Repair Priorities

Transportation spending strategies to save taxpayer dollars and improve roads

Smart Growth America *and*
Taxpayers for Common Sense

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Smart Growth America
Making Neighborhoods Great Together

TAXPAYERS FOR COMMONSENSE
MAKING GOVERNMENT WORK

This report is a product of Smart Growth America and Taxpayers for Common Sense.

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Any errors and all interpretations are the responsibility of Smart Growth America and Taxpayers for Common Sense. Please direct questions about this report to Roger Millar, PE, AICP, Director, Smart Growth America's Leadership Institute at (406) 544-1963 or rmillar@smartgrowthamerica.org.

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Executive Summary

Decades of disproportionate spending by states on road expansion at the expense of regular repair have left many state roads in poor condition. Federal Highway Administration data indicate that half of all major state roads were in "fair" or "poor" condition in 2008, and in 2009 the American Society of Civil Engineers gave the nation's roads a "D-," down from a "D" in 2005.[1,2]

In spite of this enormous repair backlog, the vast majority of states continue to inadequately fund road repair projects. By underfunding repair and allowing roads to fall out of good condition, state leaders are choosing the most expensive type of repair possible, as rehabilitating a road that has completely deteriorated is substantially more expensive than keeping that road in good condition in the first place. Adding further urgency to these budget concerns is that with every dollar spent on new construction, states add to a road system they are already failing to adequately maintain. As a result, states face a large and growing financial burden.

Rehabilitating a road that has deteriorated is **substantially more expensive** than keeping that road in good condition.

A smarter investment: road repair and preservation
Investing in repair and preservation does more than make headway on an inevitable problem; it actively reduces the scale of future costs. According to the American Association of State Highway and Transportation Officials, every $1 spent to keep a road in good condition avoids $6-14 needed later to rebuild the same road once it has deteriorated significantly.[3] Prioritizing repair and preservation makes good fiscal sense and brings with it a host of additional benefits. This report examines road conditions and spending priorities in all 50 states and the District of Columbia and recommends changes at the state and federal level that would benefit taxpayers while creating a better transportation system.

Federal taxpayers have a significant interest in seeing that states keep the nation's roads in a state of good repair. Though much of the funding for repair and preservation comes from state and local budgets, billions of federal dollars are also spent each year on these roads. Federal funds built a large portion of these major state roads, and allowing states to under-invest in repair and preservation greatly reduces the value of these federal investments. In addition, roads in poor condition can negatively impact interstate trade and travel, the effects of which can be felt across large regions and across state lines.

State leaders make a number of decisions about transportation spending that shape their long-term financial trajectories. All 50 states and the District of Columbia can benefit from aligning transportation policies with capital spending decisions to make sure roads are kept in good repair. Doing so can prevent neglected preservation from undermining the value of their own infrastructure investments.

Introduction

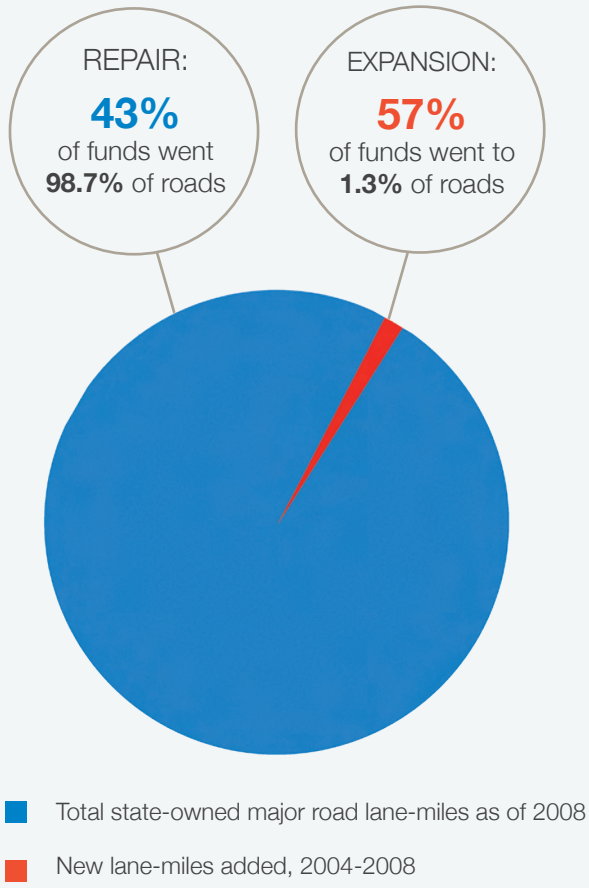
For decades, states have invested disproportionately in road expansion and left regular repair and preservation underfunded. Between 2004 and 2008, most states spent more on expansion than repair and added a cumulative 23,300 miles of roads to their transportation systems during these years.[4] These projects represented only 1.3% of total state-owned highway miles, yet their construction accounted for a staggering **57%** of combined road repair and expansion expenditures during this period.[5]

As a result of these spending decisions, road conditions in many states are getting worse. Federal Highway Administration (FHWA) data indicate that half of all major state roads were in "fair" or "poor" condition in 2008.[6] In 2009 the American Society of Civil Engineers gave the nation's roads a "D-," down from a "D" in 2005, and this decline in road conditions is directly related to state spending decisions.[7] South Carolina, for example, spent 18% of its highway capital budget on repair projects between 2004 and 2008, but spent 41% on expansion. The percentage of South Carolina roads in "good" condition during this time dropped from 45% to 33%, the largest decline of any state (see the tables on pages 26 and 29 for more details).[8]

Neglecting repair and preservation costs taxpayers billions of dollars in preventable expenses. A few cracks and potholes might not seem like the makings of an impending budget crisis, but putting off repairs today means spending much more in the future. Repair costs rise exponentially when roads are not routinely maintained. According to the American Association of State Highway and Transportation Officials (AASHTO), every $1 spent to keep a road in good condition avoids $6-14 needed later to rebuild the same road once it has deteriorated significantly.[9] Underfunding repair and delaying these projects is inefficient and drives up future financial liabilities. Too much focus on expansion and too little on repair also means that with every dollar spent on new construction, states add to a system they are already failing to adequately maintain.

FIGURE 1

Expansion vs. repair:
State transportation funding priorities
Between 2004 and 2008, states spent $37.9 billion annually on repair and expansion of roads and highways. Of these funds, 57% went to road widening and new road construction – just 1.3% of roads. 43% went to preservation of existing roads, which make up 98.7% of the system.



State and federal leaders can encourage better spending priorities. Investing proportionally more in existing roads can help states spend their limited funds more wisely. Leaders in all 50 states and the District of Columbia can better align capital spending decisions with sound transportation policies to improve road conditions. This includes setting goals that would result in better roads and investing to meet those goals, focusing attention on heavily used roads,and choosing better projects for investment of scarce resources. These strategies will ensure taxpayer dollars are spent wisely and result in a better road network.

Federal leaders also have a vested interest in seeing transportation funds spent more efficiently. Allowing states to under-invest in repair and preservation greatly reduces the value of past and future federal road investments. In addition, roads in poor condition can negatively impact interstate trade and travel, the effect of which can be felt across large regions and across state lines. Federal transportation policy strongly influences state transportation decisions, and current federal policies may be contributing to the lack of progress in the states. For this reason, reform is essential at both the state and federal levels. Prioritizing repair and preservation will improve road conditions while protecting taxpayers from increased future liabilities.

I. Expanding roads at the cost of repair

For decades, states have invested disproportionately in road expansion and left regular repair and preservation underfunded. Between 2004 and 2008, states together added 23,300 lane-miles of major roads and spent more to build these new miles than they did to repair and maintain all 1.9 million lane-miles of their existing highways.[10,11] The roads built as part of these expansion projects represent only 1.3% of states' total highway mileage, but the projects consumed 57% of the combined funds spent on road repair and expansion – $22 billion. Meanwhile, repair and preservation of the remaining 98.7% of states' roads accounted for only 43% of that spending – $16 billion.[12]

State-by-state spending priorities

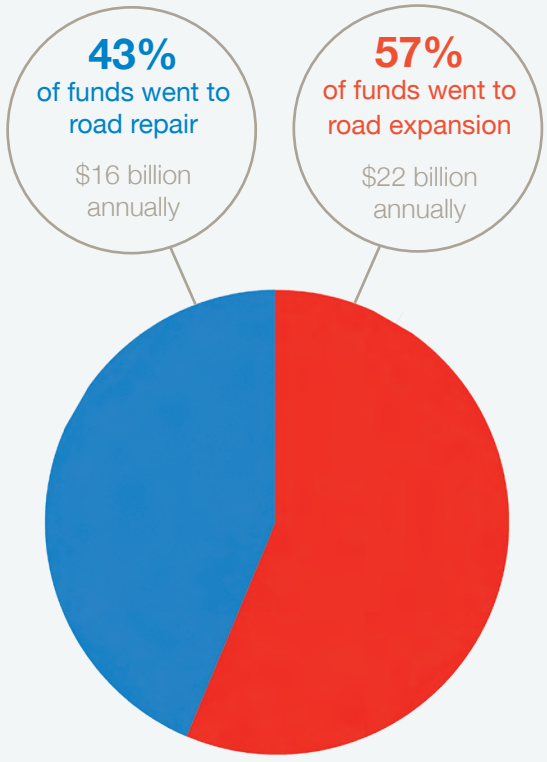
More information about each state's spending is available in Appendix A, Table A-IV.

In addition, a series of 50 profiles with detailed information about each state's transportation spending decisions, road conditions, and other investment strategies that make the most of taxpayer dollars are available online as a companion to this report. View the profiles and a map of state-by-state statistics at www.smartgrowthamerica.org/repair-priorities.

FIGURE 2

Average state highway system capital spending, 2004-2008

Of the combined funds spent on repair and expansion, 57% went to building just 1.3% of the network. The remaining 43% went to repairing the 98.7% of roads already built.



II. Poor funding choices means roads are wearing out across the country

Many states have chosen to defer road repair and preservation, resulting in deteriorating network conditions. The scope of this problem goes beyond a few potholes or cracks. Based on data provided to FHWA by the states, an estimated 52% of the country's major roads (732,500 lane-miles) were in "fair" or "poor" condition as of 2008.[15] The American Society of Civil Engineers 2009 Report Card for America's Infrastructure gave the nation's roads a "D-," down from a "D" in 2005 and a "D+" in 2001.[16]

Poor road conditions are a large and growing financial liability for states.

These poor road conditions are a large and growing financial liability for states and FHWA data illustrates how overwhelming this burden has become. States would collectively need to spend $43 billion every year for 20 years to bring roads currently in poor condition up to good and then keep roads in good condition going forward (see Table 1). To put this number in perspective, it is a higher level of spending than what states are currently spending on all repair, preservation, and new capacity combined. This makes clear that states' priorities have drifted too far from regular preservation and repair and in so doing have created a deficit that will take decades to reverse.

Only four states (Florida, Michigan, New Jersey, and New York) and the District of Columbia are spending at or above the level necessary to keep good roads good and make bad roads better. As a result of Florida's investment, 78% of its major roads are in good condition, even with a large number of heavily trafficked roads. The District of Columbia (0% good), New Jersey (19% good), and New York (39% good) are all aggressively addressing past underinvestment.

Michigan is a good example of a state that has improved its road network by adopting policies that emphasize investment in repair and preservation. The Michigan Department of Transportation (DOT) implemented a program called "Preserve First," which prioritizes projects that improve the conditions of existing roads and bridges.[17] Between 2004 and 2008, the state allotted 86% of combined repair and expansion funds to road repair and preservation projects. As a result, Michigan's roads are improving faster than most other states: the percentage of roads in good condition rose from 48% in 2004 to 60% in 2008.[18]

The remaining 46 states are spending below the minimum threshold and can therefore expect worse road conditions in the future. For more information about these figures see Appendices A and B.

