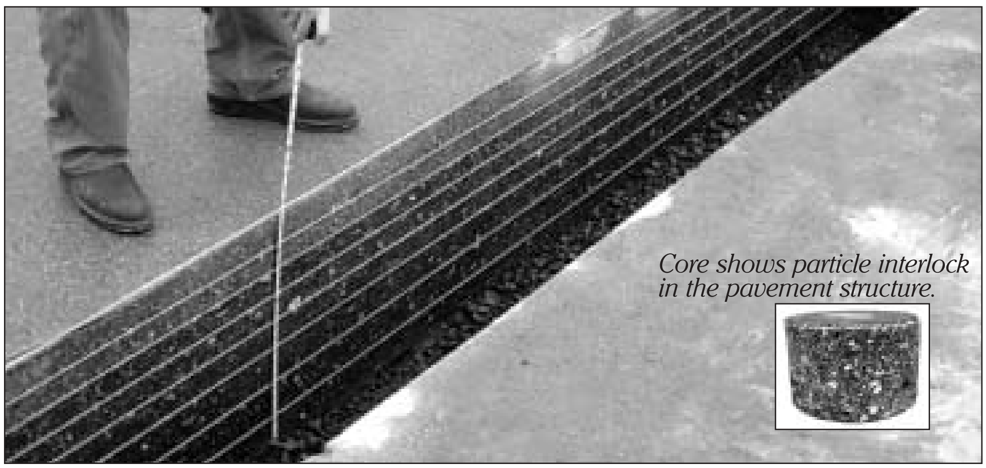
slag Successes

News and Information about the Iron and Steel Slag Industry



# ACBF slag is major component of NCAT test track research

## Air-Cooled Blast Furnace Slag mixtures perform well under accelerated loading



*Core shows particle interlock in the pavement structure.*

*Technician measures the multi-layered NCAT asphalt test track in Auburn, AL.*

**INTRODUCTION**

Air-cooled blast furnace slag was one of the primary coarse aggregates to be placed in the initial NCAT test track. Constructed in the spring of 2000 in Auburn, AL, this asphalt test track was constructed as a 1.7-mile oval having 13 test sections in each of the North and South tangent portions of the track; 10 were comprised of slag. An accelerated loading of 10 million ESALs was applied over a two-year period.

Ten sections in the North tangent were 12.5 mm Superpave mixtures composed of blast furnace slag coarse and fine aggregate and limestone fine aggregate. Differing blends were used to create gradings above and below the maximum density line using 60 – 70 % slag. These sections were sponsored jointly by the FHWA and Alabama and Indiana DOTs. The remaining tangent sections were composed of other aggregate types, such as granite, crushed gravel, limestone and marble/schist. All of the sections performed well in terms of rutting resistance and durability.

There were other variables evaluated in these slag test sections such as comparisons between neat and polymer modified asphalts, the effects of using 0.5 % asphalt above optimum and a comparison of SBS and SBR modifiers. The neat asphalt was a PG 67-22 and the polymer grades were PG 76-22.

*Continued*

**RESEARCH**

The primary mix characteristic of interest was resistance to rutting. A standard pavement section was used throughout the track and was composed of 6 in. crushed aggregate base, 5 in. permeable asphalt base and a 15 in. split asphalt base with the upper 6 inches using a PG 76-22 in order to eliminate fatigue failures. The top 4-inch layer represented the individual research section and was designed as either a single lift or a split surface/binder layer

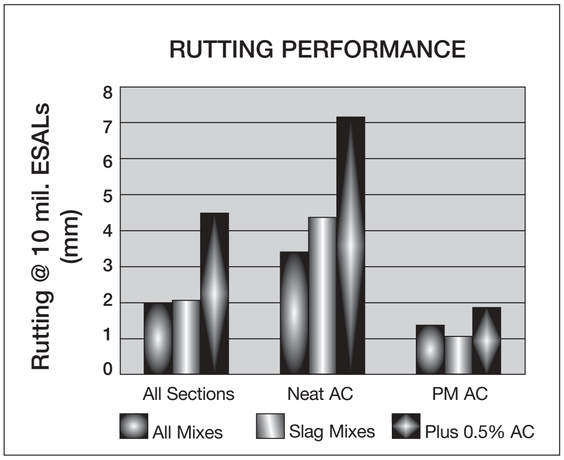
**PERFORMANCE**

The track surface was monitored weekly for distress and rutting measurements were made for each section using a vehicle-mounted laser device. At the end of the track life of 10 million ESALs, final measurements were made using a string line to measure rutting.

***Table of Rutting Measurements***

| | Optimum AC | Optimum + 0.5% AC |
|---|---|---|
| ***All Sections*** | 2.0 mm | |
| ***Slag Sections*** | 2.2 mm | |
| ***All w/Neat AC*** | 3.4 mm | |
| ***Slag w/Neat AC*** | 4.5 mm | 7.2 mm |
| ***All w/Polymer Mod.*** | 1.5 mm | |
| ***Slag w/Polymer Mod.*** | 1.1 mm | 1.8 mm |

Other than the mixes designed with asphalt in excess of optimum, the slag mixtures performed as well as the others. Rutting less than 5-6 mm is considered acceptable in most cases (1 mm = 0.04 in.). It is interesting to note that the rutting resistance of mixtures with increased asphalt can be improved by using a polymer-modified asphalt. Although there is about a 60% increase in rutting when adding 0.5% extra neat asphalt, the substitution of a polymer-modified asphalt reduces the rutting to a negligible level. This may allow for the use of higher asphalt contents which is known to improve fatigue resistance.




**SUMMARY**

ACBF slag has a long history of excellent performance in asphalt mixtures. The slag performance in this track was also excellent regardless of the mixture grading. Mixtures both above and below the maximum density line all performed well, supporting the flexibility of slag under a variety of design concepts.

This research supports the excellent success that can be expected when good quality ACBF slag is used in properly designed hot mix asphalt.

*This is another Slag Success Story brought to you by the National Slag Association.*