



A publication of the South Carolina Department of  
Transportation Office of Materials and Research

# The R D & T Newsletter

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## Study on Graded Aggregate Base Courses Completed

Dr. Ron Baus of the University of South Carolina recently completed the research project SPR No. 630, "Investigation of Graded Aggregate Base (GAB) Courses." The primary objectives of this study were to investigate the feasibility of relaxing current SCDOT GAB gradation specifications and to investigate the feasibility of allowing GAB layer



Soil Stiffness Gauge (Humboldt Mfg. Co.)

thicknesses greater than 8 inches in flexible highway pavement structures. Seven granular base materials used by the SCDOT were tested. Plate Load and Soil Stiffness Gauge (SSG) tests were performed on GAB layers compacted in the laboratory. Two field test sections were installed and tested using a Falling Weight Deflectometer (FWD) and SSG. Routine laboratory tests were also performed on the granular materials to determine the soil physical

properties. Nuclear gauge tests were performed to measure compacted density and water content.

The research approach used was to compare modulus and permanent deformation resistance of the GAB materials. GAB modulus was measured in full-scale laboratory pit tests and in field test sections. Rutting resistance was measured by full-scale laboratory cyclic plate load tests. In the laboratory pit tests, finite element analysis was performed to compare the stress-strain conditions and deflections under wheel load and plate load. A linear program was developed to back-calculate the GAB modulus from static plate load test results. The GAB moduli inferred from plate load tests were compared with the SSG measured moduli. In the field sections, FWD tests results were analyzed using SNSC and EVERCALC programs. The back-calculated moduli were compared with field SSG measurements.

The conclusions were based on a limited number of laboratory and field tests. Factors such as field environmental and wheel load conditions as well as variation of structural components are far more complicated than can be reproduced in environment-controlled laboratory setups. It was therefore

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## Drive to Survive: Nighttime Road Construction Poses Increased Safety Risk

At an April 4 event marking the seventh annual National Work Zone Awareness Week (NWZAW), ARTBA urged motorists to drive slowly and stay alert when navigating through nighttime road construction zones.

Brian Holmes, executive director of the Maryland Highway Contractors Association ARTBA's state chapter affiliate noted that nearly 1,100 workers and motorists are killed annually in a roadway construction zone. Approximately 50,000 people or one every nine minutes are also injured in these sites each year, Holmes said.

### Increased Safety Risks

As the nation's roadways have become more congested, operating at capacities never intended by designers, states have shifted construction work to nighttime to help

minimize the impacts on motorists. The result, according to ARTBA, has been increased safety risks for workers.

"Most road construction workers have very legitimate concerns about their safety because of the danger associated with nighttime construction work," Holmes said. "Reduced visibility, motorist fatigue, and greater exposure to drunk and drugged driving are just some of the major hazards facing workers at night."

Holmes said strategic illumination, visible police presence and stepped up speed enforcement would help enhance safety. He delivered his remarks at a nighttime NWZAW event held on the Washington, D.C., National Mall near the U.S. Capitol. It was organized by the Federal Highway Administration, the American Association of State Highway & Transportation Officials

and the transportation construction industry.

### A Long-Time Safety Leader

ARTBA is a long-time leader in roadway work zone safety initiatives. The ARTBA Transportation Development Foundation (ARTBA-TDF) developed and manages the National Work Zone Safety Information Clearinghouse, based at the Texas Transportation Institute, which offers the world's largest on-line library on the subject (<http://wzsafety.tamu.edu>).

For more information on these and other ARTBA safety programs, contact ARTBA Vice President of Safety & Education Brad Sant at: [bsant@artba.org](mailto:bsant@artba.org).

## RDEC Approves Research Topics

The Department's Research and Development Executive Committee (RDEC) met December 2, 2005 to approve funding for research projects for the next two years. The South Carolina Department of Transportation (SCDOT) held its second Research Workshop on September 27, 2005 at the Columbia Conference Center in Columbia, South Carolina. The workshop marketed the research program and served as the primary research topic solicitation for RDEC.

As a result of the workshop, 52 problem statements were submitted to the Department's Research Unit.

After all problem statements were received, they were reviewed by the Research Staff for completeness and to clarify any questions. A ballot was then prepared and forwarded to RDEC members along with copies of the problem statements and summary information from the Research Workshop. Each member rated the topics on a scale of 0-5 (0 no need, 5 great need) then returned the ballot to the Research Unit.

