

Research and Technology Review

Safety Measures to Forecast and Prevent Traffic Crashes

By: Dr. Zong Tian

A team led by Dr. Zong Tian with participation from Hongyan Gao and Lynwood Johnson, graduate students in the transportation program at the University of Nevada, Reno (UNR) conducted a research project with support from the Nevada Department of Transportation (NDOT) titled, "Developing Effective Traffic Safety Approaches to Saving Lives on our State's Highways and Streets." The research focused on development of proactive traffic safety measures to forecast and prevent traffic crashes before they occur.

"I am tired of seeing people killed every day on our nation's highway systems," said Russ Law, a long-time NDOT engineer, who initiated and strongly supported the research idea. Over 300 traffic fatalities occur on Nevada's highways and streets every year. Insufficient roadway capacity, engineering design, and roadway environment can have impact on traffic fatalities. The current practice of traffic safety programs primarily relies on crash statistics, such as crash frequency, crash rate, and crash severity, for making roadway improvement decisions. Such an approach is considered a passive or reactive approach because corrective action takes place only after crashes have occurred. Because highway crashes are actually rare events and are random in nature, it requires relatively long periods (normally 3~5 years) be-



An example of a difficult-to-see marked crosswalk after the hill

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fore statistically significant crash data can be obtained. Crash statistics are also affected because a large number of non-injury crashes normally are unreported.

A proactive approach to management of traffic safety improvements is to monitor crash surrogates and take corrective actions before a crash occurs. The two major crash surrogates that the research team investigated included citizen's complaints and tire skid marks. The research focused on the roadways in the Reno-Sparks area. During the 2-year long research period, the research team conducted an on-line survey to solicit citizens' inputs regarding their safety concerns on particular roadway locations. Based on the information gathered from the survey, the research team conducted site visits and identified problems which may be corrected by low-cost engineering solutions. A list of sites was recommended where actions should be taken to remedy the problems.

Another major effort was to correlate tire skid marks with crash statistics. Tire skid marks may be indicators of some unusual driving behaviors and potential safety hazards. According to the research, the intensity of tire skid marks on freeways was strongly related to the crash frequency, suggesting tire skid marks (intensity and type) should be constantly observed at certain locations to identify any potential safety problems and to take preventive actions.

The study is scheduled to conclude in December of 2009. A final report will be available upon the completion of the project.

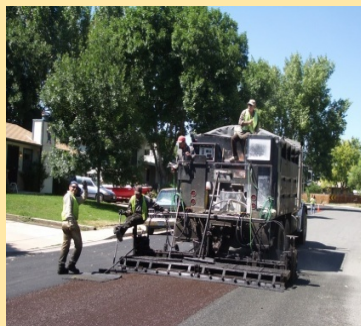
Performance Evaluation of NDOT Pavement Maintenance Activities

By: Dr. Peter Sebaaly, Principal Investigator

Maintenance plays an essential and integral part in the life of a pavement. Pavements which are left to deteriorate without timely maintenance treatments are likely to require major rehabilitation and reconstruction much sooner than those which are properly maintained. The importance of maintenance is as readily acknowledged today as it was over 80 years ago. The fundamental concept of maintenance is to slow down the deterioration process to avoid a catastrophic failure. Typically, the cost of maintenance is 10-15 percent of the expected cost to repair the ultimate failure that will occur without the application of maintenance activities. For example, national data indicate that every \$1 spent on maintaining the pavement surface saves \$5 on major rehabilitation that will be required if the maintenance activities are not conducted. This hypothesis also holds true for all highway maintenance activities.



Crack Sealing



Slurry Seal



Final Result

Deteriorated Pavement Surface Maintained with Crack Sealing and Slurry Seal

The most difficult part of implementing a maintenance program is the estimation of the long term performance of the various maintenance activities. Attempts have been made over the past 30 years to develop generic models that can accurately predict the long term performance of pavement maintenance activities. It is well known that the main objective of a pavement maintenance activity is to maintain the current condition of the pavement and slow down the rate of deterioration. In this respect, it should be understood that a maintenance activity does not have strength by itself, and its long-term durability comes mainly from the conditions of the pavement that it has been applied upon.

The pictures on page 2 show a deteriorated hot mixed asphalt (HMA) pavement experiencing some light raveling and age related cracking. The maintenance treatments applied were crack sealing followed by a slurry seal. The picture on the right shows the final result of the maintenance activity: a pavement in a much better condition with an increase in its functional performance.

In the past, the Nevada Department of Transportation (NDOT) has applied several maintenance techniques with differing results. These techniques vary from crack sealing to surface treatments to patching applications. In 2006, NDOT initiated a project to identify and study the performance of the maintenance techniques used on HMA pavements in Nevada. The project addressed pavement maintenance activity documentation that qualifies various maintenance techniques, performance of maintenance activities to find the most cost effective maintenance techniques, and development of a pavement maintenance activities program. In addition, new maintenance guidelines will be developed based on the findings and a search will be conducted to identify new and emerging maintenance activities that have not been implemented in Nevada.

