ER ECOROADS

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الشركة ملف

.الإنزيم وتكنولوجيا البيئية التكنولوجيا في المخضرم ، Lee Lindenbaum قبل من 1997 عام في ER ECO الطريق مفهوم تطوير تم طريق في المستخدمة الطريق تثبيت تقنية لتحسين الدولية والميدانية الصارمة المعملية الاختبارات من سلسلة Li أجرى ، سنوات 7 لمدة 2003. أغسطس في رسميًا ER ECO طريق إطلاق تم .ER ECO

حيث من وفعال فعال بشكل الطرق وقواعد الطرق ومتانة وكثافة قوة زيادة على تساعد الطرق لتثبيت تقنية عن عبارة ER ECO طريق إن ، المياه لاختراق مقاومة دائمة قاعدة وتخلق التربة خصائص تغير الإنزيم على القائمة تركيبته فإن ، الضغط قبل بالماء مزجه عند .التكلفة .والتآكل ، الجوية والعوامل

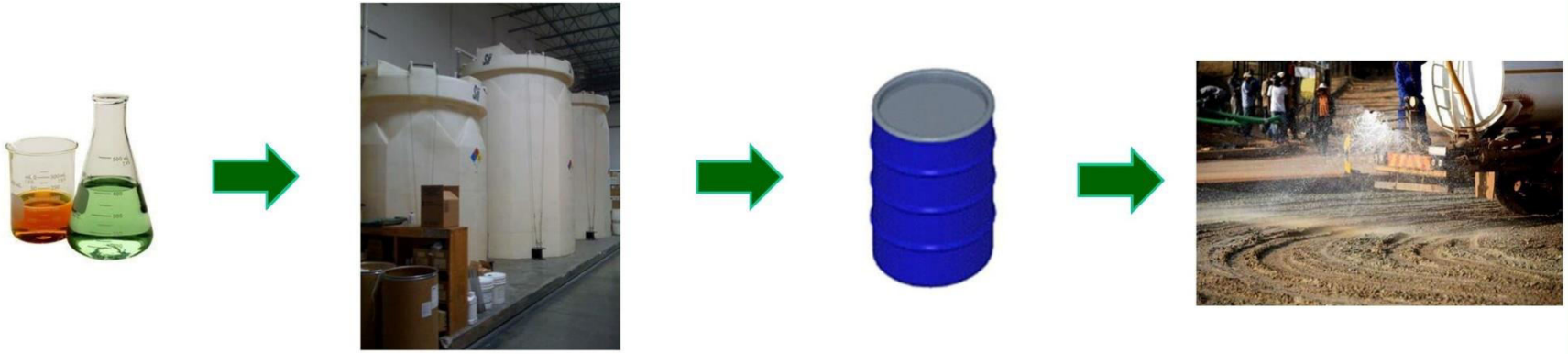
على العملاء تساعد والتي الحيوية الكتلة على القائمة الأخرى البناء منتجات من مجموعة الآن ECO road تقدم ، ER لـ الناجح الإطلاق مع .المستدامة البناء تقنيات في رائدًا بكونه ER ECO طريق يفخر .البيئة على تأثيرها وتقليل البناء عمليات وتبسيط المال توفير

بالإضافة كونيتيكت ولاية في واسعة اهتمامات لديه مارك .ER Eco طريق إلى التطوير في الخبرة من عامًا 30 من أكثر زوكير مارك يجلب العالمي والتجارة بالأسواق واسعة معرفة لديه .Benchmark Partners مالك بصفته المتحدة الولايات شرق شمال من أخرى أجزاء إلى

ER ECO: وتطبيق الطريق اختبار

موجز مجرد هو أدناه .العالم أنحاء جميع في ويستخدم ER ECO طريق اختبار تم
والتطبيق للاختبار العديدة الأماكن ببعض قائمة
لمدة اختبار عملية وتتضمن ، العالم في التصاريح أصعب من واحدة ، CalTrans باسم أيضًا والمعروفة ، كاليفورنيا في النقل وزارة تعد قاسية ظروف ظل في عامين.
الطرق من العديد لدينا .الأولى تطبيقاتنا أحد المغرب بلد
عامًا 12 من لأكثر يوم كل الشاحنات آلاف قبل من تستخدم.
نيويورك ولاية في بناؤها يتم التي الجديدة الطرق مواصفات في نيويورك لولاية البيئية الطرق تضمين تم.
الرئيسية الطرق على نيويورك مدينة أنحاء جميع في ER ECO طريق باستخدام خندقًا 998 وضع تم ، سنوات خمس مدار على نيويورك يوميًا مركبة 300000 من أكثر تحمل التي.
شنتشن :التالية المقاطعات في الطرق من العديد يوجد الصين البلد .البلاد أنحاء جميع في الريفية الطرق من كيلومترات عدة لدينا بنما البلد وشنغهاي وبكين وجيلين وتشينغداو.
البلاد أنحاء جميع في الصناعية الطرق من العديد فنزويلا دولة.
الإكوادور البلد يوتا مينيسوتا في واشنطن ولاية جامعة الأمريكي بالجيش المهندسين سلاح

مواقع إلى زهيدة وبتكلفة بسرعة تسليمه ويمكن مركّز سائل شكل ER ECO طريق يتخذ تقريبًا أسبوع غضون في العالم حول البناء.



- تقنية ER ECO Roads هي الأساسية صيغة من مملوكة والمواد الإنزيمات الخافضة للتوتر السطحي والمكونات العضوية الأخرى كاليفورنيا في المصنوعة.
- السوق في الإنزيمات متعدد منتج أول
- الأمريكي بالجيش المهندسين سلاح قبل من المعتمد الوحيد الإنزيم منتج.
- التربة لتثبيت المتعددة الإنزيمات لاستخدام اختراع براءة على للحصول بطلب ER ECO road شركة تقدمت.

ECOROADS؟ نظام هو ما

وكثافة قوة من فعال بشكل ويزيد ومبتكر ومُجرَّد الحيوية الكتلة على قائم للتربة مثبت نظام هو ® ECOROADS SYSTEM البناء ومواقع الطرق تربة ومتانة.

