MOVING FORWARD

OHIO DEPARTMENT OF TRANSPORTATION
RESEARCH & DEVELOPMENT

"He who does not look ahead, remains behind." (Spanish Proverb)

Ohio Department of Transportation, Office of Research and Development 2007 Volume 3

Cooperative Research Seminar 2007

ODOT's Office of Research and Development (R&D) hosted the 2007 Cooperative Research Seminar at the Crowne Plaza Columbus North in Columbus, Ohio on August 30, 2007. One hundred twenty-nine individuals participated in this biennial event. Representatives from consulting firms, academia, local governments, state agencies, private companies, technical associations, and federal agencies joined personnel from ODOT to discuss the department's research goals spanning state fiscal years 2009 through 2013.

The event began with an opening session where the R&D Administrator, Monique Evans, presented the Department's six strategic research focus areas and the overall goals of the seminar. From there, the event broke into three breakout sessions. Ten program offices presented their individual strategic research plans and draft problem statements. Feedback was sought from session participants to identify the following:

- gaps between the department's strategic focus areas and the projects proposed by the program offices;
- potential overlaps between projects;
- new research topics/projects for consideration;
- opportunities for partnerships; and
- refinements to proposed projects already identified by the department.

While the program offices were focusing on specific technical issues, a special session was held to discuss research opportunities for local governments. Marianne Freed, Administrator of the Office of Transit, and Leonard Brown, Director of Ohio LTAP, lead a brainstorming session to identify challenges faced by locals governments and ways in which research could assist them in meeting their goals. This highly interactive session produced fifteen key areas in which research studies could be beneficial for locals.

The report on the findings of the 2007 CRS is available on the announcements page of the R&D website (http://www.dot.state.oh.us/divplan/research/). A special web page that will house the strategic research plans for all ODOT offices is being developed. It will contain the most recent versions of the matrices and the draft problem statements, as well as information on the Department's strategic research focus areas. A link will be placed on the R&D website once this page is operational.

Attention Attendees of the 2007 CRS: We Want Your Feedback!
A survey link was recently emailed to you. If you haven't taken the time to complete this evaluation, please do so as soon as possible. Help us make this event as useful as possible. The survey is available at the following link:
http://www.surveymonkey.com/s.aspx?sm=oN4Ul3sO8_2f725fxbuZC2wg_3d_3d

Review of ODOT's Overlay Design Procedure

By: Jagannath Mallela, Applied Research Associates

Like several other agencies around the country, preservation and rehabilitation of existing hot-mix asphalt (HMA), portland cement concrete (PCC), and composite (HMA overlaid PCC) pavements firmly remains one of the core functions of the Ohio Department of Transportation (ODOT). ODOT's districts routinely perform pavement rehabilitation design using a deflection-based procedure. The current version of this procedure has been in place since 1996 and is largely based on the *1993 AASHTO Guide for the Design of Pavement Structures*. The main difference between the AASHTO Guide and the ODOT process is that the former is based on deflections measured using the Falling Weight Deflectometer (FWD) and the latter on Dynaflect deflections. Besides this, there are other minor procedural modifications that adjust the design calculations to Ohio's specific site and design conditions.

As part of a recent effort undertaken by ODOT's Office of Pavement Engineering, with the assistance of the Division of Information Technology, the overlay design is being converted from FORTRAN to an enterprise-level code. During this conversion, a provision to allow the bituminous surfaced pavements to be milled for clearance before being rehabilitated with an overlay was added. However, the current design procedure does not include a method for determining effective thickness of the existing pavements (including flexible, rigid, and composite) after milling. In addition, there is uncertainty over the structural coefficient to be assigned to the overlay if it is made up of supposedly "superior" performing materials such as polymer modified asphalt (PMA) mixtures.

These questions were answered by the research team which included contractor and ODOT personnel by:

1. Reviewing available literature on the impact of milling on overlay design;
2. Critically reviewing the existing ODOT overlay design procedure;
3. Systematically studying pavement structural responses measured on several "real world" pavements using the Dynaflect and structural capacity estimated using DOITOVER as the pavement goes through the three stages of rehabilitation – pre-milling, post-milling, and post-overlay;
4. Obtaining and examining core data at multiple locations on each project and correlating the observations to measured responses and structural capacity;
5. Obtaining and recording construction history, PCR, and traffic data prior to the milling operation; and
6. Developing short-term and long-term recommendations to modify the existing ODOT approach to pavement rehabilitation design.

