

PAVEMENT INDUSTRY



MEET OUR TEAM



TERRA PAVE PRODUCTS for PAVEMENT INDUSTRY

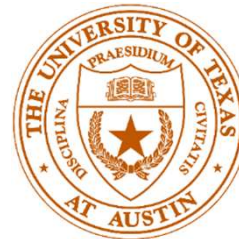
TERRA PAVE PRODUCTS are the ECO-FRIENDLY COST-EFFECTIVE SOLUTIONS to the CHALLENGES in these MARKETS

TERRA PAVE TEAM

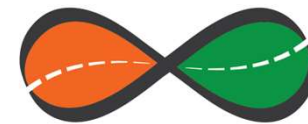
INTRODUCING
TERRA PAVE PRODUCTS



IMPROVING *the* ROADS *of the* WORLD™



TERRA PAVE
INTERNATIONAL



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INNOVATION



Terra Pave International of The University of Texas at Austin (UTA-TPI), has developed **COST-EFFECTIVE**, **ECO-FRIENDLY**, water-based polymer products for **CONSTRUCTING** and **MAINTAINING** roadways, parking lots, airfields, and all other traffic-bearing surfaces.



TERRA PAVE
INTERNATIONAL



EI is the leader in **SUSTAINABILITY** and **REVOLUTIONIZING** the field of pavement materials, zero-energy custom building, solar electric yachts, and solar renewable energy.



EEI/UT-TPI'S PRODUCTS – TERRA PAVE

EEI/UTA-TPI's line of Eco-Friendly, Non-Toxic, Non-Petroleum-based, Non-Corrosive, Non-Hazardous, Waterproof, **Water-based polymer products** address most aspects of pavement construction and maintenance:

- ✓ *Early maintenance/Pavement preservation*
- ✓ *New construction*
- ✓ *Unpaved dirt roads*



EEI/UT-TPI'S PRODUCTS – TERRA PAVE



ROAD MAINTENANCE:

1. *Early asphalt maintenance/Pavement preservation*
 - **Fog Seal – Terra Fog**

NEW ROAD CONSTRUCTION:

1. *New construction - Waterproof layer MC30 replacement*
 - **Prime Coat – Terra Prime**
2. *Unpaved dirt roads, airfields, parking lots, road base, etc..*
 - **Concrete Replacement – Top-Seal White**
3. *Paved roads, highways, runways, etc..*
 - **Concrete Replacement – Top-Seal White**
 - **Wearing Surface/Asphalt Replacement – Top-Seal Black**

TERRA PAVE PRODUCTS – MATERIALS & EQUIPMENT COST SAVING



* Soil Grader



* Soil Compactor



* Water Sprayer

NO SPECIAL EQUIPMENT or HANDLING PROCEDURES REQUIRED

TERRA PAVE → ENVIRONMENTALLY SAFE

- ◆ NON-HAZARDOUS
- ◆ NON-CORROSIVE
- ◆ NON-PETROLEUM BASED
- ◆ NON-TOXIC
- ◆ WATERPROOF
- ◆ IMPROVED BRAKING DISTANCE

COST-EFFECTIVE



TERRA PAVE PRODUCTS – APPLICATIONS



- Cost-Effective
- Non-Hazardous
- Non-Corrosive
- Non-Petroleum Based
- Non-Toxic
- Waterproof

Improved Braking Distance

Environmental Eco-Friendly with No Special Handling

- Asphalt Pavement Roads replacement/repair
- Bifacial Solar Panel Albedo Surface
- Cart Paths
- Farms & Ranches
- Hazardous Material Capping & Sealing
- Horse Farms & Arenas
- Military Convoy & Tank Trails
- Parking Lots / Roads
- Solar Farm Roads / Access Roads
- Water Retention Basins

- Aircraft Runways
- BMX Tracks
- Cars/Vehicles Lots
- Foundations
- Heavy Haul Roads & Mining Roads
- Hydroseed & Hydromulch Tackifier
- Mine Tailings Capping & Reclamation
- Shoulders
- Temporary Roads & Detours
- Pond Linings ... and MUCH MORE

- Base Stabilization
- Bunker Liners
- Driveways/Dirt Roads
- Golf Courses
- Helicopter Landing Pads
- Landfill Capping & Reclamation
- Odor & Vapor Suppression
- Slope Erosion Control
- Walking Trails & Paths



NREL USA DEPARTMENT OF ENERGY – AWARD TOP 10 2019-2020

TOP 10 Eco-Friendly Products 2019-2020

National Renewable Energy Lab
USA Department of Energy



CONGRATULATIONS, ROUND 2 FINALISTS

Team Asoleyo Architectural Solar Cells Herndon, VA	Team Solpaver New Braunfels, TX	Team Terra Pave Austin, TX
Team Integrated Silicon Technologies Pittsburgh, PA	Team SunFlex Solar Tempe, AZ	Team VespSolar Norman, OK
Team Orison Inc. Cody, WY	Team Switched Source LLC Vestal, NY	
Team Resilient Power Systems Georgetown, TX	Team Taka Solar Mountain View, CA	

American-Made SOLAR PRIZE

Winner Solar Prize Round 2 semifinalist

October 4, 2019

TERRA PAVE PRODUCTS

On behalf of the National Renewable Energy Laboratory (NREL), the American-Made Challenges Prize Team would like to congratulate Solar Prize Round 2 semifinalist! ECOLOGICAL ESTATES LLC

TERRA PAVE PRODUCTS ARE THE ECO-FRIENDLY COST-EFFECTIVE SOLUTIONS FOR THESE ISSUES FOR SOLAR FARMS

DIRT/DUST SOILING SOLAR PANELS	OVERGROWN WEEDS & VEGETATION	GROUND ALBEDO FOR BI-FACIAL PANELS REFLECTED SUNLIGHT	NOT ECO-FRIENDLY CONCRETE ASPHALT
WINNER			

The Eco-Friendly Cost-Effective products (Top-Seal White™, Top-Seal Black™) were developed, manufactured in Austin, TX, tested on a small scale and field applied and proven through testing with the Texas Department of Transportation (TxDOT), US Army, the City of Austin, TX and City of San Marcos, TX. The products support strength and binding properties, dries within an hour thus allowing work to be completed early and safely. Products have no odor or tracking issues and is much faster to apply following EPA approved test method shows that no detectable petroleum hydrocarbons, volatile, semi-volatile, hazardous petroleum hydrocarbons, or heavy metals are present.

TERRA PAVE + ENVIRONMENTAL SAFE

- NON-HAZARDOUS
- NON-CORROSIVE
- NON-PETROLEUM BASED
- NON-TOXIC

COST-EFFECTIVE

NO SPECIAL EQUIPMENT OR HANDLING PROCEDURES REQUIRED

ESTATES ECO International

Supported by the U.S. Department of Energy, Solar Energy Technologies Office; Directed by the National Renewable Energy Laboratory

WEBSUMMIT LISBON, PORTUGAL NOVEMBER 2021 – TOP 10 WORLD WINNER



TOP 10 Eco-Friendly Products in the WORLD
2021

Web Summit Lisbon, Portugal

LISBOA' Roads - Continue

Carlos Manuel Félix Moedas –
announces deal with Terra Pave
International to save the city of
Lisboa only 2 weeks 1 day on the
job as the Mayor of Lisboa,
Portugal.



Confidential and Proprietary Information

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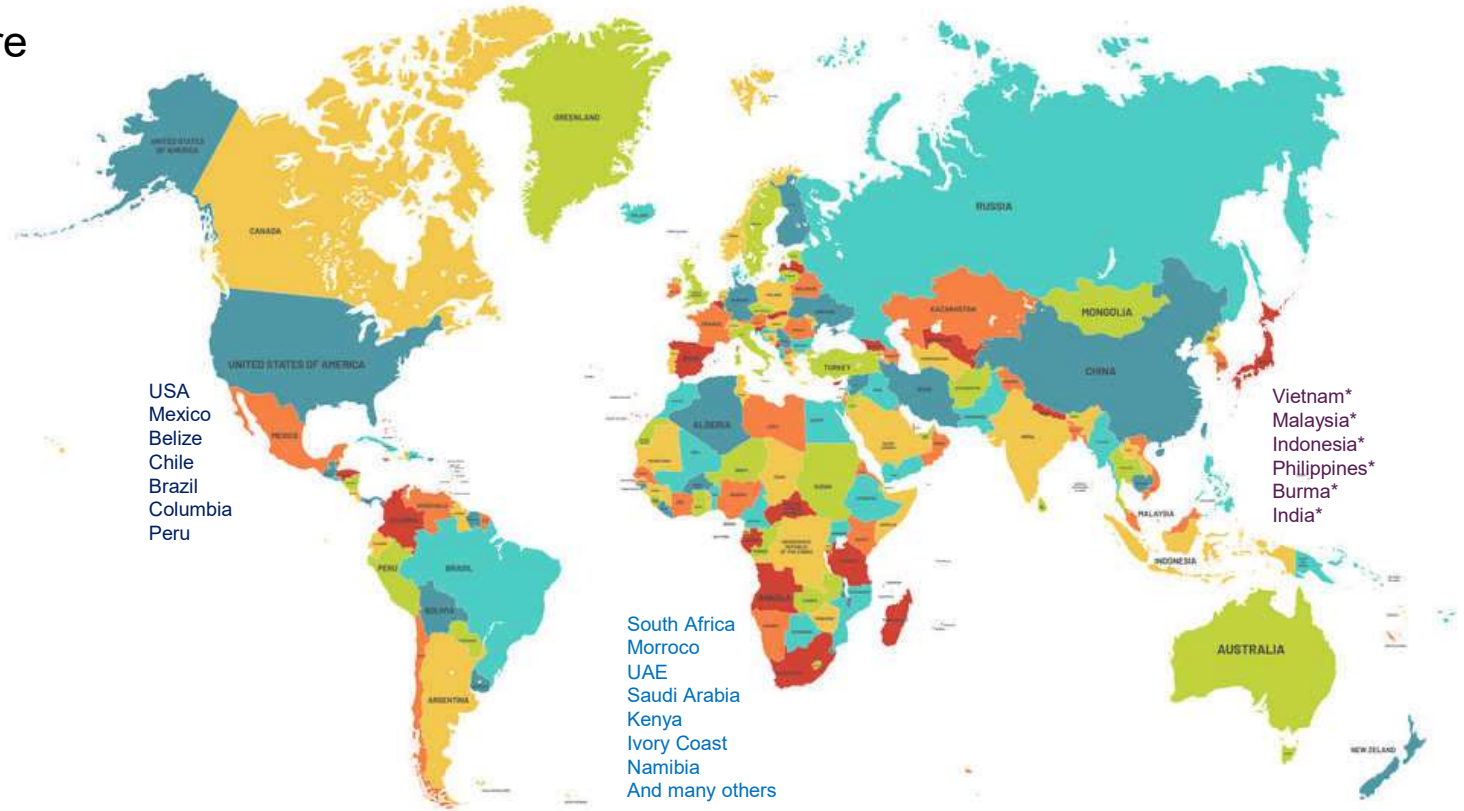


PROMOTED & SOLD IN +30 COUNTRIES

Terra Pave Products were tested by



Sandia
National
Laboratories





TOP-SEALTM

TOP-SEAL TERRA FOG
Asphalt Maintenance Product
Pavement Preservation

APPROVED BY TXDoT
(Texas Department of Transportation)

DEFINITION OF PAVEMENT PRESERVATION

The USA Federal Highway Administration (FHWA) defines pavement preservation:

A program employing a network-level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that:

- *extend pavement life,*
- *improve safety, and*
- *meet motorist expectations (enjoyable ride)*
- *no car damages due to distressed roads.*

DEFINITION OF PAVEMENT PRESERVATION

➤ The chart below illustrates the performance of pavements over time.

