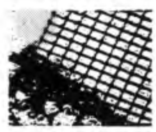
OUR FOCUS TODAY

BX (Biaxial) Geogrids
and how they can help you solve
site Subgrade Problems for
any pavement type

OUR FOCUS TODAY

...improve the performance or
provide economic benefits
of any flexible pavement

Geogrids



Biaxial

- **Bi-Directional**
- **Polypropylene**
- **High Strength @ Low Strains**
- **Pavements & Foundations**

Geogrids

Uniaxial

- **One Directional**
- **HDPE**
- **High Strength @ Low Strains**
- **Slopes & Retaining Walls**

Biaxial Geogrids

Two Basic Applications

Base Reinforcement

&

Subgrade Improvement

Base Reinforcement

Structural Pavement Reinforcement

Reduce Aggregate Thickness for Immediate Economy

MDOT - Ionia Co. Road Commission

Increased Service Life for Long-Term Economy

Subgrade Improvement

Soft Soil Reinforcement

Cost Effective Solution

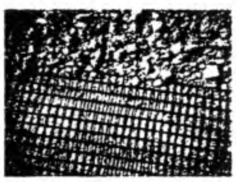
Immediate Results

Alton Heights Subdivision - Alton, KY

Geogrids

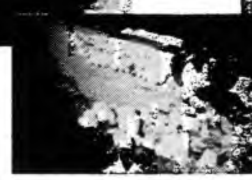
Are <u>NOT</u> Fabrics

- Different Functions
- Different Properties
- Different Specification Criteria



Fabric Uses

French



Fabric Used in Pavements

They Do Not Reinforce

They Separate

Subgrade Improvement Mechanisms

<u>Literature Review on Geotextiles</u> - COE

"...if geotextiles are included in the structure (of a pavement), no structural support should be attributed to geotextiles."

"geotextiles should be used in filtration, drainage, and separation, but not reinforcement."

AASHTO M288

Generic Geotextile Spec

- **Filtration**
- **Drainage**
- **Erosion Control**
- **Silt Fence**
- **Separation**

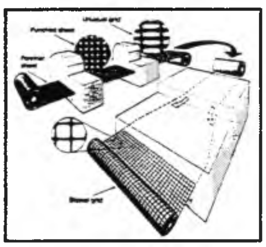
But Not Reinforcement!

Geogrids Were Designed to Reinforce

What is the difference between Fabrics & Geogrids?

DISTINCTIONS

Tensile Modulus



Strain Compatibility

TENSILE MODULUS

A fancy word for the relationship between the amount a material will stretch under a given load

Geogrids have a high Tensile Modulus Compared to Fabrics

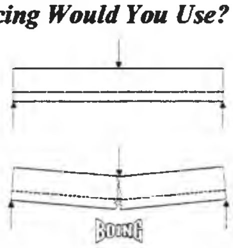
TENSILE MODULUS

What Type of Reinforcing Would You Use?

- Steel Rebar

-or-

- A Bungee Cord *of Equal Strength*



The High Tensile Modulus Steel - of Course!

TENSILE MODULUS

Subgrade Soils are Like Concrete

- **Weak in Tension**
- **Fail with very little Stretching**

-Therefore-

Reinforcement Must have a High Modulus

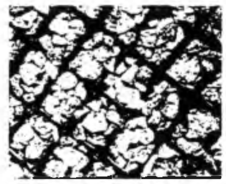
Field Proof

TENSAR Geogrid

Fabric

Note how the Fabric Ruts

DISTINCTIONS
Apertures



Mechanical Interlock

Confinement

DISTINCTIONS
Flexural Rigidity

Stiffness helps protect existing subgrade strength

Structural Capabilities

These properties allow biaxial geogrids to provide Structural Value

Less Stone and Less Cost
-vs.-
Fabrics and Chemical Treatments

BX Geogrid Reinforcement Capabilities

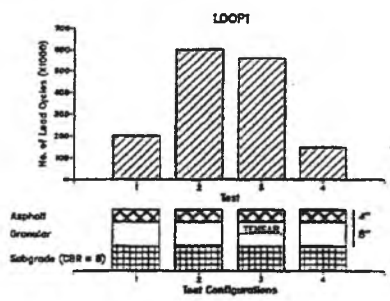
Even works where you

think it's not needed

i.e. good subgrades

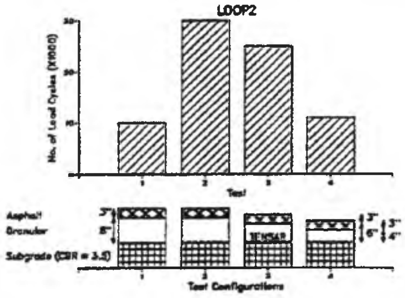
Proven by Research and.....
In-ground Performance

1984 University of Waterloo - *Test Results*



Extended Service Life (Higher SN Value)

1984 University of Waterloo - *Test Results*



Reduced Aggregate Thickness - Maintains Same Service Life

Traffic Benefit Ratio (TBR)

Ratio of the number of loads to failure with Geogrid
vs.
without Geogrid

1984 University of Waterloo
<u>The Bottom Line</u>

- **Traffic Benefit Ratio (TBR) = 3.0** ***or an increase to 300% of original service life***
- **Up to 50% Reduction in Base Course Thickness**

Summary of Research

- **<u>University of Waterloo</u>**
  BX1100 **TBR = 3**
- **<u>Corps of Engineers</u>**
  BX1100 **TBR = 2.7** ***BX1200*** **TBR = 4.7**
- **<u>University of Alaska</u>**
  BX1100 **TBR = 2-3** ***BX1200*** **TBR = 2-10**
- **<u>Montana State University</u>**
  Verifies a Minimum BX1100 TBR = 3

TBR Varies Some with Base Thickness

1992 US Army Corps of Engineers

- **USDOT/FAA commissioned study for reinforcing airfield pavements**
- **Phase I - Geotextile Literature Review**

1992 US Army Corps of Engineers

Phase I - Geotextile Literature Review
states that...

"...geogrids have more potential than geotextiles for reinforcement of flexible pavements."

Also

"... if geotextiles are included in the structure, no structural support should be attributed to geotextiles."

1992 US Army Corps of Engineers

Phase II - Geogrid Literature Review

"Geogrids perform better than geotextiles in base layer reinforcement mainly because of grid interlock with aggregate particles. Poor friction properties of geotextiles do not allow good interlock with aggregate particles"

-Therefore-

Full Scale Testing of Geogrids was Recommended

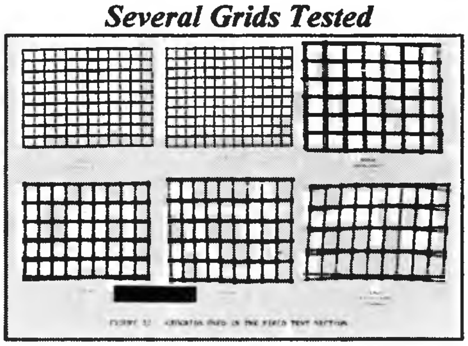
1992 US Army Corps of Engineers

Phase III - Geogrid Reinforcing Full Scale Test

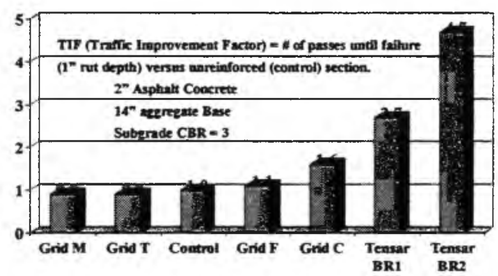
Full Scale Test Report on all commercially available geogrids

1992 US Army Corps of Engineers

Several Grids Tested



COE Results



Not All Geogrids Perform The Same

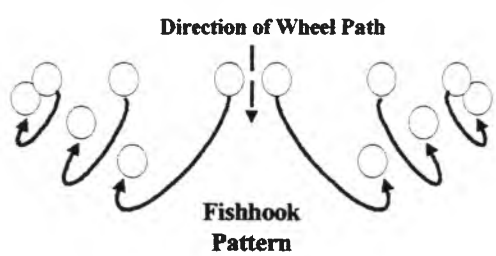
Why the Difference in Performance???

