinformation/statistics/2011/hm60.cfm.
- FHWA Highway Statistics. (2017). "Functional System Lane Length - 2017; Lane-Miles." Table HM-60. https://www.fhwa.dot.gov/policyinformation/statistics/2017/hm60.cfm.

Determining road conditions

FHWA's "Highway Statistics Series" includes data on pavement conditions reported for "public roads" in terms of centerline miles, broken up by state and by road functionality type. FHWA reports the number of centerline miles within various pavement condition thresholds. FHWA has also defined what thresholds constitute "good," "fair," and "poor" pavement condition. The research team applied these definitions to FHWA's data to calculate the percentage of states' road networks in each condition bracket for 2009 and for 2017; see Tables A2 and A3.

States report pavement conditions to FHWA using two metrics: the International Roughness Index (IRI), an objective measure of the cumulative deviation from a smooth surface in inches per mile using laser technology; and the Present Serviceability Rating (PSR), a subjective evaluation of ride quality. States report pavement condition for all larger roads to FHWA in terms of IRI; these larger roads include rural interstate, rural minor arterial, rural other principal arterial, urban interstate, urban other freeways and expressways, and urban other principal arterial. For smaller roads, states can report conditions in terms of either IRI or PSR. Low IRI scores indicate smoother pavement. PSR scores range from 0 to 5, with higher scores indicating smoother ride quality. FHWA defines good, fair, and poor pavement quality for both metrics:

Pavement condition brackets

Ride Quality Terms	IRI Rating	PSR Rating
"Good"	< 95	≥ 4.0
"Fair"	≤ 170	≥ 2.0
"Poor"	> 170	< 2.0

Note: This edition of Repair Priorities uses different thresholds for "good," "fair," and "poor" pavement quality for PSR ratings than previous editions. Previous Repair Priorities reports used the thresholds established in the Federal Highway Administration's Conditions and Performance report (Exhibit 3-1): https://www.fhwa.dot.gov/policy/2015cpr/chap3.cfm. This edition uses thresholds established in the rulemaking following the Moving Ahead for Progress in the 21st Century (MAP-21) Bill. Source: Code of Federal Regulations (2017, April 1). Title: PART 490 - NATIONAL PERFORMANCE MANAGEMENT MEASURES; Context: Title 23 - Highways; Section 490.311 "Calculation of pavement measures." https://www.govinfo.gov/content/pkg/CFR-2017-title23-vol1/xml/CFR-2017-title23-vol1-part490.xml#seqnum490.313.

The project team used the reported data on pavement conditions (in FHWA Tables HM-63 and HM-64) to calculate the number of centerline miles of public roads in good, fair, poor and unreported condition and the percentage of public roads in each condition.[11,12] This required summing the data from tables HM-63 and HM-64 for all functionality types within each of the above pavement condition brackets for 2009 and 2017. FHWA does not report conditions data for several smaller road functionality types including local roads and rural minor collectors, so these roads were excluded from this analysis.

11 FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles By Measured Pavement Roughness/Present Serviceability Rating." Table HM-63. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm63.cfm.
12 FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles By Measured Pavement Roughness." Table HM-64. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm64.cfm.

Table A2: Public road conditions across jurisdictions, 2009 (centerline miles)

STATE	Public centerline miles of major road	Miles in "good" condition	% good	Miles in "fair" condition	% fair	Miles in "poor" condition	% poor	Miles with unreported conditions	% unreported
Alabama	24,295	9,804	40%	11,366	47%	2,726	11%	400	2%
Alaska	3,869	1,017	26%	1,703	44%	768	20%	380	10%
Arizona	12,730	6,658	52%	4,621	36%	1,037	8%	414	3%
Arkansas**	21,543	4,327	20%	13,152	61%	3,933	18%	131	1%
California	54,685	9,277	17%	28,037	51%	17,339	32%	32	0%
Colorado	16,734	5,580	33%	9,576	57%	1,349	8%	230	1%
Connecticut	6,150	2,484	40%	2,728	44%	937	15%	-	0%
Delaware	1,532	763	50%	544	36%	223	15%	2	0%
Florida	25,897	12,576	49%	11,630	45%	684	3%	1,007	4%
Georgia**	29,178	18,911	65%	10,142	35%	74	0%	52	0%
Hawaii	1,552	158	10%	800	52%	594	38%	-	0%
Idaho	10,875	4,389	40%	6,119	56%	144	1%	223	2%
Illinois	33,724	10,892	32%	21,580	64%	1,252	4%	-	0%
Indiana**	22,622	9,234	41%	11,222	50%	2,165	10%	1	0%
Iowa**	24,516	6,911	28%	13,845	56%	3,686	15%	74	0%
Kansas	24,572	9,604	39%	12,738	52%	2,189	9%	41	0%
Kentucky	13,889	5,012	36%	8,550	62%	326	2%	-	0%
Louisiana	13,346	4,454	33%	5,387	40%	3,344	25%	160	1%
Maine	6,313	1,975	31%	2,736	43%	1,602	25%	-	0%
Maryland**	7,671	2,453	32%	2,811	37%	2,374	31%	33	0%
Massachusetts**	11,102	6,929	62%	2,647	24%	1,520	14%	6	0%
Michigan	31,794	12,591	40%	15,695	49%	3,507	11%	1	0%
Minnesota	32,439	19,336	60%	10,474	32%	2,489	8%	140	0%
Mississippi	21,380	4,654	22%	12,982	61%	3,744	18%	-	0%
Missouri	30,547	5,596	18%	16,950	55%	7,805	26%	195	1%
Montana	12,539	7,903	63%	4,190	33%	442	4%	3	0%
Nebraska	15,333	8,230	54%	6,207	40%	883	6%	13	0%
Nevada	6,322	3,917	62%	1,928	30%	465	7%	12	0%
New Hampshire	3,409	1,208	35%	1,532	45%	669	20%	-	0%
New Jersey	10,316	920	9%	4,662	45%	4,638	45%	97	1%
New Mexico	10,899	4,313	40%	4,121	38%	2,295	21%	169	2%
New York**	26,984	8,010	30%	12,099	45%	6,659	25%	215	1%

