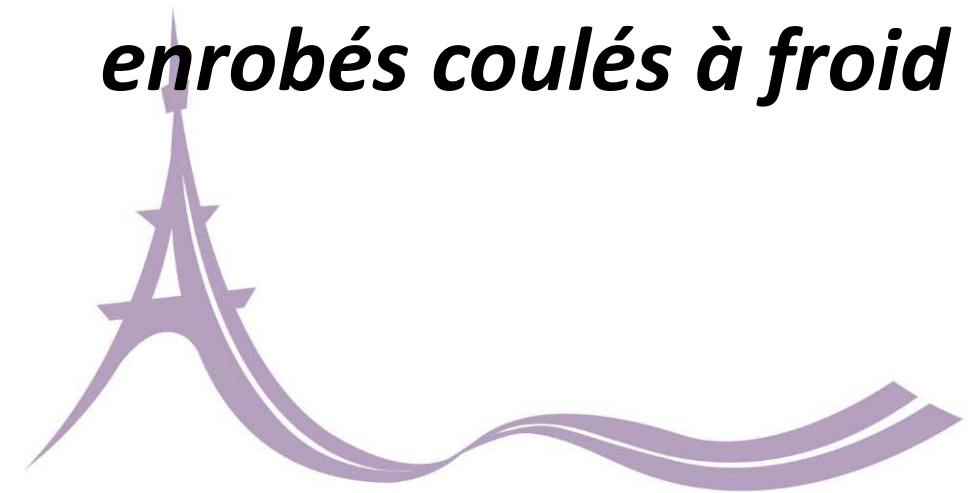


# Measurement of the effectiveness of fiber reinforced micro surfacing mixtures

*Evaluation technique de l'apport des fibres pour les enrobés coulés à froid*



PAVEMENT PRESERVATION & RECYCLING SUMMIT

**PPRS** PARIS 2015  
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Yang Yifan, Maggie Shi,  
Haze Hu and Zhu Zheng  
MeadWestVaco





## Outline

- › Micro surfacing background information
- › Re-inforcement considerations
- › Measurement of the fiber effectiveness in the laboratory and in the field
- › Closing remarks

MICRO SURFACING  
BACKGROUND  
INFORMATION | 1

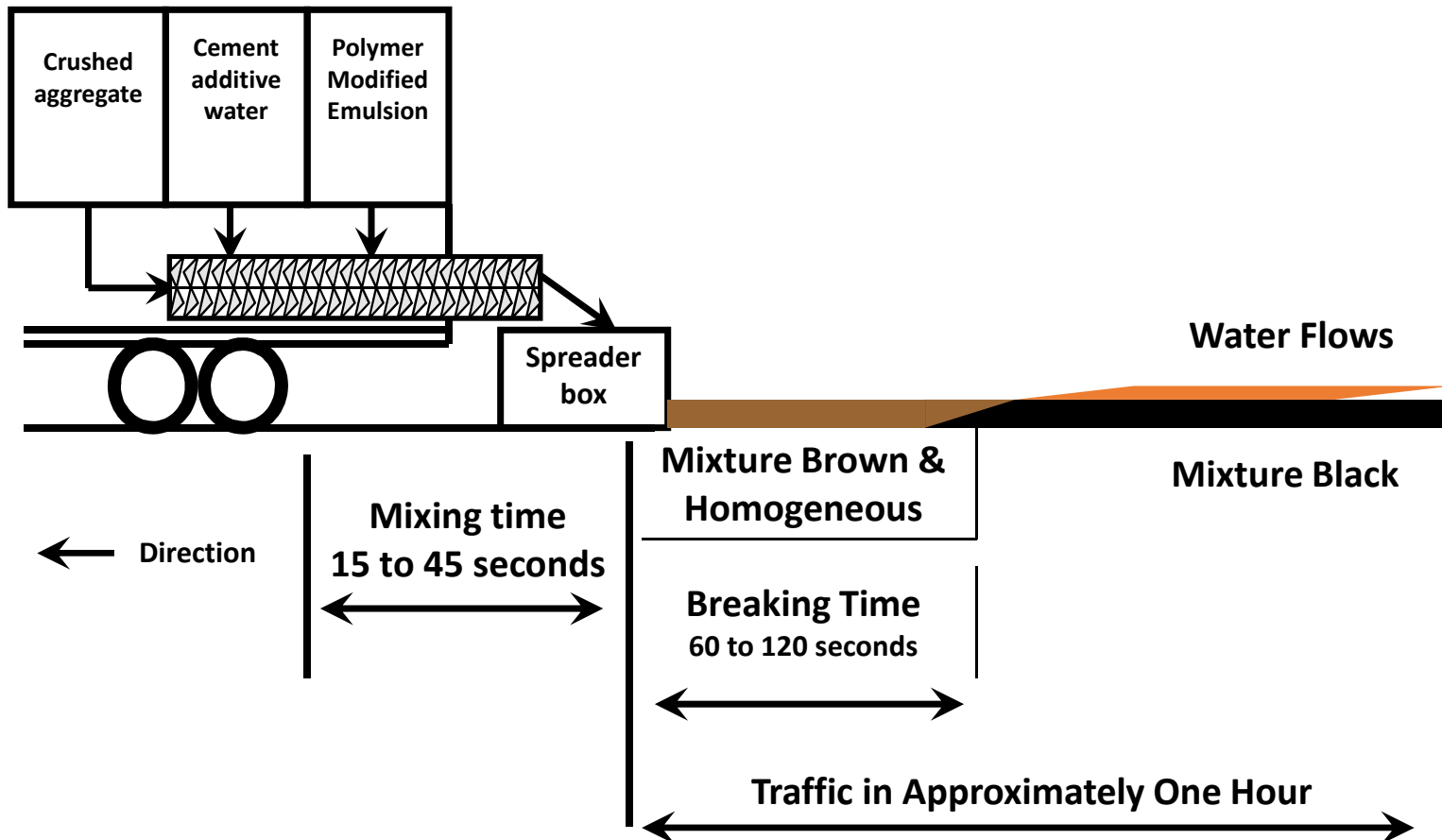
## What is Micro Surfacing?

