

PRODUCT INNOVATION PLAYS A KEY ROLE IN BRIDGE PRESERVATION

BY LORELLA ANGELINI

Actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements, restore the function of existing bridges, keep bridges in good conditions, and extend their useful life. Preservation actions may be preventative or condition driven”—this is the definition of bridge preservation, as outlined in 2010 by the Bridge Preservation Expert Task Force Group (BPETG) sponsored by the Federal Highway Administration (FHWA).

This definition marks a radical change in the approach of U.S. Department of Transportation (DOT) agencies toward bridge maintenance as their focus has shifted from the repair of heavily deteriorated structures (“worst come first”) to the extension of service life of bridges in a good state (“keep good bridges good”). The new preservation approach is supported by sustainability considerations linked to the age of the 600,000 U.S. bridges. In the next 10 years, almost half of these bridges will have more than 50 years of age, thus exceeding the life span for which they were designed. It is well-known that with age comes deterioration.

To implement a successful preservation approach, it is essential for State DOT agencies to have access to new, innovative materials that can improve the performance of bridge structures and achieve long-term durability. For this reason, BPETG designed and implemented two mirroring surveys, one tar-

geting product manufacturers, and the other State DOT agencies, with the objective of understanding the challenges that these two parties encounter in the development and release of new, innovative products. The surveys were headed up by BPETG members: Lorella Angelini, Consultant, who reached out to product manufacturers; and Dave Juntunen, Michigan DOT, who contacted State DOT agencies.

This article reports the findings of the surveys and the recommendations for actions from the BPETG. Its purpose is to advance a dialogue about initiatives that can create a favorable environment toward innovation for bridge preservation.

The article also serves as a follow up to a previous article, “Bridge Preservation: A Wise Investment,” published in the 2013 March/April issue of this magazine.

GOAL OF THE SURVEYS PRODUCT MANUFACTURERS

- Compile information about number and type of new, innovative products released on the market in the past 5 years;
- Understand challenges encountered by manufacturers to create and release innovative products on the bridge preservation market;
- Evaluate knowledge of innovation resources available to the industry; and
- Gather ideas that could facilitate the path to deploying new, innovative products on the bridge preservation market.

STATE DOT AGENCIES

- Identify what new or innovative bridge preservation products state agencies have begun using in the past 5 years; and
- Identify challenges that agencies have encountered in the adoption of new products, or existing products used in an innovative way, for bridge preservation.

PARTICIPANTS IN THE SURVEYS

Twenty-five product manufacturers (Fig. 1) completed an online survey that was managed by

1	BASF Construction Systems	14	Phoscrete Corporation
2	CentriPipe – AP/M	15	RJ Watson
3	CeraTech	16	RPM – Alteco Polymers
4	ChemMasters	17	Sika Corporation
5	Cortec Corporation	18	Simpson Strong-Tie
6	CTS Cement Manufacturing	19	Termarust Technologies
7	D.S. Brown Company	20	Transpo Industries
8	E-Bond Epoxies	21	Unitex – Dayton Superior
9	Evonik	22	Vector Corrosion Technologies
10	Fyfe Company	23	Wasser Corporation
11	Kaufman Products	24	Watson Bowman Acme
12	Kwik Bond Polymers	25	Willamette Valley Company
13	Liquid Concrete		

Fig. 1: Product manufacturers participating in the online survey

the Transportation System Preservation Technical Services Program (TSP2) in collaboration with the Virginia DOT. Most manufacturers (14) specialize in concrete repair. Other significant fields of specialization are crack sealing (eight), deck overlay (seven), and expansion joints (five).

Of the 48 states surveyed, 24 State DOTs responded (Fig. 2).

FINDINGS

PRODUCT MANUFACTURERS

In the past 5 years, each manufacturer participating in the survey launched two to five products on the bridge preservation market.

