Texas Department of Transportation

C & M T

Technical Advisory

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Use of PFC to Improve the Performance of CRCP

Introduction

Results of a recently completed project in the San Antonio district show that an overlay with Permeable Friction Course (PFC) can dramatically improve the performance of a Continuously Reinforced Concrete Pavement (CRCP). This project is the first of it's kind in Texas. However, this practice has gained widespread acceptance in Arizona. As a result of their previous successes, the Arizona Department of Transportation (ADOT) recently launched a campaign to use PFC to overlay most, if not all, existing CRCP in the greater Phoenix area.

Results from the Texas Department of Transportation's (TxDOT)'s project in San Antonio show that an overlay of only 1.5 inches of PFC:

- improved the ride quality of the existing CRCP by approximately 61%
- improved the skid resistance by over 200%
- reduced the noise levels by an average of 14 decibels (dB).

A noise reduction of 3 to 6 dB is normally considered to be very good. The noise reduction of 14 dB experienced on the San Antonio project is not only considered outstanding but is very possibly the largest noise reduction ever recorded on a TxDOT project.

PFC overlays on CRCP appear to merit serious consideration, given that Texas has a large amount of existing CRCP that currently ranks poorly in terms of ride quality and noise.

Background

The project is located on IH 35 between mile marker 166 (near Walzem Road) and 168 (near Weidner Road). The New Braunfels Area Engineer (Greg Malatek, P.E.) and his assistant (Michelle Kopp, P.E.) were the engineers in charge of the project. The project was let in May of 2002, awarded to Dean Word Company, Ltd, and completed in the fall of 2002.

The existing CRCP was constructed in the early 1980s. The existing CRCP was generally sound, with only minor distresses. Safety concerns were the primary reasons for placing a hot mix overlay on the CRCP because skid resistance of the existing CRCP was low and the roadway had a history of numerous wet weather accidents. In addition to the safety concerns, the existing CRCP was also extremely rough and, therefore, extremely loud. Complaints were common. In some ways it represented a "worst- case-

scenario" of pavement performance. It was not **comfortable,** but it was **durable**. In other words, it was "a problem that wouldn't go away."

The Area Engineer chose an asphalt rubber (AR) version of PFC for the overlay. AR (which contains approximately 18% crumb rubber) was chosen as the binder due to its excellent adhesive characteristics and history of successful performance on CRCP overlays in Arizona. PaveTex Engineering designed the PFC mixture and Cox Paving provided the AR binder. The mix was designed to have 8.3% binder and a total of more than 18% air voids.

To date, TxDOT has approximately 20 overlays with PFC. PFC mixtures are used extensively throughout the southern region of the United States. The most common mixture of PFC utilizes fibers and polymer modified asphalt. PFC with AR is the second most common. PFC is the surface mix of choice in Florida, Georgia, Alabama, South Carolina, and Arizona. It is gaining popularity in Texas, New Mexico and other states due to its benefits:

- reduced hydroplaning
- improved skid resistance
- reduced splash and spray
- improved visibility of pavement markings
- reduced traffic noise
- improved ride quality

Results

Before and after ride quality results are presented in Table 1. Ride quality was measured using the International Roughness Index (IRI) with a high-speed inertial profiler. On average, the roughness was reduced by 128 inches per mile with the PFC overlay. This represents approximately a 61% improvement in ride quality. Research has shown that improving the ride quality of CRCP pavements can significantly extend its performance life by reducing the dynamic loading associated with roughness.

