Sounding confident

As MoDOT program comes to close, U.S. as whole makes slow progress on deficient bridges

Most of Missouri's lowest-rated bridges are now safe and sound, or will be by the end of the year. Beyond that, the state is locked into a house of uncertainty.

By Bill Wilson
Editorial Director

Arguably the most effective bridge maintenance efforts in recent memory, the Missouri Department of Transportation's (MoDOT) $685 million Safe and Sound Bridge Delivery Program is expected to run out of life in September, more than a year ahead of schedule, but not before 804 of the most susceptible crossings were strengthened.

According to MoDOT special assignments coordinator Bob Brendel, in just three years Missouri has reduced the number of deficient bridges by more than 400, reversing a negative trend that weighed heavily on the minds of MoDOT personnel for decades.

"In a short period of time we have taken a big bite out of the apple," Brendel told Roads & Bridges.

It may be a long time before the Safe and Sound success is duplicated. According to Brendel, MoDOT's construction budget is about half of what it was seven years ago, and the agency has reverted to maintenance-only mode.

"With this program, we sold bonds and we are paying it back with a percentage of our federal bridge dollars, but we do not have the opportunity to do that again right now."

At press time, prime contractor KTU Constructors had rehabbed a total of 684 bridges, most averaging 150 ft long and 24 ft wide, and 41 more were currently under construction. The program, however, almost did not make it out of March with federal funding set to expire. The 90-day extension passed by Congress, and criticized by many, actually kept MoDOT's most important initiative going.

"If they hadn't passed the extension we were going to cancel our April letting, which probably would have had a much more negative impact," said Brendel.

Once the learning curve was conquered, the Safe and Sound movement became swift and nimble. At the beginning, KTU Constructors wondered how it was going to move workers, equipment and materials across the state. The strategy was to hit the major routes and work out from there.

The state of the bridge network in Kansas City also helped simplify matters. Since a bulk of the deficient bridges—almost half according to Brendel—were located in northwest Missouri, KTU Constructors spent much of the first two years in the area before branching out.

Transporting equipment also called for some creative thinking. To speed project delivery, precast concrete beams have been used extensively, which require large cranes for assembly. Load-rated bridges often got in the way, and KTU Constructors had to work around them to reach some bridge sites.

Brendel recalled one bridge close to the Iowa state line called for the contractor to access from the Iowa side, which required a change in schedule because Missouri's neighbor has a load restriction on roads until after the last frost of the season.

KTU Constructors also took full advantage of deficient bridges that were close together, sometimes closing down as many as three of them at the same time to make the necessary repairs.

The great floods of 2011 tossed another layer of discomfort on the scene, which required KTU Constructors to be flexible enough to shut a project down mid-stream due to the weather and move to drier working conditions before returning a few weeks later.

The average design-build bridge closure has been 42 days. Traditional bridge repair delivery usually lasts 90 days.

Little by little

Once again Roads & Bridges surveyed bridge owners across the U.S. and asked them about the condition of their span network, and it does appear that state DOTs are slowly chipping away at the deficiencies. Back in 2010, 25% said the number of functionally obsolete bridges had gone up in their state, while 11% indicated they were down and 64% said the figure had stayed the same. This year, just over 22% said functionally obsolete bridges increased, while 16% said the number actually declined. Sixty-one percent reported no difference.

On the structurally deficient side, 32% of R&B survey respondents said the number had gone up in 2010, 17% said it was down and 51% said the number remained flat. Two years later, just over 30% claimed the number of structurally deficient bridges was on the rise, while 21.9% indicated the number was down

