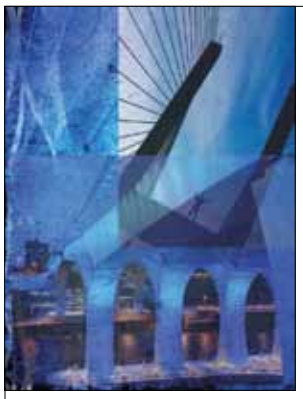


BETTER Bridges

Bridge Inventory 2009

By Tina Grady Barbaccia

State of Bridges

Shockingly high number of bridges remain sub-standard

There are 597,787 bridges in America, 288,920 interstate and state bridges and 308,867 city/county/township bridges.

But 21.6 percent – or 62,504 – of the interstate and state bridges are structurally deficient (SD) or functionally obsolete (FO). And 25.7 percent of the city/county/township bridges – or 79,394 – are SD/FO.

Maintenance, personnel, training, age, environmental restrictions, a need to minimize traffic disruption, capacity and corrosion issues remain major barriers to lowering the rate of bridges becoming deficient, despite some respite coming from stimulus fund money.

Texas leads the nation with the most combined structurally deficient and functionally obsolete bridges. The state has 9,564 – 19 percent – of its total 50,316 bridges as SD/FO. Of the total 32,862 interstate and state bridges, 4,182, or 31 percent, are SD/FO. Of the 17,454 total city/county/township bridges, 5,383 or 13 percent are SD/FO.

Pennsylvania is second with 9,130 of its total 23,562 bridges, or 39 percent, as SD/FO. The state has 16,668 total interstate and state bridges, with 5,971 -- 36 percent -- reported as SD/FO. Forty-six percent, or 3,159 of all the state's 6,875 city/county/township bridges are considered SD/FO.State officials note that funding is the greatest challenge to lowering the state's rate of bridge deterioration, but corrosion, heavy salt use and more traffic than bridges were designed to carry cause the greatest damage.

But, Lance Savant, P.E., with Pennsylvania Department of Transportation's Bureau of Design, says his state expects to be able to lower its rate of its structurally deficient and functionally obsolete in the coming year. "Pennsylvania has its accelerated bridge program which focuses on replacing/repairing SD bridges," Savant says. Nonetheless, bridges could certainly be improved if the state could "devote more funds to bridge preservation…to keep the good bridges good," he says. Many of the other states' agencies echo the same sentiment.

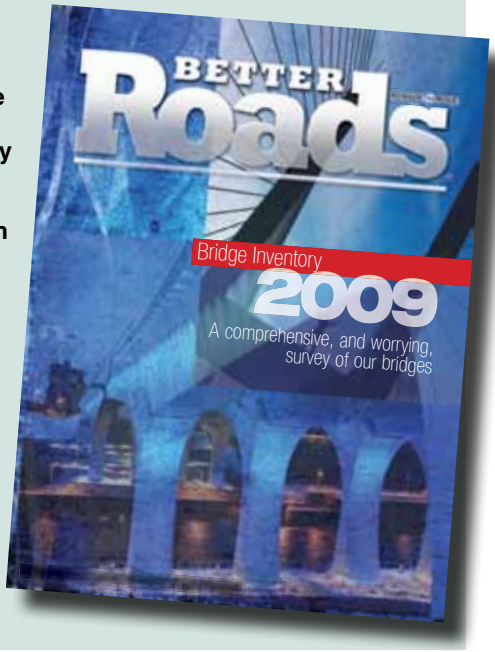
Following Pennsylvania, in order, the other top five states with the highest number of combined total SD/FO bridges are Missouri, Ohio, and Oklahoma.

Missouri has 24,096 total bridges, a combined total of 7,103, or 29 percent, which are SD/FO. There are 10,249 total interstate and state bridges, 2,838, or 28 percent, of which are SD/FO. Of the 13,847 total city/county/township bridges, 4,265, or 31 percent are SD/FO.

Ohio has 6,993 -- 23 percent -- of the total 30,617 in the state being SD/FO. Of the total 11,639 interstate and state bridges, 2,475, or 21 percent, are SD/FO. Of the total 18,978 city/county/township bridges, 4,518, or 24 percent, are SD/FO.

Finally, 6,904, or 29 percent, of Okla-

The Better Roads Bridge Inventory is an exclusive, award-winning, annual survey that has been conducted since 1979. Bridge engineers from every state and Washington, D.C., are sent a survey with both qualitative and quantitative questions. The Federal Highway Administration, in consultation with the states, has assigned a sufficiency rating, or SR, to each bridge (20 feet or more) that is inventoried. Formula SR rating factors are as outlined in the current Recording and Coding Guide for Structures Inventory and Appraisal SI&A of the Nation's Bridges. The qualitative data is gathered through a questionnaire about major issues concerning bridge conditions and maintenance.



homa's 23,646 total bridges are SD/FO. Of its 7,660 total interstate and state bridges, 1,639, or 21 percent, are SD/FO. Thirty-three percent, or 5,265, of the state's 15,986 total city/county/township bridges are SD/FO.