Funding for repair: Case studies in deterioration vs. improvement

Between 2004 and 2008, South Carolina spent 41% of its highway capital budget on expansion and 18% on repair and preservation. During that time, the percentage of South Carolina's roads in good condition dropped from 45% to 33% - the largest decline of any state.[13]

Conversely, South Dakota spent 78% of its total highway capital budget on road repair and preservation during this period, increasing the percentage of its major roads in good condition from 36% to 52%.[14]

Table 1: State pavement conditions, expenditures and estimated "state of good repair" costs

This table is based on analysis of data published by FHWA. It reflects each state's road conditions and repair and preservation funding need, as well as how much states actually spent on road repair and preservation annually on average for 2004-2008. For a detailed description of how each of these numbers were calculated, see Appendices A and B.

State	Estimated state-owned lane-miles of major roads*	Major road lane-miles in good condition*	Major roads in good condition as a percent of total	Annual spending on road repair and preservation for all state-maintained roads, 2004-2008 (in millions)	Percent-age of total highway capital budget	Total annual road repair and preservation investment needed (in millions)
Alabama	27,807	20,671	74%	$337	31%	$630
Alaska	8,600	1,665	19%	$162	44%	$275
Arizona	17,020	12,081	71%	$195	20%	$428
Arkansas	35,875	10,536	29%	$119	18%	$891
California	51,346	15,200	30%	$674	17%	$1,277
Colorado	22,709	9,551	42%	$245	37%	$531
Connecticut	9,795	3,510	36%	$135	25%	$233
Delaware	4,063	1,841	45%	$65	21%	$265
D. of Columbia	1,344	0	0%	$95	44%	$86
Florida	42,358	33,242	78%	$1,150	25%	$950
Georgia	47,000	38,460	82%	$865	48%	$1,069
Hawaii	2,471	240	10%	$62	33%	$65
Idaho	11,997	6,844	57%	$173	45%	$280
Illinois	40,522	18,523	46%	$912	33%	$994
Indiana	28,229	16,561	59%	$406	33%	$650
Iowa	22,999	10,558	46%	$172	32%	$552
Kansas	24,018	15,168	63%	$390	46%	$551
Kentucky	32,501	13,826	43%	$384	30%	$1,377
Louisiana	27,650	10,147	37%	$362	28%	$935
Maine	13,734	6,134	45%	$171	59%	$429
Maryland	13,494	6,469	48%	$213	18%	$354
Massachusetts	8,266	4,406	53%	$130	12%	$199
Michigan	27,150	16,187	60%	$1,265	59%	$647
Minnesota	29,159	16,226	56%	$180	21%	$672
Mississippi	26,899	9,718	36%	$60	7%	$652
Missouri	60,995	16,327	27%	$399	31%	$1,794
Montana	22,849	15,516	68%	$188	51%	$549
Nebraska	22,459	12,772	57%	$224	45%	$520
Nevada	11,857	8,462	71%	$112	20%	$295
New Hampshire	6,380	2,865	45%	$89	46%	$208

New Jersey	8,447	1,609	19%	$421	24%	$215
New Mexico	23,643	11,828	50%	$123	37%	$687
New York	37,008	14,551	39%	$1,170	39%	$910
North Carolina	52,351	24,958	48%	$190	10%	$3,816
North Dakota	16,875	10,172	60%	$193	61%	$387
Ohio	47,332	29,256	62%	$685	36%	$1,134
Oklahoma	30,007	10,153	34%	$149	22%	$735
Oregon	18,132	10,010	55%	$155	19%	$416
Pennsylvania	57,307	17,007	30%	$616	27%	$2,093
Rhode Island	2,779	678	24%	$34	16%	$72
South Carolina	48,240	15,767	33%	$122	18%	$2,056
South Dakota	18,012	9,371	52%	$241	78%	$428
Tennessee	36,667	25,716	70%	$116	13%	$833
Texas	164,859	55,825	34%	$692	11%	$4,458
Utah	15,497	6,664	43%	$182	32%	$356
Vermont	6,014	2,027	34%	$80	51%	$152
Virginia	44,838	20,932	47%	$58	5%	$2,813
Washington	18,532	10,330	56%	$181	14%	$426
West Virginia	22,160	5,628	25%	$136	20%	$1,633
Wisconsin	29,234	15,054	51%	$429	37%	$685
Wyoming	14,599	7,690	53%	$156	55%	$357
Average	**27,727**	**12,920**	**47%**	**$315**	**27%**	**$844**
Total	**1,414,078**	**658,932**	**47%**	**$16,064**	**27%**	**$43,020**

*FHWA only reports pavement conditions for major roads and only in centerline-miles. The researchers estimated lane-miles of major roads in order to calculate the estimated cost of improving fair and poor major roads to good condition. See Appendix A for methodology.

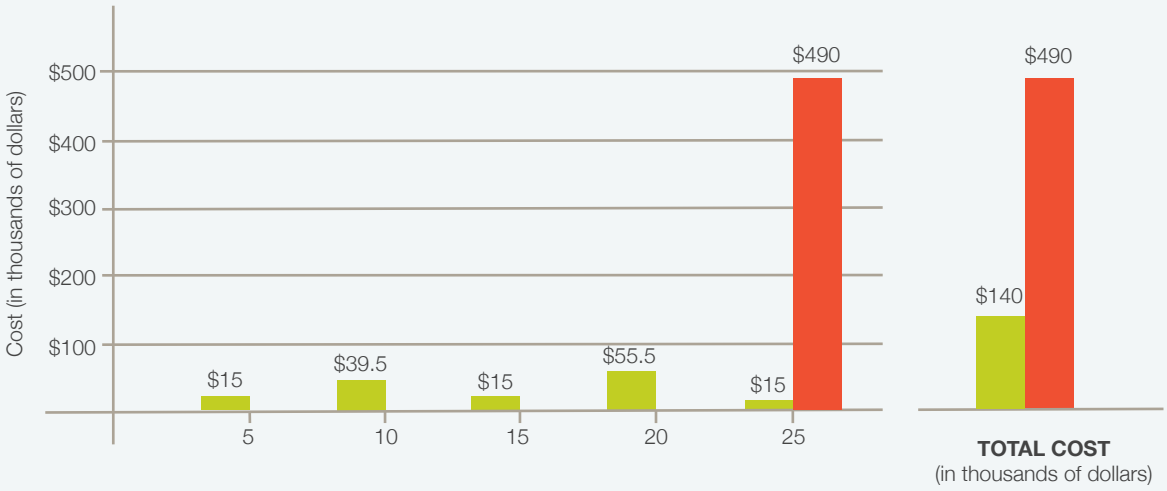
III. Deferred repair and preservation creates long-term financial liabilities

Deferring necessary repair and preservation means spending much more to fix those roads later, and repair costs rise exponentially as roads are left unmaintained. According to AASHTO, every $1 spent to keep a road in good condition avoids $6-14 needed later to rebuild the same road once it has deteriorated significantly.[19]

FIGURE 3

Routine preservation vs. deferred repairs

The full cost of preserving one lane-mile (■) in good condition over time is less than half of the cost of letting an identical lane-mile (■) deteriorate to poor condition and then making major repairs. State investments in repair should be revised to acknowledge this valuable cost saving strategy.



Allowing the lane-mile to deteriorate and then making major repairs **more than doubles the cost** of that lane-mile over 25 years (based on a recommended sample system preservation program published by FHWA).

Source: Larry Galehouse, James S. Moulthrop, and R. Gary Hicks. 2006. Principles of Pavement Preservation. http://www.fhwa.dot.gov/pavement/preservation/ppc0621.cfm.

Figure 3 compares the cumulative cost of routine preservation investment with the cost of letting pavement deteriorate to poor condition prior to repair. Although the state must invest in preservation periodically over the life of this typical road, the cumulative costs are relatively minor. Maintaining the road in good condition over time costs **less than half** the cost of making major repairs after letting the same road deteriorate to poor condition.

Preserving a road in good condition through periodic repair is significantly cheaper than allowing it to degrade and then rebuilding it. By prioritizing maintaining roads in good condition, states can avoid the substantially higher cost of bringing crumbling roads back to a state of good repair down the line.

New roads today add to preservation costs tomorrow

New construction adds to future annual repair liabilities. Assuming a 50-year pavement life cycle and the regular preservation and repair schedule detailed in Appendix B of this report, every new lane-mile a state builds costs, on average, an estimated $22,300 a year to consistently keep in a state of good repair. Accordingly, the 23,300 lane-miles of new capacity added to highways between 2004 and 2008 increased national repair needs by $520 million per year.

Hard times and tough choices for states

Dwindling state transportation budgets are forcing states to make tough spending decisions, and it's important now more than ever to spend limited funds wisely. Many state Departments of Transportation predict revenues will decline in coming years, and the picture may be even more bleak for four reasons:

- *Gas tax revenues are decreasing.* Federal and state fuel tax receipts account for 24% of total state transportation revenues nationwide, and several states rely on gas tax revenues for over 40% of their transportation funding. In the past several years, however, gas tax revenue has failed to adequately fund the nation's transportation demands, and states can expect to receive fewer federal dollars in the future.

- *Federal funding may soon be greatly reduced.* Congress has yet to reauthorize the federal surface transportation bill that expired in 2009. The bill allocates hundreds of billions of dollars to states for transportation projects but absent a new revenue source or an increase in the federal gas tax, any new authorization bill will provide vastly limited funding compared to previous authorizations. From 2004 through 2008, federal contributions made up an average of 26% of state transportation revenues, with several states relying on the federal government for over half of their transportation budget.

- *State general funds are stretched.* Current fiscal pressures are likely to lead to reduced contributions to transportation infrastructure from state general funds. An average of 4% of state transportation revenue came from state general funds during the years 2004 through 2008, but some states rely on general funds for up to 19% of their transportation revenues.

- *Transportation debt is consuming revenues in some states.* Interest payments on outstanding bonds increasingly constrain state transportation budgets. Between 2004 and 2008, eight states devoted more than a fifth of their highway revenues to paying off transportation debt.

States face a harsh reality. They must address demands on the nation's transportation network with fewer resources. Tough budget times create an imperative to evaluate past spending choices and make more strategic decisions moving forward. Despite declining revenues, states can still invest strategically to improve road conditions and reduce future repair liabilities.

IV. States can do more to keep roads in good condition

Keeping roads in good repair can significantly reduce repair costs over their lifetime, and establishing targets for road conditions can help states achieve these goals. Researchers surveyed pavement management performance goals set by state Departments of Transportation (DOTs) to see what, if any, road condition goals exist and whether states are meeting them (see Table 2).

Table 2: Quantifiable state performance measures and targets for pavement condition[23]

The table below maps out the performance measures and targets established by state DOTs. The targets are categorized by how the DOTs set their goals.[24] Several states share performance measures which have been abbreviated here, including: International Roughness Index (IRI), Pavement Condition Rating (PCR), Pavement Condition Index (PCI), Pavement Quality Index (PQI), and Pavement Serviceability Index (PSI).