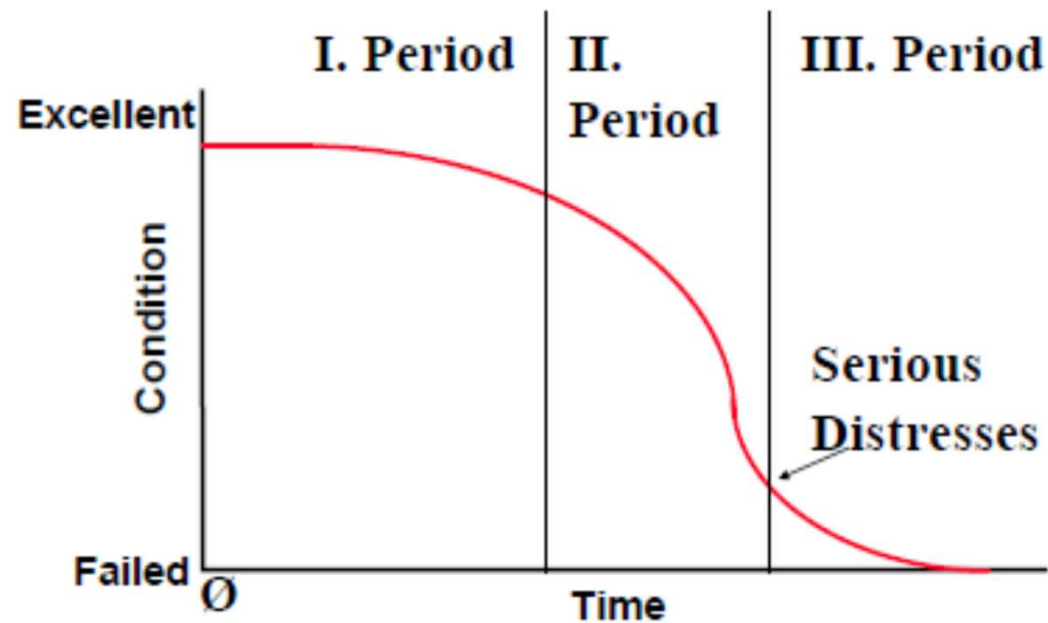


Figure 1-1. The Concept of Preventative Maintenance.

DEFINITION OF PAVEMENT PRESERVATION

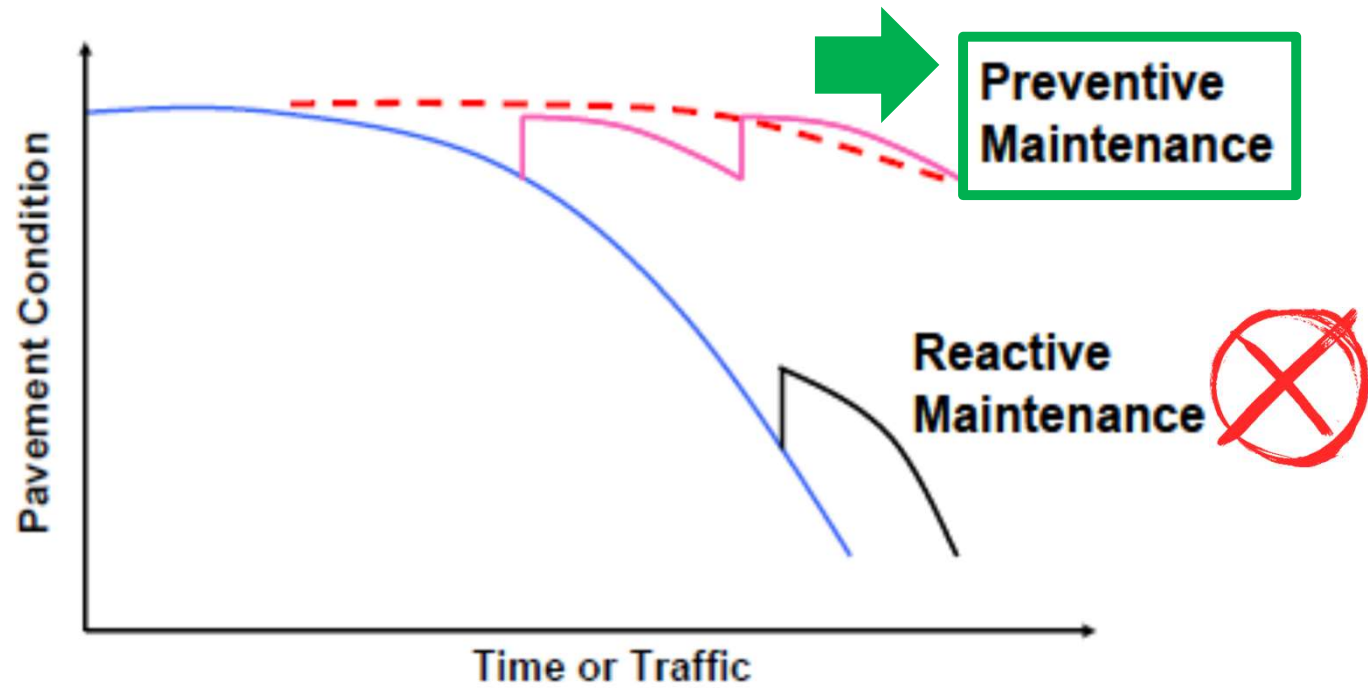


Figure 1-2. Pavement Condition.

PAVEMENT PRESERVATION

- *Pavement preservation* utilizes a combination of preventive and routine maintenance, with a heavy emphasis on prevention.
- Maintaining roads in good condition is:
 - or Preventive Maintenance:
 - ✓ easier,
 - ✓ faster,
 - ✓ minimize traffic disruptions,
 - ✓ less costly than repairing roads with heavy damage.



PAVEMENT PRESERVATION

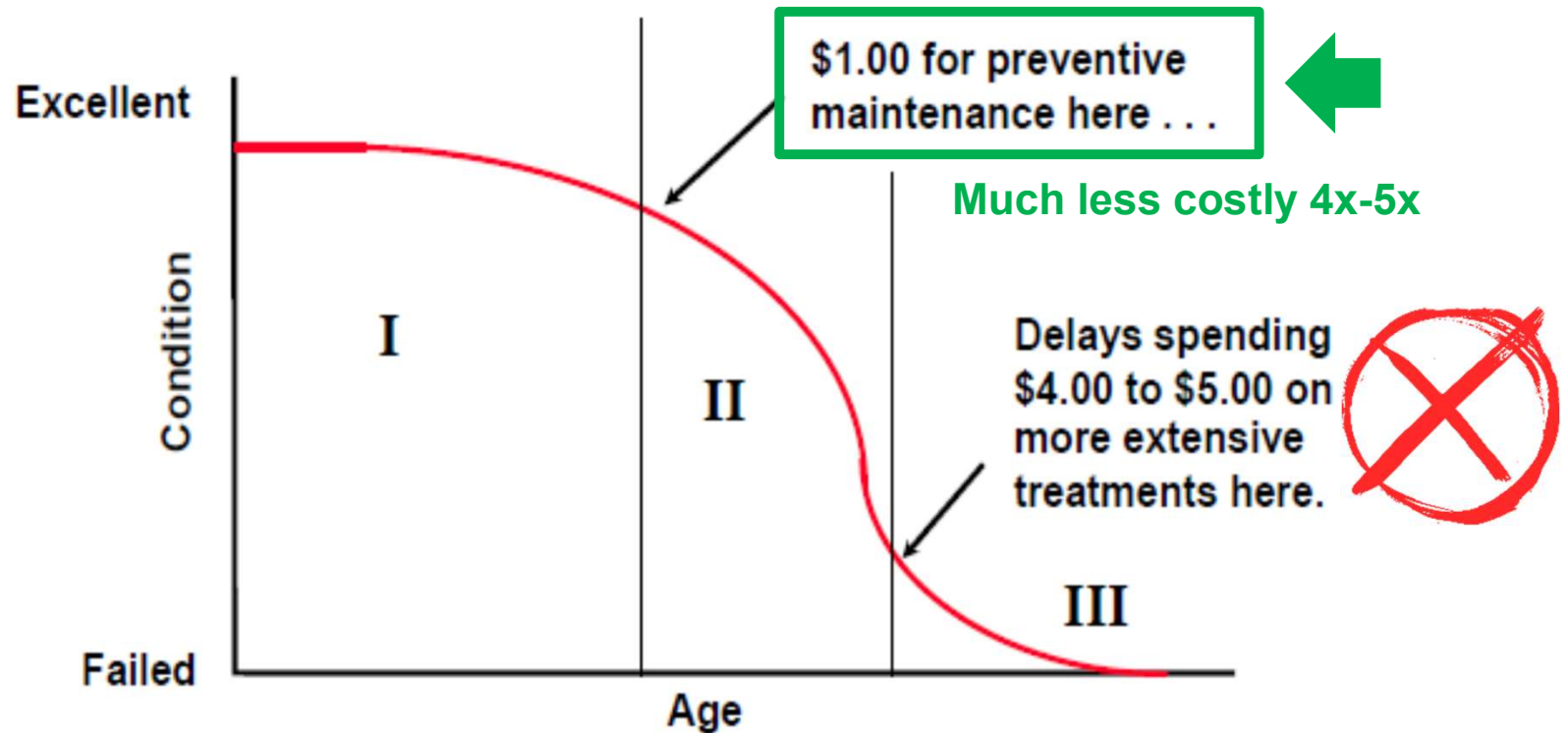


Figure 1-3. The Costs Associated with Preventative Maintenance.