Items 3 and 4 constituted the biggest part of this work. Nine (9) composite and eight (8) flexible pavements were selected for evaluation from ODOT's FY 2005 and 2006 construction season for this purpose. The locations of the projects are provided in Figure 1. An in-depth evaluation of the projects was conducted by ODOT and the project team. On 7 of these 17 projects, side-by-side FWD testing was also performed in addition to Dynaflect testing. The measured deflections were used to compute the following indices and parameters:

- Overall structural capacity — maximum deflection, S_1; effective structural number, SN_{eff} (for flexible pavements) or effective thickness, D_{eff} (for composite pavements).
- Upper layer structural capacity—spreadability (SPR); composite elastic modulus, E_p (for all layers above the subgrade in flexible pavements).
- Subgrade support—fifth sensor deflection S_5 (for flexible pavements); AREA (for composite pavements); subgrade M_r (for flexible pavements) or k-value (for composite pavements).

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Overlay Design Continued - From Page 2

Data analysis included verifying if the statistical trends in the computed structural indices from the pre-milling to post-milling to post-overlay stages were in accordance with the hypotheses formulated based on engineering judgment vis-à-vis these trends.

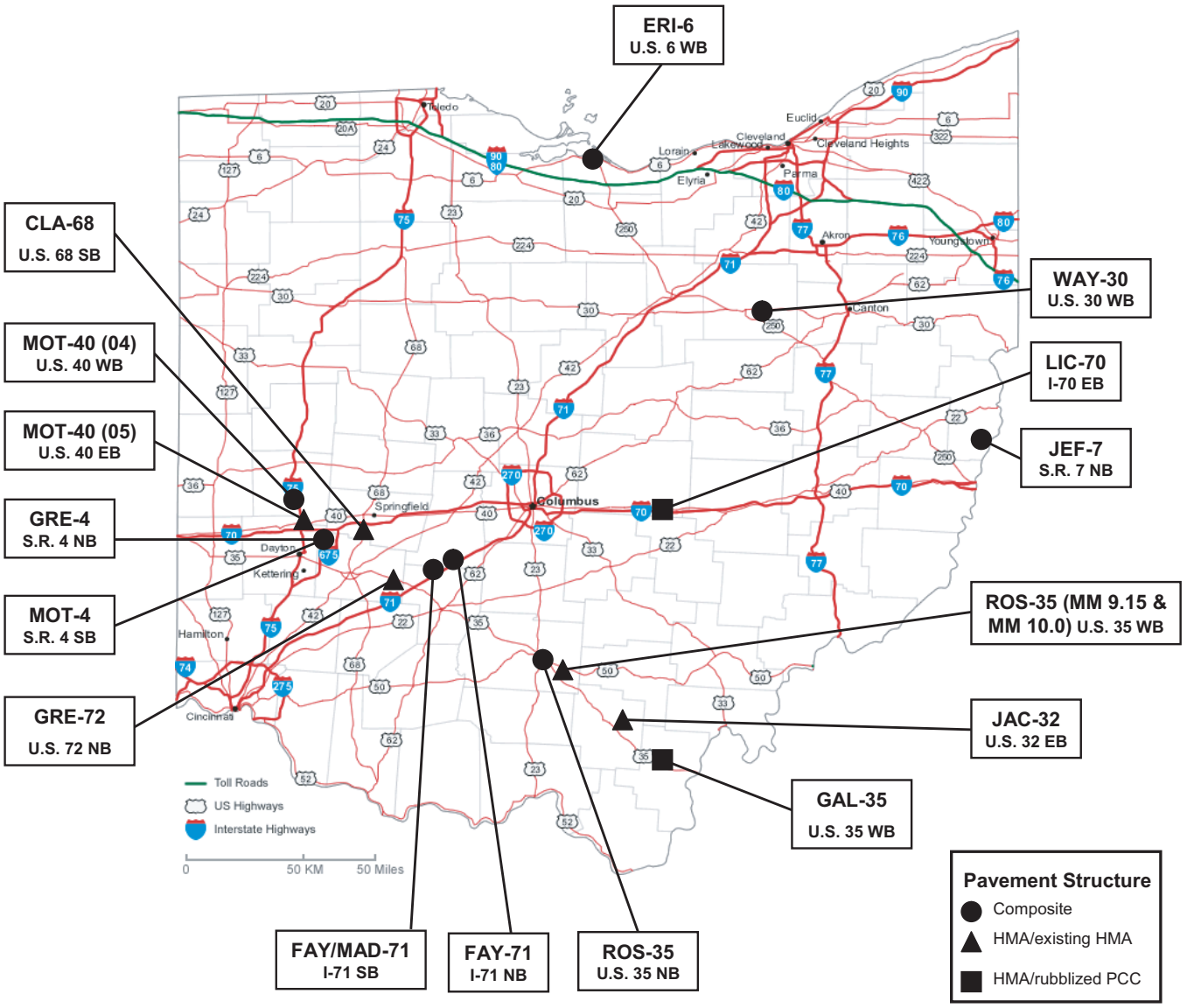

Figure 1

Observations, Conclusions, & Recommendations

It was observed that, in a majority of the cases, deflection indices such as S_1, S_5, and SPR trended correctly as the rehabilitation progressed from one stage to the next, e.g., post-milling deflections were higher than post-overlay deflections. However, in evaluating the flexible overlay design process, it was noted that the M_r appeared to fluctuate a lot (by more than 50 percent in some cases) from one rehabilitation stage to the next and that the trends were inconsistent with expectations. As a consequence, the E_p, SN_{eff}, and the required structural number (SN_{req}) for those sections also did not follow the expected trends across the various rehabilitation stages. An analysis around this undesirable finding showed that the instability in the calculated M_r could be attributed to the relatively low magnitudes of the S_5 deflections from Dynaflect.

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Overlay Design Continued - From Page 3

Despite these inconsistencies in the data, the following general observations were made with regard to flexible pavements:

- Impact of Milling on SN_{eff} For 4 of the 8 projects evaluated, milling off 1.5 to 3 inches of existing HMA significantly affected SN_{eff}. On average, post-milling SN_{eff} decreased 17.4 percent. The magnitude of decrease depended on milling depth, existing pavement thickness, and condition.