STATE	Public centerline miles of major road	Miles in "good" condition	% good	Miles in "fair" condition	% fair	Miles in "poor" condition	% poor	Miles with unreported conditions	% unreported
North Carolina	21,933	9,311	42%	10,763	49%	1,568	7%	292	1%
North Dakota	13,898	6,991	50%	6,587	47%	321	2%	-	0%
Ohio	28,981	15,366	53%	11,672	40%	1,482	5%	462	2%
Oklahoma	29,442	6,774	23%	13,225	45%	9,436	32%	7	0%
Oregon	17,088	6,350	37%	9,560	56%	1,176	7%	2	0%
Pennsylvania	28,187	6,891	24%	13,663	48%	7,113	25%	520	2%
Rhode Island	1,709	251	15%	1,120	66%	338	20%	-	0%
South Carolina	20,960	5,445	26%	12,740	61%	2,776	13%	-	0%
South Dakota	15,069	6,668	44%	6,012	40%	2,367	16%	22	0%
Tennessee**	17,558	9,725	55%	6,862	39%	971	6%	-	0%
Texas	82,350	22,103	27%	51,435	62%	6,458	8%	2,353	3%
Utah	8,387	2,423	29%	5,426	65%	538	6%	-	0%
Vermont	3,815	862	23%	1,642	43%	1,311	34%	-	0%
Virginia**	21,284	6,922	33%	13,720	64%	612	3%	30	0%
Washington	19,385	7,480	39%	9,754	50%	2,150	11%	1	0%
West Virginia	10,421	2,532	24%	4,965	48%	2,923	28%	-	0%
Wisconsin	28,237	9,417	33%	12,931	46%	4,741	17%	1,148	4%
Wyoming	7,845	3,629	46%	3,638	46%	560	7%	18	0%
U.S. Total	945,393	339,225	36%	468,489	50%	128,702	14%	8,888	1%

*** These states saw a major change in the number of miles reported in FHWA's pavement condition tables for 2009 vs. 2017. This is likely due to inconsistencies in reporting practices and means 2017 results for these states may be skewed.*

Source – Calculated based on data in the following tables:

- FHWA Highway Statistics. (2009). "Functional System Length - 2011 Miles By Measured Pavement Roughness." Table HM-64. http://www.fhwa.dot.gov/policyinformation/statistics/2009/hm64.cfm.
- FHWA Highway Statistics. (2009). "Functional System Length - 2011 Miles By Measured Pavement Roughness/Present Serviceability Rating." Table HM-63. http://www.fhwa.dot.gov/policyinformation/statistics/2009/hm63.cfm.

Table A3: Public road conditions across jurisdictions, 2017 (centerline miles)

STATE	Public centerline miles of major road	Miles in "good" condition	% good	Miles in "fair" condition	% fair	Miles in "poor" condition	% poor	Miles with unreported conditions	% unreported
Alabama	24,814	13,095	53%	8,204	33%	3,430	14%	85	0%
Alaska	3,612	1,394	39%	1,120	31%	729	20%	368	10%
Arizona	12,260	4,967	41%	4,660	38%	2,356	19%	277	2%
Arkansas**	9,741	3,487	36%	5,355	55%	854	9%	46	0%
California	54,010	9,271	17%	20,208	37%	24,104	45%	427	1%
Colorado	16,560	5,372	32%	7,285	44%	3,613	22%	289	2%
Connecticut	6,335	1,355	21%	2,801	44%	2,179	34%	0	0%
Delaware	1,584	699	44%	586	37%	293	19%	5	0%
Florida	27,563	13,921	51%	11,095	40%	2,152	8%	395	1%
Georgia**	16,828	10,823	64%	5,136	31%	801	5%	67	0%
Hawaii	1,552	263	17%	637	41%	649	42%	3	0%
Idaho	9,751	4,178	43%	4,918	50%	509	5%	145	1%
Illinois	31,100	12,001	39%	13,072	42%	6,011	19%	16	0%
Indiana**	15,286	8,305	54%	4,775	31%	1,930	13%	276	2%
Iowa**	5,143	2,727	53%	1,642	32%	456	9%	318	6%
Kansas	24,344	10,682	44%	11,114	46%	2,495	10%	54	0%
Kentucky	12,878	5,815	45%	5,672	44%	1,234	10%	157	1%
Louisiana	13,267	4,661	35%	5,100	38%	3,308	25%	198	1%
Maine	6,169	2,531	41%	2,250	36%	1,379	22%	9	0%
Maryland**	2,917	1,917	66%	660	23%	329	11%	10	0%
Massachusetts**	5,324	1,534	29%	2,157	41%	1,587	30%	45	1%
Michigan	34,246	14,132	41%	11,963	35%	8,128	24%	23	0%
Minnesota	30,888	15,931	52%	10,327	33%	4,603	15%	27	0%
Mississippi	21,755	6,371	29%	8,879	41%	6,467	30%	38	0%
Missouri	30,075	9,485	32%	13,530	45%	7,027	23%	33	0%
Montana	12,538	6,777	54%	4,278	34%	1,442	11%	41	0%
Nebraska	16,252	10,390	64%	4,624	28%	1,134	7%	103	1%
Nevada	7,433	3,919	53%	2,436	33%	1,072	14%	6	0%
New Hampshire	3,550	1,570	44%	1,080	30%	896	25%	4	0%
New Jersey	10,893	2,369	22%	4,797	44%	3,723	34%	4	0%
New Mexico	11,867	3,781	32%	4,430	37%	3,640	31%	17	0%
New York**	16,803	7,719	46%	5,482	33%	3,228	19%	374	2%
North Carolina	21,499	9,116	42%	9,414	44%	2,845	13%	125	1%
North Dakota	12,197	7,787	64%	3,201	26%	1,203	10%	6	0%
Ohio	30,075	14,650	49%	10,054	33%	5,333	18%	39	0%
Oklahoma	30,235	8,827	29%	11,432	38%	9,925	33%	51	0%
Oregon	17,784	7,259	41%	9,223	52%	1,260	7%	41	0%

