

Research and Technology REVIEW

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Research Bulletin

NDOT RESEARCH:

EVALUATION OF NEW PAVEMENT TECHNOLOGIES IN NEVADA

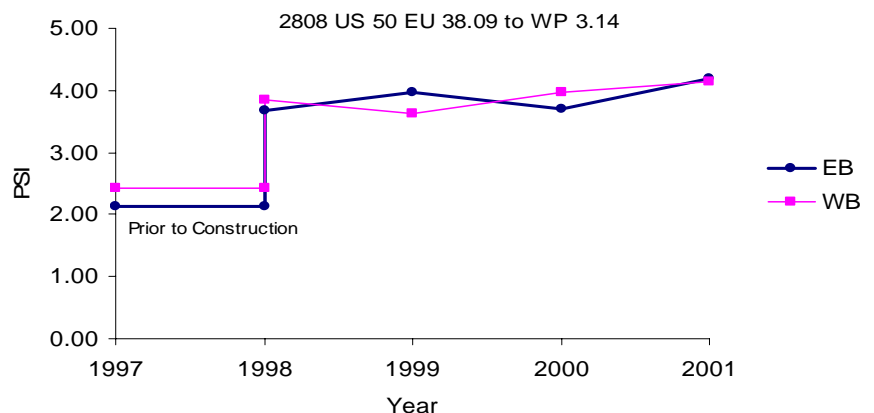
Throughout the past decade, NDOT has experimented with new technologies for the rehabilitation of flexible pavements. Research programs, including field test sections and laboratory evaluations, were implemented to assess the applicability of the new technologies under Nevada's traffic and environmental conditions. Cold In Place Recycling (CIR) and Crumb Rubber Modified (CRM) mixtures were among the various technologies that were evaluated. A recent report was produced documenting the performance of these two technologies under Nevada's conditions. The following are excerpts from the report's conclusions and recommendations.

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Performance of Cold in Place Recycling Projects

NDOT started using the CIR technology in 1995 to rehabilitate low to medium volume roads serving between 30 and 300 Equivalent Single Axle Loads (ESALs)/day. CIR consists of milling, screening, and crushing the top 2"-3" of the existing HMA layer and remixing it with a low percentage of asphalt emulsion. The resulting compacted layer represents a flexible base that is resistant to fatigue cracking and moisture damage. A new surface layer consisting of a HMA mix or a seal coat is usually applied over the CIR layer. The CIR is believed to strengthen the existing pavement by treating many types and degrees of distresses. The figure below shows the performance of a typical CIR project in terms of the present serviceability index (PSI) which is an overall indicator of the quality of the pavement.



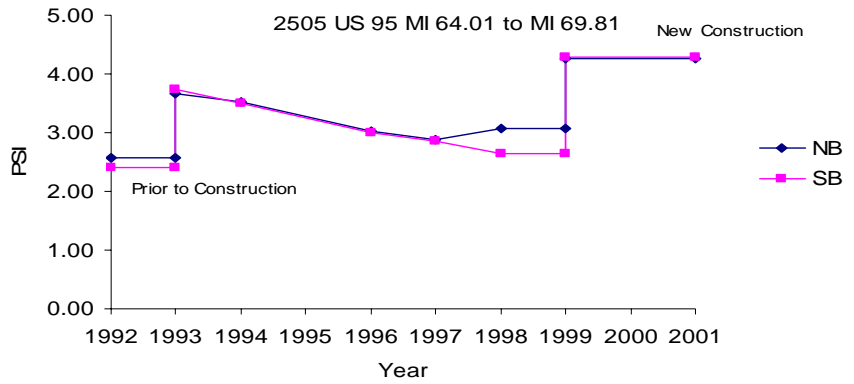
Based on the review of the long-term performance of four CIR projects located throughout the state, CIR is an effective rehabilitation treatment for roads with low-medium traffic levels. Both laboratory testing and field performance proved that the CIR process produces a more flexible and stable base course with a greater tendency to resist fatigue and thermal cracking, and rutting. Also the use of lime in the CIR mix makes it more resistant to moisture damage which greatly improves the

