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# ROAD STABILIZER PRODUCT PERFORMANCE

## Seedskadee National Wildlife Refuge

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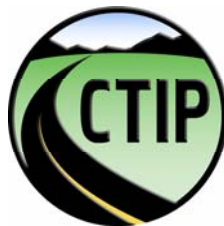
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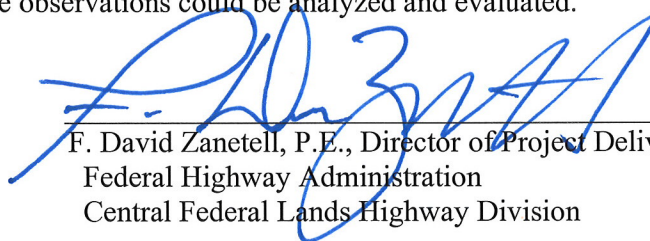
**Central Federal Lands Highway Division**  
**12300 West Dakota Avenue**  
**Lakewood, CO 80228**

## FOREWORD

The Federal Lands Highway (FLH) of the Federal Highway Administration (FHWA) promotes development and deployment of applied research and technology applicable to solving transportation related issues on Federal Lands. The FLH provides technology delivery, innovative solutions, recommended best practices, and related information and knowledge sharing to Federal agencies, Tribal governments, and other offices within the FHWA.

The FLH designs, administers and oversees an increasing amount of aggregate surfacing roadwork for clients in remote locations. Federal Land's clients, such as the National Park Service, US Forest Service, and Fish and Wildlife Service, often have limited budgets for construction and maintenance of their unpaved roads. Thus, identifying methods to effectively control dust and prevent raveling, rutting, wash boarding, and potholing on these unpaved roads is an important goal of the FLH.

The primary objective of this project, like its predecessor project at Buenos Aires National Wildlife Refuge in Arizona, was to evaluate six different road stabilizer products for potential use on FLH projects for dust control and surface stabilization. This project at the Seedskaadee National Wildlife Refuge in Wyoming evaluated the same six products, but the climate, road surfacing material, and depth of stabilization were different. A new objective monitoring system was added so that trends over time as well as comparative observations could be analyzed and evaluated.



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F. David Zanetell, P.E., Director of Project Delivery  
Federal Highway Administration  
Central Federal Lands Highway Division

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### Technical Report Documentation Page

