

# RESEARCH AND TECHNOLOGY

# REVIEW

Published by the Nevada Department of Transportation

Volume 6 Number 3

RESEARCH DIVISION

Summer Issue, 1997

## SPOTLIGHT ON RESEARCH PROJECTS IN PROGRESS

### CRASH CUSHIONS AND END TERMINALS

Over the years, the Research and Technology Review has reported on a variety of attenuating devices that have gone on to become approved for use on NDOT projects. During the early days of the department's product evaluation program, some committee members were reluctant to approve these devices due to concerns that the districts would

be forced to maintain a large inventory of replacement parts. However, since the department's acceptance of guidelines presented in the NCHRP Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features," we have approved several crash cushions and guardrail end terminals meeting the test criteria in this report.

While the Report 350 contains many changes when compared with its predecessor, NCHRP Report 230, its major changes are: different test vehicles, to reflect the growing number of pickup trucks, sport-utility vehicles, and smaller cars; changes to the number and impact conditions of the test matrices; adoption of "test" levels as opposed to "service" levels; changes to the evaluation criteria; and adoption of the International System of Units (SI). Interestingly enough, as the NCHRP 350 guidelines

gained acceptance, many manufacturers expressed concerns that they would be unable to meet the new crash-testing criteria due to the early test failures of certain devices. However, industry has met the challenge with many new and improved designs that have met these higher safety standards. The resulting changes in today's market have given states a wide range of

*(please see Crash Cushions page 4)*

### THE ANNUAL NTPEP MEETING

This year's National Transportation Product Evaluation Program (NTPEP) meeting was held in Albany, New York, with the beautiful Hudson River Valley providing the setting.

An AASHTO program designed

*(please see NTPEP page 5)*

#### In This Issue

350 Crash Cushions.....	1
NTPEP.....	1
PEC Recap	
Petraflex .....	2
Techstar .....	2
Pacific Pipe.....	3
Online .....	3
Netek.....	4





**Product Evaluation Committee  
PEC RECAP  
JUNE 16, 1997**

The Petraflex mattresses are placed on geotextile fabric that provides permeability through the revetment system. The Petraflex company claims that the interlocking units and the two-way connecting cables allow this system to articulate with unequalled strength and stability.

In their initial review, the Hydraulics Section commented that our needs are generally met with inexpensive, low-maintenance alternatives such as riprap, rigid concrete structures and gabion baskets/mattresses. However, they also expressed an interest in learning more about the potential benefits of this system, and recommended approval of the vendor's field test request.

The PEC voted to approve a field test of this system at the discretion of the Hydraulics Section.

Besides the proposed uses for this product, the Hydraulics Section and the Structures Division are also reviewing the possibility of testing this product as a replacement for slope paving under certain structures where we have experienced erosion problems. As proposed by PEC member Dale Lindsey, this type of earth stabilizing system may prevent the build up of water that has caused erosion under cracked slope paving.

Watch for updates in a future issue of the RTR. ☆

**PETRAFLEX**

**Erosion Control Revetment System**

The Petraflex articulating concrete revetment system consists of interlocking concrete blocks connected with polyester cables to form preassembled mattresses. Petraflex has designed these mattresses for ease of delivery and connection in the field using lateral polyester cables and aluminum crimping sleeves (see figure 1). Designed to provide an armored surface for long-term erosion control, its applications include, but are not limited to: earthen dams, shoreline protection, pipeline river crossings, local scour, construction scour, canals, water-control structures, and spillways.

