

North Dakota DOT  
Pavement Preservation Training  
Distress Evaluation, Project Selection and  
Preparation

Rex W. Eberly

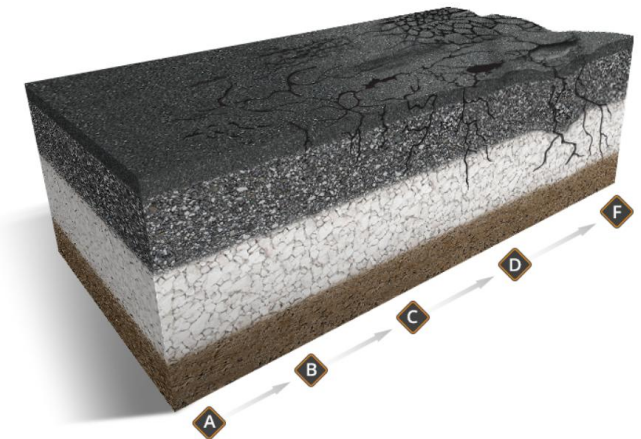
National Center Pavement Preservation



MICHIGAN STATE  
UNIVERSITY

# Section 3 – Asphalt Surface Distresses and Project Selection

- ▶ Recognize the Difference Between Preservation and Preservation Maintenance.
- ▶ Identify Functional Distresses in Asphalt Pavements.
- ▶ Understand the Basics of Selecting and Designing Pavement Preservation Projects.



# PRESERVATION VS. PRESERVATION MAINTENANCE

## ▶ PRESERVATION

- GOAL IS TO PLACE A TREATMENT THAT PRESERVES THE SURFACE AND EXTENDS RSL (REMAINING SERVICE LIFE)
- TIME BASED
  - EARLY AND OFTEN
- ADD SERVICE LIFE
- GENERALLY, LESS EXPENSIVE TREATMENTS

## ▶ PRESERVATION MAINTENANCE

- GOAL IS TO REPAIR SURFACE DEFECTS, PRESERVE THE SURFACE AND EXTEND RSL (REMAINING SERVICE LIFE)
- TIME AND CONDITION BASED
  - PLACED AS EARLY AS POSSIBLE WHEN DEFECTS OCCUR.
- STOP THE DETERIORATION AND ADD SERVICE LIFE.
- MORE AGGRESSIVE PRESERVATION TREATMENTS
  - COMBINATION TREATMENTS

# PRESERVATION VS. PRESERVATION MAINTENANCE

## ◦ PRESERVATION PROCESSES

- FOG SEAL
- REJUVENATORS
- CRACK SEAL\*
- CHIP SEAL
- MICRO SURFACING

## ◦ PRESERVATION MAINTENANCE PROCESSES

- CRACK SEAL / CRACK FILL / MASTIC
- CHIP SEAL
  - SCRUB SEAL
  - FIBER MAT
- PRESERVATION HMA OVERLAYS
- MICRO SURFACING
- CAPE SEALS

# When Should We Not Use Thin Surface Treatments?

## Structural Defects Vs. Functional Distress

- ▶ Chip Seal or Micro surfacing should **NOT** be placed on a Pavement with Structural Defects.
- ▶ A Structural Defect means either the Pavement or the Base has failed.
  - Pavement Failure
    - Stripping – the asphalt no longer adheres to the rock
    - Potholes – if not repaired
    - Rutting – if continuing to rut
    - Longitudinal and Transverse Cracking – Heavy
  - Base Failure
    - Alligator Cracking – the base or sub-base has failed and no longer supports traffic loading.
    - Water and / or fines pumping – the base is failing, and Alligator Cracks will soon appear
- ▶ Chip Seal or Micro surfacing can be used to treat **moderate** Functional Distresses.
- ▶ A Functional Defect, if not treated may become a Structural Defect.
- ▶ A Functional Defect is often caused by environmental or traffic conditions.
  - Rutting – if rutting has stopped
  - Bleeding
  - Longitudinal and Transverse Cracks – Light to Moderate
  - Polishing
  - Raveling

Structural

Functional (Surface)

# Pavement Structural Distress – Stripping



# Pavement Structural Distress - Potholes (Unrepaired or Inadequately Repaired)



# Pavement Structural Distress – Rutting (Continuing to Rut)



# Pavement Structural Distress – Cracking High Severity



# Pavement Structural Distress – Cracking High Severity



# Base Structural Distress – Fatigue Cracking – High (Alligator Cracking)



# Base Structural Distress – Water or Fines Pumping



# Functional Distress – Bleeding



# Functional Distress – Rutting (Compaction)



# Functional Distress - Cracking Light



# Functional Distress - Cracking Moderate



# Functional Distress – Polishing Light



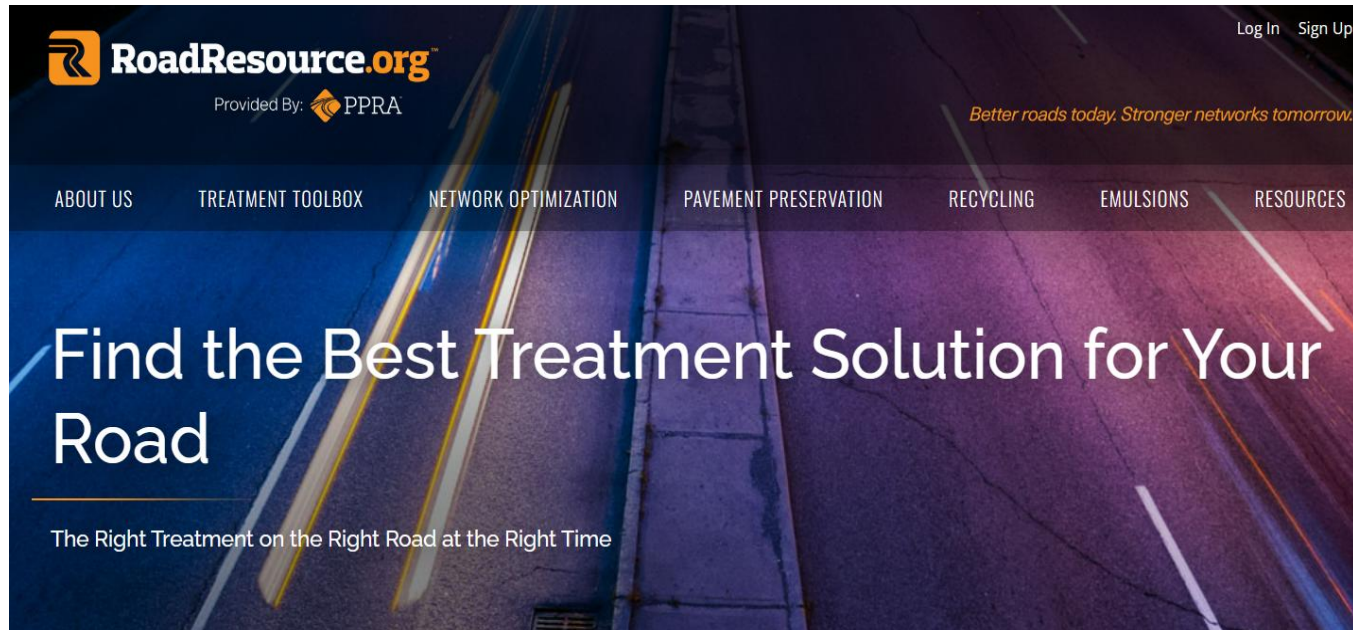
# Functional Distress – Raveling Light



# Functional Distress – Cracking Light



# WWW.RoadResource.org



The screenshot shows the homepage of RoadResource.org. At the top left is the logo for RoadResource.org, with the text "Provided By: PPRA" below it. In the top right corner, there are links for "Log In" and "Sign Up". A navigation menu is located below the header, containing the following items: ABOUT US, TREATMENT TOOLBOX, NETWORK OPTIMIZATION, PAVEMENT PRESERVATION, RECYCLING, EMULSIONS, and RESOURCES. The main content area features a large, stylized image of a road at night with light trails. Overlaid on this image is the text "Find the Best Treatment Solution for Your Road" in a large, white, sans-serif font. Below this headline is a smaller line of text: "The Right Treatment on the Right Road at the Right Time". At the bottom of the page, there is a decorative green and white graphic element.

RoadResource.org  
Provided By: PPRA

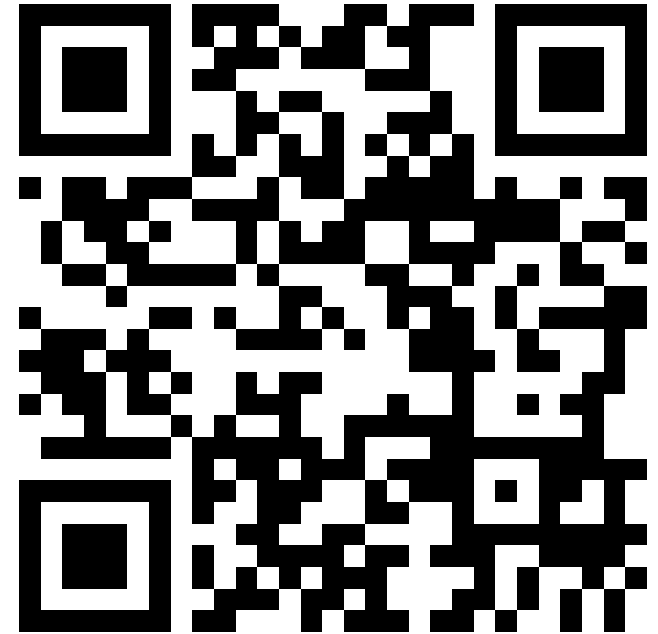
Log In Sign Up

Better roads today. Stronger networks tomorrow.