The Research Staff then averaged the ratings for each topic and prepared a spreadsheet that was forwarded to the RDEC members prior to the meeting.

The RDEC then met to discuss the topics, combine those that were similar, and develop a final prioritized list of topics for inclusion in the SPR Program. The following page contains the topics that were approved with the last two contingent on available funds.

At least one topic from all seven breakout groups from the Research Workshop was selected for funding. Projects will be initiated in the order as prioritized by the RDEC.

	Number	Title
1.	05-TS-01 & 05-DRB-02 & 05-PDP-04 & 05-PDP-01	Support for Roadside Improvements and Selected Clearing using Hazard Index Safety Study of Limiting Clear Zones to 30 Feet Cost Effectiveness of Relocation of Utilities to Increase Roadside Safety Illegal Encroachments
2T.	05-HY-01	Regional Flood-Frequency Update for Rural South Carolina Watersheds
2T.	05-MBM-01	Optimal Maintenance Crew Composition and Enhancement of Crew Productivity
4.	05-DRB-01	Behavior of Pile-Cap Connections Subjected to Seismic Forces
5T.	05-BO-01	Establish Successful Mitigation Strategies for Management of Growth and Development
5T.	05-CM-01 & 05-DRB-09	Borrow Materials Properties and Location Geotechnical Database for Highway Design
7.	05-HY-02	Development of Hydraulic Capacity Curves for Highway Drainage Inlet Structures in South Carolina
8T.	05-CM-05	Synthesis of Optimal Usage of Available Aggregates in Highway Construction and Maintenance
8T.	05-MBM-02	Guidelines for Pavement Marking Applications
10T.	05-CM-02	Validation of Contractor Testing Data in the Materials Acceptance Process
10T.	05-CM-03	Mechanistic/Empirical Design Guide Implementation
10T.	05-MBM-04	Investigate Simplifying Bridge Expansion Joint Design and Maintenance
13.	05-TS-02	Evaluation of Communication Alternatives for Intelligent Transportation Systems (ITS)
14.	05-BO-06	Feasibility of Establishing a High-Speed Rail Corridor Connecting Florence, Myrtle Beach and Charleston Using Existing Rail Lines
15.	05-MBM-05	Systems for Rapid Repair of Highway Bridges*
16.	05-CM-10	Simplified Repair Strategies for Embankment Repair*

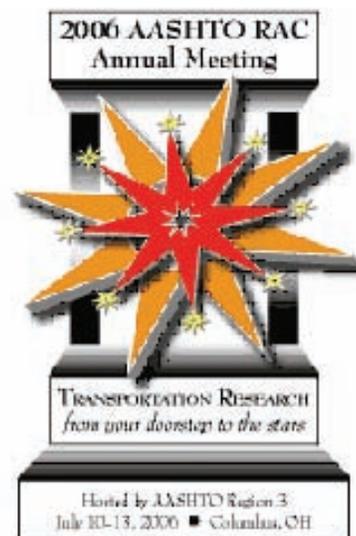
\* contingent upon available funding

## 2006 AASHTO RAC Meeting

AASHTO Region 3 and the Ohio Department of Transportation will serve as hosts for the 2006 Annual Meeting of the AASHTO Research Advisory Committee (RAC) on July 10-13, 2006 in Columbus, Ohio. The AASHTO RAC provides advice on transportation research matters to the Standing Committee on Research (SCOR) and the AASHTO Executive and Policy Committees. RAC helps SCOR accomplish its goals by providing assistance in identifying research needs, defining research emphasis areas, utilizing research findings, maintaining an overview of state related research activities and funding, and employing the National Cooperative Highway Research Program (NCHRP) effectively.

The meeting provides an opportunity for the committee to conduct its annual business and to network with others interested in transportation research. Discussions will

focus on what is needed today to prepare for the long range future of transportation and the role SCOR (and RAC as the agent of SCOR) should have in the identification and development of a national research agenda. Sessions covering local as well as national research activities will be offered in addition to a variety of exhibits by government agencies, university transportation centers, and others.



