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del Asfalto, A.C.



XII CONGRESO INTERNACIONAL
AMAAC
LA FUERZA DE LA UNIÓN



SEMINARIO INTERNACIONAL DEL
ASFALTO

21,22 y 23 SEP/2022

LEÓN, GTO.

CONSERVACIÓN DE LA
INFRAESTRUCTURA VIAL



THE IMPACT OF EMULSIONS IN PAVEMENT PRESERVATION

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OUTLINE

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- 02 Pavement 101
- 03 Pavement Preservation
- 04 Pavement Preservation Materials
- 05 Pavement Preservation Techniques
- 06 Closing Comments



IBEF

International Bitumen Emulsion Federation
ibef.net



IBEF

Introduction and Vision

Introduction: The International Bitumen Emulsion Federation is member driven federation of association membership represented by thirteen regular members associations.

AEMA – USA	AfPA – Australia	AMAAC – Mexico	ABEDA – Brazil
ATEB – Spain	FBS – Germany	HAPA – Hungary	JEAA – Japan
PAPA – Poland	REA – United Kingdom	Sabita – South Africa	SFERB – France
SITEB – Italy , along with twenty-one associate members.			

Vision: The International Bitumen Emulsion Federation is the recognized and acknowledged international reference for bitumen emulsion technology enhancement and information exchange.



IBEF

Mission

Promote the efficient, effective, and safe use of bitumen emulsions as viable solution for road maintenance throughout the World.

Collect market information and promotional material used in various emulsion-producing countries and disseminating it for the benefit of all.

Exchange technical information and best practices on standardization, safety standards, production and use of bitumen emulsions.

Actively seek opportunities with existing platforms at international and local levels to provide representation and be the voice for the Bitumen Emulsion Industry.

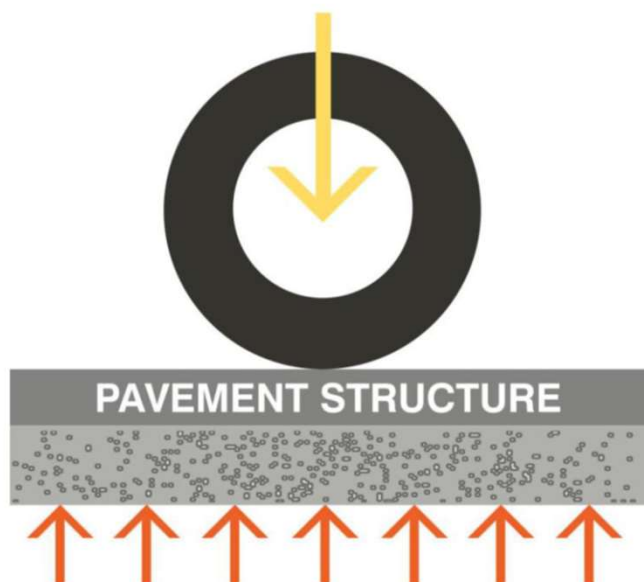
Conduct periodic worldwide technical symposiums dedicated to bitumen emulsions.



PAVEMENT 101



PAVEMENT 101 – PAVEMENT DESIGN



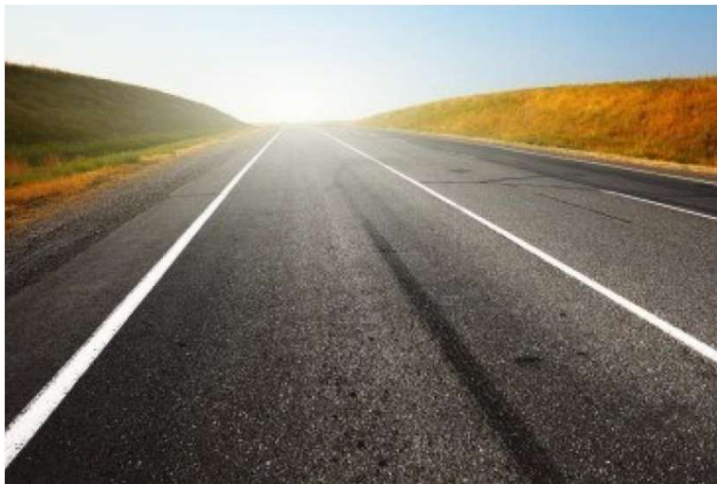
Modern pavements design relies on the premise that the underlying subgrade can support design traffic load if the subgrade is kept dry.

