CITY OF FORT WAYNE MASTER UPDATED: 03/12/2018

SECTION 31 05 19

Geosynthetics for Earthwork

NTS: This section is intended for projects that use geosynthetics for aggregate separation, and underdrain.. Use this section for permanent geosynthetic applications, edit based on project specific requirements. This Section is referenced by multiple other sections, when editing conduct careful coordination between Sections in the project manual.

1. GENERAL
   1. DESCRIPTION
      1. Scope:
         1. Contractor shall provide all labor, materials, equipment, and services required to provide and place geosynthetics as shown and specified.

NTS: Insert at (--1--) below only sections covering products, construction, and equipment that a user may expect to find in this section, but are specified elsewhere. Do not list administrative and procedural Division 01 sections.

* + 1. Related Sections:
       1. (--1--)
  1. MEASUREMENT AND PAYMENT
     1. Geotextile:
        1. Work Item Number and Title

**31 05 19-A Geotextile**

* + - 1. This item shall include all costs associated with Site grading, including compaction, where shown on the Drawings, to adjust existing grade to new elevations. This item also includes all costs associated with scraping existing pavement, where shown on the Drawings, to remove sediment and debris.
      2. The payment shall be on a lump sum basis.
      3. Areas included in this item are as shown on the Drawings. Areas within the limit of trench excavation shall not be included under this pay item and are included under the pay item for the pipe material.
  1. REFERENCES
     1. Standards referenced in this Section are listed below:
        1. American Society for Testing and Materials, (ASTM).
           1. ASTM D1505 – Test Method for Density of Plastics by the Density-Gradient Technique.
           2. ASTM D1693 – Test Method for Environmental Stress-Cracking of Ethylene Plastics.
           3. ASTM D4355 - Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
           4. ASTM D4491 – 99a(2009) Test Methods for Water Permeability of Geotextiles by Permittivity
           5. ASTM D4632 - 08 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
           6. ASTM D5199 – Test Method for Measuring Nominal Thickness of Geosynthetics.
  2. QUALITY ASSURANCE
     1. Manufacturer's Qualifications:
        1. Geosynthetic manufacturer shall be a specialist in the manufacture of geosynthetic cushion fabric, and have produced and successfully installed a minimum of five million square feet.
  3. SUBMITTALS
     1. Action Submittals: Submit the following:
        1. Product Data:
           1. Submit geosynthetic manufacturer's data, Specifications, installation instructions and dimensions.
     2. Informational Submittals: Submit the following:
        1. Certificates:
           1. Submit an affidavit certifying that the filter fabric furnished complies with all requirements specified herein.
           2. No fabric shall be shipped until the affidavit is submitted to the Engineer.
  4. PRODUCT DELIVERY, STORAGE AND HANDLING
     1. All geosynthetics delivered to the Site shall be labeled by the manufacturer identifying the manufacturer's name and product identification.
     2. All rolls and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer if any loss or damage exists to geosynthetics. Replace loss and repair damage to new condition, in accordance with manufacturer’s instructions.
     3. Geosynthetics shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Geosynthetic rolls shall be shipped and stored in relatively opaque and watertight wrappings.

NTS: Delete any geotextile products not required for project.

1. PRODUCTS
   1. GEOTEXTILE

NTS: Edit and review the geotextile products listed below based on project specific requirements. Products specified below are referenced in other Sections, specifically Section 01 57 13- Erosion and Sediment Control, coordinate requirements and references prior to editing or removing products.

* + 1. Woven Geotextile – Driving Surface Aggregate Separation
       1. Geotextiles for aggregate separation shall be woven to prevent elongation and provide aggregate separation. Geotextile shall conform to the following:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Physical Properties** | **Test Method** | **Unit** | **Minimum Value** | **Physical Properties** |
| **MD** | **CD** |
| Tensile Strength (at ultimate) | ASTM D4595 | lbs/ft | 2640 | 2460 |
| Tensile Strength (at 2% strain) | 480 | 588 |
| Tensile Strength (at 5% strain) | 1212 | 1356 |
| Tensile Strength (at 10% strain) | 2340 | 2412 |
| Factory Sewn Seam | ASTM D4884 | lbs/ft | 1250 | Factory Sewn Seam |
| Flow Rate | ASTM D4491 | gal/min/ft2 | 50 | Flow Rate |
| Permeability |  | cm/sec | 0.04 | Permeability |
| Permittivity |  | sec-1 | 0.70 | Permittivity |
| Apparent Opening Size (AOS) | ASTM D4751 | U.S. Sieve | 30 | Apparent Opening Size (AOS) |
| UV Resistance (at 500hrs) | ASTM D4355 | % strength retained | 80 | UV Resistance (at 500hrs) |

