Performance Evaluation of NOVACHIP: Ultrathin Friction Course

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Summary of Texas Department of Transportation Research Project 553

Problem Statement:
In many urban and high-volume traffic areas, conventional pavement rehabilitation or preventative maintenance materials pose problems to highway engineers. For example, rock sometimes loosens on chip seals, or unacceptable traffic congestion results from crews waiting for materials to cure. In addition, some conventional surface rehabilitation materials can sacrifice skid resistance or do not adequately protect the underlying pavement from surface water.
Highway departments facing tighter budgets must develop new methods to cost-effectively and efficiently repair roadway damage. A promising alternative to traditional roadway rehabilitation treatments is a French-developed process, NOVACHIP, sometimes known as ultrathin friction course.
The process consists of placing a layer of hot-mix material over a polymer-modified asphalt tack coat with a special paving machine. Layer thickness ranges from 10 to 20 mm, depending on the maximum size of the stone (typically 1.5 times the diameter of the largest stone).
The hot-mix material is a gap-graded mixture and includes a large portion (70 to 80 percent) of single-sized crushed aggregate bound with a mastic composed of sand, filler (if needed), and asphalt binder. Engineers describe this mixture as "hot, coated chippings."
The binder content of the asphalt-aggregate mixture ranges from 5.3 to 6.0 percent. The heavy tack coat consists of a polymer-modified emulsified asphalt, and the application rate commonly varies between 0.7 and 1.0 liters per square meter.
A specifically designed paving machine applies the NOVACHIP surface. This machine combines the functions of an asphalt distributor and a laydown machine. The paver applies both the tack coat and hot asphalt mixture in a single pass. This heavy application of tack helps to ensure adhesion of the friction course to the underlying pavement and reduces the possibility of surface water intruding into the pavement substrate.
Although 11 countries report the successful application of 15 million square meters of NOVACHIP over the past five years, the technology is unproven in the U.S.

Objectives
The Texas Transportation Institute (TTI) conducted study 9-553, Performance Evaluation of NOVACHIP: Ultrathin Friction Course, in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA), to thoroughly investigate and evaluate the NOVACHIP construction process and its performance over a period of three years.
To accomplish this, the San Antonio District of TxDOT selected 14 km of SH 46 in Comal County and 6 km of US 281 in Bexar County for a surface rehabilitation project using the NOVACHIP process. In addition, a 3 km pavement section on US 281 served as a control, or "no treatment," section.
Prior to construction, researchers visually evaluated the sites to document existing conditions and measure ride quality and skid resistance. The surface of US 281 was a double chip seal that was in relatively good condition. The primary types of distress observed were some slight to moderate bleeding in places and slight raveling. SH 46 was also in good condition. The primary surface distress was longitudinal cracking and some slight raveling. The cracks showed signs of previous sealing, but at the time of the survey, were partially sealed.
Following construction, researchers conducted semi-annual evaluations of the pavements and documented the performance. Additionally, researchers collected friction data semi-annually and measured ride quality annually.

Findings
Field performance of NOVACHIP was excellent throughout the study. Three years following the rehabilitation project, the surface was essentially in the same condition as it was immediately after construction, showing no signs of significant distress.

The NOVACHIP surface significantly increased the skid resistance of the pavement and had a higher skid resistance than the control section. In addition, researchers observed a slight improvement in ride quality. Evaluation of the process revealed several distinct advantages. The process is suitable for use on high-volume pavements because there is no chip loss. It is also resistant to mat damage caused by turning and braking maneuvers. Researchers found that NOVACHIP cures quickly and has the ability to reshape minor surface irregularities. The process also appears to offer:
excellent aggregate retention;
excellent sealing of the old surface to prevent or minimize the intrusion of surface water;
superior surface macrotexture;
strong adhesion to underlying surface that minimizes delamination; and
low rolling noise characteristics.

Implementation
NOVACHIP is a promising preventive maintenance treatment or surface rehabilitation technique for asphalt concrete pavements with distinct advantages over conventional surfacing methods. This treatment offers engineers an alternative to chip seals, microsurfacing, open-graded friction courses, or thin asphalt concrete overlays.
The NOVACHIP process is ideal for use in urban areas and high-traffic volume areas where other preventive maintenance treatments pose problems. Researchers recommend using NOVACHIP as a skid-resistant surface layer. They also suggest that further study be conducted to determine the cost effectiveness of the process.
While this is a relatively new treatment, the availability of NOVACHIP is improving and its use is becoming more prevalent. Two contractors in the U.S. are now distributing the process. In addition, during the past three years, crews installed more than 1 million square meters of NOVACHIP in the northeastern part of the country.

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The contents of this summary are reported in detail in the following TTI Research Reports:
553-1, "Evaluation of NOVACHIP - Construction Report," Cindy K. Estakhri and Joe W. Button, September 1994.
553-2F, "Performance Evaluation of NOVACHIP: Ultrathin Friction Course," Cindy K. Estakhri and Joe W. Button, November 1995.