- › A designed mixture of:
  - Polymer modified emulsified asphalt
  - Mineral aggregate
  - Mineral filler
  - Water
  - Other additives
- › Quick cure - Quick traffic
  - Traffic ready in about 1 hour
  - Can be done at night
- › Uniformly spread over a properly prepared surface
  - ISSA A-143
  - ASTM D-6372

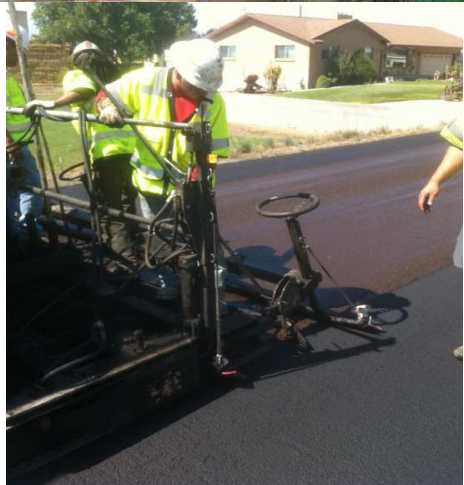




# Micro Surfacing - Machine Schematic



# Micro Surfacing Has A Global Track Record



- › Economical product:
  - Maintenance treatment less than 1 cm thickness
  - Can fill ruts as repair treatment
- › Environmentally Efficient





# RE-INFORCEMENT CONSIDERATIONS | 2



# What Additional Micro Surfacing Values are Desired?

- › Improved flexibility and resistance to cracking
- › Greater durability
- › Low noise