ABOUT US TREATMENT TOOLBOX NETWORK OPTIMIZATION PAVEMENT PRESERVATION RECYCLING EMULSIONS RESOURCES

## Find the Best Treatment Solution for Your Road

The Right Treatment on the Right Road at the Right Time



## RoadResource.org

A COMPREHENSIVE RESOURCE FOR  
OPTIMIZING NETWORK MANAGEMENT



PPRA™

*Better roads today. Stronger networks tomorrow.*

# AGENDA

1 | Background

2 | Website Features

*Treatment Toolbox | User Profile | Network Optimization*

[RoadResource.org](http://RoadResource.org)

# Three Associations Join Together to Support the Industry at Large



FORMING THE PAVEMENT PRESERVATION & RECYCLING ALLIANCE



PPRA<sup>TM</sup>

*Better roads today. Stronger networks tomorrow.*

# Two Guiding Questions

---

How do we equip road owners & end users with **tools to increase the successful use** of pavement preservation and recycling?

1

---

How do we better disseminate research, success stories, and learning across all agencies, **making information more accessible?**

2



# Build A Better Network

With the Optimized Approach



IMPROVE YOUR  
OVERALL NETWORK  
CONDITION



GET THE LOWEST  
LIFE CYCLE COST  
PER ROAD



MAXIMIZE  
YOUR ECO  
BENEFIT

**RoadResource.org**

# Which treatment is best for my road?

Input pavement criteria or select photos for treatment options

PAVEMENT CONDITION

PLEASE SELECT ▼

PRIMARY DISTRESS

PLEASE SELECT ▼

ROAD TYPE

PLEASE SELECT ▼

SURFACE TYPE

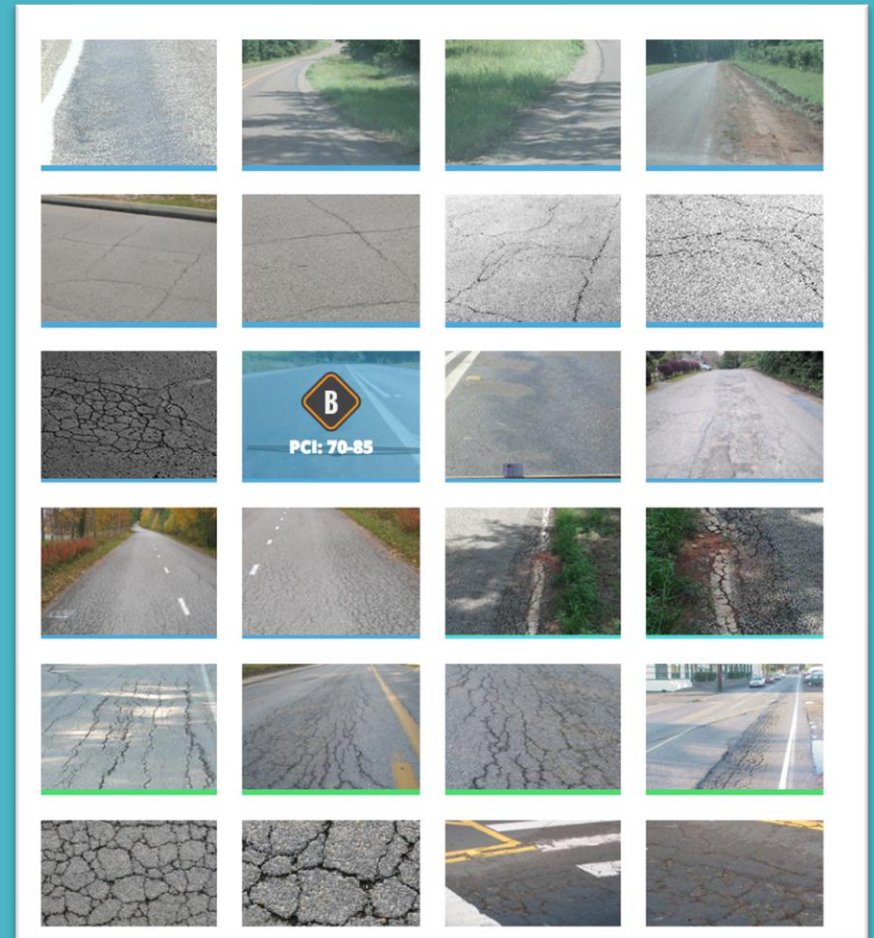
PLEASE SELECT ▼

OTHER FACTORS TO CONSIDER ⚠

- FOG SEAL
- REJUVENATING FOG SEAL
- CRACK SEAL
- SLURRY SEAL
- CHIP SEAL
- MICRO SURFACING
- ULTRATHIN LIFT HMA
- CAPE SEAL
- SCRUB SEAL
- MICRO-MILLING
- TACK COAT
- PRIME COAT
- COLD PLANING
- HOT IN PLACE RECYCLING
- COLD IN PLACE RECYCLING
- COLD CENTRAL PLANT RECYCLING
- FULL DEPTH RECLAMATION
- BASE STABILIZATION
- SOIL STABILIZATION/MODIFICATION

*\* This tool is designed to help explore possible solutions but should **not** be regarded as a formal recommendation for your pavement. Contact a supplier or contractor near you for a specialized consultation.*



# Treatment Resource Center

## Ensure treatment success with comprehensive information on 18 treatments

- OVERVIEW
- ABOUT
- PROCESS & VARIATIONS
- EXPECTATIONS
- COST
- HISTORY
- BEST PRACTICES
- PRE-CONSTRUCTION
- SITE SELECTION
- MATERIAL SELECTION
- MIX DESIGN
- SPECIFICATION REVIEW
- CONSTRUCTION
- PREPARATION
- WEATHER REQUIREMENTS
- EQUIPMENT
- CALIBRATION
- TRAFFIC CONTROL
- APPLICATION
- QUALITY CONTROL
- INSPECTION
- TESTING PROTOCOL
- TROUBLESHOOTING
- ACCEPTANCE
- RESEARCH & PERFORMANCE
- SUCCESS STORIES

### FOR PAVEMENT CONDITIONS **C-D-F** (PCI of less than 70)

A cost-effective, long-lasting, greener alternative to conventional maintenance and rehabilitation techniques. Cold In-place recycling (CIR) is a process that cold mills and recycles the top 2-5 inches of asphalt using a continuous train operation. Through the complete reuse of existing material, CIR greatly reduces trucking, time and natural resources to significantly lower project costs. Generally, any road that is a candidate for mill & fill is a candidate for CIR.

- 20%–50% less expensive than conventional maintenance and reconstruction methods
- Reduce Greenhouse emissions by Up to 90%
- Reuses 100% of existing materials
- 20%–40% faster construction times
- Adds 15–20 years (combined with appropriate wearing course)
- Most agencies use SLCs between 0.30–0.38 (Recent research indicates values from 0.36–0.44 may be more appropriate)

#### ISSUES ADDRESSED

- Frequent, severe, non-load distresses in top lift of hot mix
- All distresses within the recycling depth (2-5 inches)
- Reflective cracking from below CIR layer
- [See all](#)

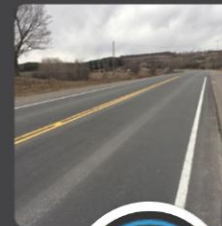
#### ATTRIBUTES

- Eliminates defects within the recycling depth
- Blocks or slows reflective cracking
- Reuses existing material in place
- Replaces 1 or 2 lifts of hot mix
- Allows for road widening where desired

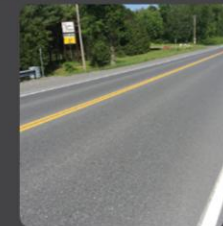
#### COMMON COMBINATIONS

CIR	Optimum Performance	Average Performance	Stop-Gap Performance
Types of Distress	<ul style="list-style-type: none"> <li>• Transverse, longitudinal, multiple cracking</li> <li>• Ravelling</li> <li>• Oxidation</li> </ul>	<ul style="list-style-type: none"> <li>• Wheelpath cracking</li> <li>• Rutting (asphalt or subgrade)</li> </ul>	<ul style="list-style-type: none"> <li>• Alligator cracking from base failure</li> <li>• Distortion</li> </ul>
Depth of Distress	Within treatment depth (2"–5")	1"–3" below treatment depth	More than 4"–6" below treatment depth
Life Extension	20–25 years	10–20 years	5–10 years

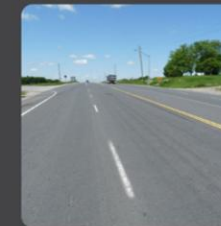
#### EXAMPLES OF ROADS THAT HAVE BEEN TREATED WITH COLD IN-PLACE RECYCLING OVER VARIOUS STAGES IN SERVICE LIFE:



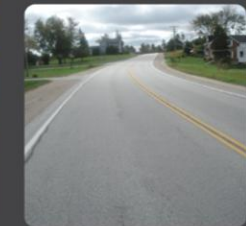
CIR 1 Year



CIR 3 years later: Prescott-Russel County Road, Ontario



CIR 5 years later: Bloomington Road, Ontario



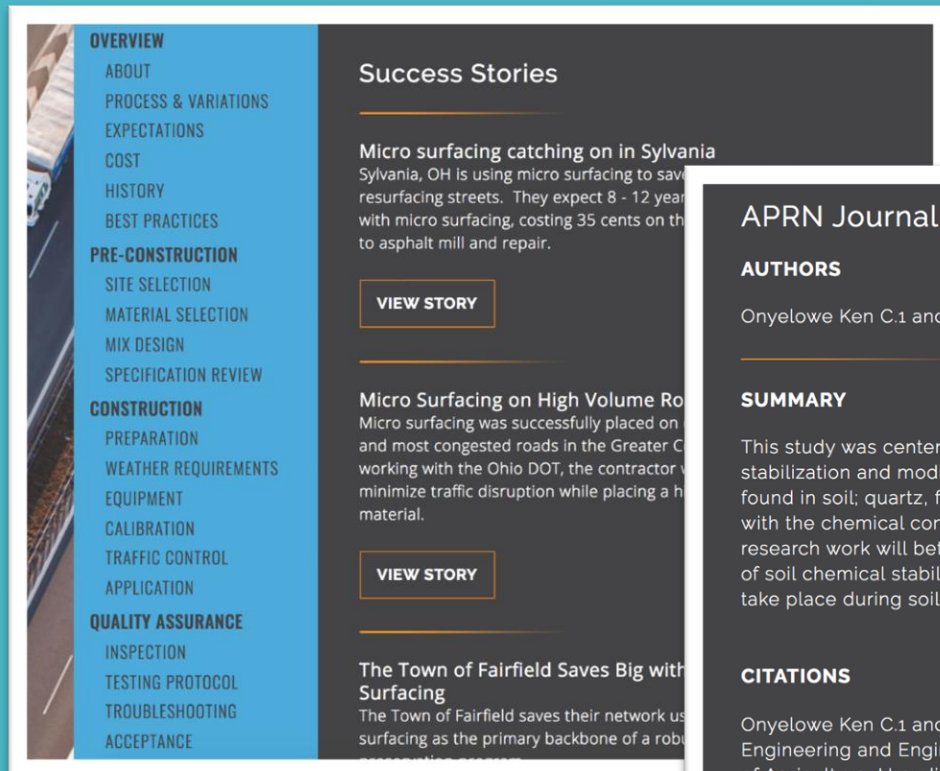
CIR 7 years later: Hwy 6, Ontario



If a CIR mix ravels excessively due to rain, the mat can be re-processed with or without adding cement to facilitate drying

# Success Stories & Research

## Use, performance & best practices in your region



**OVERVIEW**  
ABOUT  
PROCESS & VARIATIONS  
EXPECTATIONS  
COST  
HISTORY  
BEST PRACTICES

**PRE-CONSTRUCTION**  
SITE SELECTION  
MATERIAL SELECTION  
MIX DESIGN  
SPECIFICATION REVIEW

**CONSTRUCTION**  
PREPARATION  
WEATHER REQUIREMENTS  
EQUIPMENT  
CALIBRATION  
TRAFFIC CONTROL  
APPLICATION

**QUALITY ASSURANCE**  
INSPECTION  
TESTING PROTOCOL  
TROUBLESHOOTING  
ACCEPTANCE

### Success Stories

**Micro surfacing catching on in Sylvania**  
Sylvania, OH is using micro surfacing to save resurfacing streets. They expect 8 - 12 year with micro surfacing, costing 35 cents on the dollar to asphalt mill and repair.

[VIEW STORY](#)

**Micro Surfacing on High Volume Road**  
Micro surfacing was successfully placed on some of the most congested roads in the Greater Cleveland area. Working with the Ohio DOT, the contractor was able to minimize traffic disruption while placing a high quality material.

[VIEW STORY](#)

**The Town of Fairfield Saves Big with Micro Surfacing**  
The Town of Fairfield saves their network with micro surfacing as the primary backbone of a robust pavement structure.



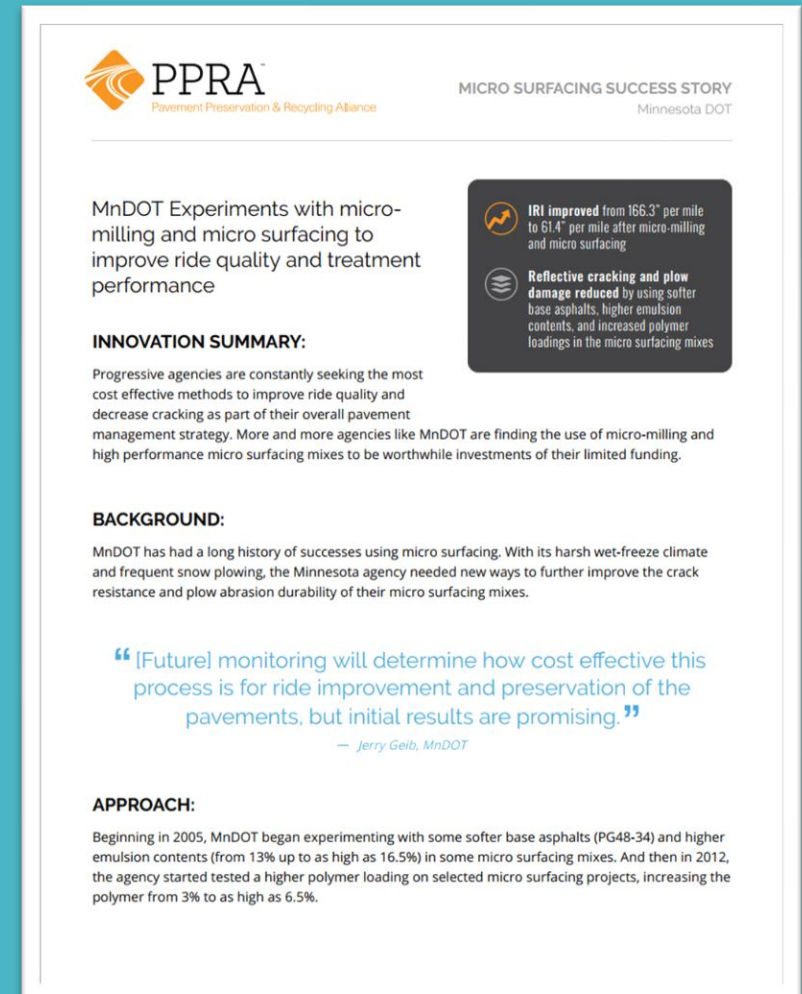
### APRN Journal of Earth Sciences

**AUTHORS**  
Onyelowe Ken C.1 and Okofofor F. O.2

**SUMMARY**  
This study was centered on elucidating the chemical reactions that bring about soil stabilization and modification. It has been established that the chemical compounds found in soil; quartz, feldspar, dolomite, calcite, montmorillonite, kaolinite etc. react with the chemical constituents found in different identified chemical stabilizers. This research work will better place designers, constructors and researcher on the choice of soil chemical stabilizer and techniques and the extent of chemical reactions that take place during soil chemical stabilization.

**CITATIONS**  
Onyelowe Ken C.1 and Okofofor F. O.2 1Department of Civil Engineering, College of Engineering and Engineering Technology, Umuahia, Nigeria Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State, Nigeria 2Faculty of Engineering, University of Nigeria, Nsukka, Nigeria

[VIEW FULL REPORT](#)



**PPRA™**  
Pavement Preservation & Recycling Alliance

MICRO SURFACING SUCCESS STORY  
Minnesota DOT

MnDOT Experiments with micro-milling and micro surfacing to improve ride quality and treatment performance

**IRI improved from 166.3" per mile to 61.4" per mile after micro-milling and micro surfacing.**

**Reflective cracking and plow damage reduced by using softer base asphalts, higher emulsion contents, and increased polymer loadings in the micro surfacing mixes**

**INNOVATION SUMMARY:**  
Progressive agencies are constantly seeking the most cost effective methods to improve ride quality and decrease cracking as part of their overall pavement management strategy. More and more agencies like MnDOT are finding the use of micro-milling and high performance micro surfacing mixes to be worthwhile investments of their limited funding.

**BACKGROUND:**  
MnDOT has had a long history of successes using micro surfacing. With its harsh wet-freeze climate and frequent snow plowing, the Minnesota agency needed new ways to further improve the crack resistance and plow abrasion durability of their micro surfacing mixes.

**“ [Future] monitoring will determine how cost effective this process is for ride improvement and preservation of the pavements, but initial results are promising. ”**  
— Jerry Geib, MnDOT

**APPROACH:**  
Beginning in 2005, MnDOT began experimenting with some softer base asphalts (PG48-34) and higher emulsion contents (from 13% up to as high as 16.5%) in some micro surfacing mixes. And then in 2012, the agency started tested a higher polymer loading on selected micro surfacing projects, increasing the polymer from 3% to as high as 6.5%.

# Compare Treatments

## Project Cost & Environmental Benefits

CONVENTIONAL APPROACH	PRESERVATION & RECYCLING APPROACH
TREATMENT: <input type="text" value="Mill &amp; Fill"/>	TREATMENT: <input type="text" value="Microsurfacing"/>
UNIT COST: <input type="text" value="\$ 10.05"/>	UNIT COST: <input type="text" value="\$ 3.24"/>
LIFE EXTENSION: <input type="text" value="10"/>	LIFE EXTENSION: <input type="text" value="7"/>
SQUARE YARDS: <input type="text" value="50,000"/>	SQUARE YARDS: <input type="text" value="50,000"/>

Total Cost: **\$502,500**  
Equivalent Annualized Cost: **\$1.01**

Total Cost: **\$162,000**  
Equivalent Annualized Cost: **\$0.46**

By choosing a preservation & recycling approach...

COST SAVINGS	<b>\$340,000</b> 54% LESS THAN MILL & FILL
ENVIRONMENTAL SAVINGS	REDUCE GREENHOUSE GAS EMISSION BY 90% REDUCE ENERGY CONSUMPTION BY 83%

That's the green equivalent of removing **17 passenger vehicles** from US roadways for a year!

29 RoadResource.org

**NOTE ON COST:**  
Every calculator gives users the ability to use average life extension numbers and cost data from an internationally aggregated cost survey (US & CA) or input their own costs and life extension relevant to their region.