Perpetual pavements are designed to carry expected traffic loads, ensuring the subgrade is preserved and that distresses such as cracking and rutting occur only in the surface.

Pavement preservation is a functional element to performance and longevity of well-designed pavements.

PAVEMENT 101 – PAVEMENT DETERIORATION

Asphalt pavements deteriorate in two ways:



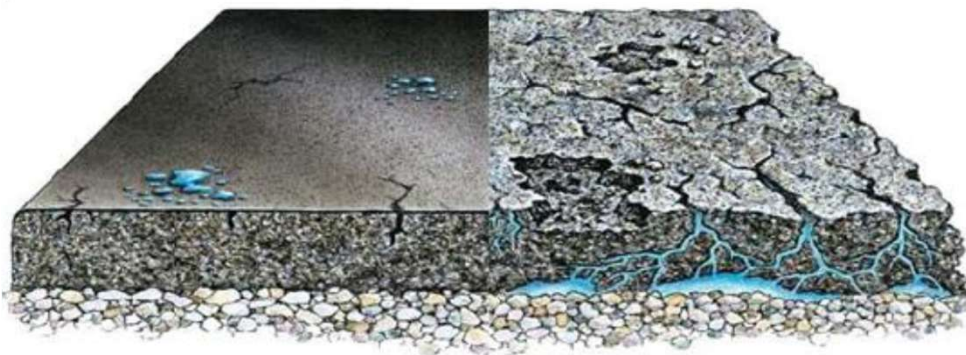
Oxidizing effects of
sun and water



Fatigue from heavy
wheel loads

PAVEMENT 101 – PAVEMENT DETERIORATION

Impact of Sun and Water



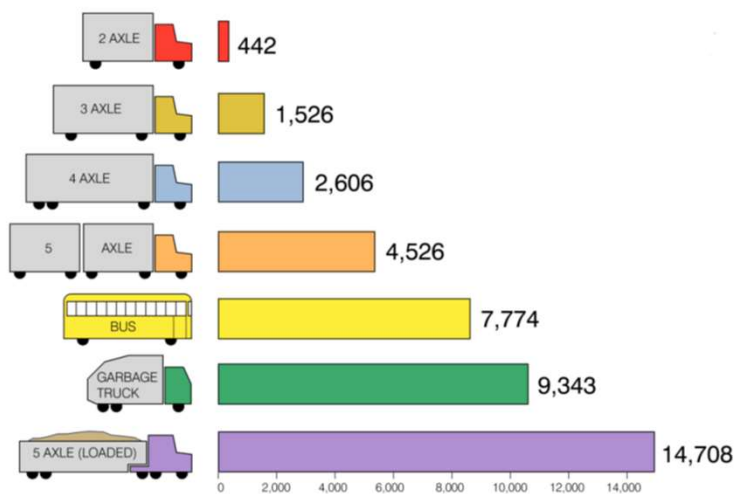
Thermal degradation from continuous exposure to direct sunlight degrades the pavement surface allowing ingress of water into the pavement structure.

Water weakens the soil beneath the pavement while traffic applies the loads that stress the pavement past the breaking point.

Eventually the pavement begins to express fatigue in the form of cracking followed by loss of pavement between cracks leading to pavement failure.