Table 1. Deficient Bridges by State

State	# Bridges	# SD	# FO	# Def	Area	SD Area	FO Area	Def Area
Alabama	16,061	1,518	2,056	3,574	8,951,183	358,765	1,412,498	1,771,264
Alaska	1,156	131	119	250	658,466	64,949	79,674	144,623
Arizona	7,738	259	669	928	4,880,545	194,277	832,849	1,027,126
Arkansas	12,641	886	1,856	2,742	6,104,343	422,813	790,979	1,213,792
California	24,609	2,927	3,968	6,895	27,856,257	4,402,810	5,907,555	10,310,365
Colorado	8,551	582	798	1,380	4,728,436	324,030	534,648	858,678
Connecticut	4,200	390	1,023	1,413	3,278,853	508,000	851,197	1,359,197
Delaware	857	50	111	161	886,595	59,308	169,262	228,569
District of Columbia	245	32	127	159	548,534	121,850	262,785	384,635
Florida	11,986	273	1,557	1,830	15,947,295	501,448	1,708,459	2,209,908
Georgia	14,694	901	1,760	2,661	8,983,388	315,494	1,098,645	1,414,139
Hawaii	1,132	144	362	506	1,309,322	43,339	153,515	196,854
Idaho	4,164	371	411	782	1,617,191	129,136	206,846	335,981
Illinois	26,436	2,319	1,742	4,061	12,700,113	1,178,179	1,890,903	3,069,081
Indiana	18,640	2,043	1,896	3,939	7,602,822	771,594	902,258	1,673,852
Iowa	24,537	5,408	1,211	6,619	7,918,241	1,027,294	607,347	1,634,641
Kansas	25,233	2,742	1,852	4,594	8,017,130	418,102	964,408	1,382,510
Kentucky	13,948	1,282	2,975	4,257	5,814,431	416,709	1,065,714	1,482,423
Louisiana	13,153	1,637	1,998	3,635	15,459,876	1,311,556	3,086,887	4,398,443
Maine	2,402	342	379	721	1,203,588	157,175	212,710	369,886
Maryland	5,214	354	954	1,308	4,850,337	240,319	1,032,887	1,273,206
Massachusetts	5,099	517	1,970	2,487	3,995,325	627,455	1,490,585	2,118,040
Michigan	10,957	1,288	1,378	2,666	6,200,619	519,149	1,256,927	1,776,075
Minnesota	13,117	1,082	379	1,461	6,135,900	298,027	334,884	632,911
Mississippi	17,032	2,480	1,349	3,829	8,671,427	602,196	805,688	1,407,885
Missouri	24,286	3,783	2,937	6,720	10,166,842	1,092,602	1,341,028	2,433,630
Montana	5,097	386	480	866	1,951,887	119,771	247,677	367,448
Nebraska	15,395	2,757	974	3,731	3,881,523	354,731	265,509	620,239
Nevada	1,783	40	176	216	1,411,994	15,707	181,660	197,367
New Hampshire	2,423	364	382	746	1,061,054	129,966	148,480	278,447
New Jersey	6,514	656	1,632	2,288	6,588,208	665,412	1,823,572	2,488,984
New Mexico	3,932	322	314	636	1,661,742	135,989	115,713	251,701
New York	17,384	2,092	4,337	6,429	12,670,592	1,756,243	5,218,944	6,975,187
North Carolina	18,214	2,334	2,603	4,937	8,767,108	1,002,729	1,054,999	2,057,728
North Dakota	4,410	719	222	941	1,210,675	85,286	45,218	130,504
Ohio	27,403	2,654	3,727	6,381	13,288,223	1,044,463	2,842,205	3,886,668
Oklahoma	23,730	5,244	1,540	6,784	8,293,455	1,225,601	758,371	1,983,972
Oregon	7,353	448	1,175	1,623	4,812,021	289,432	1,151,338	1,440,770
Pennsylvania	22,320	5,563	3,749	9,312	12,400,088	2,057,870	2,883,705	4,941,575
Rhode Island	751	158	223	381	771,017	183,426	229,915	413,341
South Carolina	9,270	1,155	788	1,943	6,624,856	548,966	579,073	1,128,039
South Dakota	5,877	1,217	218	1,435	1,662,166	190,725	94,825	285,549
Tennessee	19,937	1,260	2,595	3,855	9,211,083	509,353	1,317,494	1,826,847
Texas	51,862	1,533	7,527	9,060	42,658,993	786,142	7,110,239	7,896,380
Utah	2,946	121	293	414	1,838,207	38,069	165,461	203,530
Vermont	2,717	254	557	811	842,490	70,107	123,371	193,478
Virginia	13,524	1,261	2,141	3,402	9,081,335	566,541	1,507,929	2,074,470
Washington	7,743	391	1,548	1,939	6,789,382	748,296	1,695,680	2,443,976
West Virginia	7,099	990	1,511	2,501	3,423,490	325,417	499,198	824,615
Wisconsin	14,024	1,204	694	1,898	6,338,056	350,597	504,587	855,183
Wyoming	3,068	411	261	672	1,238,371	177,451	102,266	279,717
Puerto Rico	2,222	251	859	1,110	2,082,626	217,308	487,392	704,700
TOTALS	**605,086**	**67,526**	**76,363**	**143,889**	**355,047,700**	**29,702,170**	**60,155,959**	**89,858,130**

