The Great Dam

Dam Removal: A lengthy public decision-making process leads to a successful outcome

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It is one of the largest dam removal projects in New Hampshire history—not to mention one of the most complex. Deftly and carefully balancing a constrained budget, public needs, stakeholder expectations, and regulatory considerations were critical to successfully navigating the 16-year journey resulting in the decommissioning of the Great Dam on the Exeter River.

A Great Dilemma

The decision to remove the Great Dam, a reinforced concrete run-of-river dam measuring 136 feet long by 16 feet high and located along the Exeter River in southeastern New Hampshire, was anything but easy. Burdened with high maintenance costs, the Town-owned dam was also a source of safety and environmental liabilities. In 2000, the Town of Exeter was notified by the New Hampshire Department of Environmental Services (NHDES) Dam Bureau of numerous safety deficiencies with the Great Dam—most notably its inability to safely withstand a 50-year storm event. Additionally, the fish ladder installed on the dam in the late 1960s was inefficient at allowing upstream passage of diadromous fish, including river herring (alewives and blueback herring), American eel, and rainbow smelt. The Great Dam, situated on the Exeter River just above the tidal influence of the Squamscott River and Great Bay further downstream, presented a significant barrier to coastal fisheries that were the original reason for native and colonist settlements in this region.

Exeter’s official seal features an alewife, signifying the importance of the coastal fishery to this Town’s history.
From the director:
National strategic planning and its impact on the NH LTAP

As some of you may already know, the Local Technical Assistance Program (LTAP) is financially supported in part through the federal transportation bill. The national program was officially established in 1991, but a number of state LTAPs including the one here in New Hampshire have been around since the 1980s (also thanks to the federal transportation bill at the time).

From this federal seed money and non-federal match funds, and over the decades, the LTAPs within each state have adjusted and morphed to best meet the needs of their local agencies. However, last year, the FHWA reorganized and shifted the LTAP into the Office of Innovative Program Delivery: Center for Local Aid Support. This is a new center at the FHWA that is just now beginning the process of developing its new strategic plan for LTAP. Their plan will include providing federal guidance to state LTAPs on what focus areas they should address - a type of guidance that has always existed in some manner in the past.

FHWA held an initial LTAP strategic planning meeting from May 9 to 10 in Lakewood, Colorado. In attendance were FHWA representatives, two state LTAP directors, a Tribal Technical Assistance Program director, as well as a number of others from the National Association of County Engineers (NACE), American Public Works Association (APWA), American Association of State Highway and Transportation Officials (AASHTO), and localities.

One of the key outcomes that appears to have come from that meeting is the need for a national local needs assessment to guide the LTAP strategic plan. This assessment survey should be distributed through state LTAPs and their partners sometime in 2017. The group also concluded that training and technical assistance done by LTAPs should be coordinated with all our LTAP partners in an effort to avoid duplication. Additionally, there was discussion on training and technical assistance needs, including the promotion of proven, market-ready innovations and serving the fundamental training needs of localities. The group also had a good discussion about allowing LTAPs the flexibility to adapt national goals and focus areas to each state’s unique local environment.

My feelings on these conclusions are that they are already typical of NH LTAP activities. We already work to serve the traditional fundamental needs of our clients and customers while balancing against the national directives. NH LTAP also promotes innovations that are relevant to the locals and works with our city, state, federal and contractor partners. Not collaborating and cooperating with our partners can result in duplicating efforts, and it wastes time and money that none of us have to waste.

So what does all this mean? Well, we will keep doing our traditional training and reevaluate all the workshops for possible duplication. In addition, you’ll be hearing more about innovations, as there will be more innovation-focused activities offered.

Until next time, thanks for all that you do.

Amy Begnoche
LTAP Director
Technology Transfer Center

Note: This letter was adapted from Iowa’s LTAP center director, Keith Knapp, Iowa Technology News, pg 2, April - June 2017.
Great Dam

Despite this, the structure was cherished by many in the community of 15,000 for its historical relevance. There had been a dam of some sort in this location for more than 350 years, and the existing structure was a contributing element of the surrounding historic district. Citizens also valued its aesthetic appeal and the recreational opportunities, mostly fishing and boating, created by its impoundment. Moreover, the Great Dam provided a critical role in the water supply for the Town and a privately owned mill complex. These considerations—along with anticipated ecological and climate resiliency benefits of dam removal—factored heavily into discussions surrounding the Great Dam’s fate.

With interest in the Great Dam’s removal revitalized the Town commissioned the Great Dam Removal Feasibility and Impact Study. The 2013 study addressed other issues not fully contemplated by earlier ones. These included: river geomorphic response; adjustments to the Town’s water supply river intake; impacts to other water users; floodwater climate change comparisons; cultural resource mitigation; river bottom adjustments to allow fish migrations; and impacts to structures, private property, and recreation.

The feasibility study demonstrated that the removal of the Great Dam would not only be technically feasible—but that it would have a variety of positive community and ecological effects. It also identified mitigation strategies to limit any adverse or unintended effects. Many public informational outreach meetings were held to discuss the pros and cons of a number of alternatives, including various dam structural modifications and dam removal. Ultimately, the citizens had the final say on the decision, with the passage of a warrant article on the Exeter Town Warrant on March 11, 2014, which allocated $1.8 million to remove the Great Dam.

Public Decision-Making: Feasibility Phase

The proposal to remove the dam came after years of engineering and scientific study, as well as much public discussion. Over the course of a decade, the Town of Exeter commissioned seven studies focusing on issues associated with repair, replacement, or removal of the dam. Shortly after the 2000 NHDES Letter of Deficiency, the Town studied the hydraulic effects of various structural dam modifications on the riverine system. A dam removal scenario was not seriously considered at that time, though, because the impoundment created by the dam was a significant source of the Town’s water supply.

By 2006, it was clear that, despite earlier approval of design funds, the community was not supportive of a proposed $17 million surface water treatment plant and pumping station needed to replace an aging drinking water facility that was flood prone and challenged with meeting ever-tightening water quality standards. The Town began to explore ways of diversifying water supplies by integrating groundwater resources with surface water. Subsequently, a $6.3 million groundwater treatment plant was designed and constructed to treat water from reactivated and recommissioned gravel packed wells. The new integrated water supply allowed for a fresh consideration of a dam removal alternative. And with this, natural resource management agencies stepped forward to advocate for the environmental benefits of dam removal—particularly to diadromous fish, water quality, and resiliency to climate change.

Design, Permitting, and Construction: Considering Multiple Factors

Removing the dam wasn’t as easy as simply demolishing the concrete structure and trucking it away. The river bed...
To begin this story, I want to let you know that I have been a member of the West Des Moines Public Works Department for over 27 years.

I began my career in 1989 as an equipment operator and today have the responsibility of being the Public Works Director. During this period of time, I have had the opportunity to witness and be a part of many changes within our organization. Some were good, others were just plain “challenging” to say the least. But the one thing I can tell you for certain is that change can be extremely difficult for a whole lot of people.

One of the major changes I have experienced over the course of my career is the cultural shift of delegating higher levels of responsibility to all levels of our city organization. To say it was somewhat of a daunting task would be a huge understatement.

