

INNOVATOR

Accelerating Innovation for the American Driving Experience

Seeing is Believing, Utah Showcase on Bridge Innovation Shows

Attending a Highways for LIFE showcase in Utah featuring a historic bridge move with self-propelled modular transporters encouraged highway professionals to consider using the technique in their own states.

The March 2011 showcase was one of many Highways for LIFE sponsors to enable transportation stakeholders to see new technologies and processes in action on construction projects. The Federal Highway Administration program also provides travel expenses so that more professionals can attend the educational events.

Participants in the Utah event observed the five-hour move of the Sam White Bridge over Interstate 15 in American Fork. It was the longest two-span bridge ever moved in the Western Hemisphere by self-propelled modular transporters, computer-controlled vehicles that transport heavy loads. The next day, FHWA and the Utah Department of Transportation offered a workshop on the technical details of the move and how to incorporate accelerated bridge construction into transportation programs.

When Highways for LIFE staff sought feedback from showcase attendees, they found that several are applying what they learned in their own states:

- Three are using or plan to use self-propelled modular transporters to speed construction of a bridge project.

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Credit: Utah DOT

Transportation professionals from around the world snap photos of the historic bridge move.

Q&A With Kirk Steudle: Accelerating Innovation to Meet Public Expectations

Kirk T. Steudle, director of the Michigan Department of Transportation, is responsible for the construction, maintenance and operation of 10,000 miles of highways, 4,000 bridges and a wide range of multimodal programs. He is the 2011–12 president of the American Association of State Highway and Transportation Officials and chairs

the second Strategic Highway Research Program's oversight committee. He spoke with Innovator about using innovation to achieve results and satisfy the public.



Credit: Michigan DOT

Michigan DOT Director Kirk Steudle

As AASHTO president, one of your priorities is accelerating innovation implementation, which is also the focus of the Highways for LIFE program. Why is that important?

Our resources are constrained, the general public is demanding more efficiencies, and they're demanding that things be done better. So this is a great time to be innovative. There's a lot of energy now behind finding new and better ways of doing things.

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Early in my career, a lot of the research was kind of abstract and didn't really solve the problems we were wrestling with. The research community has really gotten focused on solving real problems for today. And we've empowered a lot of our employees at the federal level, at the state level and at the local level to find better ways of doing things. The other piece of it is technology. The availability of technology is changing the way we work.

How does using innovation help state DOTs during challenging economic times?



The contractor on a Michigan Highways for LIFE project opted to use self-adjusting temporary traffic signals to minimize motorist delay during construction.

whether they're in a department of transportation or in a management and budget office, to recognize that you may need to have some short-term pain to have long-term savings.

But using innovation can help us in a number of ways. Not only can it save us money in the long term, it can help us get better results and it can show the public we're doing things differently and being more on the cutting edge.

Another priority for you is promoting asset and performance management. Why is it important for transportation agencies to use results-driven programs?

In the early 1990s when ISTEA [Intermodal Surface Transportation Efficiency Act] was passed, they required management systems to be put in place. What we learned is that this is really good information. It gave us different insight into the decisions we were making. Those systems later matured into the pavement data systems and bridge management systems we have today. So state DOTs have been on this path for 20 years. A lot of them do a great job of measuring the assets they have.

The latest push is a strong movement to more of a performance- or results-based approach. I think that comes from society in general saying, "Let's be more accountable for the money we're spending." There's an old adage that what gets measured gets done. I really do believe that.

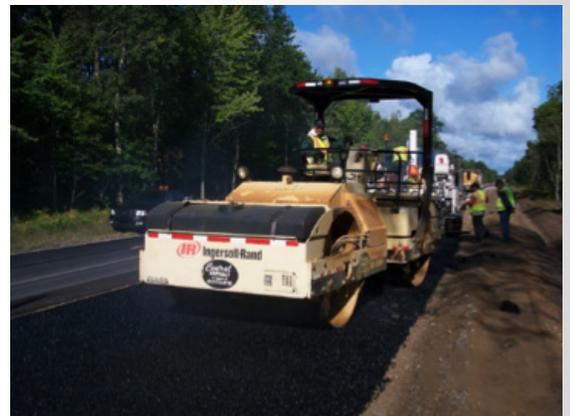
What role does performance measurement play in Michigan's transportation program?