	Pavement Targets					Performance Measures	
STATE	**Minimum % in fair condition or better***	**Minimum % in good condition or better***	**Minimum % in excellent condition**	**Maximum % in poor condition**	**Target condition (on 1-100 scale) for entire road network***	**Performance measure**	**Target timeframe**
Alabama		*Not specific*				Distress rating	By Oct. 2012
Alaska					66	Pavement Serviceability Rating	2008-2028
Arizona		95%				Present Service Rating	Annual
Arkansas	*No target*					PCR; IRI	--
California				30%		N/A	By 2012
Colorado	60%					Remaining Service Life	By 2016
Connecticut		*Not specific*				IRI	Quarterly
Delaware	85%					Overall PCR	Annual
D. of Columbia	90%					PCI	N/A
Florida	80%					Pavement Condition Survey	Through 2015
Georgia					75	Pavement Condition Evaluation System	3-5 years from 2011
Hawaii					80	PCI	By 2021
Idaho	82%					Percent of pavement in good or fair condition	N/A
Illinois	90%					Condition Rating Survey	FY2011-2016
Indiana				10%		IRI	Annual
Iowa	75%				62.5	PCI; Sufficiency Rating	2009
Kansas			82.50%			Pavement Condition	1999-2009
Kentucky				30%		PCI	N/A
Louisiana	88%					Pavement Rideability Condition Quality Index	Each fiscal year
Maine	*No target*					PCR	--
Maryland	84%					N/A	N/A
Massachusetts					75	PSI	2011-2015

Michigan	90%					Sufficiency Surface Condition Rating; IRI	2005-2030
Minnesota		70%		2%		Ride Quality Index	2009-2028
Mississippi			*No target*			PCR; PSR	--
Missouri		85%				PSR	2011
Montana				3%		Average Ride Index	2011-2013
Nebraska		84%				Nebraska Serviceability Index; IRI	Annual
Nevada				8%		IRI	Annual and ultimately
New Hampshire			*No target*			Ride Comfort Index	--
New Jersey	80%					Surface Distress Index; IRI	2009-2019
New Mexico		92.5%				PSI	FY2011
New York		80%				PCI - incorporates Surface Rating and IRI (adjusted for NYSDOT)	2010-2015
North Carolina		82.5%				PCR	2010
North Dakota		90%				IRI	N/A
Ohio	90%					PCR	FY2011-2012
Oklahoma		*Not specific*				Sufficiency Rating	2010-2035
Oregon	78%					Good-Fair-Poor Rating; Distress Survey	Over the long term
Pennsylvania				7%		IRI	Ongoing
Rhode Island			*No target*			N/A (not developed)	--
South Carolina		*Not specific*				PQI	By Dec. 2012
South Dakota					76.67	Pavement Surface Condition Index	N/A
Tennessee		87.5%		12.5%		PQI; Maintenance Rating Index	Every 3 to 5 years
Texas		90%				Pavement Condition Score	By FY 2012
Utah	70%					Half Car Simulation RQI; Condition Index	N/A
Vermont				25%	70	PCI	Annual
Virginia	83.5%					Current Condition Index; IRI	By FY2011 and FY2013
Washington	90%					Pavement Structural Condition; IRI; Rutting	Annual
West Virginia			*No target*			N/A (Qualitative assessment)	--
Wisconsin				10%		PCI	N/A
Wyoming		51%				PSR	2010
Total:	**16**	**11**	**1**	**10**	**7**		

40 states as well as the District of Columbia have quantifiable condition targets; 6 states do not. Four states have a target which is not specific or not quantifiable.

Note (*):
"Fair" includes the expressions fair, fair or better, fair or good, current or better, acceptable, tolerable or above, not deficient.
"Good" includes the expressions good, good or better, good to very good, good to excellent.
"Excellent" includes the expressions excellent and highest condition.
"Not specific" indicates targets that do not refer to a specific, quantifiable target but shows the state DOT's intent to improve.
Original scale adjusted to a 0 to 100 scale.

This review of each state's pavement performance goals reveals that many states are indeed meeting or approaching their established performance measures. However, the fact that the nation as a whole earned a D- for road conditions on the 2009 American Society of Civil Engineers report card implies that states' current standards are set too low to effectively improve conditions.

Arkansas, Maine, Mississippi, New Hampshire, Rhode Island, and West Virginia do not have benchmarks for pavement conditions, which means they lack an important way to set and evaluate goals for ideal road conditions. Alabama, Connecticut, Oklahoma, and South Carolina have qualitative performance standards but do not have specific quantitative benchmarks.

In addition 15 states have established quantifiable performance targets for a minimum percentage of pavement to be "fair" or "not poor." This is not the best way to measure performance, however, as this category includes roads in good condition as well as roads that are only one pothole away from being in poor condition.[25] In all, conditions standards need to be strengthened.

Additional benefits of investing in repair

Road repair and preservation can put Americans back to work
Investing in road repair and preservation is an excellent job creator. Funds from the American Recovery and Reinvestment Act that went to road repair projects created 16% more jobs per dollar spent than funds that went to expansion projects.[21] Repair and preservation projects also create opportunities for a greater variety of workers, require less spending on land acquisition, and get through the permitting and planning phases more quickly. These factors put more people to work faster.

Good roads benefit drivers
Roads in good condition save money for drivers. Cars get better gas mileage when driven on smooth roads, so drivers go farther on a single tank of gas. Smoother roads are also gentler on tires and suspensions, reducing repair costs. The added price of rough roads averages $335 per motorist annually and can reach $746 per year in areas with the highest concentrations of rough roads.[22]

V. Moving forward: strategies for state and federal leaders

Bringing existing roads into good repair and maintaining them in that condition will improve roads and reduce future preservation and repair liabilities. Changes to transportation policy at the state and federal level can help states reach that goal.

State recommendations

As stewards of the highway infrastructure discussed in this report, state DOTs have the responsibility to ensure that the nation's roads are well maintained. To accomplish this, states need benchmarks to help prioritize which roads need immediate repair and measure how their system is performing. Establishing transparent and comparable performance measures in all 50 states will help state DOTs keep roads well maintained.

Establish high but achievable condition targets

Establishing road condition targets that set a high bar – and connecting funding and project selection to these targets – will improve the condition of states' roads and highways. This means setting a target for "good or better" condition rather than "fair or better," which only eleven states have done to date.

Once a high standard is set, states can develop maintenance and capital improvement programs to meet these targets, measure progress toward goals over time, and make funding decisions accordingly.

Improve transparency for greater public support

These targets demonstrate a commitment to improving conditions and will likely have greater taxpayer support if they are developed through a public process, made readily available, are transparent and comparable to the targets set by other states, and follow objective, results-oriented criteria.

States can make performance targets and annual road condition reports easily accessible and available to the public, but many DOTs do not currently do so. The Government Accountability Office reports that 48 states have developed performance targets for pavement condition, but a review of DOT websites found that 10 states do not currently make specific, quantifiable targets available to the public.[26] DOTs that fail to make these targets easily accessible lose a great opportunity to increase transparency, show taxpayers that funds are spent effectively, and rally support for repair and preservation.

Some states maintain particularly strong websites where citizens can access road data. The DOTs in Idaho, North Carolina, Virginia, and Wyoming all maintain interactive dashboards on their websites that allow viewers to easily identify the road condition performance targets for the state and the most recent pavement conditions.[27] Making the targets and conditions accessible and understandable to the public allows these DOTs to demonstrate accountability for how they spend taxpayer funds.

Focus attention on heavily used roads

Roads with higher traffic volumes require more frequent repair and preservation. These heavily trafficked roads currently account for some of the worst conditions in the country.

Roads that carry high traffic volumes are the arteries for communities and local economies, and letting them deteriorate to and remain in poor condition is especially costly for the individuals who drive along them and the businesses that rely upon them. Drivers pay as much as $746 annually in additional vehicle operating costs in areas with a high concentration of rough roads, more than twice the annual cost for the average American driver.[28] The cumulative cost to drivers in regions with a number of heavily used roads can rise substantially as conditions deteriorate.

Many of these heavily used roads are also important freight corridors, which, when allowed to deteriorate, can have significant negative impacts on local and regional economies. As the cost of shipping goods into and out of a city or region increases, the cost of the goods themselves increase as well, making the things people buy more expensive and the goods businesses sell less competitive.

> "Highway, transit and intermodal assets identified as being in the national interest should be brought into a state of good repair and modernized [by] establish[ing] performance measures to guide government investment."
>
> - U.S. Chamber of Commerce[29]

Focusing repair and preservation investments strategically on high volume roads will reduce costs for a greater number of drivers and businesses, even if it does not raise overall state pavement condition as fast as lots of low-cost fixes to low volume roads. Ranking and prioritizing preservation projects – with the help of criteria such as traffic volume and rate of pavement deterioration – allows states to develop effective pavement preservation schedules that ensure resources are going to the roads that provide the greatest benefit. Taxpayers can then be sure they are getting the most impact for their investments.

Consider job creation, return on investment, and long-term costs when making spending decisions

States should pick transportation projects based on criteria that include lasting positive impact on both budgets and local economies, not just short-term gains. Repair and preservation of existing roads is cost-effective, has been shown to create more jobs per dollar than investments in expansion, reduces long-term liabilities for states and the federal government, and helps local businesses and individuals. Integrating the broader economic implications into spending decisions will result in projects that help improve road conditions as well as economic conditions.

The Pennsylvania DOT (PennDOT), for example, has taken major steps in prioritizing repair and preservation projects with existing funds by adopting "Smart Transportation" principles that have allowed PennDOT to reshape the way transportation dollars are allocated throughout the state and focus investments on existing road infrastructure.[30] In recent years, PennDOT has steadily increased the portion of highway capital dollars spent on road repair and preservation projects from just 10% in 2004 to 43% in 2008.[31] As a result, PennDOT, which is responsible for some of the oldest road infrastructure in the country, has increased the percentage of its lane-miles in good condition from 26% in 2004 to 29% in 2008.[32]

Federal recommendations

Federal taxpayers have a significant interest in seeing that states keep the nation's roads in a state of good repair. Though much of the funding used for repair and preservation of these roads comes from state and local budgets, billions of federal dollars are spent each year on this as well. Federal funds were also used to build a large portion of these roads, so allowing states to under-invest in preservation and repair greatly reduces the value of these federal investments. In addition, roads in poor condition can negatively impact interstate trade and travel, the effects of which can be felt across large regions and across state lines.

Encouraging state spending patterns that favor repair and preservation will make the most of federal investments in America's roads. The federal government should establish criteria and performance standards for the overall condition of federal-aid highways. States meeting these goals should be allowed to use preservation and renewal program funds for other transportation purposes. States that fail to meet these performance standards, however, would be required to use more of these funds for repair and preservation until their roads achieve a state of good repair. This would help ensure that highways operate efficiently, while informing citizens and elected officials of progress in improving the condition of their highways. This transparency can be further enhanced by requiring states to periodically update their plans for getting highways to or keeping them above performance standards and reporting to Congress on this progress.

Conclusion

Prioritizing repair and preservation will improve road conditions while protecting taxpayers from increased future liabilities. As this report reveals, states have disproportionally invested in road expansion and left regular repair and preservation underfunded, and worsening road conditions in many parts of the nation reflect this failure.

Repair and preservation costs are rising faster than DOTs can address them and the overall need for repair far outstrips available funding. As a result, the financial burden of these repairs is growing at an alarming rate.

States need to commit to getting repair backlogs under control. They can start by setting high but achievable goals for their pavement conditions, and making funding decisions and selecting projects that support these goals. Additionally, focusing investment on heavily used roads has benefits for states beyond just improving their road systems.

Federal lawmakers, for their part, can play a crucial role in encouraging states to invest transportation funds more efficiently. States are responsible for preserving the significant federal investment in their road systems, so it is appropriate to establish criteria and performance standards regarding the condition of federal-aid highways.

Endnotes

1 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

2 American Society for Civil Engineers. Report Card for America's Infrastructure, for years 2001, 2005, and 2009. http://www.infrastructurereportcard.org/.

3 American Association of State Highway and Transportation Officials (AASHTO) and The Road Information Project. (2009). "Rough Roads Ahead: Fix Them Now or Pay for It Later." http://roughroads.transportation.org/.

4 This figure represents the number of lane-miles added to state-owned roads during that time. Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

5 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

6 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

7 American Society for Civil Engineers. Report Card for America's Infrastructure, for years 2001, 2005, and 2009. http://www.infrastructurereportcard.org/.

8 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

9 American Association of State Highway and Transportation Officials (AASHTO) and The Road Information Project. (2009). "Rough Roads Ahead: Fix Them Now or Pay for It Later." http://roughroads.transportation.org/.

10 "Lane-miles" is 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. This is FHWA's standard metric for measuring state road networks.

11 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

12 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

13 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

14 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

15 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

16 American Society for Civil Engineers. Report Card for America's Infrastructure, for years 2001, 2005, and 2009. http://www.infrastructurereportcard.org/.

17 Michigan Department of Transportation. (2010). http://www.michigan.gov/mdot/.

18 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

19 American Association of State Highway and Transportation Officials (AASHTO) and The Road Information Project. (2009). "Rough Roads Ahead: Fix Them Now or Pay for It Later." http://roughroads.transportation.org/.

20 FHWA Highway Statistics. (2008). "Revenues Used by States for State-Administered Highways - 2008." Table SF-3. http://www.fhwa.dot.gov/policyinformation/statistics/2008/sf3.cfm. Calculated for years 2004-2008. Total annual highway revenues from federal sources, general funds, and state gas taxes were each averaged for the five years to determine the percentage of total highway revenues coming from each source.