STATE	Public centerline miles of major road	Miles in "good" condition	% good	Miles in "fair" condition	% fair	Miles in "poor" condition	% poor	Miles with unreported conditions	% unreported
Pennsylvania	28,631	8,625	30%	11,395	40%	8,595	30%	15	0%
Rhode Island	1,761	199	11%	629	36%	926	53%	7	0%
South Carolina	21,094	7,487	35%	9,790	46%	3,800	18%	17	0%
South Dakota	14,969	5,958	40%	6,951	46%	2,040	14%	19	0%
Tennessee**	5,191	3,910	75%	882	17%	235	5%	163	3%
Texas	80,065	17,690	22%	53,037	66%	8,623	11%	715	1%
Utah	9,177	3,483	38%	3,623	39%	2,050	22%	21	0%
Vermont	3,758	1,860	49%	1,255	33%	634	17%	9	0%
Virginia**	12,752	5,761	45%	5,584	44%	1,334	10%	74	1%
Washington	20,162	5,115	25%	9,090	45%	5,920	29%	37	0%
West Virginia	10,487	2,669	25%	4,538	43%	3,272	31%	8	0%
Wisconsin	28,334	9,376	33%	10,778	38%	8,167	29%	14	0%
Wyoming	7,937	5,148	65%	2,147	27%	629	8%	13	0%
U.S. Total	853,446	326,362	38%	353,298	41%	168,551	20%	5,235	1%

*** These states saw a major change in the number of miles reported in FHWA's pavement condition tables for 2009 vs. 2017. This is likely due to inconsistencies in reporting practices and means 2017 results for these states may be skewed.*

Source – Calculated based on data in the following tables.

- FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles By Measured Pavement Roughness." Table HM-64. http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm64.cfm.
- FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles By Measured Pavement Roughness/Present Serviceability Rating." Table HM-63.http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm63.cfm.

Summary of methodology changes for this calculation in *Repair Priorities 2019*

Previous editions of *Repair Priorities* estimated pavement conditions for the subset of roads nationally that are owned and managed by state departments of transportation. Since FHWA only reports conditions for all public centerline miles of road (across all jurisdictions), this required using FHWA's data to estimate the roads managed by each state in good, fair, and poor condition. For this edition, the project team chose instead to simply use FHWA's data to calculate pavement conditions for all public roads nationwide. This allowed the team to evaluate all of the nation's roads and develop a more accurate estimate of the full spending needed to bring them into good repair.

Determining state spending on road repair and preservation and expansion

The project team calculated state-by-state spending on road repair and preservation and road expansion for 2009-2014; see Table A4.

FHWA reports these expenditures under the category of highway capital spending, a subset of total state spending on highways. FHWA also reports additional types of highway expenditures outside of capital spending, including: Maintenance and Highway Services; Administration, Research and Planning; Highway Law Enforcement and Safety; Interest; and Bond Retirement. Maintenance and Highway Services typically refers to road upkeep such as salting and snow plowing rather than to pavement preservation and repair treatments, though some discrepancies exist in how states report this data to FHWA.

FHWA reports highway capital spending broken down into categories of expenditure types in FHWA Table SF-12A.[13] The project team classified each of FHWA's reported expenditure types as either "roadway expansion," "roadway repair," or "other capital expenditures," as follows:

- Roadway expansion: comprised of spending in FHWA-defined categories including: Right of Way; New Construction; Reconstruction – Added Capacity; and Major Widening;
- Roadway repair and preservation: comprised of spending in FHWA-defined categories including: Reconstruction – No Added Capacity; Minor Widening; Restoration and Rehabilitation; and Resurfacing); and
- Other capital expenditures: including spending on bridge repair and construction, safety expenditures, engineering expenditures, traffic operation expenditures, and environmental enhancements.

The project team totaled expenditures in each of these categories for each state and then averaged them over the years 2009-2014 (the latest year with available data) to determine average annual spending on repair and preservation and on expansion.

13 FHWA. (2014). "State Highway Agency Capital Outlay – Classified by Improvement Type." Table SF-12A. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2014/sf12a.cfm.