In the earlier part of my career, like many other public organizations, the core managerial style of many of our city leaders could have been considered “para-military.” In other words, it was the “do as you’re told and follow orders” philosophy. Not to get too far off track, but that memory brings me back to a time when I was a new employee who thought I had a good idea to improve a work process in my department. When I approached my supervisor with the idea, I was told, “You get paid to do what you’re told, not to think.” Imagine how “engaged” that made me feel—my new reality was “so much for promoting any ideas for process improvement in this city.”

The world of management and leadership is changing rapidly in our profession. Go sit through some education sessions at the APWA PWX, North American Snow Conference, or some of your chapter events, and you will quickly find out that many of the typical challenges most managers deal with are personnel-related in nature. Whether the issue is succession planning, generational gaps, or maybe labor relations, the work environment is changing quickly. And by the way, the old stand-by option of “burying your head in the sand” is probably not going to get you anywhere with this one, as the problem is not going away anytime soon.

So, as a manager of staff who wants to implement some changes in an organization, what are some things you might want to consider?

I will give you a few suggestions and some of my personal experiences.

“Let employees have the opportunity to fail.”

Butch Says
(Pearl of Wisdom)

Know BEFORE you mow

It is best to walk before you mow, looking for water or gas shutoff’s, phone pedestals, guy wires, and overhead obstructions, that could damage your mower or tractor. Watch for large rocks, stumps, and litter that could be picked up by the mower and thrown onto the road way. (Remember, objects can be thrown up to 300 feet from your mower!) You also need to be mindful of bee nests, poison ivy or poison oak, drug related items, such as drug paraphernalia. Also, be mindful of heat related health issues. Have enough water with you to stay hydrated.

The highway community’s top priority is a safe surface transportation system. With budget constraints at all levels of government, it is also imperative to get the greatest value for every transportation dollar the American people invest. A nationwide focus on innovation is essential to both.

Since 2009, the Federal Highway Administration’s efforts to further innovation have centered on the Every Day Counts (EDC) partnership with States and other public and private stakeholders to encourage widespread use of proven, market-ready solutions. Through this collaboration, FHWA is advancing innovations that speed project delivery and deploying technologies that save time, money, and--most important--lives.

In 2015, the Fixing America’s Surface Transportation (FAST) Act included EDC by name, directing FHWA to continue cooperating with stakeholders to deploy new practices and technologies and create a culture of innovation in the highway community. Not only is this a vote of confidence in what EDC stakeholders have accomplished together, but also it ensures that this partnership focused on innovation will remain a driving force to improve program delivery and transportation infrastructure for years to come.

Designed to complement other initiatives focusing on technological advances, EDC plays an important role in helping transportation agencies harness innovation to deliver the best value for every taxpayer dollar. As U.S. Department of Transportation Deputy Secretary Victor Mendez, who launched EDC in 2009, said, “We’ve committed ourselves to a course that will benefit the American taxpayer. Every Day Counts is about fulfilling our mission in a better, smarter, faster way.”

To that end, every 2 years FHWA works with State transportation departments, local governments, tribes, industry, and other stakeholders to identify a new set of innovations that merit widespread deployment through EDC. The fourth round (EDC-4) will advance 11 innovations in 2017 and 2018. This fall, transportation leaders will gather at regional summits to learn about the EDC-4 innovations and commit to implementing those that fit the needs of their highway programs.

Embracing Innovations

Already, the EDC partnership has had a positive impact on the highway community’s adoption of new technologies and processes. Every State has used 10 or more of the 32 innovations promoted during the first three rounds of the initiative. Some have adopted more than 20.
Several EDC innovations are now mainstream practices in many States, enhancing the highway system and benefiting travelers. They include advances such as time- and money-saving methods of accelerated bridge construction, energy-saving warm-mix asphalt, and the Safety EdgeSM paving technique to prevent roadway departure crashes.

In addition, EDC has encouraged the development of State Transportation Innovation Councils (STICs), groups that enable public and private sector stakeholders to collaborate on innovation deployment. STICs—active in all 50 States, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Federal Lands Highway—form the backbone of a national transportation innovation network dedicated to creating a world-class highway system through innovation.

STIC partnerships are the heart of EDC. Their mission is to evaluate innovations from sources such as EDC, the American Association of State Highway and Transportation Officials (AASHTO) Innovation Initiative, and the second Strategic Highway Research Program (SHRP2) and spearhead the adoption of those that add value to their State highway programs.

“EDC and other technology initiatives have really been critical in helping States save money and save time,” said AASHTO Executive Director Bud Wright.

He cited the Tappan Zee Bridge replacement, which featured seven EDC innovations, such as design-build project delivery, paperless project management through e-Construction, and prefabricated bridge elements. The project also used three SHRP2 products, one of which was complex project management strategies. “Because of that synergy, we were able to take what we learned on that project and apply it to other projects,” D’Angelo said.

At the same STIC meeting, Shailen Bhatt, executive director of the Colorado Department of Transportation, described the Colorado STIC’s focus on using innovations to drive customer satisfaction. His agency delivered a project to replace the Pecos Street bridge over I–70 in Denver using accelerated bridge construction and the construction manager/general contractor method to maximize design and construction efficiency.

A post-project survey of customers found that more than 90 percent were satisfied to very satisfied with the use of accelerated bridge construction to streamline the project, and more than 85 percent were pleased with the overall project. “It’s clear that when you deploy innovation and accelerated construction techniques, the public notices and that buys you credibility,” Bhatt said.

Through the EDC initiative, FHWA demonstrated that having a STIC, defined processes for the deployment of innovations, and engaged leadership lays a foundation for fostering a culture of innovation within States. In addition, with a STIC in every State, the highway industry is creating a workforce adept at putting innovations to work to address transportation challenges and a national innovation network to exchange best practices and share lessons learned. The STIC network is not only critical to identifying and deploying innovation today, but also it will continue to play that role in the future.

Combined, the deployment of new strategies and technologies through each EDC round and the nationwide reach of the STIC network are moving the transportation community closer to the ultimate goal of creating a permanent culture of innovation, one that embraces innovation as the standard way of doing business.

All STICs work to make transportation innovation mainstream, but their approaches are as different as the States they represent. For example, the New York State STIC emphasizes creating synergy through the use of multiple innovations on a project.

“As powerful as each innovation is in improving project delivery and quality, reducing congestion and costs, and enhancing safety... the much greater benefit is in combining innovations on a project or program,” said Daniel D’Angelo, deputy chief engineer of the New York State Department of Transportation (NYSDOT), at a national STIC meeting.
Engaging Employee

1. **Attempt to involve your employees in decisions where you feel it would be appropriate.** That does not mean that they need to be involved with “every” decision, just those that may impact them directly and they may be able to assume some ownership. Here is a real-life example: We were changing our field staff work hours and moving toward a 10-hour summer schedule. Wearing my “engaging employee’s hat,” I told them we could have some flexibility in their work hours and that I would leave it up to the work group to decide. Giving the employees the flexibility of making that decision led to increased productivity and enhanced job satisfaction.

2. **Learn from other agencies’ successes and challenges.** Every organization is unique in one way or another; however, there are tremendous opportunities to network with others in our profession. Reach out to others in our industry and see what stories and ideas they may have to share.

