

PAVING WITH PLASTICS

RICHARD WILLIS



- Trade Association representing asphalt industry

- NAPA's Mission
 - Support
 - Advocate
 - Advance

**What Is
NAPA?**



Thank you, New Jersey!

Gold Club (50+ Years)

- Weldon Materials Inc., Weldon Asphalt Div.
- Arawak Paving Co. Inc.
- Barrett Asphalt Corp.
- Smith-Sondy Asphalt Construction Co. Inc.

30-Plus Club

- American Asphalt Inc.
- The Walter R. Earle Corp.
- Colas Inc.
- GAF
- Horizon Engineering Consulting
- K&L Gates LLP
- Milano Contracting
- REIVAX Contracting Corp.
- Renda Roads Inc.

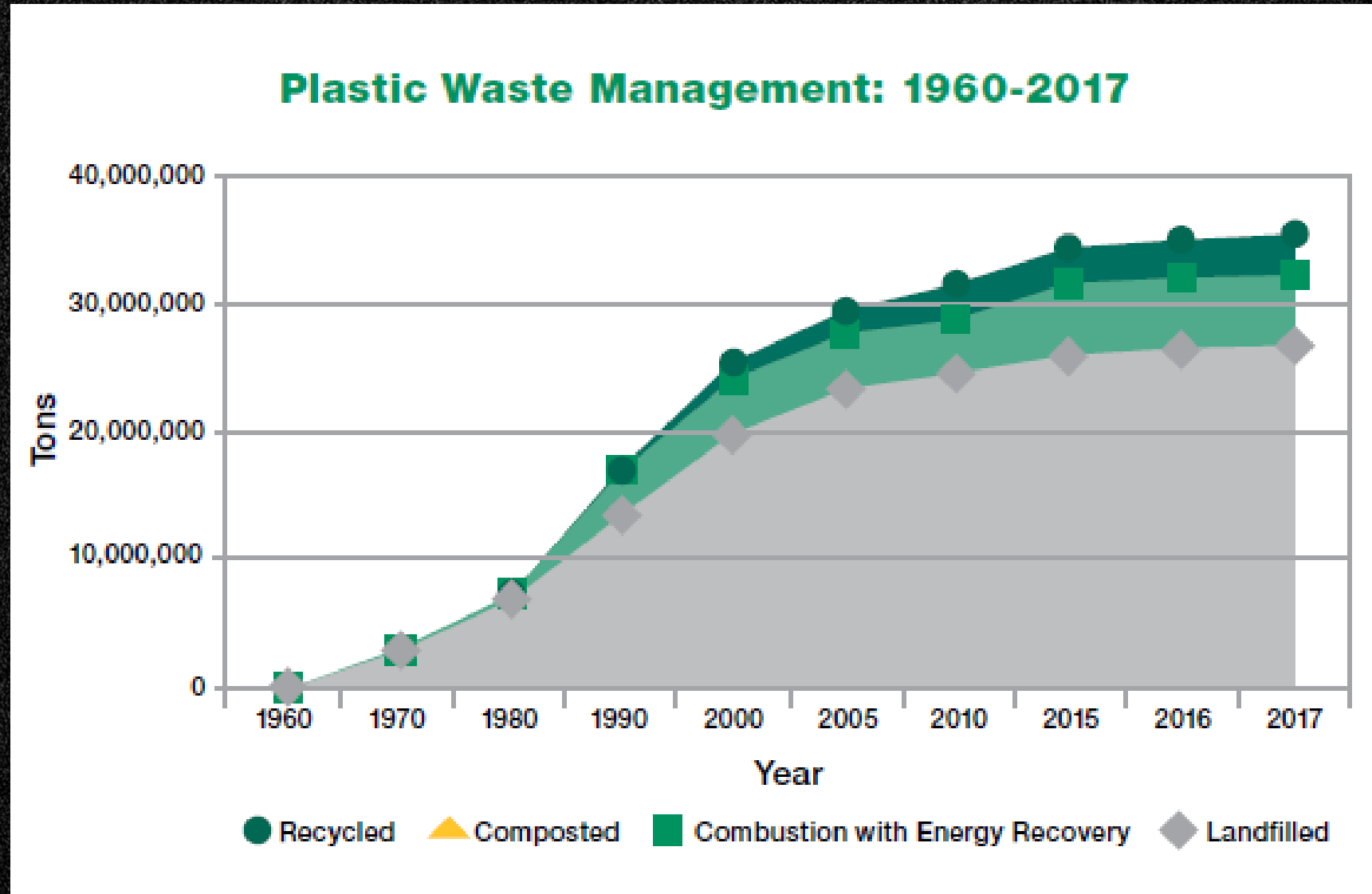
- Three E's
 - Engineering
 - Economics
 - Environment

