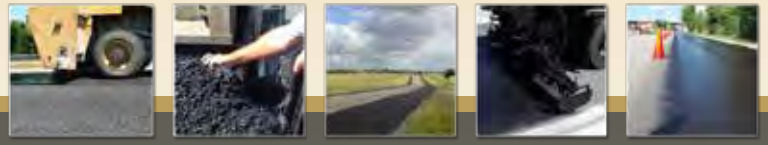
Tire Rubber Modified Asphalt

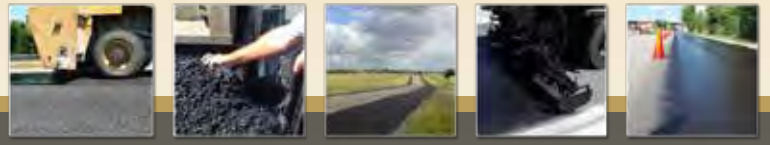
Tire Rubber Modification History

In the late 1800's many states tried Tire Rubber Modified project, some had problems, the industry vowed never to try it again!!!



Tire Rubber Modification History

In the early nineties ISTEA mandated use of tire rubber in order to get federal funding. Tire rubber technology was still not well develop. Some projects had problems and the industry vowed never to try it again!!!!

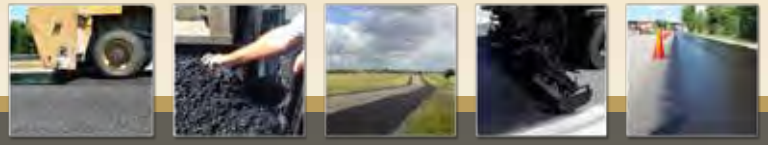


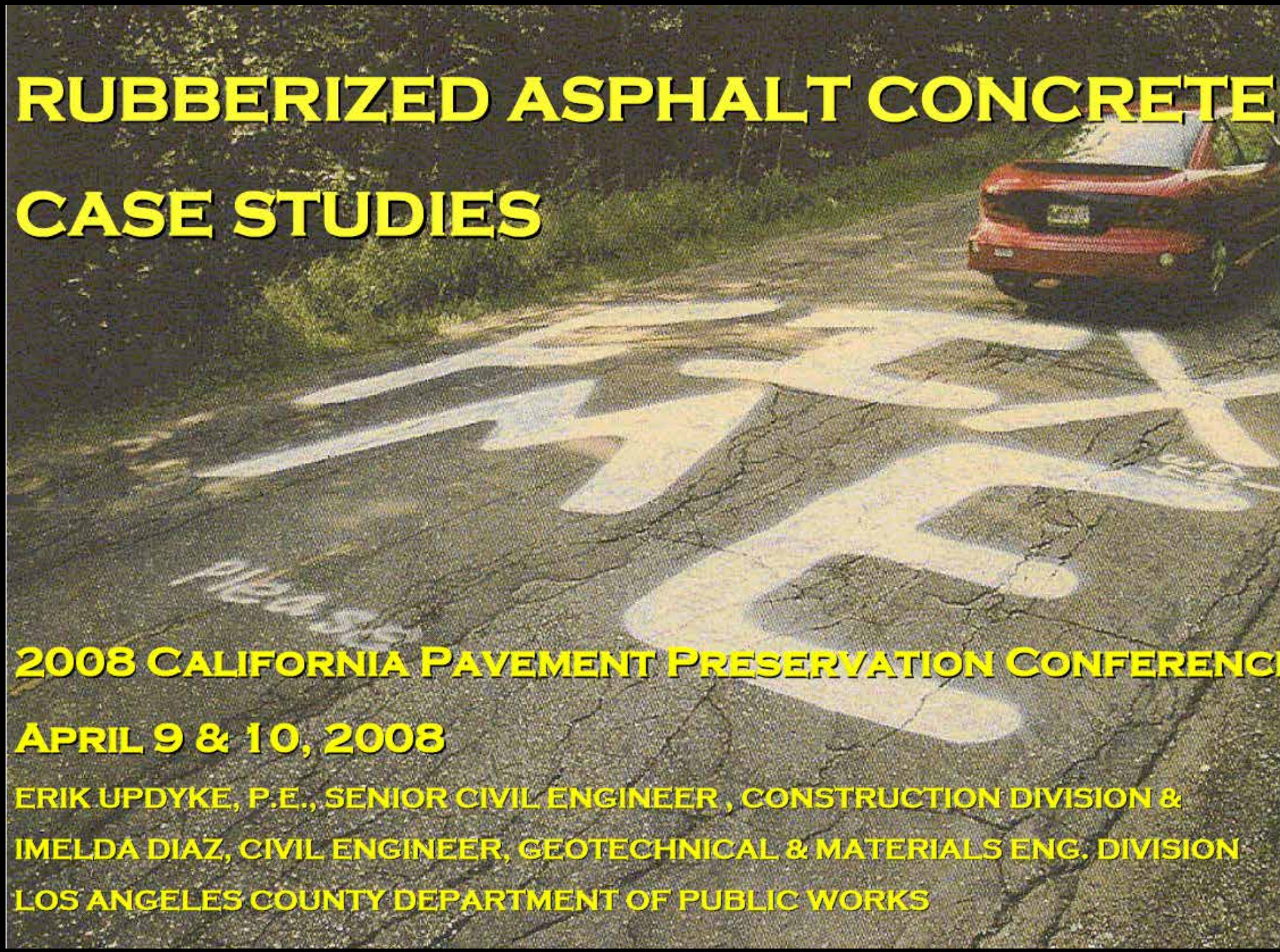
Types of Tire Rubber Modification Processes