PAVEMENT 101 – PAVEMENT DETERIORATION

Impact of Heavy Loads

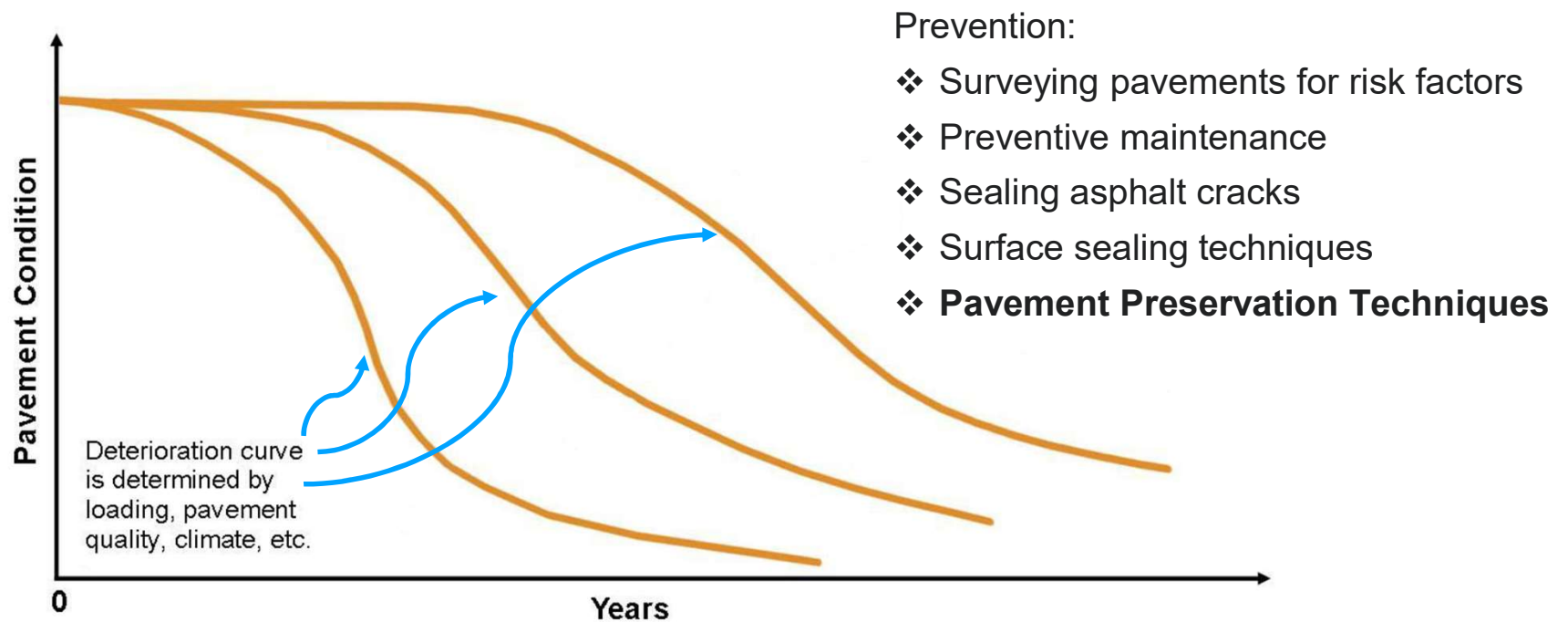


COMPARATIVE VEHICLE PAVEMENT STRESS
(S-10 BLAZER = 1 VEHICLE UNIT)