21 American Association of State Highway and Transportation Officials (AASHTO) and The Road Information Project. (2009). "Rough Roads Ahead: Fix Them Now or Pay for It Later." http://roughroads.transportation.org/.

22 Heintz, J., Pollin, R., and Garrett-Peltier, H. (2009). "How Infrastructure Investments Support the

U.S. Economy: Employment, Productivity and Growth." Political Economy Research Institute. University of Massachusetts at Amherst. http://www.peri.umass.edu/236/hash/efc9f7456a/publication/333/.

23 State departments of transportation websites and phone survey conducted between January and April 2011. Refer to Appendix C for technical memo.

24 States use a wide variety of measurement techniques for their benchmarks, which makes compiling national data and comparing the states challenging. Each state annually reports pavement conditions to FHWA using the International Roughness Index (IRI), a measure of pavement smoothness, but states use a variety of performance metrics in setting their own condition goals. Many have set a goal to have a minimum percentage of state-owned pavements in "fair," "good," or "excellent" condition, descriptors that cover different ranges of condition in each state. Others have set a maximum percentage of pavement that is allowed to be in "poor" condition or established a target on a numerical scale that the entire state network should meet.

25 State departments of transportation websites and phone survey conducted between January and April 2011. Refer to Appendix C for technical memo.

26 U.S. Government Accountability Office. (2010). Statewide Transportation Planning: Surveys of State Departments of Transportation and Regional Planning and Development Organizations (GAO-11-78SP, December 2010), an E-supplement to GAO-11-77. Survey of State Departments of Transportation, Performance Measures, Question 34. http://www.gao.gov/special.pubs/gao-11-78sp/s34.html.

27 Idaho Transportation Department. (2011). Transportation System Dashboard. http://www.itd.idaho.gov/dashboard/default.htm. And: North Carolina Department of Transportation. Organizational Performance. https://apps.dot.state.nc.us/dot/dashboard/. And: Virginia Department of Transportation. (2011). VDOT Dashboard v3.0. http://dashboard.virginiadot.org/. And: Wyoming Department of Transportation. Interactive Dashboard. http://www.dot.state.wy.us/wydot/administration/strategic_performance/strategic_plans/dashboard.

28 American Association of State Highway and Transportation Officials (AASHTO) and The Road Information Project. (2009). "Rough Roads Ahead: Fix Them Now or Pay for It Later." http://roughroads.transportation.org/.

29 U.S. Chamber of Commerce. Recommendations to Congress Regarding SAFETEA-LU Reauthorization. http://www.uschamber.com/lra/recommendations-congress-regarding-safetea-lu-reauthorization.

30 Pennsylvania Department of Transportation. Smart Transportation. http://www.smart-transportation.com/

31 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

32 Calculated based on the Federal Highway Administration's Highway Statistical Series, for years 2004-2008. See Appendix A for full methodology.

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

This appendix presents the methodology and detailed state data for three major calculations used in this report. For 2004 and 2008:

- Total and change in lane-miles for each state (Table A1);
- Road conditions for all state-owned roads (Tables A2 and A3); and
- Total capital spending on road expansion and repair by state (Table A4).

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.

Determining lane-miles added

The extent to which states expanded their road networks between 2004 and 2008, the last year for which a full dataset is available, was determined by calculating the difference between the total miles of road owned by each state in 2004 and the total miles of road owned by each state in 2008 based on data in FHWA's "Highway Statistical Series" (see Table A1). 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). The total lane-miles – rather than centerline-miles – added to each state's road network between 2004 and 2008 was used 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 change from 2004 to 2008 and some major increases that may not be due entirely to new construction.

Table A1: Lane-miles added 2004-2008

State	2008 total state-owned lane-miles	2004 total state-owned lane-miles	Lane-miles added 2004-2008
Alabama	28,121	29,240	-1,119
Alaska	11,699	11,605	94
Arizona	18,819	18,449	370
Arkansas	37,119	36,425	694
California	50,541	50,522	19
Colorado	22,948	23,051	-103
Connecticut	9,800	9,777	23
Delaware	11,693	11,421	272
D. of Columbia	3,274	3,277	-3
Florida	42,439	41,266	1,173
Georgia	47,498	46,785	713
Hawaii	2,477	2,432	45

Idaho	12,137	11,990	147
Illinois	42,150	41,823	327
Indiana	28,458	28,315	143
Iowa	23,036	22,673	363
Kansas	23,988	23,905	83
Kentucky	61,499	60,941	558
Louisiana	38,501	38,395	106
Maine	18,115	18,609	-494
Maryland	14,671	14,624	47
Massachusetts	8,659	8,713	-54
Michigan	27,459	27,578	-119
Minnesota	29,266	28,987	279
Mississippi	27,743	26,397	1,346
Missouri	75,656	72,613	3,043
Montana	24,490	18,591	5,899
Nebraska	22,487	22,404	83
Nevada	13,055	13,199	-144
New Hampshire	8,825	9,110	-285
New Jersey	8,480	8,441	39
New Mexico	29,237	29,273	-36
New York	38,142	38,084	58
North Carolina	170,084	168,029	2,055
North Dakota	16,986	16,832	154
Ohio	49,034	48,767	267
Oklahoma	30,114	29,863	251
Oregon	18,264	18,267	-3
Pennsylvania	88,475	88,252	223
Rhode Island	2,923	2,901	22
South Carolina	89,976	89,713	263
South Dakota	18,071	17,970	101
Tennessee	36,521	35,720	801
Texas	193,188	190,226	2,962
Utah	15,699	15,260	439
Vermont	6,038	6,047	-9
Virginia	125,281	124,304	977
Washington	18,443	18,308	135
West Virginia	70,792	69,927	865
Wisconsin	29,481	29,247	234
Wyoming	15,594	15,584	10
Average	**36,421**	**35,963**	**457**
Total	**1,857,446**	**1,834,132**	**23,314**

Determining road conditions

FHWA's "Highway Statistical Series" includes data on pavement conditions reported for all public roads in terms of centerline-miles, broken up by state and by road functionality type. FHWA reports data on conditions in raw form but provides definitions for "good," "fair," and "poor" pavement condition. These definitions were applied to FHWA's raw data to calculate the percentage of states' road networks in each condition bracket for 2008; see Table A2.

States report pavement conditions to FHWA using two conditions metrics: the International Roughness Index (IRI), a measure of pavement smoothness based on assessments conducted using laser technology; and the Pavement Serviceability Rating (PSR), a subjective evaluation of ride quality. FHWA requires that all conditions for states' larger roads be reported in terms of IRI; "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 centerline-mile conditions in terms of either IRI or PSR. Centerline-miles of pavement receive an IRI score based on deviation from a smooth surface in inches per mile, with low scores indicating smoother pavement. PSR scores range from 0 to 5 and higher scores indicate smoother ride quality. FHWA defines good, fair, and poor for both metrics:

Ride quality terms	IRI rating	PSR rating
"Good"	< 95	≥ 3.5
"Fair"/"Acceptable"	≤ 170	≥ 2.5
"Poor"	>170	< 2.5

Source: Federal Highway Administration. (2009). "Pavement Terminology and Measurements." Conditions and Performance: 2008 Status of the Nation's Highways, Bridges, and Transit. Section 3-2. https://www.fhwa.dot.gov/policy/2008cpr/pdfs/chap3.pdf.

Since FHWA's conditions data are reported in centerline-miles for all public roads and does not break out roads by ownership, determining the percentage of major state-owned lane-miles in good, fair, and poor condition required an extrapolation from public roads to major state-owned roads and a conversion from centerline-miles into lane-miles. FHWA's raw conditions data were used to calculate the total centerline-miles of public roads in each of the three conditions. FHWA's reported state-owned centerline-miles was divided by the number of public road centerline-miles to create a conversion ratio for each state and functionality type. The number of public major road centerline-miles in good, fair and poor condition were multiplied by these conversion ratios to determine the number of major state-owned centerline-miles in each condition. Centerline-miles were converted into lane-miles using the methodology described in the previous section.

Table A2: Road conditions 2008

STATE	Estimated state owned lane-miles of major roads*	Major road lane-miles in poor condition	Poor condition lane-miles as % of total	Major road lane-miles in fair condition	Fair condition lane-miles as % of total	Major road lane-miles in good condition	Good condition lane-miles as % of total	Lane-miles of major roads with unreported conditions	Lane-miles with unreported conditions as % of total
Alabama	27,807	905	3%	5,897	21%	20,671	74%	333	1%
Alaska	8,600	1,472	17%	3,496	41%	1,665	19%	1,966	23%
Arizona	17,020	687	4%	3,679	22%	12,081	71%	573	3%
Arkansas	35,875	6,915	19%	18,129	51%	10,536	29%	295	1%
California	51,346	9,905	19%	25,890	50%	15,200	30%	350	1%
Colorado	22,709	1,659	7%	10,733	47%	9,551	42%	766	3%
Connecticut	9,795	1,342	14%	4,938	50%	3,510	36%	5	0%
Delaware	4,063	554	14%	1,657	41%	1,841	45%	11	0%
D. of Columbia	1,344	1,234	92%	102	8%	0	0%	8	1%
Florida	42,358	836	2%	8,049	19%	33,242	78%	232	1%
Georgia	47,000	2,004	4%	5,952	13%	38,460	82%	585	1%
Hawaii	2,471	798	32%	1,425	58%	240	10%	8	0%
Idaho	11,997	1,261	11%	3,064	26%	6,844	57%	827	7%
Illinois	40,522	5,979	15%	15,892	39%	18,523	46%	128	0%
Indiana	28,229	1,748	6%	9,892	35%	16,561	59%	29	0%
Iowa	22,999	2,534	11%	9,614	42%	10,558	46%	292	1%
Kansas	24,018	1,371	6%	5,616	23%	15,168	63%	1,863	8%
Kentucky	32,501	764	2%	17,919	55%	13,826	43%	7	0%
Louisiana	27,650	5,883	21%	11,010	40%	10,147	37%	609	2%
Maine	13,734	2,659	19%	4,937	36%	6,134	45%	5	0%
Maryland	13,494	2,587	19%	4,233	31%	6,469	48%	204	2%
Massachusetts	8,266	1,202	15%	2,615	32%	4,406	53%	44	1%
Michigan	27,150	3,127	12%	7,658	28%	16,187	60%	177	1%
Minnesota	29,159	1,705	6%	10,813	37%	16,226	56%	415	1%
Mississippi	26,899	3,904	15%	13,180	49%	9,718	36%	96	0%
Missouri	60,995	11,431	19%	32,798	54%	16,327	27%	439	1%
Montana	22,849	601	3%	5,040	22%	15,516	68%	1,692	7%
Nebraska	22,459	1,370	6%	6,441	29%	12,772	57%	1,876	8%
Nevada	11,857	420	4%	2,691	23%	8,462	71%	284	2%
New Hampshire	6,380	1,131	18%	2,355	37%	2,865	45%	29	0%
New Jersey	8,447	2,579	31%	4,026	48%	1,609	19%	233	3%
New Mexico	23,643	4,042	17%	6,656	28%	11,828	50%	1,117	5%
New York	37,008	5,793	16%	16,004	43%	14,551	39%	660	2%
North Carolina	52,351	3,616	7%	23,768	45%	24,958	48%	9	0%
North Dakota	16,875	774	5%	5,066	30%	10,172	60%	863	5%
Ohio	47,332	2,891	6%	15,076	32%	29,256	62%	109	0%

Oklahoma	30,007	6,058	20%	12,588	42%	10,153	34%	1,208	4%
Oregon	18,132	860	5%	6,943	38%	10,010	55%	319	2%
Pennsylvania	57,307	12,357	22%	27,852	49%	17,007	30%	91	0%
Rhode Island	2,779	771	28%	1,324	48%	678	24%	7	0%
South Carolina	48,240	5,554	12%	26,755	55%	15,767	33%	164	0%
South Dakota	18,012	2,198	12%	5,534	31%	9,371	52%	909	5%
Tennessee	36,667	1,755	5%	9,193	25%	25,716	70%	3	0%
Texas	164,859	13,936	8%	93,741	57%	55,825	34%	1,358	1%
Utah	15,497	753	5%	7,580	49%	6,664	43%	499	3%
Vermont	6,014	1,817	30%	2,161	36%	2,027	34%	9	0%
Virginia	44,838	2,833	6%	20,929	47%	20,932	47%	143	0%
Washington	18,532	1,189	6%	6,974	38%	10,330	56%	39	0%
West Virginia	22,160	5,801	26%	10,693	48%	5,628	25%	37	0%
Wisconsin	29,234	2,437	8%	11,127	38%	15,054	51%	617	2%
Wyoming	14,599	890	6%	5,894	40%	7,690	53%	125	1%
Average	27,727	3,076	11%	11,286	41%	12,920	47%	444	2%
Total	1,414,079	156,892	11%	575,599	41%	658,932	47%	22,653	2%

***** "Major roads" refers to a subset of all state-owned roads that includes only those of larger traffic volume. "Major roads" excludes roads classified as "rural minor collector," "rural local," and "urban local" in FHWA datasets.