Several Tire Rubber Modified Asphalt Systems

- Wet Method (Crumb Rubber/Asphalt Rubber)
- Dry Method
- Terminal Blend
- Terminal Blended “Hybrid”

http://techtransfer.berkeley.edu/pavementpres08downloads/PP08Updyke.pdf
http://www.rubberform.com/news.php?id=108





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Imelda Diaz, Civil Engineer, Geotechnical & Materials Eng. Division
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Understanding how tires are used in asphalt

October 16, 2010
by By Dwight Walker, P.E.

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At one time, the push to use tires in asphalt seemed to primarily be just a means of getting rid of piles of scrap tires. For many agencies, their first experience with crumb rubber in asphalt resulted from the mandate included in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1993. But now, the emphasis of using tires in asphalt binder is to improve pavement performance.

Asphalt binders modified with ground tire rubber (GTR) have several positive qualities. Adding ground tire rubber to asphalt can contribute to improved rutting resistance, skid resistance, ride quality, pavement life and reduced pavement noise levels. Adding rubber to the asphalt liquid retards aging and oxidation of the resulting binder, which increases pavement life by lessening brittleness and cracking. Rubber-modified asphalt binders can be used in open-graded asphalt mixtures, which have reduced hydroplaning, vehicle spray and reduced pavement noise.

Some basic descriptions

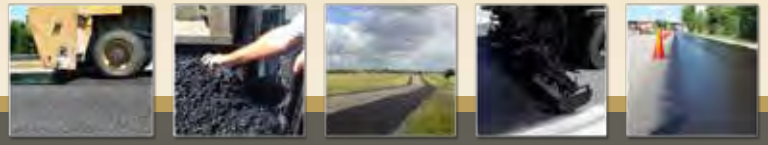
Defining some of the terms commonly used regarding tire rubber in asphalt may be helpful. The descriptions included here are intended to give a general understanding of meaning rather than to constitute a specification or standard. Various organizations and agencies have established definitions and standards, which should be used where applicable.

Crumb rubber modifier (CRM) or ground tire rubber (GTR) is recycled tire rubber which has been ground into very small particles to use as an asphalt modifier.