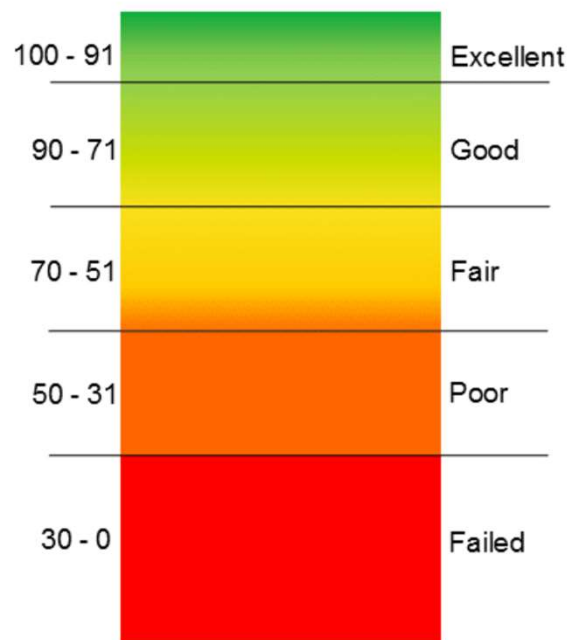
Traffic is also a major contributor to pavement deterioration. Combined with degradation from the sun and water effects, traffic accelerates pavement deterioration.

Insufficient pavement structure to support traffic demand is always a concern, normal deterioration due to traffic is to be expected.

PAVEMENT DETERIORATION CYCLE



EVALUATION OF PAVEMENTS: PCI



Developed by the U. S. Army Corp of Engineers during World War II and standardized by ASTM, the Pavement Condition Index (PCI) is an objective and rational basis for determining pavement condition and establishing maintenance priorities.

EVALUATION OF PAVEMENTS: PCI



PCI = 100
Excellent 100-91



PCI = 70
Fair 70-51



PCI = 51
Fair 70-51



PCI = 38
Poor 50-31



PCI = 28
Failed 30-0



PAVEMENT PRESERVATION

PAVEMENT PRESERVATION / PRESERVACIÓN DEL PAVIMENTO

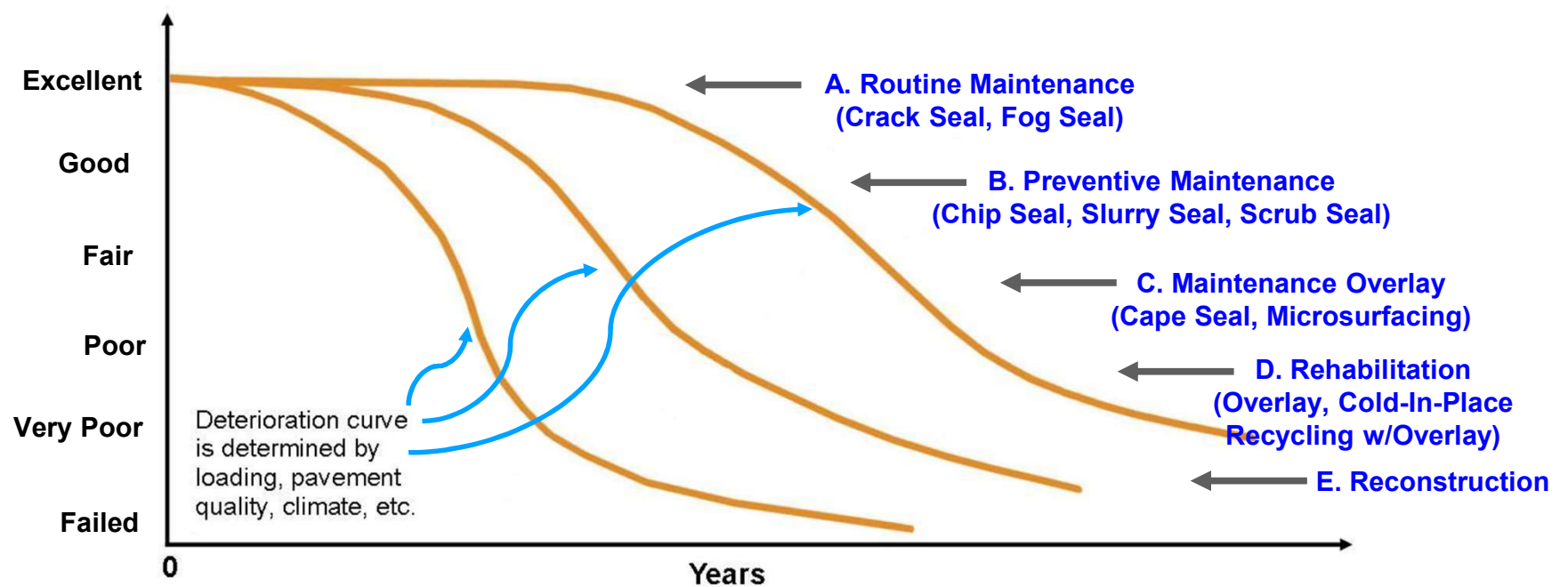
Applying the **CORRECT TREATMENT**
Aplicar el **TRATAMIENTO CORRECTO**