Like Pennsylvania, Oklahoma also expects to be able to lower its number of SD/FO bridges within the coming year. Bob Rusch, bridge division engineer for the Oklahoma Department of Transportation, says this is the fourth consecutive year the number of bridge projects in the state's eight-year Construction Work Plan has increased and represents the largest increase in bridge work ever incorporated into the plan.

"The department's Federal Fiscal Years 2010 –2017 Construction Work Plan enumerates priorities for highway and bridge construction during the next eight years and includes more than $4 billion in improvements to the state's bridges and highways," Rusch says. "The plan continues the agency's focus on bridges with an increase of more than 100 bridges over last year's plan for a total of more than 560." In addition, he adds, "The department is also continuing to make strides in our State Bridge rehabilitation Program which provides significant repairs to existing bridges."

The actual number of bridges doesn't always paint the most accurate

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A Five-Year Look at America's Bridge Inventory

Type of Bridge	2005	2006	2007	2008	2009
Interstate and state bridges					
Total surveyed	287,197	285,942	287,431	288,511	288,920
SD/FO	63,574	62,517	62,855	63,910	62,504
City, county, township bridges					
Total surveyed	308,428	309,247	310,384	308,893	308,867
SD/FO	85,552	83,479	81,459	81,032	79,394
Total overall bridges surveyed					
Total	595,625	595,189	597,185	597,404	597,787
***SD/FO**	149,126	145,996	144,314	144,942	141,898

***SD/FO = structurally deficient, functionally obsolete**

Source: *Better Roads 2009* ***Bridge Inventory Survey***

A **temporary** funding frenzy

Even with the American Reinvestment and Recovery Act (ARRA), better known as the stimulus, funding availability is still one of the biggest challenges in lowering the number of states' deficient bridges, say respondents to the *Better Roads* survey. From The Midwest to the South to the Southeast to South Dakota and even as far-flung as Hawaii and Washington, D.C, agency officials still rank funding availability as one of the greatest challenges to repairing derelict bridges.

However, ARRA has provided some relief and has increased the level of funding for bridges. It has enabled maintenance and reconstruction of some bridges that would otherwise not be possible. The results of ARRA spending range from having no effect or a minimal effect to modest or significant impact. These responses are not unfamiliar to highway transportation official assessing the impact of the stimulus. Anwar Ahmad, assistant bridge engineer for the Virginia Department of Transportation, tells *Better Roads* that the stimulus "was a much-needed booster for our bridge program."

David Koenig, bridge structural service engineer with the Missouri Highway and Transportation Department, agrees, noting that the ARRA has had a very positive, "large impact" on Missouri's bridge projects. "Many bridge projects have been moved up in the schedule and more have been addressed," he says.

Minnesota has benefited from stimulus money. "Over 50 bridges on Minnesota's state and local highways have been advanced with ARRA funding," says Tom C. Styrbicki, P.E., bridge construction and maintenance engineer, Minnesota Department of Transportation Bridge Office. "The projects include everything from minor repairs to full bridge replacements. The ARRA program was a particular benefit to bridges in the local system."

Steve Anderson, Nebraska Department of Roads, Bridge Divisions, says the stimulus "has accelerated a few projects [at the] state and local level."

Don Cooney, infrastructure project management administration, Department of Transportation, Asset Management Division, Washington, D.C., also notes that "the ARRA has increased the level of funding for bridges" in The District.

Chris Potter, Utah Department of Transportation, Bridge Design & Operations, says his state is using the money to replace several structurally deficient bridges and bridge decks. "In addition, we are using it to apply preservation treatment to several bridges," he says.

Kent Barnes, Montana Department of Highways, Chief Bridge Bureau, says that although the ARRA helped to fund a few additional short-span bridges, for the most part, it had a "low impact on the bridge program."

Paul Santo, bridge design engineer, Hawaii Department of Transportation, says the stimulus also has "assisted in funding a couple of bridge projects, [but] it has not made a significant difference." Benjamin W. Foster, assistant bridge maintenance engineer, Maine Department of Transportation, says in his state, "a modest amount" of money was used for bridges.

Kansas DOT's John Jones says some bridges were "let" that otherwise would not have been, but "we're still waiting on next year's distribution." Essentially, he says, some projects that were financially marginal became feasible. The same was true for Texas. Alan Kowalik, P.E., bridge inspection engineer for the Texas State Department of Transportation, says that bridges that were on the state's "Five-Year List" were moved up to be replaced and repaired.