Types of Tire Rubber Modification Processes

Wet Method (AR, CRM)

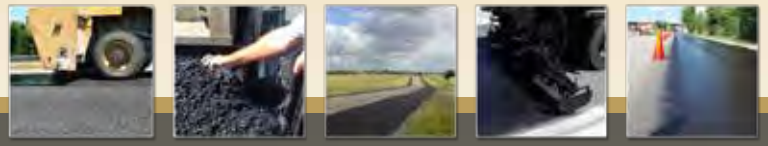
- Crumb Rubber Asphalt Cement
- Oldest of tire rubber asphalt technologies
  - MacDonald Method started in 1960's
- Strong association "RPA" promoting crumb rubber technology (AR,CRM)
- Dedicated ASTM specification defining this system as Asphalt Rubber (AR)
  - ASTM D 8-88
- 5%-15% crumb rubber
- 40 to 80 mesh top size



Types of Tire Rubber Modification Processes

Wet Method

- Requires thorough mixing of the crumb rubber in hot asphalt cement and holding the resulting blend at temperatures (375°F to 450°F) for a designated minimum period of time (typically 45 minutes) to permit an interaction between the crumb rubber and asphalt.
  - Requires special blending equipment.
  - Requires constant agitation once mixed.
  - Since the asphalt is modified, most state now consider the contractor the binder supplier. Must do the appropriate QC certification and testing.
  - AC contents are typically 0.2-1.5% higher depending on crumb rubber particle size.
    - Tire Rubber filler must be considered when determining actual binder content within the mix.



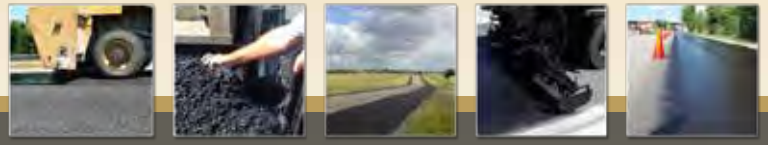
Types of Tire Rubber Modification Processes

Wet Method

Types of Tire Rubber Modification Processes

Dry Method

- Any method that includes scrap tire crumb rubber as a substitute for 1 to 3 percent of the aggregate.
  - The crumb rubber acts as a rubber aggregate in the paving mixture and is added to the plant before the hot AC is introduced.
  - Although there may be some limited interaction of the CRM with the asphalt cement during . . .
    - mixing in the AC plant, silo storage, hauling, placement and compaction, the asphalt cement is not considered to be modified in the dry process.
  - Requires both mix time and temperature to be increased in the plant



Types of Tire Rubber Modification Processes

Dry Method

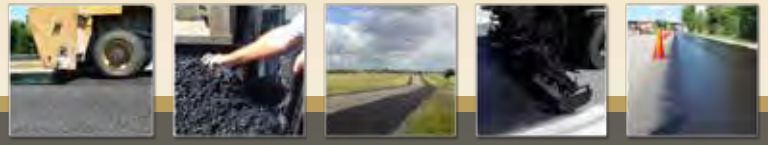
Types of Tire Rubber Modification Processes

Wet and Dry Mixes

In the wet mix process, rubber and bitumen are reacted together at high temperature to produce a crumb rubber binder. The crumb rubber binder is added to aggregate in a mixing plant in the same way as any other binder.

In the dry process, however, dry rubber particles are added to aggregate and bitumen in a pugmill at the asphalt mixing plant. The rubber is usually mixed with the aggregate prior to bitumen addition but is still considered part of the binder.

