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A REVOLUTION IN GEOGRID TECHNOLOGY

Tensar International Corporation

Build Better Roads with Mechanically Stabilized Aggregate Base

Value Engineering

Contingency

Design

Tensar.

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Key Geogrid Use Number 1

Unpaved Roads/Subgrade Improvement

Over-excavation with improved fill
Geotextile Fabric
Chemical Soil Treatment
or

Geogrid

FHWA “The Geosynthetic Design and Construction Guidelines" reference manual (FHWA NHI-07-092)

5.2-1 Temporary Roads and Working Platforms

Where the soils are normally too weak to support the initial construction work, geosynthetics in combination with gravel provide a working platform to allow construction equipment access to sites. This is one of the more important uses of geosynthetics. Even if the finished roadway can be supported by the subgrade, it may be virtually impossible to begin construction of the embankment or roadway. Such sites require stabilization by dewatering, demucking, excavation and replacement with select granular materials, utilization of stabilization aggregate, chemical stabilization, etc. Geosynthetics can often be a cost-effective alternate to these expensive foundation treatment procedures.

Evaluating The Subgrade

1) Geotechnical testing
2) Historical site issues such as pavement rutting, slab cracking, or foundation problems
3) Construction site problems
4) Proof roll

Typical Proof Roll

The primary purpose of the California Bearing Ratio test is to determine the bearing capacity and the mechanical strength of road sub-bases and subgrades. In this test in the laboratory, the sample is prepared at Proctor's maximum dry density or any other density at which the test is required. A plunger of a standard area is then pushed into the soil at a fixed rate of penetration, and the force required to maintain that rate is measured. **The CBR value is then defined as the ratio of the measured force to that required for similar penetration into a standard sample of crushed California limestone rock:**

Type of soil	CBR range
Clay	1-3
Sandy clay	4-7
Well graded sand	15-40
Well graded sandy gravel	20-60

Full scale testing of products is required in order to use industry standard design methods such as Giroud-Han

$$h = \frac{0.868 + (0.661 - 1.006 J^2)\left(\frac{r}{h}\right)^{1.5} \log N}{\left[1 + 0.204\left(\frac{3.48 CBR_{bc}^{\ 0.3}}{CBR_{sg}} - 1\right)\right]} \left(\sqrt{\frac{\frac{P}{\pi r^2}}{\frac{s}{f_s}\left[1 - 0.9 e^{-\left(\frac{r}{h}\right)^2}\right] N_c f_c CBR_{sg}}} - 1 \right) r$$

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Why Does Geogrid Work – Confinement of the Fill

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NY Thruway with Reinforced Subgrade

Which equation can be used to build a mechanically stabilized layer for soft subgrade improvement?

A) **E = MC squared**
B) **V=IR**
C) **F=MA**
D) **The Giroud–Han Method**

$$h = \frac{0.868 + (0.661 - 1.006 J^2)\left(\frac{r}{h}\right)^{1.5} \log N}{\left[1 + 0.204\left(\frac{3.48 CBR_{bc}^{\;0.3}}{CBR_{sg}} - 1\right)\right]} \left(\sqrt{\frac{\frac{P}{\pi r^2}}{\frac{s}{f_s}\left[1 - 0.9 e^{-\left(\frac{r}{h}\right)^2}\right] N_c \, f_c \, CBR_{sg}}} - 1 \right) r$$

To Accurately Predict How a Geosynthetic Will Perform as a Unpaved Road or Subgrade Stabilization:

A) Use only geosynthetics calibrated to an industry accepted design method
B) Select a product based on its tensile strength
C) Trust the installer on the job

Key GeoGrid Use Number 2

Pavement Performance Improvement with Confined Aggregate Base

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- **AASHTO 1993**
- **Traffic = Structural Number taking into account the type of layers and their thickness, subgrade modulus, and drainage**
- **ESALs = $S_n(D_f)(M_r)$**

M_r – The Subgrade Resilience Modulus

Subgrade Resilient Modulus is a measure of the elastic response of a soil (e.g., how well a soil is able to return to its original shape and size after being stressed) under repeated loading.