- FHWA, 2015

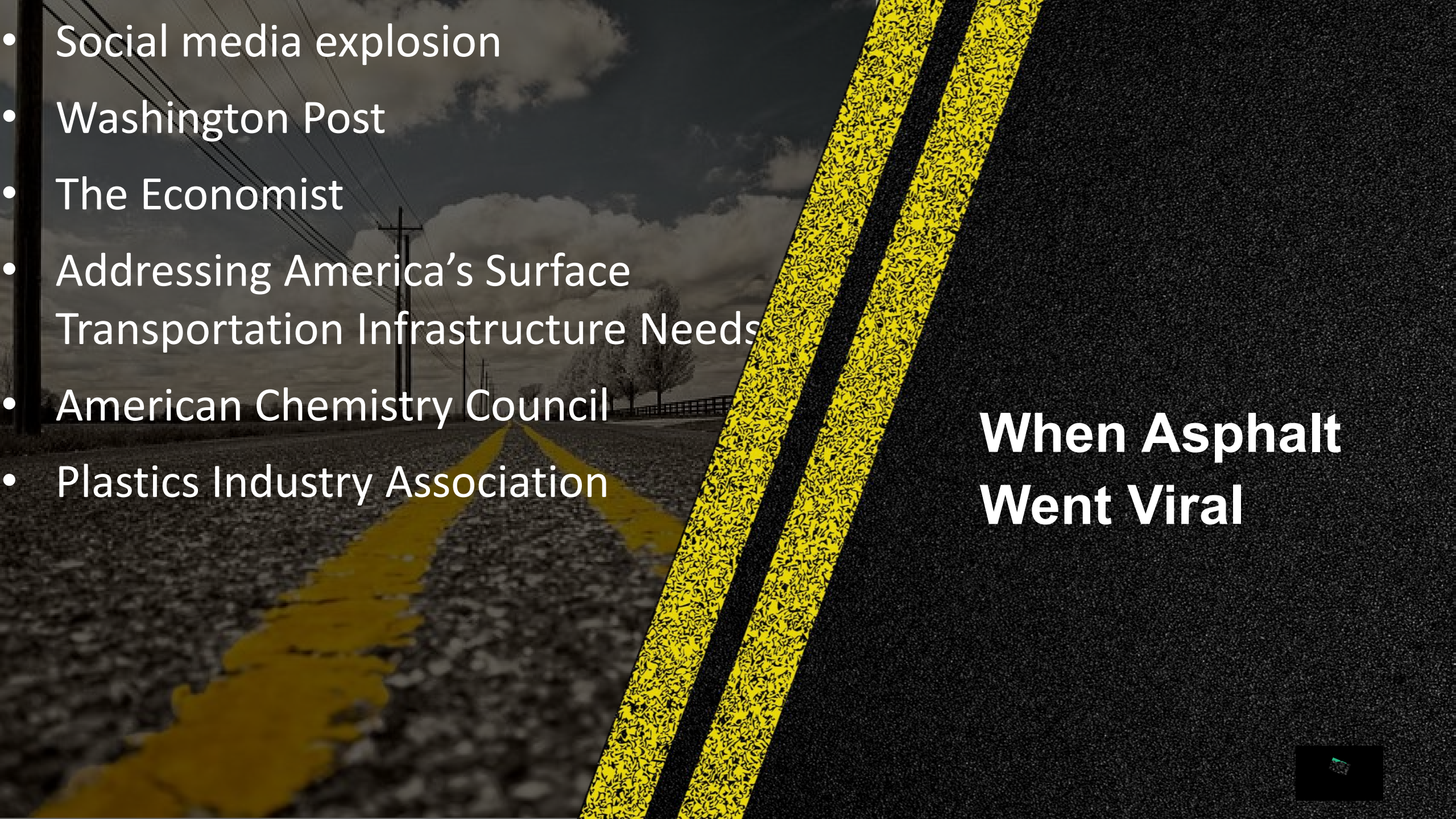
FHWA Recycling Policy



Current Status




(EPA, 2020)

