



**2005 Purdue Road School
Back to Basics:
Geosynthetics and Road Applications**

**Geosynthetic Applications for
Indiana Roads**

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**INDOT Requirements for use of
Geosynthetic Products**

1. From the INDOT Approved List of Geotextile and Geogrid
2. Acceptance is based on
 - a.) Type A Certification
 - b.) per Section 913.18 for riprap
 - c.) per Section 913.19 for under-drains
 - d.) per Section 913.21 for geogrid

Geosynthetic applications currently in use:

Geotextile

1. Under drains
2. Erosion control
3. Separator layer
4. Drainage

I-69 Installation of the geotextile



I-69 Erosion Control Mat



I-69 Erosion Control Mat



Geosynthetic applications currently in use (con't.):

Geogrid

1. Subgrade Treatment
2. Foundation Improvement for
 - a) Retaining walls
 - b) Embankment over the soft ground
3. Slope reinforcement
4. Modular Block Wall

Types of geogrids



Biaxial Geogrid

Property	Test Method	Value
Material:	ASTM D 4101	98 % (min.)
Polypropylene		
Carbon Black	ASTM D 4218	0.5 % (min.)
Rib Spacing	I D Calipered ¹	35.6 mm (nom.)
MD		
CMD	"	35.6 mm (nom.)
Open Area	COE Method ²	70 % (min.)
Modulus	GRI GG1-87 ³	204.3 kN/m (min.)

¹Maximum inside dimension in each principal direction measured by calipers.

²Percent open area measured without magnification by Corps of Engineers method as specified in CW 02215 Civil Works Construction Guide, Nov. 1977.

³Secant modulus at 2% elongation measured by Geosynthetic Research Institute Test method 1-87.

Subgrade Treatment

Section 207.03

General Requirements

The subgrade shall be constructed uniformly transversely across the width of the pavement including 2 ft. outside the edge of the shoulders or curbs unless shown otherwise on the plans, by one of the following methods:

- a) **Chemical Modification in accordance with 215,**
- b) **Aggregate No. 53 in accordance with 301,**
- c) **Geogrid in accordance with 214 placed UNDER Aggregate No. 53 in accordance with 301, or,**
- d) **Soil Compaction to 100% of Maximum Dry Density.**

Type IV

- **225 mm (9 in.) of the subgrade excavated and replaced with coarse aggregate No. 53 on geogrid.**



Where to use geogrid option for subgrade treatment

1. Shallow Utilities
2. Urban Areas
3. Narrow Widenings
4. Unstable Subgrade
5. Restricted Schedule for Construction
6. Minimize Traffic Hazards

Subgrade Dilemmas...