Better Bridges
Bridge Inventory
2009

picture of deficiency or obsolesence. A state with fewer bridges could have a higher percentage of bridges that are SD/FO, but the numbers of SD/FO bridges could actually be relatively low.

The highest percentage of SD/FO bridges in the nation – 55 percent – is in the District of Columbia. By percentage, Rhode Island** comes in second with 53 percent SD/FO bridges, followed by Pennsylvania at 39 percent, Hawaii at 38 percent and New York at 37 percent.

Regardless of what the official statistics show about the number of bridges that are SD and FO, some bridge engineers say that we should look at the square footage of SD and FO bridges to get a true picture of the situation. Ray Mumphrey, highway bridge program manager with the Louisiana Department of Transportation, says that while the number of SD/FO bridges may have decreased, the square footage may actually be increasing. "It may look like we're making progress [in the nation] with the number of deficient bridges, however larger bridges are becoming deficient which increases the square footage of deficient bridges," Mumphrey says. "There are a lot of interstate [bridges] becoming deficient, although the numbers of deficient structures may have gone down."

Adds John Jones, M.S., P.E., Bridge Manuals, Modeling and Policy Engineer with the Kansas Department of Transportation (KDOT): "In all cases, square footage is the best indicator of [their] status."

Clearance and capacity concerns

Even after the August 2007 collapse of I-35W Mississippi River Bridge in Minnesota, bridge needs are still not being seen as "critical," says Dan Holderman, P.E., a bridge management engineer with the North Carolina Department of Transportation. "Even after the I-35W collapse, [there is still] very little emphasis on bridges and other infrastructure."

Investigators found that the Minneapolis bridge, which killed 13 people when it collapsed into the Mississippi River failed because of a flaw in its design, when it announced its findings on Jan. 14, 2008. The designers had specified a metal plate that was too thin to serve as a junction of several girders, investigators say, according to a *New York Times* report immediately following the findings.

The bridge, which was designed in the 1960s, lasted 40 years. However, like most other bridges, *the Times* reported, it gradually gained weight during that period, as workers installed concrete structures to separate eastbound and westbound lanes and made other changes, adding strain to the weak spot.

This is when the bridge problem becomes more than a structural issue.

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Better Bridges Bridge Inventory 2009

The Federal Highway Administration, in consultation with the states, has assigned a sufficiency rating, or SR, to each bridge (20 feet or more) that is inventoried. Formula SR rating factors are as outlined in the current Recording and Coding Guide for Structures Inventory and Appraisal SI&A of the Nation's Bridges.

Our thanks to all the state highway engineers for their continuing cooperation and special effort to provide current data.