- 
- Social media explosion
 - Washington Post
 - The Economist
 - Addressing America's Surface Transportation Infrastructure Needs
 - American Chemistry Council
 - Plastics Industry Association

When Asphalt Went Viral



- 
- Reclaimed asphalt pavement
 - Recycled asphalt shingles
 - Recycled tire rubber
 - Plastics?

**Recycling
Responsibly**



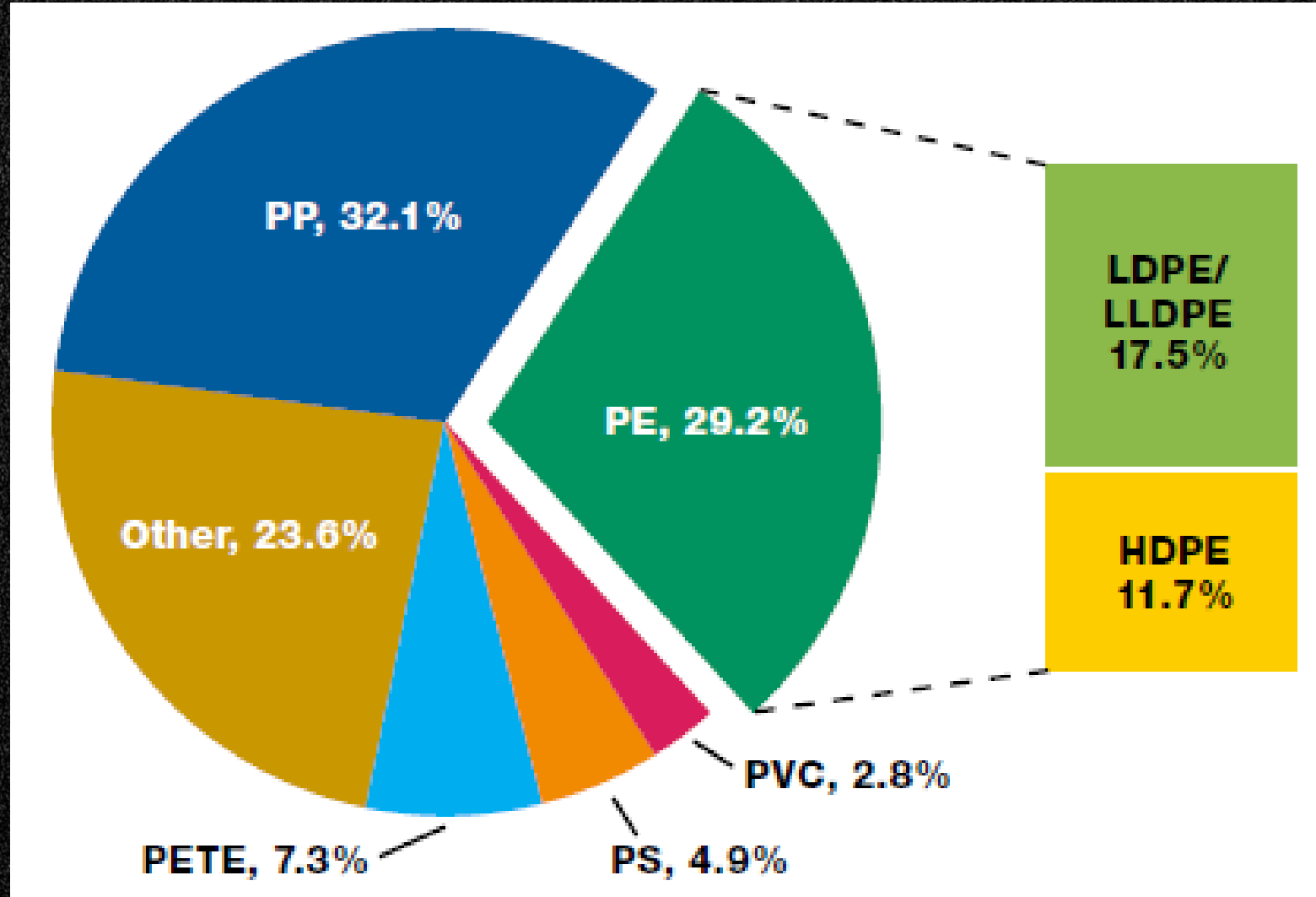
It's Just Plastic, Right...?