Common Material Properties

- **Tensile Strength and Modulus**
- **Aperture Size**
- **Junction Strength**
- **Stiffness**

COE Enlist the Help of Dr. Kinney

Soil Particle Movement



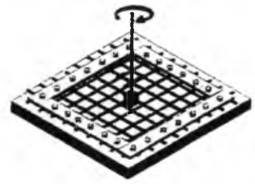
How Properly Designed Geogrids Work

CONFINEMENT

Aggregate Restraint

University of Alaska & COE

Torsional Rigidity Modulus

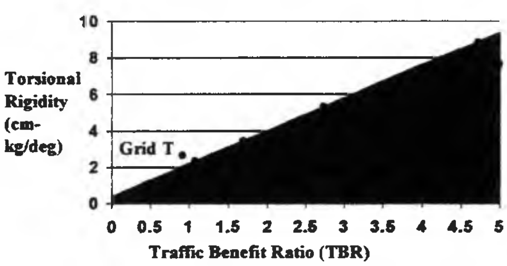


A Measure of the Resistance to:

- **In-plane Rotation**
- **Fishhook Particle Movement**

Correlates to In-Ground Performance

In- Ground Performance is Predicted by Torsional Rigidity



TORSIONAL RIGIDITY

"Not all Geogrids are Equal"

Specifications Sheet Comparisons
DO NOT Prove Equivalence

Biaxial Geogrids

Two Basic Applications

Good Subgrades

&

Poor Subgrade

BX Geogrid Applications

Base Reinforcement & Subgrade Improvement

Combination

Subgrade Improvement

Soft Soil Reinforcement

Cost Effective Solution

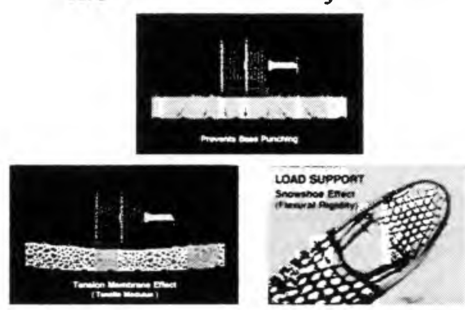
Immediate Results

THE PROBLEM!

THE SOLUTION!

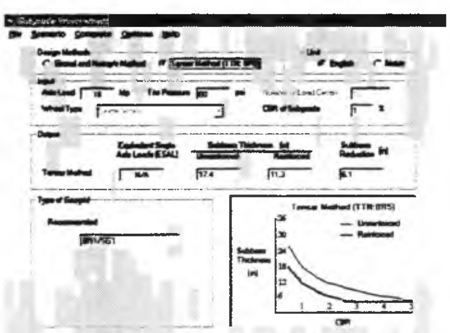
Subgrade Improvement Mechanisms

Are Similar to Base Reinforcement



Design Tools

SPECTRA
Pavement Systems



Good Subgrades

Structural Pavement Reinforcement

Reduce Aggregate Thickness for Immediate Economy

MDOT - Ionia Co. Road Commission

Increased Service Life for Long-Term Economy

Base Reinforcement

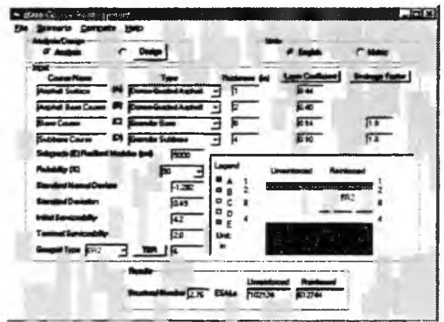
Economic Benefits

- Reduced Initial Construction Cost
- Quicker Construction
- Up to 50% Less Aggregate Base Required

Less Expensive Pavement

Design Tools

SPECTRA Pavement Systems



BX Installation

- Easy to Install
- Cost Effective
- No special equipment

- Immediate Results
- Readily Available

BX Installation

One-Step Application
- No mixing
- No waiting

Environmentally Friendly
- No Dust to drift or breathe

STRUCTURAL Geogrids

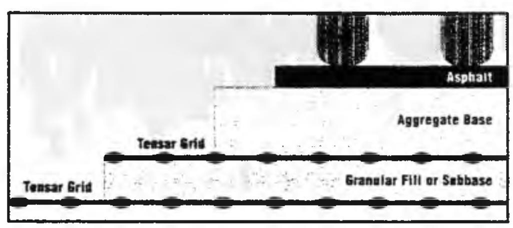
Proven Performance & Economy in Good Subgrade Conditions

Base Reinforcement

Proven Performance & Economy in Poor Subgrade Conditions

Subgrade Improvement

BX Geogrid Applications



Base Reinforcement & Subgrade Improvement
Combination