In the late 1990s, our Michigan State Transportation Commission set a bridge and pavement condition goal. We wanted 90 percent of roads in good condition by 2007 and bridges by 2008. That drove us to abandon our "worst first" approach and develop a different method of looking at this, a whole-network approach as opposed to fixing what fell apart this year. We've taken that further and developed performance measures for the traditional hard assets, but also for the rest of the department.

One example of measures we use is serious injuries and fatalities from crashes. On almost every project we do we look at the safety aspects. If there is something we need to fix, a crash pattern we need to address, we do it. When you focus on safety within each project, you can drive crash numbers down. Our fatality rates have been falling just as they have throughout the country.

Another measure we've had in place for awhile but that we're giving even greater attention now is on time and on budget. For 10 years, the requirement from our Transportation Commission has been to manage our program within 5 percent of what it was originally bid at. Last year we ended up at 1 percent. The average over the last five years has been 2 percent.

Last January, Gov. Rick Snyder unveiled a Michigan Dashboard to tell people how we're doing. Two of those 20-some measures dealt with transportation, serious injuries and fatalities in crashes



The use of performance contracting on the M-115 rehabilitation project enabled the contractor to offer a five-year pavement warranty.

and condition of bridges. He charged each department to come up with our own dashboard, so we have an infrastructure dashboard that deals with how roads and bridges and transit and all the rest fit together from the public's perspective. We put a button for MDOT performance on the front page of our website (www.michigan.gov/mdot) so all that information is right at your fingertips.

What did you learn from the Highways for LIFE demonstration project to rehabilitate part of M-115 using performance contracting, in which you defined results and contractors proposed how to achieve them?

It was a great project for us to really get our feet wet with performance contracting and say, "What's possible here?" It was great for the contractors to figure out things they could do differently. What we got out of the project was something we could not have specified in the documents.

For example, we could not have specified the types of lane control and traffic management they used. It's a heavily traveled road in the summer, but they found a way to not impact traffic. We could not have specified that they work in that manner, but we opened it up and said we're going to award this contract based on who gives us the best value. The winning contract also included a warranty for the pavement that was longer than what we normally would have specified.

What we've done is move some of the things that were successful into the specifications and say, "We need to do this all the time." We found that contractors are more receptive to scheduling work so that it's less intrusive, so we've gotten a little more aggressive in scheduling work during off-peak times. Another piece is ride quality. The road is unbelievably smooth because that was one of the focus areas the contractor was working on, so we now know they can make it smooth. We're now trying to expand performance contracting into other areas of the department, such as maintenance.

What advice would you give your counterparts in other states about using innovation?

You have to empower people. You have to have lots of communication from the executive office in the DOT or whatever the top of the governing structure looks like in the organization. But it can't be just a top-down approach that says "thou shalt go innovate." It's about setting up a structure that allows people to participate and inject their ideas into the discussion.

A little while ago, I asked everybody in the department to tell me what we need to stop doing and what we need to do more of. I have this three-ring binder on my desk that probably has 100 suggestions in it, and I'm determined that we're going to implement at least half of them. We're still working our way through what the implementation implications are for each suggestion. Everybody's suggestion is getting a thorough evaluation. I think it's important to communicate directly with the staff to get ideas. And once you have them, you've got to follow up on them.



Massachusetts Bridge Project Makes 'Best Ideas' List

The *Boston Globe* included the Massachusetts Department of Transportation's "Fast 14" project and the Federal Highway Administration's Every Day Counts initiative on its list of "Boston's best people and ideas of 2011."

The Massachusetts DOT replaced 14 Medford bridges in less than three months rather than the four years the job would take with traditional construction practices. Keys to success cited by the newspaper were the use of prefabricated elements and rapid-setting concrete, practices encouraged by the Every Day Counts initiative to speed delivery of construction projects. The project received a Highways for LIFE grant to use innovation.



To see the list, visit www.boston.com/lifestyle/gallery/peopleideas2011?pg=17.