The following recommendations have been made based on the findings of the research:

- To apply the national terminology for NDOT's maintenance activities.
- To adopt fourteen maintenance techniques: Chip seal, crack filling, fog/flush seal, machine patch paver laid plantmix, machine patching, machine patching blade laid plantmix, machine patching blade laid cold mix, maintenance overlay cold mix, maintenance patching (less than 500 ft), overlay inlay (over 500 ft), roadway improvements, sand seal, and scrub/slurry seal.
- To collect data from NDOT's PMS information on the above techniques.
- To analyze the techniques identifying their effectiveness.

This research project will be concluded by producing a final report which incorporates new pavement maintenance guidelines and a list of other emerging maintenance activities for Nevada.

Research problem statements for 2010 Submitted

Forty-three (43) problem statements have been submitted to NDOT research division for funding. The Research Advisory Committee will evaluate the statements by April 2009 and the Principal Investigators of the selected statements will be invited to produce research proposals.

Farewell to our Research Chief

On February 9, 2009, we gave a sad farewell to our Research Chief, Tie He. Tie chose to retire with his wife Man Zeng after his son graduated from Washington State University.

Tie began his illustrious career with the Nevada Department of Transportation almost fourteen years ago as a Chemist II in the Materials laboratory. In April 1998 he transferred to Research as the Product Evaluation Coordinator. After working his way through the ranks, he eventually became Chief of Research in June of 2004. We all wish Tie He and his family a happy future.



PRODUCT EVALUATION COMMITTEE (PEC) MARCH 2009 MEETING SUMMARY

Vendor Presentations: Two vendors made presentations to the Product Evaluation Committee (PEC) at the March 2009 meeting:

Safeco Industries LLC

Matt Graham (Matt@SafeCoIndustries.com), Safeco Industries, LLC, informed the PEC committee that high visibility is the greatest need for flaggers in today's demanding work zones. With one in three flaggers being injured or killed over their career, this need cannot be overstated.



Before Sign Illumination

The Traffic-Alert 18 and the Traffic-Alert 24 internally illuminated flagger paddles have been designed for employees working in high speed zones, night paving operations, and low visibility environments by enhancing sign visibility for work zone areas.

The Nevada Department of Transportation is considering these devices for work zone areas to enhance the safety of our employees.



Close-up of the photograph after Sign Illumination

Rehbein Environmental Solutions Incorporated

Jonas Sipaila (jsipaila@resolutions.com), Rehbein Environmental Solutions Incorporated (RESI), presented information on the Environmental Passive Integrated Chamber (EPIC) system, which relies on capillary water movement and evapo-transpiration from a subsurface water supply. The EPIC System provides moisture to the eco system above ground while reducing irrigation needs up to 85% compared to conventional irrigation methods. The system captures rain water in the right-of-way and stores the water until needed or diverts the water to a specified location. The PEC moved to accept the system as a field test in the Lake Tahoe area.



QPL Field Tests

NDOT currently has 10 field test projects at various stages of completion. A demonstration of one of these field test projects was held on March 10, 2009, at the Galleria Project in Henderson, Nevada. Jiffy clips serve as an alternative to the traditional hand tying of rebar on bridge decks. The clips are applied using a mechanical applicator gun at the rate of fifty (50) clips/per minute. This significantly reduces the project hours needed to tie the rebar and allows the employee to stand up rather than bend down minimizing worker compensation claims.

Matt Fitzpatrick (Matt@jiffyclip.com), Project Management demonstrating TiClipping of rebar.



Step 1: Positions equipment over rebar



Step 2: Tap TiClip over rebar



Step 3: TiClip secures rebar in place

“Flat” or “Half Moon”

Guideposts were removed from NDOT projects per a decision by the PEC. NDOT experienced approximately a seventy percent (70%) rate of failure in high wind locations where the guideposts snapped near the ground.

QPL Deletions

The PEC removed Textured Coatings of America (TexCote)’s Rainstopper from the Qualified Products List (QPL) due to several failures and confusion in product literature. After these concerns are addressed, TexCote will be welcome to participate in the product evaluation process.

Vendor Reinstatement to QPL Process

In the Research and Technology Review’s December 2008 issue, readers were advised that ceiling anchors pulled out from a Boston tunnel caused ten (10) precast concrete panels and hardware weighing 52,000 pounds to fall. As a result the Federal Highway Administration (FHWA) issued a Notice of Suspension for Powers Fasteners Incorporated’s products. After subsequent investigation, Powers Fasteners Incorporated was reinstated by the FHWA. The Nevada Department of Transportation (NDOT) followed up FHWA’s action with a formal reinstatement of the company’s right to participate in the product evaluation process with the exception of fast set epoxy products.



Step 4: View of Final Project

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Also, look at our webpage on the NDOT Homepage under, "Reports and Publications", for our research publications.

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**About NDOT's
R&T Review**

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

Research and Technology Review is published quarterly by the NDOT Research Division. Its purpose is to provide the latest information on the NDOT research activities including product information and other pertinent research topics.

If you have comments or need additional information regarding any of the topics discussed in this issue, please contact the Research Division.

*Edited by
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