

REVIEW

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RESEARCH DIVISION

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RESEARCH BULLETIN

New Research Projects Selected for FY 2002 R,D&T Program

The NDOT Research Management Committee, in its meeting of July 25th, 2001, approved five new research projects to be added to next year's Research, Development and Technology Transfer (R,D&T) program. 1) Exploring alternative strategies for the rehabilitation of low-volume roads in Nevada. The Materials Division will conduct this research as an in-house project. The proposed project will explore new rehabilitation strategies as alternatives to a two-inch overlay for low-volume roads in Nevada; 2) Evaluation of strategies to control erosion along U.S. 50 between Carson City and Lake Tahoe. Dr.



Photo 1: Severe erosion along U.S. 50 resulting from a culvert with free discharge.

Keith Dennett at the University of Nevada, Reno, was selected as the principal investigator for the project. This research is designed to tackle erosion problems as shown in the photos (photo 1 and photo 2) and will evaluate the effectiveness and suitability of alternative, economical, long-term erosion control strategies designed to establish and maintain a cover of protective vegetation. Specific erosion control strategies that will be examined include surface treatments like chemical stabilization and the installation of erosion

control blankets and mats; 3) Durable marking materials research. The Research Division and the Materials Division will jointly conduct this research as an in-house project. This project will systematically explore the cause of the epoxy paint failures that NDOT is experiencing and evaluate other durable pavement marking materials. The final product of this research will be a matrix showing the appropriate durable pavement marking system to be used on NDOT projects based on life-cycle costs, traffic volumes, climatic conditions and pavement

types; 4) Development of new specifications and acceptance criteria for flexible guideposts. The project is intended to be a collaborative effort between the department and the University of Nevada, Las Vegas. The proposed scope of work includes developing new specifications and acceptance criteria in conformity with the test protocols of the National Transportation Product Evaluation Program through studying the relationship between the test

In This Issue

New Research Projects.....	1
Q/A on R,D, & T.....	2
Product Evaluation.....	3
Pavement Marking.....	3
Culvert System.....	3

parameters and actual field performance. 5) WASHTO video conferencing. This is a pooled-fund study aimed at putting experts from the WASHTO states in direct contact with each other via video conferencing for the exchange of ideas and as a resource for problem solving.

In addition to the above named projects, a research proposal will be developed regarding the study of pedestrian safety in Las Vegas. A technical panel will be formed to develop a problem statement and a subsequent request for proposal will be issued; the project will be initiated during FY 2002. ?

Questions and Answers about the NDOT Research, Development and Technology Transfer (RD&T) Program

1) What do I do if I have a research idea?

Any NDOT employee who has a research idea is encouraged to contact Alan Hilton by phone at (775) 888-7803 or via e-mail at ahilton@dot.state.nv.us. Based on your preferences, the Research Division can provide you with a Research Problem Statement form or have staff write the problem statement for you. The problem statement can be submitted to the Research Division at any time. However, problem statements must

be submitted prior to January 31 to be



Photo 2: Erosion along U.S. 50 is exacerbated by steep slopes and shallow soil profiles.

considered for the following year's program. In addition, in October of each year, the Research Division will solicit research problem statements from each NDOT division/district.

2) What are the requirements for a research problem statement?

Suggestions for research are generally made on the Research Problem Statement form. There are five elements on the form: A) Problem Statement (brief statement of operational problem); B) Proposed Research (briefly describe what needs to be done); C) Urgency (what are the ramifications if the problem is not solved); D) Anticipated Benefits/Implementation, and E) Submitter (Name and Division). Also, it is required that all problem statements must be submitted to the appropriate division head or district engineer for approval prior to being

submitted to the Research Division.

3) Do I get to do the research if I submit a problem statement?

Yes and no. It depends on the topic of the proposed research. In most of the cases, the research, if approved, will be contracted out to a university or a consultant. In some cases, if NDOT has expertise in the topic and available time to

perform the work, the research will be conducted in-house. In these cases, you may be asked to be involved in conducting the research. Nevertheless, you will be asked to serve as a research project panel member to direct and monitor the research regardless of whether it is approved as a contract or in-house research project.

4) What are my division/district's responsibilities if a research project is initiated based on the statement?