State	Total interstate & state bridges	Total *SD/FO	%	Total city/county/ township bridges	Total *SD/FO	%	Total all bridges	Combined total *SD/FO	%
Alabama	5,720	1,173	21%	10,086	2,465	24%	15,806	3,638	23%
Alaska	807	164	20%	142	52	37%	949	216	23%
Arizona	4,719	561	12%	2,558	273	11%	7,277	834	11%
Arkansas	7,176	1,102	15%	5,230	1,480	28%	12,406	2,582	21%
California	12,325	1,892	15%	11,626	2,631	23%	23,951	4,523	19%
Colorado	3,429	483	14%	4,690	634	14%	8,119	1,117	14%
Connecticut	2,932	1,075	37%	1,244	432	35%	4,176	1,507	36%
Delaware	849	157	18%	9	4	44%	858	161	19%
District Of Columbia	215	118	55%	0	0	n/a	215	118	55%
Florida	6,166	856	14%	4,884	1,116	23%	11,050	1,972	18%
Georgia	6,046	773	13%	8,521	1,981	23%	14,567	2,754	19%
Hawaii	773	297	38%	402	149	37%	1,175	446	38%
Idaho	1,289	273	21%	2,339	416	18%	3,628	689	19%
Illinois	8,176	1,705	21%	18,078	2,738	15%	26,254	4,443	17%
Indiana	5,717	928	16%	12,871	3,163	25%	18,588	4,091	22%
Iowa	4,092	539	13%	20,707	6,139	30%	24,799	6,678	27%
Kansas	5,376	772	14%	20,562	4,381	21%	25,938	5,153	20%
Kentucky	8,870	2,589	29%	4,736	1,283	27%	13,606	3,872	28%
Louisiana	7,934	2,193	28%	5,220	1,674	32%	13,154	3,867	29%
Maine	2,074	549	26%	211	87	41%	2,285	636	28%
Maryland	2,899	619	21%	2,240	718	32%	5,139	1,337	26%
Massachusetts*	3,490	1,247	36%	1,551	587	38%	5,041	1,834	36%
Michigan	4,403	1,003	23%	6,437	1,647	26%	10,840	2,650	24%
Minnesota	3,915	378	10%	9,794	1,455	15%	13,709	1,833	13%
Mississippi	5,653	1,118	20%	10,920	2,971	27%	16,573	4,089	25%
Missouri	10,249	2,838	28%	13,847	4,265	31%	24,096	7,103	29%
Montana	3,034	450	15%	1,828	407	22%	4,862	857	18%
Nebraska	3,507	236	7%	11,479	3,300	29%	14,986	3,536	24%
Nevada	1,092	161	15%	688	34	5%	1,780	195	11%
New Hampshire	1,500	334	22%	959	423	44%	2,459	757	31%
New Jersey	2,421	614	25%	4,049	1,162	29%	6,470	1,776	27%
New Mexico	2,966	370	12%	729	226	31%	3,695	596	16%
New York	8,329	3,226	39%	9,070	3,229	36%	17,399	6,455	37%
North Carolina	17,481	5,349	31%	763	194	25%	18,244	5,543	30%
North Dakota	1,127	63	6%	3,142	835	27%	4,269	898	21%
Ohio	11,639	2,475	21%	18,978	4,518	24%	30,617	6,993	23%
Oklahoma	7,660	1,639	21%	15,986	5,265	33%	23,646	6,904	29%
Oregon	2,681	731	27%	3,983	805	20%	6,664	1,536	23%
Pennsylvania	16,688	5,971	36%	6,874	3,159	46%	23,562	9,130	39%
Rhode Island**	606	326	54%	167	87	52%	773	413	53%
South Carolina	8,342	1,777	21%	846	314	37%	9,188	2,091	23%
South Dakota	1,807	169	9%	4,003	1,273	32%	5,810	1,442	25%
Tennessee	8,135	1,227	15%	11,400	2,240	20%	19,535	3,467	18%
Texas	32,862	4,182	13%	17,454	5,382	31%	50,316	9,564	19%
Utah	1,843	295	16%	1,020	162	16%	2,863	457	16%
Vermont	1,077	359	33%	1,606	591	37%	2,683	950	35%
Virginia	11,796	3,004	25%	1,432	443	31%	13,228	3,447	26%
Washington	3,164	951	30%	3,891	891	23%	7,055	1,842	26%
West Virginia	6,862	2,463	36%	112	77	69%	6,974	2,540	36%
Wisconsin	5,093	585	11%	8,806	1,402	16%	13,899	1,987	14%
Wyoming	1,938	95	5%	847	282	33%	2,785	377	14%
TOTALS	**288,944**	**62,454**	**21.6%**	**309,017**	**79,442**	**25.7%**	**597,961**	**141,896**	**23.7%**

*** - Massachusetts - 2008 data** **** - Rhode Island - 2007 data**

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It also becomes a capacity and a clearance issue. Although bridges can be functionally obsolete (e.g. geometrically deficiencies such as waterway openings, width, clearance issues, etc.) they are still considered safe to the motoring public even if they aren't up to the standards – such as the current-day recommended width – for modern-day standards and commerce. "We have so many oversize and overweight vehicles that go through Indiana, [and] we have to route vehicles all over the place because of structurally deficient, low-capacity or low-clearance bridges," said Bill Dittrich, state bridge inspection engineer for the Indiana Department of Transportation. "In the early to mid 1980s, we [the state of Indiana] didn't allow permitted vehicles on our interstate highways. Now, we are letting trucks go over them."

Mike Clements, Georgia Department of Transportation state bridge engineer, says that's part of the problem in his state, too. "Increased weight limits" is Georgia's major cause of bridge damage, he says.

Because structurally deficient bridges can also be a safety concern to the public, Indiana DOT's Dittrich says, highway agencies, the media and political people have keyed in on that term, "structurally deficient." But that is not where the money is being spent. "We're spending a ton of money on adding capacity, but not addressing structurally deficient the way we should. Many of our existing bridges are reaching the point where they are now becoming structurally deficient.," he says. Bridges can be neglected for a while and their condition won't change a great deal. But all of a sudden, Dittrich says, "there will be a whole lot of structurally deficient bridges and there just isn't the money to address them all at once."

The training and retention predicament

Training and retention is a major concern when it comes to bridge inspection and repair. It's no secret that the construction industry faces a shortage of qualified workers, and it carries over into bridge repair and inspection. "Bridge inspectors aren't given the respect they should be," Dittrich says, adding that a mindset exists that "anyone can do the work." But it's to

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Q A

What major overhauls are needed to the systems of planning, building and maintaining bridges in the United States at the federal, state and local level? Why?