PAVEMENT PRESERVATION

- This maintenance strategy offers many benefits to road users as well.
 - ✓ By keeping roads in good condition, **preventive maintenance** improves safety conditions.
 - ✓ **Enjoyable ride & no car damages** due to distressed roads.
 - ✓ The **ride quality** of the road is **increased**, making driving a more comfortable and pleasant experience



TERRA FOG



Before Application with Terra Fog™

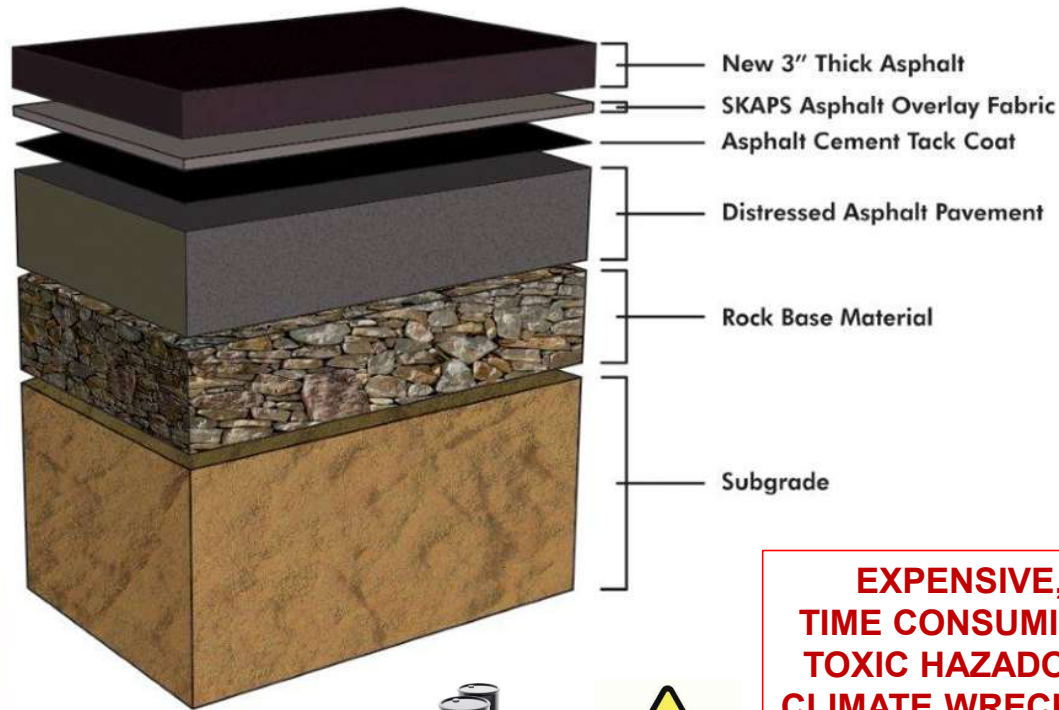


After Application with Terra Fog™

Terra Fog is a high-quality, environment-friendly, and cost-effective solution for improving performance and extending service life in chip seals, and asphalt pavements.

PAVEMENT PRESERVATION

TOXIC Process to Repair Distressed Asphalt Pavement



**EXPENSIVE,
TIME CONSUMING,
TOXIC HAZARDOUS
CLIMATE WRECKING**



TERRA FOG



Existing Distressed
Asphalt Road stack

**Eco-Friendly, Cost-Effective
Preventive Maintenance
PROCESS**



TERRA FOG CITY OF AUSTIN 1ST STREET TEST SECTION



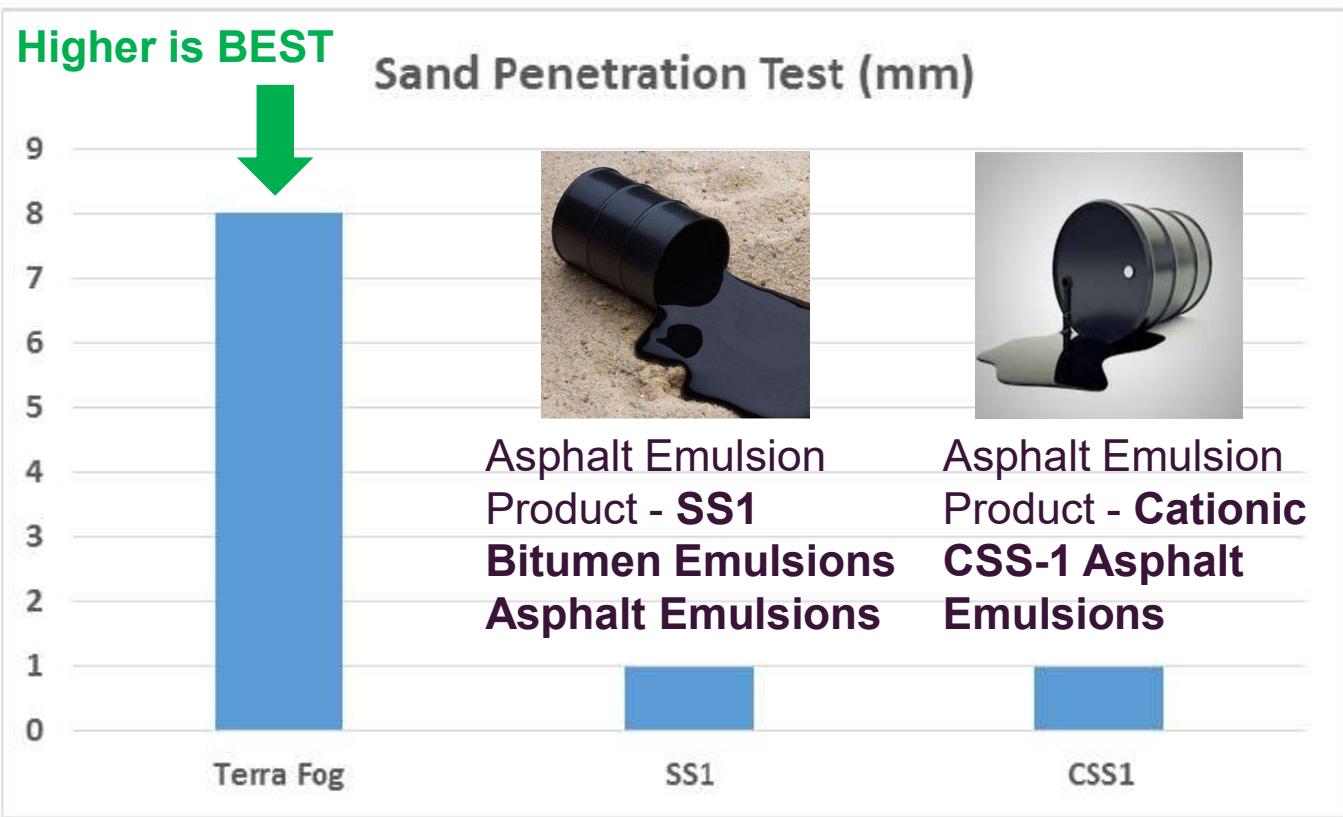


SHOW VIDEO

<https://youtu.be/BjJ19b6il3M>

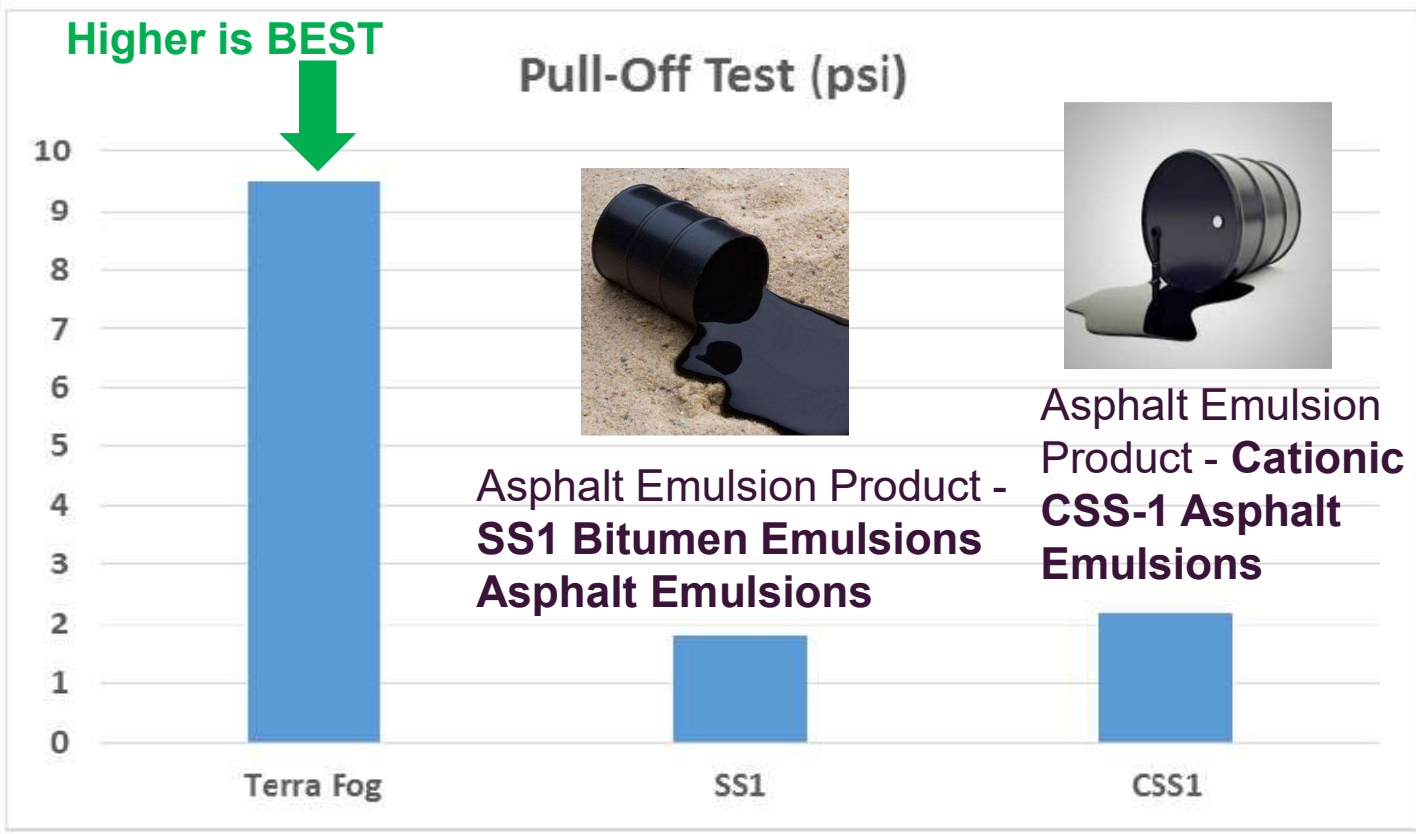


PAVEMENT PRESERVATION



Sand Penetration Test Results for CSS1, SS1 and Terra Fog

PAVEMENT PRESERVATION

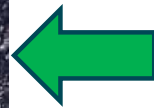


Pull-Off Test Results for CSS1, SS1 and Terra Fog

TERRA FOG CITY OF AUSTIN, TX USA TEST SECTION



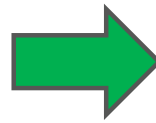
Fresh **Terra Fog** atop



Chip Seal



Fresh **Terra Fog** atop
old, oxidized asphalt



TERRA FOG – RIO D, BRAZIL ROAD REPAIR



Environmentally Safe
Superior Strength
Cost-effective
Impermeable
Rapid Curing



TERRA FOG - CITY OF AUSTIN, TX USA TEST SECTION

Chip Seal vs. Chip Seal with **Terra Fog** overlay





TERRA FOG - CITY OF AUSTIN, TX USA TEST SECTION

Chip seal section with Terra Fog did not loose any aggregate

whereas

Section without Terra Fog lost significant amount of aggregate less than one year after construction



TERRA FOG - CITY OF AUSTIN, TX USA TEST SECTION



Section with Terra Fog

Section with Terra Fog

Section without Terra Fog



Texas Department of Transportation

125 EAST 11TH STREET | AUSTIN, TEXAS 78701-2483 | (512) 506-5821 | WWW.TXDOT.GOV

February 1, 2016

Yetkin Yildirim, Ph.D., PE

President & CTO

Terra Pave International

www.terrapaveinternational.com

Yetkin,

This is a letter to confirm what we discussed about use of Terra Fog on TxDOT projects. As you know we've used Terra Fog on projects and spot work in San Antonio and Austin, and I've also seen the applications by the City of Cedar Park. All of these appear to have worked well and seem to be good treatments.

