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concrete pavement preservation (CPP) slashes repair costs

City of Baytown, Texas, Lowers Expected Price Tag by 80 Percent with CCP

CCP Techniques are Less Invasive, Low-Cost Alternatives to Full Concrete Replacement

WHEN THE CITY OF BAYTOWN, TEXAS, FACED RIDE QUALITY AND DRAINAGE ISSUES on a heavily traveled main street in 2015, the city's Public Works and Engineering Department needed to find a cost-effective repair strategy.

Installed in the 1980s, N. Main Street is a concrete road that serves as a major right-of-way, with two lanes in each direction as well as a turn lane. It also is a truck route that serves nearby industrial areas. The aggregate used in the original construction was river rock, an exceptionally hard material. Measurements from hardness tests on the aggregates were an 8 on the Mohs scale of mineral hardness; in comparison, diamonds measure a 10. Some of the roadway's ride quality issues were due to the wearing away of the cement paste layer and consequent exposure of the hard rock.

On the section of street in need of repair, pavement condition index (PCI) measurements averaged 43, with four sections being in the low 20s to mid-30s. The PCI scale is based on a 100-point range, with 0 representing the worst conditions and 100 representing the best. Reconstruction was considered, but with an estimated cost between $12 million and $13 million, the city didn't have adequate funding for a project of that scope, said Kevin Harvill, assistant director of public works and engineering.

Through word of mouth, Harvill's team learned about concrete pavement preservation (CPP).

» AN IDEAL CPP CANDIDATE

CPP is a non-overlay option that consists of engineered techniques to repair areas of distress in concrete pavement without changing its grade. It restores the pavement to a like-new condition, reducing the need for major, more costly repairs. By addressing the causes of pavement distress, CPP minimizes further deterioration and ensures continued durability for decades to come. In contrast, covering the distress with an asphalt overlay does not correct the root causes, allowing the distress to manifest again within a short time to typically become a larger, more expensive problem.

For a pavement to be a good candidate for CPP, it should show an adequate level of structural integrity. Prior to project inception, the extent and severity of distresses should be analyzed so proper repair methods can be determined. The types of deterioration to look for include poor ride quality, cracked slabs, corner breaks, joint pumping, faulting at transverse or longitudinal joints and joint sealant failure. For long-term repairs, chemistry problems such as alkali silica reaction (ASR) should not be present in the pavement.

"One of the keys to success on the N. Main Street project was the timely application of CPP treatments before the pavement deteriorated to the point where the repair cost would outweigh the benefits. CPP typically works best when applied before excessive cracking and spalling manifest due to long-term neglect," said John Roberts, executive director of the International Grooving & Grinding Association (IGGA).

» TURNING TO THE EXPERTS

Because the public works department had no experience with a CPP program, one of the first steps was to meet with experts to learn more. Harvill and his team consulted with states that have performed or overseen CPP projects and took online training classes through the University of Iowa's National Concrete Pavement Technology Center (CP Tech Center). They also consulted with IGGA, which serves as a technical resource for pavement preservation and restoration.

During project planning, IGGA experts and Baytown officials inspected the roadway, confirming that the pavement showed adequate structural integrity and was a good candidate for CPP. They then worked together to develop specifications, gleaning insights from states with detailed specifications already in place.

"In addition to helping us refine the specs, IGGA assisted us in determining when to bid the project as well as identified contractors across a larger geographic area," said Harvill. Highway contractor Interstate Improvement, based in Faribault, Minn., was selected to perform grinding, cross-stitching and dowel-bar retrofits because of their extensive experience with CPP. Nathan Sirek, project manager with Interstate, visited Baytown and consulted with department officials before work commenced.

"On city streets, public access and aging utilities generally lead us to less invasive repairs, such as cross-stitching and dowl-bar retrofits," said Sirek. "These are also low-cost alternatives to full concrete replacement. Partnering with Baytown's Public Works and Engineering Department to identify and implement the proper repair for each distressed area was the key to a successful project."

Construction began in 2020 and was completed in Spring 2021. The city replaced approximately 20 percent of the road surface, with CCP work including:

- Full-depth panel replacement.
- Dowel-bar retrofit (using 300 dowel bars) for transverse cracks.
- Cross-stitching (using 2500 deformed rebars) for longitudinal cracks and joints.
- Replacement and resetting of manholes.
- Approximately 47,000 square yards of diamond grinding, removing approximately 1/8-1/4 inch.
- Crack repair and sealing.

Diamond grinding the extremely hard river rock aggregates originally used to construct N. Main Street proved to be especially challenging.

"The combination of hard exposed aggregates, manholes and/or valve boxes to grind around, and intersections with cross-slopes requiring daylight grinding made the project time-consuming. Plus, the location of the pavement within city limits made it desirable to create an aesthetically pleasing surface in addition to the goal of improving ride quality," said Sirek.

» RESULTS: DRAMATICALLY LOW COSTS, SMOOTH PAVEMENT

The project was a success by all measures. Cost savings were enormous, with CPP treatments being completed for $2.2 million—less than 20 percent of the cost of reconstruction—saving the city approximately $10 million. PCI measurements improved to an average of 75 to 80. Not only were department officials pleased with the rideability of the finished road surface, but residents were as well.

For cities looking to stretch their budgets, achieve sustainability benchmarks and have high-quality concrete roads, CPP is a wise approach.