SECTION 1

Treatment Toolbox

PPRA User Account

SECTION 2

*Tailor tools & calculators to your area*

SECTION 3

Network Optimization



PPRA™

*Better roads today. Stronger networks tomorrow.*

# User Account Capabilities

- Enter unit cost, life extension, and structural numbers from your area
- Update units of measure for US or Canada

# My PPRA Account

## Input cost tools

Make the most of the site &

### Stored Data & Preferences

**Units of Measure**

Select the display units for site-wide calculators

U.S. DOLLARS     CANADIAN DOLLARS

US STANDARD     METRIC

**My Stored Data**

Input data relevant to your region. When you are logged in, this data will auto-populate within calculators across the website for more accurate comparisons and tools.

This data will NOT be used or monitored by any associations within PPRA or other third-party sources. The purpose of this dashboard is only to better equip users with more useful and relevant information.

Pre-loaded cost data was gathered from a nationally-aggregated cost survey. [Learn More.](#)

Treatment Type	Unit Cost (Per Sq. Yard)	Life Extension	Structural Coefficient
Base Stabilization + 4" HMA	1.0	15.0	0.23
Cape Seal	1.0	10.0	0.0
Chip Seal	2.06	6.0	0.0
Cold Recycling + 1.5" HMA	13.98	15.0	0.34
Cold Recycling + Double Chip Seal	10.36	13.0	0.34
Crack Seal	0.48	2.0	0.0
Fog Seal	11.0	2.0	0.0
Full Depth Reclamation + 4" HMA	28.54	25.0	0.22
Granular Base (New)	0.0	0.0	0.1
HMA	0.0	0.0	0.44
Hot In-Place Recycling +1.5" HMA	11.91	11.0	0.43
Hot In-Place Recycling- 1" Single Chip Seal	11.91	11.0	0.43
Micro Surfacing- Double Lift	3.92	8.0	0.0
Micro Surfacing- Single Lift	2.77	6.0	0.0
Rejuvenating Fog Seal	0.67	3.0	0.0
Remove Existing Asphalt	0.0	0.0	0.0

### NOTE:

Change aggregate data into costs, life extension, and structural numbers relevant to you. Tools throughout the site automatically re-populate with your data every time you log in.

SECTION 1

Treatment Toolbox

SECTION 2

PPRA User Account

SECTION 3

Network Optimization

*Information at the Network Level*



PPRA™

*Better roads today. Stronger networks tomorrow.*

# Calculators & Concepts

- Network How-To
- Equivalent Annualized Cost
- Life Cycle Cost
- Remaining Service Life
- Cost-Benefit Value

# Equivalent Annualized Cost

## Compare treatment cost based on Life Extension

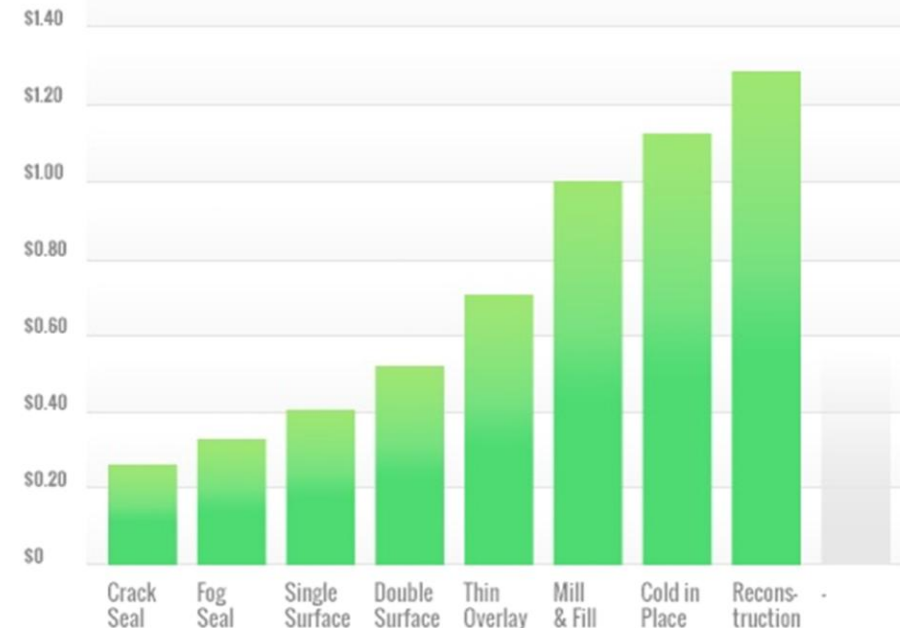
Use our nationally aggregated data or enter your own data

Treatment Type	Cost Per Sq Yard	Life Extension	EAC \$ SY/YEAR
▼ Crack Seal	\$0.50	2	\$0.25
▼ Fog Seal	\$1.00	3	\$0.33
▼ Single Surface Tr,	\$2.00	5	\$0.40
▼ Double Surface Tr.	\$4.25	8	\$0.53
▼ Thin Overlays	\$7.00	10	\$0.70
▼ Mill-and-Fill	\$12.00	12	\$1.00
▼ Cold In Place	\$17.00	15	\$1.13
▼ Reconstruction	\$25.00	20	\$1.25
▼ -	-	-	-

[Clear Data / Chart Your Own](#)

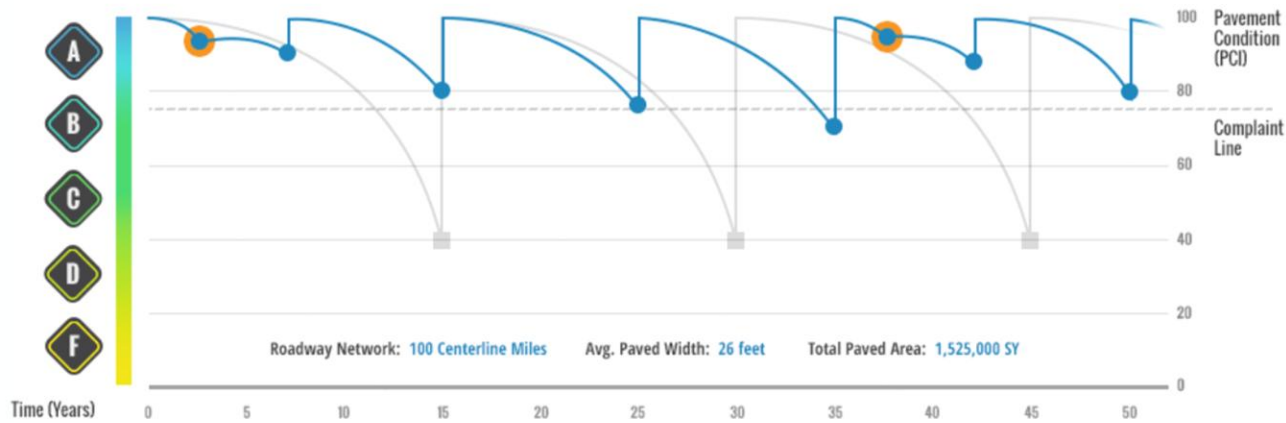
CHART IT

EAC By Strategy \$/SY/YEAR



# Life Cycle Cost Calculator

Save big over the life of your pavement with progressive maintenance



Conventional Approach

Optimized Strategy

Cost/SY Over 50 Years: **\$48.00**

- Year 15: Mill & Fill with 2-in. HMA overlay
- Year 30: Mill & Fill with 2-in. HMA overlay
- Year 45: Mill & Fill with 2-in. HMA overlay

Cost/SY Over 50 Years: **\$28.65**

- Years 3 & 38: Micro Surfacing
- Years 8 & 43: Chip Seal (Single)
- Years 15 & 50: AR Chip Seal (Double)
- Year 25: Bonded Wearing Course
- Year 35: 1¼-in. Hot Mix Overlay

Inflation/CPI

5 %

Interest Rate

2.5 %

Total Paved Area

1,800,000 SY

## CONVENTIONAL PLAN

Year	Treatment Type	Cost in Constant Dollars	Future Cost	Present Value
0	Mill & Overlay	\$ 18.00	\$18.00	\$18.00
5	Slurry	\$ 1.80	\$2.30	\$2.03
10	Mill & Overlay	\$ 18.00	\$32.33	\$24.04
15	Slurry	\$ 1.80	\$4.13	\$2.71
20		\$ 0.00	\$0.00	\$0.00
ADD ROW		\$39.60	\$56.76	\$46.78

## OPTIMIZED PLAN

Year	Treatment Type	Cost in Constant Dollars	Future Cost	Present Value
0	Scrub Seal with Micro	4.25	\$4.25	\$4.25
5	Rejuvenating Seal	0.45	\$0.57	\$0.51
10	Micro Surface	1.80	\$2.93	\$2.29
15	Rejuvenating Seal	0.45	\$0.94	\$0.65
20		0.00	\$0.00	\$4.25
ADD ROW		\$6.95	\$8.69	\$11.95

Net Present Value: **\$00.00/SY**  
Total Life Cycle Cost: **\$70.4M**

CALCULATE

Net Present Value: **\$00.00/SY**  
Total Life Cycle Cost: **\$00.0M**

By choosing an optimized treatment strategy...

OPTIMIZED STRATEGY  
TOTAL SAVINGS

\$19.35/SY × 1,525,000 SY =  
**\$29,500,000**

# Remaining Service Life

## How much life is your network gaining or losing each year?

ABOUT CALCULATOR

### Remaining Service Life

#### Is your network gaining or losing life each year?

Understanding Remaining Service Life (RSL) is critical to designing a treatment plan that stretches your budget further and reverses the trend of a deteriorating network.

[Download the FHWA RSL pub IF-07-006](#)

#### CRITICAL CONCEPT

**A 500-mile network loses 500 mile-years of life annually.**

Every year, every mile of your network loses 1 mile-year of life. To avoid losing ground, the roadway owner must design a treatment plan that adds 500 mile-years of life or more!

