National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

NCAT Test Track Design, Construction and Performance

First Cycle

RESEARCH SYNOPSIS 02-12

Introduction

This report documents the research results from the first cycle of the 1.7-mile NCAT Test Track – one of the most advanced and comprehensive facilities of its kind in the world. The primary objective of the test track was to provide an accelerated loading facility that could be used to rapidly and simultaneously test a large number of test sections. This allows validation of laboratory tests and pavement design procedures, and evaluation of performance of different hot mix asphalt (HMA) mixtures under traffic similar to that observed on highways. Loading of test pavement began in Fall 2000 immediately after construction was completed.

Experimental Design

Figure 1: Layout of Test Sections

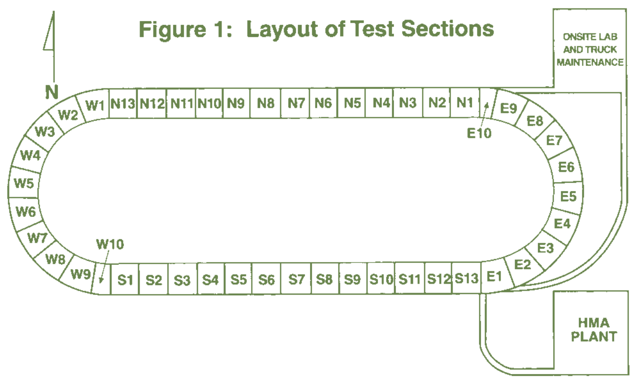

Figure 1. shows the layout of the test track, which has 46 test sections – 26 test sections on the two tangents and 20 on the curves. Test sections consist of 2 inches (50 mm) of binder course and 2 inches (50 mm) of wearing course. All test sections are underlaid with 24 inches (610 mm) of HMA base course and 4 inches (100 mm) of permeable asphalt base. Rutting was the primary distress expected in most test sections. Because of the extremely thick structure, fatigue cracking was not expected to be a problem.

Several performance comparison experiments were conducted in the first cycle. These included:

- comparison of fine-graded versus coarse-graded mixes
- evaluation of the effect of asphalt binder type (neat or modified) and grade (such as PG 67-22 and PG 76-22) on performance
- evaluation of the effect of 0.5 percent extra binder content on performance
- evaluation of the effect of aggregate type on performance
- comparison of the performance of Superpave, SMA and open-graded friction courses

Other small studies included evaluation of the effect of grinding transverse joints on performance, the effect of traffic on friction, the rate of densification of HMA, and the effect of pavement smoothness on fuel consumption, as well as a test of the permeability of the various HMA mixtures.

Several aggregates were used on the track, including soft and hard limestones, granite, gravel and slag. Reclaimed asphalt pavement (RAP) was also used in a few sections.

All dense-graded mixes were designed with the Superpave mix design method. The nominal maximum aggregate size of the wearing course mix ranged from 9.5 mm to 12.5 mm.

Figure 2. Accelerated loading of test sections is accomplished with four heavy loaded triple-trailers.

Trafficking was accomplished with four trucks pulling triple trailer assemblies (Figure 2.) around the track at 45 mph for 17 hours a day, six days a week, in order to apply 10 million ESALs of traffic to the track within two years. The rigs were driven approximately 1.6 million miles to accomplish this.

Key Findings

- Automatic belt sampling at the plat and mix sampling devices used during construction provided rapid, safe, and representative samples.
- Over a 2-year period, the highest average 7-day maximum pavement temperature was 61.4°C (142.6°F) at 20 mm below the surface. This compares well with the expected temperature calculated using Superpave procedures.
- Very little rutting occurred in any of the test sections after 10 million ESALs were applied. The average rutting at the track was approximately 0.12 inches (3 mm) after 10 million ESALs. Rutting is typically not considered to be a problem until its magnitude reaches approximately 0.5 inches (12.5 mm). The two test sections with the most rutting (approximately 0.25 inches or 6 mm) were sections that did not use modified asphalt and in which an additional 0.5 percent asphalt binder was added.
- The amount of deformation calculated from changes in wheel path densities exceeded the actual measured rutting. This supports the fact that most of the test sections had very stable mixtures. The small amount of rutting that was measured was probably related primarily to densification.

- Under traffic, the mixes using PG-67 asphalt binder densified more than the mixes using PG-76 asphalt binder. This may indicate that a little more binder can be used in the higher PG grade mixes to improve durability.
- The amount of rutting was about 60 percent less in the sections with PG-76 than in sections with PG-67.
- Adding an additional 0.5 percent asphalt binder increased the rutting in the PG-67 mixes by approximately 50 percent but had negligible effect on PG-76 mixes. Hence, it may be possible to design mixes with higher PG grades at slightly higher asphalt contents to improve durability.
- The performance of the coarse-graded and fine-graded mixes was approximately equal with regards to rutting.
- The track roughness, as quantified by the International Roughness Index (IRI), increased slightly during two years of traffic from the mid 60s inches/mile at the start of the cycle to the mid 70s inches/mile at the end of two years.
- The dynamic modulus test did not appear to be related to rutting. The triaxial repeated-load test and the Asphalt Pavement Analyzer wheel-tracking test did show a trend relating laboratory results and field performance.

Acknowledgements and Disclaimer

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