Bio-based Asphalt Rejuvenator

Innovations in sustainable asphalt pavement.

Agency – Vendor Partnership

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A History of Asphalt pavement.

Asphalt occurs naturally in both lakes and in solid rocks.

Trinidad's pitch lake

By Daniel Tzvi - https://commons.wikimedia.org/w/index.php?curid=1960710

Slide 4

By Daniel Tzvi - https://commons.wikimedia.org/w/index.php?curid=1960710

Cheron Calder, 2023-03-24T23:20:32.870

The word asphalt comes from the Greek “asphaltos” meaning “secure.”

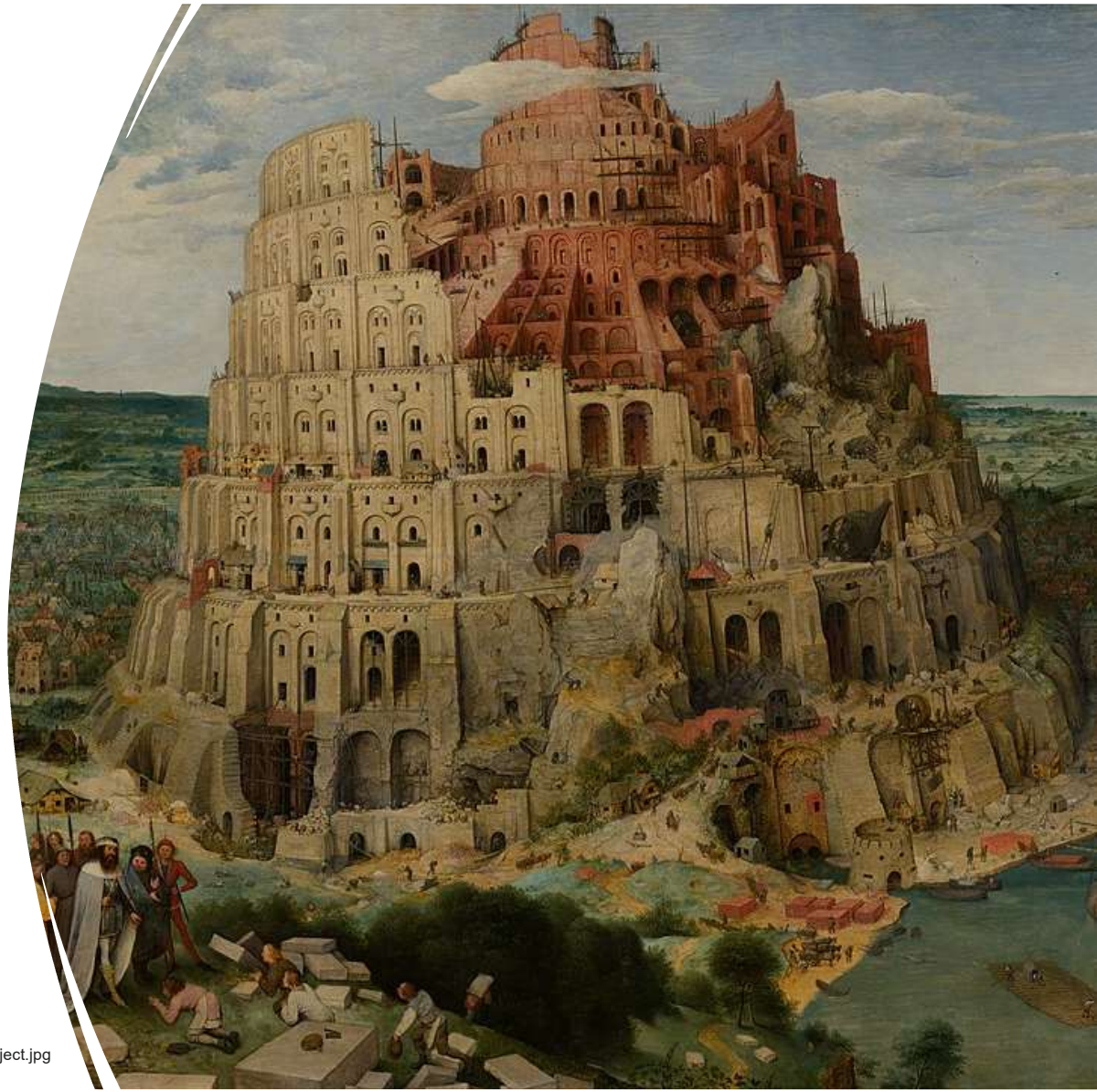
Waterproof baths and water tanks.