Pavement conditions were analyzed specifically for larger volume roads, referred to as "major roads" in this report. These larger volume roads are a subset of total state-owned roads. FHWA's datasets divide roads into functionality types (e.g., rural interstate, rural minor arterial, urban principal arterial, urban collector, etc.). FHWA does not report pavement conditions for roads classified as rural minor collector, rural local and urban local. These roads are categorized as "non-major," and as a result are omitted from the analysis of conditions.

Total lane-miles of "major roads" owned by each state was calculated, which required removing roads falling into the three "lower volume" functionality types from the lane-mile count. While publicly available FHWA data reports centerline-miles owned by each state in the classifications listed above, total lane-miles for each state are classified into one of only two categories – "urban" or "rural." As a result, determining the total lane-miles of "major road" owned by each state required calculating the total centerline-miles of "major roads" for each state and then converting these totals to lane-miles. Total centerline-miles of "major roads" owned by each state was determined by removing the reported centerline-miles of rural minor collectors, rural local roads, and urban local roads from statewide totals.

To convert centerline-miles of "major roads" owned by each state to lane-miles, the ratios of lane-miles to centerline-miles was determined for all public roads in each state for each of the functionality types considered "major." In contrast to state-owned roads, FHWA aggregates data on all public roads (including state, county, town, township, Indian tribe, and municipal or other local governments) by road functionality type for both centerline-miles and lane-miles, making it possible to extrapolate how many lane-miles make up one centerline-mile for each functionality type on average.

Total lane-miles by functional system, for all public roads	divided by	Total centerline-miles by functional type, for all public roads	equals	Lane-mile conversion ratio by functional type

The calculated ratios of lane-miles of public roads to centerline-miles were used as multipliers and applied to the total reported centerline-miles of major state-owned roads for each state and road functionality type. Lane-mile totals for each functionality type were then summed to determine statewide total lane-miles of "major roads" owned by each state in 2008. This analysis required making the assumption that the ratios of lane-miles to centerline-miles for all public roads in each state would be equivalent to the ratios of lane-miles to centerline-miles for state-owned roads.

For states referenced individually in this report (South Carolina, South Dakota, Michigan and Pennsylvania), the analysis calculated total lane-miles of state-owned "major roads" and the percentage of lane-miles in good condition for 2004 using the above methodology to determine the change in conditions from 2004 to 2008.

Table A3: Change in road conditions 2004-2008

State	Estimated state-owned lane-miles of major roads	Lane-miles in good condition	Lane-miles in good condition as a % of total	Change in % of lane-miles in good condition, 2004-2008
Michigan	27,317	13,060	48%	12%
Pennsylvania	56,894	14,732	26%	4%
South Carolina	40,740	18,130	45%	-12%
South Dakota	17,894	6,466	36%	16%

Determining state spending on road repair and preservation and expansion

FHWA's "Highway Statistical Series" was used to determine state-by-state spending on road repair and preservation and road expansion for 2004-2008; see Table A4 for more information. FHWA includes these expenditures under the category of highway capital spending, a subset of total state spending on roads. Types of expenditures not considered capital spending include: Maintenance and Highway Services; Administration, Research and Planning; Highway Law Enforcement and Safety; Interest; and Bond Retirement. The Maintenance and Highway Services category refers to road upkeep such as salting and snow plowing rather than to pavement preservation and repair treatments.

FHWA reports capital spending in two ways: as a portion of total spending on roads and broken down into categories of expenditures types. These expenditure categories were reviewed and classified as one of the following: (1) road expansion projects (composed of spending in FHWA-defined categories including Right of Way; New Construction; Reconstruction – Added Capacity; and Major Widening); (2) road repair and preservation projects (composed of spending in FHWA-defined categories including: Reconstruction – No Added Capacity; Minor Widening; Restoration

and Rehabilitation; and Resurfacing); or (3) other expenditures including spending on bridge repair and construction, safety expenditures, engineering expenditures, traffic operation expenditures, and environmental enhancements. Expenditures in each of these categories were totaled for each state to determine annual spending on repair and preservation and expansion.

In FHWA's capital spending dataset, there is a discrepancy between the capital outlay "total" for each year that comes from summing all capital expenditure categories and the reported total reflected in the full highway budget. The magnitude of the discrepancy varies from state to state and from year to year and is due to the fact that states typically do not categorize every capital dollar when reporting totals to FHWA. This discrepancy was addressed by calculating the percentage of capital spending for each state that went to road repair and preservation projects and to road expansion projects for 2004-2008, and then applying the percentages to the capital spending reported in the full state highway budgets. This analysis required making the assumption that the portions of capital expenditures for each state that went to repair and preservation projects and expansion projects would also apply to the total capital dollars with unreported expenditure categories.

Table A4: Annual state highway capital expenditures (average 2004-2008)

		Spending on expansion			Spending on repair		
State	**Total annual expenditures on capital projects**	**Annual capital spending on road expansion**	Annual capital spending on road expansion as % of **total capital spending**	Annual capital spending on road expansion as % of **total spent on road expansion and repair**	**Annual capital spending on road repair and preservation**	Annual capital spending on repair and preservation as % of **total capital spending**	Annual capital spending on repair and preservation as % of **total spent on expansion and repair**
Alabama	$1,087,499,600	$445,436,347	41%	57%	$337,480,483	31%	43%
Alaska	$372,559,800	$80,657,970	22%	33%	$162,274,793	44%	67%
Arizona	$978,454,200	$568,192,209	58%	74%	$195,142,776	20%	26%
Arkansas	$665,870,600	$340,811,678	51%	74%	$118,772,555	18%	26%
California	$3,993,240,200	$790,707,369	20%	54%	$674,290,234	17%	46%
Colorado	$670,609,800	$169,594,887	25%	41%	$245,458,173	37%	59%
Connecticut	$544,636,800	$180,739,717	33%	57%	$135,376,895	25%	43%
Delaware	$309,668,200	$84,066,508	27%	57%	$64,640,894	21%	43%
D. of Columbia	$214,013,200	$361,403	0%	0%	$94,587,508	44%	100%
Florida	$4,672,872,400	$2,226,175,911	48%	66%	$1,149,835,045	25%	34%
Georgia	$1,803,907,600	$424,233,986	24%	33%	$865,174,741	48%	67%
Hawaii	$188,440,400	$64,852,319	34%	51%	$62,106,674	33%	49%
Idaho	$385,725,400	$50,721,886	13%	23%	$172,809,240	45%	77%
Illinois	$2,755,240,600	$1,034,741,209	38%	53%	$911,859,128	33%	47%
Indiana	$1,212,592,800	$543,773,324	45%	57%	$406,035,168	33%	43%
Iowa	$530,166,200	$190,243,738	36%	53%	$171,769,836	32%	47%
Kansas	$850,367,600	$240,144,966	28%	38%	$390,023,979	46%	62%
Kentucky	$1,262,299,000	$301,691,843	24%	44%	$383,524,162	30%	56%

Louisiana	$1,275,104,000	$412,979,250	32%	53%	$362,375,147	28%	47%
Maine	$290,321,000	$37,938,572	13%	18%	$170,541,204	59%	82%
Maryland	$1,163,072,000	$281,446,117	24%	57%	$212,993,767	18%	43%
Massachusetts	$1,112,199,200	$483,405,953	43%	79%	$130,104,775	12%	21%
Michigan	$2,140,721,600	$199,239,025	9%	14%	$1,264,955,433	59%	86%
Minnesota	$852,987,000	$384,993,981	45%	68%	$179,502,595	21%	32%
Mississippi	$904,379,000	$666,270,494	74%	92%	$60,209,764	7%	8%
Missouri	$1,277,702,000	$337,644,479	26%	46%	$399,249,899	31%	54%
Montana	$371,330,800	$79,498,430	21%	30%	$188,304,242	51%	70%
Nebraska	$494,014,000	$25,843,124	5%	10%	$224,069,986	45%	90%
Nevada	$548,844,800	$297,520,772	54%	73%	$112,148,154	20%	27%
New Hampshire	$193,881,600	$38,557,258	20%	30%	$88,740,610	46%	70%
New Jersey	$1,764,662,000	$611,605,405	35%	59%	$421,361,544	24%	41%
New Mexico	$328,077,200	$89,676,047	27%	42%	$122,791,754	37%	58%
New York	$2,964,186,200	$107,670,142	4%	8%	$1,170,335,879	39%	92%
North Carolina	$1,921,296,200	$1,218,566,537	63%	86%	$190,343,775	10%	14%
North Dakota	$314,847,800	$49,047,061	16%	20%	$193,034,951	61%	80%
Ohio	$1,910,211,600	$451,772,850	24%	40%	$684,820,545	36%	60%
Oklahoma	$675,063,600	$340,916,006	51%	70%	$149,255,454	22%	30%
Oregon	$811,270,200	$210,926,442	26%	58%	$155,079,358	19%	42%
Pennsylvania	$2,315,647,800	$857,412,518	37%	58%	$616,303,040	27%	42%
Rhode Island	$213,666,200	$21,401,457	10%	38%	$34,399,912	16%	62%
South Carolina	$672,910,600	$274,672,598	41%	69%	$121,559,400	18%	31%
South Dakota	$310,261,400	$29,361,931	9%	11%	$240,762,199	78%	89%
Tennessee	$916,880,400	$487,283,884	53%	81%	$115,527,729	13%	19%
Texas	$6,553,243,800	$4,093,416,646	62%	86%	$691,747,743	11%	14%
Utah	$560,908,000	$217,460,770	39%	54%	$181,861,538	32%	46%
Vermont	$158,073,000	$11,878,438	8%	13%	$80,350,963	51%	87%
Virginia	$1,135,665,400	$606,746,793	53%	91%	$58,384,747	5%	9%
Washington	$1,322,680,200	$478,935,334	36%	73%	$180,737,304	14%	27%
West Virginia	$670,207,800	$227,407,199	34%	63%	$135,603,507	20%	37%
Wisconsin	$1,164,939,600	$414,897,816	36%	49%	$429,428,993	37%	51%
Wyoming	$281,112,200	$38,976,788	14%	20%	$155,624,656	55%	80%
Average	**$1,178,206,522**	**$427,892,498**	**36%**	**58%**	**$308,356,713**	**26%**	**42%**
Total	**$59,001,033,000**	**$21,377,081,038**	**36%**	**58%**	**$15,726,192,365**	**27%**	**42%**

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Appendix B:
Annual cost of repairing and maintaining states' roads

Table B1: Estimated annual funding need for repair and preservation of state-owned roads