- Impact of New HMA Materials on a_{OL} There was a general increase in pavement structural capacity due to either the use of superior HMA materials in the overlay or the removal of deteriorated existing HMA materials, or both. There was not enough data, however, to characterize the source and magnitude of the improved pavement structural capacity.

Further, for composite pavements, the following conclusions were drawn:

- Impact of Milling on D_{eff} For 5 of the 9 projects evaluated, milling of 1.5 to 3 inches of existing HMA does significantly affect D_{eff}.
- Impact of New HMA Materials on a_{OL} The observations here were the same as those for flexible pavements.

For unbonded PCC overlays:

- Impact of Milling on D_{eff}. This aspect was not extensively studied directly on this project. It is recommended that the existing method be used until further research is conducted.

Based on these findings, the recommendations from this study are made at two levels. In the medium to long-term it is recommended that ODOT look into using an FWD-based overlay design approach after suitably modifying the DOITOVER program or adopting AASHTOWare DARWin to work in conjunction with these deflections. Until this process is in place, ODOT can continue to use its existing procedure with the following adjustments derived specifically from the design, condition, coring, and deflection data from this study:

- A correction factor to the Dynaflect computed subgrade M_r that makes the calculated moduli more consistent with FWD measured estimates of laboratory M_r values.
- A corrected SN_{eff} for flexible pavements to account for the effect of milling off portions of the existing HMA layer.
- A corrected D_{eff} for composite pavements that accounts for the effect of milling off portions of the existing HMA layer.

The correction procedures for each of the items noted and the basis for them will be presented in the final report for this project. Finally, it is highly recommended that ODOT thoroughly verify these modifications, before fully implementing them in the overlay design process.

Message from the Administrator

By: Monique R. Evans, P.E.

Shortly after we hosted our 3rd Cooperative Research Seminar in August, I had the pleasure of participating in a Florida DOT Research Peer Exchange. This peer exchange brought research managers from several DOT's, NCHRP and FHWA together in Orlando to observe Florida's first Research Symposium and to share best practices associated with strategic planning for transportation research. Approximately 150 representatives from Florida academia and the Florida DOT spent 1.5 days envisioning the future of transportation and generating research ideas and concepts they could consider in response to that future. They were challenged to think beyond incremental benefits that could be obtained within a 2-5 year time frame and to identify "leap frog" concepts that might not come to fruition for another 25 or 50 years. While this was an unusual exercise for many participants, by the end of the second day they had collectively identified over 50 different concepts that could be pursued in five high-priority areas for Florida DOT.