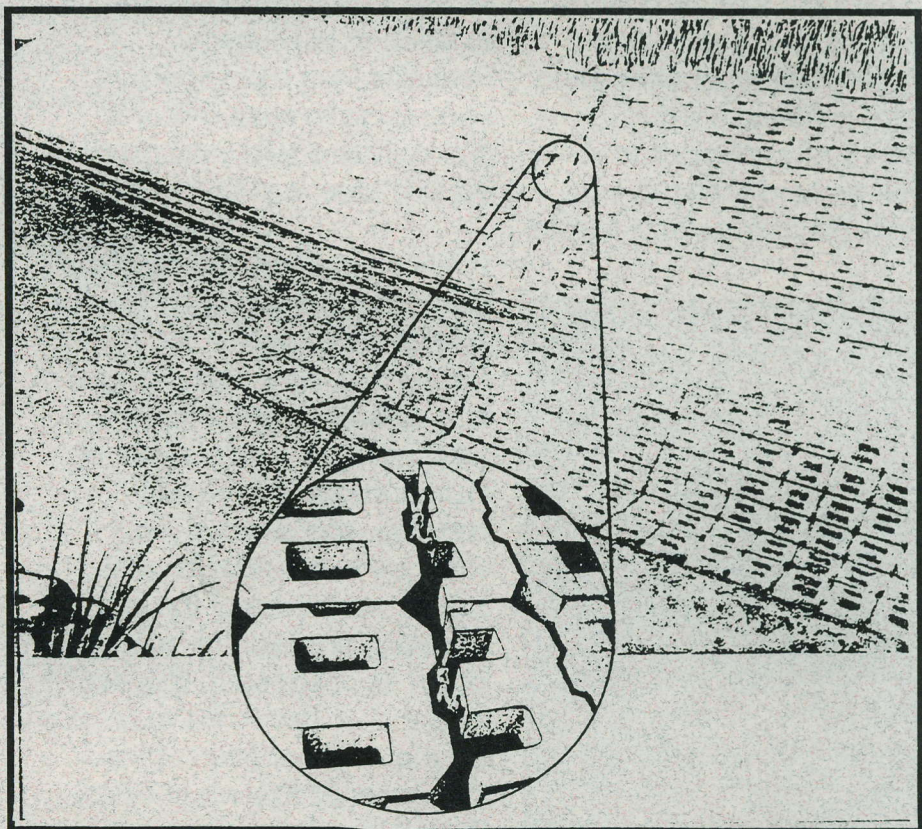


Fig. 1 Petraflex Section View



**TECHSTAR, Inc.**

**W-Seal Bridge Expansion Joint System**

The TechStar company has developed a bridge expansion joint material called W-Seal. Described as a compression-seal/strip-seal

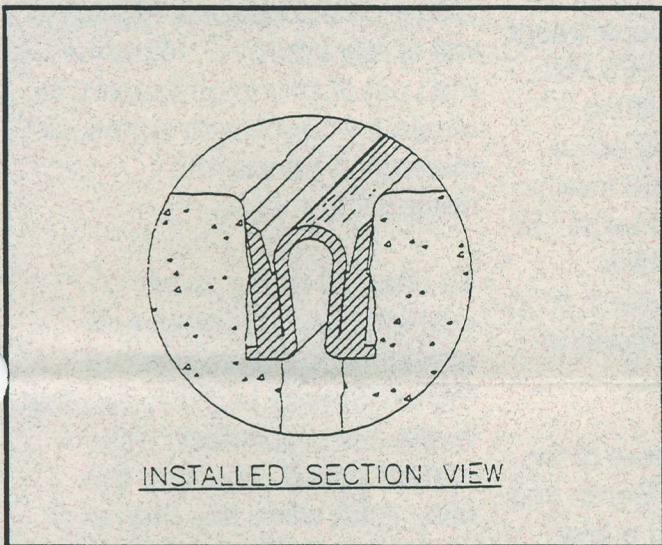


Fig. 1 Techstar W-Seal Installed Section View

design, they name the W-Seal for its "W" shape when prepared for installation into the joint (see figure 2). It is the compression of its side flanges that provides equal force against the walls of the joint ensuring a "perfect" seal. Designed for use in nominal joint openings from 1.5 to 3.2 inches, the W-Seal is claimed to withstand movements up to three inches. It is available in either Neoprene or Santoprene, however, TechStar recommends the Santoprene version for its superior bonding strength with the joint face. In

addition, the Santoprene material is reinforced with a plastic backing claimed to add enhanced puncture and tear resistance.