Wayne J. Seger, civil engineering manager 2, Tennessee Department of Transportation, Bridge Inspection/Repair Office: **"Keep politics out of bridge replacement selection. Replacement selection should be need-based only. Do not divert bridge funds to other programs."**

Al Harris, resource management analyst, Kentucky Transportation Cabinet, Divisionof Maintenance: **"Less money spent on architecturally pleasing details and more on maintenance friendly bridges."**

Anwar Ahmad, assistant bridge engineer with the Virginia Department of Transportation: **"Adoption of a national 'maintenance and preservation first' policy supported by a reliable and sustained funding mechanism. Focusing on deficient bridges alone will lead bridge owners to focus on addressing or reacting to worst-condition first [bridges]. A successful bridge program should have three focus areas: 1.) Ordinary and preventive maintenance, 2.) Rehabilitation, and 3.) Replacement and new construction. In most cases, the most feasible treatment for a deficient bridge is replacement. The same or higher emphasis needs to be placed on preservation as placed on replacement and new construction activities and needs."**

Paul Santo, bridge design engineer, Hawaii Department of Transportation: **"More funding at all levels."**

How deficient and obsolete bridges breakout in 2009

States and the District of Columbia have provided separate counts for the latest numbers on the breakdown of their structurally deficient and functionally obsolete bridges.

State	Interstate & State Bridges							City/County/Township Bridges						
	Total Bridges	Total FO	%	Total SD	%	Total *SD/FO	%	Total Bridges	Total FO	%	Total SD	%	Total *SD/FO	%
Alabama	5,720	987	17%	186	3%	1,173	21%	10,086	1,056	10%	1,409	14%	2,465	24%
Alaska	807	91	11%	73	9%	164	20%	142	24	17%	28	20%	52	37%
Arizona	4,719	488	10%	73	2%	561	12%	2,558	217	8%	56	2%	273	11%
Arkansas	7,176	807	11%	295	4%	1,102	15%	5,230	868	17%	612	12%	1,480	28%
California	12,325	1,135	9%	757	6%	1,892	15%	11,626	1,437	12%	1,194	10%	2,631	23%
Colorado	3,429	239	7%	244	7%	483	14%	4,690	322	7%	312	7%	634	14%
Connecticut	2,932	896	31%	179	6%	1,075	37%	1,244	224	18%	208	17%	432	35%
Delaware	849	124	15%	33	4%	157	18%	9	2	22%	2	22%	4	44%
District Of Columbia	215	99	46%	19	9%	118	55%	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Florida	6,166	791	13%	65	1%	856	14%	4,884	932	19%	184	4%	1,116	23%
Georgia	6,046	676	11%	97	2%	773	13%	8,521	1,132	13%	849	10%	1,981	23%
Hawaii	773	256	33%	41	5%	297	38%	402	84	21%	65	16%	149	37%
Idaho	1,289	202	16%	71	6%	273	21%	2,339	150	6%	266	11%	416	18%
Illinois	8,176	979	12%	726	9%	1,705	21%	18,078	1,052	6%	1,686	9%	2,738	15%
Indiana	5,717	621	11%	307	5%	928	16%	12,871	1,556	12%	1,607	12%	3,163	25%
Iowa	4,092	307	8%	232	6%	539	13%	20,707	1,013	5%	5,126	25%	6,139	30%
Kansas	5,376	704	13%	68	1%	772	14%	20,562	1,548	8%	2,833	14%	4,381	21%
Kentucky	8,870	1,922	22%	667	8%	2,589	29%	4,736	721	15%	562	12%	1,283	27%
Louisiana	7,934	1,543	19%	650	8%	2,193	28%	5,220	612	12%	1,062	20%	1,674	32%
Maine	2,074	307	15%	242	12%	549	26%	211	12	6%	75	36%	87	41%
Maryland	2,899	501	17%	118	4%	619	21%	2,240	469	21%	249	11%	718	32%
Massachusetts*	3,490	902	26%	345	10%	1,247	36%	1,551	364	23%	223	14%	587	38%
Michigan	4,403	627	14%	376	9%	1,003	23%	6,437	576	9%	1,071	17%	1,647	26%
Minnesota	3,915	240	6%	138	4%	378	10%	9,794	327	3%	1,128	12%	1,455	15%
Mississippi	5,653	779	14%	339	6%	1,118	20%	10,920	486	4%	2,485	23%	2,971	27%
Missouri	10,249	1,121	11%	1,717	17%	2,838	28%	13,847	1,707	12%	2,558	18%	4,265	31%
Montana	3,034	388	13%	62	2%	450	15%	1,828	268	15%	139	8%	407	22%
Nebraska	3,507	96	3%	140	4%	236	7%	11,479	1,016	9%	2,284	20%	3,300	29%
Nevada	1,092	142	13%	19	2%	161	15%	688	18	3%	16	2%	34	5%
New Hampshire	1,500	194	13%	140	9%	334	22%	959	181	19%	242	25%	423	44%
New Jersey	2,421	341	14%	273	11%	614	25%	4,049	769	19%	393	10%	1,162	29%
New Mexico	2,966	155	5%	215	7%	370	12%	729	131	18%	95	13%	226	31%
New York	8,329	2,512	30%	714	9%	3,226	39%	9,070	1,818	20%	1,411	16%	3,229	36%
North Carolina	17,481	2,719	16%	2,630	15%	5,349	31%	763	105	14%	89	12%	194	25%
North Dakota	1,127	36	3%	27	2%	63	6%	3,142	233	7%	602	19%	835	27%
Ohio	11,639	1,897	16%	578	5%	2,475	21%	18,978	2,119	11%	2,399	13%	4,518	24%
Oklahoma	7,660	800	10%	839	11%	1,639	21%	15,986	824	5%	4,441	28%	5,265	33%
Oregon	2,681	596	22%	135	5%	731	27%	3,983	510	13%	295	7%	805	20%
Pennsylvania	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rhode Island**	606	176	29%	150	25%	326	54%	167	42	25%	45	27%	87	52%
South Carolina	8,342	761	9%	1,016	12%	1,777	21%	846	85	10%	229	27%	314	37%
South Dakota	1,807	95	5%	74	4%	169	9%	4,003	136	3%	1,137	28%	1,273	32%
Tennessee	8,135	916	11%	311	4%	1,227	15%	11,400	1,455	13%	785	7%	2,240	20%
Texas	32,862	3,836	12%	346	1%	4,182	13%	17,454	3,922	22%	1,460	8%	5,382	31%
Utah	1,843	210	11%	85	5%	295	16%	1,020	73	7%	89	9%	162	16%
Vermont	1,077	181	17%	178	17%	359	33%	1,606	336	21%	255	16%	591	37%
Virginia	11,796	1,915	16%	1,089	9%	3,004	25%	1,432	300	21%	143	10%	443	31%
Washington	3,164	799	25%	152	5%	951	30%	3,891	663	17%	228	6%	891	23%
West Virginia	6,862	1,473	21%	990	14%	2,463	36%	112	44	39%	33	29%	77	69%
Wisconsin	5,093	386	8%	199	4%	585	11%	8,806	387	4%	1,015	12%	1,402	16%
Wyoming	1,938	16	1%	79	4%	95	5%	847	109	13%	173	20%	282	33%
Totals[+]	**272,256**	**37,984**	**14.0%**	**18,499**	**6.8%**	**56,483**	**20.7%**	**302,143**	**32,435**	**10.7%**	**43,848**	**14.5%**	**76,283**	**25.2%**