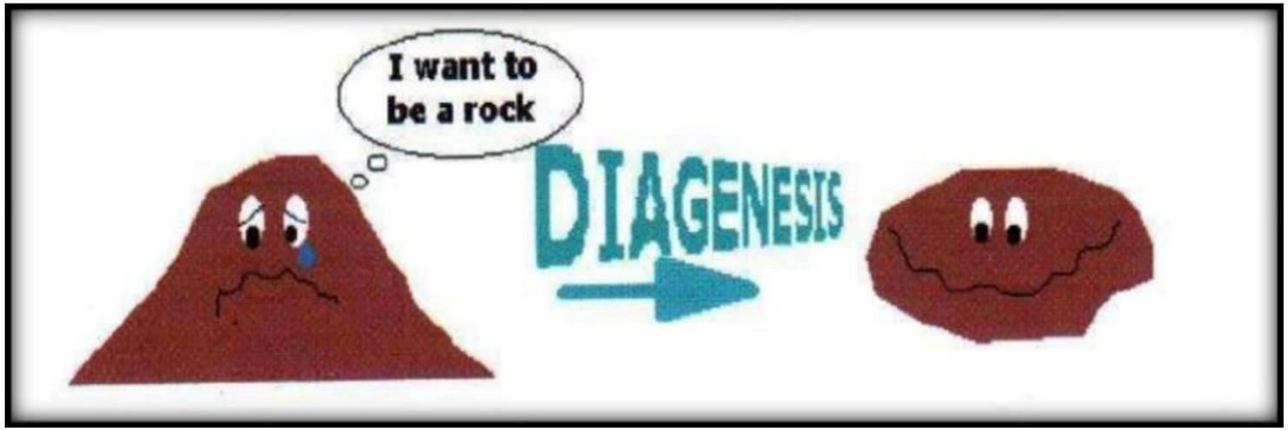
قاعدة لبناء الاقتصادية الأنظمة أحد إنه .التربة خصائص تغيير في تساهم الإنزيمات متعددة تركيبة من سامة غير مركزة تركيبة طريق.

مستقرة ركيزة إلى ويحولها المحلية التربة على تصلب تأثير له.

التربة انضغاط يدعم ER ECOROADS

وبالتالي معًا بالجسيمات يلتصق إنه .التربة رطوبة محل تحل المتأين ECOROADS نظام إنزيمات على تحتوي سائلة تركيبة .التربة ضغط في يساهم

.التعرق من أشكال هي والتثبيت الضغط .صخور إلى وتتحول ، فيزيائية لتغيرات الرواسب تخضع حيث ، التكوّن عملية هي هذه



ECOROADS SYSTEM® نظام يعمل كيف

معقدًا أو خاصًا تدريبًا يتطلب ولا الاستخدام سهل إنه.

Scarification of the soil

Applying the mixture

Mixing soil

Compacting

Compacted road
(ready to be used or set for any type of topping)

Road covered for longer life

ER ECO للطرق وقت أفضل

لتسريع كمحفز يعمل إنزيم على المنتج يحتوي .التربة ضغط قوة تحسين على يعمل الإنزيم على قائم منتج هو Roads ER ECO
.وثباتًا وتماسكًا كثافة أكثر تربة يخلق مما ، الطريق مادة التصاق وتقوية

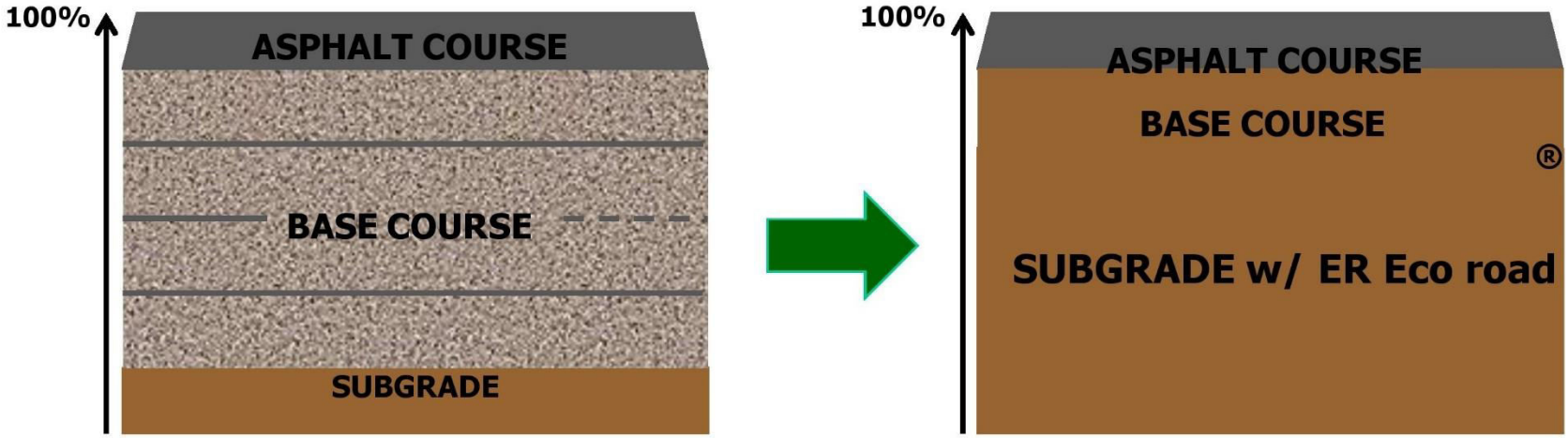
الغاز توزيع نظام في شائع بشكل الموجودة المواد لجميع آمن المنتج هذا أن الداخلية المعملية الاختبارات أثبتت مع للتلامس وآمن كاوي وغير للتآكل قابل وغير سام غير المنتج فإن ، المواد سلامة بيانات لورقة وفقًا .لدينا .والبشر الأليفة الحيوانات / البرية والحياة النباتات

ظروف من متنوعة مجموعة ظل في أنه .Materials Testing، Inc شركة أجرته الذي المستقل الاختبار أظهر .المعالجة غير التربة من أعلى ٪85 بنسبة فائقة تحمل قدرة المعالجة التربة توفر ، الأرضي التحميل

هذا أظهر ..." :يلي ما إلى بإيجاز الجيش سلاح في والهياكل والجيوتقنية الهندسة مختبر أجراها دراسة تشير ."كبير بشكل التربة قوة زيادة على القدرة المنتج

.CalTrans مشاريع في للاستخدام ER Eco طريق على الموافقة تمت ، 2008 ديسمبر في

المحلية تقوي الحيوية الكتلة على قائمة سائلة تركيبة عن عبارة ER ECO road®
مستقرة طريق قاعدة فى التربة



- لتلبية كبير بشكل به المرتبطة والتكاليف الأساسي الصخري الركام كمية لتقليل 200٪ بنسبة السفلية الطبقة يقوي القوة أهداف.
- الحالية البناء عمليات باستخدام المحلية السفلية الطبقة تربة على مباشرة تطبيقه يتم.
- البناء عملية في انقطاع أي دون بسرعة يعالج

الطرق لمشاريع الكربونية البصمة من كبير بشكل ER ECO طرق استخدام يقلل

... لميل

10,000+ tons of mined rock

500+ truck trips

800+ gallons of gas

- طريق ER ECO غير نفسه سام تمامًا وغير وقابل خطير للتحلل البيولوجي.
- ... للتو بدأت "الخضراء" الطرق حركة

