TensarTech® Stratum® Foundation Mattress System: Model Specification

This document is intended to form a basis for Tender documents where the TensarTech® Stratum® Foundation Mattress System is required.

General

This work shall consist of constructing a 1.0m thick TensarTech Stratum basal mattress to act as a foundation to embankment construction. Components used to fabricate the TensarTech Stratum system include transverse geogrid diaphragms, diagonal geogrid diaphragms, base geogrid and ancillary items and shall comply with this clause.

1. Geogrid Reinforcing Elements

a. Geogrid reinforcing elements shall be manufactured in accordance with a management system which complies with the requirement of BS EN ISO 9001:2008. If required by the Engineer, the Contractor shall provide evidence of the manufacturer's certification of its Quality Assurance System and the Environmental Management System.
b. Geogrid reinforcing elements shall be durable and have excellent chemical, microbiological. UV and oxidative resistance based on 3rd party review. They shall be resistant to hydrolysis, aqueous solutions of salts, acids and alkalis, be non-biodegradable and have a minimum of 2% finely divided carbon black, as determined by ASTM D1603-14, well dispersed in the polymer matrix to inhibit attack by ultra violet light.

1.1 Transverse and Diagonal Diaphragms

a. All diaphragms shall be a geogrid manufactured from high density polyethylene sheet, oriented in one direction so that the resulting ribs shall have a high degree of molecular orientation which is continued through the integral transverse bar.
b. The diaphragms shall be geogrid manufactured in accordance with a Quality Management System which complies with the requirements of BS EN ISO 9001:2008. If required by the Engineer, the Contractor shall provide evidence that the manufacturer's Quality Assurance System has been certified to conform with BS EN ISO 9001:2008 by an external authenticating authority approved by the Department of Trade and Industry.
c. The long term creep rupture strength P_C (Ultimate Limit State), for a design life of 120 years, shall be in accordance with the following table at a mean temperature for design country (10°C, 20°C or 30°C). This shall be determined by application of standard extrapolation techniques to creep data obtained in accordance with BS EN ISO 13431:1999.

		Geogrid Type - design life of 120 years		
	Units	**StratumGrid1**	**StratumGrid2**	**StratumGrid3**
$P_{C\ 10°C}$	**kN/m**	**45.93**	**61.31**	**71.09**
$P_{C\ 20°C}$	**kN/m**	**42.16**	**56.28**	**65.27**
$P_{C\ 30°C}$	**kN/m**	**38.23**	**51.03**	**59.17**

d. The geogrid shall have an appropriate partial factor for site installation and construction damage, determined by the particle size distribution of the reinforced fill and in accordance with the values used in the design. This factor shall be based on full-scale tests carried out in accordance with BS8006 Annex D and witnessed by an independent Approval Authority. If required by the Engineer, the Contractor shall provide supporting documented evidence of testing for this and any other partial factors assumed in the design. Partial factors for site installation and construction damage based on limited laboratory based testing are not acceptable.
e. Any site joints in the geogrid roll length shall be capable of carrying 100% of the geogrid Long Term Creep Rupture Strength. If required by the Engineer, the Contractor shall provide evidence of this.
f. The strength of the junctions between the longitudinal ribs and transverse bars, as determined by the Geosynthetics Research Institute, Drexel University, USA, Test Method GG2-87, shall be not less than 95% of the Quality Control Strength.

1.2 Base geogrid

a. The base of the TensarTech Stratum system shall be formed using a stabilisation geogrid and shall have a hexagonal structure with ribs oriented in three directions. The resulting triangular-shaped apertures are defined by ribs having a high degree of molecular orientation which is continuous through the node.
b. The stabilisation geogrid shall have Radial Secant Stiffness measured at 0.5% of 390kN/m (within a tolerance of -75kN/m) measured in accordance with EOTA Technical Report TR41
c. The Radial Stiffness Ratio shall be 0.8 (within a tolerance of -0.15), measured in accordance with EOTA Technical report TR41.
d. The junction efficiency shall be 100% (within a tolerance of -10%) measured in accordance with EOTA Technical report TR41.
e. The hexagon pitch of the stabilisation geogrid shall be 80mm (within a tolerance of ±4mm) where hexagon pitch is the distance between alternate parallel ribs, measured in accordance with EOTA Technical report TR41.