[+] Pennsylvania did not report SD/FO breakdowns

Better Bridges Bridge Inventory 2009

Combined Total All Bridges

Total Bridges	Total FO	%	Total SD	%	Total *SD/FO	%
15,806	2,043	13%	1,595	10%	3,638	23%
949	115	12%	101	11%	216	23%
7,277	705	10%	129	2%	834	11%
12,406	1,675	14%	907	7%	2,582	21%
23,951	2,572	11%	1,951	8%	4,523	19%
8,119	561	7%	556	7%	1,117	14%
4,176	1,120	27%	387	9%	1,507	36%
858	126	15%	35	4%	161	19%
215	99	46%	19	9%	118	55%
11,050	1,723	16%	249	2%	1,972	18%
14,567	1,808	12%	946	6%	2,754	19%
1,175	340	29%	106	9%	446	38%
3,628	352	10%	337	9%	689	19%
26,254	2,031	8%	2,412	9%	4,443	17%
18,588	2,177	12%	1,914	10%	4,091	22%
24,799	1,320	5%	5,358	22%	6,678	27%
25,938	2,252	9%	2,901	11%	5,153	20%
13,606	2,643	19%	1,229	9%	3,872	28%
13,154	2,155	16%	1,712	13%	3,867	29%
2,285	319	14%	317	14%	636	28%
5,139	970	19%	367	7%	1,337	26%
5,041	1,266	25%	568	11%	1,834	36%
10,840	1,203	11%	1,447	13%	2,650	24%
13,709	567	4%	1,266	9%	1,833	13%
16,573	1,265	8%	2,824	17%	4,089	25%
24,096	2,828	12%	4,275	18%	7,103	29%
4,862	656	13%	201	4%	857	18%
14,986	1,112	7%	2,424	16%	3,536	24%
1,780	160	9%	35	2%	195	11%
2,459	375	15%	382	16%	757	31%
6,470	1,110	17%	666	10%	1,776	27%
3,695	286	8%	310	8%	596	16%
17,399	4,330	25%	2,125	12%	6,455	37%
18,244	2,824	15%	2,719	15%	5,543	30%
4,269	269	6%	629	15%	898	21%
30,617	4,016	13%	2,977	10%	6,993	23%
23,646	1,624	7%	5,280	22%	6,904	29%
6,664	1,106	17%	430	6%	1,536	23%
n/a	n/a	n/a	n/a	n/a	n/a	n/a
773	218	28%	195	25%	413	53%
9,188	846	9%	1,245	14%	2,091	23%
5,810	231	4%	1,211	21%	1,442	25%
19,535	2,371	12%	1,096	6%	3,467	18%
50,316	7,758	15%	1,806	4%	9,564	19%
2,863	283	10%	174	6%	457	16%
2,683	517	19%	433	16%	950	35%
13,228	2,215	17%	1,232	9%	3,447	26%
7,055	1,462	21%	380	5%	1,842	26%
6,974	1,517	22%	1,023	15%	2,540	36%
13,899	773	6%	1,214	9%	1,987	14%
2,785	125	4%	252	9%	377	14%
574,399	**70,419**	**12.3%**	**62,347**	**10.9%**	**132,766**	**23.1%**