Number	Type	Application	Melting Point (F)
1	Polyethylene Terephthalate (PET)	Water Bottles	>482
2	High Density Polyethylene (HDPE)	Plastic bags	266 but can vary
3	Polyvinyl Chloride (PVC)	Pipes	212-500
4	Low Density Polyethylene (LDPE)	Trays	230-248
5	Polypropylene (PP)	Hinges	320-330
6	Polystyrene (PS)	CD Casing	GS at 212
7	Others	Baby bottles	---



NATIONAL ASPHALT
PAVEMENT ASSOCIATION

Plastic Breakdown in MSW



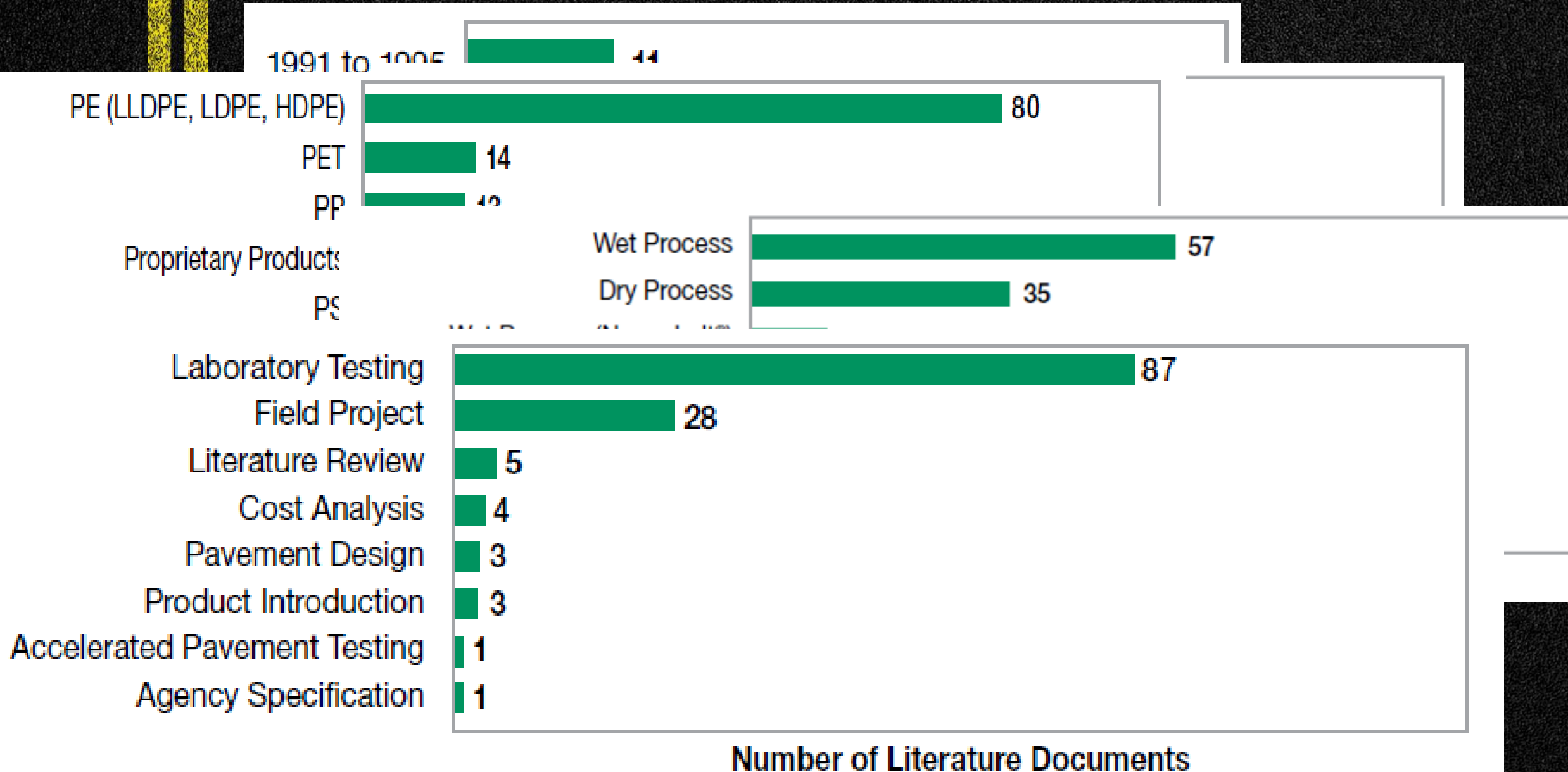
(DuBois, 20202; based on EPA, 2017)