## The Use of Fiber as Micro Surfacing Re-inforcement Could be a Viable Option

- › Fiber can be reliably added in the field



## Ability to Deliver Fiber into the Micro Paver Pugmill

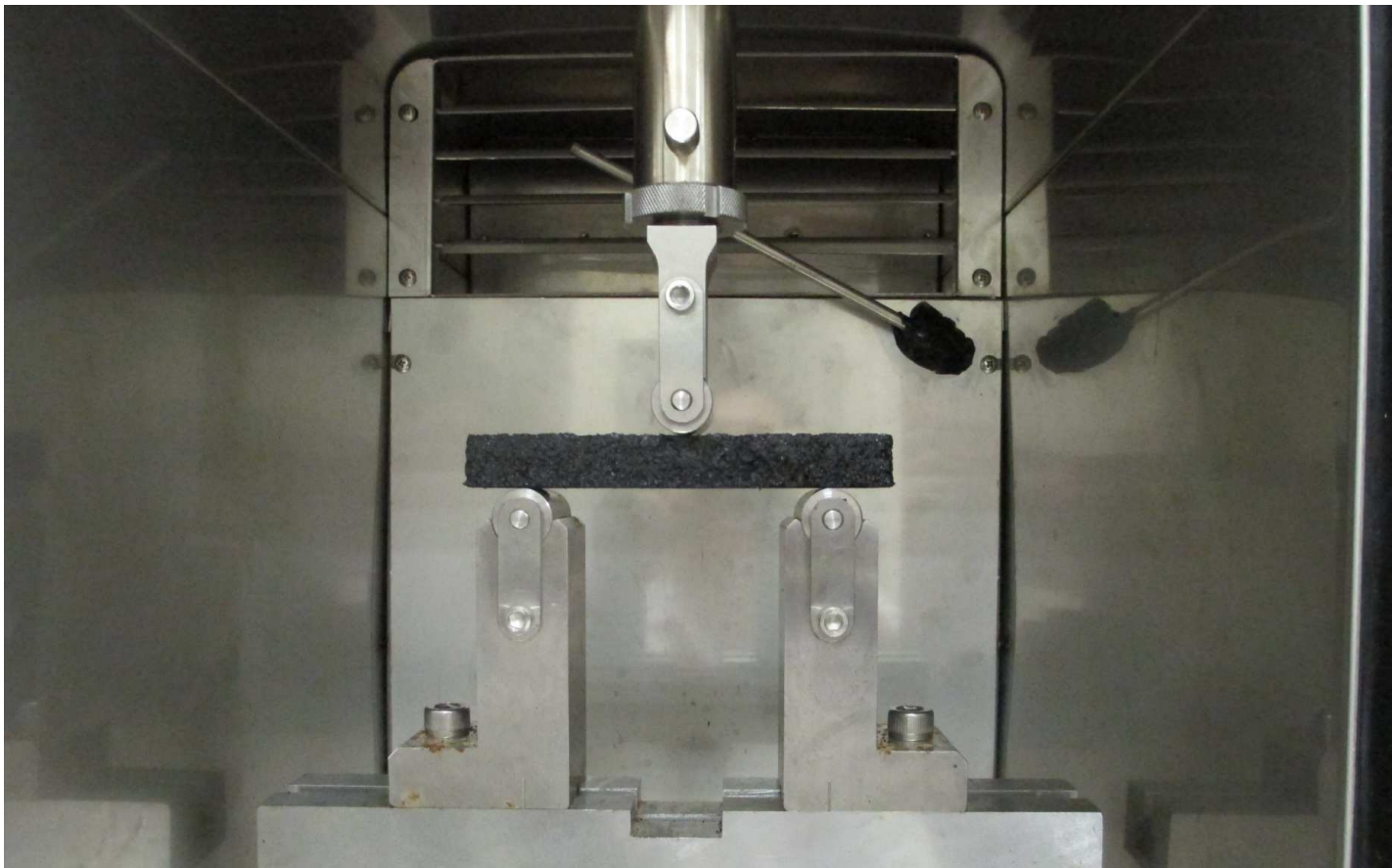


# FIBER EFFECTIVENESS IN THE LABORATORY

Introduction of a flexural  
cracking test to quantify  
fiber effect