2. Handling, Storing and Marking of Geogrid Elements

a. TensarTech Stratum materials shall be delivered to the site ready for installation into the works. The various grades of material shall be clearly marked for identification.
b. The materials shall be unloaded, stored and handled in such a manner as to avoid damage

3. **Jointing of Reinforcing Elements**

a. Diaphragm lengths may be joined with HDPE joint bars of suitable size and shape which are capable of transferring the Design Strength between successive lengths of diaphragm.

4. **Overlaps and Fixings**

a. Adjacent base grid lengths shall be overlapped by 300mm or as shown on the drawings
b. Transverse diaphragms shall be fixed along one edge to the grid base with suitable fasteners. Diagonal diaphragms shall be fixed to transverse diaphragms and held in place, prior to cell filling, using nodal connectors.

5. **Connections**

a. The Contractor shall provide details of the proposed HDPE joint bars and HDPE nodal connectors, and prove their suitability for use to the satisfaction of the Engineer.

6. **Fill**

a. Fill shall be natural gravel, natural sand, crushed gravel, crushed rock other than argillaceous rock, crushed concrete, chalk or well-burnt colliery spoil and shall meet the following requirements.
b. The material shall be well graded, shall have a uniformity coefficient greater than 5, and lie within the limits of Table 25/4 for either Type a or Type 6F2 fill in accordance with the UK Specification for Highway Works or limits as otherwise stated by the Engineer.

BS Sieve Size	Percentage passing by mass	
	Type a	Type 6F2
125mm		100
90mm	100	80 - 100
75mm	85 - 100	65 -100
37.5mm	85 - 100	45 - 100
10mm	40 - 70	15 - 60
5mm	25 - 45	10 - 45
600μm	8 - 22	0 - 25
75μm	0 - 10	
63μm		0 - 12

Table 25/4: TensarTech Stratum Fill

c. The material passing the 425μm BS sieve when tested in accordance with BS 1377: Part 2:1990 shall be non-plastic.

7. Supplementary Notes

7.1 General

a. A Tensartech Stratum basal mattress is a three-dimensional cellular structure formed from a series of interconnecting cells. These cells are fabricated on site using grid reinforcement and then filled with granular material resulting in a 1m deep structure.
b. Design is based on full strength being available in the transverse and diagonal cell diaphragms throughout the Tensartech Stratum system. Either unjointed diaphragms may be used or, alternatively, diaphragms which are connected using a joint capable of transmitting their full strength. All diaphragms and all connectors are required to have a design life of 120 years.

7.2 Geogrid Reinforcing Elements

a. Two types of reinforcing elements are used to construct a TensarTech Stratum system:
   - triaxial geogrids to form the base and a platform on which the cell diaphragms can be fabricated.
   - uniaxial geogrids to form the transverse and diagonal cell diaphragms. These uniaxial grids should have high initial modulus to contain fill as it is placed without allowing large displacements.

8.– Construction of TensarTech Stratum System

Further details on the construction of a Tensartech Stratum can be found on Tensar Construction Sequence: CS/TensarTech Stratum. Summary details are provided below.

8.1 Fabrication Details

a. HDPE Joint bars to join successive ends of transverse and diagonal diaphragms should be durable and of the correct shape to ensure continuity of full strength.

8.2 Assembly summary

a. Cell assembly is achieved by rolling out the base grid and overlapping by 300mm. The transverse diaphragms should be fixed at one edge to the base grid with cable ties or HDPE braid then raised to the vertical plane and tensioned.
b. Cable ties shall be type T50S or similar approved.
c. HDPE braid shall be three-strand monofilament, with a nominal breaking strength of 2kN.
d. Diagonal diaphragms are held in place with nodal connectors. The cells are now ready for filling.
e. Nodal connectors shall be of the size and shape shown on the drawings.
f. Typical joints, fixings and overlaps should be as shown on the contract drawings.
g. Cells shall be formed such that a regular "diamond" pattern is created.

8.3 Cell Filling

a. Cell filling should be in accordance with the contract drawings.

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