Carbon Footprint Reduction

CO2 Reduction Figures for 25%, 50%, and 75% Reductions in Aggregates per Kilometer of Road			
Asphalt Concrete Pavement (Kg of CO2/1Km)	186,826kg	186,826kg	186,826kg
Reduction in the need for Base rock	**25%**	**50%**	**75%**
CO2 Savings from reduction of Base 1	6320kg	12640kg	18960kg
Total CO2 Reduction*	6202.79kg	12522.79kg	18842.79kg
Total Base 1 CO2 (New Base1 + ECOroads CO2)**	**205902.81kg**	**199582.81kg**	**193262.81kg**
Percent Reduction	**2.92%**	**5.90%**	**8.88%**
CO2 Savings from reduction of Base 2	9480kg	18960kg	28440kg
Total CO2 Reduction*	9245.5896kg	18725.5896kg	28205.5896kg
Total Base 2 CO2 (New Base2 + ECOroads CO2)**	**28674.410**	**19194.410**	**9714.410**
Percent Reduction	**4.11%**	**8.33%**	**12.55%**

Base 1 (M^3):	**1600**	**Base 2 (M^3):**	**2400**
8 meters wide		8 meters wide	
0.2 meters deep		0.3 meters deep	
1000 meters long		1000 meters long	

Construction Aggregate:	**1m^3 of base**	**Base 1**	**Base 2**
CO2 Emissions (Kg):	15.80kg	25280.00Kg	37920.00Kg

*Reduction less CO2 from shipping ECOroads 2100 miles (2000 miles air; 100 miles truck)

** *ECOroads CO2 emissions at production are unknown but transportation figures are available*. Assuming a 25% reduction in the need for aggregates at a Base 1 amount, the total aggregates' embodied CO2 would drop from 25,280kg to 18,960kg. Therefore, at this lowest level, the production of a single gallon of ECOroads would have to emit 526kg (6320kg/ 12gallons) of CO2 to be as polluting as the base course. At the other end, a 75% reduction in Base2 would require a the production of a single gallon of ECOroads to embody 2350kg of CO2.

ER ECOroads® يتفوق على تثبيت منتجات التربة البديلة من حيث الأداء والتكلفة والأثر البيئي.

	ER ECO road®	الانزيمات الفردية	البوليمرات	حجر الكلس
فعالية مثبتة	✔	◯	✔	✔
دائم	✔	✔	◯	✔
قابلية التطبيق على نطاق واسع	✔		✔	◯
فعاله من حيث التكلفه	✔	✔		
سهل النقل	✔	✔		✔
صديق للبيئة	✔	✔		◯

يكتسب العمل زخمًا وشعبية بعد عدة سنوات من التشغيل في مرحلة متقدمة من البحث والتطوير.

- تم بناء أكثر من 30 طريق تجريبي في 5 قارات ، ولا حاجة لأي منها الصيانة أو الإصلاح على مدى 10 سنوات

- اختبارات معملية ناجحة للغاية في جميع أنحاء العالم مع العديد من أنواع التربة
  - ، والعديد من المعامل الخاصة Tx DOT ، Minn DOT سلاح المهندسين بالجيش الأمريكي ، -

- معتمد للاستخدام في العديد من البلدان والولايات المتحدة.
  - نيويورك ، كاليفورنيا ، يوتا ، واشنطن -
  - إسرائيل وتايلاند وفنزويلا والمغرب وملاوي وروسيا ورابطة الدول المستقلة وبنما -

- تستخدم حاليًا مع العملاء التجاريين الأوائل:
  - الشبكة الوطنية / NYC DOT -
  - فنزويلا - شبكة الطرق الزراعية -
  - لإسكان ذوي الدخل المنخفض ECObric كينيا - الطرق و -
  - بنما - طرق وزارة بنما -

"لقد اختبرنا عددًا من منتجات الإنزيم في الماضي و [ER ECO طريق] هو الأفضل منها جميعًا.
" منتج الإنزيم الأول الذي تم اختباره والذي أدى إلى زيادة قوة التربة بشكل ملحوظ.
- سلاح المهندسين بالجيش الأمريكي

ECOroads CASE STUDY

Mining Road: Zibo City, China

KEY FACTS

Date Built
2007

Sponsor
BETE Company

Distance
1.5 km

Purpose / Use
Mining Access

Soil Type
Clay

Weather
10C to 40C;
medium rainfall

Performance
No maintenance required to date

Construction Time
1 day

Finishing
Single chip

Lab Testing
Huizhou Geological

ECOroads Builds Pathways to the Future

Over the next two decades, global infrastructure spending is expected to total $25 to $30-trillion dollars, with a sizeable portion of that being spent by the Chinese, who are expected to spend no less than $200 billion, 40% of which is going towards transportation systems. Along with building and upgrading 300,000 kilometers of rural roads in 2009, The People's Republic hopes to expand what is already the world's second largest expressway network by 40% over the next decade. With ECOroads, these rising costs can be mitigated by up to 40% by reducing the need for importing aggregates used in road construction while simultaneously cutting the road's carbon footprint.

In 2007, TerraFusion partnered with a local distributor to build a demo road for mining purposes in Zibo City using ECOroads. The 1.5 kilometer road was built in one day using local soil material — largely clay — with a single chip seal coating. Despite having 50-ton trucks use the road on a regular basis, to date the road has had no maintenance or repair requirements whatsoever.

We are proud and excited that ECOroads will be part of helping China grow and green its infrastructure in the coming years.

ECOroads CASE STUDY

Heavy Farm Road Road: Bangkok Area, Thailand

KEY FACTS

Date Built
2008

Purpose / Use
Heavy Farm

Soil Type
Sandy Clay

Weather
10C to 45C;
very heavy rainfall

Performance
No maintenance required to date

Finishing
Prime coat

Lab Testing
Kasetsart University

ECOroads Withstands Monsoon Conditions

One of the major challenges facing road infrastructure in Thailand is the constant flooding associated with the annual monsoon season. Concrete bases crack up, levees and soil beds are regularly damaged, and roads get built and washed out on a regular basis, especially in rural areas with farm and rice paddies.

TerraFusion has been working in Thailand, for the past three years to help the Thai government and regional agen-cies tackle this issue. Existing soil materials in the locations where we'vebeen working have CBR levels under 5%. ECOroads strengthened thesesoils up to 30% CBR, so the contractor was able to salvage and use thelocal soil, saving .removal and dumping costs

After extensive laboratory testing, we collaborated to construct a demonstration road in 2008 using only local materials and a simple prime coat of emulsified asphalt and local sand. Thanks to ECOroads, the contractor was able to reduce the total number of layers required to build the road from four to two. The road has already withstood its first rainy season with flying colors (no cracking, pot holes or rutting), whereas surrounding roads have washed away as usual. The ECOroads solution promises to save at least 40% of the costs of building a more traditional road and well over 50% of the costs of maintaining these roads on a regular basis.

Because of the weather, government budgets often focus on revitalizing and reclaiming deteriorated roads — ECOroads is in a prime position to capitalize on this opportunity as well.

ECOroads CASE STUDY

KEY FACTS

Date Built
2001

Sponsor
AlterTech, Inc.