3. **Let people fail.** That’s right, I will repeat that statement again: Let employees have the opportunity to fail. If you don’t instill in your employees the ability to try new ideas and “push it to the next level,” your organization will become stale and a breeding ground for the “we have always done it that way” mentality.

4. **Look for the “diamond in the rough.”** In other words, look for the hidden abilities that many of your staff may possess that may take some encouragement, mentoring, and refining to develop. Also, look for those hidden “leaders.” This is the staff member who may possess many qualities and attributes to take the organization to “new heights.” Leadership does not always simply mean becoming a manager, it can also mean leading a group of your peers in the right direction.

5. **Last but not least, figure out whose back you want the monkey on.** To me, this simply means “who” do you want to take responsibility for the various decisions that need to be made in your organization? For many decisions, the monkey may need to stay on your back, but for many others you may be able to delegate them to the staff members that will be impacted and be able to take ownership in them.

“99 percent of success is built on failure.”

Charles Kettering

American inventor, engineer, businessman, and holder of 186 patents.
The year is 2016. It is officially the twenty-first century and pizza still has calories, Pluto’s no longer a planet, and time travel isn’t real (yet.) However, the world has not disappointed completely. There may not be hover cars in the year 2016, but one thing was developed—driverless/connected vehicles.

Rumors and curiosity arise as these works of innovation have started to enter the highway construction industry, but driverless work trucks are rolling around the corner before everyone’s eyes, and finally belief is sitting passenger.

They have launched testing of a driverless semi-truck, and Google’s self-driving car, but in terms of a truck to protect those who are out on the highways painting lines, inspecting bridges, or installing a traffic signal…where is their truck?

The Autonomous Truck Mounted Attenuator (ATMA) truck made its appearance on the scene in August 2015 when a demonstration of the driverless truck’s abilities was done for the media in Bethlehem, Pennsylvania. The demonstration took the country by storm, and the news of the invention went viral—instantly. Within 24 hours there were over one million retweets, 300,000 Facebook shares, and countless media outlets, including NBC, MSN, and CNN that had picked up the story. The support of this new invention was staggering, and the highway construction industry wanted to know more.

It is already widely known what a TMA truck is supposed to do—save the lives of the construction workers in front of it. This truck has been around for over a decade, and they are one of the main reasons (sometimes the only reason) why both workers in a construction zone and drivers’ lives are saved. They reduce damage to structures, vehicles and motorists, while also absorbing the colliding vehicles kinetic energy. “If a TMA truck is meant to be struck by drunk drivers, texters, and oblivious motorists…then why would anyone put a man in it waiting to be struck?” It only makes sense to make this vehicle autonomous, eliminating the danger put on the life of the TMA truck driver inside of it.

A study published this year in the Journal of the Transportation Research Board found that TMAs cut work zone injuries and fatalities from rear-end crashes in half. One of the study’s authors, Gerald Ullman of Texas A&M’s Transportation Institute, said, “There is considerable interest in autonomous truck-mounted attenuators, both for their potential to reduce risk, and as a way to save on labor costs.” As innovative as this whole thing sounds, the world is still asking one question—“Is it safe?” According to the U.S. Department of Transportation’s National Motor Vehicle Crash Causation Survey, 94 percent of road accidents are caused by human error, and it is said that driverless technology will drastically lower, if not eliminate, this factor.

But, driverless does not automatically mean there is absolutely no human control over the vehicle. The National Highway Traffic Safety Administration defines different levels of autonomous vehicles. Most of the driverless vehicles already being tested in the market, like Google’s for example, are level 3 which means limited self-driving automation. Level 3 allows the driver to take control of all safety-critical functions under certain conditions, and the driver is expected to be available to take back control when needed.

Level 3 is not where these vehicles are capped off. Level 4 is a fully self-driving vehicle, requiring no driver control other than someone to input the destination. And to clear the air…yes, a level 4 has been invented, specifically for those public workers who are risking their lives every day to make roads safer for the people who drive on them.
Driverless Trucks

A company in Pennsylvania has invented a level 4 ATMA truck. Royal Truck & Equipment, located in Coopersburg, Pennsylvania, partnered with Micro Systems Inc. from Fort Walton Beach, Florida, to develop this driverless technology. Micro Systems already supplies unmanned vehicles to the military but took a giant leap into the public works industry back in August 2015.

This ATMA truck is outfitted with an electromechanical system and fully integrated sensor suite that will enable leader/follower capability that allows the ATMA to follow a lead vehicle completely unmanned. The technology is being adapted to the roadway construction industry and helping increase safety with the removal of human beings from crash barrier trucks.

As stated, this operation of the ATMA will be conducted in a configuration called leader/follower to replicate real-world operation. The configuration includes a human-driven vehicle, who is the leader, followed by an unmanned vehicle, who is the follower. The leader vehicle is a human-driven vehicle that will be outfitted with an NAV Module that is strapped to the roof of the vehicle during testing. The NAV Module contains a GPS receiver, system computer, digital compass, and a transceiver. It transmits GPS position data called “eCrumbs” back to the follower vehicle, which then uses the data to follow the exact path and speed of the leader vehicle at each point along the route. The NAV Module can be easily unstrapped and removed from one vehicle and installed on another if a different leader vehicle is required. To sum it up, it’s the twenty-first century of “Simon Says” but with vehicles and not humans.

Driverless trucks are determined to make the road safer. About 1 in 10 highway deaths occurs in a crash involving a large truck, according to the U.S. Department of Transportation statistics. Therefore these trucks are intended to cut down those 3,600 yearly truck accident deaths. And unlike those texters, drunk drivers and oblivious motorists, these autonomous trucks won’t swerve into a work zone and risk the lives of those public workers trying to move cones, repaint lines, repair potholes, and so on.

Safety is a huge aspect for these trucks but they can also be convenient, save the time, and save the labor of a public worker. It no longer takes two separate people to drive two separate trucks. This means that one worker will be able to concentrate on operating both trucks while the second worker can concentrate on other tasks that require their skills. In terms of convenience, more TMAs can be onsite to protect workers and hold extra supplies; and now 10 vehicles will only require five drivers because of the leader/follower capability.

The road to driverless vehicles is not a flat one but it’s getting a little less bumpy. With these level 4 ATMA trucks already on their way later this year in Florida for a pilot program, these innovations are sure to take the rest of the world by storm shortly. Although people have their doubts if these trucks will actually decrease human error, one thing is for sure: the intention of this invention is to allow workers to be taken out of harm’s way, and be able to go home to their families at the end of the day. Bottom line is this—the safety of all public workers outweighs pizza without calories any day of the week.

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Full Solar Eclipse August 21st, 2017

Please follow these tips to drive safely on the day of the solar eclipse:
• Don’t stop along the interstate or park on the shoulder during the event.
• Exit the highway to safe location to view and/or photograph the eclipse.
• Don’t take photographs while driving!
• Don’t try to wear opaque eclipse glasses while operating a vehicle.
• Turn your headlights on -- don’t rely on your automatic headlights when the eclipse blocks out the sun.
• Watch out for pedestrians along smaller roads. People may be randomly parking and walking alongside the roadway in the hours around the eclipse to get the best view.
• Prepare for extra congestion especially on the interstates in the path on the day before, day of and day after the eclipse.
• Avoid travel during the eclipse or in the area of the main path if you can

How to Make Better Decisions on Addressing Pavement Needs

New research argues that focusing on the remaining service interval is a more effective management strategy than fixing the worst first or threshold-driven approaches.

