



**SPECIAL PROVISIONS  
FOR  
SYNTHETIC SUBSURFACE DRAINAGE LAYER**

**Boone County  
RTB-RB-34-(013)--90-00**

**THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS AND APPLICABLE DEVELOPMENTAL SPECIFICATIONS.**

**121019.01 DESCRIPTION.**

The Contractor shall furnish all labor, material, and equipment to complete installation of Synthetic Subsurface Drainage Layer (SSDL), including all necessary and incidental items, in accordance with the Manufacturer's Installation Guidelines, Contract Drawings and this Specification.

**121019.02 MATERIALS.**

**A. Properties.**

The SSDL needs to meet all the properties shown in Table 121019.02-1 that follows. For SSDL not meeting the material properties in the tables show below, submit the following at least 15 days prior to bid:

1. Full scale independent testing in a pavement structure inclusive of the alternate SSDL, quantifying flow rates over time.
2. A list of 5 comparable projects that are similar in size and application, located in the United States, and where performance can be checked after at least 5 years of service life.
3. A sample of the alternate SSDL.
4. Additional information as requested by engineer to evaluate the alternate SSDL.

**B. Polymer.**

The polymer used to manufacture the Geonet component of the SSDL shall be polyethylene, which is clean and free of any foreign contaminants. Re grind material, which consists of edge trimmings and other scraps, may be used to manufacture the Geonet; however, post consumer recycled material shall not be used.

**C. Geonet.**

The Geonet shall be manufactured by extruding three sets of polyethylene strands to form a tri-planar drainage net structure consisting of a thick vertical rib with diagonally placed top and bottom ribs.

**D. Labels.**

Labels on each roll of SSDL shall identify the length, width, lot and roll numbers, and name of Manufacturer.

**E. Geotextile.**

A Geotextile shall be heat bonded to both sides of the Geonet. Heat bonding shall be performed by the manufacturer prior to shipping to the site. The geotextile shall be a nonwoven needle punched synthetic fabric meeting the property requirements of Table 121019.02-1 for the PCC Section and Table 121019.02-2 for the HMA Section.

**F. Tack Coat**

Unless otherwise stated, tack coat shall meet the requirements of the Supplemental Specifications for Flexible Pavement.

**TABLE 121019.02-1: REQUIRED GEOCOMPOSITE DRAINAGE LAYER PROPERTIES FOR PCC SECTION**

PROPERTY	TEST METHODS	UNITS	VALUE	QUALIFIER
<b>TRI-PLANAR CORE<sup>1</sup></b>				
Density	ASTM D 792	g/cm <sup>3</sup>	0.94 – 0.96	Range
Carbon Black	ASTM D 4218	%	2-3	Range
Rib Spacing (top & bottom)	Callipered	inch	0.4	Typical
Central Rib Spacing	Callipered	inch	0.5	Typical
Unsupported Aperture Area	Callipered	inch <sup>2</sup>	0.3	MAX
Thickness	ASTM D 5199	mil	300	±10 %
<b>NONWOVEN GEOTEXTILE<sup>1</sup></b>				
Strength	AASHTO M 288	Exceeds Class 1		
U.V. Resistance (500 hrs)	ASTM D 4355	%	70	MARV
AOS	ASTM D 4751	US Std Sieve	80	MaxARV
Permittivity	ASTM D 4491	sec <sup>-1</sup>	1.1	MARV
Water Flow Rate	ASTM D 4491	gpm/ft <sup>2</sup>	90	MARV
<b>SSDL PERFORMANCE</b>				
Pavement Fatigue Number of cycles before cracks propagate		Cycles	3000	Notes <sup>2</sup>
Capillary Barrier	ASTM 5918	Effective		Notes <sup>3</sup>
Coefficient of Permeability	ASTM D 4716	ft/day	56,700	Notes <sup>4</sup>
<b>DIMENSIONS &amp; FLOW ORIENTATION</b>				
Roll Size	12.75 ft x 200 ft			
Direction of Primary Flow	Across the roll width @ approximately 45 degrees			

Qualifiers: MARV=Minimum Average Roll Value (MARV), MAV=Minimum Average Value, MAX=Maximum Value, MaxARV=Maximum average roll value.