Not only was I able to share our experiences from hosting three similar strategic planning forums, but I also left with several ideas for how to make our future seminars more productive. While we received several good ideas from seminar participants this year, overall we did not get the level of discussion in Ohio we had anticipated. So, in 2009 we plan to make some significant changes. We will adopt some of the ideas I picked up in Florida and many of the suggestions we received from this year's CRS evaluations. The goal will be to make our seminar a little less "reactive" and a lot more "cooperative."

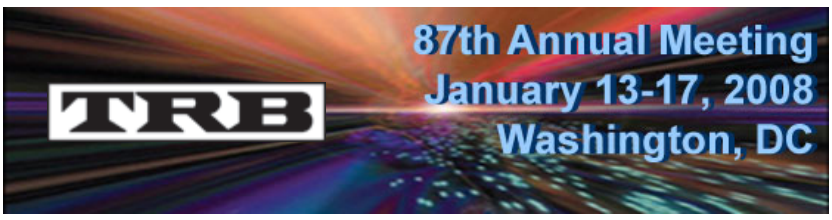
If you have any suggestions for how to improve the seminar, please let us know. You can send us an e-mail, give us a call, fax a note, or even mail us an anonymous letter. Our contact information is available on the back of this newsletter.

2008 TRB Annual Meeting

The 87th TRB Annual Meeting will be held in Washington, DC on January 13-17, 2008. The TRB Annual Meeting program covers all transportation modes, with more than 3,000 presentations in nearly 600 sessions addressing topics of interest to all attendees—policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions. The spotlight theme for 2008 is "*Partnerships for Progress in Transportation*".

All advance registrations should be completed by the attendees via the Internet before November 30, 2007. Visit the Annual Meeting website, www.TRB.org/Meeting, for meeting registration, hotel reservation, workshop, special event, and general scheduling information. The Interactive Preliminary Program contains full session and individual presentation information, and registration enables access to session room location. You will be able to use the Interactive Preliminary Program on the website in *mid-November* to conduct searches by session title, paper title, keywords, author, and subject area to plan your personalized itinerary which includes meeting room names.

New this year: TRB has combined the Annual Meeting registration and hotel reservation processes. Now when you register for the meeting, you will also have the ability to make your hotel reservations by using TRB's new Annual Meeting Housing Bureau. Only Annual Meeting attendees who have first completed the meeting registration process will be allowed to make hotel reservations at TRB contracted hotels. These hotels will only accept reservations made through the Annual Meeting Housing Bureau.



New Pooled Fund Study Participation

More than one agency may have a common interest in solving a transportation-related problem. If so, a pooled fund study may be used to jointly fund research, development, and technology transfer activities. Federal and State transportation agencies may initiate pooled fund studies. Local and regional transportation agencies, private industry, foundations and colleges/universities may then partner with the sponsoring agencies on such projects.

ODOT has recently made commitments to participate in the following pooled fund studies:

Traffic Analysis & Simulation Pooled Fund Study

As congestion grows on our nation's roadways, increasing pressure is put on transportation professionals to find more innovative and efficient transportation solutions. Transportation professionals use traffic analysis tools to find the best transportation solutions for their region. However, as our transportation solutions become more sophisticated and complex, so do our traffic analysis tools. As a result, many public agencies are facing new and difficult issues regarding the usage of traffic analysis and simulation tools for transportation decision-making. Rather than have each public agency address these challenges and issues separately, agencies could tackle these issues in a collective and comprehensive manner through the Pooled Fund Study (PFS) process.

The goal of this proposed project, led by the Federal Highway Administration, is to improve the state-of-the-practice in traffic analysis and simulation so public agencies can make the best possible transportation investment decisions based upon high-quality traffic analyses. The objectives of this study are to assemble regional, State, and local agencies, and FHWA to: 1) identify challenges and issues common among those responsible for conducting, managing, and/or approving traffic analysis and simulation studies; 2) suggest approaches to addressing identified issues; 3) initiate and monitor projects intended to address identified challenges and issues; 4) provide guidance and recommendations and disseminate results; 5) provide leadership and coordinate with other agencies, groups, or forums interested in traffic analysis and simulation; and 6) promote and facilitate technology transfer related to traffic analysis and simulation issues nationally. The ODOT technical liaison for this study is Dirk Gross.