By Beth Visintine, Gonzalo R. Rada, James M. Bryce, Senthil Thyagarajan, and Nadarajah Sivaneswaran
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The public has high expectations of transportation infrastructure. Namely, pavements and bridges should be in good repair and provide consistent, high-quality service. To meet these goals, the State and local departments of transportation charged with managing these assets work to achieve and sustain a desired state of good repair over the life cycle of the assets at minimum practicable cost.

Through pavement management systems, DOTs employ a strategic and systematic process that focuses on managing each asset over its life cycle. That process typically involves a structured sequence of maintenance, preservation, rehabilitation, and reconstruction actions.

The challenge is making the best use of limited agency resources, while providing an optimum level of service to road users. Accomplishing that goal requires monitoring the condition of the pavement network and forecasting its performance in order to plan effectively for future construction actions. Predicting when to apply treatments to achieve and sustain a desired level of service at the minimum practicable life-cycle cost is critical to managing pavements. In essence, knowing—or being able to estimate—the future condition of pavement sections is the rational basis for making informed decisions regarding pavement infrastructure.

However, multiple ambiguities are associated with the commonly used terminology—“remaining service life”—from how to define it to how different agencies interpret, apply, and exchange data on pavement conditions. For example, does the phrase refer to the time from the present to when the pavement is expected to fail—meaning it needs major, costly work—or from the present to when it reaches an unacceptable level of service requiring some intervention, which could be less extensive and less costly? As a result, agencies have tended to focus on dealing with the worst, more costly problems first, rather than using an approach based on the lowest life-cycle cost for managing their assets.

Seeking to eliminate the ambiguities inherent in the existing terminology, and ultimately reduce the costs of maintaining the Nation’s transportation assets, researchers working with the Federal Highway Administration are exploring an alternative terminology based on the concept of remaining service interval. The key difference between the two concepts is that while remaining service life computes the time until a pavement reaches a predefined terminal condition, remaining service interval computes the time until any treatment is applied to achieve and sustain a desired level of service over the life cycle of the assets at the minimum practicable cost. Here’s what you need to know about the remaining service interval concept and how it can improve the practice of managing pavements.

What’s Wrong with Remaining Service Life?
Engineers typically define the term “remaining service” as the period over which a pavement section adequately performs its desired function or performs to a desired level of service. The phrase “remaining service life” often refers to the time from the present to when a pavement reaches an unacceptable condition, requiring a construction intervention. Although predicting the time until a treatment should be applied is a critical component at all levels of decisionmaking, the current terminology poses a number of challenges with regard to interpreting and using relevant data properly, as well as exchanging information among agencies on pavement condition and performance.

“Because pavements are repairable systems, use of the word ‘life’ is an improper concept, given that pavements...
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do not ‘die,’” says Gary Elkins, senior associate engineer with Amec Foster Wheeler. “Correctable component failures do not define the system life.”

Another common definition of remaining service life is the time until the next rehabilitation or reconstruction action. But rehabilitation and reconstruction are two different actions in terms of the condition of the pavement at the time of construction, and their associated costs vary dramatically. Attempting to interpret estimates of remaining service life from mixed rehabilitation and reconstruction segments provides little information to decisionmakers. Also, the timing of future rehabilitation or reconstruction will depend on what lower level treatments are applied during the rehabilitation period.

An unintended consequence of using current remaining service life terminology is that it may promote the more costly “worst-first” approaches to correcting pavement deficiencies, where the pavement is allowed to deteriorate to poor condition or its “threshold limit” before taking steps to preserve or rehabilitate it. By expressing pavement condition in terms of remaining service life, decisionmakers and laymen alike expect pavements in the worst condition to be treated first. This is not ideal for managing pavements, as it tends to cost the most and results in an overall pavement condition that is inferior to that achievable through other approaches.

Defining Remaining Service Interval

Beginning in 2008, FHWA spearheaded research to develop the concept of remaining service interval under contract DTFH61-08-D-00033-T-09001, “Definition and Determination of Remaining Service and Structural Life.” The results of that research are reported in Reformulated Pavement Remaining Service Life Framework (FHWA-HRT-13-038) and Pavement Remaining Service Interval Implementation Guidelines (FHWA-HRT-13-050).

Remaining service interval does not simply consider the end of life as promulgated by the remaining service life philosophy, but instead takes into account the complete spectrum of maintenance and rehabilitation activity applied to the pavement system.

The concept of remaining service interval is based on the idea that a pavement’s maintenance and rehabilitation requirements cannot be defined by a single value representing the end of its life. Instead, pavements should be described based on intervals used to communicate the amount of time before a treatment is required to provide
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had been regraded during construction of the dam in the early 1900s, and simply removing the concrete dam from the river would have left behind a steep river section that would have been a barrier to upstream fish migration.

Furthermore, the dam was located adjacent to several historic buildings—even tied into masonry walls not owned by the Town. And, the riverbed elevations still played a role in maintaining water levels upriver at the Town’s drinking water intake in the river. Construction plans, therefore, had to include re-contouring the river bottom to a very specific planform, profile, and cross-section to optimize upstream fish passage, ensure stream bank stability, and maintain minimum water levels at the water supply intake. It was a lengthy process to build consensus between competing interests and site constraints.

The design included several novel approaches to manage design complexities. The Town and design team worked with state and federal resource agencies to develop innovative procedures to estimate critical river flows and analyze fish passage and stability criteria. The consultant also worked with the National Oceanic and Atmospheric Administration (NOAA) and the US Fish and Wildlife Service to use a new, unpublished survivorship model to estimate fish passage success rates and iteratively refine the proposed design. The team also worked closely with the owner of the former mill, now residential condominiums, to upgrade their air conditioning system to a closed system to eliminate the need to use river water for cooling; switching to the new system saved money and allowed for more flexibility during the river restoration.

In April 2016, bids were received from prequalified bidders; the successful bidder was SumCo Eco-Contracting of Salem, Massachusetts. Construction began in earnest in July. The region experienced extreme drought conditions prior to and throughout the construction period. These conditions decreased the need for water management activities on the construction site and allowed a condensed construction schedule. Finally, after years of planning, the removal project was substantially complete in only ten weeks.

Collaboration and Successful Outcome

Because of the environmental benefits of dam removal, a number of partners contributed funds and technical expertise to the project, including NOAA, the New Hampshire Department of Environmental Services (NHDES) Aquatic Resource Mitigation Program, NHDES Coastal Program, NHDES Rivers & Lakes Management and Protection Program, the NH State Conservation Committee, and the NH Fish and Game Department. Funding and technical support from these agencies helped to cover nearly half of the total project cost.

A true success story, the Great Dam removal project has helped eliminate a public safety and financial liability—while restoring a total of 21 river miles to a free-flowing condition, including 8 miles on the main stem of the Exeter River and 13 miles of its freshwater tributaries, improving diadromous fish passage and water quality. Removal of the dam will reduce the depth and severity of flooding in the community—reducing the size of the 100-year floodplain in Exeter by an estimated 200 acres, which will prevent future impacts to citizens and public infrastructure. Ultimately, the dam removal has increased the community’s resiliency by reducing the severity of future floods, and improved overall water quality for the Town and surrounding Exeter River area, while protecting critical water supplies.

