Stormwater Best Management Practice

Fiber Rolls

Minimum Measure: Construction Site Stormwater Runoff Control
Subcategory: Sediment Control

Description

Fiber rolls (also called fiber logs or straw wattles) are tube-shaped erosion control devices filled with straw, flax, rice, coconut fiber material or composted material. Manufacturers wrap each roll with either UV-degradable polypropylene netting for longevity or 100 percent biodegradable materials like burlap, jute or coir (MDOT, 2015). Fiber rolls reduce the erosive potential of stormwater on long or steep slopes by helping to slow, filter and spread overland flows. This helps minimize rill and gully development, prevent erosion, and reduce sediment loads to receiving waters by filtering stormwater and capturing sediment. Fiber rolls also complement other permanent stormwater control measures used for source control and revegetation such as straw mulch, erosion control blankets, hydraulic mulches or bounded fiber matrices for slope stabilization.

Applicability

Design engineers and construction staff have used fiber rolls to control erosion in a variety of areas—along highways and at construction sites, golf courses, ski areas, vineyards and reclaimed mines. They typically use fiber rolls when stabilizing and revegetating slopes. They can also place fiber rolls along the shorelines of lakes and ponds to provide immediate protection by dissipating the erosive force of small waves and help enable permanent vegetation establishment. Construction staff should not use fiber rolls in channels, particularly channels that are experiencing erosion from concentrated flows, or in reaches with large debris loads.

Fiber rolls can be suitable for the following applications (City of Seattle, 2017):

- Along the toe, top, face and at-grade breaks of exposed and erodible slopes to shorten slope length and spread stormwater as sheet flow.
- At the end of a downward slope where it transitions to a flatter slope.
- Along the perimeter of a project (can be an alternative to silt fence).
- At downslopes of exposed soil areas or slopes needing stabilization until construction staff establishes permanent vegetation in the area.
- Around temporary stockpiles.

Fiber rolls also have several benefits that design engineers should consider when specifying erosion control practices. As an alternative to silt fence, fiber rolls have some distinct advantages, including the following (CWS, 2008):

- Installation is easier, particularly in shallow soils, rocky material or frozen ground or near sidewalks and tree roots.
- They are more adaptable to slope applications and contour installations than other erosion and sediment control practices.
- They blend in with the landscape and are less obtrusive than other erosion and sediment control practices such as silt fence.
- They do not obstruct hydraulic mulch and seed applications.
- They store moisture for vegetation immediately adjacent to them or seed mixes within the rolls.
- Construction staff can remove them or leave them in place after the site establishes vegetation. Straw and biodegradable netting will break down into the soil, adding organic material to the soil.

Siting and Design Considerations

Construction staff can use prefabricated fiber rolls or roll them on-site. In either case, fiber rolls consist of rolled tubes of erosion control blanket or fiber material wrapped in netting. When rolling the tubes on-site, each tube should be at least 8 inches in diameter, and bound at each end and every 4 feet along the length of the roll with jute-type twine (MDOT, 2015).

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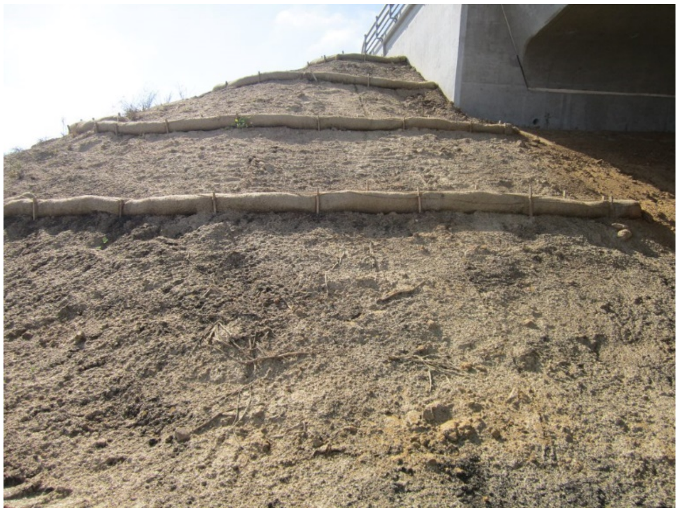

Fiber rolls can control erosion when installed perpendicular to the slope and spaced appropriately.

Credit: Anthony D'Angelo for USEPA, 2015

Projects on a Slope

Construction staff should install fiber rolls along the contour of a slope, perpendicular to the direction of flow. They should turn the ends of each roll upslope to prevent stormwater from flowing around the roll (MDOT, 2015). Construction staff should install fiber rolls in trenches at least 2 inches deep. In fact, some localities recommend depths greater than 2 inches: the City of Seattle recommends a trench depth of 5 to 7 inches for steep, soft or loamy soils and 3 to 5 inches for shallow slope, hard or rocky soils (City of Seattle, 2017). Spacing between rows of fiber rolls for slope installations also depends on slope and soil type. According to the Montana Department of Transportation (MDOT), soft, loamy soils require more closely spaced rows than hard, rocky soils. The MDOT recommends the following average spacing intervals for 8-inch-diameter fiber rolls (MDOT, 2015):

