**CELLULAR CONFINEMENT SYSTEMS: (1-16-18)**

**Description**

Install cellular confinement systems, i.e., geocells on slope faces and fill geocells with seeded compost in accordance with the contract. Geocells are required or an option for slope erosion control to establish vegetation at locations shown in the plans and as directed. Define “tendons” as straps or cords laced through geocells to support the weight and resist sliding of expanded and filled geocells on slope faces.

**Materials**

Refer to Division 10 of the *Standard Specifications*.

|  |  |
| --- | --- |
| **Item** | **Section** |
| PVC Pipes | 1044-6 |
| Geocells | 1056 |

Provide geocell accessories (e.g., stakes, anchors, pins, clips, staples, rings, etc.) recommended by the Geocell Manufacturer/Vendor. For tendons, use woven polyester or aramid strapping with widths of either 3/4" or 1" and sufficient break strengths for geocell designs. Provide Type 1, Type 2 or Type 4 material certifications for tendons in accordance with Article 106-3 of the *Standard Specifications*. Use seeded compost blankets that meet the *Compost Blanket* provision.

**Preconstruction Requirements**

For geocell designs, submit PDF files of working drawings and design calculations at least 30 days before the preconstruction meeting. Do not start geocell installation until a design submittal is accepted. Provide designs sealed by an engineer licensed in the State of North Carolina and approved by the Geocell Manufacturer/Vendor.

Design cellular confinement systems in accordance with the plans. Design cellular confinement systems for a minimum factor of safety of 1.3 for all failure modes and ground snow loads from Figure 7-1 of the *ASCE Minimum Design Load and Associated Criteria for Buildings and Other Structures*.

Assume a unit weight of 80 pcf for seeded compost and a friction angle of 28 degrees for the interface between filled geocells and slope faces. For slopes constructed with Class II or III select material, use a friction angle of 34 degrees and a unit weight of 115 pcf for select material. For slopes constructed with Class I select material or borrow, use a friction angle of 30 degrees and a unit weight of 125 pcf for select material or borrow. Assume Class I select material or borrow is saturated and use effective stress for determining passive resistance.

Anchor geocells at tops of slopes by burying ends of geocells behind slope crests or wrapping tendons around PVC pipes buried behind slope crests. Supply driven anchors or stakes as needed to hold geocells in place but do not consider them for design. Use the Ovesen Method to design the anchor slab, i.e., pipe deadman and neglect wall friction. Use a reduction factor of 3.0 for determining tendon rupture and tie tendons with bowline, clove hitch or other approved knots.

Submit working drawings and design calculations for acceptance in accordance with Article 105-2 of the *Standard Specifications*. Submit working drawings showing typical cross sections, plan views with geocell layout, details of the cellular confinement system including all accessories and a detailed installation procedure. Include details of slope and crest anchorage systems and tendon sizes and locations. Submit stability calculations for each cross section with different surcharge loads, geometry or material parameters. At least one analysis is required for each slope angle with the tallest slope.

Before beginning geocell installation, the Engineer may require a preconstruction meeting to discuss the construction and inspection of the cellular confinement systems. If required, schedule this meeting after all geocell submittals have been accepted. The Resident or District Engineer, Area Construction Engineer, Geotechnical Operations Engineer, Contractor and Geocell Installer Superintendent will attend this preconstruction meeting. If geocells are required for reinforced soil slopes (RSS), the RSS preconstruction meeting may also serve as the geocell preconstruction meeting provided all geocell submittals have been accepted before the meeting and the Geocell Installer Superintendent attends the meeting.

**Construction Methods**

Control drainage during construction in the vicinity of RSS and embankments with cellular confinement systems. Direct run off away from slopes and protect slope faces from erosion. Compact slope faces in accordance with the contract. A smooth firm surface free of rocks, clods and debris is required before placing geocells on slopes.

Submit documentation that the Geocell Installer is prequalified by the Geocell Manufacturer/Vendor and has successfully completed at least 2 geocell projects within the last 3 years. Each project should comprise at least 1,000 sy of geocells installed on slopes with angles and heights similar to those for this project.

If the Geocell Installer does not have the required project experience, a Geocell Manufacturer/Vendor representative is required to assist and guide the Geocell Installer on-site for at least 8 hours when the first geocells are placed. If problems are encountered during construction, the Engineer may require the manufacturer/vendor representative to return to the site for a time period determined by the Engineer.

Install cellular confinement systems in accordance with the accepted submittals. Follow installation instructions in the accepted submittals for geocells and all accessories including procedures for installing tendons and anchoring geocells at tops of slopes.

Place seeded compost blankets in accordance with the *Compost Blanket* provision except fill expanded geocells in place with seeded compost to a depth sufficient to cover the geocells. Keep geocells filled and covered with compost and maintain and repair compost blankets per the provision to establish and support vegetation.

**Measurement and Payment**

*Geocells* will be measured and paid in square yards. Cellular confinement systems will be measured along slope faces as the square yards of expanded geocells in place. The contract unit price for *Geocells* will be full compensation for providing designs, submittals, labor, tools and equipment, supplying and installing cellular confinement systems and all accessories including tendons and PVC pipes and any incidentals necessary for geocell installation.

Seeded compost blankets will be measured and paid in accordance with the *Compost Blanket* provision.

Payment will be made under:

|  |  |  |
| --- | --- | --- |
| **Pay Item** |  | **Pay Unit** |
| Geocells | | Square Yard |



**PE SEAL NAME**

**PE #**