Using temporary bypass bridges helped the Wisconsin DOT improve safety and cut construction time nearly in half on a Highways for LIFE demonstration project.

Temporary Bridges Save Time and Money on Mississippi River Crossing

Temporary bypass bridges helped the Wisconsin Department of Transportation complete a four-bridge reconstruction project on a rural highway across the Mississippi River in nearly half the time of conventional construction methods.

The project was on Wisconsin Highway 25 between Nelson, Wis., and Wabasha, Minn., the only connection across the Mississippi between the states for more than 30 miles (48 kilometers) and a vital link for commerce and emergency vehicles. The agency received a Highways for LIFE grant to try innovation on the project to save time and money and enhance safety and quality.

During reconstruction of three of the bridges, traffic was routed onto temporary bypass bridges—a first for the Wisconsin DOT. The use of temporary bridges to maintain two-way traffic allowed the contractor to schedule all major construction activities in one season instead of two. That reduced impact on travelers by 45 percent, narrowly missing the Highways for LIFE goal of a 50 percent cut in the time traffic is affected compared to traditional staged construction.

The bypasses increased safety during construction by separating workers from traffic. They also enhanced the durability of the finished bridges by allowing for monolithic deck construction, eliminating the longitudinal deck joint used in conventional construction.

Other innovations demonstrated on the project included open bent piles, which reduced impact on adjacent wetlands; precast bridge elements, which saved time; and high-performance concrete and special approach aprons, which are expected to extend bridge service life.

Experience for Future Projects

“The experience gained on this project will give Wisconsin DOT the background for planning future projects where

these innovations could be useful,” according to a Federal Highway Administration report on the project, *Wisconsin Demonstration Project: Multiple Bridge Reconstruction on WIS 25 Across the Mississippi River*.

No construction-related crashes or worker injuries occurred during the project, which met the safety goal for Highways for LIFE projects. The finished project features wider bridges, additional off-road parking and upgraded beam guards that are expected to contribute to increased safety in the future.

Smoothness across one bridge was increased, while the other bridges stayed about the same. Although one bridge showed a 71 inches-per-mile drop in its International Roughness Index measurement, the bridges fell short of the Highways for LIFE goal. Tire-pavement sound intensity tests on two bridges showed a moderate decline in noise, although the lowest measured value was slightly higher than the Highways for LIFE goal.

Minimizing User Delays

A cost-benefit analysis revealed that the Wisconsin DOT's innovative approach generated a cost savings of \$3.6 million, or 29 percent of the \$12.5 million project cost, over conventional construction practices. A significant amount of the cost savings was from minimizing user delay costs through the use of multiple bypasses.

The amount of temporary structures needed on the project—about 66,000 square feet (6,132 square meters)—caused industry to increase its regional supply, making materials readily available for future projects. The project “provided the DOT an opportunity to push the envelope of typical construction practices in Wisconsin,” the report noted.



To read the Wisconsin and other technical reports on Highways for LIFE demonstration projects, go to www.fhwa.dot.gov/hfl/summary/projects_summary.cfm.

Seeing is Believing, Utah Showcase on Bridge Innovation Shows, continued from cover

- Five have launched efforts to evaluate the use of accelerated bridge construction techniques by their highway agencies.
- Two have given presentations to peers on what they observed at the showcase.
- Three are promoting the use of accelerated bridge construction by their agencies.
- Two have joined FHWA Every Day Counts teams in their states to expand innovation use.
- Two have already used self-propelled modular transporters and prefabricated bridge elements.

Understanding the Possibilities

“The showcase I attended was the first of this kind for me, and it helped me to expand my knowledge about the benefits of ABC,” said Albert Nako, seismic standards engineer for the Oregon DOT. “Currently, ODOT is working intensively to adopt ABC as the most practical method for building a bridge.”

Paul Vaught III, bridge standards manager for the Louisiana Department of Transportation and Development, agreed. “Seeing the innovation and technology used during the bridge move has provided me with a greater understanding of what possibilities exist in the area of rapid bridge construction and replacement,” he said, adding that his agency is drafting a standard bridge construction matrix to enable it to evaluate the use of prefabricated bridge elements and systems and self-propelled modular transporters on projects.