- 1:1 slopes = 10 feet apart
- 2:1 slopes = 20 feet apart
- 3:1 slopes = 30 feet apart
- 4:1 slopes or flatter = 40 feet apart

Construction staff should stake fiber rolls securely into the ground using wood stakes (at least ¾ inch thick) or metal stakes. Metal stakes may be easier to drive into hard or compacted ground. Construction staff should drive stakes through the middle of the fiber roll and deep enough into the ground to anchor the roll in place. The stakes should extend at least 12 inches below the ground surface (MDOT, 2015). The City of Seattle recommends a 24-inch stake for use on soft, loamy soils while an 18-inch stake for use on hard, rocky soils; in either case, 2 to 3 inches of the stake should protrude (City of Seattle, 2017). Construction staff should stake fiber rolls every 4 feet (MDOT, 2015), though municipalities sometimes permit wider spacing if construction staff also place the roll in a deep enough trench.

Projects Without Slopes

Construction staff can also use fiber rolls at projects with minimal slopes. Typically, construction staff install fiber rolls along sidewalks, on the bare lot side, to keep sediment from washing onto sidewalks and streets and into gutters and storm drains. For installations along sidewalks and behind street curbs, it might not be necessary to stake the fiber rolls, but it is still necessary to dig trenches. Fiber rolls placed around a storm drain or inlet should be 1 to 1½ feet back from it.

Limitations

There are several limits to the installation and overall performance of fiber rolls (CWS, 2008):

- Fiber rolls are not effective unless trenched and in contact with soil.
- Fiber rolls can be difficult to move once saturated.
- If construction staff do not properly stake and entrench fiber rolls, high flows can transport them.
- Fiber rolls on steep slopes and sandy soils will require frequent maintenance to make sure they stay in contact with soil and gullies or riling do not develop.
- Fiber rolls have a very limited sediment capture zone, so they may need frequent maintenance.
- Construction staff should not use fiber rolls on slopes subject to creep, slumping or landslide.

Maintenance Considerations

The maintenance requirements of fiber rolls are minimal, but construction staff should regularly inspect installed fiber rolls while the site is active or when stormwater flow is occurring to ensure that the rolls remain firmly anchored in place and equipment traffic does not crush or damage them. During periods of inactivity and dry weather, construction staff may space out inspections by as much as 2 weeks (CWS, 2008). When sediment accumulation reaches one-third of the height of the roll on the upslope side, construction staff should remove the sediment. They should repair or replace split, torn, unraveled or slumping fiber rolls.

Following project completion, construction staff can leave fiber rolls in place as a soil amendment to help promote moisture retention and organic matter accumulation. If construction staff remove fiber rolls, they should collect and dispose of accumulated sediment and fill any holes, trenches or depressions to grade. If necessary, they should re-seed or re-plant exposed soil to aid in permanent stabilization (MDOT, 2015).

Effectiveness

The sediment removal performance of fiber rolls is generally good but is highly variable depending upon factors like media type, stormwater flow rate and sediment composition. The Minnesota Department of Transportation commissioned a laboratory study that found that, under controlled conditions, median sediment removal rates varied between 72 percent for wood fiber rolls and 92 percent for compost rolls (Wilson, 2019). Although field conditions are generally more variable, proper use should ensure similar removal rates.

A restoration project in the Flint Creek watershed demonstrated the effectiveness of fiber rolls as a shoreline protection device to reduce shoreline erosion. The project used fiber roll installation, along with other bioengineering techniques, along the shorelines of creeks to reduce the effects of wave action. Project staff installed native plants in the fiber rolls. As a result, the growth of vegetative cover increased and helped to stabilize the slopes along the banks of the creek. Ultimately, the water quality of Flint Creek improved (U.S. EPA, 2001).

Cost Considerations

Material and installation costs of fiber rolls depend on a number of factors, including fiber media type, netting type and roll size. The cost for a fully biodegradable straw roll in polymeric netting can range from $8 to $10 per linear foot (RSMeans, 2019). Although fully biodegradable netting can cost more than non-biodegradable netting, the labor cost savings from not having to remove the control measure—as well as the subsequent benefit to soil condition and vegetation establishment—may justify this cost. However, there is still the cost to remove and dispose of sediment that accumulates to at least one-third the distance between the top of the fiber roll and the ground surface.

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

References

City of Seattle. (2017). *City of Seattle stormwater manual volume 2: Construction stormwater control*.

Clean Water Services (CWS). (2008). *Erosion prevention and sediment control planning and design manual.* Clean Water Services of Washington County.

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U.S. Environmental Protection Agency (U.S. EPA). (2001). Restoration of the Flint Creek watershed: Restoration partnership completes multiple projects. In *Section 319 success stories: The successful implementation of the Clean Water Act's Section 319 nonpoint source pollution program* (pp. 87-88). U.S. Environmental Protection Agency.

Wilson, B. (2019). *Sediment control log performance, design, and decision matrix for field applications.* University of Minnesota. Commissioned by Minnesota Department of Transportation.

Disclaimer

This fact sheet is intended to be used for informational purposes only. These examples and references are not intended to be comprehensive and do not preclude the use of other technically sound practices. State or local requirements may apply.