Table A4: Annual state highway capital expenditures in thousands of dollars (average 2009-14)

State	Annual avg capital spending	Roadway expansion		Roadway repair		Other capital expenditures	
		Annual average spending	% of total capital spending	Annual average spending	% of total capital spending	Annual average spending	% of total capital spending
Alabama	$1,054,459	$298,462	28%	$427,564	41%	$328,434	31%
Alaska	$428,207	$75,602	18%	$168,566	39%	$184,038	43%
Arizona	$1,189,547	$620,570	52%	$180,463	15%	$388,513	33%
Arkansas	$907,555	$409,848	45%	$173,561	19%	$324,146	36%
California	$3,910,413	$638,260	16%	$1,359,493	35%	$1,912,661	49%
Colorado	$817,182	$248,606	30%	$243,805	30%	$324,770	40%
Connecticut	$760,472	$144,644	19%	$159,782	21%	$456,047	60%
Delaware	$324,368	$116,174	36%	$61,538	19%	$146,656	45%
Florida	$4,527,857	$1,198,406	26%	$1,669,147	37%	$1,660,305	37%
Georgia	$1,482,486	$402,783	27%	$510,233	34%	$569,469	38%
Hawaii	$266,414	$85,981	32%	$83,207	31%	$97,226	36%
Idaho	$461,386	$85,571	19%	$166,391	36%	$209,423	45%
Illinois	$2,935,776	$583,226	20%	$1,175,937	40%	$1,176,613	40%
Indiana	$1,919,996	$940,614	49%	$386,494	20%	$592,889	31%
Iowa	$845,951	$261,725	31%	$342,609	40%	$241,617	29%
Kansas	$1,012,787	$344,245	34%	$329,359	33%	$339,184	33%
Kentucky	$1,439,153	$512,430	36%	$432,504	30%	$494,219	34%
Louisiana	$1,775,066	$522,084	29%	$384,293	22%	$868,689	49%
Maine**	$276,535	$31,493	11%	$180,737	65%	$64,305	23%
Maryland	$1,335,539	$330,834	25%	$260,861	20%	$743,844	56%
Massachusetts**	$1,050,132	$36,930	4%	$238,906	23%	$774,295	74%
Michigan	$1,506,953	$122,960	8%	$814,867	54%	$569,125	38%
Minnesota	$1,063,864	$295,310	28%	$329,661	31%	$438,893	41%
Mississippi	$1,193,357	$916,454	77%	$44,262	4%	$232,641	19%
Missouri	$1,466,900	$448,763	31%	$300,589	20%	$717,548	49%
Montana	$466,541	$95,860	21%	$208,576	45%	$162,105	35%
Nebraska	$529,745	$25,943	5%	$279,922	53%	$223,879	42%
Nevada	$577,713	$311,417	54%	$119,657	21%	$146,638	25%
New Hampshire**	$276,432	$72,954	26%	$125,162	45%	$78,315	28%
New Jersey**	$2,476,888	$185,354	7%	$1,414,679	57%	$876,855	35%
New Mexico	$482,148	$91,662	19%	$187,537	39%	$202,949	42%
New York**	$3,794,065	$255,569	7%	$1,636,923	43%	$1,901,573	50%
North Carolina	$2,420,087	$1,327,462	55%	$266,987	11%	$825,637	34%
North Dakota	$523,825	$49,985	10%	$355,104	68%	$118,736	23%

State	Annual avg capital spending	Roadway expansion		Roadway repair		Other capital expenditures	
		Annual average spending	% of total capital spending	Annual average spending	% of total capital spending	Annual average spending	% of total capital spending
Ohio	$2,251,767	$391,627	17%	$898,854	40%	$961,286	43%
Oklahoma	$1,166,559	$383,468	33%	$316,781	27%	$466,310	40%
Oregon	$767,224	$103,719	14%	$192,857	25%	$470,648	61%
Pennsylvania**	$3,873,959	$1,128,191	29%	$870,418	22%	$1,875,351	48%
Rhode Island**	$240,421	$6,701	3%	$47,979	20%	$185,741	77%
South Carolina	$767,133	$182,174	24%	$247,766	32%	$337,193	44%
South Dakota	$367,747	$43,357	12%	$253,384	69%	$71,007	19%
Tennessee	$1,484,522	$539,629	36%	$241,793	16%	$703,100	47%
Texas	$7,259,320	$3,471,222	48%	$1,058,901	15%	$2,729,197	38%
Utah**	$1,460,836	$680,538	47%	$377,415	26%	$402,883	28%
Vermont	$222,675	$22,496	10%	$101,337	46%	$98,842	44%
Virginia	$1,296,917	$400,190	31%	$248,468	19%	$648,259	50%
Washington	$2,777,625	$968,791	35%	$571,613	21%	$1,237,221	45%
West Virginia	$893,885	$281,043	31%	$171,935	19%	$440,907	49%
Wisconsin**	$1,583,255	$571,755	36%	$524,451	33%	$487,049	31%
Wyoming	$390,763	$60,136	15%	$212,680	54%	$117,946	30%
Total	$72,304,409	$21,323,219	29%	$21,356,009	30%	$29,625,176	41%

*** These states did not provide data to FHWA for at least one year of the analysis. Therefore, results may be skewed.*

Source:

- FHWA. (2009). "State Highway Agency Capital Outlay – Classified by Improvement Type." Table SF-12A. http://www.fhwa.dot.gov/policyinformation/statistics/2009/sf12a.cfm.
- FHWA. (2010). "State Highway Agency Capital Outlay – Classified by Improvement Type." Table SF-12A .http://www.fhwa.dot.gov/policyinformation/statistics/2010/sf12a.cfm.
- FHWA. (2011). "State Highway Agency Capital Outlay – Classified by Improvement Type." Table SF-12A. Note: Accessed and saved by T4America in 2014. This table is not currently available online.
- FHWA. (2012). "State Highway Agency Capital Outlay – Classified by Improvement Type." Table SF-12A. http://www.fhwa.dot.gov/policyinformation/statistics/2012/sf12a.cfm.
- FHWA. (2013). "State Highway Agency Capital Outlay – Classified by Improvement Type." Table SF-12A. http://www.fhwa.dot.gov/policyinformation/statistics/2013/sf12a.cfm.
- FHWA. (2014). "State Highway Agency Capital Outlay – Classified by Improvement Type." Table SF-12A. http://www.fhwa.dot.gov/policyinformation/statistics/2014/sf12a.cfm.

Appendix B: Calculating the annual cost to keep our roads in acceptable repair

This analysis evaluates the annual funding needed to (1) preserve the roads currently in good and fair condition nationwide in that acceptable state through routine pavement management practices ("**routine preservation need**") and (2) bring the backlog roads currently in poor condition into good repair over a 6-year period ("**major rehabilitation need**").

Table B1 summarizes the estimated need for each state.

Summary of major methodology changes for this calculation in *Repair Priorities 2019*

For the 2019 edition of *Repair Priorities*, the project team wanted to estimate a snapshot of the current funding needed to keep the nation's roads in a state of good repair to inform the next federal transportation reauthorization legislation. For previous editions of *Repair Priorities*, the project team sought to estimate longer-term needs. This shift prompted several changes to the methodology. As a result, the funding needs estimated in this edition should not be compared directly to those estimated in previous editions.

Previous editions of *Repair Priorities* annualized the cost of the Major Rehabilitation Need for roads in poor condition over a 20 year period; this analysis looks at a 6-year period to provide an estimation of the funding that would be needed to address the backlog over a standard six-year federal transportation reauthorization bill.

Previous editions also focused on estimating the spending needed exclusively for the subset of roads nationwide that are managed by state departments of transportation. As FHWA does not report pavement condition specifically for state-managed roads, this required first estimating the number of state-managed roads in poor condition in need of major rehabilitation. For this edition, the project team focused on all public roads across jurisdictions to better understand the full magnitude of the current spending needed to preserve and repair the nation's roads. As a result, the estimated need is significantly greater than previous editions.

Finally, for previous editions of *Repair Priorities*, the project teams calculated the annual routine preservation need based on the full network—in other words, what level of investment would it take each year to preserve the full network of roads managed by states through ongoing asset management. For this edition, because the project team sought a snapshot of current needs, the project team calculated this routine preservation need exclusively for roads currently in good and fair condition to avoid double-counting the poor roads used for the major rehabilitation need.

Table B1: Estimated annual spending needed to repair all public roads (across jurisdictions) over a six-year period.

STATE	**Routine preservation need:** Annual cost needed to maintain roads currently in good and fair condition in that acceptable state	**Major rehabilitation need:** Estimated cost per year to bring the backlog of lane-miles in poor condition into good repair over a six year period	Total annual spending needed on road repair over six years
Alabama	$4,370,178,645	$1,073,563,001	$5,443,741,646
Alaska	$604,355,584	$225,184,967	$829,540,551
Arizona	$2,806,912,982	$986,110,075	$3,793,023,057
Arkansas	$4,605,337,950	$659,559,956	$5,264,897,906
California	$5,236,868,959	$6,338,185,733	$11,575,054,692
Colorado	$3,468,266,772	$1,473,850,929	$4,942,117,701
Connecticut	$721,076,425	$557,092,717	$1,278,169,142
Delaware	$272,691,215	$93,475,640	$366,166,855
Florida	$6,057,758,415	$756,673,142	$6,814,431,557
Georgia	$6,211,177,000	$462,040,570	$6,673,217,570
Hawaii	$136,447,298	$146,509,700	$282,956,998
Idaho	$2,439,584,930	$199,508,207	$2,639,093,137
Illinois	$5,935,102,429	$2,174,357,895	$8,109,460,324
Indiana	$4,240,375,569	$912,705,969	$5,153,081,538
Iowa	$5,175,703,508	$939,737,718	$6,115,441,226
Kansas	$6,245,592,758	$1,097,877,952	$7,343,470,710
Kentucky	$3,621,485,812	$568,357,164	$4,189,842,976
Louisiana	$2,342,770,737	$1,205,624,016	$3,548,394,753
Maine	$871,790,729	$369,755,723	$1,241,546,452
Maryland	$1,505,251,532	$282,316,179	$1,787,567,711
Massachusetts	$1,308,431,064	$899,824,036	$2,208,255,100
Michigan	$4,690,256,331	$2,259,823,126	$6,950,079,457
Minnesota	$5,851,648,806	$1,545,284,296	$7,396,933,102
Mississippi	$2,727,460,161	$1,710,892,337	$4,438,352,498
Missouri	$5,087,935,686	$2,392,196,679	$7,480,132,365
Montana	$3,187,500,967	$612,448,444	$3,799,949,411
Nebraska	$4,330,051,207	$520,637,148	$4,850,688,355
Nevada	$2,085,646,477	$520,026,069	$2,605,672,546
New Hampshire	$597,229,342	$296,774,853	$894,004,195
New Jersey	$1,341,047,571	$1,027,151,912	$2,368,199,483