If a division/district supports the project and the proposed research is approved, the division/district, depending on the proposed research, may be required to

(Continued on page 4)

Product Evaluation Committee (PEC) Meeting Recap

APPROVED

Durable Liquid Pavement Marking Materials

In light of problems with the durability of epoxy striping paint and a need for alternatives to epoxy, the PEC approved a field test of HPS-4 and HPS-5 liquid pavement marking materials from Innovative Performance Systems (IPS).

Technological advancements have created a new generation of durable pavement marking products such as HPS-4, modified urethane marking, and HPS-5, two-component polyurea marking. According to the vendor, the advantages of these products are cure speed and application temperature, color stability throughout life cycle (up to 5 years), durability, adhesion, and high retroreflectivity. HPS-4 offers performance and life-cycle improvements over current epoxy formulations with the benefit of being sprayable through existing epoxy striping machines.

The IPS products will be evaluated on the same test deck as the 3M Liquid Pavement Material 1200. Performance characteristics of the tested materials, e.g., durability, colorfastness, and retroreflectivity, will be monitored during the evaluation period. All the data collected from the test deck will be used in a research effort to develop specifications and qualified product lists (QPL) for durable pavement marking materials.

Prior to approving the field test, other states that have experience with IPS products were surveyed to determine a history of past use and/or testing. Currently, NDOT does not have any specifications or acceptance criteria covering these types of pavement marking materials. If these products perform as claimed, specifications for modified urethane pavement markings and polyurea pavement markings will be developed with subsequent establishment of QPLs for these types of products.

As mentioned above, this field test is part of a research project on a comprehensive approach to developing alternative durable pavement marking materials. As described above, this research project will result in a matrix showing the appropriate durable pavement marking material to be used under varying conditions.?

APPROVED

Con-Arch Reinforced Culvert System

Based on a recommendation of the

Bridge Division, the PEC approved a trial installation of the Con-Arch system - a reinforced concrete arch structure that can be used for culverts, small span bridges, storm sewers, underpasses, and cut and cover tunnels. The system will be evaluated to determine its constructability and functional performance as a reinforced-shotcrete culvert under Nevada conditions.

The recommendation for a trial installation in Nevada was based on a recently completed evaluation of the system by the Highway Innovative Technology Evaluation Center (HITEC) including full-scale load testing. The HITEC evaluation protocol included constructability/practicality, functional performance, maintenance requirements, safety aspects and environmental characteristics. The soil-structure interaction element in the calculations was also addressed in this evaluation protocol. Overall, the evaluation consisted of computer analysis and field-testing of the



Photo 3. Constructing Con-Arch culvert system

standard and special Con-Arch structures. These test load conditions included two trucks with tandem axles loaded to 71,000 lb per axle that were placed in the structure at 1-ft, 2-ft, and 3-ft depths of fill. Then a single axle load was simulated using hydraulic jacks to a maximum capacity of the load system. In the single axle load tests, both the standard and the special designs carried 235,000 lb or greater live load without reaching an ultimate limit state or ultimate load capacity. The load test was considered successful in that both structures met AASHTO design criteria, demonstrated the durability and functionality of the culvert system and validated the design procedure.

If successful under Nevada conditions, the Con-Arch structure could be used as a design alternative to our standard drainage structure (standard box culvert) based on project-specific requirements. ?

(Continued from page two)

commit staff time to serve on the research project panel, provide information or test sites (if needed) to the researcher(s), and see to the implementation of the research findings.

5) What happens after a problem statement is submitted?

After a research problem statement with the affected division's support is submitted to the Research Division, it

will be presented at the end of the problem statement solicitation cycle to the department's Research Advisory Committee (RAC) for ranking. Each member of the RAC ranks every problem statement based on whether the statement is aligned with the department's strategic research plan, the urgency of the problem and potential for implementation. Following the ranking, the Research Division issues requests for proposals (RFPs) for the highest rated problem statements. ?

(To be continued in the next issue of the Newsletter).

The 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 evaluation and other pertinent research topics.