Seams of ships.

Credit https://vaasphalt.org/the-history-of-asphalt/

Babylon was the first known use of asphalt to build roads in 625 B.C.

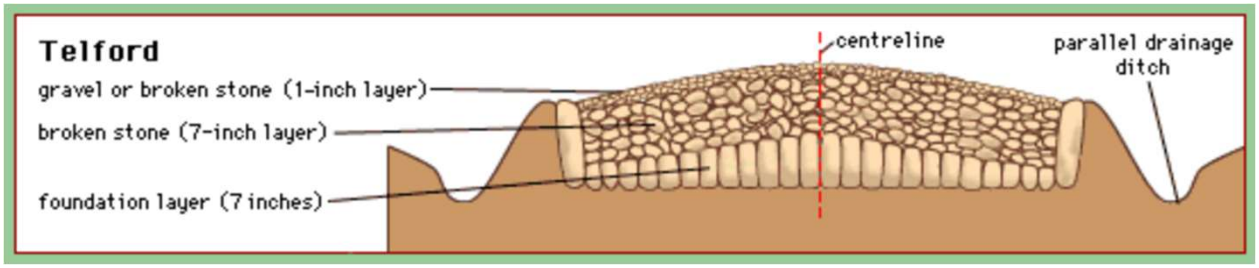
"And they had brick for stone and bitumen for mortar.” Genesis 11:3



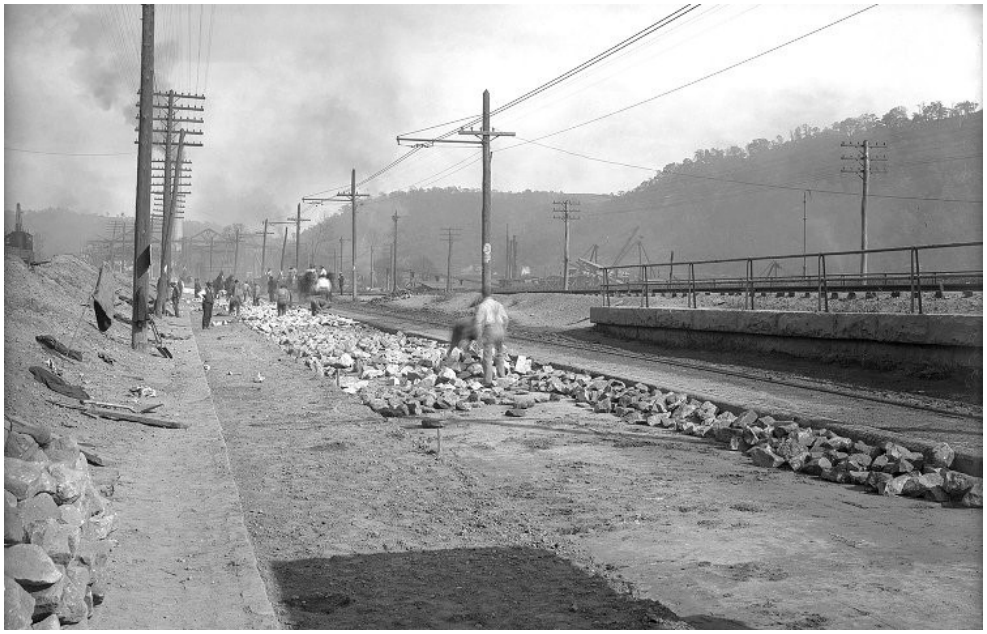
Pieter Bruegel the Elder - The Tower of Babel (Vienna) - Google Art Project.jpg

“Telford Pitching”
Thomas Telford (1757 – 1834) a Scottish Engineer, used high quality cubical stone blocks.

Masons were used to camber the surface of the blocks.