*** - Massachusetts - 2008 data** **** - Rhode Island - 2007 data**

Better Bridges
Bridge Inventory
2009

America's Bridges < continued

the contrary. "The qualifications keep increasing," Dittrich says, "and you need training." He likens it to an untrained paramedic showing up to an emergency scene. "You don't want to have a guy to show up in an ambulance who hasn't had CPR training in 10 years," Dittrich notes. "Half of my inspectors aren't engineers, but they are expected to know things an engineer would know…and we don't have adequate funds for training and travel to training. If I can't keep them up to date, how can they be expected to see the problems they need to see? Or, they may see them [problems] but not understand what is significant and what isn't."

The growth of virtual training tool such as Webinars has helped somewhat with the lack of funds for training. However, when there are a limited number of inspectors this training takes time away from fieldwork regardless whether it's on a computer or in person traveling to a training site. Dittrich points out that one of his inspectors just completed a Webinar on gusset plates but that employee said he ended up working for what seemed like 24 hours if he counted in virtual training and completing paperwork on bridge inspection reports. "You can inspect all you want, but it doesn't do any good if you don't have enough personnel or enough funding to address

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Q&A

If you could change any aspect of your department to improve your bridges, what would it be?

Noel Clocksin, secondary road engineer for the South Dakota Department of Transportation: **"A more streamlined federal aid process and state process for local structure so we can get deficient structures replaced more quickly."**

Paul Jensen, Montana Department of Highways' Bridge Bureau: **"Increased maintenance because repair is cheaper then replace[ment]."**

Alan Kowalik, P.E., bridge inspection engineer for the Texas State Department of Transportation: **"More bridge maintenance to keep them from becoming '50."**

Dan Holderman, P.E., bridge management engineer with the North Carolina Department of Transportation: **"Bridge funding [because] more bridges become deficient each year than are removed from the list, [and a] larger dedicated bridge maintenance fund."**

Don Cooney, infrastructure project management administration, Department of Transportation, Asset Management Division, Washington, D.C.: **"Improvement in the promptness of funding and procurement."**

Lee Floyd, bridge maintenance engineer, South Carolina Department of Highways: **"Prioritizing. [The] Commission took away a good system."**

Al Harris, resource management analyst, Kentucky Transportation Cabinet, Division of Maintenance: **"Preventative maintenance costs less than waiting for a bridge element to go bad and then replacing it."**

Travis McDaniel, P.E., bridge engineer, Wisconsin Department of Transportation: **"More focus on preventative maintenance."**

Charles P. Brand, bridge engineer with the Arkansas Department Highway Transportation Department: **"Implement bridge management with a staff dedicated to only that function [to] stretch funding $$ more efficiently and cost effectively."**

Chris Potter, Utah Department of Transportation, Bridge Design & Operations: **"Have dedicates structures staff to oversee bridge construction. Our construction inspectors don't have the experience to oversee all aspects of a bridge construction."**

Mitchell K. Carrs, P.E., bridge engineer, Mississippi Department of Transportation: **Reduce bottlenecks in project processes to expedite bridge replacements and rehabilitation, specifically environmental.**

Tom C. Styrbicki, P.E., bridge construction and maintenance engineer, Minnesota Department of Transportation Bridge Office: **"Increase funding for bridge replacement and repair to maintain a network condition level that is acceptable."**

the problems that are found," Dittrich said. There is enough work to keep his inspectors busy all the time, he says, but it's still a major problem if they aren't properly trained or if there aren't enough of them to get the job done and done well. "Not having enough personnel is our No. 1 problem. The work keeps increasing therefore everyone has to do more."