John Oliver, ARRB Transport Research



Types of Tire Rubber Modification Processes

Terminal Blend

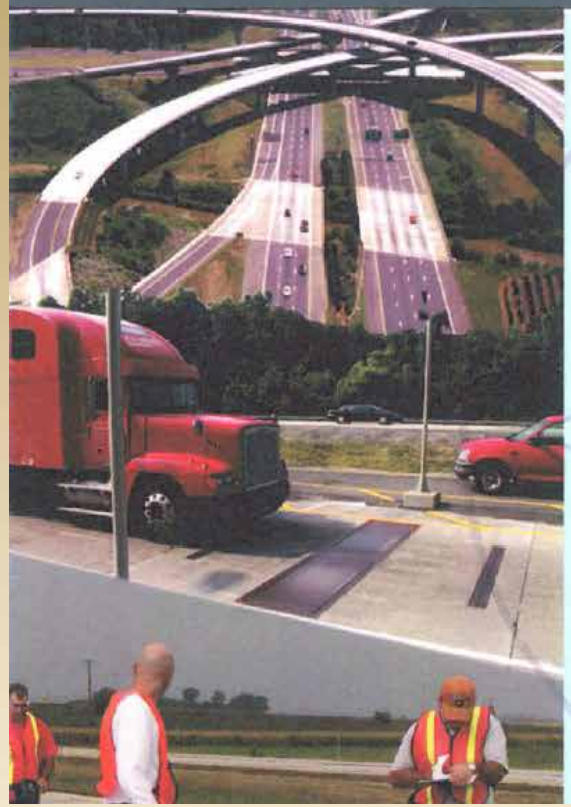
- Tire rubber is blended with hot asphalt cement at the refinery or at an asphalt terminal and transported to job site in tankers.
- Polymers and other additives may also be included
- Two types of Terminal Blend Processes
  - Vestenamer® reacted system
    - A polymer added to the binder to react the GTR with the binder
    - http://www.illinoistollway.com/documents/10157/90097/RP_ARA_WRV_GTR+Summary+Report-FINAL_06252007.pdf
  - Smaller Sized Tire Rubber particles reacted into asphalt (-60 mesh)
    - http://www.missouribusiness.net/eac/docs/mod_asphalt.asp

    Both systems have visible crumb rubber particles
    - Tire Rubber component is a filler within the asphalt cement
    - Tire Rubber particles can be screened from asphalt cement
    - Tire Rubber Settlement and Phasing is usually an issue
      - Although some supplier are working to fix

Seneca Asphalt

APPLIED RESEARCH ASSOCIATES, INC.
TRANSPORTATION

EXPANDING THE REALM OF POSSIBILITY



Preliminary Summary Report

Ground Tire Rubber (GTR) Asphalt Pavement Demonstration Project

Contract: RR-06-9092

http://www.illinoistollway.com/documents/10157/90097/RP_ARA_WRV_GTR+Sumary+Report-FINAL_06252007.pdf

Modified Asphalt Solutions

Missouri Small Business & Technology Development Centers
A University of Missouri Extension Partn

MissouriBusiness.net

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Business Resource Library | Find a center | Newsletter: read or subscribe

Business Going Green
Modified Asphalt Solutions: Where the rubber IS the road!

If you have driven south into Branson on Highway 65 lately, you may not have noticed you were driving over asphalt manufactured with ground tire rubber (GTR). Yet one company in Missouri is paving the way for more widespread use of old tires in constructing better roads, parking lots, and athletic tracks.

Workers lay asphalt at the NCAT track in Auburn, AL, where GTR made by Modified Asphalt Solutions is one of the top performing sections of track.

Terry Rainey, the chief operating officer of Modified Asphalt Solutions explains: "The biggest challenge that we have faced is acceptance and education on using GTR as an alternative asphalt modifier. Early experiments with rubber asphalt ended with mixed results, and many state transportation departments still remember those days and are reluctant to try it again."

