Test Procedure for

TESTING GEOGRIDS

TxDOT Designation: Tex-621-J

Effective Date: August 1999

1. SCOPE

1.1 Use this method to sample and test geogrid materials used in construction.

1.2 Characteristics Covered

- aperture size
- percent open area
- thickness
- flexural rigidity
- tensile strength and modulus
- junction strength and efficiency.

1.3 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

2. DEFINITION

2.1 *Geogrid*—a synthetic planar structure formed by a regular network of tensile members with appropriate apertures to allow interlocking with surrounding soil or aggregate for the purpose of reinforcement and/or segregation.

3. SAMPLING

3.1 Unless otherwise specified, sample geogrid in accordance with Tex-735-I.

4. DETERMINING APERTURE SIZE

4.1 Measure the maximum inside dimension of the aperture in each principal direction.

4.2 Randomly take 5 measurements from apertures in each direction by means of vernier calipers.

4.3 Measure accurately to 0.01 mm (0.0004 in.)

5. DETERMINING PERCENT OPEN AREA

5.1 Cut a representative 203 × 254-mm (8 × 10-in.) specimen from the geogrid sample, maintaining a continuous pattern of the aperture.

5.2 Trace the grid pattern, using light projection, onto a piece of paper.

5.3 Weigh grid pattern (paper) and record total weight.

5.4 Cut out the aperture areas from the grid pattern on the paper, separate them from geogrid area and weigh the cutouts.

5.5 Record readings to the nearest 0.001 g.

5.6 Determine the percent open area by dividing the weight of the cutouts by the weight of the paper and multiply by 100.

6. DETERMINING THICKNESS

6.1 Determine the thickness of ribs and junctions with vernier calipers by taking the average of 5 readings selected randomly at different locations of the grid.

6.2 Follow ASTM D 1777.

7. DETERMINING FLEXURAL RIGIDITY

7.1 Follow ASTM D 1388, Option A, except that the width of the specimens will be 3 ribs, with the cuts made at the midpoints between the ribs.

8. DETERMINING TENSILE STRENGTH AND MODULUS

8.1 *Apparatus:*

8.1.1 *Tensile testing machine,* capable of testing with a constant rate of extension (50 mm/min. [2 in./min.]), and measuring the tensile force, typically with a load cell having the capacity to test the full range of samples. It must be able to display and record the entire force versus elongation curve during the test.

8.1.2 *Testing clamps,* with 25 × 50-mm (1 × 2-in.) serrated jaws and appropriate clamping power to prevent slipping or crushing.

8.2 *Preparing Test Specimens:*

8.2.1 Test specimens must contain one rib with 3 junctions in the direction of concern.

8.2.2 Use junctions at each end of the specimen for clamping; the center node represents the repeat unit.

8.2.3 Test 5 specimens in each direction (md and cmd).

8.3 *Procedure:*

8.3.1 Balance and calibrate the test system.

8.3.2 Determine the gauge length, to the nearest 0.01 mm (0.0004 in.), by measuring from the center point of the end junctions.

8.3.3 Mount the specimen in the clamps, using the junctions at each end, in line with the direction of pull.

8.3.4 Tighten the grips sufficiently to prevent slippage of the sample during the test, but not to the point where damage would occur to the specimen.

8.3.5 Use the initial gauge length of the sample to determine the modulus at a specified elongation.

8.3.6 Test the sample using a crosshead speed of 51 mm (2 in.) per minute.

Note 1—Unless otherwise specified, determine the modulus at 2% elongation, based on the gauge length as measured above.

8.3.7 Calculate the average maximum rib tensile strength and average geogrid rib tensile strength as described under Section 8.4.

8.4 *Calculations:*

8.4.1 Calculate average maximum rib tensile strength:

$$T_{rib} = \frac{\sum_{i=1}^{n} T_i}{n}$$

Where:

T_{rib} = average maximum rib tensile strength, N

T_i = maximum rib tensile strength of i_{th} specimen, N

n = total number of test specimens (5).

8.4.2 Calculate average geogrid rib tensile strength:

$$T_{grid} = (T_{rib})(n_{rib})$$

Where:
T_{grid} = average geogrid rib tensile strength, N/m
n_{rib} = number of ribs per meter.

8.4.3 Calculate average secant modulus at 2% strain:

$$M_{2\%} = \frac{\sum_{i=1}^{n} T_{2\%}}{\frac{n}{0.02}}(n_{rib})$$

Where:
$M_{2\%}$ = Average secant modulus at 2% strain, N
n = Total number of test specimens (5)
$T_{2\%}$ = Tensile strength of the i_{th} specimen at 2% elongation.

8.4.4 Report the average geogrid tensile strength to the nearest Newton/meter and the average secant modulus at 2% modulus to the nearest Newton.

9. DETERMINING JUNCTION STRENGTH

9.1 *Apparatus:*

9.1.1 *Tensile testing machine,* capable of testing with a constant rate of extension and of measuring the tensile force, typically with a load cell having the load capacity to test the full range of samples. It must be able to display and/or record the complete force-elongation curve during the test.

9.1.2 *Junction clamps,* able to provide the appropriate clamping power to prevent slipping or crushing.

9.1.3 *Rib clamps,* with 51 × 25-mm (2 × 1-in.) serrated jaws to secure the rib portion of the specimen without slipping or crushing.

9.2 *Preparing Test Specimens:*

9.2.1 Prepare the specimens in the shape of a "T" by cutting junctions from each direction.

9.2.2 Cut the specimens to allow for the maximum amount of transverse rib on each side of the junction to be tested.

9.2.3 The center rib must be long enough—a minimum of 3 nodes—to allow clamping action within the rib clamp.

9.2.4 Test 5 specimens in the direction of concern.

9.3 *Procedure:*

9.3.1 Balance and calibrate the tensile machine.

9.3.2 Install testing clamps.
Note 2—The junction clamp is the upper fixture, and the rib clamp is the lower fixture.

9.3.3 Mount specimen so that the rib clamp attaches to the center rib of the "T" and the junction clamp attaches on both sides to the transverse rib. The junction clamp should grip the specimen as close to the junction as possible without actually contacting it.

9.3.4 Load the specimen at a rate of 51 mm (2 in.) per minute until rupture occurs.

9.3.5 Determine junction strength as described under Section 9.4.

9.4 *Calculations:*

9.4.1 Calculate average maximum junction tensile strength:

$$J_{rib} = \frac{\sum_{i=1}^{n} J_i}{n}$$

Where:
J_{rib} = average maximum junction tensile strength, N
J_i = maximum junction tensile strength of i_{th} specimen, N
n = Total number of test specimens (5).

9.4.2 Calculate average geogrid junction strength in the direction of concern:

$$J_{grid} = (J_{rib})(n_{junction})$$

Where:
J_{grid} = average geogrid junction strength, N/m
$n_{junction}$ = number of junctions per meter.

9.4.3 Calculate junction efficiency strength:

$$E_{junction} = \frac{J_{rib}}{T_{rib}} x100$$

Where:

$E_{junction}$ = junction strength efficiency

J_{rib} = average maximum junction tensile strength, N

T_{rib} = average maximum rib tensile strength, N.

9.4.4 Report the average maximum junction tensile strength (J_{rib}) to the nearest Newton, average geogrid junction strength (J_{grid}) to the nearest Newton/meter, and junction strength efficiency ($E_{junction}$) to the nearest whole percent.