to the **CORRECT PAVEMENT**
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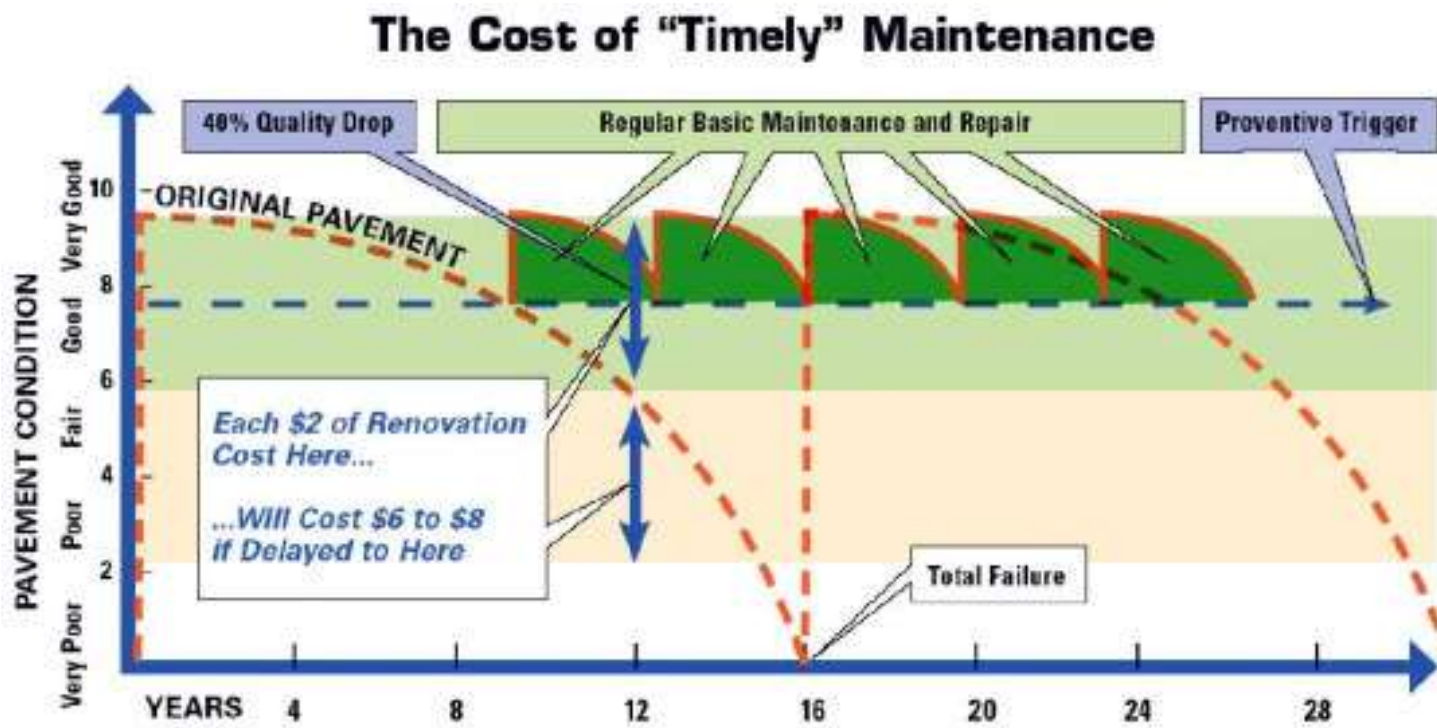
at the **CORRECT TIME**
en al **MOMENTO CORRECTO**