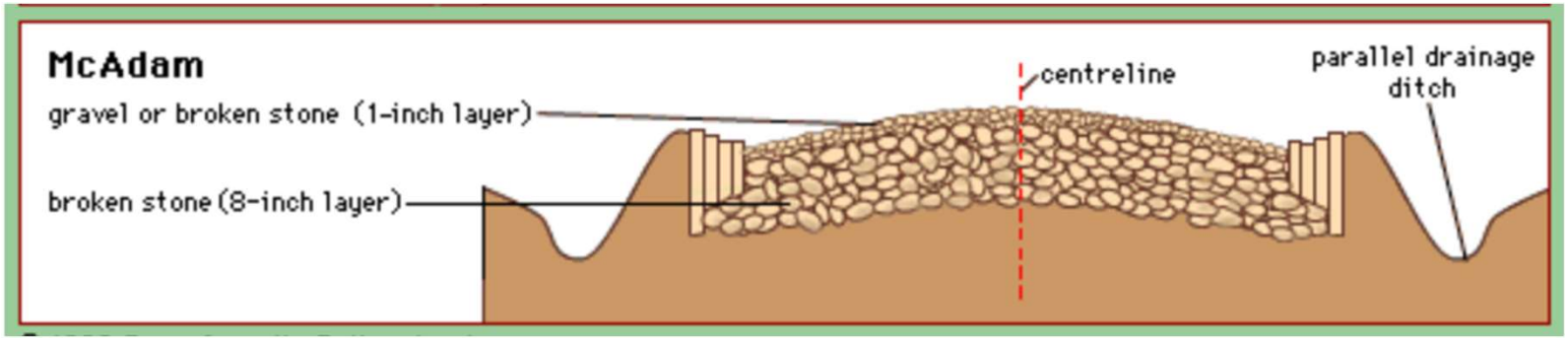


https://kids.britannica.com/students/assembly/view/19288



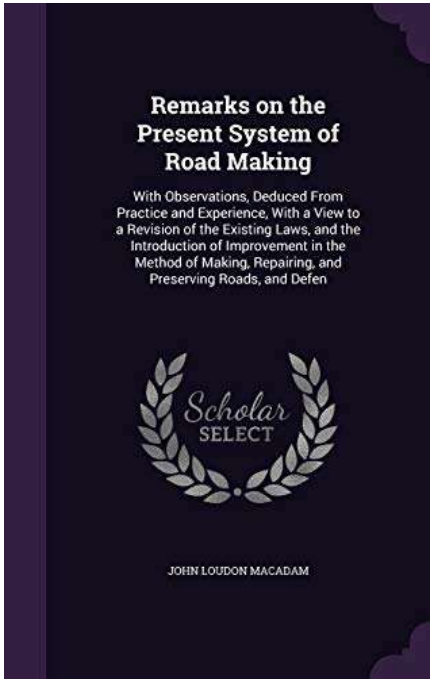
Rakeman – First American Macadam Road.jpg

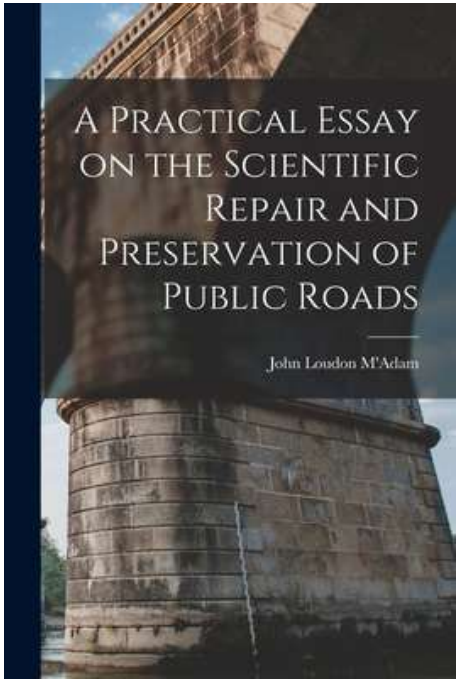
John McAdam (1756 – 1836) the Scottish Commissioner for Paving and Surveyor General of Roads, for the Bristol Turnpike Trust, pioneered the technique of using shallow, compacted crushed stone layers.



"Macadamized" roads, used stone dust and water to fill the cracks between stones which resulted in a smoother surface.

