Coir Block System (fabric attached coir block) add New Dimension to Streambank Stabilization Projects

Using geotextiles to confine soil in lifts between layers of live plants has become an increasingly popular, environmentally-friendly technique for creating a vegetated retaining wall in stabilizing streambanks. A unique, recently-developed biodegradable block system that combines a densely-packed block of coir fiber with a woven coir fabric (Figure 1) is designed to make construction of these encapsulated soil lifts or terraces easier, while producing a stronger, longer-lasting structure at a lower cost. It represents the next generation of this soil bioengineering technique by improving the performance of fabric-wrapped soil lifts. In each case, this unique approach provided a cost-effective way to improve the performance of fabric-wrapped soil lifts. “It represents the next generation of this soil bioengineering technique,” says Lanka Santha, P.E., who developed the system.

Figure 1 . BioD-Block system

Building the lifts

In many situations, fabric-wrapped soil lifts offer a much more natural alternative to hard armor practices, like concrete, gunnite or rock rip rap, to protect streambanks from erosion. This approach restores streambank in a way that blends in with the site and improves habitat for fish and wildlife. Typically, the soil lifts are constructed by placing soil on top of a portion of two horizontal geotextile fabrics. An outer layer of a synthetic geogrid or a suitable biodegradable fabric, such as a coir fabric of twisted coconut fibers woven into a strong mesh, provides high tensile strength to reinforce the soil. An inner

layer of nonwoven coir, burlap or other matting prevents piping of soil fines through the coarser outer fabric. After the soil is compacted, the remaining fabrics are wrapped over the front and top of the soil mass and staked in place. These lifts are built one on top of another and set back to form a geotextile retaining wall.

Live plant cuttings, usually dormant willows, are placed between the layers, protruding from the face of the constructed bank. These branches reduce the shear stress on the face of the bank. The cuttings plus the static weight of the wrapped soil lifts produce a strong structure that is designed to withstand bank shear forces until the vegetation becomes established. As the willows grow, their dense branches help protect the bank from the erosive forces of flowing streams. These branches also provide cover and shade for fish and wildlife. At the same time, the fibrous root systems of the willows bind the soil particles to anchor the lifts. By the time any natural fabric materials degrade, the willows should be well established and stabilizing the bank.

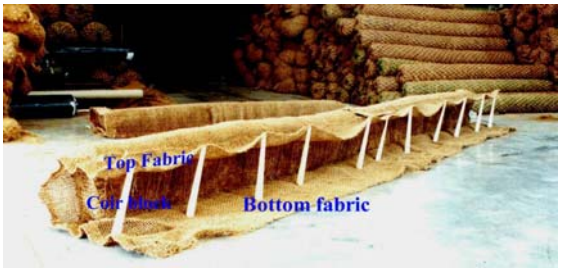
In some cases, however, this technique has failed to meet performance expectations. The Alaska Department of Transportation study, published in 2003, which evaluated eleven streambank restoration sites where a geogrid was combined with an inner burlap filter to build fabric-wrapped soil lifts. At one river site, twenty feet or more of the soil lifts had partially collapsed (Figure 2). It appeared that bank ice or spring ice floes had ripped the geogrid apart and soil material had disappeared where the burlap filter had deteriorated. At one creek restoration project, flooding completely destroyed fabric-wrapped soil lifts. Gravel and soil was removed along as much as 20 ft. of the streambank from holes in the burlap fabric in the face of the lifts. Meanwhile, much of the geogrid material was trailing out from the remaining soil lifts. “Improvements to the methods and materials used in fabric encapsulated soil lifts should be considered,” the report states. “Outer fabrics with greater tensile strength and abrasion resistance, or other techniques, should be evaluated for use on streams where ice damage may occur.”

Figure 2: Failed soil lift

A better way

The BioD-Block coir block system is designed to improve the performance of fabric-wrapped soil lift technique. It consists of a coir fiber block made of tightly compressed, long coir fibers and measuring 10 ft. long, 9 in. wide and 16 in. high, and a woven coir fabric. This fabric wrapped around one side and the top and bottom of the block leaving two free ends (Figure 3). As with conventional soil lifts, soil is place on the bottom fabric and covered with other piece of fabric extending back from the top of the block. Unlike, conventional soil slifts, however, the coir block forms the face of the soil lift. Depending on application, the blocks are available in a choice of three fabric lengths – to match site conditions. The fabric extends back 16 to 48 inches from the top from 28 to 75 inches from the bottom. Wrapped woven coir fabric in BioD-Block has machine direction dry tensile strength of 1740 lbs per foot and cross direction dry strength of 1176 lbs per foot.

Figure 3. Detail coir block system



Advantages of coir blocks over conventional fabric-wrapped soil lifts

- A sturdier, more durable structure

Part of this reflects the coir block. The thick block provides better support and protection for the soil behind it than fabrics alone. What's more, the roots of willows and other vegetation grow into the block, embedding it to the soil and creating a solid, natural protection for the soil mass. The way in which the woven coir fabric is manufactured also contributes to the systems higher performance. The tensile strength in the machine direction contributes to the structural support of the build soil lifts. It is about 40 percent stronger than the cross direction tensile strength of typical coir fabrics used to build soil lifts. The male-female ends of the block produce, strong continuous sections while maintaining structural integrity. The result of all this is stronger, more stable structure with constant layer heights (Figure 4).

Figure 4. Streambank with coir block system

- Stronger joint

The male-female ends in the coir block system provide strong continuous sections while maintaining its structural integrity (Figure 5).

Figure 5. Connection in coir block system

- Faster, easier construction

The coir blocks provides a fixed height for the soil layers, greatly reducing the time and effort required to make the soil layers with a more attractive, uniform height.

- Lower construction costs

In most situations, the coir block system eliminates the need for an inner fabric. Also, the ease of construction cuts labor expenses.

- Wide-ranging versatility

The coir block system can be used in a number of different ways to restore streambanks, depending on individual site conditions.