Though Congress and the Federal Highway Administration (FHWA) approved funds in the last highway bill – SAFETEA-LU – that were to be used for training and development and would cover travel, per diem, etc., the money ultimately comes off the top of the money a state gets for its bridge program, Dittrich says. "We're caught in a situation. The federal government and Congress said, 'We made money available,' but the states need money for construction. That means we don't have money to give to the guys for training. I think every state has this kind of issue. The regular money we get, we use the best we can. But we aren't necessarily being effective with getting the structurally deficient bridges taken care of."

Dittrich says to address the need for better training, his state inspectors have peer group meetings 4 to 6 times a year. Bridge inspectors from throughout the state get together to talk about ideas, inspection and repair methods that have and have not worked, creating a forum to share knowledge.

"Nothing frustrates a bridge inspector more than to see something that's fixed and have it fail again in five years," Dittrich says. "If you put a new deck down and it's not cured properly, then it cracks, salt gets in, and it deteriorates. But decks and concrete can be made and cured right. It all starts with the mix and rebar…knowing where to stop the rebar."

This is where the training comes in, Dittrich points out, because it can mean the difference between a bridge that lasts and a bridge that falls into disrepair before its time. "If you jackhammer off all the bad concrete, , you still have good with chlorides in it," he points out. "You'll have new concrete with no chlorides next to old concrete with chlorides. This difference in chloride concentration will set up a battery cell which will accelerate the corrosion of the rebars in the vicinity. Therefore testing should be conducted prior to making repairs to see if the choride levels are low enough to use zinc anodes, or if more advanced cathodic protection is required.

"That means you need to have a corrosion specialist go through it," Dittrich points out. "But this is all new stuff – it's not done on a widespread basis. We'd love to have our maintenance people be able to do this when they make a patch because they fix an area…when they come back a year later, it's worse than ever. It all comes back to training, so when they start [on a project], they [know how to] do it right so it will last."

Environmental challenges

Environmental restrictions continue to affect how well states and municipalities can replace and repair deficient bridges. These restrictions often slow down the process of repairing and replacing bridges, and sometimes, a less-appropriate structure type is used to replace the bridge, KDOT's Jones notes. This just exacerbates the problem of structurally deficient bridges because more appropriate materials that would

keep a bridge in better condition longer are not used.

"When a small span structure can efficiently be replaced with a standard box culvert, the environmental regulatory agencies providing oversight feel that culvert floor is considered 'loss of stream length' and has to be mitigated," Jones points out. "Also, if there are threatened or endangered species present or perceived to be present, that also has to be mitigated."

The process for reviewing this is complicated by the wide variations in what is considered "acceptable," even to the point that it depends on who in the various agencies is conducting the review, he says.

"Additionally, we must develop a full set of plans, then send it in and wait," Jones says. "The process is difficult, time consuming and expensive. The frustrating part is [that] some of the reviewers do not understand the bridge engineering principles involved. And some of solutions are not hydraulically feasible."

Adds Steve Anderson from Nebraska's Department of Roads, Bridge Division: "Environmental constraints hamper the swift programming and completion of projects."

Time is ticking

Time constraints are also a major roadblock to repairing and rebuilding the bridges that need the most work, says Dittrich.

"When it came to using ARRA Funds, often the the bridges that needed the most work, weren't the ones worked on," Dittrich says. "I had a number of bridges that we proposed in the early part of the ARRA Program that we wanted to work on and do them right." But as time progressed, he says, the deadlines were getting closer and closer so although the agency had money to spend, functionally obsolete or structurally deficient bridges weren't the ones necessarily worked on. Basic maintenance was done to some of the bridges, but Dittrich says his agency will have to go back and do additional work on those where we couldn't take care of all the problems. "To increase the vertical clearance under bridge to address the obsolescence can take a while unless a project is ready to go," Dittrich notes.

And the time to finish a project once it does get underway is problematic. For example, he says, when it's time to do a concrete pour, "instead of slowing down to do it right, as soon as concrete trucks get out there [on the jobsite], people just rush, rush, rush. Everyone is in a hurry."

Richard Dunne, P.E., manager of structural engineering for the New Jersey Department of Transportation (NJDOT), also feels the time crunch. He says if he could change any aspect of his department to improve the bridges under its jurisdiction, it would be "[a] willing[ness] to inconvenience motorists more." Currently, Dunne says, "we do the majority of our work at night and/or in very small time windows."

The Kansas Department of Transportation also identifies with this challenge. "It seems like no one wants to take the heat for detouring traffic, so we end up carrying traffic through construction, which requires the work to be phased," says KDOT's John Jones. "In some instances – like a rail repair – this is less of an issue. However, for deck repair or replacement, this becomes challenging." ❖