Period Covered: April 1, 2008 through June 30, 2008 (Quarterly Report)

ALDOT Progress Report for the

State Planning and Research Program

PROJECT TITLE: Accelerated Performance Testing on the 2006 NCAT Pavement Test Track		
PROJECT MANAGER(S): R. Buzz Powell, PhD, PE Ph #: (334) 844-6857	**SPR Project No:** TPF-5(124) ALDOT Research Project No. 930-637P	**Project is:** ____ PLANNING __X__ RESEARCH & DEVELOPMENT
Annual Budget	**Multi Year Project** Total Budget for Project $9,412,225.00 Total Cost to Date for Project $5,762,491.22	

Background

The Pavement Test Track is a full-scale accelerated performance test (APT) facility managed by the National Center for Asphalt Technology (NCAT) at Auburn University. The project is funded and directed by a multi-state research cooperative program in which the construction, trafficking, and pavement evaluation are carried out on 46 different 200-foot test sections around the 1.7-mile oval test track. Each test section is constructed utilizing the asphalt materials and design methods used by individual sponsors. A fleet of heavy trucks is operated on the track in a highly controlled manner in order to apply a design life-time of truck traffic (10 million equivalent single axle loads, or ESALs) in two years. The current project represents the third three-year research cycle of the NCAT Pavement Test Track.

Objectives

The primary objectives of the project are to: (1) identify pavement structures and materials with superior field performance and lower life cycle costs; and (2) provide information for the calibration and validation of the Mechanistic-Empirical Pavement Design Guide (MEPDG).

Design and Construction of Test Sections

When each research cycle is completed, test sections are either left in place for the application of additional traffic or rebuilt in the manner that best meets the needs of sponsors. The third research cycle includes: (1) eight sections built in 2000 (all mix performance sections), 16 sections built in 2003 (12 mix performance sections and four structural sections) and 22 sections built in 2006 (15 mix performance sections and seven structural sections). Mix performance sections are perpetual pavements in which distresses are confined to various combinations of experimental surface mixes. Structural sections are typically thinner, highly instrumented pavements that are intended to provide information for the MEPDG.

Truck Operations

Trucking operations for the third phase of the NCAT Pavement Test Track began after the completion of the reconstruction activities in November of 2006. A fleet of five trucks runs two shifts a day. An AM driver shift runs from 5:00 AM until approximately 2:00 PM, and a PM driver shift runs from 2:00 PM until approximately 11:00 PM.

At the end of the reporting period, a total of 7,751,895 ESALs (77 percent of the 10 million ESAL goal) had been safely applied to the surface of the 2006 NCAT Pavement Test Track. This means that the eight sections originally placed in 2000 had been subjected to approximately 28 million ESALs and the sixteen sections built in 2003 had been subjected to approximately 18 million ESALs. All mixes in both previous studies were designed for 10 million ESALs.

Laboratory Performance Testing

There are 31 unique asphalt mixtures that consist of 27 Superpave and Stone Matrix Asphalt (SMA) mixtures as well as four Permeable European Mix (PEM) and Open Graded Friction Course (OGFC) mixtures. The laboratory testing plan focuses on evaluation of the 27 Superpave and SMA mixtures.

NCAT has finished testing of binder, dynamic modulus, flow number and rutting susceptibility using the Asphalt Pavement Analyzer (APA). Analyses of these test results are almost completed. Results of these analyses will be discussed in the next sponsor meeting.

Structural Pavement Study

Dynamic data collection has continued on a weekly basis. Each week, three passes of each truck in each test section are captured. The data are then processed and added to their respective databases.

The second round of stop-testing was conducted on June 9 and 16 on sections N2, N3, N8, N9, N10 and S11. Another round of testing is scheduled to be completed this fall.

Processing of the strain and pressure data collected during the initial and second round of testing has begun. Figure 1 illustrates the collected creep data from Section N2 collected on March 3 from a longitudinal strain gauge. These strain traces represent just the creep portion of the strain response once the load had come to a stop over the strain gauge. There are nine traces representing three replicates of the load at 30, 60 and 90 seconds, respectively. The variations in strain response are due primarily to differences in load placement during each replicate of testing. It is important to note that very high levels of strain can be achieved in even short loading durations. For example, the highest creep strain level achieved (200 $\mu\varepsilon$) was reached after just 30 seconds of loading.

