



POOLED FUND ANNOUNCEMENT

Project Title

Accelerated Performance Testing on the 2009 NCAT Pavement Test Track

Financial Partners

Numerous state DOTs, FHWA, and private sector research sponsors

Commitment Start Year

2009

Commitment End Year

2012

Duration of Work

42 months

Commitments Required

\$7,000,000

Commitments Received

Pending

Background

The NCAT Pavement Test Track was originally constructed as a result of interest and support from state Departments of Transportation (DOTs) who shared a concern for reducing and predicting distresses in their flexible pavements. The cost for other states to sponsor the construction, testing, trucking and evaluation of experimental pavements was greatly reduced by a commitment from the Alabama Department of Transportation (ALDOT) to fund the original construction of the facility up to the top of the supporting pavement structure. The inaugural track was completed in the summer of 2000 and subjected to 10 million ESALs of heavy truck traffic through December of 2002. Built as a perpetual pavement, the first cycle of testing was a study of surface mix performance for forty-six 200 ft test sections. The facility was rebuilt in the summer of 2003 and loaded with another 10 million ESALs, this time with a combination of mill/inlay surface mixes and variable thickness structural sections. Likewise, the 2006 track was a combination of more varied thickness structural sections and mill/inlay surface mixes (again subjected to 10 millions ESALs of heavy truck traffic).

The 2009 NCAT Pavement Test Track is expected to consist of an even larger structural experiment as well as more mill/inlay surface mixes, with formal research sponsorship expanded to include private sector partners. Track research sponsors have always been encouraged to choose experiments that meet their specific research needs. Individualized test sections will still be optional on the 2009 Track; however, NCAT is also encouraging sponsors to consider supporting a pre-designed six section “Group Experiment” that is intended to encompass multiple timely issues that are important to the entire pavement community. All sections in the “Group Experiment” will be supported by the same subgrade and base, and the total thickness of all bituminous lifts will be 7 inches. This thickness was chosen because in past studies 7-inch sections exhibited significant performance differences within the planned traffic cycle.

In addition to a control section that will be built with conventional hot-mix asphalt (HMA), two sections will be built using different warm mix asphalt (WMA) technologies in every lift. Although the two WMA technologies will be selected by the sponsors who choose to financially support the experiment, it is envisioned that one of the sections will be foamed and the other will be produced using an additive. These sections are proposed because reduced energy demand, lower emissions, and enhanced workability make WMA technology a very attractive alternative for the construction industry if it can be proven that early rutting, moisture damage and structural performance are not compromised.

As a result of the rising cost of virgin materials, pavement engineers are also very interested in high recycled content mixes. There are some concerns that the use of high percentages of reclaimed asphalt pavement (RAP) in surface mixes may compromise durability. Likewise, there is concern that high RAP content base and binder mixes may compromise fatigue resistance. It is critical that decision makers determine whether high RAP content mixes are suitable for these applications so that specification limits can be set at the highest level that exhibits performance characteristics comparable to virgin mixes. In order to address this issue, one section will be built with a high RAP content in lower lift(s) and low RAP contents in upper lift(s). Another section will be built with high RAP contents in both lower and upper lifts.

Many state DOTs are using drainable surface mixes in order to improve wet weather driving visibility, lower accident/fatality rates, and reduce noise created by pavement tire interaction. Although drainable surface mixes have aggregate structures that are very similar to rut resistant stone matrix asphalt (SMA) mixes (less the voids-filling dust), it is typically assumed they do not contribute to the load carrying potential of the pavement structure. The sixth section in the “Group Experiment” will be built identical to the control section, except that the conventional surface mix will be replaced with a drainable surface mix.

By monitoring response instrumentation (i.e., pressure plates and strain gauges) installed in each of these sections at the time they are constructed and by documenting changing surface conditions (rutting, roughness, cracking, etc.) under heavy truck traffic, it will be possible to compare both surface and structural performance. It is expected that this information will provide for the optimization of specifications regarding the deployment of these modern technologies on the pavement infrastructure with a high level of confidence. As a complementary bonus, the private sector plans to build additional instrumented structural test

sections to investigate the use of alternative binders through direct comparison with these six “Group Experiment” sections.

Utilization of as many sections as possible for structural purposes would facilitate the implementation of mechanistic-empirical (M-E) methods for structural pavement design. For example, the development of the new Mechanistic-Empirical Pavement Design Guide represents a significant change and advancement over existing design methodologies. Historically, the structural design of asphalt pavements has been largely empirical based upon vehicle designs, axle loads, and material properties. The new design guide, however, relies heavily on principles of engineering mechanics to produce thickness designs that control specific modes of pavement distress.