Distance
1 km

Purpose / Use
Mining Access

Soil Type
Sandy Clay

Weather
10C to 40C;
low rainfall

Performance
Seven years of 6-day / week use with no need for maintenance or repair

Construction Time
1 day

Finishing
1/4 inch double chip seal

Lab Testing
LPEE

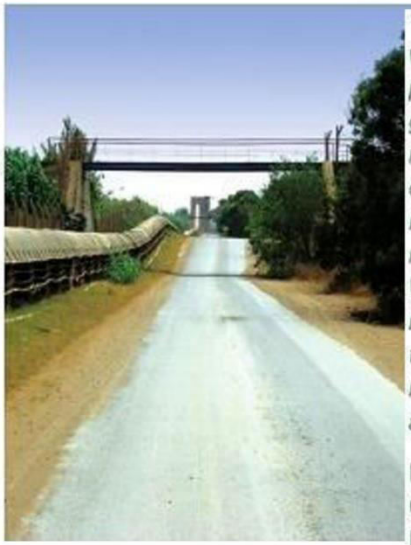
Mining Road: Casablanca Area, Morocco

ECOroads Redefines Expectations for Mining Roads

Mining roads are famous for requiring almost daily maintenance, re-grading and repair, often requiring the commitment of a full-time grader, water truck and operating professionals. This is a costly and time-consuming endeavor that has until recently simply been part of life for mining operations.

In 2001, TerraFusion was asked by **Altertech**, a materials and construction company, to construct a number of mining roads in four distinct areas of the country of Morocco. The longest of these roads was a 1 kilometer mining access road, built entirely from local materials — no mineral aggregates were used — and capped with a double chip seal. The road has been in constant use for the past 8 years, with 40-ton and heavier mining trucks using the road 6 days a week.

In all this time, the road has exhibited no pot holes or rutting, and has required no significant maintenance of any kind. According to Altertech, the road continues to perform as designed, at a great savings to the mining company.



"We have been working with ECOroads for the past five years, with great results, completing roads in different parts of Morocco, including Rabat, Casablanca, Marrakesh and Ouarzazate. We have been most impressed with this technology and how it has produced such amazing results for us."

Hassan Hamdi
CEO, Altertech
Morocco

المعدات اللازمة لنظام ECOROADS

ممهدة الطرق / الكسارة و / أو الجرافة

شاحنة لنقل المياه بالرش

طن مدحلة واسطوانة 14

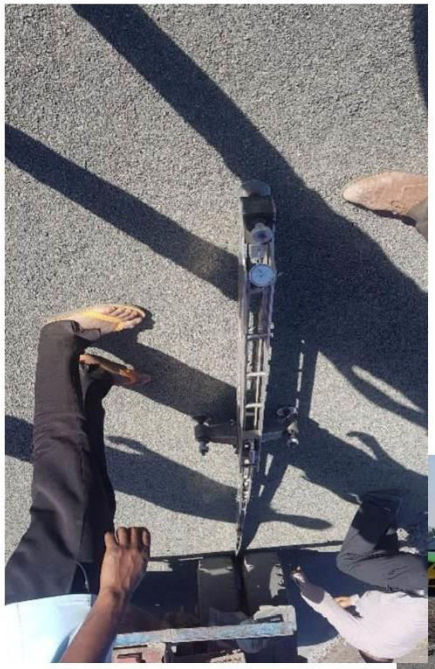
Uzbekistan project

After one year

Ethiopia project

Ethiopia project

C.B.R Testing



Deflection test

After six month

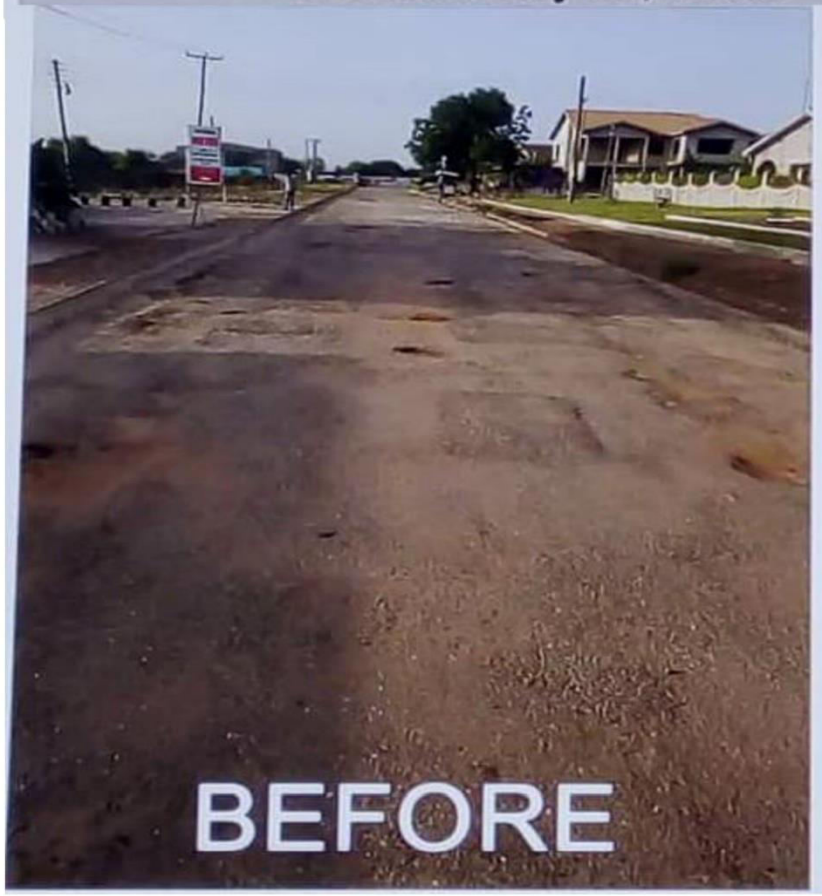
Ghana project

Before

After using ER Ecoroads

Ghana project

The First Newly Test Constructed Road in Ghana, using ECOROADS Solution at Community 20, Tema - Ghana, Near Top Star Hotel.

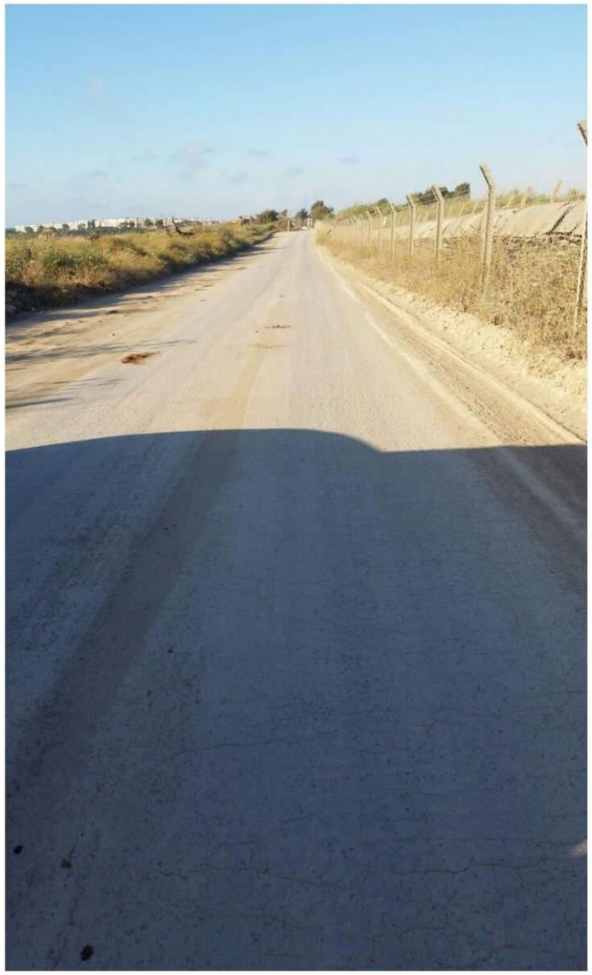


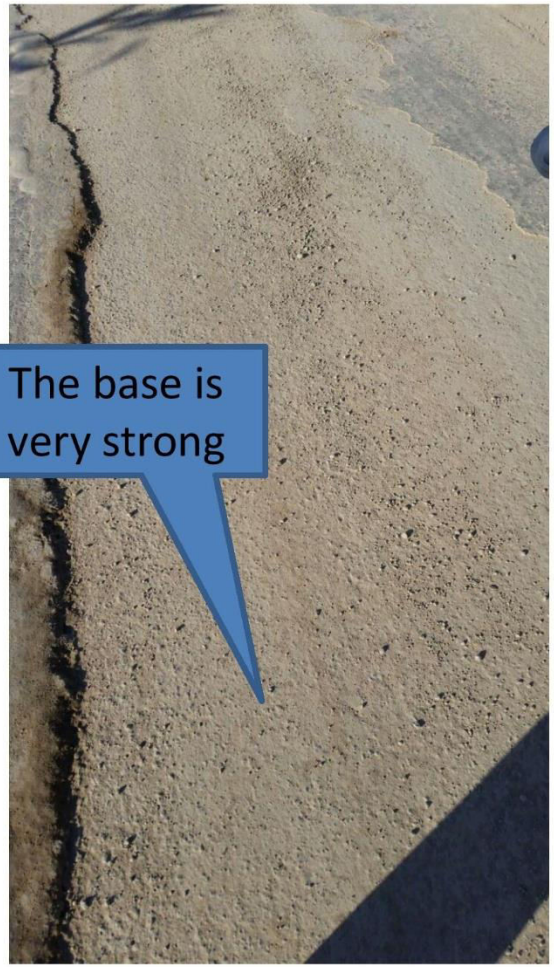
Quarry road, Aïn Atiq, Morocco

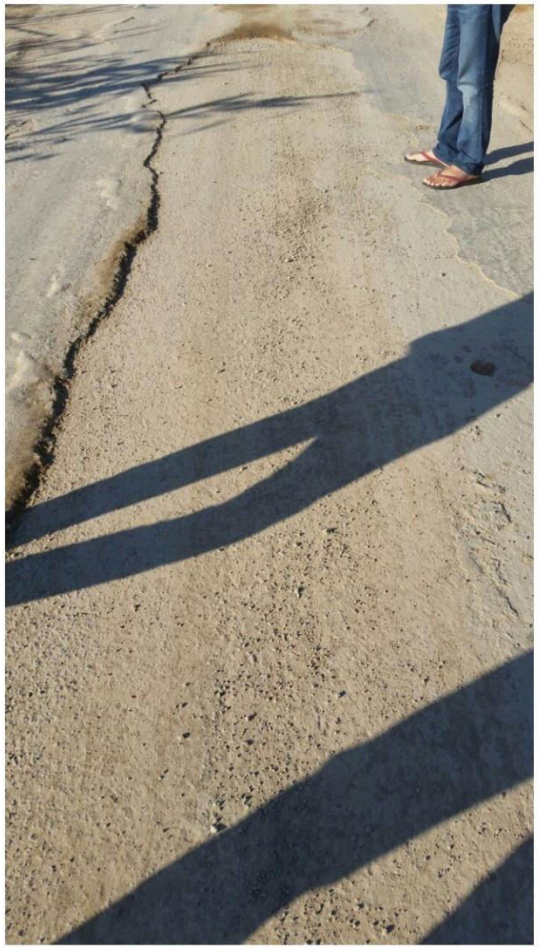
June 2001 just after been treated with ECOROADS SYSTEM

January 2008 the road is still intact, after 7 years

Road after 14 years without any treatment








BOMAG
FAYAT GROUP


IWA-VORTAC
3 CH 80 124/304
DME .6 NM

ER ECOROADS





SAFETY DATA SHEET

ER ECO ROAD	SDS Number : AB9ECODS	Revision Date: 06/26/2017

1. PRODUCT AND COMPANY IDENTIFICATION:

Product Name: ER ECO ROAD
Product Code: AB9ECODS
Product Use: Biomass-Based Soil Stabilization Solution
Synonyms: None
Chemical Formula: Mixture of substances listed below with nonhazardous additions
Restrictions: Road Construction Use Only

Manufactured For: ER Eco road
1725 AVENUE M
BROOKLYN, NY 11230
718.252.8092

Emergency contact: Chemtrec 800.424.9300
CCN No. 21541

2. HAZARD IDENTIFICATION:

GHS CLASSIFICATION:

HEALTH	***ENVIRONMENTAL***	***PHYSICAL***
Eye Irritation: Category 2	***Acute Toxicity: None Known*** ***Chronic Toxicity: None Known***	***None***
	***Signal Word:*** ***Warning***	

Hazard Statements
Causes eye irritation

Precautionary Statements

Wear protective gloves/protective clothing/eye protection/face protection
Avoid breathing mist or spray.

IF IN EYES: Rinse with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation occurs or persists: Get medical attention.
IF ON SKIN: Rinse skin with water for several minutes. If skin irritation occurs or persists: Get medical attention. Wash contaminated clothing before reuse.
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Call a POISON CENTER or physician.
IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.

Store in a closed container.
Dispose of contents/container in accordance with local regulation.





3. COMPOSITION/INFORMATION ON INGREDIENTS:

INGREDIENT	CAS NO.	PERCENT	HAZARDOUS
2-ETHYLHEXYL SODIUM SULFATE	126-92-1	1 - 2%	YES
DIPROPYLENE GLYCOL MONOMETHYL ETHER	34590-94-8	0.1 – 0.5%	YES
Exact Percentages are being withheld as trade secret information.			

4. FIRST-AID MEASURES:

Eye Contact: Rinse with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation occurs or persists: get medical attention.
Skin Contact: Rinse skin with water for several minutes. If skin irritation occurs or persists: Get medical attention. Wash contaminated clothing before reuse.
Inhalation: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
Ingestion: Rinse mouth. Do NOT induce vomiting. Call a POISON CENTER or physician.

5. FIRE-FIGHTING MEASURES:

Fire Extinguishing media: Use water spray dry chemical, carbon dioxide or regular foam. Move containers away from fire area if can be done without risk.
Hazards during fire-fighting:
Containers may rupture when exposed to extreme heat.
Protective equipment for fire-fighting:
Wear NFPA-approved self-contained breathing apparatus, helmet, hood, boots and gloves.