I'd be interested in seeing the product used on some TxDOT projects in other locations, and getting feedback from the TxDOT users on the application. Of course we don't have a statewide specification for this type of material yet; these projects would feed into the process of rolling a spec out.

So, if you identify TxDOT Districts who are interested in Terra Fog, I would encourage them to use it on a trial basis. Please ask them to contact me, and I can provide additional information and a draft specification on request.

As always, contact me any time.

Gerald D. (Jerry) Peterson, P.E.

Asphalt, Chemical and Calibration Branch Manager

Construction Division

OUR GOALS

MAINTAIN A SAFE SYSTEM • ADDRESS CONGESTION • CONNECT TEXAS COMMUNITIES • BEST IN CLASS STATE AGENCY

An Equal Opportunity Employer

RECOMMENDATION FROM TXDOT (TEXAS DEPARTMENT OF TRANSPORTATION)





TOP-SEALTM



TOP-SEAL TERRA PRIME
Replacement for TOXIC MC-30, AEP
Pavement Quality & Durability

PROMOTED and SOLD in MORE THAN 30 COUNTRIES,

TERRA PRIME (PRIME COAT)



Terra Prime improves highway quality and durability by **waterproofing, plug capillary voids, coat and bond loose mineral particles** in the sub-base layer of asphalt pavements. Terra Prime penetrates, bonds and stabilizes the sub-base layer of asphalt pavements, thereby waterproofing it before placing the hot mix asphalt. Reducing the heat-absorption from the sun.

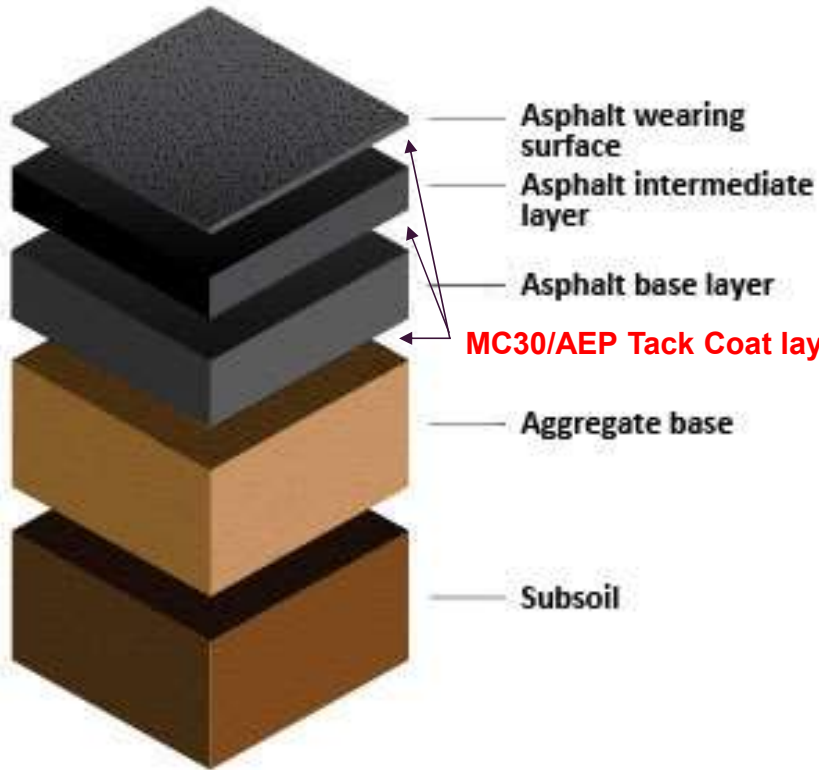
As a **replacement** for **Toxic/Cancer-Causing Kerosene of MC-30, AEP**, it has advantages such as:

- Water-based
- Cold-applied
- Faster Curing
- Greater Strength
- Non-flammable
- Non-toxic
- No VOCs (Volatile Organic Compounds)
- Reduce the heat-absorption from the sun



TERRA PRIME (PRIME COAT)

ASPHALT ROAD CROSS SECTION



TERRA PRIME

(Toxic MC30, AEP Replacement)

- waterproofing,
- plug capillary voids
- coat and bond loose mineral particles

TERRA PAVE PRODUCTS - RECOMMENDATION

CITY OF SAN MARCOS, TX ENVIRONMENTAL ENGINEER

Product testing, done by San Antonio Texting Labs shows that it has no detectable concentrations of volatile, semivolatile, heavy metals or petroleum hydrocarbons. The analysis of TerraPave and AEP, and clearly shows the advantage of this product for human health and the environment. Costs are equivalent to AEP when comparing amount of product applied per unit area (gallons/ft² or yd²).

The Streets Department estimates that between 4500 to 6000 gallons of AEP oil is used each year on the city's mill and overlay projects performed in-house. By changing to TerraPave, the city will reduce the application of 37,500 to 50,040 pounds of oil each year to the environment. This total includes a reduction of 5,200 to 6,900 pounds of chemicals that are covered under the TCEQ's Texas Risk Reduction Program for spills to the environment.

Furthermore, the Streets Manager is also considering requiring all of the city's asphalt contractors to use TerraPave instead of AEP for city roads. This proactive step will have a significant multiplying benefit for the environment in San Marcos, Texas.

(a) Prepared by Elizabeth (Lisa) Arceneaux, P.E. local environmental engineer.

Lisa Arceneaux, P.E., CISEC, CPESC
Environmental Engineer
City of San Marcos, Texas



TERRA PRIME (PRIME COAT) – REDUCE HEAT-ABSORPTION

Terra Prime improves highway/road quality and durability by reducing the heat-absorption from the sun. City of Phoenix, AZ 36 miles of roads to reduce the heat. **NOVA PBS – Weathering the FUTURE**

It has advantages such as:

- Water-based
- Cold-applied
- Faster Curing
- Greater Strength
- Non-flammable
- Non-toxic
- No VOCs (Volatile Organic Compounds)
- Reduces the heat absorption from the sun

<https://www.pbs.org/wgbh/nova/video/weathering-the-future/>
Premiered: April 23, 2023

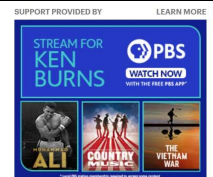


SHOW VIDEO

The screenshot shows the NOVA PBS website interface. At the top, there are navigation links: WATCH, TOPICS, SEARCH Q, and SCHEDULE. The main content area features a video player for 'Weathering the Future', which includes a play button, a progress bar at 12:57 / 53:31, and a volume icon. Below the video player, the title 'Weathering the Future' is displayed, followed by the subtitle 'Americans use ancient wisdom and new technology to fight extreme weather.' Metadata includes 'PREMIERED: 4/12/23', 'RUNTIME: 53:31', and 'TOPIC: PLANET EARTH'. There are also social media share icons for Twitter, Facebook, and YouTube. To the right of the video player is the PBS logo and the text 'PUBLIC BROADCASTING SERVICE'.

It's hard not to notice: our weather is changing. From longer, hotter heat waves, to more intense rainstorms, to megafires and multi-year droughts, the U.S. is experiencing the full range of impacts from a changing global climate. At the same time, many on the front lines are fighting back – innovating solutions, marshaling ancient wisdom, and developing visionary ideas. The lessons they're learning today can help all of us adapt in the years ahead, as the planet gets warmer and our weather gets more extreme. (Premiered April 12, 2023)

Join producers and experts from "Weathering the Future" for clips, a panel discussion, and audience Q&A on April 25th at 7PM ET. Register for the event here: <https://bit.ly/3Uufnl2>





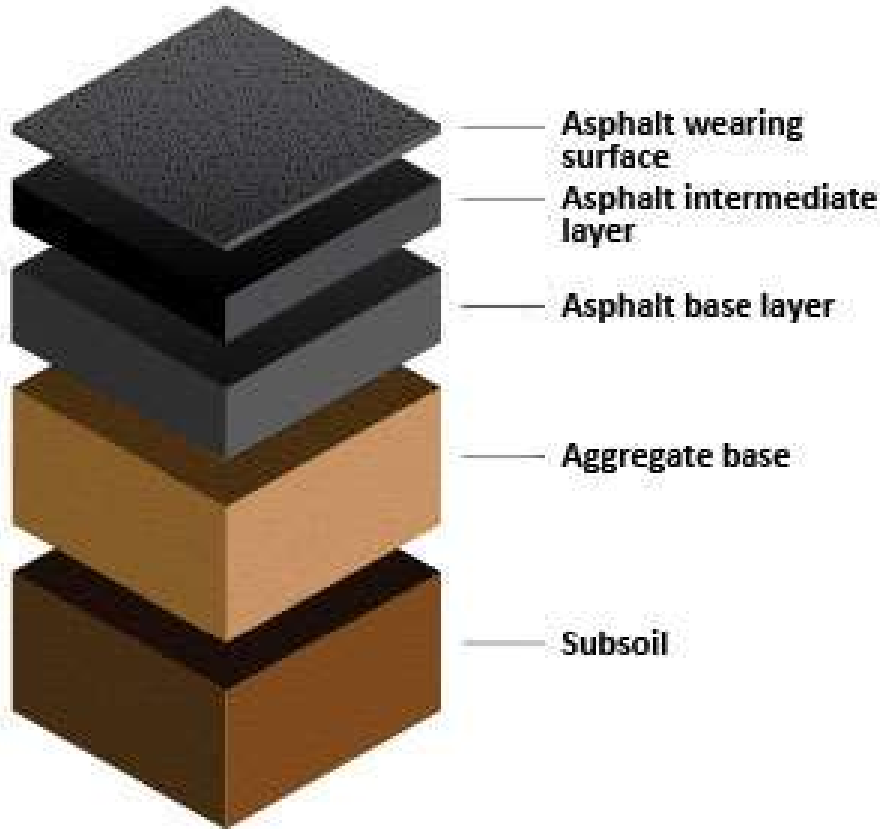
TOP-SEALTM

TOP-SEAL White (TSW)
Liquid Soil Sealant & Stabilizer
Concrete Replacement

PROMOTED and SOLD in MORE THAN 30 COUNTRIES

TERRA PAVE WHITE (BASE, UNPAVED ROADS)

ASPHALT ROAD CROSS SECTION



TERRA PAVE WHITE
(Base, Concrete Replacement,
Unpaved Roads, Airfield, etc..)