- Soft and wet subgrade



US27 Subgrade Soil Test Results

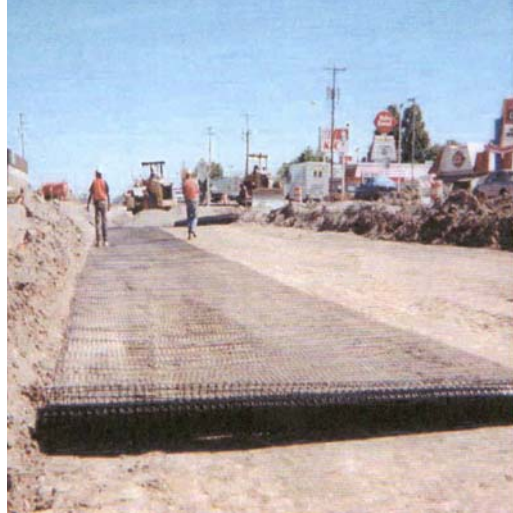
Boring #	Sta. & Offset	Sample Type	Sample Depth (m)	Blows per 0.3m	Textural/AASHTO Classification	Dry Unit Wt. (kN/m ³)	Max. Dry Unit Wt. (kN/m ³)	Relative Comp. (%)	Moisture Content (%)	Optimum Moisture Content (%)	Moisture Content Difference (%)
SG-1	395+05 CL	SS-1	0.45-0.90	11	Si Cl Lo / A-6(8)	16.4	17.5	94	21	15	+6
		SS-2	0.90-1.20	11	Si Cl Lo / A-6(8)	16.3	17.5	94	24	15	+9
SG-2	402+15 37.0' Lt.	SS-1	0.30-0.75	9	Si Cl Lo / A-4(6)	16.0	17.2	93	25	16	+9
		SS-2	1.05-1.20	10	Si Cl Lo / A-4(6)	16.5	17.2	96	18	16	+2
SG-3	408+00 25.0' Rt.	PT	0.30-0.90	5	Cl / A-6(8)	16.0	17.0	93	25	16	+9
		SS-2	1.05-1.20	9	Cl / A-6(8)	16.5	17.0	96	18	16	+2
SG-4	413+90 20.0' Lt.	SS-1	0.30-0.75	10	Si Lo / A-4(3)	16.0	17.0	93	20	15	+5
		SS-2	1.05-1.20	9	Si Lo / A-4(3)	15.8	17.0	92	21	15	+6
SG-5	421+68 20.0' Rt.	SS-1	0.45-0.90	11	Cl Lo / A-6(11)	16.8	17.5	96	22	15	+7
		SS-2	0.90-1.20	14	Cl Lo / A-6(11)	17.2	17.5	98	18	15	+3
SG-6	428+50 20.0' Lt.	SS-1	0.45-0.90	10	Cl / A-7-6(30)	15.9	17.2	92	24	16	+8
		SS-2	1.05-1.20	10	Cl / A-7-6(30)	15.9	17.2	92	25	16	+9
SG-7	434+15 25.0' Rt.	SS-1	0.45-0.90	13	Sa and Gvl.*	----	----	---	---	---	---
		SS-2	0.90-1.20	7	Cl / A-7-6(30)	15.1	17.2	87	27	16	+11

SS = Split Spoon * Test not performed on Sand and Gravel
PT = Push Tube

Grid Installation on U.S. 27

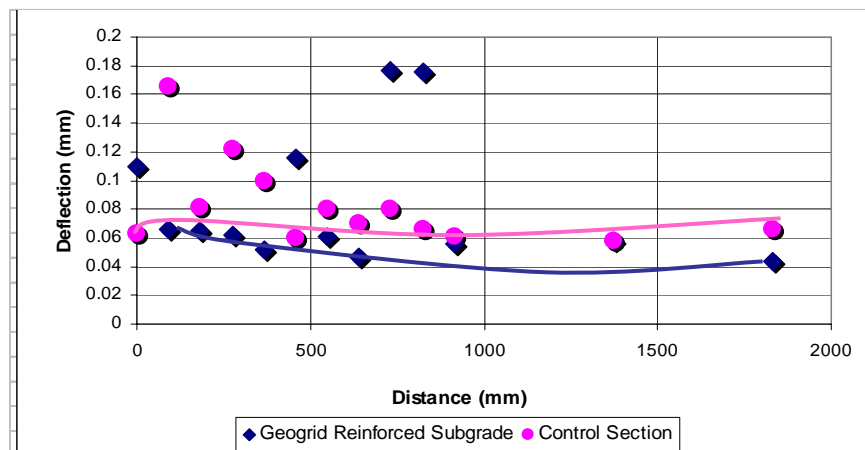


US27 Reconstruction thru Decatur, Indiana



After encountering soft subgrade under the mainline and turn lanes, geogrid was installed after consultation with the INDOT Project Engineer.

Deflection Evaluation (by FWD)



SR9 Bypass Reconstruction Marion, Indiana

Unstable subgrade conditions in this highly developed corridor on the south side of Marion required the use of geogrid.