Attending the Utah showcase helped him understand the process, benefits and obstacles involved in accelerated bridge construction, said Michael Menghini, assistant state bridge engineer for the Wyoming DOT. “It also allowed us to meet people in the industry and discuss various types of advanced bridge construction and how they could benefit our department and the citizens of Wyoming,” he said.

Useful Information

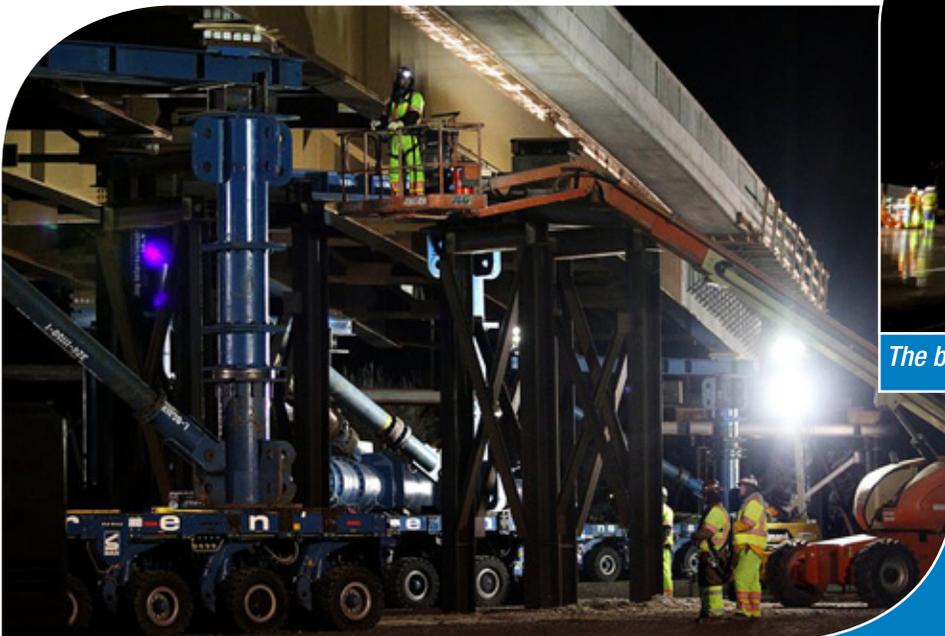
“The information gained about accelerated bridge construction will be very beneficial toward the successful completion of an ongoing project in Nevada using ABC techniques,” said Jessen Mortensen, bridge engineer.

The Minnesota DOT plans to use self-propelled modular transporters to move a bridge superstructure into place on a 2012 project. “Information and lessons learned from the Utah showcase project helped convince us the project is doable,” said Paul Rowekamp, bridge standards and research engineer.

Harividan Parikh, bridge engineer for the Pennsylvania DOT, shared what he learned at the Utah showcase in a presentation to agency colleagues. “One project is in the design process which will utilize some of the concepts learned from the Highways for LIFE event,” he said.



To sign up for future Highways for LIFE showcases, go to www.fhwa.dot.gov/hfl/events.cfm.



Crew members prepare to move the Sam White Bridge with self-propelled modular transporters.



The bridge nears its final destination over I-15.

Credit: Utah DOT

Credit: Utah DOT



States Try Precast Elements to Build Bridges Faster

The use of precast concrete elements will dramatically speed bridge construction on Highways for LIFE demonstration projects in Rhode Island and Oregon.

The Rhode Island bridge, a \$2 million, two-lane structure near East Greenwich, will consist of virtually all precast elements. Bridge construction will take just 60 days, a third of the time needed for conventional cast-in-place construction, said Rahmat Noorparvar, principal civil engineer with the Rhode Island Department of Transportation.

The Oregon bridge, a \$2.3 million, two-lane structure in Baker County, will feature full-depth precast deck panels, which the Oregon DOT has not used in general practice because of concerns about potential leakage at the deck panel construction joints. That problem has been addressed, and the contractor estimates it will take seven days to place the deck panels and cure the closure joints, compared to about 3.5 weeks for a cast-in-place deck.