- Continued on Page 7: Pooled Fund Studies -

Pooled Fund Studies Continued - from Page 6

Evaluation of Non-Intrusive Traffic Detection Technologies Phase III

Non-intrusive sensors are defined as those sensors that can be installed, calibrated and used without disruption to traffic. The most common non-intrusive technologies (NIT) used for traffic detections include: passive or active infrared, magnetic, microwave or radar, ultrasonic, passive acoustic, and video. Other, more recent applications use infrared technology to classify vehicles by counting each vehicle's axles from the side of the road. Since 1994, the Minnesota Department of Transportation (Mn/DOT), the Federal Highway Administration (FHWA) and pooled fund study members have implemented a series of NIT sensor evaluations. The most recent project, completed in 2005, designed, fabricated and field tested a portable non-intrusive traffic detection system. These studies have provided valuable information, benefiting both public and private agencies in selecting appropriate technologies for their own data collection purposes.

The objective of the proposed project, led by the Minnesota Department of Transportation, is to conduct field tests of the latest generation of non-intrusive traffic sensors. The field tests will assess the capabilities and limitations in detecting traffic under a variety of conditions. Specific test conditions will be driven by the needs of participating state agencies. The ODOT technical liaison for this study is Tony Manch.

Interstate Technical Group on Abandoned Underground Mines (ITGAUM) Support

The Interstate Technical Group on Abandoned Underground Mines (ITGAUM) has been active and growing since formed in 1997. The group is closely affiliated with the TRB Subcommittee on Abandoned Underground Mines (AFP10(3)). Through volunteer efforts, past biennial meetings have been held, and work on various action items completed. Though accomplishments have been made, certain research efforts and other activities of interest to the group have not been accomplished due to the ad hoc nature of the support. Most of the ITGAUM members have expressed interest in a pooled fund project to fund development of a best-practices manual, research projects, two biennial meetings and other committee activities. This study is lead by the Kansas Department of Transportation. For more infiormation, visit http://www.fhwa.dot.gov/mine. The ODOT technical liaison is Brian Logston.

Join ODOT R&D at OTEC 2007

Join transportation officials, government, and members of the academic community at the 2007 Ohio Transportation Engineering Conference (OTEC) at the Columbus Convention Center on October 23 and 24, 2007. OTEC is one of the nation's largest transportation conferences featuring exciting speakers, technical sessions, an exhibit area of approximately 200 booths, and over 2,000 participants. This year's theme is "The Ohio Transportation Network: A Gateway to Economic Growth." Engineers, government officials, professors, researchers, regional planners, consultants, contractors, students, industry representatives, and anyone with an interest in transportation are encouraged to attend. Several sessions at OTEC will focus on subjects related to ODOT research projects. Earn continuing professional development credits (CPDs) for attending sessions such as:

- o Overview of the ODOT Geotechnical Data Management System (Session 6A)
- o Field Testing and Performance of Metal Culverts in Ohio (Session 8A)
- o Designing, Constructing, and Correcting: Bridge Rideability (Session 10B)
- o Pavement Condition Rating Software Demonstration for Locals (Session 21D)

Be sure to stop by the Office of R&D exhibit booth in the exhibitor's hall at OTEC! For more information on OTEC, including the schedule, or to register on-line, visit the conference website at http://www.otecohio.org.

October 23rd Opening Session Speaker: Govenor Ted Strickland with Director James Beasley (ODOT) and Dean Bud Baeslack (OSU)

October 24th Luncheon Speaker: Larry Winget

ODOT Research Agreements Revised

ODOT has recently updated the standard research agreements. Significant changes have been made to the following sections:

- Cost Principles (Changes in the agreements for Commercial Organizations only)
- Payment
- Reports
- Equipment and Instrumentation
- Rights in Data, Patents, and Copyrights: Public Use
- Patent and Copyright Indemnity (*NEW SECTION*)
- Notice and Assistance Regarding Patent and Copyright Infringement (*NEW SECTION*)
- Termination of Contract
- Minority Business Enterprise Policy and Obligation
- Ohio Elections Law
- Ohio Ethics Law Requirements

Versions of all four research agreements with the changes tracked in red text are available on the R&D website: http://www.dot.state.oh.us/divplan/research/announcements/announcements.htm. If you have any questions concerning the new agreements, contact the Office of R&D at 614-644-8135 or send an email to research@dot.state.oh.us.