6. ACCIDENTAL RELEASE MEASURES:

Personal precautions:
Use recommended personal protective clothing and equipment. To prevent slipping, do not walk through spilled material.
Environmental precautions:
Follow all Federal, State and Local regulations when storing and disposing of substances. Do not allow material to run off of work area, and material should be absorbed, collected and disposed of in accordance with regulations. Keep product from entering storm drains. Consult local and federal guidelines for proper disposal of these materials.
Cleanup:
- *For small amounts of released material:* Mop or vacuum up then transfer to suitable container for disposal. - *For large amounts of released material:* Dike around spilled material to contain. Spilled material may be mopped or vacuumed up, then transferred to plastic containers for disposal.

7. HANDLING and STORAGE:

Handling:

General advice - No specific measures are necessary provided product and recommended protective clothing/equipment are used correctly. Do not mix with other chemicals. This is a commercial product, not intended for home use. Keep out of reach of children.

Storage:

General advice - Protect against physical damage. Store in tightly closed containers in a cool, well ventilated area. Do not allow product to freeze.

Shelf Life:

12 months

8. EXPOSURE CONTROLS and PERSONAL PROTECTION:

Advice on system design:

Provide local exhaust ventilation to control vapors for published exposure limits.

Personal protective equipment (HMIS rating 'B'):

Eye protection: Wear safety glasses with side shields or safety goggles to prevent exposure or full face shield if splash hazard exists.

Skin protection: Chemical-resistant gloves. Wear appropriate protective clothing to prevent possible skin contact.

Respiratory protection: Not normally required. Avoid breathing mists or spray. Use proper NIOSH-OSHA respirator if ventilation is inadequate.

General safety and hygiene measures: Exercise stringent hygiene practices to minimize exposure. If contact occurs, wash any body part with soap and water immediately. Wash hands after use, and before eating, drinking or smoking.

Other protective measures:

Nearby running water on the job site is necessary, should an accident occur.

Exposure Guidelines:

ACGIH TWA: 100 ppm (34590-94-8)
STEL: 150 ppm SKIN(34590-94-8)
OSHA PEL: 600 mg/m3 and 100 ppm SKIN(34590-94-8)

9. PHYSICAL and CHEMICAL PROPERTIES:

Appearance:	Brown Turbid	Flash Point:	None
Odor:	Mild	Upper/Lower Flammability Limits:	No information available
pH value:	7.0+/- 0.5	Relative Density (water):	1.00
		Auto-Ignition Temperature:	No information available
		Decomposition temperature:	No information available
Specific gravity:	1.00 (H2O = 1)	Partition Coefficient	No information available
Solidification temperature:	No information available	Odor Threshold	No information available
Freezing/Melting point:	32 °F (0 °C)	Viscosity:	< 10 cps.
Boiling point:	212°F (100 °C)	Partition Coefficient	No information available
Vapor density:	No information available	Solubility in water:	Miscible
Vapor pressure:	No information available		
Evaporation Rate:	No information available		
Regulatory VOC:	0.5 % by weight (concentrate)		

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
MATERIALS ENGINEERING AND TESTING SERVICES
TRANSPORTATION LABORATORY—MS 5
5900 FOLSOM BOULEVARD, ROOM 151
SACRAMENTO, CA 95819-4612
E-MAIL: <New_Products@dot.ca.gov>
PHONE: (916) 227-7073
FAX: (916) 227-7118
TTY: 711

Flex your power!
Be energy efficient!

December 16, 2008

ER Eco Road, Inc.
1725 Ave M
Brooklyn, NY 11230

Dear Mr. Cukier:

The California Department of Transportation (Caltrans) has reviewed the following product as a possible application for road/base stabilization.

Product	Tracking Number
ER ECO Roads ECO-DS (for Road/Base Stabilization)	NPE 05-05-025

The Pavement Related New Product Needs Assessment Committee (PRNP-NAC) has made the following determination:

- The Contractor can choose the method and/or product for base stabilization, as long as all requirements are met by the vendor and/or contractor for the proposed product.

Should you have any technical questions regarding the review of this product, please contact Mr. Hamid Moussavi with the PRNP-NAC. Mr. Moussavi can be reached at (916) 227-7175.

If this product is proposed for use on any Caltrans construction contract or procured for use by Caltrans maintenance forces, quality assurance testing may be performed by Caltrans to verify material properties actually meet those required in the specification.

Product review and acceptance or approvals do not constitute an endorsement of this product by Caltrans.

"Caltrans improves mobility across California"

ER ECOROADS





Thank you for giving Caltrans the opportunity to review this product. If you have any questions regarding the new products review process, please contact the New Products Desk at (916) 227-7073.

Sincerely,

L. JANIE SPENCER
Assistant New Products Coordinator
Materials Engineering and Testing Services
Division of Engineering Services

cc: NHosseinzadeh – DES/METS/Flexible Pavements
HMoussavi – DES/METS/Flexible Pavements

nationalgrid

May 7, 2014

Mr. Leigh Lindenbaum
TerraFusion

Re: EcoRoads Soil Stabilization Initiative

Mr. Lindenbaum,

NGrid has been involved in the research and testing of soil stabilization using the EcoRoads product dating back to April of 2008. Our testing has included both field and laboratory analysis. NGrid believes that providing a superior sub-base, prior to the introduction of permanent paving materials, will lead to a more stable and durable restoration.

During our NYC DOT approved pilot program, which started in March, 2009 and ended in March, 2011, NGrid completed over 850 various sized openings at more than 475 protected street locations within our NYC service territory (Brooklyn, Queens and Staten Island). Based on NYC DOT - NGrid joint field inspections (between myself and the Director of Highway Inspections / Quality Assurance) as well as independent NYC DOT inspections, test results proved favorable and soil stabilization to be an effective method for achieving superior soil compaction through increased soil density.

In addition to the aforementioned benefit of using this process, NGrid believes that this initiative supports the DOT's "Sustainable Streets" strategic plan as well as the City's plan for a "greener" New York by reducing our carbon footprint during roadway restoration. This is achieved by a decrease in discarded roadway debris, landfilling, noise, noxious emissions, etc. We also believe that as a result of this process the quality of life will be enhanced through improvements in permanent restoration cycle times and reductions in construction-related vehicular traffic, steel roadway plating and associated complaints.

Based on the results of the pilot program and benefits that will be derived by using a soil stabilization agent, NGrid is hopeful that we can move forward from the successful pilot program to full implementation of the soil stabilization process. NGrid further seeks to clearly define the operational criteria for implementation and is fully committed to meeting and exceeding DOT's expectations.

Thank you for your support and assistance in this matter. If you should have any questions or comments, please do not hesitate to contact me at 516-545-2245.

Sincerely,

Andrew J. Vorbeck
Principal Engineer
National Grid

ECOROADS





REPUBLICA DE PANAMA

MINISTERIO DE OBRAS PUBLICAS
Departamento de Ensayos de Materiales

Panamá, 11 de mayo de 2012 **DEM-429-12**

Ingeniero
Eliézer Broce
Director Nacional de Inspección
E. S. D.