The highest number of new products (15) released during this 5-year period involve deck overlays (Fig. 3). Manufacturers in this field have expressed an above average (7 on a scale of 1 to 10) level of satisfaction with the product launch. In the field of concrete repair, a long-established technology, 10 new products were launched with the lowest level of satisfaction (5) by manufacturers. The level of satisfaction rises with niche technologies, such as coatings (9), joints (8), and fiber-reinforced polymer (FRP) (7). However, a smaller number of new products were released for these technologies in the past 5 years: three products for coatings, five for joints, and two for FRP. Examples of new, innovative technologies launched in the past 5 years include:

- High-ratio calcium sulfonate alkyd (HRCSA) one-coat system to stop active corrosion of deteriorated steel bridges by continuously releasing inhibitors into joints and crevices. For surface preparation, HRCSA requires pressure washing, which differs greatly from sandblasting and negative-air containment of traditional multi-coat systems.



Fig. 2: Map showing responding State Departments of Transportation (in blue)

- Ultra-low-viscosity penetrating epoxy healer-sealers for sealing concrete bridge decks (Fig. 4). This new generation of epoxy resins for gravity feed applications penetrates deeply into concrete cracks in bridge decks, thus providing longer application cycles and lowering the frequency of deck maintenance work.

For most manufacturers (23%), the main source of innovative ideas comes from ongoing dialogue with DOTs, both the central offices and the districts. Ideas also come from relationships with contractors (17%) and project experience (16%). Apart from time and cost (mentioned by 22% and 10% of manufacturers, respectively) for new product development, what makes it difficult for manufacturers to turn an idea into a commercial product is the combination of inconsistency of specifications from state to state (mentioned by 27% of manufacturers) and limited opportunities for field tests (24% of manufacturers).

For most manufacturers (25%), product innovation is driven by DOT long-term performance

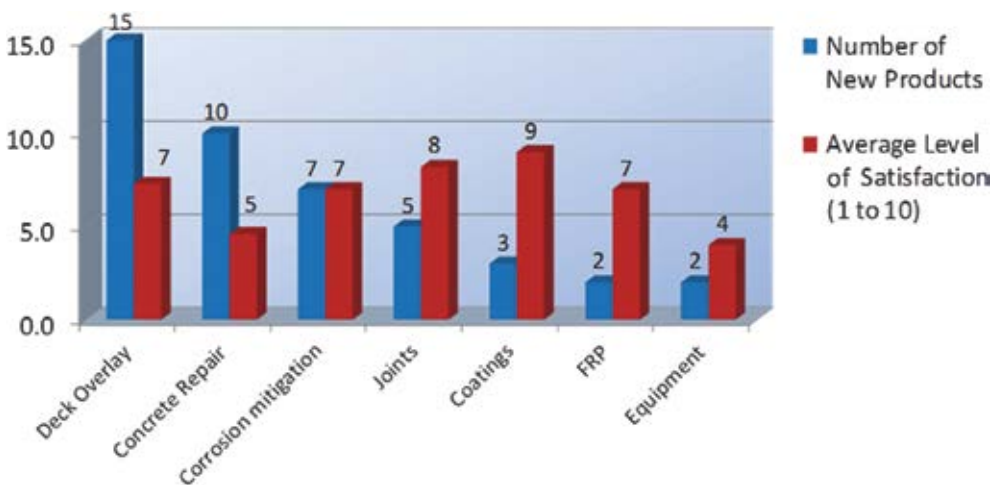


Fig. 3: Manufacturer level of satisfaction with the launch of a new product—deck overlay shows the highest number of new products (15); concrete repair has one of the lowest levels of satisfaction (5); coatings and joints have the highest levels of satisfaction (9, 8), but also a limited number of new products (3, 5)



Fig 4: Epoxy healer-sealer penetration into concrete cracks as large as 0.002 in. (0.05 mm) Photo courtesy of Dayton

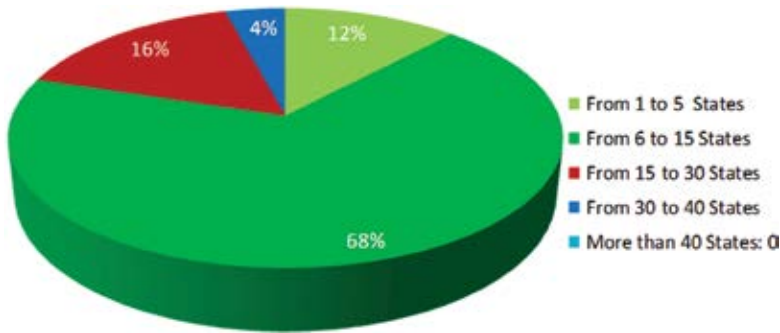


Fig. 5: Targeted states—80% of manufacturers target less than one-third of U.S. states (15) when launching a new product for bridge preservation

requirements. Other drivers are easiness of application (18% of manufacturers), reduction of application time (18%), and installation cost (10%). Environmental regulations play a role for a small number of manufacturers (9%).