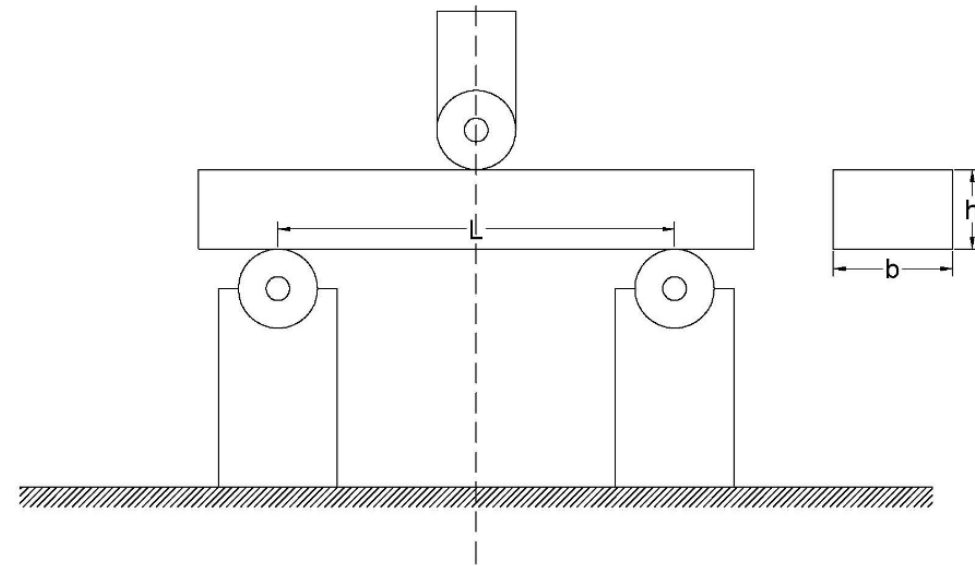
| 3

## Proposed Flexural Beam Test



## Proposed Flexural Beam Test

- › Vertical loading rate of 1 mm/minute
- › Conditioning of 2 -16 hours
- › AREA under the load displacement curve as energy estimation



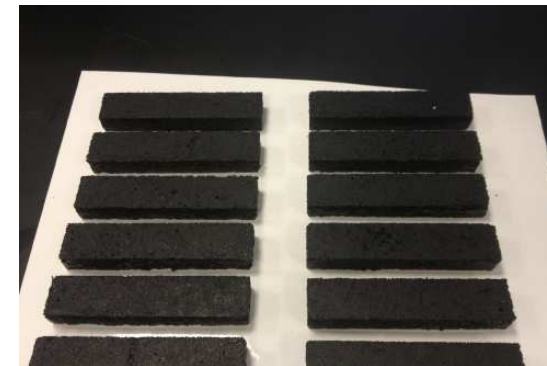
Beam width (after compaction):  $b = 30 \text{ mm}$