Missouri's acceptance of GTR is growing, however, since the Missouri Department of Transportation financed testing of the material at the National Center for Asphalt Technology in Auburn, AL. "We were very pleased that MODOT chose our material to be tested side-by-side with another asphalt binder using Styrene Butadiene Styrene," says Terry enthusiastically. "With all other factors being equal, the GTR modified section is not only outperforming the SBS pavement, but is currently one of the top performing sections of track at NCAT."

http://www.missouribusiness.net/eac/docs/mod_asphalt.asp

Types of Tire Rubber Modification Processes

- **Terminal Blended "Hybrid"**

- Tire rubber is blended with hot asphalt cement at the refinery or at an asphalt terminal, transported to job site in tankers and is handled the same as any neat asphalt cement.
  - Tire rubber is fully dispersed into the asphalt medium
  - Meets ASTM D2042 Solubility Standards
    - Tire Rubber particle size is less than 1 micron
  - Meets all PG grading test
    - No special testing equipment or test specification
  - Asphalt cement is now modified with tire rubber
    - Tire Rubber Modified Asphalt is Homogeneous
    - Mixing and Compaction Temperatures remain constant
    - Excellent Stability
    - No Settlement or Phasing, Does Not Require Agitation
- Polymers and other additives may also be included

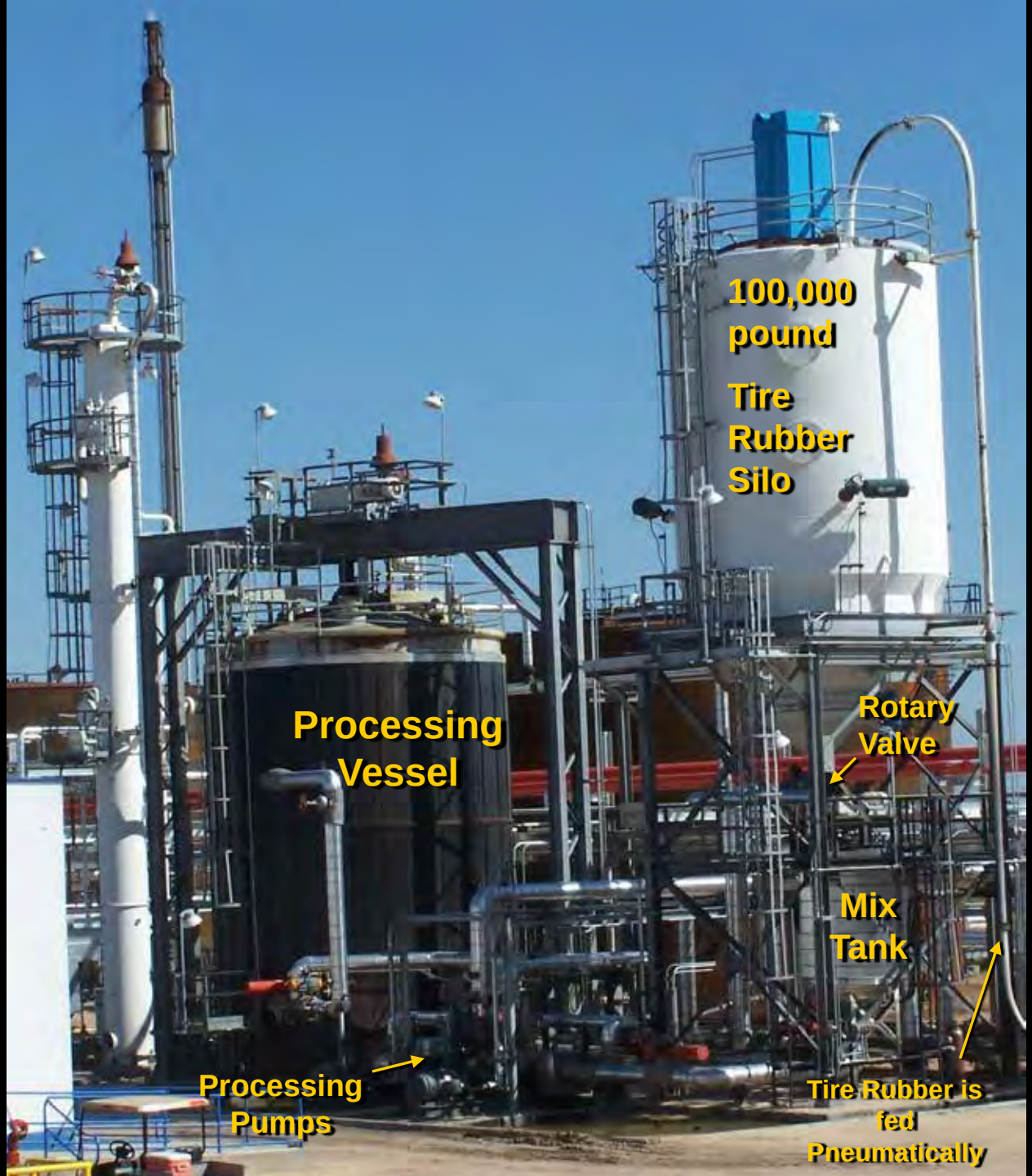
How Small is a Micron?

