Newest Advancements in Slurry Seal and Micro-Surfacing Systems

> Scott Metcalf 10-13-2016



Slurry Seals are applied at one stone thickness. Typically 12-16 lbs. per Syd

Micro Surfacing applied at Multi-Stone thickness Typically 25-30 lbs. per Syd





# A picture is worth a thousand words

Let's set the stage, imagine a road 4 years old in good shape with no cracks. It only has slight to moderate chain wear, snow tire wear, rutting in wheel paths, no cracks and 7,000 ADT. Now imagine that one lane is Slurry Sealed, the other lane is Micro-Surfaced and a control section untouched. What does it look like 6 years later?





### Close up with straight edge looks like Pavement Preservation is paying off

Slurry Seal

after 6 years





# **NCAT Pavement Test**

Track

### National Center for Asphalt Technology

at AUBURN UNIVERSITY



# **Track Research Goals**

- Help state DOTs implement positive change
- Promote real innovation for the industry.
- Track Research overview
- Track preservation (APT)
- Lee Road 159 (low ADT)
- 2015 research cycle (high ADT)

### So what can we take away from the findings?



# **Benefits of Preservation**







Dartmouth Tests Next Generation Pavement Preservation



# What is new in Polymer Modification in Asphalt Emulsions

- Typically anything over 4% polymer is very sticky and hard to work with.
- Hard to emulsify SBR, and with SBS latex the chemistry of the latex starts to override set and break times of the emulsion.
- Performance from lab to field is very different.



Specification Hi- Mod Emulsion	Property Test	Specification	
	(AASHTO)	Min	Max
Asphalt Base Properties			
Original DSR, kPa (G*/sin δ, 10 rad./sec) @ 76°C	T315	1.00	
Emulsion Properties			
Viscosity, Saybolt-Furol, @ 122°F, SFS	T59	15	150
Sieve Test, % T59 0.1	T59		0.1
Residue by Evaporation, % T59 62	T59	62	
Residue Properties From Low Temperature Evaporation	PP72-11, Procedure B		
MSCR @ 64°C, Recovery @ 3.2 kPa, %	TP70	75	
Jnr @ 3.2/kPa	TP70		0.50



The MSCR TEST is Critical to early performance in power steering burns and long term durability from snow plows as seen in the next slides.



# HiMod Slurry Seal and Micro-Surfacing

Multiple Stress Creep Recovery What is it? and how does it Help?



### Softening Point ASTM D36





#### **DSR Test will indicate the presence of a polymer**







Twist deformer acting on a box

#### **Elastic Recovery Test**





### **How an Elastic Material Behaves**





### **Material Testing Terms**

Need to understand these terms...

Strain Stress Pascal Jnr



Strain is the response of a material to a <u>stress</u> along with the relative *change in shape or size* of an object as a *result of a stress* 

Stress is the internal force per area associated with a stress and has the same units as pressure

Pascal – N/m<sup>2</sup> – Pressure and Stress unit of measurement equal to 0.000145 PSI

Jnr = Unrecovered Shear Strain/Applied Shear Stress



### Multiple Stress Creep Recovery

#### What does MSCR mean?

... test method is used to identify the presence of elastic response in a binder and the change in elastic response at two different stress levels. Nonrecoverable creep compliance has been shown to be an indicator of the resistance of an asphalt binder to permanent deformation under repeated load.



## **MSCR**

Unrecovered Shear Strain

20

Time seconds

Cycle 2 Unrecovered

30

(permanent) strain

25

(permanent) strain

35

Applied Shear Stress

Cycle 1 Unrecovered

(permanent) strain

15

Used to determine polymer in the AC/elastomeric properties Material tested at two different stress levels, 1 second strain, 9 second recovery time for ten cycles

80

70 60

50 %

40

30

20

10

0

0

5

10

Strain,

 $J_{nr} =$ 

100 Pascals Jnr % Recovery

3200 Pascals Jnr

% Recovery

% Difference between Jnr at 100 Pascals and 3200 Pascals Graph of Jnr vs % Recovery at 3200 Pascals





## **One Cycle in Detail**



Plot showing the determination of the % recovery in the MSCR test



#### **Power Steering Burn Test.** Five turns to left and five turn to the right

- Conventional Micro on the Left Vs HiMod and Micro is on the right.
- Same rock, both down for 11 months.
- Temp 93F air, surface temp 120F



Below we have a side by side comparison of CQS-1H vs. CQS Hi Mod. The power steering burn on the CQS is greater than the HiMod. The Himod is more of a scuff than a tear to the base.