Height (after compaction)  $h = 18 \pm 2 \text{ mm}$

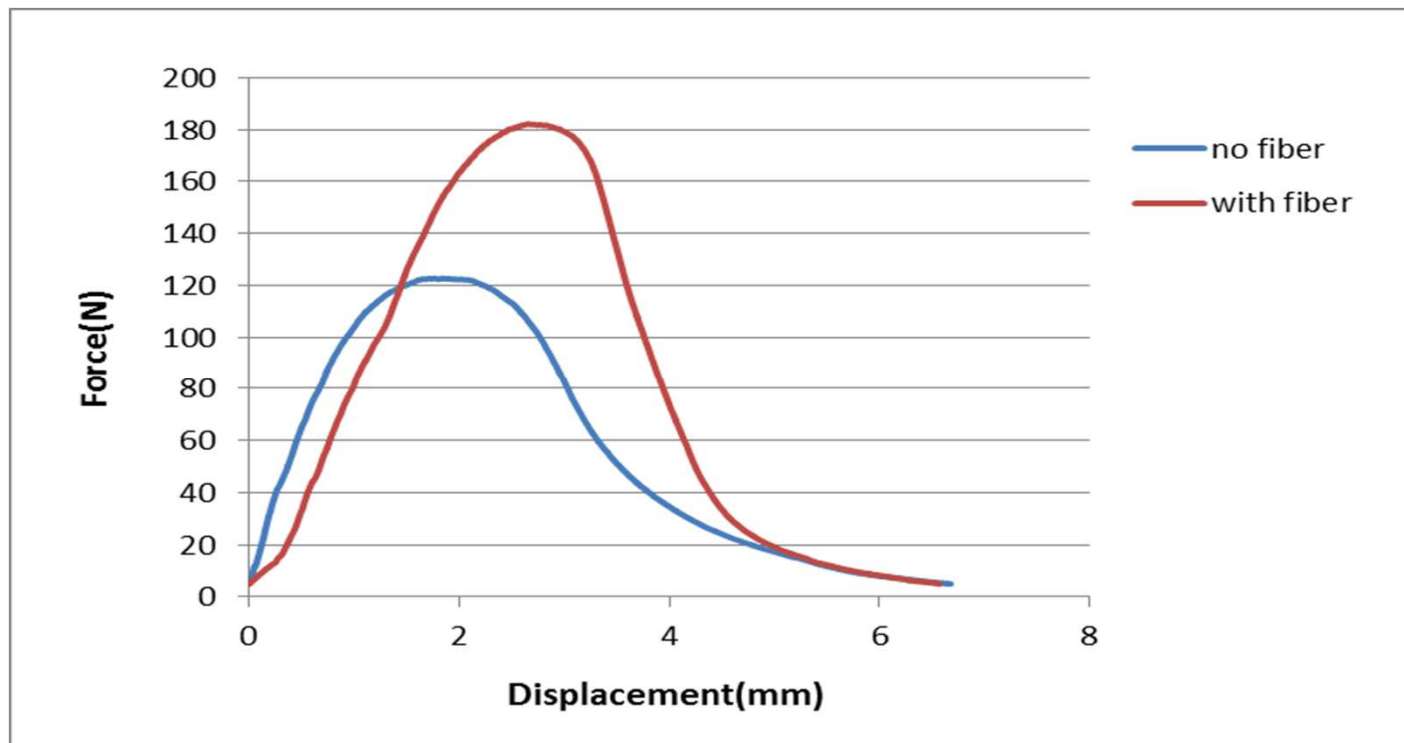
Span length,  $L = 100 \text{ mm}$

## Primary Sample Preparation Steps

- › Combine JMF components and mix thoroughly to quickly fill the beam mold
- › Cure filled beams
- › Compact specimens to simulate early traffic densification
- › Demold and condition to test temperature