using the **CORRECT MATERIALS**
usando los **MATERIALES CORRECTOS**

PAVEMENT PRESERVATION TIMING



PAVEMENT PRESERVATION CONCEPT





PAVEMENT PRESERVATION MATERIALS

BITUMEN/ASPHALT BINDERS

Two common forms of bitumen/asphalt binder used in pavements construction. Hot-Asphalt and Liquid-Asphalt

Liquid Bitumen: Cutback and Emulsified Bitumen

Cutback and emulsified bitumen are called liquid bitumen because they are liquid at ambient temperatures.

Cutback bitumen is made by adding a diluent (typically a petroleum distillate) to refined bitumen.

Cutback bitumen has been reported to be used in road construction since the 1800s. The 1930s saw major expansion of cutback bitumen use.

Emulsified bitumen a mixture of two normally immiscible components (bitumen and water) and an emulsifying agent (soap is an example) was placed in 1903, the first bitumen emulsion patent was filed in 1906.

Use of bitumen emulsions has grown considerably over the past century.

Liquid Bitumen Products

Gasoline or Naphtha	Kerosene	Slowly Volatile & Non-Volatile Oils	Water And Emulsifier	Water And Emulsifier
Bitumen	Bitumen	Bitumen	Bitumen	RC, MC, or SC Liquid Bitumen
Rapid Curing (RC)	Medium Curing (MC)	Slow Curing (SC) Road Oils	Bitumen Emulsion	Inverted Emulsified Bitumen

THE COMMON TREND IS REDUCTION OF CUTBACK USAGE

- ❖ Engineers and environmentalists are concerned with the use of cutback bitumen for three primary reasons: **environmental issues**, **fire hazards** and **potential health risks** posed to construction workers.
- ❖ Since 2016, jurisdictions in CN and the US have adopted practices to reduce VOC emissions from the road construction sector. This involves restrictions on use of cutback bitumen or prohibition of use.
- ❖ **Canada:** In 2017 CN issued a Code of practice for reduction of VOC emissions from cutback and emulsified bitumen. Reduction of VOC emissions by at least 40% over a six-year period.
- ❖ **Mexico:** In MX use of cutback is allowed, and is included in the Mexican specifications, however, there is limited to no current use. PEMEX ceased production; private concerns produced with several safety issues. Emulsified bitumen filled the void with a switch to emulsified bitumen in the early 1990s.
- ❖ **Nordic Region:** “In the Nordic region the use of cutbacks has been reduced from about 10 kt in 2010 to virtually nothing in 2021.” Source Nynas.
- ❖ **France:** Surface dressing is now around 140 million sq.m per annum, out of which not more than 10 to 15% using cutback (fluxed) bitumen (high flash point cutter; no kerosene). The main reason for using cutback bitumen is resistance to change by road agencies and contractors.
- ❖ **New Zealand:** Waka Kotahi NZ Transport Agency changing procurement of hot cutback bitumen to use of bitumen emulsion in highway sealing operations Technical advice note #21-07 (11 June 21).

EMULSION ENVIRONMENTAL ADVANTAGES

- ❖ Less energy consumption which is a major part of the cost borne by the road industry.
- ❖ Saving energy therefore means costs savings that will be transferred to the owner's and to the global community.
- ❖ Fuel or gas savings will result in a reduction in CO₂ emissions.
- ❖ No negative influence on HSE compared to standard bitumen.
- ❖ Extending the service life of the end product in which emulsion is used is a critical tool for reducing the environmental impact of bitumen.
- ❖ To maximize emulsion's service life, the correct design, use and planned maintenance is necessary especially for roads.