STATE	**Routine preservation need:** Annual cost needed to maintain roads currently in good and fair condition in that acceptable state	**Major rehabilitation need:** Estimated cost per year to bring the backlog of lane-miles in poor condition into good repair over a six year period	Total annual spending needed on road repair over six years
New Mexico	$2,675,464,795	$1,743,323,868	$4,418,788,663
New York	$4,642,940,740	$1,632,717,507	$6,275,658,247
North Carolina	$4,732,602,171	$1,068,322,253	$5,800,924,424
North Dakota	$3,849,726,598	$657,688,638	$4,507,415,236
Ohio	$5,174,671,884	$1,656,403,346	$6,831,075,230
Oklahoma	$3,783,855,041	$2,841,364,069	$6,625,219,110
Oregon	$3,621,414,351	$411,053,007	$4,032,467,358
Pennsylvania	$4,215,641,747	$2,692,218,045	$6,907,859,792
Rhode Island	$144,828,936	$236,916,425	$381,745,361
South Carolina	$3,197,232,432	$1,038,453,518	$4,235,685,950
South Dakota	$3,483,852,136	$884,020,920	$4,367,873,056
Tennessee	$4,655,928,807	$325,528,486	$4,981,457,293
Texas	$14,559,190,255	$2,699,703,047	$17,258,893,302
Utah	$1,921,684,400	$822,319,921	$2,744,004,321
Vermont	$583,330,029	$174,248,096	$757,578,125
Virginia	$3,519,384,605	$647,824,789	$4,167,209,394
Washington	$2,830,180,266	$1,754,723,265	$4,584,903,531
West Virginia	$1,321,343,126	$891,574,782	$2,212,917,908
Wisconsin	$4,082,656,869	$2,536,673,086	$6,619,329,955
Wyoming	$1,398,393,764	$182,173,019	$1,580,566,783
U.S. Total	$168,637,491,325	$62,734,625,265	$231,372,116,590

Calculating the "Routine Preservation Need"

Once a road is built, a combination of regular repair and preservation along with periodic major rehabilitation is required to keep it in a state of good repair. This section calculates the annualized cost of keeping the nation's public roads across jurisdictions that are currently in good and fair condition in that acceptable state through routine investment in repair.

Determining the annualized cost to preserve a lane-mile of road in good or fair condition

The project team for the first edition of *Repair Priorities* (2011) developed average annual costs to preserve a lane-mile of of road in good or fair condition through routine repair, as well as to rehabilitate a lane-mile of road that has fallen into poor condition. The team estimated these average costs using information about the cost of various construction activities compiled by FHWA from DOTs around the country. While these

average costs do not capture regional variations attributable to climate, topography, etc., they allow for a "big picture" assessment. For this 2019 edition, the project team updated the costs used previously to reflect the level of inflation for road construction costs as of 2017.

The following assumptions went into calculating the annual Routine Preservation cost per lane-mile:

- Asphalt and concrete roads have a 50-year life cycle from initial construction, a figure based on conversations with representatives from PennDOT and other industry experts. A national approximation is used for this analysis, but road lifecycles actually vary based on a number of factors including traffic flow, climate and pavement type.
- Over the course of 50 years, a regular preventative treatment schedule is required, as outlined in Table B2.
- At the end of 50 years, all pavement requires major rehabilitation to address shifting or weakened foundations and other problems.

The project team for the first edition of *Repair Priorities* estimated a per-lane-mile cost for each pavement treatment included in the life cycles in Table B2 by averaging the costs from different application samples made available in FHWA's 2010 report "Performance Evaluation of Various Rehabilitation and Preservation Treatments."[14] Table B3 shows these average costs per pavement treatment. Sample applications were provided from six states (California, Kansas, Michigan, Minnesota, Texas and Washington). The per-lane-mile costs for all treatment applications were summed to calculate the total life cost for keeping one lane-mile of pavement in a state of good repair. The total was divided by 50 years (representing the assumed life of a road) to yield the annual cost figure. These treatment cycles were then vetted with an advisory team of representatives from PennDOT and other industry experts.

Table B2 does not include all the techniques that may be used under all situations and different geographic conditions. Though the schedules assume a major rehabilitation at the end of 50 years, a road often needs to be completely reconstructed at the end of its life cycle, which is significantly more costly than major rehabilitation. Thus, the calculation here represents a minimum cost based on a minimum universal treatment schedule applied across all 50 states. A state-customized treatment schedule would yield a more precise price tag, but this standardized approach is designed to provide a national comparative snapshot.

Note that the costs outlined below are in 2009 dollars. For the 2019 edition, the project team updated these costs to reflect actual inflation of construction costs between 2009 and 2017.[15]

14 Federal Highway Administration. (2010, January). Performance Evaluation of Various Rehabilitation and Preservation Treatments. Available at https://www.fhwa.dot.gov/pavement/preservation/pubs/perfeval/perfeval.pdf.

15 Federal Highway Administration. (2019, April 8). National Highway Construction Cost Index (NHCCI) 2.0. Available at https://www.fhwa.dot.gov/policy/otps/nhcci/pt1.cfm.