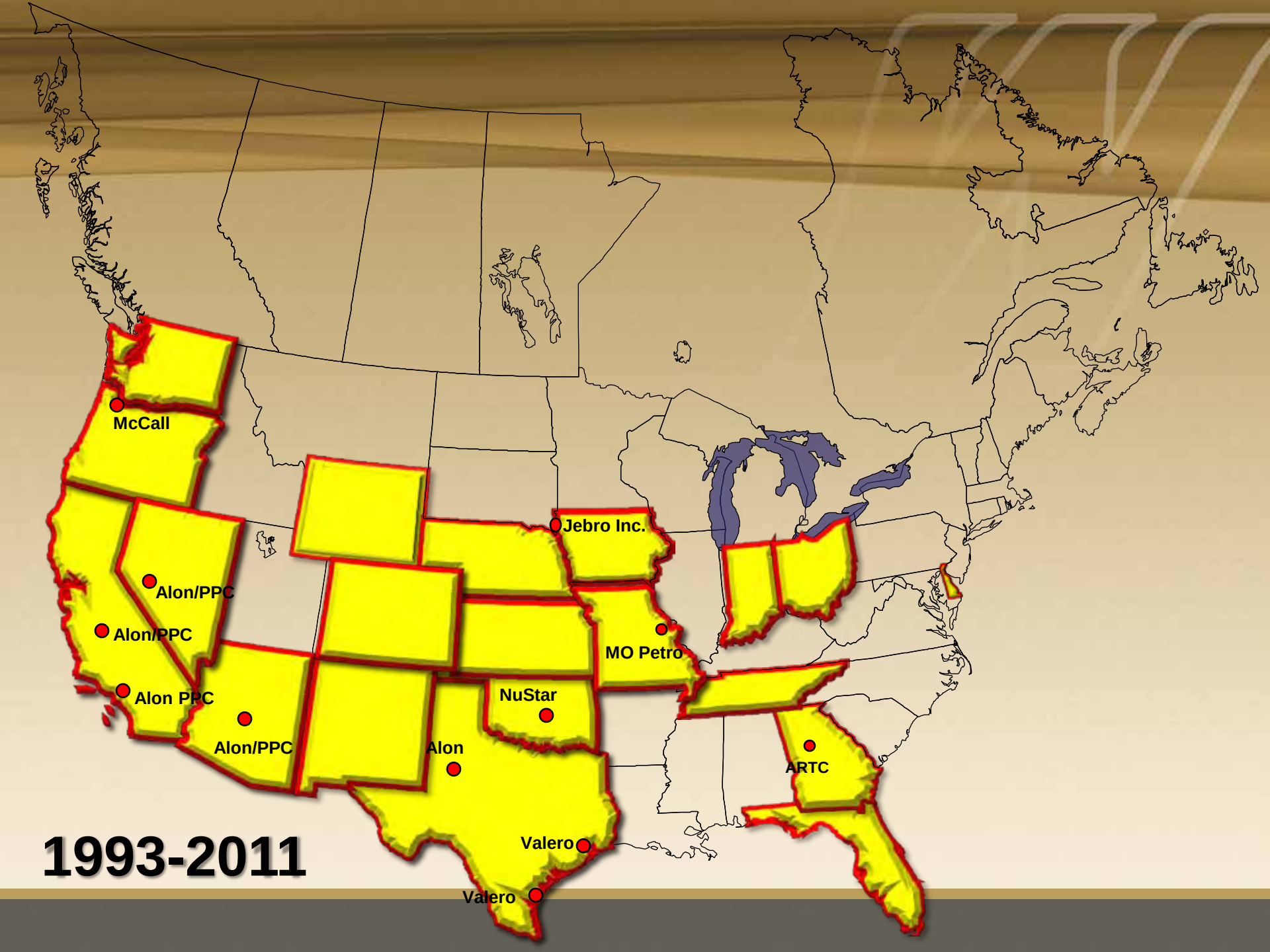
WRIGHT Asphalt Products Co.

Particle Size Chart	(microns)
1/16 inch (0.0661”)	1,680
40 mesh silica sand (0.0165”)	425
200 mesh sieve (0.0029”)	75
Mold	3 - 12
Talcum Dust (baby powder) (0.0020”)	0.5 - 50
Bacteria	0.3 - 40
Anthrax	1 - 5
TRMAC™ 25% Tire Rubber Asphalt Cement (0.0000394”)	0.5 - 1
Sea Salt	0.035 - 0.5
Viruses	0.05 - 0.3

TRMAC Processing Facility

Alon Refinery
Big Spring, TX

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Jebro Inc.
Alon/PPC
Alon/PPC
MO Petro
Alon PPC
NuStar
Alon/PPC
Alon
ARTC
Valero
Valero
1993-2011

Products and Processing Using Terminal Blend "Hybrid" TR System

Tire Rubber Modified Paving Grade Asphalts Cements

- Standard PG Grades – Dense Graded Mixes
- PG Plus Grades – High Performance Mixes
- Warm Mix Standard Grades – Dense and Open/Gap Graded Mixes
- Warm Mix Polymer Modified Grades - Dense and Open/Gap Graded Mixes
- Hot Applied Chip Seal Binders – Neat and Polymer Modified

Tire Rubber Modified Cutback Asphalt Cements

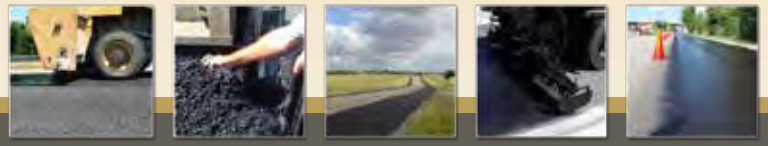
- **(MC)** Medium Cure Graded
- **(SC)** Slow Cure Graded

Tire Rubber Modified Asphalt Emulsions

- Rapid Set Chip Seal
- Micro Surfacing Slurry Seals
- Standard Slurry Seals
- Cold In-Place Recycling
- Cold Mix

Tire Rubber Modified Seal Coats

- Tire Rubber Modified Surface Sealer
- Tire Rubber Modified Fog Seals



FHWA
ALF TESTING FACILITY

Modified Binder Chip Seals

A Technical Review

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2010 CCSA Pavement Preservation Conference
"Cost Effectiveness of Preventative Maintenance"
Embassy Suites, Seaside, CA
January 20-21, 2010

Wright Asphalt Tire Rubber "Hybrid" products since 1993. . .

1,726,809 tons

of tire rubber modified binders has been applied in pavement preservation and hot mix applications by Wright Asphalt

186,061,806 pounds

of tire rubber has been used by Wright Asphalt within these tire rubber modified binders

13,290,129 tires

Wright Asphalt kept out of landfills!

Any Questions contact

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Houston, TX 77043-4501

office # 281/452-9084
fax # 281/452-2562
lab # 281/452-0166

Dan Quire 615-290-3600
dquire@wrightasphalt.com


Thank You!