TOP-SEAL WHITE (TSW)



TSW is a water-based polymer soil additive that powerfully binds **EXISTING** soil particles into a hardened and moisture-resistant mass or **Eco-Friendly Waterproof Concrete Replacement**.

TSW will

- (1) **stabilize and waterproof road bases,**
- (2) **prevent soil erosion**
- (3) **pavement for dirt and, un-improved roads**

TOP-SEAL WHITE

CONSTRUCTION & RECONSTRUCTION

- **Paved and Unpaved Road Bases**
- **Airfields, Runways, Helicopter Landing Pads**
- **Landfills**
- **Embankments**
- **Foundations For Homes & Commercial Buildings**
- **Driveways**
- **Slope Erosion Control**
- **Water Retention Basins & Pond Linings**
- **Cart Paths, Golf Courses**
- **Base Stabilization**
- **Military Convoy & Tank Trails**
- **Solar Energy Farms/Albedo Bifacial Solar Field – TSW Albedo**

HOW DOES TOP-SEAL WORK?

After being evenly and thoroughly distributed into the soil, and with good compaction, Top-Seal will begin the process of **irreversibly transforming from a liquid to a solid.**



* Soil Grader



* Soil Compactor

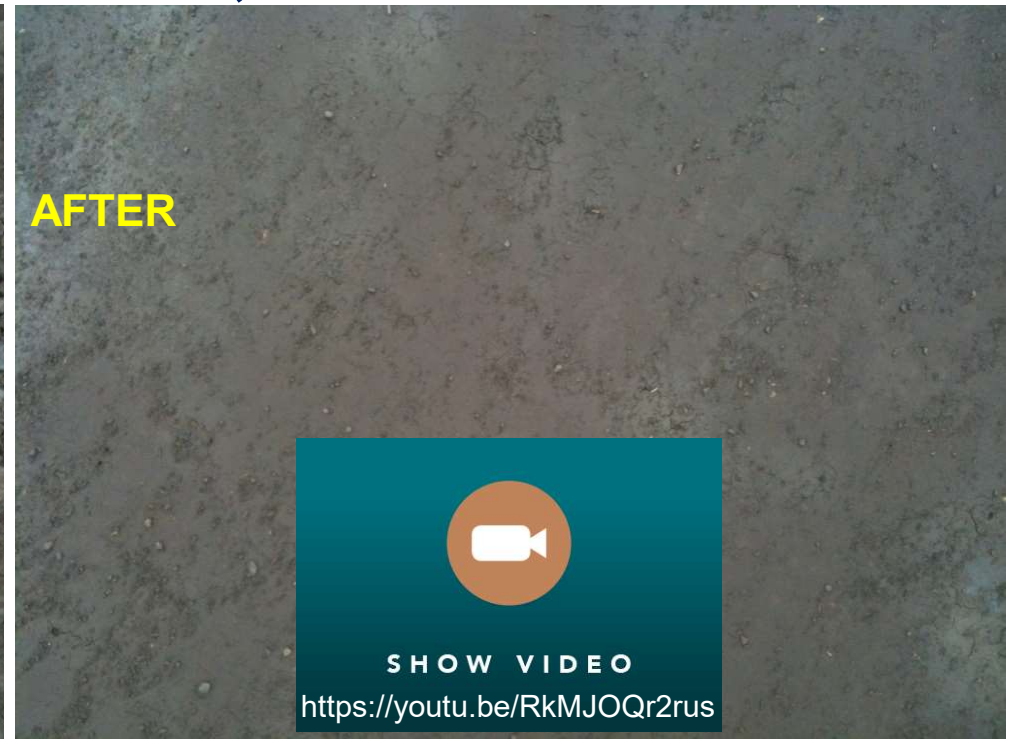


* Water Sprayer

The product continues to interact with the soil as a hardening agent that dramatically **increases soil strength** and **resistance to moisture.**

BASE STABILIZATION A CLOSER LOOK

BEFORE & AFTER TSW™ in CHILE, SOUTH AMERICA



EXTREMELY CHALLENGING

Top-Seal was “**BATTLE TESTED**” with a daily exposure to the **extremes of severe weather conditions** and **constant convoys of M1-Abram tanks and other heavy armored vehicles** at a military installation in Central Texas USA.

The following slides will show how well Top-Seal can be expected to perform in extremely challenging environments.

IMPROVEMENT OF A MILITARY ROAD



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COMPARISON SIDE-BY-SIDE



ANOTHER COMPARISON



TOP SEAL WHITE – EXXON-MOBIL PROJECT

Terra Pave White - Corpus Christi, TX – Exxon Mobil road project completed with Terra Pave White - Ultra-heavy Module for the Exxon GCGV project near Corpus Christi, Texas crossed the finish line.

This was 4.5 miles of heavy haul road (HHR) supporting up to 140psi SPMT wheel loads transporting up to 12,000 Metric Tonne modules. There were over 100 transport runs with over 30 ultra-heavy modules. The design was for 10,000 cumulative axle passes over any one point.