More Quality, Less Maintenance

For both bridges, the use of precast concrete is expected to enhance quality and reduce maintenance requirements because the components are manufactured in a controlled environment. Accelerated bridge construction methods—mainly the use of precast concrete—will reduce the length of road closures, easing construction impact on travelers. And closing the two roads will eliminate the risk of work zone crashes. Both projects are using Highways for LIFE grants to include innovation.

Rhode Island's Frenchtown Brook Bridge No. 435, which resembles a culvert to carry Davisville Road over Frenchtown Brook, will feature precast footings, three-sided bridge segments and wall stems for the wing walls. This is the first time the Rhode Island DOT has used precast elements in nearly all segments of a bridge. The agency has made limited use of precast bridge elements in the past, but it is not standard practice, a position that may change in light of this demonstration project, said Noorparvar.

The bridge is a 150-foot-long (45.7-meter-long) structure that spans 28 feet (8.5 meters) over Frenchtown Brook. Each of the 25 three-sided precast elements is an arch shape that is 6 feet (1.8 meters) wide. The four wing walls of the structure consist of precast concrete wall stems placed on precast concrete footings.

The new U.S. 30 Burnt River Bridge in Oregon will be a 160-foot-long (48.7-meter-long) structure that passes over the Burnt River and the Union Pacific Railroad. The bridge will be 30.5 feet (9.2 meters) wide—two lanes plus shoulders.

Precast, prestressed bulb-tee girders will span from the north to south abutments. Precast deck construction will speed construction, and because the panels span the full width of the bridge, there will be no longitudinal joints, said Bruce Johnson, state bridge engineer with the Oregon DOT.

Innovative Features

Deck panels will consist of a specially formulated concrete mixture designed to minimize rutting from stud-tired tires. The Oregon DOT worked with Oregon State University and FHWA to formulate the mixture, which has a high silica fume content for abrasion resistance and low permeability.

Ultra-high-performance concrete will make up the closure pours between the deck panels. FHWA and Coreslab Corp. have developed the mixture to the point that it is ready for production use in demonstration projects. FHWA researcher Benjamin Graybeal tested closure pours under 2 million loading cycles and the closures did not crack, so they won't leak, Johnson said. Plus, the concrete can fully develop the strength of reinforcing steel over a 6-inch (152.4-millimeter) length of rebar, so the width of the closure pours can be reduced to 6 inches.

The Oregon DOT will use steel diaphragms between the prestressed girders to speed erection time compared to standard cast-in-place concrete diaphragms, Johnson said. While that feature is not new in some states, it is new to Oregon.

"Coincident with this project, our engineers have developed statewide standards that will enable us to continue with this type of construction," said Johnson. "We have identified one other bridge where we possibly could use these materials and techniques. We think the result will be more durable, longer-life bridges than we have built in the past."



Coreslab used a grant from the Highways for LIFE Technology Partnerships Program to test bridge deck panels made with ultra-high-performance concrete. For information, see www.fhwa.dot.gov/hfl/partnerships/coreslab/index.cfm.



New Manual Helps Agencies Make the Most of ABC Technologies

A new state-of-the-practice manual is available to help transportation agencies establish a successful accelerated bridge construction program.

The Federal Highway Administration published *Accelerated Bridge Construction: Experience in Design, Fabrication and Erection of Prefabricated Bridge Elements and Systems* to enable highway professionals to do the following:

- Understand the types of ABC technologies and prefabricated elements used in bridges today.



Scheduling Software Keeps Highway Agencies on Track for Project Success

More state highway agencies are taking the adage “time is money” to heart by strengthening timely project delivery, an effort aided by using sophisticated scheduling software to manage construction programs and collaborate with contractor partners.

Momentum is growing for more aggressive project management and it’s moving up to the program level, according to David Unkefer, construction and project management engineer at the Federal Highway Administration, who moderated a Web conference on the topic.

“Construction Project and Program Management Using Scheduling Software” was part of the free “Innovation” series sponsored by Highways for LIFE and the National Highway Institute. The Web conference featured the New York State Department of Transportation’s experience with a statewide scheduling management system.

