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Nexa Giboyeaux

Abel Recon's Sprayroq certified crew member applies SprayWall polyurethane lining to the prepared stormwater structure. (Photos courtesy of Abel Recon)

FOCUS: STORM

KEEP IT FLOWING

A sprayed-on structural coating enables rehabilitation of large stormwater pipes without traffic disruption and at major cost savings

By Mary Shafer

There's a word for traffic disruptions around Harrisburg, the Pennsylvania state capital: ugly. When two dual pipelines running deep beneath one of the area's busiest arteries showed signs of deterioration, no one wanted to repair it by conventional dig-and-replace methods.

Instead, the Pennsylvania Department of Transportation (PennDOT) settled on a trenchless solution involving a spray-on structural coating. The job saved

months of traffic disruption and an estimated \$2.6 million.

Harrisburg nestles between the eastern slopes of the Allegheny Mountains and the Cumberland Narrows of the Susquehanna River. The city of nearly 50,000 people is surrounded by small towns that the city's growth has absorbed.

Just across the river lies Camp Hill, home to the Book Clubs of America, which depends on Route 11/15 to transport inventory to and from its warehouses. Many other transportation-intensive businesses also rely on

this artery, which runs along the river through the town of Wormleysburg.

The Harvey Taylor Bridge connects Route 11/15 (locally called North Front Street) with Harrisburg's busy downtown and government complex. Beneath this bridge on the Wormleysburg side is a culvert that collects water from a small tributary, along with storm runoff from the bridge. It sends this water directly into the river through a double-barrel set of 75-foot-long, 54-inch-diameter corrugated metal pipes.

About a half-mile southeast sits the John Wormley House Historic Site, home of the city's founder. Next to that site, a similar set of stormwater pipes, 88 feet long and 60 inches in diameter, drain out to the river.

This stretch of North Front Street carries some 17,000 vehicles per day. So when a PennDOT inspection revealed the beginnings of serious structural deterioration and crushing (deflection) in both sets of pipes, it was a nightmare scenario.



Charlie Mitzel, spray application technician, uses absorbent material to remove water from between the corrugations in the culvert before final drying of the pipe.

Digging not an option

“When we started this project in 2000, we tried to do it locally, in-house,” recalls Nexa Giboyeaux, PennDOT highway design project manager. “Due to traffic control issues, we never finished. We could never replace those pipes.” In 2007, Giboyeaux took control of the project, hiring the Larson Design Group engineering firm of Montoursville to analyze and solve the problem.

The firm found that the problem was the pipes’ 20-foot depth. Replacement would mean digging a 10- by 20-foot trench on each site to enable upsizing of the pipes to box culverts — necessary to bring the pipes, laid in the mid-1940s, up to modern code standards. Then the trenches would have to be backfilled and road approaches milled and re-paved — all without compromising the environment or the historic site.

Even with detours, most of the work would have to be done at night to reduce traffic

disruption. The job would entail 10 weeks of site preparation followed by excavation and replacement for each pipe — a total of nine months for all four pipes.

The project was estimated to cost \$4.2 million — provided the culvert beneath the bridge would not also require upsizing. “If we had to replace

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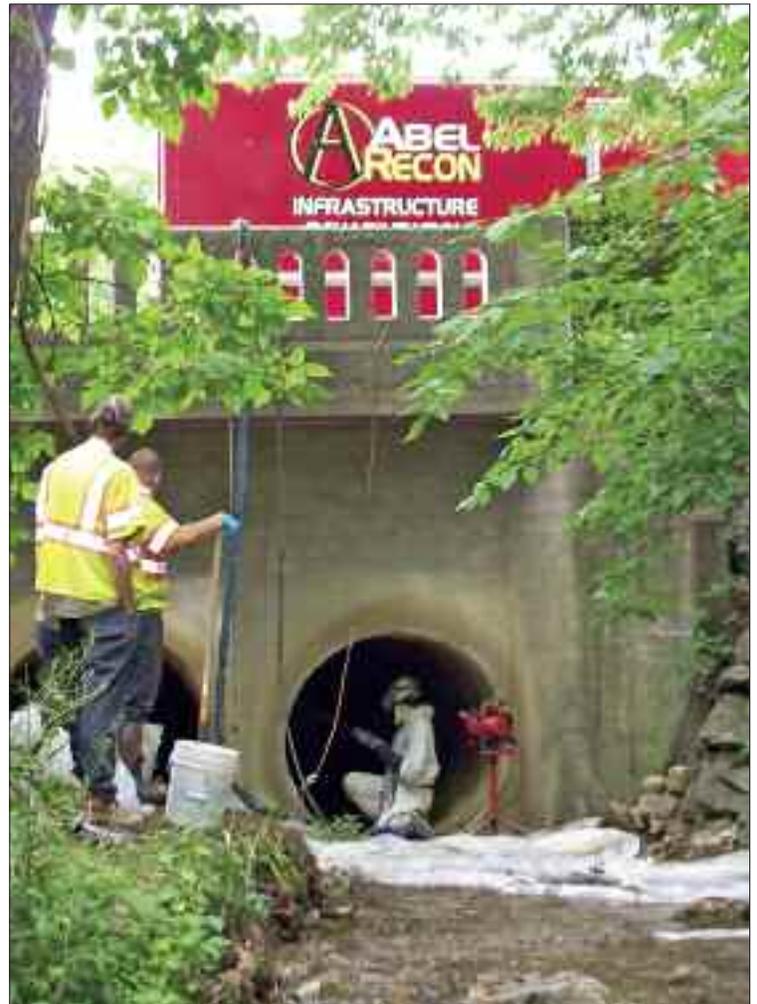
Nexa Giboyeaux

those culverts, we probably would have had to upsize them for the new designs, probably to at least a box culvert,” says Kevin Keefe, PennDOT assistant construction engineer. “Then, you’re talking about an additional \$700,000 to \$1 million.”