# Flexural Beam Results



FIBER MICROSURFACING

PROJECTS

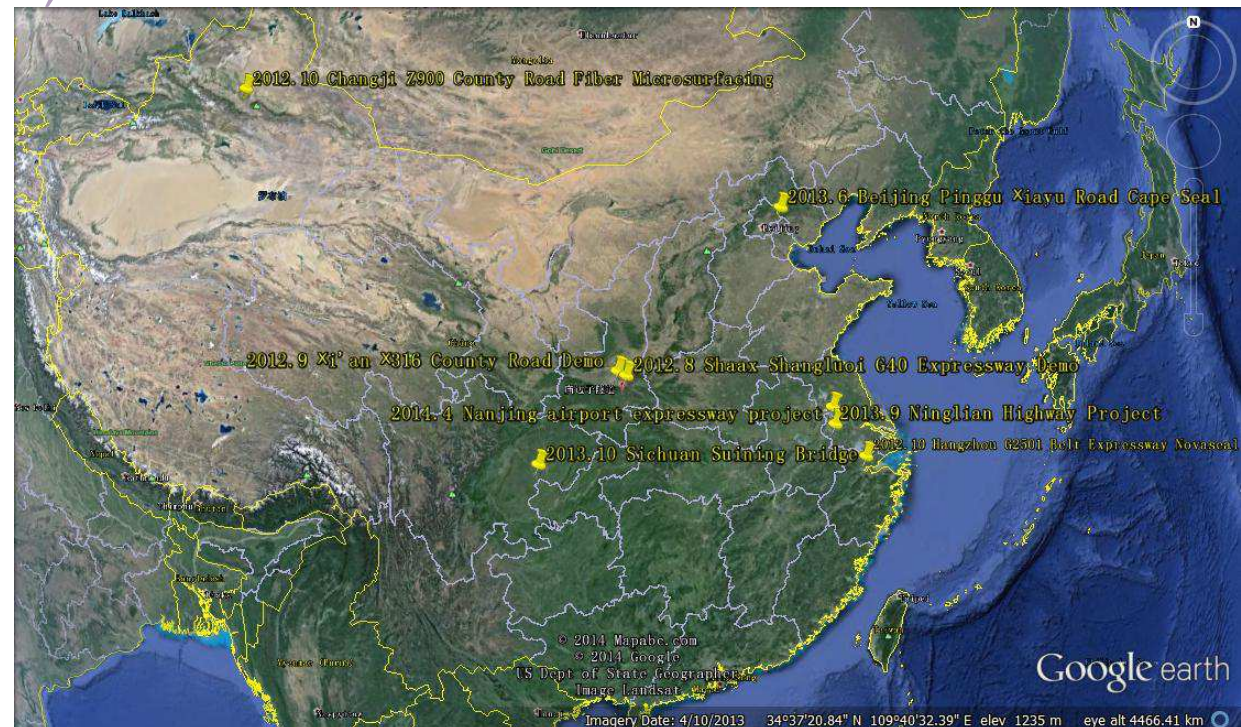
China Experience

| 4



# Recent Fiber Micro Surfacing China Projects

- 08/2012: Shaaxi Shangluo G40 Expressway Demo 5,000 m<sup>2</sup>
- 09/2012: Xi'an X316 County Road 10,000 m<sup>2</sup> <- Detailed Case Study
- 10/2012: Changji Z900 County Road 95,000 m<sup>2</sup>
- 10/2012: G2501 Hangzhou Belt Expressway Novaseal, 55,000 m<sup>2</sup>
- 06/2013: Beijing Pinggu Xiayu Road Cape Seal, 119,000 m<sup>2</sup>
- 09/2013: Ninglian expressway 130,000 m<sup>2</sup>
- 10/2013: Sichuan Suining Tongde Bridge 30,000 m<sup>2</sup>
- 04/2014: Nanjing airport expressway 50,000 m<sup>2</sup>



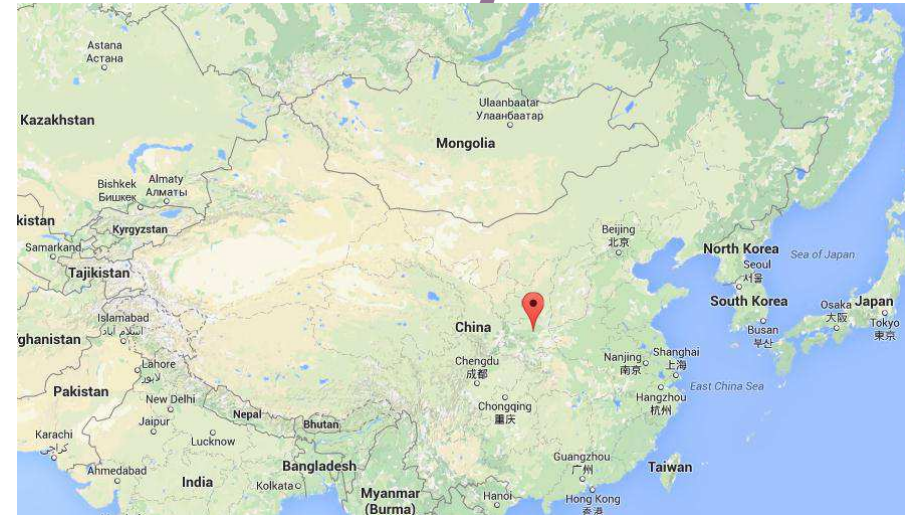
FIBER EFFECTIVENESS  
IN THE FIELD

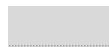
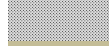


X316 Fiber Microsurfacing  
Case Study

| 5

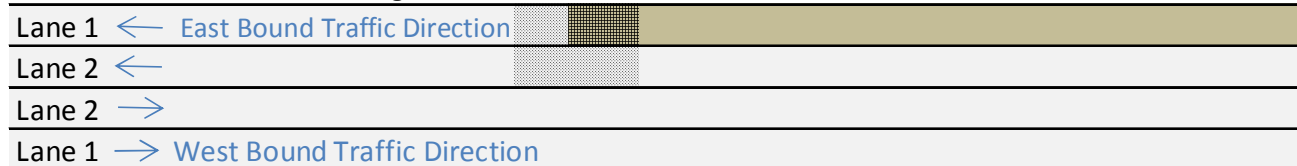
# Xi'An (Shaanxi) China Case Study

- › A fiber test section was constructed by Shaanxi Guolin Highway Engineering on September 22-23, 2013
- › Xian Dao County Road 316



-  Conventional Micro Surfacing
-  Conventional Micro Surfacing Evaluation Section (65 m Section for Detailed Crack Map)
-  Fiber Reinforced Micro Surfacing
-  Fiber Reinforced Micro Surfacing Evaluation Section (95 m Section for Detailed Crack Map)