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If you have comments or need additional information regarding any of the topics discussed in this issue, please contact **Alan Hilton**, Research Division Chief, at (775) 898-7962. ahilton@dot.state.nv.us



NDOT LIBRARY RECENT ACQUISITIONS

(Received April 1 through June 30, 2001)

CONSTRUCTION

Implementation of Highway Advisory Radio (HAR) for Construction Zones in Louisiana (FHWA/LA.00/339), Louisiana DOT; **3194**

Review of Improved Compaction Equipment and Technology (FHWA/NJ/1999-11) New Jersey DOT; **5106**

Using the Concrete Maturity Meter for QA/QC (PA-2000-026+97-04(22), Pennsylvania DOT; **5150**

Ground Vibrations Monitoring for Construction Blasting in Urban Areas (FHWA/CA/OR-2001/03), Caltrans; **5307**

HYDRAULICS/ENVIRONMENT

An Evaluation of the Effectiveness of Existing North Carolina DOT Wetlands Mitigation Sites (FHWA/NC/00-002), North Carolina DOT; **1376**

Modeling the Transport of Non-Attainment Pollutants in the "Hot Spot" Region of the North Central Phoenix Valley (FHWA-AZ00-490) Arizona DOT; **2372**

Assessment of Mitigating Embankment Settlement with Pile Supported Approach Slabs (LA99/333), Louisiana DOT; **3196**

Experimental Utilization of Tire Shreds to Enhance Highway Drainage (ME 0020), Maine DOT; **4875**

HEC-RAS 2.2 for Backwater and Scour Analysis-Phase One (K-TRAN:KU-009-9), Kansas DOT; **5002**

MAINTENANCE

Guide for Snow and Ice Control, AASHTO; **5138**

Lumimark Traffic Striping System Construction Report (UT-01.07), Utah DOT; **5162**

MATERIALS/PAVEMENTS

Investigation of the Applicability of Intrusion Technology to Estimate the Resilient Modulus of Subgrade Soil (FHWA/LA.00/332); **3197**

Evaluation of Ground Granulated Blast Furnace Slag in Concrete (Grade 120) Louisiana DOT; **3195**

Permeability and Stability of Base and Subbase Materials (FHWA/OH-2000/017) Ohio DOT; **3776**

Evaluation of Soil Modification Mixing Procedures (K-TRAN:KU-00-6), Oregon DOT; **5003**

Waterborne Traffic Paints a Study for the Potential Improvement in Drying Time and Cost-Effectiveness (SPR-0004(24) 12323T), New Hampshire DOT; **5097**

Resilient Modulus Properties of New Jersey Subgrade Soils (FHWA/NJ/2000-1), New Jersey DOT; **5102**

Recycled Plastic Fibers for Asphalt Mixtures, (FHWA/NJ/2000-04), New Jersey DOT; **5103**

Evaluation of Pothole Materials (FHWA/NJ/2001-02), New Jersey DOT; **5105**

Evaluation of FB-3 Modified Wearing Course (FHWA-PA-2001-002+97-04(16); Pennsylvania DOT; **5110**

Evaluation of Aggregate Sections at MN/Road (MN/RC-2000-29) Minnesota DOT; **5121**

A Study of Open Graded Base Course Performance (RDT01-007), Nevada DOT; **5160**

LTTP Data Analysis: Relative Performance of Jointed Plain Concrete Pavement with Sealed and Unsealed Joints (NCHRP 20-50(2), NCHRP; **5170**

Automated Feasibility Analysis of Cathodic Protection (Cp) and Electrochemical Chloride Extraction for Reinforced Concrete Bridge Structures in Pennsylvania (FHWA-PA-2001-005+96-31(5)), Pennsylvania DOT; **5224**

PLANNING/PROGRAM DEVELOPMENT

Methodology for Determining the Impact of Highway Bypasses in Oklahoma (FHWA/OK 01-03), Oklahoma DOT; **3709**

Knowledge Management Technologies (K-TRAN:KSU-00-5), Kansas DOT; **4999**

Impact of New Speed Limits on Kansas Highways (K-TRAN:KSU-98-3), Kansas DOT; **5000**

A Guidebook for Evaluating the Indirect Land Use and Growth Impacts of Highway Improvement (FHWA-OR-RD-16S), Oregon DOT; **5006-5007**

Transportation Engineering Planning and Design, Georgia Institute of Technology; **5136**