2555(CBR) to the .64 power

or

1500(CBR)

S_n – The Structural Number

Pavement S_n = sum of layers = $S_{n1} + S_{n2} + S_{n3}$

or

$S_n = LC_1(T_1) + LC_2(T_2) + LC_3(T_3)$

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Independent, Validated Full Scale Testing

US Army Corps of Engineers®

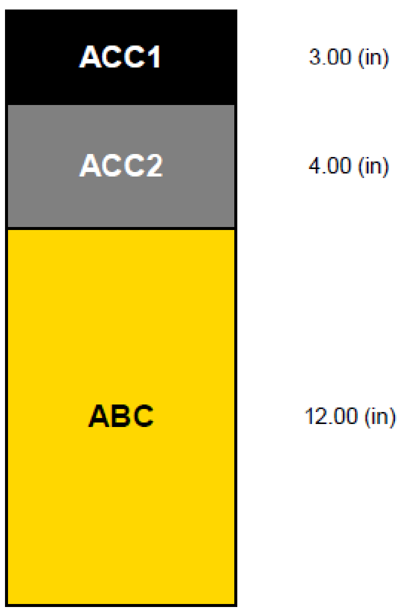
Design Parameters for AASHTO (1993) Equation

Reliability (%)	= 95	Initial Serviceability	= 4.2
Standard Normal Deviate	= -1.645	Terminal Serviceability	= 2.0
Standard Deviation	= 0.49	Change in Serviceability	= 2.2

Aggregate fill shall conform to following requirement:

D50 <= 27mm (Base course)

Unstabilized Pavement

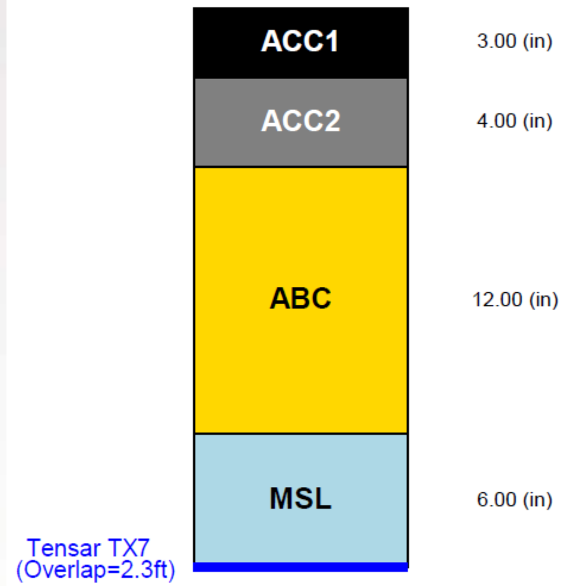


Subgrade Modulus = 3,000 (psi)
Structural Number = 4.540
Calculated Traffic (ESALs) = 615,000

Unstabilized Section Material Properties

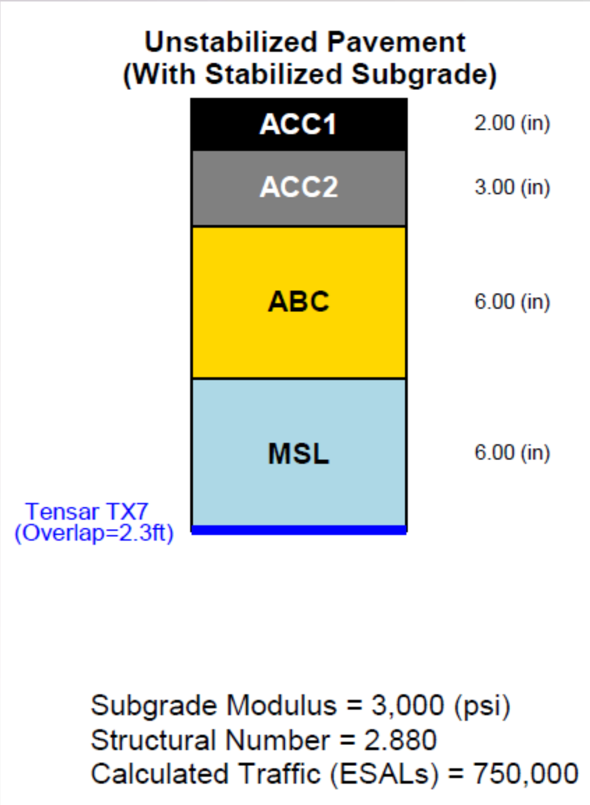
Layer	Description	Cost ($/ton)	Layer coefficient	Drainage factor
ACC1	Asphalt Wearing Course	70	0.420	N/A
ACC2	Dense-graded Asphalt Course	70	0.400	N/A
ABC	Aggregate Base Course	20	0.140	1.0

Unstabilized Pavement (With Stabilized Subgrade)



Subgrade Modulus = 3,000 (psi)
Structural Number = 4.540
Calculated Traffic (ESALs) = 16,858,000

