SOLUTIONS

RESEARCH PROGRAMS
FALL 2012

IN THIS ISSUE

PROJECT HIGHLIGHTS

Feasibility of Using Recycled Asphalt Pavement (RAP) in Portland Cement Concrete Pavement (PCCP) - Phases 1 and 2

http://www.mdt.mt.gov/research/projects/mat/cement.shtml

The primary goal of these projects is to develop and characterize a concrete suitable for transportation-related applications in which a portion of the conventional aggregate has been replaced with reclaimed asphalt pavement (RAP). Preliminary research has demonstrated the feasibility of creating concrete with RAP aggregate; however, these prior studies focus on short-term mechanical properties of the material, and do not address long-term durability characteristics of the concrete, as these two projects will. The results of these research projects may provide another option for using plant mix while conserving natural resources and energy. In addition to the environmental advantages of using these materials, other benefits may include (1) increased life cycle of concrete pavement in comparison to flexible pavements and (2) the potential for reduced costs with the use of on-site RAP, which may be less expensive than using traditional aggregates that are quarried and transported to the job site.

The Montana Department of Transportation (MDT), in cooperation with the Western Transportation Institute (WTI), is close to wrapping up the first phase of these research projects and beginning the second phase. Phase 1 research investigated the effects of RAP on several mechanical properties along with key durability characteristics, and used both mineral and chemical admixtures to enhance concrete performance. The research project began with a literature review and moved into mix design development and validation of key properties. During this task, Design of Experiments (DoE) methodology was used, which produced a mathematical model suitable for predicting the global behavior of concrete mixtures containing RAP aggregates. The model also was used to develop and evaluate several potential mix design scenarios that met MDT specifications for PCCP. These mix scenarios were presented to the project technical panel, who then selected two mixes for further evaluation (high RAP replacement and high strength mixes). The last suite of testing was conducted on these two mix designs for a comprehensive determination of material properties, and included:

CONTINUED ON PAGE 2

- Compressive Strength
- Elastic Modulus
- Tensile Strength
- Shrinkage
- Creep

The durability of the concrete is especially important with regard to constructing sustainable infrastructure. The durability tests conducted were:

- Alkali Silica Reactivity (ASR)
- Absorption
- Abrasion
- Chloride Permeability
- Freeze–Thaw Resistance
- Scaling

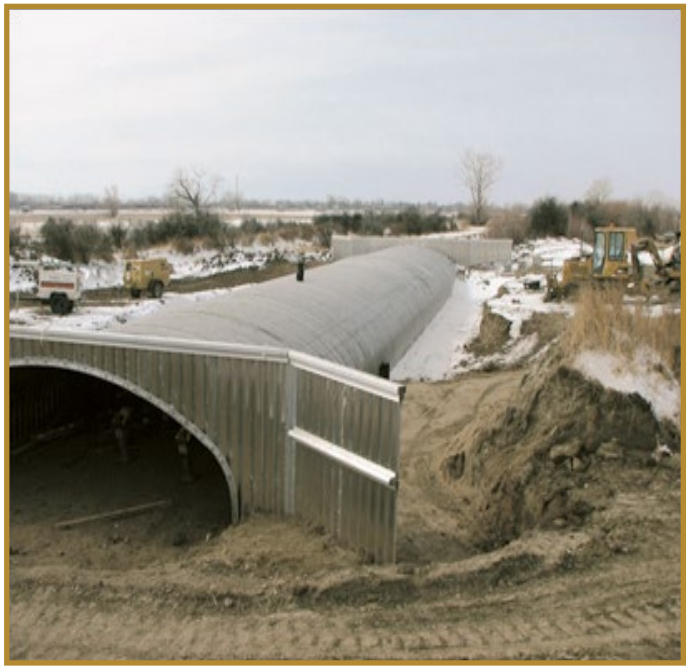
Three duplicate specimens were tested for each test method and time period to ensure reliable results and, where applicable, control specimens made with traditional aggregates also were tested to provide a comparative basis for performance.