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The Exeter River, under low flow and extreme drought conditions in September 2016, immediately following removal of the Great Dam and restoration of the river bed optimized for fish passage.
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an acceptable or above-acceptable level of service at the lowest practicable life-cycle cost. Implicit in this change in terminology is the idea that describing a pavement using service intervals more closely reflects how pavements are maintained. That is, not all pavements are allowed to reach terminal serviceability. Also implicit in this change in the terminology is that a given pavement can be described using a string of numbers that represents an optimal treatment sequence and timing.

An Example of the Remaining Service Interval Concept

Applying the Remaining Service Interval at the Project Level

The remaining service interval considers life-cycle costs in proposing a structured sequence of actions to maintain, preserve, repair, rehabilitate, and replace pavements to provide needed functions safely and reliably over the life cycle of the asset at minimum practicable cost. Further, remaining service interval has the ability to unify the outcome of different management approaches for determining needs by focusing on when and what treatments are needed, as well as the service interruption created. This approach to managing pavements also can enhance communication, because the remaining service interval provides details of the sequenced actions needed to manage the assets, as opposed to assigning a single ambiguous term to the pavements.

Implications for Asset Management

The two most recent transportation funding bills, the Moving Ahead for Progress in the 21st Century Act (MAP-21), passed in July 2012, and the subsequent Fixing America’s Surface Transportation (FAST) Act, passed in December 2015, helped set the stage for the remaining service interval concept by requiring performance management and a State asset management plan for the National Highway System to improve or preserve the condition of the assets and the performance of the system, in accordance with section 1106(a) of MAP-21, codified as 23 U.S.C. 119. MAP-21 requires State DOTs to develop processes to manage their pavements and bridges for their whole life. Now, the remaining ser-
Culture of Innovation

the diverging diamond interchange, one of the intersection and interchange geometrics promoted in 2013 and 2014 during EDC-2.

This interchange, with a continuous left-flow design, enhances safety by reducing the number of traffic conflict points and improves traffic flow by decreasing the number of signal phases. After the diverging diamond interchange concept was developed by Advanced Transportation Solutions founder Gilbert Chlewicki and studied at FHWA's Turner-Fairbank Highway Research Center, it began drawing the interest of agencies like the Missouri Department of Transportation (MoDOT).

MoDOT constructed the Nation’s first diverging diamond interchange, which opened in Springfield in 2009. Since then, another 65 have been built in 25 States. More are under construction or at the planning stage.

“The recent, rapid deployment of diverging diamond interchanges across the United States has been quite remarkable,” said Mark Doctor, FHWA safety and design engineer. “This is a real tribute to how this innovation has been transformative in the field of highway engineering.”

The Idaho Transportation Department’s first diverging diamond interchange, built at the intersection of I–86 and Yellowstone Avenue in Chubbuck, has been hugely successful in reducing crashes. Forty crashes were reported from 2010 to 2013, when construction began. Since the new interchange opened in 2014, just three crashes have been reported.

High-friction surface treatments (HFST), another EDC-2 innovation, are cutting crashes, injuries, and fatalities at what used to be safety trouble spots. These pavement overlay systems have exceptional skid resistance not typically provided by conventional paving materials; therefore, they help motorists maintain better control of their vehicles. More than two-thirds of States use HFST—up from 14 before it was named an EDC innovation—and at least 5 have made it a standard practice.

HFST is yielding safety dividends. The Pennsylvania Department of Transportation (PennDOT), which has applied HFST at more than 200 high-priority crash locations, conducted a followup study of 12 spots in Northampton and Lehigh Counties where HFST was used. PennDOT found a 100-percent drop in fatalities and major injuries. Likewise, when the Kentucky Transportation Cabinet analyzed 43 applications in its HFST program to address roadway departure crashes, it found annual crashes had fallen 73 percent on curves and 78 percent on ramps.

Accelerated bridge construction techniques, part of all of the first three EDC rounds, are now used widely. These techniques enable highway agencies to replace bridges in hours and reduce planning and construction efforts by years, lessening traffic delays and in many cases lowering project costs. One technique States are adopting is slide-in bridge construction, in which a bridge is built next to an existing structure and then slid into place after the old bridge is removed.

In New York, NYSDOT used the slide-in method to replace two bridge superstructures on I–84 during 20 hours over one weekend. The project would have taken 2 years to build with conventional methods and would have required building a temporary road and bridge to channel traffic during construction. Using innovation saved $900,000 in construction costs and $1.37 million in user delay costs. Together, the savings represent 22 percent of the project’s $10.2 million budget.

EDC-3 Success Stories

The success stories have continued in EDC-3, which ends in December 2016. For example, geosynthetic reinforced soil–integrated bridge system (GRS–IBS) technology—another accelerated bridge construction technique—helps agencies deliver low-cost, durable structures that can be built quickly with readily available equipment and materials.

Before GRS–IBS was named an EDC technology in 2010, it had been used on only a few projects. Now the number of GRS–IBS structures is nearing 300 nationwide, and 8
States have adopted the technology as a standard practice. In New Mexico, a road crew with the Ohkay Owingeh Pueblo used GRS–IBS to replace the White Swan Bridge near Santa Fe. Benefits of using GRS–IBS instead of conventional technology on the project included shorter construction time—2.5 versus 4.5 months—and lower project costs—less than half.

The need for robust connection systems for prefabricated components on bridges is driving interest in ultra-high performance concrete (UHPC), a steel fiber-reinforced material that improves durability and simplifies construction when prefabricated bridge elements are used to accelerate project completion. Seventeen States and Washington, DC, are using UHPC connections on bridge projects or planning to institutionalize use of the technology. New Jersey and Pennsylvania have made UHPC connections a standard practice on bridge projects that use prefabricated elements.

The New Jersey Department of Transportation used UHPC on deck replacements on the Pulaski Skyway rehabilitation project and a project on Route 46 over the Musconetcong River Bridge project. PennDOT has incorporated UHPC into its publications and standards and considers it a tool in the agency’s toolbox.

States also report dramatic savings in time and money when they replace the paper-based approach to the management of construction documents with e-Construction—the collection, review, approval, and distribution of documents in a digital environment. Six States have made e-Construction a standard practice, and an additional 19 States use e-Construction tools, such as digital signatures and collection technologies for field data.

The Michigan Department of Transportation, with a 2015 construction program of $1.2 billion, estimates its use of e-Construction is saving $12 million a year while slashing construction modification times from 30 days to just 3.

Agencies also are finding success with road diets, a low-cost strategy to make roads safer and communities more livable. A road diet reconfigures a roadway cross section to safely accommodate all users—motorists, bicyclists, and pedestrians—while increasing mobility and reducing crashes. Road diets are now a standard practice in 11 States and Washington, DC. Another 30 States are installing road diets and identifying potential sites for roadway reconfiguration.

Studies show a 19- to 47-percent decline in crashes when a road diet is installed on a four-lane undivided road. The Virginia Department of Transportation achieved even better results when it reconfigured a 2-mile (3.2-kilometer) segment of Lawyers Road in Reston from four lanes to three with a two-way turn lane in the middle and added bike lanes. A safety study 5 years after the road diet revealed a 69-percent drop in crashes.