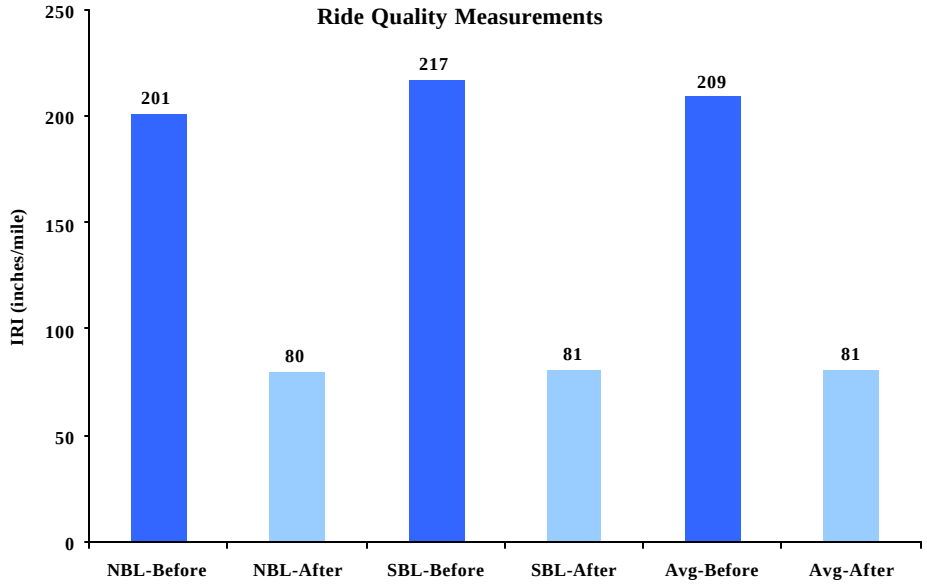

Table 1. Average Ride Quality Measurements

The before and after sound pressure (noise) measurements are presented in Table 2. The measurements were taken along the edge of the pavement using handheld noise meters. The results in Table 2 are the average readings taken at several locations along the project. The locations were documented so that the before and after readings could be taken at the exact same locations. On average, the noise was reduced from 85 to 71 dB. The reduction of 14 dB is significant because sound pressure is measured on a logarithmic scale. In laymen's terms, the noise was reduced by more than half. Noise reduction of this magnitude can be considered even more significant when compared to what is normally achieved by constructing noise walls along the highway. Such construction is relatively time consuming and expensive. Costs typically run over 1 million dollars per linear mile.

After the PFC overlay on this project, numerous compliments were received related to noise reduction from local business owners and residents. Numerous positive comments were even received on a radio "call-in" talk show.

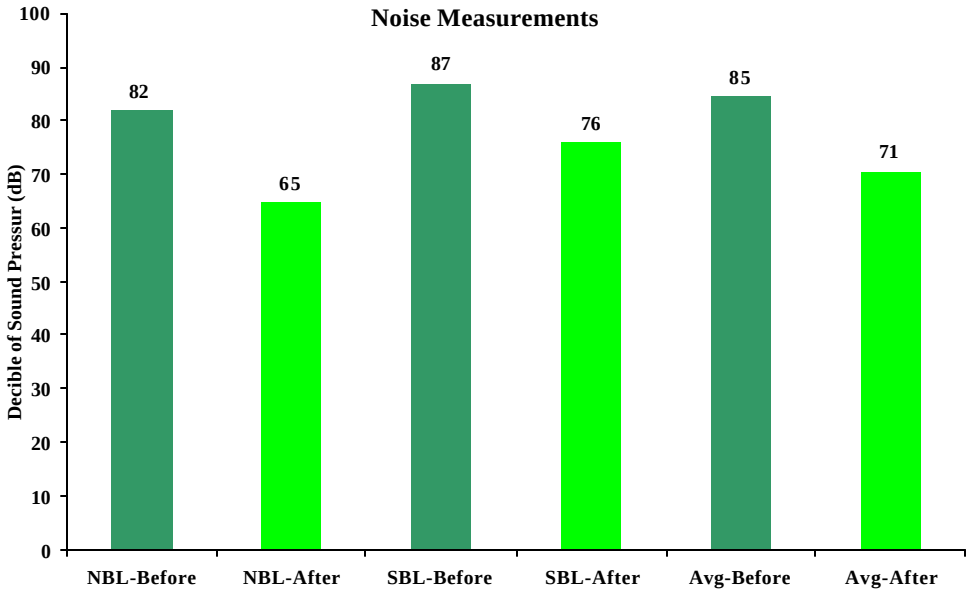

Table 2. Average Sound Pressure (Noise) Measurements

Conclusions

Early results from TxDOT's first PFC overlay on CRCP are extremely positive. If this project has the long-term success experienced in Arizona, this paving strategy should dramatically improve the performance of CRCP pavements in Texas. This combination strategy has the potential to optimize the durable properties normally associated with CRCP and add the safety and comfort properties associated with hot mix asphalt pavements. PFC and CRCP may be a winning combination to address TxDOT's vision to provide pavements that are **comfortable**, **safe,** and **durable**.

If you would like more information, contact Dale A. Rand (512.506.5836) or Amitis Meshkani (512.506.5847) at the Flexible Pavements Branch of the Construction Division.

Special thanks to TxDOT employees in the New Braunfels Area Office, San Antonio District pavement management staff, the Asphalt Institute, PaveTex Engineering, Cox Paving, and Dean Word Company.