

# RESEARCH AND TECHNOLOGY

# REVIEW

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## SPOTLIGHT ON RESEARCH PROJECTS IN PROGRESS

### PERFORMANCE OF LIME IN HOT MIX ASPHALT PAVEMENTS

As approved by the NDOT Research Management Committee for a 1998 research project, the NDOT Materials Division, teamed up with the University of Nevada Civil Engineering Department, is conducting research on the performance of lime in hot mix asphalt (HMA) pavements. This research project aims to tackle the problems associated with water sensitivity of asphalt-aggregate mixtures. Specifically, the objectives of this project are

to define the effectiveness of lime as an antistripping agent, determine the effectiveness of lime in the marination process, and revise as necessary the water sensitivity acceptance criteria for HMA mixtures using the modified Lottman test.

Stripping in asphalt concrete pavements has been a nagging problem in Nevada for many years. It causes pavement failures in the forms of raveling, rutting and cracking. Partial or complete stripping can lead to a strength loss of about 70 to 95 percent, which requires thousands, even millions of dollars in repair.

Stripping is the result of moisture infiltrating the asphalt concrete layer, leading to the loss of adhesion between the asphalt cement and the aggregate surface. Although several methods for either eliminating or correcting the causes of stripping are available, using an additive

appears to be the most acceptable. Three types of additives are generally recognized as treatments for stripping mixtures: hydrated lime, liquid antistripping agents (usually amines), and Portland cement.

The use of these additives in Nevada has produced varying results in construction projects. Hydrated lime appears to be the most effective antistripping additive. Liquid antistripping agents and Portland cement have had variable success. Hence, lime has been used exclusively as an antistripping agent in Nevada since 1986.

Hydrated lime functions in part like mineral filler and can also help to alter the chemistry of an aggregate surface. Several theories have been recognized as to why lime is so effective. First, lime improves the bonding

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Lime in Hot Mix Asphalt*

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**PEC Recap**

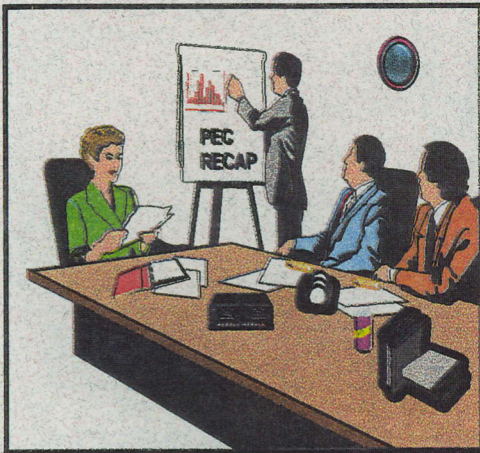
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Product Evaluation Committee

**PEC RECAP**

**March 25, 1998**



**APPROVED**

**BUNDY Pad  
for Raised Pavement  
Markers**

**W**hen the raised pavement markers get lost, a new product can be considered to fix the problem. The PEC approved the BUNDY pad from Flint Trading Inc. in March, 1998 as an alternate adhesive for raised pavement markers.

BUNDY is a nontoxic, zero V.O.C., preformed thermoplastic adhesive. It comes in a 13 cm x 13 cm, 125 mil thick square, and in a variety of colors including white, black, yellow and blue. Glass beads are intermixed in all

colors except for black.

A BUNDY can be used on asphalt, brick and concrete. It fits most of the markers available in the market - round, square, or oblong. BUNDY provides increased daytime visibility, enhanced night time retroreflectivity, and positive ID on the road surface if the marker is lost.

The BUNDY pad will be added to the approved product list under NDOT's current specifications for pavement marker adhesives. Because installation is labor intensive, the BUNDY pad will be used primarily for maintenance and repair. ☼

**FIELD TEST**

**A Reflective Delineator  
for Raised Curbs**

**A** reflective delineator, model No. CM-1 from ASTRO OPTICS CORP., was approved by the PEC in March 1998, for a field test in District I. This delineator is designed to provide obvious, easy-to-follow delineation of all median curbs along or around traffic, divisional, and channelizing islands.

The CM-1 delineator features precision-molded prisms that are

hermetically sealed to provide a brilliant signal from raised curb barriers under all weather conditions. Differing from a raised reflective pavement marker, this delineator mounts at 90° rather than 45° to a flat surface so that it can reflect the light directly back.

This delineator is approximately 8.7 cm x 5.7 cm x 1.9 cm in size. It consists of a reflector made with methyl methacrylate and a housing made with acrylonitrile butadiene styrene. The delineator comes in amber, crystal and other colors available on request. It can be mounted with solvent cement such as epoxy. To provide adequate reflectorization, it is recommended to be spaced every three or four feet. Compared with a regular reflective pavement marker, its cost is higher, but it is still cost effective in the long run.