Based on a review of the product literature and a recommendation from Bill Crawford, Assistant Chief Bridge Engineer, the PEC approved a field test installation of the W-Seal in an upcoming

bridge joint replacement project in Las Vegas this summer. Patty Mamola, Asst. District 1 Engineer, will serve as the principal investigator for this field test, which she will conduct along with field testing of several other similar joint systems. ⚡

**PACIFIC CORRUGATED PIPE COMPANY**

Representatives of the Pacific Corrugated Pipe Company presented their new steel-ribbed polyethylene pipe (SRP<sup>2</sup>). By using the structural strength of steel and the corrosive/abrasive protection of polyethylene, the Pacific Corrugated Pipe Company has designed this pipe to provide the best qualities of both materials. In addition to its inner lining of

extruded polyethylene, this zinc-coated steel pipe is also coated on its exterior surface with DOW Chemical's TRENCHCOAT, a 10-mil polymeric film. Owing to this high level of corrosion and abrasion protection, the SRP<sup>2</sup> has a claimed life expectancy of 100 years.

While this product may be an improvement over spiral-ribbed metal pipe that is already approved for use on NDOT projects, the PEC rejected the vendor's field test request and deferred further action until current ASTM and AASHTO reviews are completed. ⚡

**RAINLINE CORPORATION**

The Rainline Corporation has developed an inverted-profile striping system using extruded thermoplastic and glass beads. The system incorporates a pressure-type extrusion method that lays the thermoplastic onto the pavement in a molten form. As the extrusion die is pulled forward, a low-pressure drop-on-type glass bead gun applies the first coat of glass beads, providing the long-term coating of embedded beads covering 50% of the line stripe. A second application of beads is

*(Please see Rainline next page)*



**Rainline**

*(continued from previous page)*

then applied to provide an upper layer of beads for high, initial retroreflectivity. Immediately following the second drop of beads, a line profiling device rolls over the thermoplastic to create the desired profile. This combination of high bead retention, durable thermoplastic material, and a raised profile, provides a durable marking system capable of providing high retroreflectivity even during wet pavement conditions.

Although the PEC agreed that Nevada has limited need for wet-weather striping, Patty Mamola, Assistant District 1 Engineer, noted that a profiled striping system may also provide a solution on certain roadways where dust often reduces the retroreflectivity of non-profiled marking materials. In addition, our limited experience with thermoplastic striping overall is cause for concern in areas where other durable marking materials have not always given us the desired results. Based on the presentation provided by Rainline's representative, Dick Norris, the PEC approved a field test in the Las Vegas area. Patty Mamola will determine an appropriate test site next to a newly placed epoxy striping project for comparison purposes. Look for a follow-up report on the performance of this system, in a future issue of the RTR.⊕



**APPROVED**

**URETEK USA's  
Concrete-Lifting  
System**

**A**fter a two-year field test, the PEC has approved the Uretek USA foam-injection, concrete-lifting system for use on NDOT projects.

First presented to the department during the December 1993 PEC meeting, this concrete-lifting system has proven itself as an effective and controllable means to lift sunken pavement slabs. In addition, the foam also fills unwanted voids to provide a solid base, reducing the likelihood of additional sinking.

The principal investigators of the Uretek field test, Peter Booth and Cliff Coleman, provided a final report on the installation and performance of this system. In their report, they state that this system provides a fast and easy means for raising concrete slabs, with the added benefit of allowing almost immediate traffic loading. In conclusion, they stated their opinion that the Uretek system is far superior to mud-jacking, and is much less costly than slab replacement. Following their recommendations, the committee agreed to approve the Uretek system for raising rigid pavements in cuts, fills, or structure approaches where settlement has occurred. They also agreed with Peter Booth's

assertion that we should use this system for settlement problems only and that it should not be considered as a solution for damaged rigid pavements.⊕

**Crash Cushions**

*(continued from page 1)*

improved crash cushions and guardrail end terminals, and safety on the nation's highways will surely improve. However, the cost of this improvement is cause for concern to states with increasing needs and decreasing means.

To date, all of the crash cushions and guardrail end terminals that have met the more-stringent NCHRP 350 test levels are proprietary, with current prices reflecting this fact. And, while this market currently exhibits healthy competition, the high price of these proprietary devices has prompted our interest in two new pooled-fund research projects: FHWA's National Pooled-Fund Study entitled "Roadside Safety Hardware Crash Tested to NCHRP Report 350", and Caltrans' Regional Pooled-Fund Study, entitled "Development of a New Guardrail End Terminal."