EDC-4 Preview
FHWA’s call for innovations to promote in the upcoming fourth round of EDC drew a strong response from stakeholders, who offered more than 80 suggestions. After developing a short list and conferring with national transportation organizations, FHWA named the following innovations to the EDC-4 roster.

**Accelerating traffic incident management data collection** promotes wider use of low-cost, available technologies that speed the collection of data, which supports improved programs to clear incidents from roadways safely and quickly.

**Advanced hydraulic modeling tools** improve on current modeling techniques used for hydraulic design by depicting physical, environmental, and habitat characteristics more accurately through three-dimensional visualization of flow, velocity, and depth.
Better Decisions

vice interval concept is poised to help DOTs manage their assets based on the optimum timing to place a treatment, rather than waiting for a given threshold.

MAP-21 defined asset management under 23 U.S.C. 101 as a “strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the life cycle of the assets at minimum practicable cost.”

Asset management offers a coordinated approach over entire life cycles. In following an asset management approach, agencies use data, economic analysis, performance measures, and performance-based goals to make decisions. Specifically, those decisions consider the most effective combination of maintenance and rehabilitation actions while minimizing reconstruction.

The remaining service interval concept is framed upon the same principle: identifying an optimized sequence of construction actions through engineering and economic analyses that minimizes the life-cycle cost while providing acceptable or above-acceptable level of service to the users. The concept quantifies future needs and liabilities, and it can help agencies as they move away from dealing with the worst first and toward an approach based on the lowest life-cycle cost for managing their pavements. Further, it can help asset managers communicate this information to agency leaders and stakeholders. As DOTs develop performance- and risk-based asset management plans, set targets, and measure their performance, as required by MAP-21 and the FAST Act, using the remaining service interval can contribute to the conscientious application of the same principles and processes.

According to Jim Mack, director of market development at building materials company CEMEX, the remaining service interval concept “provides insight on the performance requirements [that is, the time extension until the next activity] that a pavement treatment must meet at the project level so that there is never too much of the network needing repair at any given time. It allows agencies to develop and compare different ‘programs of projects’ at the project level—and see their impact at the network level—so that better programming decisions can be made.”

Further, he adds, “Every pavement network will have pavements at different ages and [in] different conditions, and the right fix depends on both the condition of the pavement and how the different potential treatments will impact the network. As such, some pavements are going to have to be preserved and maintained in order to stay in their current condition, while others will need a more in-depth rehabilitation.

“By selectively matching individual pavement section conditions with the performance requirements dictated by the [remaining service interval], and using ... the mix of... treatments available to repair the pavements, agencies can use their limited financial resources to spread the amount of work out among the different categories of maintenance, preservation, rehabilitation, and construction treatments in order to determine the best long-term strategy to maintain the system in a state of good repair.”

Validation at the Project Level

To validate the concept, the FHWA researchers used remaining service interval to assess real-world problems at the project, network, and strategic levels. FHWA project DTFH61-13-C-00016, “Application and Validation of Remaining Service Interval Framework to Pavements,” focused on this validation effort.

The FHWA researchers’ approach to validating the remaining service interval concept at the project level consisted of developing optimal treatment strategies for a given pavement section over a defined timeframe using mechanistic-empirical models. That is, the researchers developed a basic algorithm to facilitate the project-level validation that combined elements from both mechanistic (calculated pavement responses like stress, strain, and deflection and use of those responses to compute incremental damage over time) and empirical (relating cumulative damage to observed pavement distress) principles.

Analyses at the project level require more detailed data that include modeling of pavement design and performance specific to the project’s location. For this effort, the researchers used data from the Long-Term Pavement Performance (LTPP) program. To predict performance, they input project-specific data and treatment scenarios into CalME, a software program for mechanistic-empirical pavement analysis developed by the California Department of Transportation. If the performance prediction resulted in a level of service deemed acceptable or above acceptable over the analysis period, the researchers used the performance prediction and structural condition as inputs for the life-cycle cost analysis. If the level of service needs were not met, the researchers revised the treatment scenario. This approach helped the researchers identify the optimum treatment sequence and quantify potential monetary losses associated with delaying that treatment.
Culture of Innovation

Automated traffic signal performance measures can revolutionize traffic signal management by providing the high-resolution data necessary to actively manage performance, improving safety and reducing congestion and costs.

Community connections techniques help planners support revitalization by seamlessly integrating transportation facilities into their community settings and developing designs that best suit the purpose and needs of individual communities.

Data-driven safety analysis, also an EDC-3 innovation, applies the latest generation of crash and roadway data analysis software to determine the expected safety performance of roadway projects more reliably, resulting in fewer and less severe crashes.

The e-Construction and partnering: a vision for the future effort, also an innovation under EDC-3, encourages highway agencies to use paperless technologies to enhance partnering among project teams, improving communication and workflow.

Integrating National Environmental Policy Act and permitting processes promotes techniques for synchronizing the various environmental reviews and permitting procedures needed for construction projects.

Applying a pavement preservation treatment at the right time (when), on the right project (where), and with quality materials and construction (how) can extend the service life of a pavement system. This innovation includes treatments and construction methods to achieve and sustain a state of good road repair in a fiscally constrained environment.

Road weather management—weather-savvy roads promotes the use of Pathfinder Project strategies to provide consistent messaging to travelers on adverse weather and road conditions. This innovation also emphasizes the use of advanced vehicle-based technologies to enable agencies to manage the transportation system proactively before negative weather impacts occur.

Safe transportation for every pedestrian, or STEP, strategies use cost-effective countermeasures to reduce pedestrian fatalities, which account for 15 percent of road fatalities, at uncontrolled crossing locations or intersections with no traffic signal or STOP sign.

Use of ultra-high performance concrete connections for prefabricated bridge elements and systems, also an EDC-3 innovation, creates a simple, strong, and durable connection that enables accelerated, cost-efficient construction of bridges.

At the conclusion of the EDC-4 summits, the Nation’s STICs will evaluate the EDC-4 innovations and decide which to implement in their respective States in 2017 and 2018. As in past EDC rounds, FHWA teams will provide technical assistance and training to help the transportation community adopt the EDC-4 innovations.

FHWA also will offer deployment assistance and incentives through its STIC Incentive and Accelerated Innovation Deployment Demonstration programs. For more information on the STIC incentive program, visit www.fhwa.dot.gov/innovation/stic/guidance.cfm. For more information on the Accelerated Innovation Deployment Demonstration program, visit www.fhwa.dot.gov/innovation/grants.

The Future of Innovation in Transportation
Through the collaboration of FHWA, State and local governments, and the private sector, EDC has become a dynamic partnership to deploy innovations rapidly and widely. The national STIC network enhances our ability to deliver a transportation system that will serve our country today—and well into the future.

Despite our success over the past 7 years, the work is not finished. As the FAST Act states, it is in the national interest to establish a culture of innovation in the highway community. The first three rounds of EDC laid a solid foundation for making the use of innovation a way of doing business. But we need to build on the gains we’ve made.
The Roads Scholar Program establishes educational and training requirements for municipal level highway practitioners, and recognizes those who have successfully completed specified T2 Center workshops. Annually, the T2 Center publishes a directory to acknowledge those who have earned an achievement level among our Roads Scholars.