State	Annual state road network preservation need	Annual repair need for major state roads in poor condition	Annual state road preservation and major road repair need
Alabama	$620,684,399	$9,214,668	$629,899,066
Alaska	$260,605,320	$14,458,384	$275,063,705
Arizona	$421,107,283	$6,830,621	$427,937,904
Arkansas	$821,766,588	$68,997,592	$890,764,180
California	$1,152,877,236	$124,545,447	$1,277,422,682
Colorado	$512,887,760	$17,793,429	$530,681,188
Connecticut	$219,844,083	$13,210,873	$233,054,956
Delaware	$260,190,799	$4,724,135	$264,914,935
D. of Columbia	$72,699,314	$13,022,663	$85,721,977
Florida	$941,872,587	$8,239,616	$950,112,203
Georgia	$1,049,245,468	$19,722,044	$1,068,967,512
Hawaii	$55,982,530	$8,700,338	$64,682,868
Idaho	$267,410,809	$12,598,385	$280,009,194
Illinois	$930,180,821	$64,193,404	$994,374,225
Indiana	$631,099,349	$19,371,219	$650,470,568
Iowa	$517,279,953	$35,049,949	$552,329,902
Kansas	$536,153,241	$14,646,922	$550,800,162
Kentucky	$1,368,965,821	$7,947,037	$1,376,912,858
Louisiana	$866,024,226	$69,347,840	$935,372,065
Maine	$402,655,737	$25,869,493	$428,525,230
Maryland	$328,435,157	$25,717,212	$354,152,368
Massachusetts	$186,908,301	$11,904,627	$198,812,928
Michigan	$608,532,039	$37,988,371	$646,520,411
Minnesota	$652,866,842	$19,054,139	$671,920,981
Mississippi	$612,014,695	$40,021,829	$652,036,524
Missouri	$1,676,336,489	$117,759,573	$1,794,096,062
Montana	$543,417,869	$6,070,247	$549,488,116
Nebraska	$502,369,848	$17,863,280	$520,233,129
Nevada	$291,103,431	$4,210,169	$295,313,600
New Hampshire	$196,683,995	$11,104,917	$207,788,911
New Jersey	$188,588,345	$25,998,038	$214,586,383

New Mexico	$647,287,823	$39,557,587	$686,845,410
New York	$849,413,871	$60,369,976	$909,783,847
North Carolina	$3,779,949,897	$36,381,505	$3,816,331,403
North Dakota	$378,820,325	$8,467,238	$387,287,563
Ohio	$1,104,061,840	$29,604,077	$1,133,665,917
Oklahoma	$670,005,793	$65,111,089	$735,116,882
Oregon	$406,995,961	$8,560,871	$415,556,831
Pennsylvania	$1,968,554,229	$124,477,292	$2,093,031,520
Rhode Island	$64,470,236	$7,717,300	$72,187,536
South Carolina	$2,001,369,618	$54,762,822	$2,056,132,440
South Dakota	$403,982,098	$24,157,963	$428,140,060
Tennessee	$815,395,019	$17,374,336	$832,769,355
Texas	$4,300,273,121	$157,330,671	$4,457,603,792
Utah	$348,177,646	$7,757,984	$355,935,630
Vermont	$134,146,571	$17,796,073	$151,942,644
Virginia	$2,784,850,523	$28,616,233	$2,813,466,756
Washington	$413,555,062	$12,618,368	$426,173,431
West Virginia	$1,574,364,030	$58,725,735	$1,633,089,765
Wisconsin	$654,616,195	$30,202,413	$684,818,609
Wyoming	$347,768,737	$9,256,093	$357,024,830
Average	**$810,683,312**	**$32,843,570**	**$843,526,883**
Total	**$41,344,848,929**	**$1,675,022,087**	**$43,019,871,015**

Determining road preservation and repair costs

This analysis evaluates the funding need based upon the average cost of various construction activities compiled by FHWA from DOTs around the country. This study examines the cost and timing of repair and preservation to see how much states would need to spend annually to (1) keep their roads from deteriorating to poor condition; and (2) bring major roads in poor condition into good repair over a 20 year period. While it does not capture regional variations attributable to climate, topography, etc., it does offer a "big picture" assessment.

I. Preserving the existing network in good condition

Determining the annualized pavement management cost

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 state's road network in a state of good repair based on its current asset inventory. The following assumptions went into calculating that cost:

- 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 life cycles actually vary based on a number of factors including traffic flow, climate and pavement type.

- During the 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.

These treatment schedules do 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 for whole network management 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 network repair and preservation price tag, but this standardized approach is designed to provide a national comparative snapshot.

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:		**$1,111,516**
Annualized cost per lane-mile:		**$22,230**

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:		**$1,150,066**
Annualized cost per lane-mile:		**$23,021**

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	**$436,933**
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	**$196,415**

*Costs for preservation, minor rehabilitation, and major rehabilitation were found in tables C.1 – C.20 from FHWA's 2010 report titled "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.

The per-lane-mile costs for each pavement treatment included in the life cycles were determined by averaging the costs from different application samples made available in FHWA's 2010 report titled "Performance Evaluation of Various Rehabilitation and Preservation Treatments." Sample applications were provided from six states (California, Kansas, Michigan, Minnesota, Texas and Washington). Only a subset of the basic preventative treatments provided in the report (see Table B3) was used to represent a minimal preservation schedule, but it should be noted that FHWA provides cost data for several other treatment types. For concrete roads, FHWA provided cost data for: joint sealing, partial depth repair, diamond grinding, HMA overlay, chip sealing, crack sealing, microsurfacing, mill and resurfacing, HMA overlay without slab fracturing, crack and seal, and unbonded overlays. For asphalt roads, treatment types included: chip sealing, crack sealing, microsurfacing, mill and resurfacing, full depth reclamation, structural overlay, and whitetopping.

Major rehabilitation costs for concrete and asphalt treatments were calculated by averaging sample application cost data from the same FHWA report. The major rehabilitation treatments were aggregated and averaged for an overall major rehabilitation cost.

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 get the annual cost figure. The annual concrete and asphalt state of good repair costs were then applied to the lane-miles owned by state highway agencies.

Calculating number of asphalt and concrete lane-miles

To calculate the total asphalt and concrete lane-miles owned by each state, the number of asphalt and concrete centerline-miles owned by states was calculated. Because the state highway

agency-owned miles are not reported by surface type (concrete vs. asphalt) within the publicly available FHWA Highway Statistics dataset, the percentages of all concrete and asphalt public roads in the state (regardless of owner) were applied to the state-owned road network to estimate how much of the state-owned network is concrete and how much is asphalt.

The percentages of asphalt versus concrete roads within the public road network were determined for each functional system type with the exception of rural minor collectors, rural locals, and urban locals, which could not be differentiated by surface type. These lower functionality roads were assumed to be asphalt in order to maintain a more financially conservative estimate of total cost. "Asphalt" roads included the surface type categories low type, intermediate type, high type-flexible, and high type-composite. "Concrete" roads were all roads that were classified as "high type-rigid." Unpaved roads were not taken into account. The percentages for each functionality type were applied to the number of state highway agency-owned centerline-miles, to create the number of state highway agency-owned asphalt and concrete centerline-miles. These centerline mile totals were then converted to lane-miles using the methodology described in Appendix A.

Asphalt roads: Sum of low type, intermediate type, high type-flexible, and high type-composite (data from all public roads)	divided by	Total roads (all public roads)	equals	Percentage of asphalt roads
Concrete roads: High type-rigid (data from all public roads)	divided by	Total roads (all public roads)	equals	Percentage of concrete roads

Generating a road network management cost

The number of asphalt lane-miles was multiplied by the annual pavement management cost for asphalt roads ($22,230), and the number of concrete lane-miles by the average annual preservation cost for concrete roads ($23,021) for each functionality type. These costs were added to create a totaled pavement management cost for each functionality type. The annual preservation cost for state highway agency-owned roads was then generated by the sum of each functionality type cost.

II. Backlog of major roads in poor condition

Creating a lane-mile cost for major rehabilitation

The unfortunate consequence of deferred preservation and repair is that roads will eventually deteriorate to the point that they need to be majorly rehabilitated or reconstructed. Roads in "poor" condition as of 2008 were assumed to require major rehabilitation in order to bring them up to a state of good repair.

FHWA identifies six major rehabilitation treatments in its 2010 report titled "Performance Evaluation of Various Rehabilitation and Preservation Treatments." These treatments are applied to either "hot mix asphalt" pavement or "Portland cement concrete" pavement. FHWA provides cost data from sample 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

average cost per lane-mile was calculated. 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 more information. This number was 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.

Generating annualized cost to rehabilitate state-owned major roads in poor condition
The number of state-owned lane miles of major roads in poor condition in 2008 (see Appendix A) was determined. The percentages of asphalt versus concrete roads for each road functional type was used to divide the roads in poor condition into concrete and asphalt. The calculated costs for asphalt and concrete major rehabilitation were applied to asphalt and concrete poor lane-miles for every functionality type of major roads. The total for asphalt and concrete major rehabilitation of state-owned major road lane-miles in poor condition were added together. This cost represented the total cost to rehabilitate all state-owned major roads in poor condition. Recognizing that states would be unable to rehabilitate all of these roads at once, it is assumed that states would rehabilitate these roads over a 20 year period. The total cost, therefore, was divided by 20 years to create an annualized cost to bring current poor major road lane-miles to state of good repair.

Key Assumptions/Data Issues:

- The ratio of lane-miles to centerline-miles for all public roads would also apply to state-owned roads. The same is true for the relative percentages of asphalt versus concrete roads.
- These calculations do not take into account that the number of roads in poor condition is likely to increase over this twenty-year period.

References for Appendix B

Costs for preservation, minor rehabilitation, and major rehabilitation

- 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.

Calculating miles for road preservation and concrete vs. asphalt percentages

- FHWA Highway Statistics. (2009). "State Highway Agency-Owned Public Roads - 2008 Miles by Functional System." Table HM-80. http://www.fhwa.dot.gov/policyinformation/statistics/2008/hm80.cfm.
- FHWA Highway Statistics. (2009). "Functional System Length - 2008 Miles by Type of Surfaces." Table HM-51. http://www.fhwa.dot.gov/policyinformation/statistics/2008/hm51.cfm.

Appendix C:
State pavement performance targets

Objective
State DOT pavement conditions targets were surveyed to (1) examine whether state DOTs have set goals to maintain their road assets in a certain condition and (2) assess the stringency of the targets states have established. The survey intends to expand the understanding of how states measure pavement performance and whether current road conditions targets are adequate enough to address the country's deteriorating roads.

Methodology
Data were collected on state road conditions targets from DOT websites, documents such as strategic plans and maintenance manuals, and direct correspondence with state DOT staff through phone and email. Contact information for the state DOTs was retrieved from the American Association of State Highway and Transportation Officials' list of members on its Standing Committee on Planning. Many states establish a target that applies to the entire network the state DOT owns, regardless of road type. In cases where states develop separate targets for specific road types, only those that fall under the category of "major roads," including urban and rural interstates, urban freeways and expressways, urban and rural arterials, urban collectors and rural major collectors were included.

The state targets are categorized by the way DOTs frame their conditions goals: (a) minimum percentage of pavement in "fair," "good," or "excellent" condition; (b) maximum percentage of pavement in "poor" condition; and (c) a target condition which the entire state network should meet.

a) **Minimum percentage of assets in "fair," "good," or "excellent" condition.** In order to account for the variance in the targets' stringency, separate categories were created to indicate which states have established a target for "fair" condition, which have established a target for "good," and which have established a target for "excellent" condition. The chart below specifies various expressions of rating condition used by state DOTs and how they are categorized.

Category	Expressions
"Fair" or better	fair, fair or better, fair or good, current or better, acceptable, tolerable or above and not deficient
"Good" or better	good, good or better, good to very good, good to excellent
"Excellent"	excellent and highest condition

b) **Maximum percentage of assets in "poor" condition.** Targets framed in this way set a threshold for a percentage of the road network in "poor condition" that should not be exceeded.
c) **Target condition for all inventoried state assets.** Few state conditions targets fall into types other than the above two. In Table 2 (page 14), the numbers listed indicate quantified target conditions, adjusted to be on a scale of 0 to 100 for comparison.

Results
40 states as well as the District of Columbia have developed performance targets for road conditions. 10 states have not established quantifiable, specific performance targets (some are in the process of developing targets, including 4 states that have set "non-specific" goals). These states have published a commitment to improving conditions annually but have not set a specific numerical target.