PAVEMENT PRESERVATION TECHNIQUES

CRACK SEALING

- ❖ Routine Maintenance
- ❖ Cleaning and Sealing
- ❖ Prevents intrusion of water and incompressible materials.
 - Retards deterioration
 - Retards cupping deformation
 - May extend life by 3 to 4 years



EMULSION PAVEMENT PRESERVATION ALTERNATIVES

The six most common bitumen emulsion techniques include:

Prime Coats/Tack Coats

Seal Coats (Fog Seal, Rejuvenating Fog Seals, etc.)

Surface Treatments (Chip Seal, Double Chip Seal, Scrub Seal etc.)

Cold-Mix

Slurry Surfacing/Cape Seal

Micro Surfacing

Agencies may use different versions of these techniques and combinations of different techniques in multiple layers.

Innovations in Bitumen Emulsion applications.

BITUMEN EMULSION ALTERNATIVES

Prime Coats: priming with modified rejuvenation emulsion (scrub)

Tack Coats: Mohammad, L. N. (2012). *Optimization of tack coat for HMA placement* (Vol. 712). Transportation Research Board. (NCHRP 9-64)

Trackless Tack – “Hard Bitumen Emulsion” – dual spray bars (COLAS)



BITUMEN EMULSION ALTERNATIVES

Surface Treatments:

- ❖ Fog Seal
- ❖ Rejuvenating Fog Seal
- ❖ Chip Seal – Standard
- ❖ Chip Seal – Modified
- ❖ Chip Seal – High Float
- ❖ Multi-layer Chip Seal
- ❖ Chip and Fog



FOG SEAL

Light application of diluted, slow-setting asphalt emulsion without aggregate cover

- ❖ Seals pavement
- ❖ Inhibits raveling
- ❖ Enriches hardened/oxidized asphalt
- ❖ Provides delineation with shoulder



BITUMEN EMULSION ALTERNATIVES

Seal Coats: Chemical and Pickering (particle stabilized) Emulsions



BITUMEN EMULSION ALTERNATIVES – SURFACE TREATMENT

Surface treatments are typically used to:

- ❖ Seal cracks
- ❖ Waterproof surface
- ❖ Improve friction
- ❖ Improve rideability
- ❖ Rejuvenate surface



BITUMEN EMULSION ALTERNATIVES

Scrub-Seal

Polymer Modified
Rejuvenator Provides:

- ❖ Surface Seal
- ❖ Crack Fill
- ❖ Corrects severe pavement distress
- ❖ Rejuvenation
- ❖ Renews surface friction
- ❖ Extends pavement life by 5-7 years
- ❖ Can be used as an interlayer



BITUMEN EMULSION ALTERNATIVES

Chip Seal

Application of asphalt and aggregate chips rolled onto the pavement

- ❖ Seals pavement
- ❖ Enriches hardened/oxidized asphalt
- ❖ Retards reflective cracking on HMA overlays
- ❖ Improves surface friction



BITUMEN EMULSION ALTERNATIVES

Slurry Seal

Mixture of well-graded aggregate & slow setting asphalt emulsion

- ❖ Type I: Seals surface cracks
- ❖ Type II: Corrects raveling/oxidation
- ❖ Type III: Fills minor surface irregularities and restores friction



BITUMEN EMULSION ALTERNATIVES

Microsurfacing

Mixture of high-quality aggregates and polymer-modified emulsion binder

- ❖ Inhibits raveling and surface oxidation
- ❖ Improves surface friction
- ❖ Fills ruts/minor surface irregularities
- ❖ Seals pavement surface



BITUMEN EMULSION ALTERNATIVES

Highly Modified Asphalt (HiMA) Microsurfacing

*Innovative technique using
asphalt binder modified
with > 6% SBS polymer*

- ❖ Conventional
Microsurfacing equipment
- ❖ High temperature tolerant
- ❖ More damage resistant
- ❖ Residential and
commercial preferred



BITUMEN EMULSION ALTERNATIVES

Cold Mix: in remote areas and to continue paving during nonattainment periods.





