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MaineDOT

Transportation Research Division

Technical Report 13-03

Field Test of a Polyphosphoric Acid (PPA) Modified Asphalt Binder on Rt. 1 in Perry

Final Report, April 2013

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Introduction

The Maine Department of Transportation (MaineDOT) uses the Superpave hot mix asphalt process and specifies asphalt binder grades using the Performance Grade criteria. The Department mainly uses asphalt binder grade PG 64-28. This is an asphalt binder material that passes the performance tests for high temperatures (rutting potential) at 64 degrees Celsius and passes tests for low temperatures (thermal cracking) at -28 degrees Celsius. In order to create the properties of PG binder, polyphosphoric acid is sometimes added to the asphalt. It is widely recognized in the industry that the addition of polyphosphoric acid to asphalt can increase the high temperature PG grade to the next higher grade. However, there are concerns among transportation agencies that this PPA could alter the long term performance of the asphalt binder. One of the major asphalt suppliers to MaineDOT paving projects uses PPA to alter their PG58-28 neat asphalt binder into a PG64-28.

PG Binders & PPA

An explanation of the specification and development of Superpave Performance Grade (PG) binder specification has been described in an FHWA TechBrief . "In the PG system the high and low temperature performance range is specified i.e., PG 64-22. The 64 represents the expected high temperature range of the binder and the -22 is the expected low temperature range. The difference between the high and low temperature range of the binder is call the useful temperature interval (UTI). All asphalt binders refined from crude oil have a specific UTI….Changes in the refining process can shift the UTI up or down, but in general they cannot change the UTI….To change the UTI of an asphalt binder it would have to be blended with an asphalt binder which has a different UTI or modified with some type of additive…The use of the Superpave binder specification has encouraged agencies to specify stretch grades. These are grades that go beyond the UTI of most neat asphalts….To meet the requirements for these grades some type of modification is needed. In many cases this would be a polymer. Polymers do quite well in increasing the high temperature properties of a binder. However, polymer modification can also affect the intermediate temperature properties of some asphalt binders. The use of PPA in combination with the polymer will minimize the increase in stiffness …. The amount of PPA needed will vary based on the crude source and polymer being used….".[1] PPA is a hydrophilic material, however, and easily absorbs water….[*and*] it has been demonstrated that binders modified with PPA content above 1%, have a tendency to absorb water and lose strength".[2] The potential for increased moisture damage and reduced pavement performance has therefore been a concern when PPA modified binder is used.

[1] FHWA Tech Brief "The Use and Performance of Asphalt Binder Modified with Polyphosphoric Acid (PPA)" , March 2012.

[2] FHWA TechBrief cited.

Project Scope

An experimental construction study was established to field test the long term performance of PPA modified PG64-28 and compare it to the PG58-28 neat asphalt binder. A highway reconstruction project, NH-1000(800)E, along Rt. 1 in Perry, Maine was selected as a suitable site for this comparison. A description of the project scope and construction details are contained in the previous report for this experimental project, dated September 2009. In summary, this full reconstruction project consists of 550mm (22”) Type B Aggregate Base Course, a 75mm (3”) Recycled Asphalt Stabilized Base layer and 135mm of Hot Mix Asphalt Pavement. The pavement consists of a 12.5mm nominal aggregate size 60mm thick base layer, a 12.5mm nominal aggregate size 40mm thick binder layer and a 12.5mm nominal aggregate size 35mm thick wearing surface. Construction was completed in 2007.

Project Location

The project is located on Route 1 in Perry, beginning 0.35 of a mile northerly of Route 190 and extending northerly 4.10 miles. The location is shown on the map.

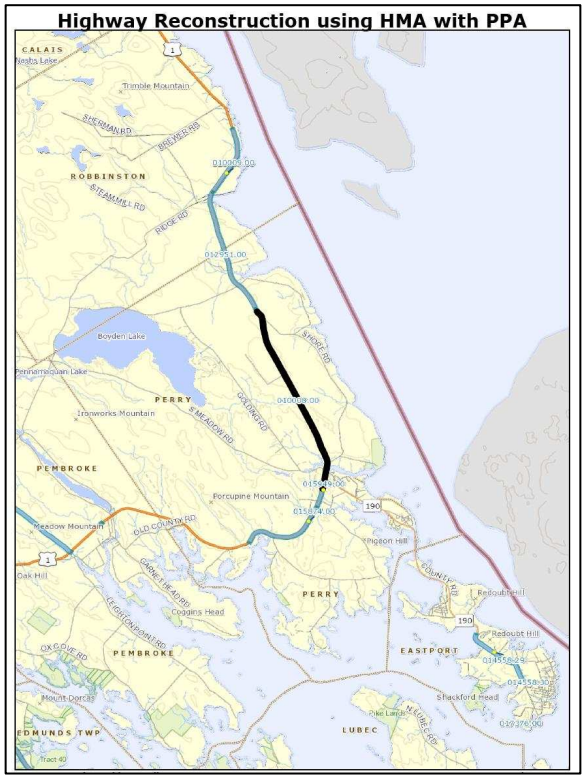

Figure 1 Location Map

Locations of Test Sections

The table in the previous reports describe the location of the different PG Asphalt Binders being evaluated. However only two sections were chosen for long term evaluation. The final test sections selected for comparison were:
Test Section 1 - Station 2+700 to 2+900 – PG58-28
Test Section 2 - Station 3+120 to 3+320 – PG64-28

The layers and binder are listed below.

Pavement Layer	Stations	PG Binder		Completed
60mm Base	2+700 to 2+900	PG58-28		2007
	3+120 to 3+320		PG64-28	2006
40mm Binder	2+700 to 2+900	PG58-28		2007
	3+120 to 3+320		PG64-28	2006
35mm Surface	2+700 to 2+900	PG58-28		2007
	3+120 to 3+320		PG64-28	2007

Evaluations

The ride and rutting data was collected in 2008 and was reported in the 2009 report. ARAN network collection images were taken in June 2010, and in 2012. The data show no anomalies. Visual observations showed that there were no pavement distresses.

Photos

The following photos show the test in 2012 for comparison. The images are from the Departments ARAN vehicle.

Figure 2 Test Section PG 58-28

Figure 3 Test Section PG 58-28

Figure 4 Test Section 2 PG 64-28

Figure 5 Test Section 2 PG 64-28

Conclusions

The section having the PG 64-28 binder has been in service approaching six years. Based on the observations from the ARAN images, both test sections are performing well. There are no obvious signs of early pavement distress. The concerns about potential deterioration that might be caused by the addition of PPA additive have not been observed on these test sections as of this date.

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