Before this new methodology gains wide acceptance or use, it must be validated and calibrated to ensure that it provides adequate design guidance using modern methods and materials under traffic by actual design vehicles. Calibration of the conservative distress models that could eliminate only a 10 percent margin of error in excess design thickness would generate an annual taxpayer savings nationwide of as much as one billion dollars. To this end, there is a need for a full-scale structural experiment to validate the methodology.

The existing infrastructure available at the NCAT Pavement Test Track presents a unique opportunity to accomplish this objective. By constructing an array of sections on the 2009 track with varying structural designs and material types, a practical study can be completed within 3 years that will make widespread, cost-effective adoption of the new Guide possible. Additionally, a larger structural experiment will build upon the experiences of both the 2003 and 2006 research cycles in which different responses and/or surface distresses were observed.

Objectives

The primary objectives of the pooled fund project described herein will be:

1. Constructing 200 ft test sections on the existing 1.7 mile NCAT test oval that are representative of in-service roadways on the open transportation infrastructure;
2. Applying accelerated performance truck traffic in the 2 years following construction;
3. Assessing/comparing the functional and structural field performance of trafficked sections on a regular basis via surface and subsurface measures;
4. Validating the M-E approach to pavement analysis and design using both surface and subsurface measures;
5. Calibrating new and existing M-E approaches to pavement analysis and design using pavement surface condition, pavement load response, precise traffic and environmental logging, and cumulative damage;
6. Correlating field results with laboratory data; and
7. Answering practical questions posed by research sponsors through formal (i.e., reports and technical papers) and informal (e.g., one-on-one responses to sponsor inquiries) technology transfer. For example, can high RAP content mixes provide the same level of performance as virgin mixes? If so, can they be used in both deep and shallow layers? Although warm mix is better for the environment, will it provide the same level of rut and moisture damage resistance as conventional mixes?

Scope of Work

The scope of work for the pooled fund project will include:

1. Hauling materials to the project from offsite locations. Material donations are typically secured by state sponsors, while reasonable hauling expenses are handled by the pooled fund;
2. Rebuilding sections in accordance with sponsors' directives via competitively bid subcontracts administered by NCAT. It is anticipated that supply and grade control of subgrades and bases, aggregate hauling, liquid asphalt supply and delivery, plant production, and mix placement may all be procured via competitively bid subcontracts. In order to reduce construction costs as much as possible, surplus equipment such as dump trucks, dozers, etc. will be provided by ALDOT in exchange for prescribed monthly usage fees. Any equipment that can not be obtained from ALDOT will be rented commercially to facilitate construction;
3. Installing both environmental (i.e., multi-depth pavement temperature probes) and response instrumentation (i.e., high speed stress and strain gages) in new experimental sections;
4. Operating a 5-truck heavy triple-trailer fleet in order to apply accelerated truck traffic following the completion of construction. Actual human drivers pilot the vehicles in order to best induce representative vehicle wander;
5. Measuring field performance each week when the fleet is parked to fully document the changes in surface condition as a function of traffic and temperature. High-speed pavement response will also be measured on a weekly basis. Pavement deflection and surface friction will be measured on a monthly basis;
6. Conducting laboratory testing to quantify basic material and mix performance properties, which will serve as the basis of performance model development; and
7. Comparing predicted and measured pavement response as well as predicted and measured cumulative pavement damage in order to validate then calibrate prevailing M-E methodologies.

Comments

This project is eligible for 100% SP&R funding. Each sponsor participating in the study is asked to contribute funding as a function of the scope of their selected research. The cost to participate varies as follows according to the amount of effort required:

- Continue traffic on existing mill/inlay section – \$55k / year (\$165k / section)
- Surface treatment on existing mill/inlay section - \$55k / year (\$165k / section)
 - Intended to provide access to project for private sector partners
 - Does not include the cost of materials, construction or mitigation
 - Commitment to rapid mitigation of failed experiments is required
- Continue traffic on existing structural section – \$70k / year (\$210k / section)
- Mill/inlay surface performance section – \$120k / year (\$360k / section)
- Mill/inlay structural performance section - \$150k / year (\$450k / section)
- Structural performance section – \$180k / year (\$540k / section)
- Group experiment - \$180k / year (\$540k total assuming 6 sponsors)
 - Actual amount will be less if more than 6 sponsors participate
 - For example, cost will be only \$72k / year (\$216k total) with 15 sponsors

November 12, 2008

Funding requirements are based on reasonable assumptions; however, if project costs increase significantly (e.g., fuel) either a proportionate amount of additional funding or a modified scope of work may be required. Please visit the project web at www.pavetrack.com for additional information.

Subjects

Accelerated Performance Testing and Pavement and M-E Design and Validation