## SCDOT To Hold A Research Peer Exchange In October 2006

State DOTs are required to hold research peer exchanges on a periodic basis as a condition for approval of FHWA planning and research funds for RD&T activities. A peer exchange team, composed of individuals familiar with DOT research programs or research activities in general, is assembled. The members, selected by the host state, can be from other state DOTs, the FHWA, other federal, state or local transportation agencies, universities, or industry. The purpose of the peer exchange is to share information on best

practices for improving research programs and management processes for all involved.

SCDOT will hold its third research peer exchange October 17-19, 2006. The Transportation Technology Transfer Service (T<sup>3</sup>S), located at Clemson University, will host the event. The Department's Research Unit is currently identifying focus points for discussion at the exchange and team members will be selected in the near future.

*(Continued from page 1)*

recommended that a long-term monitoring program be conducted on the two field test sections that have varied base layer thicknesses. Based on test results, it was proposed that the maximum percent passing the No. 4 sieve for Macadam be relaxed from the current specification limit of 50% to 60% (the current SCDOT limit for passing the No. 4 sieve for Marine Limestone). Construction and long-term monitoring of new flexible pavement test sections with thick (greater than 8 in.) GAB

layers and modified GAB gradations – constructed with careful quality control and appropriate instrumentation – were recommended. Comparisons of laboratory and field SSG measurements with plate load test results and FWD test results indicated SSG has great potential to directly measure stiffness of base and subgrade materials. Research conducted in North Carolina, Maryland, Texas, and other states confirms this potential.

Also included in the study was a preliminary investigation of

SSG applicability for assessing compacted GAB materials. Study results suggested that the SSG offers an alternative tool for pavement material quality assurance and construction control, compared to other devices that are either more time consuming, difficult to use, or require cumbersome operational procedures. It was suggested that the SCDOT study the SSG further and consider SSG implementation for material characterization in future mechanistic-empirical pavement design approaches.

## Study Examines Outsourcing of Selected Maintenance Activities

Dr. Lansford Bell of Clemson University recently completed SPR No. 653, "SCDOT Maintenance Outsourcing: Cost Comparison and Decision Factors." This study was conducted to examine the relative merits of outsourcing highway maintenance activities as opposed to performing those activities with in-house forces. The project examined the costs associated with maintenance work performed within the state for 20 maintenance-related activities. A survey of other states was also conducted as part of this research. Responses indicated that the primary driving forces for outsourcing maintenance activities in other states were lack of agency equipment or expertise and a recently expanded maintenance workload. Both positive and negative experiences with outsourcing were cited. In some cases anticipated cost savings were not attained, litigation issues arose, and pilot programs were cancelled.

Data from SCDOT projects indicated that in-house unit costs for activities such as chip sealing, drainage pipe installation, mowing, sign installation, and full depth patching were about the same as outsourcing unit costs. The cost of some activities were difficult to compare due to the complexity of the work included in contracts and the fact that certain activities have historically been performed exclusively either in-house or by contract.

A secondary objective of this research project was to examine a number of critical non-cost related decision factors. The project also included workshops conducted in all seven SCDOT district offices to examine subjective

factors that impact various maintenance activities. District personnel cited equipment availability, local contractor expertise, SCDOT inspection and contract administration capabilities, seasonal work fluctuations, and the need for immediate SCDOT response to specified problems among their decision factors. Professional personnel attending these workshops expressed uniform and strong opinions emphasizing the unique environment within each district and county, and the importance of retaining autonomy with respect to outsourcing decisions at the local level. Workshop participants also suggested that improvement be made to standard outsourcing contracts to give them more leverage with respect to specification conformance. Suggestions for improved contracting procedures included requirements for maintenance contractor prequalification, contract retainage, and mandatory pre-bid site visits.

A third research objective was to determine to what extent contractors would be capable of undertaking additional work, and to obtain their perceptions for improving the maintenance outsourcing process. Limited conclusions could be ascertained from the limited survey response, but it appears that the contractors agree to many suggested improvements, including mandatory pre-bid inspections and a prequalification process.

Dr. Bell is scheduled to begin the next phase of this project, "Maintenance Outsourcing Phase II: Improving the Maintenance Contracting Process," in 2006.

**Comments and Suggestions**

The *RD&T Newsletter* is published on behalf of the SCDOT by the SC Transportation Technology Transfer Service (T<sup>3</sup>S) at Clemson University.

If you have suggestions, comments or article submissions for the newsletter, please contact Mike Sanders at 803-737-6691, or mail them to:

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