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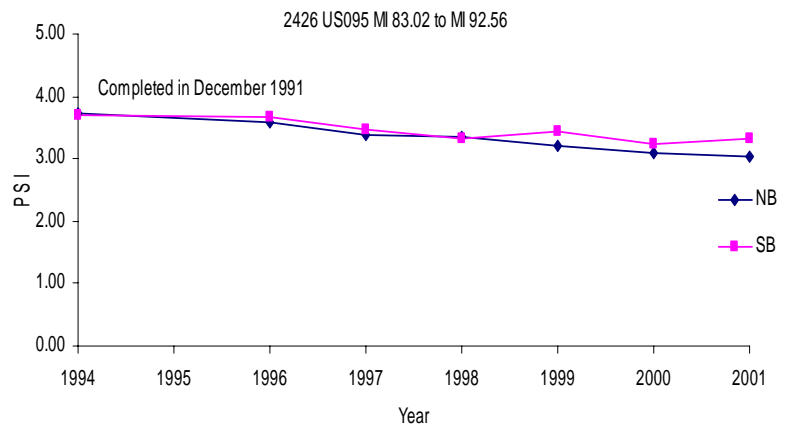
mixture's long term durability. Based on the performance of the CIR projects in Nevada, NDOT will continue to use CIR for rehabilitating low-medium traffic volume roads.

Performance of CRM projects

It is believed that asphalt pavements containing rubber are more flexible under heavy loads, which results in less cracking and durability problems. It has also been observed that asphalt containing rubber is more resistant to cold-weather cracking and warm-weather rutting. During the early 1990s NDOT constructed several sections to assess the benefits of CRM mixtures in resisting the prevailing asphalt pavement distresses, i.e. rutting, moisture damage, fatigue and thermal cracking. Based on a large amount of field performance data throughout California, Caltrans recommends that rubber-modified mixtures could be designed at half the thickness of conventional mixtures. This led to the construction of thin overlays on most of Nevada's CRM projects. Again, the PSI was used to monitor the long-term performance of CRM projects. The figure below compares the performance of a CRM mixture to the performance of NDOT's conventional mixture under the same traffic and environmental conditions.



Performance of CRM Mix



Performance of Conventional NDOT Mix

The following represents the conclusions drawn from Nevada's experience with CRM mixtures.

- NDOT started experimenting with very thin CRM overlays (3/4") with and without the stress absorbing membrane interlayer (SAMI) in an effort to offset the additional cost of CRM mixtures. The performance of both projects was very unsatisfactory with the SAMI being ineffective in retarding reflective cracking.
- The next step was for NDOT to increase the thickness of the CRM overlay. Two projects used a 1.5" CRM overlay with SAMI. The long term performance of the two projects were unsatisfactory indicating that doubling the thickness of the ARC overlay and including a SAMI is still ineffective.
- Finally, NDOT decided to increase the thickness of the CRM overlay to the same thickness as the conventional HMA overlay with and without an open grade. One project used a 2" CRM overlay with open grade and another project used a 2" CRM overlay. The 2" CRM overlay with 3/4" open grade showed comparable performance to the conventional HMA overlay but the 2" CRM overlay without the open grade showed unsatisfactory performance.

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In summary, NDOT's experience with CRM mixtures indicated that for CRM overlays to be effective under Nevada's conditions, they must be constructed similar to the conventional HMA

overlay with a minimum thickness of 2" and a ¾" open graded course. This requirement made CRM overlays too expensive to be considered as a rehabilitation alternative in Nevada.

Product Evaluation Committee (PEC) Meeting Recap

APPROVED

Reinforcing pavement fabric field test

At its June 3, 2003 meeting, the PEC discussed and approved a field test request from TechFab LLC. The company requested a test of their T1343 pavement interlayer composite (structural grid) used in road construction and maintenance operations.