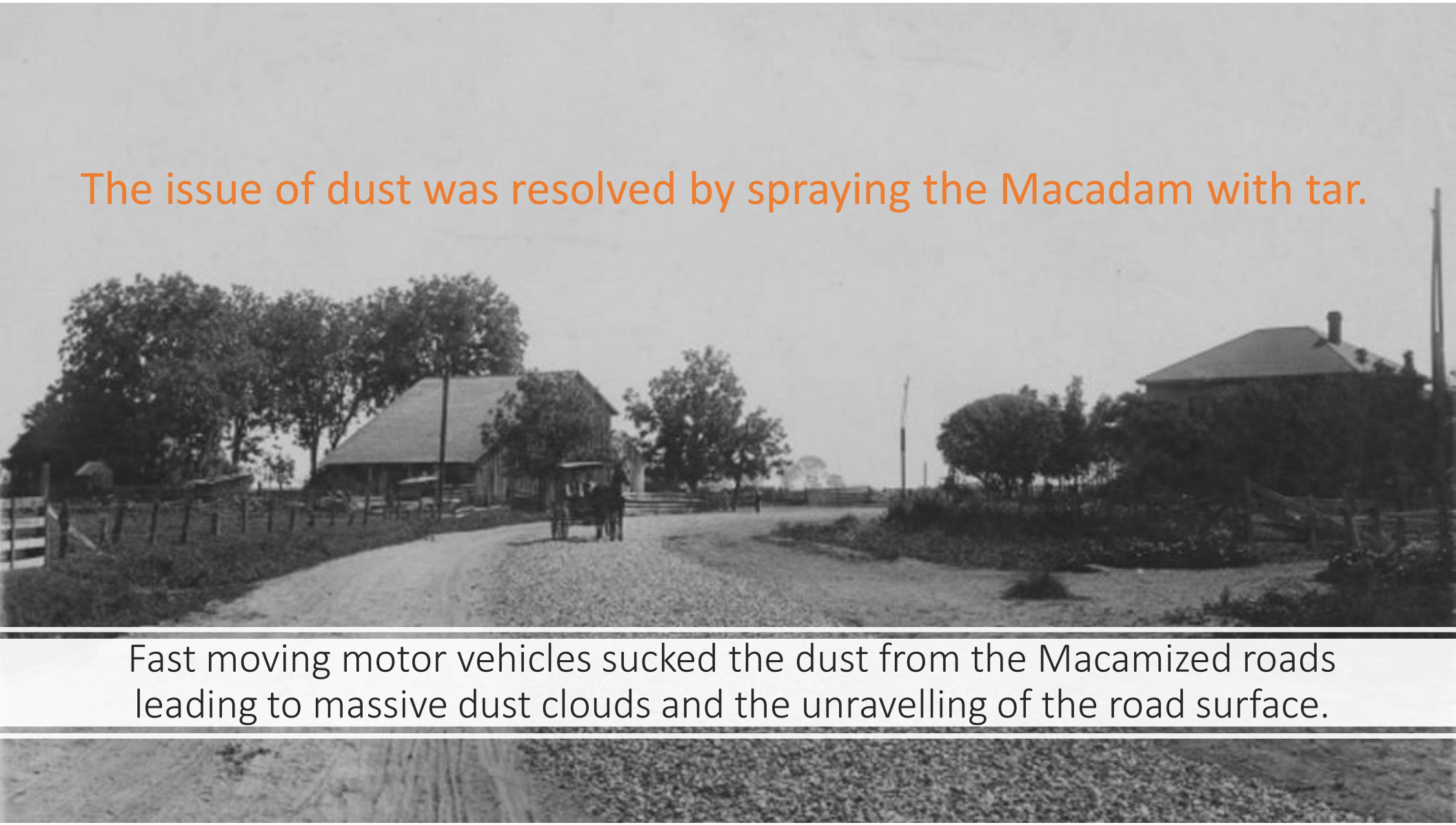
The cambered structure ensured that water would drain off the road.





The Macadam method was adopted globally.

The issue of dust was resolved by spraying the Macadam with tar.



Fast moving motor vehicles sucked the dust from the Macamized roads leading to massive dust clouds and the unravelling of the road surface.

In 1902 Edgar Purnell Hooley patented the process of heating tar, adding slag and crushed stones to create a road surface that could be steam compacted smooth.

https://www.bbc.co.uk/nottingham/content/articles/2009/07/03/edgar_hooley_tarmac_feature.shtml

Accidental Discovery of Tarmac

In 1901, Hooley was walking in Denby, Derbyshire, when he noticed a smooth stretch of road close to an ironworks. He was informed that a barrel of tar had fallen onto the road and someone poured waste slag from the nearby furnaces to cover up the mess.[3]

https://en.wikipedia.org/wiki/Tarmacadam

At the turn of the century, petroleum production expanded to meet the demands of internal combustion engines.

Bitumin a bi-product of petroleum, became more readily available and gradually supplanted the use of tar in Tarmac road construction.

Automobile sales created demand for more and better roads.

WWII sparked innovations in asphalt to provide military aircraft with surfaces that could stand up to heavy loads.

Interstate Highways Act of 1956

$51 billion to states for road construction.