Since January 1, 2015, there are six levels in the NH Roads Scholar Program, plus an additional “side award.” Each Level has a defined number of contact hours, and Level 2 requires attendance at workshops in specific subject areas. A contact hour is an hour of actual instruction. A typical one day workshop includes 5 hours of instruction in a specific subject area to ensure that training covers a range of subjects essential to local road management. In addition, if Roads Scholar participants earn 20 contact hours in the Safety category, they earn a Safety Champion award.

### Roads Scholar 1
Requires 25 contact hours

- William Barrette, City of Claremont
- Brian Barry, City of Franklin
- Eric Becker, Town of Salem
- Shawn Berry, Town of Ossipee
- Craig Blais, Town of Bedford
- Joshua Blaisdell, Town of Rye
- Ryan Boisvert, Town of Merrimack
- Erica Brittner, City of Lebanon
- Brian Capone, Town of Salem
- Lawrence Carpenter, City of Lebanon
- Jay Cavallaro, Town of Bedford
- Mike Collins, Town of Plainfield
- Tim Collins, Town of Thornton
- George Cooper, Town of Loudon
- Martin Culver, NHDOT District 1
- Dan Davis, NHDOT District 2
- Caleb Dobbins, NHDOT Highway Maint.
- Crystal Eastman, NHDOT District 2
- Neil Eldridge, Town of Ossipee
- Ronald Evans, Town of Effingham
- Aaron Fleury, Town of Sanbornton
- Daniel Freeman, Town of Bow
- Kevin Gilbert, Town of Wentworth
- Timothy High, Town of Milford
- Josh Kennett, Town of Plainfield
- Ken Kreis, City of Franklin
- Julie Kroupa, NHDOT District 4

### Roads Scholar 2
Requires 50 contact hours in specific subject areas: 5 hours of Environmental, 10 hours of Safety, 5 hours of Supervisory, 20 hours of Technical, 10 additional hours

- Kevin Callanan, Town of Sunapee
- Seth Garland, Town of Wakefield
- Leland Gray III, Town of Tilton
- Michael Laughy, Sr., Town of Wakefield
- Stuart MacDandolos, Town of Haverhill
- Adam Mendoza, Town of Pembroke
- William B. Sargent, Town of Littleton
- Chris Sullivan, NHDOT District 6

### Senior Roads Scholar
Requires 75 contact hours

- Peter Beede, Sr, Town of Moultonborough
- Geoff Benson, Town of Salem
- Steven Boyd, Town of Derry

Continued to page 22
Culture of Innovation

Over the next 2 years, STICs across the country will lead the deployment of the innovations in EDC-4. These are innovations we already know will enhance the highway system, but they need a boost so more States learn about them, use them, and make them mainstream practices.

Over the long term, it is crucial that we expand on the work done through EDC and the STIC network to ensure the focus on innovation becomes a permanent part of our transportation culture. We need to engage the STIC network more fully than ever and learn from each other’s successes and failures. We need to continue to pursue the broadest range of innovations and adopt those that offer the best opportunity to save time, money, and lives. We can meet America’s future transportation needs only with an organized and ongoing commitment to innovation.

Gregory G. Nadeau is administrator of the Federal Highway Administration. Previously, he served as the agency’s acting administrator and deputy administrator, focusing heavily on the development and administration of the Every Day Counts initiative.

For more information, see “EDC-4: Introducing a New Round of Innovations” on page 2 in this issue of Public Roads or visit www.fhwa.dot.gov/innovation/everydaycounts.

One Town’s Community Outreach Success Story

By Alan Cote, Superintendent of Operations, Town of Derry, NH

On May 20, 2017 the Derry Public Works Department partnered with the Derry Fire Department, Derry Police Department, and Derry School District to host a “Touch A Truck” event and Firemen’s Muster at West Running Brook School in Derry.

In addition to municipal equipment several private companies joined in with tractor trailers, pavers, bucket trucks, and even a helicopter! It was a very busy day and it was hard to track how many people came through. Conservatively, we estimate one thousand people came through during the day.

Children and adults seemed very intrigued by the equipment we had on display and it was a great chance to answer questions the public has about our operations. All the employees who worked that day were volunteers.

I was very proud of the turnout by employees on a sunny Saturday. Given the success of the event, we are already planning to repeat this event annually.

Alan R Côté can be reached at (603) 432-6144 ext. 5452 alancote@derrynh.org
Better Decisions

The validation of remaining service interval at the project level showed that regular evaluations of pavement structures provides the opportunity to identify the optimum treatment sequence that yields the lowest life-cycle cost for a given pavement section.

Validation at the Network Level

The overall goal of validating the remaining service interval at the network level was to further develop the concept using real-world data from a State’s pavement management system. The researchers selected the Maryland State Highway Administration as one of the agencies to participate in the validation process. First, the FHWA researchers gathered the agency’s models and data, and then they recreated the optimization approach for treatment selection used in the software that Maryland employs for pavement management. Next, the researchers compared the outputs from implementation of the remaining service interval concept to the outputs that Maryland supplied. These comparisons helped ensure that the researchers had properly replicated the State’s process and that all models and costs implemented in the validation code matched the outputs supplied by the State agency. Once the researchers had validated the concept using Maryland’s approach, they based the remaining service interval optimization on minimizing total life-cycle cost over the time horizon.

The researchers then compared the results of the remaining service interval implementation to the results from Maryland’s analysis in terms of annual costs, work type, and condition metrics. This comparison showed that the remaining service interval methodology did, in fact, lead to a consistent prediction of treatment needs, performance, and costs over the analysis period.

To demonstrate the differences, the researchers obtained data from the State DOT on the pavements’ remaining service life and compared that to the timing until first treatment from the remaining service interval optimization. Remember: Remaining service life computes the time until the pavement reaches a predefined terminal condition, while the remaining service interval computes the time until any treatment is applied to achieve and sustain a desired level of service at the minimum practicable life-cycle cost. The researchers found that this analysis demonstrated that practically no relationship exists between the information on remaining service life obtained from Maryland and the time until the first pavement treatment as determined by the remaining service interval optimization for treatment selection based on lowest life-cycle cost.

“As adding the remaining service interval concept to our pavement management system could be a great help to our districts as they plan their projects,” says Geoff Hall, chief of the Pavement and Geotechnical Division of the Maryland State Highway Administration. “Our current system using remaining service life is great at communicating current conditions, but it is not effective at communicating how soon a ‘do-nothing’ section—one with large remaining service life—should be preserved. We can let them know what projects should be fixed in the next few years, but we have no way to communicate when the

As evidenced by the scattering of data points in this plot, there is little correlation between the data on remaining service life provided by the Maryland State Highway Administration and the time until first treatment, as obtained from the remaining service interval optimization. If these two values were better correlated, the data would follow more of a linear trend. This evidence shows that needed treatments could be overlooked or not communicated by only providing the remaining service life.
Better Decisions

‘do-nothing’ sections should be fixed, what projects may be just beyond the horizon, or what would be the best alternates if they could not get to the initial list of recommended projects.”