Paving grid T1343 installation in Denver, Colorado. For the NDOT project, the grid will be supplied without the light weight polyester fabric.

T1343 is a continuous glass fiber grid made from a heavy-duty structural grid composed of fiberglass strands embedded in a polymeric resin. When the product is installed, the high modulus grid side structurally reinforces the asphalt overlay.

T1343 grid with an asphaltic compatible coating has been improved and features: 1) 100 kilo newtons of strength in both warp and fill direction; 2) the grid has "integrity" which is exhibited in the bond strength of the "cross-over" of the warp and fill

strands. This integrity allows the grid to maintain its "square" shape as it is being put down in the field. This translates into more effective reinforcement of the asphalt overlay; and 3) an "aperture size" that is a minimum of ½ inch (nominal size of aperture is 0.80 inch x 0.80 inch).

As we reported earlier, at its September 2002 meeting, the PEC approved establishment of a Qualified Products List (QPL) and specifications for pavement reinforcing fabric under section 731.03.01. Acceptance criteria for this type of product include field-testing to verify in-service performance even though the product may meet NDOT current specifications. The Materials Division reviewed this product information and recommended that T1343 reinforcing pavement system be installed on the next suitable construction project. The purpose of this test is to verify the constructability of the T1343 grid. This product will be installed side-by-side with Glasgrid, pavement-reinforcing fabric from California Paving Fabrics that is listed in the QPL.

APPROVED

Red-light running detection tool

The PEC approved a request from the Traffic/Safety Division to establish a QPL for red light detectors under specification number 623.05.26.

Traffic signal compliance presents special problems because traffic pursuits could be dangerous to law enforcement officers and other motorists. Use of a red light detector is one of the ways to counter this problem. This device allows law enforcement officers to position themselves on the far side of the intersection, which precludes the need to follow the offender through the intersection. Red-light detection is a rapidly developing product field that could provide an important tool for improving highway safety and preventing the running of red lights.

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Red-light running detection devices are being deployed for use on a number of NDOT projects. To date, Traffic has approved and used two manufacturers of red-light detection systems - McCain Traffic Supply and Synchronex. To ensure that approval of the red light detectors is in line with the established product evaluation process, Traffic proposed establishment of a QPL for red light detectors. Future approvals of red-light detectors for use on NDOT projects will depend on a product's compliance with NDOT Standard Specifications for this type of product covered under section 623. Companies seeking to place their products on this QPL will be directed to submit a product evaluation proposal for acceptance under current NDOT specifications. If Traffic approves the product, it will be added to the QPL.

APPROVED

Polyurea striping paint to promote quality roadway delineation

The PEC approved a request by the Materials Division to establish specifications and a QPL for advanced pavement markings – polyurea-based traffic paint. By establishing specifications and a QPL for polyurea markings, the PEC addressed the immediate operational need for this type of striping paint in District I. The PEC action will result in a higher quality of striping, fewer failures of pavement marking materials and improved safety on Nevada roadways.

Currently, six states have “formalized” polyurea specifications – Georgia, Illinois, Iowa, Kentucky, New Jersey and North Carolina. The NDOT polyurea specifications have been developed based upon review of other state DOTs specifications as well as data collected by NDOT staff through the research test sections in District I. They consist of combined contract pull sheets under sections 632, 729 and 730 of the NDOT Standard Specifications as well as based on product durability, retroreflectivity, chemical and physical properties. Polyurea striping paint specifications will be included in future contracts that specify polyurea permanent pavement markings.

The initial QPL is comprised of three products from 3M (LPM 1200), Epoplex (LS90) and Innovative Performance Systems (HPS-5). These products comply with established specifications. In the future, manufacturers seeking approval of their polyurea paints will be directed to submit a proposal for product acceptance under current specifications. Based on Materials' evaluation and recommendation a product would be added to the QPL.



The Research Division administers the Department's research, development and technology transfer program and serves as the “clearing-house” for product evaluations

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