R&D's Definition of Equipment Changes

It has finally happened! After much discussion and deliberation, the definition of equipment for research projects has been updated. Equipment is now defined as:

> "an article of non-expendable, tangible personal property having a useful life of at least two years and an acquisition cost of **$1,000** or more per unit, or a combined value of **$1,000** for components which are assembled into a larger unit. **An item that meets these criteria, but is permanently embedded or attached to pavement, structure, or other infrastructure in such as way as to result in irreparable damage to the item itself or the article to which it is attached shall not be classified as equipment**."

This definition applies to new research projects with contracts executed after August 2007. The definition of equipment for active research projects remains unchanged. Inventory for active projects should continue to be maintained in accordance with the equipment definition noted in the project's contract.

***Attention Researchers*:**
As you are preparing your proposals, if you have an item that is excluded from being considered equipment because it is permanently embedded or attached to something as noted above, be sure to clarify that in your proposal.

Research Review Sessions

The Office of R&D will be holding annual review sessions during the month of October. Anyone who is interested in the progress of ODOT research may attend. Attendees will receive documentation for purposes of recording Continuing Professional Development hours. Those sessions scheduled to date are shown below. All will be held at ODOT central office in conference room 3C and will last for approximatly one hour. Additional sessions will be posted on our website as they are scheduled.

October 4, 2007

- 1:00 p.m. - Long Term Monitoring of Moisture Under Pavements, SJN 134170

October 15, 2007

- 10:00 a.m. - Forensic Investigation of AC and PCC Pavements with Extended Service Life, SJN 134280
- 11:15 a.m. - Monitoring and Modeling of Pavement Response and Performance, SJN 134287

October 16,2007

- 9:30 a.m. - Guidelines for Implementing NCHRP 1-37A M/E Design Procedures in Ohio, SJN 134300
- 1:00 p.m. - Airborne LiDAR Reflective Linear Feature Extraction for Strip Adjustment and Horizontal Accuracy Determination, SJN 134316

HEY RESEARCHERS! FY2009RFP and OPREP 2009 solicitation will occur on January 7, 2008! More details coming soon.

Omar Abu-Hajar Goes to Structures

The Office of R&D is down a person. Omar Abu-Hajar relocated to the Office of Structural Engineering on October 1, 2007. We wish him the best in his future endeavors.

Questions concerning research projects in the structures and hydraulics area should now be addressed to Monique Evans at research@dot.state.oh.us.

Calendar of Events

October - 2007

October - Quarterly progress reports due for all active research projects
October 8 - Columbus Day - ODOT Closed
October 4, 15-16 - Research Project Review Sessions - For more information contact ODOT R&D at research@dot.state.oh.us
October 19 - FY 2009 problem statements for RSC consideration due to ODOT R&D (*Internal Submissions Only*)
October 23-24 - OTEC 2007, Columbus, Ohio - For more information visit http://www.otecohio.org/

November - 2007

November 1-2 - AASHTO SCOR Meeting, Las Vegas, NV
November 12 - Veterans' Day ODOT Closed
November 22 - Thanksgiving Day - ODOT Closed
November 30 - RSC meets to select and prioritize research needs for fiscal year 2009

December - 2007

December 14 - Program offices submit revised RFPs to ODOT R&D for annual solicitation in January
December 25 - Christmas Day - ODOT Closed

January - 2008

January - Quarterly progress reports due for all active research projects
January 7 - Fiscal Year 2009 RFP Soliciation issued by ODOT R&D
January 7 - OPREP 2009 Soliciation issued by ODOT R&D
January 1 - New Year's Day - ODOT Closed
January 13-17 - Transportation Research Board Annual Meeting, Washington, DC - For more information visit: http://www.trb.org/meeting/
January 15 - Martin Luther King Day - ODOT Closed

For information on TRB Sponsored Conferences and Workshops go to http://trb.org/calendar

Final Reports Available on the WWW

Final reports for research projects completed since 2000 are available on our website. Visit http://www.dot.state.oh.us/research/default.asp to get a copy of the following reports received since the last newsletter and many others:

Environmental
Topic 10: *VAR - Statewide Noise Abatement Alternatives*, McCormick Taylor (June 2006)

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