**NOTES:**

1. Geotextile and core properties listed are prior to lamination.
2. Cyclic Fatigue Test was performed at the University of Illinois, Advanced Transportation Research and Engineering Laboratory. The test was performed on a concrete beam supported by the SSDL overlying a clay subgrade. The Stress Ratio defined as: Load Stress / Flexural Strength of the Concrete Beam = 0.83.
3. USACE Cold Regions Research and Engineering Laboratory (CRREL) "Freezing tests on lean clay with Tenax tri-planar geocomposite as capillary barrier"
4. Coefficient of permeability is calculated with the measured SSDL transmissivity and the nominal core thickness. SSDL transmissivity is tested along the primary flow direction with the boundary conditions as follows: steel plate/Ottawa sand/SSDL/Ottawa sand/steel plate, 1 hour seating period @ 15,000psf and gradient 2%.

**TABLE 121019.02-2: REQUIRED GEOCOMPOSITE DRAINAGE LAYER PROPERTIES FOR HMA SECTION**

PROPERTY	TEST METHODS	UNITS	VALUE	QUALIFIER
<b>TRI-PLANAR CORE<sup>1</sup></b>				
Density	ASTM D 792	g/cm <sup>3</sup>	0.94 – 0.96	Range
Carbon Black	ASTM D 4218	%	2-3	Range
Rib Spacing (top & bottom)	Callipered	inch	0.4	Typical
Central Rib Spacing	Callipered	inch	0.5	Typical
Unsupported Aperture Area	Callipered	inch <sup>2</sup>	0.3	MAX
Thickness	ASTM D 5199	mil	280	±10 %
<b>NONWOVEN GEOTEXTILE<sup>1</sup></b>				
Strength	AASHTO M 288	Exceeds Class 2		
U.V. Resistance (500 hrs)	ASTM D 4355	%	70	MARV
AOS	ASTM D 4751	US Std Sieve	70	MaxARV
Permittivity	ASTM D 4491	sec <sup>-1</sup>	1.4	MARV
Water Flow Rate	ASTM D 4491	gpm/ft <sup>2</sup>	110	MARV
<b>SSDL PERFORMANCE</b>				
Capillary Barrier	ASTM 5918	Effective		Notes <sup>2</sup>
Coefficient of Permeability	ASTM D 4716	ft/day	56,700	Notes <sup>3</sup>
<b>DIMENSIONS &amp; FLOW ORIENTATION</b>				
Roll Size	12.75 ft x 200 ft			
Direction of Primary Flow	Across the roll width @ approximately 45 degrees			

Qualifiers: MARV=Minimum Average Roll Value (MARV), MAV=Minimum Average Value, MAX=Maximum Value, MaxARV=Maximum average roll value.

**NOTES:**

1. Geotextile and core properties listed are prior to lamination.
2. USACE Cold Regions Research and Engineering Laboratory (CRREL) "Freezing tests on lean clay with Tenax tri-planar geocomposite as capillary barrier"
3. Coefficient of permeability is calculated with the measured SSDL transmissivity and the nominal core thickness. SSDL transmissivity is tested along the primary flow direction with the boundary conditions as follows: steel plate/Ottawa sand/SSDL/Ottawa sand/steel plate, 1 hour seating period @ 15,000psf and gradient 2%.

### **121019.03 CONSTRUCTION.**

#### **A. Delivery, Storage, and Handling.**

1. The Contractor shall check the material upon delivery to verify that the materials received are the proper type and grade.
2. The SSDL rolls shall be stored in a clean and dry environment, off the ground and out of direct sunlight (materials should never be exposed to direct sunlight for more than 30 days), and shall be protected from excessive heat, cold, mud, dirt, and dust.
3. The contractor and the installer shall handle all SSDL in such a manner as to ensure it is not damaged in any way.
4. To prevent wrinkles, maintain proper tension and alignment when unrolling the SSDL.
5. Steps should be taken to prevent the leading edge of the material from curling up by securing it to the subgrade with sandbags or steel pins.
6. SSDL shall be rejected if it has defects including holes, deterioration, or damage incurred during storage or transportation.