See how this agency reallocated funds to inject more life into their network, using the same budget

### RSL Calculator

#### How to use this Tool

Use the calculator below to explore how different treatment combinations can be varied to inject maximum life into your network and use your resources more wisely. See examples and learn more about remaining service life [here](#).

Total Network Lane-Miles

1000

Average Lane Width (ft)

15

Total Budget

\$ 5000000

Remaining Budget

\$2,920

Treatment Type	Category	Life Extension	Lane-Miles* Treated	Lane-Mile-Years	Unit Cost	Total Cost
Rejuvenating Fog Seal	Preservation	3.0	25	75	0.67	\$147,400
Micro Surfacing- Double Lift	Preservation	8.0	34	272	3.92	\$1,172,864
Chip Seal	Preservation	6.0	40	240	2.06	\$725,120
Cape Seal	Preservation	10.0	24	240	5.20	\$1,098,240
Minor Mill & Fill	Rehabilitation	11.0	2	22	9.80	\$172,480
Cold Recycling + 1.5" HMA	Rehabilitation	15.0	4	60	13.98	\$492,096
Full Depth Reclamation + 4" HMA	Reconstruction	25	2	50	28.54	\$502,304
Full Depth Remove & Replace	Reconstruction	25.0	2	50	39.01	\$686,576

ADD ROW

YOU ADDED  
1,009 LANE-MILE-YEARS OF LIFE

9  
LANE-MILE-YEAR  
NET GAIN

13%  
OF ROADS ADDRESSED

# Cost-Benefit Value

## Which projects will give the “biggest bang for the buck?”

### Cost-Benefit Value

With limited funding, how do I prioritize my projects?

CBV offers roadway managers a way to prioritize projects while accounting for the variables relevant to you and the realities of traffic, cost and life extension.

$$CBV = \frac{(\text{Traffic} / \text{Constraint Factor}) \times (\text{Life Extension})}{(\text{Unit Cost}) \times (\text{PCI})}$$

Total Network Lane-Miles ?

500

AADT Constraint ?

7

Total Budget

\$ 2500000

Two road comparison: Which road should I treat first?

**ROAD 1** Worst First ? Reconstruction AADT: 5000 PCI: 30  $\frac{(5000_{AADT} / 7_{CF}) \times (25_{YEARS})}{(\$39_{PER\ SY} \times 30_{PCI})} = 15\ CBV$

**ROAD 2** Pavement Preservation Chip Seal AADT: 5000 PCI: 75  $\frac{(5000_{AADT} / 7_{CF}) \times (6_{YEARS})}{(\$2_{PER\ SY} \times 75_{PCI})} = 29\ CBV$

Road Name	Segment From / To	PCI ?	AADT ?	Length (ft)	Width (ft)	Treatment	Life Extension ?	Unit Cost ?	Segment Cost	Cumulative Cost	CBV
Midway road	Oakland to Folsom	86	8500	26400	15	Rejuvenating Fog Seal	3.0	0.67	\$29,480	\$29,480	63.22
Thom Ave.	Oak to Rowland	84	5500	105600	15	Crack Seal	2.0	0.48	\$84,480	\$113,960	38.97
Beach Street	Baxter to Clayton	64	7500	36850	15	Cape Seal	10.0	5.20	\$319,367	\$433,327	32.19
Adams Street	First to 17th	72	6500	47520	15	Micro Surfacing- Dou	8.0	3.92	\$310,464	\$743,791	26.32
Williams Ave.	Clayton to Market	68	3500	42680	15	Chip Seal	6.0	2.06	\$146,535	\$890,325	21.42
Arthur Ave.	Condor to Southw	43	7000	32650	15	Full Depth Reclamat	25.0	28.54	\$1,553,052	\$2,443,377	20.37
Canal Street	Cherry to Park	62	3000	7920	15	Minor Mill & Fill	11.0	9.80	\$129,360	\$2,572,737	7.76
South Road	Redding to Shenar	47	1500	16500	15	Full Depth Remove &	25.0	39.01	\$1,072,775	\$3,645,512	2.92
						Select...			\$0	\$3,645,512	0.00

Budget Line

### CRITICAL CONCEPT

For Equal Traffic, Preservation Has A Higher Benefit.

# Project Selection and Preparation for Pavement Preservation



# Questions to Guide Project Selection

- ▶ Is the intent Preservation or Preservation Maintenance?
- ▶ Do I have any untreated light to moderate cracking?
- ▶ Do I have isolated base repairs?
- ▶ Is a Chip Seal feasible for this location?
  - Traffic, Night Work, High Speed, Political
- ▶ If Preservation Maintenance:
  - What are the Primary and Secondary Distresses?
  - How Quickly is the Deterioration Happening?
  - Is the Pavement Dry and Oxidized or Flushed and Slick?
  - Is there Light ( $< 1/2$ " ) or Moderate ( $> 1/2$ " ) Rutting?

# Preparation for Preservation Projects

## ▶ Early Stage–

- Crack Treatments
- Structural Leveling
- Full Depth Repairs
- Tree Trimming
- Herbicide Treatment
- Edge Milling
- Micro Milling

## ▶ Final Stage

- Surface Cleaning
- Structure and Casting Protection
- Pavement Marking Removal
  - Thermoplastic and Buttons
  - Paint is not generally removed unless it is very thick.
  - Pre-Tacking prior to Chip Seal.
- Gutter Protection
- Railroad Crossing Protection

# Crack Treatments

- ▶ Crack Treatments Should Always Precede a Surface Treatment
- ▶ All Crack Treatments Should be Completed At Least 30-Days Prior to Surface Treatment.
- ▶ Overband Thickness Should be Less Than 1 / 8”
- ▶ Mastic Applications Should be Flush or Slightly Below the Surface.



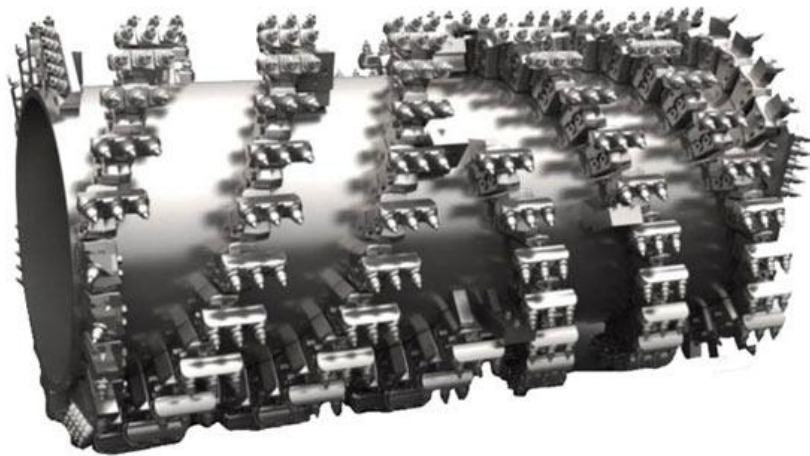
# Leveling and Full Depth Repairs

- ▶ Surface Repairs Should Be Completed at Least 30-Days Prior to Surface Treatment.
  - Cold Mix Patches Should be Given Additional Cure Time
- ▶ Patches Should Be Left Flush or Slightly Below the Surface.
- ▶ Ride Quality of Leveling and Patches Must Equal the Desired Ride Quality of the Finished Pavement.

**Important Note: Chip Seal and Micro surfacing May Level Slight Depressions in the Pavement. A Bump Will Always Be a Bump!**

# Edge Milling / Micro Profile Milling

- ▶ Severe Edge Drop Offs on Curb and Gutter Sections should be Edge Milled before Preservation Treatments.
- ▶ Rough, Flushed or Highly Oxidized Surfaces Can be Profile Milled with a Micro Milling Head.



*Micro Milled Surface*   *Fine Milled Surface*

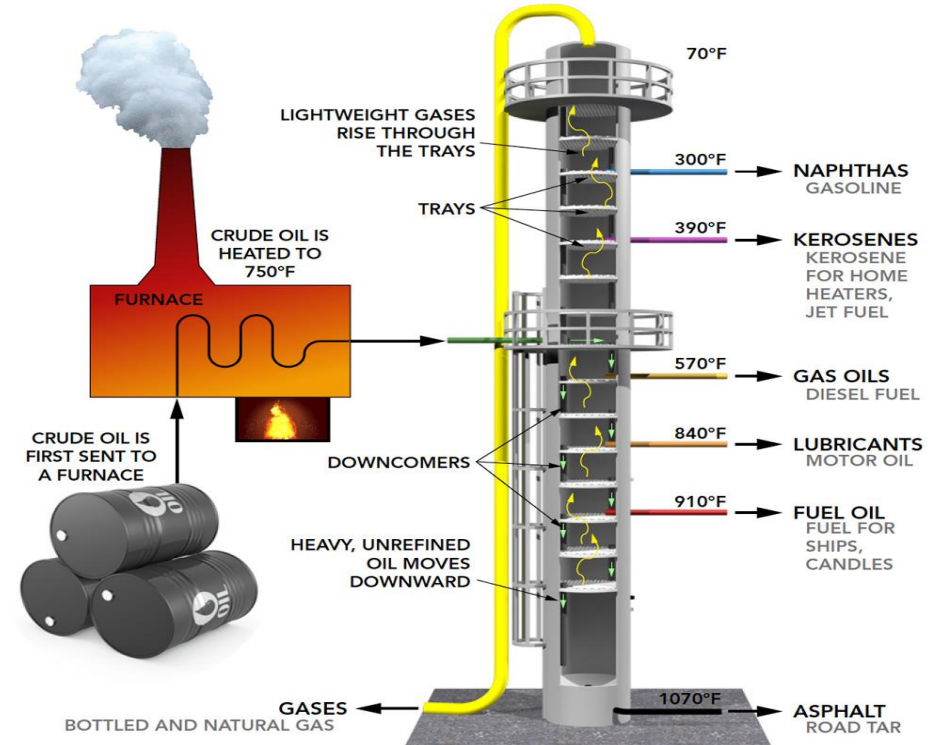
Keystone Mfg.