Or



Higher Performance , Reduced Asphalt Thickness, Reduced Cut Depth

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Laydown Yards

Road Reclamation

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Grid Installed Over Separator

Paver

Finished Road

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Burlington County Highway Department
Church Road Reconstruction
Medford Township New Jersey

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Change Order #3

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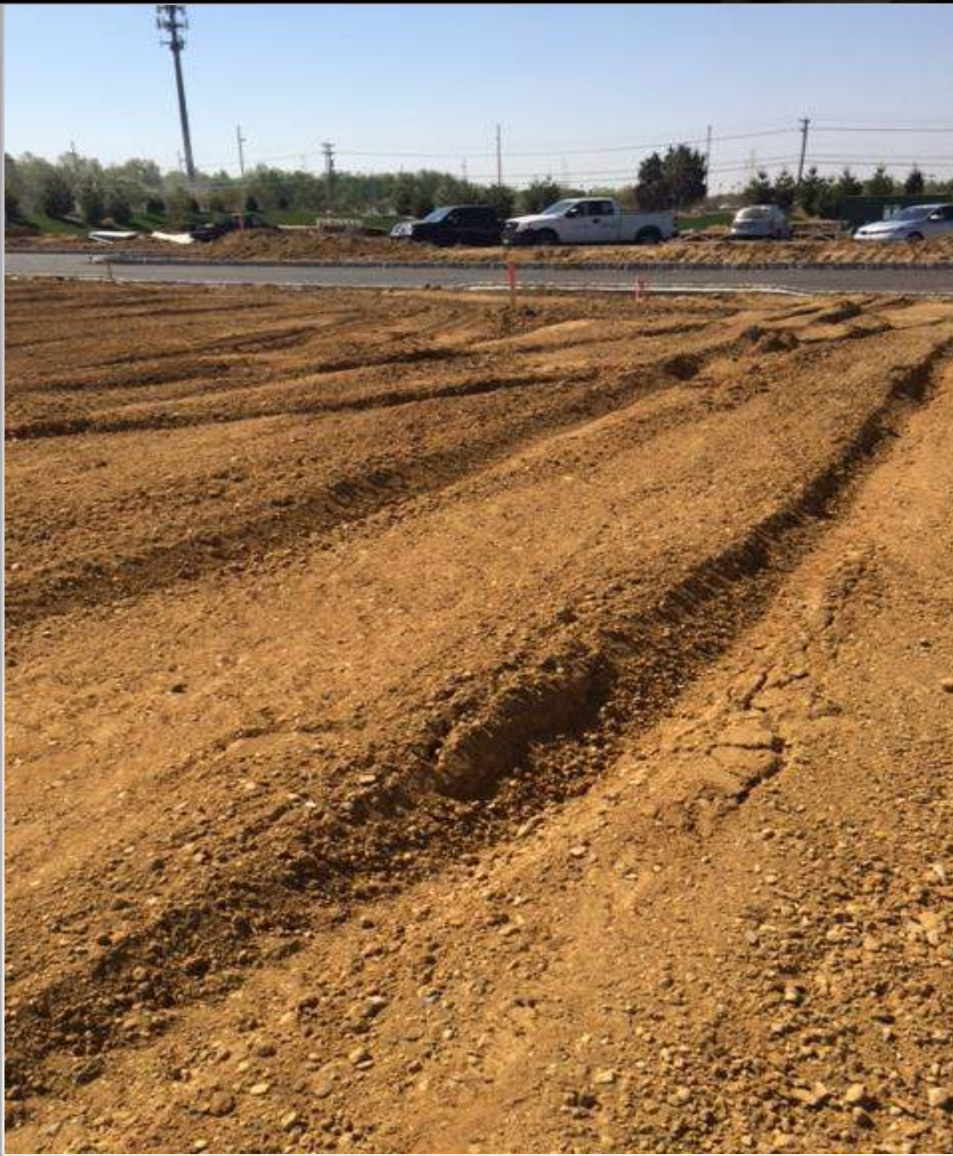

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A major benefit to improving subgrade soils with geogrid is:

A. Faster Construction time
B. Extruded geogrid can be installed in any soil type
C. Geogrid can be installed in wet soil or in rainy conditions
D. Geogrid provides a major cost reduction when compared to other methods for improving soft subgrade soils
E. All of the above

Once the Base is Established for the Long Term

Tensar GlasGrid and GlasPave

Reflective Cracking

Thermal and Load Associated

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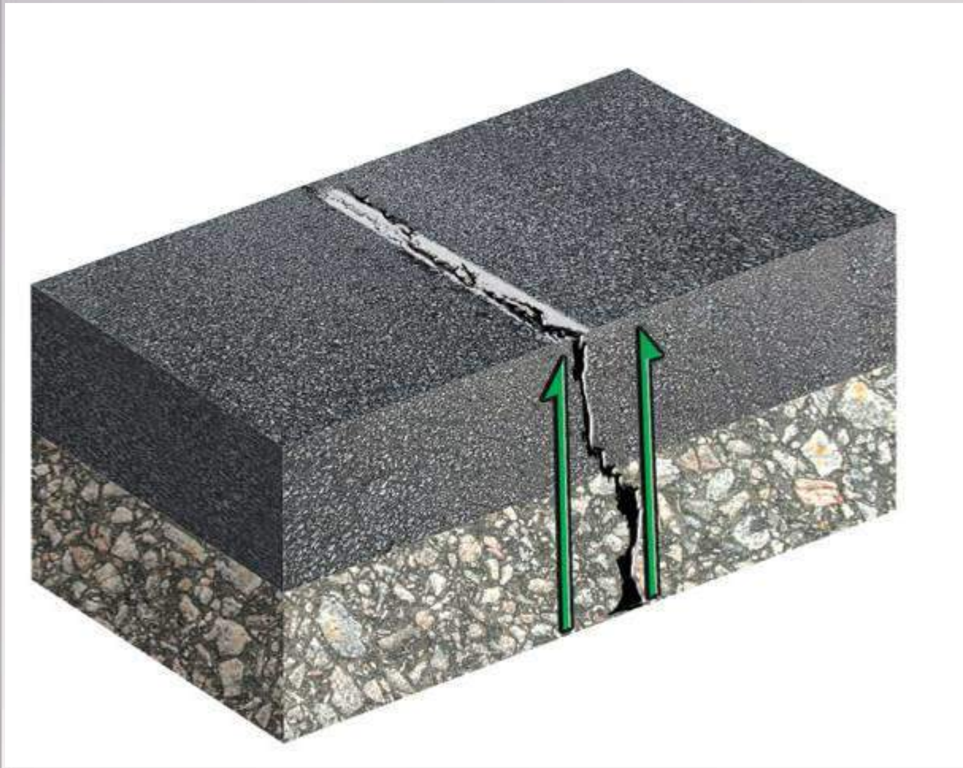