Sharing Information

When the agency began implementing the system four years ago, one goal was to become more transparent by sharing information with stakeholders, said Mark White, manager of the New York State DOT Construction Project Management and Controls Group. “By the end of 2012 we hope to be posting cost and scheduling data for all projects on our website,” he said. “Another goal is for 90 percent of projects to be delivered on time and with less than 5 percent cost overruns.”

The agency wanted a Web-based system that would allow planning, design and construction staff to manage project schedules in real time; replace previously used tools with a single software product; and facilitate communication and early efforts to mitigate delays.

The solution it chose, Primavera P6 Enterprise software, is accessible in field offices and to contractors and

consultants working on projects. The agency’s information technology staff and consultants provide system support to help staff learn and use the program’s features effectively.

“The big benefit is that everybody on the project team uses the same software, we all see the same schedule, and we can all do it at the same time if we need to,” White said. Not only does it facilitate collaboration among partners, it also improves project management and reduces delays. “And once you have a schedule for all of your projects, it allows you to start using it as a program management tool.”

Real-Life Application

The New York State DOT has put the scheduling system to use on the rehabilitation of the Alexander Hamilton Bridge and Highbridge interchange ramps in Manhattan and the Bronx, one of the largest projects in the agency’s history.

Several issues have caused delays on the five-year project, including the discovery of deterioration in the arch floor beams when the bridge’s concrete deck was removed. The project team mitigated delays by using the software to perform what-if scenarios and making adjustments such as stage changes.

“We were able to use the [Primavera] schedule to model these efforts and get buy-in from the whole project team, all because we maintained the integrity of the schedule,” said Frank Perricelli, lead schedule reviewer on the project and associate vice president at AECOM Transportation.

A well-maintained schedule can help avoid project claims, said Scott Lowe, principal of Trauner Consulting Services. “Ninety-nine percent of the claims I see have delay as a component, and the reason is we don’t have good time management systems and supporting tools on our projects. Because of that, we often don’t have an established way of resolving our differences.”

A good solution is a critical path method scheduling system, which can be developed using software such as Primavera. This provides a clear record of the schedule for a project’s completion, which can be used to resolve issues. “Right now we’re clearly in our infancy” in the highway industry with the use of enterprise, or organization-wide, installations such as the one at the New York State DOT, Lowe said. “The good news is we are implementing CPM scheduling more and more at DOTs across the country.”

- Assess specific sites for the most appropriate ABC technology use on a project.
- Implement an ABC construction program using prefabricated bridge elements and systems.
- Understand the long-term durability of bridges built with prefabricated components.



To download the manual, go to www.fhwa.dot.gov/bridge/abc/docs/abcmanual.pdf



To view a recording of the Web conference and register for future “Innovation” sessions, go to www.fhwa.dot.gov/hfl/innovations/webinars.cfm.



World of Asphalt, March 13–15, 2012, Charlotte, N.C.
Information at www.worldofasphalt.com.

Bridge Preservation, Highways for LIFE/National Highway Institute Innovation Web Conference, March 15, 2012, 2:30 to 4 p.m. ET. Register at www.fhwa.dot.gov/hfl/innovations/webinars.cfm.

American Concrete Institute Spring Convention, March 18–22, 2012, Dallas, Texas. Go to www.concrete.org/events/ev_conventions.htm.

Conference on Transportation Asset Management: Making Asset Management Work in Your Organization, April 16–18, 2012, San Diego, Calif. See www.trb.org/conferences/assetmanagement2012.

Design/Build in Transportation Conference, April 25–27, 2012, Phoenix, Ariz. Details at www.dbtranspo.com/index.cfm.

ITS America Annual Meeting and Exposition, May 21–23, 2012, National Harbor, Md. Register at www.itsa.org/events/majorconferences/2012-meeting.

RILEM International Conference on Cracking in Pavements, June 20–22, 2012, Delft, Netherlands. Information at www.rilem2012.org.

Innovator, published by the FHWA Highways for LIFE program, advances implementation of innovative technologies and processes in the highway industry. Its audience is transportation professionals in highway agencies, trade and research groups, academia and the private sector, and the driving public.

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