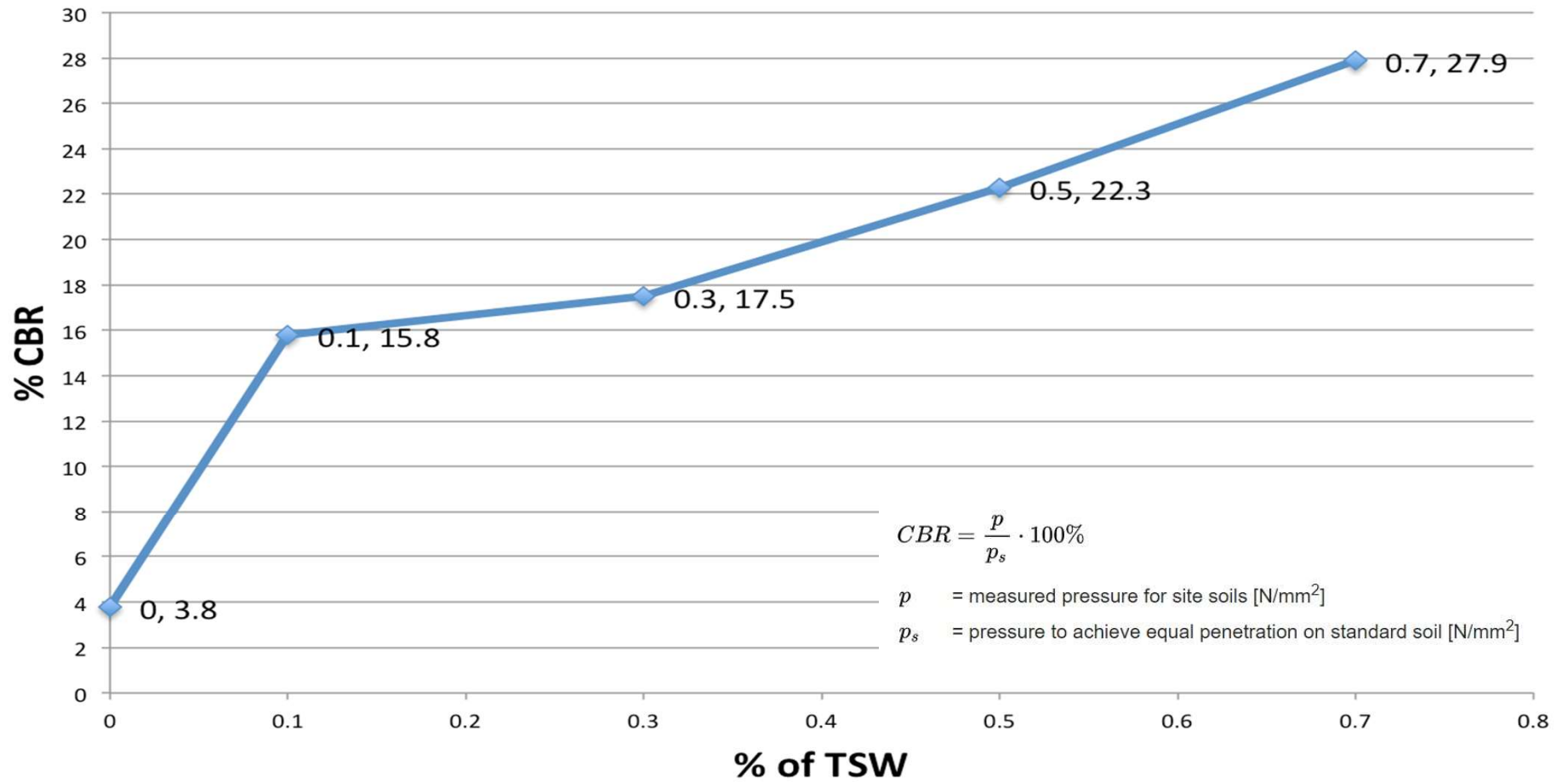
<https://vimeo.com/377598222>



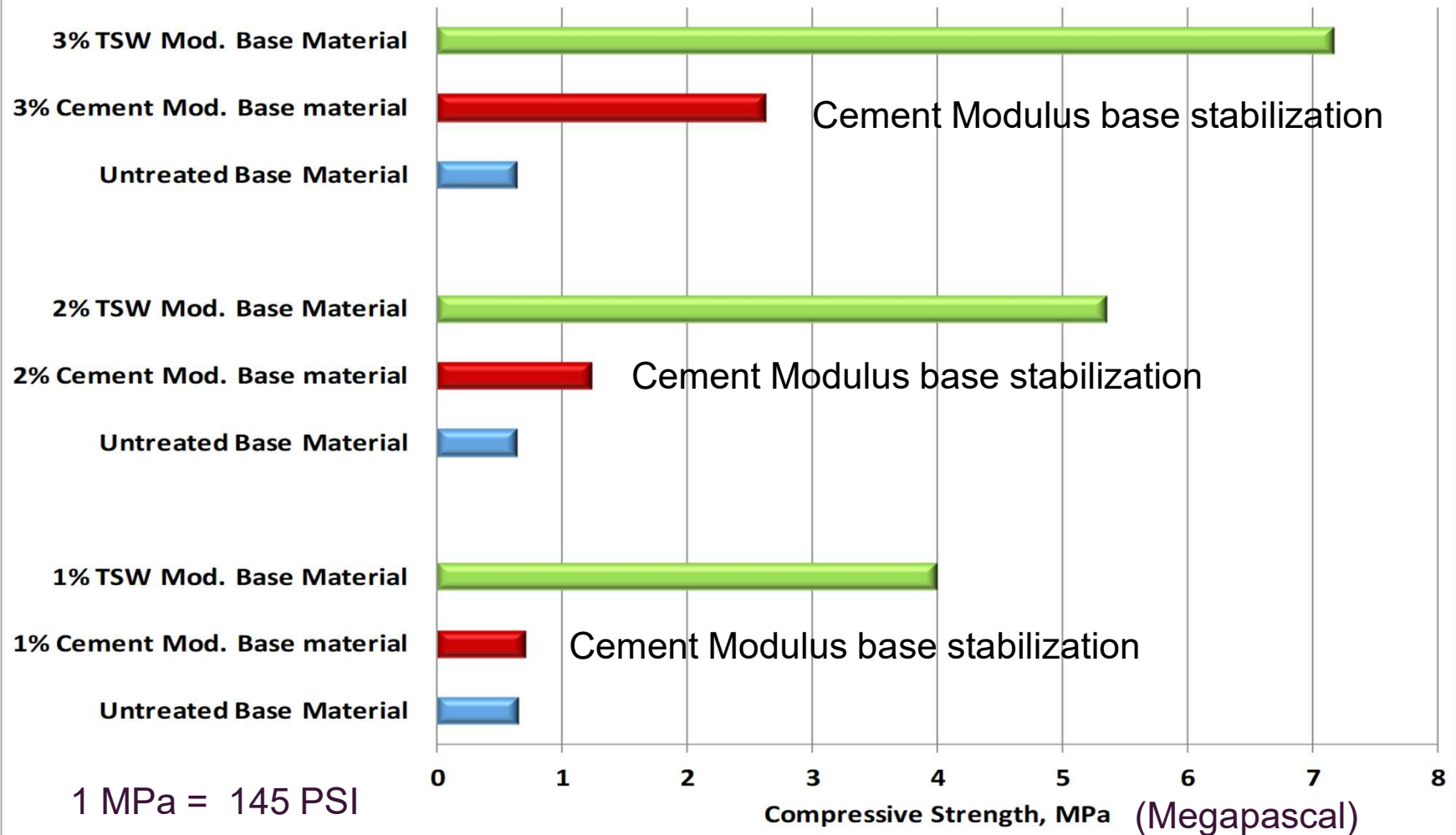
SHOW VIDEO



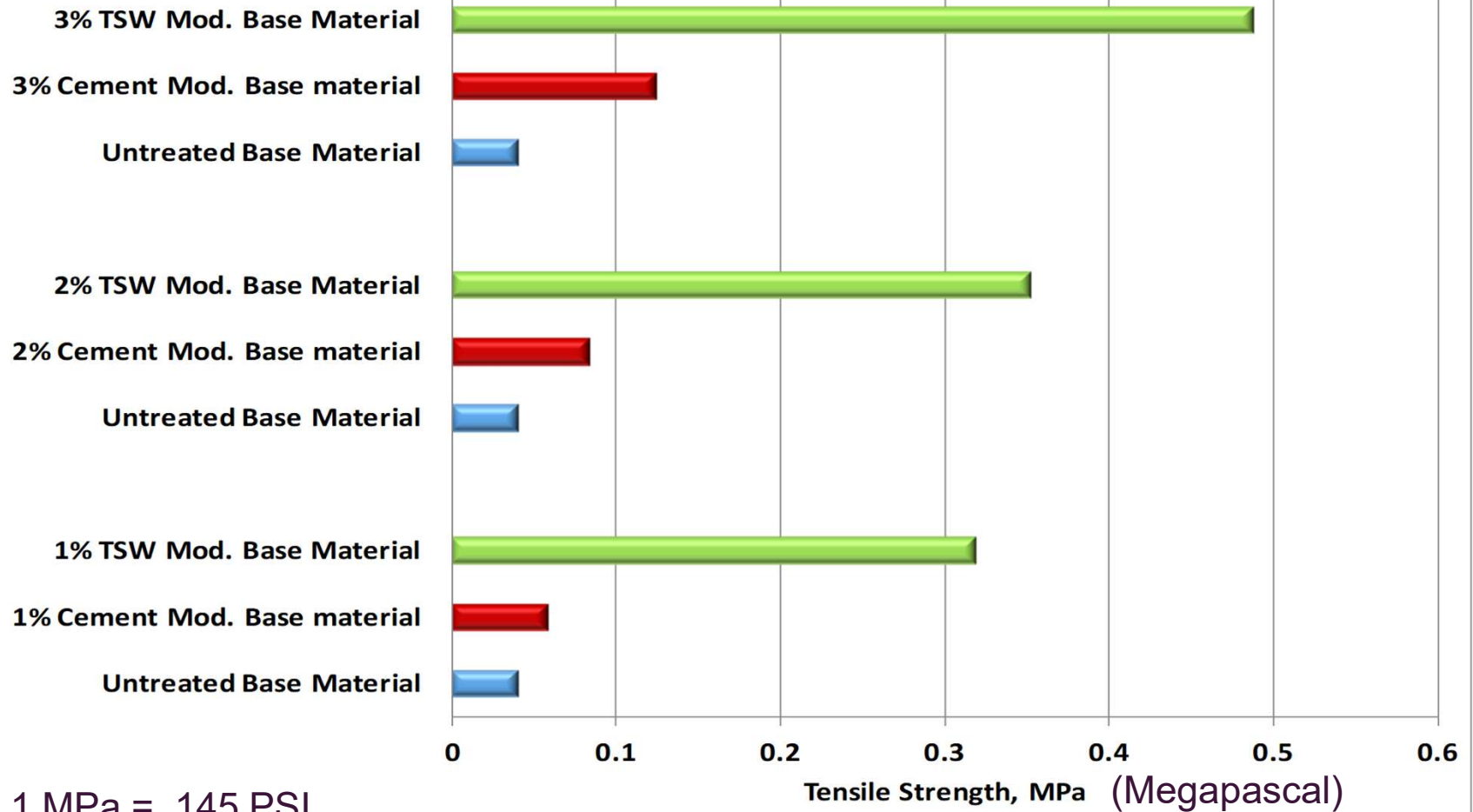
CBR Chart (California Bearing Rate)