#### **Type II Slurry**



#### **Type II Hi-Mod Slurry**



Victorville, California 08/11/2015 one week after lay down.

#### La Quinta, Ca near Palm Springs Comparison

The traditional Slurry is tearing and the other is scuffing. After one week of service, 90% reduction in power steering burns in cul-de-sacs.

# Type II Slurry 2.5% polymer

# Hi Mod Type II Slurry

#### Cul du sac done with conventional LMCQS-1h, not Hi-Mod



#### Adjacent cul du sac done with Hi Mod



# Hi-Mod Emulsion for Micro Surfacing and Slurry Seals

- An innovative new product (high polymer content) which is much tougher than its conventional counterparts
  - Higher temperature tolerant to reduce scuffing and tearing
  - More damage resistant to resist snow plow situations







# Verification: Contabro Test On The Road: Demonstrations/Projects



### **CANTABRO LOSS**

#### Scope

- This test method determines the abrasion loss of compacted slurry, micro and himod micro samples.
- Measures the breakdown of various emulsion specimens utilizing the Los Angeles Abrasion machine





#### **Test Procedure**

#### **Mold specimens**



Oven dry specimens in an oven until cured, not exceeding 24 hours. Temperature of oven shall be no greater than 140 F and not less than 122 F. Weigh specimen and record as A.

Place individual specimen in the Los Angeles testing machine. (do not include steel balls)

Rotate the machine at a speed of 30-33 rpm's for 300 revolutions. After 300 revolutions, discard any loose material broken off of the specimen. Weigh the specimen record as *B*.

### Calculation

Use the following formula to measure Cantabro Loss:

$$CL = \frac{A-B}{A} \times 100$$





### Cantabro Testing Type III ISSA Micro-Surfacing Gradation after 300 revolutions

#2 Micro Type III

Conventional Slurry Seal Type III #3 Himod Type III

Table 1: Cantabro Testing							
Type A (2) Aggregate							
	Conventional	HiMA	w/ Fglass Fibers	w/ MicroTekk			
Test 1	3.34	0.85	3.31	2.02			
Test 2	4.26	0.62	2.66	2.31			
Test 3	3.77	0.74	2.71	2.80			
Test Avg	3.79	0.74	2.89	2.38			

#### Figure 1: Cantabro Testing



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Dartmouth Tests Next Generation Pavement Preservation



### WHY USE Hi-Mod Emulsions

### The Performance:

This is the toughest emulsion that can be specified for these categories. It can handle the early damage.

- Project selection is the same as any other Micro or Slurry seal project.
- Mix design is the same.
- Inspection is the same.
- Emulsion Specification is different.
- Construction is slightly different as the contractor must use an augured box due to the higher viscosity of the mix, i.e. much thicker.



Specification CSS-1EP	Property Test Procedure (AASHTO)	Specification	
		Min	Max
Asphalt Base Properties			
Original DSR, kPa (G*/sin δ, 10 rad./sec) @ 76°C	T315	1.00	
Emulsion Properties			
Viscosity, Saybolt-Furol, @ 122°F, SFS	T59	15	150
Sieve Test, % T59 0.1	T59		0.1
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The MSCR TEST is critical to early performance in power steering burns and long term durability.



must use an augured box with Hi Mod emulsions

"We are confident Hi-Mod will extend service life by a couple of years over conventional micro surfacing, making it a more cost-effective process for the end users."