The energy crisis in the 1970s sparked innovations in conservation of natural resources.


How many total lane miles are in the USA (2020)?
8,790,746 lane miles (p/FHWA report 2020)
How many total lane miles are in Washington state (2020)?
168,271 lane miles (p/FHWA report 2020)
What percentage of roads in the US are paved with asphalt?
94%

What is the expected lifespan for asphalt?

Between 10-25 years with preventative maintenance.

"WSDOT has historically had a fix it early fix it thin policy with regard to pavements."

WSDOT preventative maintenance program was initiated in 2010 in response to funding shortfalls.

Initial goal of the preventative maintenance program was to extend useful life of pavement by at least 2 years.

- WSDOT Preventative Maintenance Study – Final Report July 2018

WSDOT defines preventative maintenance as a “planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system . . .

Preventative Maintenance Study Final Report July 2018

Preventative Maintenance Study Final Report July 2018

Crack seal

Chip Seal

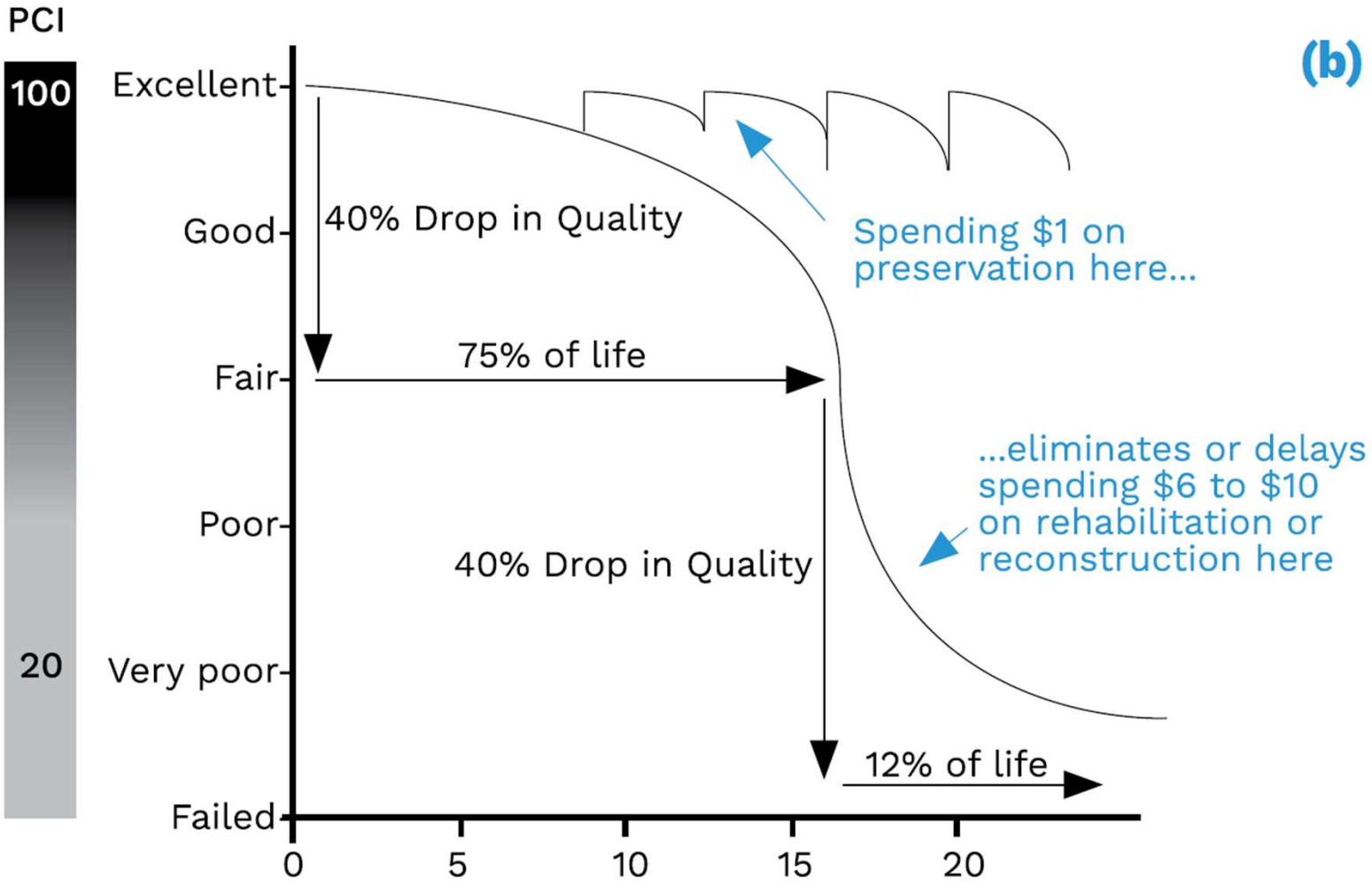
Dig Out

Blade Patch

The “Primary recommendation is that preventive maintenance techniques are best applied when distress is first observed.”