States assess conditions using a variety of performance measures. States are required to report conditions to the Federal Highway Administration using the International Roughness Index (IRI) and the Pavement Service Rating (PSR), but a number of states use other metrics for assessing conditions as well. Examples include the Pavement Conditions Index (PCI), which is used by several states, as well as a number of metrics developed by individual states such as the Sufficiency Surface Condition (SSC) rating for Michigan and the Average Ride Index (RI) for Montana.

Conditions are typically divided into different brackets (usually some variation of "excellent," "good," "fair," "poor," etc.), and the scales for these categories differ substantially between states. For example, Iowa and Delaware both set targets in terms of the Pavement Conditions Index (PCI). However, while Delaware considers pavement with a PCI score below 50 "poor," Iowa considers a score below 40 to be "poor."

Of the 40 states that have established quantitative pavement conditions targets, over half set targets for "fair" or "not poor" pavement condition. 15 states and the District of Columbia have set targets for a minimum percentage in "fair" or better condition, and 10 states have set targets for a maximum percentage in "poor" condition. 11 states set targets aiming at "good" or better condition, while only one state, Kansas, set a target for "excellent" condition. 7 states set a numerical target condition that they aim to maintain for their entire network.

Targets also varied greatly in their level of availability to the public. The majority of states have their targets and performance measures available in some form, either through a portion of their website explaining their pavement management program or through a report. However, the targets differ substantially in terms of their transparency. Some states have an interactive dashboard on their websites, allowing the public to easily comprehend the targets and performance measures. Others intentionally do not make their targets available to the public because they consider their metrics for conditions too highly complicated or technical.

Table C1: Details – state pavement targets

The following table contains detailed information on states' targets. Categories of information include sources, the performance targets, the performance measure used to establish the targets, and the target scales. In the table, information denoted with an asterisk (*) indicates that the data is not available and is supplemented from previously established inventories of performance measures.

State	Source	Pavement Condition Target	Performance Measure	Scale
AL	2008 Alabama Statewide Transportation Plan - 20-year plan	Not specific "Roadway with a rating of marginal or below should be labeled as deficient. Lowest rating threshold of 55 for any road."	Distress Rating	On a scale of 0 to 100 Good = 70.1 - 100.0; Fair = 55.1 - 70.0; Marginal = 0.0 - 55.0
AK	Performance Details, Office of Management and Budget	Increase Pavement Serviceability Rating (PSR) to 3.3 by October 2012.	Pavement Serviceability Index (PSR)	Rating-PSR Value (0-5) Very Good - > 4.0; Good - >3.5 to 3.9; Fair - 3.1 to 3.4; Mediocre - 2.6 to 3.0; Poor - < 2.5
AR	2006 Arkansas State Highway and Transportation Department Needs Study and Highway Improvement Plan	N/A	Pavement Condition Rating (PCR)	On a scale of 0.0 (unpaved facilities) to 5.0 (new, superior pavements) Poor = 0.0 - 2.8; Fair = 2.9 - 3.7; Good = ≥ 3.8
	Arkansas State Highway and Transportation Department, Planning and Research Division			
AZ	The FHWA and ADOT Stewardship and Oversight Agreement for Arizona	95% of State Highway System should have Good Ride Quality (PSR > 3.2)	Present Service Rating (PSR)	Good = >3.2
CA	Performance Measures	Ensure that distressed pavement does not exceed 30% of the system's lane-miles.		
CO	Colorado DOT FY 2010-2011 Budget Request November 2, 2009: Strategic Plan	Goal (desirable target): Achieve 60 percent good/fair pavement condition system wide; Objective (realistic reflection): Maintain or improve the system-wide pavement condition forecast for 2016 of 40 percent good/fair condition based on 2008-2035 Resource Allocation.	Remaining Service Life	
CT	CDOT Performance Measure Report: 2010 Third Quarter	Not specific. Increase percentage of roads with good ride quality of IRI less than 95.	IRI	Good = IRI < 95; Acceptable = IRI 95-170; Poor = IRI >170
DC	Action Agenda - Progress Report - 2010	Achieve and maintain at least 90% of federal aid roads and 73% of local roads in fair or better condition.	PCI: Pavement Condition Index	On a scale of 0 to 100 Good = 71-85; Fair = 56-70
DE	Issue Brief: Transportation Infrastructure, American Society of Civil Engineers, 2007	Maintain 85% of roadways at Fair or Good ratings.	Overall Pavement Condition Rating (OPC)	Good = ≥60; Fair = 50 - 60; Poor = ≤50
FL	Performance Briefs: Maintenance and Preservation, Oct. 2010	Ensure that 80% of pavement on the State Highway System meets department standards. Achieve 100% of the acceptable maintenance standard on the State Highway System.	Pavement condition survey	Scale of 0-10 based on ride quality, crack severity and average depth of wheel-path ruts
GA	Georgia Department of Transportation FY 2011 Strategic Plan Update, Feb. 2011	Interstates with average daily traffic (ADT) >/= 50,000 maintained at PACES rating of 80 or more. All other interstates: PACES rating of 75 or more. Multi-lane 02 routes with an ADT of 25,000 or great at a PACES rating of 75 or more. Other routes at a PACES rating of 70 or more	Pavement Condition Evaluation System	On a scale of 0 to 100
HI	HB 1531 passed by House of Representatives 26th Legislature, 2011: Highway Modernization Program; Taxes; Fees; Pilot Programs	To achieve and maintain a pavement condition index of 80 or higher on all roadways in the statewide highway system.	Pavement Condition Index (PCI)	
IA	Iowa Department of Transportation Performance Report FY2009	Interstate = 65 Commercial industrial network = 60	Pavement Condition Index (PCI)	Scale of 0 (worst) to 100 (best) representing the condition of state highway pavements. *Good = 60-80; Fair = 40-60
		75% of highway miles should meet or exceed a sufficiency rating of tolerable or above.	Sufficiency Rating	

ID	Transportation System Dashboard	82% of entire State Highway System in good or fair.	Percent of pavement in good or fair condition	Roughness, cracking, and rutting are measured by driving a specially equipped profiler van over the entire State Highway System during spring and summer. The collected data along with visual inspections are then used to rate pavement conditions as good, fair, poor, or very poor.
IL	Scale description FY 2010 Rating Survey Summary Report, Oct. 2010 Targets Illinois Department of Transportation, Statewide Program Planning, Bureau Chief	90% of state-maintained road mileage in Acceptable condition.	Condition Rating Survey (CRS)	» Descriptive Categories: On a scale of 1 (completely failed) to 9 (best/new condition) Excellent = 7.6 - 9; Good = 6.1 - 7.5; Fair = 4.6 - 6; Poor = 1 - 4.5 » Pavement Needs: Acceptable (Accruing and adequate) Needs improvement (Backlog): condition has deteriorated to the level where an improvement is recommended now.
IN	Indiana Department of Transportation Asset Management/Planning staff	No more than 10% of pavement network system should be above "poor" condition.	IRI	Good = <100; Fair = 101 - 169; Poor = >170
KS	Kansas Department of Transportation 2010 Annual Report	Percent of miles in highest condition Interstate = 85%; Non-interstate = 80%.	Pavement Condition	N/A
KY	Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2010	No more than 30% of the pavement shall be rated as "poor."	Pavement Condition Index (PCI)	Good: Greater than +0.4 Fair: Between 0.0 and 0.4 Poor: Less than 0.0
LA	Louisiana Department of Transportation and Development Five-year Strategic Plan July 1, 2011 – June 30, 2016	Effectively maintain and improve the State Highway System so that the system stays in its current or better condition each Fiscal Year. Interstate Highway: ≥97%; National Highway: ≥95%; Highways of Statewide Significance: ≥80%; Regional Highway: ≥80%	Pavement ride-ability condition quality index	The indicator is calculated by summing the mileage in fair or better condition for each specific calculation of highway dividing the number of total miles of that classification of highway.
MA	2011-15 Highway Capital Investment Plan, Sept. 2010	Achieve PSI target of 4.0 for interstate highway and 3.5 for non-interstate highway systems.	Pavement Serviceability Index	Scale of 0 to 5 Interstate: Excellent = 3.5-5; Good = 3-3.49; Fair = 2.50-2.99 Non-interstate roadways: Excellent = 3.5-5; Good = 2.8-3.49; Fair = 2.3-2.79
MD	2011 Annual Attainment Report on Transportation System Performance	Maintain 84% annually of "acceptable ride quality"; at 87% in 2009.	N/A	N/A
ME	Scale description Pavement Condition Ratings & Images	N/A (Confirmed with MDOT staff)	Pavement Condition Rating	Scale of 0 to 5 Excellent = 5; Good to Excellent = 4; Good = 3.3; Fair to Poor = 2.4; Poor = 1.2; Very Poor = 0.8
MI	Transportation System Condition Report	Improve or sustain 90% of trunkline pavement in fair or better condition based on Sufficiency (pavement condition).	Sufficiency Surface Condition (SSC) rating.	(1) *Excellent:* None or very little pavement deterioration. (2) *Good:* Some initial deterioration not yet requiring appreciable amounts of maintenance. (3) *Fair:* Occasional deterioration requiring routine maintenance operations. (4) *Poor:* Frequent occurrence of surface deterioration requiring more extensive maintenance and/or reconstruction. (5) *Very Poor:* Extensive surface deterioration. Warrants reconstruction soon.

MI, *cont.*		Improve or sustain 90% of trunkline pavements in fair or better condition (ride quality)	IRI	Good: IRI less than 95 inches per mile. Fair: IRI between 95 and 170 inches per mile. Poor: IRI greater than 170 inches per mile.
MN	Mn/DOT Statewide 20-year Highway Investment Plan 2009-2028	Over 70% of road miles to be in "good" condition. Below 2% of road miles to be in "poor" condition.	Ride Quality Index (RQI)	On a scale of 0 to 5, measuring smoothness.
MO	Target Missouri Long Range Transportation Plan, 2007 Performance measures and scale description Missouri Guide for Pavement Rehabilitation, 2002	85% of Missouri's busiest highways – the major highway system – to good (acceptable) condition	Present Serviceaiblity Rating	Split evenly between roughness and visual distress Non-interstate routes: Acceptable = ≥32; Marginal = 29 - 32; Unacceptable = <29 Remaining Arterials: Acceptable = ≥31; Marginal = 29 - 31; Unacceptable = <29 Collectors: Acceptable = ≥30; Marginal = 29 - 30; Unacceptable = <29
MS	Multiplan 2035, Chapter 6: Highway and Bridge Needs Assessment	N/A (Confirmed with MDOT staff)	Pavement Condition Rating	A composite index comprising cracking, rutting, faulting, and distresses in the pavement. On a scale of 0 (impassable) to 100 (excellent condition). Excellent= 95-100; Very Good - 89 - 95; Good = 82 - 89; Fair = 72 - 82; Poor = 63 - 72; Very Poor = 44 - 60; Failed= 0-44
		N/A	Pavement Serviceability Rating	On a scale of 0 to 5 Very good = 4 - 5; Good = 3 - 4; Fair = 2 - 3; Poor = 1 - 2; Very poor = 0 - 1 "Deficient" and require resurfacing = 3.4 or less. "Reconstruction level" = 1.8 or less.
MT	Targets 2013 BIENNIUM GOALS AND OBJECTIVES	Provide a ride experience for the traveling public within desirable or superior range (average ride index above 60) with less than 3% of lane-miles exhibiting poor ride characteristics.	Average Ride Index (RI)	A measure of the quality (smoothness) of the ride as perceived by the highway user. Superior = 81 - 100; Desirable = 61 - 80; Undesirable = 46 - 60; Unsatisfactory = ≤45;
	Scale description Performance Programming Process		*Overall Pavement Index	*Good = 63 - 100 Fair = 45 - 62.9 Poor = <45
NC	2010 Report on the Condition of the State Highway System, Appendix C	Percent pavement in good condition Interstate = 85 Primary = 80	Pavement Condition Rating	Good = ≥80
ND	Performance Measure Report Card North Dakota Department of Transportation staff	Percent in excellent or good condition Interstate = 95% Interregional corridor = 90% State corridor = 85%	IRI (as of 2007)	Excellent < 60; Good 61 - 95; Fair 96 -132; Poor > 132
NE	Targets Nebraska Department of Roads Performance Measures, Nov. 2010	84% of highway system miles in "good" or "very good" condition.	Nebraska Serviceability Index	A subjective scale of 0 (very poor) to 100 (very good). Very Good = 90 - 100; Good = 70 to 89; Fair = 50 to 69; Poor = 30 to 49; Very Poor = 0 to 29
	Measure description Pavement Management System Manual	84% of all miles of the highway system shall be maintained at an acceptable ride quality of at least "Good" or "Very Good."	IRI	On a scale of 0 (smooth) to 4.22 and greater. Very Good = <0.86; Good = 0.86 - 2.48; Fair = 2.49 - 3.33; Poor = 3.34 - 4.21; Very Poor = 4.22