Ref.: Caminos Estabilizados con Enzimas de Panamá Oeste y Coclé

Ingeniero Broce:

Atendiendo su solicitud, realizamos una visita de evaluación a caminos de Panamá Oeste y Coclé que fueron estabilizados con la enzima EcoRoads, con el fin de observar su desempeño y a la vez tomar muestras para verificar la compresión inconfinada del suelo estabilizado por este método.

Cabe señalar que los seis caminos visitados, estaban en buenas condiciones, no se observaron deformaciones y el material estaba duro, de manera que costó un poco la extracción del mismo para la prueba.

Los resultados obtenidos de la prueba de compresión inconfinada son los siguientes:

Proyecto	Compresión inconfinada kg/cm^2	
	Probeta #1	Probeta#2
Pueblo Nuevo-Aguacate-Laja Lisa	41.0	67.0
Faldares - La Onda	40.0	37.0

Como puede apreciarse, los resultados obtenidos están por arriba de los valores especificados en la ETG – Capítulo 70 "Estabilización con Productos Químicos, Poliméricos, Enzimáticos e Inorgánicos de base, Sub-bases y Terracería para Pavimentos" que exige que si la estabilización es para utilizar como sub-base, la resistencia a compresión inconfinada mínima es de 15 kg/cm^2 y si es para capa base, el valor mínimo exigido es de 30 kg/cm^2.

Atentamente,

Ing. Alba de Bravo
Jefa del Departamento de Ensayos de Materiales

c.c. Ing. Maricel Acosta, Sub-directora de Inspección
Ing. Eduardo Rodriguez, Coordinador de proyectos

INSTITUTUL DE CERCETARI IN TRANSPORTURI

[illegible]

Institutul de cercetări în transporturi
INCERTRANS S.A.
IEȘIT Nr. 2294
Luna 12 Ziua 21

Către:

NABEL TRADING CORP- N.Y. USA

Urmare a solicitării dvs., vă comunicăm că la S.C. INCERTRANS S.A. București se află în curs de elaborare Agrementul Tehnic pentru ***„ECOROADS- stabilizator chimic pentru drumuri de pământ"*** fabricat de NABEL TRADING CORP- N.Y. USA.

Până la această dată s-au efectuat teste de laborator care confirmă calitatea corespunzătoare a produsului.

Acest document este valabil până la emiterea Agrementului Tehnic de către S.C. INCERTRANS S.A. București conform "Instrucțiunilor privind procedura de Agrement Tehnic pentru produse, procedee și echipamente noi în construcții - I.A.T. 1- 2002" transmise de MTCT, ce constituie anexă la HG 766/1997.

DIRECTOR GENERAL
ing. Daniel George COSTACHE

TOTAL P.02

TRANSPORT RESEARCH INSTITUTE
393, Calea Griviței, Bucharest

Institutul de cercetări în Transporturi
INCERTRANS S.A.
IEȘIT Nr. 2284
Luna 12 Ziua 2

To,
NABEL TRADING CORP NY - USA

Following your requirement, we comunicate you that at SC INCERTRANS SA-Bucharest, there is in course of elaboration the Technical Agreement for "ECOROADS chemical stabilizer for earth roads" produced at NABEL TRADING CORP NY-USA.

Up to the present, there were carried out laboratory tests, which confirm the adequate quality of the product.

This document is valid until the Technical Agreement is issued by SC INCERTRANS SA- Bucharest, according to "The instructions concerning the procedure of Technical Agreement for products, procedures and new equipment in constructions- I.A.T. 1-2002" sent by MTCT, which represents the appendix to HG (Government Decision) 766/1997.

GENERAL DIRECTOR,
Eng. Daniel George [illegible]

INCER S.A. Bucharest

ECOROADS





DEPARTMENT OF THE ARMY
ENGINEER RESEARCH AND DEVELOPMENT CENTER, CORPS OF ENGINEERS
GEOTECHNICAL AND STRUCTURES LABORATORY
WATERWAYS EXPERIMENT STATION, 3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

11/29/2007

REPLY TO ATTENTION OF CEERD-GM-A

Leigh L Lindenbaum
Founder
ER Eco Road, Inc

NOTE: The information below is NOT to be used for advertising or promotional uses AT ALL. Mr. Lindenbaum presented to me that these results were intended for his Board of Directors only and that no other use will occur. The US Army ERDC does not approve, certify, or endorse any commercial products.

The US Army ERDC Airfields and Pavements Branch conducted considerable stress-strain testing of your product, but only under unconfined conditions for both dry and 'wet' samples at a single strain rate. In the wet test, the sample is soaked on one side for 15 minutes immediately prior to testing. We do these simple tests as we are usually interested in rapid structural improvements to the soil from additives. I realize that there are a number of benefits that some products will impart to a soil (such as reduced swell, rewetting potential, etc…) and that improved UCS (Unconfined Compressive Stress) properties may not be the target of some products. Curing is at 25°C and 50 percent relative humidity). The soil is Mississippi delta clay with high plasticity (around 60) and a high fines fraction. Moisture content was at 36 percent, CBR about 6-8 percent. The soil was dried at 60°C then brought to 36 percent moisture content with the additive at concentration in the mix water. Compaction was with a Pine gyratory compactor to 114 pcf (ponds per cubic foot) density. Sample size is 3 inches diameter x 6 inches high.

The following charts detail the testing of three commercial products versus 4percent cement (we used Type III for fast setting) and various doses of lime. Terrafusion's product "ER Eco Road" (Product C) was mixed in a low concentration (your recommended dosage of 1ml per 5L water) and a higher concentration (5ml per 5L water). The performance difference between these test items was negligible. The data are the average of three tests. Unfortunately, I don't have the statistic analysis completed on these test results yet but will point out where the differences appear statistically significant.

In the dry condition, the improvement in stress to failure is substantial and significant compared to the control, Product A, Product B, and lime after 28 days of cure time. ER Eco Road and 4 percent Type III cement were comparable in strength after 28 days cure time. Type III cement gave the best strength at a one day cure, with similar strength to ER Eco Road. After three days, Type III cement is

still the highest strength. The strain data has higher variance than the strength but indicates that most of the additives reduce the 'flexibility' of the soil, especially at early cure times.

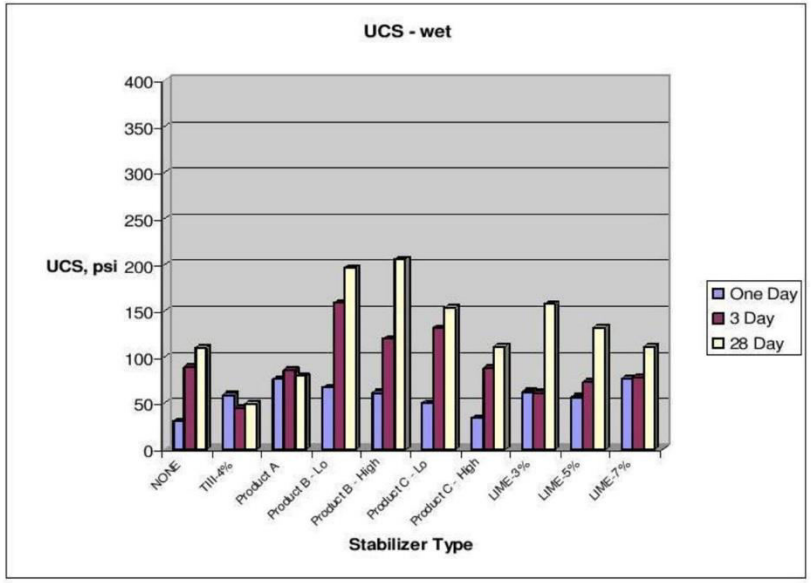
In the wet testing, Product B exhibited the highest strength, with low dosage EcoRoads having similar strength to 3 percent lime after 28 days. This test is primarily used as a gauge to assess the moisture sensitivity of the additives.