Table B2: Pavement treatment schedules for asphalt and concrete

Asphalt treatment schedule (over 50 year life cycle)		
Year Applied	Treatment Type	Cost per lane-mile
0	(Initial Construction)	N/A
5	Crack Sealing	$2,211
6	Microsurfacing	$26,654
10	Crack Sealing	$2,211
14	Mill and Resurfacing	$220,212
14	Chip Seal	$44,124
18	Crack Sealing	$2,211
19	Microsurfacing	$26,654
23	Crack Sealing	$2,211
26	Mill and Resurfacing	$220,212
26	Chip Seal	$44,124
30	Crack Sealing	$2,211
31	Microsurfacing	$26,654
34	Crack Sealing	$2,210
38	Mill and Resurfacing	$220,212
38	Chip Seal	$44,124
42	Crack Sealing	$2,211
43	Microsurfacing	$26,654
50	MAJOR Rehabilitation	$196,415
Total life cost per lane-mile, 2009:		$1,111,516
Annualized cost per lane-mile, 2009:		$22,230
Annualized cost per lane-mile modified based on construction cost inflation as of 2017:		$23,966

Concrete treatment schedule (over 50 year life cycle)		
Year Applied	Treatment Type	Cost per lane-mile
0	Initial Construction	N/A
8	Joint Sealing	$8,375
15	Partial Depth Repair	$25,459
15	Diamond Grinding	$76,892
15	Joint Sealing	$8,375
25	Partial Depth Repair	$25,459
25	Diamond Grinding	$76,892
25	Joint Sealing	$8,375
35	Partial Depth Repair	$25,459
35	Joint Sealing	$8,375
35	HMA Overlay	$79,313
36	Chip Seal	$44,124
40	Crack Sealing	$2,211
41	Microsurfacing	$26,654
47	Partial Depth Repair	$25,459
47	Joint Sealing	$8,375
47	Mill and Resurfacing	$220,212
47	Chip Seal	$44,124
50	MAJOR Rehabilitation	$436,933
Total life cost per lane-mile, 2009:		$1,150,066
Annualized cost per lane-mile, 2019:		$23,021
Annualized cost per lane-mile modified based on construction cost inflation as of 2017:		$24,819

Table B3: Average cost per pavement treatment type

PREVENTATIVE PRESERVATION treatments (number of cost samples available)*	Average per-lane-mile cost
HMA overlays (13)	$79,313
Chip seal (15)	$44,124
Micro-surfacing (9)	$26,654
Crack sealing (11)	$2,211
Mill and Resurfacing (10)	$220,212
Diamond grinding (8)	$76,892
Partial depth repair (4)	$25,459
Joint sealing (3)	$8,375

Costs for preservation, minor rehabilitation, and major rehabilitation were found in tables C.1 – C.20 from FHWA's 2010 report, "Performance Evaluation of Various Rehabilitation and Preservation Treatments." (http://www.fhwa.dot.gov/PAVEMENT/pub_details.cfm?id=666)

Treatment costs from sample states were presented as a per-lane-mile dollar figure. These figures varied among sample applications due to geographic, economic and other factors.

Estimating number of asphalt and concrete lane-miles

This analysis differentiates between repair costs for a lane-mile of asphalt road versus a lane-mile of concrete road. FHWA reports centerline miles of public roads in each state by surface type (asphalt vs. concrete) in FHWA Table HM-51, but does not report lane-miles by surface type within the publically available FHWA Highway Statistics dataset.[16]

To estimate the total asphalt and concrete lane-miles in each state, the project team calculated the percentages of total centerline-miles in each state that are asphalt versus concrete, and then applied those percentages to the total public lane-miles in each state, as reported in FHWA Table HM-60.[17] This allowed the project team to estimate how many lane-miles in each state are asphalt versus concrete based on how many centerline miles in each state are asphalt versus concrete.

"Asphalt" roads included the surface type categories bituminous and composite. Unpaved roads were not taken into account.

16 FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles by Type of Surfaces." Table HM-51. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm51.
17 FHWA Highway Statistics. (2017). "Functional System Lane-Length - 2017 Lane-Miles." Table HM-60. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm60.cfm.

Estimating the annual cost to preserve roads in good and fair condition in that acceptable state

FHWA reports pavement condition in Tables HM-63 and HM-64 in terms of centerline miles, not lane-miles.[18,19] Therefore, to estimate the cost to preserve roads currently in good and fair condition in that state, the project team first had to estimate the total lane-miles in each state in good, fair, and poor condition.

To do this, the project team multiplied the percentage of centerline miles of road in each state in good, fair, and poor condition (as calculated in Appendix A) by the total lane-miles of public road in each state reported in FHWA Table HM-60.[20] Doing so generated an estimated number of lane-miles in each state in good, fair, and poor condition. This required making the assumption that the portions of each state's total centerline miles in good, fair, and poor condition would apply to the state's total lane-miles as well.

FHWA does not report pavement conditions according to surface type (asphalt versus concrete), so the project team also made the assumption that the portion of centerline miles in each state that are asphalt versus concrete as of 2017 is the same as the portion of estimated lane-miles in good and fair condition that are asphalt versus concrete. This assumption is unlikely to be accurate because asphalt and concrete roads deteriorate at different rates, but the project team determined that it was the best approach possible given available data.

The project team then multiplied the estimated number of asphalt lane-miles in each state in good and fair condition by the 2017 annual pavement management cost for asphalt roads ($23,966), and the estimated number of concrete lane-miles in good and fair condition by the average annual preservation cost for concrete roads ($24,819). These costs were summed to create a total pavement management cost for each state.

Calculating the "major rehabilitation need" for roads in poor condition

The unfortunate consequence of deferred preservation and repair is that roads will eventually deteriorate to the point that they need major rehabilitation or reconstruction. Roads in "poor" condition as of 2017 were assumed to require major rehabilitation in order to bring them up to a state of good repair.