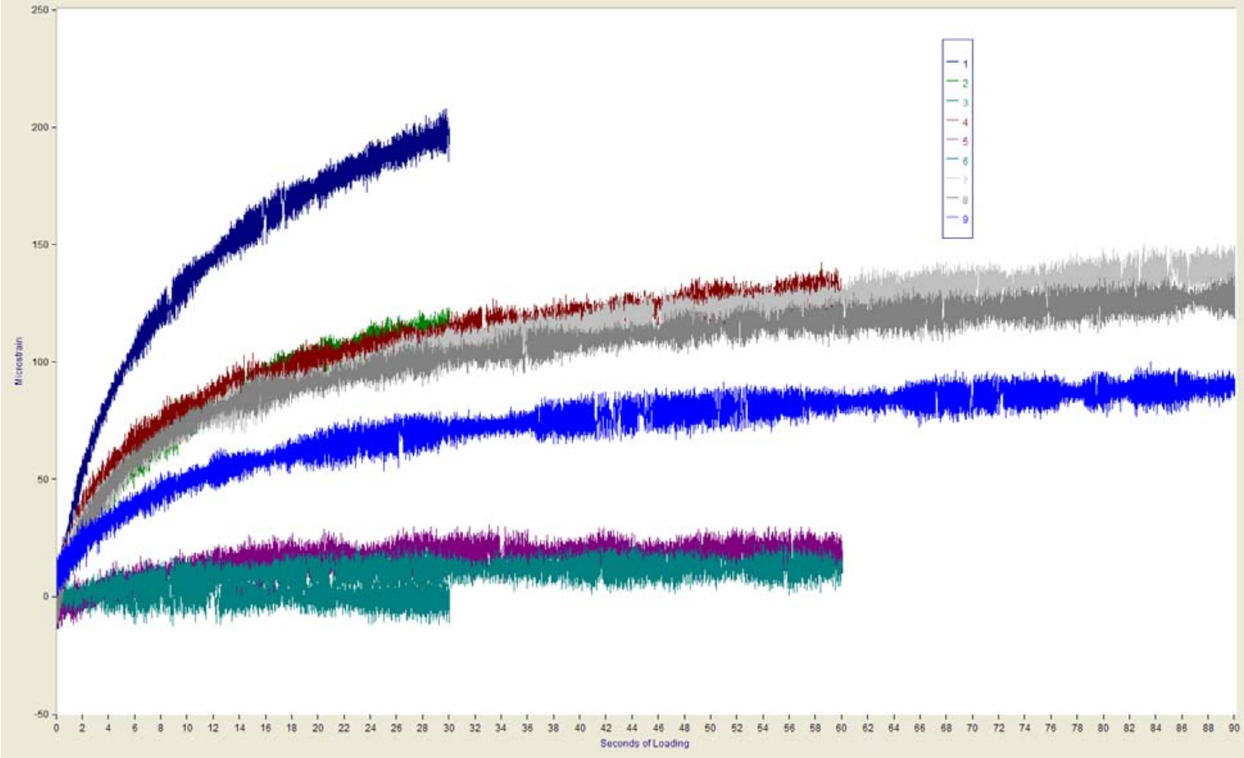

Figure 1 Section N2 Measured Creep Response with Longitudinal Strain Gauge.

In addition to examining the strain traces visually as shown in Figure 1, the data processing also features fitting a 10^{th}-order polynomial to the curves which will enable further analysis and computation of creep compliance as a function of time, t. Table 1 lists the regressions coefficients and corresponding R^2 for the curves shown in Figure 1 according to the regression equation:

$$\text{Microstrain} = C0+C1*t+C2*t^2+C3*t^3+C4*t^4+C5*t^5+C6*t^6+C7*t^7+C8*t^8+C9*t^9+C10*t^{10}$$