* + - 1. Product and Manufacturer:
         1. Mirafi 140N.
         2. Or equal.
    1. Non-Woven Geotextiles –Aggregate Separation
       1. Install Geotextiles for aggregate separation including but not limited to these applications.
          1. Temporary sediment trap
          2. Rock check dam
          3. Riprap
          4. Dewatering bag aggregate underlayment
       2. Non-woven geotextiles for aggregate separation shall conform to the following:

|  |  |  |  |
| --- | --- | --- | --- |
| **Physical Properties** | **Test Method** | **Unit** | **Min Value** |
| Grab Tensile Strength | ASTM D 4632 | lbs. | 200 |
| Grab Tensile Elongation | ASTM D 4632 | % | 50 |
| Puncture Strength | ASTM D4833 | lbs. | 500 |
| Apparent Opening Size (AOS) | ASTM D 4751 | U.S. Sieve | #80 |
| Flow Rate | ASTM D 4491 | gal/min/ft2 | 95 |

* + 1. Geotextiles for Underdrains
       1. Non-woven geotextiles shall be used to protect the underdrains. Non-woven geotextiles for underdrains shall conform to the following:

|  |  |  |  |
| --- | --- | --- | --- |
| **Physical Properties** | **Test Method** | **Unit** | **Min Value** |
| Grab Tensile Strength | ASTM D 4632 | lbs. | 80 |
| Grab Tensile Elongation | ASTM D 4632 | % | 50 |
| Trapezoid Tear Strength | ASTM D 4533 | lbs. | 30 |
| Permittivity | ASTM D 4491 | sec-1 | 2.1 |
| Flow Rate | ASTM D 4491 | gal/min/ft2 | 155 |

* + 1. Woven Geotextiles for Gabion and Revetment Mattresses
       1. Woven geotextiles for gabion and revetment mattress shall conform to the following:

|  |  |  |  |
| --- | --- | --- | --- |
| **Physical Properties** | **Test Method** | **Unit** | **Min Value** |
| Grab Tensile Strength | ASTM D 4632 | lbs. | 200 |
| Grab Tensile Elongation | ASTM D 4632 | % | 15 |
| Trapezoid Tear Strength | ASTM D 4533 | lbs. | 75 |
| CBR Puncture | ASTM D6241 | lbs. | 700 |
| Permittivity | ASTM D 4491 | sec-1 | 0.05 |
| Flow Rate | ASTM D 4491 | gal/min/ft2 | 4 |
| UV Resistance | ASTM D 4355 | % Strength Retained | 70 @ 500 hr |

* + - 1. Product and Manufacturer:
         1. Terra Text GS.
         2. Geotex 200 ST.
         3. Or equal.
    1. Woven Geotextiles for Sediment Barriers – Silt Fences
       1. Install Geotextiles for aggregate separation including but not limited to these applications.
          1. Silt Fences
          2. Temporary inlet protection
       2. Geotextile fabrics for use in sediment barriers shall conform to the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Woven Geotextile Fabric Requirements** | | | |
| **Sediment Barrier Installation** | | | |
| Physical Property | Test Method | Unit | Min. Value |
| Grab Tensile Strength | ASTM D 4632 | lbs. | 95-125 |
| Grab Tensile Elongation | ASTM D 4632 | % | 15 |
| Puncture Strength | ASTM D 4833 | lbs. | 60 |
| Apparent Opening Size (AOS) | ASTM D 4751 | U.S. Sieve | #30 |
| Permittivity | ASTM D 4491 | sec-1 | 0.1 |
| Flow Rate | ASTM D 4491 | gal/min/ft2 | 10 |

NTS: Article “2.2 below is a specialized geo-synthetic that provides structural support to the underlying soil support, and is typically used between a paving surface and subgrade. Edit or delete as required for project.

* 1. GEOGRID FOR SUBBASE STABILIZATION

NTS: Retain one version of paragraph “a” below. Select the appropriate material based on project specific soil materials and driveway intended use.

* + - 1. Provide the following geogrid:
         1. Geogrid TX140, as manufactured by Tensar Corporation.
         2. Geogrid TX160, as manufactured by Tensar Corporation.
         3. Or equal.
      2. Structural Soil Reinforcement Geogrid – The geogrid shall be integrally formed and deployed as a single layer having the following characteristics:

NTS: Retain one version of the material properties below based on selected project specific material. Delete the other.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TX140** | | | | |
| **Index Properties** | **Longitudinal** | **Diagonal** | **Transverse** | **General** |
| Rib pitch, mm (in) | 40 (1.60) | 40 (1.60) | - |  |
| Mid-rib depth, mm (in) | - | 1.2 (0.05) | 1.2 (0.05) |  |
| Mid-rib width, mm (in) | - | 1.1 (0.04) | 1.1 (0.04) |  |
| Nodal thickness, mm (in) |  |  |  | 3.1 (0.12) |
| Rib shape |  |  |  | rectangular |
| Aperture shape |  |  |  | triangular |
| Rib Aspect Ratio (height: width) |  |  |  | > 1.0 |
|  |  |  |  |  |
| **Structural Integrity** |  |  |  |  |
| Junction efficiency,(1) % |  |  |  | 93 |
| Aperture stability,(2) kg-cm/deg @ 5.0kg-cm |  | 3.0 |
| Radial stiffness at low strain,(3)  kN/m @ 0.5% strain | 225 |
| Radial stiffness at low strain,(3)  (lb/ft @ 0.5% strain) | 15,430 |
|  |  |
| **Durability** |  |  |  |  |
| Resistance to chemical degradation(4) |  |  |  | 100% |
| Resistance to ultra-violet light and weathering(5) |  | 100% |
|  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TX160** | | | | |
| **Index Properties** | **Longitudinal** | **Diagonal** | **Transverse** | **General** |
| Rib pitch, mm (in) | 40 (1.60) | 40 (1.60) | - |  |
| Mid-rib depth, mm (in) | - | 1.8 (0.07) | 1.5 (0.06) |  |
| Mid-rib width, mm (in) | - | 1.1 (0.04) | 1.3 (0.05) |  |
| Nodal thickness, mm (in) |  |  |  | 3.1 (0.12) |
| Rib shape |  |  |  | rectangular |
| Aperture shape |  |  |  | triangular |
| Rib Aspect Ratio (height: width) |  |  |  | > 1.0 |
|  |  |  |  |  |
| **Structural Integrity** |  |  |  |  |
| Junction efficiency,(1) % |  |  |  | 100 |
| Aperture stability,(2) kg-cm/deg @ 5.0kg-cm |  | 3.6 |
| Radial stiffness at low strain,(3)  kN/m @ 0.5% strain | 430 |
| Radial stiffness at low strain,(3)  (lb/ft @ 0.5% strain) | 29,500 |
|  |  |
| **Durability** |  |  |  |  |
| Resistance to chemical degradation(4) |  |  |  | 100% |
| Resistance to ultra-violet light and weathering(5) |  | 100% |

1. EXECUTION
   1. INSPECTION
      1. Contractor shall examine the conditions under which the Work is to be installed and notify the Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.
   2. GEOTEXTILE INSTALLATION - GENERAL
      1. Cut geosynthetic to proper width prior to placement. Width should be enough to conform to the trench perimeter with at least a 6 inch top overlap.
      2. Place the geosynthetic roll over the trench, and unroll enough geosynthetic that the geosynthetic can be placed down into the trench.
      3. Anchor the edges of the geosynthetic with heavy objects to prevent the geosynthetic from falling into the trench.
      4. Where overlaps are necessary between rolls, allow for 3 foot overlap from the upstream to the downstream roll.
      5. All geotextiles shall be weighted with sandbags or the equivalent when required. Such sandbags shall be installed during placement and shall remain until replaced with cover material or geomembrane.
      6. Contractor shall take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.
      7. Geotextiles shall not be exposed to precipitation prior to being installed, and shall not be exposed to direct sunlight for more than 15 days.
   3. GEOTEXTILE REPAIR
      1. Any holes or tears in the fabric shall be repaired as follows:
         1. On slopes: A fabric patch shall be sewn into place using a double sewn lock stitch (1/4-inch to 3/4-inch apart and no closer than 1-inch from any edge). Should any tear exceed ten percent of the width of the roll, that roll shall be removed from the slope and replaced.
         2. Non-slopes: A fabric patch shall be spot-seamed in place with a minimum of 24-inches of overlap in all directions.
   4. PLACEMENT OF COVER MATERIALS
      1. Contractor shall place all cover materials in such a manner to ensure the geotextile is not damaged; minimal slippage of the geotextile on underlying layers; and no excess tensile stresses in the geotextile.
   5. GEOGRID INSTALLATION
      1. Examination
         1. The Contractor shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the Contractor to be free of flaws or damage occurring during manufacturing, shipping, or handling.
      2. Preparation
         1. The subgrade soil shall be prepared as indicated on the construction drawings or as directed by the Engineer
      3. Installation
         1. The geogrid shall be laid at the proper elevation and alignment as shown on the construction drawings.
         2. The geogrid shall be installed in accordance with the installation guidelines provided by the manufacturer or as directed by the Engineer.
         3. The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required by fill properties, fill placement procedures or weather conditions or as directed by the Engineer.
         4. Granular fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid and/or movement of the geogrid.
      4. Repair
         1. Any roll of geogrid damaged before, during and after installation shall be replaced by the Contractor at no additional cost to the Owner.
         2. Proper replacement shall consist of replacing the affected area adding 3ft of geogrid beyond the limits of the affected area.
      5. Protection
         1. Follow the Manufacturer’s recommendations regarding protection from exposure to sunlight.

+ + END OF SECTION + +