- Plastics Recycling
 - Collection
 - Shredding
 - Washing
 - Decontamination
- Significant investment needed

Plastic Recycling



When In Doubt ... Do A Lit Review

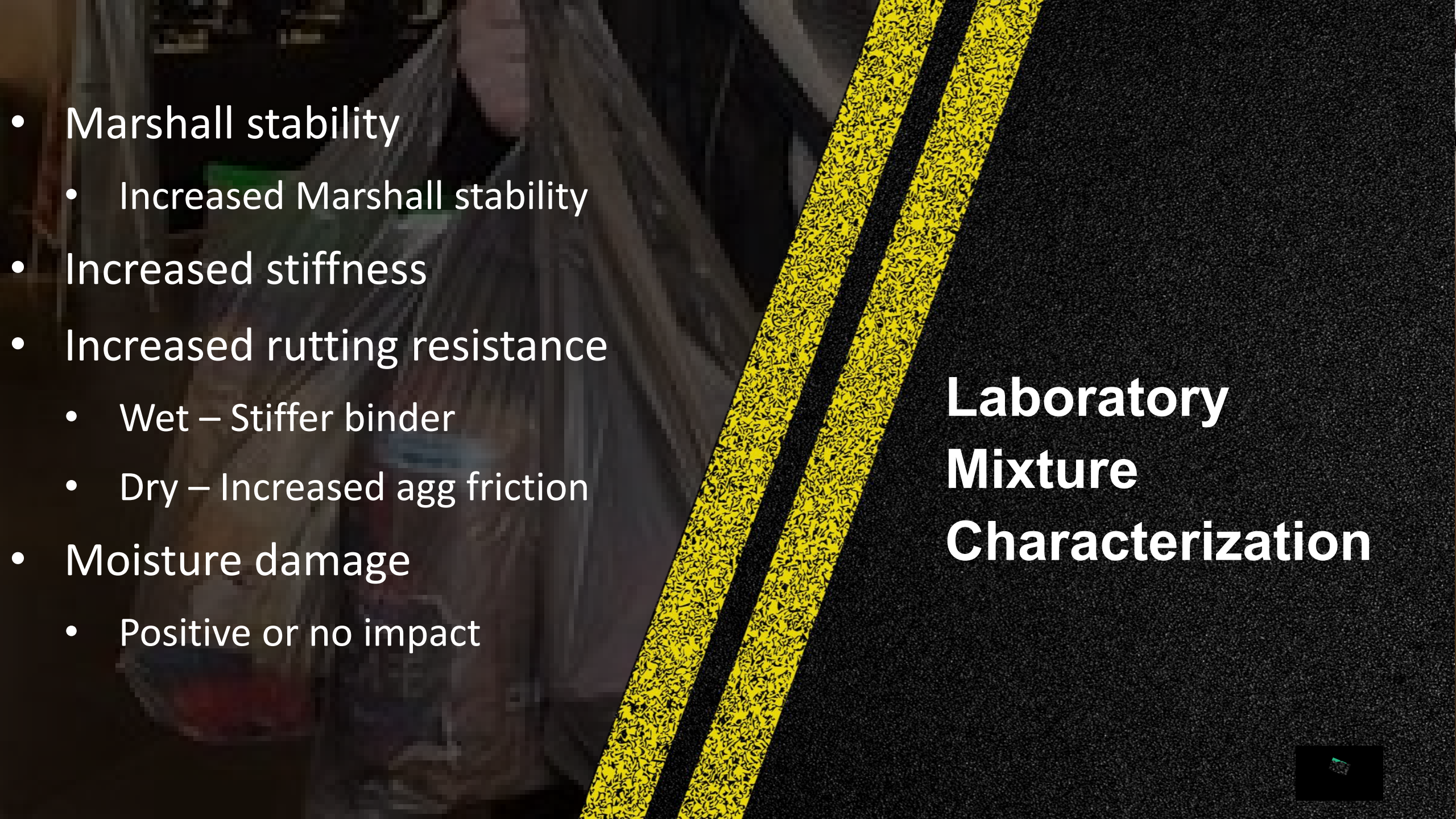


- Wet Process
 - Modification or replacement?
 - 2 – 8% by weight of binder
 - Low melting point needed
- Dry Process
 - Aggregate replacement
 - Mixture modifier
 - Aggregate modifier
 - 0.2 – 1% by agg weight

Wet v Dry

- Binder Performance
 - Plastic stiffens asphalt binder
 - Little data on fatigue
 - Little data on low-temperature
- Phase separation tendencies
 - Additives may help
- PE insoluble in many solvents

Laboratory Binder Testing


- 
- Marshall stability
 - Increased Marshall stability
 - Increased stiffness
 - Increased rutting resistance
 - Wet – Stiffer binder
 - Dry – Increased agg friction
 - Moisture damage
 - Positive or no impact

Laboratory Mixture Characterization

- Most documentation on plant operations relates to Novophalt®
 - High-shear blending unit


Plant Operations



- 
- One study documented construction
 - Difficult to compact
 - Heavy rollers required
 - French construction
 - Temperature sensitive,
but compaction not an issue


Construction



- 
- Two potential concerns in literature
 - Leaching of toxic components
 - No adverse effects (one study)
 - Chlorine-based gases from PVC

**Health &
Safety**



- 
- The background of the slide features a dark, atmospheric photograph of a winding road through a mountainous landscape. A prominent yellow diagonal stripe with a black border runs from the bottom left towards the top right. In the upper right, a large, dark statue of a mythical creature, possibly a dragon or a bull-dog, is visible. The overall tone is dark and moody.