Algorithms for Vehicle Classification (MN/RC-2000-27), MN DOT; **5169**

Evaluation of Alignment Tolerances for Dowel Bars & their Effects on Joint Performance, (RC-1395), Michigan DOT; **5325**

RIGHT-OF-WAY

Movements in Land-Use Regulations (FHWA-AZ-01-507(2), Arizona DOT; 5151

STRUCTURES

A Modal Parameter Based Technique to Inspect Welded Reinforcement Splices during Construction (FHWA/CA/TL-2000/08), California DOT; **1374**

Dynamic Testing and Analysis of Non-Prismatic Reinforced Concrete Bridge Columns Retrofitted with FRP Jackets (RDT-01-003) UNR Earthquake Research; **2759**

Shake Table Testing of Flared Bridge Columns with Steel Jacket Retrofit (RDT-01-002) UNR Earthquake Research; **2765**

Effects of Confinement and Flares on the Seismic Performance of Reinforced Concrete Bridge Columns (RDT-01-004), UNR Earthquake Research; **2777**

Evaluation of Hydrogen Fuel Cell Power Source for Cathodic Bridge Protection System (FHWA 2001-04), New Jersey DOT; **5015**

Development of Optimal Concrete Mix Designs for Bridge Decks (CDOT-DTD-R-2001-11), Colorado DOT; Bridge Deck Evaluation Using Portable Seismic Pavement Analyzer (PSPA) (FHWA/NJ/2000-05 CAIT 26); **5104**

Soundwall Standards Research for Nevada, Part I & II, (RDT01-006) NDOT; **5158**

High-Performance Concrete Using Nevada Aggregates (RDT01-005), Nevada DOT; **5159**

Sensitivity Analysis of Fatigue Evaluation of Steel Bridges (RDT97-011) NDOT; **5233**

Performance of a Soil Nail Wall in a Frost Susceptible Environment: Results from the First and Second Winters (ME97-10a), Maine DOT; **4874**

TRAFFIC/SAFETY

A Portable Real-Time Traffic Control System for Highway Work Zones (FHWA/OH-2000/011) Ohio DOT; **1211**

Adiem II End Terminal for Concrete Barrier: Final Report (OR-EF-01-08), Oregon DOT; **1375**

Lane Transit District "Curb Your Car" Project (OR-RD-01-11), Oregon DOT; **3708**

R & D Network Shadow Advanced Traffic Operations Center to Model Signal Timing for Severe Weather Conditions (UT 01.03), Utah DOT; **4876**

Pedestrian Control at Intersections: Phase IV (MN/RC-2000-28), Minnesota DOT; **4997**
Motor Vehicle Traffic Accident Summary, South Dakota DOT; **5111**

Traffic Volume Monitoring Related Research, FHWA-PA-2001-010-97-04(93) Pennsylvania DOT; **5122**

The Role of Intelligent Transportation Systems (ITS) in Intermodal Air Cargo Operations (UCB-ITS-RR-2000-5), university of California at Berkeley; **5125**

Impacts of Resurfacing Projects with and without Additional Safety Improvements (17-9(2)) NCHRP; **5127**

Arizona Intelligent Vehicle Research Program Phase One 1997-2000 (FHWA-AZ-01-473(1)), Arizona DOT; **5152**

Arizona Local Government Safety Project Analysis Model (FHWA-AZ-01-504), Arizona DOT; **5153**

Intelligent Transportation Systems (ITS) Opportunities for Oklahoma (FHWA/OK 01-02), Oklahoma DOT; **5154**

Bicycle-Friendly Rumble Strips (CDOT-DTD-R-2001-4), Colorado DOT; **5161**

Comparison of Roundabout Operations to Four Way Stop and Signal Controlled Intersections Using NETSIM Simulations (RDT 01-008), Nevada DOT; **5218**

Median Safety Study (Interstates and Expressways) (FHWA-PA-2001-009-97-04(11)), Pennsylvania DOT; **5220**

REFERENCE BOOKS

Standard Handbook for Civil Engineering, South Florida Water Management District; **5135**

The Civil Engineering Handbook, Purdue University, Indiana; **5141**

AASHTO 2001 Publications Catalog, AASHTO; **5156**

Catalog of U.S. Government Laws, Regulations, Decisions, and Guidelines, 5188