**Synteen offers the widest range of base course reinforcement geogrids and high strength geotextiles in the industry.**

### SYNTEEN SF11 AND SF12 FAMILY OF PRODUCTS

SF11 and SF12, made of high molecular weight , high tenacity multifilament polyester (PET) yarns woven into a stable network placed under tension, offer high strength at low strain rates.

These PET based products are an excellent option for projects that demand custom roll widths and lengths for a cost effective approach to reduce waste created by overlap design requirements.

In addition, the roll-out ease of Synteen PET biaxial grids makes SF11 and SF12 a wise choice for faster installation over other biaxial polymer types.

### STF P11 AND STF P12 POLYPROPYLENE (PP) GEOGRIDS

These biaxial PP products meet the specifications that may require a high resistance to bending and stability in high pH soil and backfill conditions.

### TF100 SERIES BIAXIAL GEOGRIDS

The TF Series of products was developed to meet a current trend in some specifications that require Aperture Stability and Radial Stiffness properties for base course stabilization and reinforcement design.

### SC SERIES HIGH STRENGTH PET GEOTEXTILES

The SC Series PET fabrics range in strength up to 60,000 lbs/ft for those applications that require separation, filtration and high strength enforcement, such as dikes, levees and embankments over soft soil.

*Allow us to be your one-stop shop for all of your biaxial geogrid and high strength geotextile needs.*

## FULL LINE OF HIGH PERFORMANCE GEOGRIDS

- *SOIL REINFORCEMENT*
- *BASE COURSE CONFINEMENT*
- *REINFORCEMENT*


**Manufactured and Distributed by**

*Synteen*

| | |
|---|---|
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| Lancaster, SC 29720 | Toll-Free: 800.796.8336 |
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# SYNTEEN

# BIAXIAL GEOGRIDS




## APPLICATION OF BIAXIAL GEOGRIDS

### UNPAVED AREAS

Construction Haul Roads, Storage Yards, Mining Operations, Logging Roads, Energy Exploration- (Oil and Gas), Wind Energy

**ADVANTAGES:**

- Substantial Reduction in Aggregate Thickness*
- Expedited Construction
- Reduced over-excavation and disposal of poor quality soils
- Elimination of most environmental issues associated with chemical stabilization of poor quality sub-base materials

### PAVED AREAS

Roadways, Airport Runways and Aprons, Parking Areas

**ADVANTAGES:**

- Substantial Reduction in Aggregate Thickness*
- Added reinforcement at the subgrade or base interface**
- Extended service life of pavement due to improved support of the roadway structural section**

*Unpaved roadways are constructed by placing a compacted layer of higher quality bearing soils, usually graded aggregate, to provide a trafficable surface for the anticipated vehicular loadings. The thickness of aggregate required is related to the subgrade soil strength (softness), equipment or vehicular weight/loading, the number of anticipated traffic passes, and the allowable rut depth.

****Please review Synteen's basic *Design Approach* included with this brochure.**

## GEOGRID BASE REINFORCEMENT BASICS

Geogrids are incorporated into standard pavement designs and construction activities to improve the long-term performance, and/or reduce initial construction costs, of paved and unpaved roadways. Geogrids improve the performance of aggregate base course (ABC) materials supporting roadway surfaces by providing confinement (lateral stability) of unbounded base courses, thusly improving their vertical stress distribution characteristics. Confinement is achieved by the geogrid restraining the lateral and vertical deformation of the aggregate, which becomes locked into the geogrid's aperture openings during placement and compaction of the aggregate. The reinforcement action (strength) of the geogrid is generated by the application of vertical stress causing lateral and vertical deformations of both the aggregate and the geogrid. Some people refer to this as the "snowshoe effect", being capable of spreading a concentrated load (foot/shoe or wheel/tire) over a larger area, sufficient to preclude a "punching" shear type failure {through the snow (foot) or soft subgrade soils (wheel).

Since geogrids spread the concentrated wheel load more efficiently, than unbounded aggregate bases, this permits a reduction in aggregate base course thickness to achieve the same applied stress to the subgrade. This is sometimes referred to as the Base Course Reduction (BCR) percentage for a geogrid reinforced, vs. unreinforced aggregate thickness. Typical BCR values for Synteen geogrids are as follows:

| Soil Subgrade Strength ( CBR ) | Base Course Reduction (BCR) of UnReinforced Aggregate using Synteen TF-100 | \|\| | using Synteen TF-120 |
|---|---|---|---|
| Greater than 6 | 24 % | \|\| | 28 % |
| 4 – 6 | 29 % | \|\| | 34 % |
| 2 – 4 | 33 % | \|\| | 39 % |
| 1 – 2 | 36 % | \|\| | 43 % |
| Less than 1.0 | 40 % | \|\| | 46 % |

Subgrade strength is the starting point for any pavement design. The most common measure of subgrade strength for pavement design is CBR, (i.e. California Bearing Ratio) and can be determined using ASTM D-1883. Typically, pavement designers utilize the lowest subgrade strength in a given length of roadway. Additionally, most pavement construction specifications include proof-rolling, to identify weak spots in the subgrade, which can be improved prior to beginning the pavement structure (layers).