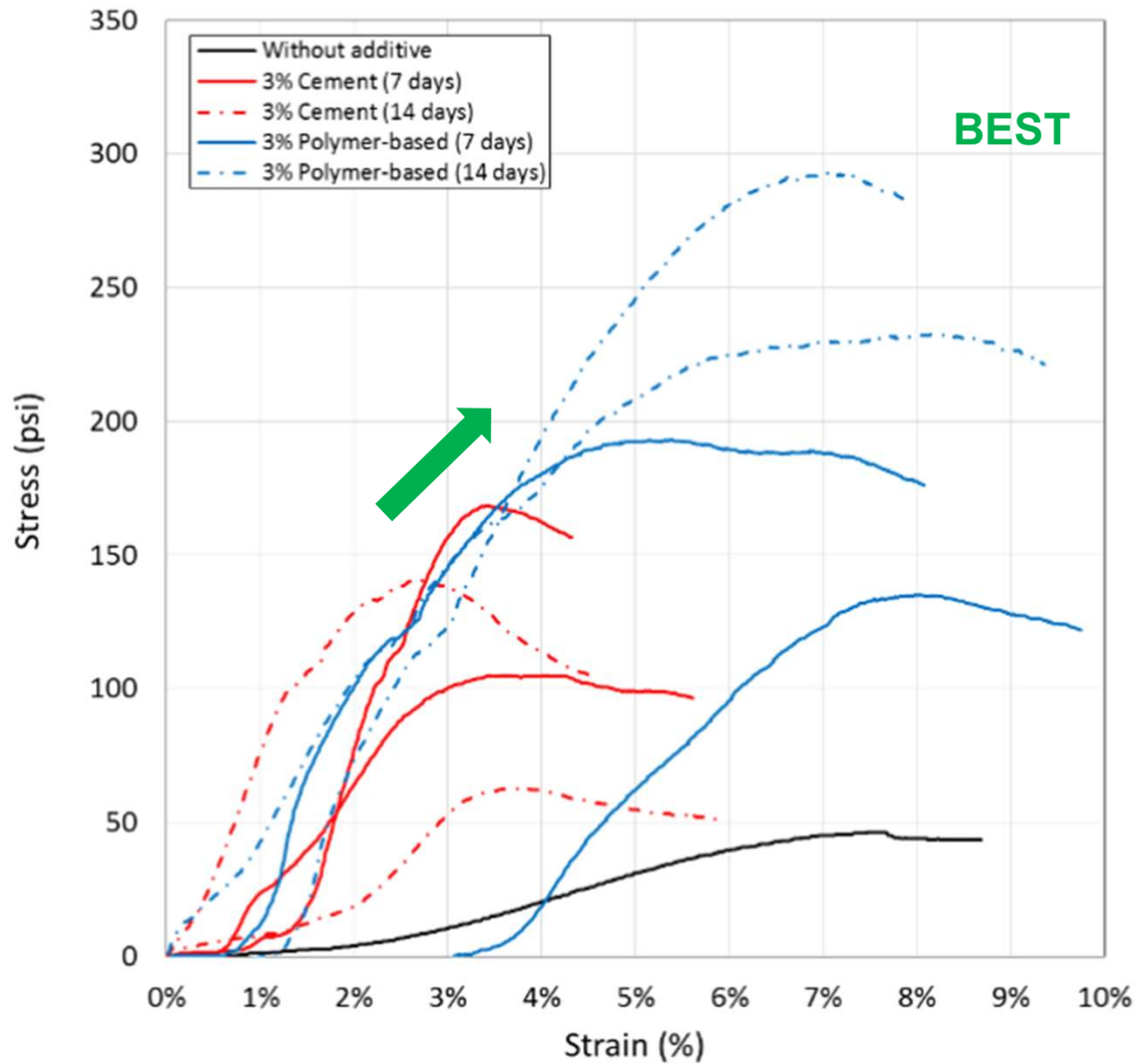


Unconfined Compressive Strength



Indirect Tensile Test





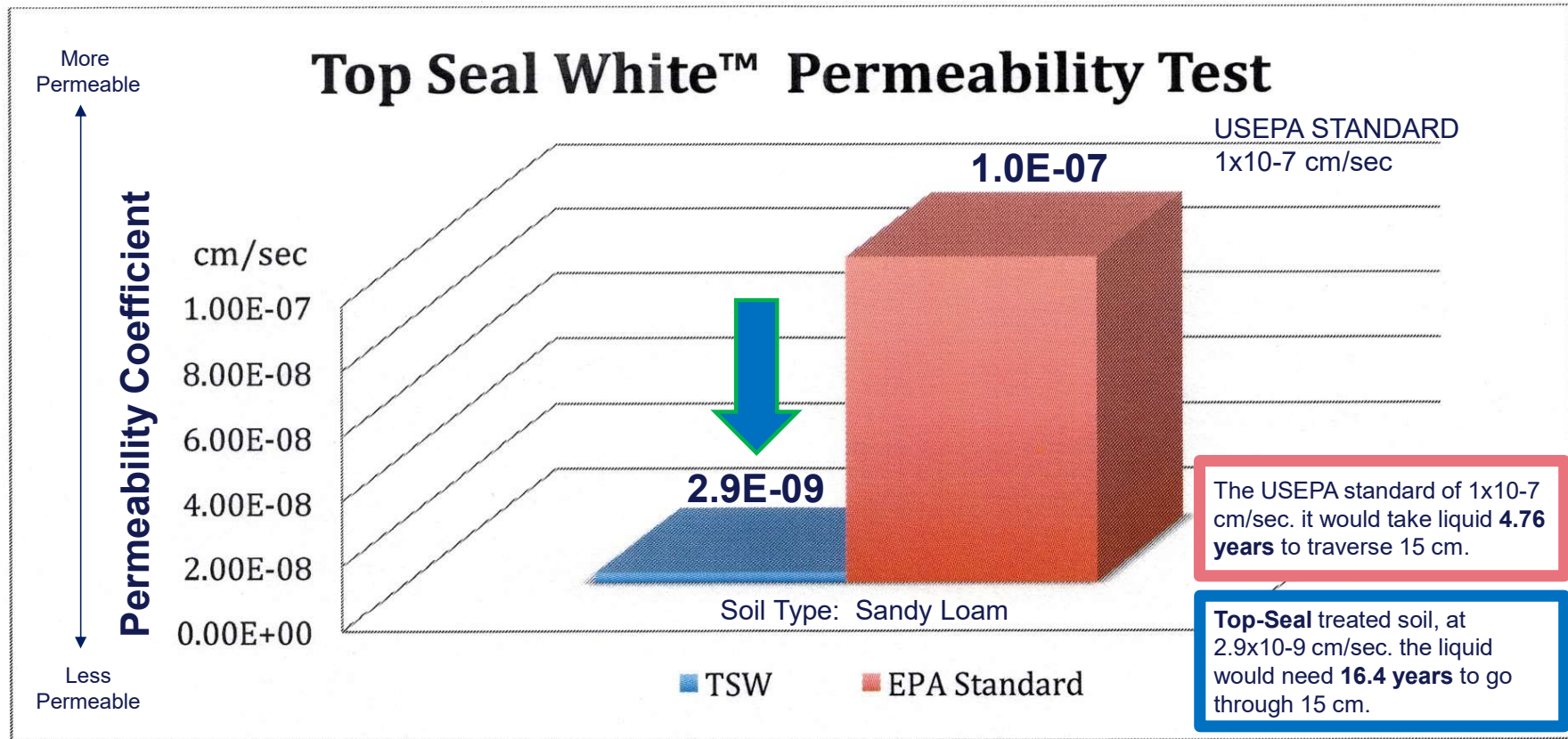
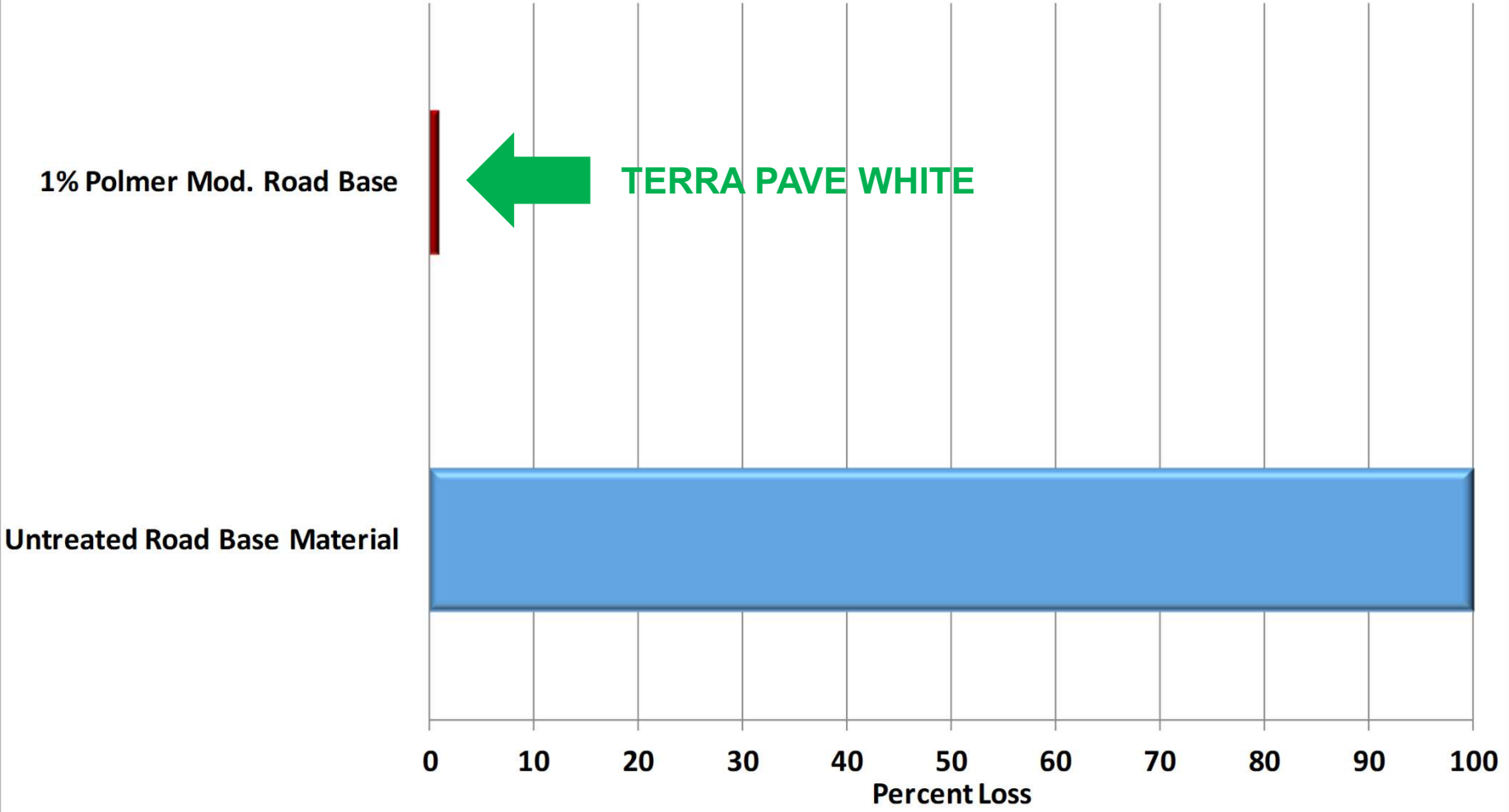


Figure 1: TSW vs. US EPA Standards

Erosion Resistance Test



BASE STABILIZATION

- **Vastly superior road base stability.**
- **A tremendous increase in strength and a significant reduction of permeability.**
- **Life expectancy of paved and unpaved roads will be significantly extended. 2x-4x times**

TOP-SEAL WHITE

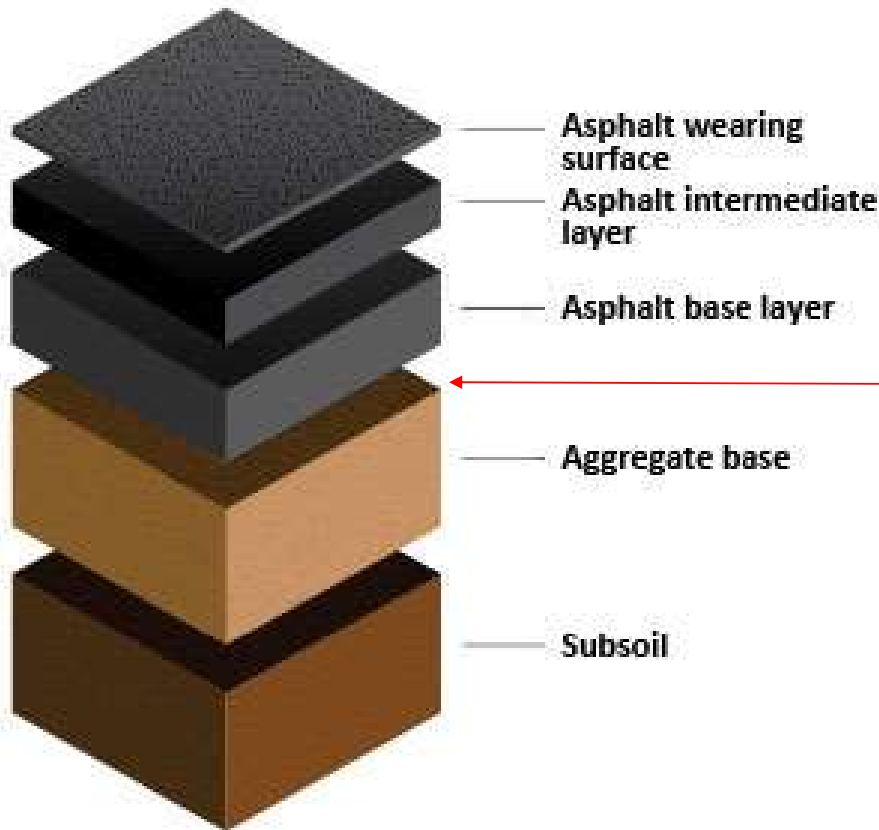


TOP-SEAL WHITE
and
TOP-SEAL BLACK

ASPHALT ROAD REPLACEMENT

TERRA PAVE WHITE & BLACK (BASE, CONCRETE, ASPHALT REPLACEMENT)

ASPHALT ROAD CROSS SECTION



TERRA PAVE BLACK
(Asphalt Replacement)

NO MC-30/AEP is needed

TERRA PAVE WHITE
(Base Replacement)

TERRA PAVE WHITE & BLACK (BASE, CONCRETE, ASPHALT REPLACEMENT)

TERRA PAVE PRODUCTS – TPW & TPB

Concrete/Cement/Asphalt Replacement



Loose soil



SHOW VIDEO
<https://youtu.be/hhcGYhf1HPs>



* Soil Grader



* Soil Compactor



* Water Sprayer

- ✓ NON-HAZADOUS
- ✓ NON-PETROLEUM BASED
- ✓ NON-TOXIC
- ✓ NON-CORROSIVE
- ✓ WATERPROOF
- ✓ IMPROVES BRAKING DISTANCE
- ✓ EROSION RESISTANCE
- ✓ NO SPECIAL HANDLING PROCEDURE
- ✓ NO SPECIAL EQUIPMENT NEEDED