NDOT has no current specifications for this type of product. However, there is an interest in changing current specifications to allow the use of this product as an alternate delineator for marking median islands and curbs. Based on the information presented by Gary Kinberg from the Astro Optics Corp. the PEC decided to field test this delineator. Assistant District I Engineer-Maintenance, Patty Mamola, is developing a work plan for the test. ☼



## Field Test Update

### Qwick Kurb Portable and Re- Usable Temporary Traffic Separator

In the winter issue, 1998, we reported that the PEC approved a field test of a traffic guidance system from the Qwick Kurb Inc. The system was proposed to be tested at a railroad crossing. However, due to the lack of a suitable test site for the product, the original proposed test plan was replaced with a new test plan and approved by the PEC in March, 1998.

The new test plan aims to test the product as a temporary traffic separator. The test site chosen is the Mt. Rose/U.S. 395 interchange, where some motorists traveling eastbound on Mt. Rose are using the westbound Mt. Rose to northbound U.S. 395 on-ramp. Two hundred feet of Qwick Kurb will be placed between the westbound travel lane and the on-ramp gore area to block this dangerous movement. Julie Masterpool of District II will coordinate the installation and testing of Qwick Kurb along with Chief Traffic Engineer, Scott Thorson. ★



Fig. 1 Qwick Kurb Portable/Re-usable Temporary Traffic-Separator

### On-Going Field Test Breakaway Signpost Bases

As approved at the September 9, 1997 PEC meeting, NDOT is conducting a field test of breakaway signpost bases. Eight different designs are included in the test. They were installed at FR WA-45 next to US 395, on the east side of Lakeview Interchange, at the south end of Washoe Valley. All installations were done in accordance with current NDOT requirements and/or manufacturer's recommendations, with sign

panels facing the east.

The objective of this test is to evaluate different designs for the sign support slipbases in order to solve the "wind walking" problem. The duration of this field test is one year. They are examined once per week for the first four months, and once every month for the remaining eight months. A final report will be distributed after the test is completed. ★

(Continued from page 1)

### Lime in Hot Mix Asphalt

of calcium with silica in aggregate. Second, there is a possible interaction with the acidic portions of the asphalt. Third, aggregates with clay coating have ion exchange and pozzolanic reactions between the calcium in lime and the silicates in clay. Further research shows that the effect of lime on the moisture sensitivity of asphalt-aggregate mixtures also depends on other factors such as types of lime and methods of applying lime to the mixtures. However, very few detailed research studies have been done to document the field performance of pavements with lime.

This two-year research project will be accomplished through the following tasks: (1) conduct a systematic review of literature on the subject; (2) evaluate the field performance of asphalt



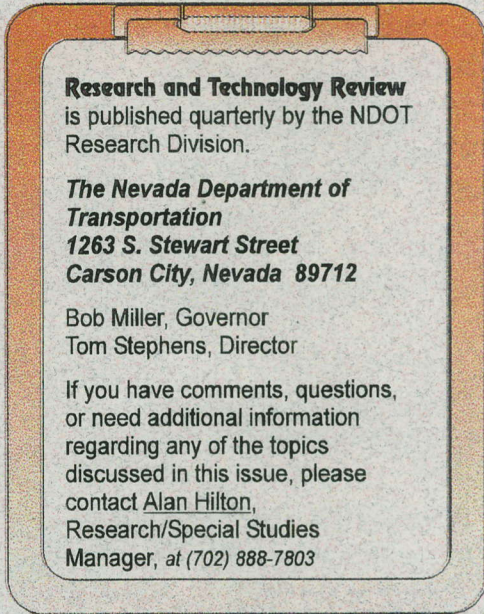
pavements with /without lime at different locations; (3) perform laboratory tests such as resilient modulus, tensile strength and water sensitivity on field cores; and (4) identify the potential benefit of marination on the aggregates that have a history of the presence of plastic fines.

At the conclusion of this research, NDOT will have documented the field performance of lime in improving the moisture sensitivity of HMA mixtures. The findings from this research will help NDOT to assess the cost/benefit ratio of using lime in the various parts of the state and make modifications in our current specifications if needed. ☆

**PRODUCT EVALUATION  
COORDINATOR APPOINTED**

Tie He has been appointed as the department's Product Evaluation Coordinator within the Research Division, replacing the recently-retired Garry Wood.

He has been with NDOT for three years, working in the Materials Division as a chemist. He earned a Ph.D. in biochemistry from the University of Nevada, Reno and has an extensive background in research, serving as a research assistant at UNR along with being a research associate for a period of time at Auburn University in Alabama. ☆



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