Phase 2 of the study will focus on evaluating the field performance of the mixtures developed and tested in Phase 1. This study will not only evaluate the performance of these materials under environmental conditions and traffic loads, it will also provide an opportunity to work out any constructability issues associated with its deployment. The Phase 2 research will begin with further development of the mix designs from Phase 1 by investigating the effects of the use of water reducers to improve economy by allowing for reduced paste/cement content in the mixes. Additionally, this study will investigate the use of fibers (as is specified in current MDT white-topping pavement specifications) in the mixes to increase their tensile capacity and reduce shrinkage. Then, the further optimized mixes will be evaluated via a suite of physical property and durability tests to verify long-term performance. In parallel with this work, two test slabs will be constructed at the Transcend research facility in Lewistown, MT. The test slabs will be instrumented to monitor shrinkage, curling, response to vehicle loads, and temperature. Finally, in addition to this continuous monitoring, the slabs will be inspected quarterly for cracking and other distresses.

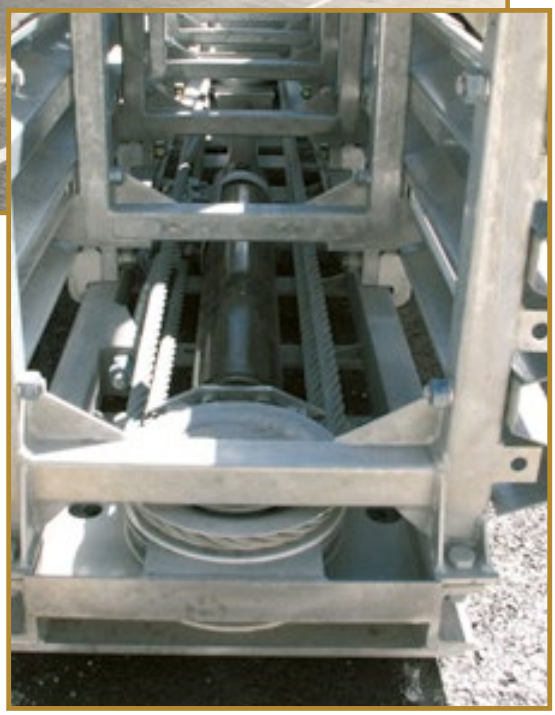
Please contact Kris Christensen (krchristensen@mt.gov, 406.444.6125) for more information.

ConTech Ribbed Aluminum Box Culvert

The realignment of Secondary 325 near Chinook (Blaine County) required the Department to install a new culvert over the existing irrigation canal. This culvert was installed in 2012. The structure chosen was the ConTech Ribbed Aluminum Box Culvert (ABC). This type of culvert is assembled on-site using preformed aluminum plates, reinforced rib sections, and nut and bolt attachment. Construction of this culvert does not require special tools or the use of large cranes. This particular unit was approximately 46.0 m (151 ft.) in length, span of 7.7 m (25.2 ft.) and a rise of 2.36 m (7.74 ft.). This design allows for quick assembly and a minimum fill depth of seventeen (17) inches. The performance of this culvert will be monitored overtime. See http://www.mdt.mt.gov/research/projects/aluminum.shtml for more information or contact Craig Abernathy (cabernathy@mt.gov, 406.444.6269).



Smart Cushion Innovations (SCI) 100GM Crash Attenuator



MDT installed five SCI crash attenuators in 2012 on Interstate 90 near Saltese, Montana. The SCI100GM is a fully redirective, speed-dependent, non-gating, bi-directional reusable crash attenuator, with a reverse-tapered design to eliminate side panel stress during a collapse. In addition it has a low angle of exit on side impacts (<1°) to keep vehicles from rebounding back into traffic. The cable system and hydraulic porting of the attenuator ensures the proper resistance is used to stop the vehicle before it reaches the end of the cushion's usable length. This device, based on a frontal impact, may be reset and back in service in under an hour with minimum cost. The performance of this crash attenuator will be monitored overtime. See http://www.mdt.mt.gov/research/projects/smart_cushion.shtml for more information or contact Craig Abernathy (cabernathy@mt.gov, 406.444.6269).