> RICHARD GOODICK VICE PRESIDENT, SEALCOATING, INC.

- The typical cost increase to use the HiMod emulsion is \$0.20 to \$0.29 more per yd<sup>2</sup>.
- The expected life increase should be 3 or more years longer than your current Slurry and Micro products.
- Many contractors have seen and expect to observe 75% reduction in raveling and post project sweeping.









# **Crack Resistance**

#### **Texas Overlay Tester**



### **13.5% Emulsion Content**

**Micro Surfacing Overlay Test** 





# **Crack Resistance**

#### **Before**



#### **6 Months After**





# eFlex Salt lake City Area

#### Before 10-9-13

#### After 7-10-16





# eFlex Salt lake City Area

Before 10-9-13

After 7-10-16







# Victorville Ca, the Mesa Linda neighborhood is a test section that was slurry sealed with

CQS-1H and HiMod Slurry Seal was also used in the year of 2015.



Roads in Red had HiMod CQS-HM at the same application rates



#### **Road Conditions**

The roads were aged oxidized with a loss of fines. The cracks were crack filled prior to Slurry /Micro.



#### eFlex Trial Victorville, California



- Hi-Mod was applied to residential streets in Victorville, California on July 31<sup>st</sup>, 2015.
- Surface temperatures reached 109°F with air temps hitting 94°F.
- Aggregate was Vulcan, Highland Type II.

### Ground Tire Rubber in Slurry Seal and Micro-Surfacing Systems

#### **Incorporation Process**

- 5% by weight of emulsion added at machine through fines feeder.
- 5% blended into the aggregate.
- 5% GTR Terminal Blended in the asphalt and then emulsified.

#### Benefit

- Meets recycling credits.
- No mix performance benefits have ever been proven.
- Greater then 5% we have seen problems with raveling in all processes.
- Due to compression and or moisture resistance.

### Ground Tire Rubber in Slurry Seal and Micro-Surfacing Systems

### Construction

- Recommend that you specify and use a rubber tire roller to roll the section to reduce raveling.
- Using very fine 30 to 80 mesh ground tire rubber.
- How to verify the amount of rubber being used ??

### **Ground Tire Rubber**





### Ground Tire Rubber Blended into Type II Slurry Aggregate

#### **30 mesh ground tire rubber**



### **Blended aggregate with 5% GTR**



### **Truck added GTR**

- **Ground Tire Rubber GTR** 
  - The GTR is being added through an extra fines feeder.
    That is mounted on the machine.



# TCity of Ontario Ca Using Tire Rubber Slurry "RPMS"

The GTR is **Digested into** Asphalt at **Processing Plant then** emulsified into a **Slurry seal or Micro Surfacing** emulsions





### TRMSS Emulsion Place as Slurry Seal or Micro Surfacing





### City of Port Hueneme CA Using RAP Aggregate with Hi mod Micro- Surfacing Emulsions





### Milling is the best source of RAP





### Cost: Utilization of 100% RAP Chip and Slurry Seal

### Crushing Utilization Concerns

- Average breakdown
  - Chip Seal 45%
  - Slurry Dust 50%
  - Other 5%





### Utilization

### **Solution**



- Utilize the source for the most productive product
- Produce multiple products if possible



### **Best Practices**

### Slurry Seal

- RAP Fines must be fresh. Material that has been stored or stockpiled too long should be re-screened.
- Stock Pile Management
  - Do not stock pile too much material
  - Use material as it is delivered (load out from all sides)
- Do not load trucks the night before
- Minimum requirement of 3% latex polymer
- Rubber tire roller, minimum three passes
- High traffic areas cannot be over asphalted



# Utilization of 100% RAP Chip and Slurry Seal

Recycled Products are Valuable. Recycled Pavement Preservation Processes are performing great. Increased Utilization will Reduce Cost. We Need Industry Help to Protect

Resources.



## **Questions** ????





# Questions

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- Ergon Asphalt and Emulsions
- <u>Scott.Metcalf@ergon.com</u>
- Savemyroads.com

