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

Subgrade Improvement  
*Soft Soil Reinforcement*  
Cost Effective Solution  
Immediate Results

Geogrids  
*Are NOT Fabrics*  
- Different Functions  
- Different Properties  
- Different Specification Criteria

Fabric Uses

Fabric Used in Pavements  
*They Do Not Reinforce*  
They Separate

Subgrade Improvement Mechanisms  
*Literature Review on Geotextiles - 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."
Geogrids Were Designed to Reinforce

What is the difference between Fabrics & Geogrids?

DISTINCTIONS

Tensile Modulus

Strain Compatibility

TENSILE MODULUS

What Type of Reinforcing Would You Use?

- Steel Rebar
- 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

Traffic Benefit Ratio (TBR)

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

1984 University of Waterloo

The Bottom Line

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

1992 US Army Corps of Engineers

- US DOT/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."

Summary of Research

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

TBR Varies Some with Base Thickness
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

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

COE Results

<table>
<thead>
<tr>
<th>Material</th>
<th>TIF (Traffic Improvement Factor)</th>
</tr>
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<tbody>
<tr>
<td>Grid M</td>
<td>1.5</td>
</tr>
<tr>
<td>Grid T</td>
<td>1.2</td>
</tr>
<tr>
<td>Control</td>
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<tr>
<td>Grid F</td>
<td>1.7</td>
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<tr>
<td>Grid C</td>
<td>1.4</td>
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<tr>
<td>Tensar BR1</td>
<td>2.1</td>
</tr>
<tr>
<td>Tensar BR2</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Direction of Wheel Path

Soil Particle Movement

Fishhook Pattern
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

Good Subgrades
Structural Pavement Reinforcement
Reduce Aggregate Thickness for Immediate Economy
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

BX Installation

- Easy to Install
- Cost Effective
- No special equipment
- Immediate Results
- Readily Available

BX Geogrid Applications

- Base Reinforcement
- Subgrade Improvement

Structural Geogrids

Proven Performance & Economy in Good Subgrade Conditions

Proven Performance & Economy in Poor Subgrade Conditions

Design Tools

One-Step Application
- No mixing
- No waiting

Environmentally Friendly
- No Dust to drift or breathe

BX Geogrid Applications

Base Reinforcement & Subgrade Improvement Combination