Source: FHWA

compared with a year ago and 47.3% said there was no change.

"In terms of bridge conditions, the state of America's bridges has improved, and the total number of deficient bridges has declined," Thomas Everett, P.E., team leader for the FHWA's Highway Bridge Program and National Bridge Inspection Program, told Roads & Bridges via e-mail. "This downward and positive trend is undoubtedly the result of more attention and resources devoted to bridges.

"The greatest challenge continues to be establishing a sustained funding source to adequately address bridge needs."

The state of New Jersey is aggressively attempting to meet that challenge. For FY 2013, the DOT is proposing a $3.2 billion plan, with $685 million dedicated to bridge repair and rehabilitation. The hope is to cut the 303 structurally deficient spans in half over the next nine years. The plan relies on a combination of federal, state and other sources of revenue. Revenue will be derived from debt issues (bonds) and pay-as-you-go, or cash.

If approved by the state legislature, part of the $685 million will help advance the $1.5 billion Pulaski Skyway rehabilitation project.

Some counties in Texas continue to stretch the dollar, but if they still cannot come up with the necessary funding to repair a bridge it can always use a limber worker or two. Bartering remains an

PBES making every day count for bridge owners

The Federal Highway Administration's (FHWA) Every Day Counts (EDC) initiative aims to identify and deploy innovation that can shorten project delivery, enhance roadway safety and protect the environment. Prefabricated bridge elements and systems (PBES), an accelerated bridge construction (ABC) strategy, is an innovation that has gained notable attention since the EDC initiative began in October 2010.

So far, 40 states, the District of Columbia and Puerto Rico, and all three of FHWA's Federal Lands Highway Divisions have begun to implement PBES into their bridge design and construction programs. In nine bridge-replacement projects nationwide, PBES used in tandem with strategic innovative contracting techniques saved $30 million, according to a FHWA cost study done before the EDC kickoff. Since the start of the EDC initiative, over 600 bridges have been designed or constructed using PBES.

"The EDC program has encouraged decision makers to realize the benefits of PBES, which has allowed bridge practitioners the opportunity to advance it and other innovations into the mainstream of the bridge industry," said Louis Triandafilou, P.E., who leads the Bridge and Foundation Engineering Team in FHWA's Office of Infrastructure Research and Development.

PBES are structural components of a bridge that are built away from the final bridge alignment to reduce the time of on-site construction and mobility impact that affects the traveling public. Effective for small and large projects, PBES applications range from deck, superstructure and substructure replacement elements to modular superstructure system replacements to complete bridge replacements.

Prefabricating deck, beam, pier, abutment and wall elements, as well as miscellaneous bridge elements such as approach slabs and parapets, can reduce on-site construction time, traffic delays and environmental impacts and improve work-zone safety, site constructability and material quality.

"This kind of innovation is exactly what President Obama means when he asks us to be smarter in the way we do business," said U.S. Transportation Secretary Ray LaHood last year. "Getting these bridges up and open to traffic quickly saves money and keeps traffic moving."

Typically, conventional bridge-construction methods involve building the substructure, superstructure, deck and other elements on-site in a linear manner, often alongside ongoing traffic. With PBES, components can be prefabricated concurrently and delivered as needed, saving time and reducing costs. Prefabricated elements are usually cast in a climate-controlled environment indoors, reducing the time spent on construction and making weather-related delays less frequent. Reduced construction time also means reduced hazards associated with dangerous settings and moving traffic. As the amount of heavy equipment time needed on-site for bridge construction is reduced, so is the environmental impact.