Table 1 Regression Coefficients for Creep Curves in Figure 1

Load	Duration, sec	R^2	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
1	30	0.99	-2.737969	41.00217	-9.479624	1.954596	-0.28848	0.028699	-0.001886	8.0224E-05	-2.11887E-06	3.15294E-08	-2.01831E-10
2	30	0.98	-0.674892	18.782195	-3.42922	0.690343	-0.107928	0.011402	-0.000787	3.4824E-05	-9.51539E-07	1.45963E-08	-9.60985E-11
3	30	0.03	-1.939836	0.2940633	0.4486203	-0.223219	0.047968	-0.005764	0.000419	-1.88669E-05	5.14267E-07	-7.78257E-09	5.02023E-11
4	60	0.98	2.4467243	21.719466	-3.43767	0.390017	-0.02924	0.001444	-4.7E-05	9.95784E-07	-1.31782E-08	9.87948E-11	-3.19959E-13
5	60	0.67	-5.293952	2.950213	-0.207501	0.014159	-0.001145	7.78E-05	-3.46E-06	9.40766E-08	-1.50907E-09	1.31102E-11	-4.75563E-14
6	60	0.43	-1.850792	1.8262657	-0.270167	0.037315	-0.003166	0.000161	-5.13E-06	1.02805E-07	-1.26795E-09	8.81436E-12	-2.64962E-14
7	90	0.98	7.5661156	12.947138	-1.188126	0.080134	-0.00363	0.000109	-2.19E-06	2.87757E-08	-2.37023E-10	1.11074E-12	-2.25691E-15
8	90	0.98	-2.471398	18.696549	-2.171556	0.165881	-0.008107	0.000257	-5.3E-06	7.07608E-08	-5.87513E-10	2.75618E-12	-5.57869E-15
9	90	0.95	9.1928798	7.7653035	-0.690165	0.048082	-0.002338	7.64E-05	-1.66E-06	2.33083E-08	-2.04333E-10	1.01112E-12	-2.1544E-15

Work has continued on back-calculation of the constituent pavement layers in each test section. Finalized cross-sections have been selected for each test section and comparisons have been made between measured and predicted pavement responses. Final non-linear models were developed for the unbound materials and modulus versus temperature models were developed for each test section. These data have been documented in a recently published thesis (Taylor, 2008).

Pavement Performance Evaluation

Every Monday, trucking is suspended so that vehicle maintenance can be performed and pavement performance can be quantified. An inertial profiler equipped with a full lane width dual scanning laser "rutbar" is run weekly around the entire track in order to determine individual wheelpath roughness, right wheelpath macrotexture and individual wheelpath rutting for every experimental section. Additionally, three random locations were selected within each section in a stratified manner to serve as the fixed test location for nondestructive wheelpath densities. Transverse profiles are measured along these same locations regularly so that rutting may be calibrated with a contact method. Figures 2 and 3 illustrate rutting performance and International Roughness Index (IRI) of test sections at the NCAT Pavement Test Track at the end of reporting period.

Next Sponsor Meeting

The next Track sponsor meeting will be hosted from 1:00 PM on August 26th to noon on August 27th. The first afternoon will consist of technical presentations at NCAT. The next morning will be devoted to test section inspections.