LIBRARY CORNER

Introduction to the New MDT Librarian

Katy Callon has recently joined the Research staff as the librarian and technology transfer specialist. Katy moved here from Olympia, WA to start this position in April 2012. She has a background working in special libraries, having previously worked for the U.S. Fish and Wildlife Service and McChord Air Force Base. Her focus has been on providing reference services, cataloging, and collection development. Katy earned a Bachelor's degree in English from Saint Martin's University in Lacey, WA and a Master's degree in Library and Information Science from the University of Washington. She, her husband Jason, and baby Andrew are greatly enjoying the Helena area, especially the sunshine.

CONTINUED ON PAGE 4

Since starting at MDT, Katy has been working on catching up on cataloging and becoming familiar with the current library collection. She has added over 300 new publications to the library catalog already. Katy is looking forward to helping MDT employees find relevant information, enhancing the MDT library collection with useful resources, and finding ways to improve MDT library services.

Some projects that are in progress for the MDT library include:

- Creating new online training to show employees how to use the library catalog (including searching and putting items on hold), how to access our database offerings, and how to search more effectively to get the right results. In-person training will still be available on request.
- Surveying MDT employees and, based on results, determining ways to improve the library collection and services to better meet employee needs.
- Making sure that all MDT research is available electronically through the Research Projects page, TRID, NTL, and NTIS.
- Networking with other transportation librarians to find out about the latest library innovations that may be useful in improving MDT library services.

Please feel free to contact Katy (kcallon@mt.gov, 406.444.6338) if you need any library or research assistance.

TRID (Transportation Research International Documentation) Database

What used to be known as TRIS (Transportation Research Information Services) has been combined with ITRD (International Transport Research Documentation) to become TRID. This database, managed by the Transportation Research Board, contains over 940,000 research records and is the one of the world's largest transportation databases. The records can be easily searched by subject, title, author, agency, and even mode of transportation.

This is a great place to look for transportation research – whether performing an initial search to see what information is available on a topic or a specific search for a particular report. Many of the records have links to the full-text, which provides immediate access to the information. The records also contain abstracts and keywords, so it's possible to quickly scan through to see if the information is really relevant to the search topic.

TRID offers ways to find the most current transportation information. Researchers can link to recent publications, making it easier to stay current with the latest transportation information. It is constantly being updated with newly available research. TRID, additionally, has the option of subscribing to RSS feeds on various topics.

TRID is especially useful because it's one location where transportation research from various state, national, and international agencies is collected; instead of having to search various websites to find information, researchers only have to visit one website. This greatly simplifies searching for and finding necessary transportation information.

Visit TRID at http://trid.trb.org/.

DID YOU KNOW?

Experimental Projects

The Experimental Projects Program involves the deployment and evaluation of new materials and/or methods in association with construction or maintenance projects. Experimental Projects range from asphalt and concrete to erosion control and slope stabilization, culverts to geotextiles, and everything in between.

Experimental projects are designed and evaluated for the purpose of determining the implementation value of these new materials and/or methods, based on performance and cost effectiveness. They are conducted in-house with Research staff participating in project design, writing work plans, obtaining FHWA approval of the work plans, attending project meetings, evaluating performance objectively, and documenting results in project reports. FHWA's approval of the work plans provides three benefits, including: 1) the ability to specify a proprietary item without the need for a public interest finding; 2) the ability to use 100% federal funds for construction of experimental features; and 3) if the experimental feature should fail prematurely, FHWA will participate in the repair at the same level as for the original construction.

Annually, an experimental projects meeting is held with attendees from design, construction, maintenance, and the districts. Each district has an assigned Field Research Coordinator (FRC) who is the liaison between their district and Research; the FRCs attend this meeting as well. The purpose of this meeting is to communicate information on current experimental projects, including: project status, performance, available reports, and any construction or performance issues. Also, these meetings are used to provide a feedback loop for design, construction, and maintenance staff. Finally, these meetings serve to determine which methods and/or materials should be implemented as accepted alternatives.

Currently the Experimental Projects Program has 20 constructed projects under active evaluation. There are a number of pending projects, with seven new projects scheduled for construction in 2013. These include:

- Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS),
- Use of an Osterberg Load Cell test in a sacrificial eight foot diameter drilled shaft to confirm design specifications for the new Thompson River Bridge,
- Poly-Carb Mark-163 Flexogrid high-friction Overlay Deck System for a bridge in Kalispell, and
- Polyvinyl chloride (PVC) pipe in a main-line application in Miles City.

