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EROSION CONTROL OF SOILS USING SOME GEOTEXTILE MATERIALS

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ABSTRACT

Running water, waves, wind, moving ice, or other earth science sheet and bank erosion forces can all cause soil or rock debris to become untangled, disconnected, and transferred from one location to another, causing erosion. Underneath stone riprap, geotextiles are a good and affordable alternative to conventional hierarchic filters. The material of the duvet may shift as a result of wave action or currents, which could lead to abrasion. Durability, dimensional stability, and resistance to tearing, puncture, and burst are the strength attributes that are typically considered to be of the utmost importance. It makes sense to build the silt fence in the shape of a horseshoe over a level area. This contributes to the runoff ponding and will improve the strength.
Keywords: Geotextile, Erosion, Sediment Control, Stability.

1. Introduction

Erosion is caused by a bunch of physical and chemical processes by that the soil or rock material is disentangled, detached, and transported from one place to a different by running water, waves, wind, moving ice, or different earth science sheet and bank erosion agents. Clayey soils square measure less erodible than fine sands and silts. Riprap is employed as a liner for ditches and channels subjected to high-speed flow and for lake, reservoir, and channel banks subject to wave action. Geotextiles square measure a good and economical different to traditional stratified filters beneath stone riprap. The geotextiles utilized in bank protection function a filter(Ansari & Daigavane, 2020,2020a).

2. Erosion Control Using Geotextile Materials

The generalized assumptions and design constraints for both unreinforced and reinforced slopes are mentioned here.

2.1 Specific Design Considerations for Erosion Control

The assumptions, design variables, the target function and therefore the design constraints are for unreinforced slope presented below.

Durability:
The term includes chemical, biological, thermal, and ultraviolet (UV) stability. All geotextile specifications should embrace a provision for covering the geotextile to limit its actinic radiation exposure to thirty days or less.

Strength and Abrasion Resistance:
The required properties can depend upon the precise application- the kind of the duvet material to be used (riprap, sandbags, concrete blocks, etc.), the size, weight, and form of the armor stone, the handling placement techniques (drop height), and also the severity of the conditions (stream rate, wave height, speedy changes of water level, etc.). Abrasion may result from movement of the duvet material as a results of wave action or currents. Strength properties usually thought-about of

primary importance square measure strength, dimensional stability, tearing, puncture, and burst resistance(Ansari & Daigavane, 2021; Daigavane & Ansari, 2021; Nene & Daigavane, 1999).

CoverMaterial:
The cover material (gravel, rock fragments, riprap, armor stone, concrete blocks, etc.) may be a protecting covering over the geotextile that minimizes or dissipates the hydraulic forces, protects the geotextile from extended exposure to actinic radiationand keeps it in intimate contact with the soil. the duvet material should be a minimum of as pervious because the geotextile. If the duvet material isn't pervious enough, a layer of fine mixture (sand, gravel, or crushed stone) ought to be placed between it and also the geotextile(Nene & Daigavane, 1994).A very important thought in coming up with cowl material is to stay the void space between stones comparatively tiny. If the void space is overly massive, soils could move from areas weighted by stones to unweighted void areas between the stones, inflicting the geotextile to balloon or eventually rupture. the answer during this case is to position a hierarchal layer of smaller stones below the big stones that may stop the soil from moving. A layer of mixture can also be required if a significant a part of the geotextile is roofed as for instance by concrete blocks. The layer can act as a pore water dissipator.

Anchorage:
At the toe of the streambank, the geotextile and canopy material ought to be placed on the bank to associate elevation below mean tide level to attenuate erosion at the toe. Placement to a vertical distance of three feet below mean tide level, or to the lowest of the bottom for streams shallower than three feet, is usually recommended at the highest of the bank, the geotextile and canopy material ought to either be placed on the highest of the bank or with two feet vertical freeboard higher than
expected most water stage. If robust water movements square measure expected, the geotextile must be anchored at the crest and toe of the streambank as shown within the Fig. 1.

2.2 Specific Construction Considerationsfor Erosion Control

The assumptions, design variables, the objective function and the design constraints are for reinforced slope presented below.

Site Preparation:
The surface ought to be cleared of vegetation, giant stones, limbs, stumps, trees, brush, roots, and alternative rubbish so hierarchical to a comparatively smoothing plane freed from obstructions, depressions, and soft pockets of materials.

Placement of Geotextiles:
The geotextile is unrolled directly on the swimmingly hierarchical soil surface. It shouldn't be left exposed to W deterioration for over one week just in case of untreated geotextiles, and for over thirty days just in case of W protected and low actinic radiation vulnerable compound geotextiles. The geotextile ought to be loosely arranged, freed from tension, folds, and wrinkles. once used for streambank protection, wherever currents acting parallel to the bank area unit the principal erosion forces, the geotextile ought to be placed with the longer dimension (machine direction) within the direction of anticipated water flow.Adjacent geotextile strips ought to have a minimum overlap of twelve inches on the sides and at the top of rolls. For underwater placement, minimum overlap ought to be three feet. Specific applications could need extra overlaps. Sewing, stapling, heat fastening, or gluing adjacent panels, either within the works or on website, area unit most popular to imbrication solely. stitching has proved to be the foremost reliable methodology of change of integrity adjacent panels.
Geotextiles is also control in situ on the slope with securing pins before putting the duvet material. These pins with washers ought to be inserted through each strips of the overlapped geotextile on a

line through the point of the overlap. Steel securing pins, 3/16 in. in diameter, eighteen inches long, pointed at one finish, and fitted with a one.5-inch metal washer on the opposite have performed well in rather firm soils. Longer pins area unit well to be used in loose soils.The maximum slope on that geotextile is also placed are determined by the friction angles between the natural-ground and geotextile and cover- material and geotextile. the utmost allowable slope in no case is larger than all-time low friction angle between these 2 materials and therefore the geotextile.