Loose soil prepared for application of TSW



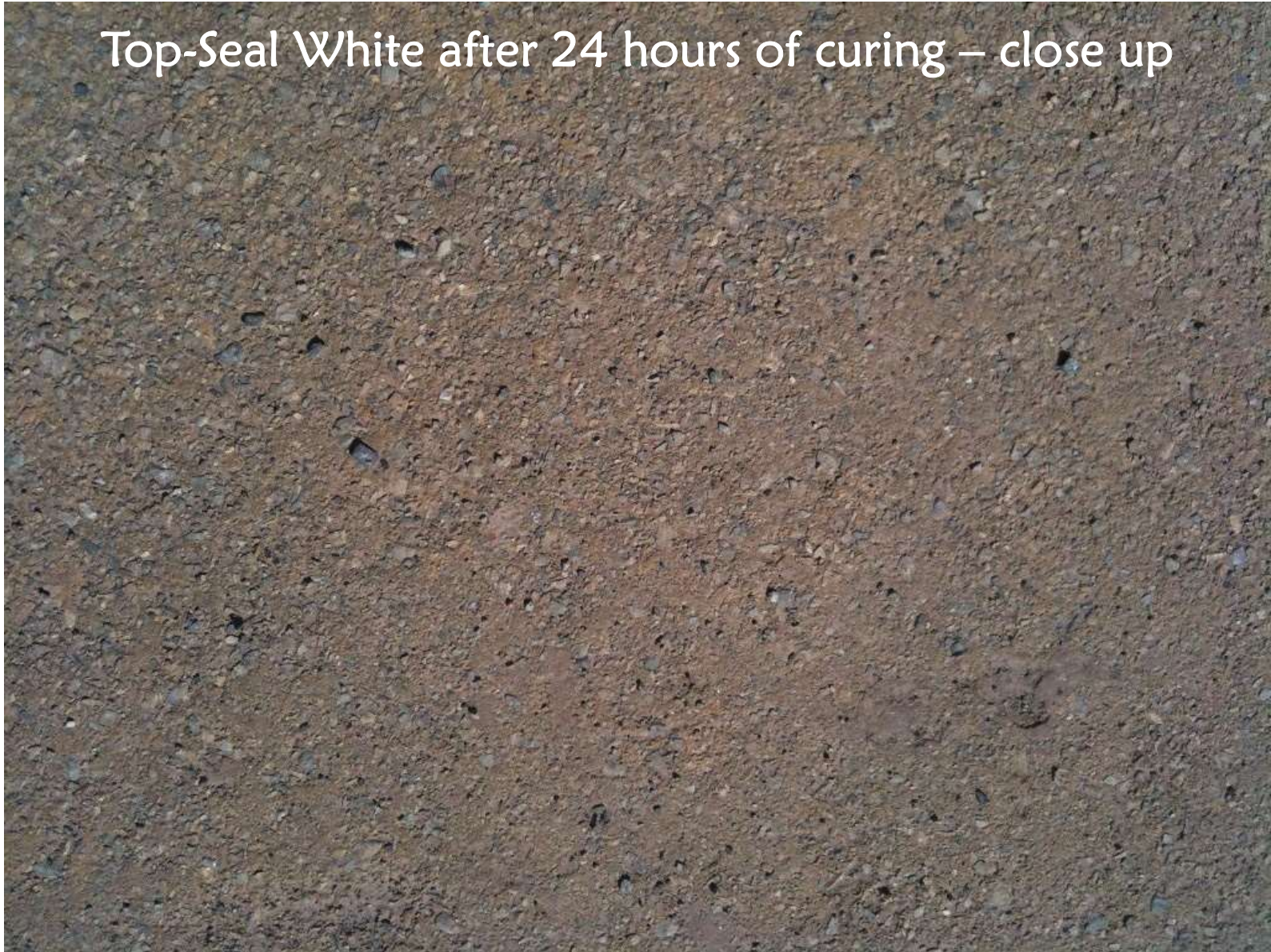
Application of Top-Seal White



Top-Seal White soaking into the soil into the base



Top-Seal White after 24 hours of curing – close up



First application of Top-Seal Black





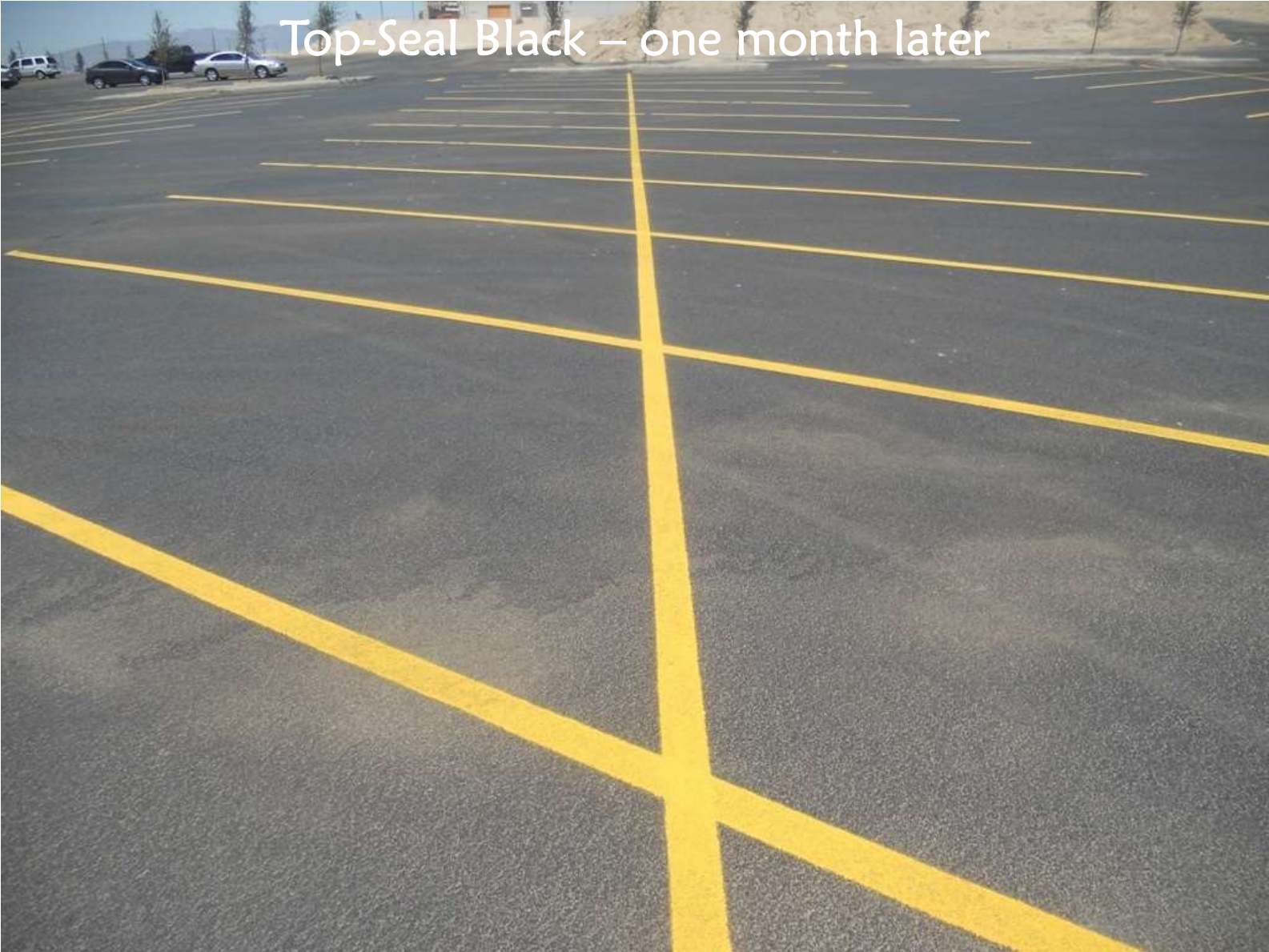
Final application of Top-Seal Black

Top-Seal Black – close up after 48 hours



Copyright © 2011 Terra Pave International, Inc. All rights reserved

Top-Seal Black – one month later



Top-Seal Black – Two Years later



PACKAGING

TP products are packaged in **55 gallon (208 liter) drums** or in **275 gallon (1,040 liter) totes**. In the interest of convenience, it is highly recommended that TP products be delivered in 275 gallon totes. The totes require less handling and each tote is equipped with an on/off valve near the bottom for easy transfer of the product into a water truck.

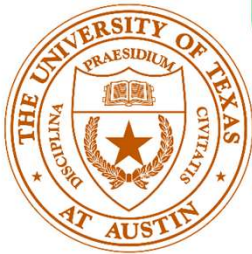


ECOLOGICAL ESTATES LLC. / EEI Holding

P.O.Box 171214
Austin, Texas USA



Thank You!



UTA-TERRA PAVE INTERNATIONAL, Inc.

West Pickle Research Center
The University of Texas at Austin
Austin, Texas USA



Email: info@ecoestates.us

Web: www.ecoestates.us



HAUL ROAD TOP-SEAL
*Commercial Grade
Dust Pollution Control*

PROMOTED and SOLD in MORE THAN 30 COUNTRIES



TOPICAL APPLICATIONS

Primarily Used for Dust Control and General Road Improvement

This type of application is the most common use for HRTS. It is cost-effective and easy to apply. All known environmental standards can be met or exceeded by using HRTS for eliminating dust pollution. Especially in mining operations where the dirt is toxic and cancer causing.



HAUL ROAD TOP-SEAL (HRTS)

HRTS is an excellent choice for **stabilizing haul roads and controlling extremely heavy amounts of dust pollution.**

Military Roads, Parking Lots, Quarries, Mines, Logging Roads



The HRTS program has been successfully used on haul roads with daily traffic extremes of hundreds of fully loaded trucks of 50 or more tons.

350 ton Trucks



INTERNATIONALLY RECOGNIZED

Featured on the cover of *Aggregates Manager* magazine, Terra Pave's former version of **Haul Road Top-Seal (HRTS™)** was internationally recognized for its excellent performance in controlling dust pollution at a large quarry in North Texas USA.



ONE YEAR AFTER INITIAL
APPLICATION **NO DUST**

BASE STABILIZATION

COMPLETED PROJECT



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BASE STABILIZATION

CONSTRUCTION of NEW ROADS or RECONSTRUCTION of EXISTING ROADS

This type of application requires the product to be mixed with water and distributed into the soil prior to each round of compaction.

This method is used primarily for rebuilding an unpaved road or for base stabilization of a paved road.