Side Road Section Marking      7      6      5



Project Start: 0 km

Project End: 3.8 km



Xian Dao County Road 316 Condition





## Xi'An (Shaanxi) China Case Study

- › Type III micro surfacing reinforced with glass fiber was applied at 1 cm thickness
- › 0.2% glass fiber BWA had minimal impact on workability or early strength gain



Laying of Fiber Micro Surfacing



Glass Fiber Presence

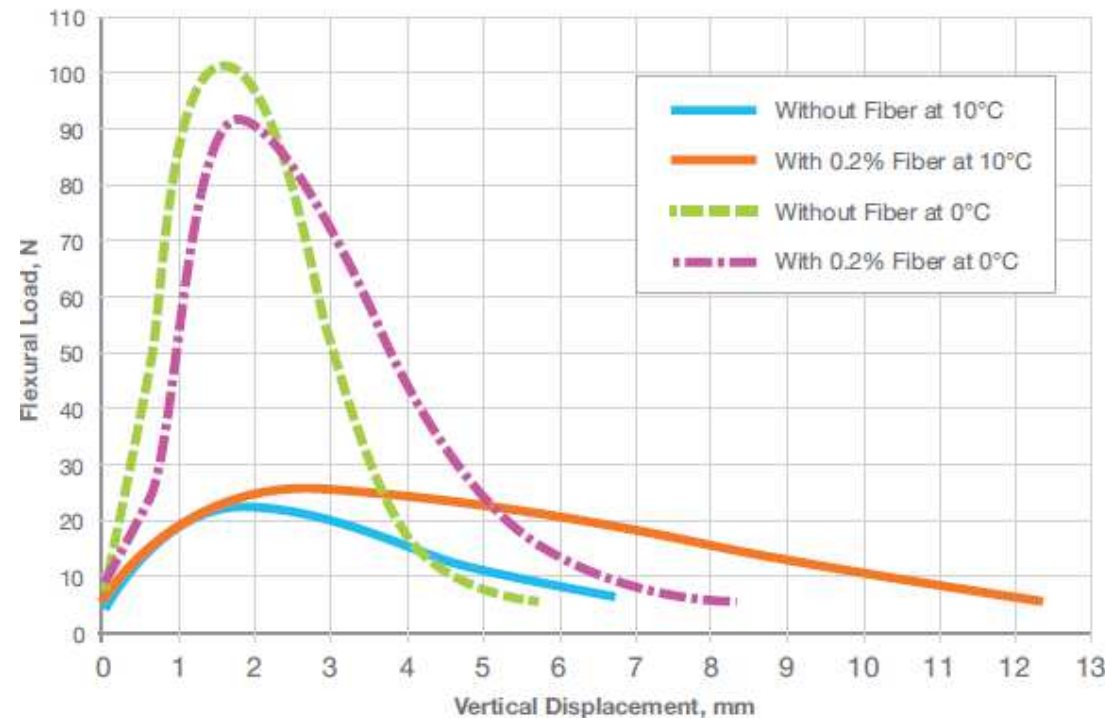


Example of Fiber Cutter Set Up

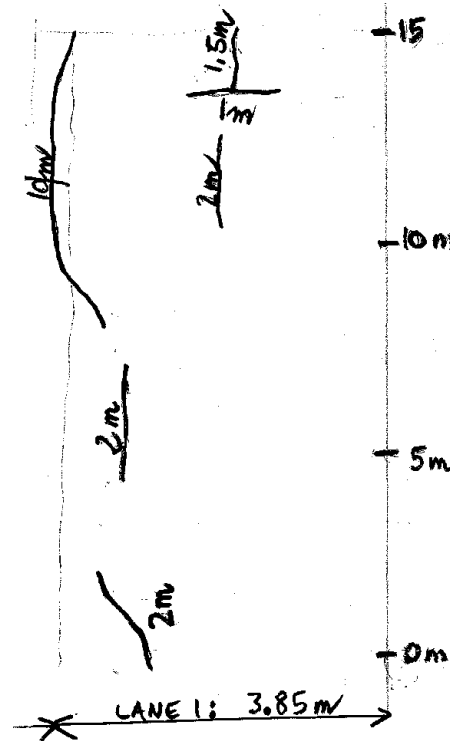
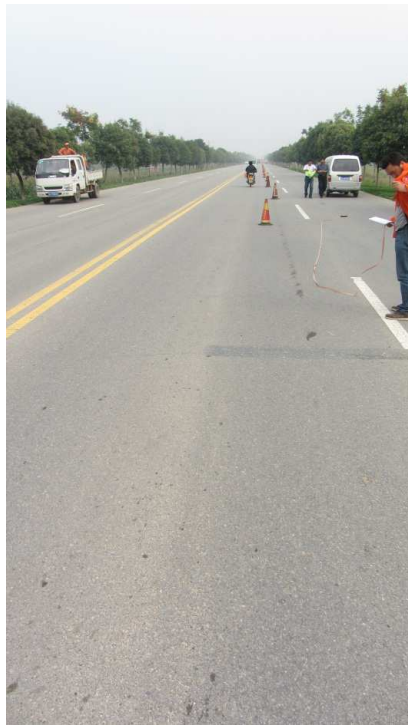