Product manufacturers' knowledge of available resources for innovation offered by the American Association of State Highway and Transportation Officials (AASHTO) and FHWA is restricted to the National Transportation Product Evaluation Program (NTPEP) (48%) and TSP2 (17%).

Most manufacturers (80%) limit the release of a new product to 15 states or fewer (Fig. 5). The difficulties of going through the Qualified Product List (QPL) product approval process, and the discrepancy of QPL procedures from state to state, are mentioned as the main reasons for releasing new products in a limited number of states.

The choice of states to release new products is based on different criteria, the most important one being the presence of a QPL category (20% of respondents) or the interest of state maintenance personnel in the technology (18%). Some manufacturers (9%) choose target states based on their regional focus while others (9%) privilege states of strategic importance. States with high market potential are frequently a priority for product manufacturers, thus leaving small states out of the innovation opportunity.

The lack of a proper QPL category within a State DOT agency is a major challenge that most product manufacturers (30%) encounter in releasing new, innovative products on the bridge preservation market. A significant number of manufacturers (25%) also pointed out a certain reluctance of some state agencies to try new products.

For most manufacturers (30%), what facilitates the release of new, innovative products is a good relationship with State DOT personnel. Easy access to lab and field tests also rank high with a significant number of manufacturers (31%).

Streamlining the QPL product approval process is definitively the most important factor for product

manufacturers (24%) to facilitate the deployment of new, innovative products for bridge preservation.

STATE DOT AGENCIES

Most of the responding State DOT agencies used two to five new bridge preservation products in the last 5 years. In the majority of cases (78% of agencies), the level of success was considered moderate.

Improved performance properties (25% of agencies) and greater durability (22%) are top drivers for the use of new, innovative products by state agencies. What actually brings agencies to use a new product is the successful experience by other states (25%) and the recurrence of the problem (19%).

In the attempt to use new, innovative products, agencies face a number of challenges, the most important ones being reported as follows (Fig. 6):

- Lack of time for process and field test (18% of agencies);
- Lack of life-cycle cost analysis data (16%);
- Time or resources necessary to create proper specifications (12%); and
- Fear of getting bad results (12%).

Ninety-five percent of State DOT agencies reported using pilot projects and maintenance trials as the top practice for the evaluation and use of new, innovative products. Other agencies expressed the need of having a life-cycle cost analysis tool (30%) and for streamlining the process to evaluate and use new, innovative products (22% of agencies).

Collaboration between DOT agencies and manufacturers is essential for the successful use of a new product for bridge preservation. The presence of a manufacturer representative at the jobsite ranks high with most agencies (26%). Agencies also value receiving information from manufacturers about their installations in other states (23%) (Fig. 7).

In contrast, DOT agencies get frustrated when manufacturers have limited experience/knowledge of their products (24%), when they have limited understanding of the agency's internal processes (24%), and when they give what are perceived as false promises (23%).

AASHTO TSP2 Bridge Preservation Technical Services Program is the most widely used resource by DOT agencies for the evaluation and adoption of new, innovative products (24%). Other resources are the National Cooperative Highway Research Program (NCHRP) (21%), AASHTO National Transportation Product Evaluation Program (NTPEP) (17%), and FHWA Innovative Bridge Research and Deployment (IBRD) (17%).

RECOMMENDATIONS PRODUCT MANUFACTURERS

Despite disparity and complexity of product approval procedures from state to state, bridge

preservation attracts investments from manufacturers for the development and release of new products and innovative technologies, as is corroborated by the number of new products launched on the market in the past 5 years. However, manufacturers are frustrated with more than one issue. Complexity of QPL process and limited opportunities for field test top the list. Manufacturers also mentioned some reluctance from DOT agencies to try new solutions.

Manufacturers have narrow expectations with the process of releasing new, innovative products

for bridge preservation. They target a limited number of states and rely on relationships with State DOT personnel to try overcoming difficulties in the product evaluation and approval process.