Last year, FHWA released a comprehensive manual, "Accelerated Bridge Construction: Experience in Design, Fabrication, and Erection of Prefabricated Bridge Elements and Systems (Pub. No. FHWA-HIF-12-013)," to assist transportation agencies and contractors in implementing ABC-PBES practices. The manual discusses major components used in ABC deployment, including PBES applications, and offers guidance on project planning, construction and inspection activities.

Over the past few years, FHWA's Highways for LIFE program has completed five PBES showcases. The program works with the industry to promote innovations that improve safety during and after construction, reduce construction-related traffic congestion and improve the quality of highway infrastructure. The showcases have attracted more than 100 people, representing FHWA, state departments of transportation, the contracting and materials industries, consultant engineering firms and academia.

In 2011, during the weekends between June and August, the Massachusetts Department of Transportation replaced 14 bridges on I-93 in Medford, Mass., using technologies promoted by the Highways for LIFE program, including PBES and other ABC solutions.

"These technologies help keep traffic moving, which lets people spend less time in their cars and have more time doing the things they enjoy," said FHWA Administrator Victor Mendez after watching some of the rapid construction.

Replacing all 14 bridges using conventional bridge construction methods would have cost much more and taken four years or longer to complete the work, during which time drivers would face long-term lane closures. **R&B**

Figure 1. Over the last year, has the number of your functionally obsolete bridges gone up, down or stayed relatively the same?

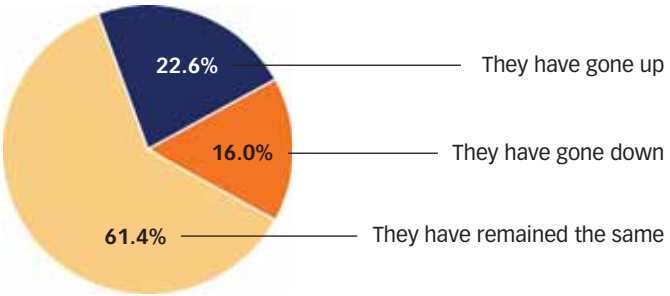
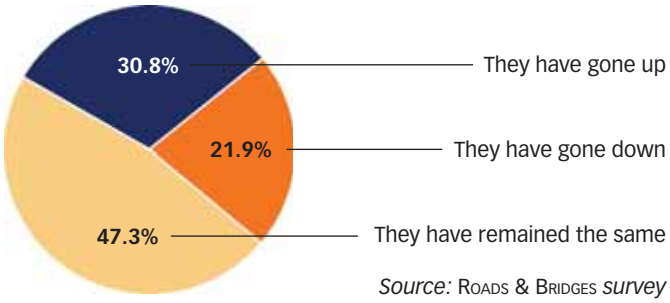


Figure 2. Over the last year, has the number of your structurally deficient bridges gone up, down or stayed relatively the same?



Source: Roads & Bridges *survey*

effective tool for the Texas Department of Transportation (TxDOT), which oversees a total of 51,808 bridges and claims more than 80% are in good or better condition.

"If there are bridges on the county system that need some repairs and the county may be a little pressed financially to address them then what we do is work a trade," TxDOT spokesman Mark Cross told Roads & Bridges. "We may trade for asphalt, materials, use of equipment and man-hours to help them cover the cost."

A diligent inspection program also helps. Cross said if trouble is spotted on a span, crews will conduct multiple scans to ensure safety.

In FY 2011, contracts totaling $294.1 million were awarded to replace or rehab 364 bridges in Texas, and $363.8 million was used to build 238 bridges. Cross did not know the FY 2012 numbers, but believed they would remain about the same.

TxDOT also is taking a stab at public-private partnerships. The state legislature allowed the agency to look at a handful of projects for potential P3 development. Perhaps the most notable P3 enterprise in the country is the SH 130 project, segments five and six, in central Texas. The $1.3 billion effort will include a heavy volume of bridge work. Beam setting on overpass bridges of the SH 130/IH-10 interchange began in April. R&B

For more information about this topic, check out the Bridge Channel at www.roadsbridges.com.