CLOSING COMMENTS

PAVEMENT PRESERVATION / PRESERVACIÓN DEL PAVIMENTO

Applying the **CORRECT TREATMENT**

Aplicar el **TRATAMIENTO CORRECTO**

to the **CORRECT PAVEMENT**

al **PAVIMENTO CORRECTO**

at the **CORRECT TIME**

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using the **CORRECT MATERIALS**

usando los **MATERIALES CORRECTOS**

SUMMARY

- ❖ Increased traffic loads demands longer lasting pavements, proper design and preservation are key. Triple Bottomline!
- ❖ **Environmental demands are setting the stage for future materials and paving concepts.**
- ❖ Pavement maintenance and preservation are key to success of pavement longevity.
- ❖ Asphalt emulsions offer the widest variety of materials and techniques to meet current and future demands.

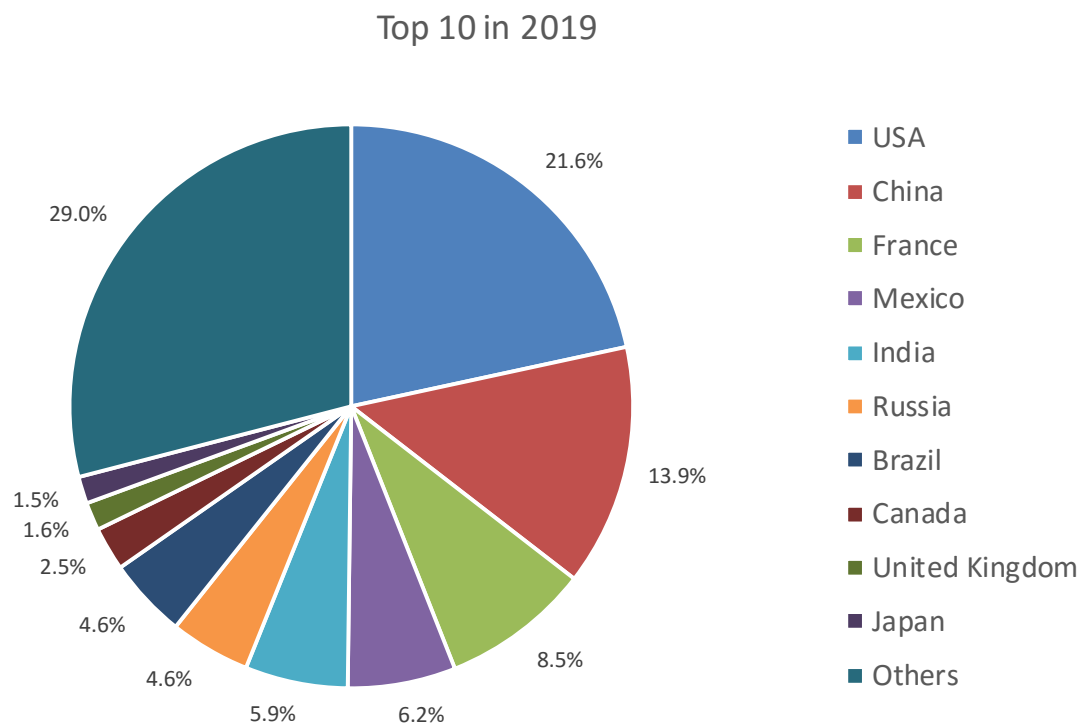
BITUMEN EMULSION USE WORLDWIDE

Results of IBEF 2019 survey

- Bitumen 137 countries 111.1 million MT
- Emulsion 99 countries 8.7 million MT

Top Emulsion Producers

- Top 10 71%
- Top 4 50%



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ERGON

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Resources

- <https://savemyroad.com/>
- <https://www.ibef.net/es>
- <https://roadresource.org/>
- <https://www.aema.org/>
- <https://www.slurry.org/>



THANK YOU

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