To raise manufacturers' expectations, key actions from the survey are reported in the following:

- Streamline the process for the introduction of new, innovative products into State DOTs QPL;
- Create geographical areas for common/similar specifications;
- Standardize testing procedures, for both lab and field tests; and

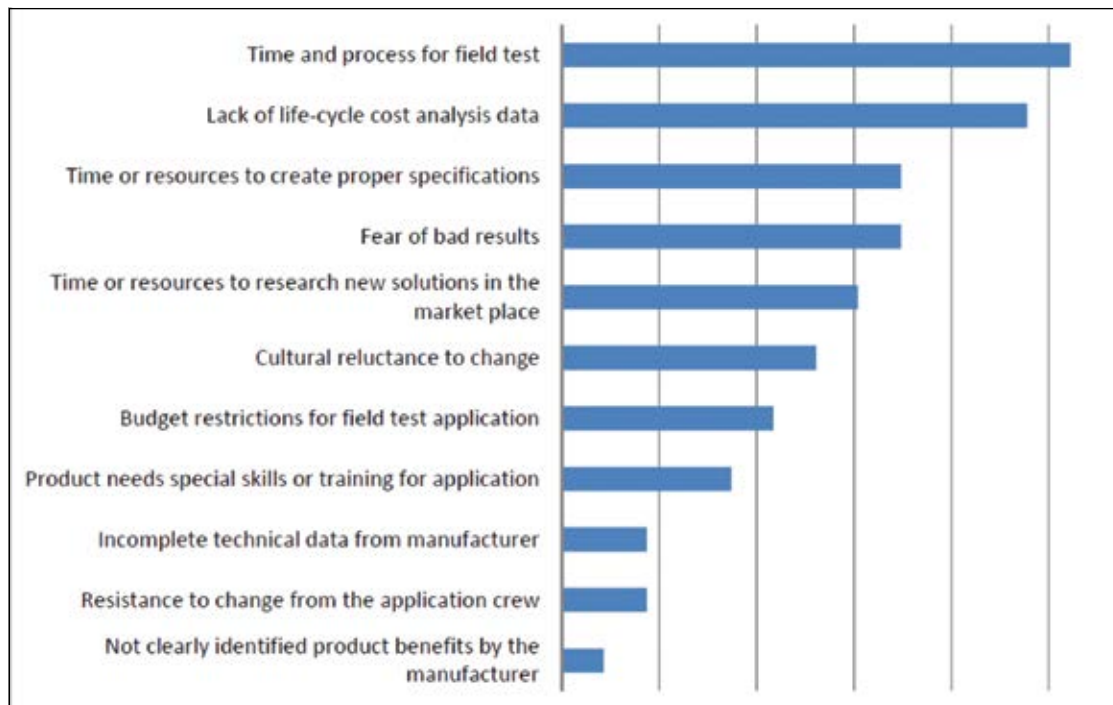


Fig. 6: Top challenges State DOT agencies have encountered with product manufacturers

