The Laboratory Performance and Field Case Study of Asphalt Mixture with Sasobit Treated Aramid Fiber as Modifier

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2021 TRB ANNUAL MEETING Transportation Research Board — 100TH Annual Meeting A Virtual Event January 2021

Michigan Tech

Introduction

- The clumping of fiber in the asphalt binder restricted the application of fiber modified asphalt mixture using the wet process.
- The dry process is easy to operate, and the distribution of fiber in the mixture using the dry process is better.
- Sasobit treatment could reduce the production temperature, thus decrease the energy consumption and environmental pollution.

Materials and test methods

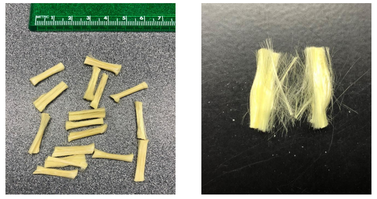
Materials

PG 58-34 asphalt binder

Property	Results	Specification
Rotational viscosity (135 ℃) (Pa·S)	0.398	< 3.0
G*/sin δ (Unaged, 58 ℃) (kPa)	1.542	> 1.0
G*/sin δ (RTFO aged, 58 ℃) (kPa)	4.147	> 2.2
G*×sin δ (PAV aged, 16 ℃) (kPa)	2346	<5000

Sasobit treated aramid fiber

Properties	Results
Materials	Aramid Fiber (50-51% by weight)
Form	Filament Yarn
Length (inch)	0.75 ± 0.03
Diameter (inch)	0.1
Tensile Strength (GPa)	2.4-3.6
Modulus (GPa)	60-80
Elongation percentage at Break (%)	3.0-4.4
Specific gravity (g/cm^3)	1.44 - 1.45
Decomposition Temperature (℃)	> 500
Treatment Properties	
Treatment Material	Sasobit® Wax (49-50% by weight)
Melting Temperature (℃)	> 77



Appearance of Sasobit treated aramid fiber

Test methods

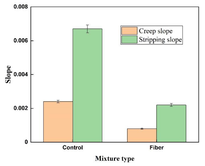
Hamburg Wheel Tracking Device

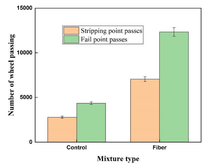
Disk-shaped Compact Tension test apparatus

UTM-100

Analysis of test results

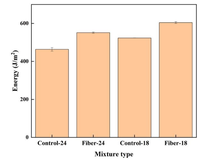
Rutting and moisture susceptibility

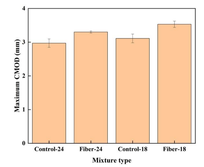




- The moisture damage in the asphalt mixture was restricted by the fiber addition.
- The rutting resistance of asphalt mixture was significantly improved after fiber modification.

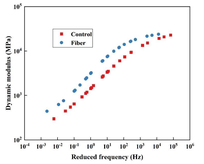
Low temperature cracking resistance

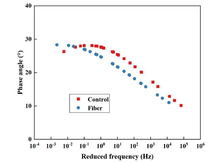




- The improvement of fiber on the cracking property of the asphalt mixture was obvious even at the lower test temperature.
- Fiber modified asphalt mixture has better deformation ability at low temperatures.

Dynamic modulus





- The dynamic modulus of modified mixture was higher, at all test temperatures under different frequencies.
- The elastic property of the asphalt mixture was enhanced after fiber modification.

Field case study

Field construction

Milling of the surface layer

Surface cleanup

Emulsified asphalt application

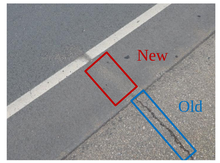
Pavement with emulsified asphalt

Mixture production in the plant

Fiber feeding in the plant

Pavement compaction

The new pavement surface



Cracking propagation restriction

Pavement condition during service period

Control section

Pavement before construction

After 1-year service period

After 2-year service period

Fiber section

Pavement before construction

After 1-year service period

After 2-year service period

Conclusions

- Fiber modification increased the rutting and moisture stability of the asphalt mixtures.
- The fracture energy and maximum CMOD of the control mixture increased after the fiber modification.
- The dynamic modulus of the asphalt mixture under different conditions was improved after fiber modification.
- The construction procedures of two types of asphalt mixtures in the field were displayed. The fiber modification significantly restricted the propagation of cracking in the asphalt mixture.

Acknowledgement: The work is carried out in cooperation with the Dickinson County Road Commission of Michigan.