## Xi'An Project Flexural Beam Results

- › Field materials used for testing with and without fiber at 0°C and 10°C
  - Area under the curve (“energy”): 18% improvement from fiber at 0°C and 73% improvement from fiber at 10°C
  - Temperature and fiber loading significant at 95% level



# Xi'An Project Field Performance



Distress Evaluation Survey and Crack Map

After 8 Months		
Fiber	Percent Reflective	
	Longit.	Transv.
No	100	86 (*)
Yes	87	68
After 25 Months		
Fiber	Percent Reflective	
	Longit.	Transv.
No	100	100
Yes	91	90

(\*) From the best performing section

# CONCLUSION

- › Micro surfacing has global track record as an effective pavement preservation technique
- › Micro surfacing is continuously being improved including with fiber
- › Sample preparation and flexural testing methods were developed to quantify to effect of fiber reinforcement in the laboratory
  - The area under the flexural load-vertical displacement curve as “energy measurement” can be used to quantify improvement from fiber reinforcement and optimize the system
  - Test temperature and fiber loading were shown to be statistically significant



# CONCLUSION (cont.)

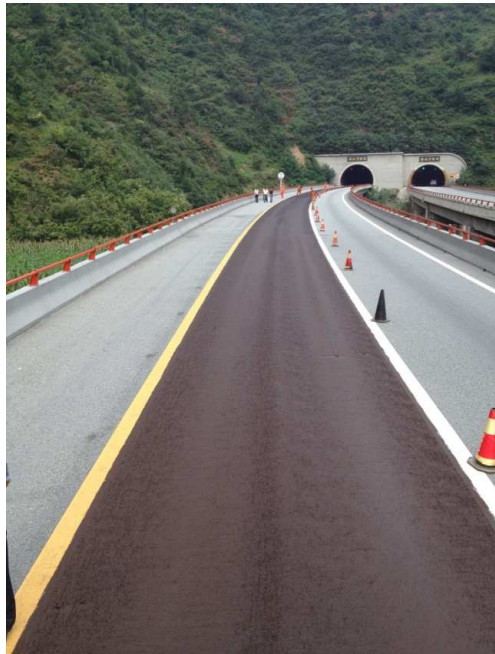
- › Fiber reinforced micro surfacing is gaining popularity in China
- › Xi'an X316 2012 case study findings:
  - Flexural fracture energy tested using field representative material was improved from fiber when tested at 0°C and 10°C
  - Fiber glass at a target rate of 0.2% by weight of aggregate could be easily added in the field
  - The addition of fiber resulted in an improvement in terms of longitudinal and cracking resistance compared to conventional micro surfacing when checked after 8 and 25 months
- › Other potential benefits from fiber usage:
  - Modified gradation and improved texture
  - Low noise

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# Thank you Questions?



August 2012 Shaanxi Guolin Shangluo G40 Expressway Fiber micro surfacing



October 2012 Hangzhou Belt Expressway (G2501) Ningbo Novaseal Fiber Project



June 2013 Focus Beijing Pinggu Xiayu Road Cape Seal with Fiber micro surfacing



March 2014 - Wuxi SHENGTONG Nanjing Airport Expressway Fiber micro surfacing



September 2013: Ninglian expressway low noise fiber micro surfacing



October 2013 Sichuan Suining Tongde Bridge Fiber micro surfacing