
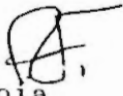


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RESEARCH UPDATENUMBER U90-3

CARBON BLACK MODIFIED PAVEMENTReference

Research Investigation P85-4, Work Plan 86-R-8, Update U88-1

Purpose

This update reviews the performance of carbon black modified and high stability control mixes in resisting the redevelopment of wheel path rutting.

History

A 3500'+ section of Route 7 paved in 1979, Court Street in Middlebury, developed distress in the form of rutting and shoving shortly after placement. By June of 1985, rutting in the wheelpaths averaged 10/16" with maximum values of 1 11/16". An investigation, completed in July 1985 (P85-4), concluded that the pavement distress was the result of a number of factors, but that the major cause was due to instability of the plant mixed base course.

In 1986, a decision was made to reconstruct two 600+ foot sections of Court Street at the School Street and Charles Avenue intersections in an attempt to determine what would be required to rehabilitate the entire project in future years. Construction was carried out under project Middlebury F019-3(39)S in August and September, 1986. The procedure included the stepped removal of the existing pavement courses with full removal over the mid section. Both mixes used AC20 asphalt with a 75 blow Marshall test criteria in place of the standard 50 blow requirement. Stability requirements were increased from 1000 lb. to 1500 lb. for Type I and to 1800 lb. for Types II and III. The pavement typical substituted two 2 1/2" courses of Type I for the standard plant mixed base course with one 1 3/4" course of Type II and one 1 1/4" course of Type III. Carbon black (MICROFIL 8 by Cabot Corp.) was added at a rate of 25 lb. per ton to the mix placed at the Charles Avenue intersection. Traffic was kept off the new pavement until the surface temperatures had cooled to 100°F.

Cost

The 730 tons of bituminous mix with carbon black added was bid at \$78.00 per ton. The high stability control mix was bid at \$35.00 per ton which was only slightly higher than the project average unit price for the item. The Cabot Corporation reports that carbon black (MICROFIL 8) was available at a cost of \$0.33 per pound FOB Franklin, LA or \$0.37 per pound at Middlebury, VT. The cost of the product has not changed through March of 1990. Cabot's Project Manager currently recommends that carbon black be added at the rate of 15% of the asphalt content if AC 20 asphalt is used. That would amount to a loading of 18 lbs., of carbon black with a reduction in the asphalt content of 11 lbs. per ton. Such usage would result in a \$6.00 per ton increase in the material cost of the modified mix.

Status

Traffic volumes have increased over the test sections and are now exceeding 16,000 vehicles per day. The sites have been examined for signs of distress or rutting each fall since placement. The results have been documented as follows:

Pavement Cracking	Carbon Black 1 diagonal crack	Control no cracks
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Ride Quality - Mays values in inch/mile at 35 mph

	1 Year (11-87)
Carbon Black	117
Control	111
Old Pavement	198

Rut Measurements - in 1/16 inch increments

Depth Replaced	1 Year (10-87)		2 Years (11-88)		3 Years (10-89)	
	CB	Control	CB	Control	CB	Control
	0	6.2	14.2	11.0	17.5	11.8
1	2.8	--	5.5	--	6.2	--
1 1/2	1.2	3.0	3.2	6.5	3.2	7.0
3	0.8	2.2	2.2	4.2	2.0	4.2
5 1/2	0.5	1.2	2.2	3.8	2.2	4.2
8	0.5	1.2	1.7	3.9	2.2	3.4

Summary

Significant findings noted through three years of service include the following:

One inch of carbon black modified mix was unable to prevent rutting

which averaged 6/16 of an inch.

One and one half inch of the high stability control mix was unable to prevent rutting which averaged 7/16 of an inch.

One and one half inch or more of the carbon black modifier mix and three inches or more of the high stability mix were able to resist above normal rutting through three years of service.

There were no increases in the amount of rutting from the second to the third year of service on either type of mix at the three inch to eight inch locations.

Preliminary Conclusions

All thicknesses of the carbon black modified mix developed less rutting than equal thicknesses of the high stability control mix.

There was no abnormal rutting in either the carbon black or control mixes where they were placed at a thickness of three inches or greater.

There was no increase in rutting at the three inch or greater thickness with either mix between the second and third years. Such results suggest the 4/16 inch average rutting in the control mix and the 2/16 inch average rutting in the carbon black mix may be the result of normal pavement consolidation rather than the plastic flow or migration of mix which is associated with serious rutting problems.

Recommendation

Based upon the performance information gathered through three years of service, it appears that removal and replacement of the binder and surface course with either a carbon black modified or high stability mix would prevent the reoccurrence of the rutting and poor riding quality present on the remainder of the original 1979 construction project.

Follow-Up

Inspections and testing will continue on the test sections.