Hendricks County Courthouse Square



Geogrid was chosen due to poor subgrade material

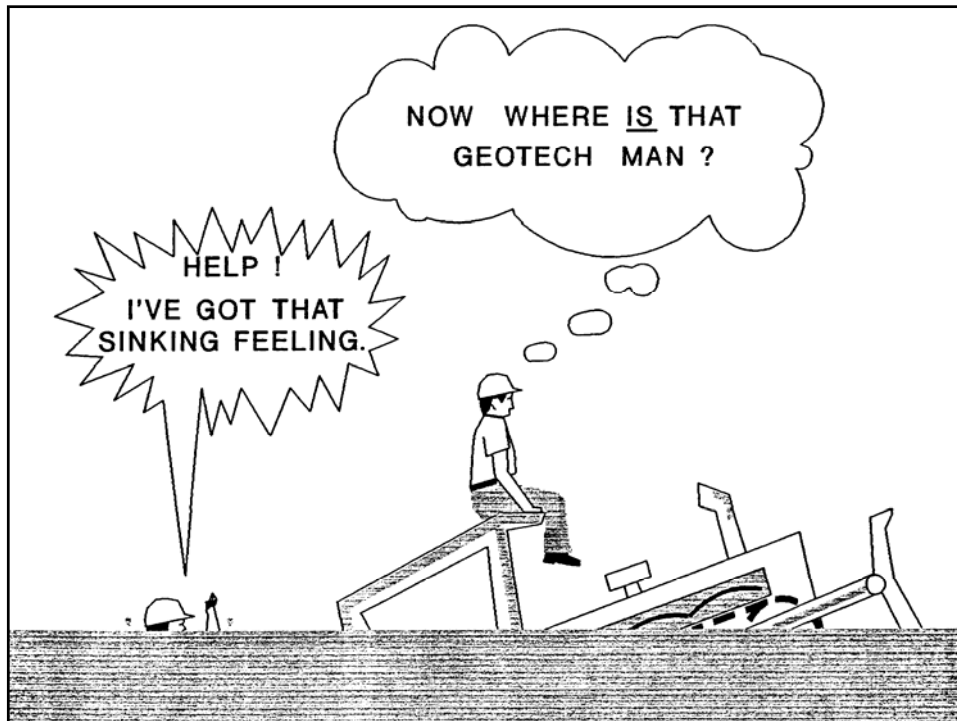
North East 2nd Street, Carmel, Indiana



Wet, soft subgrade conditions warrants a need for quick and effective construction.

Foundation Improvement

Geogrid Embankment Over Soft Foundations



US24 “Hoosier Heartland Highway” West of Huntington, Indiana

2 layers of geogrid is sandwiched between 2' of native material.



US24 “Hoosier Heartland Highway” West of Huntington, Indiana



**Sandwich design
of geogrid and 2'
of native material
provided a solid
platform on which
to build.**

US24 “Hoosier Heartland Highway” Peru, Indiana



Using partial undercut and replace with geogrid over wick drains to provide a drainage blanket over the (30') peat deposit.

US24 “Hoosier Heartland Highway” in Peru, Indiana

Two layers of grid sandwiching 2' of #8 stone, 4000 wick drains overlaid 30' of peat deposit on this northbound to eastbound on-ramp.



Slope Reinforcement

I-69 Slope Failure



I-69 During Construction



I-69 Slope Correction Using Geogrids as Reinforcement



I-69 Installation of the geotextile



I-69 Finished Slope with Erosion Control Mat



Indianapolis Museum of Art River Bank Stabilization



Geogrid combined with non-woven geotextile in welded wire baskets and riprap fill. Terraced slope treatment used to restore and stabilize a breach in narrow bank separating the White River from an oxbow lake.

Modular Block Walls

- At the present time, no pictures are available.

Future Uses of Geogrid

1. Reinforcement for MSE Walls
2. Geogrid Casing for Geopier Applications
3. Use of Geogrids with Tire Shreds

Questions?