Preventative Maintenance Study Final Report July 2018

Figure 111. OR2a, SR8, the site received an HMA grind/inlay in 2017, C9001, five years after installation.



RePlay Agricultural Oil Seal and Preservation Agent 2017. Figure 1b, Galehouse et al. 2006


Preventative maintenance should occur before visible signs of distress in the asphalt.

The process of oxidation breaks down bitumen, making the asphalt harden and embrittle.

Major stressors to asphalt:

- UV Rays
- Oxygen
- Weather conditions, especially rain and freeze-thaw cycles
- Drainage issues
- Traffic loads
- Poor quality materials or poor workmanship

2019 Study

Found that, “rejuvenating seals are a low-cost option for preventing or retarding the surface deterioration of pavements…

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IN THIS ISSUE

National Center for Asphalt Technology NCAT at AUBURN UNIVERSITY

Evaluation of Rejuvenating Fog Seals

Delta Mist™ rejuvenator is applied to Section S3 of the NCAT Test Track.

A rejuvenating fog seal is a type of pavement preservation treatment applied to an existing asphalt pavement surface to preserve its functional and structural integrity and delay a more costly rehabilitation treatment in the near future.

A fog seal consists of a slow setting asphalt emulsion (e.g., SS-1, SS-1h, CSS-1 and CSS-1h) diluted with one to four equal parts of water and applied at rates between 0.06 - 0.13 gal/yd^2 on an existing pavement surface without a cover aggregate. It is intended to penetrate into the surface pores of the pavement to seal very small cracks and surface voids as well as coat surface aggregate particles. Pavement surfaces with high void contents are more susceptible to oxidative aging due to greater exposure of the binder to air and higher temperatures. The asphalt binder becomes stiffer, and consequently, more brittle through oxidation, leading to deterioration.

Rejuvenators can be added to fog seals to treat raveled and aged pavements by improving penetration into the pavement and improve the flexibility of the aged binder. Rejuvenators are petroleum or bio-based oils with chemical and physical characteristics selected to restore properties of the aged asphalt binder in the surface layer. Adding a rejuvenator to a fog seal reduces the likelihood of cohesive failure within the asphalt binder film and can slow the rate of aging caused by oxidation. For

Table 2. Performance-based classification of rejuvenating products.

Grade	Surface Treatment Product
A	BioRestor®
	RePlay™
B	Regen-X™
	Delta Mist™
	Reclamite®
C	CMS-1PF
	RejuvaSeal

Why choose a bio-based solution?

- Bio-based products are derived from plants and other agricultural, marine, and forestry materials.

- Bio-based products provide renewable alternatives to petroleum products.

- Bio-based alternatives perform as well or better than the petroleum-based alternative.

RePLAY west

Asphalt-Rejuvenating Sealer

RePlay is a penetrating fog seal that restores asphalt strength and flexibility, retarding the growth of cracks and slowing the unravelling of the asphalt surface.

RePlay is:

- 88% biobased, mostly soybean oil
- 12% recycled Styrofoam.

RePlay restores asphalt elasticity and strength.

RePlay penetrates the surface of asphalt up to 1.25”.

RePlay restores the oil in the bitumen lost to oxidation.

Polymers from the Styrofoam bind to the asphalt mix, restoring its strength.

RePlay extends the useful life of asphalt 5-7 years per application.

RePlay is carbon negative.

RePlay sequesters carbon.

RePlay is clear, it does not increase heat island effect.

RePlay does not create polluting runoff.

RePlay prevents the use of petroleum-based products.

RePlay Value Proposition

- Quick and easy to apply.
- Cures in 30 minutes.
- Clear – no restriping needed.
- 100% non-toxic, bio-based.
- Can be applied in cool temperatures (32 degrees) and at night.
- Cost $2.50 - $3.00 p/SY – Installed.
- Cost reduced 50% when self installed.
- Reapply every 5-7 years.