# Emulsion 101



# Why Emulsify Asphalt?

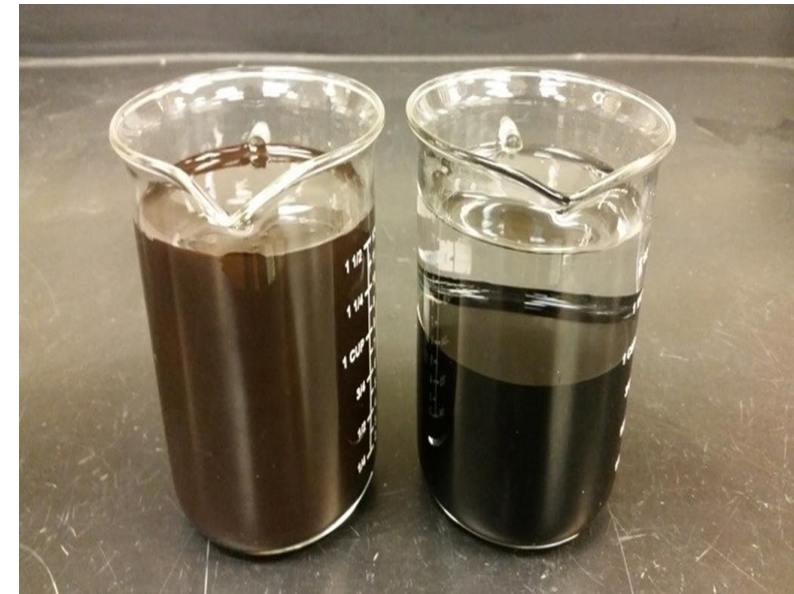
- ▶ Asphalt Cement can occur naturally or is refined from crude oil.



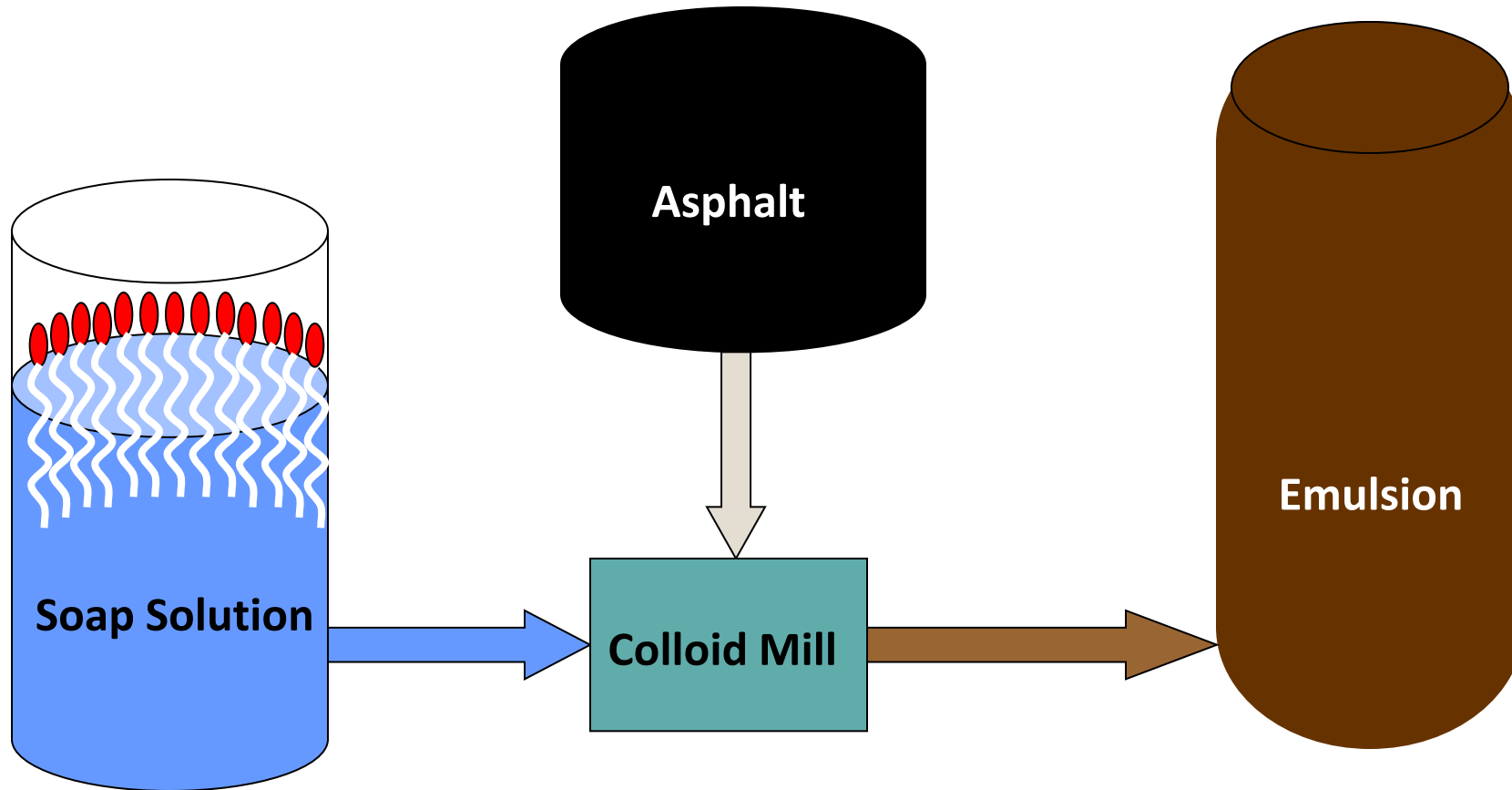
# What is an Emulsion?

An emulsion is a homogeneous mixture of two immiscible liquids.

- Immiscible liquids:
  - Liquids that normally don't mix
    - Oil (or, in this case, asphalt) and water
- Homogeneous:
  - The mixture is the same throughout
  - No layering



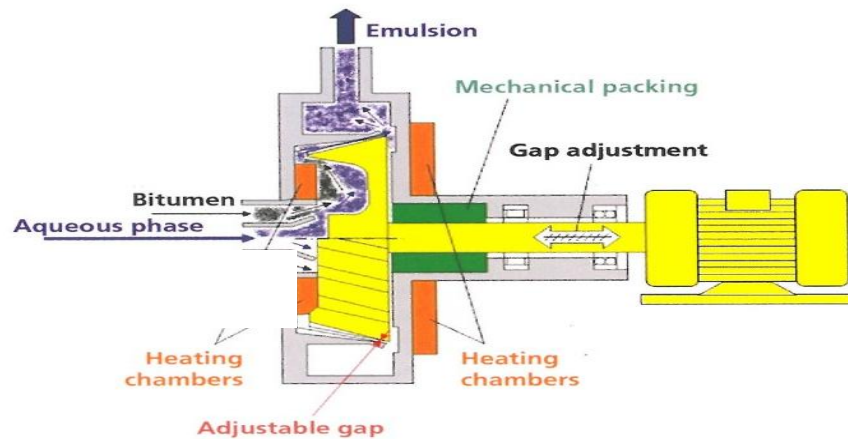
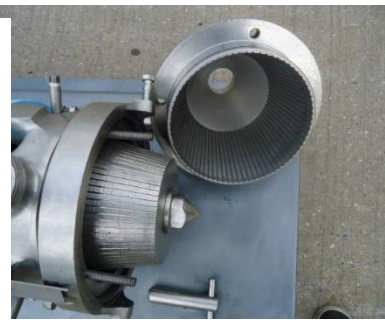
# Batch process diagram