For more information, view general information on experimental projects, active project listing, specific project information, or contact Craig Abernathy (cabernathy@mt.gov, 406.444.6269).

CALENDAR OF EVENTS

November

TRB IDEA Proposals Due (11/1/12)
2012 UTC Spotlight Conference on Sustainable Energy and Transportation: Strategies, Research, Data (11/8-9/12)
AASHTO Annual Meeting (11/15-19/12)
TRB Annual Meeting Preliminary Announcement

December

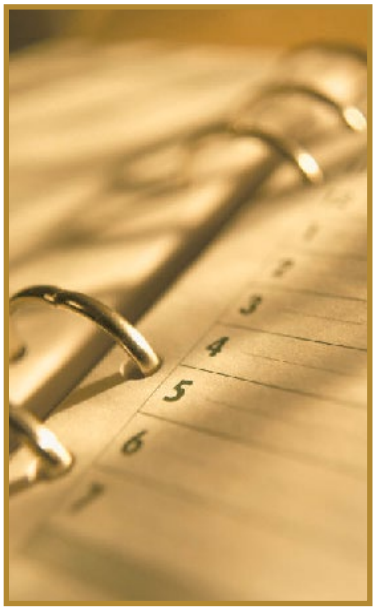
AASHTO SCOR Meeting (12/4-5/12)
MDT RRC Meeting (12/12/12)
FHWA Annual Accomplishments Report Due
NCHRP Project (FY 2014) Ballot Distributed to SCOR and RAC

January

RAC/SCOR Meeting (1/13/13)
TRB Annual Meeting (1/13-17/13)
MDT RRC Meeting (1/30/13)

February

NCHRP Synthesis Research Statements Due (2/15/13)
MDT RRC Meeting (2/27/13)
NCHRP Project Ballots Due



March

TCRP Synthesis Research Statements Due (3/15/13)
MDT RRC Meeting (3/27/13)
AASHTO SCOR Meeting
NCHRP FY 14 Projects Chosen

April

National Library Week (4/8-14/13)
MDT Research and Library Customer Appreciation Day (4/10/13)
MDT RRC Meeting (4/24/13)
MDT Research Topic Statements Due (4/30/13)

NEW RESEARCH REPORTS

2012 Montana Summer Transportation Institute

Portable Concrete Barrier Assessment

Livability for Montana Transportation

Montana Intercity Bus Service Study

GPR Analysis

Local Transportation and Land Use Coordination: Tools and Gaps

A listing of all past and current projects can be found at www.mdt.mt.gov/research/projects/sub_listing.shtml.

NEW RESEARCH PROJECTS

2014 Asset Management Conference and Training on Implementation Strategies Pooled-Fund Study

Recycled Asphalt Pavement (RAP) in Portland Cement Concrete Pavement: Phase 2

Evaluating Wildlife-Vehicle Collisions and Habitat Connectivity in the Madison Valley and Hebgen Lake Areas

Impacts to Montana State Highways Due to Bakken Oil Development

A Peer-to-Peer Traffic Safety Campaign Program

Re-Evaluation of Montana's Air Quality Program

Evaluation of Lateral Pile Resistance Near MSE Walls at a Dedicated Wall Site Pooled-Fund Study

Passive Force Displacement Relationship for Skewed Abutments Pooled-Fund Study

Determination of Material Properties and Deflection Behaviors for Contemporary Prestressed Beam Design

A listing of all past and current projects can be found at www.mdt.mt.gov/research/projects/sub_listing.shtml.

REMINDER

Information on research services and products, such as research and experimental project processes and reports and technology transfer services, can be found on the Research web site at www.mdt.mt.gov/research.

MDT's library collection can be searched through the library catalog. Visit the library home page for a link to the catalog.

CONTACT US

Sue Sillick – Research Programs Manager
406.444.7693
ssillick@mt.gov

Kris Christensen - Research Projects Manager
406.444.6125
krchristensen@mt.gov

Craig Abernathy – Experimental Projects Manager
406.444.6269
cabernathy@mt.gov

Katy Callon – Librarian
406.444.6338
kcallon@mt.gov