Giboyeaux directed Larson to research alternatives while she sought information on the Internet. Larson moved forward with the hydraulic study and flow impact reports on several options being considered.

“We had a brainstorming session with PennDOT management,” Giboyeaux says. “I

Joe Knight, spray application technician, applies SprayWall lining to the host pipe.



WIGGLING THE FOOT IN THE DOOR

Hap Witmer, general manager of Abel Recon, isn’t one to let an opportunity pass him by. Once his company completed the Wormleysburg double pipe rehabilitation, he pursued more structural spray coating projects with PennDOT.

“I’m actually in the design phase for another corrugated pipe job,” he says. “It’s buried about 85 feet deep.” When PennDOT built this road, which passes through a valley and then climbs a mountain, it laid a pipe to accommodate a stream at the valley bottom, then filled the rest in and paved over it. Now the pipe needs help.

Abel can access the 72-inch corrugated pipe by parking its trucks at the top of the hill and stretching hoses down to it. Crews will be able to prepare and spray it even though the trucks can’t get down to the pipe.

gave some input, they gave some. We ran a few different scenarios and picked the top technologies that met our time, money, quality, safety, environmental and traffic impact requirements.”

Viable choices included

cured-in-place pipe (CIPP) lining and structural spray coating over pressure-jetted pipes and grout-filled voids.

Environmental concerns

PennDOT ultimately chose Sprayroq SprayWall



The foreground pipe is shown lined and is back in service while the other pipe has had its flow diverted while being prepared for lining. The pipes discharge directly to the Susquehanna River.

polyurethane coating for its ability to strengthen and protect the structure. Application would not disrupt traffic. Because both sets of pipes were accessible to man entry, no trenches would be needed.

In addition — in keeping with the agency’s green initiatives — the material would release no volatile organic chemicals (VOCs). Finally, the project would not release any debris or contaminants to the river. That meant it required no EPA permits — only Standard General Permits from the Department of Environmental Protection.

Abel Recon, infrastructure rehabilitation contractors based in Mountville, won the bid to apply the material.

The logistics of the two sites were not challenging.

“We did the whole project with a spray truck, a prep truck and a pickup truck,” says Hap Witmer, Abel Recon general manager. “We just parked them in normal parking spots alongside the road.”

Abel Recon worked the sites with a crew of seven, taking hoses into the pipes from the tops of the culverts. The banks were not disturbed, and no restoration was needed. To prepare the site, workers built temporary walls and dikes using boards and sandbags to divert water from the work pipe into its twin. The pipes were already coated with coal-tar epoxy, commonly used on corrugated metal pipe to extend its life.

The epoxy offered good adhesion for the coating, but Abel Recon needed to pressure-wash any loose material, using pressures from 2,000 to 3,000 psi. Technicians installed tightly woven “silt sacks” (catchment bags) at

the pipe ends to catch debris and keep it from entering the river.

Night spraying

Next, workers used grout to restore the corrugated profile of the pipes near the exposed ends, where air and moisture had pitted and eaten through the metal. “There were some pinholes and maybe some 1-inch holes, but other than that, the rest of it was in fairly good shape,” says Witmer.

The surface preparation took a single 12-hour day shift for each pipe. Then the night shift sprayed on the polyurethane coating, applying it at a relatively uniform 500 mil thickness, based on the ASTM 1216 material design equation for structural integrity of materials. Uniformity was audited by American Testing of Lancaster.

Application proceeded at about 10 feet per hour. The team used about 15,000 pounds of material for all four pipes. Because the coating cured quickly, water flow was restored within minutes after application and thickness testing. Abel Recon crews worked around the clock. Pleasant May weather with a favorable curing temperature of 50 degrees helped smooth progress.

In the end, the project saved significant time, labor and money and avoided months of traffic disruption that would have aggravated motorists.

Cost benefits

The biggest benefit was

cost reduction. “The original scope for the project was to replace these pipes, and do ADA ramps in the intersections to current standards,” says Giboyeaux. “We’d have milled old pavement from the road, and then down into two inches of roadway. We’d have removed all that black material, then put down brand-new overlay on the road. With all that together, the budget scope was \$4.2 million.”

Instead, the pipe rehabilitation alone cost \$275,500, and the entire project cost \$1.4 million — a savings of \$2.6 million. Rehabilitation of each dual pipe took about four days. “Just to give you an idea, with \$2.6 million, we can pave probably around seven to eight miles, if we just overlay,” says Giboyeaux.

“We minimized the traffic impact, minimized and in places eliminated environmental impact, and saved money and time, all with one quality product. Often we don’t have the luxury to close down a road.”

Witmer finds his own satisfaction in a job well done. “You know, to be able to work with PennDOT on new materials and, hopefully, help them do projects a lot cheaper than just their normal dig and replace — it’s exciting.” ♦

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