--Debbie Deep, Ingevity,  
ISSA presentation

# Equipment needed

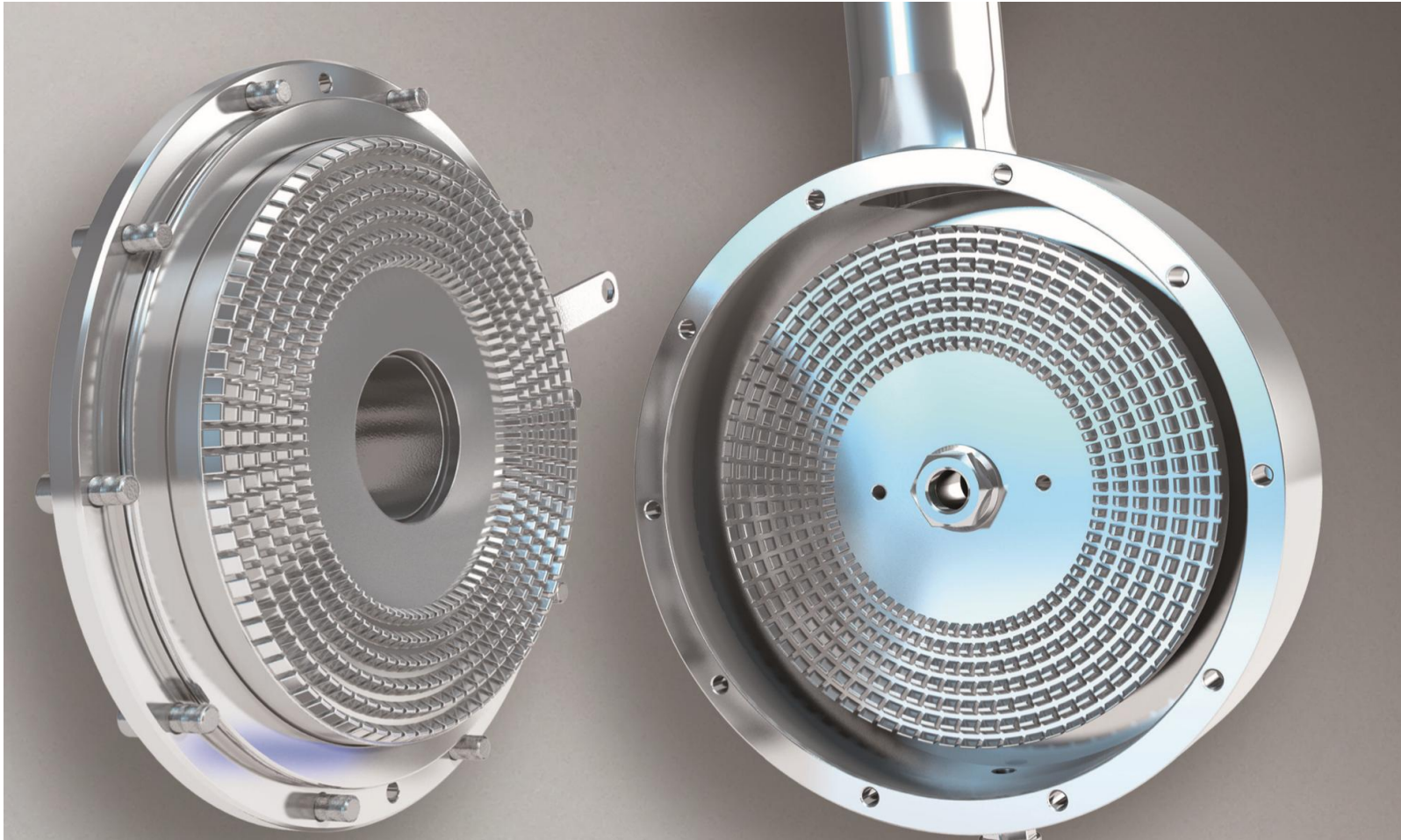
- ▶ Colloid Mill and motor
  - Motor is the source of the energy
  - Rotor–Stator translate that energy into the
  - Different geometries with different motors
  - Not all colloid mills are the same



*Bitumen Emulsions,*  
SFERB



# Mill Rotor/Stator



Stator

Rotor



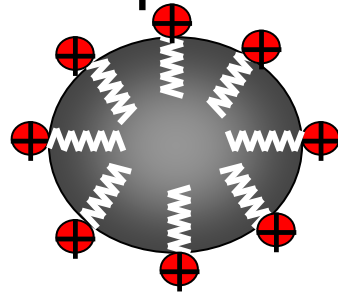
Stator

Rotor

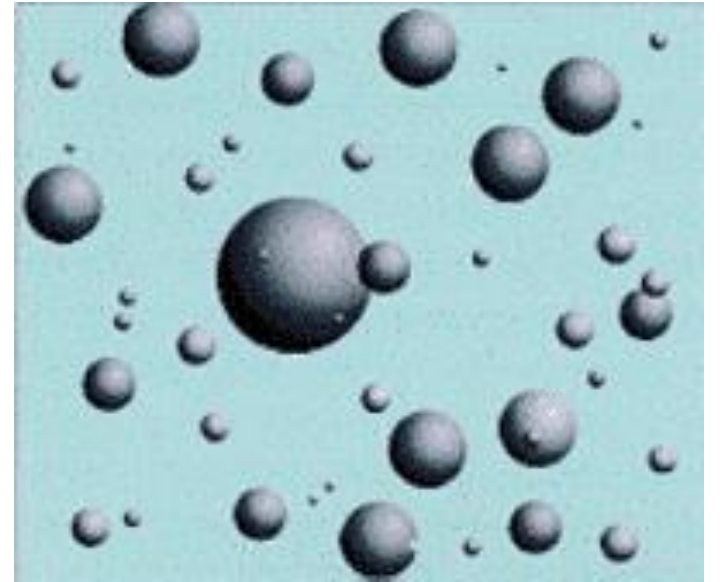
“Gap” is the clearance between the rotor and stator

# Two steps

1. Asphalt is sheered into many small particles by a colloid mill
2. The soap chemistry (emulsifier) stabilizes the particles



*The smaller and more single-sized the particles are, the better the emulsion*



# EMULSION CLASSIFICATIONS

## IONIC CHARGE

Formulated for compatibility with specific aggregates and components



## AGGREGATE COATING THICKNESS

Utilizes a chemical formulation that promotes a gel quality to the emulsion, increasing performance



## SPEED AT WHICH EMULSIONS ARE SET

Engineered for optimal break time and workability



## VISCOSITY & HARDNESS

To accommodate specific application methods and climates

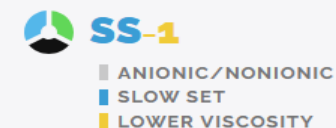
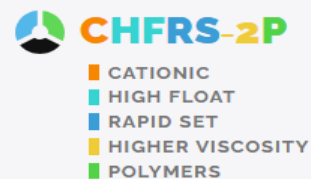


## POLYMERS & ADDITIVES


To achieve strength, adhesion, elasticity, durability or other performance demands



## EXAMPLES:



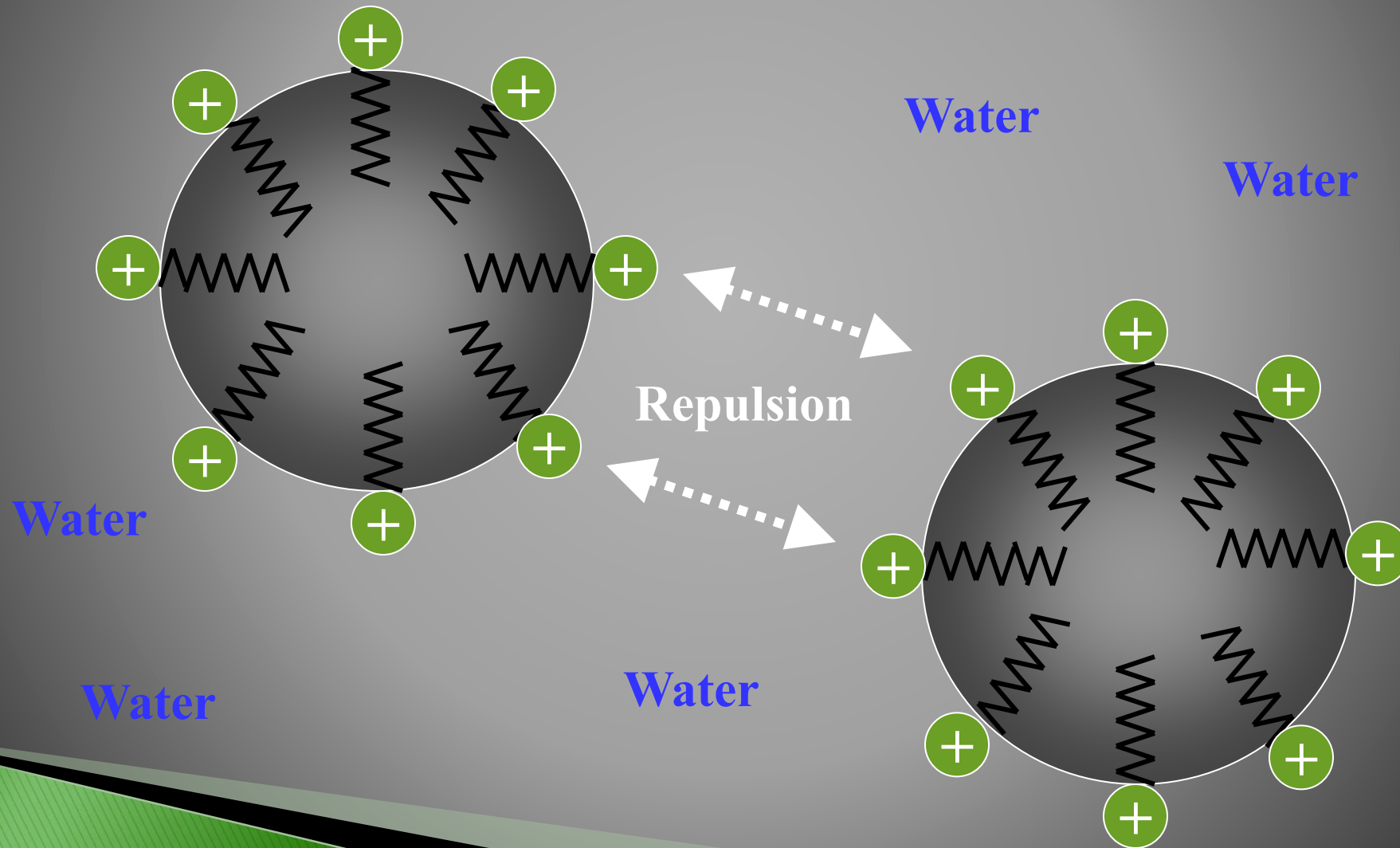
# Why Do We Use Polymer (Latex) in Emulsion?