Hall continues, “Remaining service interval will enable us to tell the districts—for every single pavement section—the optimal time range to preserve pavements. For example, although a section with a remaining service life equal to 10 is in worse condition than a section with a remaining service life equal to 25, it may be more optimal to preserve [the latter] compared to rehabilitating the former in terms of providing the lowest life-cycle costs. Remaining service interval will tell us that.”

The validation work with the Maryland State Highway Administration demonstrated the feasibility of implementing the remaining service interval approach with relatively few changes to an agency’s existing models and data. In this validation effort, only the optimization method used in the treatment selection was modified, given the state of the models provided by the DOT. Although the change in optimization method is a significant change from the perspective of network-level decisionmaking processes, the researchers did not attempt any changes to data collection, the performance models, or the criteria for selecting treatments.

Takeaways from the Study

As affirmed through this research, the concept of remaining service interval can enhance the decisionmaking process, as well as improve how maintenance and rehabilitation needs related to pavements are communicated to stakeholders at all levels. In addition, remaining service interval is directly in line with MAP-21 and the FAST Act and can help DOTs as they move away from fixing the worst pavements first to an approach based on the lowest life-cycle cost. By implementing this concept, DOTs can optimize the timing of treatments, ultimately leading to lower costs and comparable conditions for road users from year to year.

The key takeaway from the study is this: Optimal decisions about pavement management should not be predicated on condition-based threshold values for treatments. Instead, to minimize the life-cycle costs, DOTs should consider applying treatments well before pavements reach threshold conditions of deterioration. Therefore, an important step toward implementing the remaining service interval concept is the development of a procedure to determine optimal strategies for scheduling pavement maintenance and rehabilitation.

As part of implementing the remaining service interval at the agency level, the researchers recommend that DOTs reevaluate their approach to treatment selection and strategy optimization to ensure that the objective function used in the analysis adequately captures agency goals. To help DOTs move away from threshold-driven decisionmaking, future research could focus on techniques for optimization at the network level. The continuous growth in computational resources has brought optimization techniques that used to be too computationally intensive into the realm of possibility.

Beth Visintine is a senior engineer for Environment & Infrastructure at Amec Foster Wheeler. She holds B.S., M.S., and Ph.D. degrees in civil engineering from North Carolina State University and is a registered professional engineer in North Carolina.

Gonzalo R. Rada is a principal engineer for Environment & Infrastructure at Amec Foster Wheeler. He holds B.S., M.S., and Ph.D. degrees in civil engineering from the University of Maryland, College Park, and is a registered professional engineer in five States.

James M. Bryce is a senior consultant for Environment & Infrastructure at Amec Foster Wheeler. He holds a B.S. in civil engineering from the University of Missouri, Columbia, and an M.S. and a Ph.D. in civil engineering from Virginia Tech.

Senthil Thyagarajan is a highway research engineer for Engineering and Software Consultants, Inc. at FHWA’s Turner-Fairbank Highway Research Center in McLean, VA. He holds a Ph.D. in civil engineering from the Washington State University in Pullman, WA.

Nadarajah Sivaneswaran is a senior research civil engineer in FHWA’s Office of Infrastructure Research & Development. He holds an M.S. and a Ph.D. in civil engineering from the University of Washington, Seattle, and is a registered professional engineer in Washington.

For more information, see Pavement Remaining Service Interval (FHWA-HRT-13-039) and Application and Validation of Remaining Service Interval Framework for Pavements (FHWA-HRT-16-053) or contact Nadarajah Sivaneswaran at 202–493–3147 or nadarajah.sivaneswaran@dot.gov.
§ Senior Roads Scholar Requires 75 contact hours
Raymond Dodier  NH DOT District 3
Scott DeCoteau  City of Claremont
William Eldridge  Town of Ossipee
Brandon Farrar  Town of Derry
Michael Fortier  Town of Bedford
Dave Goodwin  Town of Campton
Damian Hetzel  Town of Enfield
Kevin Marter

§ Master Roads Scholar Requires 100 contact hours
Marcelino Acebron  Town of Bow
Wayne Almon  Town of Exeter
Matthew Clark  NH DOT District 4
Robert Gray III  Town of Conway
Randall Heglin  Town of Jaffrey
Wayne Lombard  Town of Merrimack
Brock Mitchell  Town of Tilton
James Pacheco  Town of Salem
Michael Stack  Town of Merrimack

§ Master Roads Scholar 2 Requires 150 contact hours and individual must be a Safety Champion
Robert Bain  Town of Campton
Robert Buxton  Town of Derry
Robert Lovering  Town of Merrimack
Peter Neary  Town of Gilford
Paul Paradis  Town of Rye
Timothy Sweeney  Town of Bow

§ Safety Champions Requires 20 Safety contact hours
Robert Bain  Town of Campton
William Barrette  Town of Ossipee
Peter Beede, Sr.  Town of Moultonborough
Christopher Boucher  Town of Raymond
Scott DeCoteau  City of Claremont
Michael Denver  Town of Gilford
Joe Feole  Town of Salem
Hazen Fisk III  Town of Greenfield
Michael Fortier  Town of Bedford
Mia Gagliardi  Town of Gilford
Seth Garland  Town of Wakefield
Leland Gray  Town of Tilton
Kevin Hammond  Town of Raymond
Greg Hogan  Town of Carroll
Julie Kroupa  NH DOT District 4
Donnie Lavsha  Town of Enfield
Michael Laughy, Sr.  Town of Wakefield
Robert Lovering  Town of Merrimack
Mark Messenger  Radford Messenger Inc.
James Nave  Town of Moultonborough
Paul Paradis  Town of Rye
Steve Paul  Town of Barrington
Christopher Rouleau  Town of Conway
Steve Smith  City of Laconia
Vincent Stearn  Town of Bow
Kevin Sullivan  Town of New Hampton
Timothy Sweeney

Brain Teaser
Here is a brain teaser whose aim is to stimulate the connections or associations between words in your temporal lobe. You will see pairs of words, and your goal is to find a third word that is connected or associated with both of these two words.

1. LOCK — PIANO
2. SHIP — CARD
3. TREE — CAR
4. SCHOOL — EYE
5. PILLOW — COURT
6. RIVER — MONEY
7. BED — PAPER
8. ARMY — WATER
9. TENNIS — NOISE
10. EGYPTIAN — MOTHER
11. SMOKER — PLUMBER
Word Search  Have fun!

NAME
AFFILIATION
E-MAIL
PHONE

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Be the first to complete this word search and send it to T2 any of the following ways to win a FREE T2 workshop!

Fax: 603-862-0620
Email: stephanie.cottrell@unh.edu
Mail: Technology Transfer Center
33 Academic Way
Durham, NH 03824

Words can be circled either upward, downward, backward, or diagonally.

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Asset Management  Community Outreach  Every Day Counts  High Visibility  Interval  Silly Sign Saturday  USDOT
Autonomous Vehicles  Concrete  Featured Workshops  Innovation  RIP RAP  Solar Eclipse  Wash Out
Backovers  Double Header  FEMA  National Safety Council  Road Business  Spotted  Work Zone Safety
Ball Bank Indicator  Emergency Management  Flooding  Play by Play  RunOvers  Triple Play
Butch Says  Emulsified Asphalt  Great Dam  Remaining Service  Safety First  Triskelion

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