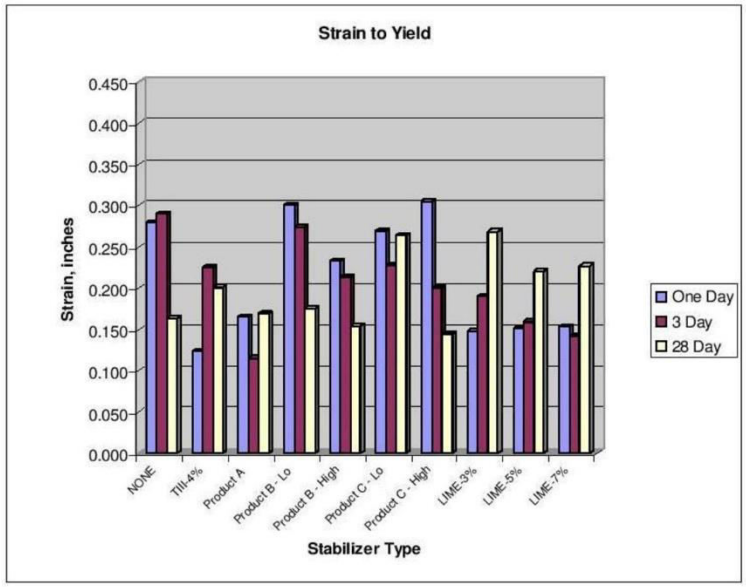
We have tested a number of enzyme products in the past and this is the first enzyme product tested that has demonstrated the capability to substantially increase soil strength (Reference Tingle et. al, Transportation Research Record 1819, pages 72-84, 2003).

Sincerely,

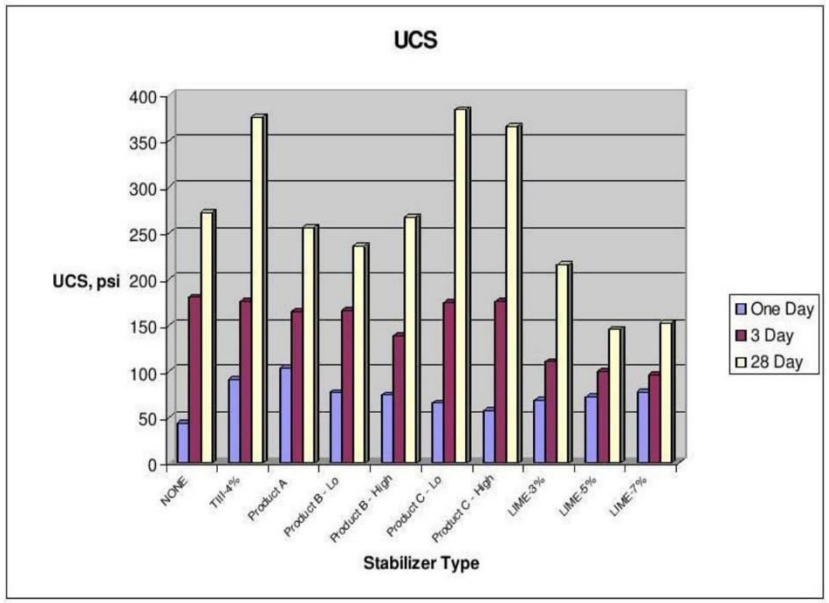
J. Kent Newman, PhD
Research Physical Scientist

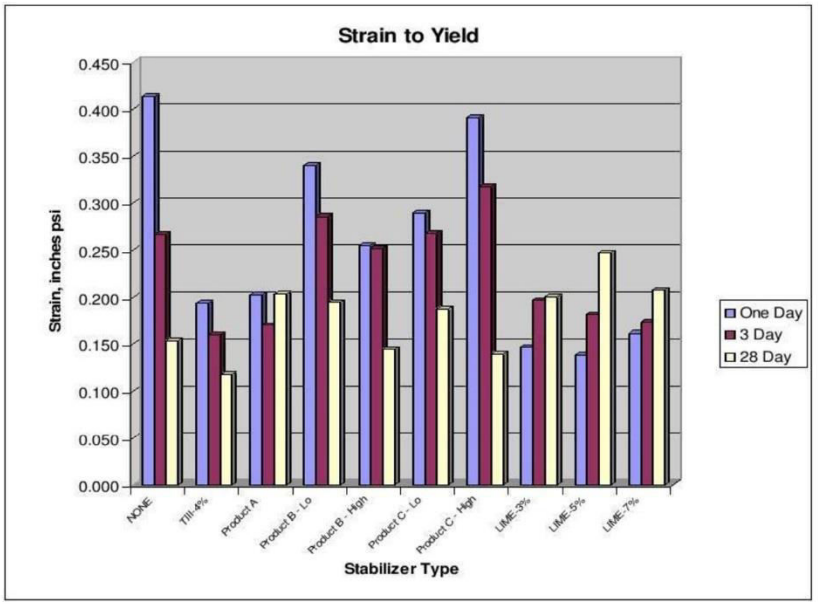
Wet Testing


UCS - wet
UCS, psi
400
350
300
250
200
150
100
50
0
NONE
Till-4%
Product A
Product B - Lo
Product B - High
Product C - Lo
Product C - High
LIME-3%
LIME-5%
LIME-7%
Stabilizer Type
One Day
3 Day
28 Day


Strain to Yield
Strain, inches
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
NONE
Till-4%
Product A
Product B - Lo
Product B - High
Product C - Lo
Product C - High
LIME-3%
LIME-5%
LIME-7%
Stabilizer Type
One Day
3 Day
28 Day

Dry Testing


UCS
UCS, psi
400
350
300
250
200
150
100
50
0
NONE
TIII-4%
Product A
Product B - Lo
Product B - High
Product C - Lo
Product C - High
LIME-3%
LIME-5%
LIME-7%
Stabilizer Type
One Day
3 Day
28 Day


Strain to Yield
Strain, inches psi
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
NONE
TIII-4%
Product A
Product B - Lo
Product B - High
Product C - Lo
Product C - High
LIME-3%
LIME-5%
LIME-7%
Stabilizer Type
One Day
3 Day
28 Day

ER ECOROADS

Building Sustainable Roads to the Future