#### **B. Construction Sequence.**

Before placing SSDL, remove loose or extraneous material and sharp objects that may come in contact with the material. Place SSDL:

1. As outlined in manufacturer's installation guide.
2. Longitudinally along the roadway alignment.
3. Without wrinkles.
4. With the main flow direction orientated down slope towards roadway edge drain, as outlined in project plans.

#### **C. SSDL Placement.**

Handle all SSDL in such a manner as to ensure it is not damaged in any way.

SSDL shall be installed and placed on a firm and prepared subgrade, with the design grade flowing towards the water collection system (edge drain, perforated pipe, or other collection structure). Place the SSDL in the proper manner at the elevations and alignment as shown in the construction drawings and as directed by the Engineer. The adjacent and adjoining SSDL rolls (side-by-side and end-to-end) shall be butted together as outlined in the manufacturer's installation guide.

##### **1. Under HMA.**

- a. Apply a tack coat using a distributor truck at a rate not to exceed 0.4 gal/sy onto the primed base or subbase surface. If the tack coat is an emulsion, then the tack coat should be allowed to cure prior to installing the SSDL. If the ambient temperatures are below 60°F, then limit the length of tack coat placement to ensure that the tack coat does not set too quickly and therefore will still allow the SSDL to become embedded in the tack.
- b. The SSDL shall be set in the tack coat with two passes from a pneumatic tire roller.
- c. The SSDL shall be positioned carefully when unfolded to ensure that there are minimal wrinkles when installing directly over the tack coat. Tension shall remain on SSDL while unfolding panels to reduce wrinkles.

- d. Apply a tack coat on top of the installed SSDL, using a distributor truck at a rate not to exceed 0.1 gal/sy (residual AC). The distributor truck should drive on the SSDL in a straight line and should not change direction while on the SSDL.

**2. Under PCC.**

- a. In order to prevent soil/cement paste migration into the Geonet core and clogging of the SSDL flow channels and the water collection system, all the cut edges (except the one connected to edge drain or perforated pipe) shall be wrapped by a geotextile with a minimum 18-inch width prior to the fill placement of concrete.
- b. Adopt the seaming details and the geotextile flaps as detailed in the installation guidelines to minimize contamination of the drainage core.

**D. Pavement Placement over SSDL.**

**1. HMA Placement.**

- a. HMA shall be placed as soon as possible on the installed SSDL. The SSDL shall not be installed unless the area can be completely paved with acceptable paving climate conditions.
- b. Water, or other quick release agent, should be used to spray the asphalt truck tires during the installation, to prevent damage to the SSDL.
- c. The asphalt trucks should minimize braking during the delivery of the mix to the paver. The HMA shall be placed using a rubber-tracked paver.
- d. The asphalt truck and rubber-tracked paver must travel cautiously in a straight forward or backward motion with minimal acceleration and deceleration over the SSDL panels.
- e. Do not Stockpile material on the SSDL or brake suddenly or turn sharply on the SSDL.

**2. PCC Placement.**

- a. PCC shall be placed as soon as possible on installed SSDL. Spray the SSDL with a fine mist of water just ahead of the concrete paver to provide a moist surface for the concrete. The SSDL shall not be installed unless area can be completely paved with acceptable paving climate conditions.
- b. If trucks are to travel directly on the SSDL, trucks must travel cautiously in a straightforward or backwards motion with minimal acceleration and deceleration over the SSDL panels. The truck driver shall make no standing turns or otherwise abrupt maneuvers on the SSDL panels with the truck. All equipment must have their exhaust outlets directed away from the SSDL.
- c. Do not Stockpile material on the SSDL or brake suddenly or turn sharply on the SSDL. Use a pneumatic tire roller at speeds less than 10mph on the SSDL to remove the roll memory.

**E. Repair.**

Prior to covering the deployed SSDL, each roll shall be inspected for damage. Two different repair techniques will be applied for 1) geotextile damage only and 2) damage to the entire SSDL (Geonet core damage). Review the manufacture's installation guide for details on these repair techniques.

**121019.04 METHOD OF MEASUREMENT.**

SSDL, in square yards, will be the quantity shown in the content documents.

**121019.05 BASIS OF PAYMENT.**

The contract price paid per square yard for SSDL includes furnishing all labor, tools, equipment, and incidentals, and for doing all the work involved in placing SSDL, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions.