DRIVEN PLASTICS

SALES PRESENTATION ENGINEERS AND PUBLIC WORKS


90%
of the
WORLD'S PLASTIC
is
NOT RECYCLED
DRIVEN
PLASTICS

ABOUT US PAGE

DRIVEN PLASTICS

Vision:
We envision a world where plastic is repurposed and no longer polluting our environment.

Mission:
We repurpose waste plastic and use it to improve the quality and cost of asphalt.

Core Values:
COMMUNITY AND COOPERATION: Our staff and partners have immeasurable value, and we strive to achieve win-win scenarios in the best interest of all parties.

RESPONSIBILITY, HONESTY, AND TRUST: Our integrity is not to be compromised, our word is our bond and bonds are our livelihood.

INGENUITY AND FORESIGHT: Our success lies in a solutions-based approach that keeps an eye on the bigger picture.

LEARNING AND LISTENING: Our collective minds remain in a constant state of readiness to grow, change, and excel at all levels.

DRIVEN PLASTICS TEAM

Mark McCollough

CEO

Industry Experience
Construction Management
Startup Growth

Marie Logsden

CSO

Business and Growth Strategy
Political Strategist
Brand/Marketing/Comms

Chris Wacinski

CTO

Process Engineer
Product Manager
Plastics Manufacturing

Adam Farmer

Director of Operations

Engineering Manager
Mechanical & Electrical
Design & Optimization

Matt “Buck” Buckstein

Director of Special Projects

Human Resources
Strategic Leadership
Process Improvement

2022 R&D 100 WINNER AND EDISON AWARDS GOLD WINNER

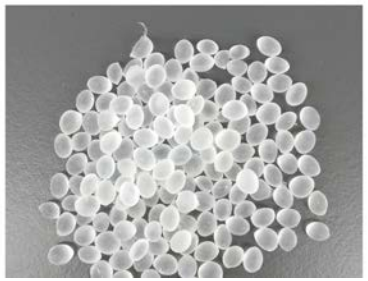
R&D WORLD TOPICS TECHNOLOGY 2022 R&D 100 AWARD WINNERS RESOURCES GLOBAL FUNDING FORECAST WEBINARS

ELVALOY™ RET MF 1177 Polymeric Post-Consumer Recycle Asphalt Paving Compatibilizer

Established in 1963, the R&D 100 Awards is the only S&T (science and technology) awards competition that recognizes new commercial products, technologies, and materials for their technological significance that are available for sale or license. The R&D 100 Awards, celebrating the program's 60th Anniversary this year, has long been a benchmark of excellence for industry sectors as diverse as telecommunications, high-energy physics, software, manufacturing, and biotechnology. This 2022 R&D 100 winner is listed below, along with its respective category.

Category: Mechanical/Materials
Developers: The Dow Chemical Company
Co-Developers: Ecologic Materials Corporation
United States

Product Description: ELVALOY™ RET MF 1177 is a multi-functional elastomer, engineered to be a drop-in to existing asphalt modification processes and blend more quickly, at lower temperatures than other polymer modifiers. It reactively modifies asphalt to enhance rutting and cracking resistance while compatibilizing recycled polyethylene (RPE) for sustainable and mechanically resilient roads.



ELVALOY™ RET MF 1177 Polymeric Post-Consumer Recycle Asphalt Paving Compatibilizer - Research & Development World (rdworldonline.com)

Driven jointly awarded with

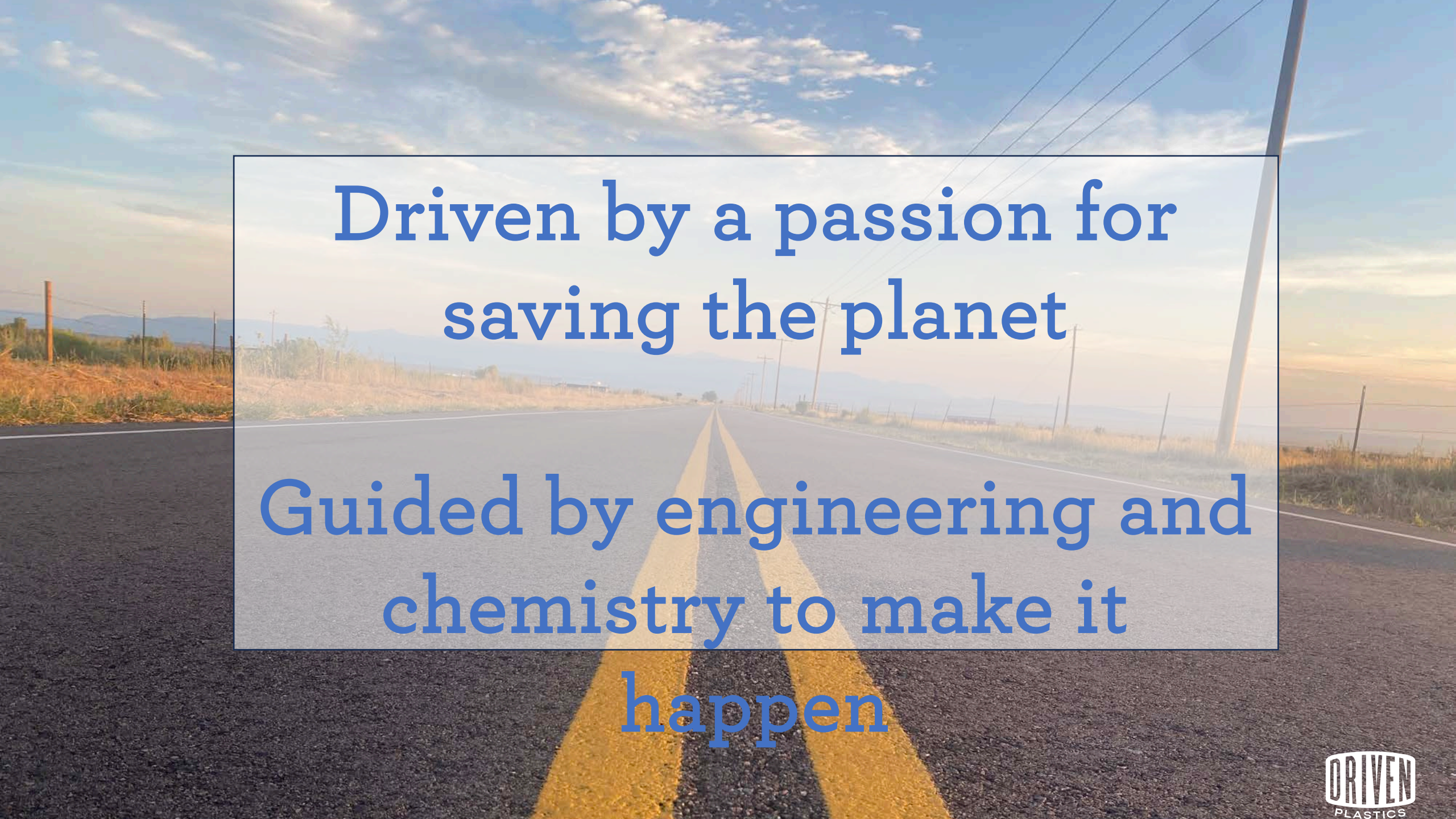
The Dow Chemical Company

EDISON AND R&D 100 WINNER

- Established in 1987
- Guided by the legacy and vision of Thomas Edison and his Menlo Park team
- ELVALOY™ RET by The Dow Chemical Company

- Established in 1963
- The R&D 100 Awards program identifies the top100 revolutionary technologies
- Elvaloy RET is a multi-functional elastomer

2022 R&D 100 WINNER


Driven by a passion for saving the planet
Guided by engineering and chemistry to make it happen
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ABOUT US PAGE

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ADDITIONAL TECHNICAL LINKS

- National Center for Asphalt Technology study showcasing rheological results from PCR polyethylene as compared to traditional asphalt modification
  - link
- National Asphalt Paving Association write up on the state of recycled plastics in asphalt
  - NAPA > Shop > Product Catalog > Product Details (asphaltpavement.org)
- DuBois et al. 56th Annual Petersen Asphalt Research Conference "Recycled Plastics For Performance Graded Asphalts) July 2019
  - link to the presentation
- Articles showcasing the product in trade magazines
  - ForConstructionPros.com
  - Asphalt Pro Article here
  - Forbes article on Missouri installation
- Driven announcement of Pueblo facility
  - Pueblo's newest company converts plastic waste into asphalt product (chieftain.com)
  - WATCH - New business brings green jobs to Pueblo (kktv.com)
- DOW video of the product
  - https://www.youtube.com/watch?v=wc8HNOcfjZU
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- Edison Awards 2023 Gold Winner
  - 2023 Winners - Edison Awards
- County of Pueblo Siloam road project video
  - Siloam Road project - YouTube

NEW

EDISON AWARDS WINNER 2023

2022 R&D 100 WINNER

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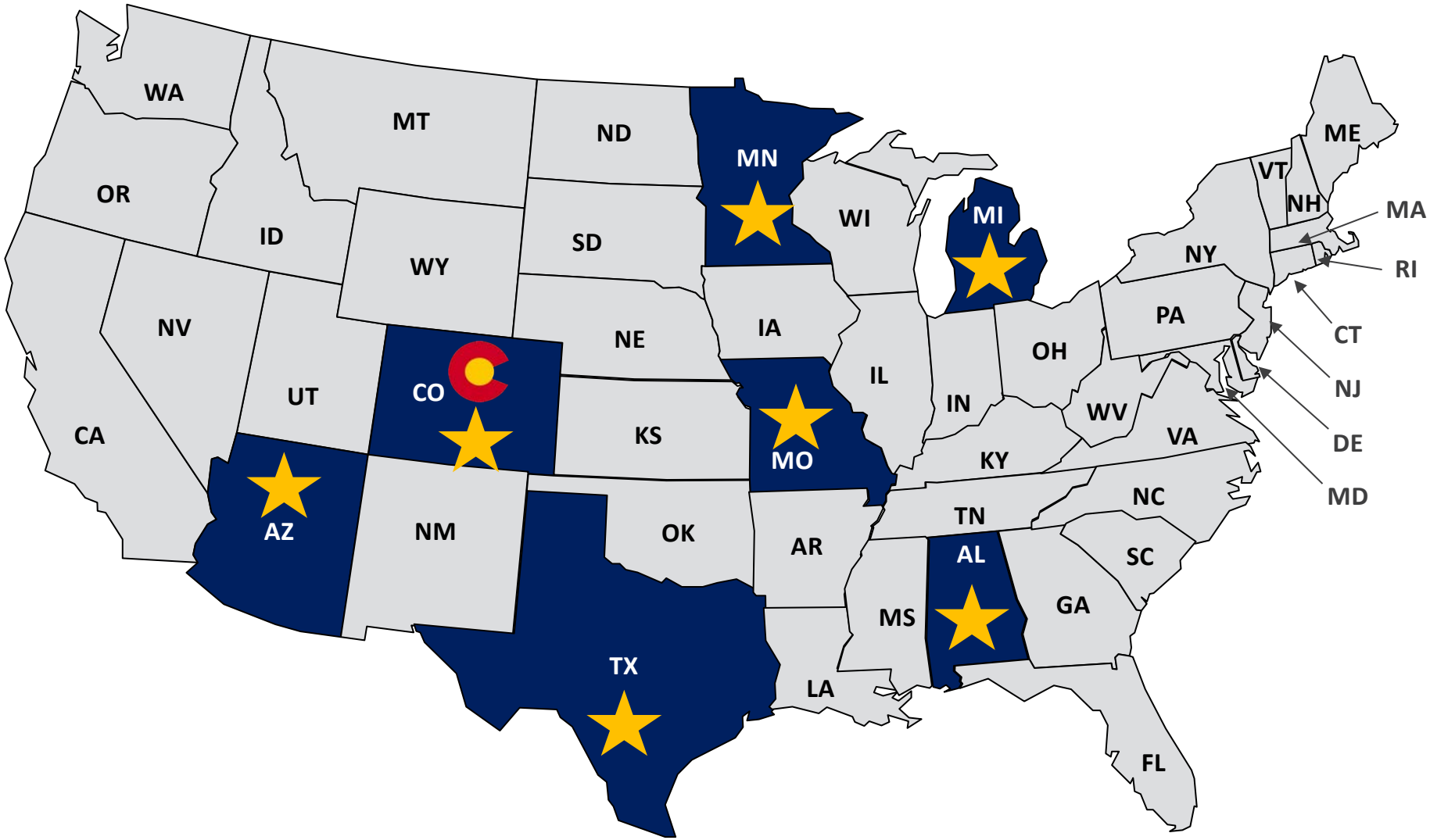
RPE INSTALLATIONS



21 installations in the US

>83 Tons or ~12.6M single-use grocery bag eq.

*Link for more information: DOW Website

ORIVEN PLASTICS

2023 MISSOURI DOT / MIZZOU I-155 PROJECT

High Performance and Economy Mix evalutated

Hi-Tech Feeder System

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OUR PROCESS

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Solution for LOCAL waste plastic problems

LOCAL waste plastic in LOCAL roads while meeting traditional pavement engineering standards

Creation of LOCAL Jobs

Solved historical recycled plastic issues of liquid separation, and contamination

Blend and sell a finished ingredient to hot-mix asphalt producers for improvement in rutting and cracking performance

FWT: ASPHALT ADDITIVE DESIGNED FOR WET PROCESSING

Recycled Polyethylene (rPE)

Reactive Elastomeric Terpolymer (RET)

PPA Co-reactant (optional) (<0.5% by weight of binder)

FWT: Custom formulated additive for asphalt binder

Oil/Binder Plant

Asphalt Plant

- Reduces material cost*
- Improves cracking and rutting**
- Uses existing PMA equipment
- Drop in for current mix designs
- Reuses up to 3 Tons of plastic per lane mile of road.

Up 3 tons of plastic per lane mile

* As compared to SBS modified binder

** As compared to unmodified binders

HYB: HYBRID PRODUCT FOR WET AND DRY PROCESSING

Reactive Elastomeric Terpolymer (RET)

PPA Co-reactant (optional) (<0.5% by weight of binder)

Oil/Binder Plant

Asphalt Plant

Recycled Polyethylene (rPE)

- **Feeder flexibility (fiber, RAP, fine returns aggregate)**
- Perfect for upcoming Balanced Mix Design
- Improved workability vs PMA
- Additives (anti-strips, rejuvenators) can be reduced or eliminated

Up to 10 tons of plastic per lane mile


~15 Tons of Polyethylene!
1 Chris for scale
JLG LIFT
SKYSTRATE EQUIPMENT
WESTWARD

POST COMMERCIAL WASTE STREAM

- Consistent chemistry of the Plastic Polyethylene (PE)
- PE has favorable characteristics for use in asphalt (melting point)
- Low contamination levels
- Predictable supply source, byproduct of a manufacturing or commercial process

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CONSTRUCTION WITH RECYCLED POLYETHYLENE (RPE)

- No change in equipment or procedures
- Easier hand work than other Polymer Modified Asphalts
- Easier clean up than other Polymer Modified Asphalts
- No offensive smell

I-155 Installation
Hayti, MO June 2023
3000 lbs. of plastic

IMPROVED PERFORMANCE CHARACTERISTICS

- More tolerant to extreme heat and heavy loads*
- Reduces rutting*
- Reduces material cost**
- Expected 5% reduction in cost of maintenance over life of road
- Extends service life of road

I-155 Installation
Hayti, MO June 2023
3000 lbs. of plastic

* As compared to unmodified binders

** As compared to SBS or polymer modified binders

OUR PROJECTS

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THREE DOW PARKING LOTS AND A DRIVEWAY SPRING 2023

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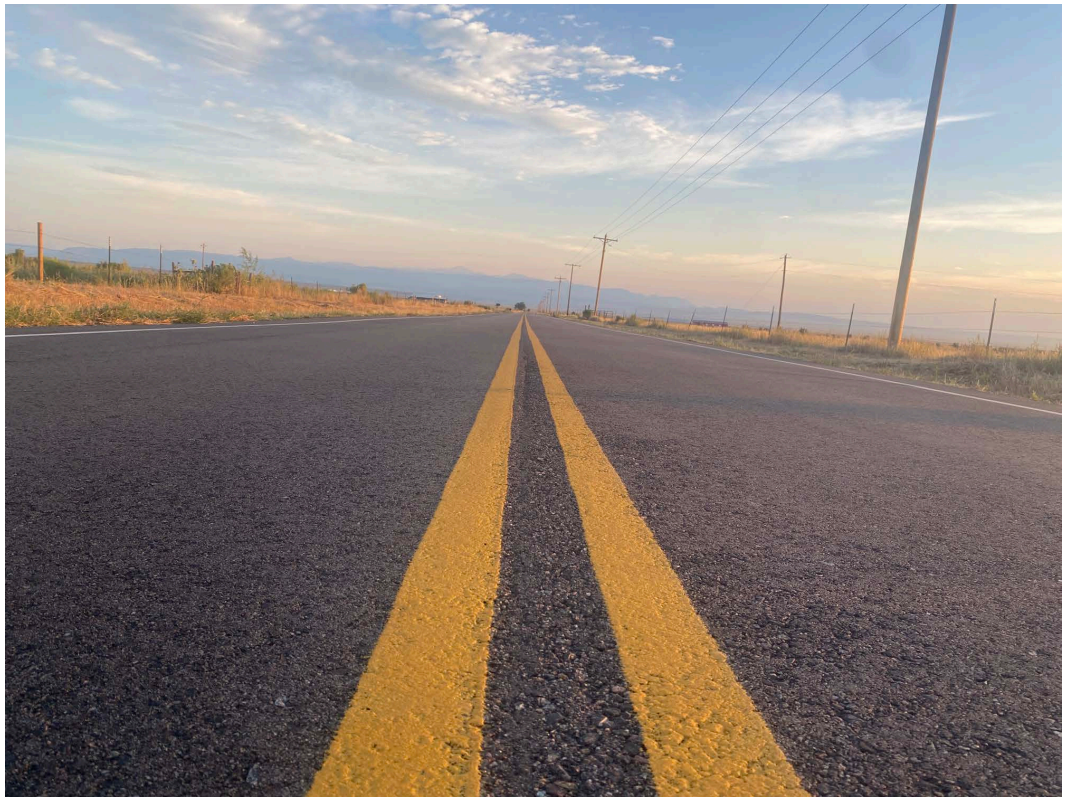
STOCKYARD, AND SILOAM ROADS
PUEBLO COUNTY, CO FALL 2022



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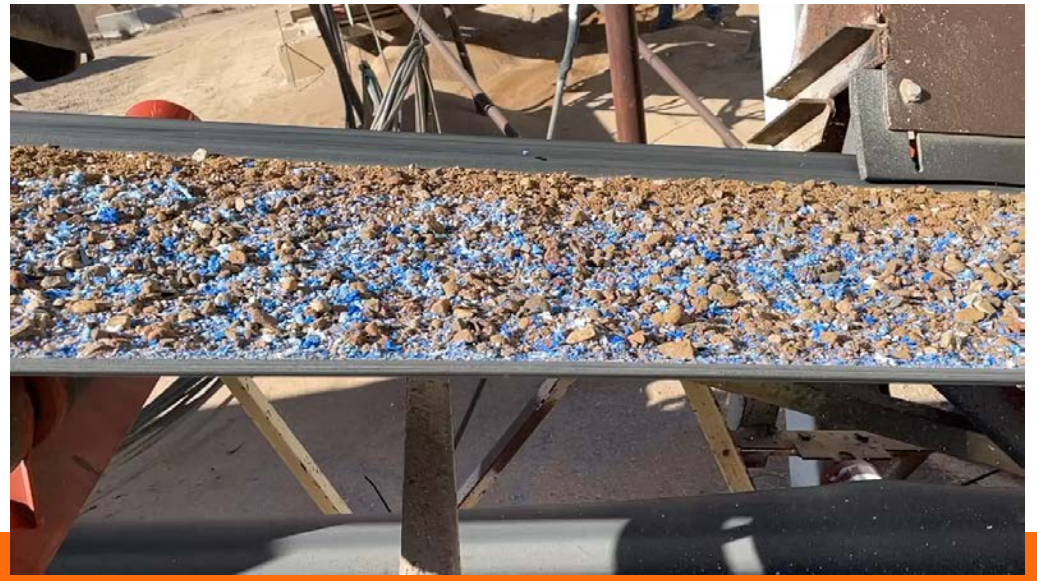
Upgrade Feeder System



Custom concept feeder system for rPE

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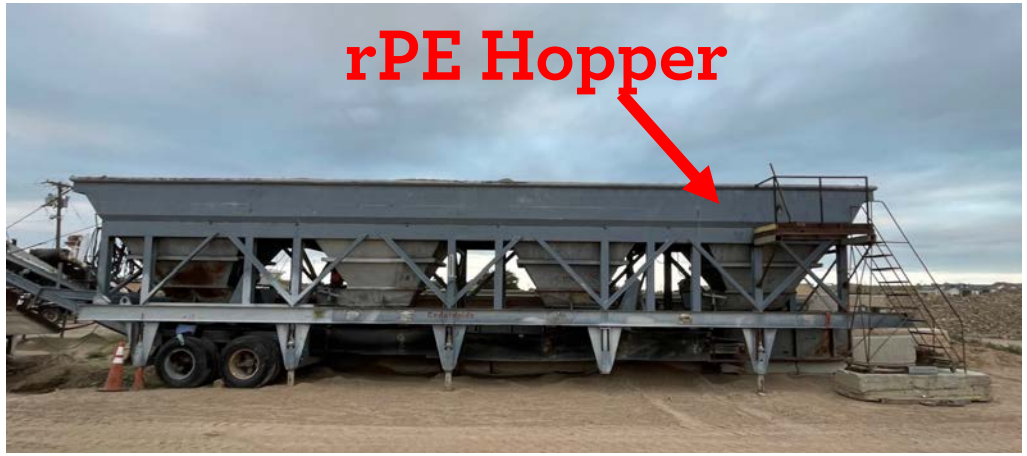
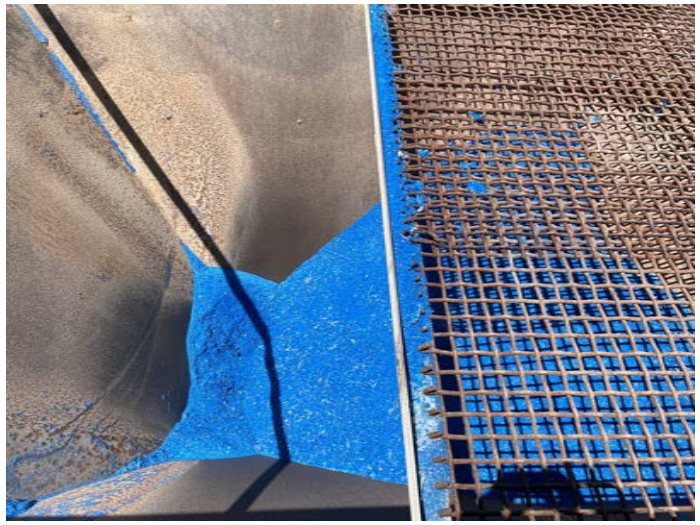
COUNTY OF PUEBLO 2023 OVERLAY





6 roads and 1 County parking lot

New hopper-based feeder system

MISSOURI DOT / MIZZOU I-155 PROJECT

High Performance and Economy Mix evalutated

Hi-Tech Feeder System

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2023 MISSOURI DOT / MIZZOU I-155 PROJECT

High Performance and Economy Mix evalutated

Hi-Tech Feeder System

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Siloam Road, County of Pueblo, CO
1.75 miles
13.5 tons of recycled plastic (~2M grocery bags)
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Siloam Road, County of Pueblo, CO
1.75 miles
13.5 tons of recycled plastic (~2M grocery bags)
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PLASTICS

TECHNICAL

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NEW

EDISON AWARDS WINNER 2023

2022 R&D 100 WINNER

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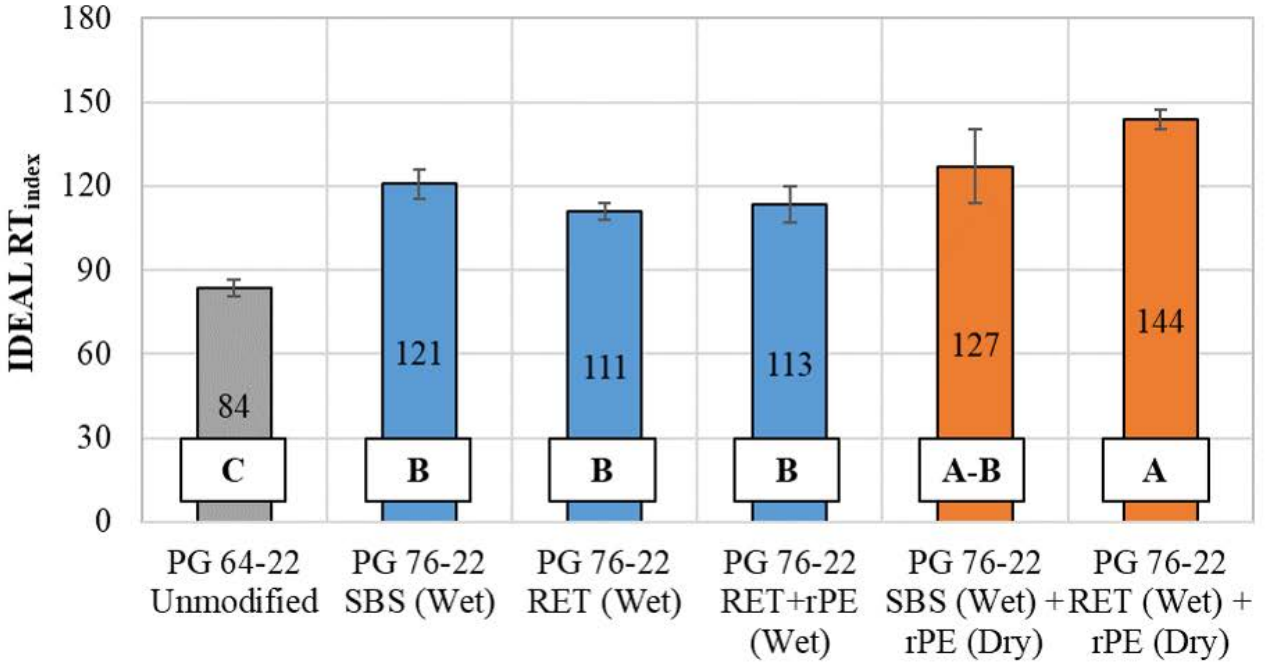
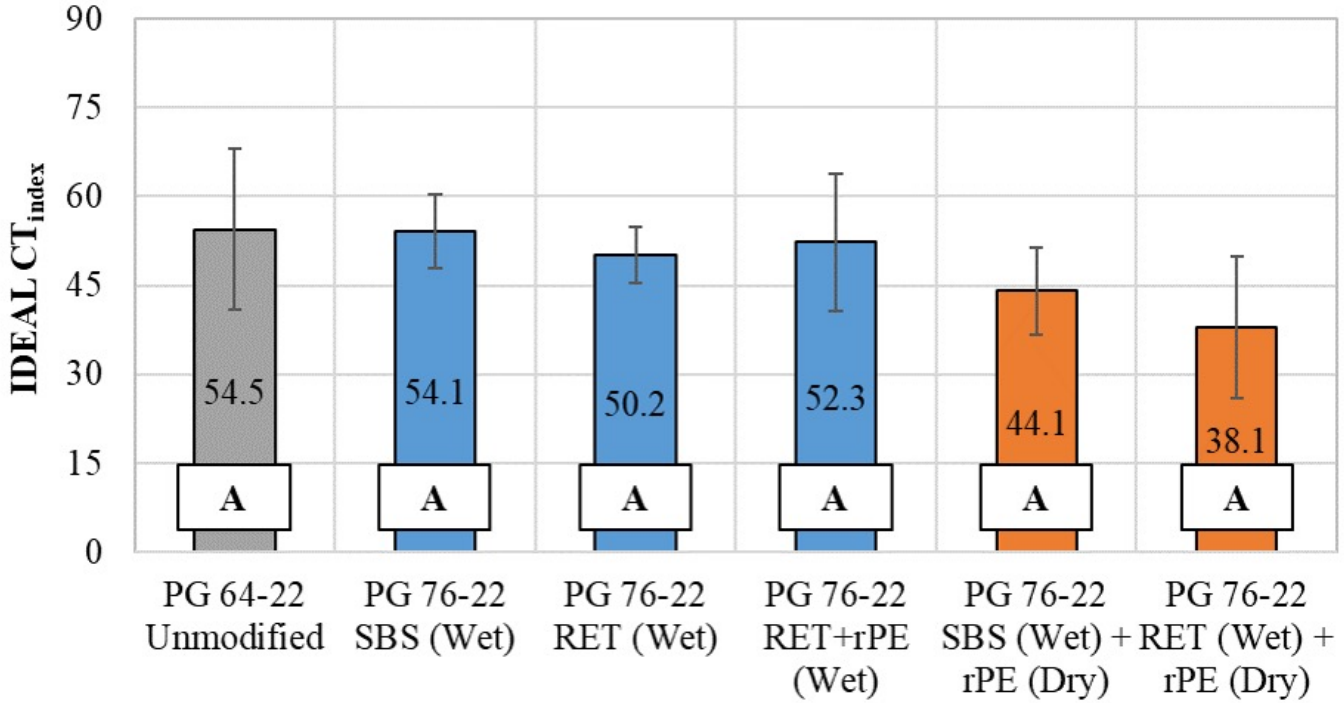
NCAT ADDITIVE GROUP STUDY: RUTTING

- NCAT evaluated unmodified, SBS, rPE asphalt
- Both SBS and rPE significantly improved rutting resistance vs unmodified asphalts
- No statistically meaningful difference in performance between SBS and rPE



NCAT ADDITIVE GROUP STUDY: CRACKING

- Evaluated unmodified, SBS, and rPE Asphalts
- No statistical discrimination between unmodified and PMA mixtures
- No impact on intermediate-temperature cracking resistance from polymer modification and adding dry rPE



IDEAL-CT

Yin et al. Performance Characterization and Fatigue Damage Prediction of Asphalt Mixtures Containing Polymer Modified Binders and Recycled Plastics, 2022 AAPT Annual Meeting

Note: SBS Dosage ~2X RET dosage

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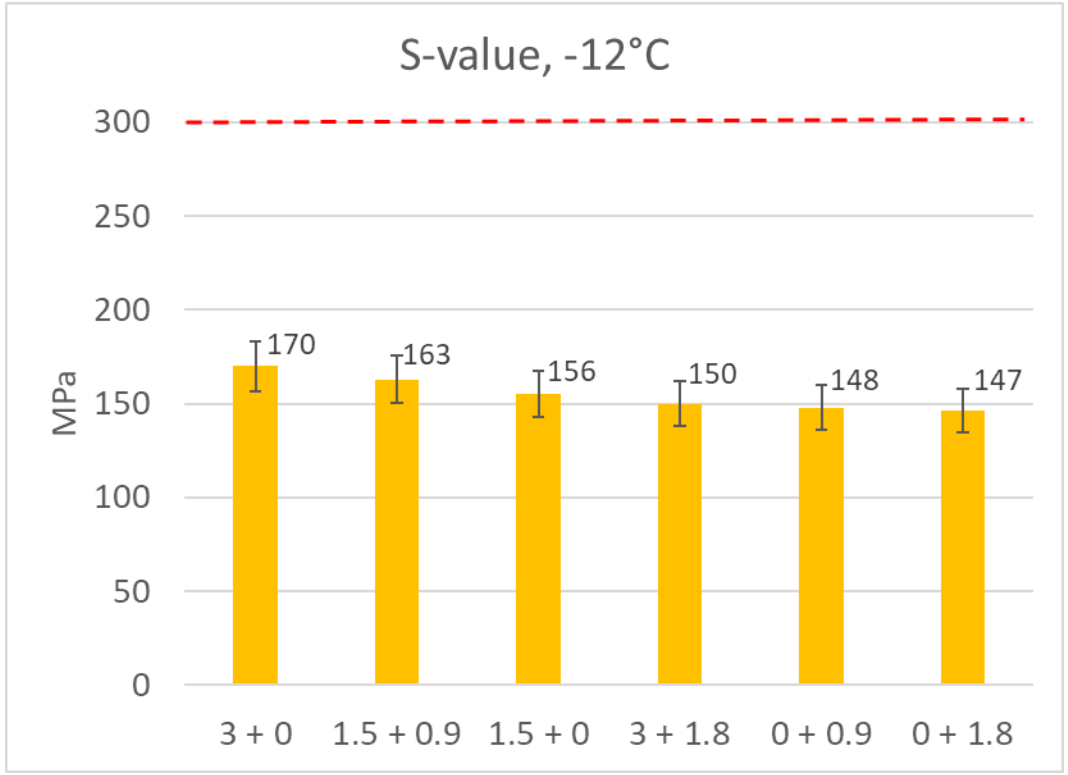
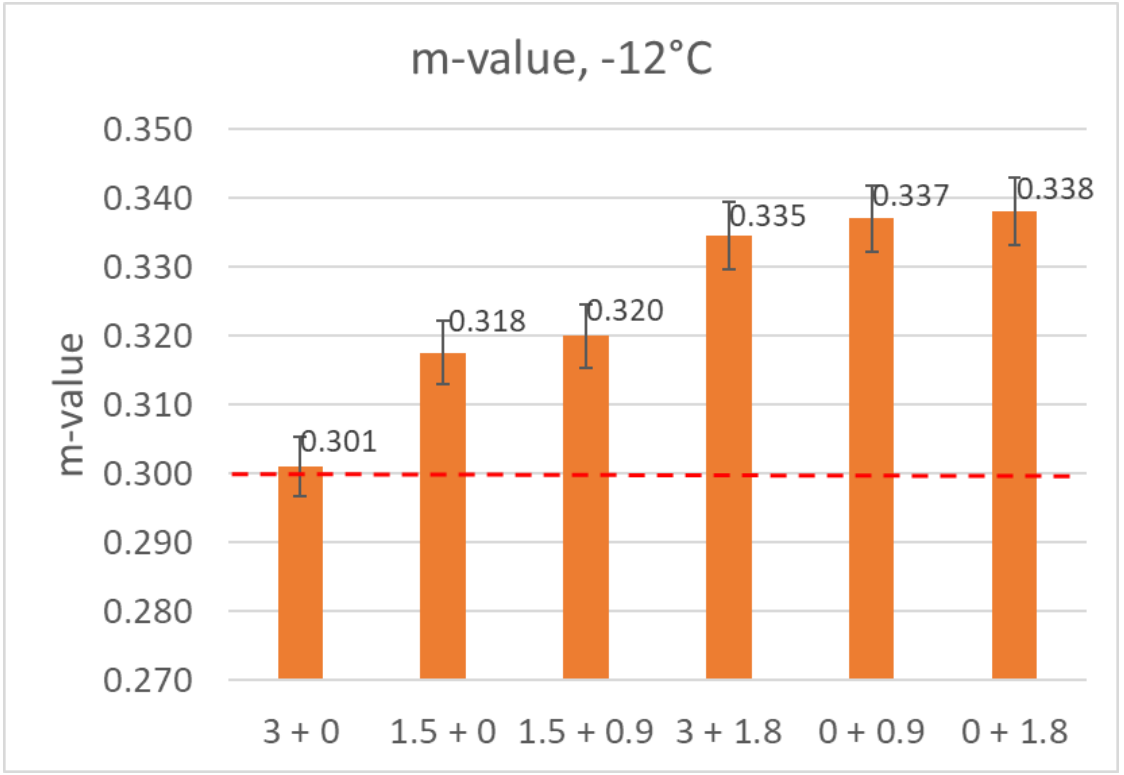
RPE + RET BLENDS MEET LOW TEMPERATURE PERFORMANCE

Values below 300 MPa indicate resistance to cracking



Values above 0.300 indicate resistance to cracking



***Numbers in x-axis denote weight %; first RPE/second RET**

Brown et al. Plastics Industry Association New End Use Marketing Opportunity meeting "ELVALOY™ RET and Post-Consumer Recycled Resins for Performance Graded Asphalts" March 2019

rPE: Recycled Polyethylene

RET: Reactive Elastomeric Terpolymer

SBS: Styrene-butadiene-styrene

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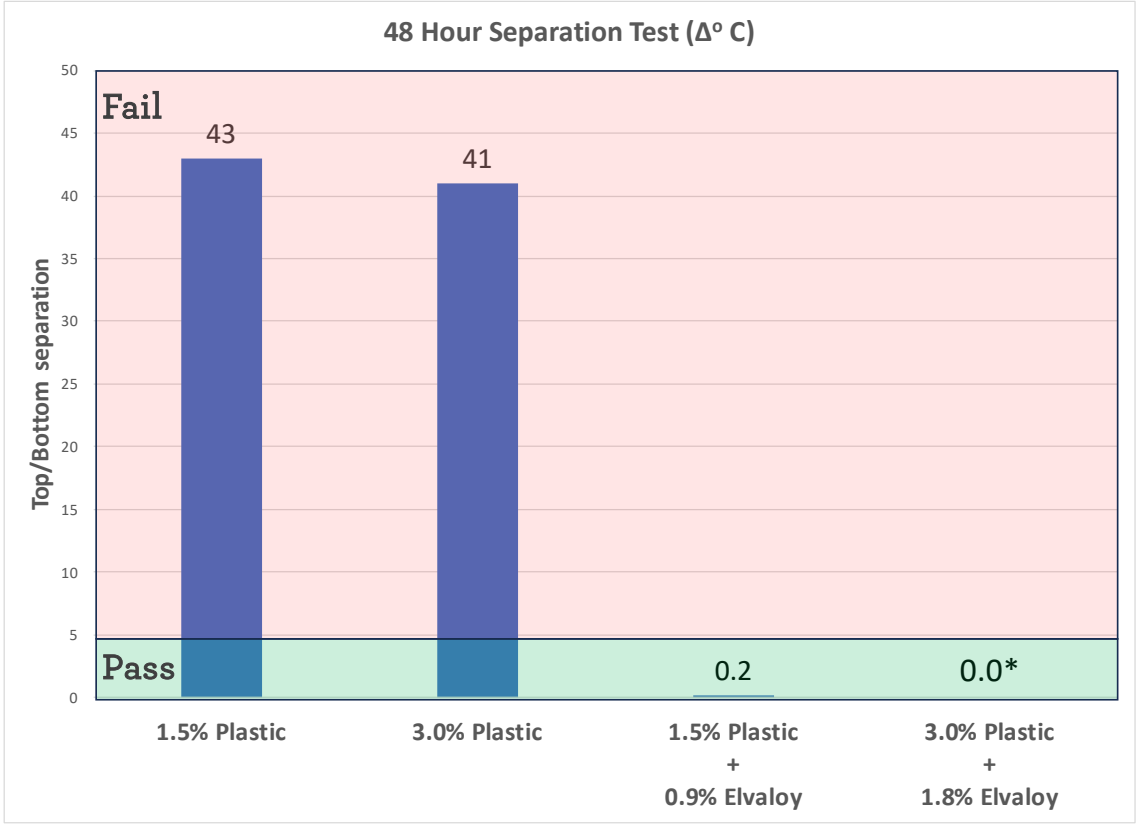
SEPARATION TEST

- Recycled polyethene (rPE) by itself fails separation tests
- Dow's Elvaloy ™ polymer significantly improves separation test to almost unmeasurable levels
- Elvaloy™ is looking for the rPE
- Chemically bonds with the rPE to form a new, resilient system



* Near or below detection limits

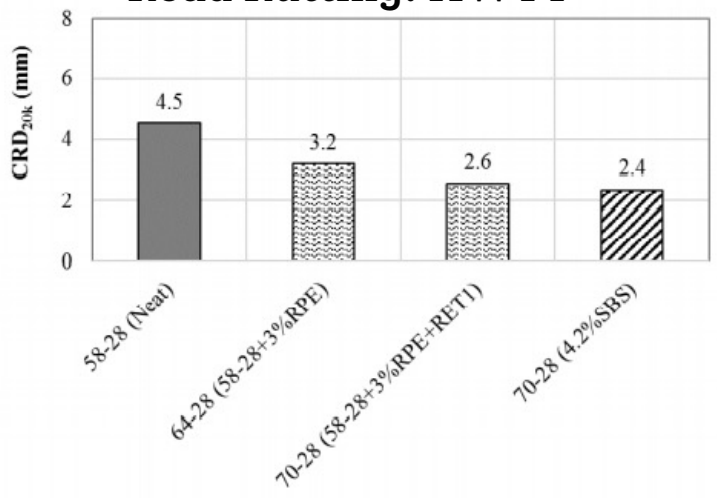
COMPARISON OF PLASTICS IN PAVEMENT DESIGN

	LOCALLY PRODUCED	RECYCLED MATERIAL	SUPERPAVE DESIGN	COST COMPETITIVE	EASE OF CONSTRUCTION	CREATES LOCAL JOBS
Recycled Plastic	✓	✓	✓	✓	✓	✓
SBS/SBR			✓	✓		

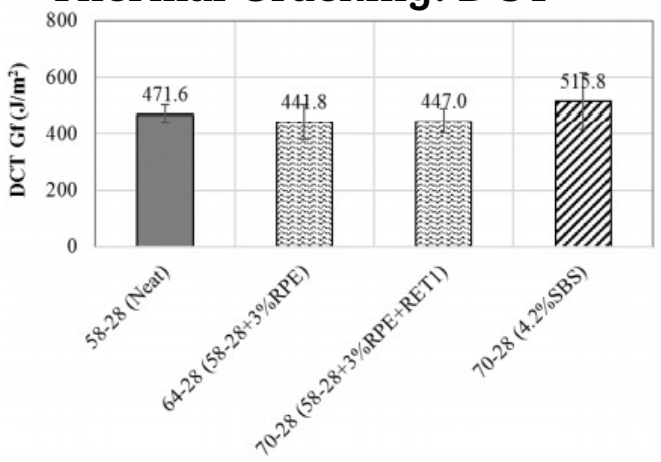
NCAT WET PROCESS STUDY HIGHLIGHTS:

Comprehensive study comparing rheological and HMA performances of Neat, rPE, and SBS modified binders

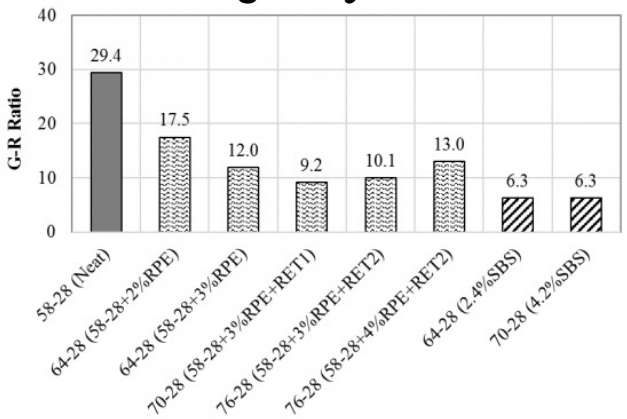
Road Rutting: HWTT



Thermal Cracking: DCT



Road Longevity: G-R Ratio



rPE: Recycled Polyethylene
RET: Reactive Elastomeric Terpolymer
SBS: Styrene-butadiene-styrene

Conclusion: rPE + RET blends will have similar performance to that of SBS

Source: NCAT NEMO phase III results

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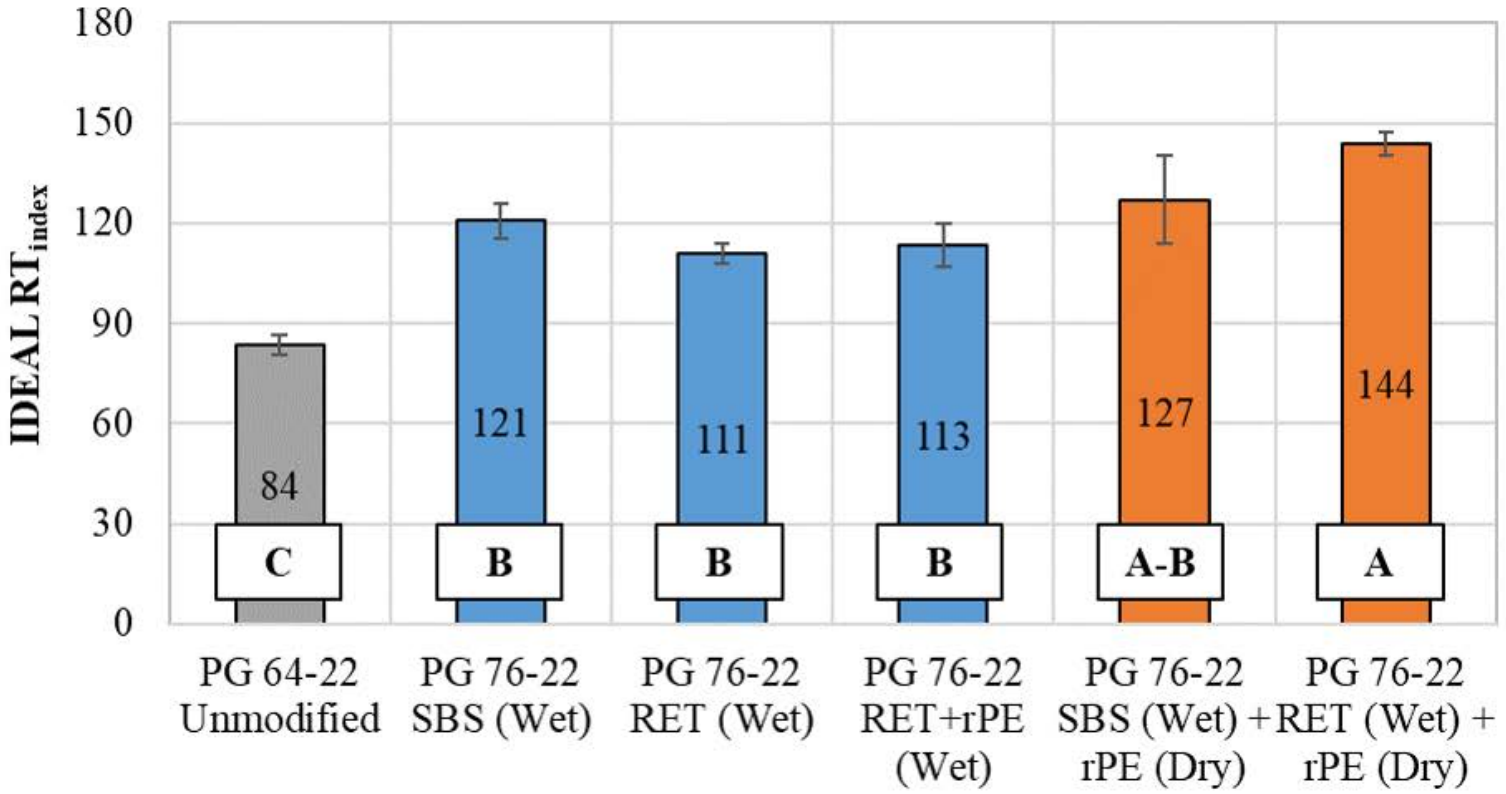
NCAT ADDITIVE GROUP STUDY

- Improved rutting resistance due to polymer modification and adding dry rPE
- Hybrid-process PMA (more rPE) > wet-process PMA > unmodified



Note: SBS Dosage ~2X RET dosage

Yin et al. Performance Characterization and Fatigue Damage Prediction of Asphalt Mixtures Containing Polymer Modified Binders and Recycled Plastics, 2022 AAPT Annual Meeting

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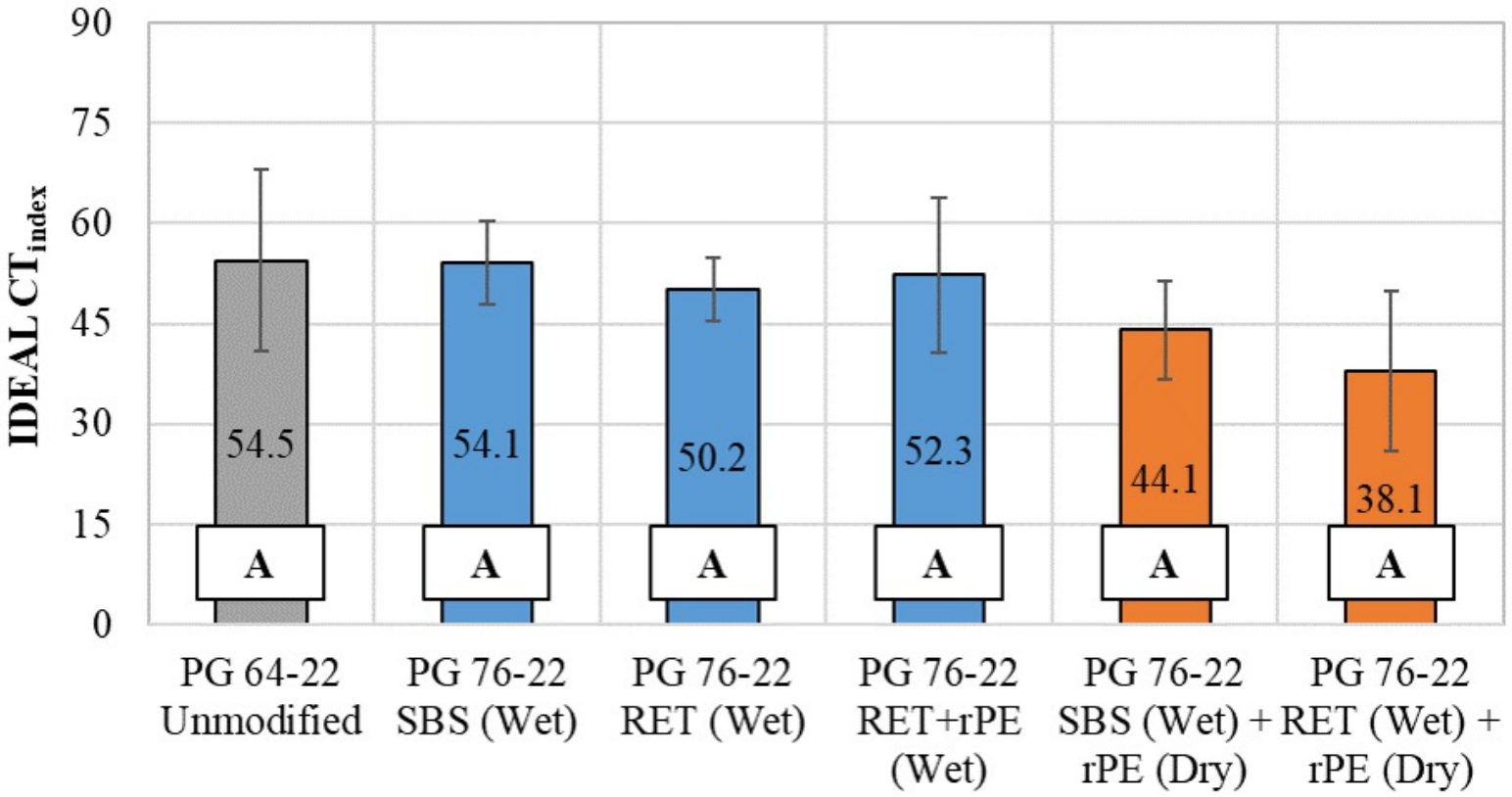

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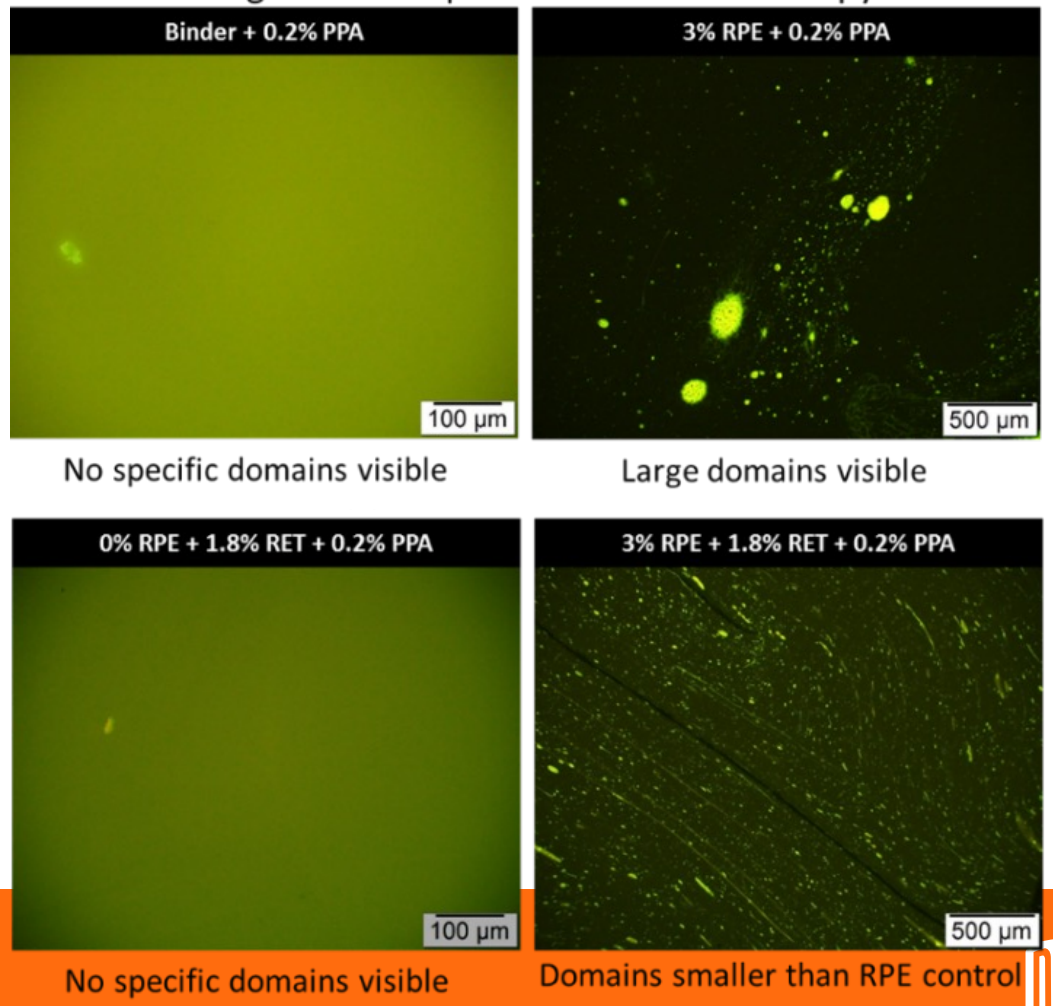
VISUALIZING RECYCLED PLASTIC INCOMPATIBILITY

PE-only modified asphalt shows phase separation

RET significantly reduces PE domain sizes demonstrating compatibilization

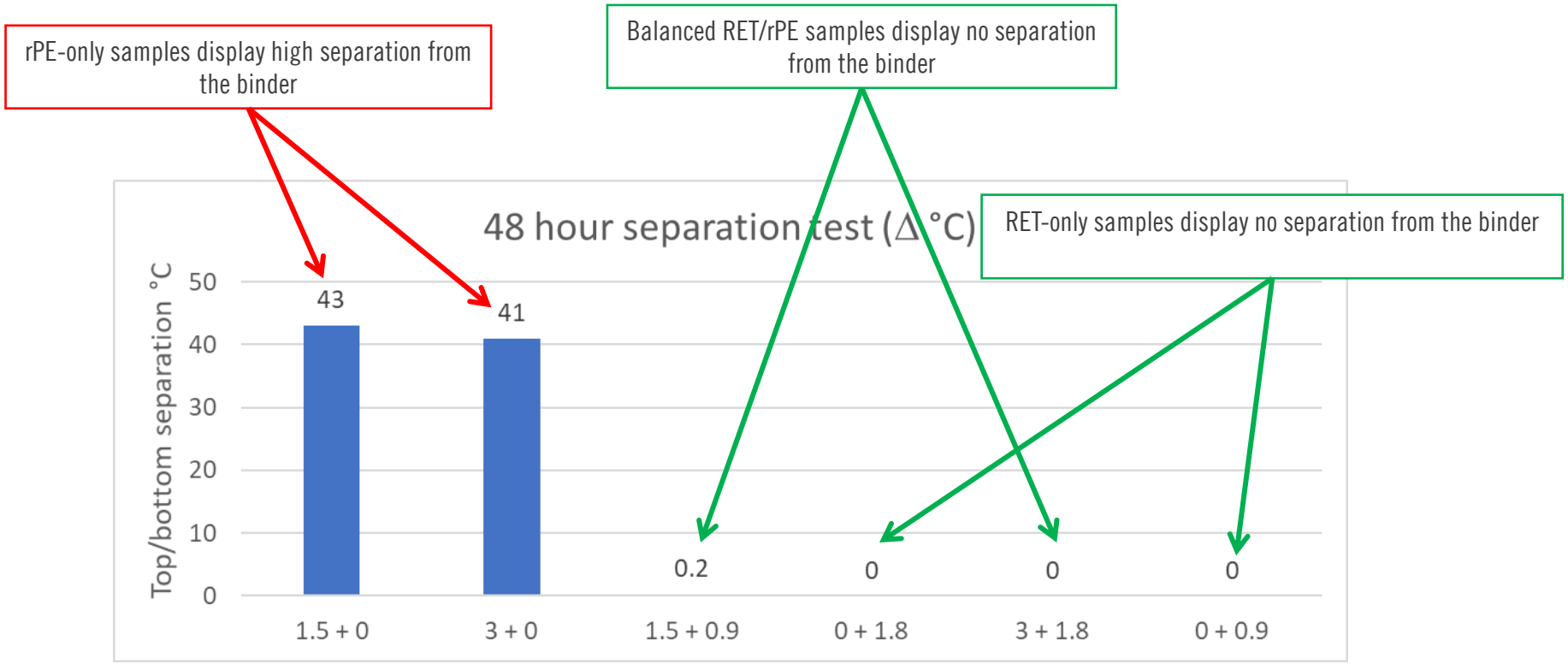
Low Magnification Epifluorescence Microscopy



Brown et al. Plastics Industry Association New End Use Marketing Opportunity meeting "ELVALOY™ RET and Post-Consumer Recycled Resins for Performance Graded Asphalts" March 2019

FORMULATED BINDER CONTAINING rPE PASSES SEPARATION TEST

- ASTM D5976 – 48 hour separation test
- Values > 4°C indicate polymer incompatibility, i.e. separation from the binder



***Numbers in x-axis denote weight %; first RPE/second RET**

rPE: Recycled Polyethylene
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SBS: Styrene-butadiene-styrene

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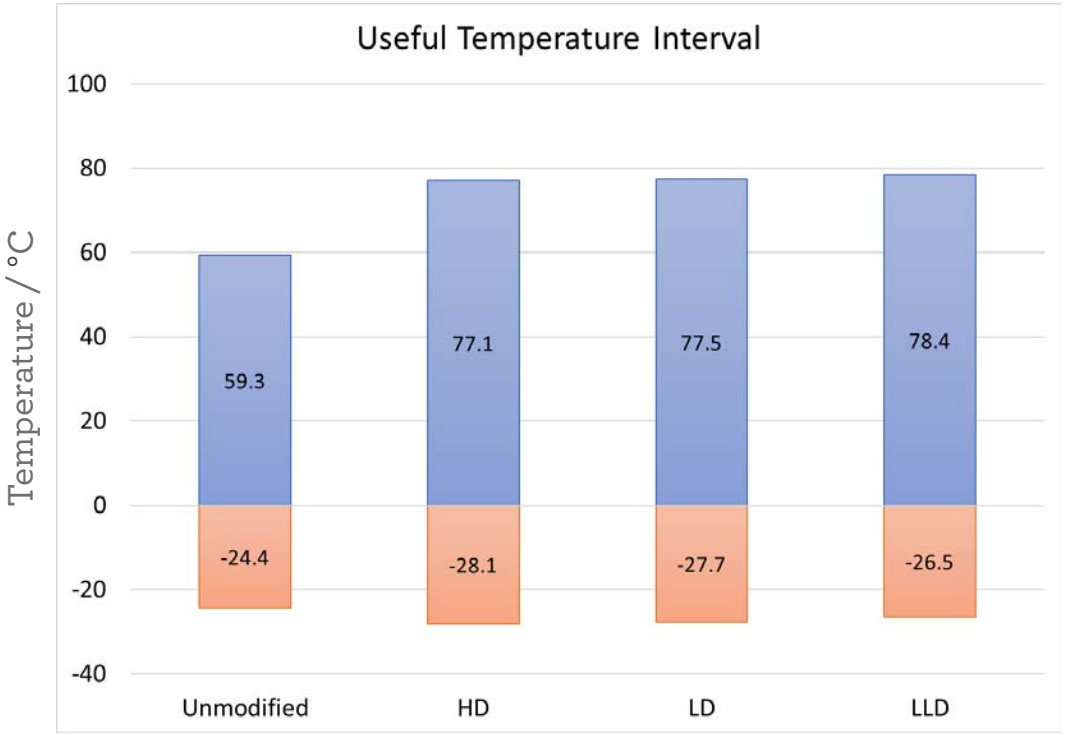
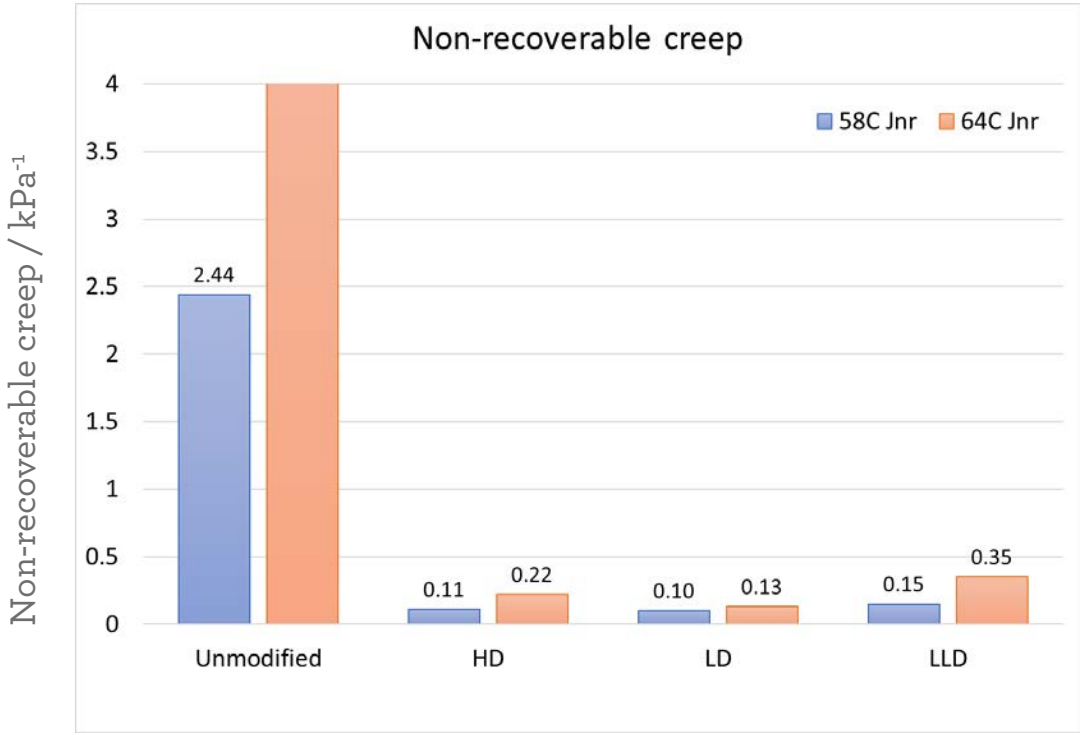
rPE BLENDS MEET LOW TEMPERATURE PERFORMANCE