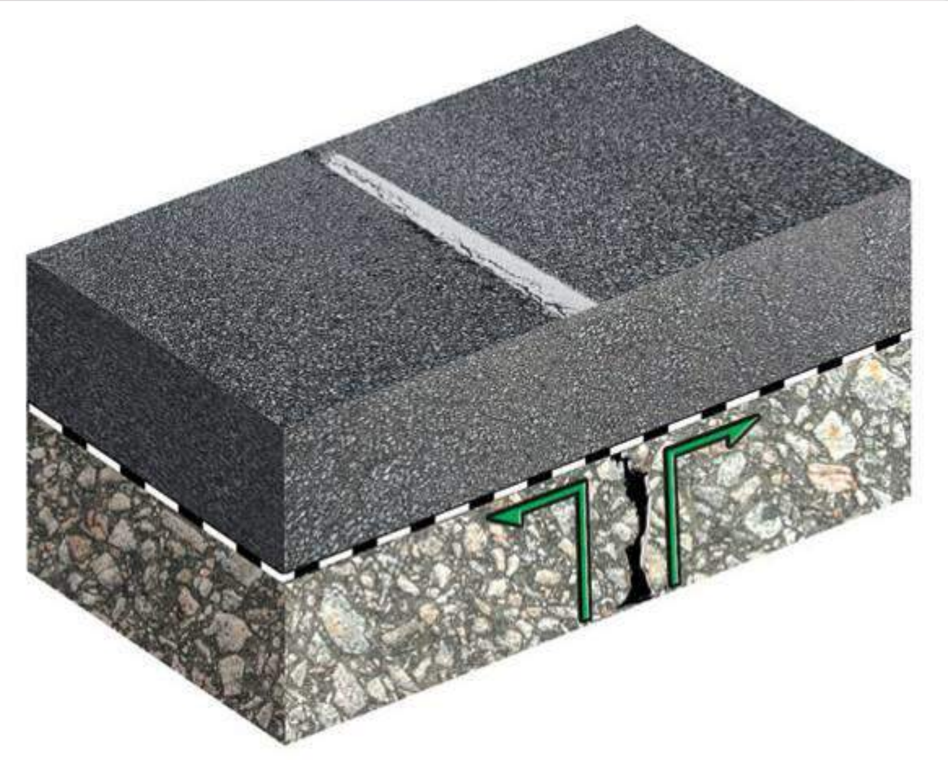


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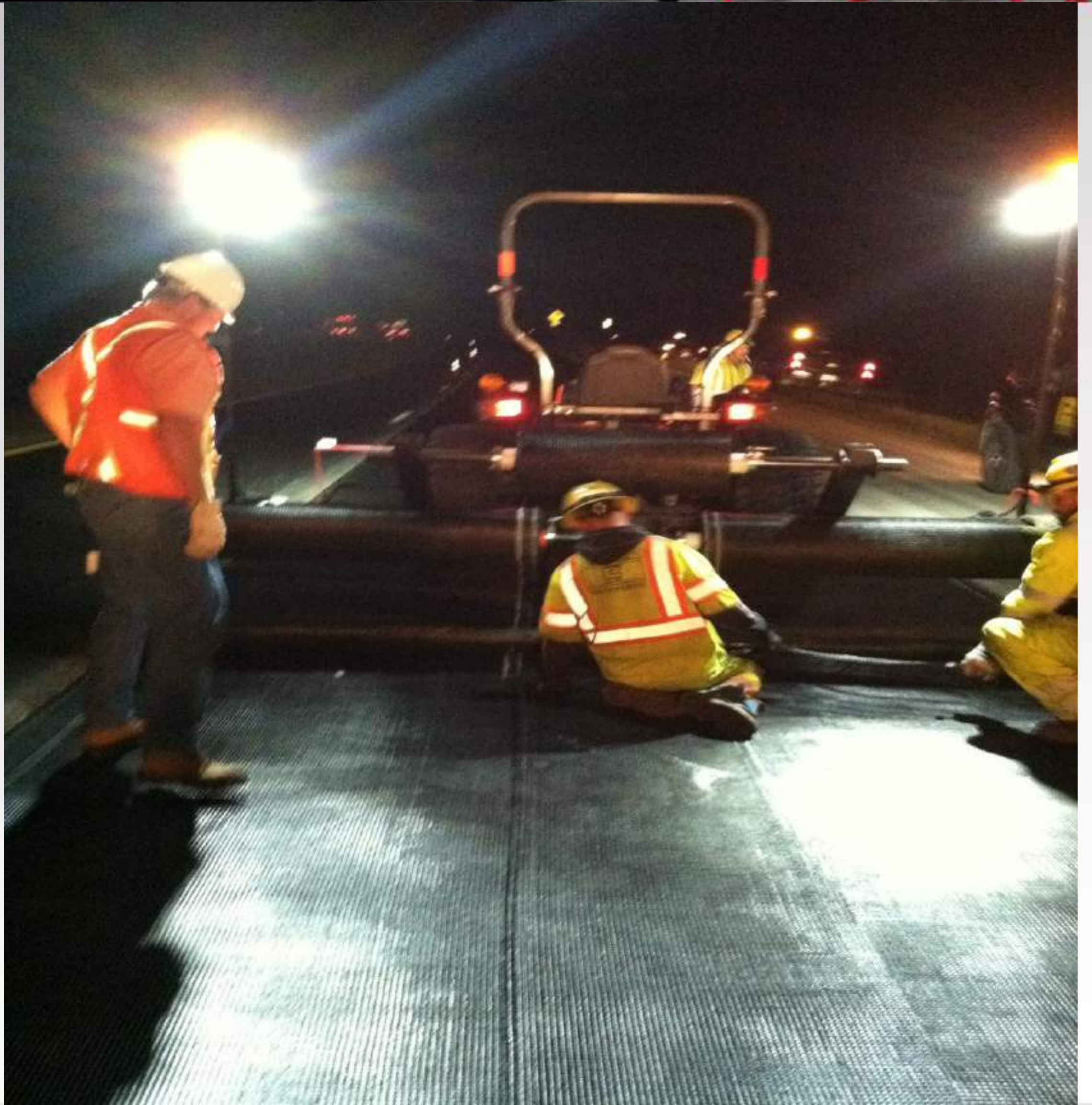
GlasGrid Installations - Examples



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Reinforcement of asphalt overlay can :

A) Extend the service life of the asphalt
B) Correct a soft subgrade problem
C) Prevent water from getting through the asphalt
D) Somtimes reduce the amount of asphalt needed for an effective overlay project
A) A, C, D

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Are Tensar Products In Your Toolbox?