- ▶ First – Latex and polymer are often used interchangeably. Kind of like tissue and Kleenex.
  - ▶ The industry started using Natural Latex from Rubber Trees. That got expensive so someone invented Synthetic Latex (Polymer) which has then morphed to other forms of Polymers (SBS, SBR) which are used in emulsion.
  - ▶ Polymer is added to emulsion to change the normal properties of the base asphalt.
- 

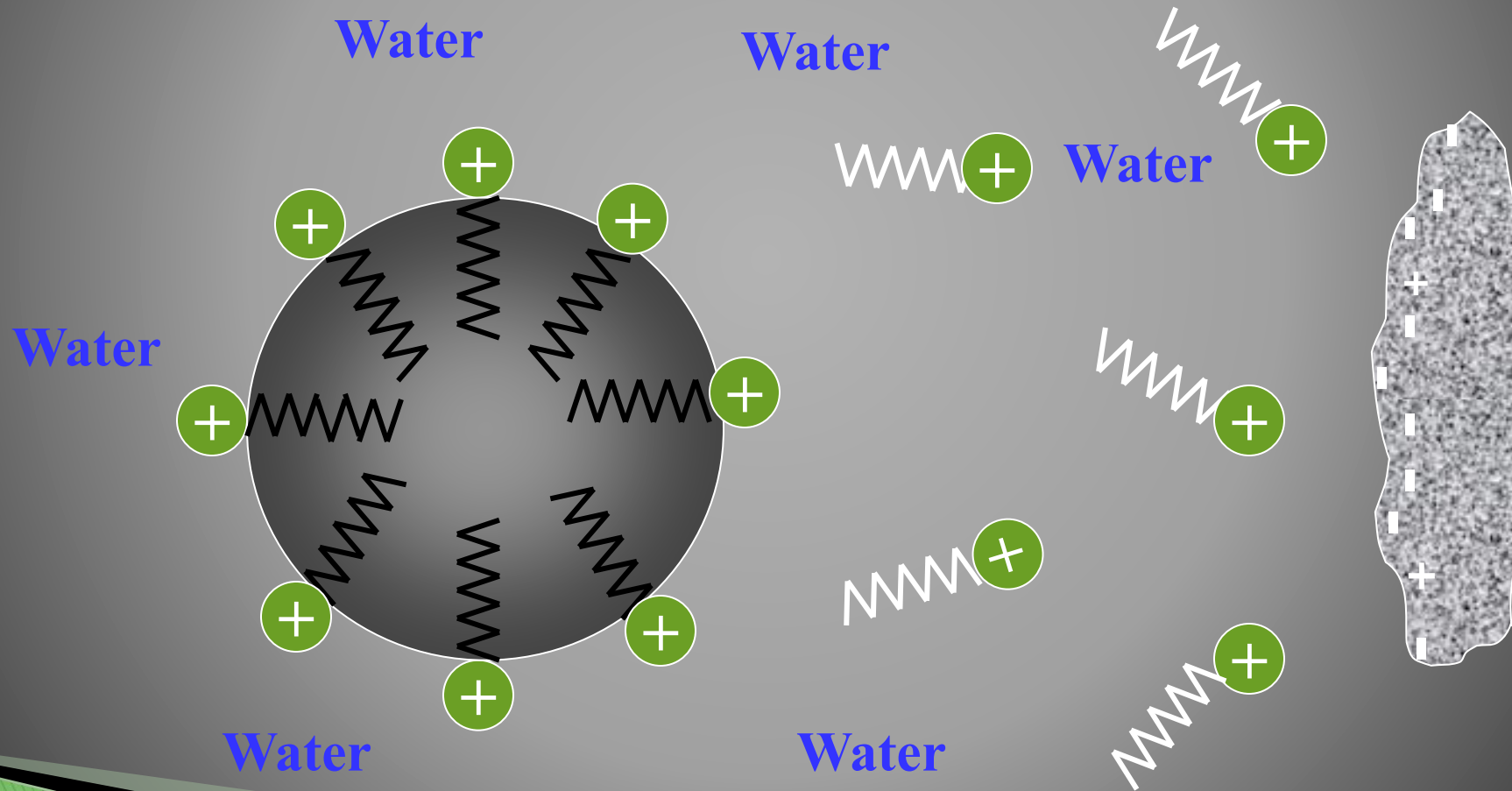
# Why Do We Use Polymer (Latex) in Emulsion?

- ▶ Polymer coats the asphalt particles while they are in suspension. It does not evaporate with the rest of the chemical package.
- ▶ The Polymer:
  - Lowers the temperature at which the asphalt gets brittle.
  - Raises the temperature at which the asphalt softens
  - It can also add strength to the asphalt / aggregate bond

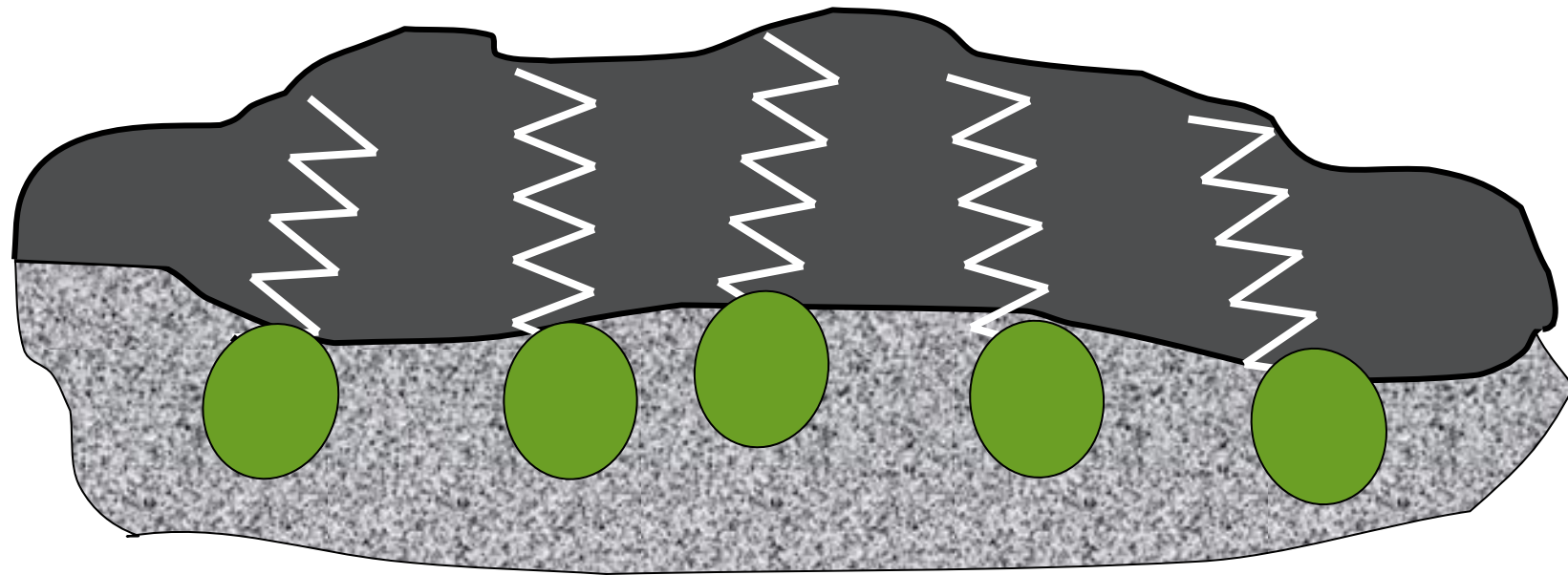
# Stabilized asphalt droplets



# The chemistry of mix time

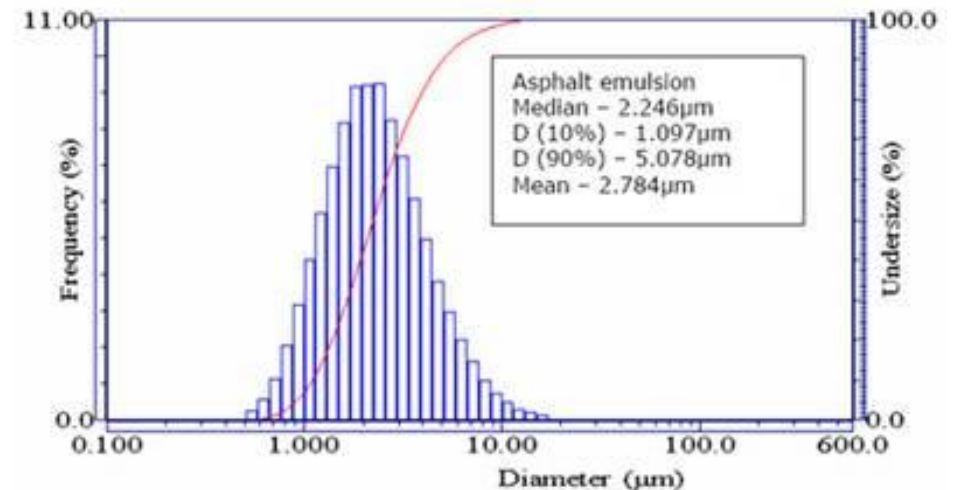
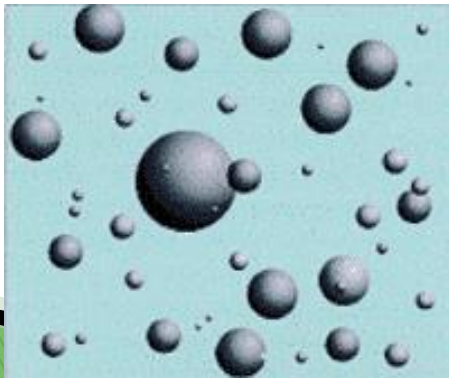


# Chemical break




# Emulsion QA and handling

- ▶ Emulsion is stored according to type of product (specs)
  - Some emulsions stored at ambient, some 140°F, others
  - Stored in insulated, heated tank, with mild, occasional agitation
  - Emulsion must cool before shipped or used
- ▶ Run tests for certification
  - Viscosity, distillations, etc.
- ▶ Particle size analysis
  - Not for certification but very important information
  - Samples during the run from the mill and tank samples



# Storage and Handling of Emulsions

- **Storage temperatures generally range from 52°C to 85°C (125°F to 185°F) depending on the intended use and specific product**
  - **Do not heat above 85°C (185°F) due to evaporation of water**
  - **Do not let emulsion freeze**
  - **Agitate gently when heating**
  - **Avoid repeated pumping and recirculating**
- 

# QUESTIONS?

