U.S. AND EUROPEAN ASPHALT TECHNOLOGIES
A Perfect Marriage

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The Hale Boggs Bridge over the Mississippi River at Luling, Louisiana, is a cable-stayed bridge with a steel deck. It is part of an important Interstate loop that carries a large traffic volume around the New Orleans metropolitan area. The bridge has four lanes—two in each direction. The design of the wearing surface for the steel deck stipulated an epoxy asphalt layer less than 100 mm thick because of that material's lower dead load weight, impermeability, and resistance to permanent deformation and fatigue. In early 1983 the wearing surface was constructed, and later that year the bridge was opened to local traffic. The area of the asphalt-covered deck was 12,240 m^2.

PROBLEM

Before construction had been completed, blisters started to form on the epoxy asphalt wearing surface. These blisters were the result of the entrapment of water vapor from moisture in the mix during construction. More than 3,000 blisters had been repaired by the time the bridge was opened to local traffic. Yet breakdown of the epoxy system continued, and resulted in distress of the wearing surface in the form of shoving and rutting.

By 1986, shoving and rutting of the mix were limited to three areas. With the connection of the southbound approach to a major highway in 1988, however, traffic volume increased to 9,000 average daily traffic (ADT), and the distress increased. In 1992 a maintenance overlay was placed on the three worst areas, approximately 280 m^2, using a polymer modified asphalt concrete (PMAC). The cost of this maintenance patching was $40,000. In 1993 the north approach was connected to the 1-310 loop, and traffic increased to over 28,000 ADT. Many new distressed areas formed in the wearing surface. A new mix design that would resist permanent deformation and provide extended fatigue life was therefore needed.

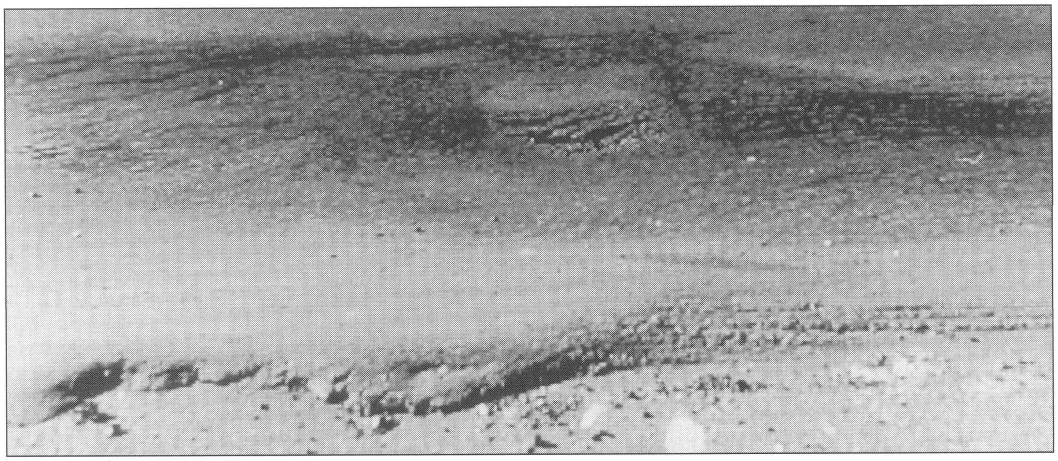
SOLUTION

Investigation indicated that the steel deck was reaching a temperature as high as 77°C inside the box girders. The high temperature was causing a loss of bond between the asphalt binder and the steel deck, resulting in the observed shoving. At that time Louisiana did not have Superpave™ mix design capabilities, so a latex modified concrete (LMC) or a PMAC overlay was proposed. LMC was eliminated after an off-site trial. The observed performance of PMAC under service conditions was better, but not satisfactory. Therefore, the Louisiana Transportation Research Center recommended a merging of two technologies: use of the Superpave™ method to specify a performance graded (PG) asphalt binder and incorporation of the selected binder in a European stone mastic asphalt (SMA).

Several polymer modified asphalt binders were tested using the Superpave™ method. A laboratory program was established to test asphalt mixes containing the selected asphalt binders. Each mix was tested for indirect tensile strength, strain at failure, indirect tensile creep, and fatigue. The test results were then statistically evaluated. On the basis of the test results, field implementation of a modified asphalt SMA containing the selected PG asphalt binder was recommended.

APPLICATION

To evaluate production, handling, and compaction issues before deck construction, an off-site test was conducted. The bridge deck construction



Breakdown of epoxy asphalt layer covering deck of bridge quickly resulted in shoving and rutting of wearing surface.

sequence consisted of removing the existing epoxy asphalt, replacing the primer coat where necessary, and applying the tack coat and the modified asphalt SMA. The PG asphalt binder was also used as the tack coat material because of the high-temperature concerns.

During the actual paving operation, a material transfer device was used to facilitate a continuous paving operation, which was essential for smooth placement of the stiff mix. The bridge was closed in one direction for the paving operation, which was limited to Sundays.

To maintain a continuous operation on the bridge deck, the plant production rate was greatly reduced, which resulted in several unscheduled construction stoppages. In addition, the viscous asphalt with its high polymer content plugged the asphalt lines, and the fine-sized material needed for the SMA sometimes had problems with the cold feed. Other than these problems, the construction of the modified asphalt SMA overlay was a success.

After 2 years the mix is performing well and shows only minor distress. The distress is limited, however, to four areas that are directly related to the construction problems noted earlier.

BENEFITS

The design load limitations on the Hale Boggs Bridge dictated that a wearing surface of less than 100 mm be used. The epoxy asphalt mix originally used for the wearing surface broke down under the extreme service conditions imposed by the Louisiana environment. The cost of the epoxy asphalt mix was $400/Mg in 1983. Monthly repairs were needed before the construction was completed, and major areas of the bridge required maintenance patching at a cost of $40,000 within a few years after placement.

The SMA mix designed using the Superpave™ PG asphalt binder has satisfactorily carried the high traffic volume on the bridge without requiring any maintenance for 2 years. The cost of the SMA mix was $94/Mg in 1995, and a total of 2,000 Mg of the mix was used. Use of the SMA mix resulted in a significant savings on initial costs as compared with the epoxy asphalt mix: the Louisiana Department of Transportation and Development estimates savings of at least $500,000. Additional savings have accrued during the last 2 years because no maintenance work has been needed. This marriage of U.S. and European technologies has therefore proven to yield significant benefits.

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