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16. Abstract <p style="text-indent: 40px;">Roadway stabilization or dust abatement products are classified into seven categories: 1) Water, 2) Water Absorbing, 3) Organic Petroleum, 4) Organic Non-petroleum, 5) Electrochemical, 6) Synthetic Polymer, 7) Clay Additives.</p> <p style="text-indent: 40px;">Six different soil stabilizers from the above categories of 2, 4, 5, and 6 were individually applied each on a 0.8-km (0.5-mi) section to a depth of 125 mm (5 in) at the Seedskadee National Wildlife Refuge in south western Wyoming. These six products were monitored for a period of two years.</p> <p style="text-indent: 40px;">Both subjective and objective monitoring systems were used to evaluate the products' effectiveness in controlling dust, wash boarding, raveling, rutting, and potholing. Materials tests and evaluation included Moisture/Density, Gradation, Liquid Limit, Plastic Limit, R-Value, CBR, and silt loading. Final analysis included an overall ranking of the six products and their performance, comparisons of silt load results and dust observations, and a correlation study of the subjective and objective monitoring systems.</p> <p style="text-indent: 40px;">For this specific semi-arid desert location and non-plastic crushed aggregate surfacing material, the evaluation of each product's performance in order from the highest rank was 1) an Organic Non-Petroleum (Lignosulfonate), 2) Water Absorbing/Organic Non-Petroleum mix (Mag/Lig), 3) Water Absorbing/Organic Non-Petroleum mix (Caliber), 4) Electrochemical Enzyme (Permazyme), 5) Electrochemical Enzyme (Terrazyme), and 6) Synthetic Polymer (Soil Sement.)</p>			
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<b>SI* (MODERN METRIC) CONVERSION FACTORS</b>				
<b>APPROXIMATE CONVERSIONS TO SI UNITS</b>				
<b>Symbol</b>	<b>When You Know</b>	<b>Multiply By</b>	<b>To Find</b>	<b>Symbol</b>
<b>LENGTH</b>				
in	inches	25.4	Millimeters	mm
ft	feet	0.305	Meters	m
yd	yards	0.914	Meters	m
mi	miles	1.61	Kilometers	km
<b>AREA</b>				
in <sup>2</sup>	square inches	645.2	Square millimeters	mm <sup>2</sup>
ft <sup>2</sup>	square feet	0.093	Square meters	m <sup>2</sup>
yd <sup>2</sup>	square yard	0.836	Square meters	m <sup>2</sup>
ac	acres	0.405	Hectares	ha
mi <sup>2</sup>	square miles	2.59	Square kilometers	km <sup>2</sup>
<b>VOLUME</b>				
fl oz	fluid ounces	29.57	Milliliters	mL
gal	gallons	3.785	Liters	L
ft <sup>3</sup>	cubic feet	0.028	cubic meters	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.765	cubic meters	m <sup>3</sup>
NOTE: volumes greater than 1000 L shall be shown in m <sup>3</sup>				
<b>MASS</b>				
oz	ounces	28.35	Grams	g
lb	pounds	0.454	Kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
<b>TEMPERATURE (exact degrees)</b>				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
<b>ILLUMINATION</b>				
fc	foot-candles	10.76	Lux	lx
fl	foot-Lamberts	3.426	candela/m <sup>2</sup>	cd/m <sup>2</sup>
<b>FORCE and PRESSURE or STRESS</b>				
lbf	poundforce	4.45	Newtons	N
lbf/in <sup>2</sup>	poundforce per square inch	6.89	Kilopascals	kPa
<b>APPROXIMATE CONVERSIONS FROM SI UNITS</b>				
<b>Symbol</b>	<b>When You Know</b>	<b>Multiply By</b>	<b>To Find</b>	<b>Symbol</b>
<b>LENGTH</b>				
mm	millimeters	0.039	Inches	in
m	meters	3.28	Feet	ft
m	meters	1.09	Yards	yd
km	kilometers	0.621	Miles	mi
<b>AREA</b>				
mm <sup>2</sup>	square millimeters	0.0016	square inches	in <sup>2</sup>
m <sup>2</sup>	square meters	10.764	square feet	ft <sup>2</sup>
m <sup>2</sup>	square meters	1.195	square yards	yd <sup>2</sup>
ha	hectares	2.47	Acres	ac
km <sup>2</sup>	square kilometers	0.386	square miles	mi <sup>2</sup>
<b>VOLUME</b>				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	Gallons	gal
m <sup>3</sup>	cubic meters	35.314	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.307	cubic yards	yd <sup>3</sup>
<b>MASS</b>				
g	grams	0.035	Ounces	oz
kg	kilograms	2.202	Pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
<b>TEMPERATURE (exact degrees)</b>				
°C	Celsius	1.8C+32	Fahrenheit	°F
<b>ILLUMINATION</b>				
lx	lux	0.0929	foot-candles	fc
cd/m <sup>2</sup>	candela/m <sup>2</sup>	0.2919	foot-Lamberts	fl
<b>FORCE and PRESSURE or STRESS</b>				
N	newtons	0.225	Poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in <sup>2</sup>

\*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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**LIST OF ABBREVIATIONS AND SYMBOLS**

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
BLM	Bureau of Land Management
CFLHD	Central Federal Lands Highway Division
CBR	California Bearing Ratio
CTIP	Coordinated Technology Implementation Program
DCP	Dynamic Cone Penetrometer
DOT	Department of Transportation
F&WS	Fish and Wildlife Service
FHWA	Federal Highway Administration
FLH	Federal Lands Highway
FP	Federal Projects
LL	Liquid Limit
NP	Non-plastic
NWR	National Wildlife Refuge
PI	Plasticity Index
PL	Plastic Limit
SCR	Special Contract Requirement
TDIPP	Technology Deployment Initiatives and Partnership Program
US	United States
USFS	US Forest Service