- Environmental Benefits
 - Preservation of resources
 - Reduction of solid waste
 - Emission reduction
 - Environmental Concerns
 - Future recyclability
 - Ongoing work


Environmental



- 200 Field Projects in Literature
 - Improved rutting
 - More cracking
- New field projects
 - India
 - Australia
 - Canada
 - New Zealand
 - And More...

Field Projects



- 
- Sourcing of plastics
 - Methods of incorporation
 - Modifier or replacement
 - Binder characterization
 - Mixture characterization
 - Plant operations
 - Construction
 - H&S
 - Environmental
 - Field performance

**Knowledge
Gaps**



- 
- The background of the slide is a photograph of a road construction site. A yellow road grader is in the foreground, and a worker in a blue uniform is standing next to it. In the background, another yellow machine is visible. The scene is set on a road with trees in the distance. A large, diagonal yellow and black striped graphic element runs across the right side of the image.
- Patience
 - Partnership
 - Communication

**Moving
Forward**



NAPA - IS-142

RECYCLED PLASTICS IN ASPHALT *PART A:*

State of the Knowledge

Richard Willis, PhD
Fan Yin, PhD, PE
Raquel Moraes, PhD

NAPA - IS-142

RECYCLED PLASTICS IN ASPHALT *PART B:*

Literature Review

Fan Yin, PhD, PE
Raquel Moraes, PhD
Anurag Anand

- NCHRP 9-66
- FHWA Project
- Field Projects
 - California
 - Texas
 - Michigan
 - Wisconsin
 - Pennsylvania
 - More...



**What's
Happening**



THANK YOU!

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