Service life has the largest influence on pavement design for a given set of subgrade strength conditions. Most pavement design methods, including AASHTO 1993, utilize the number of passes of a standard axle load to define service life. The standard axle load is 18,000 lbs supported by two wheels on the traffic surface. All traffic axle loads (larger and smaller) are converted, using equivalency tables developed through empirical research, to this Equivalent Single Axle Load (ESAL). ESALs are usually calculated on a daily or weekly basis, and then multiplied by the total number of days or weeks in the design service life of the pavement. Therefore, ESALs become the measurement of pavement service life in terms of load applications, not time. A designer should check the prevailing state DOT requirements for minimum ESALs (service life) prior to finalizing any pavement section.

The pavement structure is the sequence of bound (asphalt & concrete) and unbound aggregate layers placed over the subgrade to support the traffic loads and provide a safe, smooth traffic surface upon which to travel. A number of different elastic and mechanistic theories have been successfully used for pavement design, the most common of which is detailed in the 1993 AASHTO "Guide for Design of Pavement Structures." The AASHTO 1993 guide converts service life requirements (ESALs) and environmental conditions (subgrade strength, drainage (m), & freeze/thaw) into a required Structural Number (SN) that the pavement structure must meet to support the traffic loading. Through empirical testing and observation AASHTO has assigned different structural layer coefficients (a) to various materials, like; asphalt ($a1 = 0.4$-$0.44$), typical aggregate base courses ($a2$ or $a3 = 0.11$-$0.14$) and drainage conditions ($m2$ or $m3 = 1.0 – 0.1$). The total pavement thickness is determined directly, using these coefficients, and various layer depths ( D1, D2, D3 [inches] ) to attain the desired Structural Number (SN), using the following equation:

$$SN = (a1)\,(D1) + (a2)\,(D2)\,(m2) + (a3)\,(D3)\,(m3) \qquad \{\text{eq } 1\}$$

Geogrids are incorporated into the pavement design using a Layer Coefficient Ratio, representing the improvement in load carrying capabilities of the aggregate when reinforced. The design equation is altered slightly to incorporate reinforcement, as follows:

$$SN = (a1)\,(D1) + (a2)\,(D2)\,(m2)\,(LCR) + (a3)\,(D3)\,(m3)\,(LCR) \qquad \{\text{eq } 2\}$$

Typical Layer Coefficient Ratio (LCR) values for Synteen geogrids are as follows. Use an LCR equal to 1.0 whenever the geogrid is not present.

| Soil Subgrade Strength ( CBR ) | Layer Coefficient Ratios (LCR) of Aggregate Reinforced with Synteen TF-100 | \|\| | with Synteen TF-120 |
|---|---|---|---|
| Greater than 6 | 1.32 | \|\| | 1.39 |
| 4 – 6 | 1.41 | \|\| | 1.52 |
| 2 – 4 | 1.49 | \|\| | 1.64 |
| 1 – 2 | 1.56 | \|\| | 1.75 |
| Less than 1.0 | 1.67 | \|\| | 1.85 |

Geogrids are most efficient and cost effective when placed coincident with the proposed finished compaction lift thickness interval, typically 6", 8", or 10". Geogrids should be placed a minimum of 6" and maximum of 12" beneath bottom of asphalt/concrete (paved) layers, or traffic surface (unpaved), and at least every 12" throughout the entire aggregate thickness, if applicable, usually when aggregate thickness is greater than 20 inches.

Synteen TF-100 and TF-120 geogrids are manufactured with the preferred strength direction perpendicular to the roll length, to facilitate rolling the product out parallel with the roadway centerline. Synteen geogrid roll widths should be overlapped a minimum of 12 inches to ensure reinforcement strength is continuous across the entire roadway width.

For a more detailed explanation of how to incorporate Synteen geogrids into pavement designs and roadway construction activities please obtain a copy of Synteen's "Basic Design Approach for Geogrid Base Reinforcement."