Placement of Canopy Material on Geotextile:

For slanted surfaces, placement of the duvet stone or riprap ought to begin from the bottom of the slope moving upward and ideally from the middle outward to limit any partial movement of soil as a result of slippy. In no case ought to drop heights that injury the geotextile be allowable. Testing is also necessary to ascertain a suitable drop height.

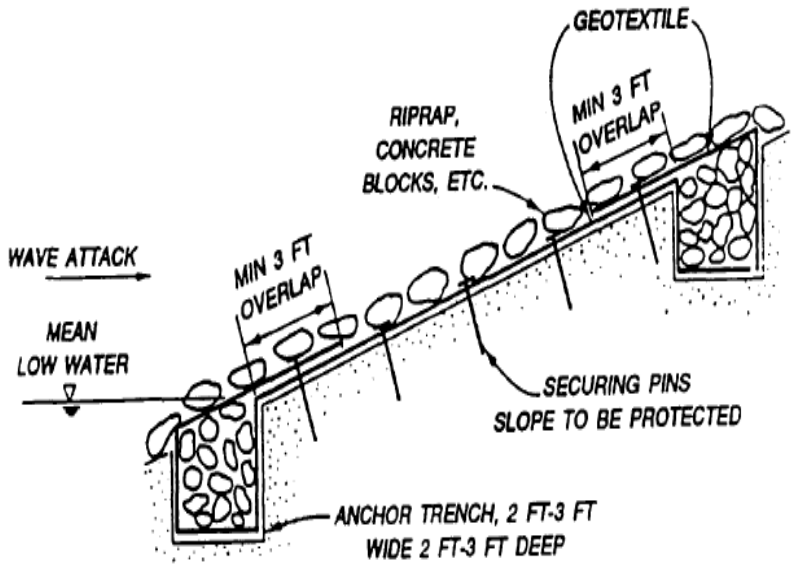

Figure 1. Pin Spacing Requirements in Erosion Control Applications

3. Sediment Control Using Geotextile Materials

Silt fences and silt curtains are sediment control systems using geotextiles. A silt fence is a temporary vertical barrier composed of a sheet of geotextile supported by fencing or simply by posts. The lower end of the geotextile is buried in a trench cut into the ground so that runoff will not flow beneath the fence. Short fences are often placed across small drainage ditches (permanent or temporary) constructed on the site. Both applications are intended to function for one or two construction seasons or until grass sod is established. The fence reduces water velocity allowing the sediment to settle out of suspension(Ansari et al. 2021; Daigavane & Ansari, 2021a).

3.1 Specific Design Considerations for Sediment Control

A silt fence consists of a sheet of geotextile and a support component. The support component may be a wire or plastic mesh support fence attached to support posts or in some cases may be support posts only (Ansari & Daigavane, 2020a;Daigavane & Ansari 2020,2020a).The designer has to determine the minimum height of silt fences, and consider the geotextile properties (tensile strength, permeability) and external factors (the slope of the surface, the volume of water and suspended particles which are delivered to the silt fence, and the size distribution of the suspended particles).

Design for Maximum Particle Retention:

A minimum of 90-pound tensile strength (ASTM D 4632 Grab Test Method) is recommended for use with support posts spaced a maximum of 8 feet apart. The geotextile should be capable of filtering most of the soil particles carried in the runoff from a construction site without unduly impeding the flow. ASTM D 5141 presents the laboratory test used to determine the filtering efficiency and the flow rate of the sediment-filled water through the geotextile.

Required Geotextile Properties:

The geotextile used for silt fence must also have:

- Reasonable puncture and tear resistance to prevent damage by floating debris and to limit tearing where attached to posts and fence.
- Adequate resistance to UV deterioration and biological, chemical, and thermal actions for the desired life of the fence.

3.2 Specific Construction Considerationsfor Sediment Control

- Silt fences ought to be created when the cutting of trees however before having any sod heavy construction activity within the geographic region.
- It's an honest apply to construct the silt fence across a flat space within the variety of a horseshoe. This aids within the ponding of the runoffand will increase the strength of the fence. ready-made silt fence sections containing geotextile and support posts square measure commercially obtainable.

4. Conclusion

Geotextiles are an effective and economical alternative to conventional graded filters beneath stone riprap. However, for aesthetic or economic reasons, articulated concrete mattresses, gabions, and precast cellular blocks have additionally been used to cover the geotextile. The type, size, and weight of cover material placed over the geotextile depends on the mechanical energy of water. Cover material that is lightweight as compared with the hydraulic forces acting on it may be moved. By removing the weight holding the geotextile down, the ground-water pressure may be able to separate the geotextile from the soil. When no longer constrained, the soil erodes. It is a good practice to construct the silt fence across a flat area in the form of a horseshoe. This aids in the ponding of the runoff, and increases the strength of the fence. Prefabricated silt fence sections containing geotextile and support posts are commercially available. They are generally manufactured in heights of 18 and 36 inches. Anchor lines hold the curtain in a configuration that is usually U shaped, circular, or elliptical. The design criteria and properties needed for silt fences additionally apply to silt curtains.

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