Determining the per-lane-mile cost to rehabilitate a road in poor condition

As with the routine preservation costs described above, the project team created per-lane-mile major rehabilitation costs for concrete and asphalt treatments by averaging sample application cost data from FHWA. FHWA identifies six major rehabilitation treatments in its 2010 report "Performance Evaluation of Various Rehabilitation and Preservation Treatments."[21] These treatments are applied to either "hot mix asphalt" pavement or "Portland cement concrete" pavement. FHWA provides cost data from sample

18 FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles By Measured Pavement Roughness/Present Serviceability Rating." Table HM-63. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm63.cfm.
19 FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles By Measured Pavement Roughness." Table HM-64. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm64.cfm.
20 FHWA Highway Statistics. (2017). "Functional System Lane Length - 2017." Table HM-60. Available at https://www.fhwa.dot.gov/policyinformation/statistics/2017/hm60.cfm.
21 Federal Highway Administration. (2010, January). Performance Evaluation of Various Rehabilitation and Preservation Treatments. Available at https://www.fhwa.dot.gov/pavement/preservation/pubs/perfeval/perfeval.pdf.

applications of the six types of major rehabilitation treatments in six states (California, Kansas, Michigan, Minnesota, Texas and Washington). For each of the treatment types, the project team calculated the average cost per lane-mile. Next, the average costs of all three asphalt treatment types and all three concrete treatment types were averaged to generate a per-lane-mile cost for the major rehabilitation of poor asphalt and concrete roads; see Table B3.

For the 2019 edition of *Repair Priorities*, the project team then updated these costs to reflect actual inflation of construction costs between 2009 and 2017. These costs were later applied to the sum of state-owned roads in "poor" condition to determine what it would cost to bring the poor roads back to a state of good repair.

Table B3: Per lane-mile cost of sample pavement treatments

MAJOR REHABILITATION treatments (number of cost samples)	
Concrete	Average per-lane-mile cost
HMA overlay without slab fracturing (rubblization or crack-and-seal) (7)	$461,805
Crack-and-seal or rubblize and overlay (with HMA) (7)	$332,558
Unbonded Overlay (7)	$516,435
Average CONCRETE major rehabilitation cost, 2009	$436,933
Average CONCRETE major rehabilitation cost, 2017	$471,071
Asphalt	Average per-lane-mile cost
Full-Depth Reclamation (12)	$166,058
Structural overlay (mill and fill) (9)	$145,053
Whitetopping (5)	$278,134
Average ASPHALT major rehabilitation cost, 2009	$196,415
Average ASPHALT major rehabilitation cost, 2017	$211,761

Costs for preservation, minor rehabilitation, and major rehabilitation were found in tables C.1 – C.20 from FHWA's 2010 report "Performance Evaluation of Various Rehabilitation and Preservation Treatments." (http://www.fhwa.dot.gov/PAVEMENT/pub_details.cfm?id=666)

Treatment costs from sample states were presented as a per-lane-mile dollar figure. These figures varied among sample applications due to geographic, economic and other factors.

Generating annualized spending need to rehabilitate roads currently in poor condition

As noted in the previous section, FHWA reports pavement condition (in Tables HM-63 and HM-64) in terms of centerline miles, not lane-miles. Therefore, the project team estimated the lane-miles in poor condition by multiplying the percentage of all centerline miles in each state in poor condition by the total lane-miles in each state. This generated an estimated number of lane-miles in poor condition in each state.

Then the project team estimated the numbers of these poor lane-miles that were asphalt versus concrete. FHWA does not publically report pavement conditions data categorized by surface type, so this required making the assumption that the percentage of total "public roads" that are asphalt versus concrete as of 2017 would also apply to lane-miles in poor condition as of 2017.

The calculated costs for asphalt and concrete major rehabilitation were applied to the estimated number of lane-miles of asphalt and concrete roads in poor condition. The resulting costs were summed to determine the total cost to rehabilitate all the roads in poor condition in each state. Recognizing that states would be unable to rehabilitate all of these roads at once, it was assumed that states would rehabilitate these roads over a 6-year period. The total cost was therefore divided by 6 years to create an annualized cost to bring current estimated lane-miles in poor condition to a state of good repair.

Sources – The project team determined per-lane-mile costs for routine preservation and major rehabilitation of asphalt and concrete roads based on the following report:

- FHWA. (2010). "Performance Evaluation of Various Rehabilitation and Preservation Treatments." Tables C.1 – C.20. http://www.fhwa.dot.gov/PAVEMENT/pub_details.cfm?id=666.

The project team calculated the centerline miles in each state in good, fair, and poor condition using the following tables (see Appendix A).

- FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles By Measured Pavement Roughness." Table HM-64.
- http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm64.cfm.
- FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles By Measured Pavement Roughness/Present Serviceability Rating." Table HM-63. http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm63.cfm.

The project team estimated the portions of public lane-miles in good, fair, and poor condition by multiplying the results from Tables HM-63 and HM-64 to the total lane-miles per state in the following table:

- FHWA Highway Statistics. (2017). "Functional System Lane-Length - 2017 Lane-Miles." Table HM-60. http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm60.cfm.

The portions of lane-miles in good, fair, and poor condition that are asphalt versus concrete for each state were estimated based on the following table:

- FHWA Highway Statistics. (2017). "Functional System Length - 2017 Miles by Type of Surfaces." Table HM-51. http://www.fhwa.dot.gov/policyinformation/statistics/2017/hm51.