NDOT has committed funding to the FHWA study that they expect will provide a mechanism for participating states to pool their funds to



ave specific safety hardware tested. State representatives met in May 1996, to develop a comprehensive list of the hardware they are interested in having tested. NDOT's representative, Steve Oxoby, Chief Roadway Design Engineer, nominated three items for inclusion on this list: more research and development on the MELT guardrail end terminal; testing of a strong-post thrie beam on wooden posts; and testing of thrie-beam guardrail on a steel post, to test level three. Oxoby has expressed his belief that this study is a good idea, and has the potential of finding a good non-proprietary end treatment that will meet NCHRP 350 testing criteria.

In keeping with Oxoby's desire for a good, non-proprietary guardrail end treatment, the Caltrans' Regional Pooled-Fund Study is designed expressly to develop such a device. The goal of this study is the development of a new end terminal that: provides a high level of safety performance, is not expensive, and will replace currently used proprietary devices.

Before its failure to meet the tougher NCHRP 350 testing criteria, many states relied heavily on the breakaway cable terminal (BCT) as a low-cost guardrail end treatment. With the demise of the BCT, many viewed the modified eccentric

loader terminal (MELT) as its logical replacement, but the MELT has been unable to meet all of the NCHRP 350 testing criteria. It is due to the inability of these two, non-proprietary end treatments to meet the more stringent test levels of NCHRP 350, that Caltrans has taken on the task of this new study.

NDOT intends to contribute funds to this project, beginning in FY 1998. ☉

**NTPEP**

*(continued from Page 1)*

to provide national field testing of commercially-available transportation products, NTPEP is funded through test fees from the manufacturers of these products and, in small part, by the 52 AASHTO member departments. For an annual membership fee of \$4500, member departments support the program's publishing costs and receive performance data on a variety of transportation products including the nine product types currently under evaluation: geotextiles, joint sealers, pavement marking materials, sign sheeting materials, erosion control products, raised pavement markers, rapid-setting concrete patching materials, temporary traffic control devices, and structural steel coatings.

While the testing and administration of these test

projects are conducted throughout the year, the bulk of NTPEP action takes place during the annual meetings. Each test project is overseen by a project panel consisting of representatives from industry and member departments having a particular interest in the type of product being tested. Together, these panel members take action on a myriad of administrative tasks concerning project work plans and the logistics involved with conducting test decks and lab testing throughout the country. Nevada's representative, Garry Wood, is currently a member of several project panels including pavement marking materials, raised pavement markers, and sign sheeting materials.

During his participation in this year's meeting, Garry had the opportunity to discuss NDOT's concerns with NTPEP project reports. He explained that NDOT supports this program because we believe that nationwide test decks provide better information and reduce the time required for product testing at the state level. However, the data presented in some NTPEP test reports has required too much time to draw performance comparisons between the products tested. While they have little doubt that NTPEP test data can be invaluable, several NDOT users of the NTPEP reports have expressed their desire for a



**NTPEP**

*(continued from previous page)*

“user-friendly” format. These comments sparked a good deal of discussion on the subject of product comparisons and the pros and cons as seen by the industry and state representatives present. In the end, those present agreed that they could make changes in the reporting format that would benefit both sides of the “product comparison” issue. It is the opinion of some that manufacturers naturally want to sell their products, but their long-term prosperity is possible only when they sell to the right

market. If true, then performance data providing buyers with an easy means to compare available products and to identify products that best meet their needs, will only improve the efficiency of matching those products with their potential buyers; the program’s ultimate goal!

Copies of the NTPEP project reports are available through the Planning Division Library. If you are interested in any of these test projects or would like additional information regarding NTPEP, please contact Garry Wood at (702) 888-7220. ☎

**Research and Technology Review** is published quarterly by the NDOT Research Division.

**The Nevada Department of Transportation**  
1263 S. Stewart Street  
Carson City, Nevada 89712

Bob Miller, Governor  
**Tom Stephens, Director**

If you have comments, questions, or need additional information regarding any of the topics discussed in this issue, please contact Alan Hilton, Research/Special Studies Manager, at (702) 888-7803



**Nevada Department of Transportation**  
1263 South Stewart Street  
Carson City, Nevada 89712