- No effect of density observed for high temperature performance
- All polymer modified formulations demonstrated improvement of low temperature properties



- No observable effect of density for non-recoverable creep studies



Wet process- 1.5 wt% rPE + wt% RET

DuBois et al. 2022-11 ASU Paving Conference "Enabling more sustainable pavements using recycled plastic and Reactive Elastomeric Terpolymers " November 2022

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FIRST HYBRID PROCESS INSTALLATION

Placed in August 2021

Joint project under Mo DOT and University of Missouri

- MU researchers develop sustainable asphalt using recycled plastic // Show Me Mizzou // University of Missouri
- 'Driving' innovation to help eliminate plastic waste // Show Me Mizzou // University of Missouri
- MoDOT uses asphalt made with plastic on Missouri road (fox2now.com)

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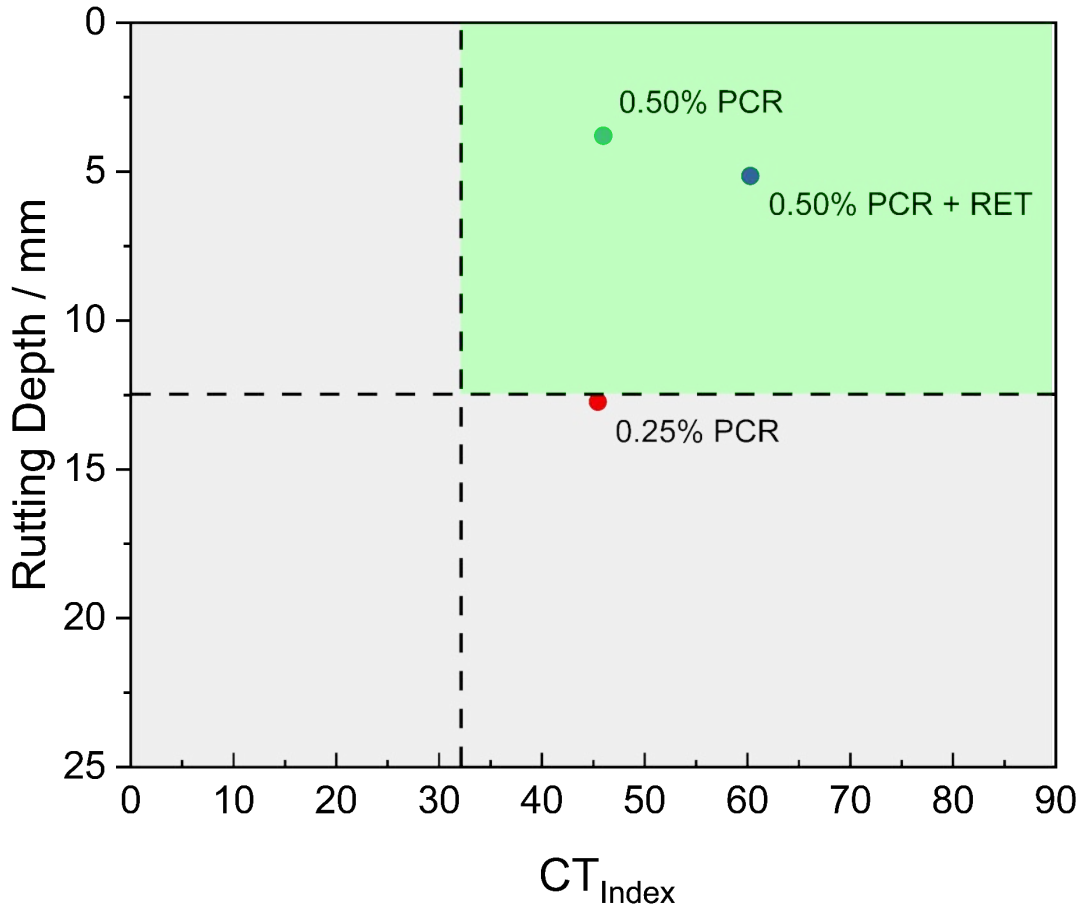
UNIVERSITY OF MISSOURI STUDY

- Balanced Mix Design targets:
  - CT_{INDEX} >= 32
  - HWTT RUT DEPTH @ 20,000 PASSES <= 12.5 mm
- Five iterations to reach to a final balanced mix design
- Contains 30% RAP + 30% SLAG
- All CT values were above threshold
- Best performer involved hybrid process
  - Wet PG64-28 ERET (1.0%)
  - 0.5 wt % dry PCR vs mix
  - 3% Evoflex CA-4 rejuvenator vs binder
    - RET compatibilization enabled removal

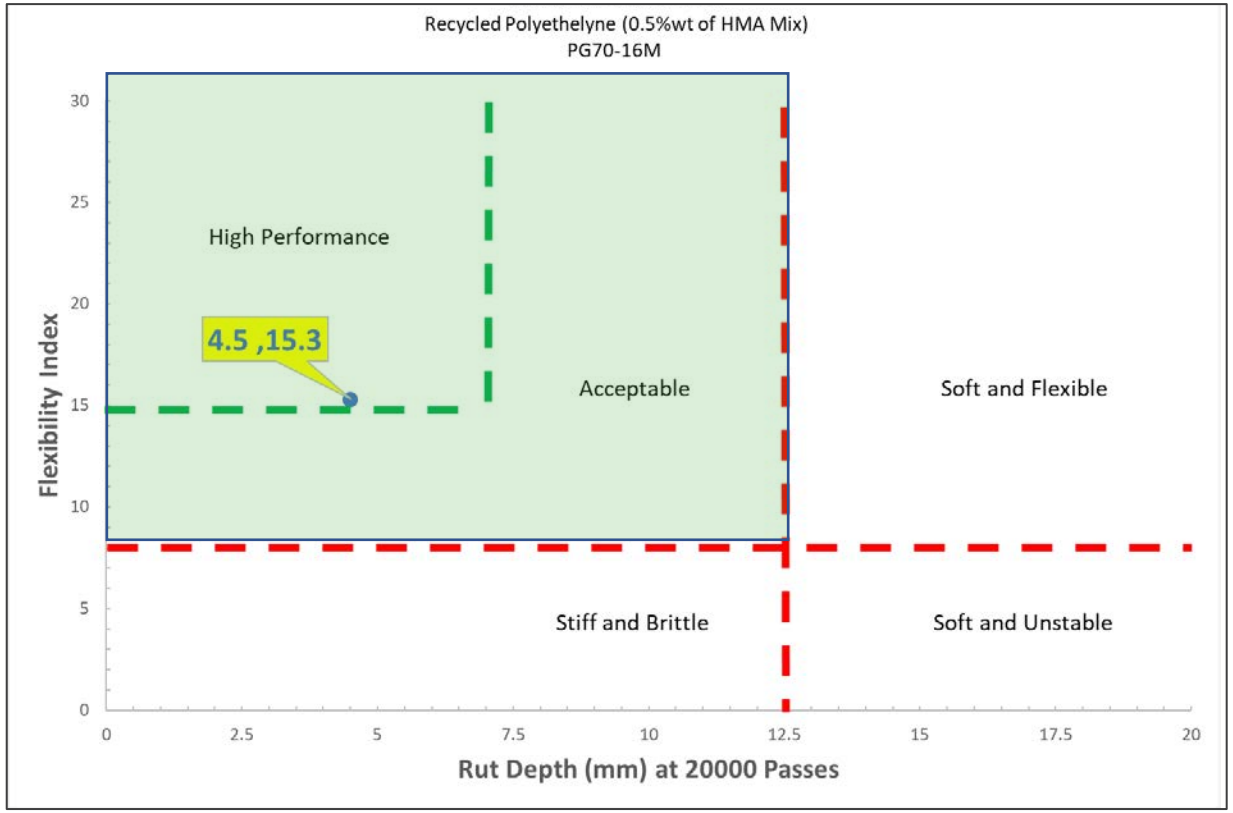


Duan et al. 2021 Fall ACS conference "Fate of Post-Consumer Recyclates in Asphalt Pavement"

EMC'S FIRST HYBRID PROJECT

Buckeye, Arizona January 2022

- 200 mix ton test section
- 1-ton recycled polyethylene (rPE)
  - ~15,000K grocery bags
- Reactive terpolymer (RET) was blending at binder modifier plant
- 0.5% rPE was blended directly into the Hot Mix Asphalt plant via fines return
- Mixture passed all laboratory and post-construction core sample tests.




Local Roads
Local Plastic
Local Jobs
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OTHER SLIDES

DRIVEN PLASTICS


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