NE, *cont.*		N/A	Present Serviceability Index	Scale of 0 (worst) to 5 (best) This is a numerical value indicating the ride quality of the pavements. PSI is a function of roughness IRI, cracking, and rutting. Very Good = 4.0 - 5.0; Good = 3.0 - 4.0; Fair = 2.0 - 3.0; Poor = 1.0 - 2.0; Very Poor = 0.0 - 1.0
NH	2011-2020 Ten Year Plan, Pavement Condition and Performance	N/A If the road is maintained and resurfaced every 8-12 years, the pavement should remain in a good condition nearly indefinitely.	Ride Comfort Index (RCI) Rut Rate Index (RRI) Transverse Index (TI) Structural Index (SI) Pavement Serviceability Rating (PSR)	All on 0 to 5 scale. RCI: represents the smoothness of the road; used to measure pavement performance 0-2.5: Major Work Required 2.51-3.49: Some Work Required 3.50-5.0: No Work Required
	New Hampshire Department of Transportation, Bureau of Materials and Research, Pavement Management Section			RRI: represents the amount of rutting/ deformation in the wheel path TI: represents the amount and severity of thermal or transverse cracks that are present on the roadway surface. SI: represents the amount and severity of fatigue cracking in the wheel paths. PSR: the composite index and is calculated directly from the four above indices
NJ	Targets Asset Management: 10 Year Performance Measures and Targets, Dec. 2009	Achieve 80 percent of pavement in Acceptable Condition over entire State Highway System (System is currently rated at 47 percent Acceptable).	Surface Distress Index (SDI)	On a scale of 0 to 5 Good = 3.5 - 5; Fair = 3.1 - 3.4; Mediocre = 2.6 - 3; Deficient (poor) = 0 - 2.5
	Performance Measures New Jersey's Roadway Pavement System FY2007		IRI	Good = 0 - 94; Fair = 95 - 119; Mediocre = 120 - 170; Deficient (poor) = >170
NM	Good to Great: Performance Measure Report, FY2011 2nd Quarter	Interstate: ≥97% of interstate lane-miles rated "Good" Non-interstate: ≥88% of non-interstate miles rated "Good"	Pavement Serviceability Index (PSI)	On a scale of 0 to 5, calculated 60% from the pavement's roughness and 40% from the pavement's surface signs of aging and deterioration. Interstate highway: Good = ≥ 3.0 Non-interstate highway: Good = ≥ 2.5
NV	2010 Performance Management Report	Annual target: 8% state maintained pavements must be preserved annually in order to maintain the pavement International Roughness Index (IRI) rating of good or fair condition. Ultimate target: 100% maintained to IRI of good or fair.	IRI	Excellent = <60; Good = 60-94; Fair = 95-119 (Interstate); 95-170 (non-interstate)
NY	Capital Program Proposal 2010-2015, New York State Department of Transportation	The proposed investment levels will maintain Interstate Highway system pavement at current conditions, with about 80 percent in good or excellent condition. Non-interstate NHS roads will end the period slightly below current condition levels.	Pavement Condition Index (PCI) - incorporates Surface Rating (SR) and IRI in calculations	Scale of 1 to 10 Excellent = 9-10; Good = 7-8; Fair = 6 Poor = 1-5;
			International Roughness Index, adjusted for NYSDOT (for pavement ride quality)	In in/mi Very Smooth = <60; Smooth = 61 – 120; Fair = 121 – 170; Rough = 171 – 220; Very Rough = >220
OH	Targets Bridge and Pavement Condition Goals FY11-12 PCR Scale Measure	At least 90% of all State maintained lane-miles meet the pavement condition rating standards. (priority roads: ≥65, general: ≥60, urban: ≥55)	Pavement condition rating (PCR) standards	On a scale of 1 to 100 (grouped from 1-6) Very Good = 90-100 (6); Good = 75-89 (5); Fair 65-74 (4); Fair to Poor = 56-64 (3); Poor = 40-55 (2); Very Poor = <40 (1)
OK	Targets 2010-2035 Long-range Transportation Plan, Chapter 8 Recommendations	Not specific "Preserve and improve the condition of roads and bridges by fully implementing asset management systems."	Sufficiency Rating	On a scale of 0 to 100 Adequate = 80 -100; Tolerable = 70-79; Inadequate = 60 - 69; Critical = ≤ 59

OK, *cont.*	Performance measures 2009 Needs Study and Sufficiency Rating Report FY 2009 - FY 2028 vol.1			
OR	Oregon Department of Transportation Performance Dashboard: Pavement Condition	To maintain pavement conditions at a target of 78% "fair" or better over the long term.	Good-Fair-Poor (GFP) Rating	On a scale of 0 to 100, based on the surface distresses present and, to a lesser degree, ride quality Very Good = 96-100; Good = 80 - 95; Fair = 50-75; Poor = 25-40; Very Poor = 5-20
	2010 Pavement Condition Report		Distress Survey	
PA	Target Long Range Plan 2000-2025, Statewide Goals and Objectives Scale description High Speed Profiler	Percent of miles rated poor reduced to: Interstates: <1% NHS: <5% Other PennDOT (non-NHS Average Daily Traffic >2,000 and <2,000): <15%	International Roughness Index (IRI)	Interstate: Excellent = ≤70; Good = 71-100; Fair = 101-150; Poor = >151 Non-interstate routes: Excellent = ≤75; Good = 76-120; Fair = 121-170; Poor = >171
	Pennsylvania Department of Transportation, Bureau of Maintenance and Operations, Pavement Management Section	N/A	Overall Pavement Index (OPI) - Pennsylvania specific	On scale of 0 to 100, incorporates pavement distress (rutting/cracking) and IRI. Interstate: Excellent = >95; Good = 86-95; Fair = 76-85; Poor = <75 Non-interstate routes: Excellent = >95; Good = 81-95; Fair = 71-80; Poor = <70
RI		N/A. Department is starting to develop Department-wide performance measures.		
SC	Target South Carolina Department of Transportation Strategic Plan, 2008-2010 Performance Measure CDOT Engineering Directive Memorandum 50	Not specific "Utilize the pavement improvement and preservation program to eliminate the decline of the average remaining service life (RSL) and maintain the current condition of our transportation system."	Pavement Quality Index (PQI)	* On scale of 0 to 5 Good = 3.4 - 4; Fair = 2.7 - 3.3; Poor = 2 - 2.6 Pavement condition for Non-interstate roads is determined by evaluating the PQI, IRI, and the percentage of pavement that has been patched.
SD	2010 South Dakota Statewide Long Range Transportation Plan	Interstate highways: 3.9 - 4.2 Major Arterials: 3.7 - 4.0 Minor arterials: 3.4 - 3.8	Pavement Surface Condition Index	On a scale of 0 (very broken up and unacceptable) to 5 (perfect)
TN	Tennessee Long Range Transportation Plan: Transportation System Performance Measures, December 2005	Interstates = 90%>3.5; 10%<2 State routes = 85%>3.5; 15%<2	Pavement Quality Index	On a scale of 1 to 5, to determine the schedule for road resurfacing *Very Good = 4 - 5; Good = 3.5 - 4; Fair = 2.5 - 3.5; Poor = 1 - 2.5; Very poor = 0 - 1
		Interstates = 90 State routes = 85	Maintenance Rating Index	On a scale of 1 to 100; to determine roadway condition and whether maintenance is needed
TX	Texas Department of Transportation Tracker - FY2010	≥90% of state-maintained lane-miles in "good" or better condition	Pavement Condition Score	On a scale of 1 (worst condition) to 100 (best condition). Based on pavement surface defects (such as ruts, cracks, potholes) and ride quality (roadway roughness). Good (or better) = ≥70
UT	Target and scale description International Roughness Index & Ride Quality Maps (dTIMS Method)	UDOT scoreboard goals: Percentage of system in fair or better condition. Interstate = 90%; State arterial = 70%; State collector = 50% GASB34 goals: 50% of system good or fair	Half Car Simulation (HCS), Ride Quality Index	On a scale of 0 to 100 Very Good = 90 - 100; Good = 70 - 90; Fair = 50 - 70; Poor = 30 - 50 Very poor = 0 - 30

UT, *cont.*	Pavement Condition Data & Condition Level Information	N/A	Condition index	On a scale of 0 to 100 Poor = 0 to 49 Fair = 50 to 80 Good = 81 to 100
VA	Biennial Report on the Condition of and Investment Needed to Maintain and Operate the Existing Surface Transportation Infrastructure for FY 2011 and FY 2012	≥82% of Interstate and Primary system pavements in fair or better condition	Current Condition Index (CCI)	On a scale of 0 to 100 (no distress) Fair = ≥ 60; Deficient = <60
		≥85% of Interstate and Primary system pavements with fair or better ride quality	IRI	Fair = ≥140
VT	Vermont Agency of Transportation Performance Measures, 2008	≥70 (on scale of 0-100) <25% of miles of pavements rated as "very poor" condition	Pavement condition index based on vehicle miles traveled	On a scale of 0 to 100 based on rutting, cracking, and roughness. Good = 80 - 100; Fair = 65 - 79; Poor = 40 - 64; Very poor = <40
WA	Targets WSDOT Strategies Regarding Preservation of the State Road Network	The Governor's Cabinet Strategic Action Plan has set a goal to maintain 90 percent of all state highway pavements in good or fair condition.	Pavement Structural Condition (PSC)	On a scale of 0 to 100 Very Good = 80- 100; Good = 80 - 60; Fair = 60 - 40; Poor = 20 - 40; Very Poor= 0-20
	Performance measures The Gray Notebook Quarter ending Dec. 2009, Preservation, Basic Pavement Types and Ratings Summary		IRI	Very Good = <95 in/mi.; Good = 95-170 in/mi.; Fair = 170-220 in/mi.; Poor = 220-320 in/mi.; Very Poor = >320 in/mi.
	Washington State Department of Transportation, Strategic Planning and Programming		Rutting	Very Good = ≤0.23; Good = 0.23-0.41; Fair = 0.41-058; Poor = 0.58-0.74; Very Poor= >0.74
WI	Connections 2030 Statewide Long-range multimodal transportation plan, Chapter 5: Preserve and Maintain Wisconsin's Transportation System	≤10% of network with Poor rating (172in/mi in IRI)	NEW: Pavement Condition Index (PCI) OLD: Pavement Distress Index (PDI) Pavement serviceability index (PSI) Rutting (RUT)	» Pavement distress index (PDI): On a scale of 0 (no distress) to 100 (worst possible conditions). Measures the structural adequacy of pavements. *Good = 20 -39; Fair = 40 - 59; Poor = 60 - 79; Very Poor = >80 » Pavement serviceability index (PSI): On a scale of 0 (worst ride quality) to 5 (best). Measures the pavement roughness and ride quality. » Rutting (RUT): Measures the inches of vehicle track depressions in each lane, which are typically caused by problems in the underlying pavement structure.
WV	A Statistical Analysis of Factors associated with Driver-perceived Road Roughness on Urban Highways	N/A	Qualitative. The Department of Highway does not currently employ a formal, stand alone performance measurement system with identified agency/system-level measures and a defined reporting cycle.	N/A
WY	2010 Long Range Transportation Plan	51% of state system's roads should be in the Good to Excellent category.	PSR (Present Serviceability Rating)	Combines a weighted calculation to rutting, ride, and cracking numbers to develop a 1-100 scale, with a score of 85 and above being either good or excellent.

References for Appendix C

Contact Information for State DOTs

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Previously established inventories of performance measures

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