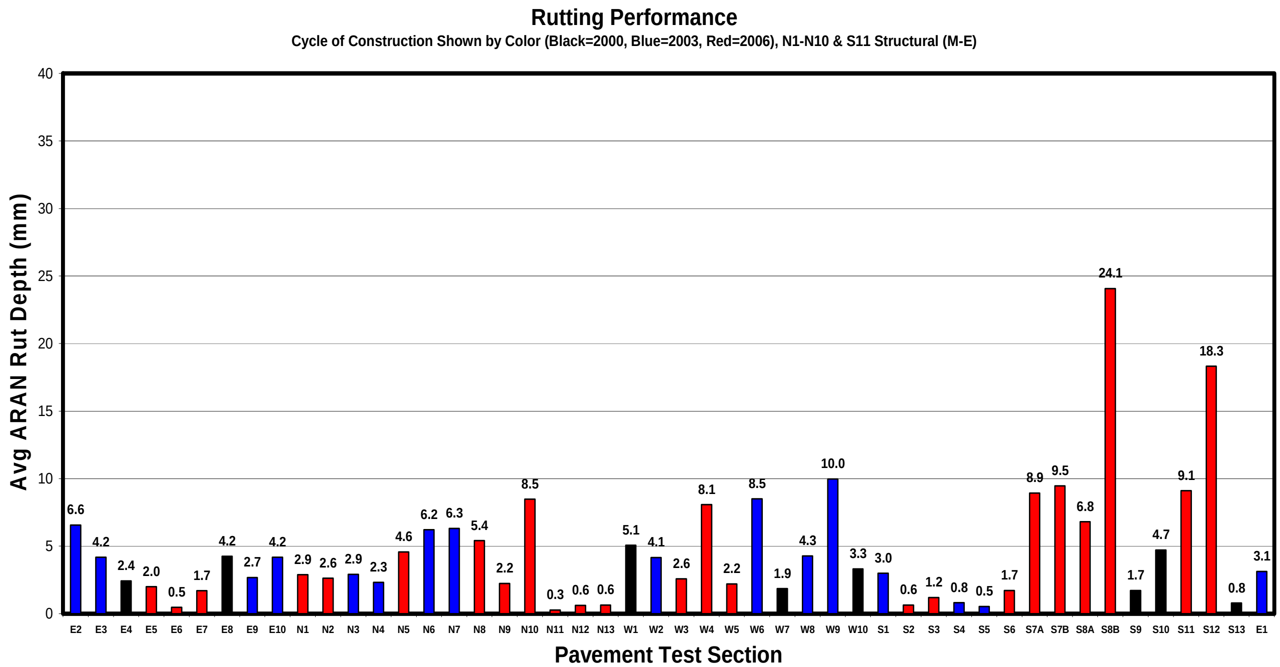

Figure 2 Rutting Performance of Test Sections at the End of Reporting Period

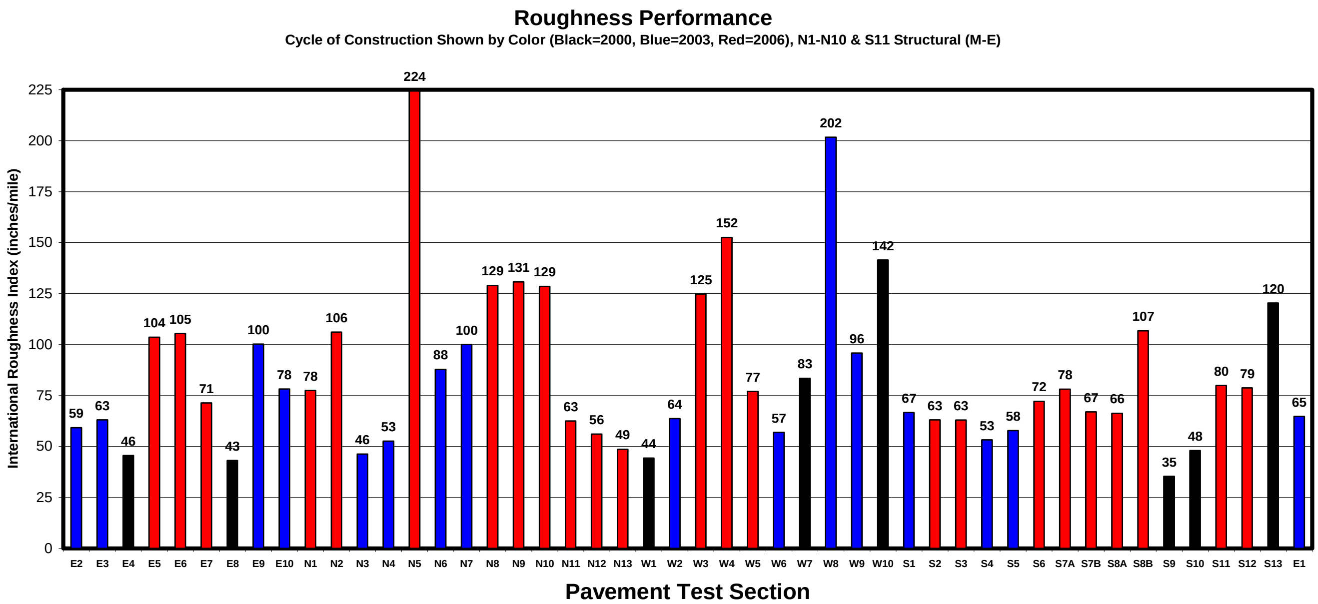

Figure 3 IRI of Test Sections at the End of Reporting Period

STATUS AND COMPLETION DATE

Percentage of work completed to date for total project ________64.2 %________

Project is:

__X__ on schedule _____ behind schedule, explain:

Expected Completion Date: ________August 31, 2009________

Please note that this project has continued with renewed requests for services and additional funding obligations and may be extended beyond the current Expected Completion Date listed above.