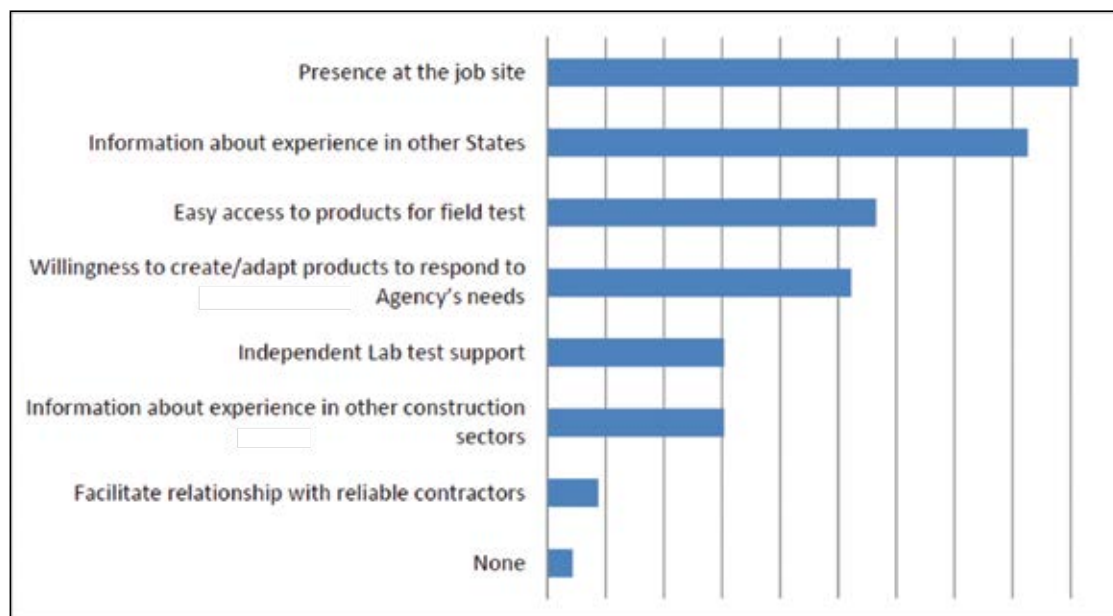


Fig. 7: Positive aspects State DOTs have encountered with product manufacturers

- Facilitate and accelerate product field evaluation. Communication with DOT agencies is vital for manufacturers to understand DOTs' needs and procedures. To build on existing relationships, recommendations are listed in the following:
 - Expand TSP2 networking and communication capacity;
 - Make manufacturers more aware of resources available for the industry; and
 - Establish key contact people within agencies for relationship with industry.

STATE DOT AGENCIES

The majority of agencies are open to try new technologies, as shown by the number of new products adopted by agencies in the past 5 years.

Similarly to manufacturers, DOT agencies feel frustrated with the complexity of the process requested to test new products and qualify them for on-going use. The insufficiency of life-cycle cost/benefit analysis and data is seen as a major limitation of the process.

To improve the process of adopting new products, a few critical recommendations stemmed from the survey:

- Adopt a simplified new product approval process; and
- Develop life-cycle cost/benefit analysis tools.

In the adoption of new products and technologies, agencies strongly rely on information from other states and from manufacturers. Providing expert information and support for field applications are manufacturers' key requisites for a successful and fruitful relationship with DOT agencies. To ease communication between DOT agencies and manufacturers, a key recommendation is to develop a preservation technology and product review site, where industry can register their products and bridge owners can review and rate them. Ideally, this service could be provided by TSP2.

CONCLUSIONS

Streamlining procedures for the evaluation and adoption of new products for bridge preservation is a key requisite underlined by both product manufacturers and State DOT agencies to create an environment that fosters innovation.

Similarity of procedures and test protocols for new product acceptance among the states is of key importance for product manufacturers. More standardization could reduce costs and time for manufacturers to release new products and spread the number of target states thus increasing the number of states that could benefit from new, innovative solutions.

A common point between product manufacturers and DOT agencies is the importance of life-cycle cost analysis. This concept is used by manufacturers in the development of new, innovative products for bridge preservation and by agencies in the evaluation of new products. However, agencies stated that more information and data are needed for an effective implementation of life-cycle cost analysis.

The need for open communication and fruitful collaboration between DOT agencies and product manufacturers is another key point that stemmed from the survey. The success of TSP2 is linked to this need.

To improve communication, manufacturers could benefit from the appointment of a person for contact and relationship with industry within each DOT agency. On the other end, agencies welcome the idea of creating a rating system for bridge preservation products, both new and existing ones. By using this system, agencies and manufacturers could share field experience, data and comments, thus achieving true transparency of information.



Lorella Angelini is a Marketing and Technical Consultant with Angelini Consulting Services, LLC. She has expertise in the field of specialty products for the maintenance, repair, and protection of concrete structures, and built her knowledge base by working for more than 25 years in managerial positions for leading global manufacturers. Angelini has experience in both Europe and the United States. She graduated as a civil engineer in Italy and specialized in marketing at SDA Bocconi in Milan. Angelini has been a member of the Bridge Preservation Expert Task Force Group coordinated by the Federal Highway Administration (FHWA) since its beginning. She is active with TSP2 (Transportation Service Preservation Technical Service Program) where she leads the social media development team and writes on the blog. She is a member of Transportation Research Board Committee AHD40, Polymer Concrete, Adhesives and Sealer, as well as ICRI and ICRI Committees 320, Concrete Repair Materials and Methods, and 330, Strengthening and Stabilization.